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THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

VOLUME XI
FROM OCT. 7TH, 1922
TO MAR. 31ST, 1923

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BOOK REVIEWS

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THE
WIRELESS WORLD
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THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

No. 164 [No. 1. Vol. XI.] OCTOBER 7th, 1922. Weekly

Dr. J. A. Fleming, F.R.S.

AUTHOR OF "ELECTRONS, ELECTRIC WAVES, AND WIRELESS TELEPHONY," COMMENCING IN THIS ISSUE.

IN this issue it is our privilege to publish the first of a series of articles contributed by Dr. J. A. Fleming, F.R.S., whose portrait appears on this page. In our issue of September 16th, we announced that the second half-yearly volume, which commences with this issue, would contain the commencing instalment of these contributions.

The appearance of these articles under the title of "Electrons, Electric Waves, and Wireless Telephony," at the present moment is extremely opportune, since it coincides with the official announcements that Broadcasting is to start at once.

With the introduction of Broadcasting, there will be thousands who will be seeking for information as to what Broadcasting is and how it is done. These articles by Dr. Fleming will exactly answer these questions. Dr. Fleming will explain in not too technical language exactly what wireless telephony is and how it is produced.

This knowledge will add enormously to the interest which those new to wireless will have in the new science, which, through the introduction of Broadcasting, is to have so great a future. Perhaps these articles will afford an even greater fascination for those acquainted with wireless, who will thereby be able to appreciate more fully the arguments put forward by Dr. Fleming and the experiments with which he illustrates them.

Dr. J. A. Fleming, F.R.S.

There have been many contributions to wireless literature dealing with the subject of wireless telephony, but never before, we feel convinced, has the subject been treated in a manner so well calculated to absorb the attention and interest of every class of reader.

Those who have read Dr. Fleming's recent book "Fifty Years of Electricity," are in a position to form some estimate of the interest which these articles will arouse. There are indeed few who have been in a position to watch the growth of wireless and contribute so largely to its development as Dr. Fleming.

Electrons, Electric Waves, and Wireless Telephony—I.

By Dr. J. A. Fleming, F.R.S.

The series of articles by Dr. J. A. Fleming, F.R.S., which will appear under the above title, are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony he gave at the Royal Institution, London, in December and January, 1921-1922. These lectures attracted very large audiences and were brilliantly illustrated by experiments and demonstrations. Over 400 applications for admission to these lectures had to be refused by the Managers owing to the sitting space in the theatre being insufficient to accommodate all who wished to attend. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication. The articles are therefore copyright, and rights of translation and reproduction are strictly reserved.

It is hardly necessary to remind the readers of " The Wireless World and Radio Review " that Dr. Fleming has been closely and practically connected with the development of wireless telegraphy and telephony from the very beginning, and was last year awarded by The Royal Society of Arts their very highest distinction, the Gold Albert Medal, for his electrical discoveries and researches, and especially for the epoch-making invention of the Thermionic Valve, which in its later developments is the foundation of all modern radiotelephony.

I.—WAVES AND WAVE PRODUCTION.

NOW that the wonderful art of wireless telephony has reached a point in its development at which it is rapidly becoming a popular pastime in place of an exceptional feat by experts, there is naturally a demand for expositions of the scientific principles underlying it, which shall be capable of being understood by the general reader.

This is not adequately supplied either by the highly technical journals or by the bulk of the popular wireless literature being poured out from the Press. Mere pictures or even semi-technical explanations of the mysteries of receiving circuits or the mode of employing thermionic valves or crystals for " listening in," do not entirely meet the public requirements.

This remarkable achievement of applied science is the outcome of the great advances which have taken place in the last quarter of a century in our knowledge concerning atoms, electrons, electric waves and electrical physics generally.

An intelligent comprehension of the *modus operandi* of the technical appliances used in wireless telephony necessitates, then, some slight acquaintance with modern scientific views concerning the nature of matter and electricity, and the possible relations of these to the more fundamental conceptions of æther, space, time and energy.

Probably the chief gain which will result from a keen popular interest in wireless telephony will be an increased public attention to the progress of electrical science. In view of recent important advances in pure science, most of our text-books on electricity as used in " Schools and Colleges " require to be re-written.

It is now seen that we have to put on the scrap-heap much of the electrical theory and many explanations of physical phenomena formerly deemed satisfactory, and start with fresh ideas.

In the following articles an attempt will be made to give in outline an account of some of these modern ideas, and advances in recent physics, as far as they bear on the evolution of wireless telephony. The highly technical details of wireless apparatus and its expert management will not so much concern us, and, in any case, is provided for in other publications and books.

When anyone not in the least acquainted with the facts of electrical physics, asks a wireless operator to explain the nature of his operations and appliances he is generally informed it is accomplished by the use of " electric waves." But any attempt to progress beyond the stage of mere phrases generally places the expert and the enquirer in difficulties.

To answer this question at all efficiently renders it necessary to build up from a deeper foundation and consider in detail what is meant in scientific language by the term *wave.* It is essential therefore to start from a consideration of familiar physical effects which can be seen with the bodily eyes, and to make of these stepping-stones by which we may be enabled to understand something of analogous processes which can only be appreciated with the eyes of the mind.

1. Surface Waves on Liquids.

The easiest avenue of approach to the study of waves in general is to discuss some of the properties and the nature of the visible surface waves in liquids. We are all acquainted with the appearance of the sea surface when it is traversed by and tossed up into waves, and also with the effects produced on the surface of still water when it has ripples created upon it by the splash of a stone thrown in. In common language we apply the term " wave " to the splashing water thrown up on the beach or rocks at the seaside (Fig. 1). This, however,

Fig. 1. Sea Waves breaking on the Rocks and Beach

is merely the result of the break-up or end of a wave, and in a scientific sense of the word it is not more properly called a wave than a house in the act of falling down could be described as a " desirable residence."

To understand what is meant by a surface wave in scientific terminology we must go out a little distance from the coast over deep sea water on some breezy day. We shall then see what appear to be rounded elevations or hummocks on the water, which move forward. To the inexperienced eye it seems as if the surface water, as a whole, was in motion in one direction.

If, however, we fasten attention upon some floating object, such as a patch of seaweed or a seagull sitting on the water, we see that as each wave passes under it the floating object is merely lifted up, pushed forward a little, then let down and drawn back, and, in short, never moves far from one position. A little thought makes it evident we have to distinguish between the motion of the water particles *per se*, and the motion or change in position of the elevations and depressions in the water surface.

We can watch with the eye the progress of a certain hump or ridge on the surface, but that hummock does not consist of the same particles of water for two successive instants.

At any one spot the actual extent of the displacement of individual particles of water may be small, and the progressive movement is merely the apparent change in place from instant to instant of the locality at which this displacement or motion is a maximum or minimum. A simple illustration of the effect may be obtained by laying transversely upon a long horizontal board a cardboard cylinder about the same length as the width of the board. To this cylinder is attached a string by which it can be pulled along parallel to itself. Over the cylinder is laid a strip of green cloth which must be taken to represent the sea surface. A small piece of paper cut out in the shape of a seagull or a small stuffed bird may then be pinned to the cloth (see Fig. 2). If, then, the card roller is pulled along under the cloth each point of the latter will be successively raised and lowered. A moving elevation of the cloth in the form of a ridge or hummock will travel along the cloth and initiate by its action on the model bird the behaviour of the water at one point and at various points in the path of the wave.

2. Definition of Wave Motion.

We are then able to give a definition of wave-motion as follows :—

If the particles of any material or parts of any construction perform successively,

Fig. 2. A Model to explain the progression of a surface wave on water.

meaning by that one after the other and not all at once, any kind of movement or displacement in which they start from and come back to a given point, this constitutes a *wave motion*. We can see this process illustrated when a gust of wind blows over a field of ripe corn. Each ear or row of ears along a certain region bows down under the pressure of the wind, and then springs up again. Row upon row of the corn-stalks successively, make their obeisance in this fashion to Hermes, and the result is that a sort of shadow sweeps over the field, very beautiful to behold, which constitutes a kind of wave.

A wave does not necessarily involve motion. It may consist in any kind of cyclical change repeated from point to point along a certain line. Thus, suppose we have a very long row of incandescent electric lamps, which by some contrivance can be switched on one at a time for a moment, and then off again. If each lamp in turn, one after the other, progressively along the row, is thus illuminated for an instant, we shall see a wave of illumination propagated along the series of lamps.

If at each point in the series the motion or change is only performed once, we have a so-called *solitary wave*. If at each point it is repeated at regular intervals we shall have produced a *train of waves*.

We can provide an illustration of a progressive wave train in the following way. Wind a length of stiff wire round a pencil or other circular sectioned rod in open turns, like a corkscrew. Fix this spiral in a frame (see Fig. 3) so that it can be rotated. Throw the shadow of it on a screen by means of an optical lantern or else the sunlight, and rotate

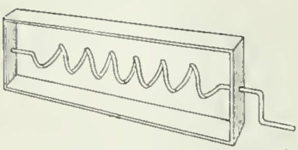


Fig. 3. A Spiral wire, the shadow of which when the wire is rotated imitates a series of progressive waves.

the screw. The shadow will present the appearance of a series of waves travelling along. If a little bit of sealing wax is put on the screw at one point its shadow will merely move up and down on the screen, thus enabling us to distinguish between the cyclical motion at each point in the system, and the apparent motion of the wave.

When dealing with trains of waves there are four terms very frequently in use which it will be convenient to define at this stage.

At any one point in the wave region the material or medium executes a certain regularly repeated motion, or else some cycle of operations. The number of times this cycle is repeated per second or per unit of time, is called the *wave frequency*. The greatest extent of this displacement or motion, or other change from its zero position, is called the *wave amplitude*.

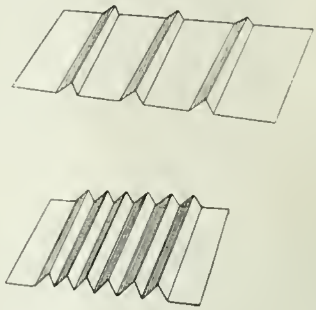


Fig. 4. Pleated paper models to illustrate the difference between "long" and "short" surface waves on water.

The shortest distance measured across from one wave hump or maximum to the next adjacent one is called the *wavelength*. It is important for the general reader to notice that the term "a long wave" does not mean a wave which is long in the direction of the crest, ridge, hump or elevation, but it means that distance between the waves is relatively large. Thus, for instance, if we pleat a sheet of paper so that the folds or ridges are close together, we might take this as an illustration of what is meant by "short" waves. If, however, the ridges or pleats are relatively far apart, they would be called "long" waves (see Fig. 4).

The terms "long" and "short" are, however, relative, and what would be a very long wave for certain purposes might be a very short one for others.

Then, in the next place, every wave moves forward parallel to itself with a certain speed called the *wave velocity*. We may, for instance, imagine a bird to fly along over the sea surface in the same direction in which the waves are travelling and to keep himself always poised above the same crest or hump. The speed with which the bird flies is then the same as the wave velocity.

In all cases of wave motion there is a connection between the wave velocity, the wave frequency and wavelength, as follows :— The wave velocity is numerically equal to the product of the wavelength and wave frequency when using the same units of length and time. Thus, if the water at any place rises and falls ten times a minute, and if the shortest distance from crest to crest or the wavelength is 20 ft., then the wave velocity is $10 \times 20 = 200$ ft. per minute.

Algebraically, the rule is expressed in the formula $W = n\lambda$, where W is the wave velocity, n the frequency, and λ the wavelength.

In many cases the velocity of the wave is quite independent of the wavelength, that is, long and short waves travel at the same speed. This is the case with wireless waves, and those similar waves which constitute light. On the other hand, it is not the case with surface waves on liquids. On the deep sea surface long waves travel faster than short waves.

Approximately speaking, in the case of deep sea waves the wave velocity is about equal to the square root of $2\frac{1}{4}$ times the wavelength. Thus, waves on the Atlantic Ocean which are spaced apart 300 ft. from crest to crest, or have a wavelength of 100 yards, travel at about 26 miles an hour, or roughly at the speed of a slow railway train. Hence, they catch up a not very quick-moving ship and passing under it, cause the ship to pitch.

3. Production of a Wave.

We must next consider a little more carefully how a wave is produced, and why it travels along when once started.

In order that a true self-propagating wave may be produced on or in a material, the latter must possess two special properties.

First, it must have elasticity of some kind; that is, it must *resist* some kind of change in it, for example, compression, twisting, stretching, or rotation, and must spring back when released.

Secondly, it must *persist* in motion or have mass or inertia, or some quality equivalent to it which causes it to store up energy when moving, or as the displacement is changing. In short, the medium must possess the power of storing up energy in two ways, viz., as potential energy in the form of some strain, or displacement, and as kinetic energy in the form of some motion, or other change not purely mechanical but equivalent to motion or release of strain.

At any one point the energy is being transformed periodically from potential to kinetic form and back again. In a wave motion in which the motion or displacement follows a simple harmonic law the average of the varying potential energy during one complete period is equal to the average of the varying kinetic energy during the same period.

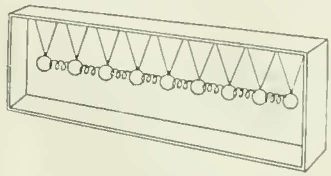


Fig. 5. A Model made with golf balls and spiral springs to illustrate the nature of a longitudinal wave.

The mode of production of a compressional wave can be studied by means of a simple model made with a number of golf balls suspended from a frame by strings so as to hang in a row, each ball being about two inches apart. The balls are inter-connected by spiral springs of brass wire, which resist compression or extension (see Fig. 5). If then the end ball is given a sudden blow with a piece of wood in the direction of the row of balls, it is set in motion and its kinetic energy expended in compressing the spring between it and the second ball. Owing to the mass or inertia of the balls the compression is not transmitted instantly to all the springs, but the spring between the balls 1 and 2 after being compressed expands again and brings ball 1 to rest and starts ball 2 in motion. This again compresses the spring between ball 2 and ball 3, and the same process is repeated from ball to ball. The movement and compression is thus handed on and finally reaches the end spring and ball, which latter flies off freely.

It is easy to watch the rather slow propagation of this wave of compression along the row of balls. As an illustration of another kind of wave called a distortional wave, a model of the following description can be made.

Stretch in a long frame a pair of parallel steel wires about half an inch apart. Thread on these wires long slips of wood or metal (see Fig. 6). The steel wires, and therefore the bars threaded on them, resist being twisted relatively to each other. Hence if we give the end bar a transverse pull so as to twist the wires between the bar 1 and bar 2, that twist will then tend to bring bar 1 back to its original place; but, having mass, it overshoots the mark and then the reverse twist applied pulls back bar 2. Each bar then continues to vibrate, but the vibrations of each bar are a little out of step with those of its neighbours on either side. The vibratory motion is passed on from bar to bar with a certain delay in phase, as it is called, and hence we have a wave of distortion transmitted along the collection of bars strung on the steel wires.

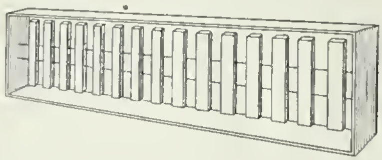


Fig. 6. A Model made with wooden bars and steel wires to illustrate the nature of a distortional wave.

There can be as many different types of wave as there are kinds of elastic resistance, and in a solid elastic substance it is possible to have two types of wave produced, one called a compressional wave in virtue of the fact that the solid resists compression and the other called distortional, in consequence of the fact that a solid resists change of shape. We have these two kinds of waves produced in the earth's crust during earthquakes.

4. Waves on Water.

In the light of these explanations we can then consider the familiar facts connected with the production of waves when a stone, for instance, is thrown upon still water in a lake.

We know that a free water surface is a level surface and that the water resists being made unlevel, and if it is momentarily heaped up or depressed at any place the force of gravitation at once restores the level.

Fig. 7. An instantaneous photograph of a ball dropping into water and creating a circular wave of elevation on it.

When a stone is thrown on water and plunges downward through the surface, it creates a temporary depression or cavity in the water. Since water is nearly incompressible, it follows that if the surface is depressed at one place it must be heaped up in some adjacent place. Therefore the plunging stone not only creates a cavity, it also heaps up the water in a circular ridge or hummock all round the depression (see Fig. 7). But this state of the water cannot continue if left to itself. The water rushes in to fill up the central cavity and its inertia carries it up into a column or hump. This involves the production of a ring-shaped depression or trough around the elevation and the first-formed annular ridge or elevation is pushed farther out. The water at the splash point thus bounces up and down, say half a dozen times before it comes to rest, and this creates as many concentric ring-shaped ridges and troughs on the surrounding surface, which then expand outwards as a family of wavelets or ripples (see Fig. 8).

Fig. 8. A train of expanding circular ripples on water created by throwing a stone into a pond.

There is one curious fact connected with this ripple band which few persons out of the thousands who throw stones into water have ever noticed. On looking carefully at the ever-expanding band of ripples it will be noticed that on the inner edge little wavelets are continually being produced and others die away at the outer edge. In other words, the waves travel through the band of wavelets faster than the group of waves moves as a whole.

This establishes an important distinction between the velocity of *a* wave and the velocity of a *group* of waves.

In the case of wireless waves there is no difference between the wave velocity and the group velocity, but for sea waves or the surface of deep water the group velocity is half the velocity of the single wave.

The waves on a water surface produced by throwing in a stone or other object, or by the wind, as in the case of sea waves, are called *gravitation waves* because the elastic resistance called into play is that due to the effort of the water surface to remain level under the action of gravitation.

5. Capillary Surface Waves.

We can, however, produce another type of wave on a water surface called a *capillary wave*, which depends upon the resistance of the water surface to stretching.

The surface of every liquid is in a state in which the surface particles draw each other together or cling more closely than those in the interior. Hence a certain effort or force is necessary to break through the surface film or to stretch it, and this surface layer endeavours always to contract or shrink up to the smallest area consistent with the boundary conditions. This is called the *surface tension* of the liquid or the *capillarity*. This last term is derived from the Latin word for a hair, because the ascent of liquids in very fine tubes such as the sap in a tree up the fine tubular tissues is due to this same action The ascent of a liquid up a fine tube is dependent upon the condition that the liquid must wet the walls of the tube.

The existence of this surface film upon liquids and its resistance to stretching gives the explanation of the fact that small bodies made of material intrinsically heavier than water can yet float upon it. If a little very clean water is put into a clean saucer, a fine clean steel sewing needle can be dropped upon the surface if held in a horizontal position close over it and released, and it will then be seen to float on the water. The needle is not heavy enough to break through the surface film but makes a little depression in it, in which the needle lies like a baby in its cradle. It is for this reason that small dust particles can lie on water and little insects can run over the surface without risking death by drowning.

We can produce capillary waves on water by holding vertically and half immersed in it a straight stiff fine wire and pushing the wire quickly forward across the surface. Round the point of immersion of the wire will be seen a group of very small waves or ripples which become of shorter wavelength in proportion as the wire is more quickly moved forward.

Again, when drops of water such as raindrops fall on the surface of pools of water, each drop as it strikes the surface creates a rapidly expanding ring-shaped ripple, which is a capillary wave. These are instances of waves on water which depend not upon gravitation but upon capillarity for their formation.

The fact that a liquid film is in a state of tension and tries to contract as much as possible is easily proved by experiments with soap bubbles. If a soap bubble is blown on the end of a glass tube and the mouth then removed from the blowing end, the bubble begins at once to shrink up, exactly as a thin indiarubber balloon would do if inflated with air and then left to itself. Another similar experimental proof is as follows:—Make a wire ring about 2 ins. in diameter, having a long wire handle, and tie across the ring a fine thread, which is not drawn quite tight. Fill the ring with a soap film by immersing it in a soap solution in such fashion that the loose thread is entirely wetted by and included in the film. Then break through the film on one side of the thread, and the liquid film tension on the other side will at once contract and pull the thread tight into the form of a curve, which then forms one boundary of the film. We see by this experiment that a liquid film is in a state of stretch or tension, and will always contract so as to make its surface area as small as is consistent with the boundary conditions. Hence it resists stretching and in virtue of this can have capillary or surface tension waves formed on it. There is one distinction between these two types of surface water wave which should be noted.

We have already explained that on deep water long gravitation waves travel faster than short ones. On the other hand, short capillary waves move faster than long ones. There is, therefore, a certain wavelength for surface waves on water, about two-thirds of an inch in length, at which surface waves travel at the slowest rate, viz., about 9 ins. a second.

This wave may be considered to lie on the boundary between true gravitation waves, which are longer, and true capillary waves, which are shorter than this critical length.

(To be continued)

The All-British Wireless Exhibition

OPENING OF THE EXHIBITION AND FURTHER DESCRIPTION OF THE EXHIBITS.

On Saturday, September 30th, the All-British Wireless Exhibition at the Horticultural Hall, Westminster, was opened by Sir Henry Norman, M.P.

At the opening ceremony Sir Henry Norman spoke warmly of the Exhibition and congratulated all those responsible for its organisation. He emphasised that the Exhibition was calculated to make a very strong popular appeal, yet, at the same time, there was a vast amount which would absorb the interest of the expert.

Referring to the introduction of broadcasting he said that all the difficulties between the companies engaged in the formation of the Broadcasting Company, and the Postmaster-General had now happily been overcome and that nothing beyond a few preliminaries now stood in the way of the introduction of broadcasting. Broadcasting in London would be speedily followed by broadcasting from the Manchester centre, and thereafter from the other six centres into which the country is to be divided.

Speaking later at a luncheon given by the organisers of the Exhibition, Sir Henry Norman, after again congratulating the organisers and community on the excellent work conducted by the Wireless Society of London, said that there were still those who thought that wireless broadcasting was only a passing craze like ping-pong or "put and take," which, given time, would soon die out. These views were not shared by himself. He believed that broadcasting was destined to become as integral a part of our everyday life as the ordinary telephone is to-day. Broadcasting, he said, was no passing craze. For a month or two it would be the general topic of conversation, but in a year or so it would have become so commonplace a necessity that it would cease to be mentioned.

Sir Henry Norman then referred to the misleading statement which had appeared in the daily press regarding the negotiations between the Postmaster-General and the committee of the Broadcasting Company. He thought that in reality the arrangements had been carried through with the most surprising speed, taking into consideration the very many questions which had had to be settled. An admirable scheme had now been devised, and thanks to the energy and care which had been shown by those engaged in the work, the Broadcasting Company had been formed, and the Articles of Association approved by the Postmaster-General.

Sir Henry Norman then referred to the absolute necessity of a first-class broadcasting programme being arranged. He referred to the speech by H.R.H. the Prince of Wales to be broadcasted next Saturday, and concluded with the hope that the final triumph of broadcasting would come when the King addressed the Parliaments of the Empire by such means.

The success of the opening day of the Exhibition might be described as exceeding all expectations. Throughout the day every part of the building was crowded with an enthusiastic attendance. The telephony broadcast transmissions received in the centre of the hall were made audible throughout the building and the quality of the transmissions left little to be desired. This Exhibition will, indeed, be an excellent send-off for broadcasting, and will give to the public the opportunity of an appreciative understanding of broadcasting possibilities.

Below we continue the description of some of the exhibits, accounts of a number of which appeared in the issue of September 30th.

The Ever-Ready Company (Great Britain) Ltd. (Stand No. 11.).

This firm is showing a large assortment of their famous batteries applicable to all wireless purposes. All kinds of various lighting devices are also exhibited, and space does not allow justice to be done to so great a variety of useful exhibits. In particular, however, may be mentioned the type of cell known as UW.1., which is here illustrated. This type of cell is specially applicable to the building up of H.T. units for wireless purposes.

A U.W.1 Cell.

S. G. Brown, Ltd. (Stand No. 43).

The exhibits of Messrs. S. G. Brown, Ltd., consist of radio telephones, loud speakers and microphone amplifiers.

There are three types of telephones. Firstly, the Type "A," which is so well known, and is claimed by the makers to be the most sensitive wireless phone in the world, and which has adjustable magnets. Secondly, the Type "D," a flat disc type of telephone, which is excellent for all-round work, and gives remarkably clear articulation. Lastly, the newly devised Type "F" telephone, which instrument is a cheaper form, and has some novel features in that the case and straps are constructed of aluminium and duralumin, highly polished and with a fine finish, and it has a special form of magnet which gives great efficiency. The total weight is only 6 ozs., and it may be considered the lightest telephone on the market.

The Microphone Amplifier is of great value when used in conjunction with a loud speaker to give increased volume of sound to fill a room.

Two types of loud speaker are exhibited, the large Type H.1. and the small Type H.2. These loud speakers with the improved curved horns are now well known, and their excellent acoustical qualities.

A special Loud Speaking Telephone Set is also being exhibited, consisting of a loud speaker with a trumpet seven feet in length and a special transmitter. These instruments will allow a person to project his voice to a considerable distance, and would enable an orator to address a huge audience in the open air under conditions where his own voice would be almost inaudible. It is claimed that this loud speaking set is the clearest and loudest yet made. The loud speaker is approximately eight times more powerful than the "Brown" Type H.1. Loud Speaker.

General Radio Company (Stand No. 26).

The General Radio Company are exhibiting wireless receiving apparatus of various descriptions, ranging from the small portable crystal sets to multi-valve receivers.

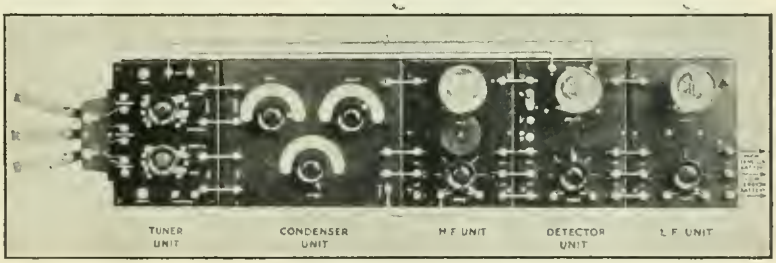
A model of a drawing-room receiver enclosed in a cabinet of period design is exhibited. This includes a loud speaker. Tuning is accomplished by rotating a single calibrated dial. To operate the apparatus, it is only necessary to press a button which controls all five valves, loud speaker, batteries and accumulators.

All parts are enclosed and mounted in cabinets, and all dials for making adjustments are clearly marked to indicate their purpose. The entire assembly of each set is secured to the ebonite panel so that, if desired, it can easily be removed from the cabinet.

The Peto-Scott Co. (Stand No. 16).

The apparatus exhibited on this stand includes a three-valve set built up in unit system from "Peto-Scott" units. The unit parts for building apparatus are supplied complete with full instructions for building and wiring so that the sets may be completed at home. These parts are carefully packed in special boxes.

A little booklet has been prepared by this company explaining the construction of various sets from the parts they supply.



Peto-Scott's Unit Sets.

G. Z. Auckland & Son (Stand No. 46).

This firm exhibits a large and varied selection of component parts, including their well-known Intervalve Transformers, which are wound in layers and spaced to give maximum efficiency, the cores being of Stalloy iron.

The variable condensers shown are of a type built upon aluminium top and bottom plates, thereby making them rigid, with no possiblity of becoming loose. The spacing of the vanes is 0·072 and the condensers are made in four sizes, viz., 0·0002, 0·0003, 0·0005, and 0·001 mfd.

Among other parts exhibited are Duolateral Coils and several types of coil holders, both table and panel, telephone transformers, knobs, dials, detectors, etc.

Complete sets, Receivers, Amplifiers (2- and 3-valve) and Power Amplifiers are also exhibited.

Messrs. Alfred Graham & Co. (Stand (No. 44).

On this stand several new products of this firm, including various forms of the " Amplion" loud speaker, are exhibited.

The " Amplion " is specially designed to be suitable for musical and vocal effects. Types for table and wall fixing are shown and will work in conjunction with any good amplifier. The G-R power amplifier constructed by the firm for this use is also on exhibition, and is adapted to operate on all plate voltages up to 300 volts.

The " Amplion " Loud Speaker.

Two wireless cabinets embodying wireless receiving sets of Marconi manufacture, and also " Algraphone " mechanisms constructed by Messrs. Graham are shown. These are so arranged that the horns or sound amplifiers are employed alternatively, either for the reproduction of gramophone records, or for wireless reception, several interesting features being present in these machines.

Both these cabinets operate with a loop or frame aerial. One of them is arranged with " Electravox " equipment, for the electrical reproduction of music either locally or at a distance. In this instrument, sounds set up by means of reproducers are not directly emitted by a horn or trumpet, but affect a microphonic transmitter of improved type.

Headgear by Alfred Graham & Co.

This is connected with a suitable transformer, and one or more loud speakers, which latter are adapted also for wireless reception.

Additional apparatus in evidence are, intervalve and step-down transformers, and the " Graham " improved headgears which are capable of fine adjustment and are extremely sensitive. Each earpiece in these instruments is adapted to be readily removed from the headband, and may be used independently.

The Automatic Telephone Manufacturing Co., Ltd. (Stand No. 52).

The Automatic Telephone Manufacturing Co., Ltd., of Liverpool, exhibit a full range of practical and well made accessories. Among these are A.T.M. head telephones, which have been designed to meet broadcasting requirements. The method of securing the telephones to the headbands is worthy of note. This permits of instantaneous adjustment, and combined with the absence of weight makes the set extremely comfortable to wear. A.T.M. loud speakers are made in two sizes, the smaller being suitable for ordinary use, and the larger for demonstrations, etc., where greater volume is required. In designing these loud speakers the object has been to secure reproduction of perfect articulation rather than mere volume of sound plus distortion. Variable and vernier condensers, fixed condensers, intervalve,

Telephone Receivers of High Efficiency by the Automatic Telephone Manufacturing Co.

valve telephone and high frequency transformers, wavemeters, buzzers, coil-holders and duolateral coils are included in the exhibit.

A wide range of "Radiak" products, manufactured by Ashley Wireless Telephone Co., Ltd., of Liverpool, are also displayed on this stand, including wireless receiving apparatus. The "Radiak," 1 to 5-valve unit system, will make a great appeal on account of its simplicity and the easy way in which it is possible to add a unit at a time similar in the way one would add to a sectional bookcase. The "Radiak" 5-valve complete unit will be found attractive because of its easy method of operation and adjustment.

Burndept, Limited (Stand No. 12a).

Messrs. Burndept, Limited, are showing a comprehensive range of apparatus finished in high-class style. The well-known Burndept Ultra IV is shown in combination with a tuning panel, which gives every possible variety of circuit by operating three small key switches. An interesting exhibit is the Burndept IV, with a plate-glass back, so that the internal construction may be studied. The well-made components and heavy former bent bare copper wiring are illustrative of the best commercial practices.

A laboratory receiving station is shown, consisting of a Tuning Panel, a Two-Valve Panel (one H.F., one Detector), containing the well-known "Rejector Circuit," described by Mr. Frank Phillips before the Wireless Society of London (see our issue of April 8th, 1922); and a two-valve low frequency amplifier. The three polished mahogany cabinets connected together by short strapping wires are models of luxury.

There is also a Burndept Transmitter in which a single valve, with grid modulation, is used. This apparatus shows signs of careful design in that a plate variometer is provided in order that the output impedance of the valve may be adjusted to the input impedance of the aerial circuit.

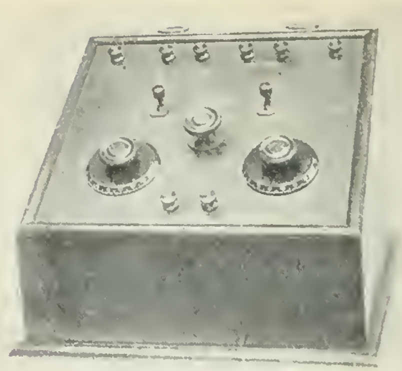
Messrs. Burndept are also exhibiting four newly designed types of Broadcast Receivers.

The "Ethophone" Junior is a simple type of crystal receiver controlled by a single dial. Signals with this little instrument

Automatic Telephone Co.'s new type Loud Speaker.

are said to be loud and clear on a 50-ft. aerial 25 miles from 2 LO. The Burndept Valve Broadcast Receivers are known by the names of Ethophones II and III respectively, being two and three-valve sets, built into desk-shaped cases, having a sloping ebonite instrument board. The valves and also the high tension batteries are contained inside the cabinets out of harm's way.

A useful feature is the provision of separate terminals for loud speaker and head telephones, together with a switch to bring either into operation at will. Low resistance telephones



The Burndept Ethophone II.

and loud speakers are used and a telephone transformer is embodied in each receiver.

Ethophone III is provided with a switch marked "High Power" and "Low Power," which serves to bring a third valve into operation when louder signals are required.

The "Ethophonola" is the Burndept Broadcast Receiver De Luxe, and consists of a four-valve receiver built into a cabinet gramophone case. There are no head receivers, as all sound issues through the doors of a sound chamber. All batteries are self-contained, and it is necessary to connect only to earth and to a short aerial wire.

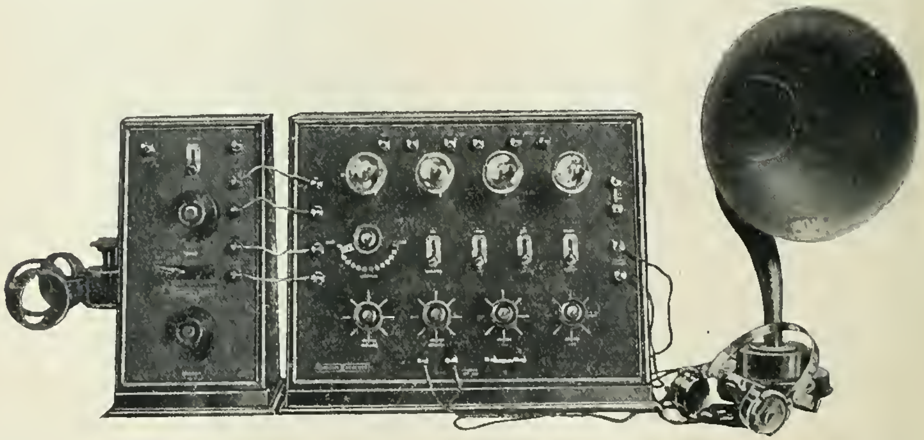
Many excellent accessories are shown in addition by Messrs. Burndept, such as variable condensers, with and without a single plate vernier controlled by a long handle, intervalve telephone transformers, rheostats, valve sockets, etc.

We learn that everything shown by Messrs. Burndept, with the exception of telephones, batteries and valves, is made throughout at their factories in Blackheath, where some 300 persons are employed.

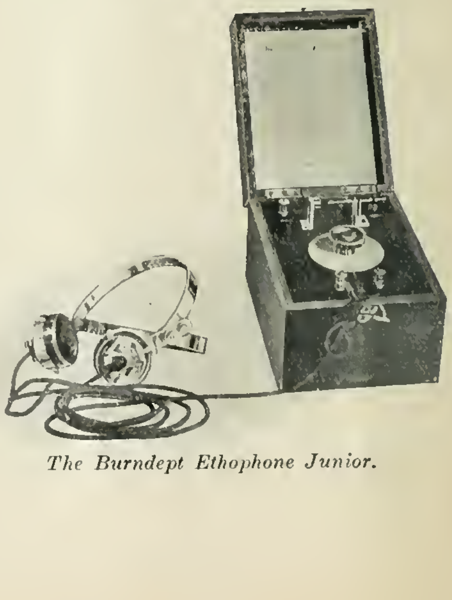
Gambrell Brothers, Ltd. (Stand No. 47).

A range of patented inductances possessing many original features are exhibited by Messrs. Gambrell Brothers, Ltd., for which are claimed the following advantages: Low effective resistance, low self capacity, the coils for broadcast reception having a capacity of 4 cms., greater range of wavelength for given variation of capacity, great mechanical strength and uniformity in size.

A double circuit tuner fitted with two variable condensers and series parallel switch for aerial condenser is an interesting exhibit. The tuner incorporates a patented coil holder



Burndept "Ultra IV" with Loud Speaker.

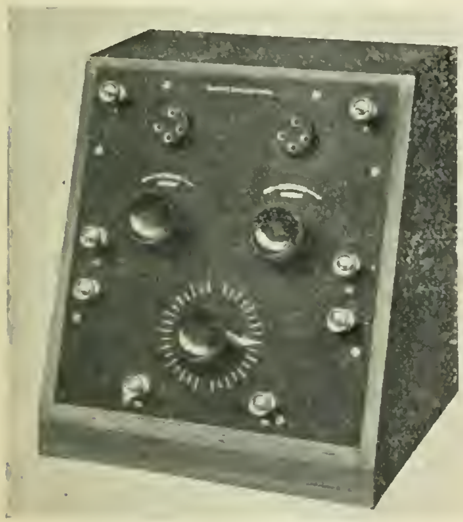


The Burndept Ethophone Junior.

by means of which the coupling between coils can be reduced to zero and even to a negative value. The adjusting handles for the coils are conveniently placed in the front of the instrument and the coils being at the rear, interference caused by the proximity of the hand is obviated. The condensers are also shielded so that the tuning is facilitated.

Another tuner embodying the same features is described as a Type A and is fitted in a sloping cabinet. It is fitted with three variable condensers. The aerial and closed circuit condensers each have a vernier adjustment. The coil holder is conveniently mounted on the top of the instrument. Two switches are provided, one series parallel for aerial condenser and one for single or double circuit working.

A range of amplifiers are exhibited, both high frequency and low frequency, also a low



Detector-Amplifier by Gambrell, Bros. Ltd.

frequency amplifier for attachment to a crystal receiver and a power amplifier for loud speaker.

Receivers are shown for broadcast reception, including a crystal set. A two-valve set in a sloping cabinet, complete with tuner, and a three-valve cabinet containing tuner, amplifier, loud speaker and all necessary batteries.

Hambling Clapp & Company (Stand No. 12.)

A number of wireless accessories are shown here which will appeal to the amateur who wishes to construct and experiment with his own receiver.

The Gambrell Inductance, a type having very low self capacity.

One or two types of valve panels, including H.F. and L.F., are shown.

The single valve L.F. panel is of interest as many experimenters require one stage of note magnification that can be easily placed in circuit, with no alteration to the existing panels.

The two-valve L.F. amplifier is fitted with a special switching device that enables the user to employ either one or two valves, or the detecting valve only, without disconnecting the telephone leads and transferring them to the detector panel.

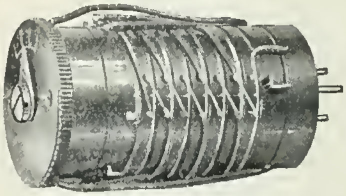
Gambrell Tuner.

A three-valve experimental panel is also shown which provides the experimenter with a panel applicable to any type of circuit; either H.F. or L.F. couplings can be quickly brought into circuit. This panel consists of a mahogany base-board fitted with three ebonite panels containing the necessary terminals for aerial, earth, coils, telephones and batteries.

Amongst other accessories are a new type of valve socket, a new type of valve holder with terminals, and a type of coil holder is designed with a view of reducing the effects of hand capacity while operating. Variable condensers of all types and capacities, H.F. transformers and L.F. transformers are also exhibited.

An exhibit of interest on this stand is a five-electrode valve due to Mr. Pragnell, which was desctibed in the issue of this Journal for June 24th, 1922, page 377.

Various designs of crystal sets known as the O.K. Crystal Sets, are shown and these include one specially intended for the use of scouts.

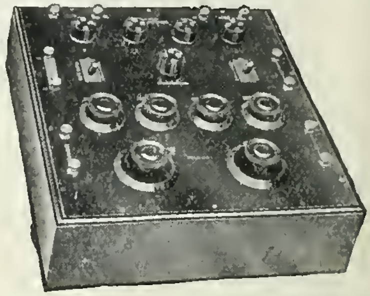


High-frequency Transformer for use over a wide range of wavelengths (L. McMichael).

L. McMichael, Ltd. (Stand No. 38).

This stand is replete with good things for the amateur, experimenter and members of the trade. Among the pieces of apparatus which deserve special attention were the "M.H. type" sets. These sets are of exceptionally fine finish and of compact design. They range from a simple one-valve panel to a four-valve set complete with condensers, filament rheostats, and switching arrangements, so that one, two, three of four valves are available at option.

The "MH 3" and "MH 4" valve sets are arranged so that both high and low frequency amplification are available. The high frequency is obtained by means of special plug-in transformers. The high frequency transformers are available in two types, one of which is the usual circular disc type plugging into a valve holder socket, eight of these being necessary for a complete set for all wavelengths. As an alternative to this, Messrs. McMichael, Ltd., have recently brought out an improved high frequency transformer unit with switching arrangement so that four ranges are embodied in one piece of apparatus, thus obviating the trouble of constantly pulling in and out the small high frequency transformers when wavelength changes are made. With these new type high frequency "plug-in" units two pieces of apparatus

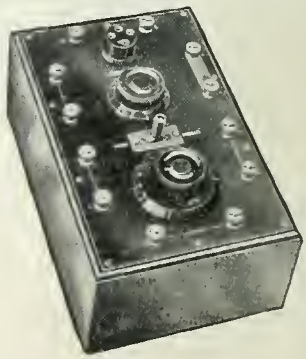


Four-valve Receiver, Type M.H.4.

only are required to cover all wavelengths from 300 metres to 25,000 metres, each piece of apparatus having foui stud switches of unique design.

It might be mentioned that these sets are manufactured at the new works at Slough, which have recently been taken over in association with Messrs. B. Hesketh, Ltd.

A feature of the stand is a specially compact and well finished set of "Radio Blocks," these being an adaptation of the unit system.



Detector Receiver Panel, Type M.H.1.

For appearance and general finish they leave nothing to be desired and we understand that for efficiency they are ahead of anything yet tested out in this line. The block itself consists of a simple machined aluminium box with ebonite top and terminals, and whether the unit be one for a high frequency, a rheostat, a detector or one for low fequency, the design, size and general appearance remains precisely the same. Any combination of valves up to even 8 or 9 can be made in a few moments and there is a special system of connecting the blocks which has hitherto not been used and which is thoroughly

Detector-Amplifier, Type M.H.3.

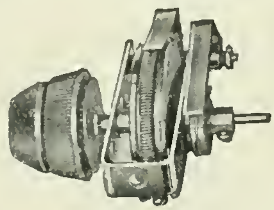
protected. It is claimed that for absence of noise when using a number of valves, these radio blocks are unequalled. A loud speaker connected to seven of these radio blocks, three high frequency, one detector and three low frequency, gives exceptionally fine and loud signals, but when no signals are coming through there is a quietness and absence of extraneous noises which is unparalleled.

Messrs. McMichael, Ltd., have been well known for a considerable time past for their very large stocks of ex-Government goods and it goes without saying that these were

Two-Valve Receiver, Type M.H.2.

well represented on their stand. The high-class workmanship put into ex-Government wireless apparatus needs no comment, and before these stocks are exhausted all experimenters would be well advised to avail themselves of the low prices ruling to obtain such useful instruments as the Mark III crystal tuner complete with head telephones (new), and aerial wire; the Townsend Wavemeter ranging from 300 to 4,000 metres; C Mark III amplifier, 50-watt Trench Set, which is both a spark transmitter and receiver, and the B Mark II receiver amplifier, which, as readers will already be aware, is the subject of a very interesting competition for amateurs. Messrs. McMichael, Ltd., are offering a prize of £50 and various consolation prizes of smaller sums for the best and generally most efficient conversion of this set, which is at present designed for short waves, so that normal wavelengths may be used. There is an opportunity for those who are interested to show their ingenuity and recoup themselves handsomely.

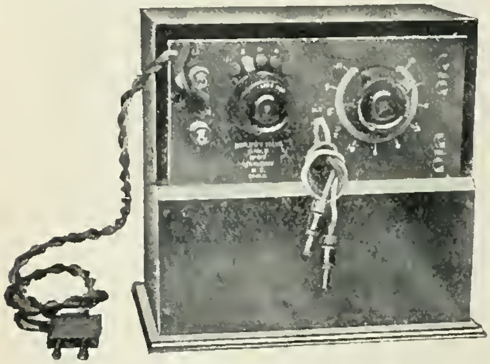
Brown's telephones were strongly in evidence, and the experimenter will be well advised to purchase this sensitive headgear at the price at which they are offered. Although a very large number were disposed of by the



New type of Variable Filament Resistance (L. McMichael).

Government and have been retailed, this supply is gradually coming to an end. It should be pointed out that two kinds are available. Messrs. L. McMichael are making a special feature of those which have been actually reconditioned by the makers, Messrs. S. G. Brown, Ltd. They hold the entire supply of these and it is obvious that telephones which have been through the makers' hands for readjustment and fitting with new diaphragms are the most desirable for the amateur to purchase.

Of general apparatus and accessories space does not permit a full description, but it would appear that everything without exception which is of use or interest to the amateur and experimenter, is available on this stand. One filament rheostat particularly stands out far beyond the average. This is of unique design and provides for vernier adjustment by a very simple method. The experimenter who knows will not need to be reminded of the importance of the fine adjustment of his filaments. The *C.W. Mk III* 2-valve receiver amplifier, suitable for all wavelengths from 300 to 3,000 metres, is one of the many ex-Government sets particularly useful for telephony reception on short wavelengths.



Specimen of Ex-Government Apparatus shown on Stand No. 38.

Metropolitan-Vickers Electrical Co., Ltd. (Stand No. 33).

The "Cosmos" Radiophone Crystal Set and the "Cosmos" Radiophone Valve Set are shown on this stand. These sets are designed for the reception of broadcasted telephony. The aim has been to produce the most efficient sets possible for this particular purpose, free from all unnecessary complications, and as a result, the sets are exceptionally compact and simple, and no technical knowledge is required for their operation.

The Crystal Set is applicable for broadcasted speech or music within distances of 10 miles of a broadcasting station, or considerably further under favourable conditions.

The Valve Set is suitable for longer distances up to 50 miles or more, and by the addition of

Chloride 25-Cell, 50-volt. R.G. Type H.T. Battery.

A Metropolitan Vickers Crystal Receiver.

a note-amplifying attachment the range may be increased to 200 miles with head-telephones, or a loud speaking telephone may be used at distances up to 50 to 100 miles. An attachment is also shown by means of which the current required for the filaments and plate circuits of the valves may be derived from the electric lighting supply wherever a D.C. supply is available, thus dispensing with the use of batteries.

A feature of the exhibit is a scale model of the proposed transmitting aerial at the Company's Trafford Park Works, and of the adjoining research buildings and laboratories in which wireless experimental work is carried on.

The Chloride Electrical Storage Company, Ltd. (Stand No. 30).

Exide Batteries made by this well-known firm are the principal exhibit of this stand.

A range of types of batteries for every wireless purpose are to be seen. A large series of low voltage Exide Batteries in celluloid boxes, also various high voltage sets of Exide Batteries. These comprise complete 24, 30, 50 and 60-volt sets, compactly fitted in wooden trays.

Examples of individual H.T. cells are shown in ebonite, glass, and celluloid containers.

Exhibits of special interest include 6 volt 40 ampere hour and 2 volt 40 ampere hour celluloid accumulator sets, which are of an unspillable type.

The special H.T. battery, the long thin plates of which are contained in a number of glass test tubes mounted on a wooden framework, is also an exhibit of interest.

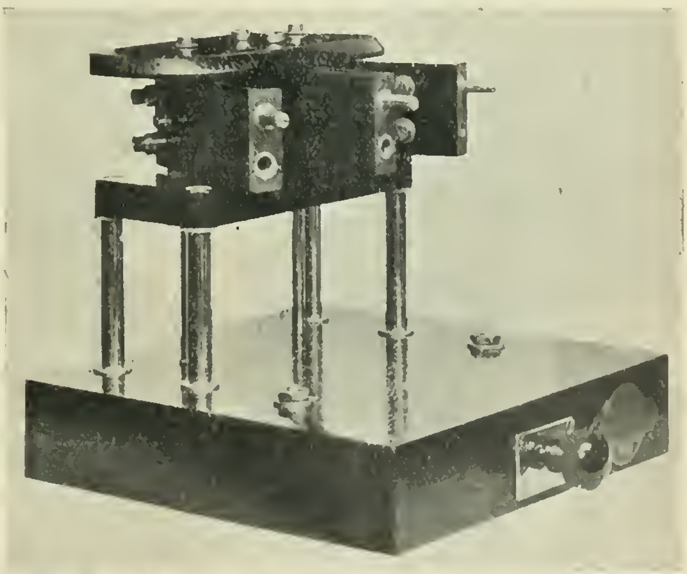
Chloride 30-Cell 60-volt AYGI type batteries.

Chloride 12-Volt. H.T. Battery with strong glass Test Tube Containers.

The Telephone Manufacturing Co., Ltd., (Stand No. 20).

A " De Luxe " cabinet set is exhibited by this firm, which has been specially designed to meet the requirements of efficiency and simplicity of control. The set is self-contained in the cabinet which is designed to harmonise with other prices of furniture.

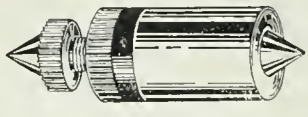
The instrument comprises a valve and crystal set, so arranged that, by the manipulation of



Igranic " Micro-Adjuster " coil holder with Vernier Adjustment.

a switch, either can be brought into operation as may be desired. Two stages of audio-frequency amplification are provided. A crystal detector of cartridge pattern is fitted in duplicate.

The loud speaker and requisite batteries are mounted in the cabinet.



"T.M.C." Cartridge Crystal Detector.

Mullard Radio Valve Co. (Stand No. 41).

The Mullard Radio Valve Co., Ltd., are well-known in wireless circles as the manufacturers of the famous "Ora" valve. The name "Ora" is derived from the unique properties of this valve as an oscillator, rectifier and amplifier. This triple function enables the one type of valve to be used for the three different purposes on any valve set, thus saving cost and eliminating difficulty in replacements.

An "Ora" Valve.

Apart from the "Ora" valve, many other Mullard valves are showing on stand No. 41. Transmitting valves, rectifying valves and receiving valves in large and small sizes, including the high power silica valve manufactured under licence from the Admiralty, are all shown and cover the whole range of wireless valve manufactures.

One specially interesting feature of the Mullard valve display is the range of valves with low temperature filaments. These are a new development which should arouse very considerable interest in view of their great advantages for all valve purposes. These valves have been successfully made by a new patented process whereby a high electron emission is obtained with a low temperature filament. The two great advantages are : (*a*) Low filament current consumption, this being approximately half the power required for a similar high temperature filament valve. The L.F. 0/100 type takes about 18-20 watts filament consumption—the normal high temperature filament valve of this type taking 36 to 40 watts. (*b*) Long life, which follows from the low temperature of the filament.

Other Mullard products comprising valve sockets and bases, condensers, grid leaks, anode resistances, telephone head-sets, H.F. and L.F. transformers, etc., are on view. Some of these are well known to the wireless public, others are being introduced as the latest products of the new Mullard factory.

The Marconi Scientific Instrument Co., Ltd. (Stand No. 32).

This Company display a comprehensive selection of their manufactures both for the amateur and commercial markets.

The apparatus and equipment represents a high standard of design and workmanship.

A special feature of the exhibit is the well-known Marconi Scientific Unit System, which has been modified to conform with the recent regulations made by the Post Office authorities.

The modifications are confined to the high-frequency stages (Unit 3) and constitute the use of tuned anode circuits which give the maximum of amplification possible throughout the full range of wavelengths in general use. Reaction is secured by means of a magnetic coupling which links the detector plate circuit to the plate circuit of the first high-frequency stage.

Special advantages are claimed for this arrangement compared with the usual closed circuit and its reaction arrangement. These include :—

1. Easy manipulation.

2. The tuned anode coils are calibrated for all wavelengths ; thus the instrument

serves the additional purpose of a wavemeter.

3. There is a minimum transference of energy to the aerial when autodyne reception is being employed.

4. The receiver is extremely silent in working, and is affected to a remarkably small degree by atmospherics.

A novel feature included in a receiver is provided by the type M.42 Rotary Tuner with unified control of reaction and tuning, which includes an automatic wavelength indicator.

Many types of receivers and amplifiers are also shown; one of interest being an

An Exhibit on Stand No. 30.

A "Marconi Scientific" Unit Set.

eight-valve receiver attached to a small loop aerial for reception of broadcasted concerts and amateur transmissions.

Two transmitters are shown, each being suitable for telephony, C.W. and I.C.W. telegraphy.

Both these transmitters employ the "choke control" method of modulation. Type No. 1 derives the high tension supply to the valve plates from a battery of secondary cells, and is normally rated at 10 watts. Type No. 2 is operative with input powers between 10 and 50 watts; the plate supply being derived from a Rotary Transformer giving 1,000 volts and 75 milliamps, running off a 12-volt accumulator battery.

The following ranges are claimed for working over average country:—Speech, 50 miles; C.W. Telegraphy, 120 miles; I.C.W. Telegraphy, 70 miles; based on the assumption that a three-valve receiver with one stage of high frequency amplification is used for reception at these ranges.

An Independent Oscillation Generator and Heterodyne Wavemeter combined, having a wave range of 300 to 600 metres, is exhibited. This little instrument may be used for the calibration of both transmitting and receiving apparatus, and it should represent a sound investment for wireless societies and others possessing transmitting licences.

Another interesting piece of apparatus is a wavemeter, having a range of 100 to 20,000 metres, and these wavemeters of this type carry the National Physical Laboratory certificate.

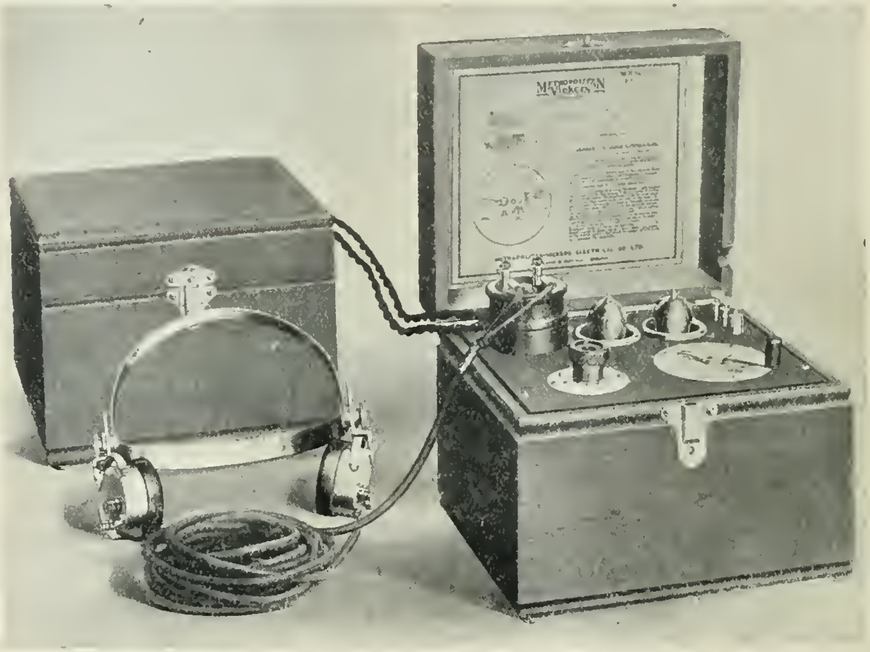
Other phases of the Company's activities in the commercial telegraph and submarine cable worlds are indicated. The process of

"M.42" Type Rotary Tuner.

Wheatstone strip perforation with the Marconi-Gell Perforator is shown in operation. One of the most interesting features in this section is the Marconi Undulator, which is used for high speed reception on the transocean circuits.

The "Aristophone" Loud Speaker is shown in a separate mahogany case for drawing-room use with "Aristophone" panels.

To those who prefer greater scope for trying alternative methods of connection, and who wish to construct their own sets without going into an unnecessary amount of bench work, the "Radiocraft" exhibits will appeal.



Metropolitan-Vickers Valve Receiver.

Radio Communication Company, Ltd. (Stand No. 45).

Exhibits which hint at activities outside "Broadcasting" are shown on this stand. These include a complete ship's equipment as fitted by the Radio Communication Co. An idea may be gained of the dimensions of Elwell land stations by a comparison of some large insulators with those used on aerials for receiving broadcasting.

A type of receiver exhibited is that known as the "Panel-type Aristophone," in which all the advantages of the "Aristophone" are obtained without costly cabinet work of the latter instrument, and which may, moreover, be purchased in several units as required. The first unit is a complete crystal receiver, and subsequent panels add valve amplification. These panels are of high grade design and finish.

Panels for a large number of purposes are standardised.

Accessories deserving of attention are the Elwell amplifying unit, bull-dog grip fittings for telephone cords, plugs, and

"Polar" Receivers, Types 32 and 35.

jacks specially designed for wireless purposes; an adaptor for making use of a gramophone as a loud speaker; air-space coils and a moulded ball for variable couplings.

Western Electric Company Ltd. (Stand No. 39).

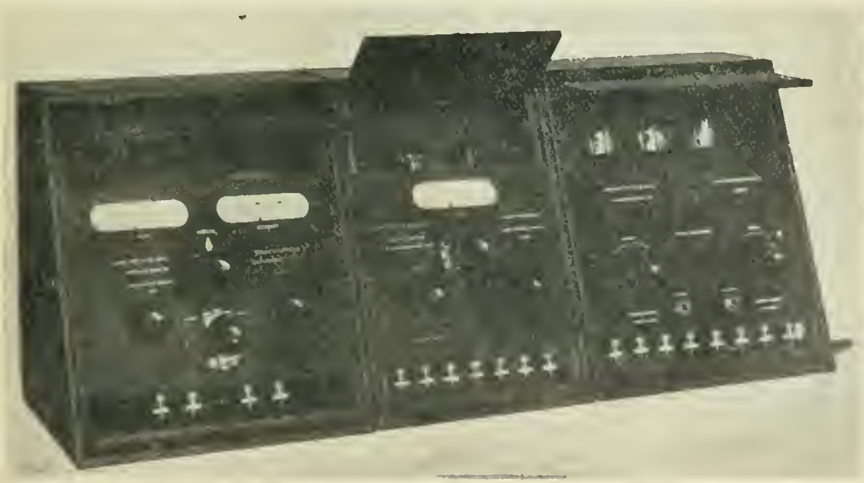
A feature of the valve apparatus shown on this stand is that all valves used are enclosed in the sets, and thus protection is assured against accidents and against dust, while the main feature of the apparatus is the simplicity of adjustment and operation. No filament adjustment is necessary at any time, and a key switch is provided in each set to control the filaments.

All valve receiving apparatus is mounted in polished mahogany cases, and the fittings are of oxidised brass.

A Single-valve Detector and Tuner is shown contained in a mahogany case, in which there is also provision for the inclusion of double head receivers. The valve filament can be seen through a mica window and a ventilation disc is provided to ventilate the interior of the case. At one end of the case there is fitted a small card with particulars of the various wavelengths, together with the respective condenser settings, and above and below are the variable condenser handles. The lower handle is set to the given wavelength of the transmitting station it is wished to receive and the upper handle is used for the finer adjustment. Thus the set is simplified by the use of only one handle for fine tuning. The valves used in this detector are made specially to Western Electric specifications.

"Polar" Cabinet Set.

The voltage on the filament is 4 volts, with a current consumption of 0·7 of an ampere, while the voltage on the plate is 30 volts with a current consumption of one-half of a milliampere.



A Combined Receiver shown on Stand 45.

The range of wavelengths of this receiver is approximately 300 to 500 metres with an aerial 30 ft. high and 100 ft. long. Two tuned circuits are employed.

Low frequency amplifiers are shown in two patterns. The first contains a one-stage amplifier with a switching key which enables the input to be switched directly to the output without passing through the amplifier. This is a convenience when desiring to reduce amplification without altering connections. The second contains two stages of amplification, and a switching key which enables one or two to be used as required without change of connections. The key, in its central position, disconnects the valves in both cases.

The Western Electric Loud Speaking Equipment consists of the Western Electric No. 44002 Loud Speaking Receiver and Amplifier, these two components being known, and supplied together, as the Loud Speaking Equipment.

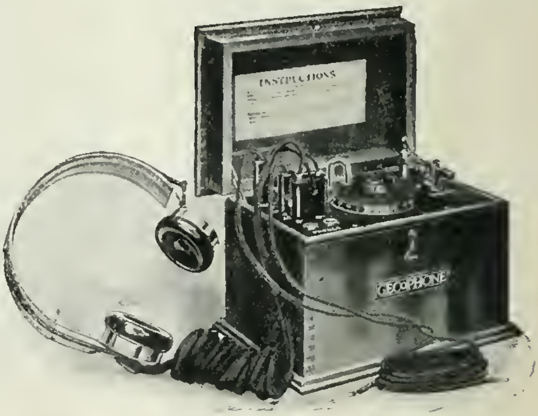
The Amplifier is specially designed for use in conjunction with the Loud Speaking Receiver and is contained in a similar box to that of the amplifier previously described. A separate key controls the filaments and is situated at one end of the case, together with a five-stop switch for the adjustment of the volume of sound.

The valves used in this amplifier are Western Electric Type Valves No. 216A.

The Western Electric Cabinet Set, Model 1 Cabinet Receiving Set, is shown, which is on Chippendale lines, 4 ft. 6 ins. wide and 3 ft. 2 ins. high.

This cabinet contains the complete equipment for the reception of wireless broadcasting, and the only connection necessary is the earth lead.

There are three divisions in the cabinet. The centre compartment contains a frame aerial, which can be rotated through 350 degs. by means of a small handle beneath the cabinet, and a loud speaking receiver is installed inside the frame aerial with the horn concealed. The left-hand compartment contains the receiving set, a single stage low frequency amplifier, and the loud speaking amplifier. The right-hand compartment contains the batteries and accumulator.

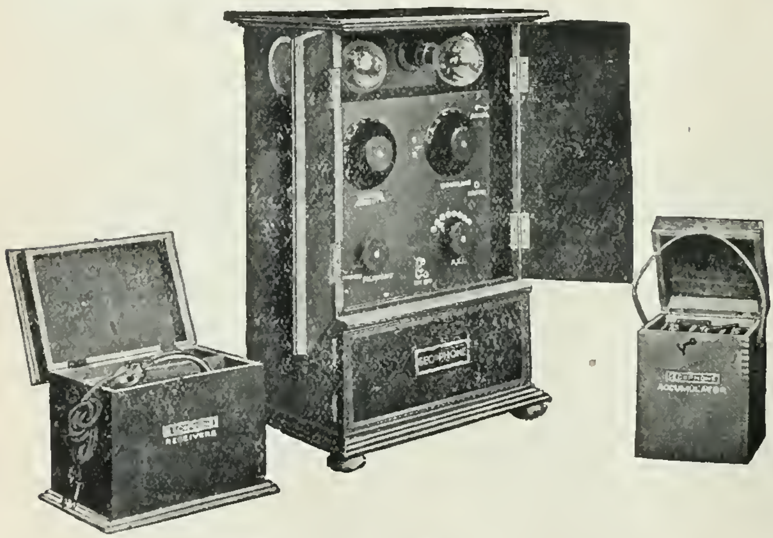


"Gecophone," Crystal Set, No. 1.

The Western Electric Model No. 2 is another finely constructed instrument.

The upper compartment contains a loud speaking receiver. The lower left-hand compartment contains a single-valve detector and tuner, a single stage low frequency amplifier and loud speaking equipment.

This cabinet is for an external aerial and external batteries, and has a terminal block for external connections.



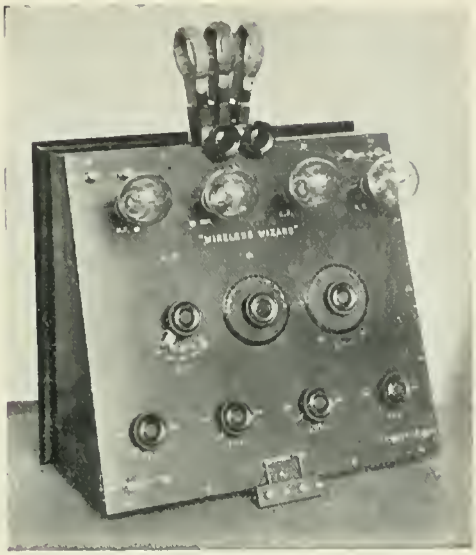
General Electric Co.'s Complete Two-Valve Receiver.

The M.O. Valve Co. Ltd. (Stand No. 28).

This company is exhibiting a comprehensive series of all types of their transmitting, receiving, rectifying and amplifying valves, ranging from the familiar V.24 type receiving valve to the latest type of high power transmitter.

Transmitting valves for the amateur are also a feature.

In conjunction with this firm the General Electric Co., Ltd., of Magnet House, Kingsway, are showing on the same stand their latest and most efficient wireless receiving apparatus, embodying two types of crystal receiving sets for the reception of broadcasting programmes, with an approximate range of 15 miles respectively, and an exceedingly high-class and well designed two-valve set for the reception of signals within a range of approximately 100 miles. This set is fitted with sockets for the addition of a coil for any other wavelengths for which broadcasting may ultimately be allowed. The whole set is supplied complete with the necessary batteries and phones. A series of panels, aerial fittings and sundries will also be shown.



Tuner-Amplifier shown on Stand No. 54.

"Gecophone" Crystal Set, No. 2.

Stanley Prince and Co. (Stand No. 54).

Apparatus known by the trade name of "King Radio" is shown on this stand. There is a two-valve receiver of attractive design. A crystal set and a one-valve set are also shown, each set being available complete with all the accessories necessary. Three and four-valve sets, termed the "Wireless Wonder" and "Wireless Wizard" respectively, are the two principle exhibits.

Mitchell's Electrical and Wireless, Ltd. (Stand No. 21).

For some time back this firm has specialised in high tension generators and manufacture several sizes from 50 to 750 watts, and 300 up to 2,000 volts. All sizes are made either self or separately exciting.

A new coil-holder and mounting for "Lokap" coils is exhibited, so that amateurs who wish to make up their own coils on the "Lokap" machine will have no difficulty in arranging an excellent three-coil tuner.

A speciality of cabinet receiving sets of both crystal and valve types are shown, complete with telephones, in polished mahogany cabinets, and the only terminals are the aerial, earth and batteries.

In addition to the above the manufactures of this firm include valve apparatus on the unit system for experimental work, and a special tuner for broadcasting wavelengths arranged so that telephony can be received with the greatest efficiency.

Automatic Wireless Reception

By W. D. Owen, A.M.I.E.E.

It would appear that the application of time switches to wireless reception is a logical step in the development of automatic electrical apparatus; yet, so far as the writer is aware, no mention of such application has hitherto appeared in the technical or lay press.

A receiver that is entirely automatic in operation must have many uses apart from the obvious one of enabling time signals to be taken by anyone unacquainted with wireless.

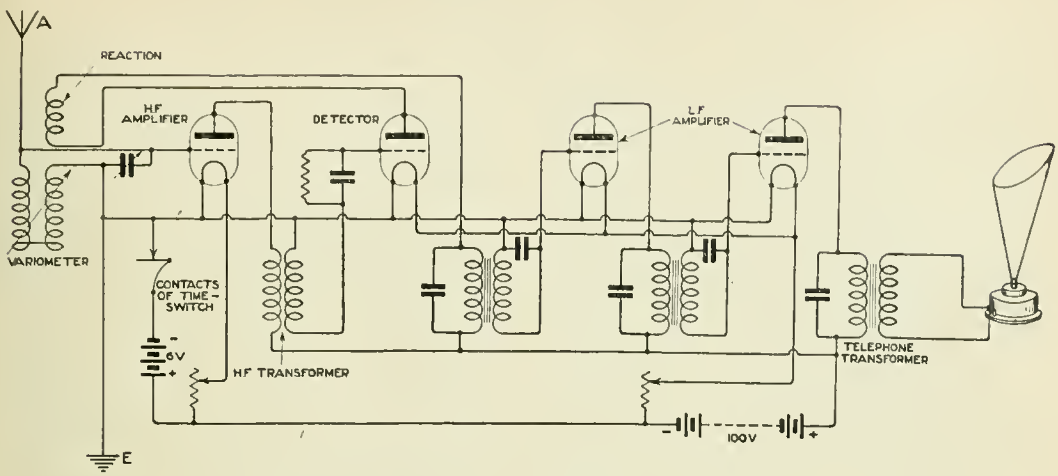
The apparatus described in this article grouped together for the purpose of illustration.

The following description of an automatic installation that has been in successful operation for several months may, therefore, be of general interest, as it may prove to be the first of its type.

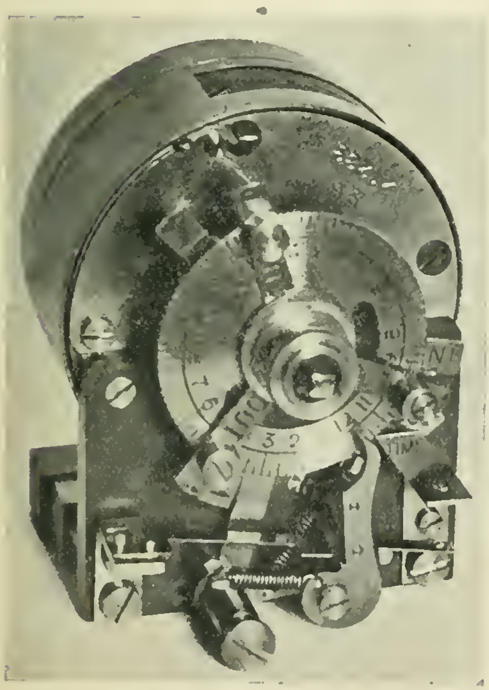
It commences its day's work at 9.15 a.m. with the 0815 meteorological report from Eiffel Tower. Then, at 11.40 a.m., the morning time signal at 1044 G.M.T. comes in. Again, at 8.30 p.m., the French and Belgian meteorological report (1930 G.M.T.) announces itself, and on each occasion the apparatus obligingly switches itself off at the termination of the message and remains inoperative until the next one comes along, when the switch automatically closes and the valves light up, whether there be an audience or not.

It is but a simple step from the reception of broadcasted time signals to the reception of broadcasted telephony; and it is probable that, by the time these lines appear in print, the English and Dutch concerts may be similarly received. There is no technical reason why this is not already an accomplished fact; but it involves the duplication of apparatus to an extent which prudence has hitherto forbidden.

The results of the writer's experiments show that it is possible to devise wireless receiving apparatus which—when once set up, tuned and



The circuit used, which is a modified French Amplifier.



The Venner Time Switch.

The apparatus used in these experiments consists of a simple tuner adjusted to a fixed wavelength of 2,600 metres for the reception of Paris spark signals, a multi-valve amplifier, Brown's loud speaker, and a special Venner time switch illustrated on this page.

The aerial loading inductances are arranged on the variometer principle and are adjusted to receive FL with the minimum value of shunted capacity. The detector-amplifier is a modified French military model L1 which, since the photograph was taken, has had two high-frequency stages removed to accommodate the time switch inside the case. This leaves four valves, one for high-frequency amplification, one for detection and two for note magnification. The circuit is given above.

The signal strength with this arrangement (and reaction almost to the point of oscillation) is such that it is a sore trial to the ears of any but a wireless enthusiast to be in the room when the set is in operation—Paris being about 700 miles distant. The aerial is a single wire of regulation dimensions, directional as regards Paris.

The time switch illustrated was specially made for the writer by Venner's, Ltd. Its function is to close the filament circuit for a predetermined time interval at certain times of the day, both the time interval and the times being subject to control. The switch illustrated completes the cycle of operations three times every twenty-four hours.

adjusted—requires no attention whatever, beyond winding up the spring of the time switch and changing the accumulators, say, once a fortnight.

The Experimental Licence

The Post Office Point of View stated at the Meeting of the Wireless Society of London.

As previously announced in this Journal, the matters which were due for discussion at the meeting of the Wireless Society of London, held on Wednesday, September 27th, included, in particular, broadcasting and the position with regard to the issue of experimental and broadcasting licences by the Post Office authorities. Whilst the discussion at that meeting will be fully reported in a subsequent issue of this Journal, it may be of interest here to give briefly the salient points brought out in a speech made by Mr. E. M. Shaughnessy of the General Post Office. Mr. Shaughnessy emphasised the necessity for the Post Office to exercise control over the issue of licences in order to safeguard the broadcasting scheme from the chaos which might result from the careless use by totally inexperienced amateurs of receivers capable of oscillating the aerial and thereby causing interference. With this object in view it has been decided that "experimental" licences will only be issued to serious experimenters and the Post Office authorities responsible for the issuing of licences will endeavour to discriminate between those who are "proper persons" to be granted licences to conduct experiments and those who are merely interested in reception of the broadcasting to whom broadcasting licences will be issued.

Mr. Shaughnessy assured the meeting that the Post Office was in no way antagonistic towards the activities of amateurs and that the issue of experimental licences would be made on as generous a scale as was compatible with safeguarding the use of the aether for the general public. Whereas it had recently been proposed by the Post Office to restrict the experimenter as regards the type of circuit which he should employ, it is now decided that the experimenter will be free to use various types of circuit for all wavelengths except the wavelengths allotted for broadcasting and over this band it is stipulated that no circuit capable of oscillating is to be employed.

We feel sure that the attitude of the Post Office will be accepted as a very reasonable one, provided, of course, that the issue of "Experimental" licences is granted on a very generous scale. If, however, the stipulation is to be made that the would-be experimenter must first have had considerable experience in wireless, it is difficult to see how this will be received by the large number of future experimenters who up till now have not had the opportunity to acquire any practical experience. Perhaps, however—and this is put forward as a suggestion—the good behaviour and also the tuition of would-be experimenters, if guaranteed by a wireless society or responsible individual, might be accepted as meeting the requirements of the Post Office in their very natural and desirable efforts to maintain order in the aether.

H.S.P.

The Wireless Society of London

An Important Announcement.

The advent of broadcasting has introduced with it certain necessary changes in the legislation which will affect to a greater or lesser degree every user of wireless telegraphy.

In particular, the effect of the new Post Office Regulations will be to make a distinction between the broadcaster and the experimenter. Hitherto all amateurs have been classed by the Post Office as experimenters, but in future there is to be an additional class, termed the broadcast licence holder, who will be granted a licence which will not give authority to experiment.

In connection with the broadcast user of wireless an important announcement is about to be made by the Wireless Society of London. Broadcast licence holders will be specially catered for by the Society and special lectures and instruction will be given to those who may desire to acquire sufficient knowledge of the subject to entitle them to obtain an experimental licence. The details of this arrangement will be published shortly. In the meantime, it would be furthering the cause of amateur wireless to make it public that the Wireless Society of London and the affiliated Societies will welcome "broadcast" licencees, and will do all that is possible to assist them wherever the desire exists to go further and join the ranks of the experimenter.

Notes

Successful Railway Experiments.

Research scientists have been conducting experiments in America with a view to establishing a system of telephonic communication with moving trains on a scale much larger than any previous scheme. Although the developments are still in the experimental stage it is now said by the railway executives that there is little doubt as to the ultimate success. The chief difficulty is interference, but many of the larger companies are sufficiently satisfied to introduce on their fast trains a wireless telephone service as an auxiliary system. Plans are now being made, and it is expected that when experiments are complete the system will be introduced on all the more important fast trains throughout the country.

Canadian Train Receiving Set.

An indication of the development of the installation of radio on trains is revealed by the fact that the annual livestock exhibit train which tours Manitoba for the benefit of farmers has now on board a receiving set for the purpose of distributing news. Enthusiasm among amateurs is growing in Canada, and considerable quantities of apparatus are being sold.

Successful Demonstration at Dereham.

At a Y.M.C.A. fête at East Dereham, Mr. H. Jewson, in whose grounds the function was held, was mainly responsible for a successful wireless demonstration. Messrs. Hobbies, Ltd., whose works are at Dereham, produced a pair of 70-ft. lattice wood masts, and erected a receiving station with apparatus in a summer house. During the afternoon parties of people were admitted to listen to time signals, messages from ships, coded messages, amateur transmissions and concerts.

The Greenwich Wireless Society.

Hon. Secretary, Mr. W. G. Kimber, 39, Bargery Road, Catford, S.E.6.

Owing to the kindness of Messrs Burndept, Ltd., the above Society will now hold the first meeting of the session at "Eastnor House," Tranquil Vale, Blackheath (Burndept Ltd.), on Saturday, October 7th, 1922 and not on Tuesday, October 3rd, as stated in a previous issue of *The Wireless World and Radio Review.*

All members and intending members are specially asked to attend, as several matters of importance are to be discussed.

Death of Mr. L. H. Walter.

Mr. L. H. Walter, who died a few days ago, was keenly interested in the scientific development of wireless telegraphy. During the Great War he translated a number of books dealing with the subject for the Air Ministry. He was the editor of "Science Abstracts" for many years and published a number of papers on electrical matters in the proceedings of the Royal Society and other journals.

Mr. Walter, who was the younger son of the late Mr. D. H. Walter, was educated in Hanover and at Trinity College, Cambridge. He took honours in the Natural Science Tripos, worked in the laboratory of Sir Alfred Ewing, and was experimental assistant to Sir Hiram Maxim. He was a member of the staff of the Institution of Electrical Engineers.

Use of Coils as H. F. Transformers.

A correspondent, Mr. A. S. D. Kennard, A.C.G.I., points out that he finds it very satisfactory to use Burndept or other similar type of coils as H.F. transformers. He uses a two-coil holder and the usual condenser. If a three-coil holder is used, then the reaction coil may be coupled to the H.F. coils, thus decreasing risk of radiation and causing interference.

Weather Reports from Greenland.

Investigations are being made by Danish authorities as the result of which it is hoped to establish a wireless weather station in Greenland. In the compiling of weather reports information from Greenland is much desired, and if the new station comes into being data of the highest value in forecasting will be available.

Marconi Concession in Austria Ratified.

The Reparations Commission having ratified the Austrian Government's concession to Marconi's Wireless Telegraph Company, the final documents relating to that concession have been signed and are now in London.

By this concession the Marconi Company is given the sole right to erect, and to work for 30 years, wireless stations for public traffic between Austria and all other countries.

Demonstration at Brighouse.

Members of the Brighouse Wireless Society gave a demonstration at the exhibition of students' work which was held at the Brighouse (Yorks) Technical Schools.

Direction Finder Demonstrated.

Capt. H. de A. Donisthorpe, of the Marconi International Marine Communication Company, conducted a private demonstration of the direction finder at the Central Station Hotel, Newcastle.

A number of shipowners and others present were highly interested.

The value of the marine direction finder as an aid to navigation has been well proved, and that value is now growing rapidly, especially since the chief maritime countries have commenced erecting special wireless "beacon" stations. These stations, situated at selected points, operate their transmitting gear during fog for the special purpose that ships fitted with direction finders may be able to take bearings on them.

Highgate Society Public Demonstration.

On Saturday, Oct. 7th, the Wireless Society, of Highgate, will give a public demonstration. Boy Scouts in uniform will be admitted free to hear the Prince of Wales' broadcasted speech.

Dissolution of Partnership.

Mr. Jas. Griffin, of the Star Delta Wireless Supply Company, points out that although he has dissolved partnership with Mr. Nicholl he is carrying on business alone under the same name.

The Wireless Society of London.

The fiftieth Ordinary General Meeting was held on Wednesday, September 27th, at 6 p.m., at the Institution of Electrical Engineers, Victoria Embankment, London.

After the minutes of the previous meeting had been read and confirmed, the President expressed regret that, owing to indisposition, Signore Marconi, who had hoped to be present to address the meeting, was unable to attend. The President then referred to various matters of business which formed the subject for subsequent discussion at the meeting. The subjects dealt with included in particular the question of broadcasting and the effect of recent regulations of the Post Office Authorities on the granting of amateur and experimental licences. (For a full report of the discussion at this meeting, see a subsequent issue of this journal.)

At the conclusion of the discussion the President announced that the following had been duly elected to membership of the Society :—

Members : Albert G. Foster, Douglas Neill-Keith, Eric E. Hart, Frank A. Greene, F. N. Nichols, William Monro Smith, Horace Freeman, Herbert W. Tomlinson, Philips Keston Turner, Arthur C. Chatwin, Lawrence L. Sims, William H. Taylor, Maurice C. J. Lloyd, Charles Cooper, Bernard J. Axten, Robert J. Sawbridge, William J. Rickets, Walter Mossop, Horace A. Thomas, Alexander C. Dixon, Oscar F. Brown, Norman F. Edwards, Cyril Midworth, N. Pensabene Perez.

Associate Members : John M. Skelhorn, Herbert Wright, Arthur J. Jacob, Stanley T. Taylor, William B. Irvin, Viscomte J. de Sibour, Trevor J. Pavey.

Foreign Member : J. Roussel.

The following Societies were accepted for affiliation :

Wembley Wireless Society.
Ilkley and District Wireless Society.
Middlesbrough and District Wireless Society.
Ilford and District Radio Society.
Shrewsbury and District Radio Society.
Ramsgate, Broadstairs and District Wireless Society.
Redhill and Reigate Wireless Society.
Durham City and District Wireless Club.
Smethwick Wireless Society.
Bishop's Stortford Wireless Society.
Radio Club de Brussels, Belgium.
Malta Radio Society.

The meeting adjourned at 7.35 p.m.

Calendar of Current Events

Friday, October 6th.

Belvedere and District Radio and Scientific Society.

Lecture on "Construction of Society's Apparatus" (third lecture of series), by Mr. S. Burman.

Saturday, October 7th.

Greenwich Wireless Society.

First meeting of session. At Eastner House, Tranquil Vale, Blackheath.

Sunderland Wireless and Scientific Association.

At 7.30 p.m. at Technical College. Annual Meeting and Presidential Address.

Sunday, October 8th.

Daily Mail Concert from the Hague, **PCGG**, 8 to 9 p.m. B.S.T., on 1,085 metres.

Monday, October 9th.

Ilkley and District Wireless Society.

At 7.30 p.m. At Regent Café. General Meeting, followed by lecture on "Capacity and Condensers," by Mr. E. Stanley Dobson.

Wireless Society of Hull.

Lecture on "Calculation of Inductances," by Mr. Hy. Strong.

Borough of Tynemouth Y.M.C.A. Radio and Scientific Society.

7.30 p.m., Buzzer Practice. 8 p.m., lecture on "Short Wave Receivers," by Mr. W. G. Dixon.

Ipswich and District Wireless Society.

At 8 p.m. At 55, Fonnereau Road. Lecture on "Matter and Energy," by Mr. R. Stanley Lewis.

Tuesday, October 10th.

Transmission of telephony at 8 p.m. on 400 metres by **2 MT** Writtle.

Wednesday, October 11th.

Redhill and District Y.M.C.A. Wireless Society.

At 111, Station Road, Redhill. Lecture on "Condensers," by Mr. Edwards.

Portsmouth and District Wireless Association.

Lecture on "Charging Accumulators by the Noden Valve off A.C. Mains," by Mr. R. Cole.

Stockton and District Wireless Society.

At 7 p.m. General Meeting.

Thursday, October 12th.

Daily Mail Concert as above.

Radio Experimental Association. (Nottingham and District.)

First Meeting in new headquarters.

Friday, October 13th.

West London Wireless and Experimental Association.

At Stamford Brook Lodge, Ravencourt Park, W.6. A popular lecture and demonstration of latest apparatus made by Messrs. Burndept, Ltd., by Mr. A. O. Gibbons.

Belvedere and District Radio and Scientific Society.

Lectures on "Crystal Circuits," by Mr. C. E. Morrison, and "Telephones and Microphones," by Mr. S. G. Meadows.

Sunday, October 15th.

Daily Mail Concert as above.

Monday, October 16th.

Finchley and District Wireless Society.

Social Evening.

Ipswich and District Wireless Society.

At 8 p.m.. At 55, Fonnereau Road. Lecture on "Armstrong Circuit Experiences," by Mr. . Dyer.

Tuesday, October 17th.

Telephony by **2 MT** Writtle as above.

Thursday, October 19th.

Daily Mail Concert as above.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

The second annual general meeting was held on September 22nd at 8 p.m., at the Leeds University. Mr. A. M. Bage (Vice-President) was elected chairman. The chairman called upon the Hon. Secretary to read the Minutes of the first annual meeting, which were accepted as correct. The Hon. Secretary then presented the report of the Committee, who had pleasure in recording a year of steady progress and success. An Exhibition of Apparatus and Demonstration of Wireless Telephony inaugurated the first complete session of the Society. Eighteen general meetings have been held, twenty-one papers, etc., having been read. Two informal meetings were also held. Most of the meetings have been held at the Leeds University. The thanks of the Committee are due to Mr. H. F. Yardley, A.M.I.R.E., of the British Wireless Supply Co., for having kindly placed rooms at the Society's disposal on several occasions. The Society was represented by letter at the Third Annual Conference of Affiliated Wireless Societies. The junior members of the Society were invited to attend a course of lectures under the direction of Mr. T. Brown Thomson of Messrs. Burndept, Ltd. (then Burnham & Co.). At the commencement of the session the membership of the Society was 47 and is now 103. The report of the Hon. Treasurer was then called for, and approved as being satisfactory in all respects. The chairman then announced the resignation of all officers, and invited any of the members present to pass any remarks on the administration of the Society during the past session. Mr. D. E. Pettigrew paid tribute to the help certain members had given him in enabling the programme of the Society to be carried out to the best degree. It was resolved to present Mr. D. E. Pettigrew with a pair of Brown's phones suitably inscribed as a recognition of his work during the session.

The election of officers followed, Mr. A. M. Bage being elected President ; Vice Presidents, Capt. F. A. Whitaker, R.E., Mr. G. P. Kendall, B.Sc. ; Hon. Secretary, Mr. D. E. Pettigrew; Hon. Treasurer, Mr. R. E. Timms ; Committee Members, Messrs. Yardley, Croysdale, S. Kniveton, O'Donohoe, Thomson, H. J. Wray and Marshall.

It was resolved that the annual subscription and entrance fees be altered to 7s. 6d. and 4s. respectively, for members over 18 years of age, and 5s. and 2s. 6d. respectively under 18 years of age. Meetings will be held weekly, formal or general meetings and informal or instructional meetings to be held alternately on Fridays. It was resolved to take steps to acquire transmitting and receiving apparatus and a sub-committee was appointed to work with the ordinary committee in dealing with the question. Accommodation for the 1922-23 session has not been completely arranged, but it is hoped to make a definite announcement almost immediately. Certain rules were then altered, following other business. After a hearty vote of thanks had been accorded to the chairman for his excellent management of the meeting, the meeting adjourned.

The Wireless Society of Hull and District.*

Hon. Secretary, Mr. H. Nightscales, 16, Portobello Street, Hull.

On September 11th, before a fair attendance of members, Mr. J. Nicholson gave a lecture on "Aerials." In the first place, the lecturer laid particular emphasis on the necessity of knowing what one intended to do before commencing work. He then proceeded by gradual steps to detail the preparation of a mast and the fittings required. In order to make the lecture more interesting, he then gave a demonstration on making guys, splicing of same, etc. In concluding he showed the gathering the method of erection and fixing of the mast and aerials. The lecture was particularly instructive to the new members, although the older members no doubt gained some useful hints. The lecturer knows his subject well, and can express himself.

On the motion of Mr. C. B. Snowden, and seconded by Major F. Holman, Mr. Nicholson was accorded a hearty vote of thanks for his interesting lecture. One new member was elected.

On Monday, October 9th, Mr. Hy. Strong is due to give a paper on "Calculation of Inductances." This is the second of a series of lectures arranged specially for the benefit of the new members, and a good attendance is looked for on this occasion.

Stoke-on-Trent Wireless and Experimental Society*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of this Society at the Y.M.C.A., Hanley, on Thursday, September 21st, there was a much larger attendance than there has been during the last few weeks.

The outside aerial has now been erected, and requires a little tuning up before the best results can be achieved. The Society has not yet received a reception licence from the Post Office, but there is every indication of this being granted in the near future. When this comes along, the practical work of the Society will be able to progress unimpeded.

Through the kindness of two of the members, a blackboard and easel will be provided to facilitate the giving of lectures.

Wireless and Experimental Association.*

Hon Secretary, Mr. Geo. Sutton, 18, Melford Road, S.E. 22.

The Association meeting at the Central Hall, Peckham, on Wednesday, September 20th, was very successful.

The members had been despondent over the persistent rumours of the threats to their liberties. They were now overjoyed to think that the situation was so much improved.

They paid a special tribute to their Secretary for the prompt and able way in which he had called public attention to the danger which had threatened them.

They were also rejoiced to hear that Sir Frederick Hall, M.P., K.B.E., had acceded to their request and had honoured them by becoming the Vice-President of the Association.

Wolverhampton and District Wireless Society.*

Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

A meeting of the above Society was held at headquarters, 26, King Street, Wolverhampton, on Wednesday, September 13th, when a very interesting and instructive lecture was given by Mr. H. Taylor (**2 KQ**) on "Hints and Tips on Receiving."

The lecture was chiefly for beginners, and commencing with the correct method of using a single-valve set, the lecturer (by means of diagrams) illustrated the importance of correct circuits.

Mr. Taylor laid great stress on the fact of having a good and permanent grid leak of correct value, and also the advantages of grid batteries and their effect upon the circuit.

Many questions were addressed to the lecturer, whose extensive experience proved exceedingly beneficial and opportune to all present. One of the chief items of discussion was the question of grid batteries, and various opinions were expressed as to their importance, permanency and correct method of coupling.

The East London Radio Society.*

Hon. Secretary, Mr. L. E. Lubbock, King George's Hall, East India Dock Road, Poplar.

On Tuesday, September 12th, 1922, the usual meeting of the above Society was held at the Lecture Hall, Woodstock Road, E.14.

The attendance was quite as good as usual and after **2 MT** (Writtle) had finished his excellent transmission the members settled down to the first of Mr. J. Keen's series of lectures, "How the Valve Works."

Mr. J. Keens is a lecturer of very considerable ability and his extensive knowledge of all matters wireless enables him to deal with his subjects in a manner which is not too simple for those of experience and not too intricate for the beginner. He traced the history of the valve from the initial conception of the idea ,and the original formation of the electron theory. After dealing very fully with the valve in all its aspects, Mr. J. Keens invited questions. The keenness of the questioning was ample proof of the attentiveness of the audience, and of the interest created by the lecture. But all questions, whether coming from senior or junior members, were ably dealt with.

Votes of thanks to both chairman and lecturer were carried and the meeting closed at 10.15 p.m.

On Friday, September 18th, 1922, the Society's buzzer class was well attended. Listening-in did not commence until 9.15 p.m. and after various interesting experiments the meeting closed at 10.20 p.m.

Mr. J. Keens also lectured on Tuesday, September 22nd, on the "Application of Valves to Receiving Circuits." All who are interested are heartily invited to attend any future lecture held under the auspices of this Society.

Southwark Wireless Telephony Association.

Hon. Secretary, Mr. W. Helps, Headquarters, King's Hall, London Road, S.E.1.

This Association held its second meeting of the month on Sunday, September 17th. The crystal set competition was carried out, and the judges, Messrs. A. O. Gibbons, A.M.I.E.E., and Winston, awarded the gold and silver medal, presented by W. F. Hurndall, Esq., after keen competition, to Mr. Fitcher, he having secured the highest number of points. The Secretary announced that the future programme was full of very good things. For the next meeting, Mr. A. O. Gibbons, had promised to give an "Elementary Lecture on Wireless," with lantern slide illustrations. Also that entrance fee would be 1s. 6d. in future, and subscriptions 1s. per month instead of 6d. Visitors would be admitted to lectures on the payment of 6d. A vote of thanks to the judges concluded the business.

Beckenham and District Radio Society.

Hon. Secretary, Mr. J. F. Butterfield, 10, The Close, Elmers End, Beckenham.

On Thursday, September 14th, the general meeting of the Beckenham and District Radio Society was held for the purpose of confirming proposed rules.

Every encouragement is given to novice members, the general programme being that each week a certain part of a crystal set is thoroughly explained with a view to instructing those anxious to make their own sets.

Up to the present the progress of the Society has surprised its founders. A few weeks ago eight persons met to formally found the Society; since then new members have joined each week. There are now 40 members, including juniors. A number already possess receiving sets, and it is interesting to record that one junior member won the first prize in Selfridge's home-made set competition. He constructed a first-class crystal set, on which Writtle can be heard.

On Thursday, September 21st, the study of component parts of apparatus was continued, the condenser being chosen for the subject at this meeting, the Vice-President being in the chair.

The Hon. Secretary continued his lecture and ably explained the construction, approximate cost and use of the condenser. A number of questions were asked and answered.

It was decided to have a question box to enable members to put in written enquiries, which would be replied to on the following Thursday immediately preceding the chief item of the agenda.

On September 28th, a variable condenser was assembled from the parts by way of practical instruction, and this condenser is being used on a receiving set, which is being made up for the Society. It is proposed to obtain a loud speaker.

Enquiries will be welcomed by the Hon. Secretary, and prospective members are asked to attend the weekly meetings held at 114, High Street, Beckenham, each Thursday at 8.15 p.m.

Barnes, Mortlake and Richmond Wireless Society.

(Temporary name.)

Hon. Secretary, Mr. E. A. Rogers, 17, Leinster Avenue, East Sheen.

An inaugural meeting of the above Society took place at East Sheen, and over 40 people attended.

Mr. F. Hope-Jones, M.I.E.E. (Chairman of the Wireless Society of London), kindly consented to take the chair, and in his opening speech gave some very good reasons why we should form such a Society.

Mr. Rogers explained what had been done so far, and apologised that Mr. Blake was unavoidably absent, and read his letter to the meeting.

It was decided that the name of the Society should be postponed until the next meeting for further discussion.

The following gentlemen were duly elected by the meeting for the coming year, which it was decided should start on October 1st :—

President, Mr. G. G. Blake, M.I.E.E., 10, Onslow Road, Richmond; Hon. Secretary, Mr. E. A. Rogers, 17, Leinster Avenue, East Sheen ; Hon. Treasurer, Mr. K. L. Davy, 11, Sheen Gate Gardens, East Sheen.

The following were elected to the Committee :—

Messrs. Swain, Lloyd, Driver, Appleton-Smith, Poole and Wootton. They were empowered to draw up the rules for confirmation at the next meeting.

The subscription was fixed by the meeting at 10s. 6d. per annum, payable in advance.

Over 30 visitors signed the membership form before leaving, and many more promised to send theirs along.

Many gentlemen with aerials known to the Society were not at the meeting, and it is hoped that they will turn up at subsequent meetings.

Several ladies were present, and the members hope to see many more.

Mr. Hope-Jones, on behalf of the meeting, thanked Mr. and Mrs. Davy for allowing the use of their room, and a hearty vote of thanks to Mr. Hope-Jones for taking the chair and being the first hon. member, terminated a most successful evening.

Full particulars of the Society will be gladly sent by the Hon. Secretary from the above address.

Swinton and District Amateur Radio Society.

Hon. Secretary, Mr. Geo. T. Bultitude, The Slade, Swinton.

At the weekly meeting of the above Society Mr. F. Finn, of Swinton, gave a lecture on "A Three-Valve Panel and its Circuit." Mr. Finn illustrated by the blackboard each valve and its connections, and then reviewed the whole circuit in detail. Later Mr. Finn gave "Points on Aerial Erection," which proved very instructive. Mr. Finn was thanked for his address.

The Society passed a resolution "That the membership be open to either sex," and new members will be welcomed every Thursday.

The Fulham and Putney Radio Society.

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

The above Society held a meeting on Friday, September 22nd, which was well attended and several new members were made.

After the buzzer class a largo variety of apparatus and components were shown by the members and a variety of interesting discussions took place regarding the various parts.

Mr. Calver presented the Society with a large number of basket coils, a large tuner coil, and also a basket-coil winding former. Mr. Hart Smith presented a book for the library and also a number of Morse code instruction leaflets.

Mr. S. W. Martin presented a piece of apparatus which, after alteration, will make an efficient practice key.

A vote of thanks was accorded to the above members, and the meeting closed at 10 o'clock, leaving some of the members listening in on Mr. E. V. Barker's multiple valve set.

Otley and District Wireless Society.

Hon. Secretary, Mr. N. Weston, Student I.E.E., 24, Guycroft, Otley.

A lecture was given by the Hon. Secretary on "Secondary Cells," describing their construction, care and maintenance, at the meeting on September 22nd. Fausé and Planté cells were dealt with, and characteristic curves showing voltage, specific gravity and discharge during charge were drawn on the blackboard of main types of prominent makers' cells. Mr. H. Johnson exhibited a novel three-valve set with combined crystal, incorporating "Dewar" switches, so that Mark III tuning coils, and duolateral coils could be used for short and long wave tuning; also one, two or all valves could be switched in circuit, or crystal only used. The set reflected great credit on the maker, and good results were obtained. A further set of lectures will be given on elementary wireless telegraphy, and it is hoped that rapid progress will be made in order to pave the way for more advanced lectures.

A fourth lady member was enrolled. Until further notice meetings will be held every Tuesday at 7.30 p.m. for Morse practice, and general meetings, and lectures every Friday, at 8 p.m.

Southport Wireless Society.

Hon. Secretary and Treasurer, Mr. R. W. Brown, 71, Norwood Crescent, Southport.

A series of very interesting lectures have been held during September by the above Society at their headquarters, Queen's Hotel, Promenade, Southport.

On Monday the 11th, Captain F. C. Poulton, O.B.E., gave a lecture on "Electrical Measuring Instruments," describing in detail the construction and working of voltmeters and amperemeters. The lecture was very instructive to all present, and was highly appreciated.

On Monday the 18th, a lecture was given by Mr. E. Lomas on "Automatic Telephones." This lecture was also very much enjoyed by all the members present.

On Monday the 25th, Mr. E. R. W. Field explained and demonstrated a new "Rejector Circuit" set.

The lectures in question have all brought full attendances, and a further series are in contemplation. Amateurs interested in the above Society can obtain full particulars upon application to the Hon. Secretary.

Streatham Radio Society.

Hon. Secretary, Mr. S. C. Newton, "Compton," Pendennis Road, Streatham, S.W.

A meeting of the above Society was held on Wednesday evening, September 13th, at the headquarters, 35, Streatham Hill, S.W. Mr. Bevan Swift as Chairman presided.

This is the sixth general meeting since the formation of the Society, and it was attended by the majority of the members and several visitors.

The Treasurer arranged for a photograph to be taken of the members, and several new members were proposed and seconded.

A demonstration was given by Mr. Smith, who used a four-valve set, very kindly lent for the occasion by Mr. Travers, of the Radio Appliances, Ltd., Streatham.

Sir William Lane Mitchell, President of the Society, whom it was hoped would have been able to turn up, sent a letter to the Secretary, expressing his regret at his non-attendance, and wishing the Society every success. The Treasurer reported on the satisfactory state of the funds of the Society, and the Secretary stated that negotiations were now taking place for affiliation to the Wireless Society of London. He also reported that application had been made to the Postmaster-General for a receiving licence. Several members promised to read papers, and a committee meeting was arranged to discuss and arrange a programme for the winter session. The meeting closed at 10 p.m., with the usual vote of thanks to those responsible for the demonstration.

The membership of this Society is growing rapidly; it is now nearly 40, and a very interesting programme is being arranged, so that members may receive instructions, advice, and spend an enjoyable evening together.

The Secretary will be pleased to receive applications from wireless enthusiasts resident in the district.

Ilford and District Radio Society.

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

On Thursday, September 14th, at an informal meeting, the Society again had the pleasure of a lecture delivered by Mr. Gregory, the Secretary. The subject, "The Elementary Principles of the Valve," is generally admitted to be a difficult one to speak on, but this was not the case with Mr. Gregory.

The lecturer began with the electron theory, and gradually advanced to the two and three-electrode valves. The working of the two-electrode valve was fully explained, showing how the valve acted as a relay. It was then shown how, by the insertion of the third electrode, the grid, the flow of electrons between filament and plate could be controlled. The practical method of plotting the "curve" of a valve was explained with the aid of diagrams and an imaginary curve was plotted. From this curve the correct point on which to work was explained.

As usual, at the end of the lecture questions were invited, but none were forthcoming, probably owing to the excellent and lucid way the lecture was given.

This was undoubtedly the best lecture the Society has had, and Mr. Gregory is to be heartily congratulated on the results of his efforts.

Owing to the fact that it was an "informal" meeting, the attendance was not as good as one might desire. Mr. Gregory has kindly consented to deliver the lecture again at a "formal" meeting in the near future.

The meeting closed with a vote of thanks to the lecturer.

Membership is increasing. Applications should be addressed to the Secretary.

Rhyl and District Amateur Wireless Society.

Hon. Secretary, Mr. C. Mitchell, 24, East Parade.

A demonstration was given on Wednesday last on a two-valve receiving set. The Society's new headquarters, Arcville College, Russell Road, proved an excellent place for reception of wireless messages. Of great interest to the members was the instruction as to how to put a small receiving set together for practical use. Each part was shown in detail and advice given on every point possible.

On Wednesday, September 27th, a lecture was given by Mr. D. T. Jones on "Accumulators."

Stockton and District Amateur Wireless Society.

Hon. Secretary, Mr. William F. Wood, 4, Birkley Square, Norton, Stockton-on-Tees.

The monthly meeting of this Society was held on Thursday, September 14th, 1922, in the Concert Hall of the Malleable Workmen's Institute, Norton-on-Tees.

The chair was taken by the Vice-President, Mr. S. G. Marston.

At the conclusion of the business a lecture entitled "The Romance of Wireless" was given by Mr. Norman Whiteley, of the Bradford Wireless Society, and profusely illustrated with slides specially prepared by the lecturer.

The progress of this particular branch of electrical science was aptly illustrated and explained, and a large and appreciative audience spent a most interesting and enjoyable evening.

At the conclusion of the meeting hearty votes of thanks were accorded to the lecturer and lanternist.

The next general meeting is fixed for October 11th.

Arrangements are in hand for holding classes during the winter season, commencing in October.

Fulham and Chelsea Amateur Radio and Social Society.

Hon. Secretary, Mr. R. S. V. Wood, 48, Hamble Street, Fulham, S.W.6.

The above Society have obtained permission to hold their headquarters at the Chelsea Polytechnic, Manresa Road, Chelsea, where all meetings will now be held every Tuesday evening from 8 to 10 p.m.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. W. R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

The inaugural meeting of the above Society was hold on Friday, September 22nd, when rules were formed and officers elected.

For the present it was agreed to limit the membership to civil servants.

A hearty invitation is given to all civil servants to join the Society and the Secretary will be pleased to forward particulars.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, The Wireless World and Radio Review, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requiremenent, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations, or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd, and p. 867 September 30th, 1922.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate, or to cut out their reaction entirely.

"J.W.C." (Streatham) *submits a blueprint showing the construction and connections of a detector panel, which is provided with terminals for aerial and reaction circuits, and asks for method of connecting up two slide inductances to this apparatus.*

Wired as shown, it is not possible to make use of a two-slide inductance with this panel, excepting of course, by using the valve as a detector only, and not producing reaction effects. To do this, connect the aerial to one end of the inductance coil and one slider to earth. Short circuit the terminals marked "reaction" and connect the one marked "G" to the aerial, and that marked "F" to the other slider. What you really require is a loose-coupled inductance. Your panel should be arranged as shown in the diagram on page 456 of July 8th issue, excepting that the variable condenser may be connected across the grid leak for use as a variable grid condenser. You might read the article referred to and follow up the constructional details given in that and subsequent issues.

"K. A. T." (Broadstairs).—Your questions do not tell us what single unit set you are referring to. However, the diagram (Fig. 1) will show you a typical set for the results described. A set as shown in this diagram may be used independently of any other apparatus. Two or more of these units may be coupled together in various ways, and it is, of course, possible to use coupled circuits and valves without using units of this type.

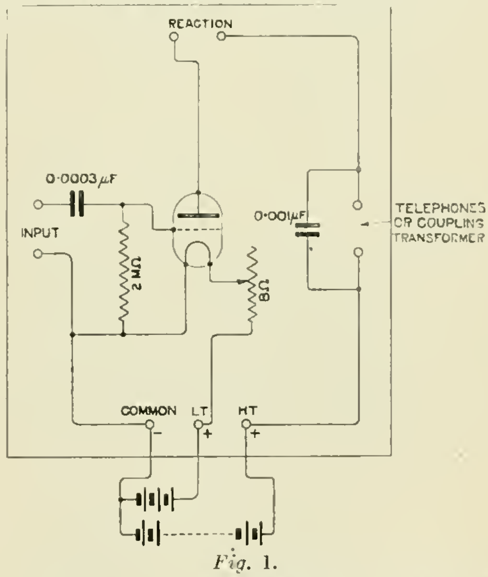


Fig. 1.

"H.W.C." (N.15) *is unable to erect an aerial of greater length than 30 ft., and asks whether we would recommend under the circumstances the use of a three-wire aerial.*

Yes, but endeavour to space your wires as far apart as possible, say at least 5 ft., whilst at the same time the spreaders must not be too heavy or the increased sagging may counteract any advantage you may gain by putting up the extra wire. The three-wire aerial will have increased capacity, and consequently when tuning with a variable condenser the adjustments will be less critical, as the proportion of variation in capacity will be less.

"**ENGINEER BEGINNER**" **(London)** *wishes to receive Dutch concerts and other telephony on a frame, and asks* (1) *Winding for suitable frame to be used with the two or three-valve set.* (2) *If the circuit shown on page* 554, *July 29th issue, would be suitable.*

(1) It is difficult to receive **PCGG** in London with a three-valve set and frame aerial. At least six will be required, the circuit being on the lines of Fig. 2, of the issue referred to. For **PCGG** the aerial might have sides of 5′, with about 10 turns, spaced ¼″ apart. More turns might be added if desired for **FL** and similar stations.

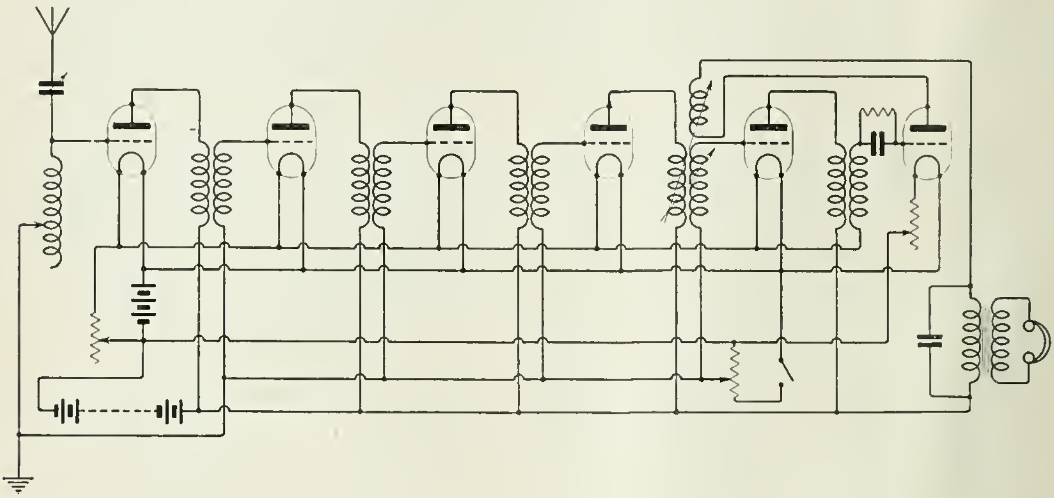


Fig. 2.

"**T.K.**" **(Runcorn)** *has constructed a 5-valve amplifier as shown on page* 117 *of* "*Wireless Telegraphy and Telephony,*" *by E. Redpath, and is not obtaining satisfactory results, and asks* (1) *The directions of windings for the transformers.* (2) *Suitable windings for H.F. transformers.* (3) *Suitability of telephone jacks and cords for receiving circuits, and* (4) *Whether the set is suitable for the reception of telephony with a loud speaker.*

(1) H.T. plus is taken to I.P., plate to O.P., grid to I.S., L.T. minus to O.S. (2) You will have to determine the exact windings of the transformers by experiment, but as a guide you must bear in mind that two single layers of 300 turns each on a 2¼″ ebonite former, insulated from one another by a single layer of empire cloth, will produce a transformer suitable for operations on wavelengths from 500/750 metres. If you adopt the type of transformer of which the windings are placed in a groove, we can, working on this basis, roughly calculate the number of turns required, bearing in mind that the concentration of the turns into a smaller space will increase the value of inductance. When winding in a groove, make both windings in the same direction, taking the leads which come out between the two windings to plate and grid, and the leads that pass from the inside of the primary and the outside of the secondary should be taken to H.T. plus and L.T. minus. (3) We do not recommend the use of the ordinary pattern telephone jack on the high frequency side of the amplifier. There is, however, a special variety of break-jack on the market which can be adopted without fear of detrimental effects. We do not understand why your reaction coil has to be reversed when altering the number of L.F. volts in circuit, as no change is made in the detector valve plate circuit however many valves are switched in or out. We can quite understand, however, that a reversal may be necessary when switching from one to two H.F. valves, and this is due to a reversal in the connections of one of the H.F. transformers. You must test your transformers out separately, and obtain identical results from each. When using two stages of H.F. amplification, the two intervalve transformers must be of identical value, otherwise one will filter out wavelength for which the other is arranged to give good amplification. (4) Yes, on a good aerial.

"**RADIO**" **(Norway)** *asks questions about the Armstrong super-regenerative circuit.*

(1) This circuit is not suitable to cover a range of 120/10,000 metres. It is probably intended as a short wave circuit. In any case wavelengths of the oscillating circuits must be several times the wavelengths of the tuning circuits. We do not advise this circuit for reception much above 1,000 metres. (2) Pancakes to tune to 10,000 metres become very unwieldy in size. For this purpose we should recommend small pancakes placed side by side with ebonite spacing washers between them about ⅛″ thick. We should suggest about 10 pancakes with 80 turns on each, and a mean diameter of 3′ as suitable.

"**A.G.C.**" **(London)** *asks* (1) *To what wavelength a coil* 11″ × 6″ *wound with* No. 26 *will tune a* 100 *ft. aerial,* 6 *ft. high.* (2) *Whether a potentiometer is needed with zincite-bornite crystal.*

(1) Approximately 2,500 metres. (2) No.

"**A.F.**" **(Wimbledon Park)** *asks* (1) *Whether it is possible to operate a relay for his present set with, say, the addition of one or two note magnifying valves.* (2) *What type of relay we would recommend him to use, and* (3) *a suitable circuit.*

Yes, this can be done, and depends entirely upon the efficiency of the relay adopted. You should connect in circuit between the secondary of the last low frequency amplifier and the relay a perikon crystal. (2) The relay to which you refer can be thoroughly recommended, or alternatively, you might try the large pattern Siemens type relay, which you can obtain from many dealers in ex-Government apparatus. (3) The whole matter of recording has been dealt with very fully by the Wireless Society of London, and a copy of their discussion on the subject, together with many useful and well-tried circuits, can be obtained on application to the Secretary.

"**E.H.B.**" **(Somerset)** *submits a circuit diagram and asks for criticism.*

For the reception of telephony, particularly on short wavelengths, you are recommended to tune your aerial and reaction coils with air dielectric variable condensers. The grid condenser should be bridged with a leak of about 2 megohms; otherwise your circuit is quite correct. As your present coil seems to tune to rather long wavelengths, you might try making up two coils as shown on page 328 of the June 10th issue, connecting one in the aerial circuit and the other in the reaction circuit, and laying them over one another to produce the necessary coupling.

"**E.B.**" **(South Croydon)** *asks* (1) *Whether capacity reaction is as efficient as magnetic reaction in the circuits usually adopted by amateurs, and* (2) *Whether the use of a loose coupled aerial circuit is recommended in the construction of receiver on the lines described on page 37, April 8th issue, and whether reaction effects will be obtained, seeing that the grid is giving a positive potential.*

(1) Tuned magnetic reaction is to be preferred to the capacity arrangement, as it is easier to manipulate, and produces constant effect on all wavelengths, whilst the efficiency of capacity reaction varies with wavelength and degree of amplification. It is not advised for use with very short wavelengths. (2) In the particular circuit to which you refer, you will find it an advantage to work with three coils—that is, a loose-coupled aerial circuit, closed circuit with tuning condenser, and tuned plate circuit. The positive potential which is applied to the grid of the oscillator and detector valves should be adopted with this circuit, but in the usual reaction circuit it is now becoming common practice to connect the filament resistance in the negative lead, joining the lead which gives the grid its potential, to the negative leg of the filament.

"**RUPERT**" **(Tottenham).** (1) Circuit as shown is quite O.K., except that a parallel condenser is not needed at 1,000 metres. A one-valve set with slab coils will not give satisfactory results on **PCGG** in London. (2) The only way to appreciably improve this set is to add further valves. (3) The loud speaker suggested will not give much results from a single valve set, except possibly from **2 LO.** It should be used with a L.F. amplifier and with an ordinary telephone transformer. (4) There are many ways of adding a second valve. See Fig. 5, page 437, July 1st issue.

"**W.H.G.**" **(London).**—The usual method of using a three coil tuner is as shown in, say, Fig. 2, page 705, August 26th issue, although this method is not likely to be allowed very much longer. Particulars regarding types of transformers, etc., will be found in these columns in various recent issues. We regret that we have not sufficient space to collect these here into one reply. You can also find many constructional details in articles on special sets, as, for instance, the four-valve station described in the July 15th and following issues. See also Fig. 3, below.

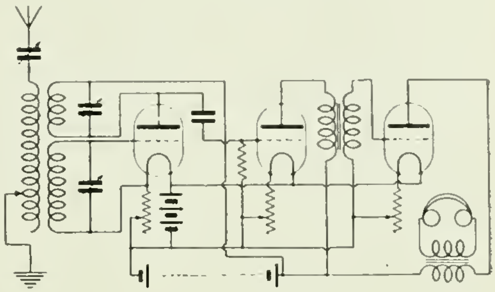


Fig. 3.

"**C.B.**" **(Ealing)** *asks* (1) *If a circuit will be suitable for reception of telephony.* (2) *Maximum wavelength to be obtained with a coil* $4\frac{1}{2}'' \times 10\frac{1}{2}''$ *of No. 24 enamelled wire.* (3) *If a reaction coil is necessary for the reception of telephony.*

(1) Yes, except that parallel A.T.C. is not necessary for short wavelengths, and for such wavelengths grid condenser should be about 0·0003 mfds. (2) Without a parallel A.T.C. this coil would tune to about 2,200 metres. This might perhaps be brought up to 3,500 metres with parallel condenser without serious inefficiency. (3) No, although additional range can be obtained by its use.

"**GRANDSIRE**" **(Ilkley).**—For 20,000 metres your coils should have up to 1,200 turns. (2) Yes, but probably not very sensitive.

"**ELECTRON**" **Whitby Bay)** *asks* (1) *If we consider a certain circuit good for telephony.* (2) *If it will be infringing any patent.* (3) *If the circuit will pass P.M.G. for licence.* (4) *What is the best transformer arrangement in the H.F. circuit to cover 300 20,000 metres.*

(1) Quite good. We presume, however, the last intervalve transformer, as well as the telephone transformer, is intended to be iron cored. If so, the primary of the former should have a condenser across it. (2) Yes, particularly in regard to reaction and the grid condenser and leak. (3) Almost certainly not. (4) We should recommend interchangeable plug-in transformers, of which about five would be required with variable condenser across one winding of each.

"J.L.S." (St. Annes) *asks* (1) *If any improvements can be made in a circuit submitted.* (2) *Reasons for variable results with this set.* (3) *For a better circuit.* (4) *For a diagram showing how to add two valves H.F. to this set.*

(1) The circuit shown is of quite good type. You might add a switch to enable you to connect in series the A.T.C. for short wavelengths. It is unlikely that reaction of this type will be allowed in the future. (2) As you do not give us any clue to the nature of the variations we cannot help you much. Your aerial insulation may be defective, or the earth variable and poor. Carefully built up, your circuit should give as good results as most others given in these columns. (4) Set might become approximately that as shown in Fig. 4, page 706, August 26th issue.

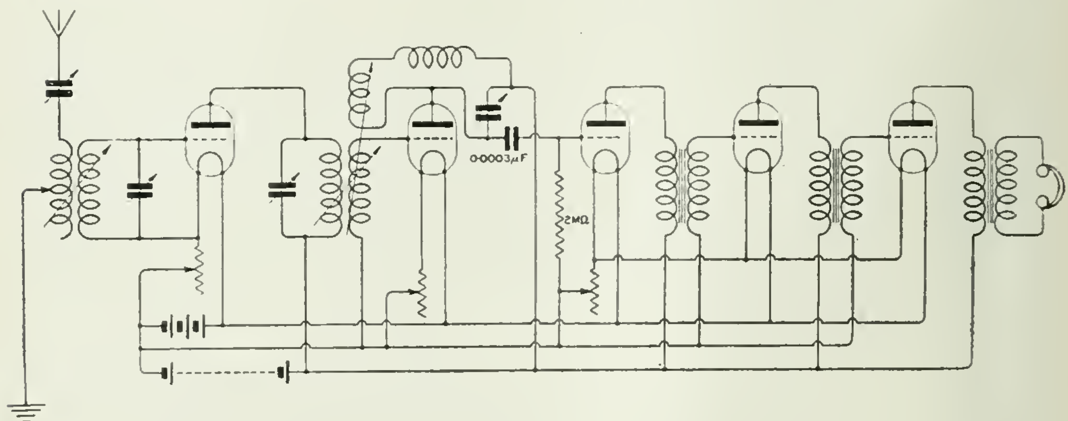


Fig. 4.

"TUNER" (Bembridge) *asks* (1) *Suitable dimensions for A.T.I. to tune 200/30,000 metres.* (2) *Suitable tappings for this inductance.* (3) *What capacity to use with it.* (4) *Formula for calculating the wavelength of a tuner.*

(1) and (2) About the only satisfactory way to cover such a range is to use a set of interchangeable honeycomb coils as listed by many of our advertisers. (3) 0·0005 mfd. for short wavelengths and up to 0·0015 mfds. for long. (4)

$$\lambda = 1885 \sqrt{L\ C}$$

metres mhys. mfds.

"H.S." (Macclesfield) *asks* (1) *For a loose coupler to tune from 200 to 1,100 meters.* (2) *Which of three arrangements of A.T.I. and A.T.C. is the most efficient.* (3) *Whether a certain set is as efficient as a certain type of instrument.*

(1) 6″ × 4″ of No. 22, secondary 5″ × 3″ of No. 26. (2) The arrangement of your Fig. 3 is the best for these wavelengths. (3) The circuit referred to is of the type suggested as an alternative.

"W.T.R." (Cheltenham) *asks* (1) *Which is to be preferred—one detector followed by two note magnifiers, or one high frequency amplifier, detector and low frequency amplifier.* (2) *Whether a four-wire aerial would give better results than a two-wire as he is limited as to length.* (3) *Whether 25 ft. of earth lead is too much, and* (4) *For the most serviceable combination of H.F. and L.F. amplification for embodying in a five-valve set, for use under unfavourable conditions.*

(1) If great range is required, it is advisable to make use of at least one high frequency amplifier, for although low frequency amplification gives greater signal strength, it will at times not bring in signals which a high frequency amplifier would render audible, though perhaps of poor strength. A combination of H.F. and L.F. is recommended, and in order to prevent re-radiation, reaction can be arranged between the plate circuit of the second valve and the high frequency intervalve transformer, as shown in the circuit on page 615 of August 12th issue. (2) The two-wire aerial would be satisfactory, but if you can conveniently arrange the four wires without undue sagging due to the wide and heavy spreaders, it would give you better results. You should, if possible, erect a small mast on the roof top to get the aerial higher than the house. Read the article on "Aerial Construction" on page 259 of May 27th issue. (3) Your earth lead is rather long, and may have detrimental effects when receiving on short wavelengths. If it is possible to well insulate it to the point of earthing, it may be an advantage. (4) For demonstration purposes you will need to use at least three L.F. valves and a receiver; making use of one H.F., one detector and three L.F., should give the results you require, though always endeavour to erect the usual suspended wire aerial for reception instead of a frame.

"C.V.T." (Headcorn) *asks for the correct method of operating his receiving set.*

As you do not say the exact type of receiver which you have purchased, we regret we cannot give you explicit details for manipulation. There is no book that would give you in brief the exact method for operating the outfit. We would recommend you to obtain a knowledge of the theory of wireless telegraphy by reading "The Elementary Principles of Wireless Telegraphy," by R. D. Bangay, followed by the "Oscillation Valve," by H. E. Penrose (*Wireless Press, Ltd.*). Why not write to the manufacturers of your apparatus and ask them for the information you require.

"**PATIENCE**" (**Redhill**) (1) *Submits a circuit of a three-valve receiver, and asks for criticism.* (2) *Why it is difficult to eliminate carrier wave in telephony, and whether we recommend the enclosing of the high frequency transformer in an iron box.* (3) *Whether his apparatus is liable to re-radiate, and* (4) *Whether we consider it suitable for operating a loud speaker on signals from* **PCGG, FL, 2 MT,** *etc.*

(1) Your aerial switching arrangement is not quite correct. You should arrange to connect the aerial tuning condenser in series or parallel with the aerial inductance only, whilst the closed circuit should have its own tuning condenser. The primary of the first low frequency transformer should be bridged with a condenser of capacity of 0·001 mfds. The condenser across the 4,000 ohm telephones is unnecessary. They should merely be connected in series with the primary of the last transformer, and arranged with a switch for disconnecting or short-circuiting when not in use. You will probably find it better to connect your low resistance telephones in series. The detector valve should be one specially selected to give good rectification, such as "Q" or "R.4b." We do not think you will find it necessary to arrange such a variety of tappings on your high tension battery, but on the other hand, the H.T. leads from each valve should be brought along separately to the battery and plugged in to suit the particular requirements of the variety of valve. (2) This depends upon the extent of modulation. Well modulated telephony produces considerably damped signals, and although much easier to receive free from howling noises, the damping, by broadening the band of wavelengths, somewhat decreases the transmitting range. Very critical adjustment of the reaction circuit is essential to eliminate the trouble, which is due more to the design of the apparatus at the transmitter than at the receiver. (3) Yes. To reduce re-radiation you might arrange to couple a reaction coil to the intervalve high frequency transformer, or at least to an inductance placed in series with the secondary. (4) For operating a loud speaker, you should add two note magnifying valves, and even then it is doubtful if you will get satisfactory results, stationed so far away and using such limited power.

"**R.C.B.**" (**Glasgow**) *submits a circuit and asks for criticism.*

The circuit is quite in order and should give good results, but we would recommend you to tune the primary of the intervalve oscillation transformer with a small variable condenser having a maximum capacity of about 0·0001. The second valve should be arranged as a detector with grid condenser and leak, and be of a type to give good rectification, and you might substitute for the resistance capacity arrangement a low frequency intervalve transformer. This will give you considerably greater signal strength. The reaction coil should be connected in the plate circuit of the second valve. Your circuit exactly as submitted should give satisfactory results, but where amplification is desired, at least one stage low frequency should be made use of. We are unacquainted with the merits of the particular type of valve to which you refer, as you do not state the type number, and there are several varieties of German valve available.

"**W.H.S.W.**" (**Cookham**) *is constructing the tuner panel described on page 471 of July 15th issue, and asks* (1) *Whether it is necessary to construct the special high frequency detector set described by the author of that article, or whether he might use it in connection with the panel described on page 455, July 8th.* (2) *Whether he could add a particular five-valve outfit to this set, and* (3) *Whether we recommend as an alternative arrangement the set described on page 554, July 29th.*

(1), (2) and (3) For a start we would strongly recommend you to make up the tuning panel for these three coils to the description to which you refer, and use this in conjunction with the single valve panel. This will bring in signals and will indicate to you the lines upon which progress should be made to produce greater amplification. The five-valve set is quite a good outfit, but in actual construction it is somewhat complicated particularly with regard to wiring up the various jacks, and if not very carefully arranged would give rise to a good deal of howling. The complete outfit as described by the author of the tuner can be recommended for general use. When you have got your single valve set working, you might add one note magnifier, and then later one high frequency valve to any design you may prefer, and advice on the construction of the various components will be given as time goes on, under the heading of "Experimental Station Design." If you are desirous of rendering telephony audible from a loud speaker, you will need at least a five-valve set, consisting of three valves as arranged for use in conjunction with the tuning unit, followed by two low frequency magnifiers.

"**F. T. S.**" (**Bromley**) *points out a slip in a reply to "Radio 3 UC," on page 603, in August 5th issue, in the last line of which a statement appears that—*

$$n = \frac{1,116}{48} = 23.$$

He suggests that this might lead to a serious inconvenience to amateurs possessing little electrical knowledge.

We much regret the error, which is obviously a compositor's slip. This should read—

$$n = \frac{111 \cdot 6}{48} = 2 \cdot 3.$$

We think that any amateur would realise the nature of the error at a glance, and not be seriously worried by it. He also asks whether certain windings would be suitable for intervalve transformers. The windings suggested would not be efficient owing to their low impedance. We should much prefer windings of 1 oz. and 3 ozs. of No. 44 DWS. The core suggested would be satisfactory, and if the wires are long enough they may be twisted round outside the windings so as to give an almost closed iron circuit.

"**L. P. E.**" (**Sutton**) *asks* (1) *Whether the switching arrangements of a three-valve set are correct to enable any combination of the valves to be used.*

Yes, except that provision should be made for switching off the filament from the first valve when it is not in use. If this precaution is omitted there will be a considerable leakage of potential through the grid and filament of the first valve.

"**T.A.J.**" **(Chingford)** *asks how to connect up a three-coil holder and coils as a single valve set.*

Coils may be connected up as in Fig. 1, page 465, July 8th issue, in which the middle coil of the diagram is the fixed coil of the tuner. Two variable condensers are necessary, used as shown in the diagram.

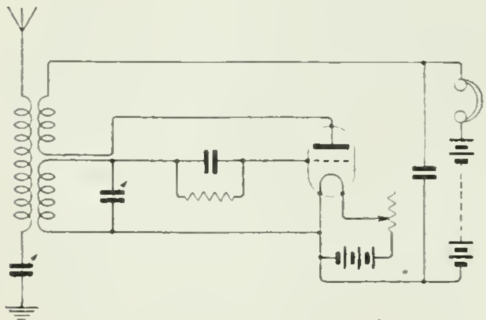


Fig. 5.

"**WINDY**" **(Maida Hill)** *asks* (1) *If an aerial for crystal reception erected parallel to, but 6′ below his aerial, is likely to give trouble or to be an advantage to both.* (2) *What H.T. voltage is required for "Ora" valves.* (3) *The relative merits of "Ora" and "R" type valves.*

(1) There is not likely to be any serious trouble with 6′ between the aerials, but if the distance had been less, each station would notice a considerable falling off in strength when the other station came into tune with it. (2) About 40 volts. (3) Without discussing the merits of any particular make of valve, a broad distinction between the two types indicated is that the cylindrical type is electrically somewhat more efficient, and the bulb type mechanically a much sounder proposition.

"**AUDIBILITY**" **(Thornton Heath)** *asks questions about the Armstrong super-regenerative circuit.*

(1) The tuning coils should be arranged in the normal way, and not as in the Reinartz tuner. (2) and (3) Gauges of wire, capacities, etc., are fairly optional, subject to the fact that the tuning circuits should be suitable for the short wavelengths to be received, and the oscillating circuits for 5,000 10,000 metres. (4) These valves may be used.

"**J.A.F.**" **(Tor-Point)** *asks* (1) *The effect on sets which he is likely to hear by moving a crystal set from Plymouth to a point a little south of Ayr.* (2) *If it is better to separate the crystals, or wire and crystal, when shutting down for the night.*

(1) FL instead of loud will probably be very weak, and the number of ships you will hear will probably be considerably reduced. (2) This is not as a rule necessary. The fact that a point which appears sensitive overnight is found insensitive in the morning does not necessarily indicate that the crystals have been injured in any way.

"**AMPLIFIER**" **(Arundel)** *refers to the L.F. amplifier on page 457, of July 8th issue, and asks* (1) *Where to connect four terminals shown to.* (2) *The object of the 18-volt, 6-volt and 4·5 volt batteries.* (3) *If the radio-frequency chokes are suitable for all wavelengths.* (4) *Why the centre of the secondary in the telephone transformer is earthed.*

(1) We regret that we have no further information as to the exact circuit this amplifier was intended to be used with. (2) The 6-volt battery is for filament lighting for all valves. The 18-volt battery is probably intended for the grid potential of the first valve. The 4·5 volt battery applies negative potential to the grids of the last three valves for the purpose of decreasing distortion. (3) The radio-frequency chokes would only be effective on short wavelengths, but would probably be unnecessary at long. We consider these chokes to be rather an ultra-refinement. (4) This is a common device to prevent howling, and to give increased stability of working.

"**L.B.C.**" **(Harrogate)** *sends a diagram of a tuner and asks* (1) *Best value of condensers.* (2) *If certain Vernier condensers will be an advantage.* (3) *Values for Vernier condensers.* (4) *Any suggestions for improvements.*

(1) 1. 0·001 mfds. 2. 0·0005 mfds. 3. 0·0005 mfds., but not really necessary. (2) Yes. (3) 0·00005 to 0·0001 mfds. (4) You might split the aerial inductance into two coils, using only one, the smaller of the two, for coupling to the closed circuit.

"**CRYSTOPHONE**" **(Wolverhampton).**—(1) The circuit shown is quite correct, as are the values of the condensers employed, except that it is useless to put a reaction coil in the anode circuit of a L.F. valve—it should be in the anode circuit of the detector. (2) There are various ways of adding another valve, most of which you will be able to get from examination of circuits recently given. (3) It is most unlikely that PCGG will be heard plainly by you on a two-valve set. It is doubtful whether you will get very satisfactory results with four. (4) Coils suggested might be wound with No. 26 wire. The reaction directly on to the aerial in the way suggested is almost certain to be prohibited in the future.

SHARE MARKET REPORT.

Prices as we go to press on September 29th are :—

Marconi Ordinary	£2	6	0
,, Preference	2	1	3
,, Inter. Marine.. ..	1	7	1½
,, Canadian		10	0

Radio Corporation of America :—

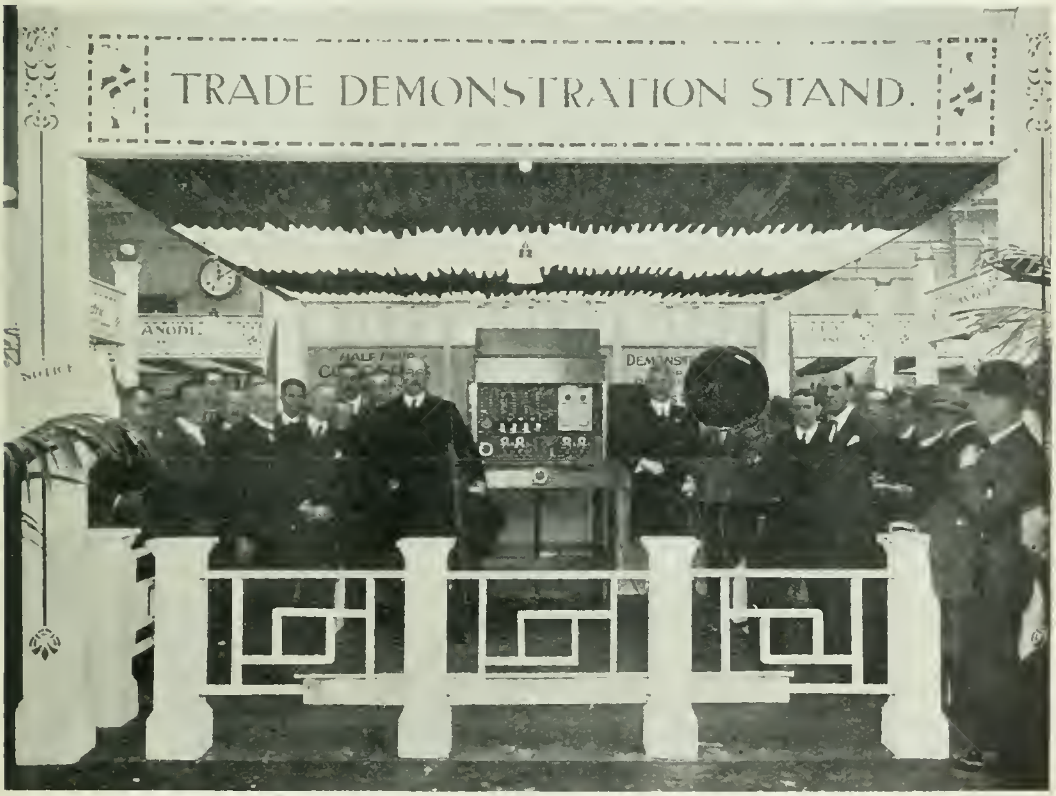
Ordinary	19	4½
Preference	13	6

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON
No. 165 [No. 2. Vol. XI.] OCTOBER 14TH, 1922. WEEKLY

The Wireless Exhibition.

THE first All-British Wireless Exhibition has now closed, but the effect which it has produced yet remains as a permanent record of the advent of British Broadcasting, and the first real introduction of wireless telephony to the general public. The popularity which the Exhibition received was an excellent indication of public interest in wireless telephony, the attendance being far beyond anything anticipated.

As already reported, the Exhibition was opened by Sir Henry Norman, M.P., and the accompanying photograph was taken after the Exhibition had been declared open. Among those present will be seen on the left Sir Henry Norman, M.P., Mr. L. F. Fogarty, Mr. L. McMichael, Mr. A. A. Campbell Swinton, Admiral of the Fleet Sir Henry B. Jackson,



A Photograph taken just after the opening of the Exhibition.

Mr. F. Hope-Jones and Mr. Bertram Day, and, on the other side of the receiver, Mr. E. H. Shaughnessy and Captain Mullard.

A photograph shown on this page was taken during a visit to the Exhibition of the Maharajah of Baroda on October 3rd.

A General View showing some of the Stands.

The receiving apparatus seen in the centre which was fitted with a frame aerial in its base was used for rendering wireless concerts audible throughout the hall, and admirably demonstrated what can be achieved in the home by the installation of a receiver. The half-hour concerts gave the public an opportunity of becoming acquainted with the attainments of wireless telephony as applicable to broadcasting, and must have contributed considerably to the large amount of business transacted by the exhibiting companies.

Distinguished Visitors at the Exhibition.

It is gratifying to think that so successful an Exhibition, and so well attended, can be held in the field of Wireless, and it must only be regarded as a forerunner of exhibitions to be held in the future under the auspices of the Wireless Society of London.

Electrons, Electric Waves, and Wireless Telephony—II.

By Dr. J. A. Fleming, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January 1921–1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication. The articles are therefore copyright, and rights of publication and reproduction are strictly reserved.

6. Experimental Illustrations of Wave Phenomena.

It is possible with a certain type of apparatus to exhibit many interesting experiments with capillary waves on water which illustrate the properties of waves in general. As arranged by the author for lecture purposes this apparatus is as follows :—A circular shallow trough is constructed, having a plate-glass bottom and an exit tap. The trough may be about 8 ins. in diameter, and should be fitted with an overflow tube so as to keep a constant depth of about $\frac{1}{2}$ or $\frac{3}{4}$ of an inch of water in it. This trough is placed on the stage of a vertical projection electric lantern so that light is sent through it and an image of any object on the surface of the water is focussed on the lantern screen. The trough is provided with a pair of fine supply tubes, by means of which drops of water coming from an elevated tank can be allowed to drop at regular interval. on the water surface in the shallow tanks As each drop falls on the water it will start a ring-shaped capillary ripple, but this ripple flits outwards so rapidly the eye cannot follow it. We can, however, render it visible as follows. In front of the lantern objective we place a metal disc with 4 or 6 holes in it. The disc must be caused to rotate by a pulley and

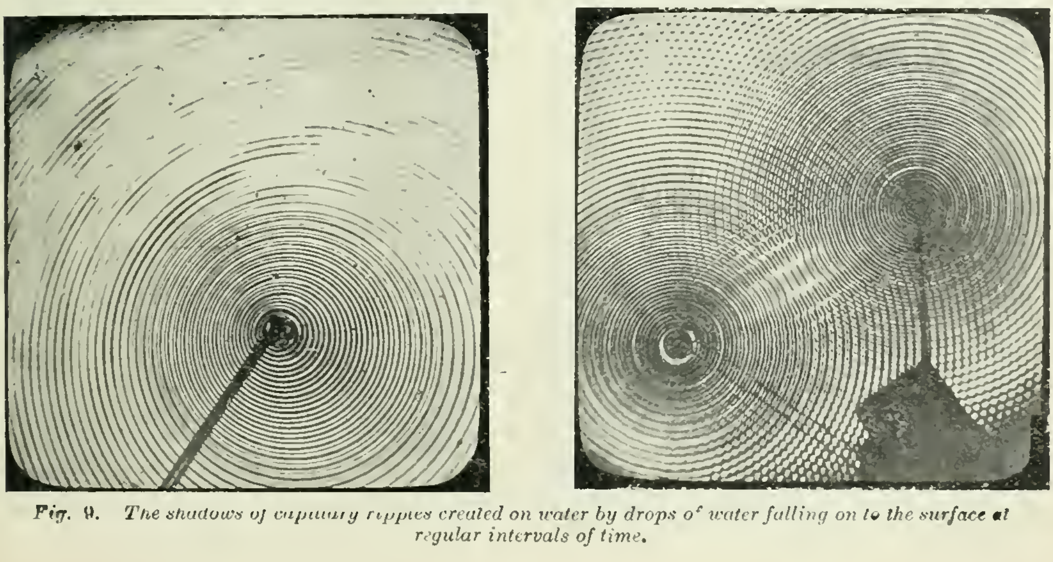


Fig. 9. The shadows of capillary ripples created on water by drops of water falling on to the surface at regular intervals of time.

belt so that as it revolves it periodically eclipses and allows the light from the lantern to pass as in a cinema projector lantern. The result is that the image on the screen is seen intermittently. If, now, the rate at which the water drops fall on the water surface is so adjusted that the interval between two drops falling is equal to the interval between the passage of two holes in the disc in front of the lantern objective lens, we shall see on the screen an image of a set of concentric annular ripples, which will appear to be stationary or can be made to expand slowly outwards by properly adjusting the speed of the stroboscopic disc (see Fig. 9).

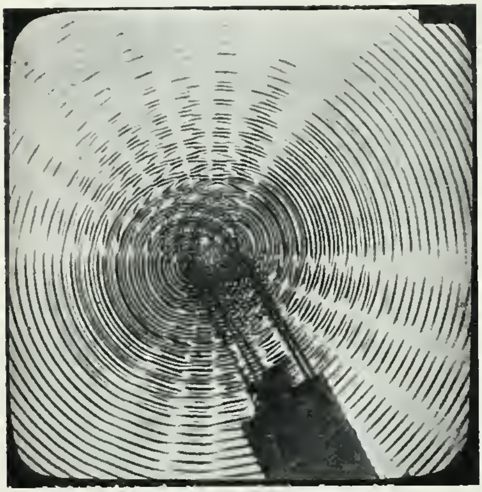


Fig. 10. The interference of two sets of circular capillary ripples or wavelets. The white portions in the diagram are the places in which the two sets of waves have interfered and destroyed each other.

With this apparatus we can show a number of instructive experiments. If we arrange two dropping tubes so as to drop water at places an inch or two apart in the tank and adjust the drops so that they fall simultaneously, then we shall see on the screen a complex pattern of ripples. Each set of drops makes its own concentric set of annular wavelets. It will then be clear that at certain places the humps of one set of waves will coincide with the humps of the other set, and the elevation of the water at those places will be increased. In the same way the hollows or depressions of one set will be in coincidence with those of the other, and will increase the depression. On the other hand there will be some places lying along certain lines at which the humps or crests of one set of waves will coincide with the hollows or troughs of the other set, and hence at these places the waves will extinguish or nullify each other. This effect is called the *interference* of waves, and is of great importance in wave phenomena in general (see Fig. 10). In fact, whenever we can obtain evidence of interference we can say with almost complete certainty that we are dealing with a case of wave motion. In our lantern tank experiment the lines along which interference is taking place from waves diverging from two centres are lines which are parts of curves called hyperbolas, because it is a property of such a curve that the difference of the distance of any point on the curve from two fixed points called the foci is constant. The condition of interference is that the distance of the point at which it takes place from the two wave sources must be a certain odd multiple of half a wavelength, and, moreover, the waves must start in the same phase at the same instant from the two sources.

Another effect well shown by this ripple apparatus is the reflection of a wave. For this purpose we put into the shallow trough a little flat wall of metal which stands up above the water a little. The dropping point is arranged at a little distance from this wall so that the miniature waves strike against it like sea waves on the coast striking a sea wall. We then see on the screen a double set of ripples, one set approaching the wall and another set moving away from it. This second set appear to diverge from a point as far

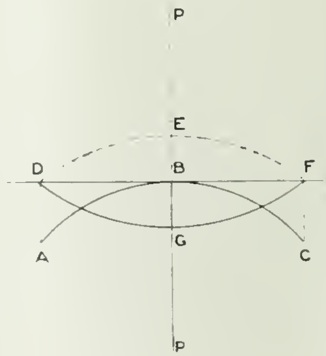


Fig. 11.

behind the wall as the actual source point is in front of it. The reason for this will be evident on looking at the diagram in Fig. 11.

Let P be the origin from which the waves diverge and let $A\ B\ C$ represent the crest of one annular wave just reaching the wall $D\ B\ F$. If the wall did not exist that wave would move onwards and an instant later would be found in the position $D\ E\ F$, which is part of a circle whose centre is at P. Since, however, all parts of the wave $A\ B\ C$ are turned back or reversed in motion on striking the wall, the actual reflected wave is found at $D\ G\ F$. It is obvious that this is part of a circle whose centre is at P', which is a point as far behind the wall $D\ B\ F$ as the actual origin P is in front of it. The actual process of reflection of the wave is as follows :—

Consider one circular crest $A\ B\ C$ (see Fig. 12), which is advancing to the wall $D\ F$.

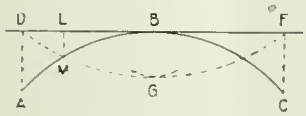


Fig. 12.

As each point on that wave reaches the wall it will create a vibration in the water, which causes a secondary wave to diverge in circles from that point. Thus, when the front of the wave touches the wall at B, a circular wave begins to diverge from B. A little later a point M on the wave reaches the wall at L, and from that point another secondary disturbance originates. Similarly, when a point A on the original wave reaches the wall at D, it gives rise to a secondary wave diverging from that point. The wave originating at B gets the start over that originating at L and that at L over the wave starting from D.

The line $D\ G\ F$ (dotted) which touches all these secondary waves at any instant is called their *envelope* and is the resultant reflected wave. Everyone knows that in the case of a reflected image in a looking glass, the image of the object appears to be as far behind the mirror as the real object is in front of it. This is simply a consequence of the fact that the reflected image is caused by light which diverges in spherical waves of a certain kind from every point on the object, and the observer into whose eyes these reflected rays enter sees the image as a collection of radiant points, each of which appears to be as far behind the mirror as the corresponding radiant point in the object is in front of it.

Many optical illusions and conjurors' tricks depend upon this principle. Thus, for instance, we can easily create the illusion of a candle appearing to burn inside a decanter of water as follows :—

Set up vertically on a table a very clean sheet of clear plate-glass and place a lighted candle at a place near it. The candle can be shaded by a little screen so as not to be seen directly but only as a reflected image in the glass surface. This image appears to be behind the glass. At that point place a large glass decanter full of water and when looked at from a certain direction, the illusion will be complete of a candle appearing to burn inside a bottle of water. (Fig. 13.)

Another important property of surface waves and of waves in general can be demonstrated by the same apparatus, viz., the refraction of waves.

If we have a set of parallel plane or straight waves which are moving in one material or medium and advancing in an inclined direction to a straight boundary between that medium

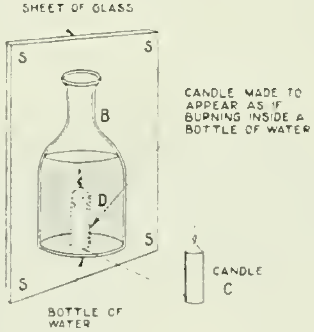


Fig. 13.

and one in which the waves move with a different velocity, then on crossing the boundary the direction in which the waves are advancing is changed. Thus, let AB be the crest line of a straight wave advancing parallel to itself towards a boundary line DF between two media 1 and 2. Let us suppose that the waves travel more slowly in medium 2 than in medium 1. Then when the left-hand end A of the wave AB passes the boundary it will proceed more slowly (Fig. 14.) Hence it will only have reached a point C and travelled a distance AC in the time that the right-hand end B will have travelled over a greater distance BD and reached the point B. Therefore the line of the wave front, viz., AB, will be slewed round into CD on crossing the boundary into the position DC. This is called the *refraction* or bending of a wave.

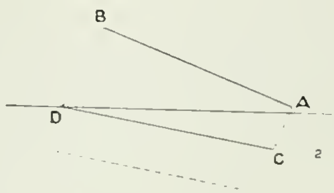


Fig. 14. A diagram illustrating the refraction of a wave.

It is this bending of the wave front when passing across the boundary of two media in which the wave has different velocities which determines so many familiar optical phenomena such as the apparent bending of a stick when placed half immersed in an inclined position in the water.

The refraction of ripples can be shown with the above described lantern apparatus as follows :—

A semi-circular thick sheet of glass is provided which fits into the lantern tank and makes one half of it more shallow than the other. One dropping tube is arranged so as to send out ripples from a point in the deeper part of the tank. These ripples spread out in circular rings. If the water level is adjusted so that over the shallow part of the tank it has a very slight depth, not more than a millimetre or so, then over this part the ripples will travel more slowly than over the deeper portion. Hence, when the ripples pass over the boundary line it will be seen, on regulating the speed of the stroboscopic disc as above described, that there is a discontinuity or change of direction of the expanding annular ripples. On the shallow part the form and curvature of the ripples is such that they appear to diverge, not from the actual dropping point, but from another point situated a little way from it (see Fig. 15).

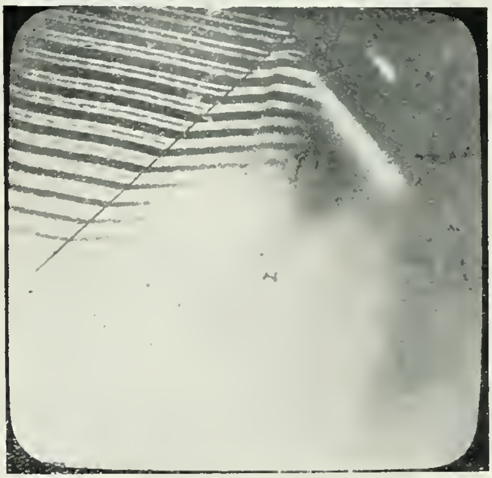


Fig. 15. A diagram showing the refraction or bending of waves in passing over from one medium to another in which they have a different velocity of propagation.

Fig. 16. Echelon waves on water produced by the motion of a swan.

7. Waves Produced by Ships.

In concluding this part of our subject, attention may be directed to a very important class of surface waves on water, viz., those made by ships, boats, and aquatic animals in moving over the surface.

If we look at any swan or duck, swimming on a pond, especially if the bird is moving quickly, we shall see a set of ripples on either side of it, each comprising a number of wavelets set one behind the other and all included between two lines, starting from the bird's breast, which are inclined to one another at an angle of 38° 56′. These little wavelets overlap and are said to be arranged "in echelon," a term derived from the French word *échelle*, for steps like a ladder (see Fig. 16).

They are probably best seen when a boy's model ship is sailing over smooth water on a pond, and it will then be noticed that in addition to the echelon waves, which start from the bows, there is another set of transverse waves behind the ship. In fact, the echelon waves and transverse waves all form part of one complete system of ship waves (see Fig. 17).

Fig. 17. Echelon waves on water produced by the motion of a boy's model ship.

This system of waves above mentioned is all included between two inclined lines, which start from the ship's bows. A construction which gives this angle is as follows :—Describe a circle and draw through its centre C a diameter $A B$. Produce this line $A B$ to a point S, such that the length $B S$ is equal to $A B$. Then from the point S draw two lines, called tangents, to touch the circle at points D and E. Then the angles $D S B$, $E S B$, are each $19^\circ\ 28'$, and the angle $D S E$ is $38^\circ\ 56'$ (see Fig. 18).

Let us consider for a moment how these waves are formed. When the ship moves forward through the water it gives a push to the water which creates an elevation and starts a wave. This push being continually repeated as the ship progresses creates a group or family of waves. One of these waves may be considered to be attached to the ship's bows, and to move forward with it. It has already been pointed out that in the case of surface waves on water the velocity of a group of waves is half that of a single wave. Hence, if when the ship is at A it starts a group of waves, the middle point of this group will have travelled only as far as B by the time that the ship itself, carrying one wave with it, has travelled double that distance and arrived at S. Hence we see that a ship moving over the water is followed by an ever lengthening train of waves, the group velocity of which is half that of the ship.

The subject of wave production by ships is of enormous practical importance, because the creation of waves absorbs or requires an expenditure of energy. In the case of a steam, petrol or electric ship that energy is derived from the coal, petrol or other source of driving power. Hence, other things being equal, the less the ship makes waves the less the dissipation of energy. Great attention has therefore been given to the design of ship's hulls with the object of determining what form has the least wave-making quality.

All the power taken up in wave-making travels away from the ship and is wasted, and hence to obtain the greatest speed for the least expenditure of propelling power, the form of the ship must be such as to create surface waves as little as possible.

In addition to the power absorption in wave-making there is also an expenditure in making eddies or little vortices in the water, and at low speeds the chief source of energy waste is in overcoming frictional resistance between the water and the hull of the ship.

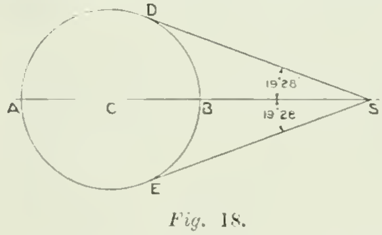


Fig. 18.

This last can be reduced by making the hull smooth, and also free from projecting studs or rivet heads, all of which also tend to create eddies in the water and increase the skin resistance and therefore energy loss. It is now the custom to predetermine the effects of any proposed form or design of ship hull, on the power required to drive it through the water at a given speed by means of experiments made on large scale models dragged through the water in a very long tank called a testing tank. The models are made to scale in paraffin wax, as this material can easily be shaped to any required form and then melted down and used over again.

The model is then dragged through the water in tank at a given speed, and by means of a sensitive recording dynamometer the power exerted is exactly measured.

As the subject of ship design is not one with which we are here concerned the mode of conducting these tank experiments need not be discussed. The reader who desires more information may be referred to the author's book, "Waves and Ripples in Water, Air, and Aether" (published by the S.P.C.K.), or to Lord Kelvin's "Popular Lectures and Addresses," Vol III (Macmillan & Co.), see the "Lecture on Ship Waves."

8.—Rotational and Irrotational Fluid Motion.

There is one point in connection with the motion of liquids to which it may not be amiss to make a brief reference. A liquid is capable of motion in two ways, one of which is called *irrotational* motion and the other *vortex* motion.

In the irrotational motion every particle of the liquid moves without rotation. If we imagine any small spherical portion of the liquid to become solidified, and that we could make a mark on this little solid sphere, and watch it as it moves with all the rest of the liquid, we should find the marked spherule moving so as always to keep its marked end pointing in one constant direction. In other words, although it may possess a progressive motion, it is not revolving in any way, or has no rotational motion. On the other hand, if the motion of the liquid is such that the selected spherule turns round continually so as to face in different directions as it progresses, and as the moon does in revolving round the earth, then the motion is called rotational. If the liquid particles rotate so as always to face towards a certain line called a vortex line, then this motion is called vortical.

We can see a vortex of water formed every time we pull up the waste-plug of a bath or wash-hand basin full of water. The water swirls round, forming what is called a whirlpool or eddy, or vortex, in which a certain part of it is revolving round an axis rotationally. A vortex in a liquid must either have its two free ends on the liquid surface or else it must form an endless vortex or vortex ring.

We can see the former type of vortex formed by drawing a teaspoon, with the bowl half immersed, quickly through a cup of tea. On the edge of the spoon will be noticed two little whirlpools of liquid which move with the spoon. These are the ends of a vortex which extends from one whirlpool to the other round the edge of the immersed part of the spoon.

On the other hand, we see an endless vortex produced in those smoke rings which many cigarette smokers can blow from the mouth or end of the cigarette.

In this case the smoky air is revolving round a circular or closed line in such fashion that the motion on the inside of the ring is in the direction in which the ring as a whole is moving forward.

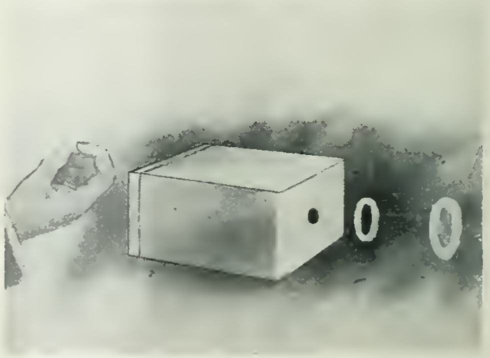


Fig. 19. Smoke rings or circular vortex rings produced by tapping the back of a paper box filled with smoke and making their exit out of a hole in the front.

They can better be made as follows:—Make a little cubical paper box of rather stiff paper, the side of which may be 3 or 4 ins. in length. Cut a circular hole about 1 or $1\frac{1}{2}$ ins. in diameter in the centre of one side (Fig. 19). Fill the box with tobacco smoke by puffing a cigarette into it. Then give a smart tap on the side of the box opposite to the hole. A smoke ring will emerge and fly through the air. A careful examination of the ring as it moves will reveal the peculiar kind of rotary motion which is taking place in the ring. The smoke merely makes evident the air motion, but the vortex ring is produced and exists when the box is tapped, whether it is full of smoke or not. We have such vortex rings produced whenever a jet of gas or liquid moves through an undisturbed mass of gas or liquid.

(*To be continued.*)

How to Prepare a Synoptic Weather Chart

By W. G. W. Mitchell, B.Sc., F.R.A.S., F.R.Met.S.

THE synoptic chart gives a " bird s-eye " view of the weather conditions at a certain instant of time over a large area. Such charts, showing barometric pressure and the more important elements of weather, appear in several of the daily newspapers, but, as previously pointed out in these articles, the

Fig. 1. Code No. 1. Cirrus (ci.).—Mares' tails with tufted ends (Cirrus-uncinus), often at about 30,000 ft.

information contained therein is several hours " old " by the time it appears in print. It is our intention in the present article to deal with the decoding and plotting of a synoptic data message. For ordinary purposes, we plot only the essential elements of barometric pressure, wind, weather, temperature and barometric tendency. The codes given in the last article

Fig. 2. Code Nos. 2 and 8.—At top, Cirro-Stratus (Ci.-St.). Uniform sheet of very high cloud, 30,000 ft. About 25,000 ft. beneath is, at bottom, Fracto-cumulus (Fr.-Cu.). A string of rugged cumulus at about 6,000 ft.

on this subject (pp. 819-822, *Wireless World and Radio Review*, September 23rd) in conjunction with the additional specifications given below are all that is required for this purpose. After a few weeks' practice, when the amateur becomes familiar with the code, the translating of the coded message to the map may be done very quickly.

We will take, as an example, the synoptic data message issued by the Air Ministry on August 20th last at 1900 G.M.T. The message, as sent out on 4,100 metres C.W., was as follows :—

01.	12622.	30055.	01178.	84356.	94279.
11.	17824.	21157.	01287.	06196.	01629.
93.	37532.	21211.	12067.		
44.	20021.	30165.	00068.	00009.	00690.
10.	17424.	41256.	00177.	43289.	0047–
92.	40820.	11113.	00186.		
15.	17724.	11163.	00277.	69696.	00070.
61.	21124.	10164.	91077.	00009.	00680.
91.	53422.	63411.	00558.	06194.	
07.	15804.	20156.	02088.	82246.	00080.
78.	20304.	30166.	51186.	00009.	00380.
94.	35200.	05508.	00670.		
03.	13224.	31054.	00268.	09093.	00260.
95.	36918.	45108.	31668.	75600.	

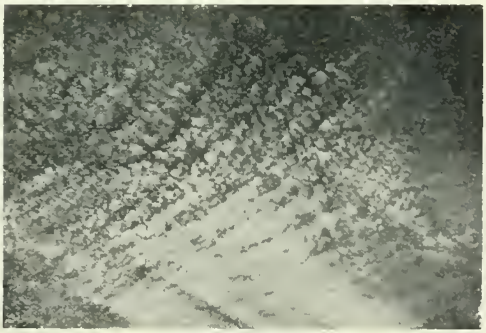
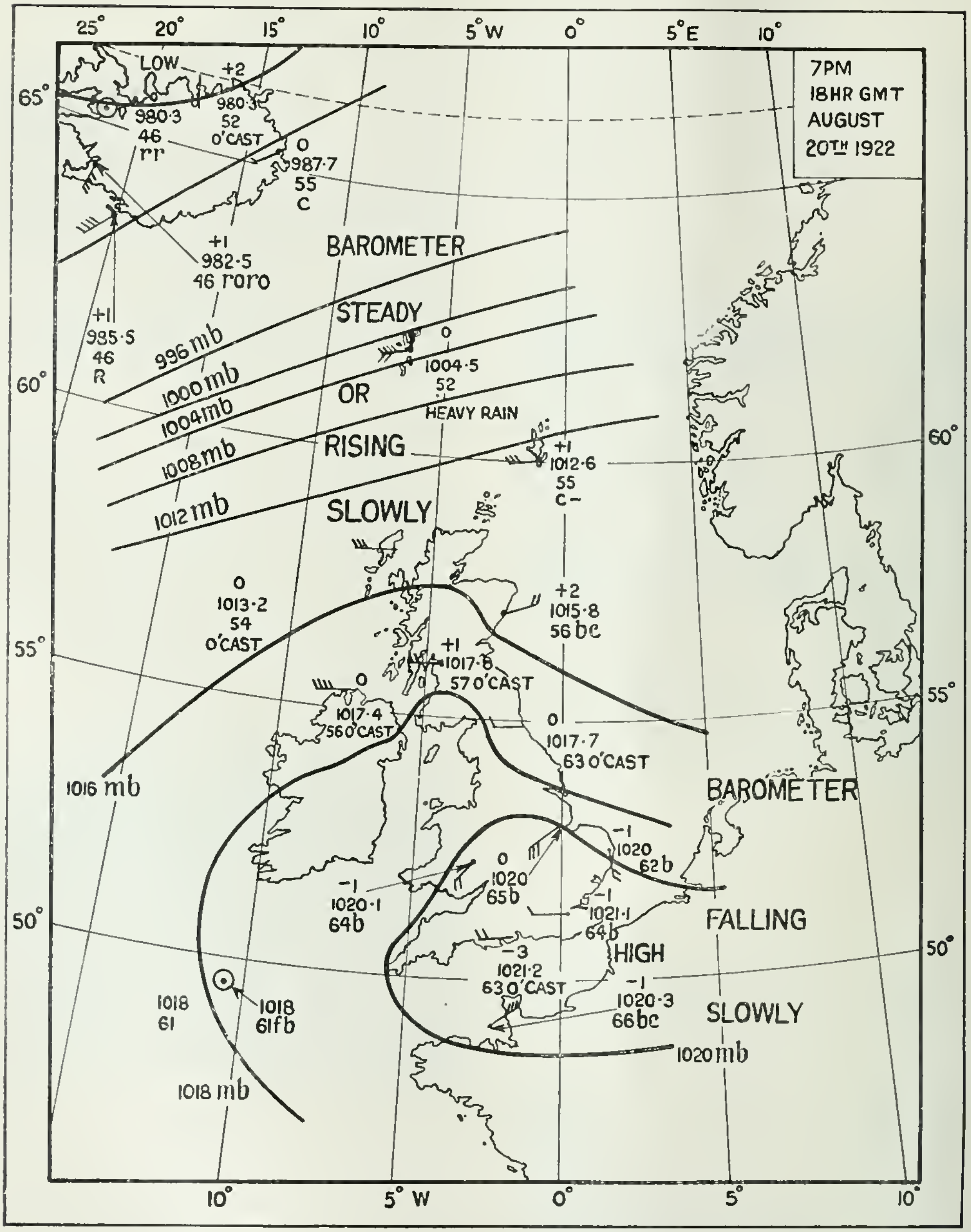


Fig. 3. Code No. 3 (Ci.-Cu.).—The Mackerel Sky. The highest form of cloudlets in waves, 20,000 to 25,000 ft.

45.	20016.	30062.	51068.	82826.	00060.	
96.	39120.	63508.	31599.			
54.	20120.	20064.	61077.	81816.	00690.	
74.	21222.	21063.	53275.	69694.	00070.	
Pilot.	32.	23214.	32120.			
	74.	12603.				
Ships.	14960.	01023.	18009.	08176.	12137.	61603.
	50106.	44884.	aaa	14959.	01157.	18144.
	28167.	12182.	61614.	69005.	73998.	



GENERAL INFERENCE TO BE DERIVED FROM ABOVE SYNOPTIC CHART.

The main Icelandic depression now lies beyond the Arctic circle, and an anticyclone is situated over the English Channel. In the north, fair to cloudy weather, with local showers, is likely, and in the south a fair and rather warm day after early morning mist, and probably local drizzle.

Fig. 4. Code No. 4.—Alto-Cumulus (A.-Cu.). Layer of large cloudlets in waves at middle height.

Fig. 5. Code No. 5.—Alto-Stratus (A.-St.). Sheet at middle height, between 10,000 and 25,000 ft.

The symbolic form of the first part of the message down to the word " pilot " is :—

$l_n l_n$ BBBDD FwwTT cbWVH ALaNh RRMMr (or $RRSV_8r$), and for ships $QLLLx_1$ $llllx_2$ $BBDDx_3$ $Fvkdx_4$ $wwGGx_5$ $TTttx_6$ $CNwrx_7$ $y_1y_2y_3y_4z$.

Concerning ourselves only with the symbols underlined, which embrace all that can be conveniently plotted on the map without overcrowding, the translation becomes :—first line (first group) station Lerwick—see key-map in last article ; (second group) barometric pressure 1012.6 mb., wind from W.-S.W. ; (third group) wind force 3, cloud increasing, temperature 55° F. ; (fourth group) positive barometric tendency amounting to 1 mb. during preceding 3 hours, past weather cloudy ; (fifth group) N=5/10th of sky covered with cloud. Second line (first group), station Renfrew, etc., etc.

drizzle." The letters have the following meanings :—

b=fine.
bc=fair.
c=cloudy.
d=drizzle.
f=fog.
h=hail.
i=intermittent (occasional).
j=adjacent (*i.e.*, in vicinity of station.)
KQ=line squall.
l=lightning.
o=overcast.
p=passing showers.
r=rain.
s=snow.
t=thunder.
tlr=thunderstorm.
⊕=halo.
=gale.

The following additional letters are sometimes used in maps :—

e=wet air without rain falling.
g=gloomy.
m=mist.
q=squally.
u=ugly, threatening.
v=extreme visibility.
w=dew

Present Weather Code (ww).

First Fig.	0	1	2	3	4	5	6	7	8	9
Second figure. 0	bc−	bc	bc+	bcjp	bc⊕	bc/f	bc/r	bc/s(h)	bctl	bc/tlr
1	co−	co	co+	cojp	co⊕	co/f	co/r	co/s(h)	cotl	co/tlr
2	fb	fo	ifb	ifo	fb−	fo−	ffb	ffo	fb+	fo+
3	pr_0	ph_0	prs_0	ps_0	PR−	PR	PR+	PH	PRS	PS
4	d_0	d_0d_0	d_0+	d−	d	dd	d+	D−	D	DD
5	r_0	r_0r_0	r_0+	r−	r	rr	r+	R−	R	RR
6	s_0	s_0s_0	s_0+	s−	s	ss	s+	S−	S	SS
7	rs_0	rs_0rs_0	rs_0+	rs−	rs	rsrs	rs+	RS−	RS	RSRS
8	$h_0(r_0)$	rh_0rh_0	$h_0(r_0)$+	h(r)—	h(r)	rhrh	h(r)+	H(R)−	H(R)	RHRH
9	tlr_0	$tlrb_0$	tlr	tlrh	TLR	TLRH	TLR	TLRH	KQ	KQH

A solidus (/) such as occurs in the combination " bc/r " separates weather at the time of observation from the preceding weather ; bc/r thus indicates " fine or fair after rain or

x=hoar frost.
y=dry air (humidity below 60 per cent.).
z=haze.

Continuity is indicated by repetition of letters. Thus ır=continuous rain. Intensity is indicated by employing capitals; thus R=heavy rain, and RR=continuous heavy rain. A suffix $_0$ means "slight"; thus rs_0= slight sleet. + means increasing, and — diminishing, in intensity or amount. KQ= line squall (*i.e.*, very heavy squalls with change of wind direction and fall of temperature).

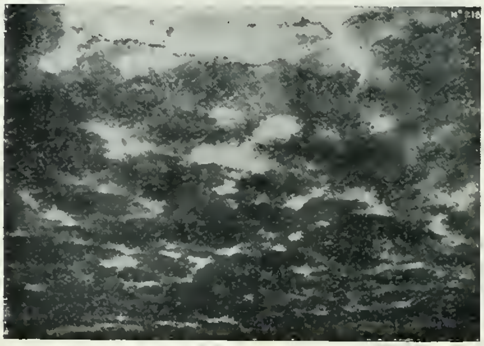


Fig. 6. Code No. 6.—Strato-Cumulus (St.-Cu. Layer of clouds in irregular order below 7,000 ft.)

Characteristic of Barometric Tendency during the three hours preceding the time of observation (c).

Code figure.		
0 = 0 or +	.. Steady or rising.	The barometer is now higher than or the same as three hours ago.
1 = + 0	.. Rising, then steady.	
2 = + —	.. Rising, then falling.	
3 = — + or 0 +	Falling or steady, then rising.	
4 = unsteady +	Unsteady, but rising.	
5 = — ..	.. Falling.	The barometer is now lower than three hours ago.
6 = — 0	.. Falling, then steady.	
7 = — +	.. Falling, then rising.	
8 = 0 — or + —	Steady or rising, then falling.	
9 = unsteady —	Unsteady, but falling.	

Past Weather in interval since last report (W).

	Code figure.	
Without precipitation.	0 =	Fair or fine.
	1 =	Cloudy.
	2 =	Overcast continuously.
	3 =	Fog or mist.
	4 =	Thick fog.
Precipitation.	5 =	Passing showers.
	6 =	Rain or drizzle.
	7 =	Snow or sleet.
	8 =	Hail or rain and hail.
	9 =	Thunderstorm.

Quarter of Globe (Q).

Code figure.	Latitude	Longitude	
1	N.	W.	Barometer in millibars.
2	N.	E.	
3	S.	W.	
4	S.	E.	
5	N.	W.	Barometeres millimetrni.
6	N.	E.	
7	S.	W.	
8	S.	E.	

The weather elements underlined should be transferred direct to the map. First insert an arrow with the appropriate number of flèches to denote wind direction and force respectively. Then write against the station the barometric pressure in mb., above this the barometric tendency and amount in half mb., using red ink for positive and black ink for negative tendencies. Below the pressure, write the temperature in degrees F, and beside this the appropriate symbol for weather. It is sometimes necessary to combine ww, W and N, to arrive at a symbol for indicating the general character of the weather. Reports from the Færoes and Iceland give barometric pressure in mm., and temperature in degrees C. The equation for conversion to mb. and degrees F are :—

(1) x mm = $4/3\,x$ millibars.

e.g. $760 \text{ mm.} = \frac{4 \times 760}{3} \text{ mb.} = 1013.3 \text{ mb.}$

(2) $y \text{ degrees C} = \left(\frac{9}{5}y + 32\right) \text{ degrees F.}$

e.g., $11° \text{ C.} = \left(\frac{9 \times 11}{5} + 32\right)°\text{F} = 19.8 + 32 \text{ degrees F.} = 51.8° \text{ F.}$

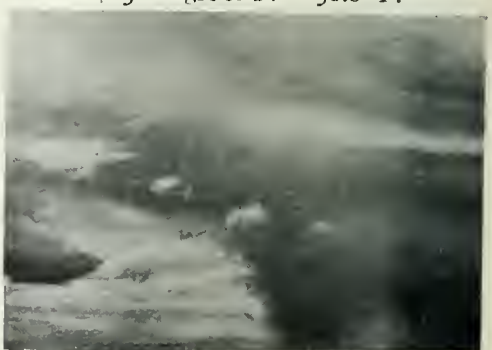


Fig. 7. Code No. 7.—Nimbus (Nb.). Shapeless cloud base at 7,000 ft., rain falling.

Fig. 8. Code No. 8.—Fracto-Cumulus (Fr.-Cu.). Rugged cumulus in drifting groups (4,000 to 6,000 ft.).

Finally isobars should be drawn in on the map*, the centres of high and low pressure marked, and a general indication of the behaviour of the barometer printed over a large area. Some little care will be necessary

Fig. 9. Code No. 9.—Cumulo-Nimbus (Cu.-Nb.) Mountainous mass reaching from about 10,000 to 25,000 ft.

at first to give the correct direction and spacing for isobars. Buys' Ballot's law is sometimes helpful in this connection, but absolute reliance should not be placed upon this law. It is usual to draw in isobars at intervals of 2 mb., and for even values, those for 1,014 mb. and over being marked in red (or drawn thick).

[* Suitable blank maps for use as synoptic charts may be obtained from The Stationery Office, Kingsway. Price 2s. 3d. per hundred, postage 8d. extra.]

The amateur is thus enabled to have a synoptic chart before him within a lapse of $1\frac{1}{2}$ hours from the actual time of the observations. He is then in a position to become his own local weather forecaster.

Fig. 10. Code No. 10.—Fracto-Stratus (Fr.-St.) Ragged stratus . drifting masses of low cloud.

Beginning on October 15th, meteorological observations taken on board the s.s. "Maud," of the Amundsen polar expedition, will be included in the "International Collective Report," issued daily from the Eiffel Tower at 11.30 G.M.T. The code used will be the same as for American stations in the same meteor and in addition the latitude and longitude of the ship will be given. It is expected that these observations will be continued for two years or more.

These codes and the "International Collective Report" will be dealt with in an article in the next instalment of this series.

The illustrations of cloud formations used in illustration of this article are reproduced by kind permission of the Controller of H.M. Stationery Office, from the Meteorologica. Observer's Handbook (M.O.233).

LIST OF AMATEUR AND EXPERIMENTAL CALL SIGNS

The Editor wishes to thank all those who have kindly checked the proofs submitted of the particulars of their stations.

Those particulars which arrived too late for inclusion in the list just issued will be included in subsequent issues of this Journal.

Experimental Station Design

(*Continued from page* 869, *September* 30*th issue.*)

These articles, which appear in alternate issues, are intended not only to be a complete guide to those new to wireless, but to give explicit details on the construction of all the components of the Experimental Station. Actual designs will of necessity in some instances be somewhat crude, in order that they can be made up without elaborate workshop equipment. Practical working instructions are given where necessary for the help of those unacquainted with the more simple processes of instrument making. Of course, where good workshop facilities exist, the designs may be readily modified.

Economy is made an essential feature, bearing in mind always that where low-priced component parts can be obtained their use has been embodied in the designs. For those who do not desire to make their own apparatus, the descriptions will assist them in selecting the equipment for their stations.

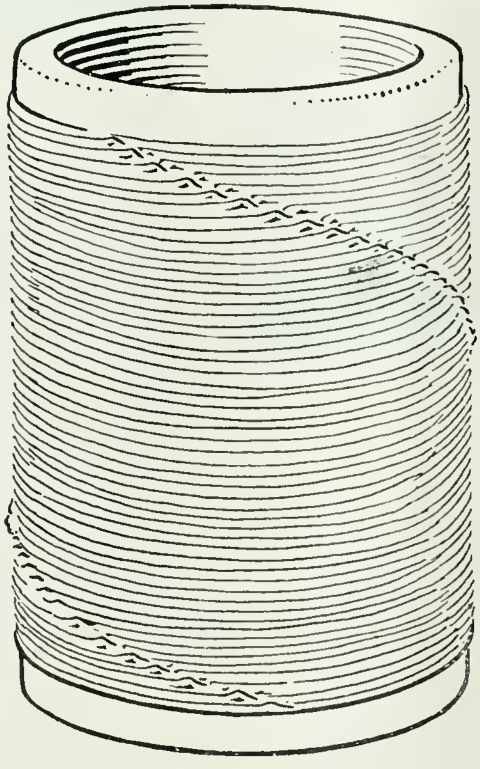
The information contained in the first few articles under this heading is to help those new to wireless and whose first aim is to build a simple set capable of receiving broadcasted telephony, and consequently may cover ground already familiar to many readers. The succeeding instalments, however, advance by easy stages, and in the course of the series the construction of an elaborate station will be evolved.

XIV.—PILE WINDING.

ONE of the most satisfactory methods of winding an inductance of comparatively high value and occupying small space is achieved by building up a number of layers. In order to minimise the detrimental effects of self-capacity, it is necessary that only successive turns are allowed to lie side by side, and consequently it is not possible to wind a single layer of many turns, and then to return over this winding with a second layer. The second layer must be piled on to the first layer as it is wound on, and the capacity evenly distributed along the whole inductance. Such a winding, consisting of two layers, is described as a "two-pile winding." Pile winding may, however, consist of several layers, five being usually the limit, five-pile winding requiring considerable skill and patience.

For those unaccustomed to the winding of single layer inductances, it might be mentioned that when winding by hand, wires between 20 and 36 S.W.G. can usually be neatly arranged, providing the diameter of the former does not exceed five inches. Large diameter formers are difficult to wind, as the turns have a tendency to run slack.

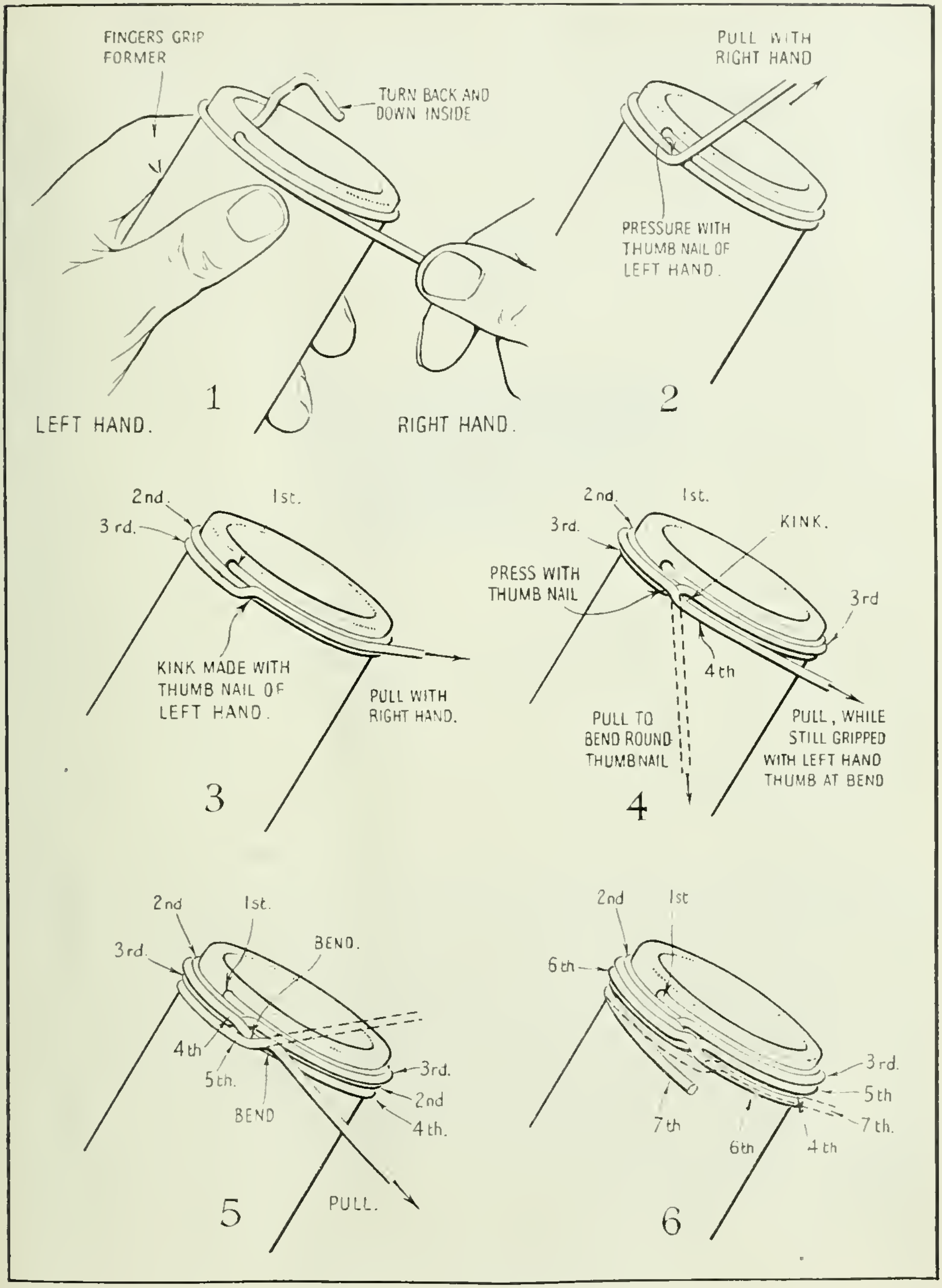
If the former is of cardboard, it must be thoroughly dried out before winding, or otherwise subsequent drying will cause contraction sufficient to make the turns loop over one another, and particularly is this the case with large diameters. To prevent absorption of moisture and subsequent deterioration of insulation, the former, after drying, should be well impregnated, both inside and out, with shellac varnish and baked in a moderately warm oven. Even when a lathe is available, it is usually better, if only one or two inductances have to be wound, to put on the wire by hand, and the method of terminating the ends of a single layer winding is shown in a previous article.*



A Pile-Wound Inductance.

The size of wire for pile winding should not be finer than 30 S.W.G., for it is difficult to make fine wire take the necessary kinks required for holding it in position. The heaviest gauge wire that can be conveniently pile wound is No. 20, as thicker wires

* Fig. 4, p. 866. Sept. 30. 1922.



Method of making of a Two-Pile Winding.

are rather difficult to bend with the thumbnail; sizes 22, 24, 26 and 28 single or double cotton or double silk covered, being particularly convenient for two-pile winding.

Two-pile winding is shown step by step on the adjoining page. In order to avoid complication when learning the method, it is better to terminate the end of the wire through a hole in the former, and Fig. 1 shows the first turn and a half completed. Two complete turns are wound on, holding and rotating the former with the left hand, while the thumb of the right hand maintains the tension on the wire. On the completion of the second turn, the wire is firmly held down with the left-hand thumbnail pressed hard on to it, and a pull in an upward direction on the wire with the right hand will make the necessary kink (Fig. 2). Then by slightly reducing the pull, the thumbnail may be slid just a little way along the wire to a point midway between the first and second turns, and the wire pulled down in line with the other turns, making a second kink and allowing the wire to lie in the dip between the first and second turns. (Fig. 3).

The turn is then continued round by revolving the former, pulling tightly all the time, and if the first two turns have been put on tightly, there will be no tendency for this turn to squeeze them apart. The first two turns of course must lie closely together, and if necessary may be pressed together with the thumbnail. On reaching the point of bending of the third turn, a cross-over must be made, as indicated in Fig. 4. The thumbnail is first of all pressed against the wire at a point just behind the cross-over, and the wire pulled downwards as indicated by the dotted lines. The thumbnail is then transferred to the other side of the cross-over and a slight upward kink made, after which the wire is continued round in contact with the former. On again reaching the point of cross-over, the wire is given a smart bend upwards, as shown in Figs. 2 and 5, and this time a little further on, say a quarter of an inch beyond the point of kinking of the third turn. The kink this time facilitates the building up of the wire into the groove provided by the previous turn. It is continued round, and when the cross-over of the fifth turn is reached, kinks are made as indicated in Fig. 4, to permit of the wire again coming down in contact with the former (Fig. 6), and removing any tendency the previous turn may have to fall out of position.

This process is continued, the points of cross-over always being an even distance beyond the previous ones, so that a uniform effect is obtained, and the kinks appear as a spiral around the wiring. After a little practice, pile-winding can be carried out quite quickly, the bends being made by a quick motion of the thumb of the left hand.

Two-pile winding is particularly useful where it is desirable to arrange a number of turns of low resistance in a small space, in order to provide tight coupling with another inductance. If it is desired to concentrate a larger number of turns into the small winding space, three, four, or five-pile winding may be attempted. For three-pile winding, three turns should be wound on side by side, and then, as shown in Fig. 2, the fourth turn should be wound between the second and third, whilst the fifth must be wound between the first and second. The sixth is wound over the top and between the fourth and fifth, and must pass on to these windings just in front of the point of cross-over. Having completed the sixth, which is at a distance of three layers out from the former, the kink is made this time in front of the point of cross-over, and the wire drops down to form the seventh turn in contact with the former and alongside the third. As soon as the point is reached where the wire crosses down from the top, that is the end of the sixth turn to the beginning of the seventh, a little pressure with the thumbnail, giving a bent back kink, will assist the ninth turn in lying firmly in position almost on top of the eighth turn. Another turn, and the winding is again three layers out from the former, after which a kink is made to facilitate the drop of the wire down into contact with the former. The process is carefully repeated, pulling the wire tightly all the time, and keeping the turns pressed closely together. The beginner should not attempt three-pile winding with finer gauges than No. 28. The methods of four and five-pile windings are easily apparent from the foregoing instructions.

F.H.H.

The All-British Wireless Exhibition

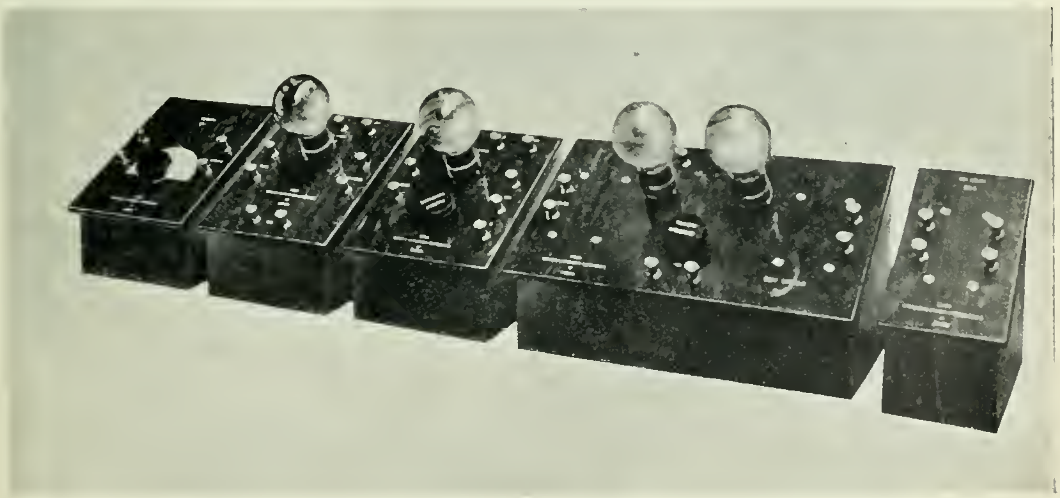
Description of Exhibits continued from p. 23, October 7th, 1922.

Anode Wireless and Scientific Instruments, Ltd., (Stand No. 2).

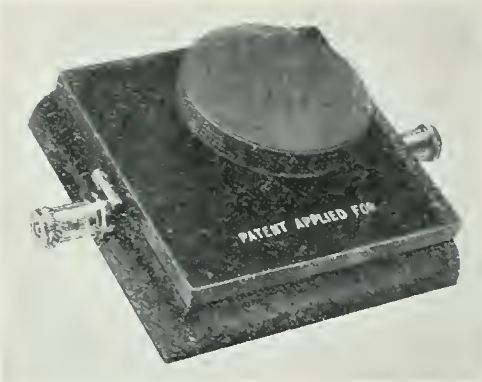
A receiving set of table design was exhibited, particularly suitable for use in a drawing-room, as it will harmonise with other furniture in the room. The wireless set itself is totally enclosed but is readily accessible by a falling panel on the side, and a loud speaker is incorporated. Articles on the table need not be disturbed when bringing the receiving set into operation. An instrument of special interest was the small variable condenser of simple construction, consisting of two metal plates with mica dielectric; one plate being moved by means of a patented screw arrangement. This condenser is beautifully finished, and occupies very little space. The screw mechanism is accurately made, and gives a smooth movement. Tuners, detectors, H.F, and L.F. amplifiers were to be seen. The full range of instruments designed on the unit principle were particularly attractive and possessed remarkably good finish.

A Table Set by Anode Wireless and Scientific Instruments, Ltd.

Unit 1 tuner employs the anode variometer system. Its range is 350-500 metres. Unit 2 is a one-valve amplifier. Unit 3 is an amplifying valve detector incorporating a combined rheostat and potentiometer. Unit 4a is a L.F. amplifier. Unit 5 is a telephone transformer.



Anode Units.



"Anode" Variable Condenser.

Fellows Magneto Company (Stand No 10).

On this stand was to be found a full range of receiving apparatus of reliable design, and many useful component parts. A five-valve panel set attracted a good deal of attention. The number of valves in circuit is varied by inserting the telephone plug in various jacks arranged along the base of the receiver panel, and any combination of high and low frequency can be effected. The set is provided with doors which close completely over the panel.

General Radio Company. (Stand No. 26).

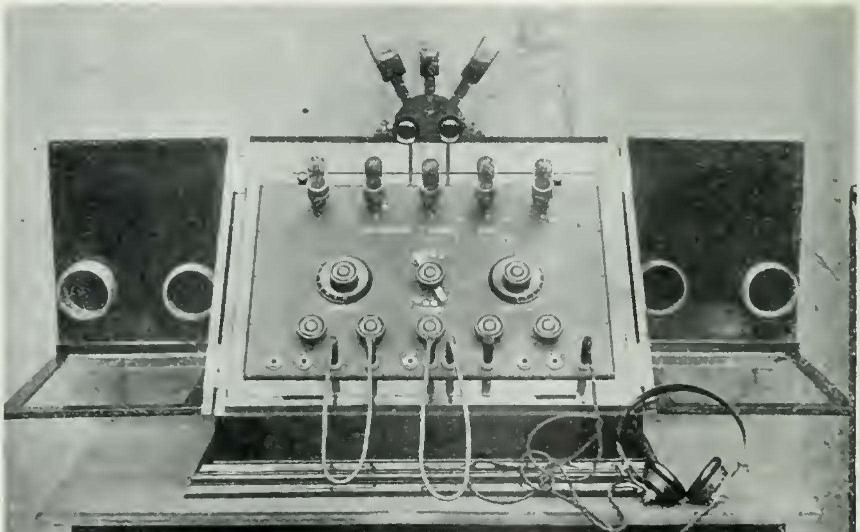
The apparatus exhibited on this stand included short wave receiving sets and amplifiers specially arranged for easy manipulation The finish of these instruments was very attractive, particularly the condenser and variometer scales, which were of nickelled metal and slightly raised. An efficient type of variometer of low self-capacity was to be seen, and was much appreciated by experimenters. It was built on a wooden frame, and had a maximum coupling between its two windings, thus providing a tuning adjustment over a wide range.

A special feature was a very beautiful multivalve cabinet receiving set. The pressing of a button provided on the front of the panel put the set into operation. To the wireless enthusiasts it was as beautiful inside as it was out.

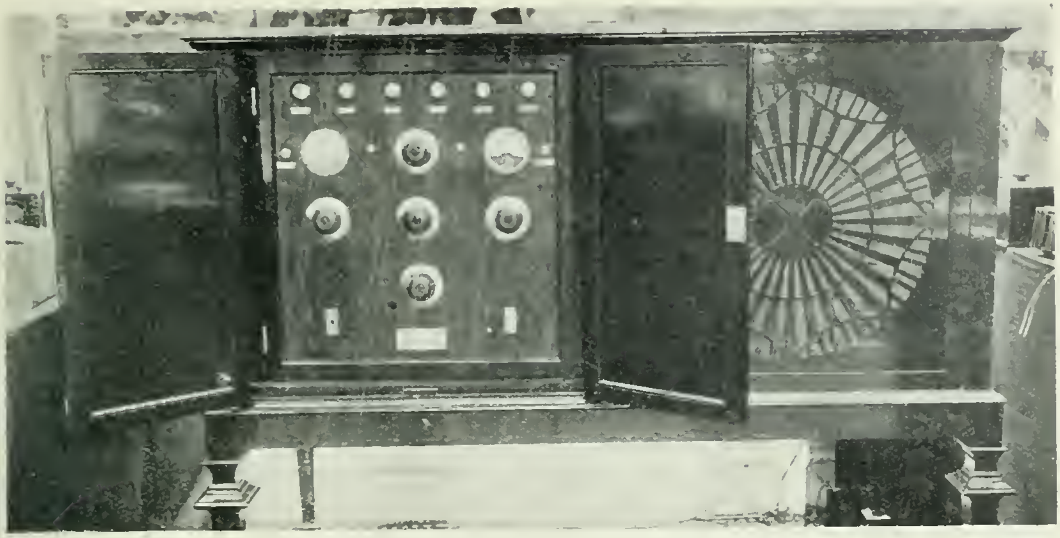
A number of components, in particular high frequency and low frequency intervalve transformers, were shown, of unique design.

Wates Brothers (Stand No. 15).

This Company is well known as suppliers of component parts, which were displayed in great variety on their Stand. A very attractive cabinet set with loud speaker was on view, incorporating apparatus of standard design.



The "Fellophone Super-Five."



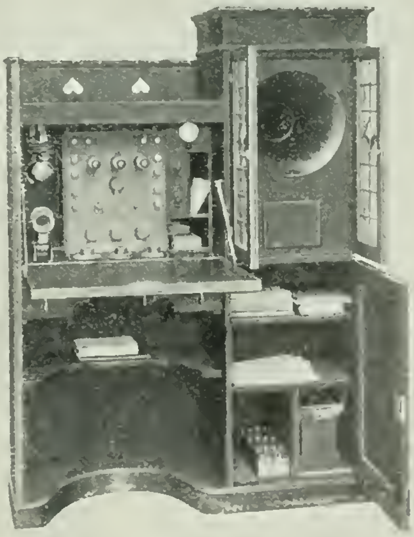
The General Radio Co.'s Cabinet Receiving Set.

"K.B." Radio Equipment Co. (Stand No. 8).

At stand No. 8 there was a selection of apparatus ranging from small parts to complete five or seven-valve sets. Of most interest was

View of Interior of Cabinet Set (General Radio Co.)

the "K.B." Unit System, by means of which a set containing any number of valves can be built up one panel at a time, without altering or throwing away any purchases previously made. This system is also supplied in parts, ready for the amateur to assemble in his own workshop. Other items of interest were two-valve sets, L.F. transformers, grid leaks, coil holders and all the small apparatus and parts constantly required by the amateur who builds his own set.



Cabinet Set exhibited by Wates Bros.

The Wireless Society of London

REPORT OF DISCUSSION HELD AT THE ORDINARY GENERAL MEETING, SEPTEMBER 27th, 1922

The President, Admiral of the Fleet Sir Henry B. Jackson, opening the meeting, said :—

Ladies and Gentlemen, our official organ, the *Wireless World and Radio Review*, in its number of September 16th, indicated the matters which would be brought to the notice of this meeting, which is the first meeting of the winter session. The most important item in that list was that we hoped Senatore Marconi would be able to give us a technical lecture. I have had some correspondence with him, and he wrote at the beginning of the month advising me that on his return from France he had received my letter, and it would give him the greatest pleasure to be present at the opening meeting of the Wireless Society of London, and to say a few words. He said he was then leaving for Italy, and that it was not certain when he could get back, but that if he could get back he would be here.

Well, Senatore Marconi has returned, but I am very sorry to say that he is not well. His doctors have said that he must not come here this evening, so we are very grievously disappointed in that particular. I think I may say on behalf of the Society that it expresses its regret for the cause of his inability to attend, and wishes him a speedy recovery, and hopes that his lecture is only postponed. May I take it for granted that you all agree to that. Senatore Marconi thanks you very much for the invitation.

This disappointment rather changes our proceedings for to-night, but still, as the *Wireless World and Radio Review* indicated, there are a good many points that I think can very well be discussed here. In fact, I think this is the first meeting of the Wireless Society since I have joined it at which members only have been present for the discussion of domestic affairs, because at the Annual General Meeting in January we have affiliated societies represented, and we cannot confine our attention to our own affairs. But to-night, as we have no technical lecture, we have the evening before us to consider various matters and to discuss them.

I am just going to run through some of the points I am to bring before your notice, and will ask you to give them careful consideration before those which require your definite approval are brought before the Annual Meeting next January.

One minor point is to remind you that several members of your Committee retire at the end of the year automatically by the rules of the Society. Now, the selection of those who will replace them is a matter that rests entirely in your hands, in the hands of the members of the Society, if they choose to take that action. If they do not do so, the selection of the proposed members will naturally fall on the Committee, and they may or may not choose people you would like. You may or may not like a change in the general type of those serving on the Committee to which you entrust your interests, and who, in my opinion, serve them very diligently and very well. It rests with you, and if you do not exercise your rights and privileges now, do not, some months hence, complain that you have a Committee which does not really represent the views of the majority of the members of the Society.

There may be amongst you some members who would like to serve on the Committee whom we do not know. If there are, I hope they will present themselves. Very often people are modest and do not like to press their claims.

The next point is the progress in the affiliation scheme of the Provincial and Suburban Societies—that is the best way of putting it—with the London Society which was initiated three years ago and has worked so well.

It has been slowly but surely forced on the minds of the Committee that the London branch cannot really be unpopular and moribund, though some rumours that this view is sometimes held in the provinces have reached me.

Our Chairman very recently, in the *Wireless World and Radio Review*, gives a very good argument why such societies as this exist at all, and why those interested in radio work should join this Society. I would only add on general principle that an organised body, even though it is small, can look after its own interests better than a large body which is unorganised, and that is one of the reasons why we suggest that members should join the Wireless Society of London. Compared with many of the societies interested in technical sciences, the Wireless Society of London is comparatively young, and, judging by its very rapid growth, it has hardly reached its manhood. This is not its own fault, as practical wireless was only born about a generation ago. It is therefore still struggling against some difficulties, but it is a live and going concern, and it is recognised by the Government authorities as such. Though mainly composed of amateur workers, it represents the most go-ahead of technical sciences, and we members may feel a certain pride in belonging to it, and may now legitimately ask our confrères in the other wireless societies (of which the greater number are already affiliated to us) whether they will not bind themselves to us still closer and form one Society, which may be a Society which represents the whole of Great Britain. Perhaps at some future date it might become an Empire society. I only put this forward as a personal view.

Briefly our proposal is that we might better be called the "Radio Society of Great Britain" than the "Wireless Society of London," the affiliated societies calling themselves by the same name, but adding the name of their branch.

Perhaps the word "radio" may not appeal to conservative minds, but it is really a more correct term than "wireless," if one considers the enormous amount of wire that is used in radio communications. Personally I always have been of a conservative mind, especially in regard to honourable names and traditions such as ours, but I think I can also claim to be one of the first practical workers in

Great Britain in this work, and yet I am now in entire agreement with the change. I really think that the fact that one of the earliest workers, of conservative mind, does not mind changing the name of the Society of which he has the honour to be President, might give the lead to others who might be rather unwilling to accept it. We have decided in the Committee that unless strong and reasonable opposition is put forward by those now belonging to or associated with this Society, that this change of title will take effect next year. In the meantime the necessary changes (which really are very small) in the existing rules of the Society and the affiliated societies can be carefully considered. I will not take up your time this evening in enlarging on the small alterations necessary. Later on we will ask the Treasurer to give his opinions on this matter, and I will ask others to talk about it later.

Another point I wish to bring forward is that in future, lecturers are requested to prepare the material of the lectures and send it in beforehand, so that the lectures can be printed in advance for distribution to those who are attending the lectures. It is a great convenience to those who wish to take any part in the discussions, and it enables publication in our official organ to take place much sooner than would otherwise be the case. I hope those who are preparing lectures for us will not omit sending them in about a fortnight beforehand.

The next point with which we have to deal is that on Thursday last the Secretary of the General Post Office, on behalf of the Postmaster-General, with Captain Loring, Mr. Brown, and Mr. Shaughnessey in attendance, received very courteously, and at very short notice, a deputation consisting of myself as President, Messrs. Campbell Swinton (Past - President), Hope - Jones (Chairman), McMichael (Hon. Secretary), and Scott-Taggart, as representatives of the experimental amateurs in this country.

We felt some anxiety as to the future of amateur experimenters and the licences which they would receive in view of the introduction of broadcasting. We had a long, amicable and straightforward discussion on the whole subject, and whilst strongly holding that our past and present rights must be fully considered, we were much impressed by the great difficulties the Post Office authorities have in attempting to satisfy all parties concerned with impartiality and justice. We gave our opinions and suggestions, and Captain Loring and Mr. Shaughnessy are here this evening to let you know at first hand what their difficulties are. I hope they will also be able to state whether any decisions have been arrived at. We must express our thanks to them and to the Postmaster-General for receiving us, and to the former for coming to us this evening.

The next point is the forthcoming Wireless Exhibition and Convention, which is to be opened next Saturday by our Honorary Vice-President, Sir Henry Norman, M.P., and which is to be held under our auspices. I think this is the first wireless exhibition to be held in this country on such a large scale. I hope everybody here will visit it, besides many others, and I think I may, in the name of this Society, wish it and its promoters every success. I shall be present at the opening, as will also Mr. Campbell Swinton, and I think we may take it that we all wish it every success.

The next point is the arrangements for the transmissions in the forthcoming Atlantic tests which are being considered by a small sub-committee and which are making good progress. The arrangements are hardly definite enough for me to set them before you this evening, so beyond wishing success to this important and difficult test of what the amateurs of Great Britain can do in return for what those in the U.S.A. did for us with such success last winter, I will not deal with the matter further now, but I think Major Hamilton, who is very interested in helping in this matter, may be able to say a few more words about it this evening.

Another point I am going to bring before you is that in July last an international gathering of representative men interested in many branches of science assembled at Brussels at the invitation of the Belgian Government to co-ordinate research work in several branches of chemistry and physics. The Union Radiotélégraphique Scientifique Internationale was one of these bodies. This Union was formed before the war, and has shown practically that it is a going concern by sending out the U.R.S.I. signals from Nantes. At this Radio Union, representatives from Belgium, France, Italy, Great Britain, Norway, the United States, and the Japanese, who also came in a short time ago, spent a whole week in serious discussion and in arranging an organisation for future work and its analysis on an international basis.

To effect this four Commissions have been formed to deal respectively with instrumental standards for radio measurements, measurement of received signals both in strength and direction, atmospherics, and collection of results obtained, and ideas from outside bodies and persons. Each country also has its National Committee, who will assist in the work of the Commissions through the representatives of each country. I may remark that I am at present the Secretary of the British National Committee, and Sir Richard Glazebrook is the Chairman and also one of the representatives of the Standards Commission. Mr. Dye, of the N.P.L., and also, I believe, Dr. Erskine Murray, are members. Dr. Howe and Mr. F. E. Smith are on the Measurements Commission, and Dr. Eccles is the President of the Atmospherics Commission, but I have not heard from Brussels definitely who are the other members. General Ferrié is President of the Union.

You may notice that a good many of these names are on the printed list of those who are officers of the Wireless Society of London. It is of the fourth, or, as it is termed, the "Liaison" Commission, that I shall speak to-night. This has been formed with the sole object of bringing into closer touch with the scientific side of the work individuals not claiming to be research workers or mathematicians, who are interested, and personally work at practical radio communication, such as operators, amateurs, designers and manufacturers of wireless apparatus. The object is to help to probe into, and we hope eventually eliminate, the many difficulties that workers experience in practical radio communication. I will give an example of how many of us might assist in this work. With a view of finding out how great an area any "click" from an atmospheric may cover, General Ferrié suggests to such observers as will take part in this that the time signals emitted by numerous stations all over the world should be the period when these particular observations are made, since they will give very accurate records of the time of observation, especially in the case of rythmic dots emitted periodically. The atmospheric clicks should be noted very accurately during these signals, and the results would be sent to a central office for analysis. If, say, 20 observers on any one day record simultaneously during these few minutes all atmospherics, and if some of these are evident on two or more records, a good idea of the area affected will be obtained, and will be of much more scientific value than a thousand clicks observed by one individual on different days. Dr. Austin gave an instance of this which proved that in the Pacific Ocean it was evident that some clicks affected several different stations, each of which was over 2,000 miles away from the other station. That was a very striking example.

Another point is the rapid fading away of signals at or near sunrise. It is often noticed, and systematic observation carried out carefully for a few days with regard to the sunset period, would also be of use. I think there are many members of this Society who could help in this, and when I mention the name of the British representative of this, the "Liaison" Commission, who was unanimously elected to the post in Brussels, I feel sure that those who can will help him in this work. It is our Past-President, Mr. Campbell Swinton, and I will ask him to supplement my remarks later, and to put my name down as the first on his list. Perhaps he will now make some remarks on what I have been saying.

Mr. A. A. Campbell Swinton.

I should like first of all to say something with regard to the proposed change of name. Though I, personally, have a sort of sentimental liking for the old name of "Wireless," I think "Radio" would be a much more scientific name, and if we are going to change we had better adopt the word "radio." But apart from that I am wholly in accord with what was said with regard to the advantage of changing the name of the Society from the "Society of London" to the "Society" or "Association of Great Britain." I think that with all our affiliated societies (there are something like a hundred of them now) it is the only logical course to take. The question will not be decided until the Annual General Meeting, and I hope that members will support the idea of the Committee that it would be advisable to maket his change.

As regards the Commission of Liaison, in connection with the Conference that has recently taken place at Brussels, I must confess personally that I am a little overwhelmed at the idea that I am to represent this country, and apparently to collect every kind of suitable wireless information from all operators and manufacturers and experimenters of this country, and, I suppose, communicate this to Brussels. It seems rather a large order, particularly for a person who is so very much occupied as I am by commercial and other affairs. But I feel it a great honour to have been selected at Brussels for this purpose, and I have accepted the position, and will do my best to carry it out. I shall have to ask all you gentlemen to help me, because it is people like you who have to do the work which I have to collect, and I hope later on, when things are a little more advanced, I shall be able to tell you more about it. At the moment I am rather in the dark as to just what it is I have to do, but you may be sure I will do all I can, and I shall ask you to assist me. I am very glad to accept the kind offer of our President, one of the earliest workers in wireless telegraphy, and will put his name first on the list.

Mr. F. Hope-Jones.

Mr. President, Ladies and Gentlemen :—If I may refer first to what the last speaker has been saying, may I remark that I rather envy him his job, and I do not think it will be a very serious one, thanks to the co-operation he will get from all amateur radio-telegraphists, not only of this Society but the provincial societies as well. May I remind him and the President that one of the first serious pieces of work which the Wireless Society of London undertook was an attempt to do the same thing. In the year 1913 I distinctly recollect how, in company, I believe, with Professor Howe, Dr. Eccles, Mr. Coursey, and several of those who were such earnest and hard workers in those days, we went up to see Professor Fleming with draft forms that we were going to discuss with him. The forms were carefully ruled out—rather elaborately so. They were to be circulated to all those amateurs with receiving licences then known in order to observe atmospherics, and the great point was that they had to be very careful to get their time exact, or otherwise their records would not have been much use. That was the obvious difficulty. Their progress was spoilt, like many other things, by the outbreak of war, but I doubt whether those efforts would have been of very much use now.

The President.

These observations were in Dr. Eccles' hands, and they have been sent to Brussels, so they will not be lost.

Mr. F. Hope-Jones.

I am glad to hear they were not lost, but quite obviously they cannot be as valuable as those proposed by General Ferrié, based on observations where the rhythmic signals are to be made use of ; and I am sure the new efforts will be a great success.

I do not know, Mr. President, what other matters you think it would be appropriate for me to deal with. May I mention one little domestic detail. Thanks to our official organ, *The Wireless World and Radio Review*, coming out every week now, we feel that the republication of the Proceedings of the Society in the form of the Journal becomes simply a matter for the library. We want the proceedings in the permanent form for our library bookshelves, and that is the only purpose which the Society Journal now fulfils. It is now suggested on that account that these proceedings shall be reprinted from our official organ only once every six months, or possibly twelve months, and posted to our members in one volume.

There again you will observe the tendency which is to fall into line with the great institutions in all such matters.

Very little mention was made by the President regarding the Exhibition, simply because he had so many things to talk about and not because it is a matter of small importance, either in his mind or in yours. We know this Exhibition is going to be a real success, and the Wireless Society of London from the very first decided that it would assist it in every way in its power, and I think we have taken responsibility for the social side of the Exhibition. We are to provide the lecturers, and I understand there will be lectures every evening in the little room upstairs, and perhaps in the afternoon as well. I ought to add that Mr. Bertram Day is a little indisposed (I take it he has been overworking) or he would have been here himself as the official organiser responsible for the Exhibition: but he has a representative here, Mr. Freeman, who will answer any questions.

There is a little matter I can mention now, as it might otherwise get forgotten, and that is that there is to be a big Convention of the Boy Scouts at Alexandra Palace on Saturday, October 7th. The Prince of Wales will be present, and on his return to York House at 7 o'clock, he is going to broadcast a message to the scouts of the Empire, or at any rate in the British Isles. He will transmit on the broadcasting wave through Marconi's, and our Secretary, with his usual promptness, the moment he was informed of this (and I think very wisely too), sent a special circular letter by that night's post to our affiliated societies suggesting that they should put themselves into communication with the local Boy Scout organisations in every town. We in London propose to do the same thing. Fifty tickets have been sent to the Boy Scouts headquarters so that they may hear His Royal Highness's message.

With regard to the change in name. It fell to me, as Chairman of the last Conference, to mention the proposed change of name. I was then only voicing opinions that were more felt than heard, and I was asked what the general idea was. I said that it was because we were doing national work. Whenever it became necessary to negotiate with the representatives of the Post Office, it fell to us to carry out such negotiations. If we do national work I think we would do that work better if we had a national title. I happen to have been privileged by the Treasurer to look through the draft of a memorandum, showing how it would affect our constitution and the nature of the alterations that would be made—mere mechanical alterations caused by the change of name—and I could see that these alterations would be very trivial. It seems to me that the framers of the constitution of the Wireless Society of London as it stands to-day might very well have had a national organisation in view, the changes required being so small. The details of the changes would, of course, be handled by an expert Committee accustomed to such questions, and the whole matter would be thoroughly gone into in good time before the Annual Meeting and before the Conference, and I take it that the change would not be effective until the Conference, when we have the advantage of the full discussion by the members and delegates of Provincial societies.

The President.

Would Mr. Freeman like to make any remarks regarding the Exhibition ?

Mr. Freeman.

The only way in which I can assist is to invite questions, which I will do my very best to answer—any questions at all regarding organising the actual work to be done towards publicity. I cannot speak as to the design of the instruments and other matters of that description, but as regards publicity and the actual work of organisation I can give you any information you desire.

The President.

These questions might perhaps be left till later on in the evening, so that we can get through our own business first.

Dr. Howe, would you care to make any remarks ?

Dr. G. W. O. Howe.

I think the proposed change of name would be wise. I have felt for some time that the " Wireless Society of London " hardly described the functions of the Society. That has been my opinion for some time, and I am entirely in favour of the change, although I cannot say that I quite agree with the reason which our President gave for changing, since although much wire is used in connection with the instruments, the transmission is wireless, and one cannot say that transmission is not wireless simply because a lot of iron and steel is used at each end. But this is a detail. The greatest disadvantage of the word " wireless " is that it has to be translated in every language into another word, whereas the word " radio " is international. That, to my mind, is the greatest reason for the change, and I am whole-heartedly in favour of substituting the word " radio " for " wireless " in all cases.

The President.

I think the next subject we had better handle is the question of those licences. Mr. Shaughnessy and Captain Loring are here, and I will ask if Mr. Shaughnessy will give us his views.

Mr. E. H. Shaughnessy.

Mr. Chairman, Ladies and Gentlemen:—The Post Office has granted licences freely in the past to all serious experimenters. There is no reason for it to change its mind now. There is some difficulty, I think you will appreciate, in distinguishing the experimenter—the real experimenter—from those people who simply want broadcasting. The question of broadcasting also involves very serious consideration. If the present state of affairs amongst those very skilled amateurs who already possess licences were to be extended, then broadcasting would be a failure. Only last night I listened to Writtle at home for a part of the time. For most of the time those experimenters who hold licences stating that they must not interfere with other stations ; that they must not use a valve which will oscillate the aerial ; those very earnest experimenters, were causing my apparatus to whistle almost incessantly. Now it is to avoid that evil being made greater than it is at present—and I think you will all agree that it is bad enough now—it is to avoid that, that we have to deal with the technical aspect of the case very carefully. With regard to broadcasting apparatus, we are going to see that this thing does not happen. We are going to test every type of apparatus that is sold for broadcasting purposes. We are going to issue licences which will enable people only to buy harmless apparatus. You can get harmless apparatus that can be very efficient. In the case of broadcasting apparatus we are stipulating that there shall be no oscillation of the aerial, that there shall be no radiation whatever. The wavelength band on which broadcasting will take place is very limited. The wavelength band on which amateurs work has been unlimited. We think that it is only fair to the large manufacturing firms who are interested in broadcasting, as well as fair to those firms who are also making broadcasting and amateur apparatus, that protection, technical protection, should be afforded for the broadcast band. In the past there has always been a stipulation on the licences that where a valve is used the circuit must be arranged so as not to cause interference with other stations. That condition, which we have trusted the possessors of the licences would honestly endeavour to fulfil, is very seldom fulfilled. We have complaints, and I personally have for the last few months listened in the evening to see how far the conditions of our licences are carried out. In future we are going to stipulate that during the broadcasting hours, and between a wavelength of 300 to 500 metres, no valve with adjustable reaction on to the aerial shall be used. I think you will all agree that it is only fair that we must ask the amateurs (who are really bound honestly by their licences) to see that they do not cause any oscillation on the aerial thereby interfering with each other and interfering with the broadcasting people. If we impose—there is no " if " about it, I am prepared to assert that we shall impose that condition—and if it is loyally observed by those people who get the licences, experimental licences, then we shall not be inclined to say that no reaction whatever may be used on any wavelength. We shall not stipulate that you must not have a reacting valve at all. Naturally we want to conserve the ether for useful work, and we also want to give serious experimenters every opportunity of experimenting with a view to improving existing conditions. That again leads to the difficulty of defining an "experimenter." Sets of apparatus are sold which go from 150 metres to 25,000 metres range in wavelength. A card is supplied; you turn the handle to such and such a stop, and you get the Eiffel Tower, or one of Leafield's harmonics.

The man who owns that set probably has never seen the inside of it. He usually buys it out of sheer curiosity to listen to signals. It is very difficult to assume that he is an experimenter. A man buys a set which he just adjusts to some particular wavelength, usually it is on the regenerative principle, and he listens in. It does not matter to him what station he hears, it may be North Foreland, but so long as it makes a noise, it does not matter what it is.

Even in a case like that I think we may be inclined to be generous in our interpretation of the term "experimenter," so long as we can be assured that such apparatus is not used for the wavelength band of 300 to 500 metres.

Recently we have been stipulating in our licences that reaction must be on to a secondary circuit coupled to the aerial. We had hoped that when we asked people to send in a diagram of the apparatus that would be used that we should then have no trouble in distinguishing the experimenter. Most of them said they proposed to use Mr. So-and-so's set. Some of the diagrams sent in were real works of art, but nothing to do with wireless telegraphy, so that did not ease our troubles. Seeing that we are being inundated with applications for licences just now, mostly as a result of broadcasting, it is very difficult to deal with them on the basis of a diagram. There is not the slightest doubt that most of the applications are simply because broadcasting is mooted.

To get back to the point of reaction being on the secondary coil. We are prepared to waive that condition, because we find that unless it is very carefully used, it is no better than going straight back on to the aerial. If it is very badly used it may be worse. We are, I think you will agree, compelled to examine carefully the applications for licences. But our attitude is not one of opposition to the experimenter. We always have taken a very generous view of applications for receiving licences, and there has been no change whatever in the attitude of the Post Office in that direction. As a matter of fact, personally I feel that those who are engaged in the art of wireless telegraphy, earning bread and butter by it, generally are so hard worked that they have no time to trouble about the inventive side of the question. It is frequently, very frequently, the man who has leisure and takes up any art or science as a hobby, who will pursue some particular point that may lead to very valuable results. We are fully alive to this.

It seems that all along we have been very generous in our interpetation of the term "experimenter."

I do not think there is any other point with regard to licensing, but if anyone desires to ask questions, and the Chairman considers they are in order, I will do my best to answer them.

The President.

Captain Loring, would you like to supplement these remarks ?

Captain Loring.

There is very little I can say in addition to the most excellent speech of Mr. Shaughnessy. Mr. Shaughnessy has put the whole case of the Post Office so very clearly that I cannot do anything more than just to tell you at the present moment we are not giving a decision.

We are not in a position to say that any decision like to support what Mr. Shaghnessy said with regard to the fact that I can assure the members there is no intention on the part of the Post Office to put any obstacle in the way of the issue of experimental licences to the proper people.

I know there has been a certain amount of comment regarding the withholding of licences—you see it in the Press—and people are wondering what is happening, but we must realise that this broadcasting question has only arisen very recently and very suddenly, and has increased the number of licensees or applicants for licences tenfold and even more, and also with the increase in the number of licensees, it is essential to adopt a definite policy, and therefore it is only wise, in the interest of all of us, that the Post Office, who is responsible for the future policy, should go as slowly as possible, and as far as may be consult the interests of all concerned, as we did only a few days ago when your representatives came to see us.

I do not think that any of you can say that during the last two or three years the amateur movement has not received very great consideration and sympathy from the Post Office Department, which is supposed to be one which is entirely devoid of these sentiments very often, and the

Post Office only desires to see the experimenter on the one hand get everything he wants in order to pursue his investigations, and on the other hand, to see the broadcasting industry, which is going to be a very considerable one, established on a proper basis, which will enable its extension without having to revise the conditions and cause friction all round by having to make new regulations. I would just like to say, as regards the word "Radio" for the Wireless Society of London, I think it is a great improvement on the word "Wireless."

There is one other little point which I should like to mention to the Society, and that is the use of this new word "broadcaster," which has recently been so freely adopted. To my mind it is a horrible word.

Mr. C. F. Phillips.

Mr. Chairman, Ladies and Gentlemen:—First of all, I think we owe a very hearty vote of thanks to the Post Office, especially to Mr. Shaughnessy and Captain Loring for their remarks this evening. I think that the Post Office is very old and very wise. They won't give too much, and they won't give it too readily. They give us little by little, but I have come to the conclusion that what they do give they give with a good grace. I think as regards "no reaction during broadcast hours," it is the wisest possible decision: that the user of an experimental set who listens to broadcast should be put on his honour, not to use a limited amount of reaction, but to use no reaction whatsoever, to take such steps as are necessary to ensure that his friends by assisting him in the manipulation of his apparatus they cannot unwittingly offend through lack of knowledge. I think it is a wise step, and I do not think it is a hard restriction, specially in view of the fact that generally the experimenter has at his disposal several valves and a very high class station to listen to. You will notice that in the broadcast band the wavelength covers the amateur wavelength of 440 metres for transmission. You might think that it is a hardship to be thus prevented from listening to your friends during the hours of broadcasting, but I think you would find in practice that if you attempted to listen to a 10-watt transmission made on 440 metres whilst a broadcasting station is transmitting on a kilowatt and a half that you would not have much chance.

Now as regards the position of the Broadcasting Company — the company that is about to be formed—I have had the honour of sitting on the Committee forming that Company, and I have taken it upon myself to urge the point of view of the amateur. At the meeting this afternoon I told the members of that Company that I proposed to say a few words this evening, and what I say I say with their consent. I want to take away one idea that may exist in the minds of some of you here, and in the minds of some who may not be here, that this proposed Broadcasting Company is in any way a monopoly. The Broadcasting Company is not a monopoly in any sense of the word.

For broadcasting to be a success somebody has to do it. In a little place like England it is quite impossible for an unlimited number of people to be allowed to broadcast, and therefore the actual broadcasting must be in the hands of a few. Also it is very necessary that the transmissions should be co-ordinated, and again we possess great advantages in one organisation if that co-ordination becomes automatic.

Now as regards the no-monopoly point. If the Broadcast Company were going to give all the transmissions and also sell all the apparatus, there would be a monopoly, but in their wisdom the Post Office authorities would not countenance such a thing as that. Anybody is perfectly free to join the Broadcast Company and to make apparatus, and he cannot be refused. That immediately destroys any question of monopoly. He has only to ask and he may join, and he may then become a member of the Company. The real object of the Broadcasting Company is to provide that the apparatus used for broadcasting in this country shall be of British manufacture. The industry is likely to be a very large one, and if it is a large industry it will employ a large number of people, and at this time, when unemployment is such a serious question. It is essential that the condition should be fulfilled that the apparatus shall be British, and that can only be done by banding together the manufacturers of this apparatus, who will have to give guarantees that their apparatus will be British.

Now as regards the amateur position. The amateur has had a free hand hitherto, and we have the assurance of the Post Office that he will have a free hand in the future. Soon there is going to be provided for him, to listen into on high power, something that he can make a loud noise with without very expensive apparatus.

He may tell the Post Office that he wants his experimenter's licence solely to listen to North Foreland, but in practice it is perfectly certain that he will at some time listen to broadcasting. The Post Office was approached with that in mind to see what can be done in order to ensure that the amateur shall pay some trifling sum in exchange for this programme. It is quite likely, and I know that this Society has recommended, that the amateur licence fee shall be slightly increased. Do not think that this is an additional tax which the Post Office requires. But when you are given an experimental licence now, you are virtually getting in addition a free ticket for the music hall.

If you are asked to pay a few shillings a year it won't be a large sum. Just put it down to the programme, for that is all it is.

One more thing I might add to what I have said. People are always asking when broadcasting is going to start. I think it will start pretty soon. In fact, I know it will start very soon indeed. There will be official broadcasting starting on September 30th to October 7th from the Horticultural Hall, for the Exhibition, at the hours of 11, 3, 6 and 8, except on Sunday. These transmissions will be made in order that people visiting the Exhibition may know what they may expect to hear when they purchase their broadcasting sets. Each transmission will be received at the Exhibition, and when once that broadcasting has been started I should not be at all surprised if it continues.

The Broadcast Committee wish me to state that never at any time have they seriously desired to limit any rights and privileges given amateurs by the Post Office in the past which they know the Post Office intend shall continue to exist that they can be quite certain they would not for their part endeavour to restrict them.

(*To be concluded.*)

The Wireless Society of London.

HOW THE BROADCAST LICENSEE MAY JOIN.

THE non-commercial user of wireless telegraphy has hitherto been confined to the class known as the amateur and experimenter, but the introduction of broadcasting has necessitated the adoption of a new name to define those non-technical users, who are nevertheless interested in wireless to the extent of listening in for the broadcast transmissions. A very large proportion of these recruits to the science will undoubtedly later on attain a knowledge of the technical side of the subject and will join the ranks of the amateur proper and the experimenter.

The Postmaster-General has recognised that the introduction of broadcasting creates a new class of user of wireless, and this class is to be accommodated with the special form of license known as the Broadcast License.

The Wireless Society of London, equally appreciative of the fact that a new factor has arisen, and that the new class of user should be specially catered for, has taken action as already indicated in the note which appeared on page 26 of the issue of this Journal for October 7th, and in taking this step the Society looks for the support of all affiliated societies.

Broadcast licensees, or those who have applied for broadcast licences, will be accommodated in the Society as Associates, and no technical qualifications will be expected of them. Those who desire to become experimenters will be given every assistance through the Society to acquire the requisite knowledge, through the medium of lectures and demonstrations to be specially provided.

The subscription for Associates is 5s. per annum, without entrance fee. Applications may be made at once to the Hon. Secretary, Mr. L. McMichael, 32, Quex Road, W. Hampstead, N.W.6.

Notes

Death of Prof. F. T. Trouton, F.R.S.

Professor F. T. Trouton, whose death took place a few days ago, will be remembered in wireless circles as one of the first experimenters in radio science in this country. He was Emeritus Professor of Physics in the University of London, and was assistant to Professor Fitzgerald of Trinity College, Dublin, for many years. His connection with the Theory of Relativity has recently been a means of bringing his name before the scientific world. Prof. Trouton took an active part in the affairs of the Royal Society, of which he was a fellow.

Lecture at Selfridge's.

Capt. H. de A. Donisthorpe gave a lecture at Selfridge's Stores on October 3rd. Experiments were carried out, and a number of interesting photographs of land and ship wireless installations were shown. At the close of the lecture music was successfully received.

Concerts at Croydon.

Croydon Public Library was used for demonstrating the reception of wireless concerts a few days ago.

A Kingston Club.

We are informed by Mr. R. J. T. Norton (2 NQ), of 14, Woodside Road, Kingston-on-Thames, that he, together with other amateurs in the Kingston district, anticipate forming a club. Those interested and who might become members are invited to communicate with Mr. Norton.

A Change of Wavelength.

An Air Ministry notice to airmen states that with effect from October 1st, 1922, the British Meteorological Synoptic message issued at 0200 G.M.T. will be transmitted on 4,100 metres C.W. instead of on 1,400 metres C.W.

A Knightsbridge Radio Club.

Mr. R. H. Davis, the secretary of the newly formed Knightsbridge Radio Club, informs us that headquarters for the members have been acquired. Communications should be sent direct to the Secretary's address, 1, Kinnerton Place, South Knightsbridge. He will gladly furnish full particulars as to membership to anyone in the district

Halifax Exhibition.

Members of the Halifax Wireless Club are demonstrating, and selling their surplus apparatus at an exhibition to be held at their headquarters, Clare Hall, Prescott Street, Halifax, on October 20th and 21st. Apparatus by leading makers will be exhibited. Special transmissions of music are being arranged.

Amateur Call Sign 2 FC.

Our list of Experimental Stations contains an error. The particulars relating to 2 FC should be cancelled.

The Armstrong Circuit.

In our next issue will appear a full constructional article on the Armstrong Super-Regenerative Receiver, written by Mr. P. W. Harris, a frequent contributor to this Journal. The receiver to be described makes use of a circuit not previously published in this country and admirable results are being obtained.

A Luncheon.

On Saturday, October 7th, a lunch was given to those responsible for the transmission and reception of the concerts in connection with the Exhibition to express personal appreciation of their work. The lunch was promoted by Mr. Duveer, of Messrs. Burndept, Ltd., and the Wireless Society of London, was also represented.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—I was interested to read in the issue of September 16th a letter addressed to you by Mr. L. M. Baker (2FN), whose transmissions of music, incidentally, I very much enjoy.

We can all understand, I think, the manner in which Mr. Skeet, of Leicester, made his mistake.

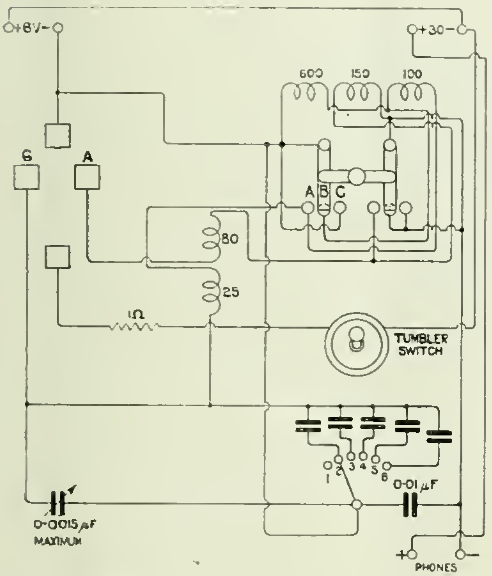
When I got one of my early attempts to work, the first speech I heard was, "Hello 2PF, 2FN calling."

Since the publication of Mr. Skeet's letter, the gentleman who I believed to be "2PF" has given out his call sign in what you no doubt will agree all amateurs should use—the "lingo" of signalling, 2 pip esses. When Writtle transmits there is no mistaking the call sign of 2 emma toc.

Gerald Harrison.

Nottingham.

ON HETERODYNES.



It is regretted that an omission was made from the circuit diagram given in *Fig.* 20, page 852. The corrected diagram is here given.

Calendar of Current Events

Friday, October 13th.

West London Wireless and Experimental Association.

At Stamford Brook Lodge, Ravenscourt Park, W.6. A popular lecture and demonstration of latest apparatus made by Messrs. Burndept, Ltd., by Mr. A. O. Gibbons.

Belvedere and District Radio and Scientific Society.

Lectures on "Crystal Circuits," by Mr. C. E. Morrison, and "Telephones and Microphones," by Mr. S. G. Meadows.

Radio Scientific Society.

7 p.m. At The Grotto Café, Todd Street, Manchester. Annual General Meeting.

Sunday, October 15th.

Daily Mail Concert from the Hague, PCGG, 8 to 9 p.m. G.M.T., on 1,085 metres.

Monday, October 16th.

Finchley and District Wireless Society.

Social Evening. (Postponed to October 30th).

Ipswich and District Wireless Society.

At 8 p.m. At 55, Fonnereau Road. Lecture on "Armstrong Circuit Experiences," by Mr. Dyer.

Tuesday, October 17th.

Transmissions of telephony at 8 p.m. on 400 metres by 2 MT Writtle.

Wednesday, October 18th.

The Institute of Physics.

At 6 p.m. At Institution of Electrical Engineers. Lecture on "Physics and the Physicist," by Mr. Clifford C. Paterson. (Third lecture of series.)

At 5-5.30; 6-6.30 p.m. Concert in aid of the Gravesend Disabled Soldiers' and Sailors' Fund. (P.M.G. permitting.)

Thursday, October 19th.

Daily Mail Concert as above.

Derby Wireless Club.

Informal meeting.

Friday, October 20th.

Powisland Radio and Scientific Society.

First meeting and lecture by Viscount Chine on "The Elementary Principles of Wireless."

Wakefield and District Wireless Society.

At 8 p.m. At the Y.M.C.A. Lecture on "A Four-Valve Receiver," by Mr. Swale.

Halifax Wireless Club.

At 6.30 p.m. At Clare Hall, Prescott Street, Halifax, and also the following day from 2.30 p.m. Exhibition of Wireless Apparatus by all the leading makers. Demonstrations and sale of members surplus apparatus.

Sunday, October 22nd.

Daily Mail Concert as above.

Tuesday, October 24th.

Telephony by 2 MT Writtle as above.

Wednesday, October 25th.

Redhill & District Y.M.C.A. Wireless Society.

At 111, Station Road, Redhill. Lecture on "Inductances," by Mr. Pescett.

Thursday, October 26th.

Daily Mail Concert as above.

Derby Wireless Club.

At 7.30 p.m. At The Court, Alvaston. Lecture on "Amplification," by Mr. E. V. R. Martin.

Friday, October 27th.

Wakefield and District Wireless Society.

Lecture on "The Relation of Inductance and Capacity to Electro Magnet Waves in Receiving and Transmitting Circuits," by Mr. Watson.

Saturday, October 28th.

Working Men's Wireless Club.

At Crowndale Road, N.W.1. Exhibition and demonstration at 1 p.m., also exhibition of X-Ray apparatus.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

North Middlesex Wireless Club.*

Hon. Secretary, Mr. E. M. Savage, "Nithsdale," Eversley Park Road, Winchmore Hill, N.21.

A meeting of the Club was held on September 20th at headquarters, Shaftesbury Hall, Bowes Park. This meeting, following close on the fête held at Palmer's Green in aid of the local hospitals, at which the Club assisted, it was thought that it would interest new members to hear how the speech received on that occasion was transmitted. The Chairman accordingly called on Mr. L. C. Holton to lecture on "The Transmission of Wireless Telephony."

Mr. Holton began by explaining the action of a simple "spark" transmitter, and showed how a group of waves finally produced a single movement of the telephone receiver. He said that the human ear could distinguish frequencies from 34 up to about 16,000 to 20,000 per second as a musical note, and went on to explain what difficulties had to be overcome before speech could be transmitted by wireless when the transmitting system employed "damped waves." He said these difficulties were easily overcome when a "continuous wave" system was used, and drew a number of circuits showing how a valve could be made to generate the necessary waves, and explained how a microphone, when connected in a suitable part of the circuit, had the effect of modulating the waves radiated, and produced speech in the receiver at the other end.

Mr. Holton then gave particulars of a more powerful circuit using one valve (the power valve) for generating the waves, and a second valve (the control valve) for impressing speech on the wave. He then exhibited the transmission panel of his set, which was well on the way to completion, and which had been made to his design by Mr. G. W. Evans. This is a particularly fine piece of work which made all those present feel envious.

After a vote of thanks to Mr. Holton, the Secretary read a letter from the Marconi Co., thanking the Club for its assistance at the fête mentioned above, when music was transmitted from **2 LO**, and received at Palmer's Green on the Marconi Co.'s instruments by their operator. It is expected that one result of the fête will be a large influx of members to the Club, particulars of which may be had on application to the Hon. Secretary.

East London Radio Society.*

Hon. Secretary, The Lecture Hall, Woodstock Road, Poplar, E.14.

A successful meeting was held at the Lecture Hall, Woodstock Road, E.14, on September 19th, with Mr. A. J. Alexander in the chair.

Informal discussion preceded the actual opening of the meeting. These short open discussions are proving of great value to the Society, and most new members' difficulties are satisfactorily disposed of by the more experienced and competent experimenters. The Society's set was then set in operation, and members listened with great interest to **2 MT.** Mr. J. Keens then delivered the second lecture of the present series, the subject being "The Application of the Thermionic Valve to Receiving Circuits." Those who knew little of the subject were agreeably surprised to find what was to them a difficult matter, ably brought within their comprehension. Those who knew a great deal of the subject were equally surprised to listen to the matter being so simply explained.

The meeting closed with votes of thanks to the Chairman and Lecturer.,

On September 22nd a further meeting was held.

On September 26th a lecture was given on "Inductance Coils," with some remarks upon crystal sets.

The Secretary will be pleased to hear from any East London amateur desirous of joining the Society.

Durham City and District Wireless Club.*

Hon. Secretary, Mr. Geo. Barnard, 3, Sowerby Street, Sacriston, Durham.

The first public lecture and demonstration organised by the above Club took place on Friday, September 22nd. The hall was packed to the limit. To suit the requirements of the majority there, Capt. H. de A. Donisthorpe did not make his address of too technical a nature.

As is always usual, some of the experiments did not come off ; however, there were some very interesting demonstrations which proved most entertaining to the crowded house.

The lantern slides were shown admirably by Mr. Bertram, who is a member of the Club. At the conclusion of the lecture, Lt.-Col. Cluff, on behalf of the meeting, thanked Capt. Donisthorpe, and asked for appreciation to be shown in the usual way.

A large percentage of those present remained behind to inspect the apparatus, which included a loud speaker, a seven-valve Marconi receiver, Seismograph, and a fine compact three-valve audio frequency amplifier belonging to Mr. D. Bromwell.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 18, Melford Road, S.E.22.

At the Central Hall, Peckham, on September 27th, the members carried out buzzer practice under Mr. Sam Middleton. The Chairman, Mr. Knight, lectured on series and parallel connections of batteries, and also different systems of electric light wiring. Mr. Bird, the newly-appointed Secretary for foreign members, read correspondence from a member stationed at Cairo.

Mr. Middleton then gave useful tips on surfacing and working ebonite, which were much appreciated.

Wakefield and District Wireless Society.*

Hon. Secretary, Mr. Ed. Swale, 11, Thornes Road, Wakefield.

A meeting of the above was held in the Y.M.C.A., Grove Road, on Friday, September 22nd, at 8 p.m. Chairman, Mr. H. H. T. Burbury (President).

The minutes were read and signed, after which Mr. Burbury called upon his son to give his lecture on the "Two-valve, High Frequency Amplifier, with a view to Maximum Amplification," a continuation from the meeting of September 1st.

Messrs. Bateman and Wrigley figured in discussion with the speaker, who explained every detail to a most appreciative audience.

All were glad to see the return of the President after his two months business vacation.

Buzzer practices are now in vogue for half-an-hour prior to each meeting.

Newcastle and District Amateur Wireless Association.*

Hon. Secretary, Mr. Colin Bain, 51, Grainger Street, Newcastle-on-Tyne.

A meeting of the above Association was held at Headquarters, Wireless School, Eldon Square, Newcastle-on-Tyne, on Monday, August 28th, at which a demonstration was given by the representative of The Sterling Telephone Co., Ltd., of the large 18-in. Magnavox loud speaker, with an amplifier. Tremendously loud signals were received.

At the following weekly meeting on Monday, September 4th, seven new members were proposed and approved of by the Committee, bringing the membership up to 81.

In view of the now rapidly increasing number of members it has become necessary to find a larger club-room, and all members were requested to endeavour to find a suitable club-room for the future use of the Association.

Letters from the P.M.G. to members applying for experimental licences were then read, and after a short discussion Mr. Burdis recommended all new members to apply for a simple non-radiating circuit at first, then after having gained experience, to apply for permission to use a more complete installation.

A very interesting discussion upon short wave inductances finished the business of the evening.

Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

The Society held their bi-monthly meeting on September 25th, at headquarters, Mercury Office, 8, Chatham Street.

The President, Mr. Cyril T. Atkinson, being the lecturer, Mr. H. E. Dyson, Vice-President, took the chair.

There was a large gathering, many new members being in evidence. The preliminary business was short, consisting mainly of a small amount of correspondence, together with discussion of a special scheme of lectures suitable for beginners, this latter item being left for the consideration of the Committee.

The Chairman then called upon the President to deliver his lecture on "Wavemeters."

Mr. Atkinson opened up with the elementary principles of wavemeter design, passing by easy stages to the consideration of one or two sound commercial instruments as follows: First the Marconi crystal type, second a Telefunken instrument, and thirdly the Townsend pattern. Each of these types received a very detailed analysis, special reference being given to the latter owing to its suitability for home construction, which was next touched upon, detailed instruction being given of a similar instrument having a simple range of from 140 to 240 metres. The lecture was concluded with an explanation of a method of calibration suitable for wavemeters of a comparatively short maximum wavelength, viz., the Lecher wire. A discussion followed, Mr. Atkinson making suitable replies to the sundry questioners. The meeting then concluded by a very hearty vote of thanks from the assembly for the interesting and useful lecture, this being proposed by the Chairman and seconded by Messrs. J. W. Pallett and D. Morton.

The next meeting of the Society took place on October 9th, the title of the lecture being "The Construction of Wireless Apparatus," by Mr. S. Skeet.

All communications regarding the Society to be addressed to the Hon. Secretary.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting at the Y.M.C.A., Hanley, on September 28th, it was announced that a temporary permit had been received from the G.P.O. pending the issue of the experimental receiving licence. The Society is now in a position to carry on its practical work unimpeded.

Arrangements were made to entertain local boy scouts on the occasion of the Prince of Wales' address to scouts from York House, broadcasted from Marconi House on October 7th.

Wallasey Wireless and Experimental Society.*

Hon. Secretary, Mr. C. D. M. Hamilton, 24, Vaughan Road, Wallasey.

On September 6th a lecture and demonstration were conducted by Messrs. Cowan and Hamilton.

A four-valve receiver was used, a detector panel and low frequency unit constructed by Mr. Hamilton, and a two-valve L.F. unit made by Mr. Cowan.

The Society's indoor aerial not being as efficient as could be wished, the results were perhaps open to criticism, but signals were received from several continental stations, and telephony from the dock board and bar ship was made audible to the members through a "Brown" loud speaker.

A field meeting was held on September 9th, excellent results being obtained on two valves. Telephony was received from several local amateurs.

Liverpool Wireless Society.*

Hon. Secretary, Mr. C. L. Lyons, 76, Old Hall Street, Liverpool (telephone 4641 Central).

A meeting was held on September 28th at the Royal Institution, Colquit Street, Liverpool. Mr. E. B. Grindrod was in the chair.

Questions were dealt with by Mr. S. Lowey, who gave blackboard diagrams. (Mr. Lowey's station was described in *The Wireless World and Radio Review* some few issues back.)

One of the series of short lectures which is proceeding in conjunction with the Society's apparatus was then delivered. At the last meeting the C. Mark III three-valve amplifier was fully described. On this occasion the Mark III. tuner was described in detail by Mr. N. D. B. Hyde, in more or less non-technical manner, blackboard diagrams being used. The receiving panel proper was taken from its case and passed round for inspection. Questions were again invited and dealt with by Mr. Hyde.

The winter session of the Society opened on October 12th, when the President, Professor E. W. Marchant, D.Sc., delivered an interesting address. All local amateurs and enthusiasts are invited to join the Society. During September over twelve new members were enrolled.

Sunderland Wireless and Scientific Association.*

Hon. Secretary, Mr. H. G. Mac Coll, 1, North Elms, Sunderland.

The last General Meeting of the session was held at the Technical College on Saturday, September 23rd. Nominations having been received for the Officers and Committee for the ensuing year, Mr. R. Sutherland Allan opened a discussion on the programme for the next session. He informed the meeting that a suite of rooms had been obtained for the Association at Westfield House, consisting of a reading room, experimental and lecture room, Secretary's office, and cloak room. These rooms are to be open daily for the use of members.

He then explained that the Committee had arranged to run a number of courses of lectures jointly with the Sunderland Y.M.C.A. Radio Society. The following courses have been arranged:—

(1) Course of 24 Wireless lectures. (2) Course of 12 lectures on Elementary Magnetism and Electricity (before Christmas), followed by 12 Elementary Wireless Lectures. (3) Course of Elementary Wireless Lectures for Beginners. (4) Lectures on other scientific subjects, lecturettes, debates, etc. (5) Four Public Popular Lectures. (6) Courses of Senior and Junior Buzzer Practice. A discussion then ensued, after which the meeting was declared informal. The Association is holding a wireless and scientific exhibition in connection with the Sunderland Housing and Health Exhibition at the Whitehall Rink from October 3rd to 14th.

The present membership is 131.

Whitley and Monkseaton Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. R. J. Oliver, 12, Waverley Avenue, Monkseaton, Northumberland.

This Society, recently formed, has 30 members.

The officers for the ensuing year are—President, Mr. H. B. Saint; Vice-Presidents, Mr. H. Kitchen, M.I.E.E., and Mr. H. F. White, M.I.R.E.; Chairman, Mr. Fred Morley; Secretary and Treasurer, Mr. R. J. Oliver. Messrs. Fred Kaye, G. M. Daniels and T. W. Stewart, were elected to serve on the Committee.

Applications for membership should be sent to the Hon. Secretary.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. Arthur I. Dabbs, 315, High Road, Ponders End, N.

The inaugural meeting of the above Society was held on September 28th at the "Falcon Inn," South Street, Ponders End, when a very satisfactory attendance was recorded. Mr. J. Kent was elected Chairman, Mr. Balfour, Treasurer, and Mr. A. Dabbs, Hon. Secretary. A Committee was elected consisting of the Chairman, Secretary, and Messrs. A. Rich, Gill and Brackenbury.

The Chairman announced that Mr. Balfour had very kindly offered the use of the room for meetings, and, moreover, was presenting the Society with a complete three-valve receiving set with loud speaker and aerial for the use of the members at the meeting room. A hearty vote of thanks was accorded Mr. Balfour, and arrangements were made for the application for the licence immediately.

The subscription decided upon is 10s. 6d. per year, the objects of the Society being to assist everybody in the district who is in any way interested in wireless either from an experimental or "broadcasting" point of view. Meetings are held every Thursday at 8 p.m. at the "Falcon Inn," and the Secretary will be very pleased to give prospective members any information if they will write him or attend the meetings. The Society has had an enthusiastic commencement, and has prospects of being very well equipped, and it is hoped that everybody in the district interested will recognise the advantages of the Society.

Bromley Radio and Experimental Society.

Hon. Secretary, Mr. J. Fergusson-Croome, "Gowrie," Wendover Road, Bromley, Kent.

The inaugural meeting was held on September 25th, at 8 p.m., at 14, College Road, Bromley. A good number of amateurs attended.

Enthusiasts in the Bromley district are invited to communicate with the Hon. Secretary.

Middlesbrough and District Wireless Society.

Hon. Secretary, Mr. Cleveland Hood, Nunthorpe, S.O., Yorks.

A meeting of this Society was held on September 18th, when Mr. Frank King delivered his paper on the "Armstrong Regenerative Circuit," after which a keen discussion took place.

It was resolved that the circuit should be applied to the Society's apparatus in order to discover what disadvantages Armstrong's new invention carries with it.

The Society has a full programme until December.

Ipswich and District Wireless Society.

Hon. Secretary, Mr. F. T. G. Townsend, 46, Grove Lane, Ipswich.

A very successful sale and exchange of members' spare apparatus was carried through under the auspices of the above Society at its headquarters, 55, Fonnereau Road, on September 25th. The stipulation was made that 10 per cent. of all sales should be given to the general fund of the Society. It was pleasing to note the presence of the Society's representatives from Felixstowe and Bury St. Edmunds. The Annual General Meeting is being held shortly, and any resolutions or suggestions should be submitted to the Committee at once.

Wolverhampton and District Wireless Society.

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

At a meeting of the above Society held at headquarters, 26, King Street, Wolverhampton, on September 27th, a most instructive and unique lecture was given by Mr. F. G. Redhead on "Psychic Phenomena and Wireless."

The subject proved an exceedingly attractive one, the lecturer endeavouring to prove that a similar action took place with the human brain as that of wireless telegraphy, the various organs acting on each other by induction, and the nerves and fibres being the conducting bodies. This was due to the electric forces of the brain. Telepathy, as he expressed it, was really a human wireless.

The lecturer went on to say that the human brain is not only a transmitting and receiving machine for electric waves, but the human body is a complete electric generating station.

A very animated and vivacious discussion followed, the subject being gone into thoroughly, Messrs. Harvey-Marston, A. A. Devey, Rushton, Jones and Court, taking part.

Fulham and Chelsea Amateur Radio and Social Society.

Hon. Secretary, Mr. R. S. V. Wood, 48, Hamble Street, Fulham, S.W.6.

The minutes of the previous meeting being read and accepted, one new member was presented to the meeting and accepted for enrolment. Total membership, 72.

During the evening Mr. Skutt gave an interesting and simple analogy of the fixed condenser, and Mr. Hawthorne dealt with the functions of the valve in answer to a junior.

Mr. Gauntlet also gave his experience on reception on a gas-pipe aerial and water-pipe earth.

The Society's headquarters are Chelsea Polytechnic, Manresa Road, Chelsea.

All communications to be addressed to the Hon. Secretary.

Clapham Park Wireless Society.

Hon. Secretary, Mr. J. C. Elvy, 12, Tavistock Street, Strand, W.C.

The second, third, fourth and fifth general meetings of the above were held at Headquarters, Studios, 67, Balham High Road, on August 9th, 23rd, September 6th and 20th, 1922, and the Society can now be regarded as a real live institution. Its headquarters being located on the 'bus and tram routes proves decidedly advantageous to members on outskirts of Streatham Hill, Balham, Clapham, Tooting, Battersea and Wandsworth. Applications for membership have been received from Wimbledon and Merton.

An aerial gratuitously provided by one of the members, Mr. F. Race, has been erected by Mr. M. P. Prout, the Hon.Treasurer, at the headquarters, and Mr. A. L. Beadle has loaned Morse apparatus for the usual "buzzer practice."

Mr. H. J. Howard gave a lecture on "The A.B.C. of Wireless," at the September 6th meeting, which provoked a healthy and instructive discussion, followed by a demonstration with a H.P.R. three-valve set, provided by Mr. Race for the evening's "listening in," necessary permission having been obtained from P.M.G.

The Hon. Treasurer has provided printed stationery for the initial stages of the Society's proceedings.

Mr. A. L. Beadle is experimenting on a device for drawing attention of passers-by to the effect that those interested in wireless should walk inside to gain information and advice.

The last meeting was noteworthy by reason of one of the new members, Mr. J. A. Daniels, giving an impromptu and most interesting discourse on wireless in general and amplification in particular, which provoked a healthy discussion, the lecturer readily adapting himself to the general satisfaction of all present.

Affiliation with the Wireless Society of London was discussed, of which more will be heard later.

The Hon. Secretary suggested a device for overcoming electrical troubles which Mr. A. L. Beadle is contending with in connection with his Morse signalling device for welcoming visitors inside Headquarters when Society is conducting its affairs.

Mr. J. A. Daniels promised to bring a five-valve set and Magnavox loud speaker for demonstrational purposes at the meeting on October 4th. Meetings will be held at 7.30 p.m. every Wednesday for the next six months. Visitors are welcomed. New members are being admitted at every meeting.

Owing to the rapid growth of the membership roll it has become necessary to bring into action the Hon. Secretary's scheme of organisation, namely, a representative for each section of the geographical area embraced by the Society. Those contemplating entering the Society are now able to call or communicate with the representative for the section in which they are resident, the representative being elected on the Committee, viz. :—Battersea: Chas. D. Richardson, Esq., 64, Sarsfield Road, Balham, S.W.12; Streatham Hill: K. S. Burch, Esq., "Shirley," 15, Woodfield Avenue, Streatham Hill, S.W.16; Tooting: A. L. Beadle, Esq., 118, Gassiott Road, S.W.17; Clapham: W. Brierley, Esq., 2, Gauden Road, Clapham, S.W.4; Balham: R. H. J. McCue, Esq., 50, Cloudesdale Road, Balham, S.W.17; J. Gray, Esq., 20, Elmbourne Road, Balham, S.W.17; Wandsworth Common: Mr. H. Austin, 60 Kyrle Road, Wandsworth Common.

Hon. Secretary, Mr. J. C. Elvy, A.M.I.E.E., 3, Fontenoy Road, Bedford Hill, S.W.12.

Working Men's College Wireless Club.

Hon. Secretary, Mr. A. Fryatt, Working Men's College, Crowndale Road, N.W.1.

The above Club is holding an exhibition on October 28th at 7 p.m., and it extends a hearty welcome to all interested in wireless.

It is hoped to arrange concerts with various broadcasters, and also to gain permission for the working of an indoor transmitter which, to amateurs who, so far, have only been acquainted with a receiving set, should prove extremely interesting.

In addition to the above, the members are exhibiting their own apparatus, the construction of which in many cases is very unique.

An X-ray exhibition is also being held in conjunction with the Wireless Club.

Belvedere and District Radio and Scientific Society.

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The fourth meeting of the above Society was held on Friday, September 22nd. The President in the chair. The Society is fortunate in having such an enthusiastic gentleman at its head.

Mr. S. Burman, during a lecture on "Construction of the Society's Apparatus," explained very clearly the principle of the rectifying panel, and at the same time considerably helped the amateur who was puzzled with the functioning of certain parts of the circuit.

Mr. S. C. Meadows followed with a lecture on the "Wireless Wave." Forthcoming lectures are as follows:—Friday, October 6th, "Construction of Society's Apparatus," third lecture of series, by Mr. S. Burnam. Friday, October 13th, "Crystal Circuits," by Mr. C. E. Morriss; "Telephones and Microphones," by Mr. S. G. Meadows.

Barnsley Amateur Wireless Association.

Corresponding Secretary, Mr. G. Wigglesworth, Y.M.C.A. Buildings, Barnsley.

The headquarters of the above Association have been finally established at the local Y.M.C.A. buildings. The members of the recently formed Wireless Section of the Y.M.C.A. have amalgamated with the Association, making it a strong and enthusiastic body of between 40 and 60 members to date.

A general meeting was convened for September 27th, to elect a President and Vice-Presidents, and also for the purpose of determining the future programme and policy of the Association.

Following are the Association's officers:—Chairman, Mr. C. Pickering; Corresponding Secretary, Mr. G. Wigglesworth; Financial Secretary, Mr. Kelly; Treasurer, Mr. J. A. T. Carr.

Intending members should communicate with the Secretary.

Sale, Altrincham and District Proposed Society.

A Society is being formed for the Sale and Altrincham district. Those interested, especially ladies, are invited to communicate with Mr. P. Newton Clough, Stanley House, Sale.

Borough of Tynemouth Y.M.C.A. Radio and Scientific Society.

Hon. Secretary, Mr. Geo. J. S. Littlefield, 37, Borough Road, North Shields.

The third Annual General Meeting of the above Society was held on Monday, September 18th, in the Y.M.C.A. buildings, Bedford Street, North Shields. Councillor A. E. Hill presided, and there was a good attendance of both old and prospective members. There were also present Mr. R. Lishman, J.P., and Mr. J. C. Burnett, B.Sc., Vice-Presidents of the Society.

Mr. Littlefield read the Secretary's report of the last year's work, which showed considerable progress, the outstanding features being the exhibition and the dinner, both of which were highly successful. During the summer months two field days were held, one at Holywell Dene and the other at Newbiggin. At the latter place, transmission tests were carried out under the guidance of Mr. Forsyth and Mr. Boutland, of Ashington. A transmitting licence for the Society is now being applied for.

The Treasurer, in his report, stated that although there had been a considerable expenditure this past year, particularly on the Club installation, the financial position of the Society was extremely good.

Mr. Thomas Hunter was cordially thanked for his services in auditing the accounts.

These reports were followed by the election of officers, the result being as follows:—Patron, the Mayor of Tynemouth (re-elected); President, Mr. J. E. Burnett, F.R.Met.Soc. (re-elected); Vice-Presidents, Mr. S. Todd, Mr. W. Hall, Councillor A. E. Hill, Mr. R. Lishman, J.P., Mr. E. E. Triggs, Mr. E. W. Heaton, F.R.G.S., Mr. J. C. Burnett B.Sc., Mr. T. Blackburn (all re-elected); Hon. Secretary, Mr. Geo. J. S. Littlefield: Hon. Assistant Secretary, Mr. D. G. Scott: Hon. Treasurer, Mr. J. E. Emery (re-elected); Hon. Auditor, Mr. Thomas Hunter, A.C.A. (re-elected); Committee, Dr. J. A. Hislop, Mr. R. Morley, Mr. H. Hutchinson, Mr. W. J. Potts, Mr. L. L. Sims (re-elected).

A vote of thanks to last year's officers was proposed by Mr. Hutchinson and carried with acclamation. Mr. Littlefield then said a few words about this winter's syllabus of lectures which was well in hand, and included a number of practical demonstrations. It is hoped to hold a three-days' exhibition in December. Items of a minor nature were then dealt with, and it was stated that the Society's apparatus would be available for the use of members on meeting nights, Tuesdays and Fridays. It was also decided that a dinner should be held at the close of the winter session. The Secretary asked all members possessing receiving apparatus to send him reports of their reception of the Chase Radio Telephony Station—**5BA**. Detailed reports of the general reception in the North Shields district could then be compiled and sent in, the information being invaluable to the gentlemen operating the station.

This concluded the business of the meeting and after a hearty vote of thanks was proposed to Councillor A. E. Hill for so kindly taking the chair at extremely short notice, the meeting closed. Afterwards several new members were enrolled. Full particulars of the Society will be gladly sent to anyone interested on application to the Hon. Secretary.

Finchley and District Wireless Society.

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Church End, Finchley, N.3.

The fourth meeting of the Society was held at the Wright-Kingsford Home, Granvill Road, when it was decided that future meetings should be held on Monday evenings, at 8 o'clock, and that a social evening should be held on October 16th. A demonstration was given on a four-valve set, kindly lent by Mr. Bishop. The membership is now over 40, and the Society is anxious to increase its numbers still further. A buzzer class is held at the close of each meeting, and is conducted by Mr. Nicholls. The subscription has been fixed at 12s. per annum for senior members, and 6s. per annum for juniors.

It is hoped to become affiliated to the London Wireless Society in the near future.

The Hon. Secretary invites enquiries from all interested amateurs in the district.

Cambridge and District Wireless Society.

Hon. Secretary, Mr. J. J. Butterfield, 107, King Street, Cambridge.

Sir G. Douglas Newton, K.B.E., M.P., J.P., has kindly consented to become patron of the Society.

Meetings for the winter session commenced on Tuesday, October 3rd, and will be held on each alternate Tuesday. It is hoped to publish further particulars later.

Knightsbridge Radio Club.

Hon. Secretary, Mr. R. H. Davis, 1, Kinnerton Place South, Knightsbridge, S.W.

A wireless club has been formed at Knightsbridge. Ideal headquarters have been obtained at St. Paul's Men's Club, Wilton Crescent Mews. The membership at present is nearly 30, and is gradually increasing. The Secretary will be pleased to hear from intending members.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12 13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requirement, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations, or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate or to cut out their reaction entirely.

"J.J.B." (Leith). The present regulations of the Postmaster-General specify that the reaction inductance may be coupled back to the secondary of the loose-coupled aerial tuning system. This being the case, the use of a switch providing for a stand-by position is no longer required. The arrangement of the three-coils is consequently of importance. The secondary circuit should be the middle coil and the reaction one of the outside coils. The tuner and stand-by switch may be abandoned.

"J.B." (N.16).—When licences are issued to experimenters permitting them to receive wireless telegraphy signals, it is stipulated that they shall make no use of any information that may come to their knowledge by the use of their apparatus. The Postmaster-General undertakes the reception and delivery of telegrams handled by wireless, and we cannot think that he would authorise you to organise any such service for yourself.

"R.G.D." (Sydenham).—A diagram is given in Fig. 1 of a three-valve receiver comprising H.F. valve, detector, and L.F. magnifier, arranged to suit the requirements of the Postmaster-General. It is at present stated that the use of the three-coil aerial circuit is permitted, which is made use of in the circuit. Should the circuit not be approved by the time you submit your application, you must embody the arrangement shown in the article on an H.F. amplifier, in our issue of September 30th (see Fig. 1.)

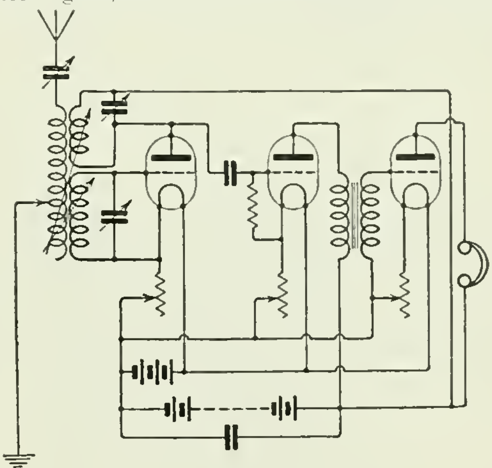


Fig. 1.

"W.D.L." (N.12).—There are many multivalve circuits given in back numbers of this journal suitable for operating a loud speaker. It is difficult to arrange H.F. amplification to cover such a wide range of wavelengths, and we suggest interchangeable high frequency transformers up to 2,000 metres, after which resistance capacity coupling is substituted. The method of doing this is shown on page 741 of September 2nd issue, where also are shown switches for throwing H.F. and L.F. valves in and out of circuit. We would also refer you to the diagram, Fig. 9, on page 743 of the September 2nd issue : also Fig. 2 and the explanatory text concerning it on page 705 of August 26th issue as a good guide.

"**R.A.H.**" **(Accrington)** *mentions experiments carried out in America for using the electric light wires of a house as an aerial by means of a special fitting, and asks* (1) *Our opinion of this innovation.* (2) *Whether it is possible to buy the necessary apparatus in England.*

(1) The suggested scheme can certainly be worked and gives quite satisfactory results in many cases for short distances. See page 695, August 26th issue. (2) A suitable fitting is now marketed by the Dubilier Condenser Co.

"**W.E.S.**" **(Maidstone)** *submits a circuit and asks how it is that a certain coil improves the strength of signals.*

We should say that this is due to the action of this coil in conjunction with the grid condenser, forming an "acceptor" circuit for the required frequency, allowing the transference of greater potentials to the grid of the valve.

"**E.C.D.**" **(Kent)** *asks* (1) *For wiring diagram using two H.F., one detector and one L.F. valves and plug-in transformers, with reaction.* (2) *Would three-valve set, one H.F., one detector and one L.F. receive telephony from Manchester.* (3) *Capacities of condensers to use in the set and* (4) *Are high resistance telephones better for these circuits than low resistance with transformer.*

(1) and (3) See Fig. 2. (2) Yes. (4) No, a correctly designed valve to telephone transformer with L.R. telephones is the better arrangement, although if it is necessary to economise there is no harm in putting the H.R. telephones directly in the plate circuit.

but if your transformer consists of separate sections not connected together except by the external leads shown, your scheme will be quite satisfactory.

"**B.C.O.**" **(Earlsfield).**—(1) Both of the circuits which you show are capable of causing radiation when connected to an outside aerial. We believe, however, that at the moment the Postmaster-General is prepared to authorise the use of the upper circuit, though he states that it is to be operated in such a way as not to cause radiation. The lower circuit, which consists of heterodyne oscillator coupled to an inductance which in turn is coupled to the aerial circuit, does, of course, radiate, though the use of a separate oscillator of this sort is, we believe, still approved by the Postmaster-General. (2) The relationship between the coils A and B depends entirely upon the amount of inductance included in the aerial circuit. Instead of joining additional inductance in series with the secondary of the aerial circuit oscillation transformer, you might simply provide a coil, placed near the secondary inductance, which is connected in series with the plate circuit inductance of the oscillator. (3) This depends entirely upon the dimensions of the frame aerial. Would probably bring in ships and Paris, other spark stations and telephony from high power broadcasting stations up to a distance of 50 miles when connected to a frame aerial having sides each of 4′. (4) It is very difficult to receive **PCGG** on a frame aerial, and we would recommend you to use one having sides of at least 6′, arranging very careful tuning for high frequency transformers.

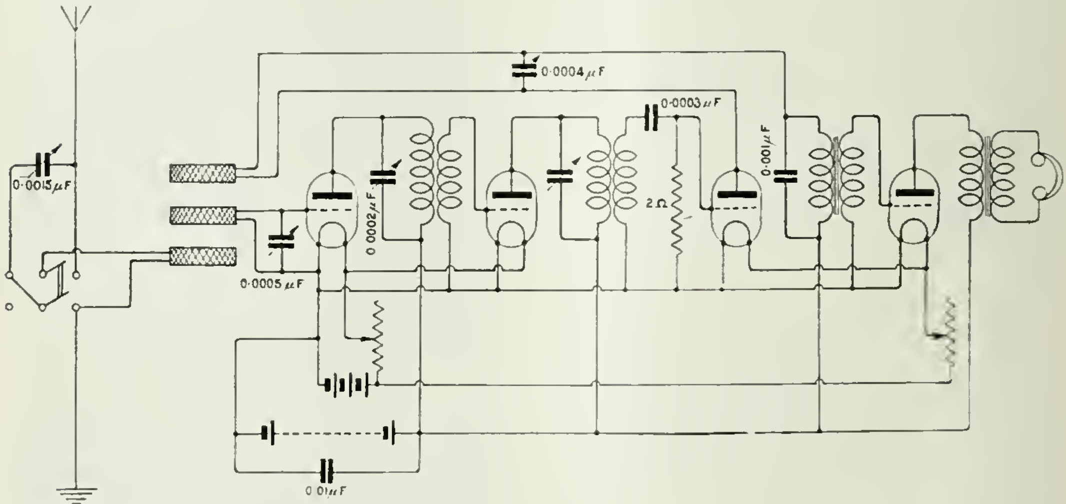


Fig. 2.

"**W.B.**" **(Cardiff)** *asks* (1) *What windings to put on bobbins of a certain size for an L.F. transformer.* (2) *Whether the connections of a H.F. transformer shown are correct.*

(1) Core B will be better. You should wind it full of No. 44 wire, preferably DWS, using half as many turns again for the secondary winding as for the primary. (2) Your diagram is not very clear,

"**W.F.S.**" **(Kent)** *asks* (1) *For three-valve circuit with switches making use of components he possesses.* (2) *Particulars of aerial inductance.* (3) *Advice on set for concerts.* (4) *If fuses are useful in L.T. circuit.*

(1) See Fig. 2 and switching arrangements shown in September 30th issue. (2) You may add coils to the aerial and closed circuits. We

cannot usefully give winding details because we have no knowledge of your aerial, condensers, or wavelength range of your variometers. (3) Use 1 H.F. in preference to another L.F. valve. (4) No.

"C.B." (Madrid).—(1) and (3) As you are desirous of using your Mark III tuner for long wave reception, you would be well advised to dismantle it and make use of the components, particularly as you wish to couple it to a valve receiver. We should recommend you to obtain a three-coil holder and set of coils, and tune your inductance with the condensers removed from the Mark III; and you might arrange for two stages of H.F. and is entirely due to the design of the intervalve transformers, and the method in which they are connected up. It may be very difficult to eliminate it, and you might try reversing the connections to the transformers, and the cores might be bridged across and joined to the H.T. plus. Alternatively, you might try separating the transformers out, and keeping the cores carefully insulated from one another. We would recommend you to substitute one stage of L.F. amplification by H.F. to the arrangement which is given in our issue of September 30th, under the heading "Experimental Station Design."

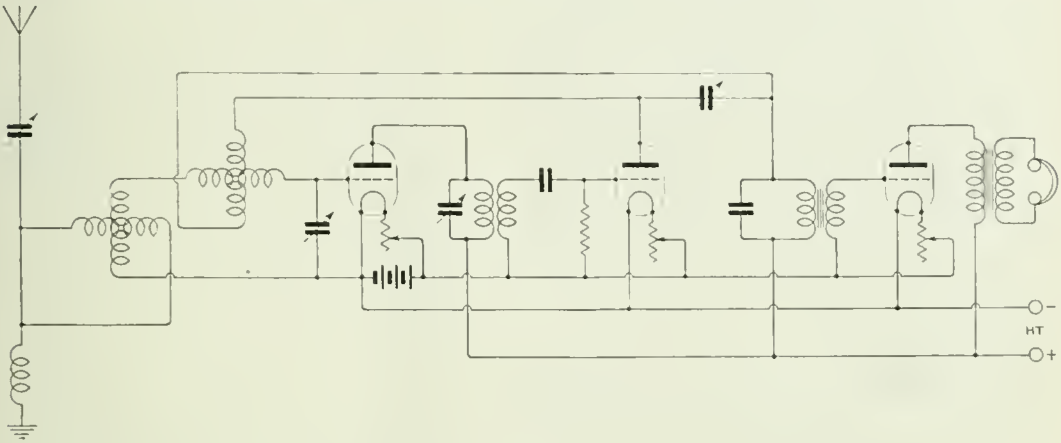


Fig. 3.

amplification followed by one L.F. amplifier. You might find it rather difficult to manipulate four stages of H.F. amplification. Numerous circuits making use of this arrangement have been given in the recent issues of this journal under the "Questions and Answers" section; in particular, Fig. 10, page 743; Fig. 6, page 741; Fig. 5, page 740; Fig. 2, page 705; Fig. 4, page 706, etc. (2) Yes; you will obtain fairly good results with the arrangement you propose, though we always advocate the use of an outdoor aerial whenever possible. (4) Usually 0·0013 and 0·00045 mfds., though one plate a little out of position may somewhat increase these values.

"A.C." (Kilburn).—Although you state that the switches shown on your set are of the Dewar type, you do not say the number of contacts to which they are fitted, and consequently we cannot work them into a circuit. However, the equipment with which your panel is provided is entirely suitable for building up the set described on page 677 of August 26th issue, and continued in the issue of September 2nd, with the exception, of course, that you have one additional valve, and an additional transformer, which can easily be arranged to provide another stage of note magnification. We think the article to which we have referred you gives you all the information you will need, and far more than we could attempt to give you here.

" " (Blackheath).—The trouble which you are experiencing is quite a common one,

"G.H." (Goteburg) *asks* (1) *If a resistance coupled four-valve circuit should be as good as a similarly coupled transformer circuit between* 1,000 *and* 15,000 *metres.* (2) *Diagram for such a circuit.* (3) *If certain apparatus could be used in the tuner.* (4) *What is a loading coil.*

(1) Probably somewhat better. (2) Diagram of Fig. 9, page 673, August 19th issue, will be quite satisfactory if the anode resistances are substituted for the three anode tuned circuits shown. (3) All the apparatus suggested is desirable, except the variable condenser across the reaction coil, which is hardly necessary. (4) Any inductance coil used to raise the wavelength of a circuit.

"——————" (Aycocks Green) *asks* (1) *If an antenna or aerial plug is any good for a crystal set.* (2) *If an antenna is more efficient with a crystal set.* (3) *If it is equal to an aerial.*

(1) (2) and (3) We do not understand what you mean by the term "antenna plug." We should imagine this to mean an arrangement for connecting an aerial to a receiver by means of a plug and socket, which is quite a satisfactory way of making connection. This, however, does not fit in with your questions. We should be pleased to give you further advice if you will explain exactly what you mean by this term. The terms "antenna" and "aerial" as generally used are synonymous. Perhaps the reply to "**R.A.H." (Accrington)** on the previous page will help you.

"F.W." (Birmingham). You will require, we should say, at least three interchangeable reaction coils to cover the range you require. A more convenient arrangement is to vary the amount of added inductance connected in series with this coil. As you have not yet constructed your H.F. unit, we would recommend you to study carefully the description given of one making use of the tuned anode arrangement, which appears in our issue of September 30th.

"**H.B.**" **(Birmingham).**—(1) The type of inductance to which you refer is quite suitable for connecting in the plate circuit of the H.F. valve. For reception on 300 metres one coil with 44 turns is suitable, whilst two coils will tune between 500 and 700 metres. Beyond this range you must find out the number required by experiment, as the inductive value depends so much upon the closeness of the coils when assembled. You should space each coil with a piece of waxed paper when building up your inductances. You will probably need from 15 to 20 coils. The coupling of the reaction coil connected in the plate circuit of the second valve to the inductance of the rejector circuit is a very satisfactory arrangement, and gives good amplification, though tight coupling is necessary. An article describing the construction of such a set is given in the issue of September 30th. You will need exactly the same number of coils in reactance and rejector circuits. You might bind the required number up into units, placing one set over the other.

"**E.R.S.**" **(Bredbury).**—(1) It is rather beyond the scope of this department to give you all the necessary details for constructing a complete three-valve receiver, but all the details you require will be found in the article entitled "A Broadcast Receiver," in our issue of August 26th, and continued in the issue of September 2nd. In order to comply with the requirements of the Post Office it is necessary that the reaction inductance shall be coupled to the secondary of the loose coupled aerial circuit oscillation transformer. (2) We cannot give the precise windings for the construction of honeycomb coils to cover the range 180/3,000 metres. It is really much easier to buy coils having definite values specified by the manufacturers. The inductive value of a honeycomb coil depends very considerably upon the precise method of winding the wire. Useful information can be obtained from the "Radio Experimenter's Handbook," by Coursey. (3) A loud-speaker constructed by adding a trumpet to the telephone earpieces is not very satisfactory. The efficiency of a loud-speaker depends essentially upon the fitting of the base of the trumpet to the earpiece and the critical dimensions of the air column contained between the base of the trumpet and the diaphragm, and the length of the air column in the trumpet. The range of the reception depends entirely upon the power of the transmitter, and the set to which we refer you would probably be capable of reception of amateur telephony over a distance of 50 miles, and high power broadcasted telephony over a very much greater range. Range depends also on the efficiency and dimensions of your aerial. (4) Primary batteries are not very satisfactory for filament heating, as during discharge the potential across the terminals steadily falls, and it will be necessary to continually adjust the filament resistance. It is not impossible to charge an accumulator from cells of the type you mention, but we do not recommend it. You will probably find large bichromate cells most suitable for the purpose of charging your accumulator.

"**J.L.C.**" **(Forest Hill).**—We at present understand that the Postmaster-General is prepared to authorise the use of a reactioncoil which is coupled back to the secondary of a loose-coupled oscillation transformer connected in the aerial circuit, as indicated on your diagram A, which is returned. Alternatively you might arrange an inductance in the plate circuit of your second valve, and couple it back to the tuned anode circuit, and the design of an instrument making use of this arrangement was given in our issue of September 30th.

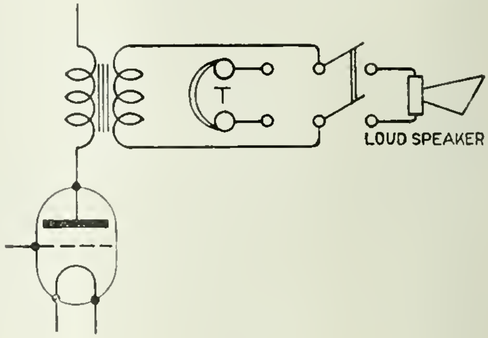


Fig. 4.

"**J.D.**" **(Huddersfield)** *asks* (1) *A diagram of a four-valve set, one H.F., one rectifying, two L.F., to comply with certain conditions.* (2) *and* (3) *Questions about re-radiation and* (4) *Questions about generator noises.*

(1) See diagrams on page 879, September 30th issue, and Fig. 4. (2) and (3) If you are reacting into the closed circuit and the set is oscillating you will be causing a slight disturbance. The set must not oscillate to receive telephony. Your local society should be able to help you. (4) The generator noise you hear is due to the small voltage ripple superimposed on the direct current generated by the machine.

"**H.A.B.**" **(Birmingham).**—The use of a grid condenser and leak as shown in your diagram is essential when using resistance capacity coupling, or the form of coupling which you have shown connected in the circuit. The grid condensers being left permanently in circuit will not have a detrimental effect provided they have a suitable value, which, for short wave working, is 0·0003 mfds. You should use valves specially designed to function as H.F. amplifiers, such as "R" or "V24." We notice that you have not provided reaction in your circuit, but when using grid condensers of the values suggested, it is not probable that rectification will be so complete that the reaction coil cannot be connected in series with the plate circuit of the detector valve.

"**P.M.**" **(E.C.I.).** — The "Burndept 200" coil will cover a range of 300-600 metres when bridged with a variable condenser having a maximum value of 0·00035 mfds. You will obviously need a number of coils to cover a wavelength range of 300 to 2,000.

"T.S." (Wolverton).—(1) Your set is correctly wired, and the cause of obtaining poor results is very probably due to the design of the H.F. transformer. Poor results in receiving circuits are practically always due to the use of inefficient transformers or unsuitable valves. The first valve should be one designed to amplify high frequency oscillations such as "R" or "V.24." The second should be an efficient rectifier such as "R4B," whilst the third for use as a note magnifier should be "R" or "R4B." The windings of the inductances are suitable for operating for a limited wavelength range. The reaction coil might be bridged with a variable condenser having a maximum value of 0·0004 mfds. to facilitate adjustment, and to bring the range of tuning within that of the aerial circuit. The condenser in the aerial circuit might be provided with a switch for connecting either in series or parallel across the aerial inductance. (2) We do not advocate the use of H.F. transformers for use on wavelengths of over 2,000 metres. For wavelengths above 2,000 metres the resistance capacity method of intervalve coupling will give results nearly equal to inductively wound transformers, and has the advantage that no tuning adjustments are required. The number of turns required for various wavelengths depends essentially upon the tightness of winding, and it is very difficult to give precise windings for transformers of the type you show. You do not state the mean diameter of the bobbin, but assuming it to be 2", you will require approximately 600 turns each for primary and secondary. Put the two windings on separately, using a fine wire such as No. 38 to 44 S.S.C.

"T.W." (Darwen).—(1) Your circuit diagram is quite in order, though, of course, we cannot recommend the use of a filament resistance having a resistance of only about 10 ohms for use as a potentiometer. It will certainly produce potential variations intermediate between the plus and minus potentials of the battery, but will consume a considerable amount of current. A suitable resistance for potentiometer is 200 to 700 ohms. If Osram "R" valves are used for H.F. amplification, the use of a potentiometer is not essential. (2) The circuit will probably operate successfully with "Ora" valves, but best results are usually obtained by employing valves specially designed to function as H.F. amplifiers, rectifying and L.F. valves. The grid condenser should have a value of 0·0003 mfds., and the grid leak a value between 1·5 and 2·5 megohms. You have stated the values of your aerial tuning condenser and closed circuit tuning condenser as being each 0·005. We presume you mean 0·0005, as a condenser having air dielectric and the value you state would be extraordinarily large. You might arrange to connect the aerial tuning condenser in series or parallel across the inductance. It is convenient also to bridge the reaction inductance with a variable condenser having a maximum value of about 0·0005. The efficiency of the outfit will depend to a large extent upon the design of the intervalve transformers, in particular those used in the high frequency circuits. The transformers should be tested out individually on a two-valve set, in order to prove that they will give quite good amplification before being assembled into the five-valve outfit.

"F.C.G." (Bury St. Edmunds).—Your circuit is, of course, quite in order, and it is one that can be thoroughly recommended for reception on short wavelengths. It is difficult to suggest why changes in the value of the aerial tuning inductance should not make any difference to the tuning, and without examining the set in the hope of finding a fault, we cannot suggest the cause of the defect. All of the values you have adopted seem to be correct and the windings of the inductances suitable for short wave reception. It may be absurd to suggest it, but is the lead from your L.T. minus to the earth and lower end of aerial tuning inductance connected up? You do not say what type of valves you are using. The first should be one designed to efficiently amplify oscillations without rectifying, such as an "R" or "V24," whilst the second should be an efficient rectifier, such as an "R4B." It is a distinct advantage to add at least one note magnifying valve, though, of course, it is not much good considering this until your set is functioning correctly. An article on the arrangement of reaction you have adopted is given in the issue of September 30th and probably contains information that may be helpful to you. It is always very difficult to suggest faults in receiving circuits from brief descriptions. Usually a glance at the instrument itself will rapidly disclose the trouble.

"R.R." (Birkdale). If you are unacquainted with the meanings of the conventional signs used in wireless circuits, it is rather beyond the scope of this department to give you all the information you will need to build up a five-valve receiver on the unit system. The most complete description of a receiver that we have published is that given on page 678 of August 26th issue, and continued in the issue of September 2nd. This is not on the unit system, but in making it up you will gain a good deal of experience in the construction and manipulation of wireless apparatus. An article on the unit system was given on page 760 of our issue of September 9th last, and this can be arranged to incorporate as many high frequency and low frequency valves as is desired. You might obtain a good deal of helpful information from the "Radio Experimenter's Handbook," by Coursey (Wireless Press, Ltd., price 3s. 6d.). We presume you are in possession of an experimenter's licence, and if you will send to us the diagram which you furnished when making application for your permit, we shall be pleased to add to it any details we may think helpful in the making-up of the set.

"V.J." (Gainsborough).—We recommend you to adopt the winding given in the article to which you refer, where a little experimental work may be necessary in order to get the precise values necessary, as the tightness of winding very considerably alters the wavelength range. For wavelengths beyond those for which the H.F. transformer is designed, we would recommend you to use resistance capacity intervalve coupling.

"M.A.H." (Croydon).—The circuit to which you refer, on page 445 of the July 8th issue, would probably not be approved by the Post Office; and we recommend you to either adopt the circuit shown on page 771, September 9th issue, or preferably, that given in the article on "Experimental Station Design," in the issue of September 30th.

"**H.S.**" **(Stretford).**—We have scrutinised the blue-print diagram which accompanied your query of the 18th inst., and which appears to be in every way correct. The circuit is quite a popular one, and can be relied upon to give good results. One connection is perhaps strange, and that is that in the secondary of the high frequency transformer you have connected a condenser in the lead to the grid of the next valve. This is quite in order, but it makes the use of a grid condenser and leak between those of the grid and filament minus quite unnecessary. For short wave working you may find that a tuned plate circuit as used in the construction of the broadcast receiver described on page 768 of August 26th issue would be preferable to the intervalve transformer which you show. You do not show the aerial tuning condenser, but we presume you intend to use one externally to the instrument.

"**G.S.P.**" **(Beckenham).**—The terminals on your panel are for use with a circuit in which the aerial inductance is coupled to the reaction coil. Such an arrangement is liable to cause serious interference, and we understand that the Post Office is prepared to authorise the use of three coils arranged, one in the aerial circuit, the middle one in a secondary circuit, and the other in the plate circuit. We would recommend, however, in order to entirely eliminate radiation, the use of the high frequency amplifying device given in our issue of September 30th.

"**NOVICE**" **(Salop)** *has loose coupled tuner, variable condenser* 0·0003 *and H.R. telephones and asks* (1) *For circuit.* (2) *Range of tuning.* (3) *Method of adding one stage H.F.*

(1) See Fig. 5. You will need an additional inductance if you desire to receive C.W. signals. Read carefully all articles on "Experimental Station Design" in back numbers. (2) About 3,200 metres. (3) See article on H.F. unit amplifier with reaction in issue of September 30th, 1922.

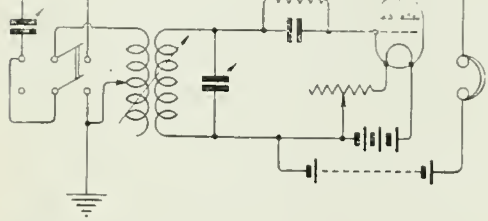


Fig. 5.

"**L.R.C.**" **(Goodmayes).**—(1) An elementary book is "Heat, Light and Sound" (Jones). (2) "Electricity in the Service of Man" (Millineaux Warmsley), Parts I and II. (3) A discourse on the Heavyside theory is rather beyond the scope of this section. The last volume of the *Radio Review* contained information on this subject. (4) Because the wavelength and hence the critical angle of reflection is different.

"**C.F.D.**" **(Whitby)** *has difficulty in reception of* **PCGG** *and asks* (1) *For criticism of circuit.* (2) *For advice in getting set to oscillate on short wavelengths.* (3) *What changes are necessary to extend range of Reinartz tuner to* 450 *metres.* (4) *Criticism of aerial system.*

(1) You will need to add one stage H.F. You might construct the unit H.F. amplifier given in issue of September 30th, 1922. (2) The arrangement of your coils probably does not provide for sufficient coupling, also tune reaction coil with variable condenser and of course, use loose coupled aerial circuit. (3) Include a few more turns when constructing inductance. (4) Read article on aerial construction on page 259, May 27th, 1922.

"**MUSIC**" **(Lowerby)** *asks* (1) *For values of condensers and H.F. transformers shown in Fig.* 10, *September 2nd issue.* (2) *For a diagram of a four-valve set to cover* 150 *to* 2,000 *metres, using two H.F., one detector and one L.F. stages, with values and particulars of construction of H.F. transformers.* (3) *Values of condensers and grid leak shown in diagram Fig. 8, September 2nd issue.*

(1) and (3) Aerial tuning condenser maximum 0·0015 mfds., closed circuit condenser maximum 0·0005 mfds., H.F. transformer tuning condenser maximum 0·0002 mfds., L.F. transformer by-pass condenser 0·001 mfds., grid condenser 0·0003 mfds., grid leak 2 megohms, reaction tuning condenser maximum 0·0004 mfds. battery by-pass condenser from 0·001 mfds. to 0·5 mfds. (2) The diagram, Fig. 4, September 23rd, 1922, issue which meets your requirements and can be thoroughly recommended. Anode tuning condensers should have a maximum value not exceeding 0·0002 mfds. Should you wish to experiment with H.F. transformers, we suggest you commence with those described in the article on "Experimental Station Design," September 2nd issue.

"**F.L.C.**" **(E.C.1).**—(1) Your proposed test by means of copper and silver coins for the sensitiveness of telephone receivers is satisfactory, and a fairly loud click should be obtained. (2) You do not state the dimensions of the frame aerial you propose to use, but we should, with the system of reception you propose to adopt, advise the use of one having sides at least 4 feet in length. The leads from the frame are bridged with a variable condenser across which is connected the crystal and primary of an intervalve transformer, which is bridged with a condenser having a value of 0·001 mfds. The secondary of the transformer is connected to the usual arrangement of two note magnifying valves, circuits for which are frequently given in this journal. (3) The specimens of wire you enclose are No. 44 S.W.G. One is single silk covered, and the other we believe has a covering of a single layer of cotton. Without knowing the dimensions of the pole pieces of your telephones, we cannot advise you as to their resistance, but the wire is suitable for winding telephone receivers of a fairly high resistance.

"**V.T.B.**" **(E.8).**—It is rather beyond the scope of this section to give you a full description of the construction of a three-valve receiving set, but all the information you require can be obtained from an article entitled "A Broadcast Receiver," in our issues of August 26th and September 2nd.

"**G.E.W.**" **(Kent).**—Your diagram is correct, although we prefer a telephone transformer. You might find it helpful to tune the reaction coil.

"**J.E.C.**" **(Brockley)** *asks* (1) *Winding for A.T.I. and reaction coil to tune in* 200-2,000 *metres.* (2) *Diagram of three-valve set.*

(1) For short wavelengths make up an inductance according to the instructions given in "Experimental Station Design," page 328, June 10th issue. For longer wavelengths, make up cylindrical coils with 5 or 6 taps, 6″ × 6″ full of No. 26 D.C.C. for A.T.I., and 4½″ × 4″ full of No. 28 D.C.C. for closed circuit. For reaction you had better react into the H.F. transformer. See Figs. 8 and 9, pages 742 and 743, September 2nd issue, Fig. 1, page 771, September 9th issue, and page 791, September 16th issue. We do not think you will gain any advantage by using separate batteries.

"**H.Y.**" **(Belgium)** *asks* (1) *For criticism of his five-valve set.* (2) *Wavelength of his aerial.* (3) *If French valves marked* "*S.I.B.*" *are suitable, and their operating values.* (4) *The difference between slab and basket coils.*

(1) You will find a switch to connect your aerial tuning condenser in series or parallel with the aerial tuning inductance helpful. Connect the reaction coil in the plate circuit of the third valve, and couple it with the closed circuit inductance. You should join a 0·001 mfds. condenser across the primary of the first L.F. transformer. Your switching arrangement is not very good. See the diagram on page 883, September 30th issue. r_1 and r_2 have rather high values. We prefer a telephone transformer. (2) Roughly 190 metres. (3) We cannot say, as we have no particulars of these valves. We suggest you enquire of the makers. (4) Inductance coils are fully explained in "The Radio Experimenter's Handbook," by Coursey.

"**CURIOSITY**" **(Islington)** *requires diagram of two-valve set using plug-in type H.F. transformers.*

(1) See Figs. 6 and 7, page 707, August 26th issue. You will gain a good deal of useful information by reading the articles on "Experimental Station Design" appearing in alternate issues. See in particular the article in September 16th issue. (2) Range 50-100 miles.

"**F.A.P.**" **(Bucks)** *asks* (1), (2) *and* (3) *Questions about his aerial.* (4) *Are Mullard* "*Ora*" *valves suitable for use in a four-valve set.*

(1) The highest mast the chimney will support depends upon the construction and condition of the chimney. About 12′ long would be reasonable. (2) Halfway between A and B. (3) About 6′. You will find the article on "Experimental Station Design" in May 27th issue, which deals with aerials, very instructive. (4) It is always better to use the valves for which the set was designed, and in this case the valves which the author of the article employs are quite satisfactory.

"**D.A.**" **(Hampton)** *asks how to add two valves to his set.*

We cannot help you much as you do not give us a wiring diagram of your set. We think you will have no difficulty if you look through several recent issues.

"**R.A.H.**" **(Clapham Junction).**—The diagram is not correct as you have drawn it. See diagram Fig. 1, page 805, September 16th issue. The telephones may be connected directly in the plate circuit, but the use of a telephone transformer is preferable. Notice the marking on the telephones and join them up accordingly.

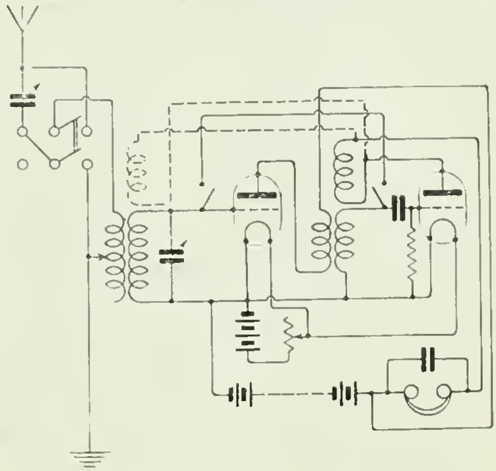


Fig. 6.

"**E.H.W.B.**" **(Bournville).**—(1) *Has a single-valve panel with three coil holders, and wishes to know how to arrange reaction when on* "*Stand-by.*" (2) *Asks questions about his set.* (3) *For a two-valve diagram with switches to cut out either valve.*

(1) With a single-valve set you cannot use reaction when on "stand-by," as the Post Office will not permit reacting directly into the aerial coil. When receiving on "tune" position you can react into the closed circuit coil, which should be the centre coil of the three. With a two-valve set you may react into the H.F. transformer as explained in recent issues, and then it will not matter whether you are receiving on "Tune" or "Stand-by." (2) No. A grid leak and condenser is better. If you want to try a potentiometer, connect it up as shown in the H.F. amplifier panel, Fig. 6, page 809, September 16th issue. If no reaction is employed you will receive everything except pure C.W. telegraphy, although, of course, reaction, when judiciously used, greatly improves signals. (3) See Fig. 6.

"**NOVICE**" **(Runcorn).**—(1) Your questions are not very clear. Use 40-50 volts H.T. and put 0·001 mfds condenser across telephones and H.T. battery. For tuning to short wavelengths connect your tuning condenser in series with the aerial coil. (2) The circuit, Fig. 1, page 771, September 9th issue, will probably suit you, also see September 30th issue. (3) The noise which you hear is probably due to induction. (4) The purpose of reaction is to transfer some of the energy in the plate circuit back to the grid circuit, where it is amplified again. It acts to reduce the resistance of the input circuit to oscillations set up by the incoming signals.

"**S.A.X.**" **(Preston).**—(1) *Enquires whether the circuit given on page* 608, *Fig.* 5, *August 5th issue, comes under the heading of those capable of energising the aerial, if so, for a rearranged* *circuit using the same components, but cutting out reaction altogether.* (2) *Windings for tuner to use with this circuit to tune up to* 6,000 *metres.* (3) *Number of plates for variable condenser of* 0·001 *mfds., and* 0·00035 *mfds. diameter of moving plates* 3″ *and spacing* 3/32″. (4) *H.T. and L.T. voltages.*

(1) A circuit of this type will radiate and will therefore not be permitted by the Postmaster-General. To cut out reaction altogether, remove the reaction coil and tuning condenser, and connect the plate of the detecting valve to the intervalve transformer. Should you wish to experiment with reaction later on you cannot do better than to use one of the methods explained in "Experimental Station Design," September 2nd and 30th issues. (2) You do not give us any particulars of your aerial. Using the full P.M.G. aerial and 0·001 mfds. tuning condenser, you might use two coils, 3″ × 3″ full of 22 D.S.C. for short waves, and 8″ × 10″ full of 26 D.S.C. for the longer waves. (3) and (4) Use 6 volts L.T. and about 60 volts H.T. with "R" valves.

"D.S." (Wilts.).—With regard to the use of interchangeable transformer and resistance capacity coupling you may gain some useful information from the article on page 760, September 9th issue, also Fig. 6, page 741, September 2nd issue. We understand at present that the Postmaster-General has no objection to reacting into the closed circuit. Potentiometer control is not necessary with "R" valves but it may be useful with your valves. We anticipate your reaction trouble will disappear when further H.F. valves are used. See also article in September 30th issue.

"SIGNALMAN" (Lancs).—We do not recommend this set. Why not make the Broadcast receiver described in the August 26th and September 2nd issues ?

"AFICIONADO" (Leeds) *asks* (1) *Whether in the formula, wavelength* $= 1885\sqrt{LC}$, *the capacity and inductance are in parallel, and how to use this formula if the capacity and inductance are in series.* (2) *The dimensions of slab coils, wound with* 36 *gauge wire, which will tune up to* 30,000 *metres with a* 0·001 *mfds. condenser.* (3) *How to cut out disturbances caused by the tramway system.* (4) *Criticism of his set.*

(1) The formula is applied to a circuit with capacity and inductance in parallel. The total capacity is the capacity of the condenser added to the self-capacity of the coil. If you have two condensers in series work out their resultant capacity first, $\frac{1}{C} = \frac{1}{c_1} + \frac{1}{c_2}$, etc., and then use the wavelength formula. (2) You do not give sufficient particulars, and we suggest you wind a number of coils and mount them side by side, bringing out the connections to a switch. (3) You will find it a very difficult matter to cut out the disturbances as you are so close to the tramway system. Add valves to your set and use a frame aerial. (4) The circuit as shown is of little value and would not be authorised by the Post Office. See Fig. 4, page 840, September 23rd issue.

"S.A.X." (Preston) *enquires* (1) *Whether the circuit given on page* 608, *Fig.* 5, *August 5th issue, comes under the heading of those capable of energising the aerial ; if so, for a rearranged circuit using same components, but cutting out reaction altogether.* (2) *Windings for tuner to use with this circuit to tune up to* 6,000 *metres and* (3) *Number of plates for variable condenser of* 0·001 *and* 0·00035 *mfds. diameter of moving plates* 3″ *and spacing* 3/32″. (4) *Values of H.T. and L.T. batteries.*

(1) A circuit of this type will radiate, and as such would not be permitted by the Postmaster-General. To cut out reaction altogether, remove the reaction coil and variable condenser, and connect the plate of the oscillating valve to the intervalve transformer. You could, of course, react into the H.F. transformer as described in "Experimental Station Design," September 2nd issue. (2) You do not state what range of wavelengths you wish to cover or the size of your aerial. (3) Roughly 22 fixed and 21 moving plates for 0·001 mfds., 7 fixed and 6 moving plates for 0·00035 mfds., though number of plates, of course, depends upon their thickness, for a given size of spacing washer. (4) Depends essentially upon type of valve used, but 45 to 70 volts is a usual H.T. potential and 4 to 6 volts for L.T.

"E.A.M.G." (N.21) (1) *Has added* 1 *H.F. valve to his single valve set and signals are weaker, and asks for cause of trouble.* (2) *When set is oscillating is it interfering with other receiving sets near-by.* (3) *Does the Post Office allow reaction, if not how to receive C.W.* (4) *Have curves, showing number of turns of wire in honeycomb coils, plotted against wavelength been published.*

(1) From the data you give us it appears that your secondary circuit will not cover the same range of wavelengths as the primary circuit, and the H.F. transformer probably does not tune to the wavelengths you wish to receive. The reaction coil shown in your sketch should couple with the closed circuit coil, and not the aerial coil. (2) When the set is oscillating it will be a source of annoyance to other amateurs in your district. (3) At present the Post Office regulations permit reaction coupled to the closed circuit, for the reception of C.W. A good method is to couple the reaction coil to an H.F. transformer as described in "Experimental Station Design," page 715, September 2nd issue, and page 791, September 16th issue. You cannot do better than adopt the circuit given on page 867, September 30th. (4) The inductance depends upon the exact method of winding, spacing, etc. You will find a number of useful curves in "Prepared Radio Measurements," by Batcher, also see page 487, July 15th, and page 320, June 10th, 1922.

SHARE MARKET REPORT.

Prices as we go to press on October 6th are :—

		£	s.	d.
Marconi Ordinary	.. ..	£2	7	0
,, Preference	.. ..	2	3	3
,, Inter. Marine	.. ..	1	7	3
,, Canadian	.. ..		10	7½

Radio Corporation of America :—

		£	s.	d.
Ordinary	.. .. ..	1	0	3
Preference	.. .. ..		14	7½

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

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The Armstrong Super-Regenerative Receiver

PRACTICAL DETAILS OF A BRITISH-BUILT INSTRUMENT.

By Percy W. Harris.

THE principles of the new Armstrong Super-Regenerative Receiver, and many of the theoretical circuits used with it, are already known to readers of this journal. There seems, however, a great lack of practical data, and for this reason the writer ventures to publish the following description of his own "Armstrong Super," which fulfils the most sanguine expectations in regard to signal strength. With "R" valves and a 2-ft. loop, 2 LO is stronger on two valves than on an ordinary set with three and an outside aerial 50 ft. long. If the directions here given are followed, any amateur with quite ordinary skill in instrument assembling can build the receiver, and if care is taken in details, the result of the work will be a handsome and fascinating addition to the wireless room.

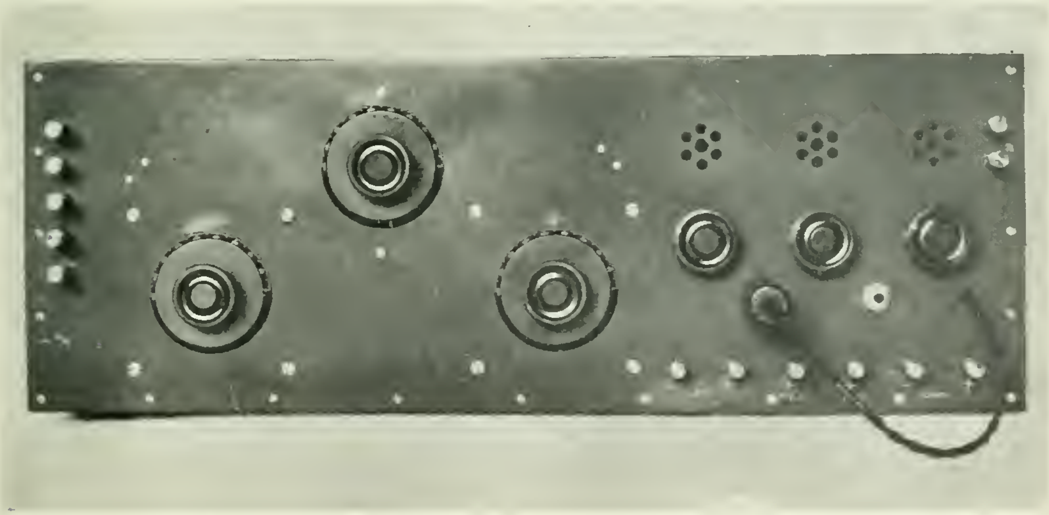


Fig. 1. A Photograph of the Armstrong Super-Regenerative Receiver showing the Completed Instrument.

Before beginning, let us refresh our minds regarding principles.

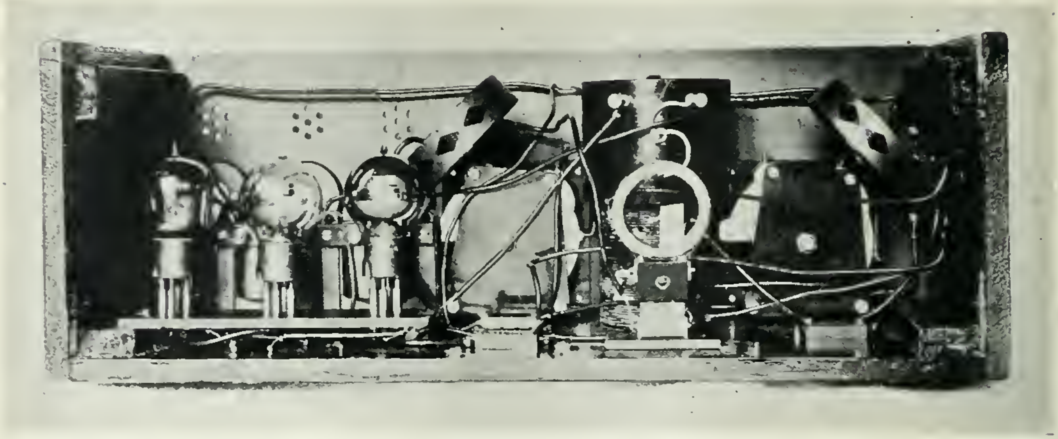


Fig. 2. A View of the back of the Armstrong Super-Regenerative Receiver with part of the case removed.

In essence, the basis of the Armstrong Super-regenerator is an ordinary regenerative receiver in which the reaction coupling is so tight that the first incoming signal sends the circuit into oscillation. This builds up rapidly and regularly until the limit of current-carrying capacity is reached. If nothing were done to it the circuit would continue to oscillate at uniform strength as long as high and low tension supply lasted, and further incoming signals would make no additional impression. It must be remembered that from the first impulse of the wave to the maximum oscillation of the valve a definite interval of time elapses, the oscillation building up by stages. At the end of a measured interval the amplitude of the oscillation built up from the impulse of a weak signal is less than the corresponding amplitude set up by a strong signal in the same period; in fact, at the end of regular periods of time (supposing the oscillation to be stopped periodically) the value of the oscillations is strictly in proportion to the strength of each original impulse. This statement may seem a little involved at first reading, but it should be grasped if the reader wishes to understand the basic principles.

In his circuits Armstrong uses a special oscillating valve circuit which periodically stops the oscillations of the valve in the regenerative circuit by making its grid positive at regular intervals, or by some other equally effective method. The most popular circuits use three valves, one for detecting and regeneration, one for oscillating, and one for note-magnification. The incoming signals set the regenerative valve oscillating, and the current goes on building up by regeneration until, after a definite interval of time, the oscillation is stopped by the quenching effect of the oscillator valve circuit. The result is that incoming signals are enormously magnified, distortion being avoided by stopping the valve oscillating at regular and very short intervals.

If we consider for a moment we shall see that the amplification is limited by more than one factor. First of all, the longer the period we can allow the valve to oscillate before quenching it, the greater will be the building up effect. If, however, we make the period too long the quenching oscillations will descend to audible frequency and interfere with reception. Secondly, we are limited by the current carrying capacity o. the valves used, for which reason the maximum effect is obtained by using transmitter valves.

Some of the new Armstrong receivers include a filter circuit between the detector and the note magnifier, so designed that it will not allow oscillations above about 3,000 per second to pass. This keeps out the whistle of the quenching frequency (if this is low), while allowing voice and music frequencies, as well as suitable heterodyne notes to pass. A filter adds considerably to the complication of the circuit, and the necessary resistances and chokes are not easily obtainable.

The present writer experimented with

several of the circuits described in these pages, but, like many others, was unsuccessful. Considerable study of American technical publications revealed the fact that nine out of every ten would-be users of the instrument were failing similarly. The reason seemed to be that not only the circuit, but the disposition of the parts must be correct. Then, by good chance, he found in one of the newer and very well edited American wireless publications, *Popular Radio*, an article by Mr. L. M. Cockaday describing a circuit and arrangement which dispensed with many of the complications. This circuit and instrument was also described in the following issue of *Q. S. T.*, certain improvements being added in the article in the latter publication. The instrument to be described is largely based upon Mr. Cockaday's description, and the writer takes this opportunity of acknowledging his indebtedness to Mr. Cockaday, *Popular Radio*, and *Q. S. T.*

terminals on the left are for connection to different loops, the particular terminals used depending on the size of the loop and the number of turns of wire. Once found, the adjustment here remains constant for a given loop. The two terminals on the right are for telephones or loud speaker, and the six below (counting from the left) are L.T. negative, L.T. positive (the H.T. negative is also connected to this terminal), H.T. positive for first two valves, H.T. positive for note magnifying valve, oscillator valve grid bias positive, oscillator valve grid bias negative. Normally these last two are short circuited, as the instrument works satisfactorily without any bias here.

Of the dials, that on the left belongs to the tuning condenser for signals, the upper dial controls a variometer for reaction, and the third dial on the right controls the condenser for regulating the frequency of the oscillating and quenching valve.

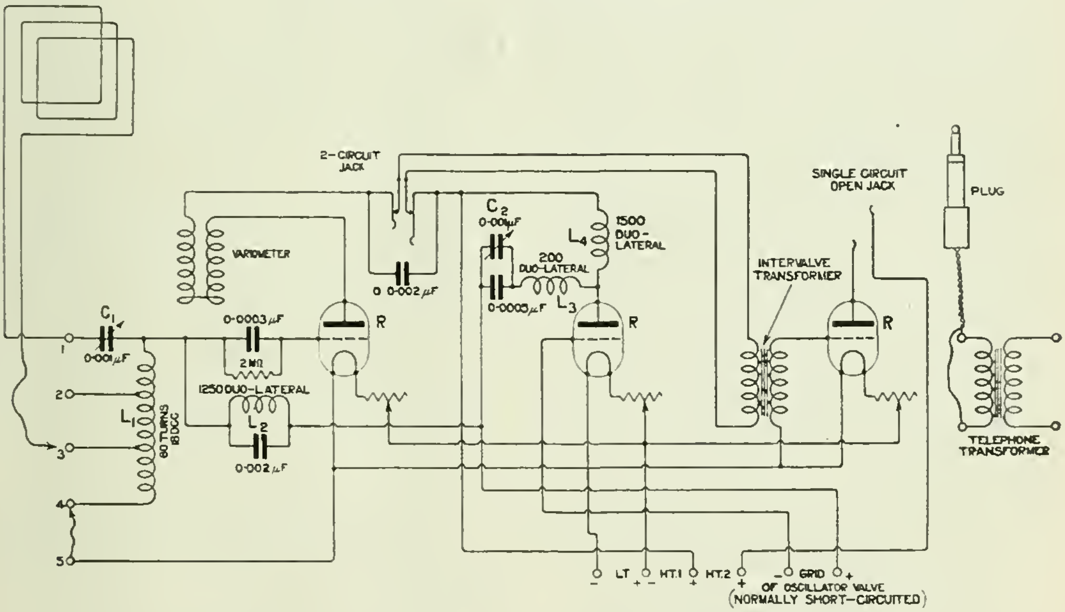


Fig. 3. The circuit used in constructing the Armstrong Super-Regenerative Receiver.

Constructionally the instrument has been modified in several ways, and these will be referred to as the article proceeds.

The photograph on the first page of this article shows the front of the completed instrument. It will be noticed that there are very few controls and variables. The five

The valves are enclosed within the instrument case, thus following a current American practice which has much to recommend it. Three sets of holes act as windows to show that all is well within. A separate filament resistance controls each valve, the knobs of these resistances being shown on the right.

Below the resistances are two jacks, into which a plug can be inserted for using either two or three valves at will. Signal strength is so great that the addition of the note magnifier is often painful.

The circuit used is illustrated in Fig. 3, and a second photograph shows the back of the instrument with portion of the case removed. In Mr. Cockaday's instrument everything is mounted on the back of the panel. The writer has adopted a slightly different method which facilitated construction and makes wiring easier.

In the instrument illustrated the panel was first prepared and drilled, and after certain portions had been mounted on it, it was fixed to the base and two uprights of the case. With this done certain other portions were mounted on the base and wiring carried out in comfort. This arrangement makes for a good disposition of the parts. Two other modifications are of interest. Firstly, the 200, 1,250 and 1,500 coils are mounted on plugs and fit into sockets, thus allowing them to be removed in a moment for other work. Secondly, instead of connecting the telephone to a plug and plugging them into one or the other of the jacks, a telephone transformer is built into the instrument, its secondary being connected by a flexible lead to the plug and its primary to the two telephone terminals of the instrument. This is, of course, a much more satisfactory arrangement than placing the telephones directly in circuit, particularly when we consider that 150 to 200 volts are used on the plate of the last valve.

In the second part of this article detailed constructional details will be given. Meanwhile, here is a list of the components required:

Ebonite panel, 24 ins. by $8\frac{3}{4}$ ins. by $\frac{1}{4}$ in. ($\frac{3}{8}$ in. would be better but makes the panel expensive.)

2 0·001 mfd. variable condensers. (If possible these should *not* have short circuiting contacts.)

1,500-turn duolateral coil (mounted).

1,250-turn duolateral coil (mounted).

200-turn duolateral coil (mounted).

3-plug sockets for above.

2 fixed condensers (Dubilier 600 pattern), 0·002 mfd.

2 fixed condensers (Dubilier 600 pattern), 0·0005 mfd.

1 fixed condenser (Dubilier 600 pattern), 0·0003 mfd., combined with 2 megohm grid leak.

1 ebonite tube, 4 ins. by 3 ins., wound full with No. 18 D.C.C wire with 3 equally spaced taps (four connections in all).

1 American pattern variometer with high maximum and low minimum. (Mine was purchased from an advertiser in *The Wireless World and Radio Review*. Certain British firms are now manufacturing them also.)

3 filament rheostats for panel mounting.

1 double circuit jack.

1 single circuit jack.

1 plug for same.

1 L.F. intervalve transformer. (This *must* be of good quality. The cheap ones, and many expensive kinds too, will burn out. Ask for an instrument which has been tested on high voltages. Certain of those on the market are tested with 1,000 volts between windings.

1 telephone transformer. (The above remark also applies here.)

3 good hard "R" valves. Better still, small transmitting valves such as the M.O. "A.T.25."

1 tapped high tension battery which will give up to 200 volts.

1 6-volt accumulator.

13 terminals.

Quantity 4 and 6 B.A. metal screws, with suitable nuts, for fixing components in place.

3 sets valve sockets, as shown in the photograph, but preferably valve bases with terminals on the upper part. These latter will facilitate wiring.

Quantity No. 18 tinned copper wire (bare).

Quantity No. 22 or 24 tinned copper wire (bare).

About 8 yds. insulating tubing for thick wire.

8 ft. of "9-in" planed deal, $\frac{5}{8}$ in. thick. (This will actually be about $8\frac{3}{4}$ ins. wide.)

Strip of ebonite about $1\frac{1}{2}$ ins. wide and long enough to take three valves. (*Note.*—If valve bases with terminals are used, this strip will not be required. The strip method with separate valve sockets is cheapest, but is a nuisance to wire.)

Quantity solder, wood screws, glue, etc.

Small loop aerial suitable for concert wavelengths. The writer uses a loop 2 ft. square wound with 12 turns of single electric light flex.

About 18 ins. silk-covered double flex.

If the above components are purchased new for the work, and are of good quality, the cost will be in the neighbourhood of £16 or £17. Many amateurs, however, will have some of the components already in hand, or can make several of them instead of buying them. With the possible exception of the variometer, all the parts are readily procurable.

(*To be concluded.*)

Electrons, Electric Waves, and Wireless Telephony. III.

By Dr. J. A. Fleming, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January 1921–1922. *The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.*

II.—Compressional Waves in Air.

We have in the next place to explain the nature of a wave which is created *in* a material, and not simply *on* the surface of a medium. To follow this explanation necessitates some effort of the power of mental vision because objective perception is more difficult or impossible.

As already mentioned, there are two types of wave which can thus be produced, viz., compressional and distortional waves, depending upon the two kinds of elastic resistance which can be offered.

A *solid* is defined as a material which offers resistance to change of shape as well as to change of bulk or size. An elastic solid is one which when slightly changed in shape or size returns exactly to its original shape or size when the deforming force is removed.

A *liquid* or *gas* is matter in a physical state in which it offers elastic resistance to change of bulk or volume, but little or no resistance to change of shape.

The elastic resistance to change of volume is called volume elasticity; and the substance is said to have compressional elasticity or compressibility. The resistance to change of shape is called rigidity, and a substance which possesses elastic resistance to change of shape is said to have distortional elasticity.

In scientific language any change of size or shape in a substance is called a *strain*, and the corresponding force causing it is called a *stress*. Elasticity is numerically measured by the ratio of stress to strain in appropriate units. Hence in scientific language a substance is called highly elastic if it requires a relatively large stress or force to make a given small strain. In common language we generally say that a substance, for example, indiarubber, is very elastic if it stretches a great deal under a small pull; but in scientific usage we call a substance such as steel highly elastic because it requires a very large stress or force to create a relatively small strain, or stretches very little under a pull. The strain is always measured by the ratio of the change in volume or length to the original volume or length.

The two types of elasticity with which we are concerned in wave propagation, are the volume elasticity and the simple rigidity or shape elasticity.

Before discussing the way in which these qualities affect the speed of wave propagation it may be well to consider in detail the process of producing a space wave or wave *in* an elastic medium such as air.

Suppose a very sudden expansion of the air is made at one place by a little explosion or by an electric spark, the effect is to compress suddenly the air in a small spherical shell lying around that point. Owing to the inertia and compressibility of the air this compression does not make itself felt at once at any great distance. When the explosion is over, this shell of compressed air immediately around the place of explosion expands again, and in so doing compresses the air in a spherical shell just outside the first layer. This again, in turn, releases itself and so the compression is handed on from layer to layer. If we picture to ourselves the region round the original centre of explosion as divided into concentric shells like the coats of an onion, we can say that each shell in turn becomes compressed and then expanded again, passing from within outwards. This gradual transference of the compression from layer to layer constitutes a wave of compression, and in air at the temperature of melting point of ice (0° Centigrade), it travels at the rate of 1,090 ft. per second or nearly 700 miles per hour.

It can be proved by mathematical reasoning, though the proof is not given here since it is somewhat difficult to follow, that the speed at which a wave travels in an elastic medium is numerically equal to the square root of the quotient of the elasticity by the density using the appropriate units.

In a gas such as air the decrease in volume produced by an increase in pressure is such that if the pressure is applied slowly the product of volume and pressure remains constant.

Let V be the original volume and let v be a small reduction in volume produced by an increase in pressure from P to $P+p$. Then by the above rule (Boyle's Law) we have—

$$(V - v)\ (P + p) = VP \text{ or}$$

$$P = \frac{V - v}{v}\ p = \frac{p}{v/V}$$

provided v is small compared with V. But $\frac{p}{v/V}$ is the ratio of increase in pressure to decrease in volume expressed as a fraction of original volume. This is therefore the compressional elasticity. Accordingly this last is numerically equal to the pressure of the gas at standard temperature 0° Centigrade. But the law of Boyle only holds good for changes of pressure so slowly applied that no change of temperature takes place.

In the case of the compression produced in air waves, the pressure is suddenly applied and it can be shown that the elasticity with which we are then concerned is measured, not by the pressure P but by 1·41 times P.

To render the above explanations clearer we may consider a numerical example.

The pressure of the air at normal barometric height, viz., 760 mm. = 30 inches and 0° Centigrade is about 2116·4 pounds per square foot. But the so-called weight of 1 lb. is 32·2 absolute units of force in British foot, pound, second units; because a mass of 1 lb. acquires under gravity a velocity of 32·2 feet per second per second, whereas the unit force imparts a velocity of only 1 foot per second. Hence the pressure per square foot in absolute units of force is $2116{\cdot}4 \times 32{\cdot}2 = 68{,}148$. If we multiply this number by 1·41 we obtain the product 96088·68, which is the numerical value of the elasticity of air at 0° Centigrade and 760 mm. for suddenly applied pressure. The density of air at the same pressure and temperature is such that one cubic foot of air weighs 0·0807 pounds. Hence if we divide the number 96088·68 by 0·0807 and take the square root of the quotient, we arrive at a number close to 1,090, which is therefore the velocity of a compressional wave in air at the above standard pressure and temperature in feet per second. In the case of water the ratio of elasticity to density is nearly 17 or 18 times that for air and the velocity of a compressional wave in water is therefore rather more than four times its velocity in air.

Although we cannot see these compressional waves in air they can nevertheless be photographed by an ingenious process which may be explained as follows :—

If we look at a shallow pool of water on a bright sunny day when there is a slight wind producing ripples on the surface of the pool, we shall see a series of bright lines on the bottom of the pool, which move with the wavelets. The curved surface of the wave makes the water act like a lens and concentrates the sun's light on certain lines, corresponding to these waves.

A wave in air is a region of condensation followed generally by one of rarefaction and the compressed air acts to some extent like a lens on rays of light. Suppose, then, that we create a very sudden sound by means of the snap of an electric spark. This starts a sound wave which consists of a single region of compression followed by a region of expansion. This air wave can be allowed to flit across a sensitive photographic plate in a dark room. It moves at the rate of 13,200 inches or so per second and therefore occupies about 1/2,000th part of a second in moving a distance of 6 inches.

Suppose a second electric spark is made at a distance from the plate, but so that its light falls on the plate. If the interval of time between the sound-creating spark and the light-creating spark is properly adjusted, the latter will impress on the photographic plate an image of the sound wave as it flits across the plate.

Some very successful experiments in photographing sound waves in this manner were carried out as far back as 1899 by Prof. R. W. Wood, and described by him in the *Philosophical Magazine* for August, 1899. He followed a method first used by Toepler, but with many improvements.

The light-giving spark was formed by the discharge of a small Leyden jar between two pieces of magnesium ribbon, clamped between two glass plates. An optical image of this spark was formed by a large lens, and the image nearly covered by a horizontal metal plate. Behind this was placed another lens which formed a faint image of the first lens on a photographic plate, which was thus uniformly illuminated. If, then, a sound wave produced by another electric spark, which takes place about one ten-thousandth part of a second before the light-giving spark is allowed to flit across the first lens, an image of the compressional wave in the form of a bright line appears upon the photographic plate when developed. We then see the compressional wave made by this spark as a circular ring-shaped image on the plate. If we allow the sound wave to impinge upon a reflecting surface we can see the reflected wave (see Fig. 20). We can in this way objectively inspect what takes place when compressional air waves are reflected or refracted in various ways.

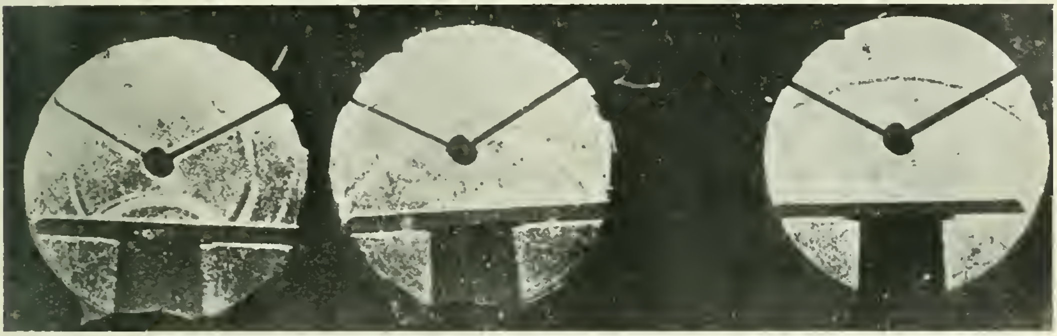


Fig. 20. Photographs of sound waves produced by an electric spark between balls. The central black dots are the balls and the inclined lines the wires leading to the two balls. The sound wave is shown reflected from a table and the three views (left to right) show the various stages of the direct and reflected waves.

Professor Wood was thus able to photograph air waves in the act of being reflected by plane surfaces or refracted by being transmitted through boxes, prisms or lenses of thin collodion, filled with gases such as hydrogen or carbon dioxide, in which compressional waves travel more quickly or more slowly than in air.

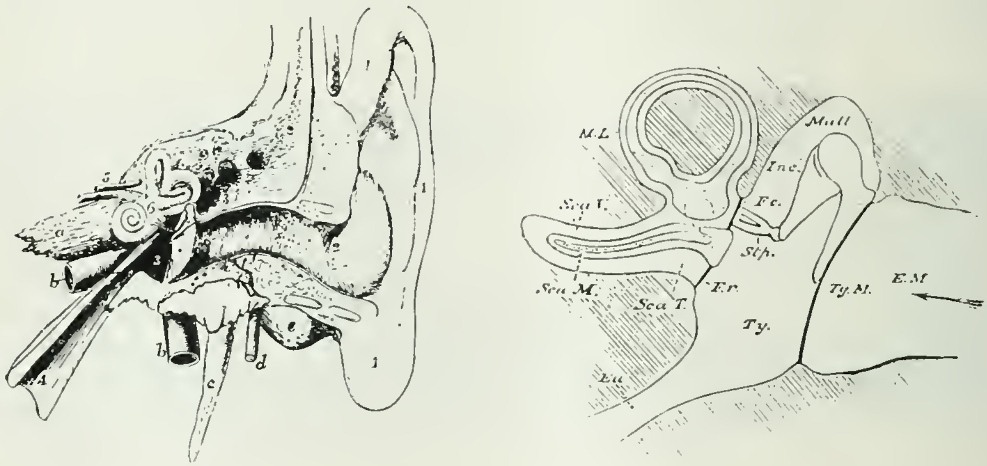
Although we cannot see these air waves with our eyes, we are provided with a pair of organs, our ears, which are extraordinarily sensitive to compressional waves in air, either solitary or in trains, provided their wave-length lies within certain limits, viz., about 30 ft. and 2 or 3 ins.

These waves excite in our ears the sensation of sound. In the human being the external organ we commonly call the ear, is merely a wave collecting shell or sound catcher, and in animals such as horses, dogs, cats, etc., it assumes the form of a curved flap or ear trumpet capable of being turned in various directions.

The true ear or actual organ of hearing is set deeply in the skull, and in mankind may be likened to a sort of house with two rooms and an entrance hall. The entrance hall is the tube opening into the external air. This is closed at the bottom by a delicate membrane like the wing of a fly, which is called the drum or tympanum. The first room of the ear, called the middle ear, is a cavity which is bounded on one side by the first tympanum and has on the other side two other inner tympana or drums. This cavity communicates with the back of the mouth by a canal called the Eustachian tube, which admits air to the middle ear (Fig. 21). The inner and outer tympana are connected by a little chain of bones called the ossicles. When a compressional wave from the outer air enters the external tube and strikes the ear-drum, it presses it in, and if the waves continue to arrive the tympanum will be set in sympathetic vibration.

These motions of the outer drum are communicated across the middle ear by the chain of bones, and act on the inner tympanum. Behind this middle chamber and deeply buried in the bony framework of the skull lies the real organ of hearing, in and by which the mere mechanical motions of the tympana are translated into sensations of sound. This inner ear contains an organ called Corti's organ in which are spread out a vast number of nerve fibres which are extensions of the auditory nerve. It is in this inner chamber, the secrets of which physiologists have not yet been fully able to explore, that the transmutation takes place of physical motions into physiological perceptions, or sensations. The ear has a marvellous power of appreciating the frequency of the air waves which enter gether. These regions of compression and rarefaction are propagated or travel through the air, but the actual motion to and fro of the air molecules themselves at any one place which gives rise to these compressions or rarefactions is very small.

The late Lord Rayleigh (third Baron) made experiments in 1877 in the open air on a calm day with a whistle giving out a sound or air wave having a frequency of 2,730. He found that such a whistle could be heard by a normal ear at a distance of 820 metres. The whistle



(*a*) *Fig.* 21. (*b*)

Fig. 21. A sectional diagram of the human ear. 1. The external lobe. 2. The entrance channel. 3. The Tympanum and middle ear. 4. The Eustachian tube. The chain of bones or ossicles connecting the tympana of the outer and inner ear cavities are shown in diagram b.

the outer ear, and also their amplitude, and in addition it detects that which is called their *wave form* or the degree of an admixture of waves of different frequency and amplitude. The difficult questions of physiology and psychology involved in the explanation of the functions of the ear in hearing do not concern us here, but it is important to understand clearly the differences between the motions in the air itself which give rise respectively to sensations corresponding to musical sounds, to mere noises, and to articulate speech.

In an air wave there is a place or places at which the air is slightly compressed, due to the air molecules being a little crowded together, and other adjacent places where it is rarified or the molecules less crowded to-

was blown with a steady blast of air and from the power required to blow it he was able to estimate that the amplitude of motion of the air particles in the sound wave at the above distance from the whistle was only 0·8 of one millionth of a millimetre. This is less than one twenty-five millionths of an inch. Yet the human ear is able to appreciate the extremely slight changes in air pressure due to the motion.

Lord Rayleigh also experimented in 1894 on the amplitude of the least audible sound waves given out by a tuning fork vibrating 256 times a second, and found it to be about 1·27 millionths of a millimetre.

It will be evident from these figures that the expenditure of energy necessary just to excite a sensation of sound in the ear is extremely small. Measurements made of the energy necessary just able to excite a sensation of light when entering the eye, show that the human eye and ear are about equally sensitive to radiant energy.

In order that an air wave may be produced it is therefore necessary for some solid body or else some puff of air to strike the stationary air very suddenly.

When, for instance, we strike a gong with a drumstick, the disc of metal is pressed in at the centre by the blow, and this produces a sudden local compression of the air on the opposite side which starts an air wave. The actual extent of motion of the wave-producing device may be invisibly small. Thus, for example, if we strike the prongs of a tuning fork and so set them in vibration, the motion is not visible to the eye. If, however, we hold near to the prongs a little pith ball suspended by a silk thread the rapid bouncing to and fro of the ball reveals the minute vibratory motion of the prongs. In the same way, although we cannot see the motions of the disc of the sound-box of a gramophone when it is playing, we can feel that it is in motion by holding the finger very gently just in contact with the disc. Even in the case of loud sound the amplitude of the motion in the gramophone diaphragm scarcely exceeds a few thousandths of an inch.

1. Sound Waves.

The next question which must be answered is as to the nature of the motion of the air particles which takes place in sound waves. We have seen that it is an extremely minute motion to and fro in the direction in which the air wave is travelling.

If we suspend a weight from the end of a very long string, say 2 or 3 yards long, fixed at the upper end, and set the weight swinging, we have an arrangement called a simple pendulum. The motion of the bob backwards and forwards exactly resembles that of the end of a tuning fork emitting a pure musical sound, and it is called a simple harmonic motion. Let the bob of the pendulum be formed of a cannister having a small hole in the bottom and let the cannister be filled with fine sand. As the pendulum vibrates the sand will run out of the hole in a fine stream. Let it fall on a long sheet of card (see Fig. 22). If the card is not moved the sand will be merely distributed in a long straight ridge. If, however, we move the card steadily and uniformly in a direction at right angles to that of the line of vibration of the bob the sand will be distributed in the form of a smooth wavy curve, called a simple harmonic curve (see Fig. 23).

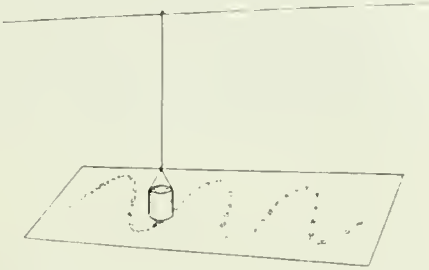


Fig. 22. A pendulum having a bob delivering a stream of sand which marks a simple harmonic curve on a transversely moving strip of paper.

We can imitate this curve in the following way. Procure a cardboard tube having a circular cross section and cut off the end

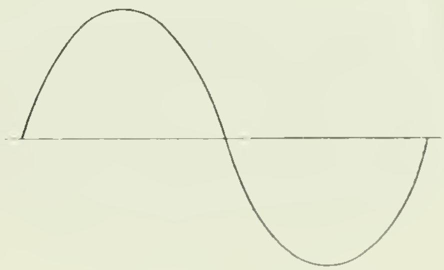


Fig. 23. A simple harmonic or sine curve.

obliquely with a sharp knife so that the slanting end will touch everywhere a flat surface applied to it. Then fold a sheet of paper several times round the tube, and with

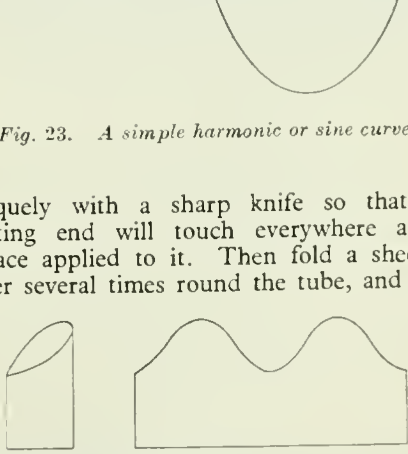


Fig. 24. Method of forming a simple harmonic curve by a sheet of paper cut to fit round a cylinder with oblique end.

scissors cut the edge of the paper to match the sloping end of the tube. Then unfold the paper and its edge will be found cut into the form of a simple harmonic curve (see Fig. 24).

Obtain if possible four tubes respectively of diameters, 3 ins., $1\frac{1}{2}$ ins., 1 in., $\frac{3}{4}$ in. and prepare in the above manner from them four sheets of paper with their edges each cut in wavy curves of the above kind, but the distances from crest to crest of the humps will be in the ratio of 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$. By placing these templates, as they are called, on a sheet of paper and passing a pencil round the curved edges, we can draw on the paper four simple harmonic curves which are said to have wavelengths in the ratio of $1 : \frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ (see Fig. 25).

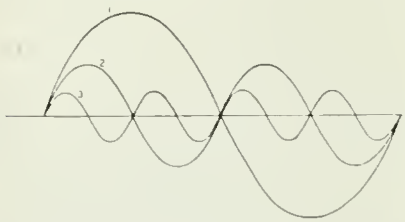


Fig. 25. Simple harmonic curves with wavelengths in ratio of $1 : \frac{1}{2} : \frac{1}{3}$.

If we describe in this way, say, two superimposed simple harmonic curves with wavelengths in the ratio of 1 to $\frac{1}{2}$, we can then add together the heights of these two curves above the mean line and obtain a third periodic curve which is said to be the sum of the other two. This third curve will be more irregular but will repeat itself (see Fig. 26).

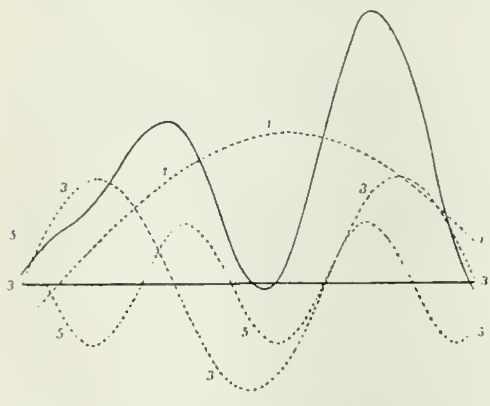


Fig. 26. A diagram illustrating Fourier's Theorem. The black firm line is a periodic curve and the dotted lines its harmonic constituents with wavelengths in ratios $1 : \frac{1}{3} : \frac{1}{5}$.

In this way we can add together or sum a number of simple harmonic curves whose wavelengths are in the ratio $1 : \frac{1}{2} : \frac{1}{3}$, etc. and obtain very complex periodic curves which, however, repeat themsleves in shape. Such curves are called complex periodic curves.

It is quite an easy thing to add together in this manner any number of simple harmonic curves of different wavelengths and amplitudes, and in any relative difference of phase; that means to say, shifted relatively to one another, but with the mean or centre lines of all the curves coincident, and thus obtain a complex curve.

2.—Fourier's Theorem.

Strange to say, it is possible to perform the reverse operation, and if we are given a complex periodic curve which repeats itself regularly, we can find out what are the simple harmonic curves out of which it is built up. The fact that this can be done for certain periodic curves was discovered by a great French mathematician, Fourier, and it is in consequence called Fourier's theorem.

The importance of this fact in connection with sound and music is very great, because it shows us that simple musical sounds, such as those of a tuning fork or open organ pipe, when combined together, can produce air waves in which the to and fro motion of the air particles is very complicated and can only be represented by the varying height of a complex curve corresponding to various distances along its mean line taken as an axis of time. Also Fourier's theorem shows us that such sounds can be analysed into a number of pure musical sounds represented by simple harmonic curves.

Before proceeding further it will, however, be an advantage to explain the manner in which we can determine the nature of the motion of the air particles in air waves given out by various sound producing sources. This is accomplished by means of an instrument called a Phoneidoscope, which is a word meaning "sound forms rendered visible."

It will perhaps be new to some readers to learn that every sound has a certain shape of wave form.

We recognise that there is a great difference between a mere noise and a musical sound, and also that there is a remarkable difference between the quality of the sound given by various musical instruments, even when playing the same note. Also we know that in articulate speech there are great differences between the various vowel sounds, even when pronounced in the same tone and loudness.

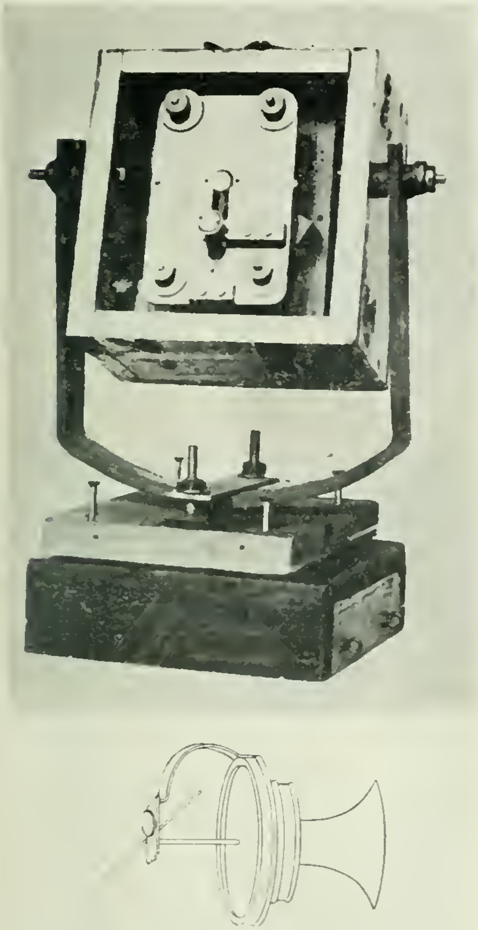


Fig. 27. The Phoneidescope. (The lower diagram shows the mouthpiece, diaphragm and tilting mirror.)

The phoneidoscope enables us to ascertain the external or physical differences which correspond to these various kinds of sounds considered as sensations. It is constructed in the following manner (see Fig. 27) :—

A metal ring has clamped to it a circular disc of very thin glass or transparent mica. This disc is best made about 2½ in. in diameter, and the ring may be fixed at the narrow end of a wooden trumpet, like a gramophone horn. When an aerial wave enters this horn it presses the disc or diaphragm as it is called, slightly outwards, and if aerial condensational waves continue to arrive, the disc is set in sympathetic vibration. To the centre of this disc is attached a small aluminium pin, cut with a chisel-shaped edge. This chisel presses on the underneath side of a small piece of celluloid, which is pivoted by a wire passed through its centre, and on the other side of the centre is a steel spring, which presses the celluloid up in the same direction as the pressure of the aluminium chisel. The little bit of celluloid has a small circular silvered glass mirror cemented to it. It will then be seen that if the mica disc moves to and fro or vibrates it will cause the little mirror to rock on its axis and the movements of this mirror will copy exactly the movements of the centre of the diaphragm. A ray of light is allowed to fall on this mirror and is reflected on to another steadily revolving mirror. The axis of revolution of this last mirror is so placed that if the diaphragm is at rest, the spot of light is carried horizontally across a screen, and in virtue of the persistence

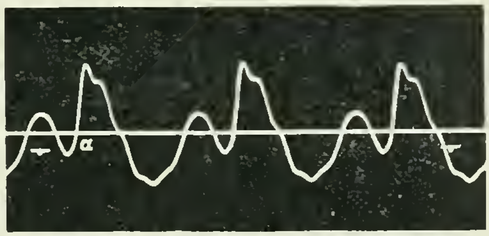


Fig. 28. Wave form of a musical sound as rendered visible by the Phoneidoscope.

of vision, appears as a narrow line of light. If, however, vibrations of the mica diaphragm take place, the spot of light is caused to move up or down and the line of light becomes a more or less regular wavy line of light (see Fig. 28). With this apparatus we can try the following experiments.

If we make near the horn any pure musical sound, we see the line of light thrown into a wavy line of simple harmonic wave form. If the sound is loud, the amplitude or height of these waves is large; but if the sound is feeble, the height is small.

Again, if we sound various notes from organ pipes or pitch-pipes, we find that if the sound is a low or bass note, the wavelength of the

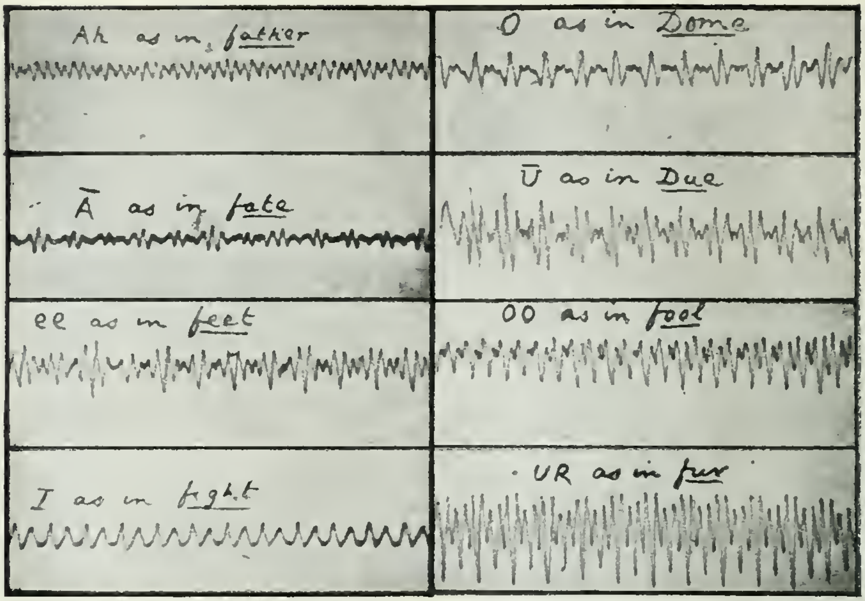


Fig. 29. The Wave forms or shapes of various vowel sounds as photographed by the Fleming Phoneidoscope.

light line waves is large, but if the sound note is high or shrill, then the wavelength is small.

If we sing to the mica diaphragm various vowel sounds, Ah, Ee, Ay, etc., we find that the shape or wave form of the light line is different in every case. If we speak to the diaphragm or recite, the line is thrown into an irregular shape (see Fig. 29).

We see, therefore, that since the amplitude or extent of motion of the mica disc is a measure of that of the air particles which beat against it, we may conclude :

(i) that the amplitude of motion of the air particles determines the loudness of the sound.

(ii) that the frequency of their vibration or what comes to the same thing, the aerial wavelength determines the pitch of the sound, and

(iii) that the wave form or sound shape of the aerial vibrations determines the quality of the sound.

A musical sound results from regularly repeated aerial vibrations, of a certain wave form. A mere noise results from irregular aerial vibrations, and articulate speech results from aerial vibrations of certain specialised forms.

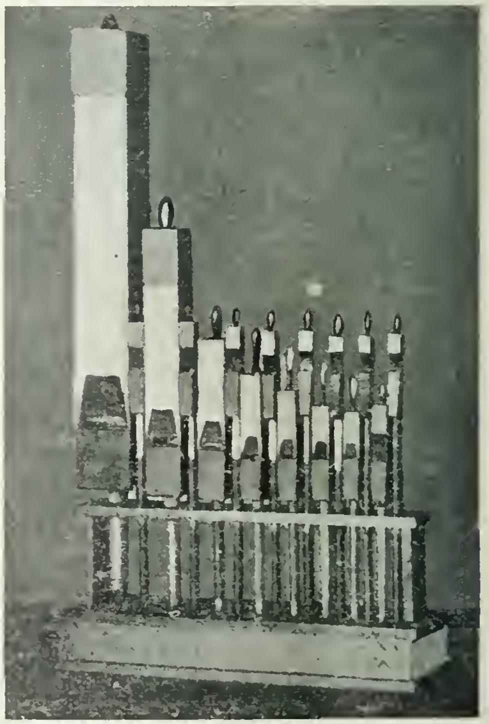


Fig. 30. A collection of organ pipes which when sounded together emit the vowel sound Ah.

Since the complex wave form of vowel sounds can be analysed into the sum of a number of simple or pure musical tones, it is possible to arrange a certain number of organ pipes to certain selected notes, such that when sounded together, they give out the vowel sounds *Ah* or *Oh* (see Figs. 29 and 30).

(*To be continued*).

More Transatlantic Tests for Amateurs.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

As most of the readers of this magazine are probably aware, American Radio amateurs, organised by the American Radio Relay League, conducted a series of signalling tests across the Atlantic in December last. The signals sent out by many of those American amateur stations were picked up in many parts of this country. Another series of similar tests is being arranged to take place towards the close of this year, when it is hoped that not only will it again prove possible to pick up signals from our American friends, but also that by means of two or three specially equipped stations in this country it may be possible to reply to them.

The tests on this occasion will embrace not only England and America but France, Belgium, Holland and probably Italy as well. No definite dates for these tests have yet been decided upon; they will probably take place on a number of days during December.

As far as arrangements have been made at present, it is proposed that during the first few days of the test American and Canadian amateurs will transmit signals for reception in England and other European countries. The best American transmitters as determined from these tests will be selected to broadcast the results of the reception of signals transmitted from this side of the Atlantic.

As on the last occasion, preliminary tests are being made in America to determine those transmitters which are best suited to take part in the final test, but on this occasion a rather stiffer condition is being imposed, viz., that in order to qualify for participation in the final tests the American transmitting stations must secure evidence of having transmitted messages for at least 1,200 miles over land.

These preliminary transmission tests have been arranged to commence on October 26th and to continue for ten days until November 4th inclusive.

Every British radio amateur who anticipates being able to listen in for American signals during the final tests is urged also to listen in during the periods of these preliminary tests, as it should prove possible to intercept some of the signals. The schedule of transmission times during these preliminary tests is set out in the table below, all times being given in G.M.T. The numbers in the columns represent the numbers of the American "Inspection Districts," these numbers being the initial numbers in the call signs of stations transmitting during these periods; C represents Canadian amateurs.

Time G.M.T.	Oct. 26	27	28	29	30	31	Nov. 1	2	3	4
0330–0345 ..	C	1	2	3	4	5	6	7	8	9
0345–0400 ..	1	2	3	4	5	6	7	8	9	C
0400–0415 ..	2	3	4	5	6	7	8	9	C	1
0415–0430 ..	3	4	5	6	7	8	9	C	1	2
0430–0445 ..	4	5	6	7	8	9	C	1	2	3
0445–0500 ..	5	6	7	8	9	C	1	2	3	4
0500–0515 ..	6	7	8	9	C	1	2	3	4	5
0515–0530 ..	7	8	9	C	1	2	3	4	5	6
0530–0545 ..	8	9	C	1	2	3	4	5	6	7
0545–0600 ..	9	C	1	2	3	4	5	6	7	8

In order to co-ordinate as far as possible the work of British amateurs during these tests the arrangements on this side have been placed in the hands of the Wireless Society of London by the American Radio Relay League, and a sub-committee of that Society has been formed to deal with the necessary arrangements. The members of this sub-committee are Major N. Hamilton, Captain N. Lea, and Messrs. C. F. Phillips, G. G. Blake, and P. .R Coursey.

Anyone intercepting signals which are apparently of American origin during the periods of these preliminary tests as tabulated above, is requested to communicate the report of his reception to the writer of this note, who is acting as secretary of the sub-committee on behalf of the Wireless Society of London. All such communications should be addressed to 138, Muswell Hill Road, London, N.10.

"JAMMED."

An Impression of the Exhibition.

By H. R. Taunton.

WE went on Wednesday afternoon. Our kindly thought was: "We'll help this Show along. Five of us—that'll boost up the receipts!" It was something of a shock, therefore, on turning the corner of Vincent Square, to run into the end of a queue. Apparently the Show was getting along pretty well without us. Having set out to patronise it, however, we were not easily to be thwarted; and in somewhat chastened mood we took our places in the procession.

We found a certain consolation in pointing out to the Cynic how utterly wrong he had been in his estimate of the popularity of the Show. "We told you so!" And by the time we had percolated as far as the entrance we had convinced ourselves we *had*. We were not the only ones the queue surprised. As we waited, a handsome Vauxhall dashed up and deposited a silk-hatted plutocrat, who, like ourselves, had evidently come with the idea of giving the Wireless Industry a "leg up." His face fell with a thud as his eye took in the waiting throng. Across his features chased disgust, dismay, doubt, and, at last, decision—like a sportsman he toddled down to his place in the distant perspective!

The gentleman who took the cash was, I think, partly answerable for the length of the queue. He was no lightning calculator. Perhaps he had mislaid his slide-rule; or fifteen pence was a larger sum than he was accustomed to handle.

I share with the criminal classes a dislike to coppers; so I gave him three, and a florin. That absolutely floored him. When presently I suggested a shilling change, bewilderment changed to suspicion. Sternly he pushed back the odd threepence, and, now on familiar ground, gave me change for the two-shilling piece—in coppers!

Once through the barrier, with the stored-up energy of the crowd behind us, we shot like a stream of electrons across the building, and "positively charged" into stand 12a. Here we were badly "jammed"; and had ample leisure to observe that the adjoining stands were 12 and 14, and to admire the persistence of our ancestral superstitions in the scientific soul of the radio specialist.

For five minutes we gazed enthralled on the backs of a six-deep crowd, who gazed enthralled on the backs of a small mob of favoured individuals inside the red rope, who gazed enthralled on a "Plus IV" receiver labelled as sold to a famous prima donna. But wild excitement is ever followed by reaction, and with the passing of time we began to get bored.

Luckily, the band struck up a lively tune, and we found pleasurable distraction in successfully persuading the Innocent that he was listening-in to 2 LO. But when he saw the blue coats of the operators in the balcony he swung to the opposite pole of incredulity; so that, when at three o'clock the real concert began, we could not convince him that the gentleman who "featured" Pagliacci was not concealed in the depths of the loud speaker.

Eventually, by kicking the ankles of those nearest us, we managed to break away from 12a, and, under the guidance of the Expert, who is nothing if he is not methodical, headed for stand number 1. The idea was to pass on to number 2, and so, thoroughly and systematically, round to number 55. We should then all be experts, even as he. But we had omitted to consult the million odd other enthusiasts, who had foolish ideas of their own on the subject, and persisted outrageously in blocking up our gangways.

The Queue outside the Horticultural Hall awaiting entrance to the Exhibition.

We started well. We sent the Expert on ahead—he is broad in the beam—and followed in single file in the vacuum caused by his transit through the serried mass. Thanks to this manœuvre we hurtled along, at something less than 186,200 miles a second, as far as stand 12. At this point, unfortunately, we were caught in an alternating current of humanity, and thereafter drifted helplessly whither it took us.

We lost the Cynic very early—lost him in the Enthusiast. He was last seen at the Radio Company's stand, bargaining for an antique lacquered cabinet with a seventeen-valve receiver—" but I must have those nice big valves I've just seen on the M.O. stand ! "

The Expert was the next to go, as we swung into the straight by McMichael's stand. Here the capacity of the gangway was severely strained. I " grid-leaked " by tripping lightly o'er the solid carpet of feet. But the Expert weighs sixteen stone ; and when he attempted to follow he vanished in a haze of " atmospherics." We never saw him again ; probably he was " tuned out."

The Innocent, of course, was soon lost in a maze of technicalities. We left him there, stuttering feebly in Morse. Knowing his habits, we thought to find him later in the bun-and-milk department. But we couldn't find *that.* And after an hour in the scrum, it was " O, for a draught of vintage ! " and never mind the Innocent ! But apparently the only thirst catered for at the Show was that for Knowledge.

I was left with the Buyer. I clung to him tenaciously. He was most useful. On business bent, he was collecting catalogues. I saw to it that he collected those I wanted—and carried them. And papers. And books. (My carrying capacity is very small—I suppose about 0·0001 microfarads.) I managed, too, to hang my umbrella on him ; but he jibbed at my suit-case—asked if I thought he was a (highly coloured) "carrier wave ! "

An enterprising man, our Buyer. The bright notion struck him to ask for samples. Get enough samples for the Firm, and he would be able to build a four-valve receiver for himself. He succeeded up to a point. He got a square inch of ebonite, and a couple of pounds of enamelled wire (in foot lengths) ; but the scheme broke down when he tried to persuade them to let him have a " Magnavox."

I tried to do a little buying myself. I wanted a small condenser. I fought savagely for a place at my chosen stand ; but in vain.

Stand 40 before the crowd came.

In the end I was reduced to scribbling my order on a five-pound note, and tossing it over the heads of the crowd to one of the attendants. I think—I hope—it reached him ; but up to date neither the condenser nor the change have reached me. I listen-in eagerly for the postman, but I can't tune him in. Don't seem to get his wavelength somehow.

Unfortunately, my intended note of the stand number was interrupted by an earnest young man in a clerical collar. His face was pale, his brow was moist, his tortoiseshell spectacles glistened with ill-suppressed emotion. It was evident he had the wireless craze badly. He clutched my arm, and asked me—me, an entire stranger !—if I would mind giving him a rudimentary exposition of the electron theory. I smote him heavily on the occiput, and withdrew.

We—the Buyer and I—next drifted to the Marconi stand. There we were exasperated to the point of madness by a scorbutic youth playing with the V2 broadcasting model, pushing the rheostat in and out to make the valve glow. It was nearly ten minutes before I could shove him away and experiment with it myself. Then the Buyer wanted a turn; but as that would have involved his transferring the catalogues, books, and umbrella to me, I led him gently but firmly away to the Metrovick stand to look at the model broadcasting station—which he could do with his hands full.

I left him for a moment to buy a certain book. The salesman was a flatterer. "I'm afraid you'll find it very elementary, sir," he said. I was, I confess, gratified. A discriminating young man! "Oh, I'm only buying it for one of our Directors," I murmured off-handedly. He smiled, as one who understands; and turned to another purchaser of the same book, a sallow youth, barely in his teens. "I'm afraid you'll find it very elementary, sir," he said. Bah! The base huckster!

I went back to add the book to the Buyer's load. I found him, good-natured soul, in converse with the inevitable Dear Old Lady.

"But what," I heard, as I hung discreetly in the offing, "what are those little glass bottles for?"

"Those, ma'am, are valves. They're full of vacuum—"

"Vacuum?" queried she. "Did you say vacuum? Dear me! Now, I always thought that was a large empty place where the Pope lived!"

"No, no. Vacuum is—er—the stuff, you know, they use for cleaning carpets. They fill those glass tubes with it, and oscillate them till they howl; and then they tune the noise, and you hear it at the other end."

(The Buyer prides himself on his firm grasp of principles. A little weak on details, perhaps—he doesn't pretend to be a technical man—but on the general theory, the rock-bottom facts, he's sound, sir, sound. And though he says it, he *has* got the knack of lucid exposition!)

His hearer nodded brightly. "Wonderful!"

"Talking, singing, anything you like!" he went on. "Listen to that ma'am. (A piano rectial.) Every note distinct! Marvellous when you think of it! There they are at Marconi House, oscillating a valve; and here we are, a hundred miles away (sic) listening to a piano, without wires.

"You don't say so!" exclaimed the Dear Old Lady. "A piano without wires! I declare! What will they think of next!"

I crept quietly away, musing fondly on this last boon of Science. A wireless piano! How gladly would I give one to the young woman in the flat below, plodding *fortissimo* up Clementi's Gradus! . . . A pleasant daydream. . . .

It lasted till I found myself strap-hanging in the crowded Tube; and so was reminded of the Show, and my four lost friends. Them I hope, not too confidently, to see again (particularly the Buyer—he's got my umbrella). And I hope to see the Show again; but in some more spacious venue, with larger stands and twelve-foot gangways; somewhere where it will be possible to see and to buy in comparative comfort. The Show was obviously successful in everything that counts as success in a Show. But in the one particular of attendance it was too, too, successful!

THE PRINCE'S AUTOGRAPH.

Following the broadcasting by His Royal Highness The Prince of Wales of an address to the Boy Scouts of Great Britain on Saturday evening, October 7th, Mr. Arthur R. Burrows, Chief of the Demonstration Department of Marconi's Wireless Telegraph Company, who was responsible for the wireless arrangements in connection with this event, has been the honoured recipient of an autographed copy of the preamble in which he announced His Royal Highness.

HIS ROYAL HIGHNESS THE PRINCE OF WALES, CHIEF SCOUT FOR WALES, WILL NOW SPEAK TO BOY SCOUTS, WHEREVER THEY MAY BE:-

Edward P

THE CHIEF SCOUT FOR WALES.

The Postmaster-General on Broadcasting.

NO WAVELENGTH LIMIT FOR RECEIVERS.

At the Annual Meeting of the Bedford Divisional Liberal Association, Women's Group, held at the Liberal Club, Bedford, Mr. Kellaway, the Postmaster-General, made a speech in which he referred to the progress in broadcasting arrangements. Mr. Kellaway said that he was glad to be able to state that there was a reasonable prospect of broadcasting services commencing in the course of the next week or two. The delay had been disappointing in some respects; but if they succeeded in starting this new form of communication in this country on really sound lines, no one would regret the delay. He thought events would show that the Post Office and the Broadcasting Company had been well advised in not being in too much of a hurry.

He had made it a condition in his discussions with the Broadcasting Company that there must be nothing in the nature of monopoly in regard to the selling of receiving sets. Every firm in the country capable of producing cheap and efficient receiving sets must be allowed to become a member of the Broadcasting Company on reasonable terms.

Those who demanded that foreign instruments should be licensed for broadcasting were in effect demanding that British capital should provide the service whilst foreign manufacturers secured the benefit. He had never had any doubt that the decision he had taken was the right one in the circumstances, and he was glad to know that he was supported by the principal wireless societies and by the overwhelming majority of the people and Press of the country.

An agreement had been come to under which receiving sets would not be limited in respect of wavelength. The result of this would be that the owners of receiving sets would be able to receive not only the programmes sent out by the Broadcasting Company, but matter broadcasted from any other centre. This would add immensely to the value of the receiving sets.

Some anxiety had been expressed by the Press at to whether the Broadcasting Company would be allowed to broadcast news. He had recently told a deputation that before permission was given to the Broadcasting Company to broadcast news, he would arrange for a meeting between these interests and the Broadcasting Company in the hope that they would be able to come to a friendly arrangement. It was obvious that the Broadcasting Company could not be allowed to take the property of the Press and the Press agencies, and he would see that these interests were properly protected in any arrangement made by the Broadcasting Company.

He was very glad to find that these important agencies took a long-sighted view. They realised, as he did, that they could not put a Chinese wall around this new form of communication and say that it should not under any circumstances be allowed to broadcast news. Such an attitude as that would be comparable to the short-sighted attitude of the men who opposed the use of machinery. If they were to make the fullest use of broadcasting it must not unreasonably be circumscribed or shackled. He had every hope that a meeting between the Broadcasting Company and the Press interests would arrive at a settlement which was just to the Press and was in the interest of this new form of communication.

The British Broadcasting Company has issued the following conditions which are to be fulfilled by Broadcast Receivers in order to obtain Post Office approval:—

1. That all types of Broadcast Receivers may be constructed for the reception of signals of any wavelengths.
2. That the apparatus shall be so constructed that it is difficult to change the arrangement of the circuits embodied in the design by means of external connections.
3. The following units, each of which must consist of apparatus assembled, connected and mounted in a single container, shall be approved:—
   (*a*) Combined Tuner and Rectifier.
   (*b*) Combined Tuner, High Frequency Amplifier and Rectifier.
   (*c*) Audio Frequency Amplifier (of Valve or other type.)

   Any combination of two or three of the above separate units (*a*), (*b*) and (*c*) will be allowed.

4. No receiving apparatus for general broadcast purposes shall contain a valve or valves so connected as to be capable of causing the Aerial to oscillate.

5. Where reaction is used on to the first receiving circuit it must not be adjustable, but must be fixed and incapable of causing oscillation.

6. Where reaction is used between a second or subsequent valve on to the Anode Circuit of a valve connected to the aerial, and there is no specific coupling provided between the first receiving circuit and the first anode circuit the reaction may be adjustable.

7. Tests of sets will be made on two aerials, one 30 ft. long and the other 100 ft. long.

8. The sets will be tested for the production of oscillations in the aerial and for interference properties with a factor of safety, *i.e.*, increasing the High Tension battery by about 30 per cent., changing valves, etc., but not by altering any soldered connections

9. The Postmaster-General must be satisfied that sets containing reaction can be reasonably repeated with consistent conditions.

10. After approval the type will be given a Post Office registered number and makers must see that the sets fulfil the non-interfering conditions before they are sold. All sets sold under the Broadcast licence shall bear the registered trade mark of the Broadcasting Company and the Post Office registered number.

11. The unit or set approved as the pattern instrument of a type shall be retained without alteration by the maker. The Postmaster-General shall have the right at any time to select any set of an approved type for test to see that the set is reasonably similar to the approved pattern. In the case of sets of an approved type employing reaction being found to oscillate the aerial the Post Office may cancel the authorisation of the future sale of that type. No change in the design of any set or unit may be made after approval without the previous sanction of the Postmaster-General.

BROADCASTING.

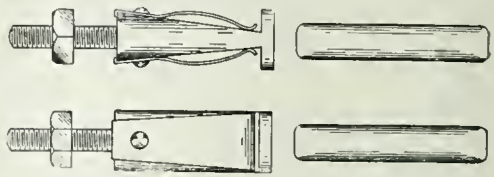
Marconi House,
Strand, W.C.2.
October 13th, 1922.

A General Meeting of Manufacturers interested in the manufacturing of broadcasting apparatus will be held at the Institution of Electrical Engineers, Victoria Embankment, London, on October 18th at 3 o'clock in the afternoon, to receive a report from the Broadcasting Company Committee on the present position.

Geo. Pells,
Secretary (pro tem).

NOVEL PLUG-IN CONNECTOR.

An interesting type of connector making smooth and reliable contact has been designed by Mr. E. E. Bramall.



It consists of a brass tube having opposite sides cut away and fitted with hard brass spring contacts. The end to which leads are joined may take the form of a lug, tag or screwed stem.

Experimenters will find this type of connector particularly useful for effecting changes in the circuit arrangements of receiving apparatus, such as interchanging inductances, altering number of valves in action, and making telephone connections at various points in the circuit and tapping out H.T. battery potential. For small transmitters, where the usual type of switch cannot be safely used for varying the inductance valve, owing to the nearness of the contact studs, plug connectors are particularly useful, and this type does not hamper rapid adjustment owing to the small amount of friction and grip upon the plug. To the experimenter who endeavours to make as much of his own apparatus as possible, it is immediately apparent that here is a useful fitment of easy construction. Not a great deal of work is required to make a number of sockets from valve legs. The centre hole is drilled out to about $\frac{3}{16}$ in. and the opposite sides filed away to expose the hole. A hole to take No. 18 brass wire or a small rivit is made to hold the brass spring pieces.

The Wireless Society of London.

REPORT OF DISCUSSION HELD AT THE ORDINARY GENERAL MEETING, SEPTEMBER 27th, 1922—*conclusion*

After Mr. C. F. Phillips had spoken on the subject of the Broadcasting Company the discussion was continued.

The President.

I do not know whether anybody else wishes to speak on this subject. We still have some other points to deal with. I think the remarks that have been made have been very clear, and will be of great value when they are published.

Mr. Hesketh.

May I ask whether any alterations have been made in the wavelength originally allotted to licensees by the Post Office. You will remember that when this question was first raised official publication was given, through our organ, *The Wireless World and Radio Review*, to the effect that the Post Office had given sympathetic consideration to a petition made through this Society. Is it to be understood from this that the wavelengths originally referred to on the licence forms have been changed, or that the changes will take place in the future.

Mr. E. H. Shaughnessy.

That is all correct. The changes have come into force, and this was the answer to your petition.

Mr. Hesketh.

Then the 1,000 metre wave has been withdrawn.

Mr. E. H. Shaughnessy.

We have not cancelled any licences, but I think the point raised is the phraseology of the Post Office reply to the petition.

Capt. Loring.

I understand the speaker was referring to the reply of the Post Office. The Post Office has approved the change, but unfortunately it had not been officially circulated.

Mr. E. H. Shaughnessy.

The point at issue is that people had licences to transmit on 1,000 metres. The Society requested that that wavelength should be changed to 440 metres. The Post Office agreed to the wavelength being changed to 440 metres, and consequently the use of the 1,000 metre wavelength is now illegal.

Mr. Hesketh.

I take it I must blame the Post Office for not having sent a notification to licensees to this effect.

The President.

I think there has been a slight misunderstanding. The position is that any amateur transmitting licence holder can use a 440 metres wavelength, but they may no longer use 1,000 metres.

Mr. H. S. Walker.

There are one or two points in Mr. Shaughnessy's speech and Mr. Phillips's speech to which I would like to refer. I am very glad to know that reaction is prohibited on the broadcast wavelength, but I should like to ask also what steps, if any, are being taken to stop interference from certain stations. I have the misfortune to live within 14 miles of one of the large stations, and when that station is working it is impossible to receive on any wavelength from 400 to 700, because of the terrible noise created by the arc. It is just possible that when broadcasting is in progress it will not be possible to receive this either. It occurs to me that perhaps Mr. Shaughnessy can say a few words about that particular station. I believe it is Northolt, and I think most of the amateurs in the vicinity of London are troubled with it. I use special rejecting circuits, but on 440 metres Northolt is impossible to get rid of. I have tried all sorts of means with my station, and there is nothing to remedy it.

The other point is with regard to Mr. Phillips's speech, and his reference to amateur stations transmitting on 440 metres. Mr. Phillips said when broadcasting is in progress the amateur would not be able to receive anything on the 440 wavelength. With that remark I quite agree, and I should like to ask what steps are being taken to protect amateur transmitting stations on 440, because I understand that broadcasting is to take place from 3 in the afternoon until 10 at night, and most amateurs work during that period. Is the amateur to be stopped altogether from working on that particular wavelength during the period that broadcasting is in operation, for it seems quite probable that that is what it may mean. There is another point which may assist the answer to that question, and that is the transmission on shorter wavelengths still. May I ask why it is that the broadcast stations have been given a band of wavelengths from 360 to 425 metres, and yet the amateur station is tied down to 440 metres? Now, if we are to take the strict letter of the law of our licences and stick to 440 metres exactly, then only one transmitting station within a vicinity of 10 miles round London would be working at one time.

Now I understand that there are only going to be eight broadcasting stations in the vicinity of Great Britain. That being so, why should they require a band of wavelengths from the limits mentioned by Mr. Shaughnessy, because I do not think it will be possible for two of these stations to be working together. If three or more work together in the same locality I tremble to think of the consequences. Just these few points could, I hope, be answered this evening.

Mr. E. H. Shaughnessy.

I do not think I can give any hope. With regard to the Northolt Station, I can assure the speaker that we are working on this problem, and we have very considerably reduced the ordinary noise you get from this powerful station. We have an arrangement there which completely removes all the trouble we were getting with certain other stations. With regard to the wavelength band 350 to 425 metres, I do not anticipate the slightest difficulties in getting the broadcasting working at the same time ast he serious experimenter. The wavelength band was chosen on a scientific basis, and provides a proper difference between the wavelengths in order that the difficulty of interference shall be overcome. The reason that that wavelength was used was because all the other waves are occupied. The ether is absolutely choked full, and we had to limit the broadcast people to this band because there were no more available. I think it is a very excellent opportunity for the experimenter, and it will enable him to produce highly selective apparatus.

The President.

I think we must pass on to the Transatlantic tests; I think Major Hamilton and Mr. Coursey might say something.

Major Hamilton.

Our Committee has met on three occasions, and we decided that we would like to use the amateur wavelength of 440 metres for these tests. We are going to ask the Post Office for the necessary permission, and I would like to take this opportunity of asking Captain Loring for his assistance in obtaining this. Through the kindness of several members of the Society who have offered the loan of various pieces of apparatus, I hope soon to be able to call upon you to listen out for our first efforts, in order that we can obtain some idea of the signal strength, constancy of wavelength and freedom from ripple. I saw Mr. E. H. Armstrong yesterday, and he has very kindly consented to listen out specially, both for our tests and for the actual trial. I do not know whether anybody here may have got any ideas on the subject. If so, I think they might be very useful to us.

Mr. P. R. Coursey.

I do not think the time is opportune to say much about the Transatlantic Tests, except that the matter is in the hands of the sub-Committee of the Society, who intend to carry out and to organise tests in both directions across the Atlantic. I might perhaps also mention that the American Radio Relay League have been already in communication with other Societies in other countries with regard to effecting communication with these countries during the forthcoming tests, and it is hoped that we may be able to arrange a programme to include transmissions between America and the various European countries.

Mr. H. H. T. Burbury.

The only remark I would like to make is that if an oscillating aerial is prohibited altogether on the broadcasting wave, which is perfectly reasonable, it seems to me quite obvious that nobody having a transmitting licence for 440 metres can use it during broadcasting hours at all; therefore there is no question of being able to listen between two amateurs, one sending on 440 metres, because you are not allowed to transmit on it.

May I ask Mr. Coursey one question: Can he give us any idea of the time that these tests will take place.

Mr. P. R. Coursey.

Probably in the course of a few weeks, when the arrangements are further advanced, we may be able to give some more definite information and details of the programmes.

Mr. L. F. Fogarty (*Hon. Treasurer*).

Mr. President, Ladies and Gentlemen:—The proposal to change the title of this Society has met so much support that I do not think it necessary to urge the matter still further. I should, however, like to give you one or two more details so as to place you in a position to give this matter careful consideration, against the time when it will be put before you as an official resolution.

I should like to say that the idea is not a new one, and that the Committee has had the matter under consideration for several months. The necessity of altering the title and constitution of the present Wireless Society of London suggested itself to me as the outcome of experience derived from an extensive correspondence with members and with affiliated societies, and because I have noticed that some of our affiliated bodies are inclined to initiate important matters, and to follow them up by dealing with the authorities individually rather than by adopting the more satisfactory method of collective co-operation through this Society, which apart from being the oldest, is, I think, the best equipped to handle all such negotiations.

With a view to obtaining as much information as possible, I took advantage of the Signor Umberto Bianchi's presence amongst us last summer to enquire into the working of the Radio Club of Italy. Signor Bianchi, as President of the Radio Club of Italy, was in possesion of first hand knowledge of extremely valuable nature, as the constitution of their Society had to be modified almost immediately after the original formation of their Club.

I also took an opportunity of discussing the working of a similar association with the President and Committee of the Société Française d'Etude de Télégraphie et Téléphonie sans fils, on the occasion of a visit to Paris in the early part of this year. The above-mentioned Society covers the whole of France and the French Colonies, and is the central body representing a very large number of smaller societies, situated throughout the French territory. I should also like to take this opportunity of placing on record my appreciation of the honour accorded to me by the above-mentioned Society, in electing me a member, for which purpose they modified their constitution so as to admit a British subject into a society which hitherto had only been open to French nationals.

I should propose, therefore, that the new title should be "The Radio Association of Great Britain," or, alternatively, "The Amateur Radio Association of Great Britain," and that all affiliated societies be free to adopt the same title, adding thereafter some distinctive sub-title, such as Liverpool, Glasgow, or Birmingham branch.

The adoption of some such scheme will, of course, necessitate a modification in the constitution of this Society, and probably also in that of affiliated bodies, who would necessarily have to adopt a standard set of rules governing their relationship to us. For instance, it will be necessary to clearly define that each branch would be entirely responsible for its own finance, and that its annual subscription to the parent body would be on the basis of numbers, larger societies contributing more in proportion to the smaller. I also suggest that the existing rule 32, defining the officers of the Society, should be modified, and should read approximately as follows :—

"The officers of the Association shall be a President, two acting Vice-Presidents, two Vice-Chairmen, the President and Secretary of all affiliated branches, and the Secretary and Treasurer of the parent association."

In place of rule 33, governing the management of the Society, I suggest the following :—

"The management of the Association shall be vested in a Committee consisting of the President and the officers mentioned in new rule 32, together with the first Past President of the former Wireless Society of London, A. A. Campbell Swinton, Esq., F.R.S., and any other Past President, to the number of three, at the invitation of the governing body, and in addition ten elected members of the Association."

I think it is desirable that consideration should be given to these details, so that a satisfactory scheme may be brought forward in the near future.

The President.

I would point out that Mr. Fogarty's remarks have not been discussed by the Committee. They are what he puts forward, and not put forward by us, because we have not gone into them. Does any other gentleman care to make any other remarks on the subjects we have been dealing with to-night before closing the meeting ?

Mr. Evans.

When Capt. Loring a few moments ago referred to the word "broadcaster," I was hoping that he would also mention another point, and that is that the term "broadcast" or "broadcasting" seems to be used as referring to the reception. To cast is to throw out, but we hear of broadcasting apparatus when I believe the speakers refer, not to the sending, but to the receiving apparatus. Cannot something be done to prevent the term "broadcaster" being used in the sense of the receiver.

Mr. C. F. Phillips.

I would like to say that it was once reported in the daily press that our station had been broadcasting the Dutch concerts, but what it turned out to be was that we had merely made it audible to an audience by means of the loud speaker, and there was no question of transmission at all.

Mr. Ward.

As a representative of the Wireless Society of Greenwich, I should like to suggest that Mr. Shaughnessy's speech dealing with the issue of licences should be distributed immediately to all the provincial societies, as I am sure they are very eager to receive any information that will be of use to them.

The President.

It will be published in our official organ very shortly.

Mr. F. Hope-Jones.

I do not think we can manage to get it distributed before it goes into *The Wireless World and Radio Review*, and I think we can hardly get our Secretary to write it out. I should think it would be out in about a fortnight.

The President.

We have certainly had an interesting discussion, and in spite of not having a technical lecture we have managed to fill up the evening, and have introduced a good many subjects. I must say I have a little sympathy with amateurs on 440 metres. I think they will have to change their hours and get up earlier in the morning. I do not see any other way out. Of course there is the 200 metre wavelength ; it is a good thing to go down to that.

Mr. E. H. Shaughnessy.

Mr. Chairman, I would just like to draw your attention to the lower band of wavelengths which is allowed to amateur transmitters—150 to 200. There is a whole band there, and a very large band. It is very efficient if you take the trouble to design your apparatus suitably.

Notes

Demonstration at Canonbury.

Harecourt Literary and Musical Society are holding a wireless demonstration on October 31st, at 8 p.m., at Harecourt Hall, St. Paul's Road, Canonbury, N.1 ,assisted by the Marconi Company.

Coming Glasgow Exhibition.

Preparations are being made in Glasgow for a public exhibition and demonstration to be held on November 4th. Under the auspices of the Glasgow and District Radio Club, the function is expected to be very popular. An opportunity will be afforded for every amateur in the Glasgow and surrounding districts to see displayed at the M'Llellan Galleries Hall, Sauchiehall Street, not only the apparatus made by other amateurs, but instruments and accessories by trade makers. A large trade show of all the latest apparatus is expected, beside which the Committee hope to have a collection of ancient and modern apparatus on view.

Two aerials will be erected for the day, and arrangements have been made for a special transmission of telephony from Eiffel Tower.

Mr. W. Yuill, the Hon. Secretary of the Glasgow and District Radio Club, is dealing with enquiries. His address is 93, Holm Street, Glasgow.

Measurement by Wireless.

Professor Richard Whiddington, M.A., D.Sc., lectured at the first meeting of the session of the Royal Philosophical Society of Glasgow on October 4th. His subject was "Measurement by Wireless." The lecturer referred to the development of wireless telegraphy and telephony during the war, and especially the thermionic valve, used in conjunction with the ordinary wireless circuits. The lecturer gave an account of a new apparatus devised by him two or three years ago, intended to measure minute length changes. Until the apparatus was devised the most sensitive arrangement was the so-called interferometer, which was, however, limited in its sensitiveness by the fact that light itself had a stricture—being, as everyone knew, a form of wave motion. Such an apparatus in fact, was only capable of indicating changes in length of the same order as the wavelength of light.

The new apparatus, he said, was not limited in this manner, and had been made to indicate changes many hundreds of times less. It was not very difficult, in fact, to measure changes in length so small as one two-hundred millionth of an inch, a distance of about the same magnitude as the diameter of a hydrogen atom. Experiments were shown with a rough form of the apparatus, only capable of indicating one ten-millionth part of an inch or so.

Wireless Telephony for Blinded Soldiers.

Among the many thousands of people who listened-in to the Prince of Wales's broadcast speech to the Boy Scouts of the nation we e the blind soldiers of St. Dunstan's.

Capt. Ian Fraser, the blind Chairman of St. Dunstan's, has been an ardent wireless experimenter for two years past and in the course of a short address following the transmission he stated that wireless telephony was opening a new world for the blind. A blind man's hobbies were limited, but wireless was one of those which he could pursue just as well as anyone else. In listening-in he was at no disadvantage to those who could see.

Blind Soldiers at St. Dunstan's being entertained by Capt. Ian Fraser to a concert on his wireless set.

Broadcasting March.

We are pleased to hear, througn the organisers of the All-British Wireless Exhibition, Messrs. Bertram Day & Co., Ltd., that the march entitled "Broadcaster," composed specially for the Exhibition by Mr. Percival H. Osborne, and which was played daily with so much success by his Blue Electra Orchestra, has been dedicated to Senatore Marconi.

The British Wireless Company.

In our October 7th issue an illustration was inadvertently omitted by the printers from the British Wireless Company's advertisement headed "The Broadcaster." Would readers kindly refer to the October 14th issue, in which the same illustration appears.

Farthest North Station.

Mr. R. F. Inkster, of King Harold Street, Lerwick, Shetland, informs us that the photograph shown on this page represents the farthest north wireless receiving set in the British Isles, and it has just been erected in a crofter's house in Delting, in the very centre of the Shetland Islands. The thatched roofs of the dwelling-house and buildings, and the open door of the garage on the right, give a striking combination of the ancient and modern.

In the town of Lerwick there are three amateur wireless receiving sets, and news broadcasted from Germany has been distinctly heard (with five and six valves).

Captain Donisthorpe on Romance.

At the opening of the winter session of the Redhill Literary Institute, Captain de A. Donisthorpe gave a lecture on "The Romance of Wireless."

Farthest North Station.

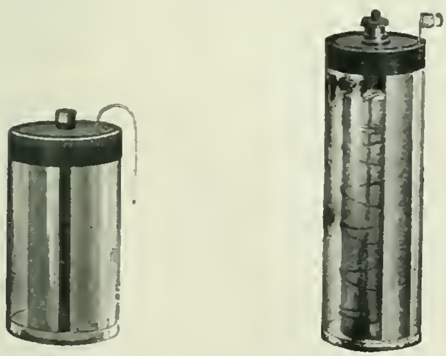
Scouts Hear the Prince.

Scouts and their friends visited the works of Messrs. J. Burns, Ltd., Chadwell Heath, to hear the Prince of Wales' broadcasted message. From the photograph will be seen with what interest the boys listened-in.

Exhibited at the Horticultural Hall.

Although the All-British Wireless Exhibition was so fully represented in these pages, there was one item which failed to find space. Messrs. Siemens' Brothers & Co., Ltd., exhibited vacuum protectors, which possess a number of advantages over the carbon block type. The opposing conductors being enclosed in a partial vacuum causes them to break down reliably at about 300 volts. An insulation resistance of about 3,000 meghoms is maintained right up to the point of breakdown. A damaged arrester can be immediately replaced. Being contained in an hermetically sealed vacuum chamber the protector, besides being highly sensitive is also dust, damp, and insect-proof.

Fuses were shown for protecting the filament accumulators and batteries in the event of a short circuit.



HT 1. *HT 3.*
Siemens' Sealed Type Leclanche cells.

Jacks, enabling a number of head sets to be used simultaneously, were also included, and these, when used with multi-valve sets, the number of valves in circuit at any one time can be varied, the connections being established automatically.

A standard switch for panel mounting was exhibited, and this is useful for many switching operations in wireless reception work.

A large number of ebonite accessories were shown, including dials, formers, valve holders, knobs, coil holder plugs, ebonite panels with tin-foil surfaces, earcaps, etc., etc., all of the Company's usual high quality material.

A full range of sizes of high voltage dry batteries and " inert " batteries were to be seen on Siemens' stand ; also 30-volt and 60-volt batteries of Fluid Leclanche Cells, small sack type, contained in suitable boxes with plug sockets to obtain tappings at various voltages.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir, Being a keen reader of this excellent magazine for over a year, I have read numerous letters published in the correspondence columns concerning reception of amateur transmissions on a limited number of valves. I should like to state that the following amateurs have been heard on a single valve reaction circuit, the set being of my own construction, using a two-wire aerial 50 ft. long and 25 ft. high, badly screened by houses. They are **2 LZ** (telephony), **2 IF** (telephony), **2 AN** (telephony), **2 OM** (telephony), **2 ON** (telephony), **2 FQ** (telephony), **2 DX** (Morse, **5 CV** (Morse), **2 DF**, **2 SZ**, **2 KT**, **2 TO**, and lastly a station whose call I have not yet discovered, **2 PW**. The last mentioned called **2 JX** at 1300 G.M.T. on October 8th. **2 MT**, **2 LO**, **FL** are received well, and **PCGG** is generally quite good. All the above telephony is received off the oscillation joint. On high wave **WSO** and **WQK** are readable.

F. Strafford.

3, Lee Road,
Dovercourt,
Essex.

At Chadwell Heath.

The instrument used at Messrs. J. Burns' works on the occasion of the Prince of Wales's broadcasted speech, was one of their standard three-valve sets seen above.

Calendar of Current Events

Friday, October 20th.

At 8.—8.30 p.m., on 350 metres. Concert.

Powisland Radio and Scientific Society.
First meeting and lecture by Viscount Chine on "The Elementary Principles of Wireless."

Wakefield and District Wireless Society.
At 8 p.m. At the Y.M.C.A. Lecture on "A Four-Valve Receiver," by Mr. Swale.

Halifax Wireless Club.
At 6.30 p.m. At Clare Hall, Prescott Street, Halifax, and also the following day from 2.30 p.m. Exhibition of Wireless Apparatus by all the leading makers. Demonstrations and sale of members' surplus apparatus.

Bradford Wireless Society.
At 5, Rendallwell Street, Bradford, Lecture on "Telephony" by Mr. J. Bever.

Belvedere and District Radio and Scientific Society.
Lecture on "Various Types of Receiving Circuits," by Mr. A. H. Norman.

Leeds and District Amateur Wireless Society.
At 8 p.m. Lecture on "nductances for all Wavelengths," by Mr. D. E. Pettigrew.

Radio Society of Highgate.
At 7.45. p.m. At the 1919 Club, South Grove, Highgate, N. 6. Lecture on "The Armstrong Super-regenerative Circuit," by Mr. H. Andrews, B.Sc.

Saturday, October 21st.

At 7.30.—8 p.m., on 350 metres. Concert.

Monday, October 23rd.

Ilkley and District Wireless Society.
At 7.30 p.m. At Regent Café. Lecture on "Electro-Magnetic Induction." by Mr. L. E. Overington.

Tuesday, October 24th.

Transmission of Telephony at 8 p.m. on 400 metres by 2 MT Writtle.

Lowestoft and District Wireless Society.
Lecture on "Land Line Telephony," by Mr. R. C. Giles.

Wednesday, October 25th.

Redhill & District Y.M.C.A. Wireless Society.
At 111, Station Road, Redhill. Lecture on "Inductances," by Mr. Pescett.

Thursday, October 26th.

Derby Wireless Club.
At 7.30 p.m. At the Court, Alvaston. Lecture on "Amplification," by Mr. E. V. R. Martin.

Luton Wireless Society.
At 8 p.m. At Hitchin Road, Boys' School. Practical Work and Experiments.

Friday, October 27th.

Wakefield and District Wireless Society.
Lecture on "The Relation of Inductance and Capacity to Electro Magnet Waves in Receiving and Transmitting Circuits," by Mr. Watson.

Belvedere and District Radio and Scientific Society.
Lecture on "The Detector Unit," by Mr. S. Burman.

Leeds and District Amateur Wireless Society.
At 8 p.m. Demonstration of "Britwire" Apparatus, by Mr. H. F. Yardley, A.M.I.R.E.

Radio Society of Highgate.
At 7.45 p.m. At the 1919 Club, South Grove, Highgate, N. 6. Lecture by Mr. Grimstead.

Saturday, October 28th.

Working Men's Wireless Club.
At Crowndale Road, N.W.1. Exhibition and demonstration at 1 p.m., also exhibition of X-Ray apparatus.

Monday, October 30th.

Finchley and District Wireless Society.
Social Evening.

Ipswich and District Wireless Society.
At 8 p.m., at 55, Fonnereau Road, Lecture on "Accumulators—Their Care and Use." by Mr. F. Boddey.

Tuesday, October 31st.

Transmissions of Telephony by 2MT, Writtle, as above.

Wednesday, November 1st.

Edinburgh and District Radio Society.
At 8 p.m. Business Meeting.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School, Lecture on "H.F. Coupling and Transformers," by Mr. C. S. Dunham.

Thursday, November 2nd.

Derby Wireless Society.
At 7.30 p.m. At The Court, Alvaston. Informal Meeting.

Friday, November 3rd.

Radio Society of Highgate.
At 7.45 p.m., at the 1919 Club, South Grove, Highgate, N.6. Lecture on "Construction of H.F. Amplifiers," by Mr. G. W. Sutton, B.Sc.

Bradford Wireless Society.
At 5, Rendallwell Street, Bradford. Debate on "The Prevention of Self-Oscillation."

Saturday, November 4th.

Glasgow and District Radio Club.
From 12 to 9 o'clock. At the McLellan Galleries Hall, Sauchiehall Street. Exhibition and Demonstration.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

West London Wireless and Experimental Association.

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

A meeting was held on September 22nd, for the first time, at the new headquarters, Stamford Brook Lodge, Ravenscourt Park, W.6. A very large number of members attended. Mr. F. E. Studt interpreted Clause 7, "Aerials," of the new conditions respecting the issue of licences by the Postmaster-General. Mr. Studt was accorded a hearty vote of thanks.

On September 29th Mr. Studt gave a very interesting paper on "A Three-Circuit Variometer Tuner." He explained its many interesting uses, and the various methods of obtaining results in connection with amateur experiments. He gave the detailed data for constructing members' own circuits. Mr. Studt was heartily thanked. A letter from the Wireless Society of London in regard to the Prince of Wales's Address to Boy Scouts was read. The Secretary appealed to all members with receiving apparatus to assist the Wireless Society of London in their programme for this special event.

Several more new members enrolled at both meetings.

Particulars will be sent by the Secretary by return of post to inquirers.

Wakefield and District Wireless Society.*

Hon. Secretary, Mr. Ed. Swale, 11, Thornes Road, Wakefield.

A meeting of the above was held in the Y.M.C.A., Grove Road, on September 29th, Mr. Wrigley in the chair.

The meeting was thrown open for questions on individual troubles. The questions were answered by specialist members.

The Wireless Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., 49, Cholmeley Park, Highgate, N.6.

On Friday, September 22nd, at the Highgate Literary and Scientific Institute, Mr. J. F. Stanley gave a demonstration of the Marconiphone V2. He gave a very clear and interesting description of the unusual circuit adopted in this set, which makes use of simultaneous high and low frequency amplification, and finally connected it up to the Society's aerial. Some excellent telephony, both from Marconi House and amateur stations, was picked up, and the simplicity of the tuning adjustments was demonstrated.

After one or two questions had been put to Mr. Stanley, and answered, Mr. F. L. Hogg gave an interesting and simple way of rapidly converting an ordinary two-valve circuit into an Armstrong super-regenerative circuit.

The second Annual General Meeting of the Society was held on September 29th, at the new headquarters, the 1919 Club, South Grove, Highgate, Mr. P. R. Coursey, B.Sc., the President, in the chair. The following officers were elected for the forthcoming session :—Chairman, Mr. H. Andrews, B.Sc. ; Vice-Chairman, Mr. L. Grinstead ; Secretary, Mr. J. F. Stanley, B.Sc. ; Assist. Secretary, Mr. L. R. Rowlands ; Treasurer, Mr. D. H. Eade ; Librarian, Mr. P. H. Youngman ; Committee : Messrs. S. Croneen, F. B. Ford and T. Russel.

The annual report and statement of accounts were adopted unanimously.

Mr. Coursey then gave his Presidential address. He dealt with the question of Broadcasting and its effect on the experimenter, and he explained the latest decisions of the Post Office with regard to the use of reaction. After dealing briefly with the forthcoming Transatlantic Tests, and the proposed change of name of the Wireless Society of London, Mr. Coursey replied to several questions put to him by members.

A motion was carried to the effect that the Society shall in future be called the Radio Society of Highgate, the word "Radio" now being recognised as more suitable than "Wireless." Mr. Stanley, the new Secretary, outlined briefly the future policy of the Society, mentioning in particular that the Society proposes to give a Radio Dance on Friday, November 17th, 1922. Further details will be announced shortly.

Ilkley and District Wireless Society.*

Hon. Secretary, Mr. E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

On October 2nd the fifth General Meeting was held at the headquarters, the "Regent Café," Ilkley, the President, Dr. J. B. Whitfield, occupying the chair.

The Secretary read the report of the Committee appointed to design and draw up the estimates for the Society's receiving set, which was adopted. The Committee will now assemble a single valve receiver and tuner built on the unit system, so as to facilitate future extensions and rearrangement of circuits for demonstration purposes.

The rules of the Society were then officially formulated, and it was resolved that a technical library be instituted, with Mr. C. D. Marshall as Hon. Librarian.

Mr. E. Stanley Dobson then gave his lecture on "Capacity and Condensers."

The theory of electrically charged bodies was first explained, with its application to the action of the condenser. The units and measurement of capacity were dealt with, and the calculation of the capacity of condensers connected in series and parallel.

The various types of condensers were next described in detail, samples of each being exhibited. The function and suitable values of all the condensers in a simple single valve receiver were given, and the lecture concluded with a few hints on the use of vernier devices for tuning in short wave telephony.

A vote of thanks was accorded to the lecturer, and before the meeting closed the announcement was made that the Society's affiliation with the Wireless Society of London had become an accomplished fact.

Edinburgh and District Wireless Society.*

Hon. Secretary, Mr. W. Winkler, 9, Ettrick Road, Edinburgh.

On October 4th, the Winter Session was opened with a lecture by Major A. W. Jayne, Controller of Telegraphs, General Post Office, Edinburgh, on "Line Telegraphy."

Sir J. Alfred Ewing, K.C.B., the Hon. President of the Society, was in the chair. He remarked on the interest which he had in the work carried out, and the pleasure which it gave him to occupy the position of President.

Major Jayne gave a general résumé of the original systems employed in telegraphy, and then described in detail the working of the more efficient machines in use nowadays. Multiflex working was fully explained in a very clear manner, and the organisation of Post Office telegraph working in all its multifarious organisations gave his audience an idea of the work which the Post Office has to cope with in busy "rush hours."

Interesting slides were used showing the work of the "signals" men in France in 1914-18.

Three elementary lectures on "Wireless" were announced to take place on 11th, 18th and 25th October, in the headquarters, 117, George Street.

A motion was approved :—"That a Research Committee should be formed to undertake work on a definite line on the second and fourth Monday of each month. That this Committee should be chosen by the Council. That the work should be in connection with the Armstrong super-regenerative circuit. That application be made to the Keith Fund for financial assistance in this work, and that short descriptions of the work done should be given at subsequent meetings of the Society."

The Hon. Secretary then made due apology for the errata appearing on the syllabus, as time did not permit the printer to issue proofs.

Bristol and District Wireless Association.*

Hon. Secretary, Mr. L. F. White, 10, Priory Road, Knowle, Bristol.

A meeting of the Association was held in the Physics Lecture Theatre of the University of Bristol at 7 p.m. on September 29th. Owing to the unavoidable absence of the Chairman, Mr. A. E. Mitchell, the Rev. H. W. Jukes was elected to fill the vacancy for the evening.

Discussion took place between the members regarding the proposed Association receiving set, and it was eventually agreed that to adopt the unit system would prove most satisfactory for experimental purposes, and that no difficulty should be experienced in making the receiver portable should occasion arise.

It was decided that no practical work in this direction could be undertaken until the Association is in possession of a workshop.

Mr. L. W. J. Silcocks was thanked for his kind offer to allow members to use his workshop in constructing the receiver until one was acquired by the Association.

The remainder of the evening was taken up by the exhibition of a 5-valve receiver brought by Messrs. Silcocks and Hebbs, which, in conjunction with a Magnavox loud speaker, produced very powerful signals on a good range of wavelengths.

New members elected brings the total up to 72.

The Secretary will be glad to give full particulars of the Association upon application.

Glasgow and District Radio Club.*

Hon. Secretary, Mr. W. Yuill, 93, Holm Street, Glasgow.

A meeting of the above Club was held in the Club Room. There was a very large attendance. The Hon. President, M. W. K. Dewar, presided after the usual preliminaries. The Chairman called on the convenor of the Club Apparatus Committee to explain the building of the club set, which his Committee had been working on during the close season. It was originally intended to build the set on the unit principle, but, through certain difficulties, this was not found possible, and a three-valve set, viz., one valve time anode method of H.F. amplification, one detector and one L.F., the usual tuning condensers being included in a separate panel, but permanently fastened to valve panel, and having a three-coil holder for taking standard makes of honeycomb or other type coil to tune over all wavelengths.

As there was a large number of new and prospective members present, the Chairman asked Mr. McLellan to give a short lecture on the general principle of wireless. This he accomplished in a very satisfactory manner, his simple explanation of technical terms being much appreciated. A hearty vote of thanks was asked, and enthusiastically given both gentlemen.

A short discussion followed on several points regarding the working and welfare of the Club.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, A.M.I.E.E., 18, Melford Road, S.E.22.

This Association, at the Central Hall, Peckham, on October 4th held the deferred "Gadget" Competition, and many members brought examples of their ingenuity. The result of the judging was: Mr. Voigt, first prize for clip to fasten into headgear telephone leads to prevent accidents by dragging delicate valve gear from the table to the floor. It provided a "weak link" in the chain, which parted easily should the cord be pulled by accident. Honourable mention was accorded to Mr. S.J. Prior, who exhibited a well-made and workable potentiometer, made up from odd scraps of material.

The meeting opened with buzzer practice under Mr. Sam. Middleton. New members are making considerable progress.

Cowes and District Radio Society.*

Hon. Secretary, Mr. L. Ingram, 1, Mill Hill Road, Cowes.

The first annual meeting of the Society was held at the headquarters, East Cowes, on September 27th, 1922. There was a good attendance, and a representative gathering included one Vice-President, namely, Mr. H. S. Benzie.

The proceedings were opened by the Chairman Mr. A. Taylor, who summarised the objects of the Society and briefly outlined the programme arranged for the coming session.

The annual report was read and adopted.

The financial position of the Society was discussed, and the balance sheet accepted.

The election ballot resulted as follows: Chairman, Mr. E. P. Bartlett; Vice-Chairman, Mr. J. V. Ellis; Hon. Secretary, Mr. L. Ingram; Committee, Mr. E. Hartridge, Mr. C. Mugliston, and Mr. W. Sherratt.

Mr. W. T. Davies, M.B.E., paid a tribute to the excellent work performed throughout the year by the retiring Chairman, Mr. A. Taylor, and proposed that he be elected Honorary Vice-President. Mr. Mugliston seconded, and the proposition was carried unanimously.

The rules of the Society, having been redrafted, were passed after minor alterations had been made.

It was decided that Mr. S. E. Saunders, O.B.E., should be asked to continue as President of the Society, also that Lt.-Col. A. T. C. Vesey, Mr. H. S. Benzie, Mr. H. S. Saunders, and Mr. G. Newman, should be asked to continue as Vice-Presidents. It was also decided to invite Capt. W. Matthews, the Hon. A. G. Guinness, Capt. Frogbrook, Canon Judkins, and Mr. J. Phillips to become Vice-Presidents.

The number of new members who attended the meeting was encouraging, and, as the Chairman remarked in his opening speech, when calling upon the present members to bring along more new members, all who are interested in wireless are cordially invited.

After a short discussion upon matters of general interest a most successful meeting closed at 9.30 p.m.

Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, 49, Cholmeley Park, Highgate, N.6.

A debate was held on October 6th, on "That in the Opinion of this House High Frequency Amplification is more suitable than Low Frequency Amplification for Amateur Experimental Purposes." Messrs. Stanley and Eade proposed the motion, which was opposed by Messrs. Hogg and Rowlands. Although the attendance was small, the majority of those present took part in the debate. Some very astonishing results were claimed on both sides, and on the division of the House opinion seemed to be fairly evenly divided, the motion being carried by 8 votes to 7. Five members present did not vote.

On October 7th a very interesting demonstration was given at the Society's headquarters at the 1919 Club, South Grove, Highgate. The presence of large crowds who had collected along the route to see the Prince of Wales drive to and from the Scout's Rally at the Alexandra Palace, was taken advantage of for a thorough and novel publicity campaign, and a "House Full" resulted.

The chief items on the programme were the concert from **2 LO** and the message to Scouts by H.R.H. the Prince of Wales, which was clearly heard, thanks to the Magnavox loud speaker. Amateur tests were picked up at random, some excellent speech and music being obtained. The demonstration was thoroughly appreciated by a large audience which included several scouts, the latter being admitted free of charge.

Full particulars of the Society and of the forthcoming Radio Dance may be obtained from the Hon. Secretary.

Stoke - on - Trent Wireless and Experimental Society.*

Hon. Secretary: Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting at the Y.M.C.A., Hanley, on October 5th, Mr. Walley (member), exhibited his three-valve set, with the aid of which members clearly heard items of the Hague concert, as well as Morse signals from British and continental stations. Mr. Walley has entirely constructed this set himself during the last seven days.

Mr. A. H. Wilson was appointed delegate to represent the Society at the forthcoming conference of the Midland Wireless Societies at Birmingham, in order to arrange the interchange of lectures.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

The opening meeting of the session was held on October 6th, a number of new members being present. After the business of the meeting, Mr. Whiteley gave a historical survey of wireless, with special reference to the mercantile marine. Special reference was made to the excellent performances of the Radio Communication Company's commercial apparatus, and the whole lecture was illustrated by lantern slides specially prepared by the lecturer. At the conclusion, a hearty vote of thanks was passed.

Mr. Liardet then exhibited a Reinartz tuner with one stage of H.F. amplification, as recently described in *The Wireless World and Radio Review*. An ordinary Reinartz tuner was also shown, and both were much admired.

Meetings will continue to be held throughout the session at the Society's rooms at 5, Rendellwall Street, Bradford. A few of the dates are:—October 20th, Mr. J. Bever, subject, "Telephony"; November 3rd, Debate, "The Prevention of Self-Oscillation"; November 17th, Cinema display (details later); December 1st, Mr. A. Liardet (title later); December 15th Mr. S. Davies, Dewsbury (particulars later); December 29th, Annual general meeting.

South Woodford Radio Society.

Hon. Secretary, Mr. L. R. Gaywood, 190, Hermon Hill, South Woodford.

The first meeting of the 1922-23 season was held at Holy Trinity Parish Hall, South Woodford, on October 3rd, 17 members being present.

The following officers were elected: President, Dr. J. Craig Crawford; Vice-President, Mr. E. Janes; Secretary, Mr. L. R. Gaywood; Treasurer, Mr. Manders; and Committee, Messrs. Cormacy, Carr, and Cameron.

It was decided to meet weekly at Holy Trinity Hall at 8 p.m. on Tuesdays.

The entrance fee was fixed at 2s. 6d., and annual subscription 5s. Particulars can be obtained from the Secretary.

Finchley and District Wireless Society.

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, N.3.

The fifth meeting of the above Society was held at the club room, Wright-Kingsford House, Granville Road, N.12, on Monday, October 2nd. Mr. Macdonald Brown kindly brought up four crystal sets of various makes for inspection. Particular interest was centred on a German one. It was decided to postpone the grand social evening until October 30th. Mr. Trussler gave a description of rays and waves as applied to wireless, and explained the atom, molecule and electron. Two new members were elected. The Secretary invites inquiries.

Nottingham Y.M.C.A. Wireless Club for Boys.

Hon. Secretary, Mr. R. Weston, 3, Harcourt Road, Nottingham.

A wireless club for boys between the age of 14 and 18 has been formed in Nottingham at the Y.M.C.A. Boys' Club, King Edward Street, where a two-valve receiving set has been installed.

The following gentlemen were elected officials at the inaugural meeting: Mr. A. Househam, President; Mr. Perkins, Vice-President; Mr. H. A. Carpenter, Chairman of the Committee and Lecturer.

New members are being enrolled, and a successful winter season is anticipated. Mr. Carpenter is giving a series of lectures on "Wireless Telegraphy and Elementary Electricity," and demonstrations take place every Thursday night.

Portsmouth and District Amateur Wireless Society.

Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

A meeting of the above Society took place at the John Pile Memorial Rooms, Portsmouth, on October 4th. The buzzer class is making rapid progress. At 8 p.m. the fortnightly business meeting took place. Various matters were discussed. After the meeting Mr. Donkin gave his lecture on "My Portable Crystal Receiving Set," telling of his exploits when he first took an interest in wireless. Mr. Donkin explained that he made a cycling tour, taking his set with him, and his adventures with regard to aerials and other items were both instructive and amusing. A hearty vote of thanks was given Mr. Donkin. After the lecture a short address of great interest was given by Mr. Harrold on his impressions of the London Wireless Exhibition. The President and Council of the Society are anxious to extend the membership, and any amateurs in the locality who are interested are invited to write to the Secretary.

Huddersfield Radio Society.

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

At a meeting on October 4th there were about 100 persons present. Mr. T. Brooke was Chairman.

A lecture was given on "The Latest Developments in Wireless Telephony" by Mr. P. Denison, of Halifax.

Mr. Denison opened by explaining, in a popular manner, various transmitting circuits used in the past and at the present time, illustrating his remarks by numerous diagrams. A number of lantern slides were used. The lecturer described the functions of the various parts of the apparatus shown, and gave interesting details of the development of his own experimental station (**2 KD**) at Halifax.

At the conclusion of the lecture Mr. Denison answered questions and was accorded a vote of thanks.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. Arthur I. Dabbs, 315, High Road, Ponders End.

The second meeting of the above Society was held at headquarters, The Falcon Inn, South Street, Ponders End, on October 5th. There was a good attendance. The Chairman stated that it was hoped to receive the licence for the Society's set in the course of a few days.

A set of rules presented by the Committee was, after discussion, passed. A programme for future meetings was also arranged.

It was decided to purchase certain books to form the nucleus of the Society's library, and these will be on loan to all members. Various apparatus will also be purchased by the Society, which can be borrowed by the members for home use.

The subscription is 10s. 6d. per annum, and a good financial position is already attained. Three new members were enrolled. Applicants for membership will be welcomed at any of the Thursday meetings, and the Secretary will be pleased to give particulars to any intending member.

Hexham and District Amateur Wireless Association.

Hon. Secretary, Mr. H. D. Lees, 8, Elvaston Road, Hexham.

The inaugural meeting of this Association took place on October 2nd. Mr. G. S. Douthwaite gave a few explanatory remarks outlining the objects of a Wireless Association, it was then unanimously decided that an Association should be formed under the above name. The meeting proceeded to the election of officers and committee.

On the completion of business Mr. Douthwaite gave a demonstration on his four-valve set with a Magnavox, which was listened to with great interest, signals being audible in all parts of the hall.

Bishop's Stortford and District Amateur Wireless Association.

Hon. Secretary, Mr. J. Cooper, Halfacres, Bishop's Stortford.

The monthly meeting at the Institute on October 6th, was well attended. Mr. L. Wright, of the North Essex Wireless Society delivered a lecture on "Elementary Principles of Valve Reception," presenting his subject in a lucid and interesting manner. Illustrations and diagrams were given, and the various methods of rectification explained in detail. On the proposal of Councillor E. F. Cooper, Vice-President, seconded by Mr. W. S. Filby, a vote of thanks was heartily given. Mr. W. A. Field, the President, occupied the chair.

On October 4th, 5th and 6th, members of the Association gave public demonstrations at the Shakespearean Bazaar held at the Great Hall, Bishop's Stortford. Large numbers queued up for every occasion and listened with interest to the Marconi concerts, etc.

On Saturday, October 7th, an invitation was given to all Boy Scouts and Cubs to attend and hear the Prince of Wales's broadcasted message. A number of Scouts from various troops were present. Reception was very clear, and rendered audible by a "Magnavox," kindly loaned by Mr. C. Randall, of the "Close," Bishop's Stortford.

Communications should be addressed to the Hon. Secretary.

Malvern Wireless Society.

Hon. Secretary, Mr. N. H. Gwynn Jones, Burford House, Great Malvern.

At a meeting of this Society at the Public Library, Mr. Percy Scott Russell, presiding, remarked that they hoped to be affiliated to the London Society, and that Mr. Dyson Perrins had kindly consented to be President.

Officials provisionally elected were Mr. Percy Scott Russell, Chairman; Mr. A. Harrison, Hon. Treasurer; Mr. N. H. Gwynn Jones, Hon. Secretary; Committee, Messrs. Jeynes, L. Mansell, Musgrave, Nadaud, Symonds, Rothwell, H. J. B. Martin, and Green.

The Society has over forty members.

The membership fee is half-a-guinea a year. Meetings are held on Wednesdays.

Hoylake, West Kirby and District Wireless Association.

Hon. Secretary, Mr. Roper Brattan, 14, Kirby Park, West Kirby.

The first General Meeting of the Association was held at Boustead's Café, Market St., Hoylake, on Monday, September 4th, 1922. Mr. T. C. Welding was appointed Chairman. The following were elected officers for the ensuing session:—Hon. Secretary and Treasurer, Mr. Roper Brattan; Hon. Assist. Secretary, Mr. S. H. Cocks; Hon. Technical Adviser, Mr. S. Evans; Committee: Messrs. T. C. Welding, J. D. Wood, P. Boustead and C. E. Price.

The subscription was fixed at 7s. 6d. per session. Sixteen applications for membership were handed to the Secretary during the meeting. A Committee meeting was held at Boustead's Café on September 11th. Mr. T. C. Welding was elected Chairman of Committee for the session.

Many important matters were discussed, it being decided amongst other things to have a question box for the general use of members.

The second General Meeting was fixed for Monday, September 18th, with a Committee meeting beforehand to transact any business.

At the General Meeting on September 18th, which was held again at Boustead's Café, Mr. S. Evans gave an address on "Hints to Beginners." Mr. Evans treated in a very able manner the matter in hand, starting with the procedure in obtaining a receiving licence from the P.M.G., next going on to show the members how to make and fix an aerial, by giving drawings on a blackboard, finishing his address with hints on earth connections.

Many interesting questions were then asked and answered, after which a very hearty vote of thanks was given to Mr. Evans. The meeting was a great success.

The third General meeting was held on Monday, October 2nd, at the Green Lodge Hotel, Hoylake, with the usual Committee meeting beforehand. This General Meeting was held in a private room in the Hotel. Mr. Corlett, of the Green Lodge Hotel, has very kindly offered the use of this room, together with the use of his three-valve set, to the Association. Needless to say this generous offer has been cordially accepted.

The Hon. Secretary, Mr. R. Brattan, gave a lecture on tuning and detecting radio signals, followed by a demonstration on connecting up and operating a simple single valve receiving set.

After several questions on the subject had been answered, a vote of thanks was given to Mr. Brattan for his lecture.

The membership is now 22, and there is every indication of a very successful session.

Beckenham and District Radio Society.

Hon. Secretary, Mr. J. Butterfield, 10, The Close, Elmers End.

On September 28th a 0·001 microfarad condenser was made up, after which a successful reception took place.

The President, Mr. Graves, brought his new four-valve set, connected up, and in a few minutes was able to get results. The Hague and Marconi House concerts were heard. Amateur transmitters were afterwards tuned in, music being received from Brentford, Blackheath and Forest Hill. A loud speaker was used.

Arrangements were made for a two days' demonstration at the Sale of Work in aid of the Church funds at All Saints', Beckenham, on October 4th and 5th.

It was hoped to arrange for the Beckenham Cubs to listen in to the Prince of Wales's address to Boy Scouts on October 7th.

Tottenham Wireless Society.

Hon. Secretary, Mr.R. A. Barker, 22, Broadwater Road, Bruce Grove, N.17.

The inaugural meeting was held on September 21st at 10, Bruce Grove, and the evening was spent in a general discussion regarding the future of the Society.

The second meeting was held on September 28th at the same address, when Mr. Fred Bourne was elected Chairman, Mr. R. A. Barker, Secretary, and Mr. Baker, Treasurer. The first half-hour was spent in buzzer practice, after which the Chairman opened a discussion on "Wireless" in general. Business was discussed and several new members enrolled.

The Chairman is drawing up a syllabus of lectures, demonstrations, etc.

Meetings will be held every week on Thursdays, 8 p.m. sharp, at 10, Bruce Grove (temporary headquarters), and the Secretary will be pleased to welcome prospective members of either sex.

Wanstead Wireless Society.

Hon. Secretary, Mr. A. B. Firman, 18, Clavering Road, Wanstead Park, E.12.

The first weekly meeting of the Society was held on Friday, September 22nd, 1922, at St. Gabriel's Church Hall, Aldersbrook Road, E.12.

After an interesting listening-in on a two-valve set temporarily installed, the President gave a lecture on the "History of Wireless," and different types of apparatus, including the coherer, magnetic detector and valves, together with a brief explanation of the electron theory. The lecture was greatly appreciated.

Mr. Chapman, a member of the Committee, pointed out that great care should be exercised in the purchase of wireless sets, as there were so many second-rate firms selling unreliable apparatus.

It is hoped very shortly to have an up-to-date four-valve receiving set installed for experimental and demonstration purposes. It is also hoped to arrange an interesting series of lectures through the coming season by the President and other prominent men of the profession.

The Brighton Radio Society.

Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton.

A meeting of this Society was held at Mr. Volk's workshop, Russell Crescent, on Thursday, September 21st. Seven new members were elected, making the total 70. A motion was entertained from the Sussex Wireless Research Society to become amalgamated with the Brighton Radio Society. It was unanimously decided to adopt the recommendations of the Executive Committee, and a special Committee was formed to effect the fusion.

It was stated that certain gentlemen had promised to give lectures during the coming session.

Any gentlemen interested in Radio in Sussex are invited to communicate with the Hon. Secretary.

Amateurs in the district are invited to listen in on Friday evenings from 7 till 9 p.m. when **2 KA**, the Secretary's transmitting station, usually carries out tests.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

At a well attended meeting held at headquarters on Friday, October 6th, after the buzzer class, Messrs. Houstoun and Calver described and explained some interesting and unique circuits which were much appreciated.

The membership is still increasing, and arrangements are being made to provide interesting and instructive meetings.

Belvedere and District Radio and Scientific Society.

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The fifth General Meeting of the above Society was held on Friday, September 29th. Improvement was shown at the buzzer practice.

Mr. S. Burman continued his lecture on "The Construction of the Society's Apparatus," dealing with the principles underlying the low frequency magnifying panel.

The Secretary briefly outlined the method of producing an alternating current, and followed with the principle of heterodyne or beat reception.

Discussion followed, especially on the different types of circuits which were thought would meet with the Postmaster-General's approval.

The sixth General Meeting of the above Society was held at the Erith Technical Institute, on October 6th.

Satisfactory progress was made at the buzzer practice from 7.30 to 8 p.m.

Mr. S. Burman gave the third of a series of lectures on "The Construction of the Society's Apparatus," in which he dealt with the high frequency amplifying unit. He outlined the three methods of high frequency amplification coupling it was decided to adopt, viz: Resistance capacity reactance capacity, and interchangable transformers. He explained, in more or less simple language, the way in which the amplified oscillations of the high frequency valves were handed on to the detector valve in each of the three methods. This lecture concludes the theoretical part; the next being on the practical side is intended to show how the various parts were made, set out and assembled.

A discussion took place on general subjects, which brought out some interesting points about earths and earials. Opinions seemed to be divided as to the efficiency of insulated wire being used as aerials against enamelled wire. Two members declared that they had found an insulated wire aerial to be far more efficient than the orthodox plain wire. Another member suggested that a kind of hysteresis might be set up in the insulations surrounding the wire by the high frequency signal oscillations which would tend towards making such an aerial decidedly inefficient. This, however, seemed to be contrary to the experience of the two former speakers.

Bromley Radio and Experimental Society.

Hon. Secretary, Mr. J. Furgusson-Croome, Gowrie, Wendover Road, Bromley, Kent.

A meeting of the above Society was arranged to have taken place at 14, College Road, on October 2nd, but owing to the sudden growth of the Society the meeting was held at the White Hart Hotel.

The Chairman, Mr. L. Stopes, put before the twenty-nine gentlemen present the objects of the Society. He mentioned that several wireless lectures and demonstrations had been fixed, and visits to Croydon Aerodrome and other places of wireless interest would be arranged, also that application for affiliation to the Wireless Society of London had been made. The Chairman then called upon the Secretary to read the rules.

The Treasurer made a strong appeal for new members.

Another successful meeting was held at the White Hart Hotel on Monday, October 9th, when a wireless demonstration was given.

A temporary indoor aerial was erected and connected to a four-valve receiver equiped with a loud speaker; signals were received from many ship and Continental stations as well as music and speech from several amateur transmitting stations.

Excellent results were also obtained by utilising instead of the usual aerial the electric light circuit connected through a very simple device to another four-valve receiver.

As a result of the meeting several new members were enrolled, thus bringing the total membership to well over 40.

Applications for membership should be made to the Hon. Secretary.

Fulham and Chelsea Amateur Radio and Social Society.

Hon. Secretary, Mr. R. S. V. Wood, 48, Hamble Street, Fulham, S.W.6.

Mr. Patterson proposed five new members at a meeting of this Society, and was seconded by Mr. Scutt.

Mr. Scutt introduced a visitor, Mr. Gunning, who gave a lecture on "The Leclanche Cell, its Construction, Chemical Action, and Deterioration." The lecturer was heartily applauded for the able way in which he gave his lecture, and was accorded a vote of thanks. Attendance at the meeting was 55. There is now a total membership of 79. Nine new members have been enrolled, and three visitors attended.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requirement, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations, or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd and p. 867 September 30th, 1922.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate or to cut out their reaction entirely.

"H.W.L." (Hove).—(1) It is not possible to give precise windings of H.F. transformers for use on various wavelengths. The wavalengths given by particular windings depend so much on the tightness of winding, and the way in which the wire is wound on. For a range of 180 to 2,600 metres, you will probably need five transformers. You should wind on primary and secondary separately, placing a piece of insulating paper between the two windings. Put on the windings in opposite directions, and the two leads coming out between the windings are taken to grid and plate. 310 turns each is approximately suitable for 600 metres, but you will need to find the other values by experiment, which can easily be done with a two-valve circuit. Try using the tuned anode arrangement, for wavelengths from 180 to 1,500 metres, beyond which you may find it convenient to use resistance capacity inter-valve coupling. (2) Connect up one H.F. transformer followed by a detector valve, to your usual aerial tuning circuit. The wavemeter may be coupled to the aerial circuit and varied until the loudest signals are heard, adjusting your aerial tuning arrangement to suit the wavelength. If you are making several sets of H.F. transformers, test out those designed to give similar wavelengths in this circuit, in order that they may all be precisely similar. (3) The reaction coil, which must slide closely to the transformer, may consist of approximately 100 turns, and additional turns can be connected in series externally to the coil by means of a studded switch. (4) One detector and one L.F. should bring in **2 LO** quite loudly.

"A.C.D." (Leeds).—(1) See Fig. 1. (2) 0·001 mfds. for aerial circuit and 0·0005 mfds. for closed circuit. (3) Not necessary.

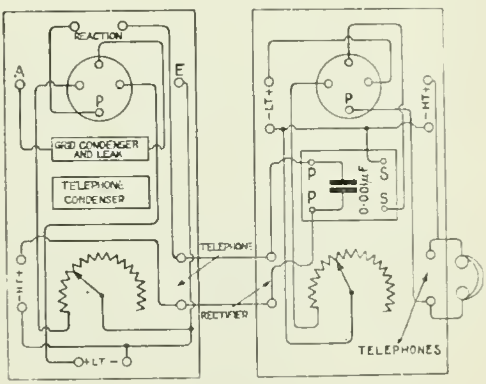


Fig. 1

"F.O.P." (Wolverhampton).—The Weston Relay which you have purchased is suitable for recording at slow speeds. We suggest you join the relay in series with the perikon detector, and work the arrangement from the last L.F. transformer of your L.F. amplifier. If you wish to experiment with relays, we suggest you read the articles on "Some Methods of Recording Wireless Signals," which appeared in the issues of October 29th and November 12th and 26th, 1921. Unfortunately, you do not give any particulars of items 3 and 5, therefore we are unable to advise you.

"F.C.B." (Northwich).—We have carefully examined your diagrams. They appear to be correct. We suggest you put a condenser of from 0·001 mfd. to 0·5 mfd. across the H.T. battery, using another condenser of 0·001 mfd. across the telephones. We consider it advisable for you to well space the L.F. transformers to prevent interaction. We assume you have made sure the grid leak and grid condenser are O.K., and the H.F. anode reactance is suitable for the wavelength range you wish to receive. If you construct the five-valve set, using 2 H.F., 1 detector and 2 L.F. and loud speaker, you will probably hear the signals all over your room.

(2) It is not possible to give precisely the number of turns required in an aerial inductance to tune to a given wavelength, as it depends so much on the precise capacity and inductance values of the aerial. (3) When using a two-wire aerial comprising 170 ft. of wire, 40 to 60 turns of mean diameter of 2½″ is usually required to tune to a wavelength of 380 metres, but here again the inductive values depend very much on the precise spacing between the turns. (4) Provided a special type of valve such as "Q" or "R4 B" is used as a rectifier, there is nothing gained in making use of a crystal.

"E.A.G." (Birmingham).—(1) The choke coil, as you suggest, may consist of 10,000 turns No. 42 S.W.G. enamelled wire, wound on the coil of an intervalve transformer. Place a layer of thin paper over every few layers of wire, as enamelled wire must not be wound too tightly. (2) An air core choke coil of 5 millihenries may be constructed by winding a three-pile winding of No. 26 S.S.C. wire on a tube 3″ diameter and 3½″ long. The winding itself is 2″ in length. If you have plenty of room, a single layer coil, 5″ diameter, 5½″ long, wound full of No. 26 S.S.C., will provide 5 millihenries of inductance. (3) We advise you not to make a variable condenser of 0·005 mfd. A condenser of this capacity, using plates of the size of your sample, would require a very large number of plates. The value is not critical, and once the adjustment is made, there will be no need to change it. We suggest you make a number of fixed condensers and switch them in parallel, until the desired result is obtained. (4) A filament resistance is quite useless as a potentiometer, which should have a resistance of at least 400 ohms, while the resistance of your filament rheostat is probably 8 ohms.

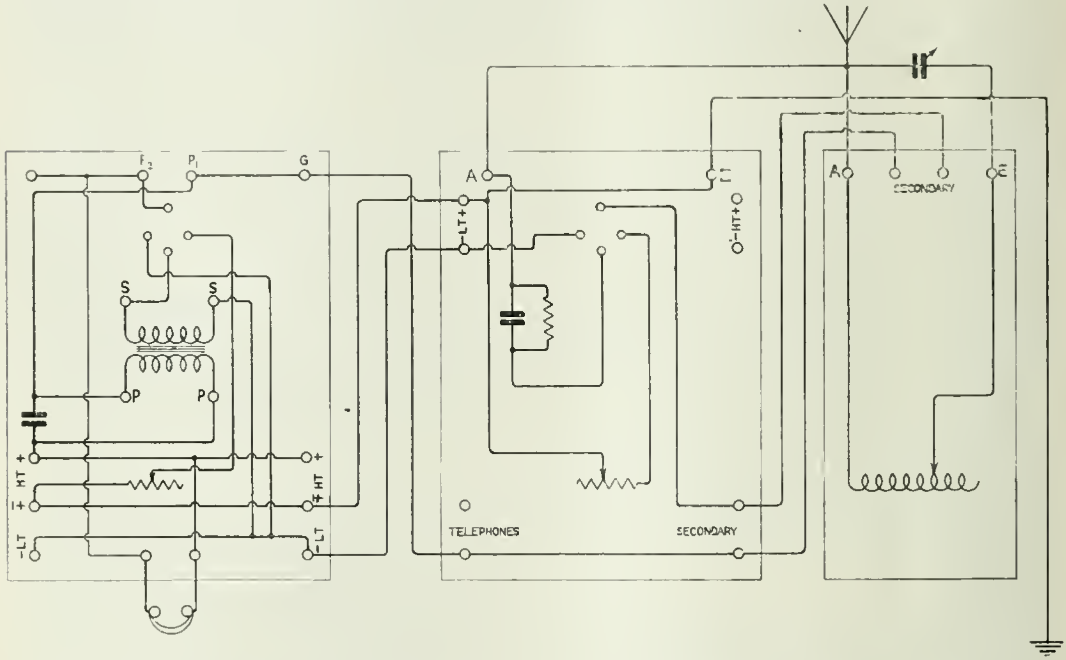


Fig. 2.

"H.F." (Towcester) *asks* (1) *For correct connections of his tuner panel, detector panel, and low frequency amplifier.* (2) *Whether his variable condenser marked* 0·000762 *is suitable for use in the set.* (3) *Why he is unable to receive* **PCGG** *although* **2 LO, 2 MT**, *etc., come in well and* (4) *Who is* **2 BF.**

(1) See Fig. 2. (2) Yes. (3) You will need the addition of one H.F. valve for reception of **PCGG**. (4) No information.

"K.K." (Stansted).—(1) Critical tuning, giving increased signal strength, may be obtained by placing in the hand or other semi-earthed conductor near the tuning inductances, is an effect frequently obtained when receiving short wavelength telephony. A very small change in the capacity in the tuning circuit may give rise to a small change in the wavelength, but of just such a critical value as to give greatly improved results. Although you point out that at the time of making the test you were apparently well insulated from earth, you must regard yourself as forming one plate of a condenser and the insulating material acting as a dielectric between yourself and the earth proper.

"S.K.F." (Newcastle-on-Tyne). We have carefully examined your diagram, and it is correct. Unfortunately you omitted to indicate the values of the components, therefore we cannot advise you whether they are suitable for **PCGG**. However, as you have received **PCGG**, we think there can be nothing wrong. You might connect a 0·001 mfd. condenser across the winding of the L.F. transformer in the detector valve plate circuit. We understand that this station increased its power about June 4th. Recently it may have been reduced, and we think you might add another H.F. valve to your set. The diagram (Fig. 3) shows the connections using 2 H.F., 1 detector, and 1 L.F. note magnifier.

"N.M.O.H.S." (Surrey).—(1) We presume you propose to use the two windings in series with a variometer in the plate circuit of the H.F. valve. With the particular type of formers to which you refer, you will not obtain the range you desire—viz., 150–1,100 metres. If you wind each former with 55 turns of No. 28 D.S.C., you will obtain a tuning range of probably about 300 to 850 metres. (2) A tapped single layer will probably be a better arrangement for use in the tuned anode circuit with your parallel tuning condenser of 0·0002 microfarads maximum. The $4\frac{1}{2}''$ former should be wound for a distance of 5″ with No. 26 D.C.C., and provided with about eight tappings at increasing intervals. A V.24 valve is quite suitable as an H.F. magnifier. (3) The best arrangement for three-valve H.F. amplifier is one arranged with tuned anode in intervalve coupling. As one end of each coil is connected to the H.T. plus, you might make a switch carrying three arms at 120 degrees to each other, moving over studs which are tappings from each coil, in order to adjust three intervalve inductances simultaneously. Each winding, of course, will need to be bridged with a variable condenser. (4) Your circuit is quite a good one. The suggested lead between the earth and the L.T. minus is not essential, though there is no harm in providing it.

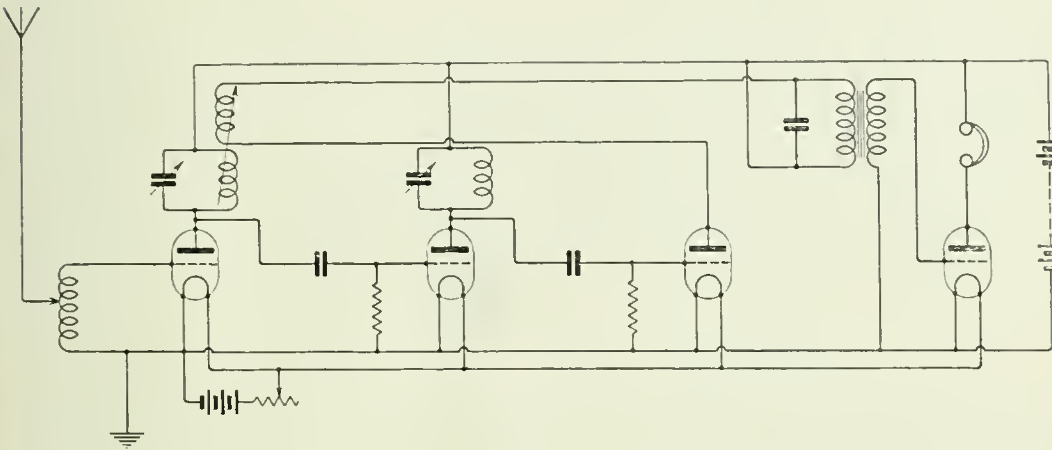


Fig. 3.

"J. McV." (Belfast).—(1) We regret the grid condenser and grid leak values were omitted from our reply, but these are generally very well known. Usual values are 0·0003 mfds. and 2 megohms, although slightly different values may be usefully employed. (2) The tuned anode method of H.F. amplification is very efficient and is to be recommended. It is generally not necessary to use more than three H.F. valves, and we suggest you make up a three-arm switch to vary the number of sections in the anode inductances simultaneously. Above about 2,000 metres a set arranged for resistance capacity H.F. amplication requires less adjusting, but does not give quite the same degree of amplification. (3) The inductance of each anode coil should be approximately the same, and the condensers should also have values very similar. The tuned anodes are, of course, tuned to the wavelength of the signals.

"C.W.A." (S.W.18.).—The choke should be made on an iron core 5″ long, $\frac{7}{8}''$ diameter, wind $\frac{3}{4}$ lb. No. 22 D.C.C. wire. You will find it convenient if a number of equally spaced taps are taken off and brought to sockets, or a row of terminals. About 6 taps are useful.

"D.G.B." (S.W.15.).—Unfortunately you do not give us particulars of your aerial, or the dimensions of the tuning inductances, therefore we are afraid we cannot help you. We shall be pleased to reply to your question if you will supply us with these particulars.

"W.S.S." (Wembley).—Making use of the 6″ diameter cylindrical former in your possession, 55 turns of No. 20 D.C.C. wire, will, with the 0·0005 mfd. series condenser, tune to 450 metres. Take tappings at the 20th, 30th, 42nd and 55th turns. The lowest wavelength you will be able to tune in is approximately 220 metres.

"F.B." (Bayswater).—The most economical method of charging your accumulators is to connect them in series with an electric heater, or carbon filament lamps. A $\frac{1}{2}$-kw. electric heater on a 200-volt supply will allow 2·5 amperes to pass through the battery; while four carbon lamps of 32 candle power each, connected in parallel, will pass about 2 amperes. It will be found that regular charging at the above rates will keep the accumulators in good condition.

"W.G.H." (Birmingham).—A three-valve circuit is shown in Fig. 4, making use of one H.F., one detector and one low frequency magnifier, to comply with the present Post Office regulations. The use of a loose coupled aerial circuit is permitted, as shown in the diagram, but we would recommend you to couple the reaction coil to the windings of the high frequency transformer or tuned anode circuit, as indicated in our issue of the 30th September, under the heading of "Experimental Station Design."

"G.R.A." (Aldershot).—It is a difficult matter to calculate the number of turns of wire required in honeycomb coils. The inductance of such coils depends very largely upon the method of winding, spacing, etc. Unfortunately you do not give us the capacity of your closed circuit condenser, and we think the best you can do is to use the next larger coil for the closed circuit coil, and the next smaller for the reaction coil, you will then determine by experiment whether the wavelength range of the aerial circuit corresponds with that of the closed circuit; if not, you will be easily able to change the number of turns in the coil.

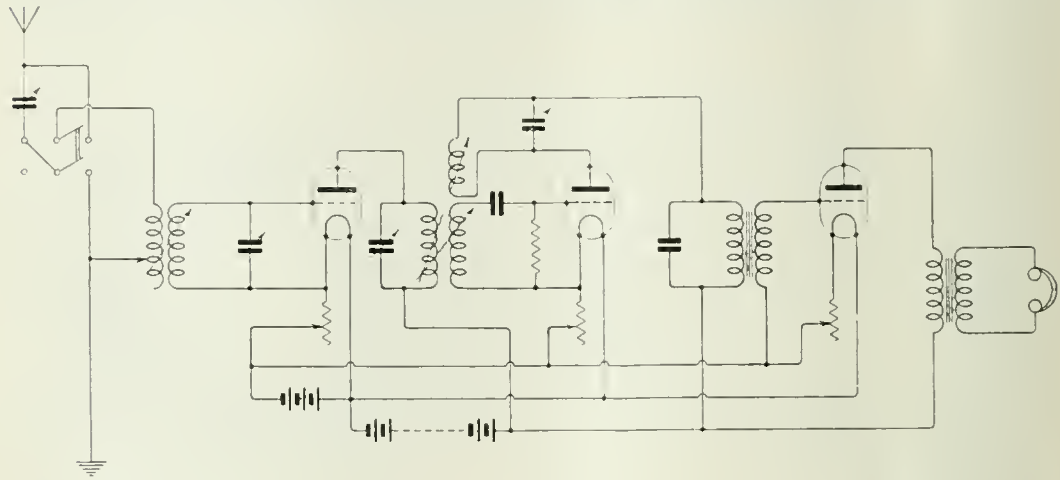


Fig. 4

"TUNER" (Bembridge).—(1) We do not understand your question; full particulars of a broadcast receiver are given in the issues of August 26th and September 2nd. (2) We do not know what telephones you refer to, so we cannot say. (3) You should consult the local authorities, although we believe there is generally no objection provided the wire is over 30 feet above the ground.

"J.K.W." (Liverpool). It is reasonable to expect that the Postmaster-General will not authorise you to use the circuit you propose, but we understood that although this circuit is capable of causing re-radiation, the Post Office were prepared to authorise its use by the experimenter. You do not say whether you are applying for a licence for the reception only of Broadcast telephony, or a licence permitting you to conduct experiments, and we now believe that provided the Postmaster-General is satisfied as to your ability to conduct experiments he will entrust you to use any apparatus you desire, providing you undertake not to cause interference. The circuit shown on page 867, September 30th issue, is recommended.

"W.S." (Guildford).—As you give us no particulars of the telephone jacks you propose using, we regret we cannot give you a circuit showing how to connect them. If you will send us particulars of the jacks, we shall be very pleased to help you.

"W.C.B." (Bradford).—(1) The diagram you send us is correct, but we suggest a series parallel switch to connect the A.T.C. in series or parallel with the A.T.I. The basket-coil arrangement you suggest is satisfactory, and you should mount them all side by side, with about ¼″ spacing between them. (2) We consider transformer coupling to be better up to 2,000 metres, and above that wavelength resistance capacity. A diagram showing socket connections, with resistance and transformer connected plugs is given on page 705, August 26th issue. (3) We think you should find a three-coil holder useful, making use of plug-in honeycomb coils. Less space will then be required for the tuner.

"O.B." (Glasgow).—We regret we are unable to advise you on the process to adopt in obtaining a post as wireless engineer or inspector in the General Post Office or other Government Department. Posts of this kind, both at home and abroad, are announced in this and other journals from time to time. We think you cannot do better than reply to one of these advertisements to which your qualifications appear to make you specially suitable. Why are you so desirous of restricting your employment to a Government Department, when really skilled wireless engineers are at present in such great demand by commercial companies?

"**W.E.C.**" **(Putney).**—Until very recently, we believe that the Postmaster-General was prepared to authorise the use of a circuit of the type which you suggest, but in our opinion it is just as liable to cause radiation as a direct coupled aerial circuit. If you have an experimenter's licence, we presume that the Postmaster-General is satisfied as to your ability to conduct experiments in wireless telegraphy, and we believe he will leave it to your discretion as to the type of circuit to adopt, but we would recommend you to use a circuit with reaction coupling, if necessary, as shown on page 867, September 30th issue.

use plug-in coils for both the anode and reaction circuit and couple them together. The anode reaction coils are described by Bull on page 678, August 26th issue.

"**W.T.A.**" **(Birmingham).** (1) You may purchase an intervalve transformer from any manufacturer of wireless gear, but if you require one similar to that described in the article of August 26th, it would be better to take the scale drawing with you for reference. (2) The receiver as described will meet the requirments of the Post Office if you leave the reaction coil terminals short-circuited. We suggest you see the articles

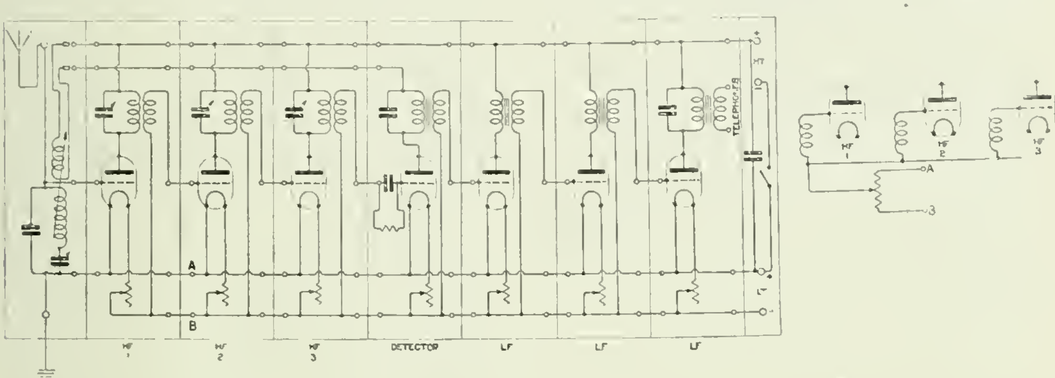


Fig. 5.

"**W.H.S.**" **(West Dulwich).**—(1) A wiring diagram using 3 H.F., 1 detector and 3 L.F. valves is given in Fig. 5. We do not recommend joining the last two valves in parallel for the loud speaker, as it is often difficult to get two valves in parallel working properly. However, if you would like to try connecting them in parallel, make up a valve unit and join its plate to the plate of the last valve, and the same with the grids and filaments. (2) As space is not a consideration you may use a variable condenser in place of the fixed condenser as you suggest, although this will give you another adjustment to make each time you tune in. The arrangement using the fixed condenser works very well. Perhaps we may suggest you use a series or parallel with the A.T.C., omitting the fixed condenser. (3) The lower diagram shows how the potentiometer is arranged to control the potentials of the grids of the H.F. valves. The grid leads are connected together and taken to the sliding contact of the potentiometer. The terminals of the potentiometer bridge the L.F. battery. Potentiometer control of the H.F. valves gives a very useful method of controlling the grid potential, and finer adjustment thereby is possible.

"**F.W.**" **(Manchester).**—Unfortunately the circuit sketched does not comply with the Post Office regulations. It is never advisable to react back directly into the aerial circuit. We suggest you add another valve, and then couple the reaction coil to the H.F. transformer as shown in the articles on "Experimental Station Design," pages 715, 791 and 865, September 2nd, 16th and 30th issues. Also see the article on page 26, October 7th issue.

"**F.W.**" **(Birmingham).**—We suggest you

on "Experimental Station Design," September 2nd, 16th and 30th issues, and make arrangements in your set to secure reaction by coupling the reaction coil to the tuned reactance anode coil.

"**T.G.O.**" **(Southport)** *asks* (1) *The gauge of samples of wire submitted.* (2) *Windings for H.F. transformers.* (3) *Particulars for making tuning coils* 350-400 *metres.*

(1) No. 1	diameter	0·0124″	= No. 30 S.S.C.
No. 2	,,	0·0076″	= No. 36 D.S.C.
No. 3	,,	0·0076″	= No. 36 S.S.C.
No. 4	,,	0·0076″	= No. 36 D.C.C.
No. 5	,,	0·0124″	= No. 30 S.S.C.
No. 6	,,	0·0076″	= No. 36 D.C.C.

(2) To tune from 350 to 400 metres, we suggest a winding of 130 turns each for primary and secondary in the 1·3/8″ diameter former, using the No. 44 D.S.C. wire in your possession. For an optimum wavelength of 1,000 metres wind 350 turns each for primary and secondary in the $1\frac{1}{2}$″ diameter former. It is generally not possible to give the number of turns accurately, and some experimental adjustments will probably have to be made. You will be able to wind 20 turns (of the wire submitted) per inch length of former. For the primary use the $3\frac{1}{4}$″ former and wind for a length of 4″, taking 9 tappings. For the secondary wind 4″ of No. 22 D.C.C. on a 3″ former, and take 4 tappings. The reaction coil may consist of 3″ of No. 28 wound on your 3″ diameter former.

(3) We cannot give exact dimensions, because you have not given us particulars of your tuning condensers. We suggest you use a series A.T.C. of maximum value of 0·001 mfd., and a closed circuit tuning condenser of maximum value 0·0005 mfds.

"H.R.S." (Exeter).—(1) A separate heterodyne will only be of use when C.W. signals are to be received. It would be difficult to use it to take the place of reaction, that is, to diminish the effective resistance of the tuner circuits to H.F. currents. To heterodyne an incoming C.W. signal, the heterodyne wavemeter is coupled to the tuner, or preferably, to the plate circuit reaction coil. Of course the reaction coil in Mr. Harris's set may be coupled to the anode coil, and you would find this arrangement satisfactory. (2) Unfortunately you do not give us any particulars of the switches you propose using, so we cannot give you a wiring diagram showing how they are connected. A simple change-over switch is all that is required for the reaction coil.

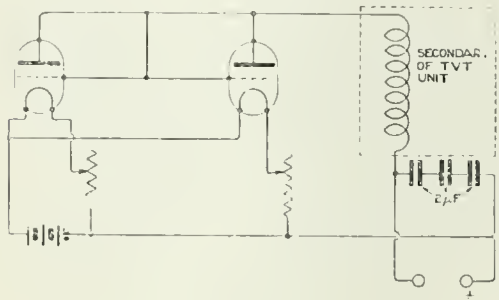


Fig. 6.

"W.G.M." (Salisbury).—It is quite a simple matter to rectify the voltage obtained from your T.V.T. unit. Join two valves in parallel, the grid and plate of each being connected. It is better to use a filament resistance for each valve. The diagram (Fig. 6) shows the arrangement, and you will notice the rectifier filaments are at high potential.

"L.B." (Cambridge).—We cannot give you the precise values necessary to set up oscillations for audio frequency of 400 per second, as the frequency produced by the neon tube depends largely upon the extent of exhaustion. If you connect in series with the source of H.T. supply a resistance having a value between 1 and 1·5 megohms, and bridge the tube with a variable condenser having a maximum value of 0·002, you will obtain a good variation of note frequencies, whilst a condenser having a value of 1 mfd., used in conjunction with the same resistance, will usually give a frequency of about one per second. These particulars apply to Osram neon lamps with resistances moved from sockets.

"G.H.S." (Ilford).—As you do not give any particulars of your tuning condenser, we cannot calculate the size of coil required. We suggest you use single layer coils for short wavelengths, and for longer wavelengths make up a set of honeycomb coils. For the lower wavelength wind a coil 4″ in diameter and 6″ long with No. 22 wire, taking off, say, six taps. You will require a set of about eight honeycomb coils to tune up to 10,000 metres, winding the honeycomb coils with No. 28 D.C.C. on a former 2″ in diameter for 1¼″. Four layers up to fifteen layers will be required to cover the whole range.

"T.R.A." (Beverley).—(1) and (2) The circuit you give is a fairly satisfactory one, but you will obtain much better results if you use a tuned inductance in the plate circuit of the first valve instead of an H.F. transformer. The constructional details of such an inductance are given in the issue of September 30th. A variable condenser having a maximum value of 0·0002 is suitable for tuning the anode inductance. (3) The circuit you show would not be suitable for reception of PCGG when followed by one L.F. magnifier, and in fact your diagram is not quite correct, as you apply the potential obtained across the ends of the inductance between grid and plate. This is perhaps permitted if you provide a bypass condenser across the telephone receivers, but then of course self-oscillation may occur, and consequently radiation. (4) The coupling of a reaction coil to an intervalve transformer is fully described in our issue of September 2nd, page 715. The necessary components are not on the market at present, but if you are an experimenter, we do not think you should have very much difficulty in constructing the arrangement shown on pages 718 or 792, yourself.

"G.W." (Bradford).—Before erecting a mast or making aerial fixtures to property, it is necessary to obtain the permission of the owner. The approval of a tenant should not be taken as sufficient, because it must be admitted that damage may accidently occur to the property. Even to be privileged by the owner to make attachment to property is not always satisfactory, for after having perhaps taken great pains to erect a good aerial, the owner may desire its removal at any time. When seeking permission it is advisable to arrange to pay a nominal rent, with, if possible, an agreement for a stated period, and with an undertaking to make good any damage directly attributable to the fixing of the aerial.

"A.C.B." (West Ham).—The diagram given on page 807 is quite correct, but it does not matter usually whether low frequency choke coils are inserted in the positive or negative lead, or both. The reason why the chokes are only connected in one lead, and that the negative, is because experimenters following that diagram may be working with an auto-coupled power transformer, in which case the positive lead from the rectifier valves may be earthed, and as the H.T. positive may also be earthed, any chokes connected along this lead would in effect be short-circuited. In wiring up to the diagram given, you may let your positive leads be at almost earth potential, whilst the negative lead and the battery which heats the filaments of the transmitter valves must be well insulated.

"A.C.W." (Walthamstow) *asks* (1) *If his diagram of connections is correct.* (2) *Range of wavelengths covered by set.*

(1) Your diagram is quite wrong. See Fig. 7, August 12th issue. Beyond this we cannot help you much, as unfortunately you omit to give the values of the components of your set. (2) Range of wavelengths covered from 200 metres to 2,000 metres, assuming you are using a 0·001 mfd. aerial tuning condenser.

"W.S.S." (Wembley).—As your former is 4″ diameter and 6″ long, and the maximum value of the A.T.C. is 0·0005 mfds., we suggest you wind a single layer of Litzendraht for 3″, and two-pile for 2½″, taking evenly spaced tappings. The total length of wire will be about 80′.

"A.H." (Purley).—(1) The issue dealing with the construction of a telephone transformer is out of print. However, if you wish to construct one suitable for use with 120 ohms, telephones, wind on a soft iron wire core ½″ diameter and 3″ long, 4 ozs. No. 34 S.S.C. for the telephone winding, and 3 ozs. No. 44 S.S.C. for the plate winding. The construction of H.F. transformers is fully dealt with in the articles on "Experimental Station Design," September 2nd and 16th issues.

"J.G." (Edinburgh).—(1) The diagram of connections sent in is quite correct, and we have no suggestions to offer for improvement. (2) The tuner described in the issue of July 29th can be altered as you suggest. We suggest you couple the reaction coil with a H.F. transformer as described in the issues of September 2nd and 16th. We do not know where you can purchase Mark III tuner coils, but you can easily make short wave coils yourself. Wind a tube 4″ diameter and 5″ long with No. 22 D.C.C., and take off 9 or 10 tappings. (3) We cannot say what range in miles you will be able to receive with your set. That depends, of course, upon the power of the transmitting station, as well as the efficiency of your set. However, you will no doubt receive signals from most of the higher powered stations.

"F.E.H." (Winchester).—It is of little use to give you working instructions for making up a short range telephone transmitter, as it is doubtful if the Postmaster General would authorise you to use it, unless you have a thorough knowledge of wireless telegraphy, and you require a transmitting licence, especially to conduct research relating to telephony transmission. If you are interested in the subject, we recommend you to obtain copies of this journal of May 28th, 1921, and June 11th, 1921, in which the subject was dealt with very fully in the Proceedings of the Wireless Society of London. A low power transmitter was also described in the issue of June 3rd, 1922.

"F.G." (Dewsbury).—The rectifier and L.F. amplifier panels shown on page 809 can, of course, be operated with a high frequency amplifier. Without a more detailed description of your apparatus we cannot suggest the reason of your failure to receive signals. The grid condenser, as often stated, should have a value of 0·0003 mfds. The condenser across the primary of the L.F. transformer need not be variable, and should have a value of 0·001 mfds. A variable condenser having a maximum value of 0·0004 might be connected with advantage across the ends of the reaction inductance. The circuit is not suitable for reception on broadcast wavelengths, as it is liable to cause interference, and we do not think the Post Office would approve of its use. Making use of the two units you have constructed, you might add a high frequency amplifier, as described in great detail on page 865, September 30th issue, where will be found a scheme of connections arranged to eliminate radiation.

"C.W.D." (Redcar) *asks for criticism of his set.*

In your diagram 1 the values are correct, but you do not say the values of grid leak and condenser. 2 meghoms and 0·0003 mfds. are usual values. The reaction coil would be better connected between the plate and H.T.+. It is useful to use a change-over switch to connect the aerial tuning condenser in series or parallel, with the A.T.I. With the condenser in parallel you will have a greater wavelength range, and you might re-wind the closed circuit with No. 26. Your No. 2 diagram is correct. It seems probable that you are using too much reaction, and we suggest you use half the number of turns.

"W.W." (Belfast).—(1) The diagram is correct, but it would be better if you connected a small condenser of 0·001 mfd. across the first L.F. transformer. It would also be better if you made use of a closed circuit, when connected to an outdoor aerial. The 40-ohm variable resistance cannot usefully be employed in a receiving set. We notice the H.F. transformers shown in your sketch are not tuned. It may be better to connect a small variable condenser of 0·0002 mfds. across the primary windings. (2) The frame, as sketched, would be satisfactory, but we think it would be better if you could reduce the length of the wire running from the frame to the receiving set. If you take several tappings from the frame and connect a variable condenser (0·0004 mfds.) across the leads running to the filament and grid, you will cover a useful wavelength range. (3) To tune to 2,800 metres, with the 0·001 mfd. tuning condenser in parallel, wind a coil 4″ diameter and 5″ long with No. 22 D.C.C. and take 5 tappings. The reaction coil may consist of a coil of 50 turns of No. 38 S.S.C. wound on a former of the same dimensions as the plug-in type H.F. transformer, external inductance being added as you require it. (See page 792, September 16th, 1922.)

"J.H.P." (West Wimbledon).—(1) and (2) No. (3) The construction of a set which will suit you very well is given in the issues of August 26th and September 2nd, under the heading, "A Broadcast Receiver." (4) Yes.

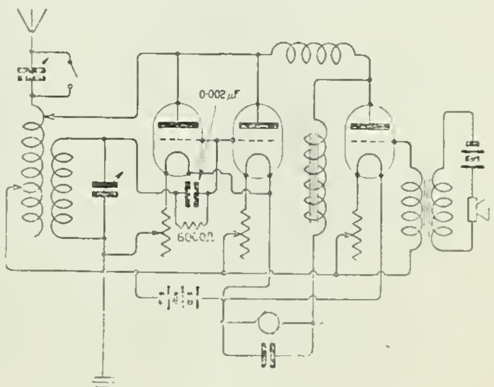


Fig. 7.

"E.F.H." (Copenhagen) *asks for a telephony transmitting circuit making use of 10 watt transmitting valves and 1,000 generator.*

See Fig. 7. For constructional information, see pages 127 to 144, May 28th, 1922, issue.

"C.B." (Lewes).—(1) The diagram of connections of your set is unfortunately not correct. We suggest you use a closed circuit coupled to the aerial circuit, and use a series parallel switch in the aerial circuit to join the A.T.C. in series or parallel with the A.T.I. A large condenser in parallel with the A.T.I. is useless when receiving short waves. Probably 6 volts and a filament resistance for each valve would help you to secure better results. (2) It is always better to use a telephone transformer. The telephones are then less liable to damage. We cannot say why your telephones have burnt out, but you may, of course, have some faulty apparatus in your set, of which we have no particulars. (3) The tuned anode method of H.F. amplification is the best arrangement to use, and we can only suggest the anode coils are incorrect valves. A large number of suitable values have been given in recent issues. The maximum value of the anode tuning condenser should be 0·0002 mfds.

"S.W." (Stoke-on-Trent).—(1) It is quite easy to couple the reaction coil to a Sullivan H.F. transformer. We suggest you wind 100 turns of No. 38 S.S.C. wire on an ebonite former a little smaller than the H.F. transformer, and arrange it to move quite close to the face of the H.F. transformer. For higher wavelengths you will be able to add coils external to the moving reaction coil, as shown in our sketch (1). (2) We regret we have no particulars of the Marconi Tuner you have purchased. We suggest you write to the Marconi Company asking them for a diagram. Without a diagram, we are afraid we cannot advise you how to convert the set. You can try connecting the grid and filament of the first valve across the crystal leads (removing the crystal, of course), and short-circuiting the telephone terminals on the tuner.

"J.B." (Gt. Yarmouth).—The correct method of joining up transformers is as you suggest. I.P. of course is the beginning end of the primary, and I.S. the beginning end of the secondary, both windings being wound on in the same direction. In joining the transformers up in this manner, the maximum voltage is impressed between grid and filament.

"H.E.N." (Oakham).—We are sorry your letter is not very clear. You say you have two L.F. valves in your three-valve set now. You therefore have already a note-magnifying valve. If you wish to add another L.F. valve, you will require one L.F. intervalve transformer, one valve socket, and filament resistance. Use a valve of the same type as that already in use in the L.F. portion of your set. We suggest you consult the advertising pages of our journal. You should have no difficulty in choosing an L.F. intervalve transformer; obviously we cannot recommend any particular manufacturer's product.

"ELECTRIC" (Sunderland) *asks* (1) *The correct way to connect up L.F. transformers and H.F. transformers.* (2) *The size of former, size of wire and number of turns for a H.F. transformer to tune from 360 to 440 metres.*

(1) If the two windings of the L.F. transformer are wound on in the same direction, the primary winding being put on first, the beginnings of the windings are labelled I.P. and I.S., and the ends of the windings are labelled O.P. and O.S. I.P. is connected to + H.T. ; O.P. is connected to Plate ; I.S. is connected to Grid ; O.S. is connected to − L.T. If the H.F transformer consists of a tube upon which one layer of wire is wound for the primary and a layer of wire is wound over the primary for the secondary in the same direction, the ends are taken thus :—I.P. is connected to + H.T. ; O.P. is connected to Plate ; I.S. is connected to − L.T. ; O.S. is connected to Grid. If the H.F. transformer is of the usual plug-in type construction, and the two windings are wound on in the same direction in the groove, the ends are connected thus :— I.P. is connected to + H.T. ; O.P. is connected to Plate ; I.S. is connected to Grid ; O.S. is connected to − L.T. The connecting up of transformers is important, in order that the capacity of the winding of the transformer shall assist as far as possible the electromagnetic transformer action, to provide maximum potential variations between the grid and filament of succeeding valves. (2) The former may be a piece of ebonite 1·1 8″ diameter, on which is wound a primary and secondary winding of 450 turns each. The wire may be No. 36 to No. 42 S.S.C. upper.

CORRECTIONS.

Mr. G. Breit, author of "Amplitude of Electrical Oscillations, generated by Electron Tubes," which appeared in the issue of July 22nd, 1922, notifies us that the following corrections should be made :—

Page 519, line 8 : Omit period after (II).

Page 519, Equation (V), should be :

$$\frac{(\dot{v}_1 - av_1)^a}{(\dot{v}_1 - \bar{a}v_1)^{\bar{a}}} = \frac{(\dot{v}_0 - av_0)^a}{(\dot{v}_0 - \bar{a}v_0)^{\bar{a}}}$$

First line below Equation (V) should read :

"This means that $\dfrac{(\dot{v} - av)^a}{(\dot{v} - \bar{a}v)^{\bar{a}}}$, etc."

Page 520, second line of Equation (5) should begin with $\beta \log v$ and not $\beta \log \dot{v}$.

Page 520, line 4 bottom : "is the value of v"—"f" omitted in "of".

Page 520, (Equation (7) should be :

$y_{\bar{A}} - y_{A_1} = \beta \log \dfrac{v_{A_1}}{v_{\bar{A}}}$. Bar omitted in $y_{\bar{A}}$.

Page 521, line 2 top : "Therefore, if

$v_P = v_{\bar{A}}\, \epsilon^{(y_{\bar{A}} - y_P)/\beta}$, etc.,"—first y omitted in exponent.

Page 521, line 19, bottom : "Now clearly for an infinite"—*infinitive* is inserted instead of "infinite."

Page 522, line 9, bottom : "$v = V - \dfrac{B - \frac{a\delta}{b}}{1 + \delta}$"

fraction line is omitted in $\dfrac{a\delta}{b}$.

Page 523, line 2, in "Illustration." Fraction line omitted in $\dfrac{\dot{v}}{v}$

SHARE MARKET REPORT.

Prices as we go to press on October 13th are :—

Marconi Ordinary	£2	10	0
,, Preference	2	5	7½
,, Inter. Marine.. ..	1	8	0
,, Canadian		11	0
Radio Corporation of America :—			
Ordinary	1	0	10½
Preference		15	0

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

No. 167 [No. 4. Vol. XI.] OCTOBER 28TH, 1922. WEEKLY

H.R.H the Prince of Wales

PATRON OF THE WIRELESS SOCIETY OF LONDON.

AT the ordinary general meeting of the Wireless Society of London, held on Wednesday, October 25th, the announcement was made that H.R.H. the Prince of Wales had graciously consented to become the Patron of the Wireless Society of London and its affiliated Societies, and that he noted it was intended to change the title to that of the Radio Society of Great Britain in the near future. The President had acknowledged this communication on behalf of the Societies, expressing the extreme gratification that will be felt by all connected with the Society at this mark of His Royal Highness's interest in the work of Radiotelegraphy. It was also announced that the President had received a request from the Chairman of St. Dunstan's Hostel for Blinded Soldiers & Sailors asking him to bring to the notice of the members of the Wireless Society of London and its affiliated Societies that many of these blind men in all parts of the country would be grateful to those Societies and to their individual members for any assistance they could give them in fitting and installing wireless receiving sets, so that they could take advantage of Broadcasting and so add an item of interest and pleasure to their darkened lives. He had interviewed the Chairman, Captain Ian Fraser, and seen the set that he has personally

Photo] H.R.H. the Prince of Wales. [Vandyk installed, with but slight assistance from one of the members of the Society, and which gives so much pleasure to the inmates of St. Dunstan's in the reception of the music and speech broadcasted by 2 LO and others. The President fully supports this proposal and considers the scheme quite practicable. He hopes that all those interested in wireless will do the best they individually can and that the Secretaries of the affiliated Societies will also assist by receiving and dealing with any requests which may reach them from blind residents in their locality.

It was stated that His Royal Highness desired especially to associate himself with this work as his first action on becoming the Patron of the Society.

The Armstrong Super-Regenerative Receiver

PRACTICAL DETAILS OF A BRITISH BUILT INSTRUMENT.

(*Concluded from page* 82.)

By PERCY W. HARRIS.

LAST week a list was given of the component parts required to build a super-regenerative receiver. Before the actual constructional work is begun, it should be pointed out that the construction of such a set cannot be recommended to the inexperienced amateur, and unless the builder is well accustomed to the operation of an ordinary regenerative receiver he will be unable to make the present instrument work. Furthermore, the Armstrong super-regenerator is as yet by no means perfect, and much remains to be done before it can be looked upon as a suitable receiver for general work. To the experimenter, however, it is a thing of delight, opening up an entirely new field of work. Whilst the actual constructional work will be found comparatively easy, the manipulation of the complete instrument requires practice, and some patience will be needed to obtain good results.

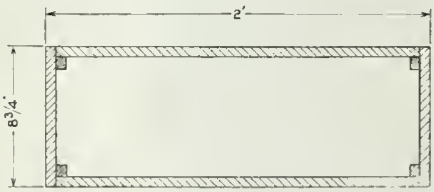


Fig. 4. How to construct the wooden case. The top and back are attached when the wiring is finished.

With these provisos the actual work of construction can be started.

First of all make a suitable cabinet. In the instrument described the component parts are mounted both on the ebonite panel and on the base to which it is attached, for which reason it is essential to make the cabinet first. A suitable box can be constructed from $\frac{5}{8}$-in. white deal, bought in nominal nine-inch widths from the timber yard. It should be bought already planed, as this will save much work.

The method of construction can best be learnt from an examination of Figs. 4 to 6 accompanying this article. The two end pieces should be attached to the base, and the top and back made to fit in place on the ledges shown. The two latter parts are only put in place when the instrument is wired.

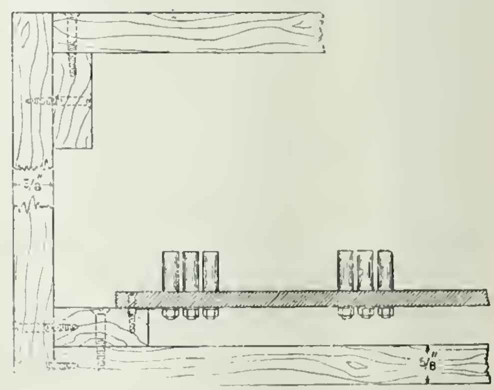


Fig. 5. Method of fixing ebonite strip with valve sockets. If valve bases with terminals are used this strip will not be needed.

The planed wood should be finished with sand or emery paper and given a coat of some water stain, followed by a coat or two of spirit or other varnish. This method is far preferable to painting with combined varnish-stain, as in this latter case the stain does not sink into the wood, but remains in the varnish, giving a much inferior effect.

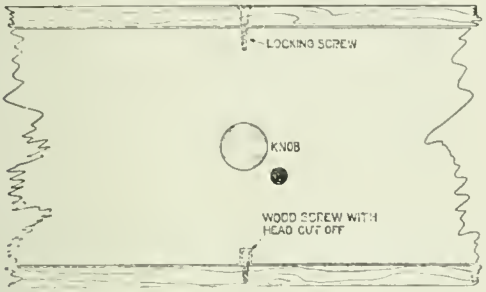


Fig. 6. Method of fixing back so as to allow easy removal.

As soon as the box is finished take the ebonite panel and give it a matt finish by rubbing with fine emery. Next take your components and arrange them on the panel until you are satisfied with the layout. This should follow as closely as possible the arrangement in the instrument illustrated, and it seems essential that the three duolateral coils should be at right angles to one another in the way shown. No difficulty will be found in arranging the positions of the filament rheostats, jacks, windows for valves, variable condensers, etc., but care must be taken to get the position of the variometer correct. In the finished instrument this must come immediately above the fixed coil mounted on the base. The position of this latter and the variometer should be considered at the same time.

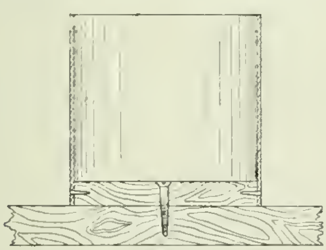


Fig. 7. Method of attaching the fixed coil to the base.

The absence of detailed measurements in the Figures may be noticed. At first it was intended to give all such details, but a few minutes consideration will show that as no two sets of components will be alike in measurements (variable condensers seem to be of all sizes, irrespective of capacity), and as the parts have to fit in with one another, such measurements would be useless. A drilling plan can only be made out when all the components are ready for assembly.

The plug-sockets can be mounted in several ways. Perhaps the simplest is to drill two holes in the panel for each socket, the holes coming immediately beneath corresponding holes in the socket. 6 BA metal screws can then be passed through the holes into the base, and will hold it in place. Most sockets have screws through the side, making contact with the brass pin and socket, and to these soldering lugs may be attached for making the necessary connections. (Fig. 8.)

When all the parts have been mounted on the panel (it is of course assumed that it has been drilled for attachment to the wooden uprights), wire up those connections which are entirely on the panel. For simplicity Fig. 9 shows both panel and base drawn in one plane, and with the help of the illustration no difficulty will be found in making the necessary connections.

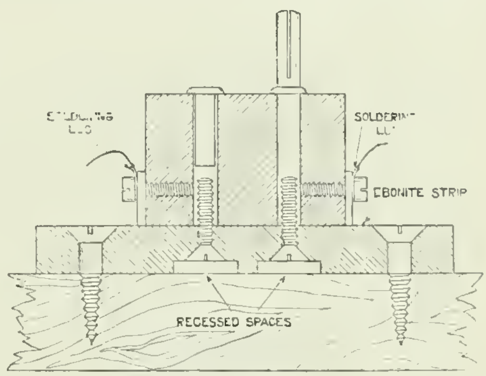


Fig. 8. Details for mounting the plug sockets.

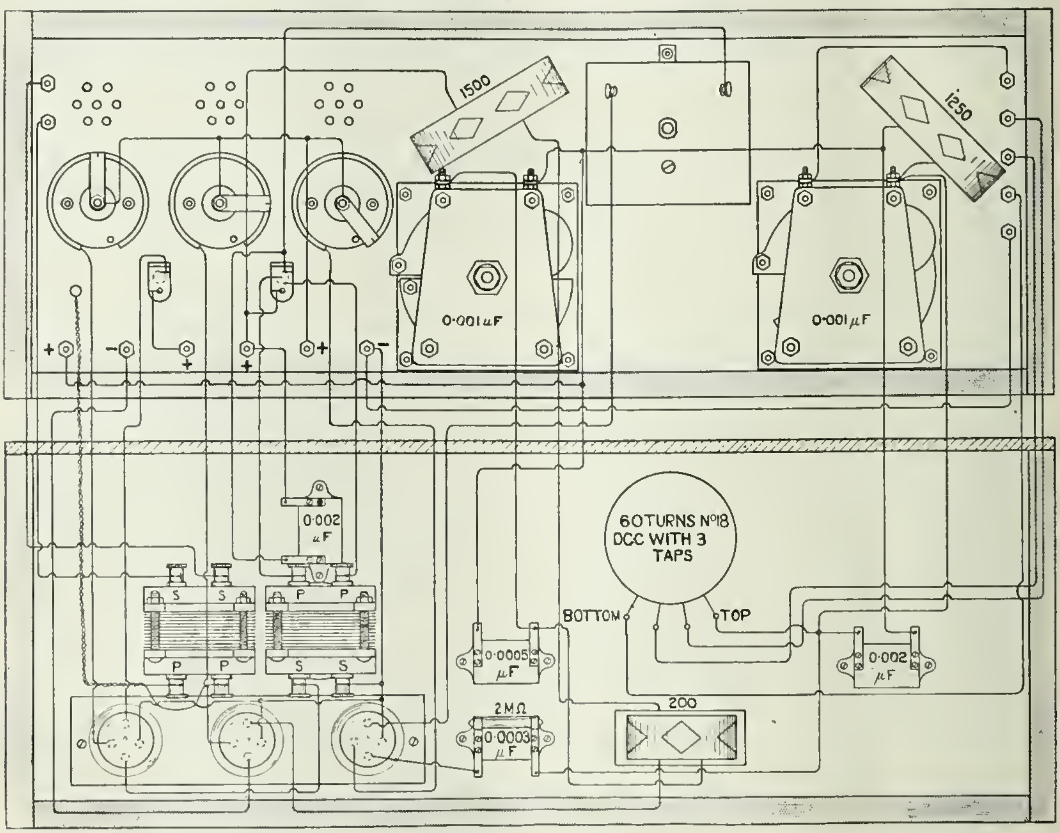
The next step is to wind the fixed coil with No. 18 D.C.C. wire. Leave a short length at the beginning, then wind a third of the coil and make a tap by twisting a loop. Wind a further third, make a second tap, and then wind to the end, leaving a short length for soldering the connection. About sixty turns will be found to go on a former of this size. A suitable method of attaching the coil to the base is shown in Fig. 7. A wooden boss is cut to fit the lower end of the former, and is secured by any suitable means, such as by three small screws. A single screw in the centre is sufficient to hold it to the baseboard.

No instructions are necessary for the attachment of the other components to the baseboard, as these are clearly shown in the illustrations. Wiring up is comparatively simple, although soldering connections to the jacks may present a little difficulty. It will be found convenient to solder lengths of wire to the jacks before the panel is fixed to the uprights. They can then be conveniently cut to the required length and soldered to the respective points after the panel is in place.

If possible, every connection should be soldered. In the American instrument, on which this receiver is based, everything is mounted on the panel, but it has been found more convenient to adopt the method described here. A telephone transformer is not absolutely essential, and it is not included in the American instrument, but the writer considers it worth while, if only to protect the telephones from the high voltages necessary to operate the instrument. As far as possible wiring is carried out with No. 18 or 20 tinned copper, but finer wire is used in difficult parts of the circuit. Insulating tubing is fitted throughout.

When all wiring is finished and coils and valves are in place, the top can be screwed down and the back fitted by any suitable method, one as used by the writer being shown in the drawings. A hole is drilled in the edge of the backboard, and this fits over a wood screw from which the head has been cut. A single screw through the top will hold the back in place, and if a knob is fitted (Fig. 6) the back can be lifted out as soon as the top screw is removed.

PANEL



BOTTOM

Fig. 9. Disposition of parts and wiring diagram. For simplicity both panel and base are shown in one plane, although, of course, they are actually at right angles.

Operation of the Instrument.

Looking at the front of the instrument, the terminals are connected as shown in the diagram in the first article. The five terminals on the extreme left are used as follows:—The top terminal is permanently connected to one lead of a small loop aerial, the other lead of which is taken to the second, third or fourth terminal as found by experiment to be best. A flexible lead should be taken from the lowest terminal to one of the others, (found by trial, but usually the top terminal). The two terminals on the extreme right are for the L.R. telephones or loud speaker. The six lower terminals are (counting from the left) for L.T. negative, L.T. positive and H.T. negative, H.T. positive for first two valves (about 150 volts for "R." valves seems about right), H.T. positive for last valve (150 to 200 volts), oscillator valve grid-bias negative, and oscillator grid-bias positive. These last two can be shorted for most valves, but some may work better with a few volts negative on the grid.

When the plug is inserted in the left-hand jack the note-magnifying valve is cut out, and when in the right-hand jack it is in circuit.

A two-foot loop with about six to nine turns of wire will be found quite suitable with this receiver.

When all is ready and the valves are in their sockets, connect a pair of telephones to the necessary terminals and plug in the left-hand jack. Now turn up the filaments quite brightly, and a high note will be heard in the telephones. Set the tuning condenser (left) at a fairly low value, the oscillator condenser at near maximum and the variometer dial near zero. Now slowly increase the variometer until a violent squawking noise is heard, then turn back slightly until this disappears. If all is well, every movement on any adjustment will be accompanied by innumerable strange heterodyne notes, howls, squawks and hisses. Telephony will first be heard as very mushy, distorted sounds, and adjustment of all dials will be necessary to remove distortion. The receiver seems to work much more efficiently on fairly strong signals, and at six miles from Marconi House gives good loud speaker strength on two valves and six turns of wire on a two-foot former. The adjustment of the filament rheostats is very critical, and it is probable that power valves will give much better results, although up to the time of writing it has not been possible to test them in the circuit. Capacity effects are rather marked and extension handles for the adjustments are recommended. The exact value of the H.T. seems also important, for which reason tapped batteries are an advantage. No difference in strength has been noticed in Marconi House signals at six miles and one, and 2 OM at ten miles was practically as strong on the same arrangement, all of which indicate that the strength is limited by the current-carrying capacity of the "R" valves so far used. C.W. comes in far better than spark, which is distorted. Leafield harmonics are very loud, and, as a matter of fact, were the first signals picked up. The

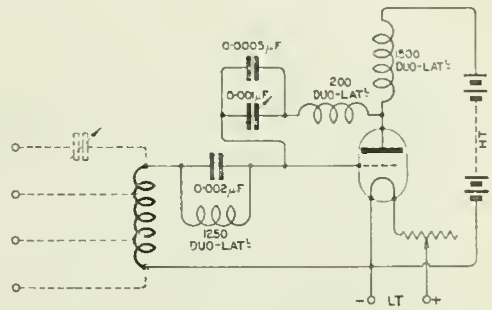


Fig. 10. Circuit of the Oscillator Valve isolated and simplified. The thick line indicates the path of the quenching oscillations through the fixed coil.

sound of spark signals is a mixture of heterodyne and true note. The high note of the oscillating valve is rather noticeable at first, but one soon gets used to it. A filter circuit on the lines indicated in previous articles in this magazine would remove this note, but would add to the complication of the receiver.

In conclusion the writer would like to state that he does not consider that the receiver described represents by any means all that can be gained by the new circuits. It is simply put forward as a working proposition which can serve as a basis for innumerable experiments. He is convinced that British amateurs will soon find a way of making it as easy to operate as the better-known arrangements. Meanwhile it remains an instrument full of strange howls and squeaks, only to be quieted by gentlest persuasion.

A final word. Whatever you do, remember that the super-regenerator oscillates violently, and must on no account be used on an outside aerial. A two-foot loop is quite enough, and probably a twelve-inch loop would do as well. Used in this way it should give no trouble with radiation.

Electrons, Electric Waves and Wireless Telephony—IV.

By Dr. J. A. Fleming, F.R.S.

The Gramophone.

It is clear there are many matters of great scientific interest in connection with that popular instrument the gramophone. There are two types of this instrument, one employing a needle and the other a jewelled point in the sound producing portion.

On examining a gramophone record we find it to be a disc made of a certain composition which softens with heat, and on it is a close spiral groove cut in the plate. In the needle records this groove is smooth at the bottom but irregularly indented at the side. The record is made to revolve steadily at about 90 revolutions a minute by the clockwork. The so-called sound-box consists of a flat metal box, carried on the end of a hollow arm, and this box has a circular disc, generally of mica as the outer face. The centre of the disc is screwed to a pivotted arm, ending in a needle which rests in the groove in the record. As the record revolves, the needle travels in the groove, but is jerked to and fro by the irregularities on the side of the groove. This causes the lever to impart corresponding vibrations to the mica disc of the sound-box, and these create aerial waves which travel up the tube and make their exit from the horn. In the case of the Pathé gramophones the groove in the record is smooth at the sides but irregularly indented at the bottom. The sound-box lever ends in a metal point tipped with a small sapphire ball. This ball travels along the record groove and jumps or bounces over the uneven bottom like a bicycle on a rough road. These vibrations are communicated to the sound-box disc and then to the air.

The marvellous thing about the gramophone is the perfect manner in which it can reproduce complex sounds such as speech, singing, noises of animals, bells ringing, cornets and violins playing and even hammers beating on anvils. The outline or profile of the irregularities on the side or bottom of the groove in the record is a copy of the wave form of the sound originally impressed on the master record, and this is faithfully reproduced in the aerial vibrations created as above described by the copies of the master record, which are sold to buyers.

This is perhaps the place to make reference to the history of a type of gramophone which is capable of giving a vastly louder sound or wave amplitude than the ordinary instruments. In this case the power required to create the aerial waves is not derived merely from the clockwork driving the record, but from a supply of compressed air furnished by an electric motor and pump. All that the rotating record does is to control the emission of this air and modulate it so as to produce aerial waves.

A sudden puff of air is capable of starting a compressional wave into existence in surrounding air. In fact, this is the underlying principle of all so-called wind musical instruments, *e.g.*, organ pipes, reeds, trumpets, cornets, flutes, etc.

Suppose, then, that a jet of compressed air is issuing from a pipe. If we can apply to the end of the pipe a valve which will control the jet of air and modulate it in accordance with the wave form of a musical sound, we shall produce the corresponding aerial waves.

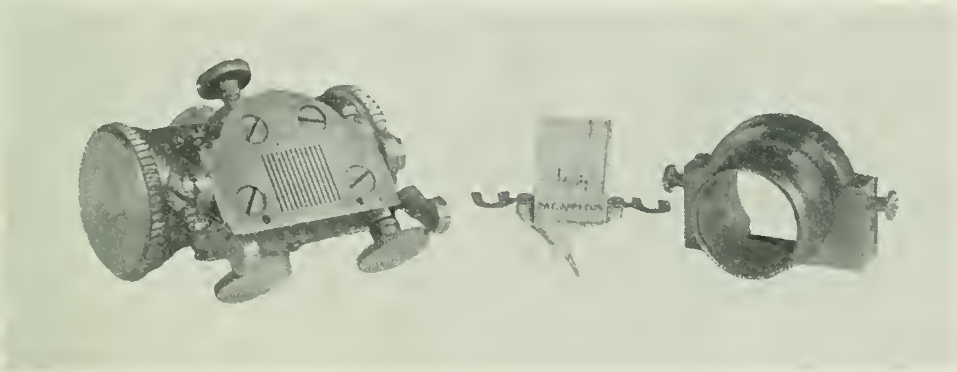
Edison seems to have had the idea in 1876 that if such a valve could be controlled by the voice, then an instrument could be made which would greatly magnify it or act as an amplifier of speech.

In the late years of the nineteenth century Mr. Horace L. Short devised a valve intended to be used for this purpose, and a few years later the eminent engineer, Sir Charles Parsons, the inventor of the steam turbine which bears his name and has effected such a revolution in ship propulsion, turned his attention to the subject.

He invented a peculiar kind of valve consisting of a metal plate with very close narrow slits in it. These slits were closed by a kind of steel comb, the teeth of which overlaid the slits and closed them. If the comb was raised a little the slits became more or less open. Compressed air was supplied under the slotted plate, and its emission controlled by very slight movements of the metal comb, which last were actuated by the vibrations of some musical instrument or by a gramophone record. In this manner very powerful aerial vibrations were created by means of feebler sounds. This invention of Sir Charles Parsons was named an "Auxetophone," and it was exhibited to the Royal Society in London in 1904, and also at the Royal Institution. It was employed in 1906 to amplify the sounds of musical instruments, violins, double bass, 'cellos, etc., but its introduction was blocked or boycotted by the band-playing fraternity because they thought it would reduce the number of executants required in bands.

More recently, a similar type of instrument has been evolved by Mr. Gaydon and manufactured by Mr. Creed, of Croydon, the well-known inventor of telegraphic printing instruments. This last form of instrument has been called a stentorphone.

Messrs. Creed and Gaydon have now perfected a form of comb-valve which can be attached to the arm of a gramophone and actuated by any needle record. The valve is supplied with compressed air under a pressure of 10 lbs. on the square inch, furnished by a simple form of rotary pump driven by an electric motor of ½ horse power. The indentations on the record, acting through the needle, control the motions of the comb-valve (see Fig. 31), and this, again, controls the emission of the air (see Fig. 32). The instrument therefore gives a much greater volume of sound than the ordinary gramophone, and can be heard over very large halls or for great distances in the open air. The general appearance of the instrument with its air compressor is shown in Fig. 33. The electric motor can be driven off any electric light supply circuit.



Courtesy—P. J. Risden, Esq.

Fig. 31. The slotted plate and Comb Valve of a Creed Stentorphone similar to that previously invented by Sir Charles Parsons.

4. The Velocity of Sound Waves.

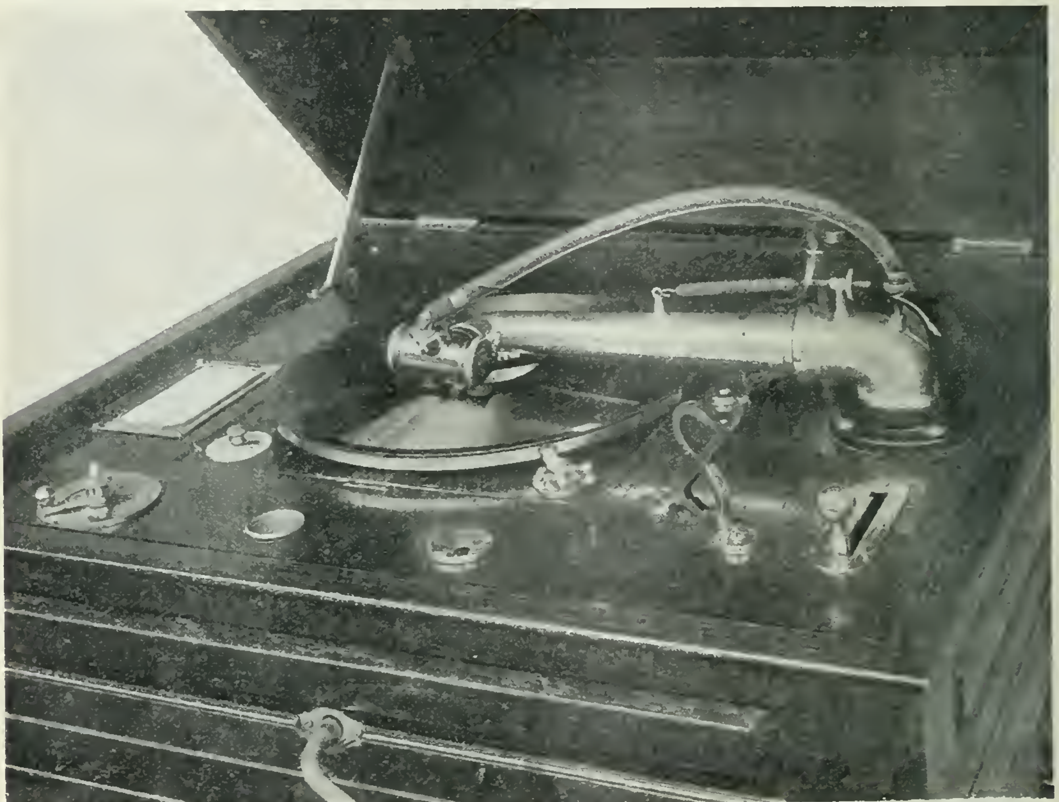
This discussion of aerial waves would probably be incomplete without some reference to methods of measuring their velocity, since these measurements have of late years received important practical applications in methods of sound-ranging for locating the position of a source of sound and in providing means for measuring the depth of the sea.

Very familiar experiences show us that a sound wave takes time to travel through the air. The delay in hearing the noise of thunder after seeing the lightning, or the explosion of a gun or rocket after seeing the flash or burst, shows that this is the case.

Modern methods of measuring extremely small intervals of time and of detecting feeble sounds have greatly increased the accuracy with which air wave velocity can be measured.

The following rather rough lecture experiment was devised by the writer for showing to a public audience that a sound wave takes a perceptible time to travel a distance of even a few feet.

If a sudden tap is given to the cover of this funnel by a little metal drumstick, it starts a wave of compression which runs along the zinc tube. On the rubber cover of the funnel was fixed a little metal disc, and matters were so arranged that the act of striking the tight rubber cover of the funnel, strained on it like a drumhead, closed an electric circuit, as well as started an air wave travelling down the zinc



Courtesy—P. J. Risden, Esq.

Fig. 32. The tone arm, valve, air delivery pipe, and Record on a Creed Stentorphone.

A couple of zinc tubes, each about $2\frac{1}{2}$ ins. in diameter and 15 feet long, were united by a bend at one end so as to make a U-shaped tube, 30 ft. long. One end of this tube was covered with a diaphragm of thin sheet india-rubber, put on like the cover of a pot of jam. The other end of the tube was stopped with a cork. Two tin funnels were provided, the wide ends of which were similarly covered with india-rubber sheet, and the spouts were inserted in holes in the long tubes, one near the cork-closed end and the other near the rubber-covered end.

tube. When that air wave reached the thin rubber cover at the far end of the tube it caused it to bulge out, and in so doing, to knock over a trigger and break or interrupt the electric circuit closed in the act of starting the wave. In this circuit was inserted an instrument called a milli-ampere meter, in which an indicating needle or index arm is moved through a certain angle by an electric current passing for a certain time. If, then, the air wave takes time to travel along the tube, a certain interval of time will elapse between the closing of the electric circuit by striking the funnel drum-head, and its interruption when the air wave so created reaches the far end and knocks over the trigger. From the deflection of the needle of the amperemeter, which then takes place, we can estimate the time taken for the air wave to travel 30 feet along the tube. From experiments made, it appears to be rather more than one thirty-fifth part of a second, which shows that an air wave travels at the rate of 1,100 feet per second.

velocity to be 334·4 metres per second, which is equal to 1,097 ft. per second.

It has been found, however, that very loud sounds certainly travel much faster in open air than sounds of moderate intensity.

It was pointed out as far back as 1808 by the French mathematician, Poisson, that the mathematical theory of the propagation of waves of large amplitude is entirely different from that which is valid when waves of small

Courtesy—P. J. Risden, Esq.

Fig. 33. View of a Creed Stentorphone Cabinet, and of the Electric motor driving the air compressor pump for supplying the compressed air.

amplitude are considered. In 1900, M. Vieille, Engineer-in-chief of the French Ordnance Bureau, showed that the velocity of the air wave produced by bursting open a thin metal disc by an air pressure of 400 lbs. on the square inch was nearly double that of ordinary sound, whilst the air waves produced by the detonation of high explosives was nearly three times the normal.

Much more exact experiments of this kind have been made and described recently by Messrs. Dixon, Campbell and Parker (see *Proceedings of the Royal Society*, London: Series A, Vol. 100, October, 1921, p. 1).

They have measured with great accuracy the velocity of compressional waves in various gases at different temperatures and in tubes made of several kinds of material.

In air at 10° Centigrade they found the

If the velocity of an air wave is known, and if the interval of time between its arrival at two places, the distance apart of which is known can be measured, then we can locate the direction of the source of sound. For suppose *A* and *B* (see Fig. 34) to be two places, the distance *A B* being known. If a sound wave sent out from some distant source arrives simultaneously at *A* and *B*, then we know that the source of sound must be somewhere in a line perpendicular to *A B*, and passing through the point half-way between them.

If the places *A* and *B* are, say, 1,100 ft. apart, and if we are dealing with ordinary not very loud sounds, and if the air wave arrives at *A* one second before it reaches *B*, then we know the source of sound must be on the line *A B* and in the direction *B A*, produced.

If the difference in times of arrival of the sound at *A* and at *B* is, say, half a second, then we can find the direction in which the sound is coming as follows. Draw to scale a line *A B* (see Fig. 34) and let this represent the distance travelled over by sound in one second. Describe as *A B* a semi-circle and find a point *C* on that curve, such that *A C* is equal to half *A B*. Then join *B C* and from the centre *O* of the semi-circle draw a line *O D* perpendicular to *B C*. Then if the sound is first heard at *B* and half a second after at *A*, the sound wave is coming in the direction *D O*. If then we have another pair of similar observing stations, we can determine another line of travel of the air wave and hence from the intersection

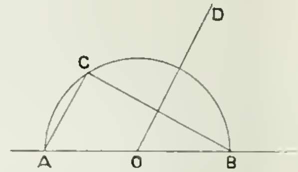


Fig. 34.

of these two lines the place of origin of the sound.

A somewhat similar method of operation called sound ranging was employed during the European War, 1914-18, for locating the position of enemy guns. Large corrections have, however, to be made for wind and other disturbing causes.

By an oversight, which is regretted, the author omitted to mention that the photographs of capillary ripples shown in Figs. 9, 10 and 13 were taken by Mr. J. H. Vincent and published by him in the *Philosophical Magazine* for June 1897, September 1898 and October 1899. Fig. 9 is erroneously stated to be shadows of capillary ripples on water. It is, in fact, a photograph of capillary ripples on a mercury surface published by Mr. Vincent in June 1897, taken by electric spark photography.

(To be continued.)

High-Frequency Amplification.

TUNED TRANSFORMER v. TUNED ANODE INTERVALVE COUPLING.

THE object of amplification is to magnify the feeble signals impressed on the aerial system so that they may be comfortably audible. For success, two conditions should be fulfilled : the characteristics of the signal itself ought not to be changed except in amplitude ; and only the signals which one desires to receive should be magnified.

Generally, for financial reasons, and for the reason that the experimenter wishes to secure results with the minimum amount of apparatus, the smallest number of valves consistent with the enjoyment of signals are used. This is precisely what should be, for the difficulties of distortionless amplification increase rapidly with the number of valves.

The detecting efficiency of a valve arranged to function properly as a rectifier varies roughly as the square of the signal strength, so that it is useless to apply very small signal voltages directly to the rectifier. High frequency voltage amplification must come before detection, and the arrangement of the apparatus associated with the valves which form the H.F. portion of the receiving gear requires careful design and handling, if good results are to be obtained.

Valves are essentially voltage operated devices, and it is necessary to maintain as high as possible the signal voltages on the grid in order that the strongest possible voltage changes will be produced in the anode side of the valve. Large potentials can more easily be produced across the input (grid-filament) circuit, the higher the grid filament impedance, and at the low wavelength upon which telephony is transmitted, great care must be taken to keep the capacity across the input circuit as small as possible. It is better to employ amplifying valves with low capacity, and stray capacity such as is caused by long leads, and self capacities in apparatus should be reduced to a minimum.

On account of capacity, the amplification which can be secured when a resistance is connected to the anode of the valve is small at these short wavelengths, and recourse is taken to either transformer coupling or to tuned anode capacity coupling.

To obtain the maximum voltage amplification which the physical structure of the valve permits, the impedance connected to its plate circuit must be very high, and as each of the two latter methods of coupling employ the principle of resonance, it may be thought that either could be used with equal advantage.

Such is not the case. On account of the transformer being tuned, it will have one sharp point of resonance with the signal, and as a telephonically modulated wave occupies a band of frequencies, (actually equal to the difference between $(f + p)$ and $(f - p)$ where f is the frequency of the " carrier " wave and p is the range of frequencies covered by the voltages set up when the microphone is disturbed by the voice), at least half of the modulated wave will not be amplified, and of the remainder, some will be amplified to a greater extent than others. Further, the secondary has still to deal with the energy.

Now, when a H.F. transformer is designed to work with a tuning condenser across the primary winding, the two windings are generally wound close together and the effect of a condenser with capacity C across the primary is to introduce an apparent capacity of $C \times \frac{1}{t^2}$ (where t^2 is the step-up ratio of the transformer) across the secondary winding. As the valve and accidental capacities across the secondary winding are added to the apparent capacity transferred from the primary, the turn ratio can only slightly exceed unity.

If, with great care, it is arranged that when the primary circuit is adjusted for resonance the secondary circuit is also in resonance, then the amplified signal which is impressed on the input of the second valve still resembles the signal energy which was applied to the input of the first valve, with the difference that only half the signal, that is either $(f + p)$ or $(f - p)$, is being used. The slight distortion which has occurred, due to the sharpness of resonance in the primary of the transformer connected in the anode of the first valve, can be partly corrected by slightly mistuning the primary of the H.F. transformer connected in the second anode circuit, so that the frequencies which before were over amplified, are this time a little under amplified. It is thus quite apparent that great care requires to be exercised both in the design and construction of the H.F. transformer if clear signals are to be obtained. As the ratio of the transformer is limited to the secondary possessing the same number of turns, or in any case only a few per cent. more turns than the primary, the great advantage of using a transformer has gone. The object of a transformer is to match impedances. For best efficiency, and to straighten out the characteristic curve of the valve to minimise distortion, the primary of the transformer was given a high impedance to secure the maximum amplification, and theoretically the secondary should be wound so that the greatest voltage step-up takes place, or in other words, as the input impedance of the second valve is of the order of a megohm, the impedance of the secondary of the H.F. transformer should be of the same order. This cannot be done, and the transformer has practically a turn ratio of one to one.

Considering now the second arrangement, that is the tuned anode, it can be seen that the anode coil is equivalent to a one-to-one transformer, and theoretically each will produce identical signal voltage strength across the input of the next valve.

The anode coil, however, is quite simple to construct—there is no secondary which requires making, having similar resonance properties to its primary—and it is not surprising, therefore, that in practice the tuned anode arrangement in the hands of average experimenters will give results far superior to any other.

The remarks as to mistuning slightly apply here also.

When care is taken to keep the impedance of the input circuit high, and the anode circuit also includes a high impedance, oscillations are easily set up. It is therefore usual to connect the grid of the H.F. valves through the leak resistance to the + L.T.

It is better when tuning, to choose the lower value of capacity which produces resonance.

W.J.

Experimental Station Design.

(*Continued from page* 54, *October* 14*th*, 1922.)

XV.—THE LAY-OUT OF AN EXPERIMENTAL RECEIVING SET.

THERE are many considerations when designing a receiver for experimental purposes, such as wavelength range, tuning arrangements, number of valves, valve control, method of amplifying, and mode of introducing reaction. In most cases it is not sufficient to make up a set comprising a definite circuit arrangement, as it is the aim of the experimenter to vary his circuit according to the nature of the reception and also to gain a knowledge of the merits of the many systems of tuning and amplifying.

A reference to the "Questions and Answers" pages of this journal indicates how popular has become the switching of valves in and out of circuit, so that the desired degree of amplification can be obtained. This has been embodied in the receiving system under description, together with switches for a variety of other purposes, including aerial to earth or instruments, additional series condenser in aerial circuit to broaden tuning on aerial tuning condenser, connecting of aerial tuning condenser in series or parallel with aerial tuning inductance, reception on aerial or tuned closed circuit, reaction coil coupled to closed circuit, or high frequency amplifying valve plate circuit; high and low frequency amplifiers in or out of circuit; also for providing for resistance, tuned anode or transformer high frequency intervalve coupling. The operation of the switches is clearly indicated in the diagram (Fig. 1), which is reproduced on a large scale for easy reference. It is a good plan to place a piece of glass on the experimenting table with the diagram beneath it, as it is then handy for reference without turning aside while receiving.

A suggested lay-out of the instruments is shown in Fig. 2. The apparatus below the dotted line is secured to the table whilst that above is fixed either to the wall or to a board standing vertically along the back.

The large number of leads somewhat complicates the appearance of the equipment, but if joints are carefully soldered and wrapped with adhesive insulating tape, they need not be taken back to screws as branching points. Consequently the length of many leads will be considerably shortened. The wire used for connecting up should be of fairly heavy gauge and well insulated in order that the connections may be mechanically strong and of low resistance. Single No. 18 wire, rubber-covered and braided, makes a good job and can be held down by means of small wooden cleats. Particular attention must be given to the leads forming parts of the valve grid circuits, in order to ensure perfect insulation and a minimum of capacity to other parts of the circuit, so as not to reduce the grid potential fluctuations. If the connections are made underneath the table and behind the board supporting the switches they may be run by the shortest paths, so as to cause them to cross each other from various angles instead of lying parallel and spaced as is necessary for good appearance when the leads are in view. The coils shown are of the interchangeable plug-in type in order to cover the desired wavelength range. For rapid tuning on short wavelengths where critical adjustment will become necessary, it is convenient to have a set of five coils, all adjusted to have identical values, for insertion in the secondary, reaction and H.F. transformer circuits, so that the tuning condensers which bridge these coils will have roughly similar settings. The reaction switch may of course be dispensed with, and the leads shown on its upper and lower terminals paralleled across, the transference of reaction coupling from transformer to aerial circuit being effected by moving the coil across from one holder to the other.

As explained in an earlier article, the purpose of coupling the reaction coil to the grid circuit of the second valve is in order to reduce to a minimum the chances of an oscillator valve energising the aerial. Since the publication of that article the Postmaster-General has expressed his approval of its use, though it has been recently stated in some quarters that this method does not achieve its object. It may be pointed out that when oscillations are set up in the plate circuit of the first valve, the only way in which they can energise the aerial circuit is by grid current, which by the author's investigation has been found usually to be so small that it is doubtful if the amplitude of the oscillations which can be set up in the

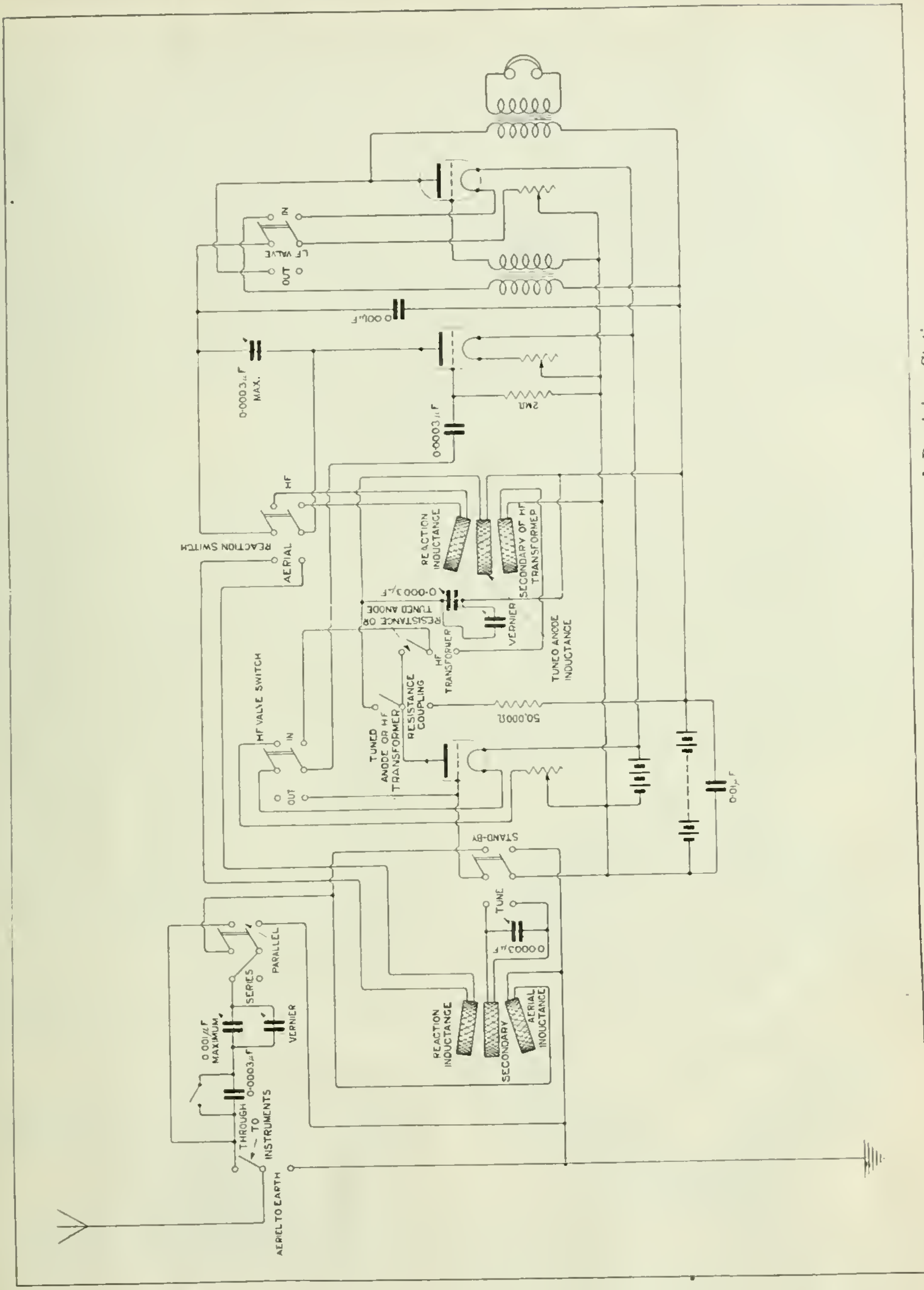


Fig. 1. Circuit Diagram of Three-valve Experimental Receiving Station.

closed circuit coil, exceed those produced in the aerial inductance by a transmitting station giving a moderate signal strength.

As a rule it is not necessary to couple the plate circuit of the second valve with its grid circuit in order to obtain the advantages of reaction, for when using the tuned anode arrangement the impedance across the electrodes of the first valve is sufficient to set up oscillations, and particularly is this the case with the "R" type valve when the filament is not at maximum brightness. When oscillating, the adjustment of the condenser across the tuned anode coil is very critical and its setting varies in unison with the closed circuit.

Modifications can easily be made to simplify the outfit or to install and operate one valve circuit at a time. The detector valve will, of course, be fitted first, together with the switches necessary for connecting it through to the aerial and telephone circuits. The low frequency amplifier presents no difficulty and can be added as soon as the necessary components are available. The high frequency amplifier can be installed, making use at first only of the tuned anode coil, which is probably the most efficient system of high frequency amplification.

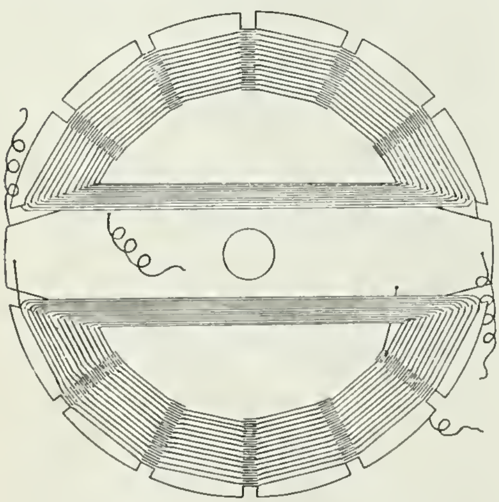
Much could be written on the manipulation of the set, but a little experience such as can be obtained by a few hours' experimenting and a knowledge of the purpose of each component will be found more helpful.

F.H.H.

A Simple Variometer.

BASKET inductances wound on thin card* are now in general use, and by arranging to slide one over another can be made to serve as a variometer or variable coupling. A sliding motion does not lend itself to easy mounting or construction, and it is necessary to either turn one coil over or reverse the connections in order to obtain a large change in the inductive value.

Two coils wound to the design shown below and mounted one over the other, make a wide range variometer with a revolving movement for adjustment. The diagram is about two-thirds full size for building a variometer for use on short wavelengths. In modifying

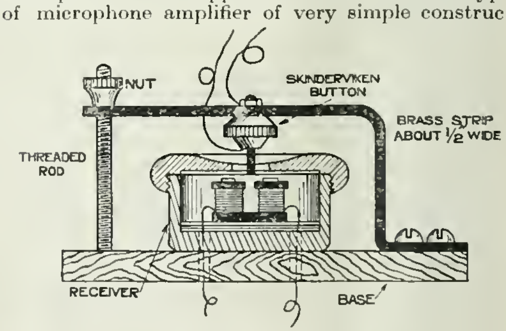


the design the reader must bear in mind that the slots must not be made so deep as to weaken the sections, and also of course each half must consist of an odd number of slots. The most convenient method of mounting is to hold one former down to the base of the instrument box or to a platform attached to the top, by means of a square piece of ebonite 1/32 in. to 1/16 in. in thickness, while the other is carried between two nuts and washers on the end of a spindle operated from the top. A hole is made in the centre of the ebonite holding down piece to give clearance to the nut which clamps the revolving inductance to the spindle. The moving inductance may practically rub on the surface of the ebonite. A condenser scale and knob can be attached to the spindle for operating the variometer and indicating the setting.

* Described on p. 328, June 10, 1922.

The Skinderviken Button.

The accompanying sketch shows a suggested use for a Skinderviken button or other form of microphone. The apparatus forms a useful type of microphone amplifier of very simple construction. The rod with the nut should carry a fine thread to allow of critical adjustment.



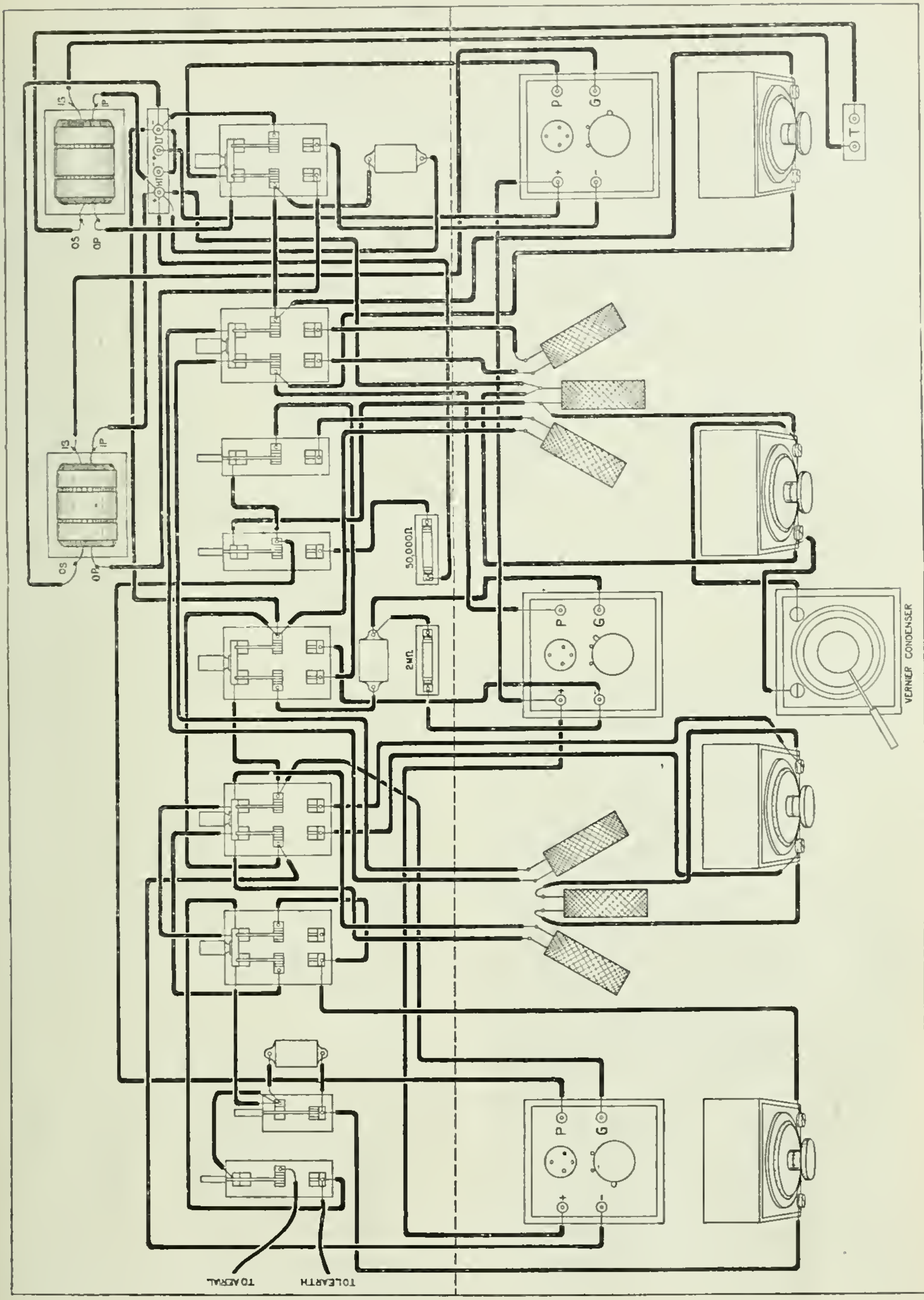


Fig. 2. The lay-out of the Apparatus of a Three-valve Receiving Set.

Wireless and International Language.

By Bernard Long, B.A.

WIRELESS science and practice, like other branches of technology, are absolutely international, and (on the practical side, especially) the common use of an "auxiliary" language would be of great advantage. One such language, if it can be so called, has indeed already been introduced, viz., the international code, by which a three letter combination, such as the well-known "SOS," has a definite meaning to every wireless operator at sea, no matter what his nationality. It is quite possible to carry on a sort of conversation, up to a point, in this code, just as is the case with marine flag signals. But such codes are very limited in scope, and in order to cater for all kinds of verbal intercourse, whether telephonic or telegraphic, a complete language is clearly necessary. Such a language, if widely adopted, would also have the advantage of simplifying international relations between wireless experts, enabling them to advance their science by freer and more effective co-operation.

The question is of great interest in connection with the extension of "broadcasting." In the case of music, which is already international, there is nothing to trouble about, but it is different with verbal transmission, as the effective range of a powerful transmitter may often cover many different countries, whereas the words transmitted are only comprehensible to a certain portion of the possible receivers. If, for example, a message is sent in French from the Eiffel Tower, it is of no use to people who do not understand French, and the time spent in sending it is wasted so far as they are concerned. But if all important news of interest outside France were transmitted in a language common to all nations and widely understood, it would reach a much larger public outside France than if sent in French.

In this connection Dr. Pierre Corret, editor of the French wireless journal, *La T.S.F. Moderne*, contributed a letter to *The Wireless World and Radio Review* of April 1st last, in which he pointed out the suitability of the well-known international language, Esperanto, for use in the manner suggested. Dr. Corret pertinently asked, what would be the use of either French or British wireless amateurs receiving messages across the Channel if they could not understand them? As wireless "broadcasting" spreads, this difficulty will become more and more widely felt, and though it is not necessary to suggest that only Esperanto should be used, it would obviously be a great advantage if amateurs were to study the language in large numbers and then ask the transmitting stations to use it at certain stated times. Messages in the international tongue would reach with equal efficacy persons in every country within range; and news, in particular, could be very suitably transmitted in this way. Information sent out in Esperanto for the use of newspapers and news agencies could, moreover, be reproduced after translation, with a maximum of accuracy, since the language is extremely logical, clear and expressive, and misunderstandings (even if an abbreviated style became common in such cases) would be extremely rare.

Again, when it becomes possible to converse freely by wireless, what will be more fascinating than for English and French amateurs to compare notes and news, and strike up friendships even if not able to meet each other? At present an Englishman may often understand French without being able to speak it (and more often read it but not understand it when spoken), and unless, therefore, the French amateur could understand English, the conversation would be rather one-sided!

Esperanto, however, can soon be mastered by both Frenchmen and Englishmen, who, in conversation on actual meeting (such as often occurs), have not the slightest difficulty in talking together freely and easily, as though they had a common mother tongue. And what is possible between French and English is equally possible between any two nationalities.

These are not mere assertions, but facts proved again and again in the Esperanto movement. They are commonplaces of daily life to those who use the international language whether for business, technical or professional matters or for ordinary social intercourse; and Dr. Corret, as a wireless expert and also an accomplished speaker and writer of Esperanto, is in the best possible position to understand the significance of these two branches of human invention and the useful way in which they can be brought together. As already indicated, its simplicity and expressiveness make Esperanto pre-eminently suitable for use in wireless work, and readers of this article who take it up will soon find out the reason. Who knows but that in the future, when a great orator, scientist, or other man of note has anything to say to the world, he will simply "wireless" it in sonorous Esperanto from Paris or some other suitable centre and be heard not only in every newspaper office within range, but by thousands of delighted amateurs as well? If the study of Esperanto spreads as the perfecting of wireless methods advances, there will be nothing to prevent this and many other fascinating developments from taking place. The demand will be the surest guarantee of the supply of news in the international tongue; but, in the meantime, let no amateur be surprised if at any time he receives (in Morse perhaps in the first instance) messages in what may seem to be a language something like Spanish but which will prove to be Esperanto.

Wireless in a Coal Mine.

By 2 ZD.

A SHORT time ago a party of five amateurs, including the writer, had the privilege of carrying out tests in wireless transmission and reception at Baggeridge Colliery, near Dudley, Staffs. The colliery officials offered us every facility above and below ground, and some very encouraging results were obtained.

On arriving at the colliery our first job was the erection of a single wire 100 ft. aerial, slung from the super-structure over the mine shaft, approximately 80 ft. high, to a railway bridge where it was only 4 ft. high. The earth lead was attached to the railway lines and proved a very efficient earth. A two-valve portable receiving set (1 rectifier, 1 L.F.) was connected up, and signals were received from continental stations, and on short waves 2 LO was clearly received. The next step was to test the transmitter; this, by the way, was an ordinary single valve, the usual plate and grid coils. H.T. 180 volts, filament 6 volts, current on plate 9 mA., radiation 0·16 amps. One of our objects was to establish communication from underground to the surface, and as the shaft was very deep (665 yards), we were rather uncertain about success with such limited power. To avoid probably hours of vain efforts, we decided to rig up an aerial in the cage and try to keep in touch with the receiver all the way down to the bottom of the shaft. Our cage aerial consisted of 40 ft. of ordinary lighting cable wound round the end beams of the cage from end to end, and an earth was effected by one member of the cage party holding the wire in contact with a ridge on the cage bottom. Complaints of "foot-ache" were incessant. The transmitting gear was installed in boxes on the floor of the cage, and signals transmitted which were received on the surface receiver, but were very unsteady and somewhat hard to read. We were lowered very slowly (transmitting all the time), and stopped about every 200 yards for reports from above. Our C.W. became very much steadier, and signals increased in strength and reached a maximum when we were three-quarters of the way down. They then decreased in strength rapidly, and finally ceased altogether when we reached the bottom.

Experimenters at the Baggeridge Colliery.

The reader can imagine the surprise we felt at these results, for we considered that putting a transmitter, aerial, etc., inside a steel box (the cage), the signals would be completely screened and would not get outside with sufficient strength to be picked up. By this time we had internal notification that it was tea-time, and we came up to the surface with that object in view. The speed of the cage was vastly different to the downward journey, roughly 96 miles per hour!

After tea we went down again and carried the transmitting gear some distance from the bottom of the shaft, and rigged up the same aerial that we used in the cage, but this time in a single length suspended mid-way between the roof and floor of the working. Our "earth" was effected by burying a coil of bare wire in a patch of very wet mud, which proved quite efficient. The transmitter appeared to be working correctly, but the plate current rose from 9 mA to 12 mA, H.T. the same—180 volts, and our aerial ammeter showed 0·18 amps. However, reports from the surface told us that they could not hear us. The aerial was then coiled up in a similar way to what it was in the cage. Again no results, so the only thing to do was to add to it, and we lengthened it to 92 ft. (single wire). The reports from the surface were most enthusiastic, and reported signals audible 6 ft. from the phones, and would we try telephony! Here I must add that the atmosphere being somewhat damp, and plenty of carbon in the air, our transmitter started giving us shocks, no matter what portion was touched, even the accumulator cases; an unpleasant shock resulted, and frequently one heard gasps and other things as an unwary hand came in contact with some part of the gear. However, we tried speech with very little success, only the words "Hello," and "2 ZD," being understandable. But with only 2·16 watts power, and nearly 700 yards of solid earth, etc., to penetrate, we considered the results very encouraging. At a future date we hope to continue our experiments with higher power, and if our measure of success increases with the power, we hope to achieve greater things than at our first attempt.

Broadcasting an Appeal for St. Dunstan's.

THE first practical application of the possibilities of radio-telephony for the broadcasting of a charitable appeal was made on the evening of Wednesday, the 18th instant, from Marconi House, when Captain Ian Fraser, the blinded Officer-Chairman of St. Dunstan's, who is one of the most capable wireless amateurs in this country, made an eloquent appeal for continued support for St. Dunstan's work for the 2,000 war-blinded men of the Empire's forces. In the course of his speech, Captain Fraser said that in his view the most interesting speculation about Radio-telephony was, whether or not it will have a great influence upon the power which an individual orator would be able to exercise by the employment of its resources in a densely populated country like England. He said that he was himself experiencing a sensation the novelty of which only a blind man could perhaps appreciate fully, for although it had been his lot to speak to many audiences, both large and small, which he could not see, yet this was the first occasion on which one important condition had been missing—the indefinable sympathy with the audience actually before him, upon which any successful speaker must be so reliant. Proceeding to voice the needs of St. Dunstan's organisation, Captain Fraser pointed out that during the last eighteen months St. Dunstan's resources, the income from which it had been hoped would stand in good stead for the lifetime of the 2,000 men who had been trained and established, had been sadly depleted. In the last six months alone, St. Dunstan's income was less than its essential expenditure by over £17,000. Captain Fraser concluded with a moving appeal to the sympathy of his great and widespread audience. "Imagine" he said, "if destiny had placed upon you the necessity of listening to all the sounds of a world you could not see for every minute of your waking hours, and ask yourself if this would not be an awful prospect. And yet it is the lot of 2,000 men who, had there been no war, would be able to conduct their lives as you conduct yours."

Broadcasting "A Matter of Days"

AGREEMENT ON THE FORMATION OF THE BROADCASTING COMPANY.

BROADCASTING in the London area, if the date has not already been announced when these lines appear, will, at all events, be within a few days of realisation.

The Committee appointed to arrange for the formation of the British Broadcasting Company made its report to the manufacturers at a meeting held at the Institution of Electrical Engineers on Wednesday, October 18th. After a somewhat protracted meeting, during which many questions were raised and replied to, the meeting concluded by unanimously agreeing to the proposal that the Company should be registered forthwith.

It was authoritatively stated that the Postmaster General would not delay in any way the granting of the license to commence broadcasting, which would be the next step after the Company had been registered.

The meeting was presided over by Sir William Noble, formerly Chief Engineer to the General Post Office.

Sir William Noble, in reporting on the present position, said that complete agreement had now been reached.

A meeting held at the General Post Office on May 18th last, was attended by representatives of 23 firms, all anxious to conduct broadcasting. Obviously it was impossible for that number of stations to be put up, and accordingly these representatives were invited to endeavour to come to some agreement for combination in a single company. After a good many communications between the parties and the authorities, the Articles of Association for the formation of one Company had been agreed upon. There would be an independent chairman, the first being Lord Gainford, a former Postmaster General.

It is intended that the broadcasting in the London area shall be conducted, at any rate temporarily, from Marconi House, and at an early date it is expected a temporary station will also be ready in Manchester. The provision of stations in the six other localities—Birmingham, Newcastle, Plymouth, Glasgow, Aberdeen and Cardiff—will receive immediate attention.

Notes

Lectures for Amateurs.

A series of lectures are being arranged to be given for the special benefit of amateurs at the London Telegraph Training College, 262, Earl's Court Road, S.W.5. These lectures will be given by Mr. Maurice Child and will be illustrated as far as possible by practical demonstrations. Full particulars of those lectures can be obtained from the Secretary of the College.

Lost Wireless Apparatus.

The owner of wireless apparatus dropped from a van passing through Wembley towards London on Monday, October 16th, at 11.30 a.m., may recover same through application to this Journal.

Theft of Material to make Sets.

In order to make wireless sets, a quantity of telephone and electrical apparatus was stolen by youths from the Furness Railway signal and store cabins. Prisoners pleaded guilty at Lancaster Quarter Sessions.

The Use of the Word "Broadcasted."

Captain F. Loring points out that he has been reported as having taken exception to the word "Broadcaster," whereas "Broadcasted" was the word to which he referred. He mentions that one does not speak of a horse as having "casted" a shoe, and similarly the use of the word "Broadcasted" is not correct. The error in reporting Captain Loring appeared on page 63 of our issue of October 14th, 1922.

Amersham Concert Reception.

A lecture was held at the Sycamore Hall, Amersham-on-the-Hill, Bucks, on Wednesday, October 18th.

The lecturer, Mr. O. J. Carpenter, was lent by the Marconi Scientific Instrument Company.

The chair was taken at 8 p.m., and the concert from 8.30 p.m. to 9 p.m., came through very satisfactorily, despite some "atmospheric" interference.

The hall was full to overflowing, and large numbers had to be turned away from the door.

A collection made in aid of St. Dunstan's realised £7, more than twice the previous record for similar collections at Sycamore Hall.

Licences for Military Applicants.

An official statement has been issued to the effect that officers and other ranks of the Regular Army, Militia, Territorial Army, or Officers' Training Corps, who wish to instal private wireless sets for sending or receiving messages are subject in all respects to the Postmaster General's regulations governing the installation and working of such sets. They should apply in their private capacities for licences to the Secretary, General Post Office, London, E.C., who will treat their applications on the same lines as those received from members of the public generally. The War Office accepts no responsibility for wireless sets other than those held on the authorised establishment of units.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—As several articles and remarks have appeared from time to time concerning the advantages, and otherwise, of a frame aerial, I thought perhaps my experiences with one would interest some of your readers.

The frame is of the Maltese cross type, and the maximum height and width is 6 feet.

Twelve common or garden tin-tacks are knocked into each point half-an-inch apart, and the wire (D.C.C. No. 30) is wound round these.

Tappings are taken from the third, eighth and twelfth turns, this giving me the following ranges—300-500, 500-900, 800-1700. This with a 0.0005 A.T.C.

My set is a three-valve, with the first valve H.F. reactance-capacity coupled; with one rectifier and one L.F. with switch for the L.F.

Now for results. As I am putting this down I am listening to the *Daily Mail* concert from The Hague. Of course, it is not loud, but it is sufficiently so to hear the tunes, although the speech cannot be understood.

Last Sunday evening (24th) when atmospherics were so bad that speech from **2IF**, **2VD** and **2ON** was at times completely drowned out, these stations were picked up on the frame and their speech *read*.

Jamming from Boulogne **FFB** was entirely eliminated.

Lympne and Croydon, as well as the French aerodromes, come in very well, as also do the machines.

North Foreland, Boulogne and various ships are quite audible through the loud speaker.

I think the above results are sufficiently good to show that the frame aerial is not so bad as it is painted.

Kent. W. E. Philpott.

INCREASE OF CAPITAL FOR MARCONI COMPANY.

At an Extraordinary General Meeting of Marconi's Wireless Telegraph Company, Ltd., held on Friday, October 20th, a resolution was passed providing for the creation of 1,000,000 new ordinary shares and granting the board extended borrowing powers. Senatore Marconi explained that the two objects for which the additional capital was needed are the development of the Company's wireless telegraph services, including the erection of new important wireless stations abroad in co-operation with German, American and French wireless interests, and the new broadcasting business. The directors estimate that the latter will keep a sum of approximately £700,000 or £800,000 more or less continuously employed for some time to come. The intention is to issue immediately £1,500,000 of Debenture stock—one-half of the total amount of new Debenture stock to be created—the stock now to be issued having the right of conversion into ordinary shares at the rate of £3 of debenture stock for one ordinary share up to 1929.

THE VALVE PATENT ACTION

Judgment by Mr. Justice P. O. Lawrence.

JUDGMENT was delivered on Thursday, October 19th, in the action brought by Marconi's Wireless Telegraph Company, Limited, against the Mullard Radio Valve Company, Limited.

In this action Marconi's Wireless Telegraph Company, Limited, as the plaintiff company, claimed an injunction to restrain the defendant company from infringing the letters patent numbered 28,413, of 1913, and 126,658, and for the delivery up of the articles or apparatus made in infringement of such letters patent and damages.

The plaintiff company are the registered owners of the letters patent numbered 28,413, of 1913, granted to the company and Henry Joseph Round for an invention of "improvements in receivers for use in wireless telegraphy," and of letters patent granted to Michel Péri and Jaques Biguet for an invention of "improvements in or relating to vacuum tubes of the audion type." They pleaded that the letters patent were valid and subsisting, and they complained of infringements, and in particular of the sale by the defendant company on or about July 8th, 1921, of "two R valves" constructed in accordance with the inventions described in the complete specification of the letters patent of 1913, and in all the claiming clauses of the complete specification of the letters patent numbered 126,658.

The defendant company by their defence alleged that they had not infringed the two letters patent. They admitted that they sold and manufactured considerable numbers of thermionic valves, but they alleged that in part such sale and manufacture was by them as agents or contractors for his Majesty's Government, and in particular the Admiralty, on written authorisation in that behalf, and they denied that such valves constituted an infringement of either of the letters patent. The defendants also alleged that the letters patent were and had been at all material times invalid.

Mr. J. Hunter Gray, K.C., Mr. James Whitehead, and Mr. Trevor Watson appeared on behalf of the plaintiffs; Sir Duncan Kerly, K.C., Mr. R. Moritz, and Mr. Courtney Terrell appeared for the defendants.

Mr. Justice P. O. Lawrence, after an examination and description of the defendant company's invention and the two letters patent owned by the plaintiff company, came to the conclusion that the Mullard valve did not constitute an infringement of either of those letters patent. His Lordship decided that the attack made by the defendant company on the validity of the plaintiff company's two letters patent failed. He said that the action failed, and must be dismissed. On the question of costs his Lordship said that he would desire to hear the arguments of counsel when they had had time to consider their position.

"Chad" Batteries.

Particulars of "Chad" batteries, for use in supplying the anode circuit of thermionic valves for reception purpose, may be obtained from Messrs. Fuller's United Electric Works, Ltd., Chadwell Heath, E. A new list of batteries has been issued.

Calendar of Current Events

Friday, October 27th.

WAKEFIELD AND DISTRICT WIRELESS SOCIETY. Lecture on "The Relation of Inductance and Capacity to Electro Magnet Waves in Receiving and Transmitting Circuits," by Mr. Watson.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "The Detector and L.F. Panel," by Mr. S. Burman. Lecture on "Graphs and their Application," by Mr. T. E. Morriss.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY. At 8 p.m. Demonstration of "Britwire" Apparatus, by Mr. H. F. Yardley, A.M.I.R.E.

RADIO SOCIETY OF HIGHGATE.

At 7.45 p.m. At the 1919 Club, South Grove, Highgate, N.6. Lecture by Mr. Grimstead.

Saturday, October 28th.

WORKING MEN'S WIRELESS CLUB.

At Crowndale Road, N.W.1. Exhibition and demonstration at 1 p.m., also exhibition of X-ray apparatus.

Monday, October 30th.

FINCHLEY AND DISTRICT WIRELESS SOCIETY. Social Evening.

IPSWICH AND DISTRICT WIRELESS SOCIETY. At 8 p.m., at 55, Fonnereau Road, Lecture on "Accumulators—Their Care and Use," by Mr. F. Boddey.

NORTH LONDON WIRELESS ASSOCIATION.

Lecture on "Short Wave Aircraft Sets (Transmission and Reception)," by Mr. A. J. Reading.

Tuesday, October 31st.

Transmissions of Telephony at 8 p.m. on 400 metres by 2 MT. Writtle.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY. Lecture on "Wireless Reception," by Mr. G. H. Lock.

Wednesday, November 1st.

EDINBURGH AND DISTRICT RADIO SOCIETY. At 8 p.m. Business Meeting.

LUTON WIRELESS SOCIETY.

At 8 p.m. At Hitchin Road Boys' School. Lecture on "H.F. Coupling and Transformers," by Mr. C. S. Dunham.

Thursday, November 2nd.

DERBY WIRELESS SOCIETY.

At 7.30 p.m. At The Court, Alvaston. Informal Meeting.

Friday, November 3rd.

Transmission of speech and concert from Bristol to the Finchley and District Wireless Society (probably *via* Marconi House).

RADIO SOCIETY OF HIGHGATE.

At 7.45 p.m., at the 1919 Club, South Grove, Highgate, N.6. Lecture on "Construction of H.F. Amplifiers," by Mr. G. W. Sutton, B.Sc.

BRADFORD WIRELESS SOCIETY.

At 5, Rendallwell Street, Bradford. Debate on "The Prevention of Self-Oscillation."

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "The Thermionic Valve," by Mr. S. G. Meadows.

Saturday, November 4th.

GLASGOW AND DISTRICT RADIO CLUB.

From 12 to 9 o'clock. At the McLellan Galleries Hall, Sauchiehall Street. Exhibition and Demonstration.

Monday, November 6th.

NORTH LONDON WIRELESS ASSOCIATION.

Lecture on "The Elementary Principles of Radio Telegraphy and Telephony, II," by Mr. F. S. Angel.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road, lecture on "High Frequency Currents," by Mr. E. Mould.

Tuesday, November 7th.

Telephony by 2 MT Writtle, as above.

THAMES VALLEY RADIO AND PHYSICAL ASSOCIATION.

Presidential address and lecture by the President.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.

At Plymouth Chambers, lecture on "High Frequency Amplification," by Mr. L. J. Voss.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.

Lecture on "Simple Telephony Transmitters," by Mr. H. C. Trent.

EDINBURGH AND DISTRICT RADIO SOCIETY.

At 8 p.m. Lecture on "Wireless Communication," by Col. Crawley.

Wednesday, November 8th.

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION).

At 6 p.m. At Victoria Embankment. Lecture on "The Effect of Local Conditions on Radio Direction-Finding Installations," by Mr. R. L. Smith-Rose, M.Sc., and Mr. R. H. Barfield, B.Sc.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.

At Station Road, Redhill. Lecture on "Tuning."

Thursday, November 9th.

HOUNSLOW AND DISTRICT WIRELESS SOCIETY. At Council House, Treaty Road, Hounslow. Lecture on "Wireless for the Beginner," by Mr. S. H. Nayler.

HACKNEY AND DISTRICT RADIO SOCIETY.

Special General Meeting to discuss reorganisation of membership, subscriptions, etc.

LUTON WIRELESS SOCIETY.

At 8 p.m. At Hitchin Road Boys' School. Practical work and experiments.

DERBY WIRELESS CLUB.

At 7.30 p.m. At The Court, Alvaston. Lecture on "Protection of Overhead Lines from Atmospherics," by Mr. S. J. R. Allwood.

Friday, November 10th.

HECKMONDWIKE AND DISTRICT WIRELESS SOCIETY. At 7.30 p.m. Exhibition and Demonstration. Opening by Mr. C. W. Leather, Cleckheaton.

RADIO SOCIETY OF HIGHGATE.

At 7.45 p.m. At the 1919 Club, South Grove. Informal meeting.

Saturday, November 11th.

HECKMONDWIKE AND DISTRICT WIRELESS SOCIETY. At 3 p.m. Exhibition and Demonstration. Opening by Lieut. H. W. Burbury, R.N., Crigglestone.

LIVERPOOL WIRELESS SOCIETY.

First meeting of Winter Session at Royal Institution. Address by Prof. E. W. Marchant.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

The first instructional meeting of the session, 1922-23, was held on October 6th, at the Society's new headquarters, The Grammar School, Leeds. At 8 p.m. Mr. G. P. Kendall, B.Sc. (Vice-President) commenced a lecture entitled "The Elementary Principles of Tuning," which (as all subsequent lectures at instructional meetings) was specially arranged to meet the needs of the section of the membership having only elementary knowledge of radio matters. Mr. Kendall thoroughly examined his subject, his very clear and concise remarks being greatly appreciated by a large audience.

The first general meeting of the new session was held at the headquarters on October 13th, proceedings commencing at 8 p.m., being the occasion of the Presidential address. The President (Mr. A. M. Bage), after passing a few introductory remarks, called upon the Hon. Secretary to discharge certain business, which included election of five new members. The President then called upon the Hon. Treasurer, who announced that the annual subscription (7s. 6d. or 5s., according to age) was now due.

The President then announced that as a result of a Committee and Sub-Committee meeting, it was proposed to impose a levy on the membership, in order to be enabled to commence the installation of an experimental wireless station. As the Committee wished to have the opinion of the Society on such a proposition, the matter was decided to be put to the vote, with the result that a practically unanimous vote supported the Committee's proposal. Preliminary announcements of the annual social were given, it being resolved by a show of hands to hold a dinner, etc., on December 22nd, 1922.

The President then called upon Mr. J. O'Donohoe to make the presentation to the Hon. Secretary of a pair of Brown's telephones, suitably inscribed, in recognition of greatly appreciated services during the last session. The Hon. Secretary expressed great pleasure in accepting the gift, heartily thanking the Society for their splendid and most acceptable mark of appreciation.

The President then delivered the Presidential address entitled "The Reinartz Tuner." Amongst the many advantages claimed for this short wave tuning device of American origin, are: that the arrangement will oscillate readily at whatever wavelength the grid circuit is tuned to; there is no necessity for continual variation of coupling, and the aerial-earth circuit may function aperiodically; the tuner may be set oscillating, or to regenerate without oscillation, tuning being effected by the grid circuit condenser only. One turn in reaction coil is sufficient to maintain oscillation as high as 600 metres wavelength. Interference is reduced at slight expense of signal strength; atmospheric disturbances are reduced, and there is no noticeable effect of "dead end" or capacity phenomena. The President explained how the above claims are justified, and remarked that the Reinartz tuner was excellent for strong signals, either Morse or telephony, but of very little use on weaker signals. In its present state the tuner is not likely to take the place of existing circuit arrangements, in spite of the fact that it is extraordinarily simple to operate and cheaper to construct. The President exhibited his Reinartz tuner, using a single valve as rectifier, the whole outfit having been put together in his workshop. The tuner was demonstrated on an aerial and many practical details explained.

The discussion which followed was both keen and prolonged, some exceptionally knotty points being submitted for analysis, to which the President ably replied.

A hearty vote of thanks was proposed and carried amidst loud applause. The President replied to the ovation, and declared Mr. T. Brown Thomson, Chairman at the next general meeting.

The meeting then adjourned.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

On October 13th there was a large gathering and several new members were enrolled, including two ladies. After the preliminary business was disposed of, Mr. Houston opened a discussion on the various forms of amplification and the screening of transformers, and Mr. Houston promised to have a set at the next meeting with a new type of screening arrangements. Another discussion was started on accumulators and Mr. Calver gave a short explanation of the various ways the plates are now made. Mr. V. Craster mentioned a method they have in America of exchanging a fully charged element for a discharged one to obviate the waiting for accumulators to be recharged.

On October 7th Mr. E. Barker, at headquarters, produced the Prince's speech on a Brown loud speaker to a party of boy scouts.

Major K. Field, of West Kensington, also entertained a large number of scouts with the speech and the Marconi concert after.

The Society being now affiliated to the Wireless Society of London, it is to be hoped that those interested in wireless in the district will join and participate in the additional advantages gained by the affiliation.

Ramsgate, Broadstairs and District Wireless Society.*

Joint Hon. Secretaries, Mr. F. Harrison, "Rochester Cottage," St. Lawrence (Ramsgate), and Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs (Broadstairs and District).

The inaugural meeting was held at headquarters, 22, Princes Street, Ramsgate, on September 28th. Two of the Vice-Presidents attended, Sir Edward Rigg, C.B., C.V.O., I.S.O., and Sir Cecil Hertslet, K.B.E., J.P. Both expressed their great pleasure at being present at the first meeting of the Society, and that they were keenly interested in its future welfare. Mr. C. E. Hume (engineer and manager of the Ramsgate and District Electric Supply Co., Ltd.) has been appointed Treasurer of the Society, and the London Joint City and Midland Bank, Ramsgate, the bankers of the Society. A number of new members were enrolled at the termination of the meeting.

The second weekly meeting of this Society was held at headquarters, No. 22, Princes Street, Ramsgate, on October 5th, when the first lecture was given by Mr. P. F. Cotton, a member of the Committee, on "The Aerial and its Construction." A most pleasing feature of the lecture was the absence of technical expressions that are so puzzling to the beginner, and the interest of all those present was apparent by the number of questions asked. The lecturer traced the construction step by step, and the whole lecture was most enjoyable. A hearty vote of thanks was accorded to the lecturer. The third weekly meeting was held on October 12th when Mr. C. E. Hume gave a very instructive lecture on "Electric and Magnetic Fields," which was followed with keen interest, and the subject was discussed by the members and many questions were put to the lecturer, who was accorded a hearty vote of thanks. At the general request of members, the weekly meetings of the Society are now held on Tuesday evenings at 7.30 p.m.

Instruction in the reading of the Morse code will take up the first half-hour of the weekly meetings.

Application for membership is invited, and full particulars may be obtained from either of the Joint Hon. Secretaries.

North London Wireless Association.*

Hon. Secretary, Mr. V. J. Hinkley, Northern Polytechnic, Holloway Road, N.

An extraordinary general meeting was held on Monday, September 25th, to reorganise the Association for the winter.

A hearty vote of thanks was accorded to both Mr. Prior and Mr. Auckland for the services they have rendered the Association in the capacities of Secretary and Chairman respectively. The loss of their services through pressure of business is greatly regretted.

The following officers and committee were elected :—

President, Dr. Reginald S. Clay, B.A., D.Sc. ; Past-President, Dr. F. C. Knight ; Vice-President, Major Basil Binyon, O.B.E., B.A., A.M.I.E.E. ; Chairman, Mr. H. Norman Wilson : Vice-Chairman, Mr. G. D. Meyer : Hon. Treasurer and Assist. Hon Secretary, Mr. Frank S. Angel ; Hon. Secretary, Mr. V. J. Hinkley ; Committee Members, Messrs. J. Nicol, B.A., B.Sc., W. Power, A. G. Hill, A. de Villiers, J. A. Reading, H. W. Nunn.

A programme has been arranged for the coming session, details of which up to November 20th are set out below. Particulars of future lectures, etc., will be published later.

October 30th, "Short Wave Aircraft Sets" (Trans. and Recept.), By Mr. A. J. Reading. November 6th, "The Elementary Principles of Radiotelegraphy and Telephony"—II, by Mr. F. S. Angel. November 13th, "Telephone Working External Routine," by Mr. A. G. Hill. November 20th, "Telephone Headgear—Constructional," by Mr. H. Norman Wilson.

This programme has been arranged with a view to interesting both the beginners and the more advanced workers, and it is hoped that large numbers who have recently taken up wireless will join the Association's ranks, and increase their knowledge of our interesting subject.

We shall be glad if members will endeavour to attend regularly at the meetings and assist in the arranging of future programmes by volunteering to read papers and give demonstrations. Items such as descriptions of sets, discussions of difficulties met with, useful hints, etc., are very useful and assist in providing both profitable and interesting evenings. The Association is very fortunate in having much of the Polytechnic's valuable apparatus available for demonstration and test purposes.

All interested in Wireless, whether beginners or expert, are invited to write to the Hon. Secretary or to attend one of the Association's meetings, which are held weekly at the Northern Polytechnic, Holloway Road, N.1, commencing at 8 p.m.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The seventh general meeting of the above Society was held at Erith Technical Institute, on Friday, October 13th.

Morse practice commenced at 7.30 p.m., during which the Secretary introduced new methods of writing down Morse, explaining the characters on the blackboard. Very satisfactory progress is maintained by all the members attending these practices.

At 8 p.m. Mr. C. E. Morriss delivered a lecture entitled "Crystal Circuits." He dealt with plain aerial reception, and coupled circuit reception, pointing out the advantages of the latter over the former, especially with respect to the selectivity obtained by loose coupling. The difficulties of tuning a coupled circuit receiver to a given signal when neither circuit is calibrated, were explained, and the ways and means of overcoming these difficulties were gone into. The lecturer detailed the various crystals he had experimented with, giving the pros and cons for each. The artificial galenas seemed to be much favoured by him for their sensitiveness and manipulation.

Mr. Meadows followed with a short lecture on "Microphones and Telephones." Emphasis was laid on the importance of joining the telephones the right way round when directly connected in the plate circuit of the valves so that the steady plate currents tends to strengthen the permanent magnets instead of to weaken them. Various useful hints were given on the rewinding of telephone magnet coils. A simple method of determining the north and south poles of the permanent magnet was demonstrated by means of a floating magnetised needle.

Question time opened at 9.15 p.m., when the subject of aerials was again referred to. The effect of corrosion on bare wire aerials was discussed, and to this was attributed a falling off of aerial efficiency due to the skin effect on high frequency currents. The Secretary suggested a scheme to encourage members to experiment, whereby circuits approved by the Postmaster-General for broadcasting would be detailed on the blackboard, and each one discussed in turn by the meeting. Experimental members would then be asked to try one of these circuits at their own stations, and to make a record of the performance of the circuit tried. The results would then be reported at a meeting, and the circuits tested out on the Society's set and compared. It was decided to adopt this suggestion, and to proceed at once with its organisation.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, A.M.I.E.E. 18, Melford Road, S.E.22.

The annual general meeting was held at the Central Hall, Peckham, on October 11th. There was a very full meeting, and the proceedings were marked with great enthusiasm. The juniors were first given their half-hour of buzzer practice, under Mr. Sam Middleton, and then Mr. Knight reminded the meeting that the Association's officers had retired according to rule. It was proposed by Mr. Child and seconded by Mr. Middleton that Mr. Knight be asked to preside over the meeting. Mr. William Le Queux was re-elected President, and Sir Frederick Hall, K.B.E., M.P., was elected Vice-President. Mr. Knight was then re-elected Chairman for the coming year, and Mr. Sam Middleton Vice-Chairman. Mr. Geo. Sutton was re-elected Secretary and Mr. G. Horwood Assistant Secretary; Mr. Kendall, Treasurer; Mr. Noakes, Librarian; Mr. Hoare, Assistant Librarian: Mr. Voigt, Installation Engineer; Messrs. Joughin, Hunter, Webb, Hersey and Ball were elected Committeemen. A proposal to alter the title of the Association to the Radio and Experimental Association was negatived by a large majority, but it was agreed that the title of the original Association be adopted as a sub-title, and the date of foundation printed on the Club notepaper. Thus the full title of the Association now is: The Wireless and Experimental Association (originally The Amateur Wireless Alliance, established 1913).

Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

The bi-monthly meeting was held on October 9th at Headquarters, Vaughan College. Ten new members were admitted.

The main business of the evening centred around the proposal of the Committee to form a student's section for the benefit of those who are being attracted to radio work by the popular broadcasting. After considerable discussion the recommendations of the Committee were accepted *en bloc*, and the Secretary is now open to receive applications for membership to this new section for which no technical qualifications are necessary.

Mr. S. Skeet was then called upon to deliver his lecture on "Set Construction"; this he did very successfully, illustrating his remarks by many beautiful examples of his own work which caused much admiration. A very interesting discussion followed, concluded by a hearty vote of thanks proposed by the President, Mr. Cyril T. Atkinson, and seconded by the Vice-President, Mr. H. E. Dyson.

The next meeting of the Society took place on October 23rd, when a general discussion was held.

All communications regarding the Society to be addressed to the Hon. Secretary.

Croydon Wireless and Physical Society.*

Hon. Secretary, Mr. B. Clapp, Meadmoor, Brighton Road, Purley.

At a meeting held at the Central Polytechnic, Croydon, on October 7th, Mr. W. A. Saville gave a lecture and demonstration on different methods of reception, one special feature being a circuit to enable one to switch in or out at will extra L.F. valves.

The Society invited members of local boy scout troops to hear the Prince of Wales's message, which was received by Mr. Saville on his set very well.

Another interesting piece of apparatus which was demonstrated was a Japanese valve which had two filaments; the lecturer explained that they could be used separately or together.

The meeting then terminated with a hearty vote of thanks to Mr. Saville for giving such an interesting lecture.

The Secretary will be pleased to give all particulars of the Society to anyone desirous of joining.

The next meeting will take place on Saturday, November 4th, 1922, at 7.30 p.m.

Plymouth Wireless and Scientific Society.*

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

A meeting of the above was held on October 10th at Plymouth Chambers, where the Society is establishing its headquarters. The main business of the evening was the discussion of the Society's wireless set. It was resolved to begin with a three-valve set, with one stage of high frequency amplification and one stage of low frequency, and the set is to be so designed as to permit readily of experimenting with various types of intervalve coupling. Offers were received from members present of five valves, two variable condensers, a three-coil holder, aerial wire and £1 in cash, so that an immediate start is to be made with the construction.

The programme for the year and copies of the rules and proposal form are now available, and can be obtained from the Hon. Secretary.

Forthcoming events include: October 31st, lecture, "Wireless Reception," G. H. Lock; November 7th, lecture, "High Frequency Amplification," L. J. Voss; November 21st, lecture, "The Armstrong Super-Regenenerative Circuit," P. Arberry.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Gt. Brickkiln Street, Wolverhampton.

At a meeting at headquarters, 26, King Street, Wolverhampton, on October 11th, a very interesting lecture was given by Mr. D. P. Baker on "Time—Sundials to Wireless."

The lecturer in his discourse took the meeting back to the old methods of recording time, leading up step by step to the most modern methods of recording time by wireless. The diagrams used and the actual apparatus produced proved that the lecturer had had a wide and varied experience. The many questions addressed to Mr. Baker at the conclusion of the lecture created a most beneficial discussion, practically every member taking part.

Clapham Park Wireless Society.

Meetings are now held weekly on Wednesdays, at 7.30-9.30 p.m., at headquarters, 67, Balham High Road, and visitors are cordially welcomed. Membership is increasing rapidly.

The sixth general meeting was held on October 4th, under the chairmanship of Mr. A. E. Radburn.

Hon. Secretary reported negotiating with Wireless Society of London regarding affiliation.

Mr. A. E. Radburn's offer to provide distinctive badges for Committee and ex-officio members of Society to be worn at meetings in order that newcomers could get into immediate touch with the executive was accepted.

Mr. J. Gray's resignation from Committee owing to lack of time was received with regrets.

Mr. Gray will still do everything in his power to further the interests of the Society.

Mr. J. A. Daniels and Mr. M. P. Prout (Hon. Treasurer) had improved the Society's aerial, and a demonstration was given by Mr. J. Ayres on his portable **2 QD** transmitting station, and Mr. J. A. Daniels with his Magnavox and valve apparatus "listening in."

Those present heard the Marconi transmission to the Wireless Exhibition, also Mr. J. Ayres from his portable set, the most successful being the messages to **2 KF**.—Mr. Partridge replying—finally the Hon. Secretary transmitting the best compliments of the C.P.W. Society, which was confirmed by hearty applause by all present.

A flashlight photograph was taken by Mr. M. P. Prout (Hon. Treasurer) and Mr. F. H. Austin (a Committee member) during the proceedings.

The events proved highly successful.

Dispite the torrential rainstorm in progress the whole evening, the Hon. Secretary remarked upon the good attendance.

In view of the headquarters not being available, it was arranged that the Hon. Secretary give the Boy Scouts' organisation the names and addresses of those members who could accommodate a few Scouts on their sets to hear the Prince of Wales's speech.

A hearty vote of thanks to the demonstrators concluded the evening.

The seventh general meeting was held at headquarters on October 11th under chairmanship of Mr. A. E. Radburn.

The P.M.G.'s permit allowing Society to conduct "listening in" had received the attention of Mr. W. Brierley, who suitably framed it, with glass both back and front. It was hung in the meeting room.

The Chairman presented badges as promised, to the Committee and ex-officio members.

Mr. A. L. Beadle reported progress with the advertising sign display.

The photograph of previous meeting's proceedings was circulated. Many members expressing a desire to possess such a souvenir, Mr. M. P. Prout will obtain copies for them at a low figure. A hearty vote of appreciation was accorded Mr. M. P. Prout and Mr. F. H. Austin.

The Hon. Secretary reported receiving reply from The Wireless Society of London, but was awaiting further information.

Mr. C. W. Richardson offered to initiate a discussion on "Aerials," etc., at next meeting, which offer was gladly accepted.

Mr. J. C. Elvy opened a discussion on "Difficulties confronting the amateur who desires to make his own apparatus, especially crystal sets." This resulted in a controversy on crystals versus

Clapham Park Wireless Society.

valves. The crystal detector shone out during the discussion as worthy of being placed in the first row for experimenters in wireless.

The Hon. Secretary invited discussion and advice on the various apparatus for tuning in, cylindrical tuning inductance with one, two or three sliding contacts—the same with loose coupling cylindrical inductance variometers. This discussion tended to lead experimenters to devote their efforts to the slab, honeycomb type. Mr. J. A. Daniels gave figures and blackboard designs.

Several letters were written on the spot by the Secretary for those who are applying for a P.M.G. experimental licence, as it is becoming generally known that such certificates facilitate the granting of licences.

Newbury and District Wireless Club.

Hon. Secretary, Mr. W. L. Taylor, The Lilies, Arthur Road, Newbury.

The first annual meeting of this club was held on September 28th, and the following officers were elected for the ensuing year:—President, Mr. H. Kent-Norris, A.M.I.M.E.; Vice-President, Capt. F. M. J. White, B.Sc.; Chairman, Mr. H. Brown; Hon. Secretary and Treasurer, Mr. W. L. Taylor; Committee, Messrs. A. Corden, H. W. Porter, P. H. Sellwood, F. Ford, J. Brown, J. B. Webb, and A. M. Povey. The balance sheet showed the club to be in a very sound financial condition. This is made possible by the generosity of the Chairman, Mr. H. Brown, who provides quarters free of cost to the club. The business of the meeting was followed by a demonstration of a fine set loaned by Mr. H. W. Porter.

A general meeting was held on October 5th, and a demonstration of a home constructed set made by the Hon. Secretary was given. This proved to be one of the best demonstrations given at the club. The transmission of a prominent local amateur **2 GG** being clearly heard and enjoyed by all present.

An interesting programme has been arranged for the present session. All interested in wireless matters in the Newbury district are invited to communicate with the Hon. Secretary.

Hornsey and District Wireless and Model Engineering Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

On October 6th the chair was taken by Mr. H. J. Pugh. A discussion was held on obtaining better meeting rooms; as nothing new had been found, it was decided to carry on at 29, Felix Avenue, Weston Park, Crouch End.

A three-valve set was then used, and good reception of the concert transmitted by **2LO** to the Wireless Exhibition was enjoyed. Also music and telephony from several amateur stations was quite clear, and weather forecasts from **GFA** and **FL** in Morse were taken down by several members. Membership is steadily increasing, and a new programme of lectures, etc., has been formed.

For particulars of the Society send stamped envelope to Hon. Secretary.

Powisland Radio and Scientific Society.

Hon. Secretary, Mr. O. Gilbert Davies, Ty-Coch, Welshpool.

At a meeting of a few wireless enthusiasts held on September 6th, under the chairmanship of Viscount Cline, the above Society was formed.

Major G. R. D. Harrison, Mayor of Welshpool, was elected President.

The Society already boasts some 30 members, and is applying for affiliation with the Wireless Society of London.

It is hoped that the Society will shortly be installed in its own quarters at the Powisland Garage, Welshpool.

, The Secretary will be glad to hear from anyone wishing to join the Society.

The first meeting was held on October 20th, when Viscount Cline will lecture on "The Elementary Principles of Wireless."

Wellingborough Wireless Experimental Society.

Hon. Secretary, Mr. F. E. Ball, Victoria, Wellingborough.

Arrangements were made by this Society for local boy scouts to hear the Prince of Wales on October 7th, at their headquarters, Victoria, Wellingborough.

Falkirk and District Radio Society.

Hon. Secretary, Mr. M. B. Blackadder, Glenmorag, Falkirk.

The opening meeting of the winter session was held on Thursday, September 7th, at 23 Vicar Street, Falkirk, with Mr. G. Walker, Vice-President, in the chair. There was a large attendance, and many new members enrolled, making the membership nearly 60.

At the meeting held on Thursday, September 14th, a six-valve receiver was installed, and clear signals were heard by means of the Society's loud speaker. During the evening a short discourse on the structure of the atom was given by Mr. Willingham, which was highly appreciated.

On September 21st a three-valve receiver and a crystal receiver made by members, were exhibited and explained. Excellent results were obtained on the Society's aerial from the valve receiver. The crystal set was designed for broadcasting, so it could not be tested. The receivers had been made by Mr. A. T. Hunter and Mr. R. B. Chalmers respectively, and both gentlemen were congratulated on the high quality of workmanship and efficiency displayed on their instruments. Intending members can have full particulars from the Secretary.

Cambridge and District Wireless Society.

Hon. Secretary, Mr. J. J. Butterfield, 107, King Street, Cambridge.

An extraordinary general meeting took place at the new headquarters in the Central Liberal Club, Downing Street, Cambridge, on October 2nd. Mr. A. J. Winship, the Chairman, opened the meeting by welcoming the members to the new headquarters. He then gave a detailed account of the activities of the Society since the last meeting, held in April, and how the Committee had successfully raised funds by giving exhibitions at the Royal Show and also at the Mammoth Show. Special mention was made regarding two friends of the Society, who had kindly loaned the necessary money in order to purchase a transmitting apparatus to enable the Committee to carry out their scheme. It was announced to the members that Sir Douglas Newton, M.P., had kindly consented to become patron of the Society. Six new members were elected during the evening. It was proposed that the meetings be held each alternate Thursday and Tuesday fortnightly, this proposition being duly carried. Mr. C. E. Lawrence was elected Hon. Treasurer in place of Mr. Banyard, who has left Cambridge. All inquiries should be addressed to the Hon. Secretary, who will be pleased to hear from any ladies or gentlemen desirous of becoming members of the Society.

Bradford-on-Avon Radio Society.

Hon. Secretary, Mr. H. Helps, 4, Ivy Terrace, Bradford-on-Avon.

The members of the above Society have built a new club-room, which takes the form of a wooden hut, 20 ft. by 10 ft. At one end is a large table upon which the receiving apparatus is arranged and at the side is a bench at which members can make their own instruments.

It was thought fitting that the opening of the new headquarters should be marked by some little ceremony. This took place on Thursday, September 22nd, when the governors of the County Secondary School were present.

The Chairman, Mr. E. Cooper, apologised for the absence of their President, Lord Fitzmaurice, and Vice-President Brig.-Gen. Palmer, C.B., M.P. He then called upon Mr. A. H. Baker, A.R.C.Sc., to declare the headquarters open.

Mr. Baker, who was received with applause, gave a most interesting and instructive speech. In conclusion, he said he had the greatest of pleasure in declaring the building open as the headquarters of the Bradford-on-Avon Radio Society.

Mr. J. Cooper, A.M.I.R.E., proposed a vote of thanks to Mr. Baker, which was carried with loud applause, and Mr. Baker suitably replied.

The Chairman then called upon Mr. Merritt, of the Western Counties Electrical and Engineering Co. (who at considerable inconvenience came from Yeovil to help the Society that evening), to tell them a little of the possibilities of radio transmission, and then to entertain the assembly with a radio concert.

Mr. F. H. Merritt wished the Society every success. A Burndept Ultra III receiver was used with a Brown loud speaker. In view of Bradford's westerly situation, the reception of the Dutch concert was a credit to the apparatus.

Mr. L. C. Willcox, of Warminster, who is Hon. Consulting Engineer to the Society, transmitted an excellent musical programme from his private station, which was received with great clarity and volume.

Hackney and District Radio Society.

Hon. Secretary, Mr. E. R. Walker, 48, Dagmar Road, South Hackney, E.8.

A report for the quarter ending September 30th, 1922, has been prepared.

The Society meets every Thursday evening at 7.30 at the Y.M.C.A., Mare Street, Hackney, E.8.

Sir Arthur Lever, Bart., has been elected a Patron to the Society, and Mr. L. L. Robinson, an honorary member.

The Society has applied for affiliation to the Wireless Society of London, as well as for an experimental licence. A Technical Sub-Committee is at present engaged in constructing the Society's wireless set, which will enable practical demonstrations to be given.

Since its inception a great deal of keenness and enthusiasm has been shown, the more expert members giving all the assistance and advice possible to new comers. There are at present over 70 members, with an average attendance of 75 per cent. At every meeting there are one or more ladies present. Members are of all ages, from 14 to 60.

As it has been found by experience that the present basis of subscription is not practicable and too high, it has been decided to hold a special general meeting on Thursday, November 9th, to discuss various matters connected with subscriptions, entrance fee, two classes of membership (senior and junior), and altered date of next annual meeting, and all members are requested to attend.

A cordial invitation is extended to all persons, especially ladies, who are interested in the subject, whether they possess radio sets or not.

Thames Valley Radio and Physical Association.

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

At a general meeting held at East Sheen on October 4th, it was decided to alter the name of the Barnes, Mortlake and Richmond Wireless Society to the above title, as many members had joined from the further districts of Teddington, Kew, Wimbledon, etc.

Mr. C. Appleton-Smith was elected Chairman to the meeting, and the minutes of the last meeting were read and confirmed. The rules were duly presented, discussed and passed.

A letter from Mr. Blake, M.I.E.E., the President, was read, in which he apologised for his absence and expressed his desire to meet all members on November 7th at a special meeting, when he will give his Presidential address and lecture (with lantern slides).

It is hoped that everyone in the district interested in wireless will be present. Hearty welcome will be extended to all visitors. Tickets for visitors can be obtained from the Hon. Secretary. These tickets are free, but the number is limited.

An entrance fee to the Association was fixed at 5s. by the meeting, and the subscription is 10s. 6d. per annum.

The next meeting of the Association was held at the Girl Guides' Hut, Wigan Institute, Mortlake (close to Mortlake Station, L. & S.W.R.) on Thursday, October 19th, at 8 p.m., when the series of lectures for the season commenced.

Burnham, Highbridge and District Wireless Society.

Hon. Secretary, Mr. L. Lott, 52, High Street, Burnham-on-Sea.

A meeting was held on October 3rd, in the Adult Schoolroom, Adam Street, Dr. N. Burns, of the Lodge, Highbridge, in the chair, to consider the formation of a local Wireless Society. There was a good number of local amateurs present, and it was decided unanimously to form such a Society, all present enrolling as members, and Dr. N. Burns as Chairman for the year. A Committee was appointed. It was decided to hold meetings every fortnight, and a buzzer class each week. Annual subscriptions decided upon were 5s.; Associates, 2s. 6d. It is hoped from the enthusiasm shown at the meeting to further extend the membership, and anyone in the district can obtain full information of the Hon. Secretary.

Papers and discussions will be arranged for, also a question box, and other means of helping members new to wireless. Twenty-one members enrolled.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, The Wireless World and Radio Review, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

In view of the serious interference which an oscillating receiver can cause to other receivers in its neighbourhood, it is understood that for broadcast wavelengths, certainly, and possibly for all wavelengths, the Postmaster-General will in future allow no type of circuit which is capable of oscillating and so energising the aerial, either directly or through any circuit coupled to it.

The necessary consequence of this restriction is that if reaction of the type commonly used in the past is still employed, it must be in such a way that the oscillation point cannot be reached over the wavelength range of the receiver, however tightly the reaction coil is coupled, and with whatever values of filament voltage or plate voltage the set is worked.

In order to comply with this requirement, it is essential that the reaction coil should be sufficiently loosely coupled to the aerial inductances as not to set up oscillations, or alternatively the reaction might be arranged between the grid and plate circuits of a high frequency amplifier as shown on p. 715 of the issue of September 2nd.

We strongly urge readers who are making or using sets of the usual reacting type to either reduce the amount of reaction which they can employ to such an extent that they are perfectly satisfied that the set can never oscillate, or to cut out their reaction entirely.

"C.H.B." (Fleetwood).—(1) A satisfactory form of three-valve unit receiver is shown in Fig. 6, page 809, September 16th issue, in which however, you should note that reaction back to the aerial tuning circuits is no longer permitted. The reaction coil should be coupled back to the H.F. transformer shown on the first panel. (2) The addition of two extra valves is advised. If only one is used it should be preferably employed as H.F. (3) There is no difference between an L.F. and an audio-frequency transformer.

"W.S." (Newcastle).—The sketch submitted is all right except that (1) There is no complete path for the H.T. Negative of the H.T. battery should be joined to the negative of the L.T. battery. (2) Telephones should be on the positive side of the H.T. battery. (3) The grid connection of the second valve should go to the negative of the L.T. instead of to the positive. (4) The only form of reaction used must be to the intervalve transformer, which brings radiation to within safe limits.

"STUCKPHAST" (Swansea) *submits a list of components in his possession, and asks for a diagram with a switch to cut out the first valve.*

See Fig. 1. If you propose not to use a telephone transformer, high resistance telephones must be used. The transformer is connected as follows:—O.P. to plates; I.P. to H.T.+; O.S. to L.T.−; I.S. to grid.

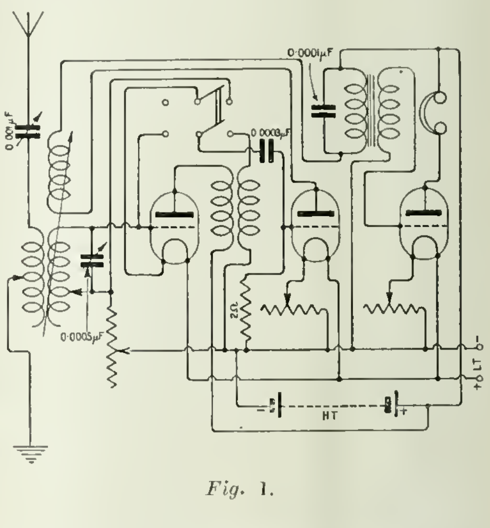


Fig. 1.

"A.F.T." (Burton-on-Trent) *asks re Fig. 2, page 507, July 22nd issue, which are the battery terminals, and (2) Who manufactures "Q.X." valves, and from whom they may be obtained.*

(1) The terminal at the extreme right-hand upper corner of the panel is the H.T. negative. The next terminal on the top is the H.T. positive. The terminal immediately below is the L.T. negative, and the terminal below this the L.T. positive. (2) The "Q.X" valve is made by the M.O. Valve Co., Ltd., and can be obtained from most dealers.

"W.B.D." (Dollar).—We regret we have no particulars of the set to which you refer, but you will find a good deal of useful information on transmission in the issues of this journal for May 28th and June 11th, 1921.

"H.C." (Wigan).—(1) The sketch enclosed with your letter shows the reaction coil coupled with the aerial coil. We do not recommend this. We suggest you use a secondary circuit, and couple he reaction coil with the secondary inductance coil Fig. 2. The sketch does not show the L.T. battery connected to the H.T., but this of course is a slip. (2) We cannot calculate the value of your glass plate condenser, because you have not given us the dimensions of the tinplate conductors. The calculation is quite simple, and is fully explained in Coursey's book "The Radio Experimenter's Handbook." (3) No exact dimensions and turns can be given for the construction of honeycomb coils to tune to definite wavelengths, because the inductance of the coils depends greatly upon the method of winding, tightness of winding, etc. We suggest using 30 pegs on each side of the former. About six coils will be required to cover the wavelength range you require. Wind one layer of No. 22 for the smallest coil, and twelve layers of No. 26 for the largest. (4) We see no reason why you should not receive telephony with the set.

former you have purchased should work well if connected in the above circuit.

"J.C." (Streatham) *wishes* (1) *To wind a coil with tappings for coarse and fine tuning, to tune from 150 to 500 metres, and asks three other questions.*

(1) Assuming you have a normal aerial, wind the 3″ diameter tube with No. 20 D.C.C. wire. For fine tuning take tappings at the following turns:—1, 2, 3, 4, 5, 6, 7 and 8. For coarse tuning take tappings at 9, 18, 27, 36, 45, 63 and 72 turns. The tube will be 4″ long. (2) Yes, you will have to submit the proposed arrangement to the Post Office. (3) This arrangement has frequently been used, and is similar to many sets on the market. (4) We suggest you see the articles on "Experimental Station Design," appearing in alternate issues.

"TUNER" (Ilford).—(1) On the primary coil make eight or nine tappings, and in the secondary, four or five. (2) Allow about 4″ of movement. (3) You will probably require at least four valves. (4) This is due to the spacing of the components in your set. Reduce the number of turns in the reaction coil by one-third.

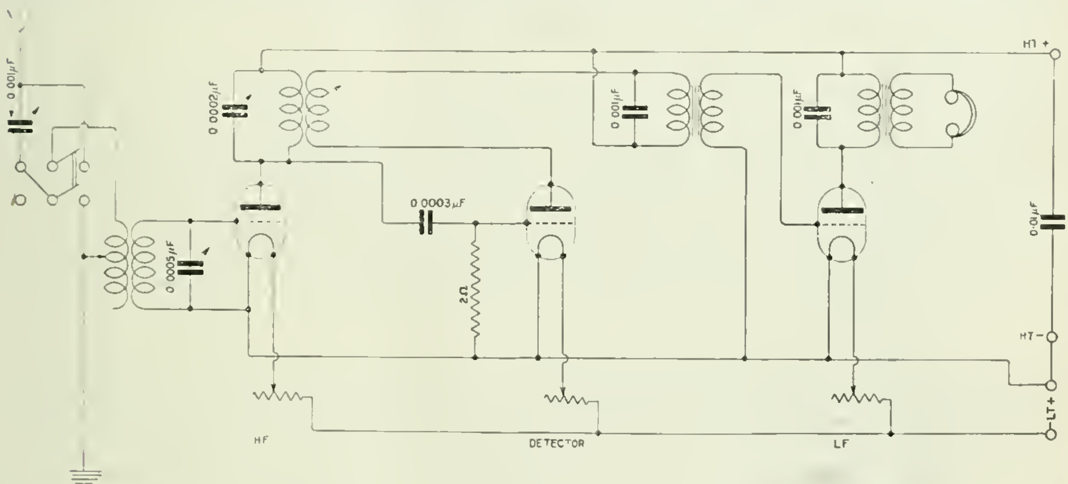


Fig. 2.

"M.J.D." (Brussels) *asks* (1) *For criticism of his set.* (2) *For suggestions to improve the set.* (3) *If "Dewar" type switches are better than battery type.* (4) *If it is advisable to build the tuner as a separate unit.*

(1) and (2) We think your first arrangement is better than the second. We suggest you make use of a closed circuit, and couple the reaction coil to the closed circuit inductance. (3) There is not much to choose between the types of switch you mention, but considerations of space will no doubt determine which is more suitable in your case. (4) Generally it is better to make the tuner a separate unit.

"W.J.S." (E.5) *wishes to add three valves to his single valve panel, and asks other questions.*

We suggest you abandon the single valve panel and construct a four-valve set on the lines of Fig. 4, page 840, but using an aerial and closed circuit. Your set would almost certainly not be licensed by the Post Office. The trans-

"J.H.L." (E.14) *asks* (1) *How to make a simple but efficient tuner suitable for single valve set.* (2) *The best method of mounting basket coils.* (3) *Will a 4-volt accumulator suffice for the L.T. battery.*

(1) and (2) We presume you wish the tuner for use over the broadcast wavelengths, and suggest you see the articles "A Broadcast Receiver," which appeared in the issues of August 26th and September 2nd. (3) A 4-volt battery will do, but a 6-volt battery would be better.

"E.R.L." (Seven Kings).—We suggest you abandon the construction of the receiver, and build a set of more usual design.

"C.H.S." (Derby) (1) *wishes to build a three-valve receiver with switches to cut out the H.F. valve, or note magnifier.* (2) *What coils, wound on a "Lokap" winder, are required for certain stations.*

(1) Page diagram in this issue. (2) We suggest you use basket coils for short wavelengths. See the issue of June 10th. For the longer wavelengths

wind coils using the narrow cam. The wire enclosed is No. 26 D.S.C., and is suitable.

"F.B." (Garches) *has a single valve panel, and wishes to know the dimensions of the coils and size of wire to use for a wavelength range of* 180 *to* 400 *metres.*

Coil A, 5 cms. of winding, using No. 22 S.C.C. (=0·7112 mm.) with six tappings. Coil B, 5 cms. of winding, using No. 26 S.C.C. (0·4572 mm.), with four or five tappings. Coil C, 3 cms. of winding, using No. 28 (0·3759 mm.)

"J.W.D." (Finsbury Park).—We suggest that you construct the Broadcast Receiver described in our issues of August 26th and September 2nd. Very complete instructions are given for making this set, and the results justify whatever pains are taken to make it. Plug-in coils are used, therefore you will be able to cover whatever wavelength range you may desire. Should you experience any trouble while making the set, we shall be very pleased to answer any enquiries you may address to us. See circuit Fig. 3 for experimental reception on wavelengths not used for broadcasting.

"W.N." (N.W.I.).—The answer to your first question depends entirely upon the licence you hold. If you hold an "Experimenter's" licence, we understand you may couple the reaction coil to the aerial or closed circuit coil. On the other hand, if you hold a "Broadcast" licence, the reaction coil must be so coupled that the aerial cannot ever be set oscillating. This is practically assured when the reaction coil is coupled to the H.F. transformer. The holder of an "Experimenter's" licence is considered competent to control reaction, while the holder of a "Broadcast" licence is restricted in the use of reaction. (2) We suggest you use a closed circuit, and arrange a switch in the aerial circuit for connecting the A.T.C. in series or parallel with the A.T.I. The reaction arrangement to which you refer is a very satisfactory arrangement, and we suggest you adopt it. You might also see the arrangements shown on page 792, September 16th and page 865, September 30th, 1922. (3) On higher wavelengths it is simply necessary to add inductance in series with the coupling coil. The inductance can be added

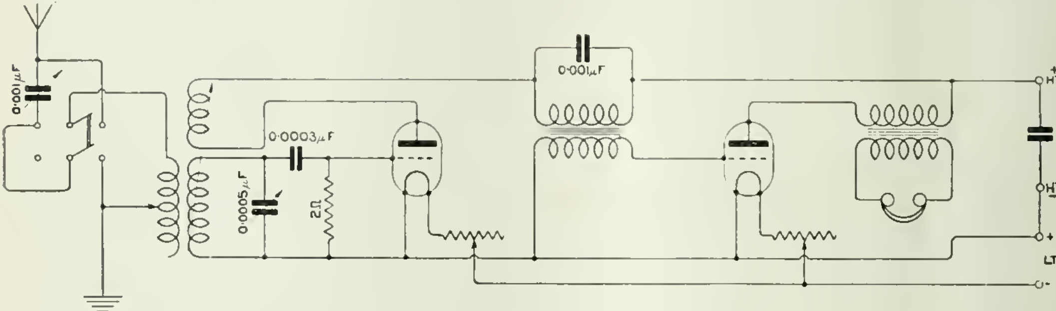


Fig. 3.

exactly as shown on page 867, September 30th issue. In the diagram are two terminals marked "X." The strap is removed and the coil is inserted. The reaction coil and A.T.I. can be constructed on the lines of a loose coupler. The values are :—A.T.C., maximum value 0·001 mfd. ; Anode condenser, maximum value 0·0002 mfd. ; grid condenser, average value 0·0003 mfd. ; fixed condenser of 0·001 mfd. ; H.T. battery condenser can be anything from 0·005 up to 0·5.

"JUMPER" (Woking) *asks* (1) *For a criticism of his set.* (2) *If he can use* 7/22 *copper cable for his earth lead.* (3) *If a glass tube will do for a lead-in insulator.* (4) *Windings for basket coils to tune in* **2 MT** *and* **FL.**

(1) We do not care for your circuit. A parallel A.T.C. on short wavelengths is useless. See Fig. 3. (2) Bare 7/22 cable will suffice, but we prefer to run insulated cable to the earth connection. (3) Yes, if it is of stout construction. (4) See the issue of June 10th, page 326. For FL use honeycomb coils.

"J.E.T." (South Africa) *asks* (1) *For dimensions of an air choke of millihenry inductance.* (2) *For dimensions of an L.F. choke with an inductance of* 1 *henry.*

(1) Wind No. 30 S.S.C. wire on a former 3″ in diameter, for a distance of 3¾″. (2) We cannot give you the exact dimensions, but if you have an intervalve tansformer and re-wind it with No. 34 S.S.C., you will have an inductance of about 1 henry ; alternatively you could make up a coil consisting of a bundle of iron wires. Make the coil ½″ in diameter and 3″ long, and wind No. 34 S.S.C. wire until the overall diameter is 2″, then bend over the ends of the wire to form a closed coil.

"B.F.W." (S.E.4).—Wind a tube of 3″ diameter with No. 22 D.C.C., and take tappings off the 25th, 54th and 80th turn.

"A.M.R." (Marlborough).—(1) There is no simple accurate formula, but you might use an intervalve transformer with the windings correctly joined in series. (2) Yes. (3) We cannot say. Probably he will. (4) Wind the frame with 15 turns of No. 18 S.W.G. spaced ¼″ apart, and take tappings to a switch.

"M.S." (N.W.8).—(1) The circuit referred to is very satisfactory. (2) See the articles on "Experimental Station Design," appearing in alternate issues. (3) A note magnifier is easily added. See several recent circuits. (4) Quite.

"A.S." (E.17).—(1) We cannot say from your description what the trouble is, but you might increase the filament battery to 6 volts, and the H.T. battery to 50 volts. (2) Make a telephone transformer to use with your telephones.

"A.E.C." (Wood Green).—It is unfortunate that you have not sent us particulars of your telephone plugs and jacks. There are so many types, and ordinary jacks are quite unsuitable for H.F. work, so that we think you would get better results by using switches or the specially constructed jacks frequently advertised in this journal. We also suggest that you make use of the tuned anode arrangement for H.F. amplification, as the results are much better than those obtained from changeable plug-in type H.F. transformers. For the short wavelengths we suggest you employ single layer coils. The A.T.I. may consist of a coil 3″ diameter by 4″ long of No. 22 D.C.C. with six tappings. The C.C.I. may consist of a coil $2\frac{1}{2}$″ diameter by 4″ long of No. 26 D.C.C. with six tappings. We cannot tell you the number of turns of wire in a lattice coil which has a specified inductance value. The inductance varies so greatly upon the method of winding that we suggest you wind, say, six coils, the smallest having 30 turns with a mean diameter of 2″, and the largest 600 turns with a mean diameter of 4″. For the smaller coils use No. 22 D.C.C. and for the larger No. 26 D.C.C.

"J.D." (Cambridge).—Diagrams are given in Figs. 4 & 5 making use of one H.F. valve, one detector valve and one L.F. valve, but using no reaction directly to the aerial circuit. We recommend you using a tuned anode arrangement instead of a H.F. transformer, and then coupling the reaction coil to the anode coil as shown on page 867, September 30th, 1922. This circuit works extremely well, and with the reaction coil coupled to the anode coil, will not radiate to cause interference.

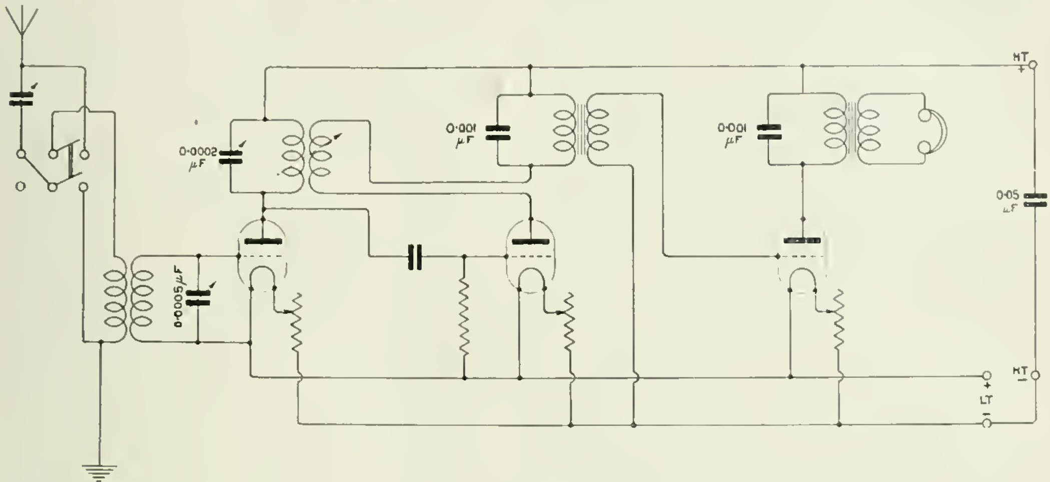


Fig. 4.

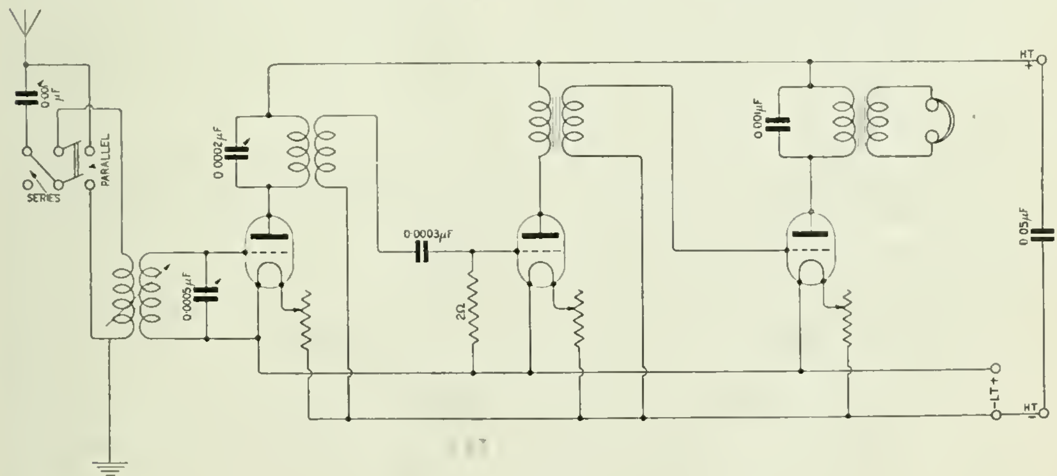


Fig. 5.

"C.S." (Swanage).—The value of the condenser which shunts the H.T. battery is not critical, and may be anything from 0·01 mfds. up to 0·5 mfds. A usual valve is 0·05 mfds., and this is quite satisfactory.

"J.T.B.W." (Rainhill).—(1) From your cover-ng letter we note that this circuit is intended to be a super-regenerative one. It is a very eccentric type; the only thing that we can be sure about is that it will not act in this way. We should strongly advise any beginner to get some experience with a normal type of set before attempting any adjustment of the Armstrong super-regenerative. (2) Neglecting for a moment the fact that the grid circuit of your first valve has no particular wavelength whatever, from the information supplied we think your wave range would probably be from 150/250 metres. (3) We should not care to hazard a guess. (4) If more than one wire is used for an aerial, the length from the lead-in to the open end may still remain 100 ft. for each wire. (See constructional details of super-regenerative receiver commencing on page 71, October 21st, 1922.

"**E.E.C.**" **(Strabane)** *asks* (1) *The capacity of a condenser suitable for smoothing out differences of potential in rectified alternating current.* (2) *The number of plates of glass dielectric,* 1/16″ *thick* $\times 3\frac{1}{2}'' \times 2\frac{1}{2}''$, *required to make this condenser.* (3) *and* (4) *Particulars of windings for transformer.*

(1) This will depend very largely on various conditions about which you say nothing, such as the purpose for which the rectified current is to be used, *i.e.*, for transmission or reception—voltage, about 1 mfd. (2) For this purpose, with the plate you suggest, you would require about 20,000 plates, which, of course, is quite impracticable. You should either use much larger glass plates—and even this will be impracticable—or paraffin paper or mica, according to the potential required. (3) and (4) You do not give enough data to enable us to say, as you furnish no information with regard to the frequency or output required. We should suggest that a closed core of one square inch section, with 200 turns of No. 18 wire. This will probably be on the safe side for normal frequencies.

"**A.N.T.**" **(Sparkbrook)** *asks* (1) *What to do with his set, which is two-valve, with one stage of L.F., if reaction back on to the tuning circuits is not permitted.* (2) *How to substitute a potentiometer for his grid condenser and leak.* (3) *If this will improve reception.*

(1) You would improve results if you use your A.T.I. in series instead of in parallel with the A.T.C. for short wavelengths. If reaction is done without altogether, we should advise you to make your valve combination one H.F. amplifier and one detector. Moreover, this would give you a chance of incorporating reaction from the anode of the second valve to the inter-valve transformer, reaction of this type being quite useful. We fail to see how you can get satisfactory results with two "Ora" valves in series on 4 volts, as your diagram shows. (2) The two ends of a potentiometer wound with a resistance of about 200 ohms, should be connected direct across the 4-volt battery, and the slider connected to the lower end of the A.T.I., the connection from the battery negative to earth being, of course, omitted. (3) The improvements, if any, obtained in this way would be very small.

"**H.T.P.**" **(Lewisham).**—Circuit is quite satisfactory, except for the fact that the aerial condenser is shown in parallel with the A.T.I. The form of reaction shown is no longer permitted. and you should couple your reaction coil back to the anode coil of the first valve.

"**R.O.S.**" **(London)** *asks questions with regard to engraving his panel.*

No ordinary workshop tools are of any use for engraving. Dies for stamping letters on metal are of practically no use as the result is too irregular and untidy to be worth while. Engraving can be done either by hand, which is a skilled craft which we do not advise you to try, or by means of an engraving machine, which is an expensive machine tool. You will be well advised to take your panel to a professional engraver. The cost of his services will be probably considerably less than the damage to the panel which you would do by trying it yourself.

"**ALPHA**" **(Westcliffe-on-Sea)** *asks* (1) *whether an arrangement of an intervalve transformer sketched is better than using it as a note magnifier.* (2) *How to add a third valve to his set.* (3) *How to determine whether he is adding the best value of H.T. to his plate.* (4) *For data for a transformer for* 300-1,500 *metres.*

(1) As shown the transformer is being added as a note magnifier. We cannot say whether it will be suitable for this. It will not if it is wound as a telephone transformer. (2) Of many possible methods, that of Fig. 2, page 772, September 9th, is very good. (3) This can best be done by trying various voltages and seeing which gives the best results: but in general the H.T. voltage is fixed almost arbitrarily, and the grid voltage adjusted to give the best results with this arbitrary value. (4) Try winding sections of about 25 turns each in heaps on a former $1\frac{1}{2}''$ in diameter. Connect these up alternately in the two windings and arrange taps to each section. You will probably want about 200 turns for each winding in all.

"**MICRO-AMP**" **(Stanbridge)** *asks* (1) *Whether there is a risk of burning out* 8,000 *ohms telephones on Leafield at about* 30 *miles, using either one or two "Ora" valves.* (2) *What is the maximum current which can be got from such valves with* 30 *volts on the plate.*

(1) No; the current through the telephones is determined by the saturation current of the valve, and not by the strength of the transmitting station. You could not get more than this even if you were only a mile or two away, instead of 30. (2) The maximum current through a receiving valve of this type is in general about 20 milliamps, but this is only obtained under special conditions, very different from those met with in an ordinary receiving circuit. In your case you are never likely to get more than 5 milliamps.

"**NEMO**" **(West Kirby).**—(1) The gauges of the wires are 22 and 32. (2) This depends on the sizes of the coils and the wavelengths required. Generally speaking No. 28 is all right for a closed circuit, and somewhat finer—say No. 34—for a reaction coil. (3) (*e*) is best, if you mean by the use of a separate heterodyne. (*a*) and (*b*) both lead to serious re-radiation, and are prohibited over the broadcasting band of wavelength. (*b*) gives better tuning than (*a*), which is thoroughly bad, and has nothing to recommend it but its cheapness.

"T.P." (Fulham).—Your diagram is not correct, and we suggest you make use of a simple telephony transmitting circuit before experimenting with a combination of 4 valves. If you have not had a good deal of experience with transmitters, you would find it very difficult indeed to secure satisfactory results with a circuit connected up on the principle of your sketch. A simple circuit is shown in Fig. 6. We recommend you to read "The Wireless Telephone: What it is," by Coursey.

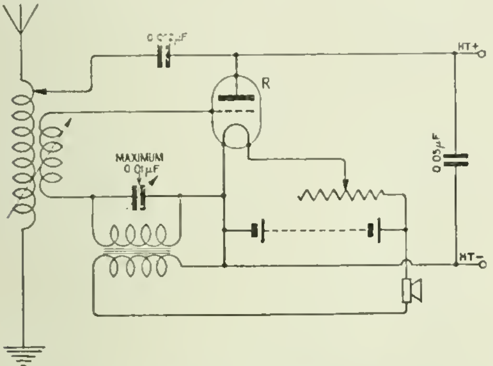


Fig. 6. Low Power Transmitting Circuit. A lead must be taken from LT—to Earth.

"DRAKE" (Bowdon) *asks* (1) *Whether a certain circuit is satisfactory.* (2) *If, when using a grid condenser, the oscillations actually pass through the dielectric of the condenser so as to affect the potential of the grid.* (3) *For an opinion on certain methods of connecting up his aerial circuit.* (4) *For an explanation of Fig. 3, page 679, of the issue nearest August 28th.*

(1) Yes, except that only one blocking condenser is necessary in the anode circuit, namely, that across transformer primary and H.T. battery. You will not obtain permission to use reaction of the type suggested. For short wavelengths the A.T.I. should be used in series with the A.T.C. (2) The instantaneous accumulation of a charge on one side of the plates, induces an imposing charge on the other side, thus affecting the potential of the grid. (3) Immaterial which method is employed. (4) The switch described is not a "plug-in" switch at all—it is a two-position throw-over switch. In one position the curved tongues make contact at A and C as shown in the diagram, all three valves then being in circuit. In the other position the left-hand tongue makes contact with B, which is not connected in circuit, and the right hand tongue makes contact with D. This means that the last note magnifying valve is cut out.

"TUNER" (Harlesden) *asks* (1) *For a former to tune from 200/4,000 metres.* (2) *The capacity of a condenser.* (3) *At what point in an A.T.I. to revolve a reaction coil.* (4) *Data for reaction coil.*

(1) Your former $8\frac{1}{2}'' \times 6\frac{1}{2}''$ will do if wound with about No. 26 wire. (2) Capacity will be about 0·0004 mfds. (3) and (4) Reaction of this type is no longer allowed owing to the fact that it is liable to give serious radiation from the aerial.

"SCAMP" (Finchley) *asks* (1) *Whether a galvanised iron tank, $18'' \times 18'' \times 30''$, buried in wet clay, will make a good earth.* (2) *Whether a parallel aerial 50 ft. away will have any effect on his.* (3) *If a Brown microphone amplifier will make comfortably loud signals in a telephone sufficient for a loud speaker.* (4) *Explanation of a freak tuning effect.*

(1) This should be very good indeed. (2) You are unlikely to be able to detect any difference from the presence of this aerial. (3) Hardly; in order to get sufficient strength for really satisfactory loud speech the signals before passing through the microphone amplifier would have to be rather uncomfortably strong. (4) As you say nothing about the nature of your set, it is rather difficult for us to explain this, but the effect is probably due to capacity reaction introduced *via* the head telephones and your body.

"L.R.T." (Merthyr Tydfil).—(1) The circuit submitted is quite correct, except that a ratio of 1/5 is rather large for an intervalve transformer. You will probably find that about 1/3 is about as large as you can efficiently employ. Also your anode resistance should preferably be considerably higher than 10,000 ohms. Also reaction of the type shown leads to pernicious re-radiation, and will be a continual source of annoyance to your neighbours. (2) You should certainly hear **FL, 2MT** should be possible, but we very much doubt whether you will get **PCGG** satisfactorily.

"H.H." (Blackheath).—We regret that we do not possess enough information to allow us to predict windings for a transformer of arbitrary form for special wavelengths as requested. The only satisfactory way of dealing with a problem like this is to make up specimens with different amounts of wire, testing for the points of best amplification, and adjusting accordingly.

"H.J.T." (Cornwall).—(1) We suggest you use the "light red" (No. 38 S.S.C.) wire for the plug in transformer, and wind the former full. If the two windings are wound on in the same direction, the outside primary wire is connected with the plate, and the inside secondary wire is joined to the grid. We cannot give you the exact number of turns, and you will have to find by experiment the most suitable value. We recommend the adoption of resistance-capacity H.F. amplification for wavelengths exceeding 1,800 metres.

(2) We consider No. 30 wire is unsuitable for winding your variometer. We suggest you use No. 22 S.W.G. The variometer is too small to cover the wave range you mention, and the design is such that the winding will possess considerable self-capacity. It would be better if you constructed special short wave coils for the broadcast wavelengths. Use the 0·001 mfd. condenser in series with the aerial. Wind a coil 3″ diameter with No. 20, and take tappings at 9, 18, 27, 36, 45, 54, 63, 72, and 81 turns. To tune up to 2,600 metres, add a loading coil in series with the above coil and connect the tuning condenser in parallel. The loading coil may be $5'' \times 5''$ of No. 24, with three or four tappings. (3) A full description of an Armstrong Super-Regenerative Receiver appeared in 21st October and also many back issues.

"D.G.M." (Norwich) *asks questions about the Broadcast Receiver described in the issues of August 26th and September 2nd.*

We suggest you use the fixed coil as the aerial inductance and the movable as the closed circuit, and do not use a reaction coil, as one is not necessary with this set. See Fig. 7. The maximum value of the A.T.C. may be 0·0015 mfds. We think the circuit will be approved by the Post Office. See the notice at the head of these columns. We cannot undertake to advise you about patents.

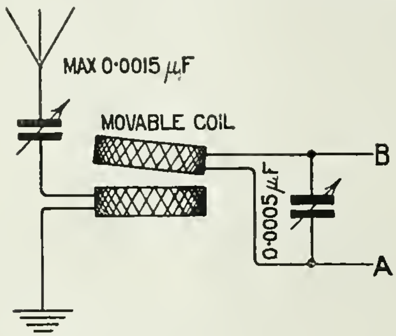


Fig. 7.

"B.Q." (Guernsey).—We suggest you employ plug-in H.F. transformers up to 2,000 metres, and above this wavelength use resistance capacity. You may, of course, use one former with a number of slots, and take tappings from the primary winding as you suggest. The windings will have to be determined experimentally, but there is a lot of useful information in the articles to which you refer. (2) The ends of the L.F. transformer should be connected as follows:—O.P. to plate; I.P. to +H.T.; O.S. to −L.T.; I.S. to grid. The sample of wire has not come to hand, and we suggest you make the intervalve transformer described in the issue of August 19th, 1922. You can try earthing the cores of the L.F. transformers, and notice whether any improvement results. The cores are sometimes connected to the +H.T. (3) The range of the set will be greatly increased, and you should receive the Dutch concert with comfort. We cannot say why you do not get better results from the Brown amplifier, as you do not give sufficient particulars. However, as you say, the amplifier may require adjusting.

"VACUUM" (Calcutta) *asks* (1) *Which of various possible arrangements will be best for aerial.* (2) *If it crosses the telephone wires, how high above the wires it should be at the point of crossing.* (3) *If the sanction of the G.P.O. would have to be obtained for taking an aerial across telephone wires.*

(1) The aerial crossing telephone wires would be somewhat the better, but the difference in efficiency is not sufficient to make it essential that you should do this. (2) The wires should not cross within 5 ft. of the telephone wires. (3) We do not know whether you are legally bound to obtain the Post Office sanction to cross their wires on your own ground, but we should advise you to refer to them before doing so.

"M.E.S." (Yorks).—The values of the condensers are:—A.T.C., maximum 0·001 mfd.; C.C.C., maximum 0·0005 mfd.; H.F. transformer tuning condenser, maximum 0·0002 mfd.; Grid condenser, fixed 0·0003 mfd.; By-pass condenser, fixed 0·001 mfd.; Telephone blocking condenser, fixed 0·002 mfd.; H.T. By-pass condenser, fixed from 0·001 mfd. to 0·5 mfd. Usual valve 0·05 mfd. We suggest you wind the A.T.I. on a former 3″ diameter 4″ long, full of No. 22 D.C.C., taking off tappings. The secondary may consist of a coil 2½″ diameter, 4″ long, full of No. 26 D.C.C. with 5 tappings. The H.F. transformer may consist of a tube of ebonite 1⅛″ diameter upon which is wound 450 turns of No. 38 S.S.C. for the primary, and the same number of turns for the secondary. The reaction may consist of 100 turns of No. 38 S.S.C. We suggest you see the articles on "Experimental Station Design," which appeared in the issues of September 2nd and 16th. The batteries and the diagram to which you refer are joined up correctly. Before constructing the set, we suggest you read the articles on "Experimental Station Design," which appear in alternate issues.

"A.E.B." (Catford).—(1) The A.T.I. may be of the single layer type, and we suggest you wind a former 6″ diameter and 8″ long full of No. 24 D.C.C., taking fifteen tappings. Alternatively you could find a number of basket coils and connect them in series. The reaction coil may be a coil 4″ diameter and 8″ long of No. 28 D.C.C. with eight tappings. (2) The variable condensers should have a maximum capacity of 0·001 mfds. Using plates and spacing washers of the size submitted, you will require 28 fixed and 27 moving. (3) The grid condenser of 0·0008 mfds. should consist of three plates, with an overlap of 1″×1⅛″. No. 2 condenser, 0·004 mfd., should consist of nine plates with an overlap of 1″×1⅛″. No. 3 condenser, 0·002 mfds. should consist of five plates with an overlap of 1″×1¼″. (4) We think you will be unable to make resistances of 50,000 ohms, and 5 megohms, which would remain constant in value. As they can be purchased for quite a small sum, we suggest you abandon the idea of constructing them. The grid condenser to which you refer should be 0·0008 mfds.

"C.S.A." (Aberystwyth).—(1) Circuit is quite satisfactory for a simple set. If, however, the crystal is carborundum, a potentiometer will considerably improve results. (2) The maximum wavelength of the coil suggested will be about 1,200 metres. (3) A slider is not necessary if your aerial tuning condenser is continuously variable. Always use as much A.T.I. and as little A.T.C. as possible at each wavelength.

SHARE MARKET REPORT.

Prices as we go to press on October 20th are:—

Marconi Ordinary	£2	8	0
,, Preference	2	3	1½
,, Inter. Marine.. ..	1	7	6
,, Canadian		10	8
Radio Corporation of America:—			
Ordinary	1	1	2¾
Preference		14	9

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

No. 168 [No. 5 Vol. XI.] NOVEMBER 4TH, 1922. WEEKLY

An Experimental Radio Transmitting Set.

By E. M. DELORAINE, ING. E.P.C.I.

GENERAL.

MOST amateur transmitting stations in this country probably use the "choke control" or "constant current" system of modulation.

having approximately the same characteristics, one tube being the oscillator and the other the modulator. The plates of both tubes are fed through a low frequency choke coil. The high

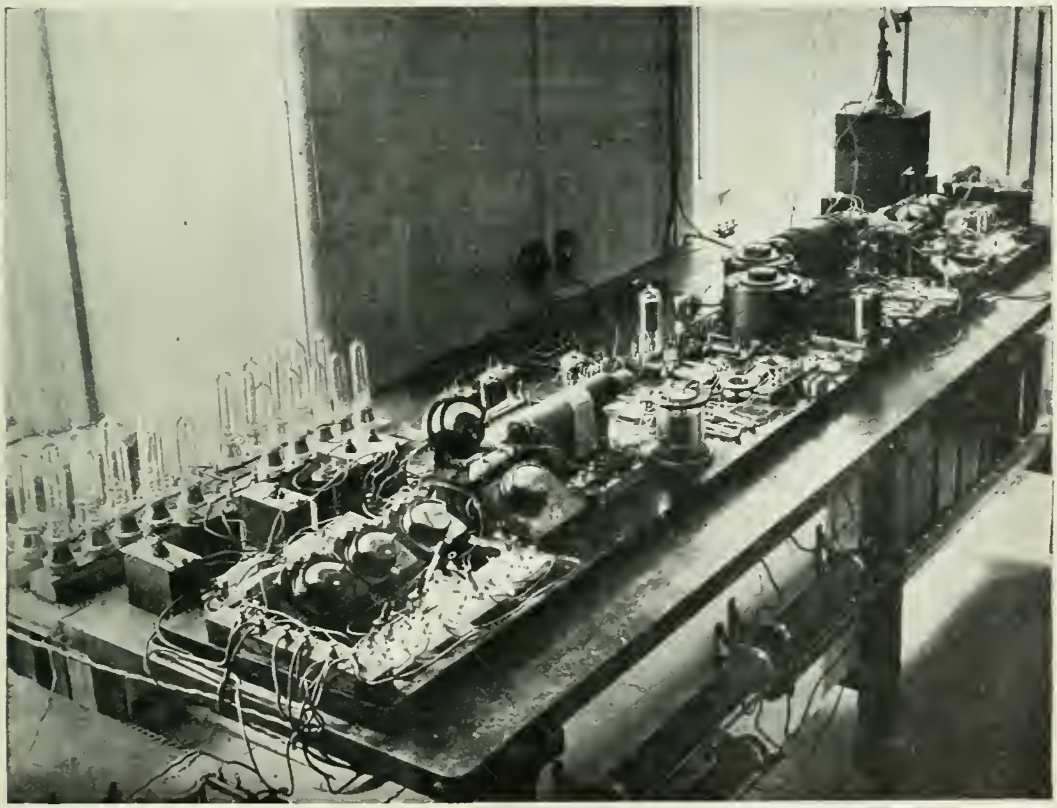


Fig. 1. General view of the Transmitter.

This system comprises essentially two vacuum tubes (or two groups of vacuum tubes)

inductance of this coil opposes rapid variation of current, and so ensures that the supplied current remains approximately constant. Between the plates of the oscillator and modulator is a high frequency choke coil which prevents the plate potential of the modulator from varying at radio frequency (Fig. 2).

If the grid potential of the modulator is constant the oscillator will supply a wave of high frequency current of constant amplitude, but if currents at speech frequency are impressed on the grid of the modulator, the plate current of the modulator will vary accordingly and produce slight variations of current through the low frequency choke coil. The inductance of the coil being large, the voltage across it varies to a considerable extent. For instance, suppose there is a 20 per cent. variation of current at a frequency of 1,000 cycles per second. If the inductance of the choke is 4 henrys, and the current 20 milliamperes, the variation of voltage will be :—

$$2\pi \times 1{,}000 \times 4 \times 0{\cdot}2 \times 0{\cdot}02 = 100 \text{ volts}$$

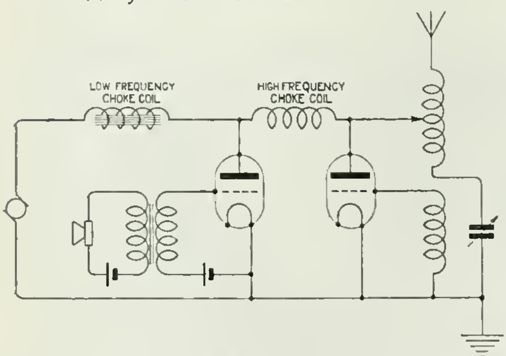


Fig. 2. Simplified circuit diagram.

If the plate supply is 300 volts, the plate potential of the oscillator tube will vary between 200 and 400 volts, in accordance with the impressed speech frequency, thus producing corresponding variations in the amplitude of the high frequency wave.

This system of modulation has a high efficiency (between 45 and 65 per cent.), and is perhaps one of the most satisfactory as far as quality and clearness of speech or music are concerned. (See Appendix I.)

Modulation by Grid Control.

It is interesting, notwithstanding the points in favour of the system of choke control, to pursue experiments with other systems of modulation. These are numerous, many of them involving in principle low efficiencies. The author has recently been experimenting with a system of grid control. It seems quite clear that a carefully adjusted transmitting set

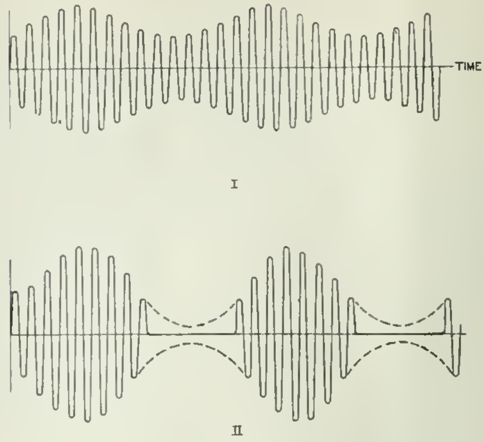


Fig. 3.

making use of " grid modulation " is able to deliver speech or music of the same grade as a set using " constant current " modulation, although the control of the former system probably requires more attention and skill than the latter.

Grid Control of the Oscillator.

It is practically impossible to obtain good modulation, with normal efficiency, using a system of direct control of the grid potential of the oscillator. If the variation of grid potential is small and the carrier wave incompletely modulated, no trouble is experienced. Speech is intelligible, if not good, but when the modulating signal is strong, oscillation suddenly ceases and then starts again (Fig. 3). Speech becomes unintelligible and music is of a very poor quality.

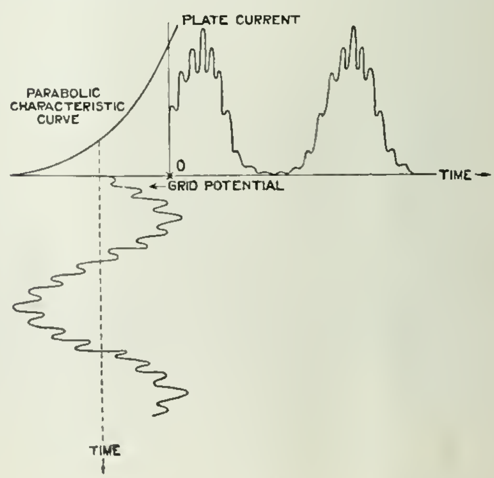


Fig. 4.

GRID CONTROL OF THE AMPLIFIER.

The idea which naturally occurs is to make use of a separate and independent oscillator and modulator, both acting on the grid circuit of an amplifier tube. This was used as far back as 1915, when speech was transmitted from Arlington to Paris, San Francisco and Honolulu. In this case, however, the amplitude of the high frequency oscillations on the grid was small compared with the amplitude of the signal at speech frequency; the modulation resulting from the parabolic shape of the grid potential space-current characteristic. When the operating point on the amplifier tube characteristic is moving up and down, the amplitude of the variation of space current is increasing or decreasing according to the slope of the characteristic at the operating point, thus producing in the output circuit, a current at radio frequency modulated according to the low frequency signal (Fig. 4).

The efficiency is determined by the amplifier and remains between 22 and 37 per cent. (See Appendix II.)

MODULATION SYSTEM IN USE.

Instead of making use of the fact that a part of the grid-potential plate-current characteristic is a parabola, let us assume now that there is a region large enough to use which is practically straight.

We can make use of a much larger oscillatory high frequency voltage, its amplitude being now equal to or greater than the amplitude of the signals at audio frequency. The combination of the modulator and oscillator current (I and II, Fig. 5) will result in a curve as represented (on III).

The resulting wave of current is impressed on the grid of the amplifier, taking care that the grid has such a steady negative potential that the operating point is at the beginning of the characteristic (*A*, Fig. 6), so that when no oscillations are impressed on the grid, the plate current will be practically zero. The amplitude of the high frequency wave must be of such a value that when the radio positive potential is at its peak value, the negative potential of the grid is halved (as shown on *B*). Now the signal at voice frequency must have a maximum amplitude equal to *A B* if complete modulation is desired, thus moving the peaks of high frequency from *A* to *C*. Consequently the output of the plate circuit and antenna current are as represented on IV and V, Fig. 5.

The quality depends to a large extent on the different adjustments and also upon the shape

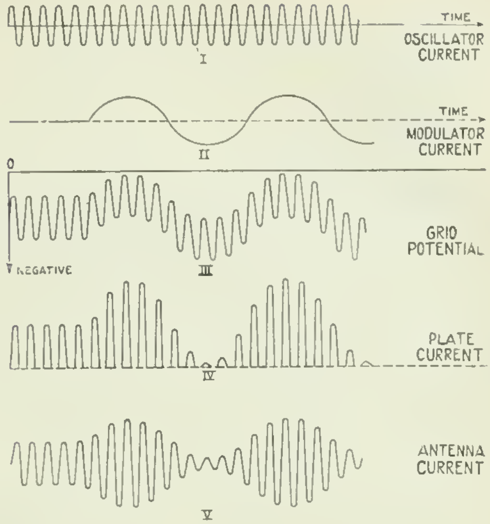


Fig. 5.

of the characteristics. This system is distortionless only to the extent that the characteristic can be assumed to be a straight line, or if some steps are taken to compensate the action of a curved characteristic.

The efficiency of this system of modulation can be raised to that of any other system (See Appendix III.)

PRINCIPLE OF THE CIRCUIT.

The circuit used for impressing both high frequency and signalling currents on the amplifier is, as a rule, as shown on Fig. 7, I. We can call this: magnetic coupling between oscillator, modulator and amplifier. The author tried a system somewhat different, which might be called a double resistance capacity coupling. Fig. 7 (II.)

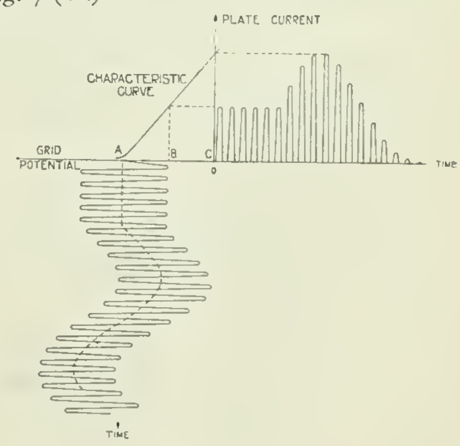


Fig. 6.

In principle we can divide this circuit into four parts:

Oscillator.
Modulator.
Amplifier.
Antenna circuit.

1. *Oscillator.* The High frequency oscillator may be of any type. It is connected in series with a condenser *C* of very small capacity and a resistance *R*. The condenser offers an easy path to the high frequency currents which are flowing through the circuit *O.C.a.b.*, thus varying the potential across *R*, as shown already in *I*, Fig. 5. These currents cannot pass through the circuit *a.L.M.b.* on account of the high impedance offered to radio frequency currents by the inductance *L*.

2. *Modulator.* The modulating circuit comprises a microphone transmitter which acts as a rule through an amplifier. Currents at voice

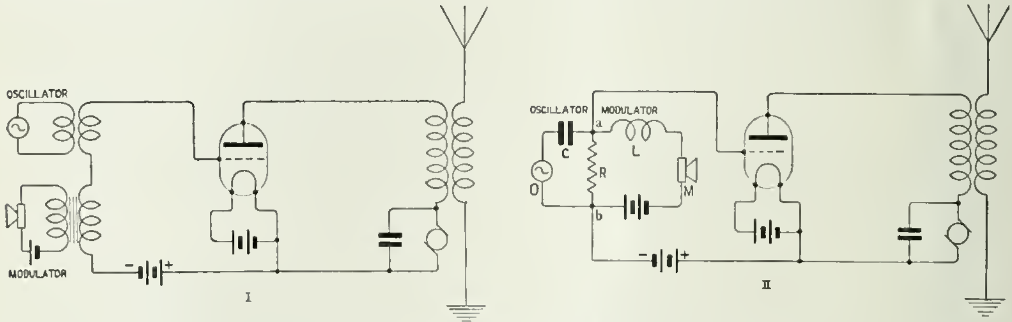


Fig. 7. Coupling arrangements.

frequency flow through the circuit *M.L.a.R.b*, thus varying the potential across *R*, as shown in *II*, but do not flow through the oscillator circuit, owing to the high impedance offered by the condenser *C* to current at voice frequency.

3. *Amplifier.* The grid is connected to the end " *a* " of the resistance *R*, the filament being connected to the other end " *b*," through the grid battery, which maintains the grid at a negative potential.

Potential variations of the grid with respect to the filament are shown in III. The plate current of the amplifier is controlled by the grid potential and has a wave shape as shown in IV.

Energy is transferred from the plate circuit to the antenna through a magnetic coupling. The modulated antenna current is represented in V.

The main advantage of this circuit is that by avoiding the use of iron core transformers, it is to a large extent free from distortion, and the efficiency of the coupling can be kept nearly constant for all frequencies above a certain minimum value.

Description of the Circuit.

The circuit used is solely of the experimental type and is subjected to frequent modifications. It is shown in Fig. 6. In the photograph, Fig. 1, the part of the set near the camera is mainly for control of filament and plate circuits and of the motor generator set. Next is the oscillator, then the amplifier. Further on can be seen the modulator, the output high frequency circuits, and finally, a one-stage low frequency amplifier with meters and control.

Vacuum Tubes.

The tubes used have been of various types but particularly the 20 and 30-0 Mullard tubes, and Western Electric tubes.

The Mullard type are well known; they have a vertical cylindrical plate made from a sheet of nickel, the grid being a spiral of molybdenum wire and the filament a straight wire of tungsten. The 0·20 valve requires a filament current of 1·5 amperes and is used with a plate voltage up to 500 volts.

The Western Electric tubes make use of oxide coated filaments. These filaments offer the most economical source of electrons at present available, that is, they give a maximum electronic emission for a given filament current. When metals are coated with certain chemical compounds their electronic emission is greatly increased. Considerations of mechanical strength, electrical resistance and non-oxidisation, led to the choice of a wire of platinum-iridium for the filament. This wire is rolled to a ribbon, to increase the surface, and the ribbon is twisted to secure better mechanical properties.

Experiments showed that a mixture of barium oxide and strontium oxide i· a number of consecutive coatings give the best results.

The most commonly used process consists in mixing barium carbonate with strontium, hydroxide with resin or paraffin and repeating the coating process. After each application the wire is raised momentarily to a temperature of about a thousand degrees, thus burning away most of the organic carrier. There remains a firmly adhering layer of oxide of barium and strontium, combined with platinum and iridium.

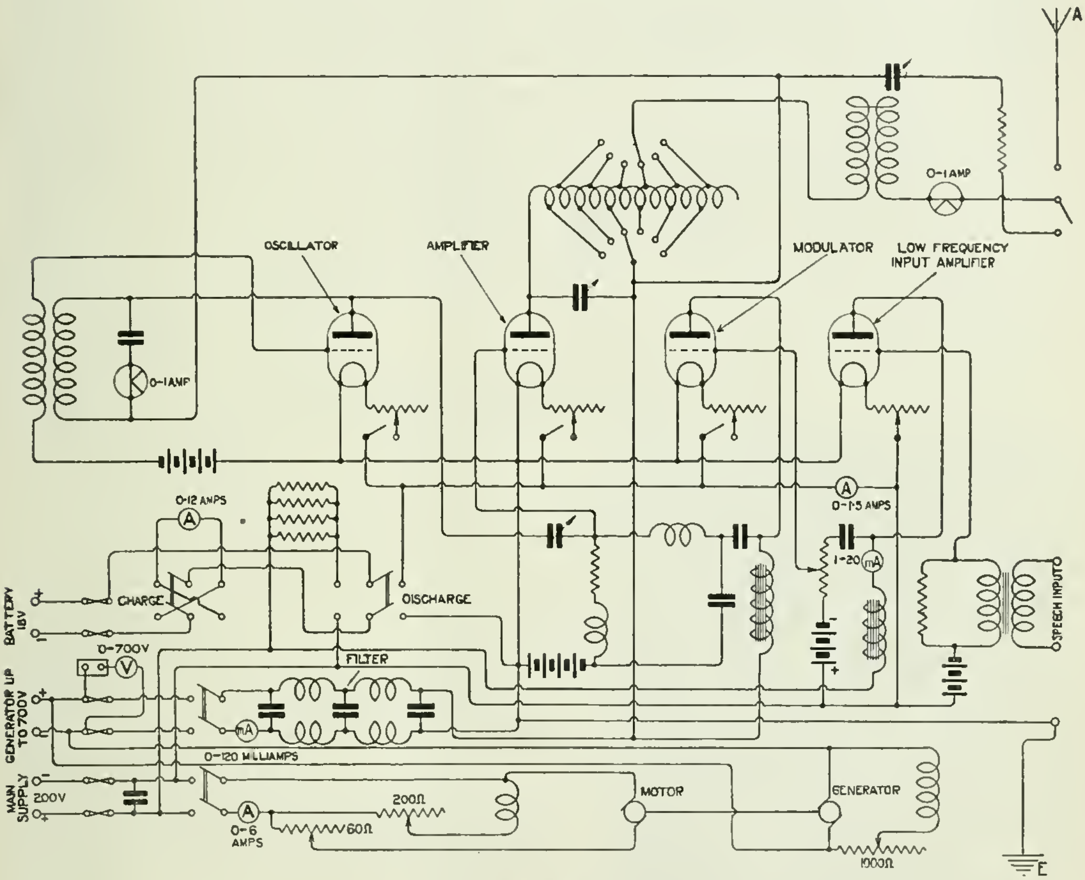


Fig. 8. Circuit diagram of the Transmitter.

The coated filament operates at a low temperature, corresponding only to a dull red heat. The emission from a square centimetre of tungsten at high temperature is about ten times greater than that from a square centimetre of coated filament. This greater density of emission from tungsten has the effect of requiring for a tungsten filament tube a smaller plate and grid structure than that required in the case of a coated filament tube having the same characteristics. This larger structure of tubes makes their manufacture an easier matter. The life of coated filaments, on account of their low temperature, is also longer than the life of tungsten filaments. The grid and plate of the Western Electric tube are of nickel, and are of a flat type, disposed on each side of a single or double V-shaped filament. (Fig. 9.)

The tubes of the latter type used in this circuit have the following characteristics :—

	Filament Current. Amperes.	*Plate Potential. Volts.*
Amplification ..	1.25	130
Output Power—5 watts	1.35	200
,, ,, 50 watts	3.4	up to 1000

OSCILLATOR.

For the oscillator a Mullard tube is used. It consists simply of a tuned anode circuit with reaction on the grid by mutual inductance.

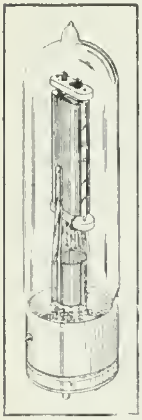


Fig 9.

MODULATOR.

A very important part in modulation is the starting point, that is, the transmitter. An ordinary solid back standard transmitter has been found to give satisfactory results. It must be remembered, however, that such a microphone is not well suited for the transmission of the higher frequencies. The voice range of frequencies is practically limited to 100 to 2,000 periods, whereas music requires a much larger range; the piano covering a range from 27 to 4,138 periods per second, the organ from 16 to 4,138. This does not include harmonics, which exceed 10,000 periods per second.

The microphone current of the solid back transmitter was able to act directly on the modulator but it was found preferable, in order to run the transmitter smoothly, to make use of one stage of low frequency amplification.

A special type of transmitter also has been tried. This is a double-button microphone made by the Western Electric Company, and intended either for radio telephone transmission, or for public address systems using loud speakers. The diaphragm is stretched till its natural frequency is raised to about 2,500 periods per second and this frequency is furthermore increased by the use of an air damping chamber. Best results are secured when the transmitter is spoken into at a distance of two or three feet. The reproduction of the speech or music is very clear, owing to the absence of resonant effects and variations in efficiency. The output of this tansmitter, however, is very small and requires amplification. A two-stage amplifier with resistance coupling increases the volume of sound to the normal standard of an ordinary microphone. (Fig. 10.)

The position of the microphone with regard to the transmitting instrument is also important. The gramophone used is an Aeolian Vocalion, with a tone control device, and this gives very good quality music. The best position of the solid back microphone was inside the horn. The double-button microphone is preferably placed at a distance of one or two feet from the horn and to the side of the gramophone as shown in Fig. 11. This position minimises any needle noise that may be present.

The modulator tube used is either a Western Electric 5-watt or a Mullard 0·20.

The oscillator and modulator act on the amplifier as previously explained. The amplitude of the voltage at radio frequency is controlled by a variable air condenser, and modulation is controlled by varying the resistance coupling between the last stage of low frequency amplification and the modulator. An inductance in series with the couplingr esistance, and a small condenser across the input of the amplifier, prevent the distortion which would be introduced by the capacities in resistance-capacity coupling.

AMPLIFIER.

The amplifier tube is a Western Electric type and has a tuned plate circuit which acts either on the antenna or on an absorbtion circuit.

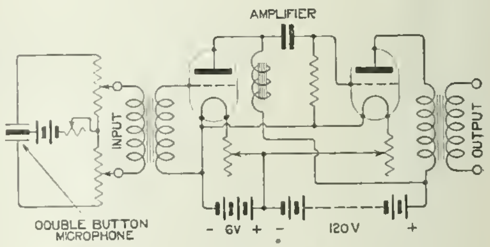


Fig. 10. *Two-stage amplifier.*

The author does not give precise data on voltage, currents, etc., because of the experimental character of the transmissions. These were never twice under the same conditions.

PLATE CURRENT SUPPLY.

It may be of interest to amateurs to state that before making use of a motor generator set, the plate current supply was obtained as shown in Fig. 12.

The main supply at 200 volts D.C. charges a condenser of 10 microfarads. This condenser is then connected in series with the mains and across another condenser of 30 microfarads. The latter consequently becomes charged at 400 volts, and supplies the plate voltage through a filter. These operations are performed by a simple commutator driven by a small power motor. This constitutes a simple method of obtaining twice the value of D.C. potential directly available, and involves very little expense.

APPENDIX I.

If the plate voltage of the oscillator is represented by :—

$$e = E\,(1 + K \sin \omega t)$$

$\frac{\omega}{2\pi}$ being the frequency of the signal impressed on the modulator, the plate current of the modulator will be :—

$$i_o = I\,(1 + K \sin \omega t).$$

K depends on the amount of modulation and will be unity when modulation is complete.

The space current in the modulator will be:—

$$i_a = I\,(1 - K \sin \omega t).$$

with

$$i_o + i_a = 2I,$$

$2I$ being the constant current supplied by the generator.

Let us call ϵ the plate efficiency of the oscillator.

The overall efficiency of the system, excluding the power dissipated in the filaments, will be equal to the oscillatory output power divided by the input power :—

$$Eff = \epsilon \frac{\frac{1}{T}\int_0^T EI(1 + K \sin \omega t)^2 dt}{E(i_o + i_a)}, \quad T = \frac{\omega}{2\pi}$$

$$= \epsilon \frac{\frac{1}{T}\int_0^T \left(1 + 2K \sin \omega t + \frac{K^2}{2} - \frac{K^2}{2} \sin 2\omega t\right)dt}{2}$$

$$= \epsilon \frac{1 + \frac{K^2}{2}}{2}$$

If modulation is complete the efficiency will be :—

$$Eff = \frac{3}{4}\epsilon$$

The efficiency ϵ of the oscillator may be 60 to 85 per cent., so that the overall efficiency of this system will be between 45 and 65 per cent.

APPENDIX II.

The modulated carrier wave may be represented by

$$i_a = I_o \sin \phi t (1 + K \sin \omega t).$$

$\frac{\phi}{2\pi}$ being the radio frequency.

If R is the effective resistance of the antenna for the frequency $\frac{\phi}{2\pi}$ the modulated power delivered to the antenna will be :—

$$p_a = RI_o^2(1 + K \sin \omega t)^2 \frac{1}{\zeta}\int_0^\zeta \sin^2 \phi t\, dt$$

with $\zeta = \frac{2\pi}{\phi}$

$$p_a = \frac{RI_o^2}{2}(1 + K \sin \omega t)^2.$$

The maximum value for complete modulation, *i.e.*, $K = 1$ is :—

$$p_a = 2RI_o^2.$$

This power is supplied by the amplifier tube. Consequently if ϵ is the plate efficiency of this tube, we have

$$2RI_o^2 = \epsilon EI,$$

thus

$$p_a = \tfrac{1}{4}\epsilon EI(1 + K \sin \omega t)^2.$$

The efficiency of this system is equal to the ratio of the integrated output power p_a to the input power EI.

$$Eff = \tfrac{1}{4}\epsilon \frac{1}{T}\int_0^T (1 + K \sin \omega t)^2 dt$$

$$= \frac{\epsilon}{4}\frac{1}{T}\int_0^T \left(1 + 2K \sin \omega t + \frac{K^2}{2} - \frac{K^2}{2}\cos 2\omega t\right)dt.$$

$$= \frac{\epsilon}{4}\left(1 + \frac{K^2}{2}\right)$$

Fig. 11. The microphones used for transmissions.

In the assumed case of complete modulation

$$Eff = \frac{3}{8}\epsilon$$

Taking again ϵ between 60 and 85 per cent. the efficiency of this system will remain between 22 and 37 per cent.

This does not include the power expended in the separate oscillator and modulator tubes, which still further lowers the overall efficiency.

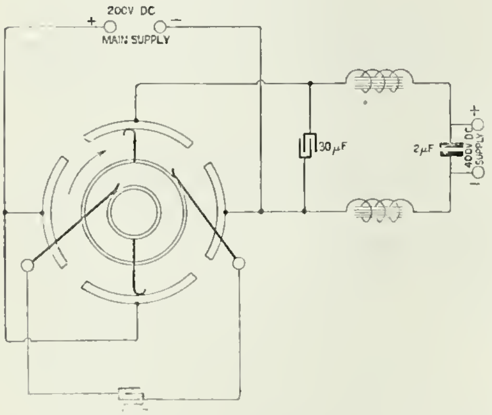


Fig. 12. Method of obtaining plate current supply.

APPENDIX III.

Let us assume the characteristic to be a straight line. In the working conditions previously described, the maximum value of impressed signalling voltage is equal to the amplitude of impressed high frequency voltage between A and B. If we take again the signalling current as a sine wave of frequency $\frac{\omega}{2\pi}$ the plate current will have an envelope :

$$i = I(1 + \sin \omega t)$$

but due to the fact that only half of the high frequency oscillation produces a flow of plate current, the mean value of plate current at signalling frequency will be :—

$$i_1 = \frac{I}{2}(1 + \sin \omega t)$$

As the plate voltage is constant, the power at signalling frequency will be :—

$$p = \frac{EI}{2}(1 + \sin \omega t)$$

and the mean power :

$$p = \frac{EI}{2}\frac{1}{T}\int_0^T (1 + \sin \omega t)dt = \frac{EI}{2}$$

The antenna current is :

$$i_a = I_a \sin \phi t\ (1 + \sin \omega t)$$

and the output energy :

$$Ri_a^2 = RI_a^2 \sin^2 \phi t\ (1 + \sin \omega t)^2$$

and at signal frequency.

$$w = RI_a^2 (1 + \sin \omega t)^2 \frac{1}{\zeta}\int_0^\zeta \sin^2 \phi t dt$$

$$\frac{RI_a^2}{2}(1 + \sin \omega t)^2$$

The maximum output energy is :

$$2\ RI_a^2.$$

This corresponds to the maximum input energy : EI. So that

$$\epsilon\, EI = 2\, RI_a^2$$

Consequently the mean output energy is :

$$W = \frac{\epsilon EI}{4}\frac{1}{T}\int_0^T (1 + \sin \omega t^2)dt = \frac{3}{8}\epsilon EI.$$

The efficiency is therefore

$$Eff. = \frac{\frac{3}{8}\epsilon EI}{\frac{1}{2}EI} = \tfrac{3}{4}\epsilon$$

The plate efficiency ϵ is about the same when using the grid control or the choke system, *i.e.*, between 60 and 85 per cent., providing the plate voltage is increased in the first case, to compensate the effect of the negative grid potential. The overall plate efficiency of the grid control system will be also between 45 and 65 per cent., so that it can compete as far as efficiency is concerned with the " constant current " system, or more generally with any other existing system.

A somewhat different method which has been suggested is to work with a very negative grid potential, so that when the high frequency currents are applied (but no signalling at voice frequency is impressed) the amplifier anode current is zero. In such a case, however, only the positive half cycle of signalling current will liberate corresponding high frequency in the antenna, and distortion results.

The Wireless Society of London

The November meeting of the Society, which will be held at 6 p.m. at the Institution of Electrical Engineers on Wednesday, November 22nd, will be a special general meeting for the purpose of authorising changes in the constitution of the Society through the alteration of certain rules. A lecture and demonstration will also be given illustrating the action of the three electrode valves by means of a mechanical model.

Electrons, Electric Waves, and Wireless Telephony—V.

By Dr. J. A. Fleming, F.R.S.

The articles appearing under the above title are a reproduction, with some additions, of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of production, and any subsequent re-publication. The articles are therefore copyright, and rights of publication and reproduction are strictly reserved.

III.—THE ARCHITECTURE OF ATOMS.

1. Molecules and Atoms.

BEFORE we can discuss the nature and properties of another type of wave called an electromagnetic wave, it will be necessary to consider briefly some of the things which modern researches have taught us concerning the structure of atoms, and the elements of which they are built up.

Twenty-five years ago no one could have given any information on this subject. In fact, even the actual existence of atoms was then in doubt. The word *atom*, derived from Greek verbal roots, signifies something which cannot be cut or divided, and any discussion on the structure of the interior of an atom would in those days have been very similar to the contents of a chapter in an old book on Natural History, headed " On Snakes in Iceland," the only information given therein being, " There are no snakes in Iceland."

So with atoms the only answer to questions as to the structure of an atom would then have been, " we know nothing about their structure and probably never shall know anything."

Although Greek philosophers twenty-five centuries ago had taught that material substances are composed of small discrete indivisible particles, no one had formulated any theory as to their inner construction, and they were only mentally pictured as extremely small spheres infinitely hard and of unknown composition. But the atomic theories of classical philosophers, such as Democritus and Lucretius, were mere speculations and had no basis in observed facts.

It was not until modern chemistry came into being by the discoveries of Cavendish, Boyle, Black, Lavoisier and Dalton, in the eighteenth and early nineteenth centuries, that valid reasons began to be given for the belief that material substance, in short, all matter is not infinitely divisible, but is composed of definite units of mass called molecules and atoms.

Suppose we consider such a substance as common table salt. We can divide it into small grains and each of these could be divided again under a microscope until we reach a particle nearly 1/100,000th of an inch in diameter, which is about the smallest size of particle visible in a good microscope. We have good reason to believe that even such a small particle would possess all the known qualities of common table salt. If we dissolve some salt in water and make a solution, no microscope yet made can show any visible particles in it, yet each drop of the liquid would taste " salt " and exhibit all the properties of common salt in chemical actions. Moreover, by an evaporation or boiling off the water we can recover the salt unaltered.

Hence we have good reason to believe that when in solution the salt is divided into particles of ultra microscopic size. But chemical experiments show that this substance can yield under the action of an agency called an electric current, the nature of which we shall consider immediately, two other substances, viz., a green poisonous gas, chlorine, and a soft metal, sodium, and therefore common table salt is called in chemical language, sodic chloride.

Moreover, effects we shall discuss later on prove that in very dilute solutions of sodic chloride, and other similar salts which conduct electric currents and are decomposed by them, the constituents, which in this case are chlorine and sodium, exist partly in an uncombined state.

Hence there is a certain small mass of sodic chloride which is the least possible mass which exhibits all the properties of common salt. It is called a *molecule* of sodic chloride.

The word molecule is derived from Latin words and means a small mass or quantity. There are various substances, about 90 in all, which have never been resolved or decomposed into any other substances and these are called *elements*. The smallest possible quantity or mass of any element which can exist as such and exhibit the chemical properties of the substance is called an *atom* of it.

Hence the molecules of complex substances are built up of atoms held together so as to form small similar bunches or groups. In certain very simple compounds such as table salt, the molecule may consist of only two dissimilar atoms, but in organic substances, such as albumen, oils, or starch, the molecule may contain many scores or even hundreds of atoms.

Even in elementary substances such as hydrogen or oxygen in the gaseous state, the constituent molecules contain two similar atoms held together.

We have been able to determine by methods which cannot here be described in detail, the mass or so-called weight and also approximately the size of molecules and atoms.

The view that small definite units of mass, called atoms, exist in the case of the elementary substances is strongly supported by the three laws of chemical combination, viz., Proust's Law of Definite Proportions, the Law of Relative Proportions and Dalton's Law of Multiple Proportions. These may be illustrated as follows : Every pure chemical compound is composed of elementary substances always in the same definite and constant proportion by weight. Thus water consists of 16 parts by weight of the gas oxygen combined with 2·016 parts by weight of the gas hydrogen, which combine and produce pure water when the gases are mixed and an electric spark sent through them. When the analysis of a pure compound is conducted with proper care it invariably yields the same proportions of its constituent elements.

The Law of Multiple Proportion may be explained as follows :—There are two known compounds of carbon (charcoal) and oxygen gas, viz., carbon monoxide (CO), a very poisonous gas, and carbon dioxide (CO_2). In the first, the ratio of mass of carbon to oxygen is 12 to 16, and in the second it is 12 to 32. The ratio of oxygen to carbon in the second is just double that in the first. It is found that whenever there is more than one compound of two elements, the ratio by weight of these elements in the two compounds is always in a simple integer proportion.

The Law of Relative Proportion is as follows : Consider three elements, hydrogen, oxygen and carbon. The first two combine in the proportion of 1 to 8 or 2 to 16, to form water. The second and third combine in the ratio of 16 to 12 to form carbon monoxide. Finally, the first and third combine in the ratio of 2 to 12 to form a gas called olefiant gas. We see then that to each element may be affixed a certain numerical value called its *chemical equivalent*, and combinations between elements always take place in the proportion by weight of the equivalents, or in some integer multiples thereof.

These facts, and many others like them, point very significantly to the conclusion that elementary substances exist in small ultimate units which are of exactly the same mass and enter into all chemical reactions without change of mass.

In short, matter is atomic in structure. Atoms unite to form molecules and molecules to form visible masses, just as letters are combined to form words and words to form sentences.

The relative mass or so-called weights of each kind of atom has been measured and is called the *Atomic weight*. It is expressed in terms either of the mass of the hydrogen atom taken as equal to 1, or of the oxygen atom taken as equal to 16. The *Molecular weight* of a molecule is the sum of the masses of the constituent atoms. Two terms, viz., *a gram-molecule* and *a gram-atom* are in frequent use. These mean respectively the quantity of a chemical substance or of an element which has a mass in grams numerically equal either to the molecular or the atomic weight. Thus the atomic weight of oxygen being 16, a quantity of oxygen weighting 16 grams is called one gram-atom of oxygen. The atomic weight of sodium is 23 and of chlorine is 35·47. Hence the molecular weight of sodic chloride or table salt is 58·47, and a mass of salt weighing 58·47 grams is called one gram-molecule of sodic chloride.

According to an hypothesis first made by the chemist Avogadro, in 1811, a gram-molecule of every kind of substance contains the same number of molecules.

In the case of permanent gases taken at standard temperature 0°C. and barometric pressure 760 mm., equal volumes therefore contain the same number of molecules and a gram-molecule occupies a volume of 22,400 cubic centimetres.

Thus 2 grams of hydrogen, 32 grams of oxygen, 28 grams of nitrogen, all have a volume of 22,400 c.c. at 0°C. and 760 mm. and contain an equal number of molecules, that number being very near to 66×10^{22} or 660,000 times a million billion in English reckoning.

This means that in one cubic centimetre there are about 30 million billion molecules. In a space of one-half of a cubic millimetre, or about the volume of a small pin's head, there are ten million times more molecules of air than there are human beings alive on the surface of our earth at present. This will give some faint idea of the exceeding minuteness and number of the molecules in the air we breathe.

Non-scientific persons are apt to imagine that these figures are mere guess work, but this is not the case. We can now count by various methods the number of molecules in a cubic inch of air with quite as close an approximation to truth as we can count the number of men, women and children in Great Britain by a census taken on the night of any given date.

2.—Dimensions of Atoms.

As regards the sizes of atoms and molecules there are various lines of argument which lead to the conclusion that approximately speaking, the diameter of an atom is of the order of one hundred millionth of a centimetre. This means that if a million atoms were placed in contact like marbles arranged in a row, they would only occupy a length of 1/250th part of an inch, or less than the thickness of the thinnest sheet of tissue paper. To count this million atoms would take at least a week, counting without stopping day and night.

An approximate measurement of atomic diameters is derived from the study of thin films of various kinds.

Skilled gold beaters can beat out one ounce of gold until it covers an area of 240 square feet. The thickness of the sheet would then be about four-millionths of an inch.

There are three units of length which are convenient for measuring very small lengths or thicknesses and these are as follows :—

A millimetre (1 mm.) is the thousandth part of a metre and is about 1/25th part of an inch.

A micron (1μ) is the thousandth part of a millimetre.

An Angström unit (1 A.U.) is the ten-millionth part of a millimetre and therefore the ten-thousandth part of a micron or 10,000 A.U. $= 1\mu$.

Roughly speaking, the diameter of an atom is about two to five Angström units.

It is possible to prepare gold leaf the thickness of which is about one-tenth of a micron or 1,000 A.U. Such leaf when held up to the light has a green colour, or is semi-transparent and transmits green light.

This gold leaf has, however, several hundred layers of atoms in its thickness, probably 300 to 500 atoms. We can, however, prepare thinner films of soapy water. If a soap bubble is blown with a suitable material, or better still, if a metal ring is filled with a soap film by dipping it into the soap mixture, and if this film is placed in a glass dust-free box in a vertical position, the film begins to thin away by drainage from the top part. Presently we notice certain small round black spots which look like holes, but are not holes, because in proper positions we can see an image of a bright light source, such as the sun reflected by them. It is possible to measure by several methods the thickness of the film in these black spots. It is found to be about 60 A.U. or six thousandths of a micron. This film, however, must be of a thickness equal to the diameter of several atoms.

The late Lord Rayleigh (3rd Baron) measured the thickness of still thinner films of oil floating on the surface of water and found them to be about 20 Angström units (A.U.) in thickness ($= 2 \times 10^{-7}$ cm.).

M. Devaux, by another method, produced films of oil on water of half the above thickness, viz., 10 A.U. In this last case the film is probably formed of a single layer of molecules of oil, and hence we see that molecular diameters must be between $1/10^7$ and $1/10^8$ of a centimetre, or approxiamtely be of the order of one hundred millionth of a centimetre or from one to five times this last length.

At this stage we must, however, define a little more carefully what we mean by the diameter of an atom or molecule. We shall show presently that atoms are not solid, sharply defined masses like billiard balls, but in all probability resemble solar systems in miniature, in which a number of still smaller particles circulate round a nucleus like planets round the sun.

3.—The Kinetic Theory of Gases.

It will be necessary, therefore, to sketch in outline the kinetic theory of gases or theory of the motion of gas molecules.

In a mass of air or gas the constituent molecules are not at rest, but flying hither and thither with immense and various speeds in every possible direction. We know that this must be the case from the facts of diffusion. If we have two vessels, one full of air or other gas and the other exhausted or vacuous, and if they are connected by a pipe in which there is a plug of porous clay or unglazed earthenware, we find that after a time some of the gas will have passed through the plug and diffused into the vacuous space. Also if the two vessels contain gases of different densities, but at the same pressure such as hydrogen and oxygen, then they both diffuse in opposite directions, but the lighter gas diffuses faster than the heavier gas. In a certain time the gases will have mixed completely so that each vessel will contain the same proportion of each gas.

We know that the gas in any closed vessel exerts a pressure on the walls. This pressure is a force in a dynamical sense of the word, and is due to the bombardment of the walls by these flying molecules. Let us suppose that there are N molecules in one cubic centimetre and that each molecule has a mass m and is moving with a velocity v. This velocity is not the same for all molecules, some are moving quickly and some slowly at any instant. Of the N molecules we may suppose one-third or $N/3$ to be moving at any instant perpendicularly to one surface of the cube of 1cm. in side and 1 square centimetre in area. If we take v to be an average velocity then mv is the average momentum of each molecule, and when it strikes the side of the cube and rebounds from it, its momentum $+mv$ is changed in direction to $-mv$ in the time taken for the molecule to move over a distance of 2 cms. Hence the change in momentum is 2 mv in a time $2/v$ seconds.

Force is defined as the rate of change of momentum and the time rate of change of momentum or force is in this case $\dfrac{2\,mv}{\frac{2}{v}} = mv^2$. Hence the pressure on the side of the cube due to the $N/3$ molecules is $\frac{1}{3}Nmv^2$.

Suppose we now take v to be, not the actual velocity of one molecule, but the *square root of the mean of the squares* of all the various molecular velocities, called the R.M.S. velocity, then since Nm is the mass of the gas in 1 c.c. $= d$, we have for the gas pressure p on a surface of one square centimetre the expression

$$p = \tfrac{1}{3}dv^2$$

Hence it follows that the *mean square velocity* v^2 is $3p/d$ and the root-mean-square velocity v is $\sqrt{3p/d}$, where d denotes the absolute gas density.

The pressure of a gas per square centimetre measured in absolute units of force, called *dynes*, which corresponds to a height of the barometer of 760 mm. or nearly 30 inches of mercury and at 0°C. is very nearly one million dynes, and the density of hydrogen gas is 1/11,200 because 11,200 c.c. of this gas weigh one gram. Hence the R.M.S. speed of the hydrogen molecule is $\sqrt{3 \times 10^6 \times 11{,}200}$ centimetres or 1,830 metres per second.

In the case of oxygen, which is 16 times denser than hydrogen, the R.M.S. speed of the molecule is close to 460 metres per second.

It is important that the reader should clearly understand what the above statements imply.

The gas molecules are flying in all possible directions and with very different speeds. If we could divide up the molecules into a very large number of groups of nearly equal velocity according to their speed, but without taking regard to direction of motion, we should find that a very small number of molecules had a zero or very small velocity and a very few had a considerable velocity, but the great majority approximate in speed to a certain " most probable speed," which is very nearly the same as that obtained by squaring the numerical value of the speeds of the different groups and then taking the square root of the mean of these squares, in other words, obtaining the R.M.S. speed.

Clerk Maxwell was the first to give a general law in the form of a mathematical expression and to give a curve for the distribution of velocity amongst gas molecules. The curve shown in Fig. 35 is a curve whose equation is

$$y = x^2\epsilon^{-x^2}$$

Where $\epsilon = 2{\cdot}71828\ldots$ etc., viz., the base of

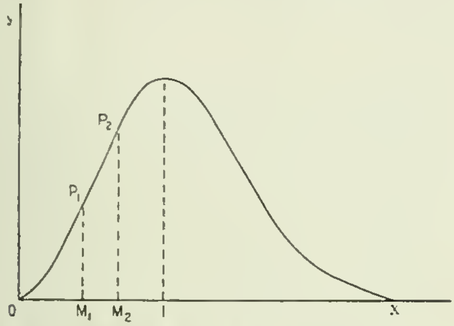


Fig. 35. *Maxwell's Curve Graph of* $y = x^2\epsilon^{-x^2}$

the Napierian system of logarithms. The curve is so drawn that the abscissa OI of the maximum ordinate is taken as equal to unity. The value of y is zero both for $x = o$ and $x =$ infinity. If we take two ordinates P_1M_1, P_2M_2, then it can be shown that the value of the area $P_1M_1M_2P_2$ multiplied by $4/\sqrt{\pi}$ gives the fraction of the number of gas molecules in any volume, the speeds of which lie between values denoted by the abscissæ OM_1 and OM_2.

Thus, for instance, in the case of oxygen gas molecules, whose R.M.S. speed is 461·2 metres per second, the following table taken from Meyer's *Kinetic Theory of Gases*, gives the speeds of various groups of molecules in metres per second.

	Metres per second
13 to 14 molecules have speeds from	0 to 100
81 ,, 82 ,, ,, ,, ,,	100 ,, 200
166 ,, 167 ,, ,, ,, ,,	200 ,, 300
214 ,, 215 ,, ,, ,, ,,	300 ,, 400
202 ,, 203 ,, ,, ,, ,,	400 ,, 500
151 ,, 152 ,, ,, ,, ,,	500 ,, 600
91 ,, 92 ,, ,, ,, ,,	600 ,, 700
76 ,, 77 ,, ,, ,, ,,	700 ,, above

It will thus be seen that all but about 10 per cent. of the molecules have speeds which lie between half and double the R.M.S. speed of 461 metres per second.

It will thus be evident that in a mass of oxygen gas the molecules are flying about in all directions for the most part with speeds which lie between 500 and 2,000 miles an hour. A very few are moving more slowly and a few more quickly .

In the case of hydrogen gas which has an R.M.S. speed about four times greater than oxygen, the molecules are moving for the most part with speeds from 2,000 to 8,000 miles an hour or 100 times faster than express trains.

In the course of this extremely rapid motion the gas molecules collide with one another. The average distance they move over between two collisions is called *the mean free path.*

In the case of air at normal pressure and temperature the mean free path is about 1/250,000th part of an inch or 1/10,000th part of a millimetre, or 1/10th of a micron. This is roughly about 500 times the diameter of a gas molecule. The mean free path varies inversely as the pressure of gas. Hence, if we make a so-called vacuum by removing all but one-millionth of the air from a vessel, the mean free path is increased to about four inches in length.

We can now give a more exact definition of what is meant by the diameter of an atom or molecule. It is the least distance between the centres of two atoms or molecules at their closest approach during a collision.

If D is the diameter of the sphere of impact or atomic diameter as defined above, and if N is Avogadro's constant, or the number of molecules in a gram-molecule, and if V is the volume of this gram-molecule and L is the mean free path, then Clausius showed long ago that the relation between these quantities is given by the equation $\pi\sqrt{2}\,LND^2 = V$ where π is the circular constant 3·1415 . . . .

From this equation we can obtain, as given by J. Perrin in his book on "Atoms," translated by D. Ll. Hammick (Constable & Co., London), the diameters of various molecules, as below :—

Helium	1·7 by 10^{-8} cm.
Argon	2·8 ,,
Mercury	2·9 ,,
Hydrogen	2·1 ,,
Oxygen	2·7 ,,
Nitrogen	2·8 ,,
Chlorine	4·1 ,,

The reader should note that the symbol 10^{-8} means one divided by 100 millions, or 1/100,000,000.

It will be seen that the diameter lies between about $1\frac{1}{2}$ and 4 Angström units, each of which is one hundred millionth of a centimetre. Since we know that Avogadro's constant is a number near to 66×10^{22}, which is the number of molecules of gas in 22,400 cubic centimetres by volume, and since we know that this volume of hydrogen weighs 2 grams and of oxygen 16 grams, it follows that we know the absolute mass or so-called weight of a molecule of these gases; it is easy to find that the mass of an atom of hydrogen is near to $1{\cdot}63 \times 10^{-24}$ gram, where 10^{-24} means 1 divided by a billion times a billion. In other words, a billion times a billion atoms of hydrogen weigh 1·6 grams.

We know, therefore, the mass and diameter of various kinds of gas molecule and the number of them in a cubic centimetre at standard temperature and pressure. We have to realise that the molecules of the air we breathe are little particles of matter somewhere about a hundred-millionth of an inch in diameter, flying about in various directions with the velocity of a rifle bullet, or say, 1,500 feet or so per second, striking against other molecules about 5,000 million times in a second, moving on an average about four-millionths of an inch between each collision, and so numerous that about 400 million billion are contained in every cubic inch of space.*

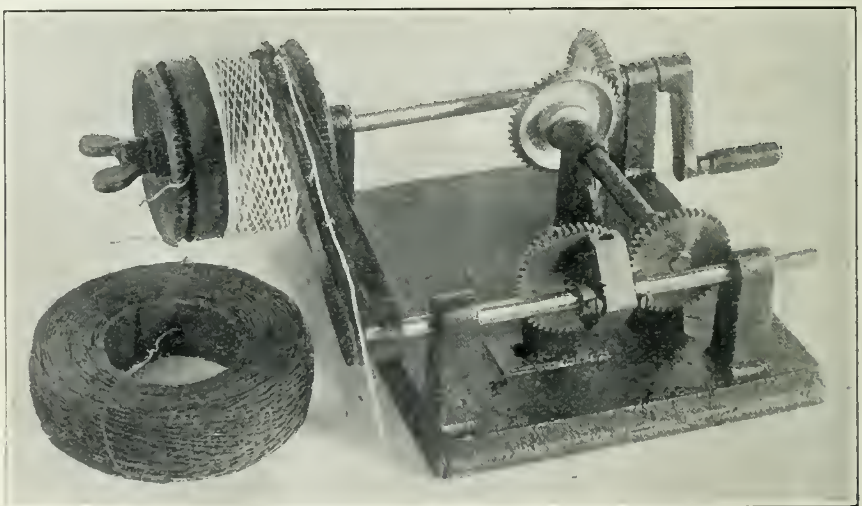
The pressure which the air exerts on the sides of a vessel containing it, which at ordinary barometric weight is about 14½ lbs. on the square inch, is due to the incessant bombardment of the inner surface of the containing vessel by these small but numerous projectiles.

Since the mass of an atom of hydrogen is $1{\cdot}6 \times 10^{-24}$ gram and the diameter of a molecule (two atoms) of hydrogen is $2{\cdot}1 \times 10^{-8}$ cm., it follows that the mean density of a hydrogen atom is about 3·3 times that of water, and that of an oxygen atom about 51 times.

* In English reckoning a billion means a million times a million, or 1 followed by 12 cyphers, but in the United States a billion means 1,000 times a million or 1 followed by 9 cyphers.

A New Coil Winder.

A new type of coil winder, possessing many novel features, has recently made its appearance. It is very robustly built, and has the advantage that the winding drum is directly driven, being on the same shaft as the handle, whilst the lighter mechanism for oscillating the guide arm is operated through substantial bevel wheels held tightly in mesh. The distance through which the guide arm moves, which controls the width of the coil, is adjusted by means of a pin set in the face of one of the wheels. Coils are built upon ebonite or strawboard cylinders, firmly gripped between two grooved cones forced together with a wing nut. The illustration shows a large finished coil wound with quite fine wire, No. 30 S.S.C. The coil partly wound is of No. 26 D.C.C., a gauge of wire which winds particularly well. The machine is heavily built and should have a long life.



Finished and partly finished coils. The utility of the machine is clearly indicated.

The Effect of Underground Metalwork on Radio Direction Finders.*

By R. L. Smith-Rose, M.Sc., D.I.C., A.R.C.S., A.M.I.E.E., and R. H. Barfield, B.Sc., A.C.G.I.

1.—Introductory.

THE Radio Research Board for some time past has had in operation an organisation of some ten stations distributed over the British Isles for the purpose of investigating in detail all the errors, both fixed and variable, to which radio direction finders are subject when used on land. The first author of the present paper has had the responsibility of selecting the sites for these stations, installing the apparatus and supervising the entire organisation from its commencement. To avoid differences of instrumental error, all the D.F. sets were identical in every detail, and were installed in standard wooden huts in as similar a manner as possible.

The system of direction finding employed is that invented by Captain J. Robinson, and largely used by the Royal Air Force. A detailed description of this system has been given by the inventor† in a paper dealing with the principles and design of the apparatus. As described in that paper

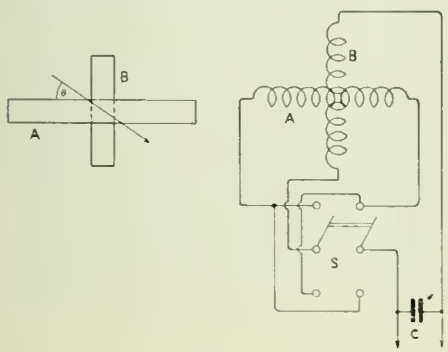


Fig. 1.

this system employs two frame coils fixed together at right angles and rotating about their common vertical axis. The two coils are connected in series through a reversing switch to a variable condenser to tune the coil system to the incoming waves (see Fig. 1). According to the position of the reversing switch the e.m.f. in one of the coils is either added to or subtracted from the e.m.f. in the other coil. Leads are taken from the terminals of the condenser to a standard form of detector-amplifier to give audible reception of the incoming signals. From a consideration of this arrangement it will be evident that in general, a change in intensity of the signal heard in the telephones will take place when the reversing switch is operated. When, however, the plane of either of the frame coils is at right angles to the direction of the incoming signals, no e.m.f. will be induced in this coil, and there will therefore be no change in signal intensity on switch reversal. A slight rotation of the system in either direction will disturb this balance, and the direction of the incoming waves can thus be determined with good accuracy, while obtaining a clearly audible signal throughout the process. To avoid a 90° ambiguity which might otherwise occur, and also to greatly increase the accuracy of the determination, one of the coils is made of much greater area-turns than the other.

In the actual sets employed the larger coil of the system is of dimensions 5 ft. by 3 ft., and wound with 30 turns of insulated copper wire with ¼ in. spacing. The small coil is similarly constructed of size 3 ft. by 2 ft. 10 ins., wound with 16 turns of wire, spaced ½ in. These two coils are screwed together and arranged to revolve in a stand about six feet high. The four leads from the two coils are brought out to a combined tuner-switch box fixed to the side of the stand. This box contains the reversing switch, and a condenser continuously variable up to about 0·008 microfarad, being suitable to tune the coil system over the range of wavelengths from 2,000 to 9,000 metres. A circular wooden scale 2 ft. in diameter is fixed to the large coil from which the direction of the incoming signal is read. These sets have an instrumental accuracy of the order of 1 degree, a perfectly definite observation being frequently obtained to an accuracy of ¼ degree under favourable conditions.

A standard form of R.A.F. amplifier has been employed in these installations, giving amplification by three valves at radio-frequency, and two or three stages of audio-frequency amplification, with an intermediate rectifying valve.

During the first part of the investigation, the observations at all the stations were limited to "spark" or damped wave signals, but the receiving sets have now been equipped with specially designed screened oscillators§ for the reception of continuous waves.

From the regular observations carried out by these D.F. stations, many thousands of readings have been received which are now being collated for interpretation. One of the first immediately obvious results which was observed was that the majority of the D.F. stations possess permanent errors, which vary greatly not only from station to station, but also in different directions around each station. In many cases these errors are small and negligible for most practical purposes for which a direction finder might be used. In other cases, however, the errors are large and much too serious to be neglected.

*A paper read before the Wireless Society of London on Wednesday, October 25th, 1922.

†J. Robinson, "A Method of Direction Finding of Wireless Waves and its Application to Aerial and Marine Navigation."—*Radio Review*, Vol. I, pp. 213-219, 265-275, 1920.

§ R. L. Smith-Rose, "On the Electromagnetic Screening of a Triode Oscillator."—Proceedings Physical Society, Vol. XXXIV, pp. 127-138, 1922.

2.—Description of Errors Experienced at Aberdeen.

In particular, it was soon observed that the results received from the station installed near the University at Aberdeen showed large errors for which it was difficult to account. These errors were found to remain reasonably constant in the day time for several months in succession, the observations made at night being subjected to large variable errors, with which the present paper is not concerned.

A summary of the permanent errors at Aberdeen being the mean day errors experienced on spark stations, between June, 1921, and April, 1922, with the addition of a few C.W. observations taken more recently, is given in the following table No. 1 :—

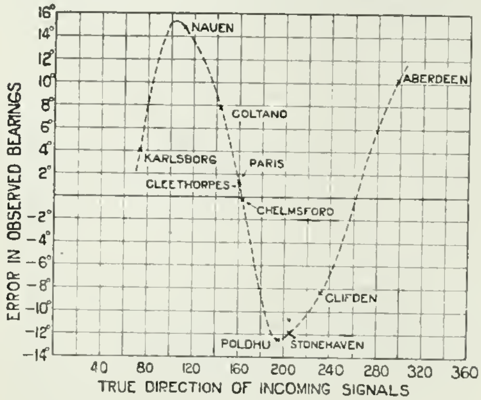


Fig. 2.

TABLE 1.

Mean Errors at Aberdeen from June, 1921, to April, 1922.

Transmitting Station.	Wave-length km.	True bearing	Mean error.
Aberdeen, C.W. - -	3·3	299·2°	+10·3°
Chelmsford, C.W.- -	3·8	160.6°	— 0·3°
Cleethorpes, S. - -	3·0	161·5°	+ 1·2°
Clifden, C.W. - -	5·8	233·8°	— 8·5°
Coltano, S. - -	4·2	144·5°	+ 7.9°
Karlsborg, S. - -	4·2	74·1°	+ 4·0°
Nauen, S. - - -	3·2	111·6°	+14·8°
Nauen, C.W. - -	4·9	111·6°	+14·7°
Paris, S. - - -	2·6	160·6°	+ 1·3°
Paris, S. - - -	3·2	160·6°	— 1·3°
Paris, C.W. - - -	8·0	160·6°	+ 1·6°
Poldhu, S. - -	2·8	196·1°	—12·6°
Stonehaven, C.W. -	4·5	204·0°	—11·9°
Stonehaven, C.W. -	5·6	204·0°	—10·7°

These results show that the errors obtained are practically independent of the wavelength used and also of the type of transmission, *i.e.*, spark or C.W. ; but they vary considerably with the true direction of the station. The manner of the latter variation is best shown by a curve as in Fig. 2. This curve indicates that the error is practically quadrantal, being similar to that produced by the metal hull of a ship.

This similarity is well demonstrated by comparing Figs. 2 and 3. Fig. 3 is a graphical representation of the observations made by the first author with the same type of direction finding set installed on H.M.S. "Fitzroy" during October, 1921. The quadrantal nature of the error produced by the metal hull of the ship is well indicated, the slight distortion evident being due to the asymmetrical distribution of the metal work, stays, etc., on the ship relative to the D.F. set. It is seen that the error is a maximum for a direction of incoming waves at approximately 45° to the ship's axis, zero error being obtained for waves arriving either along or at right angles to the axis.

3.—Possible Causes of the Error.

Owing to the regularity of the above curve on the Aberdeen site it would appear that the cause of the error is very local, since waves coming from quite different directions are affected in a similar manner. In seeking for an explanation of the error the following points were considered.

(*a*) *Refraction due to Coast Line or other Geographical Features.*

Since waves coming from oversea are affected similarly to those arriving overland the effect cannot bo ascribed to coastal refraction, *i.e.*, a deviation in the direction of propagation of a wave in crossing the boundary between media of different conductivity, such as from sea to land. The magnitude of the error also is much greater than that previously experienced due to refraction even at much lower wavelengths* As the ground in the neighbourhood is reasonably flat, particularly in the direction towards the coast at a distance of three-quarters of a mile, it may be assumed that this large error is not due to hills or mountains, which are also known to produce changes in the direction of waves passing in their neighbourhood.

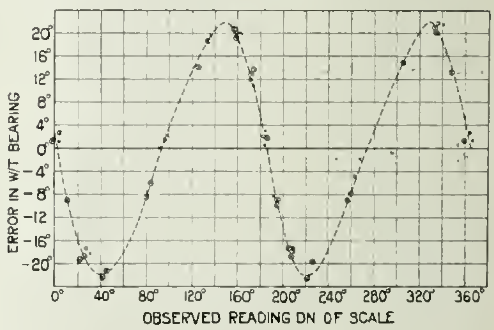


Fig. 3.

(*b*) *Overhead Wires.*

A plan of the immediate neighbourhood surrounding the hut in which the D.F. set is situated at Aberdeen is given in Fig. 6. This shows that the hut is within 55 yards of a stretch of twenty overhead telephone wires, in a direction nearly due east at this point. Previous experiments on the effect of such wires carried out by the authors have shown that at any distance

* See for examplo : T. L. Eckersley, "Refraction of Electric Waves," *Radio Review*, Vol. I, pp. 422-8, 1920.

greater than 40 yards the errors due to them are not greater than 2° or 3°.

It will also be observed from Fig. 6 that a wire fence passes within 14 yards of the hut. It will be shown later that this fence was not responsible for the errors.

(c) *Geological Features.*

In the absence of any obvious cause of the error above ground, it was reasonable to search for this below the ground. A study of the geological maps of the neighbourhood of Aberdeen showed

Fig. 4a. Photograph showing mode of carrying the D.F. set without dismantling.

the sub-soil to be fairly uniform in structure, although the survey was naturally not carried out in sufficient detail to render impossible the existence of a sudden change in structure in the vicinity of the hut.

4.—Need for Local Experiments.

Owing to the absence of an explanation of the cause of the errors as indicated in the previous paragraph, it was considered desirable to carry out experiments in the neighbourhood of the D.F. station at Aberdeen to verify that the error was purely local and to trace the cause if possible. These experiments were accordingly carried out by the authors during the week ending April 29th, 1922, with a small portable single-frame direction finding set. As this instrument was specially designed for the purpose, and contained one or two novel features, a brief description of it is given.

5.—Description of D.F. Set Used.

The requirements borne in mind in the design of this instrument were:—

(a) Moderate portability of the whole set by two persons, involving a rapid change in the position within one or two hundred yards, and not necessitating the dissembling or disconnecting of the apparatus.

(b) To have a good receptive power over a range of wavelengths of from 1·0 to 10·0 kms., and

(c) To give indications of observed bearings correct to at least 1°.

The apparatus is shown in the photographs, Figs. 4 and 5. The set was made to carry either of two box-shaped frame coils, that shown in the figure being the larger, and of dimensions 4 ft. square by 8 ins. deep. This coil is wound with 34 turns of No. 20 S.W.G. silk-covered copper wire insulated with ebonite combs at the corners with a spacing of about $\frac{3}{16}$ in. The "area-turns" of the coil are 544 square ft. turns, and its effective inductance = 3·02 millihenries. A pane comprising a variable air condenser and four fixed mica condensers with paralleling switches is mounted at the bottom inside the frame, rotating centrally with the latter. These condensers connected across the frame coil give a tuning range on the latter of from 2·0 to 10·0 kilometres, while the smaller coils gave a range with a lower limit but overlapping this. This smaller coil was 2 ft. 6 ins. square, wound with 25 turns at $\frac{1}{8}$ in. spacing. The "area-turns" of the coil are 156 square ft. turns, and the effective inductance is 1·17 millihenries. With the above condenser panel, the range of wavelengths covered is from 1·0 to 6·0 kilometres.

The small wooden platform upon which the coils were carried was mounted at the top of a brass tube 1 in. diameter, which formed the rotating

Fig. 4b. View of the set raised on the roof of the hut at Aberdeen, position 1c. (*See Table* 2.)

spindle of the set. This spindle passed centrally through the top of a large wooden box, and was supported on a pivot at the bottom of the box. The dimensions of the box are 23 ins. by 18 ins., by 15½ ins. high, and it is entirely covered with tinned iron sheet, one side being removable and normally closed with about 2½ ins. tight overlap. This box serves as a shielded container for the amplifier, its associated batteries and all connecting leads. A standard R.A.F. six-seven valve amplifier was used, which gave good reception for all wavelengths between 1·5 and 9·0 kms. The batteries employed consist of a 70-volt H.T. battery comprising 50 small dry cells fitting into a compartment of the above box, and a 6-volt 50 ampere-hour accumulator battery for the valves filament current. The leads from the coil circuit are taken down the hollow brass spindle to the amplifier. The filament resistances of the latter are controlled externally through two circular holes cut in the movable side of the tin box. The telephone cord is brought out through another hole, and the external portion of the cord is encased in a metallic spiral sheath connected to the screening box. The whole set of frame coil and screened box is supported on wooden legs, the bottom of the box being 15 ins. above the ground. The box is also provided with a pair of wooden carrying handles projecting on each side to enable two persons to carry the complete outfit. (See Fig. 4a.)

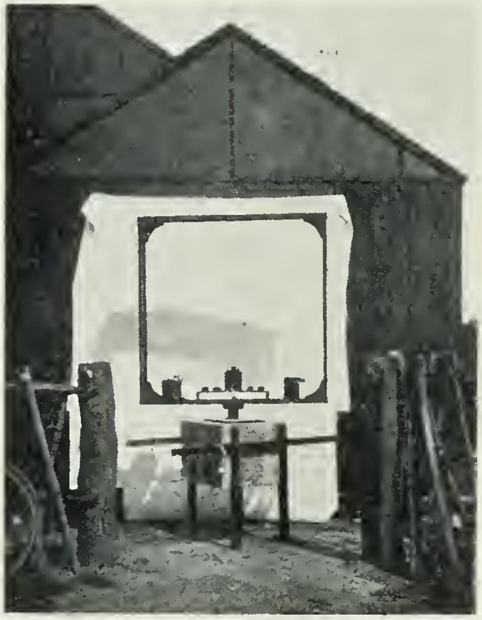


Fig. 5a. Portable single-frame direction finding set

A horizontal scale is provided on the top of the box over which moves the pointer attached to the rotating table. When the outfit is set up at any desired position it is adjusted by means of the compass so that the pointer indicates true geographical bearings when the coil is set at the minimum or zero position for received signals.

The top side of the wooden framework was covered with tin foil immediately below the wire turns. By connecting this tin foil to the shielded box below the circuit it was found that the "minimum" of the set was considerably improved, and enabled the observation of fairly accurate bearings. Tests made on the set showed that the observed bearings were correct to 1° or 2°, which is within the limits of error experienced by a normal D.F. set on land.

6.—Use of the Portable Set at Aberdeen.

The "accuracy" or angle of zero signal, to which the bearings were observed with this frame coil at Aberdeen, varied from 0·5° to 10°, the latter angles being usually due to the weakness of signals at a comparatively remote place such as Aberdeen. Signals from Poldhu and Chelmsford, for instance, were practically inaudible at Aberdeen over an angle of 10° to 20° round the minimum position, but experience has shown in both this and other experiments that such large angles do not prevent the mean reading being correct to 1° or 2°. A certain amount of difficulty was also experienced at Aberdeen due to transmissions from Stonehaven, only 16 miles distant, which practically prevented observations on any station on a neighbouring wavelength.

7.—Exploration of the Site.

On carrying out a careful inspection of the site in the neighbourhood of the hut containing the D.F. set, it was found that in addition to the possible causes of error mentioned in section 3, there were three other circumstances to be taken into account:—

(*a*) The first, which was judged to be the most important, was the existence of a large sewer crossing the field and passing directly under the hut. The sewer was located by the discovery of a line of manholes in this and neighbouring fields, its position being shown on the sketch map, (Fig. 6). It rises to a depth of only 1 ft. 6 ins. below the surface at a point immediately under one corner of the hut. In fact the ground in this locality is piled up to form a slight mound. Inspection by means of the manholes showed the sewer pipe to be of egg-shaped section, varying 3 ft. to 6 ft. high and to be constructed of brick and concrete. Except at the manholes, no part of it appeared to be made of iron and enquiries made from the local surveyors confirmed this conclusion. This being the case it could not be reasonably expected to produce any errors on radio bearings.

Fig. 5b. Portable single-frame direction finding set.

A survey of the direction of the sewer, however, showed this to be 170° from true North, while it will be noted that the error curve in Fig. 2 has zero error for the direction 163°, this latter being the direction of the axis of the hypothetical mass of metalwork which would (in the manner of the hull of the ship) be required to produce a quadrantal error curve of the same general shape as the above. The approximate coincidence of these directions, therefore, could not but be regarded as suspicious in spite of the reputed absence of metalwork in the sewer.

(*b*) The second was that at the point where the sewer crossed the small brook an iron plate 3ft. 6ins. square by ¼in. thick was discovered on inspecting one of the manholes at this point. It was also found that the brook was conducted under the sewer by means of an iron pipe about 40 ft. long.

(*c*) The third was the existence of two rubbish dumps as indicated in Fig. 6. These were found to be chiefly composed of metal cans and scrap for the lower three or four feet of their depth, being mixed and covered with cinders and clinker. As one of these dumps of size 115 by 85 yds. and 5 ft. deep was situated at only a few yards from the hut, it was not considered impossible that this comparatively large mass of metalwork might produce some errors in bearings.

8.—DESCRIPTION OF EXPERIMENTS.

In consideration of the somewhat complicated local conditions, it was decided to experiment in different positions in the neighbourhood with a view to locating the cause of the errors more definitely. In all, 18 positions were tried and a total of 350 observations were made of the bearings of various transmitting stations. A summary of these observations is given in Table 2.

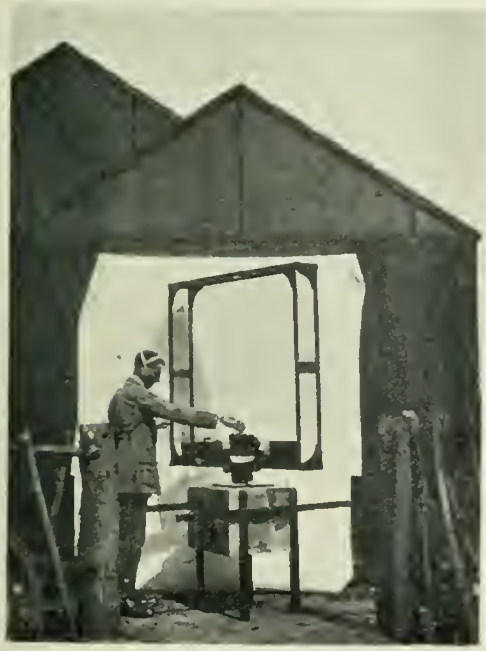


Fig. 5c. Portable single-frame direction finding set.

The positions referred to by numbers in the table are shown in the diagram Fig. 7 which is an enlargement of the central part of Fig. 6.

TABLE 2.

GENERAL SUMMARY OF RESULTS OF EXPERIMENTS. MEAN ERRORS AT EACH POSITION OF D.F. SET. (See Fig. 7.)

Station Obsvd.	(km.)	True bearing.	1a	1b	1c	2	3	4	5	6	7	8	9	10	11	12 Fence uncut.	12 Fence cut.	13	14	15	16	17	18
Nauen	{3·2 / 4·9}	110·6	+15°	+15°	+11°	+14°	+8°	+9°	+6°	0°	+1°	+6°	+2°	+9°	—	+7°	+7°	6°	−4°	−7°	0°	0°	+17°
Paris	{8·0 / 2·5}	160·6	+1°	—	—	—	−1	—	—	−3	−2	+6	+1	—	—	—	—	—	—	+9	+2	+2	—
Chelmsford	3·8	163·6	0°	—	—	—	—	—	—	−4	−6	+6	+1	—	—	—	—	—	—	—	+1	−1	+1
Poldhu	2·5	196·1	−13°	—	—	—	−11	—	—	—	—	−5	—	—	—	—	—	—	—	—	—	−2	—
Stonehaven	{5·6 / 4·5}	204·0	−11	−12	−8	−10	—	+1	—	3	−1	+1	−1	−4	−3	−5	−5	+1	+1	+7	0	−0	−8
Clifden	6·5	233·8	−9	−9	−6	—	—	—	—		−2	—	—	—		−1	−1	0	0	−4	−1	−1	−7

TABLE 3.
Mean Error in Various Positions of D.F. Coil.

Transmitter observed.	Along Sewer								Within 80′ of Sewer line.				Within 300′ of Sewer line.			
	No. 1	No. 2	No. 6	No. 10	No. 12	No. 13	No. 15	No. 18	No. 7	No. 5	No. 11	No. 14	No. 9	No. 8	No. 16	No. 17
Nauen	+15	+14	0	+9	+7	−6	+7	+17	+1	+6		−4	+2	+6	0	0
Paris	+1		−3				+9		−2	0			+1	+6	+2	+2
Chelmsford			−4					+1	−6				+1	+6	+1	−1
Poldhu	−13													−5		−2
Stonehaven	−11	−10	−3	−4	−5	+4	+7	−8	−1		−3	+4	−1	+1	0	0
Clifden	−9				−1	0	−4	−7	−2						−1	−1

In positions 1b. the D.F. set was raised two feet above its situation in position 1a, whilst in position 1c it was raised nine feet above the first position by erecting it on the roof of the hut. It will be seen that only a very slight decrease in error is produced by raising it to the latter and none at all to the former position.

In position 12 the set was very close to the wire fence shown in Fig. 6 and here the opportunity was taken of investigating the effect of the fence on the bearings.

Accordingly a length of about 100 ft. of the fence nearest to the set was isolated, to effect which each wire was cut at either end of this length and a piece of string inserted in the gap. Observations taken before and after cutting the fence are recorded in the table and it will be seen that no difference in bearings could be detected. This proves conclusively that the part played by the fence in producing the errors is negligible.

The comparative freedom from errors experienced in positions 16 and 17 show equally well that the rubbish dumps do not have any appreciable effect, and the fact that large errors are experienced in positions 13 and 15 is good evidence that the telegraph wires are not alone responsible for the phenomenon since these positions are over 200 yards from the wires.

9.—Interpretation of Results.

On the whole it cannot be doubted that the results are in accordance with the theory that the main distortion is caused by a part of the sewer though the distance from the sewer at which errors can still be detected is rather great.

In order to make this more clear, the results have been rearranged in Table 3, being classified

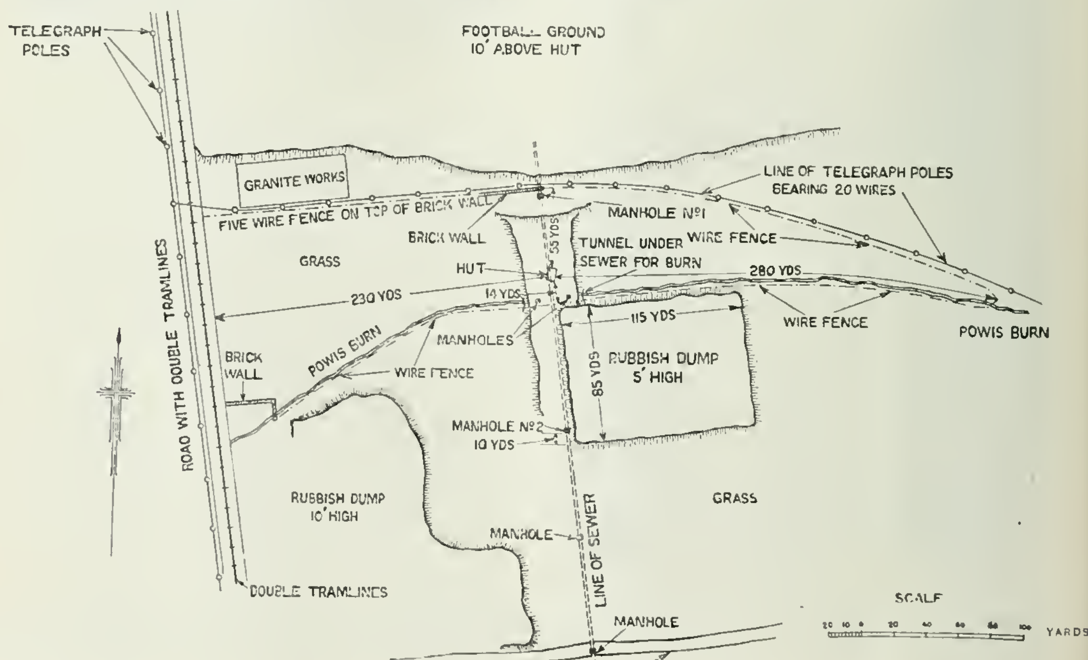


Fig. 6.

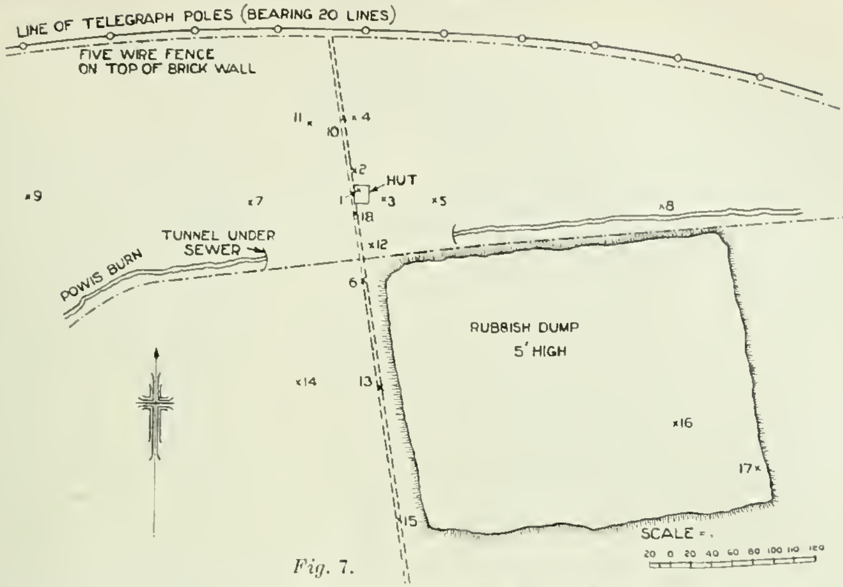


Fig. 7.

according to their position with regard to the sewer. None of the results in Table 2 which have been omitted from Table 3 will be found to contradict this hypothesis, they are merely left out on account of their irrelevancy.

Table 3 shows :—

(*a*) That in general, the errors decrease as the distance from the sewer is increased, becoming negligible at about 300 ft. from its line ; position 8, however, is an exception, as considerable errors were experienced here. It can only be concluded that these were due to the telegraph wires which are comparatively close at this point.

(*b*) It urther shows that the errors at points along the sewer are a maximum in the locality of the hut falling off on each side of it.

(*c*) That a point on the top of the sewer apparently exists (*i.e.*, near position 6) where the errors are practically negligible ; as this point is passed travelling along the sewer the errors from the majority of stations change in sign, rising to considerable values on the other side of it (positions 13 and 15).

From these facts the presence of a metallic object of length of the order of several hundreds of feet and of comparatively small width, with its length coinciding with that of the sewer, seemed undoubtedly to be indicated, and the result in (*c*) though perhaps unexpected, does not contradict this theory. This suggests the special construction of a section rather than the whole of the sewer as being responsible for the effect. Enquiries already made had obtained from the local authorities particulars of the structure of the sewer with the definite statement that it contained no metal work. In view of the general evidence, however, it was now thought necessary to obtain a check as to the reliability of this information. The authors therefore obtained access to the actual plans of the sewer, when it immediately became clear that the particular part of the sewer in the locality of the D.F. hut was, in fact, a special section with special construction owing to its proximity to the surface. Reference to the special plans which had hitherto escaped the notice of the surveyor, revealed the existence of a strip of "expanded steel" 6 ft. wide by 300 ft. long and 8 ft. below the surface at the hut, forming the foundation of this special section of the sewer.

10.—Conclusion.

This discovery, therefore, fully confirmed the prediction which could be made from the experiments carried out, as to the existence of a mass of metal work buried entirely beneath the surface of the ground at a depth of several feet. Owing to the several other local conditions already described, which might contribute to the errors to a small degree, it was not considered expedient to continue the investigation in any further detail. This investigation, however, serves to indicate how very difficult it is to find a site on land, particularly near large towns, which is suitable for radio direction finding, for there may literally be "more in it than meets the eye." The experiments also suggest a possible application of a radio direction finder in another sphere for the location of masses of metalwork underground, such as water and gas mains, streaks of minerals, metal ores, etc. It is not at all impossible that we shall soon be reading in the newspapers that Radio Expert Blank now offers his services for the location of gold or other hidden treasure, at a fee depending entirely on results. We may even shortly receive the prospectus of a company to be floated with a view to exploiting this application.

The authors desire to acknowledge their indebtedness to the Radio Research Board and to the Directional Wireless Sub-Committee of the Board for providing the facilities for the carrying out of these experiments, and for granting permission to publish the results. They have also to acknowledge the assistance during the experiments of Messrs. J. E. Ritchie, M.A., B.Sc., and J. Coull, the observers of the Radio Research Board at Aberdeen.

Recent Developments in Radio Telegraphy and Telephony.

MR. E. H. SHAUGHNESSY, O.B.E., M.I.E.E., M.I.R.E., of the Wireless Section of the General Post Office, will give a lecture on "Recent Developments in Radio Telegraphy and Telephony" at the Regent Street Polytechnic on Friday, November 3rd, at 6 p.m.

The chair will be taken by Mr. F. J. Brown, C.B. C.B.E., an Assistant Secretary of the Post Office, and by permission of H.M. Postmaster General, and with the co-operation of the Marconi and Broadcasting Companies, the lecture will be followed by a demonstration of wireless telephony on a scale not hitherto attempted in this country. The magnitude of the demonstration will be seen from the programme :—

7.0 to 7.5 p.m. Sir William Noble, Chairman of the Broadcasting Committee, speaking at Marconi House, will introduce, by wireless, the Lord Mayor of Bristol.

7.10 to 7.20 p.m. An address by the Lord Mayor of Bristol, given at his residence in Bristol, transmitted over the "Wired Wireless" circuit to Paddington, thence to Marconi House by wire, and there broadcasted.

7.25 to 7.30 p.m. Recital at Bristol by Mr. E. E. Aickin, of the Post Office Engineering Department.

7.30 to 8.30 p.m. Instrumental and vocal concert broadcasted from Marconi House, the names of the artistes being announced.

During the concert Major T. Worswick, Director of Education, will broadcast an address.

British Amateurs Heard at Nice.

M. Leon Deloy, president of the Radio Club de la Côte d'Azur, Nice, has sent us the following report of reception. As all the reception was done on a single valve with 40 or 80 volts on the plate and no filament rheostat or grid potentiometer, they show the excellence, he says, of the British amateur transmitters.

"2 KF was heard early in October on a set I had installed in Saône et Loire. Signals good and easily readable when he was radiating 0·8 amperes. The receiver was three DL coils and two condensers, the telephones Baldwin and the aerial a single wire 85 metres long, 8 metres high.

"I am now back at 8 AB, Nice, and have already heard 2 JZ when he was radiating 1·25 ; signals good ; 2 ON telegraphy QSA and telephony QSA ; 2 OM telegraphy and telephony, signals good and 2 KF signals QSA. All this was heard with a "Tuska" receiver (variometer in the plate) and an aerial of one wire 160 metres long, 20 metres high.

"But the most remarkable result is that of Mr. Besneux, Treasurer of our Club, who heard 2 JZ at the same time as I did, using three home-made honeycomb coils, two condensers and a single valve on an aerial ten metres long, stretched one metre from the wall, between two windows of his flat in town."

A further communication from M. Leon Deloy states that "to night I heard excellent telephony from 2MT, and very good telegraphy from 2OD, all on same single valve receiver. Also two stations on telephony around 440 metres unreadable under "QRM" from spark stations.

THE TRANS-ATLANTIC TESTS.

With reference to the trial transmissions conducted in America in connection with the above tests, will those who have succeeded in receiving these signals in this country or elsewhere in Europe please communicate their results to Mr. Philip R. Coursey, B.Sc., either direct or care of this office. Mr. Coursey is acting as secretary of the sub-committee appointed by the Wireless Society of London to organise the Trans-atlantic tests on this side. The only report of reception so far is received from Mr. W. W. Burnham. Details of reception will be published later.

Notes

Whale Warnings.

Warnings of the locality of whales are now transmitted from the Mosquito Bay Station, East Greenland.

Spanish Club Invites Correspondence.

In the Club Reports columns of this issue will be found an invitation to amateurs in this country either individually or collectively to correspond with the Radio Club de España, Madrid.

Royal Corps of Signals Lectures.

Lieut. D. J. Davies has arranged to give a series of public lectures at the Park Street Drill Hall, Cardiff, dealing with the theory and practice of wireless apparatus. Lieut. Davies is in charge of the Wireless Section of the Royal Corps of Signals at Park Street.

German Valve Case.

Four arrests have been made in Germany on charges of obtaining transmission valves belonging to the Telefunken Company. The valves, which were patented, were sold abroad, but we understand they have been recovered.

L.C.C. Schools to Teach Wireless.

An important step in the progress of radio education has been taken by the London County Coucil. Approval has been given for the inclusion in the curriculum of 25 schools the tuition of this branch of science. So far 13 schools have actually been given permission. We understand that the apparatus is to be constructed by the boys in the course of their training. The London County Council schools are not the first to be associated with wireless. Several provincial schools have erected sets, as we have previously mentioned in this journal, but the move on the part of the London County Council will probably arouse interest in educational circles throughout the country.

Sheffield Society and Press Experiments.

Mr. F. Lloyd's presidental address to the Sheffield and District Wireless Society was used as a means of testing the ability of the *Yorkshire Telegraph and Star* to make use of wireless as a means of rapid publication in press. At the newspaper office a reporter listened in, while at the Mappin Hall of the Applied Science Department of the University of Sheffield, Mr. Lloyd delivered his address. The speech occupied twenty-five minutes. Within an hour and three-quarters the paper containing the speech was on sale a mile away. This time could have been reduced had not a delay occurred in waiting for other matter which had to be published at the same time. The experiment was considered highly successful. It must be borne in mind that the reporter's shorthand report had to be transcribed before being handed to the compositor to be set in type.

For the coming year the following officers have been elected for the Sheffield and District Wireless Society :—President, Mr. F. Lloyd ; Hon. Secretary, Mr. L. H. Crowther ; Assist. Hon. Secretary, Mr. L. A. K. Halcombe ; Hon. Treasurer, Mr. C. H. Hainsworth ; Chairman of Committees, Messrs. W. Forbes-Boyd and H. Lloyd. The Society has 112 members, and the accounts show a credit balance.

Wireless in School.

Starbeck Council School, Leeds, is one of the schools where the installation of wireless apparatus has been added to the equipment. In order to make this possible the necessary finance has been obtained by profits on the school gardening.

Lectures at Nottingham.

A special course of fourteen experimental lectures on "Wireless, its Origin and Development," by Prof. E. H. Barton, F.R.S., and Mr. A. H. Franks, B.Sc., is to be delivered at the University College, Nottingham, commencing on Friday, November 3rd, at 7 p.m.

Aeroplane Control.

Experiments are being carried out in France as the result of which it is hoped to establish a means of controlling aeroplanes without either pilots or passengers on board. At first a pilot will ascend with a machine and only intervene should the control from the ground fail. Afterwards, if experiments are successful, an attempt will be made to control more than one machine from a master aeroplane occupied by a pilot.

Mauritius Naval Wireless Station Closed.

As the naval wireless Station at Mauritius has been closed, its service with ships is being undertaken for the present by the tug *Labourdonnais*. The call letters are **VRK**. Its location is Port Louis Harbour. The hours of service are 0400-0800, and 1200-1400 G.M.T.

New Regular Transmission.

The French high-power station at Basse-Lande near Nantes, call letters **UA**, has inaugurated a broadcast private message programme on C.W. to ships at sea which are out of the range of the ordinary coast stations in France. The times of transmissions are 2100 to 2200 G.M.T., and when necessary 1600 to 1700 G.M.T., on a wavelength of 2800m. (spark). The range of the station is 1,500 nautical miles.

Mr. E. H. Shaughnessy on Leafield.

At the Borough Technical School, Wellington, Mr. E. H. Shaughnessy, O.B.E., M.I.E.E., delivered a lecture on "The Imperial Wireless Station at Leafield." The meeting was held under the auspices of the North Wales Centre of the Institution of Post Office Electrical Engineers. Members of the Shropshire Philosophical Society and the Shrewsbury and District Radio Society were invited to attend. Permission was given by the P.M.G. for the Leafield Station to send a special message to the meeting and this was received on the apparatus of Mr. C. L. Naylor, a member of the local Radio Society. The message was as follows :—"Leafield Wireless Station. The first station of the Imperial wireless chain sends greetings to the inhabitants of Shrewsbury. Oxford Wireless Station is anxiously awaiting the arrival of its bigger brothers in the Imperial chain, but in the meantime is ready and willing to transmit messages to and receive messages from those sons and daughters of Shrewsbury dwelling in the less distant portions of the Empire." The message was in Morse code.

Calendar of Current Events

Friday, November 3rd.

Electrical Power Engineers' Association.
At 7 p.m. At the Institution of Electrical Engineers. Lecture on "The Application of Radio Methods to the Distant Control of Electrical Apparatus," by Mr. P. R. Coursey, B.Sc. (Members of Wireless Societies invited.)

Finchley and District Wireless Society.
Reception of speech and concert from Bristol in co-operation with the Broadcasting Companies, via Marconi House.

Radio Society of Highgate.
At 7.45 p.m. At the 1919 Club, South Grove, Highgate, N.6. Lecture on "Construction of H.F. Amplifiers," by Mr. G. W. Sutton, B.Sc.

Bradford Wireless Society.
At 5, Rendallwell Street, Bradford. Debate on "The Prevention of Self-Oscillation."

Belvedere and District Radio and Scientific Society.
Lecture on "The Thermionic Valve," by Mr. S. G. Meadows.

Hornsey and District Wireless Society.
Lecture by Mr. Davy.

Leeds and District Amateur Wireless Society.
At Grammar School. Lecture on "Diagram Interpretation," by Mr. D. E. Pettigrew.

Regent Street Polytechnic.
At 6 p.m. Lecture on Recent Developments in Radio Telegraphy and Telephony by Mr. C. H. Shaughessy, O.B.E. (see also p. 172.)

Saturday, November 4th.

Dewsbury and District Wireless Society.
At Moot Hall. Also on 6th and 7th Exhibition and Demonstration.

Glasgow and District Radio Club.
From 12 to 9 o'clock. At the McLellan Galleries Hall, Sauchiehall Street. Exhibition and Demonstration.

Sunday, November 5th.

Daily Mail Concert from the Hague. 3 to 5 p.m., on 1,085 metres.

Southampton Wireless Telephony Association.
At 7 p.m. At King's Hall, London Road, S.E.1. Wireless Concert in aid of King's College Hospital.

Monday, November 6th.

North London Wireless Association.
Lecture on "The Elementary Principles of Radio Telegraphy and Telephony, II," by Mr. F. S. Angel.

Ilkley and District Wireless Society.
At 7.30 p.m. At Regent Café. Demonstration and lecture on "A Speculation of the Supposed Relation Between Electricity and Matter," by Dr. J. B. Whitfield.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Lecture on "High Frequency Currents," by Mr. E. Mould.

Finchley and District Wireless Society.
Lecture on "Manufacture and Construction of Valves.

Hornsey and District Wireless Society.
General Business and Discussion.

Tuesday, November 7th.

Transmissions of Telephony by 2 MT, Writtle, as above.

Thames Valley Radio and Physical Association.
Presidential address and lecture by the President.

Plymouth Wireless and Scientific Society.
At Plymouth Chambers. Lecture on "High Frequency Amplification," by Mr. L. J. Voss.

Lowestoft and District Wireless Society.
Lecture on "Simple Telephony Transmitters," by Mr. H. C. Trent.

Edinburgh and District Radio Society.
At 8 p.m. Lecture on "Wireless Communication," by Col. Crawley.

York Wireless Society.
At 7.30 p.m. At Grand Café, Clarence Street. Lecture on "Wireless Telegraphy, its History and Development," by Mr. V. O. Newton.

Wednesday, November 8th.

Institution of Electrical Engineers (Wireless Section).
At 6 p.m. At Victoria Embankment. Lecture on "The Effect of Local Conditions on Radio Direction-Finding Installations," by Mr. R. L. Smith-Rose, M.Sc., and Mr. R. H. Barfield, B.Sc.

Redhill and District Y.M.C.A. Wireless Society.
At Station Road, Redhill. Lecture on "Tuning"

Thursday, November 9th.

Hounslow and District Wireless Society.
At Council House, Treaty Road, Hounslow. Lecture on "Wireless for the Beginner," by Mr. S. H. Nayler.

Hackney and District Radio Society.
Special General Meeting to discuss reorganisation of membership, subscriptions, etc.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School. Practical work and experiments.

Derby Wireless Club.
At 7.30 p.m. At the Court, Alvaston. Lecture on "Protection of Overhead Lines from Atmospherics," by Mr. S. J. R. Allwood.

Dewsbury and District Wireless Society.
Lecture on "Inductance," by Mr. Skinner.

Friday, November 10th.

Heckmondwike and District Wireless Society.
At 7.30 p.m. Exhibition and Demonstration. Opening by Mr. C. W. Leather, Checkheaton.

Radio Society of Highgate.
At 7.45 p.m. At the 1919 Club, South Grove. Informal meeting.

Belvedere and District Radio and Scientific Society.
Lecture on "Properties of Crystals," by Mr. H. H. Smith.

Leeds and District Amateur Wireless Society.
Lecture on "Some Gadgets of a Faddist," by Mr. G. P. Kendall, B.Sc.

Manchester Wireless Society.
Annual General Meeting.

Saturday, November 11th.

Heckmondwike and District Wireless Society.
At 3 p.m. Exhibition and Demonstration. Opening by Lieut. H. W. Burbury, R.N., Crigglestone.

Liverpool Wireless Society.
First meeting of Winter Session at Royal Institution. Address by Prof. E. W. Marchant.

Books Received

Tracked by Wireless. By William Le Queux. (London : *Stanley Paul & Co.* Cr. 8vo. 7s. 6d. net. and Fcap 8vo. 2s. net.)

Radio for Everybody. By A. C. Lescarboura, Editor of *Scientific American.* (London : *Methuen & Co., Ltd.* 170 illustrations.)

How to Retail Radio. By the Editor of Electrical Merchandising. (*McGraw-Hill Publishing Co., Ltd.* Pp. 226, illustrated. 6″ × 4″. Price 10s. net.)

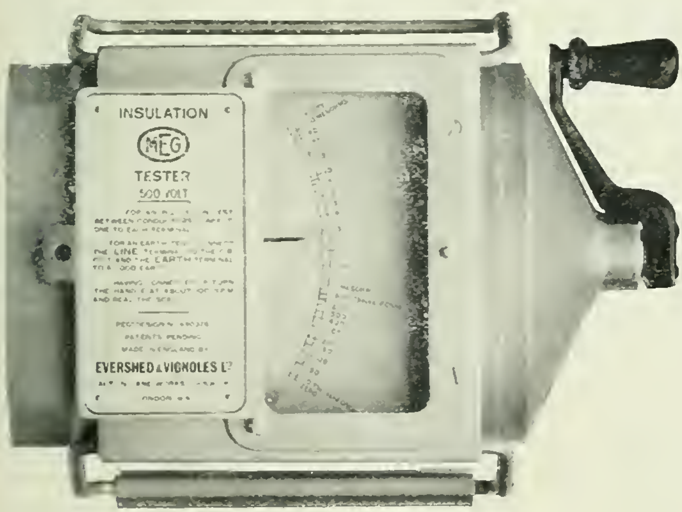
Elements of Radio Telephony. By William C. Ballard. (London : *McGraw-Hill Publishing Co., Ltd.* Pp. 132, illustrated. 6″ × 4″.)

Working Diagrams of Valve Amplifying Receiver Circuits. Arranged by H. W. Sullivan. (London : Winchester House, Old Broad Street, E.C.2. 4th Edition. 36 pp. 7″ × 4¼″. Illustrated. Price 1s.)

Working Diagrams of Valve Receiving Circuits. (London : *Radio Instruments, Ltd.*, 12, Hyde Street, Oxford Street, W.1. 21 diagrams. 7⅜″ × 4¾″. Price 1s.)

A New Testing Instrument.

Messrs. Evershed and Vignoles have recently placed upon the market a new insulation tester, called the "Meg." This instrument is of excellent design and construction, and weighs 7 lbs., about half the weight of the well-known "Megger," which



The "MEG.," an Insulation Tester.

has made the name of Evershed and Vignoles famous. Modern production methods and highly efficient testing and inspection, together enable the instrument to be moderately priced and backed by a guarantee.

A Portable Receiving Set.

On page 759 under the above title the article by Mr. A. Lovering states, "I can get down to 4,000 metres." This should have read 400 metres.

The Wireless Society of London

At the Ordinary General Meeting, held on Wednesday, October 25th, the following were elected to membership of the Wireless Society of London :—

Members :—Charles James Pratt, Eric D'Eresby Moss, Victor Delebecque, Percy Thomas Beard, Major Edward Williams, Charles Menten Benjamin, William Ross Craik, Ivan Scott Spain, Niels Nielsen Ladefoged, Harry H. Bond, Neville Ryland Davis, Egerton G. Pulford, Junr., Colonel George Frederick Handel McDonald, O.B.E., Major Phillip Albert Smith, Sir George Stuart Forbes, John H. White, Owen B. Thomas, Geoffrey E. Duveen, William Samuel James, Douglas Ashton Wade, John Eaton Monins, B.A., Gerald Marcuse, Captain K. E. Hartridge, Henry Charles Parker, William Ernest Wallis, Cyril Herbert Mocatta, Henry Arthur French, Captain Herbert Stanley Prince, M.B.E., S. Goodchild, Reginald Charles Horrocks, Edward John Bray, Lewis Henry Taylor, George Howard Nash, C.B.E., Alexander Thomas Wallace, William Smith, Henry James Cook, Dudley Sanders, George Walter Bowen, James F. Doyle, Edgar Wilfred Lindley, Frank Stanley Wates, Charles Dibdin, John Delmore Taylor, Walter Wakefield Burrowes.

Associate Members :—Eric Cuddon, Isadore Bernard Davidson, Charles Creswick Atkinson.

List of Societies and Clubs accepted for Affiliation :—Newport and District Radio Association, Sutton and District Wireless Society, Streatham Radio Society, The Hamilton and District Radio Society, Walthamstow Amateur Radio Society, The Bedford Physical and Radio Society, The Finchley and District Wireless Society, Hackney and District Radio Society, Cheltenham Wireless Association, London County Council Wireless Society, The Fulham and Putney Radio Society, The Belvedere and District Radio and Scientific Society, Wanstead Wireless Society, Coventry and District Wireless Association, The Aberdeen and District Wireless Society, Fulham and Chelsea Amateur Radio and Social Society.

A Wireless Doll.

"Wireless parties" were catered for at special prices at the Stratford Empire Theatre during the week ending October 28th. The programme included an act by Miss Nella Allen, who introduced a wireless doll, by means of which the singer was assisted by herself. At the close of the performance patrons of the theatre were invited to propose tests should they be sceptical as to the doll being operated by any other means than those advertised.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. Field, 28, Holmwood Gardens, Finchley, N.3.

On October 9th the above Society elected its permanent officers, who will hold office for one year. Chairman, Mr. Trussler; Secretary, Mr. Field; Treasurer, Mr. Nicholls; and a Committee of six, Mr. Bishop, Mr. Macdonald Brown, Mr. Cannon, Mr. Wilck, Mr. Chamberlain, Mr. Cooper.

Arrangements for the grand social evening on October 30th included permission from the P.M.G. to receive musical transmissions from **2OM** and **2ON**. Application for affiliation to the Wireless Society of London was reported to have been made.

A further meeting was held on October 16th, when the good news that the affiliation was completed was made public. Mr. Trussler continued his lecture on the elementary theory of wireless, after which the Marconi Scientific Co.'s unit system wireless set was demonstrated, musical transmissions from **2KT** and **2OM** being made audible on a Brown's loud speaker, kindly lent by Mr. Cannon in conjunction with a Brown's relay belonging to Mr. Chamberlain. During the buzzer class, which was held from 9.30 till 10, the Committee met and made the final arrangements for the social evening on October 30th. Mr. Heppel was given complete charge of the catering part, and arrangements for a pianist and a violinist to come and supply the music for dancing have been completed. Mr. Wilck has kindly consented to give a lecture on November 6th; the subject of which will be announced later.

Arrangements are hoped to be completed for the reception of a wireless speech and concert from Bristol, which is to be sent by telephone from Bristol to Marconi House, and to be broadcasted from there; this is to take place at 1 o'clock on November 3rd. Mr. Turner, of Regent Street Polytechnic, is in charge of the affair, and he is to give a descriptive lecture of his apparatus to the Society before the reception.

The Hon. Secretary invites inquiries from all interested persons in the neighbourhood.

North London Wireless Association.*

Hon Secretary, Mr. V. J. Hinkley, Northern Polytechnic Institute, Holloway Road, N.7.

The 102nd meeting of the association was held on October 16th, at 8 p.m. at the above Institute. Mr. Norman Wilson was in the chair.

The Chairman pointed out the objects of the Association in assisting members over any technical difficulties they may be up against, and that they had only to ask any question relating to wireless to bring forth willing help in the matter. Attention was specially drawn to this as a new member had nearly left the previous meeting without some necessary information in connection with a set he was building.

Mr. F. S. Angel was then called upon to deliver the first paper of his series, "The Elementary Principles of Radio Telephony."

The lecturer commenced by discussing the nature of electricity as a form of energy. He then performed some experiments dealing with static electricity. After showing that different kinds of charges were produced by friction between various materials, he went on to talk about static induction. From this point he led up to the action of a condenser and showed an arrangement to illustrate the difference there is in the dielectric constant of various materials by means of weights hung at the centres of horizontal cords and rubber strips. By means of an electroscope with a plate capable of being moved nearer to the leaf system, Mr. Angel demonstrated that the capacity of a condenser increases as the thickness of the dielectric is diminished.

This being the end of the first paper a discussion then took place and Mr. Angel was able to give satisfaction to a number of questioners.

The meeting closed with a hearty vote of thanks to Mr. Angel for the interesting evening.

Full particulars of the association may be had on application to the Hon. Secretary.

West London Wireless and Experimental Association.*

Club-room: Stamford Brook Lodge, Ravenscourt Park, W.6.

Hon. Secretary, Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

On October 13th, Mr. A. O. Gibbon, of the Engineer-in-Chief's Department, G.P.O., gave a popular lecture on the present-day position of wireless telegraphy and telephony before a large gathering of members and their friends. The lecture was undoubtedly one of very great interest to all present. The speaker remarked that wireless was one of the greatest benefits to mankind, and referred to the wonders achieved since the introduction of the thermionic valve, the Aladdin's lamp of to-day; also of the vast research work being carried out in connection with the microphone. Further, the present position of broadcasting was fully explained, both in the interests of the bona fide experimenter and the simple "broadcaster," or those persons only desiring reception for entertainment only.

In connection with the lecture, Messrs. Burndept, Ltd., exhibited one of the latest pieces of apparatus manufactured by themselves, viz., their L.F. II Receiver, which was demonstrated by their representative, Mr. F. O. Read, M.I.Radio E., and all those present were delightfully entertained with speech, music and signals from many amateur, ship and land stations.

Mr. Read kindly replied very fully to all questions relating to the apparatus, which is a three-valve set, consisting of one detector and two note magnifiers, each valve being controlled by a rheostat, so that one or two stages of note magnification can be obtained at will. Both Mr. Gibbon and Mr. Read were accorded a very hearty vote of thanks in the usual manner, and all querists were satisfactorily answered by both lecturer and demonstrator before leaving for home.

The Secretary will be delighted to hear from any gentlemen desirous of information respecting the objects, etc., of the Association.

Liverpool Wireless Society.*

Secretary, Mr. C. L. Lyons, 76, Old Hall Street, Liverpool (Telephone, 4641 Central).

A meeting of the above Society was held at The Royal Institution, Colquitt Street, Liverpool, on October 12th, Mr. J. Wainwright in the chair. There was a record attendance.

This was the first meeting of the winter session, which promised to be one of the greatest interest. After confirming the minutes of the previous meeting, the Chairman called upon Professor E. W. Marchant, D.Sc., to deliver an address.

The Professor addressed the meeting at some length, dealing with the subject, "Wireless Broadcasting," in a most able and pleasing manner. Briefly tracing the early history of wireless telegraphy point by point, right up to the latest developments of the science, he entered upon the main features of his address, which were the advantages and disadvantages of wireless broadcasting as we might expect it to develop into in the course of a very short space of time. The professor concluded his remarks amidst great applause, and Mr. Hengler proposed a vote of thanks.

The remainder of the evening was devoted to a practical demonstration by courtesy of Messrs. B. N. B. Wireless, Ltd., of Renshaw Street, Liverpool, and reasonably satisfactory results were obtained of telephony, musical items, etc., although only one stage of radio-frequency amplification was used and the apparatus was connected to an indoor aerial. The instruments demonstrated were the Marconi Scientific Instrument Company's units, and consisted of 1 H.F. stage, detector panel, and three L.F. units, the sounds being made audible to all present through a "Magnavox" loud speaker.

A vote of thanks was passed in favour of Messrs. B. N. B. Wireless Ltd., and the instruments were left for close inspection by all present.

The next meeting was held at the same address on October 26th.

Wireless Society of Hull and District.*

Secretary's Address: 16, Portobello Street, Hull.

There was a large attendance at the monthly lecture on October 9th, when Mr. Hy. Strong (acting Vice-President) gave an instructive paper entitled "Calculation of Inductance." After a brief description of what inductance really is and its varying effects, the lecturer proceeded to give in detail, and at some length, the various formulae for calculating this property when constructing different types and classes of coils such as the solenoid type, pile-wound, basket, slab and others. He had gone to considerable trouble in carefully preparing a large number of elaborate tables and calculations which he exhibited, and if his paper was perhaps a little too mathematical for some of those present, yet it cannot be denied but that a very instructive evening was spent. A number of members joined in the discussion which followed.

A hearty vote of thanks was accorded to the lecturer on the proposition of Mr. Steel, seconded by Mr. Brazendale.

The chair was occupied by the President (Mr. G. H. Strong), and six new members were elected.

All members who have any pieces of apparatus to dispose of are asked to send in particulars to the Hon. Secretary, as it is proposed to hold shortly a sale of members' surplus apparatus. New members are reminded that there is a small library of technical works in connection with the Society. For the present the library is kept at the offices of Messrs. G. H. Strong & Son, Prudential Buildings, Hull. It is free to members of the Society and it is hoped that full use will be made of this facility.

Radio Experimental Association.*
(Nottingham and District.)

Hon. Secretary, Mr. F. E. Bailey, 157, Trent Boulevard, West Bridgford, Notts.

The first meeting of the new session was held in the headquarters of the Association, The People's Hall, Heathcote Street, Nottingham, on October 12th, when a considerable number of prospective members turned up.

Mr. Gosling lectured on the construction and method of using the wavemeter, and later gave a description of his home-made five-valve amplifier and tuner. The amplifier was so designed as to permit any combination of valves to be used from 1 to 5. The tuner possessed several novel features, proving beyond doubt that Mr. Gosling is fully justified in calling himself a radio experimenter. Prior to the close of the meeting, Mr. Allan, the Treasurer, read out the financial statement for the past year. The same was heartily approved by those present.

Gentlemen wishing to become members will be welcomed at the meetings.

Plymouth Wireless and Scientific Society.*

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

At a meeting of the above on Tuesday, October 17th, at Plymouth Chambers, experiments were carried out using the electric lighting mains as an aerial. The results obtained were only fair, and it was agreed that an outdoor aerial was far superior to this method.

Buzzer practice will in future be carried out on Thursday evenings from 7.30 p.m., one of the members, Mr. B. Clark, an ex-operator, having kindly offered to carry out the instructional work. It is hoped also to have a course of elementary lectures in the near future.

Particulars of the Society may be obtained from the Hon. Secretary.

Brighton Radio Society.*

Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton.

A meeting was held at Mr. Volk's workshop, Russell Crescent, Brighton, on October 5th. Two members were elected.

On September 26th a meeting of the Amalgamation Joint Committee was held, representatives of the Sussex Wireless Research Society and of the Brighton Radio Society being present. As a result of this meeting certain recommendations were put to the Brighton Society, and it was decided (1) To amend the Society's title to read, "The Brighton and Hove Radio Society." (2) To elect a supreme council of four members; to elect an organisation committee of six members; to elect a technical committee of six members. (3) That there be two classes of membership (*a*) full membership, fees 10s. entrance, 10s. subscription; (*b*) Associate membership, fees 5s. entrance, 5s. subscription. That all present members be full members. That any present member may become an associate member if he so desires. That before any associate member can become a full member he must satisfy the council or a person appointed by the council that he has a sufficient knowledge of valves and valve apparatus, and more especially of the circuits and apparatus used in the elimination of re-radiation and interference. (4) That the officers of the Society be— President (Chairman of the Council ex officio), Hon. Secretary, Assist. Hon. Secretary, Hon. Treasurer, Hon. Librarian. (5) That the funds and effects of the two Societies be pooled and the funds placed in a banking account. (6) That full members and associate members have the same voting power, but that associate members are not eligible for election to the technical committee.

It is thus intended to put the new Society on a superior level, and to do its utmost in the interests of the science, at the same time regarding the decision of the P.M.G. as a very wise attitude.

Newport and District Radio Association.*

Hon. Secretary, Mr. Edward R. Brown, 92, Corporation Road, Newport.

On October 12th, before a large gathering of members, Mr. W. D. Lewis Evans, M.A., Abertillery, gave a very fine address upon "The Construction of an Amateur Three-Valve Station."

Added interest was given to the lecture by Mr. Lewis Evans placing on view a three-valve instrument which he himself had built up—a highly instructional address punctuated by anecdotal references to the humorous side of the "mysteries" of wireless being thoroughly enjoyed and appreciated.

Mr. J. H. M. Wakefield occupied the chair, being supported by the Hon. Secretary, Mr. Edward R. Brown.

A hearty vote of thanks, proposed by Mr. H. W. Winslow, and supported by Mr. A. Treverton Jones, was accorded the speaker, who, in replying, said that the Association provided a long-felt want to the wireless amateurs of Monmouth.

Wanstead Wireless Society.*

Hon. Secretary, Mr. A. B. Firman, 18, Clavering Road, Wanstead Park, E.12.

A very successful meeting of the Society was held on October 12th, when Mr. Nickless, a vice-president of the Society, demonstrated the comparative values of the tuned anode circuit and the leaky grid rectifier in the reception of wireless telephony.

The Marconi concert was received very well on Mr. Nickless's apparatus, also the test records of Major Parker transmitted to the Society after the conclusion of the concert, both of which were much appreciated by the members present.

The Society meets every Thursday evening at St. Gabriel's Church Hall, Aldersbrook Road, E.12, at 8 p.m.

Fulham and Chelsea Amateur Radio and Social Society.*

Hon. Secretary, Mr. R. Wood, 48, Hamble Street, Fulham, S.W.6.

On October 17th three new members we proposed and seconded, the meeting accep their enrolment. Mr. Hubbard offered to a series of twelve lectures, one every a week; this was accepted. Another me . Cox, also gave a short lecture dealing th transmission and reception, explaini part by means of apparatus. He was hea auded for the simple way he had expre elf.

The Secretary was then asked t a short lecture on reaction, its use and abu , and the P.M.G.'s objections to the use of it. This was also simply dealt with for the benefit of junior members, and again appreciation was shown in the usual way.

A library has been started, and a librarian is shortly to be appointed.

Owing to the increased number of members it is proposed to adopt a second room at the college and divide the meetings.

The total membership is now 86.

Guildford and District Wireless Society.*

The weekly meetings of this Society recommenced on October 16th with a demonstration of the "Armstrong Circuit" by Mr. E. P. Brown (a member). Mr. Brown explained at length the advantages and disadvantages he had experienced with the circuit during his experiments and use of it, after which Mr. F. A. Love (**2HX**) very kindly obliged with a transmission of speech and music. The whole of the reception was received on a frame aerial. The demonstration was thoroughly enjoyed by all present.

On October 21st a party from the Society visited the Aldershot Military Wireless Station, and spent an extremely interesting and instructive time, the method of automatic transmission and reception being the chief point of interest. The visit was the last of several which have been made to neighbouring stations, both commercial and amateur, all of which proved valuable from an educational point, to those who attended.

The Hon. Secretary, Mr. Rowland T. Bailey, 46, High Street, Guildford, will be pleased to answer all enquiries regarding membership.

Radio Club de Espana, Madrid.

Secretary, Sen. F. Castana, Fernandez de los Rios 25.

The establishment of this club took place some time ago and immediately met with satisfactory results. In twenty days nearly 250 members were enrolled. As readers of this journal the members through their secretary send greetings to all English amateurs. Reciprocal correspondence is invited. Amateurs wishing to communicate with this club should write direct to the Secretary, whose address is given above.

Scarboro' and District Wireless Club.

By arrangement with Messrs. Fattorini and Preese, Bradford, Mr. R. J. Leeves (representing Mr. W. R. H. Tingey, London) gave telephony demonstrations through loud speaking instruments to the members on October 14th and 15th.

An interesting winter session is being arranged by the Committee.

Portsmouth and District Amateur Wireless Society.

Hon. Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

The weekly meeting of this Society was attended on October 11th by a good number of members. After the usual buzzer class, a talk was given by Mr. R. G. H. Cole, the Secretary, on accumulator charging on the Noden valve system. Following discussion, Mr. Cole gave a further interesting talk on his transmitting apparatus, and also upon the various receiving sets he had experimented with at various times. A hearty vote of thanks was given Mr. Cole.

The Society was very pleased to receive Mr. Simpson, of Radiophones, Ltd., at their meeting, and this gentleman gave a very interesting talk upon broadcasting plans. Mr. Simpson very kindly offered to demonstrate his three-valve set to the Club, and his offer was gladly accepted.

The Society are still anxious to increase their membership, and all amateurs who would care to join the Society will be certain of a hearty welcome. Prospective members should address communications to the Hon. Secretary.

Wakefield and District Wireless Society.

Hon. Secretary, Mr. Ed. Swale, 11, Thornes Road, Thornes, Wakefield.

A meeting was held on October 6th in the Y.M.C.A., when Mr. R. Leedal read a paper on "Accumulators." Many useful hints on the use and care of accumulators were given by Mr. Leedal. On October 13th, another meeting was held in the Y.M.C.A., when Mr. Bateman gave a very interesting lecture on his own receiving station. Mr. Bateman had on show a good deal of his apparatus and very ably described it, drawing diagrams on the blackboard and showing how one, two or three valves could be used at will.

The Society hope to move into new quarters in the Technical and Art School in a week or two.

Tottenham Wireless Society.

Hon. Secretary, Mr. R. A. Barker, 22 Broadwater Road, Bruce Grove, N.17.

The third meeting was held on October 5th, preceded by half-hour's buzzer practice. The Chairman gave a lecture on "Retroactive Amplification," which was of great interest. Business was then discussed and it was proposed by the Chairman that the future place of meeting should be the Bruce Grove Schools, Sperling Road, and that the evening should be changed to the Wednesday of every week. This proposition was seconded by Mr. Baker and carried unanimously.

It was proposed that a General Committee should be formed, and in addition to the present four members, namely, the Chairman, Secretary, Treasurer and Mr. Bower, a further three members should be elected. These were decided by vote, and Mr. Winter, Mr. Hall, and Mr. Glyde were appointed.

It was also decided that the Society should have a library, and Mr. F. Allard was elected as librarian.

An interesting programme has been formed for the next four meetings, and intending members should join immediately.

Particulars of membership on application to the Hon. Secretary.

Hyde Amateur Radio Society.

Hon. Secretary, Mr. Alfred Stainthorpe, 5, Cheapside, Hyde, near Manchester.

The above Society holds its meetings in the Flowery Field Hotel. Favourable progress is being made and enjoyable evenings spent in "listening-in" to the various signals and telephony from Writtle on Tuesdays. The opening of the Manchester broadcasting station is eagerly waited for. It is hoped to announce an open evening very shortly.

Information regarding the Society can be obtained on application to the Hon. Secretary.

Barnsley and District Amateur Wireless Association.

Hon. Secretary, Mr. G. W. Wigglesworth.

At the official opening night of the above Association, held on October 11th, the President, Major E. A. Barker, M.C., delivered his inaugural address at the new headquarters, Y.M.C.A. Buildings.

The address, which included a brief history of the Association from the time of its establishment in 1913, was followed by a lecture divided into two parts—the first part on "Heterodyning," and the second part on "Directional Wireless." In his remarks upon Heterodyning, *i.e.*, of beat reception without an oscillating aerial, the President emphasised the necessity for eliminating interference with other people's reception, and pointed out the great assistance which could be rendered by the Association, by instructing its members in the theory of wireless, so that they may be real *bona fide* experimenters, and not merely "dabblers." To this end the President stated his intention of presenting to the Association a "Heterodyne" wavemeter.

The President's lecture on Directional Wireless was based upon his extensive experience during the war. This was clearly elucidated by means of a large map, and appliances for tracing both land and air transmitting stations. A series of lantern slides greatly added to the illustrative part of the lecture. At the conclusion, a hearty vote of thanks was passed to Major Barker.

A programme of the future work of the Association is being prepared, the chief items being a series of lectures on elementary Wireless Theory by the Secretary, Mr. G. W. Wigglesworth.

Guildford and District Wireless Society.

Hon. Secretary, Mr. Rowland T. Bailey, 46, High Street, Guildford.

On October 7th the above Society arranged for a party of Boy Scouts to "listen in" to the Prince of Wales's speech. The speech was heard with wonderful clearness, and the party were keenly interested. The weekly meetings of this Society recommenced on October 16th with a demonstration of the Armstrong Circuit, by Mr. E. P. Brown. With the rapidly increasing numbers of wireless enthusiasts it is hoped the membership will swell proportionately. The invitation is again extended to all who are interested to visit the rooms at 46, High Street, Guildford, on any Monday at 7 p.m., or communicate with the Hon. Secretary at the same address.

Portsmouth and District Amateur Wireless Society.

Hon. Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

The usual monthly business meeting of the Society was held at the John Pile Rooms on October 18th. There was a good attendance of members, and further new members were elected. Various other matters were dealt with, and it was suggested that the Society should hold a social evening at an early date, a committee being elected to deal with this matter.

After the meeting an address was given by a member, Mr. Harrold, on "Detectors." Mr. Harrold dealt with the earliest form of detectors used, and various diagrams were passed among the members to illustrate these detectors. Unfortunately there was no time for Mr. Harrold to complete his lecture with regard to valve detectors, but it is hoped the conclusion will be delivered subsequently. A very hearty vote of thanks was given Mr. Harrold.

Southampton and District Wireless Society.

Hon. Secretary, Mr. T. H. Cutler, 24, Floating Bridge Road, Southampton.

A meeting of the above Society held on October 4th resulted in a pleasant evening being spent. Arrangements were made for a visit from the Signalling Section, R.E. "Wireless Section," Capt. Grist, M.C., and various other officers attending. This is the opening of a series of visits being arranged by the Secretary. The Society will shortly pay a visit to the "R.E." also the University College. Mr. C. E. Chester, of the University College, is a member of the above Society, and will, during the winter months, give several lectures.

At a general meeting held on October 11th, rules, etc., were drawn up, and judges appointed for the single valve competition. Substantial prizes are offered, and quite a large number of members have entered. Closing date for entry first week in November.

The Society have made application for a transmitting licence, and hopes in a short time to erect the same. Anyone in Southampton district can have full particulars of rules, etc., on applying to the Hon. Secretary.

Stockton and District Amateur Wireless Society.

Hon. Secretary, Mr. W. F. Wood, 4, Birkley Square, Norton-on-Tees.

The monthly meeting of the above Society was held in the concert hall of the Malleable Workmen's Institute, Norton Road, Stockton, on October 12th. The Chair was taken by Mr. J. Mulcaster. The Secretary announced that the aerial was nearly ready for erection, and would be in use in a very short time.

The President stated that during the evening a member had come forward and had kindly arranged to provide the Society at once with a very handsome receiving set. A set of rules was submitted to the members and accepted. The question of entrance fees, etc., was left in the hands of the Committee.

The membership is steadily growing, and now numbers over 80.

After the meeting a lecture was given by Mr. R. King, of the Middlesbrough Wireless Society, on "The Application of the Three Electrode Valve to Receivers."

Votes of thanks to the lecturer were given for his very interesting lecture, to which he suitably replied.

Bromley Radio and Experimental Society.

Hon. Secretary, Mr. J. Fergusson-Croome, 26, Wendover Road, Bromley, Kent.

Another successful meeting of the above Society was held at the White Hart Hotel on October, 17th when some 30 members attended.

The Marconi Concert from Writtle **(2 MT)** was remarkably well received on a four-valve set constructed by Mr. Allen, which was amplified further by a "Brown" Microphone Amplifier and rendered audible to all present by a "Brown" loud speaker.

The Secretary announced that the weekly meetings of the Society would in the future be held at the Ex-Service Men's Club, where the usual lectures and demonstrations would be preceded by a Morse buzzer class conducted by Mr. Allen.

Mr. Allen was then called upon to give a brief description of his set, which proved both interesting and instructive.

Some further music was received from Blackheath **(2 FQ)**.

As a result of the meeting several new members were enrolled, bringing the total membership to nearly 50.

The rapid growth of the Society is in no small way due to the manager of the White Hart Hotel, who has so generously given accommodation to the Society and to whom the Society tender their best thanks.

Cowes District Radio and Research Society.

Hon. Secretary, Mr. L. Ingram, 1, Mill Hill Road, Cowes, I.W.

The Society held the first meeting of the second year at the headquarters, East Cowes, on October 4th. The evening was devoted to an exhibition of receiving sets owned and mostly made by the members. A numerous and varied assortment of apparatus was exhibited, ranging from a four-valve amplifier to a tiny crystal set, measuring two inches by one inch, and capable of receiving signals on three separate wavelengths. Several unique and useful components were on view also. The different circuits were explained by the members and demonstrations were given, providing a most interesting evening to all concerned.

On October 7th the Society entertained about thirty members of the local Scouts' organisation, including representatives of the Boy Scouts, the Sea Scouts, and the Rovers, enabling them to "listen in" to the Prince of Wales's message. The Prince's voice was heard distinctly by all, thanks to Mr. Ball, who kindly brought along his four-valve set and a loud speaker for this occasion. The musical items which followed were thoroughly enjoyed. At the conclusion, Capt. W. Matthews, thanked the Society on behalf of the Scouts for a most interesting and instructive demonstration.

On October 11th the Society enjoyed a splendid lecture upon "Direction Finding," given by Mr. C. Mugliston. The lecturer explained the apparatus used and the methods adopted in a very clear manner, also the uses to which it was put. The questions which followed the lecture proved how much it was appreciated.

Mr. Mugliston has kindly promised to give other lectures during the present session.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of* 1*s., or* 3*s.* 6*d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"A.S." (Morecambe) *asks* (1) *What is the difference between rectifying, note magnifying, H.F. amplifying, L.F. amplifying, detecting and audio-frequency panels.* (2) *If wiring of his panel is correct.* (3) *For a diagram using the three panels, and using basket coils or duolateral coils.*

(1) Without going into details, the function of each panel is indicated by its name. (2) The diagram (Fig. 1) shows how to connect the panels together. It appears from your sketch, that the transformers are connected outside the panel. (3) See the articles on "Experimental Station Design," appearing in alternate issues.

"D.H." (Beckenham).—It will be quite easy, of course, to convert your "Metro-Vickers" crystal receiving set to a single-valve set, though it is doubtful if a single valve arranged as a detector would give better results than the crystal with which it is at present fitted. A reacting valve circuit, of course, would produce good results, but is liable to cause interference. If you are not satisfied with your present receiver, the only useful fitment which it includes being the variometer, we suggest that you commence to build a three-valve receiver, making use of the non-radiating arrangement described in our issue of September 30th.

"G.G." (Sydenham).—The diagram to which you refer shows the connections of a very simple set. No. 39 S.W.G. enamelled wire is not suitable for winding intervalve transformers, and we suggest you make the transformer exactly as shown in the issue of August 19th, 1922. Full constructional details are given, and you should meet with no difficulty.

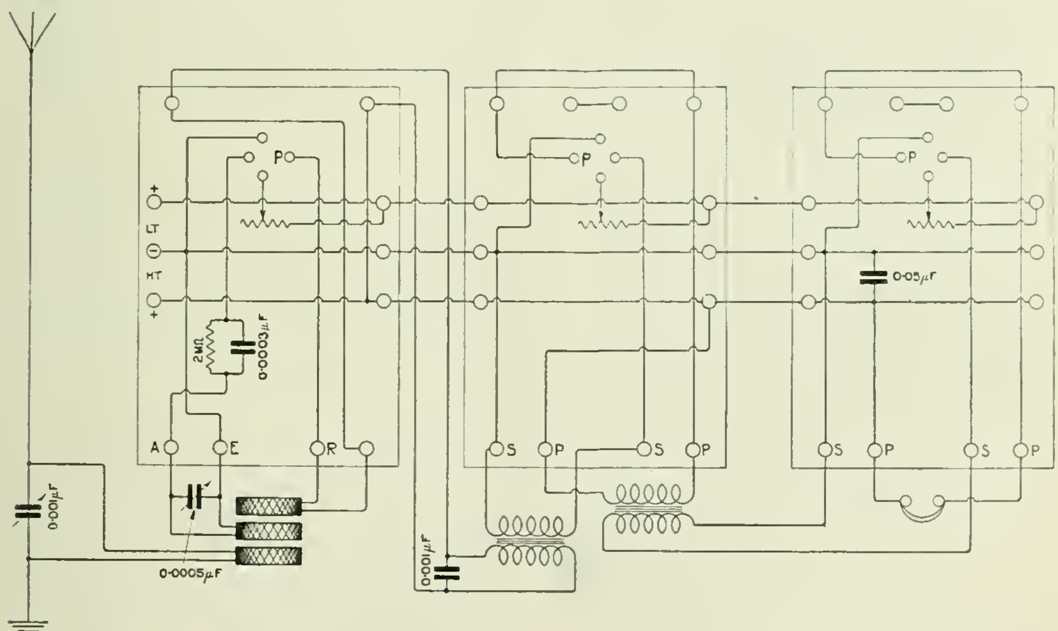


Fig. 1.

"G.E.T." (Harrow).—We do not like your diagram. We understand you are using a set comprising 1 H.F. transformer coupled valve, 1 detector valve, and 2 L.F. coupled valves. We suggest you rewire the apparatus to Fig. 2, page 880, September 30th issue, or if you would like to use switches to cut in or out valves at will, try the circuit on page 883, September 30th issue, but omitting the first valve.

"G.G." (France) *asks various questions.* (1) The wavelength of your aerial circuit cannot be reduced much below half the natural wavelength of the aerial, which in your case would be half 300 metres. (2) We suggest for short wavelengths you make up a coil 3″ diameter, 4″ long, wound with No. 22 D.C.C., taking, say, 6 tappings, and use a series tuning condenser of maximum value 0·0015 mfds. (3) High resistance telephones must be used when you wish to connect directly with the anode and +H.T. When you wish to use the low resistance telephones, a telephone transformer must be employed. Each have their advantages, and we prefer to use the L.R. telephones and transformer.

"A.J.H." (Bexhill-on-Sea).—As to the use of an artificial aerial for transmission purposes, we would point out that an aerial of this sort is specially authorised by the Postmaster General for laboratory test purposes, on the express understanding that it is specially arranged to have a very limited transmitting range—say not more than a few yards. If your intention is to aim at transmitting over a distance of two or three miles, a frame aerial is quite unsuitable, and from the wording of your permit it is obvious that the Post Office is not desirous that you should transmit over this range. You should have stated your requirements when making application, supporting your request by evidence that transmission over two or three miles would be helpful to you in your experimental work.

"R.E.W." (Camberwell).—We consider the connections shown in your diagram "C" to be best for your purpose, although a switch to join the A.T.C. in series or parallel with the A.T.I. is recommended. It is very desirable that variable coupling be provided between coils C1 and C2, and the provision of this adjustment will amply repay in result any slight effort required to use it. If the inductance of the reaction coil C1 is made suitable for broadcast reception, external inductance will have to be added when you wish to receive transmissions on longer wavelengths. Two coils could therefore be connected up to the switch as indicated in the sketch, one suitable for the Hague transmissions and the other for Paris. It is quite possible to arrange for the inductances to be fixtures, but in that case switches will be required, and it is for you to decide whether to use a number of switches, or to use a few plug-in coils. We suggest you use plug-in coils, which are easier to build and use than dead-end switches.

"B.A." (Thetford) *asks* (1) *The best way of erecting a 80′ telescopic mast.* (2) *What sort of set should be used to get the Hague, Paris and broadcasting stations.* (3) *If a microphone amplifier would give better results than two valves added to a single valve set.*

(1) The only satisfactory way of erecting a mast of this size is by means of a derrick, itself about 20 to 25 ft. high. Three of four guys should be run from the top of the derrick to their proper places on the mast, while the latter is lying on the ground. The mast is then pulled up by pulling down the derrick, side guys being used to prevent either the mast or the derrick falling over sideways while the mast is being pulled up. See page 261, May 27th, 1922; also "Mast and Aerial Construction for Amateurs," by Ainsley (1s. 6d.). (2) A three-valve set with reaction back to the anode of the first valve would probably give the desired results with the stated aerial. (3) No; two valves properly arranged will be superior to a microphone amplifier, and will give you much less noise in operation.

"HOME-MADE" (Barrow-in-Furness) *asks* (1) *How much No. 40 wire would be needed for a telephone transformer, and what other wire to use with it.* (2) *Whether a sample of mica is suitable for making condensers.* (3) *Capacity of a condenser with 59 plates 9 cms. in diameter, using ⅛″ spacing washers.*

(1) 3 ozs. of No. 40 may be used for the H.R. winding, with 6 ozs. of No. 32 for the L.R. winding. (2) The sample referred to has not come to hand, but any grade of mica will be of good enough quality for the construction of receiving condensers. (3) 0·0028 mfds.

"R.S." (Grimsby).—We cannot state the exact number of turns which should be wound in the slots, as you have omitted to tell us what range of wavelengths you wish to cover, and we suggest you experiment a little until best values are obtained. We suggest you wind each slot with 100 turns of No. 40 S.S.C. copper wire. Only a few ounces of wire is required.

"H.W." (Harrogate).—Without entering into a discussion as to the relative merits of amplifiers recommended by various writers, we think you would be well advised to leave the suggested amplifier alone, and construct Bull's "Broadcast Receiver" (described in the issues of August 26th and September 2nd). Full constructional particulars are given, and you can easily arrange to cover wavelengths up to 2,000 metres. We suggest you employ the coils exactly as described in the article.

"E.H.R." (Pirbright).—There is not of necessity something wrong with your set because you hear Paris without an A.T.I. Paris is employing such a large amount of power that sometimes a crystal receiver not connected to the aerial will pick up sufficient energy to produce an audible signal. The probable reason for not having received short wave telephony is that your set will not tune down to the wavelength. The A.T.C. should be in series with the A.T.I., and short wave H.F. transformers must be used. The values of the four condensers are quite suitable. We think it is very improbable that your aerial is radiating energy. When the reaction coil is coupled with the H.F. transformer, the only energy which could be radiated is that produced by the small grid circuit flowing in the grid filament circuit of the first valve. This is so small as to be almost negligible.

"G.S." (Edinburgh).—Without discussing the merits of any particular make of H.F. transformer, one has to remember that if untuned H.F. transformers are used, the number of tuning adjustments are reduced; hence tuning is not in any way critical. If, on the other hand, each H.F. transformer is tuned, the number of adjustments is increased, tuning is critical, and the set requires more careful handling. To receive telephony properly it is essential that critical adjustments are provided, but, of course, they should not be so numerous that tuning in becomes a difficult operation.

"C.B." (Liverpool) *asks* (1) *For a diagram of connections making use of apparatus already in his possession.* (2) *Wavelength range of set.* (3) *Nearest Broadcasting Station.* (4) *For advice.*

(1) See Fig. 2. (2) and (3) Wavelength range 250 metres to 1,500 metres. You will have no trouble in hearing the nearest broadcasting station (Manchester). (4) Write to the Secretary, Post Office, pointing out the alteration.

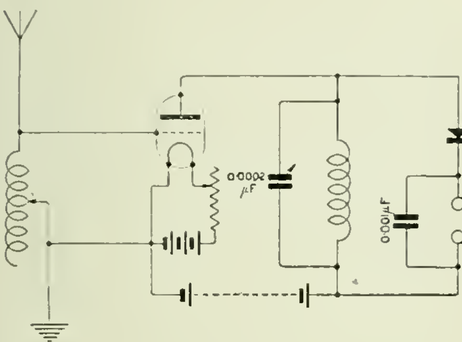


Fig. 2.

"G.R." (Shrewsbury).—We cannot criticise the action of the Postmaster General with regard to withholding from you an experimental receiving licence, and moreover, we are unable to offer you very much advice as to supporting your claim, without knowing the reasons you have stated as to why you wish to conduct experiments in wireless telegraphy. The Post Office are prepared to authorise experimenters to use wireless apparatus where it is apparent that they have some serious theme of research in view, and they are qualified in the manipulation of wireless apparatus. We would recommend that you become a member of a Wireless Society which is affiliated to the Wireless Society of London, in order to show that you have a serious interest in the subject. You might then draw the matter to the notice of the local Secretary, who might, if he considers necessary, endorse yonr application and pass it to the Wireless Society of London for recommendation.

"L.J.W." (Middlesex).—(1) As you wish to receive the broadcast transmissions only, a cylindrical tapped coil is the best form of inductance. A coil 3″ in diameter and 4″ long, of No. 22 D.C.C., with nine or ten tappings, will be quite suitable for the aerial inductance, while a coil 2½″ diameter and 4″ long, of No. 26 D.C.C., with, say, six tappings, will be suitable for the closed circuit. The aerial tuning condenser should be in series with the A.T.I. while receiving short wave signals. (2) If you possess a set of coils, you might try a small coil in the aerial circuit, the next larger for the closed circuit, and the biggest for the reaction coil. (3) We regret we cannot give you a layout, panel dimensions, etc., and we suggest you look through recent issues of our journal, and we think you will have no difficulty in choosing a suitable design.

"E.R.S." (Bredbury).—We have frequently stated in this journal that the arrangement you propose to adopt is, in our opinion, unsatisfactory, and will cause interference to other amateurs receiving on the wavelength to which your set is adjusted. If you hold an experimental licence you are permitted to use just whatever circuit you like, and it is assumed that you are sufficiently skilled to know whether or not your circuit is likely to cause interference. We recommend you to read the Questions and Answers section of the last few issues, and also to read the article under the heading "Experimental Station Design" in the issue of September 30th last. A statement has now been made by the Postmaster General, as no doubt you are aware, regarding oscillating receiving sets. This statement is reprinted in our issue of October 21st.

"H.N." (Huddersfield).—The Postmaster General is not likely to approve the use of the circuit shown on page 780 for reception on broadcasting wavelengths. If you hold an experimental licence you are privileged to use any circuit you like, using your own discretion as to whether you think it is likely to cause interference. A circuit likely to be approved by the Post Office is given on page 867 of September 30th issue, and the conditions concerning the types of circuits used in broadcasting apparatus have been recently stated in the press, and further information appears in the issue of this journal of October 21st.

"W.C.B." (Birmingham).—The grid tuning condenser is very necessary when tuning to short wavelengths. You may try the circuit without it, but you will find it is better to tune the grid. A grid leak is not necessary in a circuit of this description. Actually the secondary of the microphone transformer acts as the leak. To apply negative potential to the grid, dry cells may be used, but it is usual to employ a leaky grid condenser. The value of the grid leak and condenser required depends on the anode potential, and is for the purpose of holding the mean grid potential at the most suitable value.

"M.S." (Ireland).—The basket coils should each be wound with No. 22 D.C.C. wire. About six will be necessary, and each should have a mean diameter of 3½″. The coils should not be laid together so that they touch each other; about ¼″ space between each coil is necessary. The reaction coil may consist of coils 3½″ mean diameter, wound with No. 28 D.C.C. We are afraid we cannot help you much, as you do not state the type of receiver you propose building.

"DON BEN" (Southall).—If the plates are $2\frac{1}{2}''$ diameter, the spacing washers $1/8''$ thick, and the plates 24 mils. thick, 47 plates will give you a capacity of 0·0005 mfds.

"S.B." (Hanwell) *asks* (1) *Whether he may use a circuit given in answer to another correspondent.* (2) *Resistance of a potentiometer.*

(1) You may certainly use the circuit given in reply to the question of another correspondent. The aim kept in mind when giving answers to queries is to make the answers as generally useful as possible. (2) The connection may be made at the negative L.T. terminal. If you wish to use a potentiometer, employ one with a resistance of about 400 ohms.

"E.M.W." (Cheshire) *asks* (1) *Questions about his set.* (2) *If proposed H.F. transformer is suitable.* (3) *Who is* **2 RC.** (4) *For criticism of his diagram of connections.*

(1) We think if you add 1 H.F. valve to your set the troubles will disappear. (2) We suggest you employ a tuned anode coil; one coil will then suffice. However, if you prefer the H.F. transformer arrangement, couple the two coils together. It would be better to make up a H.F. transformer exactly as described in the issue of September 3rd, page 715. (3) We have no information. (4) The proposed arrangement will do quite well, but the reaction coil should be connected between the anode and transformer.

"J.E." (Birmingham).—We think the transformers might suit your purpose, and you should certainly try them, and compare them with the results obtained from a standard transformer.

"R.B." (Ireland).—There is no critical value for the anode choke coil, and we suggest you wind a coil $1''$ diameter, $3''$ long, with No. 28 D.S.C. wire. The anode blocking condenser may have a value of 0·001 mfds. This value is not at all critical and the only point in connection with it is that its insulation must be capable of withstanding three or four times the voltage of the high tension supply. The aerial tuning inductance may consist of 40 turns of No. 16 D.C.C. wire on a $3\frac{1}{2}''$ diameter former, tappings being taken at every turn at the aerial end; and the grid coil may consist of 60 turns on a former $3''$ in diameter. We notice you have not shown the key connected in circuit. It is usually convenient to key directly in the high tension supply lead, but if the high tension voltage is above three or four hundred volts, we suggest you use a grid leak and condenser, then join the key so that when it is depressed the grid leak is connected across the grid condenser. We are afraid we cannot give you much information, as the diagram submitted does not show the valves or power you propose using.

"O.P.S." (Dingwall).—The sample of wire submitted is No. 42 S.S.C. copper wire. We suggest you make the low frequency intervalve transformer of the closed core type, making use of a bundle of iron wires. The core should be $\frac{1}{2}''$ diameter and $3''$ long; the primary winding should be 10,000 turns of No. 42, and the secondary 15,000 turns of No. 42. The primary winding should be wound on first. About 6 ozs. of wire will be required.

"S.S." (Leyton).—We do not care for the circuit as jacks are used in the H.F. circuits. A diagram of a 5-valve set, exactly as you require, is given on page 883, September 30th issue. The values of the components are marked in. The vernier condenser is joined in parallel with the A.T.C.

"M.V.D.T." (Southampton). *asks* (1) *A question about an instrument he has bought.* (2) *How to charge his accumulator off 200 D.C. wires.*

(1) We regret we cannot help you, since we have no particulars of the apparatus to which you refer. (2) We suggest you join the accumulator in series with 200-volt, 32 candle power carbon filament lamps. The lamps are joined in parallel.

"J.A.F." (Ayrshire) *asks various questions about his set.*

(1) You will hear ship stations, broadcast transmissions certainly, and local transmissions. (2) We suggest you fix a mast to the stunted tree as tall as convenient, and run the aerial from the mast to the chimney stack. Use a double wire aerial.

"JUMPER" (Woking) *asks* (1) *For a diagram of a 3-valve set using 1 H.F., 1 Detector, 1 L.F.* (2) *For particulars of a reaction coil.* (3) *Range of set.*

(1) The diagram to which you refer (page 883, September, 30th issue) is very easily followed, and we think you will be able to modify the diagram yourself. (2) The reaction coil may consist of 100 turns of No. 38 S.S.C. wire, inductance being added in the reaction circuit for longer wavelengths. (3) You may hear **PCGG** and should hear all British broadcasting stations.

"J.H." (Edgbaston) *asks* (1) *For criticism of his set.* (2) *Why set howls.* (3) *What coils to use.* (4) *For suggestions to improve set.*

(1), (3) and (4). The reaction coil is shown coupled to the aerial coil, and no closed circuit is employed. This is wrong. We suggest you use a closed circuit, and couple the reaction coil to the anode coil of the first valve, as explained in recent issues. The A.T.C. should be in series with the A.T.I. when receiving on short wavelengths. The batteries are correctly connected. (2). The howling is probably the result of too much reaction, and with a circuit of this type you will in all probability be causing interference and spoiling the enjoyment of others.

SHARE MARKET REPORT.

Prices as we go to press on October 27th are ;—

Marconi Ordinary	£2	6	3
,, Preference.. ..	2	2	6
,, Inter, Marine ..	1	7	3
,, Canadian		10	$10\frac{1}{2}$
Radio Corporation of America :—			
Ordinary	1	0	0
Preference..		14	3

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

No. 169 [No. 6 Vol. XI.] NOVEMBER 11TH, 1922. WEEKLY

The Transatlantic Communication Tests.

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

THE main object of the forthcoming transatlantic communication tests between American, Canadian, and European radio amateurs is not only to pick up signals from the other side of the Atlantic as was done last year, but also, if possible, to establish communication in both directions across the ocean solely between amateur stations, and using the amateur wavelengths. While arrangements are well in hand for the use of specially equipped transmitting stations in this country during these tests, there are doubtless also many other amateur stations which have established long-distance signalling ranges, and which could therefore take part in the tests with some chance of success. It is very desirable that this country should have several transmitting stations in operation during the tests in order to give the Americans plenty of signals to listen for. Several French stations will also be transmitting.

TRANSMISSION TO AMERICA.

In order to avoid confusion it will be necessary to arrange a special programme of transmissions, so that each station taking part has a special period allotted to it, and also a special set of code letters so that the receptions in America can be checked up.

Every amateur transmitting station that has an authentic record of having transmitted signals over at least 400 to 500 miles is therefore asked to communicate with the writer of this note as soon as possible, if they are willing to take part in the tests. The exact dates of the transmission tests from this side have not yet been settled, but they will follow the transmissions from the United States, which are to take place in December.

The particulars required are :—

Name and Address of Licensee of station, and exact location of the station.

Call Letters.

Wavelength to be used.

Maximum ranges already attained (telegraphy).

These transmission tests will continue for several nights, each station taking part being allotted a different time for transmission on successive nights, and being requested to adhere strictly to these times and not to transmit on other periods. Owing to the time difference between the United States and Great Britain it will not be practicable to commence the tests until midnight or 1 a.m. G.M.T.

In order to allow time for the completion of the final arrangements it is requested that everyone willing to take part in these tests will notify the writer before November 22nd, at the address stated below. The special code letters, and details of what is to be transmitted during the tests will be sent by post to each entrant shortly before the commencement of the tests, the dates of the commencement of which will be announced later in these columns.

RECEPTION FROM AMERICA.

As in last year's tests the transmissions from America and Canada will be sent on the usual American amateur wavelengths in the neighbourhood of 200 metres, and also on the special wavelengths in the neighbourhood of 365 metres, which are licensed to some of their stations. Transmissions will take place during a period of approximately five hours on each night, the stations taking part being allotted a different portion of the five hours period on successive nights. The wavelength of the transmissions at any given time will therefore be different on successive nights, but it will be possible to circulate a list of the wavelengths of the transmissions to be made during each period each night a short time before the commencement of the tests.

In order that any information of this kind which may possibly arrive too late for publication in these columns may be circulated to all those who wish to listen in for the signals, it is requested that every one desiring to take part in the reception tests notify their name and address to the writer before November 22nd.

Last year's tests again emphasised the necessity of asking everyone possessing wireless apparatus to refrain from using it during the periods of the tests unless they are actually using it for listening in. Except in the most favourable circumstances the signals from the other side will on the whole not be of great strength, so that any local jamming may completely spoil the tests. There is already so much interference on these wavelengths by the harmonics from high power stations that all other avoidable interference must be eliminated if success is to be attained. The radiation from oscillating receiving sets on these short wavelengths is so large that a single oscillating receiver may spoil the chances of many others for several miles round.

Too great an emphasis cannot therefore be laid on the necessity of avoiding the use of such apparatus during the tests, and the substitution therefor of a separate heterodyne to pick up the C.W. transmissions. The use of one or more high-frequency amplifying valves in front of the detector valve is helpful in this direction too, since not only is the receiver thereby rendered more sensitive, but also the radiation from the aerial is also reduced should the set accidentally be brought into the oscillating state. Any of the recognised forms of tuned high frequency amplification can be used for this purpose with great advantage, but precautions must be taken to prevent the set oscillating, as there is a great tendency to do so in these arrangements unless additional damping is provided in the circuits, either by inserting high resistances in the oscillating circuits, or by appropriate *reversed* reaction, or by increasing the damping of the grid circuits by impressing a positive potential upon the grids of all the amplifying valves.

The separate heterodyne oscillator should be coupled to the plate circuit of the detector valve rather than to the aerial or associated circuits, so as to remove the point at which the oscillations are impressed upon the system as far from the aerial as possible. In this manner the harmful effects of heterodyne radiation from the aerial will be minimised.

Details for the construction of a heterodyne oscillator suitable for the shorter wavelengths of these tests, *viz.*, around 200 metres, have been given by the writer in these columns. (Vol. IX. pp. 461-464 and 493-497.), while other patterns of similar instruments have also been described at a later date which can be used over a wider range of wave-lengths so as to include the longer transmission wavelengths as well. One of these patterns of instrument suitable for the use of plug-in coils for any wavelength that was described in the *The Wireless World and Radio Review* for May 6th (p.161), May 13th (p.194) and May 27th (p.252) should prove quite suitable, while the heterodyne wavemeter described in the issue for September 30th last, is also suitable since it covers all the wavelengths that are to be used in these tests, as well as the longer waves.

For the benefit of those readers who have not the above issues, an article giv.ng constructional details of a suitable instrument will be published next week.

As in connection with last year's tests there has already arisen a demand for the transmission of testing signals to enable prospective listeners-in to properly adjust their sets. Arrangements are being made for these, and it is expected that an announcement with regard to them will be made in next week's issue of *The Wireless World and Radio Review.*

The arrangements made by the American Radio Relay League for their preliminary tests to determine their best transmitters were recently announced in these columns, and have led a number of amateurs to listen-in for them. Reports already to hand indicate that several American stations have been heard, so that the main tests next month should be productive of even better results than were obtained last year.

Broadcasting of Results.

It will be remembered that during last year's tests a broadcast report was made each morning by Carnarvon radio station, which report was repeated slowly by New Brunswick station for the benefit of the American amateurs, giving the results of the receptions made by

Mr. Godley, the representative of the American Radio Relay League who was listening-in in Scotland. Through the kindness of the Marconi Company, and of the Radio Corporation of America, it will again be possible to broadcast such daily reports from Carnarvon, so that every amateur in the country will be able to obtain information of the progress of the tests by listening in to these reports each morning. They will be sent specially at twelve words per minute to make it easy for everyone to pick them up.

The French Committee which is arranging the part to be taken by the French amateurs both in listening and in transmitting, has also arranged for daily transmissions to be made from Sainte Assise station (near Paris), which reports will be repeated by Marion Station in the United States. These reports will be sent from Sainte Assise immediately following the reports from Carnarvon, the times being 0700 G.M.T. for Carnarvon, and 0710 G.M.T. for Sainte Assise.

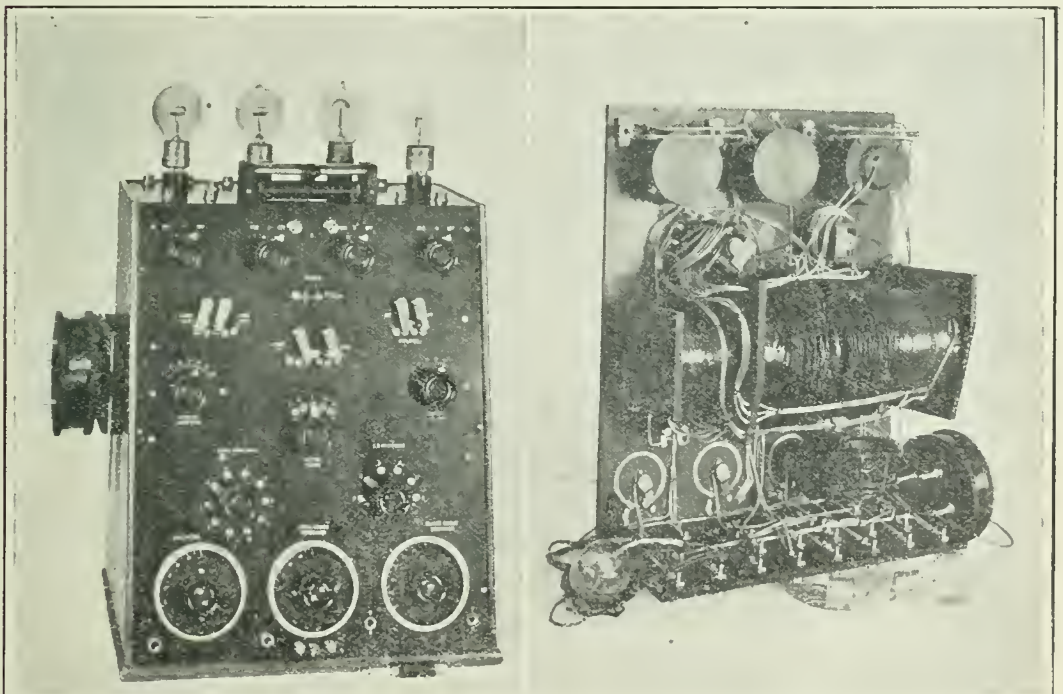
In order to enable these daily reports to be prepared, it is requested that everyone taking part in the reception tests will make a report each day as far as possible setting out the results that they have obtained, so that they can be included in the next report.

Further details of the codes, etc., that will be used for these daily broadcast transmissions will be given in a later issue.

It is requested that all enquiries and communications relative to these tests be addressed to the writer *c/o The Wireless World and Radio Review.*

A Universal Receiver.

THE receiver shown in the accompanying photographs is designed for reception on all wavelengths, and arranged so



The Valve Receiver. The view of the interior shows the construction of the Inductances and method of wiring.

that any combination of valves can be thrown in circuit. The sloping front panel is secured to the top, which carries terminals, valves, and potentiometer, and as is seen, can be removed entirely from the box-work without deranging the connections. The terminals are of the screw type in order to avoid the unpleasant effect which is produced by employing a large number of tall terminals.

The aerial circuit is tapped out on to a ten-point switch, and in moving the arm over the contacts, the rotating spindle operates a barrel switch arranged to entirely disconnect the inductances not in use. The closed circuit has a six-point switch similarly arranged. This closed circuit can either be used as a secondary, tuned anode, or reaction coil, by operating the two-arm switch in the middle of the instrument. A five-stud switch taps out singly the end turns of the aerial inductance, and is very convenient for fine tuning. The short wave portion of the aerial inductance, which tunes up to about 1,000 metres, consists partly of a single layer and partly two-pile winding. For longer wavelengths the inductance consists of two, three, or four-pile winding followed by spaced basket coils—an arrangement which gives a minimum of self-capacity.

High frequency amplification is provided on the tuned anode principle, and rectification is either effected by the second valve or the perikon detector, which can be seen on the front of the panel.

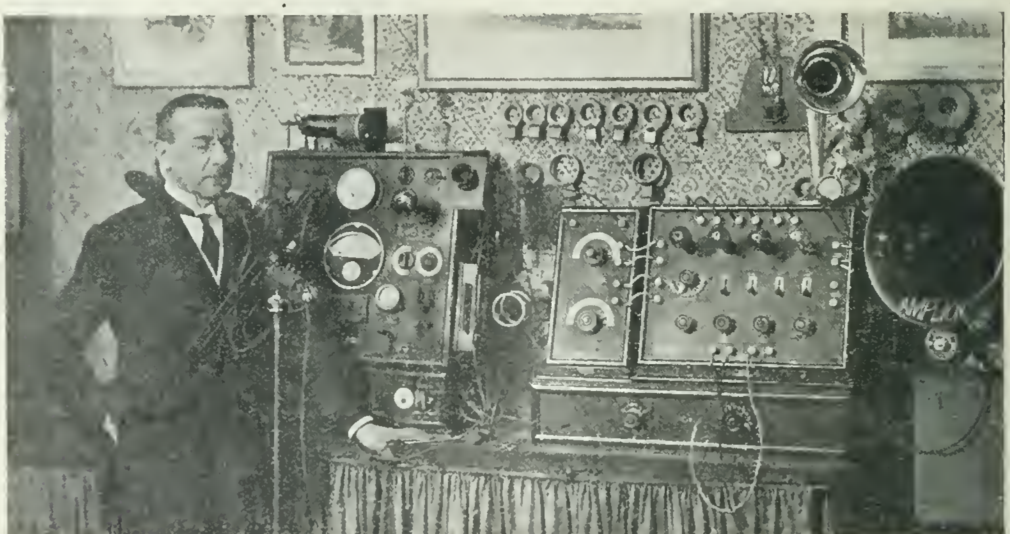
The condenser on the left forms part of a heterodyne wavemeter circuit, arranged to cover the full wavelength range and varied by plug-in coils shown on the left in the front view. A hinged platform varies the extent of coupling between the aerial circuit and the wavemeter coil.

Aerial tuning and closed circuit condensers are provided, also terminals for connecting up a five-plate vernier condenser.

A low frequency amplifier can be thrown in circuit by a switch. The other switches are so arranged that not only can any combination of valves be used, but also the valves can be abandoned altogether and simple crystal reception made use of. The telephones are connected in circuit by plugs and jacks.

The wiring up is effected with bare wire in insulating sleeving, carefully arranged and bundled in order that no detrimental effects are produced. F.H.H.

Broadcast from 2 KO Birmingham.



The Rt. Hon. the Lord Mayor of Birmingham Broadcasting an Appeal in aid of Hospitals from the experimental station of Mr. C. S. Baynton (2 KO).

Amateur Transmissions in the London Area.

It is obvious to everyone that the time has come when some further organisation is desirable amongst amateurs holding transmitting licences in the London area. With this end in view the Committee of the Wireless Society of London have arranged for a private Meeting of such amateurs to be held at the Institution of Electrical Engineers on November 13th at 6.30 p.m Certain schemes will be suggested, and it is desired that there should be the fullest possible discussion on the matter Mr. Maurice Child will be in the chair.

Electrons, Electric Waves, and Wireless Telephony VI.

By Dr. J. A. Fleming, F.R.S.

The articles appearing under the above title are a reproduction, with some additions, of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

4.—Atomic Structure.

We are then naturally led to consider the very important question of atomic structure and architecture to which all the foregoing discussion has been only preliminary.

The first step in this knowledge was taken about 1898 or 1899, when Sir Joseph Thomson began his epoch-making work which led to the discovery of the *corpuscle* or *negative electron* as a constituent element of all atoms. This work grew, very naturally, out of the previous researches of Sir William Crookes on electric discharge in high vacua, and the discovery in 1895 by W. Röntgen of the so-called X-rays, which marked the beginning of a new era in physics.

Crookes had found that when a glass bulb exhausted to a very high vacuum had one platinum electrode, called the cathode, sealed through the glass connected to the negative terminal of an induction coil, and another similar electrode, called the anode, connected to the positive terminal of the coil, then when the induction coil was in action, not only was the glass rendered fluorescent, but particles of some kind were projected from the cathode, which moved away in straight lines, normal to the surface of the cathode, could produce fluorescence in many substances placed in their path, could cause little mica vanes to rotate like a windmill, and also could cast shadows of metal objects on the glass wall of the tube (see Fig. 36). Crookes showed that these particles each carried a charge of negative electricity.

Crookes named these particles " radiant matter," but they were subsequently called " cathode rays " or " cathode ray particles." Up until 1895, this high vacuum electric discharge hardly possessed more than a purely scientific interest, but in that year W. Röntgen made a discovery of great practical importance. He found that when such a high vacuum tube was in operation and the glass fluorescent, paper or wood coated with a fluorescent material such as barium platinocyanide, was also made fluorescent, even outside the vacuum tube, when held near it, and, moreover, that some substances, such as heavy metals, stopped the radiation producing fluorescence, whereas this radiation passed freely through wood, paper, leather and other materials opaque to light rays.

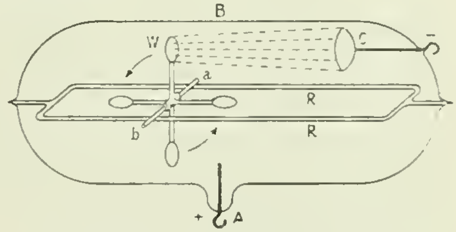


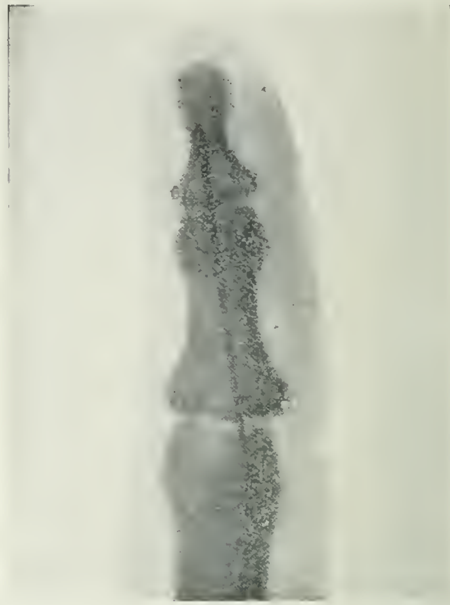
Fig. 36. Crooke's Electron Mill.

B—Highly exhausted bulb.
C— Cathode or negative cathode.
A Anode or positive electrode.
W—Little Rotor with mica waves which rotates and rolls along glass rails R.R. under impulses of electrons radiated from cathode.

The great sensation of that day was, however, the discovery that the new rays, then called X-rays, from their unknown nature, passed freely through the fleshy tissues of the living human hand, but were more or less stopped by the bones. Also that since these rays could affect a photographic plate enclosed in a black paper envelope, it was possible to photograph the bones in the living hand and unerringly fix the position of any metallic bodies, e.g., bullets, needles, etc., in the flesh

(Fig. 37). Again, it was found that these X-rays produced a certain degree of temporary electric conductivity in air or other gases through which they passed.

Fig. 37. X-ray photograph of a hand with shot embedded in it.



X-ray photograph of finger with a needle embedded in it.

The investigation of the nature of the cathode rays and of the X-rays was taken up very carefully about the end of last century. Two views had previously been held as to the cathode rays. Crookes and his followers maintained that they were material particles of some kind projected from the negative electrode in the high vacuum tube. Other physicists regarded them as some form of ætherial vibration.

Sir Joseph Thomson settled the question by experiments of a remarkably ingenious and important character. If an electrified particle is made to move across the space between the poles of a powerful magnet in a direction at right angles to the line adjoining these poles, it experiences a deflecting force which is at right angles to the direction of its motion and that of the so-called magnetic force which last lies in the direction of the line joining the magnetic poles. This magnetic force is a quantity measurable in certain units. Let us denote by the letter H the magnitude of this magnetic force. Let the velocity of the electrified particle be v centimetres per second, and let it carry an electric charge, denoted by the letter e, as regards amount. Then when the particle carrying an electric charge of e units moves with a velocity v in a direction at right angles to a magnetic force H, it experiences a deflecting force numerically equal to the product Hev, which is in a direction at right angles to the direction of H and v.

Under these conditions the electrified particle of mass m is being continually acted on by a force at right angles to its direction of motion and hence it moves in a circle of radius v, such that $Hev = mv^2/r$.

Therefore we have the relation

$$\frac{m}{e} v = Hr.$$

Suppose in the next place that we cause an external electric force to act on the electrified particle having an electric charge e. Let the magnitude of this electric force be denoted by E. Then a force measured by the product Ee acts on the particle. Let the direction of the impressed electric force E be so adjusted that the deflecting force produced by it on the electrified particle is exactly opposite in direction and equal in amount to the deflection produced by the magnetic force. We can then equate the two expressions for the deflecting force acting on the particle and have the equation

$$Hev = Ee$$

or

$$v = \frac{E}{H}$$

Hence, if we measure, as we can do, the magnetic force and the electric force, we can determine from their numerical ratio the velocity v of the cathode particle.

Again, having found the velocity v we can from the previous equation, viz., $Hev = mv^2/r$ or $Hev = mv$, find the ratio of e/m or of electric charge to mass of the cathode particle. For from the above equations we see that

$$\frac{e}{m} = \frac{E}{H^2 r}$$

Hence, if we measure the radius of the circular path of the cathode particle when deflected by the magnetic force H, and also the electric force E, at right angles to H, which is necessary just to annul the deflection, we can calculate the value of E/H^2r and thus determine the ratio e/m. This ratio is an extremely important number and the investigations for its exact determination have been very numerous. The apparatus generally used is shown in Fig. 38. It consists of a glass tube about two inches wide, ending in a large bulb B, 10 or 12 inches in diameter. At the extreme end is sealed in a platinum wire, ending in an aluminium dish C, which forms the cathode or negative electrode. The positive electrode A is another wire sealed into a short side tube. When these electrodes are connected to the secondary circuit of an induction coil, or better still to the poles of an electrostatic generator such as a Wimshurst electrical machine, which keeps the cathode negatively electrified, a torrent of cathode particles are projected from it, when the tube is highly exhausted of its air so as to make a good vacuum in it.

In the vacuum tube are placed a pair of baffle plates, E, with small holes in them, which allows a thin stream of cathode particles to pass. These fall on the spherical end of the tube, which is coated inside with a phosphorescent material called willemite, or with powdered zinc blende. The cathode particles impinging on this screen make a bright green spot of light on it. Within the tube are also placed a pair of metal plates, pq, which can be electrified, one positively and the other negatively, so as to create the required deflecting electric force we have denoted by E. Also that same part of the tube is placed between the poles of a powerful magnet so as to supply a deflecting force Hev in the contrary direction, but in the same line as the electric force E.

From the deflection caused by the magnetic force alone we can find the radius r of the curve along which the cathode particle moves, and we can thus determine both the velocity v and the ratio e/m.

When these experiments are carefully conducted, it is found that the velocity of the cathode particle will vary with the potential difference, as it is called, of the electrodes, but in a high vacuum tube may be of the order of 100 million feet per second, or about one-tenth of the velocity of light. This is an enormous speed, and it is due to this immense

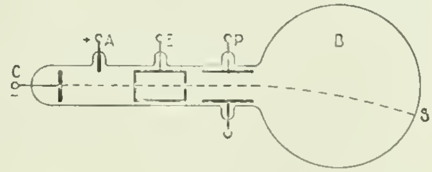


Fig. 38. Cathode Ray Tube and Bulb.

C—Cathode or negative electrode.
B—Highly exhausted bulb with fluorescent screen on its spherical end S.
A—Anode.
E—Baffle plates.
P—Deflecting plates.

velocity that the cathode particles are able to make a luminous spot on the phosphorescent screen.

Sir Joseph Thomson found, in 1899, that the ratio of e/m for the cathode particle was quite independent of the metal of which the cathode was made or of the residual gas in the tube. Under all circumstances exactly the same ratio was obtained. The numerical value was nearly $1{\cdot}77 \times 10^7$ when the charge e is measured in the so-called electromagnetic units. This electromagnetic unit of quantity is the quantity of electricity conveyed by a current of 10 amperes when flowing for one second or one ampere when flowing for 10 seconds, or about the quantity of electricity which passes through the filament of a 16 candle-power 200-volt lamp in a minute and a half.

This constancy in the ratio of e/m for all particles indicates that they are identically the same in every case.

We must make a little digression to explain the manner in which this ratio can be determined for the hydrogen atom and what conclusions can be drawn from it.

If we place two platinum or gold plates in water which is slightly acidulated and connect these plates with a storage battery of a couple of cells, we see bubbles of gas arising from both plates. By collecting these gases in separate tubes we can prove that the gas arising from the plate in connection with the positive pole (marked red) of the storage cell is oxygen and the gas collected at the other plate is hydrogen. By measuring the volume of these gases collected we can find that the passage of a current of one ampere for one second through the acidulated water liberates 1·04 ten-thousandths of a gram of hydrogen in the form of gas. These two gases are produced by the electro-chemical decomposition of the acid which is mixed with the water. Suppose for the sake of simplicity that we consider the water to have been acidulated with hydrochloric acid. Each molecule of this acid consists of an atom of hydrogen united to an atom of chlorine and the chemical formula is therefore *H Cl*.

Absolutely pure water is not a conductor of electric current, or at least a very bad one

If we put into this water a little hydrochloric acid the water causes a number of the hydrochloric acid (*H Cl*) molecules to become separated into atoms of hydrogen which are positively electrified and atoms of chlorine which are negatively charged. In this state the electrified atoms are called *ions* and the acid is said to be partly *ionised.* The word *ion* means a wanderer and they are so called because they wander about in the liquid. When a hydrogen ion collides with a chlorine ion they may become reunited into a hydrochloric acid molecule for a short time, but presently the ions are detached again. If then we place in the acid water two metal plates which are electrified the negative plate attracts and draws to it at the instant when it is free the positively charged hydrogen ion and the positive plate similarly attracts the chlorine ions.

The cholorine ions, however, have a strong affinity for hydrogen ions and they even take these away from molecules of water thus reforming *HCl* and liberating oxygen ions against the positive plate. These hydrogen ions then take negative electricity from the negative plate and the oxygen takes positive electricity from the other plate, re-forming hydrogen and oxygen atoms which in turn unite, pair and pair, to form molecules, and these constitute the bubbles of gas liberated.

We see, therefore, that the electric current which passes through the electro-chemical vessel, consists of charges of electricity which are carried by hydrogen and chlorine ions. To every hydrogen atom there corresponds a certain electric charge. If, therefore, we wish to determine the ratio of charge to mass for a single hydrogen atom or ion we have only to determine how much electricity passes, corresponding to the liberation of one gram of hydrogen at the negative electrode. Now, exact experiment shows that a current of one ampere flowing for one second, conveys a quantity of electricity called one coulomb, which is one-tenth of an absolute unit of electric quantity, and this liberates 0·0000109 grams of hydrogen. Hence, the ratio of charge to mass or e/m for the hydrogen ion is a number near to 10,000 or 10^4. We have seen, however, that the ratio of charge to mass or e/m for the cathode particle is $1{\cdot}77 \times 10^7$ or $1{,}770 \times 10^4$ or 1,700 to 1,800 times greater than e/m for the hydrogen ion.

The question then at once arose: is this difference due to a difference in charge or to a difference in mass between the cathode particle and the hydrogen atom or ion?

5.—CATHODE PARTICLES OR ELECTRONS.

Sir Joseph Thomson gave a reply to this question in 1899 by experiments of extraordinary skill and ingenuity.

It was found that particles in every way similar to cathode particles are liberated from the surface of polished zinc and some other metals when they are illuminated by ultra-violet light or light rays of very short wavelength. Also they are liberated from Radium and the X-rays of Röntgen liberate them from molecules of air.

When produced by either of these methods these cathode particles have the power of condensing round themselves water vapour present in air and forming a minute water spherule or drop of water.

The white clouds we see floating in the sky are composed of such small water drops. All air, unless specially dried, has in it a certain proportion of water vapour which is an invisible gas. If, however, the air is cooled below a certain point it cannot hold as much water vapour in solution and it gets rid of and deposits the excess by forming a cloud or mist. This is the explanation of the early morning mists in the atmosphere which are really formed during the night, when the atmosphere is cooled and the excess of water vapour condensed to water spherules. These small drops of water fall very slowly through the air owing to the friction or viscosity of the air.

Many years ago Sir George Stokes gave a formula connecting together the diameter (d) of the drop with viscosity (q) of the air and the final or constant velocity (v) which the falling drop attains. This formula is $v = \frac{1}{18}\frac{gd^2}{q}$ where g stands for the acceleration of gravity and is nearly 981 in centimetres and seconds as units.

When moist air is chilled by being suddenly expanded it has been found that the excess of moisture is not readily converted into droplets or mist unless there are dust particles in the air. These, however, assist the condensation by affording nuclei round which the water vapour condenses. Many years ago it was discovered by Mr. C. T .R. Wilson that cathode particles could act in the same manner in perfectly pure dust-free air.

If such pure air is suddenly expanded and cooled a cloud does not form but the air becomes supersaturated with moisture. If then cathode particles are introduced a cloud forms at once. Wilson found that if the supersaturation did not exceed a certain amount only the negative or cathode particle acted as a nucleus or core for the condensation of water vapour round it, and a cloud or mist is formed in the vessel in which the moist air is suddenly expanded.

Sir Joseph Thomson and Prof. H. A. Wilson applied this method to determine the cathode particle electric charge as follows :

He suddenly expanded pure dust-free air in a glass vessel and thus supersaturated the air with moisture. He then introduced into this air a number of cathode particles either by allowing ultra-violet light to fall on a zinc plate in the vessel or else by exposing the air to the X-rays. The expansion was performed in a glass vessel having in it two metal plates, an upper and a lower, which could be connected at pleasure to a voltage battery of a certain number of cells so as to make the upper plate positive and produce a certain electric force in the space between the plates. When the cloud was formed by the condensing action of the cathode particles each of the latter condensed round itself a drop of water and began to fall downwards. The rate of falling, by Stokes' law, is determined by the size of the drop, and from the observed rate of sinking of the upper sharp surface of the cloud we can calculate the diameter of the minute drop of water from the formula given above and hence the mass of the drop. When the cloud has sunk a certain distance the upper metal plate is given a positive electric charge and this produces an electric force E in the space between the plates which can be adjusted until it just arrests the fall of the drops.

We then know that since each drop contains a cathode particle of electric charge e we must have the equation

$$Mg = Ee$$

Where M is the mass of the drop and g the acceleration of gravity. From this equation e can be determined.

Some admirable measurements of the same kind, only using oil or mercury vapour in place of water vapour, have been carried out by Professor R. A. Millikan in America. The best and final result is that the cathode particle carries a negative electric charge of $4{\cdot}774 \times 10^{-10}$ electrostatic units or $1{\cdot}591 \times 10^{-20}$ electro magnetic units. In other words, six million billion cathode particles carry between them a quantity of electricity equal to that conveyed by a current of one ampere in one second.

It was thus found that this very small quantity of negative electricity is a natural unit which cannot be divided, and is in short an *atom of electricity*. Electricity was thus seen to be a commodity like cigars or cigarettes or things of the kind that are supplied only in multiples of some finite unit.

To this atom of negative electricity the late Dr. Johnstone Stoney gave the name of *the electron*, but the term electron is now applied to the cathode particle, or negative corpuscle as a whole.

It became clear, therefore, that identical electrons were constituents of all material atoms and could be extricated from them.

6.—Electrons as Constituents of all Atoms.

It was not then a long step from this point to the suggestion that atoms consisted of groups of electrons, arranged in a certain way and held together by the attraction of some form of charge of positive electricity. The first suggestion was that this positive charge of electricity, the nature of which was unknown, existed in the form of a sphere of the size of the atom and that the negative electrons were distributed through it like pips in an orange, but able to circulate about or revolve in it.

The late Lord Kelvin made this suggestion first, and its consequences were mathematically developed by Sir J. J. Thomson.

If we suppose the sphere of positive electricity to be composed of stuff which attracts electrons external to itself with a force which is inversely proportional to the square of the distance, then it can be shown that a sphere of such positive electricity would attract an electron embedded in it, towards its centre, with a force proportional to the distance of the electron from the centre. If then by any means the electron is set in motion, it will revolve round the centre of the sphere of positive electricity in a circular orbit included within the boundary of that positive sphere.

If a number of such electrons are included in the sphere they will arrange themselves in certain rings or orbits, certain arrangements being stable and others unstable. An illustration of this sort of structure is found in an interesting experiment due to Mayer.

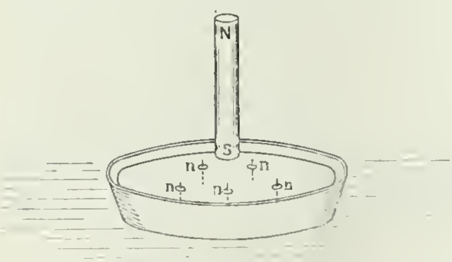


Fig. 39. Mayer's Magnet Experiment.
Little magnetised needles floating vertically in water and caused to arrange themselves in a pattern by a magnet NS held over them.

A large number of sewing needles are thrust through little discs of cork. The needles are all magnetised and then, if placed in water in a basin with the cork button slid along to one end, the needles will all float vertically in the water. If then the upper ends are all similar magnetic poles, the needles will repel each other like electrons, and if left to themselves will get as far apart as possible.

If the opposite pole of a bar magnet is now held near the surface of the water the needles will be drawn to it but will be mutually repelled. Under this double action they will arrange themselves in certain forms (see Fig. 39). Thus three needles will set themselves at the angular points of an equilateral triangle, four at the corners of a square, five at corners of a pentagon. Certain arrangements are, however, unstable, especially if the needles or electrons are in rotation round the centre, and when more than a certain number of needles or electrons exist in the group the arrangement is not stable unless they are arranged in two or more rings.

Certain facts discovered by Sir Ernest Rutherford, and strongly supported by the theoretical investigations of Professor N. Bohr, of Copenhagen, seem to militate against the view that the positive electric charge is diffused over a sphere the size of the atom, but strongly support the view that it is concentrated in a small centre or nucleus which is very small compared with the size of the material atom itself, and perhaps not large even compared with the size of a negative electron.

The theory of atomic structure now somewhat widely held, called the Rutherford-Bohr theory, is that a chemical atom consists of a nucleus which is composed of negative electrons, held together by still smaller positive electrons, the positive electrons predominating in number so that the whole nucleus has a resultant charge of positive electricity if we assume that the charges of positive and negative electrons taken singly are equal.

Thus, for instance, the nucleus of the Helium atom is supposed to contain four positive electrons and two negative, which are bound by mutual attraction and repulsion into a compact mass, which Rutherford concludes has a diameter of not more than one ten-thousandth part of that of the whole atom, which we have seen to be of the order of one-hundred-millionth of a centimetre. This nucleus has, therefore, a resultant positive charge equal to two units, taking the unit to be the electron charge. Around this nucleus circulate two negative electrons like planets round the sun and the atom, taken as a whole, is therefore electrically neutral.

The atom, on this theory, is a solar system in miniature. The nucleus corresponds to the central sun and the negative electrons to the

If any of you use direction finders in London you will observe that you get errors in any house. When I find that Paris is about seven degrees off what it ought to be, I know Paris is perfectly correct, but I am perfectly correct also, because I have a permanent error of seven degrees. I get no error on Horsea, and yet on Ongar, which is almost reciprocal, I get an error of five degrees.

It is well worth while remembering, in using direction finders in London, that with water-pipes, electric light leads, telegraph and telephone wires and iron balcony rails you cannot expect to get true bearings. You know the error is not due to the stations, therefore you should plot out your curve and see what the errors are, and you will know what the correcting factor should be.

Notes

A Wired Wireless Demonstration.

On Friday evening, November 3rd, a demonstration of wired wireless took place at the Regent Street Polytechnic as previously announced in this journal.

Mr. E. H. Shaughnessy, head of the Wireless Section of the General Post Office, gave a lecture on recent developments in radio telegraphy and telephony, when he dealt with the work which was being done at Leafield. In the course of his lecture, he mentioned that the daily news service maintained from Leafield to Halifax, Nova Scotia, was regarded by Americans as the fastest Transatlantic service in existence.

During the evening, by permission of the Postmaster-General and with the co-operation of the Marconi Company and the British Broadcasting Company, a demonstration of wireless telephony was given. Sir William Noble, speaking from Marconi House, introduced the Lord Mayor of Bristol, who delivered an address from his own home. This was transmitted by "wired wireless" to Marconi House, and thence broadcasted.

An instrumental and vocal concert was afterwards broadcasted from Marconi House.

African Stations.

Tete station, Lourenço Marques, is now almost completed. Direct communication with Lisbon is to be established. Smaller stations have already been erected at Inambane and Chai-Chai on the coast.

American Call Signal WWAA.

The general call signal **WWAA** has been assigned for all vessels operated and controlled by the Radio Corporation of America. This general call signal will be used by Radio Corporation of America ships or coast stations desiring to ascertain whether there is an R.C.A. ship within range, and any R.C.A. vessel hearing another ship or coast station calling **WWAA** should answer. Also this general call signal will be used in broadcasting messages to R.C.A. ships.

Wireless Apparatus in Aircraft.

At the first public session of the International Commission for Aerial Navigation consideration was given to the report of a Sub-Committee on the use of wireless apparatus on aircraft. It was agreed as a general principle that all aircraft engaged in public transport must carry wireless apparatus. At present this provision is applied only to aircraft able to carry ten or more persons. Aircraft carrying fewer than ten persons, and flying more than 100 miles over land without landing, or more than 15 miles over sea, must carry wireless apparatus within two years.

Messages to Aeroplanes.

Haren **(OPVH)** telephones frequently to aeroplanes flying between Brussels and Paris, Brussels and London, and Brussels and Amsterdam. Messages on 900 metres are usually transmitted at twenty minutes past each hour from 11.20 to 4.20. Weather reports are given in French and English.

Telephony from Eiffel Tower.

The Eiffel Tower Station now transmits telephony at 7.20 a.m., 11.15 a.m. and 5.10 p.m. It is anticipated that the power will be increased in the near future.

Belgian Meteorological Transmissions.

Transmissions from the Brussels Meteorological Institute **(OPO)** are made on (C.W.) 1,500 metres at so slow a rate that amateurs are easily able to read the messages, which are in Morse code.

Königswusterhausen.

Daily transmissions of telephony from Königswusterhausen, Berlin, are on a wavelength of 2,800 metres, and the times are 6 to 7 a.m., 11 a.m. to 12.30 noon and 4 to 5.30 p.m.

Address of 2 ZY Required.

Reception of **2 ZY** has been reported, and excellent telephony recorded. We have been asked for the address of this station.

Wireless Insurance Policy.

Liverpool Marine and General Insurance Company, Ltd., have issued a comprehensive policy covering all risks in connection with an amateur wireless installation at a premium of 7s. 6d.

Canadian Government Radio Director in London.

Mr. C. P. Edwards, O.B.E., Director of Radio for the Canadian Government, arrived in London on the 30th October. He is to advise the Hon. Ernest Lapointe, M.P., Canadian Minister of Marine, in connection with the conference between the Canadian and Imperial Authorities in regard to the Imperial Chain.

Wireless at St. Bride's Institute.

At St. Bride's Institute, Ludgate Circus, E.C., a lecture and demonstration on "Broadcasting" is to be given on November 14th. The lecturer, Mr. H. A. Hankey, is an ex-Fleet Wireless Officer. By arrangement with Marconi's Wireless Telegraph Company, the event is being held under the auspices of the National Association of Supervising Engineers. Tickets are obtainable from Mr. A. Brammer, 63, Queen Victoria Street, E.C.4.

The New Licence for Broadcast Reception

BROADCAST LICENCE.

A 41602

WIRELESS TELEGRAPHY ACT, 1904.

Licence to establish a wireless receiving station.

Messrs The Wireless World & Radio Review
(Name in full)
of 12/13 Henrietta St. Ldn WC ...is hereby
(Address in full)
authorised (subject in all respects to the conditions set forth on the back hereof) to establish a wireless station for the purpose of receiving messages at 12/13 Henrietta Street
(address of Station)
...for a period ending on the ... ember next.
(date of expiration)

APPARATUS USED UNDER THIS LICENCE MUST BE MARKED

The payment of the fee of ten shillings is hereby acknowledged.

Dated 3rd day of November 1922

Issued on behalf of the Postmaster-General

W. G. N.
(Postmaster)

Signature of Licensee **WIRELESS WORLD & RADIO REVIEW.**

Stamp of Issuing Office. BEDFORD ST. STRAND B.O. 3 NO 22 W.C.

If it is desired to continue to maintain the station after the date of expiration a fresh Licence must be taken out within fourteen days. Heavy penalties are prescribed by the Wireless Telegraphy Act 1904, on conviction of the offence of establishing a wireless station without the Postmaster-General's Licence.
2801 G & S 194

CONDITIONS.

1. The Licensee shall not allow the Station to be used for any purpose other than that of receiving messages.

2. Any receiving set, or any of the following parts, vizt.:—Amplifiers (valve or other), telephone head receivers, loud speakers and valves, used under this licence must bear the mark shewn in the margin.

3. The Station shall not be used in such a manner as to cause interference with the working of other Stations. In particular valves must not be so connected as to be capable of causing the aerial to oscillate.

4. The combined height and length of the external aerial (where one is employed) shall not exceed 100 feet.

5. The Licensee shall not divulge or allow to be divulged to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal) or make any use whatsoever, of any message received by means of the Station other than time signals, musical performances and messages transmitted for general reception.

6. The Station shall be open to inspection at all reasonable times by duly authorised officers of the Post Office

This Licence may be cancelled by the Postmaster-General at any time either by specific notice in writing sent by post to the Licensee at the address shewn hereon, or by means of a general notice in the London Gazette addressed to all holders of wireless receiving Licences for broadcast messages.

N B —Licences may only be held by persons who are of full age, and any change of address must be promptly communicated to the issuing Postmaster.

2801

At the top will be seen a reproduction of the front of the licence. The Conditions are on the back of the form.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—In a book of Standard Tables for Radio, published in London, there is given a formula for finding the distance between two points on the earth's surface. The example worked out is :—

	Latitude.	*Longitude.*
San Francisco ..	.. 37°44′40″ N.	122°24′40″ W.
Choishi ..	.. 35°44′08″ N.	140°51′12″ E.

and is not as simple as it could be.

Compare with the following way of making the calculation, in which *d*.lon. is the difference of longitude, and *d*.lat. the difference of latitude :

lat. 37°44′40″	log. cos	9.89804	
lat. 35°44′08″	log. cos	9.90941	
d.lon 96°44′28″	log. hav	9.94717	
	log.hav	9.55462	= N.hav 0.35860
d.lat 2°00′32″			N.hav 0.00031
Distance = 73°36′35″			N.hav 0.35891

73 × 60 = 4380
— 36½ = 4416½ nautical miles.

Las Heras, 1960.
Buenos Aires,
Argentina.

Juan Christensen.

To the Editor of The Wireless World and Radio Review.

Sir,—With reference to the Proceedings of the Wireless Society of London, reported in your issues of October 14th and 21st, I regret to notice the apathy shown to the experimenter as distinct from the receiver of "broadcasting."

The prohibition of the use of reaction (which if pressed to its logical conclusion implies that transmitting would not be allowed) on wavelengths from 300 to 500 metres, during the hours 5 to 10 p.m. on weekdays, and all day on Sundays (the very times when many experimenters are obliged to work) seems grossly unfair.

I would ask why this prohibition should be extended beyond the upper limit of the broadcasting band, viz., 425 metres. It is further proposed that the experimenter shall pay an increased fee for an "entertainment" which is to debar him from carrying out any experiments he may wish to do. I trust that the wireless societies, in their present prosperity, will do all in their power to maintain the privileges of those who were early members.

Trinity College,
Cambridge.
October 24th, 1922.

"Experimenter."

Books Received

Disposal Board Radio Instruments and their Application to Experimental Uses. By P. R. Coursey, B.Sc. (London : *Messrs. Leslie McMichael, Ltd.*, Providence Place, West End Lane, N.W.6. Illustrated. Price 1s. 6d.)

Calendar of Current Events

Friday, November 10th.

Heckmondwike and District Wireless Society.
At 7.30 p.m. Exhibition and Demonstration. Opening by Mr. C. W. Leather, Cleckheaton.

Radio Society of Highgate.
At 7.45 p.m. At the 1919 Club, South Grove. Lecture by Prof. E. Mallett, M.Sc.

Belvedere and District Radio and Scientific Society.
Lecture on "Properties of Crystals," by Mr. H. H. Smith.

Leeds and District Amateur Wireless Society.
Lecture on "Some Gadgets of a Faddist," by Mr. G. P. Kendall, B.Sc.

Manchester Wireless Society.
Annual General Meeting.

Saturday, November 11th.

Heckmondwike and District Wireless Society.
At 3 p.m. Exhibition and Demonstration. Opening by Lieut. H. W. Burbury, R.N., Crigglestone.

Liverpool Wireless Society.
First meeting of Winter Session at Royal Institution. Address by Prof. E. W. Marchant.

Sunday, November 12th.

Daily Mail Concert from the Hague, 3 to 5 p.m., on 1,085 metres.

Monday, November 13th.

North London Wireless Association.
Lecture on "Telephone Working : External Routine," by Mr. A. G. Hill.

Wireless Society (Hull and District).
At the Signal Corps Headquarters. Lecture on "Calculation of Capacity," by Mr. Hy. Strong.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Annual General Meeting.

Finchley and District Wireless Society.
Lecture by Mr. Wilck.

Tuesday, November 14th.

Transmissions of Telephony by 2 MT, Writtle, as above.

Wednesday, November 15th.

Edinburgh and District Radio Society.
At 8 p.m. At Headquarters. Lecture on "Need for International Language in W.T." By Mr. A. Boyd Anderson, F.B.E.A.

Thursday, November 16th.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School Exhibition and Demonstration (Messrs. Radio Instruments Co.).

Derby Wireless Club.
At 7.30 p.m. At "The Court," Alvaston. Informal meeting.

Friday, November 17th.

Bradford Wireless Society.
Cinema Display.

Birmingham Experimental Wireless Club.
At Digbeth Institute, Birmingham. Lecture by Mr. P. R. Coursey, B.Sc. (All members of Federated Midland Wireless Societies invited.)

The Wireless Society of London

Report of Proceedings at the Ordinary General Meeting held on October 25th.

An ordinary general meeting of the Society was held on Wednesday, October 25th, at 6 p.m., at the Institution of Electrical Engineers.

After the minutes of the previous meeting had been read and confirmed, the **President** said :—

The list of members proposed for election is being distributed in the usual way, to be collected at the end of the meeting. It is very satisfactory to note the very large increase at every meeting of the number of members joining us, and also the lists of Societies and Clubs becoming affiliated.

Before calling upon our lecturers, Mr. Smith-Rose and Mr. Barfield, to give their paper, there are a few matters of business to go through. The first is that a letter has been received from Messrs. Bertram Day & Co., thanking our Society for associating itself with the late Exhibition. We, in our turn, may well congratulate Mr. Bertram Day on a very great success.

Now I have a very important announcement to make to you, and I feel very proud that, as President, I should have to do it. The announcement is that His Royal Highness the Prince of Wales has graciously consented to become the Patron of the Wireless Society of London and the affiliated Societies, and he notices that we intend to change our name to the Radio Society of Great Britain. I think, ladies and gentlemen, that this is a very great honour for the Society. (Applause.)

There is another matter which I have to bring to your notice. I have had an appeal from Captain Ian Fraser, who is in charge of St. Dunstan's Hostel for Blinded Soldiers and Sailors. Captain Fraser is himself a blind man. He is interested in wireless, and was an amateur before the war. He asks me to bring to the notice of those connected with the Wireless Society of London suggestions whereby they can help individually blinded men all over the country, who wish to take up wireless. I visited St. Dunstan's, and had a long talk with him, and he has written me a letter explaining what he wants. He has his own wireless apparatus, which he practically built up with his own hands, with very slight assistance from one of our members. I will ask the Secretary to read his letter, which will be published later on, and I may say that His Royal Highness wishes to associate himself as his first act as Patron of this Society, with this appeal for St. Dunstan's. I think that alone will be sufficient to push it. We all have sympathy with these men in their darkened lives, and if they can be helped by us individually, I think we shall be glad to assist.

The following is the text of the letter which was then read :—

The Council of the Wireless Society of London have had under consideration a request from Captain Ian Fraser, the Chairman of St. Dunstan's, that they should bring to the notice of wireless amateurs a direction in which they can contribute very materially to the instruction and entertainment of blind people who are, or will be, interested in radio-telegraphy and telephony. Captain Fraser was himself blinded in the war, and has, both before and since he lost his sight, made a hobby of the study of radio and allied sciences. He states from his own practical experience that it is possible for a totally blind person, with no more knowledge of the subject than the average ordinary amateur, to look after his instruments, accumulators, batteries, etc., and manipulate them with great accuracy and without any sighted assistance. He further claims that with a little more knowledge of the subject, the connecting up of instruments, experimenting with various circuits, and even the building up of simple apparatus, is not outside a blind man's reach. In his appeal to the Council Captain Fraser points out that, in spite of the above, there are initial difficulties such as the fitting up of an aerial, leading-in tube, etc., which the most skilful blind man cannot undertake, and that in the case of absolute beginners unusual difficulties present themselves in connection with the choice of suitable apparatus to purchase, learning how to use it, etc.

Since a blind man is deprived of many forms of enjoyment which are available for those who can see, Captain Fraser asked the Council if it would consider these points on behalf of its members, and take steps to place them before the Councils or Committees of all associated or affiliated societies with the following objects: (1) To obtain an indication as to whether or no the societies would be willing to make a special point of arranging for one or more of their members to make a particular friend of any blinded soldier or other blind person who might qualify for membership of the society, and undertake to give him the personal assistance which is obviously required in the directions outlined above; and (2) if it is indicated that the affiliated societies are willing to help in this way, it is suggested that a notice should be printed in the *St. Dunstan's Magazine*, and in the *Braille Press*, and that all other suitable steps be taken to let blind people know that if they apply to either the Wireless Society of London or to Captain Fraser they will be put in touch with their local society, the members of which (if the blind person qualifies in all other respects for membership) will be willing to welcome him and give him special assistance.

It is understood that no financial assistance is asked for in connection with this scheme, but merely personal service and interest, and the Council of the Wireless Society of London unanimously resolved to ask all affiliated societies to consider this matter and indicate to the Council, or direct to Captain Fraser, Headquarters of St. Dunstan's Work, Inner Circle, Regent's Park, N.W., if they are willing to co-operate.

There are 35,000 blind persons in the United Kingdom, of whom 2,000 are blinded soldiers. Probably only a relatively small number will be interested, but by them the help asked for will be greatly appreciated, and already Captain Fraser has the names of a few blind people who would welcome assistance on the lines indicated.

I take it that those present here approve of this appeal to the members of our Society.

I will now ask the Chairman to make a few remarks.

Mr. F. Hope-Jones (*Chairman*).

Ladies and Gentlemen : One announcement which ought to be made to-night is that we propose to call the next monthly general meeting (on the fourth Wednesday in November) a *special* general meeting, the object being that it may be competent to make alterations in our constitution by certain changes in our rules. We try to keep the rules. There are very precise regulations bearing on them. The last three state how the other rules can be amended. Rule 42 states in effect that if the alterations emanate from the general body of the membership apart from the Committee they must be signed by ten members, and must be in our hands a month before the meeting, and it must be either an annual meeting or a special general meeting. Rule 43 states that any alterations are to be sent by the Honorary Secretary to all members at least a fortnight before that annual general or special general meeting. It will mean that you will get your notices a fortnight before the next meeting, rather earlier than usual. Rule 44, the last rule in our constitution, provides that no amendments shall be adopted unless at least three-fourths of the votes are in favour of such action. I will briefly mention the subjects of change. One has already been referred to in the minutes which have just been read, that is the new class of membership called Associates. It may strike you as a little bold that action of that kind should be taken in advance of an alteration of the rules, but I can assure you that we only break our laws in the interest of the Society when occasion or emergency really demands it. In this case, as you know, broadcasting and the announcement that there should be two classes of licences created a new class that ought to be taken under our wing, and if we had not done so, perhaps other people would have thought it necessary to start associations for that purpose.

And then the change of name. Did you notice the terms in which the President announced the great honour of our royal patronage ? Apparently His Royal Highness the Prince of Wales has gone out of his way to note that the name of the Society is to be changed from the Wireless Society of London to the Radio Society of Great Britain.

It was mentioned in the minutes of the last meeting which you have just heard read that that matter was still only mooted and would receive further serious consideration. All I can tell you, gentlemen, is that it *has* received further serious consideration, and practically a chorus of approval There has been, I think, no voice raised against the proposal, certainly none in the provinces among our affiliated Societies, who are most concerned. I will not trouble you with the precise alterations now because you will find them with the notice calling the next meeting.

Another matter which I am desired to mention is the proposal that we should institute some prizes. We have had the suggestion knocking at our door for some time, but the Council has been so much engaged with other important matters that they have not been able to do justice to it. They have received an enterprising offer from a prominent member who suggests that we might announce a prize for the most efficient Armstrong Super-Regenerative Circuit. The Americans are setting themselves very closely to work on that subject, and this gentleman feels keenly that we should not be beaten on the other side of the Atlantic, and has made a generous offer of a ten-guinea first prize. The Committee proposes to issue the conditions forthwith, and there will very likely be a second prize.

The President.

I am sorry to take up so much time from the lecture, but it is necessary to bring these things before your notice. I will now ask Mr. Smith-Rose and Mr. Barfield to give their lecture on "The Effect of Underground Metalwork on Radio Direction Finders." (*See pages* 165-171 *of issue of November 4th*, 1922.)

At the conclusion of the paper and discussion (*see page* 202 *of this issue*) the **President** said :—

All the large number of members and associate members up for ballot have been elected, and the list of the Societies accepted for affiliation. (*For list see page* 176 *of issue of November 4th.*) In addition a large number of Associates have joined the Society.

There are also several other members in addition to those in the printed list and passed by the Committee who will be put up for ballot next month.

The next meeting will be on the fourth Wednesday in November. You have heard already that it will be a special one. There will also be a lecture.

The meeting adjourned at 7.15 p.m.

Wireless in Schools.

Mr. R. J. Hibberd, Grayswood School, Haslemere, is compiling a list of Primary, Secondary and Public Schools which possess wireless apparatus. Particulars would be gladly received by him as follows :—(1) Name and type of school. (2) Date apparatus was installed or made. (3) Nature of work carried on.

New Station at Phuto.

At Phuto, near Saigon, the Compagnie Générale de Télégraphie sans Fil has erected a new station. Direct communication with Saint Assise, and also with Tananarivo, Madagascar, is to be effected.

New Station at Lausanne.

At Lausanne a new station has been erected. Transmissions are on 900, 1,400 and occasionally 2,610 metres. Telephony on 900 is transmitted from the station to aeroplanes leaving Le Bourget. Messages are also sent to Dijon on 1,400 metres between 11 a.m. and 12 noon.

Chess Played by Wireless.

An interesting experiment conducted by the local wireless club at Guildford consisted of a chess match in which the moves were communicated by wireless. The match was played by the Guildford Chess Club.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Willesden Wireless Society.*

Hon. Secretary, Mr. G. D. Wyatt, 70, Craven Park, Harlesden, N.W.10.

Several changes in the administration of the Society have recently taken place, and the Society has now settled down in its new headquarters at The Harlesden Public Library, Harlesden, N.W.10.

A very interesting programme has been arranged for the winter session. Regular meetings are held every Tuesday evening from 8 p.m. to 10 p.m. Owing to the kindness of several of the long-standing members who have volunteered their services as instructors, provision has been made for the less experienced members to gain knowledge through the medium of elementary lessons. These lessons will precede the ordinary meeting on Tuesday evenings, commencing promptly at 7 p.m. Lectures by well-known people will be a feature of the Society's future programme and, as the club apparatus has been enlarged, it is confidently anticipated that adequate demonstration of the principles involved in the lectures will be possible. A new twin-wire aerial is shortly to be erected.

Hamilton and District Radio Society.*

Hon. Secretary, Mr. James M'Killop, 22, Dalziel Street, Hamilton.

The above Society is now in full swing.

Lectures have been arranged for every Friday evening at 8 p.m. by members and others who have knowledge of the subject. Already lectures have been given by Mr. Jas. Brawn (Vice-President) on different types of receivers for beginners; Mr. D. Miller, on "Electricity and Magnetism"; Mr. S. B. Becket (President), on "Possibility of Communication with Mars," and Mr. McCammond on "Accumulators." The Vice-President has kindly loaned a three-valve transformer-coupled receiver for use in the Society's room until the instrument under construction is completed.

Bradford Wireless Society.*

Hon. Secretary, Mr. G. Bever, 85, Emm Lane, Heaton, Bradford.

A meeting was held in the club-room at Randallwell Street, on October 20th, with Mr. A. Liardet in the chair. The minutes of the previous meeting having been passed as correct, and three new members elected, the Chairman called upon the Secretary to give his lecture on "Telephony." In an exceedingly able manner Mr. Bever dealt with the various circuits appertaining to telephony transmission, illustrating his remarks by numerous diagrams. At 9 p.m. a demonstration of telephony was given from the lecturer's station (2QK) and rendered audible all over the hall by means of his four-valve receiving set in conjunction with a Magnavox loud speaker and power amplifier. Reception was exceedingly good, both from 2QK and other stations. A vote of thanks was accorded to Mr. Bever for the lecture and demonstration. Thanks were also expressed to Mr. Longbottom who had kindly loaned the Magnavox apparatus.

The arrangements for the Society's annual exhibition are now in hand, to be held at the end of January. The Organising Secretary, Mr. N. Whiteley, 8, Warrels Terrace, Bramley, Leeds, will be glad to hear from any firms desirous of exhibiting apparatus. Communications will receive prompt attention.

Aberdeen and District Wireless Society.*

Joint Secretary, Mr. James S. Duthie, M.A., 148, Forest Avenue, Aberdeen.

The Society met in new quarters at Aberdeen Grammar School, on October 20th. Dr. Fyvie, Marischal College, occupied the chair.

The following gentlemen being duly elected accepted office:—President, Dr. Fyvie; Vice-President, Dr. McLeod; Secretary and Treasurer, Mr. W. W. Inder, M.I.R.E.; Joint-Secretary, Mr. James S. Duthie, M.A. General Committee: Messrs. John Miller, Cumming, Walker, Shearer, James Miller, Watson. Technical Committee: Dr. Fyvie, Messrs. Inder, John Miller.

It was unanimously decided that ladies would be eligible for membership.

Mr. G. W. G. Benzie was presented with a leather suit-case, on his leaving for India to take up an appointment. Mr. Cumming, in making the presentation, thanked Mr. Benzie for the great interest he had taken in the Society, and wished him every success in his new sphere of work. Mr. Benzie, in a happy reminiscent speech, thanked the members of the Society for their great kindness.

The meeting terminated with an inspection and demonstration of the Society's five-valve set.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 18, Melford Road, S.E.22.

On October 18th, at the Central Hall, Peckham, the scheme of the "Agenda Committee," was considered. Five members were elected whose sole duty on that committee is to ascertain the special needs of the other members in the various stages of wireless progress.

Should a member desire to know how to construct a crystal set, the committee member for the elementary grade would ascertain the special circumstances of his case and report to the Secretary, who then would take steps to ensure that at an early "elementary" meeting, that member's difficulties would be fully gone into.

Should an advanced member desire to know whether a separate heterodyne will meet his special needs, the pros and cons would be gone into by one of the valve specialists for the benefit of the whole meeting, and if the younger members did not receive immediate benefit they would probably make notes for the future.

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

An informal discussion was held at the 1919 Club, Highgate, on October 13th, when several interesting points were raised by members. Mr. Andrews explained the results of some experiments on the damping of an oscillatory circuit caused by the introduction of a crystal detector and pair of telephones. Messrs. Hogg and Grinstead contributed some useful remarks on the value of the ratio, "Inductance to Capacity," in an oscillatory circuit.

Mr. Stanley emphasised the necessity of thoroughly insulating the units of a high tension battery when made up of pocket lamp batteries.

It is unfortunate that at these discussions nearly all the talking is confined to the more advanced members. New members and novices are urged to take a more active part in the discussions.

On October 20th, Mr. Grinstead gave an instructive lecture on "Valve Characteristics and Design." Mr. Grinstead is an expert on this subject, and the theory of valve design was very ably dealt with. Both transmitting and receiving valves were discussed, and the differences in their design carefully explained.

All members are urged to do their utmost to ensure the success of the Radio Dance to be given at the Gate House, Highgate, on Saturday, November 25th. There are still a number of tickets to be disposed of in order to cover expenses. Single tickets, 7s. 6d. and double tickets 12s. 6d. inclusive, may be obtained from the Hon. Secretary.

Birmingham Y.M.C.A. Wireless Club.

Hon. Secretary, Mr. R. Jenkinson, Y.M.C.A., Dale End, Birmingham.

The winter programme commenced on October 17th, a demonstration being given by Mr. H. H. Whitfield (2 LG), of Messrs. Cook & Whitfield Wireless, Ltd.

Telephony by Mr. Baynton (2 KO) was heard with remarkable clearness by about 100 people.

The equipment at present consists of a three-valve receiving set. Lectures are to be given fortnightly.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. Frank S. Adams, 110, Ivor Road, Sparkhill, Birmingham.

The first Conference of Midland Wireless Societies convened by the Birmingham Experimental Wireless Club, was held at the Y.M.C.A., Dale End, Birmingham, on October 14th.

Dr. J. R. Ratcliffe, M.B., F.R.C.S., President of the Birmingham Club, took the chair.

The following Societies were represented:—Birmingham Experimental Wireless Club, Birmingham Y.M.C.A. Wireless Club, Burton-on-Trent Wireless Society, Coventry Wireless Association, Smethwick Wireless Society, Wolverhampton and District Wireless Society.

A telegram was received from the Stoke-on-Trent Wireless and Experimental Society, regretting that their delegate was unavoidably detained, and would be unable to attend.

A letter from the Rugby and District Wireless Club was read in which the Hon. Secretary expressed his regret that the Club would be unable to send a delegate.

The formation of a Federation of Midland Wireless Societies was formally approved. It was also resolved that a periodical should be published as the official organ of the federation.

The title and objects of the Federation have not been finally decided upon, this being left to a further conference which will be held shortly.

The proceedings terminated with votes of thanks to Dr. Ratcliffe and Mr. F. S. Adams

Brighton and Hove Radio Society.

Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue.

The first general meeting of the above Society was held on October 11th, 1922, at 7.30 p.m. After electing a chairman for the evening, the election of officers and committees took place.

Capt. C. Hoghton (late President of the Sussex Wireless Research Society) was unanimously elected President for the ensuing year. A supreme council of four and executive and technical committees of six members were elected. The Society's very energetic Secretary, Mr. D. F. Underwood, was elected Secretary of the new Society, and Mr. Phelp, the past Assist. Secretary of the Brighton Radio Society, Assist. Secretary of the new Society. A new Treasurer, Mr. Mons, was elected, and the Brighton Society's librarian elected to the new post.

Demonstration at Birmingham Y.M.C.A. Wireless Club.

Smethwick Wireless Society.*

Hon. Secretary, Mr. R. H. Parker, F.C.S., Radio House, Wilson Road, Smethwick, Staffs.

A successful meeting of the above Society was held at the Technical Institute on September 22nd, when Mr. Saunders gave his lecture on "Electric Waves and Radio Activity." The lecture proved to be very interesting, and a hearty vote of thanks was accorded to Mr. Saunders.

At a meeting on September 29th, Mr. S. D. Waltho in the chair, after the usual buzzer practice instructed by Mr. Headley on this occasion, it was decided to hold weekly meetings; one week to be given to lectures and the other week for experimental purposes on the Society's apparatus.

Mr. Headly was elected to represent the Society at the Conference of Midland Wireless Societies.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

At a meeting held on October 20th, which was well attended, a considerable amount of business was done. The Society's headquarters are being moved to Fulham House, Putney Bridge, which is the headquarters of the 47th (2nd Lon.) Div. Signal Company, and the wireless room has been placed at the Society's disposal one evening each week by the commanding officer.

There is a very fine aerial fixed and the room is equipped with 120-watt and 30-watt C.W. sets, also a 20-watt spark set, and the Society has a collection of apparatus of its own.

It was also arranged that a technical committee of the following members, Messrs. Hart-Smith, Wooding, Calver, Houstoun and Galton be formed to deal with the arranging and making of apparatus and most of the members present promised to assist by giving apparatus or component parts to the Society.

It was proposed that the Secretary write to the Wireless Society of London stating that the Society was in full sympathy with their views regarding the change of title and the amalgamation of all Societies.

The Secretary was asked to write stating the Society's views regarding the broadcasting restrictions.

Regarding the transatlantic tests for amateurs the Society intend to apply for special permission to transmit for these tests.

Mr. Calver gave the first of a series of lectures on the elementary principles of wireless; the first lecture was entitled "Ether Waves and Rays." Mr. Calver treated the subject very fully and the members were very appreciative.

A very hearty vote of thanks was accorded to Mr. Calver.

The outlook for the Society is very promising and with a fully equipped club-room membership should increase.

Belvedere and District Radio and Scientific Society.*

Hon. Sec., Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The eighth general meeting of the above Society was held at the Erith Technical Institute on October 20th.

The usual buzzer practice took place from 7.30 to 8.0 p.m., members making good headway at five words per minute.

The Secretary informed the meeting that the Postmaster-General's receiving permit had arrived. He read a letter from The Wireless Society of London, stating that The Belvedere and District Radio Society had been approved for affiliation, which places it as the recognised Society for Erith and Belvedere.

At 8.15 Mr. A. G. Norman spoke on the subject of choosing a type of receiver. He classed wireless amateurs in three groups: (1) The broadcaster; (2) the serious experimenter, and (3) the man who was satisfied with his set, *i.e.*, the non-progressive man, outlining the type of receiver most suitable for each group. For the broadcaster, crystal receivers were suitable on well designed aerials for moderate distances from the broadcasting centres, valve receivers being used for longer distances. The serious experimenter would, of course, have no fixed arrangement, but would always be trying something different, or working on some fresh "gadget," therefore the set for him must be very flexible in its adaptation.

Mr. R. G. Herschell gave a short elementary lecture on "Resistance, Inductance and Capacity," explaining the fundamental actions of these three important properties of the electrical circuit. Although the lecture was necessarily brief, quite a deal of information was gained by beginners, and was appreciated by all.

Finchley and District Wireless Society.*

Secretary, Mr. A. E. Field, 28, Holmwood Gardens, N.3.

On Monday, October 23rd, a lecture on "The Principles of the Valve" was given by Mr. Trussler. At the close of his lecture, which was exceedingly clear to even the absolute novice, a demonstration was given on a three-valve home-made set by Mr. Heppel, on which excellent results were obtained.

Radio Experimental Association (Nottingham and District).*

Hon. Secretary, Mr. F. E. Bailey, 157, Trent Boulevard, West Bridgford, Notts.

A meeting of the above Association was held in the People's Hall, Heathcote Street, Nottingham, on October 19th. Mr. Gill, having taken the Chair in the unavoidable absence of Mr. Thornton, informed the meeting that the lecturer for the evening was unable to attend through illness. Mr. Ford, however, stepped into the breach and gave an interesting lecture on "Aperiodic Transformers," setting forth clearly the essential points to be borne in mind when designing such transformers to function efficiently over a comparatively large band of wavelengths. Following the lecture an interesting discussion took place.

Will all members please note that commencing Thursday, November 2nd, meetings will be held weekly at Messrs. Bennett's Garage, Shakespeare Street, Nottingham, where an ideal room, with aerial already installed, has been secured for the use of members.

Glasgow and District Radio Club.*

Hon. Secretary, Mr. W. Yuill, 93, Holm Street, Glasgow.

In the club-room on October 19th, Mr. W. K. Dewar presided before a very large attendance, and remarked that he thought the club would soon require larger premises.

After the usual preliminaries, the Chairman called on Mr. Yuill to open a discussion on the best circuit to use for a valve broadcasting reception set to comply with the P.M.G. Regulations, and the following gentlemen took part:—Messrs. Quinn, Todd, Wright, McDade, Nicholson and Morrison. After a show of hands Mr. Morrison was declared the winner of a M.O. "R" valve, kindly presented by the General Electric Company, Ltd., 71, Waterloo Street, Glasgow, for the best reply. This was a new innovation, and the Chairman asked for a show of hands to see if the members would like a similar night later in the session, and this seemed to be the unanimous opinion.

The next meeting was held on October 26th, when a full discussion of the arrangements for the exhibition on November 4th took place.

Hornsey and District Wireless and Model Engineering Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

At a meeting on October, 13th, 1922, the chair was taken by Mr. H. J. Pugh. The usual business was gone through and one new member was elected. The Chairman then called on Mr. H. Davy to give his lecture as per programme.

Mr. H. Davy gave an interesting lecture on "The Thermionic Valve as a Detector," after which many questions were asked which showed that the large attendance had taken particular interest in the subject which was so ably explained by the lecturer.

The meeting was then thrown open, and discussion took place on the merits of high and low frequency amplification. A new programme of interesting lectures, etc., has been arranged. Particulars may be obtained from the Hon. Secretary on receipt of stamped envelope.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. Walter R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

A meeting of the above Society, which was held on October 19th, was opened with buzzer instruction under Mr. G. H. Vine. Very satisfactory progress is being made.

This was followed by a lecture on the "Rudiments of Wireless," by Mr. W. D. Keiller, technical adviser to the Society. He dealt very ably with the subject, explaining the molecular theory of magnetism, electrons, atoms, positive and negative currents, etc. After answering several questions the lecturer was accorded a hearty vote of thanks.

New headquarters have been obtained at John Street Chapel, John Street, Theobalds Road, W.C.1. and a splendid series of lectures will be given during the winter session.

Particulars of affiliation to the Wireless Society of London have been received and it is hoped to become a member in the near future.

Full particulars as to membership, etc., may be obtained from the Hon. Secretary.

Clapham Park Wireless Society.

Hon. Secretary, Mr. J. C. Elvy, A.M.I.E.E., 12, Tavistock Street, Strand, W.C.2.

The eighth general meeting was held at headquarters on October 18th.

There was the usual crowded attendance which promised a lively discussion. Mr. A. E. Radburn was again elected Chairman for the evening.

After election of new members, the Hon. Secretary reported that he was still awaiting further information to facilitate the passage of the Society towards affiliation with the Wireless Society of London.

Several copies of flashlight photographs of October 4th evening's proceedings were secured by members.

Mr. C. W. Richardson opened the discussion on "Aerials and Cognate Matters" by a lecturette delivered in a pleasing and instructive manner with the aid of blackboard diagrams and apparatus he had brought along with him.

All present were ably conducted through the so-called mysteries of aerials, wavelengths, inductances, condensers, aerial oscillations, the latter two items being regarded by the lecturer as misnomers. The course adopted by the lecturer was in tabloid form, showing how the principles of wireless were made easily understandable by following the first principles of force, inertia and capacity. As a measure of appreciation by his audience he was prevailed upon by them to continue his lecture and demonstration on November 1st.

An interesting discussion was entered into by Messrs. Beedle, Hon. Secretary, Hon. Treasurer, Daniels, R. McCue, Hurst, Bruce, and the Chairman, introducing "Transposition of Energy, Heat, Skin effect of A.C. versus Resistance."

A hearty vote of thanks was accorded the lecturer.

The Hon. Secretary reported a gracious offer on the part of Mr. F. H. Haynes to describe the building up of "An Amateur Three-valve Receiving Set," to be followed by demonstration and discussion, which offer the members gladly accepted. Mr. F. H. Haynes agreeing to come to the next meeting, October 25th, for that purpose.

Proposed Gorton (Manchester) and District Wireless Society.

Hon. Secretary (*pro tem*), Mr. G. Sykes, 13, Longford Street, Gorton.

Amateurs, experimenters and all interested in wireless matters within the Gorton district of Manchester, are asked to communicate with the gentleman whose name is given above. Mr. Sykes, together with Mr. T. E. Rowe, 8, Fairhaven Street, Hyde Road, W. Gorton, hopes to receive sufficient support to enable them to inaugurate a society.

Rhyl and District Amateur Wireless Society.

Hon. Secretary, Mr. C. Mitchell, 24, East Parade, Rhyl.

At the meeting on October 18th, a lecture was given by Dr. Goodwin. His subject was "Induction." Dr. Goodwin prefaced his remarks by saying that although induction was his subject, yet he intended it to cover a very wide field, as so many electrical forces came under the title of induction. Dr. Goodwin then explained the meaning of the term as far as it was possible. He dealt with the mysterious happenings when certain electrical forces were let loose, no matter how minute, and explained the result. From the scientist's point of view it might be comparatively clear, but the lay mind had difficulty in understanding why the universe was not a heap of dust after listening to some of the happenings which were possible, with limitations, which the lecturer dealt with. But the system of electrical induction was so closely allied to wireless that it would be almost impossible to either transmit or receive telephony without it. Why it was that we should have two coils, separated by space with no connection, yet, when one is charged with electricity the other takes a charge also, seemed almost beyond comprehension. All these things were dealt with by Dr. Goodwin in a lecture which created profound interest.

St. Helens Radio Club.

Hon. Secretary, Mr. C. Hodgson, Crescent House, Liverpool Road, St. Helens.

Meetings of the above club will be held in the Y.M.C.A. Buildings, North Road, every Tuesday night at 7.30 p.m.

Arrangements are being made to provide interesting and instructive meetings.

Applications for membership should be made to the Hon. Secretary.

Paddington Wireless and Scientific Society.

Hon. Secretary, Mr. L. Bland Flagg, 61, Burlington Road, Bayswater, W.2.

The fourth general meeting of the Society was held at the Institute under the Chairmanship of Vice-President Dr. J. H. Vincent, and the attendance created quite a record. The business of the Society included the minutes of the last meeting and the presentation of the monthly accounts, after which the recommendations of the Committee were put before the members. The recommendations included a Sale and Exchange and the election of the following hon. members :—Messrs. Clements, Alexander, Sutton and Styles.

A crystal receiver was very kindly presented to the Society by Mr. A. Hoban, which was acknowledged by a very hearty vote of thanks from the chair, and endorsed by the meeting. A working committee of four was formed to take over the erection of the new aerial, which it is hoped to see in service very shortly.

A new section was opened under the heading of "Student Membership" to cater for the second year day students of technical institutes and grammar schools in the immediate neighbourhood of the Institute, particulars of which can be obtained from the Hon. Secretary.

Mr. A. L. Beak, A.M.I.E.E., read a very interesting paper entitled "High Frequency Amplification." Mr. Beak dealt mainly with resistance capacity, coupled amplifiers, the intricacies of which he elucidated very fully. A short discussion followed, after which the meeting closed with a vote of thanks to the lecturer.

Enquiries re membership should be addressed to the Hon. Secretary.

Ayr and County Radio Society.

Hon. Secretary, Mr. J. Blair, Rosebank, Marchfield Road, Newton-on-Ayr.

Following a public invitation, the above-named Society was formed. The undernoted officers were elected :—President, Mr. D. M. Sproat ; Vice-President, Mr. Rich Currie ; Hon. Treasurer, Mr. W. Robertson, jnr. ; Hon. Secretary, Mr. J. Blair. Committee : Miss Jean Raince, Messrs. Auld, Cassells, Headley, Oliver, Robertson, Lamont and Ross. Members are now being enrolled.

The newly formed Society has six fully qualified holders of P.M.G.'s Certificates, and of these one is Miss Raince.

The Society is greatly indebted for its being to the Vice-President, Mr. R. Currie, of Messrs. Reid & Co., and also to the valuable information received from Mr. W. Yuill, Hon. Secretary, Glasgow and District Club, who honoured the meeting with his presence.

The Society wish to express their appreciation to Mr. M. Miller, **2MG**, for his transmissions of telephony which were picked up, but owing to ship stations jamming it was only heard intermittently. Classes will be formed for each class of member, viz., Morse, Construction and Technical. It is fully anticipated that a very prosperous Society has been inaugurated.

The Society meets every Friday at 8 p.m., beginning October 27th, in the show rooms of Messrs. Reid & Co., High Street, Ayr.

Communications should be addressed to the Hon. Secretary.

Eastbourne Amateur Wireless Society.

Hon. Secretary, Mr. W. F. G. West, 11, Bolton Road, Eastbourne.

The above Society has been formed and the Secretary will be glad to reply to and give full particulars of the Association's objects and terms of subscription to all gentlemen who are interested and desire to seek membership. Several lectures have already been given, and have been well attended.

A programme for the winter session is being arranged for, and members will be notified in due course. The Secretary would be very grateful to hear of any gentlemen who can give a lecture or otherwise contribute to the programme.

It is hoped very shortly to announce that permanent headquarters have been obtained, where it is proposed to erect a wireless set for the use of members.

A lecture was arranged for October 31st.

Bolton Wireless Society.

Secretary, Mr. D. Walford-Drucquer, 4, Bold Street, Bolton.

At a Special General Meeting held on October 13th the following members were elected to hold office :

Chairman, Mr. C. Kershaw ; Vice-Chairman, Mr. R. C. Walch ; Hon. Secretary, Mr. D. Walford-Drucquer ; Hon. Treasurer, Mr. J. Waller ; Committee : Mr. J. McLeod, Mr. G. T. Woodley, Mr. C. Andrews, Mr. C. H. Smith.

The meeting was devoted to general discussions on the way the Society had been run in the past and many things were promised by the new Committee, and everybody looks forward to a very good season.

The new Committee met on October 17th, and the following business was dealt with :—(1) That the Society becomes affiliated with the Wireless Society of London. (2) That the subscriptions be reduced to 10s. 6d. per year for full members and 5s. per year for junior members. Entrance fee for junior members to be 2s. 6d. Same to come into force forthwith. (3) That membership cards be issued to all members. (4) That a dance be arranged to be held the week preceding Xmas. (5) That two whist drives be arranged ; one to be held in the first week in November and the other in the first week in December. (6) That the Society goes in for transmitting. (7) That the Society obtains a new five-valve receiving set. (8) That the Society join the Relay League. (9) That the Secretary take charge of the winter entertainments and that he arranges a good programme including some interesting lectures. (10) That the Annual General Meeting be held on the last Tuesday in September each year instead of December, as at present. (11) Alterations were made in the rules to be brought up at the next General Meeting. (12) Mr. McLeod was asked to take charge of the arrangements with reference to transmitting, and he asked Mr. Andrews and Mr. Smith to form a sub-committee under him to carry out this work.

All the above were resolved, and after about an hour's general discussion on the running of the Society, the meeting was declared closed by the Chairman.

The new Committee ask for new members to the Society, and can promise them a real good programme.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wire ess work. Readers should comply with the following rules :—(1) Each questions should be numbered and written on a separate sheet on one side of the paper, and addressed " Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the " Questions and Answers " coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a " nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"P.T." (Maldon).—(1) The precise details for converting a single valve panel into a two or three-valve set conforming with the regulations of the Postmaster-General, were given on page 865 of our issue of September 30th last. (2) One is not permitted to construct or instal wireless apparatus without first obtaining permission from the Post Office. We cannot advise you on the qualifications required by the Post Office in the award of an experimental licence, but we understand that you have to satisfy them that you have a serious interest in experimental wireless work. Why not pass your question to the Post Office, and ask them for a statement as to the qualifications which they are desirous you should hold.

"I.C.B." (W.2.).—Certainly it is possible to render ordinary land-line telephone messages audible in a loud speaker, or strongly magnified in headgear telephone receivers. We should recommend you to use a three-valve note magnifier connected as shown in Fig. 1, on which all necessary values are given. Before connecting this apparatus to your telephone, we would advise you to obtain permission from the Post Office.

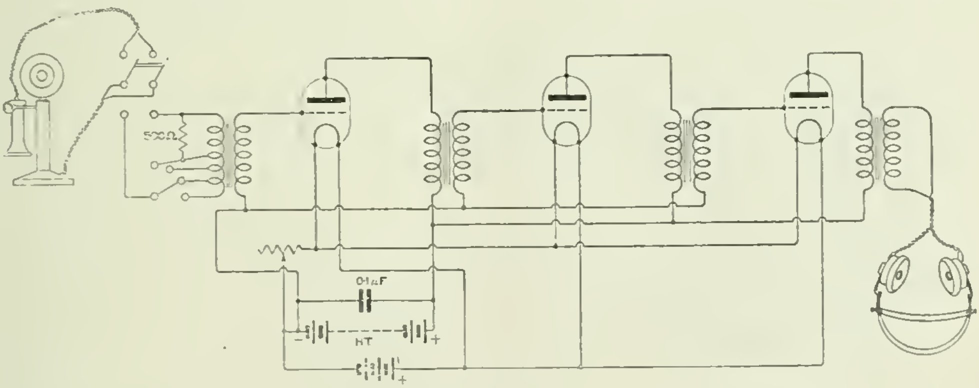


Fig. 1.

"H.S.F." (Greenock).—An experimental licence authorising you to construct your own apparatus will be probably awarded by the Postmaster-General if you make it clear to him that you have some definite theme of research in view, and that you are fully qualified to use wireless apparatus in such a way as not to cause interference. However, why not write to the Secretary of the Post Office and obtain the necessary forms, and if you have any difficulty, then write to us.

"C.G.S." (Brighton).—Circuits which are not capable of energising the aerial to a serious extent have been repeatedly given in this journal for the past six weeks. We would refer you in particular to the instalment on Experimental Station Design in our issue of September 30th last, which has apparently escaped your notice. With regard to the unit system, it must be capable of being assembled in such a way that the circuit cannot be easily modified by the user. Anyhow, submit your proposed designs to the Post Office.

"G.F.P." (Hayes).—(1) Yes, but reacting back to the tuning circuits in this way is liable to lead to oscillation and seriously interfere with the pleasure of other listeners in your neighbourhood. (2) About 2,000 metres. (3) 0·00065 mfds. (4) You should certainly be able to get **2MT** with a single valve as H.F. amplifier followed by a crystal, but we doubt if this arrangement will be sensitive enough to give **PCGG** unless your aerial is a very good one.

"E.H.W." (Twickenham).—(1) The diagram of a single valve receiver which accompanied your letter will certainly not meet with the approval of the Post Office. The conditions specified by the Post Office are clearly stated in a recent issue, and very many circuit diagrams of arrangements which will not cause serious interference have both given in our issues for the past six weeks. Removal of the variometer from the aerial circuit will in no way reduce the extent of radiation which your proposed circuit would produce. (2) The Post Office, we understand, are prepared to authorise the use of a set in which the reaction coupling is fixed, and is arranged so loosely as not to seriously energise the aerial inductance. However, why not make up a two-valve set with tuned anode high frequency amplification and couple the plate circuit of the second valve with this anode inductance, and add a third valve if necessary.

"SPARKS" (Morecambe) *asks* (1) *For a diagram of a two-valve set to meet certain conditions.* (2) *Parts required for this set.* (3) *If he will get* **2 LO**, **2 MT** *and* **PCGG.**

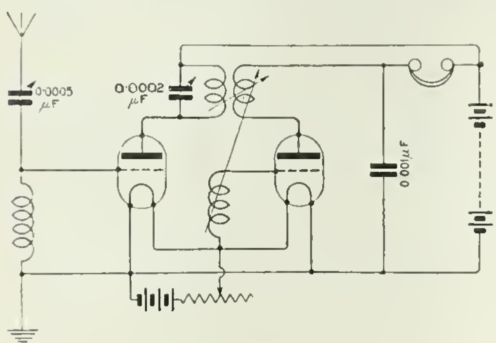


Fig. 2.

(1) See diagram (Fig. 2). (2) Two variable condensers. Aerial tuning inductance reaction coil. H.F. transformer. Two valve holders. One filament resistance. H.T. and L.T. batteries. One pair of telephones. (3) It is very doubtful whether you will get any of these stations.

"F.S." (Hants) *asks* (1) *For a diagram of connections using 2 H.F., 1 Detector and 2 L.F. valves with switches to cut out any valves.* (2) *Whether capacity reaction should be substituted for direct reaction into the aerial circuit.*

(1) The circuit given on page 883, September 30th issue, is just the diagram you require. (2) Reaction of the type you suggest should not be used. We suggest you couple the reaction coil to the first H.F. transformer secondary. There will then be little possibility of energy being radiated from your aerial.

"SPARKS" (Ilkley) (1) *Proposes to install an experimental spark transmitter.* (2) *Asks whether the formula, watts = volts × amperes, is correct when applied to a circuit connected to an accumulator.*

(1) The circuit submitted will not be satisfactory, and apparatus joined up as you suggest would seriously interfere with other experimenters working on a wavelength anywhere near your own. We understand transmitting licences are issued to experimenters for specific purposes, and we suggest you apply for a licence before commencing experiments. (2) The formula, watts = volts × amperes, is quite correct. If the current is 5 amperes, and the voltage drop across the apparatus is 2 volts, 10 watts are being used in the circuit.

"S.O.H." (Eastbourne).—(1) The method of modulating at the transmitting stations enters largely into this question. Where the modulation is good, no difficulty should be experienced. If the transmitted oscillations are very slightly modulated the result of using reaction to hear the weak signals is to cause the set very easily to oscillate, and so you hear the carrier wave. (2) We cannot say with any degree of certainty what causes the trouble you mention. You might try removing the condenser, when the self capacity of the winding will probably be sufficient to by-pass the H.F. current. The more likely cause of the trouble, however, is probably to be found in the grid condenser and leak. The grid leak may have become faulty. (3) As your aerial tuning condenser has a rather low value, we think you will have to use a larger coil in the aerial circuit than in the closed circuit when using the series connection. Try the arrangement, aerial condenser in series, No. 150 coil in aerial circuit, and No. 75 in closed circuit, and choose the most suitable value of reaction coil. (4) The arrangement for parallel working which you suggest is quite satisfactory, but it will be necessary to take care not to use too much reaction. The aim should be to alter the positions of the coils until best results are obtained. Generally the reaction coil has to be well away from the closed circuit coil. The connections of your set are quite correct and in every way are suitable. We assume the grid condenser has the correct value—0.0003 mfds.

"AMATEUR" (Northants) *asks* (1) *How to make the most advantageous frame aerial with the highest efficiency.*

As you do not state the wavelength range over which you wish to receive, we cannot give you much useful information. However, frame aerials are fully described in "Mast and Aerial Construction for Amateurs," by Ainsley, price 1/6.

"C.L." (Huddersfield) *asks* (1) *Why a certain circuit sketched gives no better results with two valves than it does with one.* (2) *How to add another valve to the set as an H.F. amplifier with the minimum alteration to the wiring.*

(1) We do not know which of your two panels was the original. The L.F. panel appears to be quite all right, but the detector fails through not having a complete grid circuit. The lower end of the A.T.I. should be connected to the filament of the valve. Possibly the failure of your note magnifying valve is due to the fact that the transformer is incorrectly wound or introduced into the circuit. The windings should be about 3,000 ohms in the anode circuit of the first valve, and 6,000 ohms in the grid circuit of the second. (2) The circuit might become similar to that of Fig. 5, August 5th, page 608, with the omission of the reaction back to the aerial there shown. The method of using transformers for part of the range and resistance capacity coupling for the rest is shown on page 705, August 26th issue.

"W.G.W. (London) *asks* (1) *Whether a set ketched is satisfactory.* (2) *Whether it will radiate, and if so, how much.* (3) *How it can be prevented from radiating.* (4) *If it will receive* **PCGG, 2 MT** *and* **FL.**

(1) Yes, except that a parallel condenser is not at all efficient on short wavelengths. (2) This set will certainly radiate unless the reaction coil is very small indeed. (3) The only way to stop it from radiating is to make the reaction coil very small and to fix it in one position. It is not possible to say how bad the radiation will be as this will depend on the constants of the aerial, etc., but if the couplings are made at all tight the radiation may be as bad as with reaction back direct on the aerial. (4) The set should receive **FL** and **2 MT**, but is not likely to be sensitive enough to receive **PCGG.**

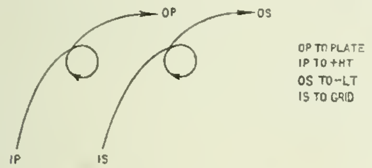


Fig. 3. Windings in a groove. Secondary over Primary.

"**J.B.**" **(Yarmouth).**—The method of connecting up H.F. transformers depends entirely upon the direction in which the coils are wound. Figs. 3 and 4 show clearly, we hope, the correct method of joining up. We cannot say how the transformers to which you refer are wound, and we suggest you connect them up according to the manufacturer's instructions.

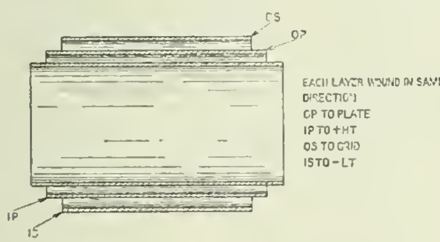


Fig. 4. Single layer windings.

"**A.M.**" **(Ryde)** *asks* (1) *Whether it is possible to use any other type of battery than an accumulator for the filament of a single valve set.* (2) *Whether it is better to have a long aerial lead-in, and a short earth lead, or vice-versa.* (3) *What he is likely to get with a single valve set.* (4) *Wavelength range with certain coils.*

(1) With some types of valve, as for instance the Marconi-Osram "DEV," which only takes 0·2 amps, a dry cell may be used: but we do not recommend the use of dry cells for any valve taking more than 0·5 amps. In any case the cells used should be of large size, and the cost of operation will be considerably more than with accumulators. (2) Long aerial lead-in and short earth lead is much preferable. (3) Most European high power stations, and ships up to perhaps 250 miles, but probably not **2 MT, 2 LO,** or **PCGG** unless conditions are particularly favourable. (4) Up to 700-800 ms.

"**M.E.G.**" **(New Brighton).**—The coils you mention would tune the circuit to about 2,000 metres with a 0·001 mfds. parallel condenser, but the use of a condenser of this size would be very inefficient, and we should strongly recommend you to use about four times as much inductance, and only a quarter of the capacity.

"——" **(Rochester)** *asks* (1) *Whether the American short wave tuner of the June 3rd issue will receive C.W.* (2) *Whether the wavelength range could be increased to* 1,000 *metres without loss of efficiency.* (3) *Whether a certain pair of coils could be used as A.T.I. and reaction coil.*

(1) If made exactly on the lines of the article it is probable that the set will receive C.W., but if it does so it will radiate badly. (2) This could be done, but if the wave were increased in this way any especial merits that the set may have would probably be lost. (3) Yes, but coils used in this way are liable to radiate badly, and therefore are to be discouraged in the interests of others receiving.

"**DADDY LONG EARS**" **(Paris)** *asks* (1) *For a criticism of a set.* (2) *For values for some of the components.* (3) *If he can use honeycombs, and if so, what sizes to use.* (4) *If he will hear* **FL, 2 MT,** *and* **PCGG.**

(1) Satisfactory except that strictly speaking all the grid resistances should be connected to some point which does not change in potential when the polarity of the filament battery is reversed, but in practice this refinement is hardly likely to be necessary. In any case we do not think that very much gain in life of receiving valves is actually obtained by reversing the filament battery. (2) (*a*) 0·0005 mfds; (*b*) 0·0002 mfds; (*c*) 50,000 ohms; (*d*) grid leak 2 megohms; (*e*) preferably 6 volts; (*f*) about 60 volts. (3) Yes, but particulars will depend on the waverange required, which is not specified. Turns may vary from about 50 for very short waves up to about 1,500 for long waves. The gauge may be about 0·5 mms., and the mean diameter about 5 cms. (4) **FL** certainly, **PCGG** very likely, **2 MT** not at all likely, as the resistance capacity coupling shown is very inefficient on such short wavelengths as are used by this station. For this purpose H.F. transformers should be substituted.

"**NOVICE**" **(Torquay)** *asks what would be the minimum requirements for a set to receive* **2 MT,** *preferably with fixed tuning, or still better with one adjustment for throwing over to a Plymouth station.*

It is rather difficult to specify suitable apparatus for use at such a distance, as at long ranges the local characteristics alter the question very considerably. If we were undertaking the work ourselves we should try a three-valve set, with one stage of high frequency amplification and one of low frequency. We should hope to get fairly good results in this way, but we should not be very surprised or disappointed if we found after test that a couple of extra valves were required. This, of course, is for telephone reception. If a loud speaker were required, two or three additional L.F. valves would be necessary, but we should hardly expect to get very good results. We should ourselves confine our activities to the new Plymouth station, as **2 MT** is hardly likely to continue in operation after the broadcasting stations commence operations.

"T.G." (Coventry) *asks* (1) *Questions about his set.* (2) *For a diagram using six valves efficiently.*

(1) It is unfortunate that you have not sent us a sketch showing the diagram of connections of your set and the values of the components. Without this information we can only offer suggestions for the improvement of your set. It is better to employ H.F. valves than L.F. valves when there are stray electric fields which may induce voltages into the set. In addition, L.F. iron coil transformers generally cause distortion. It is, therefore, better to use the minimum number of L.F. stages of amplification. (2) We prefer, when using six valves, to employ three as H.F. amplifiers, one as detector, and two as L.F. amplifiers. The tuned anode method of H.F. amplification is generally accepted as the best, and we suggest you continue to use this method. You will find the tuning critical, and there should be no difficulty whatever in eliminating stations transmitting on a wavelength which is only slightly different to that which you wish to receive. When receiving short wavelengths, the A.T.C. should be in series with the A.T.I., and a switch for connecting the A.T.C. in series or parallel would be a useful attachment to your set. Fig. 5 shows the connections, and usual values for the parts are marked in. We suggest you see the articles on "Experimental Station Design," which appeared in our issues of September 2nd, 14th and 30th.

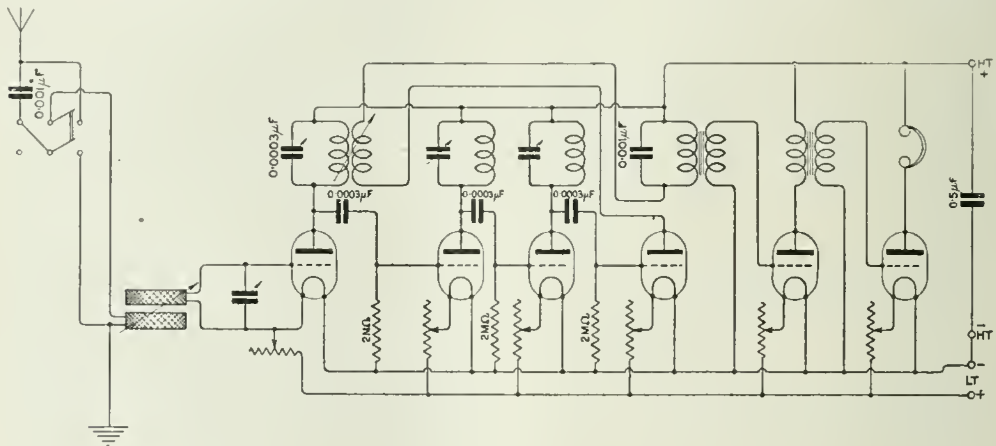


Fig. 5.

"V.H.G." (Bolton).—(1) The gauge of the wire submitted is No. 20 S.W.G. (2) Approximately 1,500 metres without the addition of a parallel condenser. (3) 0·0005 mfds., which may be obtained approximately by the use of plates of glass 0·1 cms. thick, with an overlap of foil of 25 square cms., and a total of 5 plates. (4) Approximately 0·0008 mfds.

"S.E." (Southampton) *asks* (1) *How the Brown patent telephone works.* (2) *The number of "The Wireless World" in which an article on the Johnsen-Rahbek loud speaker appeared.* (3) *If the Armstrong super-regenerative circuit can be regarded as a practical proposition and likely to give good results in the hands of an average amateur.*

(1) Detailed information is given in various textbooks, including Eccles' Handbook. Briefly, a light steel reed is supported in the field close to the poles of a permanent magnet of roughly horseshoe shape, carrying the windings for the operating currents. To the reed is attached a light diaphragm by which the air is set in motion, giving rise to the sound. (2) Nos. 34, 35 and 36, Vol IX; also May 6th, 1922. (3) No; the adjustment and the proportioning of the parts is very critical. Every set put up needs elaborate experimental work to determine suitable values for the constants to make it function at all, and we think that no one but a skilled experimenter is likely to get satisfactory results with it.

"H.E.N." (Watford) *asks* (1) *For windings for a telephone transformer for use with* 1,300 *ohms telephones.* (2) *If it is possible to receive C.W. with a valve set with ordinary reaction, without giving out enough radiation to affect other receivers.* (3) *If the circuit of Fig. 4, page* 636. *August 12th issue, is capable of receiving C.W.*

(1) Telephones of this resistance may be used without a telephone transformer. Transformer may consist of open core 3″ in length by ½″ diameter, with 2 ozs. No. 44 S.S.C. for primary, and 1½ ozs. No. 38 S.S.C. for secondary. (2) This can be done quite easily if more than one valve is used in the set. It can be done in any way which involves taking the reaction coupling back to any point which is not nearer to the aerial than the anode of the first valve. If only a single valve is used there is no safe way. (3) Certainly.

"WAVELET" (Keighley).—(1) You do not give us any information about the tuning condenser, but if this has a normal value for a set of this type, say 0·0005 mfds., you should be able to tune up to nearly 3,000 metres, and down to somewhere in the neighbourhood of 300 metres. (2) L.R. telephones with a telephone transformer may certainly be used with a crystal set. (3) 0·0005 mfds. is quite big enough for the tuning condenser, and 0·001 to 0·002 mfds. for the blocking condenser. (4) The buzzer, key, and cell should be connected across a few turns of the A.T.I.

"W.W." (Brighton) *asks* (1) *The number of turns to wind in a basket coil to tune in 2,700 metres.* (2) *How many turns to tune in 360-425 metres.* (3) *How many turns to tune in 180-360 metres.* (4) *For diagram of a single valve set using a three-coil holder in his possession.*

(1), (2) and (3) It is not possible to give the exact number of turns to wind a basket coil to give

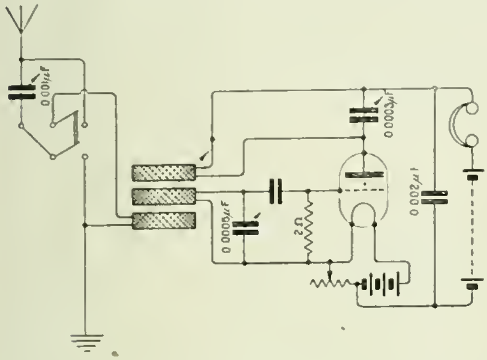


Fig. 6.

a certain inductance. The inductance varies with the spacing, method of winding, etc. Assuming you will use a 0·001 coil A.T.C. in parallel with the coils to tune in 2,700 metres, we suggest you wind five coils of No. 30, each coil having 80 turns. With the tuning condenser in series on the short wavelengths, two coils in series, each coil having 50 turns of No. 20, will tune in 360-425 metres, and one coil with 60 turns of No. 20 will tune in 180-360 metres. (4) See Fig. 6.

"J.F." (Berks) *asks* (1) *For a criticism of his circuit.* (2) *Whether a broadcast licensee is only permitted to receive broadcast signals.* (3) *Can a holder of a broadcast licence use reaction above 500 metres.*

(1) We have examined your diagram of connections, and we are afraid you will be unable to use reaction in this circuit. We suggest you cut out the reaction coil altogether. We think you would get much better results if you added one high frequency valve. Reaction could then be provided for. The reaction coil would be connected between the anode and telephones, and would be coupled to the tuned anode of the first valve. A large number of circuits have recently appeared in this journal. (2) and (3) We understand that the holder of a broadcast licence is not restricted in so far that he may receive signals of any wavelength. The restriction applies to the use of reaction and the employment only of apparatus approved by the Post Office. The set must be so designed that under no circumstances will the aerial circuit oscillate.

"F.J.W." (Leyton) *asks whether he can connect a transformer to his set, and so strengthen the signals.*

Unfortunately a transformer cannot be connected to increase the strength of signals, and we suggest you add a valve as note magnifier, using the connections given in several recent issues of this journal.

"SOLDIER" (Woodseats).—The addition you suggest can certainly be made; the valve or valves being added as low frequency amplifiers. To do this it is not necessary to alter your set in any way. It is merely necessary for you to introduce the one winding of an input transformer in front of your first valve in place of the telephones. Many diagrams of one and two-valve low frequency amplifiers will be found in recent issues.

"C.A.S." (Ealing) *asks* (1) *If it is desirable to earth-wire garden poles against lightning.* (2) *Should lightning arresters be fitted at point of entry of aerial wire into the house.* (3) *Would a vacuum type lightning arrester affect reception.*

(1) Poles are not generally earth-wired, but there certainly is no harm in so doing. A No. 12 galvanised iron wire should be twisted around the bottom of the pole, and run up the side of the pole. At the top end it may project 6 or 8 inches. (2) and (3) A vacuum type lightning arrester will suit your purpose very well, and should be fitted across the aerial and earth at the point of entry of the aerial into the house. A switch should be provided, so that when the set is not being used the aerial may be directly connected with earth. These precautions should be taken, otherwise damage to the set may result from the effect of static charges, as well as the effect of lightning. Sometimes a highly inductive leak is connected across the aerial condenser as a protection against static charges but this will largely be unnecessary if you adopt the other arrangements. No loss in reception efficiency will result through the use of the above protective apparatus.

"W.K.N." (Hounslow). We cannot give you precise windings, and it would be much more satisfactory if you wound the coils exactly as described, and then experiment yourself until the best results are obtained.

"G.L.E." (Woolwich) *asks* (1) *For a two-valve circuit suitable for use with certain apparatus.* (2) *For windings for a transformer suitable for use with 300 ohm. telephones.*

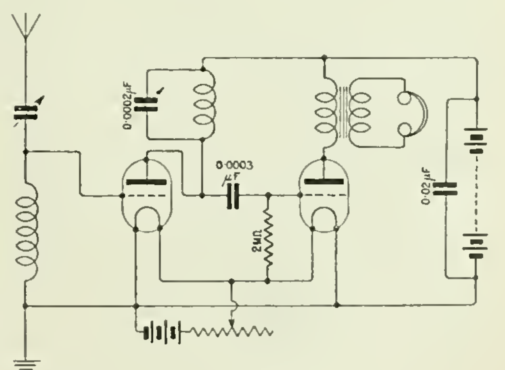


Fig. 7.

(1) See diagram (Fig. 7). (2) Core ½″ diameter of iron wires, about 4″ long, primary wound with 3 ozs. of No. 44, and secondary wound with 6 ozs. of No. 34.

"**R.V.J.**" **(Brixton)** *asks for the issues in which appeared a description of a set which will receive broadcast.*

We suggest you see the articles entitled "A Broadcast Receiver," which appeared in the issues of August 26th and September 2nd.

"**N.N.L.**" **(Cheam).**—(1) The diagram submitted is not quite correct, and we suggest you use the circuit shown in Fig. 8. Care must be exercised in the selection of suitable jacks. The springs must be very well spaced and robust. (2) A suitable frame aerial for your purpose would be a frame 4′ square with 16 turns of No. 18 wire with 6 tappings, the wires being spaced ¼″ apart.

"**H.P.H.**" **(Herts)** *asks (1) The range of a crystal set. (2) For an explanation of "Dead-end" effects. (3) If he may add one L.F. valve. (4) Where to obtain books dealing with wireless.*

(1) We are afraid you will only receive local signals when using a crystal set. (2) "Dead-end" effect is the name given to the loss of efficiency which arises when, for example, only a small portion of a big coil is in use. It is overcome by breaking up the coil into sections. The proposed coil is far too large for short wavelengths, and we suggest you wind another coil making it 4″ diameter, 5″ long, and using No. 22 D.C.C. wire, taking 8 tappings. The A.T.C. should be in series with the A.T.I.

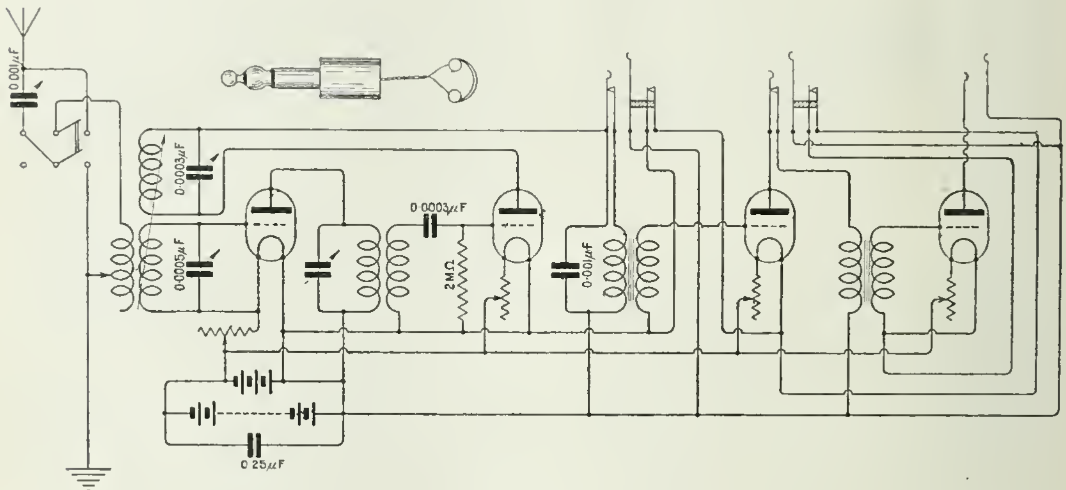


Fig. 8.

"**ENQUIRER**" **(Chelmsford)** *asks (1) The number of turns of wire to wind in a 2½″ diameter former for use as a reaction coil. (2) Values of condensers in microfarads and inductances in microhenries to tune to 360 metres. (3) Whether his set is suitable for operating a loud speaker.*

(1) Wind 100 turns of No. 38 S.S.C. wire. (2) The aerial condenser should have a maximum value of 0·001 mfds., and should be in series with the A.T.I. The closed circuit condenser may have a maximum value of 0·0005 mfds. The aerial coil should possess an inductance of 450 microhenries, and the closed circuit 220 microhenries. The waverange will be from 600 metres to 2,000 metres. (3) We think your set is suitable to operate a loud speaker. However, if you cannot get sufficient signal strength, add one L.F. valve.

"**G.A.Q.**" **(Birmingham).**—The suggested coils are suitable, but it is just as well to use a single layer coil, which you can make yourself. Wind a coil 4″ diameter and 5″ long, of No 22 D.C.C. and take 8 tappings. The circuit given on page 60, April 8th issue, will be quite suitable if you connect the primary of the transformer in place of the telephones, and join the telephones to the secondary side of the transformer.

"**A.B.**" **(Staffs.)** *(1) Submits a circuit for criticism. (2) and (3) Asks the wavelength range of coils. (4) Whether a proposed arrangement is correct.*

(1) The diagram is correct, except that the plate and grid connections are reversed. This we presume to be merely a clerical error. (2) We cannot say without a knowledge of the size of the coil. (3) 2,600 metres with condenser in parallel and 800 metres with the condenser in series. (4) The arrangement will work very well.

SHARE MARKET REPORT

Prices as we go to press on November 3rd, are :—

Marconi Ordinary	£2	5	0
,, Preference	2	2	9
,, Inter. Marine.. ..	1	7	7
,, Canadian		10	10½
Radio Corporation of America :—			
Ordinary		18	0
Preference		13	6

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

No. 170 [No. 7 Vol. XI.] NOVEMBER 18th, 1922. Weekly

The Amateur Position.

HOW BROADCASTING AFFECTS THE EXPERIMENTER.

IT has already been mentioned in these columns that no surprise should be felt at the fact that many new situations have arisen with the introduction of the proposed schemes for broadcasting, but we do not think that at the time that statement was made it was realised that the problems arising therefrom would present themselves so rapidly and forcibly as has been the case. And in this connection reference is made only to the amateur problems, by which is meant the matters which affect in particular those who were experimenters before broadcasting was talked of, or who will join the ranks of the experimenter proper in the future. There is not space in this issue to make reference to the other problems, which have confronted the Postmaster-General and those who have been responsible for bringing the British Broadcasting Company into being.

Only a year or two ago practical amateur wireless was illegal in this country, and for some time the authorities would not give way on the question of the re-issuing of licences after the war. The struggle to win back for the amateur some of his pre-war rights and generally to reinstate the wireless experimenter was a long and arduous one which required much hearty co-operation on the part of all amateurs throughout the country and many interviews and petitions to the Post Office Authorities. These concessions, or rights (it is of no material importance by which name they are described) having once been obtained are not likely to be permitted to be encroached upon or modified without some sign of a struggle to resist any such attempt.

A well established precedent in law is often as good as a statute, and undoubtedly the status of the amateur has been very well established within the last two years.

Perhaps before going any further it would be well to emphasise that in writing these lines there is not the least intention to adopt an antagonistic attitude towards broadcasting. On the contrary, the amateur wants broadcasting. and would have been very disappointed if it had not come. If any support of this statement is necessary the reader need only be referred to the fact that it was entirely through the agency of a very forceful petition to the Authorities from the amateurs of this country as a body that broadcasting first came into being, when the Postmaster-General authorised the regular weekly transmissions from Writtle.

Broadcasting is a very good thing indeed, and should receive every encouragement from everyone concerned, but at the same time it should be remembered that it is possible to have too much even of a good thing, and if there is any danger of the amateur and experimenter being " crowded out," so to speak, of his rights, then there must and certainly will be objections raised.

Broadcasting, it is understood, will take place from 5 p.m. to 11 p.m. daily, and throughout the day on Sunday, and the official regulations state that reaction must not be used at all during these times over the range of wavelengths covered by the broadcasting stations. This means that no reception of continuous wave telegraphy may be conducted between these times on the amateur wavelength of 440 metres. Since the hours to be covered by broadcasting are literally the only times during which the true experimenter (unless he is engaged on commercial experimental work, or is a person of leisure) can conduct his experiments, the regulation is equivalent to banishing the amateur to the shorter wavelengths below the broadcasting band, and depriving him altogether of the use of the 440 metre wavelength as soon as broadcasting commences. The chief danger that threatens the amateur position is that in the near future he must expect to find himself in the minority as far as the general users of wireless are concerned, and a minority may often be overruled by a majority vote however well established and just may be the claims of the minority. Perhaps the position of those amateurs who have transmitting licences is even less envious, since their work on 440 metres will apparently have to cease altogether, although many of them are pioneers in amateur work, and may be regarded as some of the most serious investigators in this country.

So much consideration then for the immediate situation which confronts the amateur and experimenter who has already established his claim to consideration in so far as he has obtained an experimental licence. There is also to be considered the position of those would-be experimenters, who, on account of the unhappy accident of the date of their applications for experimental licences find that their applications are turned down, and they are recommended to content themselves with a broadcast reception licence. Unfortunately, the number of these disappointed enthusiasts is increasing daily, and it is therefore not altogether surprising that, in spite of the fact that as a whole we are a law-abiding nation, rumours should reach us of the possibility of the illegal establishment of unlicensed receiving stations, despite the very serious penalties that are risked in so doing.

It is of course appreciated that the whole question is a very difficult one for the Authorities, who could not under any circumstances be expected to issue experimental licences to all and sundry without any guarantee that the shrieks and howls of radiation would not compel every sane experimenter and broadcast listener-in to close down in disgust. We feel, however, that it should be possible to arrive at some happy medium when those who genuinely desire to join the ranks of the experimenter should be allowed to do so provided that reasonable guarantees could be given that the recipients of licences would conduct their experiments in a proper manner, with due respect for other users of the aether, and would not earn for themselves the title of "aether hogs." There must be some hundreds, though still a small proportion of the total future users of wireless, who are attracted to the science entirely on account of its fascination as a hobby, in the practice of which the construction of their own apparatus and the possibilities which experiment with all kinds of circuits may present, would form the chief interest.

There is yet another side to this question. We refer now to the development of the industry of manufacturing wireless apparatus which has taken place as a result of the proposals for broadcasting, and the stimulus which this has given to public interest in the subject. The retailing of wireless apparatus parts is now confined to those users who will construct apparatus for themselves or conduct experiments, whilst the broadcast licensee is accommodated with complete sets of approved design. The majority of those firms who undertake to provide complete sets for the broadcast licensee will produce their own parts for incorporation in their sets, and this leaves to the manufacturer of parts only, no outlet for the disposal of his goods except through retail sales to the experimental licence holder. The net result is that many manufacturers who would otherwise have been content to leave the manufacture of the complete sets to the larger firms, are finding themselves compelled to assemble complete sets in order to come into the field and share in the industry.

Some readers, perhaps, are reminding themselves that broadcasting has as yet scarcely started, and that these questions are therefore brought forward prematurely. To this we would reply that it is better to face the facts beforehand and look for a remedy. We feel sure that the delay in broadcasting is due to the honest desire on the part of the Authorities and the Broadcasting Company to present broadcasting to the country with as many as possible of the problems which it has brought with it solved to the satisfaction of all parties.

H.S.P

A Separate Oscillator for the Transatlantic Tests.

(Wavelength Range, 170-440 metres.)

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

As was mentioned in last week's note on the subject of the forthcoming Transatlantic tests which are to take place in conjunction with the American Radio Relay League, it is essential that a separate heterodyne be employed when listening for C.W. signals, in order to avoid interference between the various stations listening-in in this country.

The mere employment of a separate heterodyne unit, however, is not of itself sufficient unless proper precautions are taken in its use. For instance, in many receiving stations direct coupling between the aerial circuit and the heterodyne is used, with the result that on

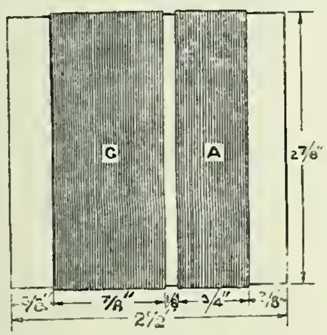


Fig. 1. The coils for the separate oscillator.

short wavelengths the radiation from the aerial is practically as strong as if an autodyne receiver were employed. The conditions are slightly improved if the heterodyne is coupled to the secondary circuit of a loose-coupled receiving tuner, but for short waves the improvement is not great, because the heterodyne has to be so slightly detuned from the frequency of the incoming signal in order to keep the beat note frequency within the audible limits that to all intents and purposes the heterodyne and the aerial are in tune as regards the transfer of energy between them. On long wavelengths the much larger frequency difference between the two circuits limits very considerably this transfer of energy, so that the heterodyne radiation is reduced by this method.

For the short waves to be used during these tests some other means must be employed for reducing radiation from the receiving aerial. The most practicable method is to keep the separate heterodyne unit as far away as possible from the aerial circuit, and also from the tuned secondary circuit coupled to the aerial, and to couple it on to some other part of the receiving circuit, so that there is at least one valve between the aerial and the part of the circuit to which the heterodyne is coupled. The best arrangement is to couple the separate heterodyne oscillator to the detector valve itself, either to its grid or to its plate circuit. It will generally be found sufficient for this purpose to place the separate heterodyne unit near to the detector valve, although if preferred, it may be placed much further away (but not near the aerial circuit) and coupled to the detector valve by means of an aperiodic circuit consisting of a coil of a few turns of wire, placed near the heterodyne and connected by a pair of leads close together to a similar coil coupled to either the grid or the anode circuit of the detector valve.

To couple the heterodyne in this way to the anode circuit of the detector valve of the receiving set a special coupling coil may be built up consisting of some six or eight turns of No. 22 S.W.G., D.C.C. copper wire, wound on an insulating tube about three inches in diameter. In the centre of this tube a similar smaller tube about two inches in diameter, and having wound on it about six turns of the same wire, should be pivoted in such a way that it can be rotated so that the planes of the two coils can be placed at any angle to one another between 0 and 90 degrees. By this means the coupling between the two coils can be varied from zero up to a maximum value. A fixed condenser of about 0·001 microfarad should be joined across the primary of the intervalve transformer coupling the detector valve to the first L.F. valve when this arrangement is employed.

The receiving sets for use during the Transatlantic tests are preferably built up with at least one or two stages of H.F. amplification, the intervalve coupling of these stages being tuned, as only by this means

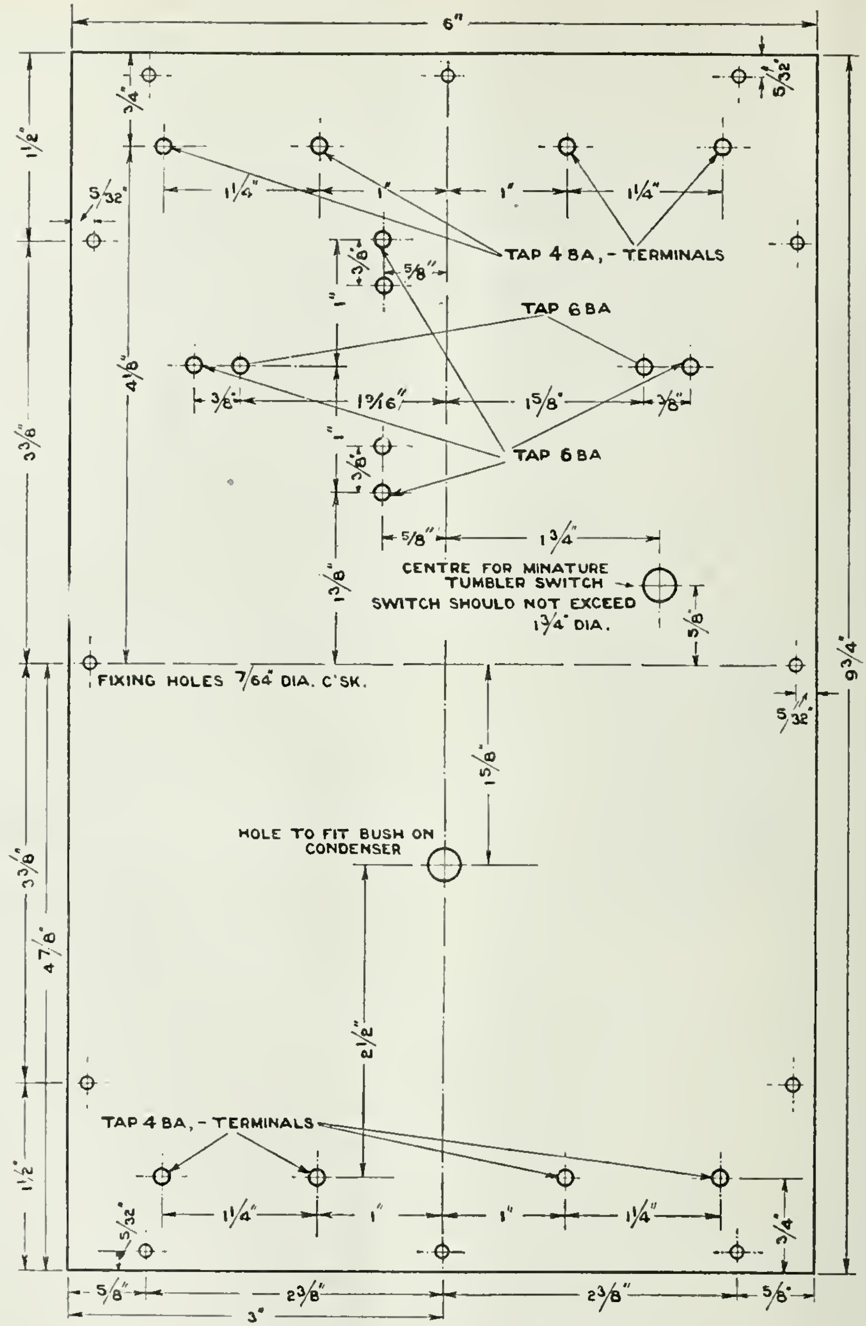


Fig. 2. Drilling diagram for ebonite top.

can efficient amplification of the short wavelengths be secured. High frequency intervalve transformers of the plug-in type, with variable condensers for tuning them to the desired range of wavelengths (which is approximately 180 to 400 metres), may be employed or the anode circuit of each H.F. valve may be tuned by a variometer or fixed coil with a variable condenser in parallel with it, using a fixed condenser to couple the successive stages together, as is customarily done in the well-known tuned-anode-reactance-capacity-coupled method of H.F. amplification. When either of these arrangements is employed some means of stabilising the whole receiver is necessary to prevent self-oscillation. This can be effected either by providing a definite reverse coupling between the plate circuit of the detector valve and the input or grid circuit of the first H.F. valve, this coupling being in the reverse direction to that normally required to produce oscillations, and being adjusted to such a

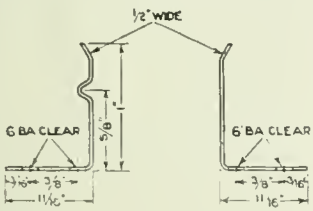


Fig. 3. Details of side clips for valve holder.

value that oscillations just cease, or by damping the H.F. valves by applying a positive potential to all the grid circuits by means of a suitable potentiometer connected across the filament battery.

The separate heterodyne can be fed from the same filament battery as is used for the main receiving set, but it is better to employ completely separate L.T. and H.T. batteries for the separate heterodyne, especially since only four volts is required for the filament of the heterodyne and six volts for its H.T. supply.

A convenient heterodyne unit for use in 200-metre reception, such as is required for the arrangements outlined above, may be constructed in the following manner. The anode and grid coils may be wound on the same former, closely adjacent to each other, as indicated in Fig. 1, in which G represents the grid coil and A the anode reaction coil. If the diameter of the winding former—which may be a waxed cardboard, or an ebonite tube—is $2\frac{5}{8}$ ins., and its length $2\frac{1}{2}$ ins. as shown, the grid coil G should have 45 turns of No. 28 S.W.G. double silk-covered copper wire, wound with the turns touching so as to occupy a length of $\frac{7}{8}$ in. A space of $\frac{1}{8}$ in. is left between the windings, and the anode coil A of 38 turns then put on, using the same wire. A variable condenser, having a maximum value of approximately 0·00025 microfarad is used for tuning purposes, and should be connected across the grid coil G. For convenience the whole instrument may be mounted in a wooden

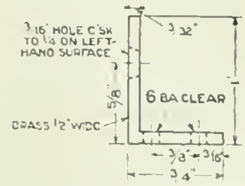


Fig. 4. Fixed end clips for valve holder.

box, with an ebonite top on which the valve holder, and the terminals for the H.T. and L.T. batteries are mounted. Convenient dimensions are indicated in Fig. 2, which also gives the positions of holes for drilling. This ebonite top should be $\frac{3}{16}$ in. to $\frac{1}{4}$ in. thick.

The outside dimensions of the box are $9\frac{3}{4}$ ins. by 6 ins. by $4\frac{3}{4}$ ins. deep, and it is constructed of wood $\frac{1}{4}$ in. thick. Any convenient wood may be used, although, of course, the appearance of the instrument is improved

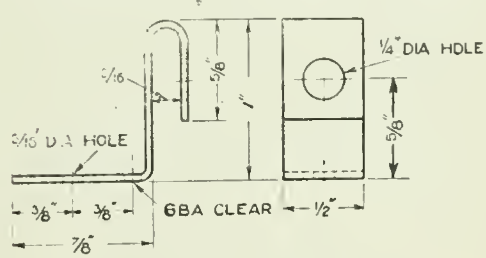


Fig. 5. Springy end clip for valve holders.

by using a hard wood such as mahogany or teak.

The ebonite top is fastened in place with $\frac{1}{2}$ in. brass screws (size No. 4), using the outer holes, marked in Fig. 2. These are shown as $\frac{7}{64}$ in. diameter, and are suitable for No. 4 countersunk or raised head brass screws. They should be countersunk so that the bevelled parts of the screw heads sink in flush with the surface of the ebonite.

Details of the dimensions of other parts required for the construction of the instrument are given in Figs. 3 to 8. It will be noted from this that provision is made for using a V 24 type of valve, which is a very convenient one to use for an instrument of this type, since

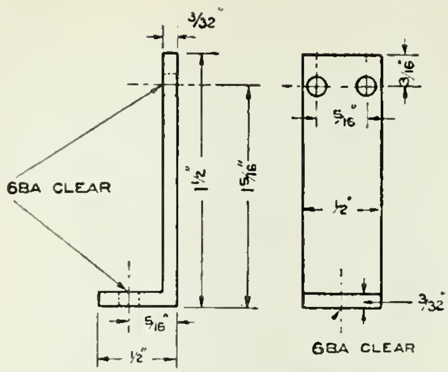


Fig. 6. Supports for coil former.

only a low value of H.T. voltage is necessary. When completed with one of these valves the instrument will usually oscillate with only six volts in the high tension battery. If preferred, a holder for a four-pin valve of the standard French or " R " type may be fitted, instead of the spring clips for the V 24 valve, so that an " Ora " type of valve may be used with but trifling alteration to the general layout of the apparatus. The low capacity of the V 24 valve, however, is advantageous for this short wave instrument.

Fig. 3 gives the details of the side-clips for the V 24 valve. They are bent up from thin springy phosphor-bronze strip, $\frac{1}{2}$ in. wide, to the dimensions shown in that sketch. These are the clips marked A and G in Fig. 9.

The end clips for the valve are shown in Figs. 4 and 5, the former being of $\frac{3}{32}$ in. brass strip, $\frac{1}{2}$ in. wide, and the latter, the flexible one, of thin springy phosphor-bronze

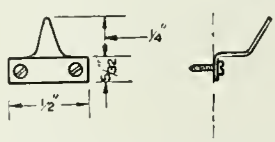


Fig. 7. Pointer for condenser scale.

strip. The thickness of this strip should not much exceed about $\frac{1}{64}$ in. These two clips are those mounted on the right and left-hand ends of the valve in Fig. 9 respectively. In Fig. 6 will be found details of the two brass angle brackets used to support the former on which the coils (Fig. 1) are wound. This is made of $\frac{3}{32}$ in. brass strip, $\frac{1}{2}$ in. wide. Two are required to the dimensions given.

The pointer for the condenser scale (shown mounted on the right-hand side of the condenser, in Fig. 9) is shown in Fig. 7. This is made of thin brass strip about $\frac{1}{32}$ in. thick. Fig. 8 indicates the dimensions of the brass strip used to short-circuit the " phone " terminals when telephones are not required connected to the set. This, of course, is usually the case when the instrument is used purely as a separate heterodyne, but the terminals are very convenient in some cases since the instrument can also be used for many other purposes, such as a C.W. wavemeter, and for carrying out many simple high-frequency measurements.

In Fig. 9 will be found a diagram of the layout of the top of the instrument, with the lettering of the various terminals, and in Fig. 10 a diagram of the connections of the instrument between these terminals, the labelling of the terminals in this diagram corres-

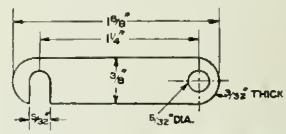


Fig. 8. Short-circuiting link.

ponding with that in Fig. 9. In Fig. 9 it will be noticed that a miniature tumbler switch is shown, to provide a filament switch for the set. The position of the centre only of this switch is indicated in Fig. 2, as the exact position and size of the holes necessary for fixing this switch in position, and for allowing the connecting wires access to its terminals, will depend upon the particular pattern of switch used. The position of these holes should therefore be marked out after the purchase of this switch. Its outside diameter should not exceed about $1\frac{3}{4}$ ins.

The terminals used (4 BA) should be screwed into the ebonite, and provided with washers and nuts on the underside for the connections. The wiring is most conveniently carried out with bare No. 18 copper wire, covered with insulating sleeving where necessary.

The former on which the anode and grid coils are wound is supported from the under side of the ebonite top by means of the brass brackets, of which the dimensions are given in Fig. 6.

The variable condenser has a maximum capacity of approximately 0·00025 microfarad. A suitable condenser for this purpose is most conveniently purchased ready made, but if it is preferred to build it up from standard component parts which are purchaseable at somewhat cheaper rates than the complete article,

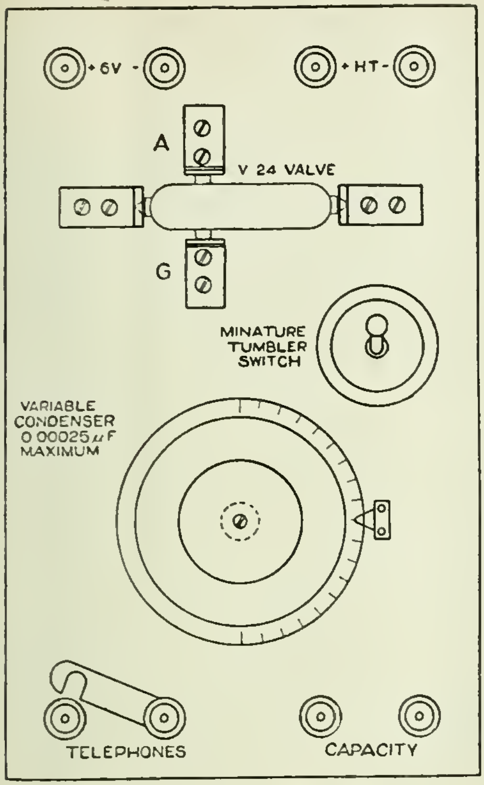


Fig. 9. Lay-out of instrument top.

it will be found convenient to use six fixed and five moving plates of diameters of $2\frac{7}{8}$ ins. and $2\frac{1}{4}$ ins. respectively. If the plates are $\frac{1}{32}$ in. in thickness the spacing washers used to separate both the fixed and the moving plates should be about $\frac{1}{16}$ in. thick.

The fixed bypass condenser of 0·01 microfarad capacity shown in Fig. 10, may be built up of tinfoil with paraffined paper, or mica, for the dielectric. More conveniently a small Dubilier Type 577 condenser of this capacity may be employed, and fixed in place on the underside of the ebonite top by two small screws.

If a four-volt accumulator is connected to the L.T. terminals of this heterodyne set no filament resistance will be necessary for the V 24 valve, but if preferred, a six-volt accumulator may be employed with a fixed resistance of about $1\frac{1}{4}$ ohms, mounted inside the heterodyne box.

An instrument constructed on these lines with a V 24 valve should oscillate readily over the whole range of the condenser scale with six volts connected to the H.T. terminals.

The negative lead of the H.T. battery is joined to the positive of the filament battery so that the two combine together in the plate circuit of the valve, giving an effective voltage of 10 in that circuit. With this arrangement care must be taken to keep the grid circuit joined up to the negative end of the filament. This will be the case if the wiring diagram given in Fig. 10 is adhered to. With such an instrument a tuning range of about 170 to 440 metres should be obtained. Care should be taken that the two windings are put on in the same direction, and that the outer end of the 45-turn coil is joined to the grid of the valve, and the outer end of the other coil to the anode—thus making the anode and grid connections to the two extreme ends of the coils. When in use as a normal heterodyne unit the telephone terminals are not required and should be short-circuited by the link provided. They are only fitted to the instrument to enable telephones to be joined in circuit as a help for calibration purposes, and for other measurements.

The two terminals marked " capacity," in Figs. 9 and 10, are connected directly across the ends of the variable condenser. A very small single plate or vernier condenser can be joined across these terminals when desired to aid in fine adjustments of the wavelength. Such an addition is particularly desirable when heterodyning these short wavelengths, as the tuning range for maintaining the beat note within the audible limits is very restricted at these high frequencies. Such an addition, however, will, of course, alter the calibration of the instrument should it be desired to use it as a wavemeter.

The readings of the instrument may be calibrated against a standard wavemeter, so as to obtain the approximate wavelength corresponding to any scale reading of the condenser. Such a calibration, however, will vary slightly with all changes in the filament and H.T. batteries, and will usually also vary somewhat when the valve is changed. It must be carried out, of course, without any additional fine adjustment or vernier condenser connected to the " capacity " terminals, as such an addition, although very convenient for use, would constitute a serious disturbing element.

An important point to note when joining up the leads inside the instrument is that the wire from the grid of the valve should be joined to the *fixed* plates of the variable condenser, the movable vanes being connected to the filament of the valve. The potential of the movable vanes will then be lower, and the presence of the hand when making adjustments will be less serious. This precaution will be found of particular value when calibrating the instrument.

When accurate work is necessary with an oscillator of this kind it is very desirable to fit a long handle to the condenser so as to enable the hand to be kept further from the instrument. Any convenient form of such handle can readily be added to this instrument, and will aid considerably the ease of its operation.

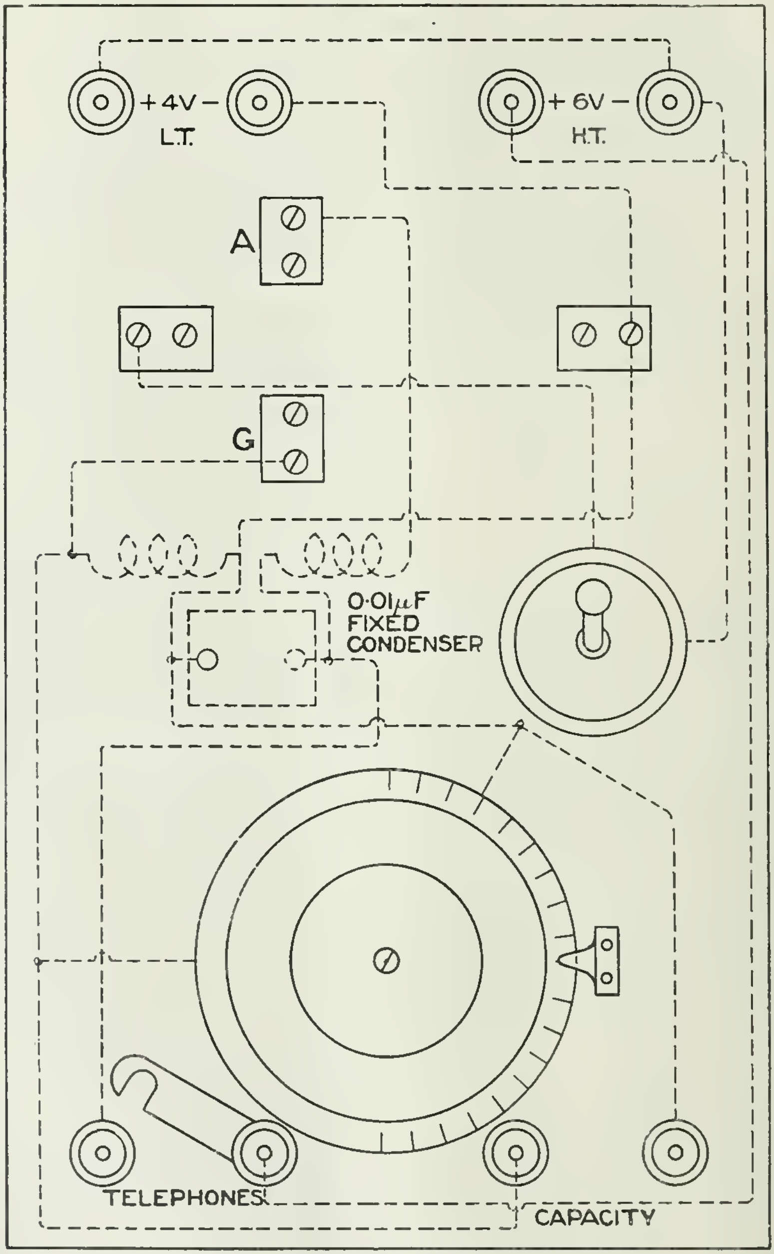


Fig. 10. Wiring Diagram.

Signal Rectification

A CONSIDERATION OF THE METHODS OF DETECTION.

It is the purpose of these notes to discuss the possible methods of rectification, using the three-electrode valve.

The high frequency energy input to the detector is always modulated, that is, high frequency and audible frequency components are present together in the signal.

The function of the detector is to transform high frequency energy to low frequency energy: therefore the circuit connected to the input of the detecting apparatus is tuned to the wavelength of the high frequency energy, and the output circuit is tuned to the low frequency energy. But the output power is not entirely in the signal. A high frequency component is present. The output circuit of the detecting valve must, then, contain a capacity which will carry this component of the signal. This capacity is present in all output circuits—sometimes in the form of self-capacity, but generally in the form of a shunt condenser which has a reactance high to audible frequencies, but low to radio frequencies. A condenser of 0·001 mfds is suitable. Its reactance at a frequency of 1,000,000 cycles per second, corresponding to a wavelength of 300 metres, is 160 ohms, and its reactance to a frequency of 1,000 cycles per second is 160,000 ohms.

The method of rectification which is most easily understood makes use of the curvature of the plate current curve. The grid potential is adjusted roughly by connecting small cells in the grid circuit, or a finer adjustment is made possible with the aid of a potentiometer. Arising from the fact that any appreciable grid current causes damping and a lowering of the input voltage, the grid is usually made negative, and adjustments of anode potential and filament current are made to bring the mean grid potential to the point on the bottom of the plate current grid voltage curve where a given signal impressed across the input circuit produces the greatest *mean increase* in the filament anode current. The rectifying action takes place because a given positive potential increment to the grid produces a larger increase in anode filament current, than an equal negative potential caused reduction, and it is this balance of energy which is available to operate the instrument connected in the anode circuit. It is to be expected that some types of valve will, for a given input voltage, produce a larger strength of signal than others. A suitable choice should be made

Since the apparatus in the anode circuit is an *energy* operated device, its impedance at the signal frequency should approximate to that of the anode-filament circuit of the valve.

Sometimes, when damping is not objected to, the upper bend of the plate current grid voltage curve is used. The mean grid potential is fixed, and the filament current is charged until maximum response is secured. A low plate potential is necessary in this case.

Now that hard valves are easily procured, the method of rectification which employs a grid condenser and leak is used. In this method the grid voltage—grid current characteristic of the valve is made use of, and the input circuit is proportioned so that grid currents flow.

Considering the grid condenser connected to the grid without the leak resistance, the negative half wave of a signal will produce a positive potential on the plates of the condenser joined to the grid. A current will flow from the filament to the grid, and will charge the condenser plates negatively. The positive half cycle of the signal will further reduce the negative potential of the grid and succeeding pulses of energy will likewise increase the negative charge held on the condenser plates connected to the grid. This reduction of grid potential causes a reduction in the normal filament anode current at audio frequencies, and the instrument in the plate circuit responds. The grid condenser should, then, have a small capacity, in order that the energy which it receives may result in the largest possible voltage fluctuations, which in turn will give maximum signal energy in the anode circuit. On the other hand, it should not be so small that an appreciable radio-frequency voltage drop takes place across it. When "R" valves are used, 0·0003 mfds. is suitable. To restore the grid potential to its normal value, a leak is provided which will allow the charge to leak away to the filament during the intervals between signals. Obviously the leak should have no lower resistance than is necessary for it to perform its function properly.

Two methods of connection are available. The leak resistance may be joined directly across the grid condenser, or it may be joined from the grid directly with the filament. The latter method is preferable.

Several adjustments for maximum audible energy are possible. The grid potential should be adjusted so that input potentials will cause the largest possible filament grid current to flow, and the anode potential and filament current should be chosen so that the steepest portion of the anode current grid volt curve will be utilised. The latter adjustments may also be made to give a steep grid-current grid voltage curve. Maximum signal strength will then be secured.

Using hard valves, the grid leak and condenser method of rectification gives results superior to any other.

Adjustments based upon conclusions reached after a study of the static characteristic curves will not be far wrong. W. J.

The Size of Accumulator to Buy

When buying an accumulator there are several points to which due consideration must be given if the battery is to give satisfactory service. First, one must decide whether one prefers a small and comparatively light affair which must be frequently charged, or a large and ponderous one which will hold a month's supply. This question must be settled by such individual considerations as distance to charging place, strength of one's arms, and so on. Supposing that a small cell is decided upon, the point to be settled next is the safe minimum size, and this demands a knowledge of the current required by valves, and also of the meaning of the term "ampere hour capacity." This last may be best understood from an example. If a battery is said to have a capacity of 20 ampere hours it means that it will give a current of 1 ampere for 20 hours, 2 amps. for 10 hours, 4 amps. for 5 hours, and so on, before requiring recharging. The matter is complicated somewhat by the common practice of rating accumulators at "ignition" capacity, which is twice the "actual" or "continuous" capacity. Thus, if the cell is said to be of 60 A.H. capacity, base your calculations upon 1 amp. for 30 hours, not 60, unless it is definitely stated to be "60 A.H. actual."

To find the minimum size for a given number of valves allow $\frac{3}{4}$ amp. of current for each valve, and an eight hours discharge rate, since that is the shortest time in which an accumulator should be discharged, whether in one spell of eight hours or in separate shorter ones totalling eight in all.

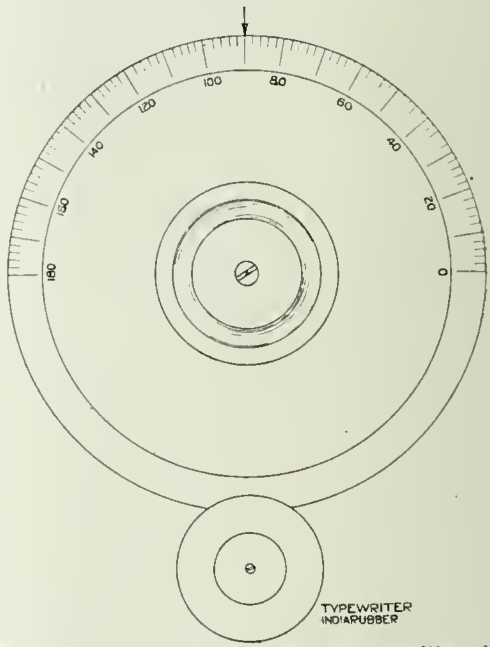
Example :—What is the smallest capacity to supply 4 valves satisfactorily?

Four valves require 3 amps.

$3 \times 8 = 24$ amp. hours.

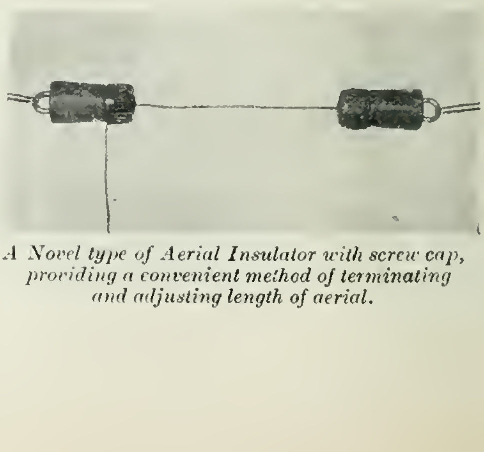
Answer :—24 A.H. actual, or say, 50 A.H. ignition. G. P. K.

Critical Adjustment of Condensers



An easily fitted device for critically controlling the setting of a condenser. The typewriter rubber makes a friction contact on the bevel of the condenser scale.

Aerial Insulators



A Novel type of Aerial Insulator with screw cap, providing a convenient method of terminating and adjusting length of aerial.

Electrons, Electric Waves, and Wireless Telephony—VII.

By Dr. J. A. Fleming, F.R.S.

IV.—ELECTROMAGNETIC FIELDS, FORCES AND RADIATION.

1.—Lines of Electric and Magnetic Force.

Before dealing at greater length with the problem of atomic structure, it will be necessary to enter into certain elementary expositions of the nature of electromagnetic fields and forces and of electromagnetic or so-called electric waves.

Theory shows that when an electrified sphere or electrically charged body is set in motion in any direction it not only exerts a force on other electrified bodies near it, called electric force, but also when moving, acts on magnets or exerts a magnetic force along certain directions. In the case of a small charged sphere in uniform linear motion, the lines of electric force are radial and the lines of magnetic force are circles whose centres lie on the line of motion and planes are perpendicular to it. The regions near electrified bodies or magnets are called *electric* or *magnetic fields*, and in these fields forces of attraction or repulsion are exerted on other electrified bodies or magnets which are called electric and magnetic forces respectively. These forces are exerted along certain straight or curved lines called lines of electric or magnetic force. Faraday considered that these lines of force are not merely ideal lines like lines of latitude and longitude, but that they have some actual physical existence and are regions in which some special actions in a universally diffused medium called æther, are taking place.

Hence we may say that an electric or magnetic field has a certain discreteness or atomic structure, and that the space within a small tubular region surrounding a line of force is in some way different from the space outside.

In the case of an electrified sphere the lines of electric force radiate from the sphere as from its centre, being equally distributed in all directions, provided the sphere is at rest. Faraday showed by numerous experiments that it is impossible to create a charge of electricity of one kind without creating also an equal quantity of the opposite kind. Hence we must consider that a line of electric force must be either an endless line or, if not, must have its ends terminated by charges of electricity of opposite sign, say, by ending on positive and negative electrons respectively, or else must start from an electron and be extended to an infinite distance.

There is, however, an interconnection between lines of electric and lines of magnetic force which may be explained as follows :—

If a line of electric force is moved parallel to itself or in a direction at right angles to its own direction it creates a line of magnetic force which runs in a direction at right angles to that of the line of electric force and to that of the motion of the latter.

The relation of the directions may be memorised by means of a " hand rule," as follows : Hold the thumb, forefinger and middle finger of the *right* hand in positions mutually at right angles like three co-ordinate axes. Then let the direction of the forefinger denote the direction of a line of electric force, and that of the thumb the direction of the motion of this line at right angles to its own direction. Then the direction in which the middle finger points will be the direction of the magnetic force produced by its motion. It should be remembered that by usual conventions the direction of an electric line of force is the direction in which it would cause a free positive electron or positively charged particle placed on it, to move. Hence for a negative electron the lines of electric force are directed *towards* the electron.

If then we consider an electron carrying its system of radial lines of electric force to be *in motion*, we see that the result is to surround the electron with a family of circular lines of magnetic force which all have their centres on the line of motion and all have their planes perpendicular to it (see Fig. 41).

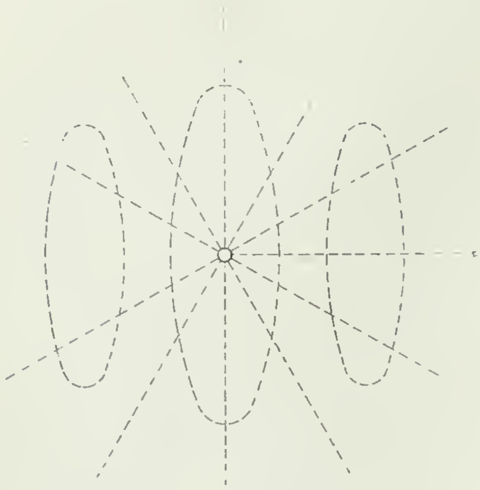


Fig. 41. Lines of Electric and Magnetic Force round an Electron.

The magnetic force at any point is proportional to the velocity and also to the resolved part or component of the electric force which is at that point perpendicular to the direction of motion. It can be shown mathematically that when the velocity or speed of the electron approaches that of light, viz., 300,000 kilometres per second, the radiating lines of electric force all crowd up into the equatorial plane, which is a plane through the centre of the electron and perpendicular to its direction of motion (see Fig. 42).

The radial lines of electric force and embracing circular lines of magnetic force then form a sort of spider's web pattern in that equatorial plane. This is called the electromagnetic field of force of the electron. This electromagnetic field represents a store of energy. If a substance of mass m, whether a bullet or a railway train, to be in motion with a velocity v, it has energy called kinetic or motional energy associated with it, which is in amount equal to $\frac{1}{2}mv^2$ or to half the mass multiplied by the square of the speed. It can be proved, though the proof is somewhat difficult, that when an electrified sphere moves with velocity v it has energy associated with it measured by

$$\tfrac{1}{2}\left(m + \frac{4}{3}\frac{e^2}{d}\right)v^2$$

where e is the electric charge, which in the

Fig. 42. Lines of Electric and Magnetic Force around an Electron moving with high velocity.

case of an electron is $1{\cdot}6 \times 10^{-20}$ electromagnetic units, or $16\ 10^{20}$ Coulombs, and d is the diameter of the sphere or electron. The letter m signifies the ordinary mass and $4e^2\ 3d$ is called the electrical mass.

2.—Size and Mass of an Electron.

The question has been much discussed whether the electron has any mass other than the electrical mass, and certain experiments by Kaufmann strongly indicate that it has not. If this is the case then the whole mass m of the electron is represented by the value of $4e^2\ 3d$ and the diameter d is equal to $\frac{4}{3}\frac{e}{m}e$.

But now we have seen that the ratio of charge to mass or $e\ m$ for an electron is nearly $1{\cdot}774 \times 10^7$ electromagnetic units and that the electric charge e is $1\ 6 \times 10^{-20}$ electromagnetic units. Hence the diameter of an electron is $\frac{4}{3} \times 1{\cdot}774 \times 1{\cdot}6 \times 10^{-13}$ of a centimetre or $0{\cdot}38 \times 10^{-12}$ cm, that is about one-third of a billionth of a centimetre. A million times a million electrons, put in a close row, would only extend a distance of about one-sixth of an inch. A negative electron is therefore very small compared with an atom, about one hundred thousandth part of the diameter of an atom. Small however as is the negative electron, the positive electron is probably still smaller We have seen that in a Hydrogen atom, consisting probably of a single positive and single negative electron, the negative electron contributes only 1/1,700th part of the mass. This implies that if the charge of the positive electron is the same as that of the negative the diameter of the former is only 1/1,700th part of that of the latter. We see, therefore, that the negative electron has a diameter of only about a hundred thousandth part of that of the whole atom and that the positive electron is perhaps 2,000 times smaller. We are now able to make a pretty clear mental picture of what an atom of matter is like according to the above theory. Imagine a cricket ball suspended in the air. At a distance of 100 or 200 feet or so from it let there be a few dozen grains of dust each not more than 1/100 inch in diameter. Let these grains, representing electrons, revolve round the cricket ball, representing the nucleus in circular orbits, the grains being arranged in shells or groups of 2, 3, 4 to 8, in various orbits, up to say 100 feet radius This would suggest what an atom would look like if it

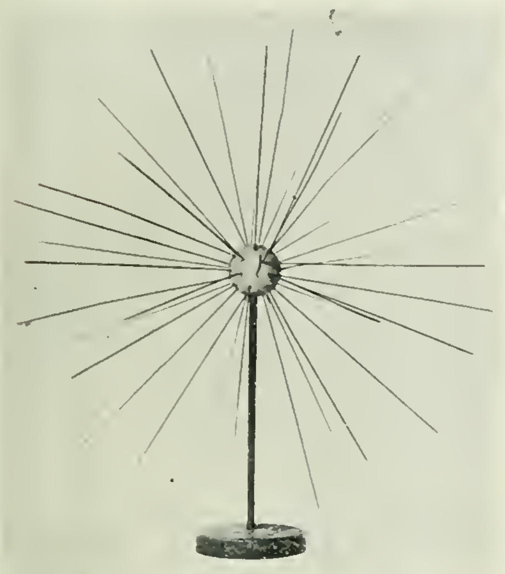


Fig. 43. A golf ball with radial wires in it to represent an electron with its electrolines.

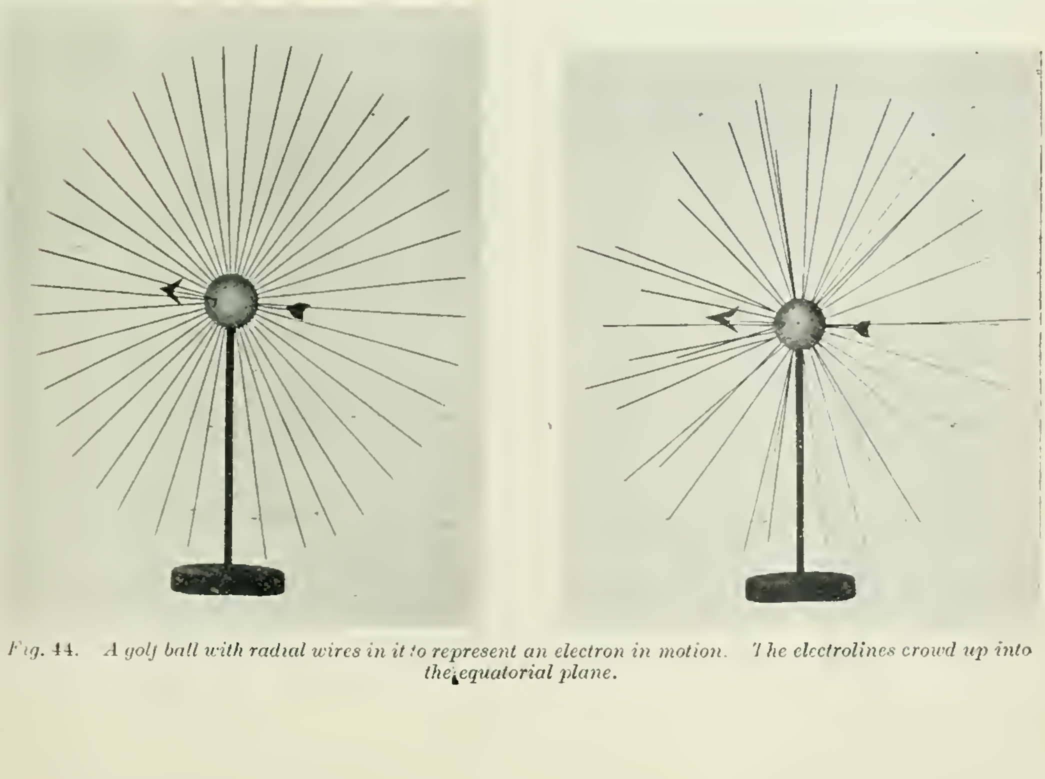


Fig. 44. A golf ball with radial wires in it to represent an electron in motion. The electrolines crowd up into the equatorial plane.

could be magnified a billion times and be then viewed from a distance of several hundred yards.

3 —Electromagnetic Waves.

Before considering the problems of atomic structure at any greater length it may be well at this stage to outline our present views on the nature of an electric or electromagnetic wave. We have seen that from an electron we consider lines of electric force to radiate. These lines may for the sake of brevity be called *electrolines*, and we may therefore picture to ourselves an electron as something like a golf ball in which have been stuck very long straight wires radiating equally in all directions, which wires represent the electrolines. These electrolines possess an elasticity of a certain kind. They resist stretching and endeavour to make themselves as short as possible. In fact the attraction between positive and negative electrons may be regarded as the result of the endeavour of these lines to shrink up in the direction of their length. Also these lines possess a quality equivalent to mass or inertia and the so-called electric mass of the electron to which we have already referred is merely the mass of the entirety of these electrolines and of the magnetolines produced by their motion.

Suppose then that an electron at rest is caused to make a sudden jump forward. It carries with it the ends of the electrolines which terminate on it, but the inertia of the line causes the rest of the line to be left behind for a moment and the result is the production of a *kink* or dislocation in the lines (see Fig. 45). This kink, however, travels outwards along the lines as the whole electroline picks up the motion. We have, however, seen that the lateral or sideway motion of an electroline gives rise to a magnetic force at right angles to itself and to the direction of its motion. Hence, as the "kink" in the electroline travels outwards it is accompanied by lines of magnetic force or magnetolines created by the motion of the electrolines.

These two sets of lines are at right angles to each other and to the direction of motion. Experiment shows that this kink travels outwards with a velocity of 300,000 kilometres per second in empty space or with the velocity of light in any medium in which the electron is placed.

This movement of electric and magnetic lines of force in the same plane is called an *electromagnetic pulse* or solitary wave and is also called *electric radiation.*

The same kind of electric radiation will be produced if an electron in uniform motion is suddenly stopped or has its velocity changed or suffers acceleration. There are, however, two kinds of acceleration. Velocity may be changed in amount, but not in direction, as when a stone is falling towards the earth,

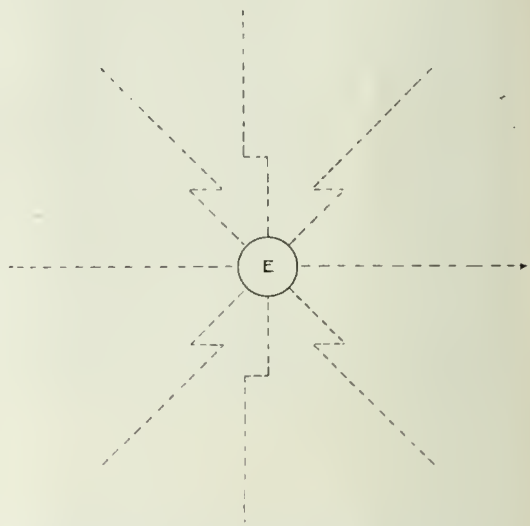


Fig. 45. Kinks produced on radial electrolines of an electron E when the latter suddenly jumps forward. The dotted lines denote the electrolines.

or the velocity may be continually changed in direction but not in magnitude as when a mass revolves with uniform speed in a circle. It appears, for reasons too long to give at this point, that an electron when revolving with constant speed in a circle round a nucleus, although in one sense of the term experiencing an acceleration towards the nucleus, is yet not radiating electromagnetic waves and therefore not losing energy. On the other hand if an electron jumps backwards and forwards in a straight line it does radiate, although the direction of its motion is always in one line. If then we imagine a number of electrons to be placed in a row in one line and all to jump to and fro in that line through a small range simultaneously, the whole lot of them would radiate and would produce an electromagnetic wave, the wave surface of which would be a co-axial cylindrical sheath or surface to the line of electrons. We shall see, when we come to discuss the subject of wireless telephony, that this is just what happens in the case of the aerial of a wireless telephone transmitter.

Before proceeding further with the consideration of the problem of electric radiation by the atoms and electrons, it will be necessary to return to the discussion of a few more matters connected with the architecture of atoms.

(To be continued.)

The Switching of L.F. Valves.

By G. P. Kendall, B.Sc.

When a set includes one or more stages of low frequency amplification it is extremely desirable to use just the necessary number of valves to produce the desired signal strength. The switching arrangements to permit of this being done must be designed with some care to avoid loss of efficiency from dead-end effects and interaction between circuits. In most cases the best solution of the problem is the use of two-pole plug and four-spring break jack, provided that they are correctly used.

Fig. 1 shows the arrangement of plug and jack. The four spring-strips of which the jack is composed may be conveniently referred to as the outer and inner springs, two of each. The outer ones are of unequal length and have their ends bent in such a way as to facilitate the introduction of the plug, and to cause one of them to make contact with the ball, and the other with the tubular part. The inner springs make contact through two pairs of platinoid points with the corresponding outer ones when the plug is out of the jack. When the plug is inserted the outer springs are pushed apart and thus disconnected from the inner ones. If, then, a jack is placed in the plate circuit of each valve, with one outer spring connected to the plate and the other to the H.T. positive, and the two inner ones to the intervalve transformer primary, it is clear that if the phones are connected to a plug we have the desired system of switching. When the plug is inserted in a given jack the phones are connected into the plate circuit of the valve, while the intervalve transformer is disconnected, thus cutting off the succeeding (unused) valves. When the plug is withdrawn the intervalve transformer primary is brought back into the plate circuit and the next valve comes into action. This will be readily understood from Fig. 2.

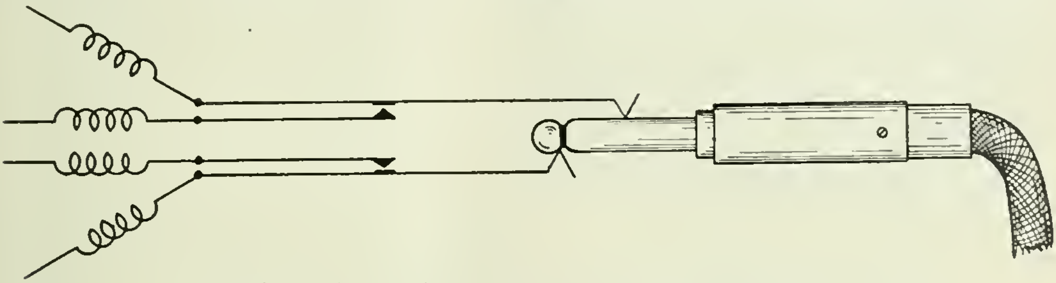


Fig. 1. L.F. Valves. Four-point break jack and plug.

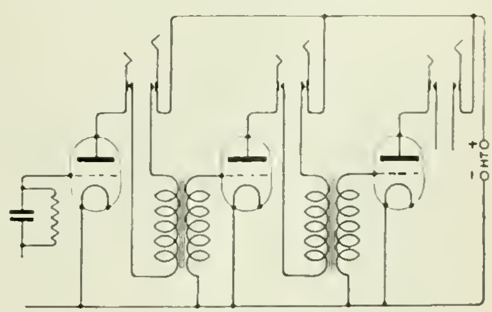


Fig. 2. Method of connecting jacks in L.F. Amplifier Circuit.

Some Recent Developments of Regenerative Circuits.*

By Edwin H. Armstrong.

It is the purpose of this paper to describe a method of amplification which is based fundamentally on regeneration, but which involves the application of a principle and the attainment of a result which it is believed is new. This new result is obtained by the extension of regeneration into a field which lies beyond that hitherto considered its theoretical limit, and the process of amplification is therefore termed *super-regeneration*.

Before proceeding with a description of this method it is in order to consider a few fundamental facts about regenerative circuits. It is well known that the effect of regeneration (that is, the supplying of energy to a circuit to reinforce the oscillations existing therein) is equivalent to introducing a negative resistance reaction in the circuit, which neutralises positive resistance reaction, and thereby reduces the effective resistance of the circuit. There are three conceivable relations between the negative and positive resistances: namely—the negative resistance introduced may be less than the positive resistance, it may be equal to the positive resistance, or it may be greater than the positive resistance of the circuit.

We will consider what occurs in a regenerative circuit containing inductance and capacity when an alternating electromotive force of the resonant

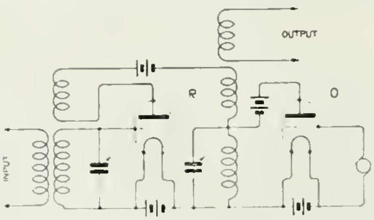


Fig. 1.

frequency is suddenly impressed for each of the three cases. In the first case (when the negative resistance is less than the positive), the free and forced oscillations have a maximum amplitude equal to the impressed electromotive force over the effective resistance, and the free oscillation has a damping determined by this effective resistance. The steady state is attained after the initial free oscillation dies out and continues until the impressed E.M.F. is removed, when the current dies out in accordance with a second free oscillation. The maximum amplitude of current in this case is always finite; it reaches this maximum amplitude in a finite time, and when the impressed E.M.F. is removed the current dies away to zero. This is the action of the circuits which are now in everyday practical use.

* Abstract of a paper read before The Institute of Radio Engineers, New York, June 7th, 1922.

In the second case the negative resistance is equal to the positive resistance, and the resultant effective resistance of the circuit is therefore zero. When an E.M.F. is suddenly impressed in this case, the current in the circuit starts to increase at a rate which is directly proportional to the impressed electromotive force and to the square root of the ratio of the capacity to the inductance of the circuit (for a given impressed frequency). If the force is impressed for an infinite time, then the current in the circuit reaches infinity. If the E.M.F. is impressed for a finite time, then the current reaches some finite value. When the im-

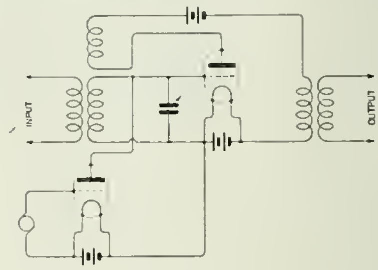


Fig. 2.

pressed E.M.F. is removed, the current in the circuit at that instant continues indefinitely with unchanged amplitude as a free oscillation. Theoretically, this is the limiting case for regeneration; practically it is always necessary to operate at some point slightly below this state at which the circuits have a definite resistance.

It is important to note here that although the circuit of this case has zero resistance, oscillations will not start unless an E.M.F. is impressed upon

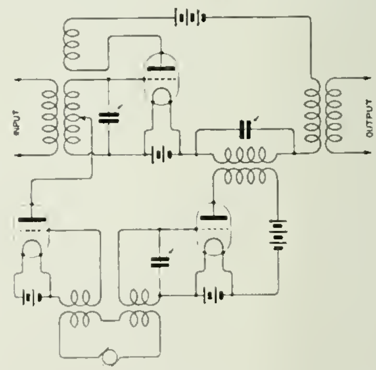


Fig. 3.

the circuit; furthermore, that oscillations once started continue with undiminished amplitude indefinitely. This state cannot be attained in practice, because the negative resistance furnished by the tube is dependent on the amplitude of the current and for stable operation decreases with increasing amplitude.†

In the third case the negative resistance introduced into the circuit is greater than the positive resistance, and the effective resistance of the circuit is therefore negative. When an E.M.F. is impressed upon a circuit in this condition, a free and a forced oscillation are set up which have some interesting properties. The amplitude of the forced oscillation is determined by the value of the impressed E.M.F. divided by the resultant resistance of the circuit. The free oscillation starts with an amplitude equal to the forced oscillation, and builds up to infinity regardless of whether or not the external

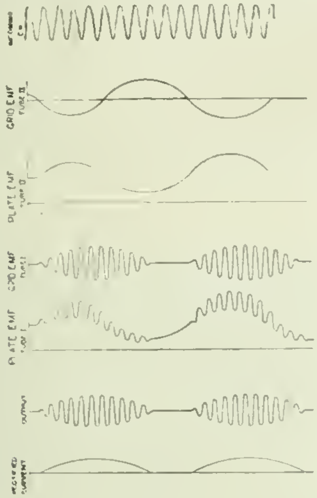


Fig. 4.

E.M.F. is removed. This free oscillation starts with an amplitude which is proportional to the impressed force, and this proportionality is maintained throughout any finite time interval (with constant impressed electromotive force).

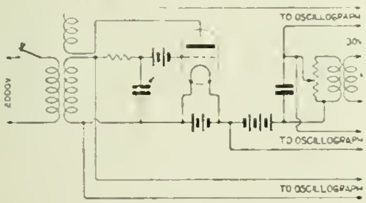


Fig. 5.

† It is very important at this point to distinguish between this purely theoretical state and the state which exists in oscillating tube circuits. In the various forms of self-heterodyne circuits a free oscillation of constant amplitude is maintained in the system and the circuit may be considered as having zero resistance, *but only for that particular amplitude of current.* An external E.M.F. impressed on the circuit always encounters a positive resultant resistance, assuming, of course, that the existing oscillation is stable. This is due to the non-linear characteristic of the tube.

It is important to note that although the negative resistance of the circuit exceeds the positive, and the effective resistance of the circuit is negative, oscillations will not occur until some E.M.F. is impressed. *Once an E.M.F. is impressed, however, no matter how small it may be, the current in the circuit builds up to infinity regardless of whether or not the external E.M.F. is removed.*

The fundamental difference between the case in which the resistance of the circuit is positive and the case in which the resistance of the circuit is negative may be summed up as follows: in the first, the forced oscillation contains the greatest amount of energy and the free oscillation is of very minor importance‡ (after a short interval of time), in the second, it is the free oscillation which contains the greatest amount of energy and the forced oscillation which is of negligible importance.

It is of course impossible, owing to practical limitations, to set up a system in which the negative resistance exceeds the positive without the production of oscillations in the system, since any irregularity in filament emission or impulse produced by atmospheric disturbances is sufficient to initiate an oscillation which builds up to the carrying capacity of the tube. It is, however, possible, by means of various expedients, to set up systems which avoid the production of such a paralysing oscillation and which approximate the theoretical case in the use of a free oscillation to produce amplification.

The first use of the free oscillation in a regenerative system for the amplification of signals appears to have been made by Turner§ in his valve relay system. Briefly, Turner prevented the regenerative circuit from producing oscillations when no signals

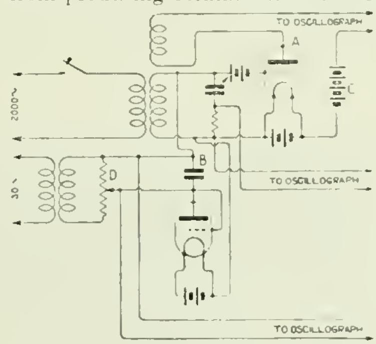


Fig. 6.

were being received by placing a negative potential on the grid of sufficient value to hold it just below that point on the characteristic curve at which self-oscillation would start. The impressing of a small electromotive force of sufficient value would carry the potential of the grid over the "threshold" value and a free oscillation would start which would build up to the limiting value

‡ This is strictly true when dealing with continuous waves which we have been considering. It is not true in the regenerative reception of spark signals, particularly of short wavelength, large damping, and low spark frequency. In this case the energy in the free oscillation exceeds the energy in the forced oscillation.

§ British Patent, 130,408.

of the tube. The system was returned to its initial sensitive state by means of a relay operated by the increase in the plate current of the tube. This relay short-circuited the feed-back coil, thereby cutting off the supply of energy and permitting the potential of the grid to drop back below the "threshold" value. As Turner explains, the device is a relay with a low limit (as distinguished from an amplifier), but it appears to be the first device in which the free oscillation set up by an impressed electromotive force produced the magnified result.

Bolitho* contributed an important improvement by replacing the mechanical relay of Turner which operated only upon the receipt of a signal by a valve relay which was continuously operated by independent means. Briefly, this was accomplished by connecting a second valve to the oscillating circuit of the Turner arrangement with a reversed feed-back connection and supplying the plate circuit of this second valve with alternating current. When the "threshold" value of the first tube was overcome and a free oscillation started in the system, the reversed feed-back of the second tube comes into action and at that time when the voltage supplied to the plate is positive, damps out the free oscillation and permits the grid of the first tube to return below the "threshold" value. This represents the second step in the utilisation of the free oscillation for the production of amplification.

It is the purpose of this paper to describe a principle of operation based on the free oscillation which is quantitative and without a lower limit. This new method is based on the discovery that if a periodic variation be introduced in the relation between the negative and positive resistance of a circuit containing inductance and capacity, in such manner that the negative resistance is alternately greater and less than the positive resistance,

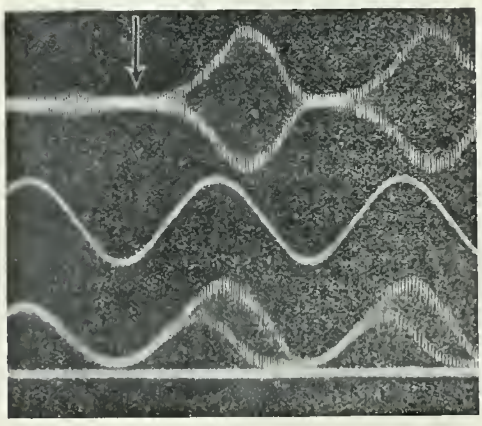


Fig. 7.

but that the average value of resistance is positive, then the circuit will not of itself produce oscillations, but during those intervals when the negative resistance is greater than the positive will produce great amplification of an impressed E.M.F. The free oscillations which are set up during the periods of negative resistance are directly proportional in amplitude to the amplitude of the impressed E.M.F. The variation in the relation between the negative and positive resistance may be carried out by varying the negative resistance with respect to the positive, by varying the positive resistance with respect to the negative, or by varying both simultaneously at some frequency which is generally relatively low compared to the frequency of the current to be amplified.

These three methods of producing the super-regenerative state are illustrated respectively by Figs. 1, 2, and 3, which figures indicate the general scheme of the system and the methods of varying the relation between the negative and positive resistance. Fig. 1 shows a method of varying the negative resistance produced by the regenerative system by varying the voltage of the plate of the amplifying tube by means of a second tube, the grid of the second tube being excited by an E.M.F. of suitable frequency.

Fig. 2 illustrates a method of varying the positive resistance of the circuit with respect to the negative. This is accomplished by connecting the plate

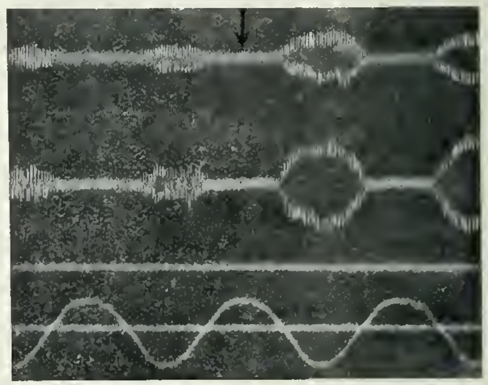


Fig. 8.

circuit of a vacuum tube in parallel to the tuned circuit of the regenerative system and exciting the grid by an E.M.F. of suitable frequency. Fig. 3 illustrates a combination of these two systems in which simultaneous variations are produced in both the negative and positive resistances and provision made for adjusting the relative phases of these two variations.

A general idea of the phenomena occurring in these systems when an E.M.F. is applied to the input circuit will be obtained from the diagram of Fig. 4, which applies specifically to the circuit of Fig. 1. This figure illustrates the principal relations existing in the system in which the positive resistance is constant and the variation is introduced into the negative resistance. It will be observed that the frequency of variation appears as a modulation of the amplified current so that the output circuit contains currents of the impressed frequency plus two side frequencies differing from the fundamental by the frequency of the variation.

Oscillograms of the essential current and voltage relations existing in the systems of the type illus-

* British Patent, 156,330.

trated by Figs. 1 and 2 were obtained with the apparatus connected as shown in Figs. 5 and 6, respectively. In the arrangement of Fig. 6, in order to produce sufficient variation in the positive resistance of the tuned circuit, which was of large capacity and low inductance, it was necessary to use a two-electrode tube in series with the auxiliary E.M.F.

Figs. 7 and 8 are oscillograms respectively for a negative resistance variation and a positive resistance variation. The signalling E.M.F. was impressed about half way along the film, the exact point at which the key was closed being indicated by the arrow. These oscillograms show phenomena which are in accordance with the explanations already given, but, in addition, show evidence of self excitation. It has been stated in the preceding pages of this paper that the basis of super-regeneration was the discovery that a variation in the relation between the negative and positive resistances prevented a system which would normally oscillate violently from becoming self-exciting. An examination of the oscillograms will show that this is not strictly true, as a free oscillation starts every time the resistance of the circuit becomes negative. It will be observed, however, that this free oscillation is small compared to that produced by the signal, and therein lies the complete explanation of the operation of the system. The free oscillations produced in the system when no signalling E.M.F. is impressed, must be initiated by some irregularity of operation of the vacuum tubes, and must start at an amplitude equal to the amplitude of this disturbance. This initial value is of infinitesimal order, and hence, in the limited time interval in which it can build up the locally excited oscillation, never reaches an amplitude comparable to the oscillation set up by a signal of any ordinary working strength.

phenomena involved will be analysed in a later part of the paper.

The rate of variation in the relation between the negative and positive resistance is a matter of great importance. It may be a sub-audible, audible, or super-audible frequencies. In radio

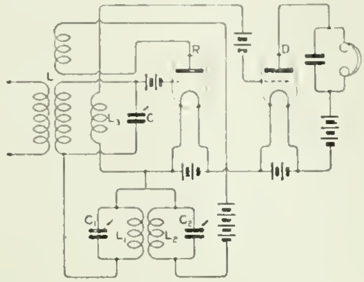


Fig. 11.

signalling, for the reception of telephony, the variation should be at a super-audible frequency. For modulated continuous wave telegraphy and spark telegraphy, to retain the tone characteristics of the signals, it must be well above audibility; for maximum amplification a lower and audible rate of variation should be used. In continuous wave telegraphy, where an audible tone is required, the variation is at an audible rate; where the operation of an indicating device is required, a sub-audible frequency may be best. The choice of frequency is a compromise, particularly in telephony, since obviously the lower the frequency the greater the amplification, and the higher the frequency the better the quality.

Some practical forms of circuits are illustrated by Figs. 9, 10 and 11, which illustrate respectively the three types of variation. Fig. 9 shows a method

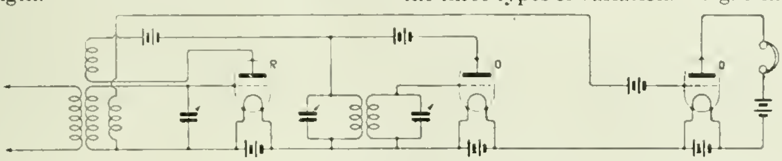


Fig. 9.

There is a second point of interest which is most evident from the curves of Fig. 7. It will be observed that there is a decided lag in the maximum value attained by the free oscillation set up by a signal and maximum value of plate voltage (negative resistance) of the amplifying tube. This is most evident from the plate current curve. It is a point of considerable interest, and the

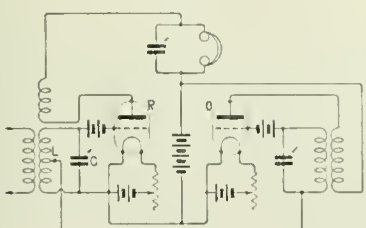


Fig 10

of varying the plate voltage of the amplifying tube *R* by means of the vacuum tube oscillator *O* coupled into the plate circuit. In this arrangement a third tube *D* acts as a detector. This is essential when an audible frequency is employed; when a super-audible frequency is used the telephones can be placed directly in the plate circuit of the amplifying tube.

Fig. 10 shows the second case in which the variation is introduced into the positive resistance of the tuned circuit. This is done by means of an oscillating tube *O*, the grid circuit of which is connected through the tuned circuit *LC* of the amplifying tube *R*. The variation in the resistance of the circuit is effected through the variation in potential of the grid of the oscillating tube. During that half of the cycle, when the grid of the oscillating tube is positive, energy is withdrawn from the tuned circuit in the form of a conduction current from the grid to the filament of the oscillating tube, thereby increasing the effective resistance of the circuit. During the other half of the cycle, when the grid of the oscillating tube is negative, no conduction current can flow through the grid circuit of the oscillating tube, and hence no resistance is introduced into the tuned circuit of the amplifying tube. In this case the amplifying tube serves also as the detector for any frequency of variation, as the tuned circuit forms a sufficiently good filter even for an audible frequency to prevent a disturbing audible tone in the telephones.

Fig. 11 illustrates the case of a simultaneous variation in both positive and negative resistances. This is accomplished by providing the amplifying tube R with a second feed-back circuit L_1C_1 and L_2C_2 adjusted to oscillate at some lower frequency, thereby introducing a variation in the negative resistance through the variation of the plate potential of the amplifier and a variation in the positive resistance by means of the variation of the grid of the amplifier. The proper phase relations between the negative and positive resistance are obtained by adjustment of the capacity of condensers C_1 and C_2 and the coupling between

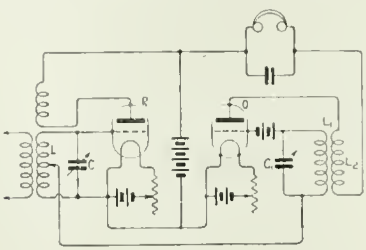


Fig. 12.

L_1 and L_2. In operation this system is very critical, and extreme care is necessary in order to obtain the super-regenerative state.

In each of the preceding cases the detecting function has been carried out either by a separate tube or by means of the amplifying tube. When a super-audible frequency of variation is employed, it is sometimes of advantage to perform the detecting function in the oscillating tube, and an arrangement for carrying this out is illustrated in Fig. 12. The operation of this system is as follows: incoming signals are amplified by means of the regenerative action of the amplifier tube R and the variations of potential across the tuned wave frequency circuit LC impressed upon the grid of the oscillating tube O. These oscillations are then rectified, and two frequencies are produced in the circuits of the amplifier tube. One of these frequencies corresponds to the frequency of modulation of the signalling wave. The other corresponds to the frequency of the variation and contains a modulation in amplitude corresponding to the modulation of the transmitted wave. This second frequency is then impressed upon the circuits of the oscillating tube with which it is in tune, amplified by the regenerative action of the system $L_1C_1L_2O$, and then rectified. The amplification obtainable with this form of system is considerably greater than that of the single amplification circuits, but is naturally more complicated to operate.

When a super-audible variation is employed in a system such as illustrated in Fig. 1, it is generally necessary to introduce a certain amount of resistance in the tuned circuit to insure the dying out of the free oscillation during the interval when the resistance of the circuit is positive. This is most effectively carried out by means of the arrangement illustrated in Fig. 13, in which a secondary coil L_1 of large inductance and high resistance is coupled to the tuned circuit LC and the energy withdrawn thereby from the oscillating circuit stepped up and applied to the grid of the tube. In the operation of this system, a curious phenomena is encountered. This is the manifestation of an inductive reaction by the plate circuit of the amplifying tube to the auxiliary frequency E.M.F. supplied the plate circuit by the oscillating tube, which comes about in the following way: When the auxiliary E.M.F. is impressed upon the plate of the amplifying tube, a current is produced in this tube in phase with the E.M.F. across the tube. Now suppose the plate voltage is at its maximum positive value. This means that the negative resistance of the circuit is a maximum in amplitude. This in turn means that the average value of the grid is becoming more positive and the current in the plate circuit is likewise increasing. Since the free oscillation in the system will increase in amplitude as long as the resistance of the circuit is negative, it will reach its maximum amplitude after the maximum positive voltage is applied to the plate. Hence the component of current corresponding to the frequency of the variation set up in the plate circuit by the rectification of the radio frequency oscillations lags in phase behind the auxiliary E.M.F. impressed on the plate. Hence the plate circuit of the tube manifests an inductive reaction to the auxiliary E.M.F. It was found that this inductive reaction could be tuned out by means of the parallel condenser C_1 with a great improvement in the stability of the operation of the system and increase in the signal strength. The resonance point is pronounced, and once the other adjustments of the system have been correctly made is as readily found as any ordinary tuning adjustment.

The problem of cascade amplification with these systems is a rather involved one on account of a great number of effects which are not encountered in ordinary methods of cascade amplification. The principal trouble is the reaction of the second

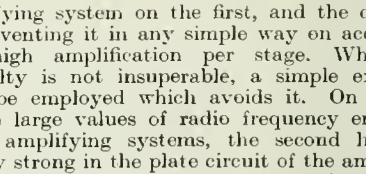


Fig. 13.

amplifying system on the first, and the difficulty of preventing it in any simple way on account of the high amplification per stage. While this difficulty is not insuperable, a simple expedient may be employed which avoids it. On account of the large values of radio frequency energy in these amplifying systems, the second harmonic is very strong in the plate circuit of the amplifying tube and is of the same order of magnitude as the fundamental if the tube is operated with a large negative voltage on the grid. Hence by arranging the second stage of a cascade system to operate at double the frequency and to amplify this harmonic, the difficulty is avoided. The general arrangement of such a system is illustrated by Fig. 14, in which the positive resistance of the circuits LC and L_1C_1 of a two-stage amplifier are varied synchronously by a single oscillator. The circuit L_1C_1 in this case is tuned to the second harmonic of the circuit LC, but the combinations of circuits which may be arranged on this principle are very numerous.

One of the curious phenomena encountered with the super-regenerative system is found when it is attempted to secure sharp tuning by the use of tuned circuits placed between the antenna and the amplifying system. The free oscillations set up in these circuits by the reaction of the amplifying system continue in these circuits during the interval when the resistance of the amplifier circuit is positive, re-excite the amplifier when the resistance becomes negative, and hence the entire system is kept in a continuous state of oscillation. The effect is most critical, and may be produced with most extremely weak couplings between the amplifier circuit and the second tuned circuit. The simplest solution of the difficulty is to perform the function of tuning at one frequency and amplification at another, and this is best accomplished by means of the super-heterodyne method illustrated by Fig. 15. This may be adapted to work on either the sum or difference frequencies, but when the higher frequency is used, care should be taken that it is not near the second harmonic of the local heterodyning current. In the particular arrangement illustrated, LCD represents, together with the heterodyne, the usual agency for changing the incoming frequency, and A represents the super-regenerative amplifier which may be of any suitable type.

Some of the results obtained in practice with super-regenerative systems compared to simple regenerative systems may perhaps be of interest. In general, it may be stated that the amplification which can be obtained varies with the frequency of the incoming signal and with the radio of the wave frequency to the auxiliary frequency. The higher the signalling frequency and the greater the ratio of this frequency to the auxiliary frequency, million times greater than that obtainable with a simple self-heterodyne circuit is readily secured. Where a super-audible frequency is used for the reception of telephone signals, amplification of fifty thousand to one hundred thousand times energy can be obtained.

In a practical way the relative amplication of the new system with respect to the standard

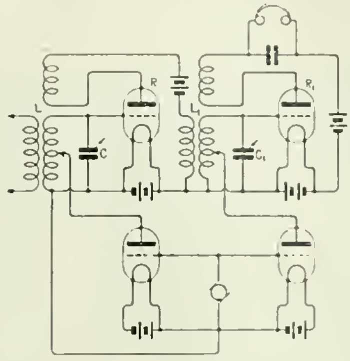


Fig. 14.

regenerative system for reception of telephone signals may be visualised as follows. With a signal so extremely weak that only the faintest of beat notes can be heard in the ordinary regenerative receiver, the super-regenerative receiver will give clearly understandable speech. For signals of sufficient strength to be understandable with the ordinary regenerative system with zero beat adjustment but not audible without local oscillations, the super-regenerative receiver will produce signals loud enough to be heard throughout the room.

Perhaps the most surprising characteristic of the system, apart from the amplification, is its selectivity with respect to spark interference when a super-audible frequency of variation is used. The explanation of this selectivity with respect, for example, to the ordinary regenerative receiver, lies in the periodic suppression of all free vibrations

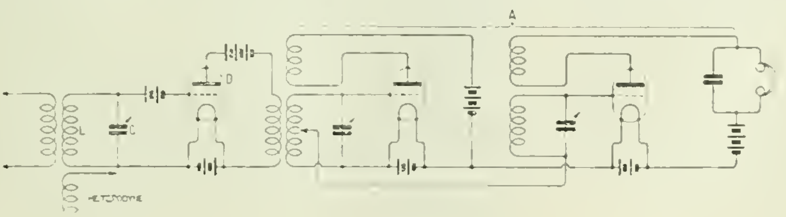


Fig. 15.

the greater the amplification. Other things being equal, it appears that the energy amplification varies as the square of the ratio of the signalling frequency to the auxiliary frequency. Hence it follows that for telegraphic signals where an audible auxiliary frequency is used, much greater amplification can be obtained than in the case of telephony, where a super-audible auxiliary frequency must be employed. Using the arrangement of Fig. 11 for a signalling frequency of five hundred thousand cycles, an energy amplification several

in the system. In the ordinary regenerative system spark interference approximates a form of shock excitation setting up a free vibration in the system which, because of the low damping existing therein, continues for a long period of time. An examination of the character of the oscillation set up will show that the energy existing in the free vibration after the initial impressed electromotive force is removed, is far greater than the forced vibration. In the ordinary system this free vibration may exist for a thousandth of a second or more. In the super-regenerative system this free vibration is damped out before it has proceeded more than one twenty thousandth of a second as a maximum. Hence the interference from spark signals is greatly reduced. This phenomenon opens up a new field for the suppression of interference produced by shock excitation.

At the present time, on a three-foot loop antenna located twenty-five miles from the station WJZ at Newark, New Jersey, and a system of the type illustrated in Fig. 12 with one stage of audio-frequency amplification (three tubes in all) the announcements and musical selections are clearly audible five hundred yards from the receiver. With the same loop at the same distance, using the arrangement of Fig. 11 without the separate detector tube, that is with the telephones directly in the plate circuit of the amplifier tube, it is possible to operate a loud-speaking telephone so that the programme from the Newark station is plainly heard through a large size room. The signals with the arrangements of either Figs. 11 or 12 are still heard loudly if the loop is discontinued from the receiver, the coils and wires of the receiver itself collecting sufficient energy to produce response.

While the new system does not amplify the ordinary spark signal with anything approaching its efficiency on continuous wave signals, one example of spark reception may be of interest. During the past winter an amateur spark station located at Cleveland, Ohio, and operating on a wavelength of about 340 metres was received nightly at Yonkers, New York, on a three-foot (1 metre) loop, and the arrangement of Fig. 13 with sufficient intensity to enable the signals to be read throughout the room.

In conclusion, I wish to express my very great indebtedness to Professor L. A. Hazeltine for much valuable aid in connection with the theoretical side and to Mr. W. T. Russell for his assistance throughout the experimental side of this development.

Broadcasting Commences.

The following statement was issued by the Broadcasting Committee on Monday, November 13th.

"Pending the formation of the British Broadcasting Company, which will be comp'eted in a few days, the Broadcasting Committee has decided to commence a limited nightly programme from the London Station. This will consist of two copyright news bulletins and official weather reports, broadcast at 6 and 9 p.m. on a wavelength of 360 metres.

"The first two bulletins will be broadcast to-morrow, Tuesday evening. Special messages indicating the progress of the General Election will be broadcast as received on Wednesday and Thursday evenings."

Broadcasting and the Lord Mayor's Show.

The accompanying photograph shows the interior of a Daimler car fitted with wireless receiving apparatus by the Marconi Company. This car took part in the procession of the Lord Mayor's Show on Thursday, November 9th. During the procession communications were sent from 2 LO (Marconi House) and being received on the car were broadcasted from a loud speaker in the car.

We understood from reports of the reception of these transmissions in different parts of this country that the band music of the procession was also distinctly audible during the time that the procession was passing in the neighbourhood of Marconi House.

The Receiving Set, which was connected to a frame aerial carried on the roof of the car.

Notes.

Manchester Society and Transatlantic Tests.

Manchester Wireless Society is conducting four special tests during November with a 1 kW. spark set. The times are from 1 a.m. to 7 a.m. G.M.T. each Sunday morning, the actual transmissions being for the duration of the first 15 minutes in each hour. **5 MS** is the call sign.

Six New Canadian Stations.

With the primary object of keeping Federal officials in touch with one another, six new wireless stations are proposed to be erected by the Government of the Dominions of Canada. The following sites are mentioned: Fort Smith, Fort Resolution, Fort Simpson, Fort Norman, Fort Macpherson (all Mackenzie River), and Dawson City.

Messages from Amundsen.

It is reported that the arrangement with Captain Amundsen and a chain of wireless stations for the transmission of daily messages has not been carried out. Amundsen's ship, the "Maud," was to transmit via Nome, Alaska, and the East Coast of America, to the Eiffel Tower. Messages were to be received by the Norwegian Meteorological Institute from October 15th onward. A few messages were received, and have been duly passed on by the Eiffel Tower. Investigation is being carried out with a view to finding the break in the chain.

Glasgow Exhibition.

A highly successful exhibition was held by the Glasgow and District Radio Club, in the McLellan Galleries, Sauchiehall Street, Glasgow, on Saturday, November 4th. The special features were the large Trade Show, the latest apparatus being exhibited by about twenty firms, the local firms being very prominent. The Club Members' Show was also fairly large, all types of ancient and modern apparatus were on view, and the workmanship of some was of high order.

Special transmissions from Paris and Northolt were received at 4 and 7 p.m., both wishing the Club every success. The set used for the reception of these messages was built by one of the Club members who is totally blind. It is in the form of a bureau with lid, and has a three-valve set containing one H.F., one detector and one L.F. The workmanship and general finish of the set is splendid, and gives particularly good signals.

Concerts were transmitted at regular intervals all day from an adjoining hall, and received in loud speakers and head phones at a number of the exhibitors' stands in the main hall. By 3 o'clock the hall was so packed that it was found necessary to stop admitting visitors for a short time. Professor Howe's lecture on "Wave Transmission" was a great success.

During the day about 100 names were taken, practically doubling the Club membership.

The office bearers and Committee beg to thank all members and others who contributed to the success of the exhibition, especially the artistes who so kindly gave their services in the transmitting room.

An Interesting Photograph.

The photograph on this page shows Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, with Mr. Thomas A. Edison. Dr. Steinmetz is showing his fellow

Dr. Charles P. Steinmetz and Thomas A. Edison examining a shattered High-Tension Insulator.

scientist some broken porcelain insulators and broken pieces of a tree limb which a few minutes before he had shattered during special high voltage tests. The demonstration took place on October 18th, at Schenectady, during Edison's first visit in 25 years.

Royal Air Force Wireless School and Squadron.

A Re-Union Dinner for Past and Present Officers of the Wireless School and Squadron will be held at the Holborn Restaurant, London, at 7 p.m. for 7.30 on Wednesday, December 6th, 1922. Full particulars and tickets, price 15s., may be obtained from F/O E. Taylor, Electrical and Wireless School, R.A.F., Winchester, Hants.

Public Demonstration at Birmingham.

At the Solihull Public Hall, Birmingham, on November 18th, a public demonstration of telephony is being given in aid of Solihull Allotment Holders' Association and the *Birmingham Mail* Christmas Tree Fund.

Mr. A. P. M. Fleming at the Manchester School of Technology.

Mr. A. P. M. Fleming lectured before an audience of over 600 on November 3rd at the Manchester School of Technology. His subject was "Radio Telephony, with Special Reference to Broadcasting."

Calendar of Current Events

BROADCASTING.—An important announcement concerning the commencement of Broadcasting appears on p. 240.

Friday, November 17th.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "Valve Control," by Mr. W. F. Ellis.

SUTTON AND DISTRICT WIRELESS SOCIETY.

At the Sutton Adult School, Benhill Avenue. Demonstration in aid of London Hospitals. Transmissions by Marconi House, at 5 to 7 p.m.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

At 7.0 p.m. At the Grammar School. Lecture on "Inductance and Capacity," Part 1, by Mr. W. G. Marshall.

BRADFORD WIRELESS SOCIETY.

Cinema Display.

Sunday, November 19th.

Daily Mail Concert from the Hague, 3 to 5 p.m. on 1,085 metres.

Monday, November 20th.

ILKLEY AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At Regent Café. Lecture on "Maritime Wireless Communication," by Mr. D. E. Pettigrew.

NORTH LONDON WIRELESS ASSOCIATION.

Lecture on "Telephone Headgear: Constructional," by Mr. H. Norman Wilson.

Tuesday, November 21st.

Transmission of Telephony at 8 p.m. on 400 metres, by 2 MT Writtle.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.

At the Technical School. Lecture on "The Armstrong Super-Regenerative Circuit." by Mr. P. Arberry.

RADIO SOCIETY OF BIRKENHEAD.

At 8 p.m. At 36, Hamilton Square. Opening meeting and Demonstration.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.

Lecture and Demonstration on the "Armstrong Super Circuits," by Messrs. Burcham and Garrood.

Wednesday, November 22nd.

WIRELESS SOCIETY OF LONDON.

At 6 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Special Meeting to consider change of name, and other business. Following, Mr. G. G. Blake will give a short paper on "A Mechanical Model Illustrating the Action of the Three-Electrode Valve." Mr. Maurice Child will also give a short paper on a "Five-Valve Selective Amplifier."

MANCHESTER WIRELESS SOCIETY.

At 7.30 p.m. In the Council Chamber, Houldsworth Hall. Discussion.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.

At 111, Station Road, Redhill. Lecture on "Operating," by Mr. Ross.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.

At 7.30 p.m. Lecture.

MALVERN WIRELESS SOCIETY.

Lecture on "Electro Magnetism and Inductance," by Mr. H. J. B. Martin.

Thursday, November 23rd.

LUTON WIRELESS SOCIETY.

At 8 p.m. At Hitchin Road Boys' School. Practical Work and Experiments.

NEWCASTLE AND DISTRICT AMATEUR WIRELESS ASSOCIATION.

At 7.30 p.m. At Armstrong College. Lecture on "The Singing Arc," by Dr. Thornton (Members of other local societies welcome).

DERBY WIRELESS CLUB.

At 7.30 p.m. At "The Court," Alvaston. Lecture on "H. F. Currents," by Mr. F. J. Allen.

Friday, November 24th.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

At 8 p.m. Demonstration of "Burndept Apparatus," by Messrs. Townend and Phillips.

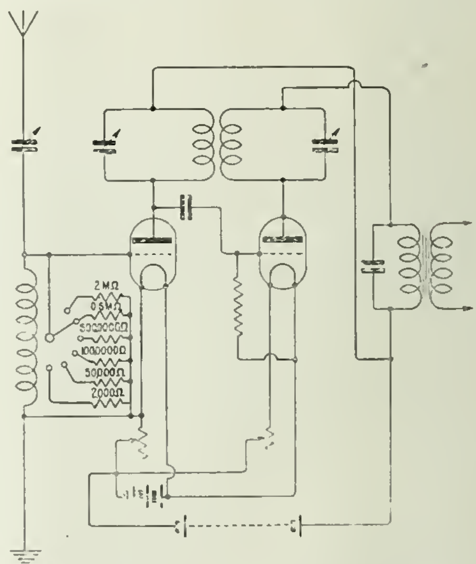
WIRELESS SOCIETY OF HULL AND DISTRICT.

At 7.30 p.m. Sale of Surplus Apparatus at the Signal Corps H.Q., Park Street.

Correspondence

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I believe the simple circuit shown will be helpful to many of your readers who possess powerful receiving sets.



Capt. Wood Smith also shows the leak circuit connected between the aerial and earth leads.

These multivalve sets, admirably adapted for the reception of weak signals and telephony, are hard to reduce in tone volume (and sometimes oscillation) when receiving powerful transmissions at short distance. R. F. WOOD SMITH, F.C.S.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter in the exact form in which they are to appear and as concise as possible, the Editor reserving the right to edit and curtail the reports if necessary.
The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.
Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Fulham and Chelsea Amateur Radio and Social Society.*

Hon. Secretary, Mr. R. Wood, 48, Hamble Street, Fulham, S.W.6.

The attendance on October 24th was very satisfactory. New members continue to enroll.

The Secretary gave the members a diagram of a single valve circuit that produces louder signals and is devoid of all "howl," the oscillations themselves being hardly audible.

A short but interesting lecture was given by Mr. Hubbard, a member, on "Elementary Electricity." The remaining part of the evening was devoted to humorous wireless stories ranging from "Firegrate Aerials" to "Dustbin Earths."

Total membership now numbers 87.

HALIFAX EXHIBITION.

A corner of the Exhibition Room.

Wireless Society of Hull and District.*

Secretary's Address, 79, Balfour Street, Hull.

There was only a fair attendance at the monthly Questions and Answers evening, October 27th.

Mr. Hy. Strong (acting Vice-President) was in the chair. Routine business was transacted, and matters arising from written questions discussed. The question of the restriction of reacting circuits directly coupled to the aerial was considered, and the opinion of most members was that the Phillips rejector circuit was a good one to use. By request the Chairman made a rough blackboard sketch of this circuit. Other questions were satisfactorily dealt with. Two new members were elected during the evening, bringing the present membership to over 80. The Society consider that the number should be at least 200, and that it would pay every experimenter to join.

Members are specially asked to note that on November 24th a sale of members' surplus apparatus will be held at 7.30 p.m.

In view of a suggestion of the Wireless Society of London with regard to a change of name and constitution, the question of obtaining a supply of printed rules and membership cards is in abeyance pending further information on this point.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

At the Erith Technical Institute on Friday, October 27th, the ninth general meeting was held.

Morse instruction and practice preceded a short lecture on "Graphs and their Application," by Mr. T. E. Morriss. Mr. S. Burman also spoke on "The Detector and Low Frequency Unit," giving many valuable hints on the practical construction of this unit.

North London Wireless Association.*

Assist. Hon. Secretary, Mr. Frank S. Angel, Northern Polytechnic, Holloway Road, N.

On October 23rd, a lecture was delivered by Mr. Power on "Microphones."

Commencing with a description of the early instruments such as the Bell type and those making use of loose contacts between metal rods or carbon pencils, he proceeded to describe the various improvements which had led up to the instruments of to-day.

Mr. Power had brought with him several kinds of modern microphones, including inset and solid-back types, which he took to pieces and passed round for inspection, at the same time explaining their construction and action.

Several questions were asked by members and answered by the lecturer, who received a vote of thanks.

At a meeting on October 30th Mr. Reading delivered an interesting lecture on Short Wave Aircraft Sets in use at the time he was in the Air Force.

The speaker divided his lecture into three parts —Transmitters, Receivers and Amplifiers—each of which he treated very fully, giving diagrams of all circuits used and details of the results obtained with them.

The transmitters described were all of the spark type, some being excited by batteries and some by alternators. In many cases tuning was effected by fixed condensers.

The receivers demonstrated were all crystal receivers in which provision was made for the addition of L.F. valve amplifiers.

Two types of amplifiers were shown by Mr Reading—a three-valve L.F. resistance capacity coupled amplifier, and one using iron-cored transformers. The latter was found to be the most efficient.

The following lectures have been arranged :— Monday, November 27th, "Elementary Principles of Radio Telegraphy and Telephony III," Mr. F. S. Angel. Monday, December 4th, "The Mark III Tuner and its Adaption to Various Circuits," Mr. G. D. Meyer. Monday, December 11th, "A Compact Receiver," Mr. L. Hirschfeld. Monday, December 18th, "Elementary Principles of Radio Telegraphy and Telephony," IV, Mr. F. S. Angel.

A special section of the Association has been formed for juniors up to the age of 18, the annual subscription to which is 5s. per annum.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 18, Melford Road. S.E.22.

At the Central Hall, Peckham, on November 1st, the Vice-Chairman, Mr. Sam Middleton, opened the proceedings with buzzer instruction. The new members showed commendable progress.

Mr. Chapman, of the staff of *Amateur Wireless*, gave some exceptionally good hints on the erection and use of short aerials and direction finding apparatus, and other members joined in the debate.

Mr. Voigt, member, discoursed on ebonite dielectrics in variable condensers and charging batteries off direct current mains. The Chairman and the Secretary took part in the latter part of the debate.

Many new members are joining.

Wolverhampton a District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Gt. Brickkiln Street, Wolverhampton.

At the meeting on October 25th, a most instructive lecture was given by Mr. Harvey-Marston on "Transmission." The lecturer brought forward many interesting points and covered a wide area in the limited time at his disposal. Mr. Marston made a special feature of small power transmission, which proved of great value to the many experimenters present. Very lucid diagrams were used, and the discussion following was exceedingly beneficial.

The Society hopes to secure the services of Mr. Harvey-Marston again in the new year.

Sheffield and District Wireless Society.*

Hon. Secretary, Mr. L. H. Crowther, 18, Linden Avenue, Woodseats, Sheffield.

The second meeting was held on November 3rd, when an exhibition of cinematograph films, kindly lent by The Western Electric Co., Ltd , was shown in the Mappin Hall at the University, Sheffield, to a large audience.

The films, which were of an educational character, were entitled "The Audion" and "Telephone Inventors of To-day."

The meeting was presided over by Mr. F. Lloyd, the new President, and a vote of thanks was passed to Messrs. The Western Electric Co., Ltd.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

On October 27th Mr. Calver described his visit to the meeting of the Wireless Society of London, and pointed out the benefits derived by affiliation. He also drew attention to the appeal from St. Dunstan's for assistance to the blinded soldiers in matters relating to wireless. It was proposed that the Secretary write to Capt. Ian Fraser, and also the local Secretary, offering to assist any local member of St. Dunstan's in wireless matters by putting him in communication with one of the members residing nearest, also the Society offers free membership.

Mr. Houstoun had on view a very compact three-valve set, and during the interval of winding a frame aerial Mr. Calver gave a graphic description of the daylight signalling apparatus used during the war. He also explained a code system, and went on to give a few of his experiences of wireless work during the war.

The membership is still on the increase, and now the Technical Committee has been formed it is hoped in a very short time to have an experimental unit set of such a design that members can try out any wiring scheme they wish.

Stoke-on-Trent Wireless and Experimental Society. *

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At the Y.M.C.A., Hanley, on October 26th, details of an interesting competition were announced. Mr. Bew, a member, offered a prize of wireless apparatus to the value of £1. Latest date for receiving entries is November 16th.

It is proposed to form a buzzer class from 7 p.m. to 7.30 p.m. on Thursdays.

A variable condenser was constructed, and some coils wound the following week.

Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

The social evening on October 30th, when about 140 people were present, was a great success. The M.C. was Mr. Macdonald Brown. The dance band was excellent, a special vote of thanks being given to them as they had given their services entirely free, and also to several excellent artists whose services made the evening the success it was. There were several musical transmissions received on a four-valve set kindly brought up by Mr. Cannon, music from **2 OM**—**2 OM** being clearly heard all over the hall—transmitted specially to the Society and his music was excellent. Mr. Heppel arranged refreshments, the service of which was excellent. Another social evening is being arranged. An Experimenter's Licence for the Society has now been obtained, and the work of making a set and of erecting a permanent aerial is being started at once.

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

At the Grammar School on October 20th, a lecture entitled "Diagram Interpretation" was delivered by the Hon. Secretary. The lecturer explained the numerous difficulties that beset a beginner where circuit diagrams were concerned, and how these could be greatly reduced by strict standardisation of symbols. Symbols were sketched and explained, and combined to form simple crystal and valve receiving circuits. The diagrams were then extended to valve and crystal combinations, two and three-valve sets, etc., the function of each component being briefly explained. A diagram submitted showed a five-valve set, four different types of intervalve coupling, with a separate heterodyne for beat reception of C.W. Discussion followed, and the Hon. Secretary was accorded a hearty vote of thanks.

A general meeting was held on October 27th, Mr. T. Brown Thomson taking the chair. Six new members were then elected. Mr. H. F. Yardley, M.I.R.E., Managing Director of the British Wireless Supply Co., Ltd., gave a demonstration of "Britwire" apparatus.

Mr. Yardley was received with loud applause. Music was received from the amateur experimental station (**2 LA**) on a multi-valve set and a Magnavox loud speaker. The music, etc., was clearly audible up to 100 yards distance away. During the intervals of the transmission, numerous "Britwire" products were submitted to the meeting for examination. The apparatus included the Mark I tuner, the Mark III three-valve receiver, the Mark IV four-valve receiver, "Britwire" L.F. magnifiers, coils, etc.

Mr. A. M. Bage (President) proposed a vote of thanks to Mr. H. F. Yardley and his assistants, this being duly carried, after which Mr. A. F. Carter, A.M.I.E.E., was elected Chairman at the next general meeting.

Woolwich Radio Society.*

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

At the Woolwich Polytechnic on October 27th, in a lecture room kindly lent by the Governors, the monthly meeting was held, there being a good attendance, including several welcomed visitors. Mr. McPherson, B.Sc., Chairman, introduced Mr. Bartle, of Blackheath (**2 LT**), who lectured on "Broadcast Reception." First taking aerials, he said that the most efficient aerial for broadcast reception was a single wire 60 ft. long for earth; a counterpoise wire strung round the garden fence was even better than the usual waterpipe earth. He also showed how the gaspipes or electric lighting wires could be used, and were extremely efficient—second only to an outdoor aerial. Then simple valve circuits were touched upon, the lecturer insisting upon the necessity of amateurs preventing their sets from oscillating while receiving telephony, and showing how one could tell if their set was oscillating or not. Then the Armstrong Super-Regenerator was dealt with, illustrated by a very beautiful and neat set that Mr. Bartle had constructed and brought with him. He showed on the blackboard the current employed, and gave constructional details and figures for the various components. He used with it a frame aerial—9 turns of spaced wire on a 26-in. loop. Though the high-pitched whistle characteristic of this circuit was easily obtained, it completely refused to amplify telephony, and it was not possible to form any idea of its power. Later, telephony was obtained on an Ethophone II, kindly lent by Messrs. Burndept. Questions were answered by Mr. Bartle, who was then accorded a hearty vote of thanks.

Weekly meetings of the Society are held at headquarters, Y.M.C.A., Thomas Street, every Wednesday evening at 7.30.

Mr. Houghton's elementary talks to beginners on the construction and manipulation of simple crystal and valve sets are being continued weekly from 8 to 8.30 p.m.

The recent sale of surplus gear was very satisfactory.

Newport and District Radio Association.*

Hon. Secretary, Mr. Edward R. Brown, 92, Corporation Road, Newport.

On October 26th, Mr. H. W. Winslow (Newport) gave illustrations of the various methods of jointing. He showed that although "soldering" and "jointing" seem somewhat elementary, it is surprising how different they appear after being carried out by a practical hand, and how easy it is to throw out of gear a whole instrument by the lack of knowledge or care upon some very small matter in this respect.

It was clearly indicated to the members that other evenings could be well spent by similar demonstrations.

This Association has now been affiliated with the Wireless Society of London.

Ilkley and District Wireless Society.*

Hon. Secretary, Mr E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

A well attended meeting of the above Society was held on October 23rd, at the Regent Café, Ilkley. The minutes of the previous meeting were read, and a new member enrolled.

Mr. L. E. Overington addressed the meeting on the subject of "Electro-Magnetic Induction."

The assembling of the Society's receiving set is well in hand, and it is hoped to have it in working order by next month.

A good programme of lectures has been drawn up for the next few months, and a particularly interesting announcement will be made in the near future.

Halifax Wireless Club and Radio Scientific Society.

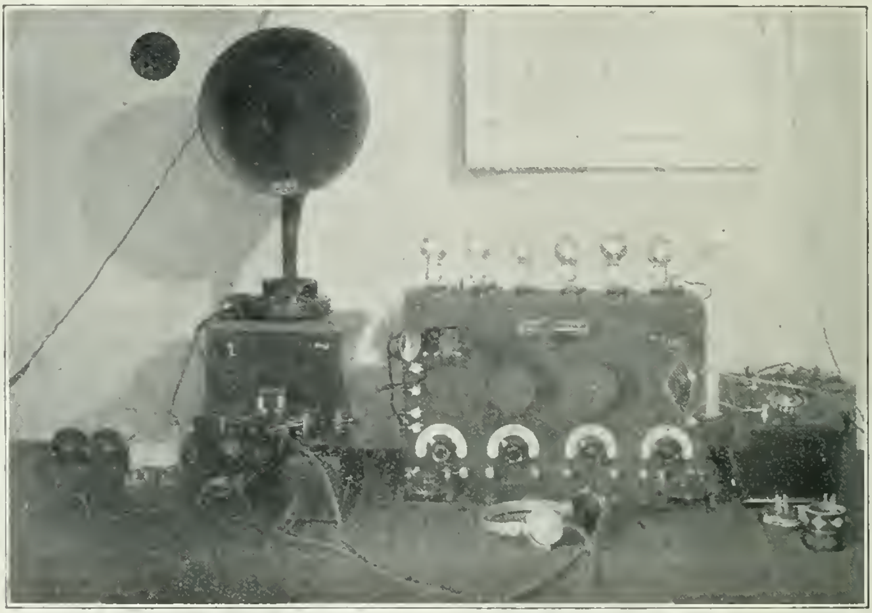
Approximately 800 people visited the exhibition held last month. Thanks are due to the Stewards, especially Messrs. L. H. Carter and H. Alroyd, also to **2 QK, 2 AW** and **2 YF.**

Mr. H. W. Sullivan sent a splendid collection of high-class components. Exhibits were sent from the following firms :—Radio Instruments, Ltd., The Mainwright Manufacturing Co., Wates Bros., The Barlow Engineering Co., Hart Accumulator Co., E. E. Rosen & Co., The General Electric Co., Marconi-Osram Lamp Co., Western Electric Co., S. G. Brown, Ltd., Burndept, Ltd.. The Wireless Press, Ltd., and the Radio Press, Ltd. Two local dealers, The Electrical Supply Stores and Denison Bros., also exhibited.

Membership of the Club is conditional on abiding by the terms of the P.M.G. licences as amended from time to time

Mr. P. Denison is preparing diagrams of receiving sets which do not contravene the regulations and

HALIFAX EXHIBITION.



The Short Wave Receiver specially built for the Exhibition by Mr. J. R. Clay, Treasurer of the Club. Received the Marconi House Transmission perfectly at 200 miles away. (The two coils in the coil holder are not primary and resistance.)

these are to be circulated among the members

A lecture is to be given by Mr. J. R. Halliwell on November 22nd, at 7.30 p.m.

Malvern Wireless Society.

Hon. Secretary, Mr. N. H. Gwynn Jones, Burford House, Gt. Malvern.

A good attendance marked the opening of the Society's first meeting on October 25th at the Drill Hall. A lecture was given by Mr. L. H. Mansell on "The History and Progress of Wireless."

He touched upon the earliest discoveries of Hertz, Marconi's early experiments and the rapid strides which have since been made. Pioneer apparatus, coherers, crystals, etc., were exhibited.

An excellent demonstration was given with the help of another member, Mr. M. Jeynes, on Mr. Mansell's five-valve set and loud speaker.

Mr. R. Green then gave a talk on the easiest way of learning Morse. Great interest was displayed by the lady members present.

Mr. Mansell-Moullin, F.C.S., the Society's Vice-President, was heartily welcomed.

The Society has had an aerial and fittings presented to them by Messrs. L. H. Mansell and M. Jeynes, and hopes to have the set of apparatus at an early date.

Meetings are to be held each Wednesday evening at 8 p.m , at the Society's headquarters at the Drill Hall, Albert Road.

Membership to date totals 57.

The second meeting was held on November 1st, when Mr. R. Green lectured on "Wave Motion in Air, Water and Æther," illustrated with blackboard diagrams.

Dewsbury and District Wireless Society.

Hon. Secretary and Treasurer, Mr. A. Horsfall, Willow Grove, 34, Lee Street, Ravensthorpe.

The winter session first lecture took place on October 12th. Mr. F. Dransfield, B.Sc., of Dewsbury, spoke on "Capacity." Discussion followed.

On October 19th, Mr. J. Bever, of Bradford. (2 QK) lectured on "The Electron Theory and the Thermionic Valve."

On November 4th, 6th and 7th, a Wireless Exhibition and Demonstration was held in the Moot

Hall. Various wireless receiving sets, both professional and amateur made, were exhibited.

Mr. Skinner, of Batley, lectured on November 9th, on "Inductance."

Nottingham and District Radio Experimental Association.

Hon. Secretary, Mr. D. F. Robinson, 99, Musters Road, West Bridgford, Notts.

On October 26th, the Chairman, Mr. J. Thornton, announced the resignation, for business reasons, of the Hon. Secretary, Mr. F. E. Bailey. The members expressed their regret, and a very hearty vote of thanks for his services was proposed and carried with enthusiasm.

The following appointments were made :—Hon. Secretary, Mr. D. F. Robinson ; Assist. Hon. Secretary, Mr. Old.

Three short papers were given by Messrs. Ley, Gill and Thornton on "The New Method of Reception."

Great stress was laid upon the point that amateurs must follow the P.M.G.'s new regulations.

Mr. N. Jackson Ley showed a method of reacting upon a novel type of plug-in H.T. transformer, and gave full particulars as to windings, etc.

Mr. J. H. Gill explained his method of H.F. aperiodic coupling using a reaction coil, and suggested an interesting line of experiment.

Mr. J. Thornton gave full particulars of a circuit which he was using with excellent result. An interesting discussion followed.

The Chairman announced that the receiving set was practically complete, and reminded members that the new headquarters were Bennett's Garage, Shakespeare Street, from November 2nd.

Proposed Society at Lee.

Mr. A. H. Kidd, A.M.Inst., R.E., "Woodlands," 39, Burnt Ash Road, Lee, S.E.12, asks for correspondence from amateurs in his district who are willing to co-operate in the formation of a Society.

East Ham and District Amateur Radio Society.

Hon. Secretary, Mr. W. Vice, 5, Thorpe Road, East Ham.

A meeting was held at 709, Manor Park, Broadway (over Lipton's shop) with the result that a new Society has been formed to take the place of the club previously held at that address.

Mr. Judge was elected Deputy Chairman ; Mr. Vice was unanimously elected Secretary. A Committee was elected, and business was discussed with encouraging results.

It was decided to hold a meeting at the same address on November 1st to discuss the Club set.

The membership is at present about 25.

The Committee wish it to be known that this club has no connection with the Radio Supply Shop at that address.

The club-rooms are open each evening from 8 till 10 p.m. Meeting night every Wednesday at 7.30.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. Moore, 175, Leavesden Road, Watford.

This newly-formed Society commenced activities on October 30th.

An aerial has been erected at the Society Room, the National Schools, Watford, and apparatus loaned by members was used for demonstration purposes.

The Society has a membership of nearly 40, and it is desired to still further increase this number.

Clapham Park Wireless Society.

Hon. Secretary, Mr. J. C. Elvy, A.M.I.E.E., 3, Fontenoy Road, Bedford Hill, S.W.12.

The Ninth General Meeting was held at Headquarters, 67, Balham High Road, at 7.30 p.m. on Wednesday, October 25th, 1922.

The Hon. Secretary made a very interesting announcement to the effect that he had received definite acceptance of tho Presidency of the Society by Sir Alfred Butt.

Members present vociferously manifested full appreciation, and expressed confidence as to the welfare of their Society in such able hands, and look forward to the time when general election activities will allow of their formally installing Sir Alfred in the Chair.

Mr. J. H. Daniels is to present to the Society a single valve panel, and Mr. M. P. Prout a valve for same, together with head-phones.

The Hon. Secretary reported that he had been in telephonic communication with Mr. Leslie McMichael, of the Wireless Society of London, regarding expediting of affiliation.

The Chairman then called upon Mr. F. H. Haynes, who gave a description, illustrated by diagrams and apparatus he had brought for the occasion, on "The Building of an Amateur Three-Valve Receiving Set."

Mr. Haynes dealt very fully with the operation and construction of every component, and explained in detail the reasons for recommending the circuit arrangement he described. A keen interest was taken in certain types of apparatus employed. The lecturer connected up a set to the particulars he gave as he proceeded with the explanation of the action of the various parts. The circuit embodied a loose coupled aerial circuit with tuning condensers, high frequency amplifier, using the "tuned anode" arrangement and detector valve, followed by a low frequency amplifier.

The discussion that followed was entered into by the Chairman, Mr. Beedle, Mr. Daniels, the Hon. Secretary, the Hon. Treasurer, Mr. R. H. J. McCue, Mr. C. D. Richardson, and Mr. Hurst.

A very hearty vote of thanks to the lecturer concluded.

An interesting impromptu discussion arose at the conclusion of the evening's programme, which affects all wireless enthusiasts, namely, the formation of a Society distinct from the Wireless Society of London, but promoted probably by manufacturers and others having commercial interests, and likely to bring into conflict the interests of the true experimenter and the manufacturer.

Southwark Wireless Telephony Association.

Hon. Secretary, Mr. W. Helps, King's Hall, London Road, S.E.1.

The first meeting of the month was held at headquarters, on October 1st, when Messrs. A. O. Gibbons and Winstone gave a very instructive lecture, illustrated by slides, on "Elementary Wireless." Interesting discussion followed. A vote of thanks to the lecturers concluded the meeting.

The second meeting of the month was held on October 15th, when Mr. Dibben gave a lecturette on the functions of a condenser, also aerials and their faults, followed by discussion.

Portsmouth and District Amateur Wireless Society.

Hon. Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

Mr. Gull, on October 25th, gave his lecture on "Broadcasting." He dealt with the present regulations made by the Postmaster-General, and various diagrams were drawn to demonstrate the requirements. Mr. Gull further explained the various American methods of receiving, and drew diagrams to illustrate how a first-class set could be made, although keeping within the regulations. An interesting talk followed, and an animated discussion arose as to the various methods that could be employed should any person have the intention of defrauding the P.M.G. or his inspectors. A further discussion arose with regard to licences, and it was gratifying to note the number of members who preferred experimenting licences, and were not merely taking up the cult of wireless for the sake of the long-delayed broadcasting concerts.

Hornsey and District Wireless and Model Engineering Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

A meeting of the above Society was held on October 16th, and was largely attended. One of the members brought his set to the club for the purpose of demonstrating the possibilities of a single valve receiver. The meteorological report from **GFA** at 8 o'clock was utilised as practise in Morse reception, and later some musical telephony from **2 ON** and **2 KT** was received, this being particularly enjoyed by new and prospective members.

At 9 p.m. the club "went into committee" for the purpose of general business. It was decided to raffle a crystal set made by one of the members in order to raise extra funds for the purchase of the club's set. An interesting discussion followed on the subject of "Broadcasting and its relation to the Amateur Experimenter."

Several new members were enrolled. Applications for membership are cordially invited by the Hon. Secretary, who will be pleased to send full particulars on receipt of stamped addressed envelope.

Meetings were held on October 20th and 23rd. Both meetings were well attended. On the 20th Mr. H. J. Pugh lectured on "Magnetism and Electricity as Applied to Wireless." On the 23rd a short lecture was given by Mr. Hunting on "The Morse Code," dealing in detail on its many and varied uses.

Afterwards members practised in sending and reading. Several new members were elected.

It is not necessary to be in possession of a licence or wireless apparatus, or have a good knowledge of wireless before joining this Society. A stamped envelope should accompany request for further particulars.

Felixstowe and District Radio Society.

Hon. Secretary, Mr. E. Cork, 3, Highfield Road, Felixstowe.

This recently-formed Society held its first annual general meeting on November 4th at Headquarters, St. Andrews' Hall, Gainsboro' Road.

The agenda included adoption of rules for constitution of Society and election of officers for the year.

A very interesting and enthusiastic time passed all too quickly. The winter programme is now being carried out. The Club hope shortly to get a receiving licence and install a club set.

The Hon. Secretary will be pleased to get in touch with wireless amateurs in the district.

Bromley Radio and Experimental Society.

Hon. Secretary, Mr. J. Fergusson-Croome, "Gowrie," Wendover Road, Bromley, Kent.

The Society now holds its weekly meetings at the Ex-Services Club, London Road, Bromley, where an aerial has been erected.

A meeting was held on Monday, October 23rd, when a four-valve set designed by Mr. L. R. Stephens was demonstrated. Music was received by a "Brown" microphone amplifier and loud speaker.

A Morse class was conducted by Mr. L. F. Allen. The Society's membership is 50 strong.

York Wireless Society.

Hon. Secretary, Mr. A. E. White, The Grand Buildings, Clarence Street, York.

At a Committee meeting held on October 17th, it was proposed to run a series of lectures on "Wireless Telegraphy and Telephony" on the first Tuesday of each month during the winter.

A lecture was given on "Wireless Telegraphy, its History and Development," by Mr. V. O. Newton, York, at 7.30 p.m., in the Grand Café, Clarence Street, on November 7th.

Taunton School Radio Society.

Hon. Secretary, Mr. H. W. Hamblin, Taunton School, Taunton.

An inaugural meeting of the above Society was held at Taunton School on October 17th. There were about 40 people present.

The following gentlemen were duly elected for the coming session :—Chairman, Mr. D. Pean, B.Sc. ; Hon. Treasurer, Mr. A .E. Viccars, B.Sc. ; Hon. Secretary, Mr. H. W. Hamblin.

The first formal meeting of the Society was held on October 24th ; there was an attendance of 42 members.

The Headmaster, Mr. H. Nicholson, M.A., kindly accepted the position of President. Mr. J. C. Tyler was duly elected Vice-Chairman; a Committee of five members was also elected.

The proceedings terminated with a lecture upon "Waves," by the Hon. Secretary.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. Arthur I. Dabbs, 315, High Road, Ponders End.

The question of affiliation to the Wireless Society of London was discussed on October 26th, and it was decided to take a referendum of every member of the Society on the subject.

Members are making good progress in Morse practice, and the Society's three-valve set is now installed and is in good working order. Most of the evening was spent in working and experimenting on the set and discussions on items of general interest.

The Society has been of assistance in helping members over licence questions.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"DOLLY TREBOR" (Cornwall) *asks* (1) *Number of turns required for honeycomb coils to tune with* 0·001 *mfd. condenser from* 1,000-30,000 *metres.* (2) *Size of wire.* (3) *Wavelength range of coils.* (4) *Which is most efficient method of H.F. amplification (a) for short waves; (b) for long waves.*

(1) and (3) You will require 6 coils. Wind the smallest coil with 40 turns, and the largest coil with 500, and the others in proportion. We cannot say exactly, because the method of winding spacing, etc., are deciding factors. (2) No. 28 D.C.C. wire is rather fine for the smaller coils, but you should try it. (4) Reactance capacity coupling will be found most efficient for all wavelengths, but it is more convenient from the point of view of minimum adjustments to use resistance capacity or wavelengths above 2,000 metres.

circuit is not permitted, we suggest you couple the reaction coil to the tuned anode coil. No electrical connections need be altered, only the coupling need be shown. The circuit is to be thoroughly recommended for wavelengths in the neighbourhood of 400 metres, and we would advise you to use the tuned anode arrangement up to a wavelength of about 2,000 metres. Above this wavelength use the resistance capacity connection. We do not recommend the use of resistance capacity for wavelengths so low as 500 metres. The values of the condensers in your diagram are correct. The anode resistance should be of the order of 70,000 w.

"F.A.P." (Walton).—The connections shown in Fig. 8, page 812, September 16th issue, will meet your requirements.

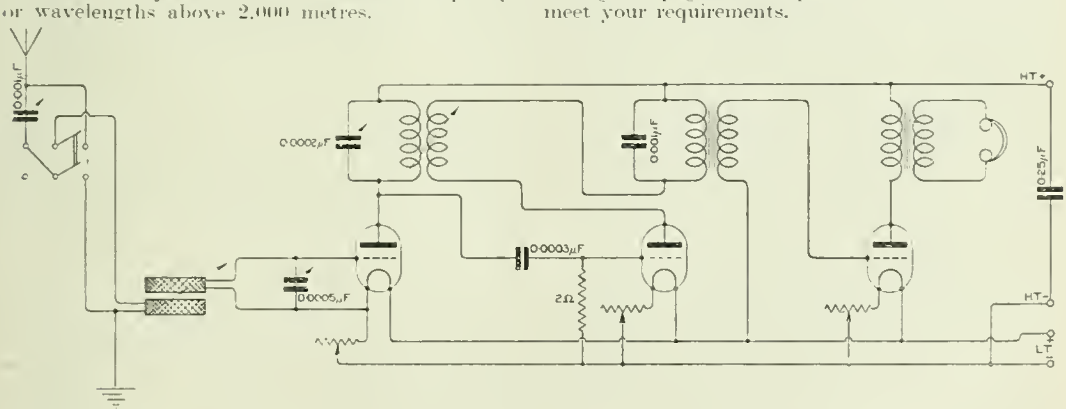


Fig. .

"SOTTO VOCE" (Dartford) *asks for a three-valve circuit with loose coupler.*

See Fig. 1. The H.F. amplifying valve has a tuned anode, and you will find the three-valve combination shown very effective.

"V.H.B." (Hampstead).—We have examined the diagram submitted, and we consider it is quite suitable. We suggest you apply for an experimenter's licence, submitting the diagram, which we think will meet with approval. If the

"C.O.B." (Manchester).—The anode coil will have to be a little larger than the aerial coil because the anode tuning condenser is smaller than the aerial tuning condenser. If you are using the A.T.C. in series with the A.T.I., the anode coil will probably be about the same size as the A.T.I. coil. The reaction coil will be a little smaller than the A.T.I. generally, but you should find by trial which coil gives most satisfactory results when connected in the reaction circuit.

"G.F.W." (Windsor).—(1) You could try and use the coils suggested, but it is better to keep to the values given in the article. (2) We cannot name any particular manufacturer who will supply a variometer, and we suggest you look through the advertisement pages of the journal. (3) We think you will find your queries with regard to the super-regenerative circuit answered in the issue of October 28th.

"IKANOPIT" (Bedford) *asks* (1) *For criticism of his circuit.* (2) *What length of No. 25 Eureka wire to use in a filament resistance.* (3) *Whether to rewind a L.R. earpiece.* (4) *Particulars of a telephone transformer.*

(1) The diagram is quite correct. You will not magnify the signals much with a single valve; in fact a single valve detector without reaction is little better than a crystal. (2) Use four yards, and take evenly spaced tappings. (3) It is difficult to advise whether to rewind the receiver or not without all dimensions of the receiver. However, you could rewind, using No. 36 S.S.C. The sample of wire submitted is No. 30 S.S.C. (4) The telephone transformers could be made as follows: Core of iron wire ½″ diameter and 3″ long; primary winding, 3 ozs. of No. 42 (sample wire is No. 42) and secondary winding, 4 ozs. No. 34.

"VALVES" (Regent's Park) (1) *and* (2) *has a former* 4¾″ *diameter and* 4⅛″ *long, and wishes to tune from* 300 *to* 5,000 *metres, using a tuning condenser of* 0·0005 *mfds. capacity.* (3) *The number of turns to wind for a reaction coil.* (4) *Whether diagram submitted is correct.*

(1) and (2) We suggest you wind the former full, using the two-pile method of winding described recently in this journal. If you wind with No. 26 D.S.C. wire, and take 10 tappings, you will cover the wavelength range desired. (3) The reaction coil could be 100 turns of No. 28, with a mean diameter of 2½″. (4) The diagram is correct, and also the method of connecting the transformer. We suggest, however, you increase the capacity of the H.T. by-pass condenser to 0·02 mfds.

"D.H.B.McC." (Leicester) *asks* (1) *For particulars of basket coils.* (2) *Whether there is any difference in the coupling schemes submitted* (3) *How to construct a L.F. choke coil.* (4) *How to use the formula wavelength* = 1885 $\sqrt{LC}$ *when there is no condenser.*

(1) We suggest you make use of the No. 22 S.W.G. wire and wind 40 turns for the smaller wavelength, and other coils of 80 and 130 turns, connecting them in series for the larger wavelength. (2) The two schemes are identical. (3) You could make use of an old L.F. transformer, or you could build one to the following particulars:—Core, iron wire ½″ diameter, 3″ long. Winding, 2 ozs. No. 40 S.S.C. wire. (4) The formula cannot be applied unless there is capacity. Coils do not possess capacity in any useful sense, and you cannot very well predict the natural wavelength of a coil you construct.

"A.L." (Liverpool).—You should use an ordinary three-valve L.F. amplifier, the input side of the first transformer being tapped for adjustment purposes. We cannot help you much, without information as to the particulars of the experiments you propose to conduct.

"G.H.R." (Ilkley).—(1) The crystal arrangement shown is useless, this should be as in Fig. 2. (2) X, 0·0005 mfds. and Y, 0·0005 to 0·001 mfds. (3) The complete circuit including X and N would have to be tunable, but if this could be done by the condenser only, there would be no need to tune the coil as well. (4) No, the present arrangement is preferable. The type of set suggested is quite good.

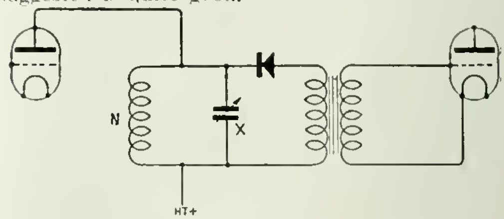


Fig. 2.

"RED ALMOND" (Leicester) *asks range or wavelength variometer most suitable for a Super-regenerative receiver.* (2) *How many plates, average thickness* 2½″ *diameter, moving plates,* 1/8″ *washers, should be used for* 0·001 *mfd. condenser.* (3) *If there is any advantage in having a large number of turns on a frame aerial instead of* 12 *or so.*

(1) We suggest you make the rotor about 5″ in diameter and the stator sufficiently large for the rotor to revolve. Wind with No. 22 S.W.G., D.S.C. (2) If the moving plates are 2½″ diameter and 23 mils. thick, and the spacing washers are 1/8″ thick, about 93 plates will be required to give a capacity of 0·001 mfds. (3) There is no advantage in having a large number of turns on your frame aerial; 15 is usually sufficient, and about 5 tappings should be made.

"· —" (Hong Kong).—(1) The variometer receiving transformer you suggest could undoubtedly be used for the A.T.I. and reactance coil of a set, but if this were done we do not think you will be able to get good results except at comparatively short wavelengths. (2) We should not recommend using finer wire than about No. 38 for rewinding these coils, and if this were done we do not think that the wavelength reached would be in excess of 2,000 metres. (3) The same tappings as on the original windings might be used. (4) Use about 8 ozs. of No. 30 for the L.R. winding, and 3 ozs. of No. 44 for the H.R. winding.

"W.S." (Wembley) *asks for winding for a coil with Litzendraht wire to tune up to about* 450 *ms., and if it is possible to use a former* 3″ × 6″ *for the purpose.*

There is not a lot to be gained by the use of wire of this type for receiving on short wavelengths, as under such conditions the resistance of the coil is in general considerably less than that of the aerial. There is no objection to its use, however, if desired. We do not know the exact gauge of the wire which you propose to use, but you will probably find that 60 turns will be sufficient on the former you suggest, if you use the 0·0005 mfds. condenser in series with the coil to tune the aerial. It is not possible to predict the exact points for tappings for particular wavelengths, but if you put three or four taps in, evenly spaced, you should be able to tune all wavelengths up to your maximum without difficulty.

"**A.G.P.**" **(Swinton).**—(1) We cannot give you a single valve circuit with reaction which will meet with the approval of the Post Office. We suggest you use the valve as a H.F. amplifier, and use a crystal for rectification. See Fig. 3. (2) The A.T.I. could consist of a coil 5″ diameter, 6″ long, full of No. 22 D.C.C. with 10 tappings, and the A.T.I. could be a coil 4″ diameter and 6″ long, full of No. 26 D.C.C. with 6 tappings.

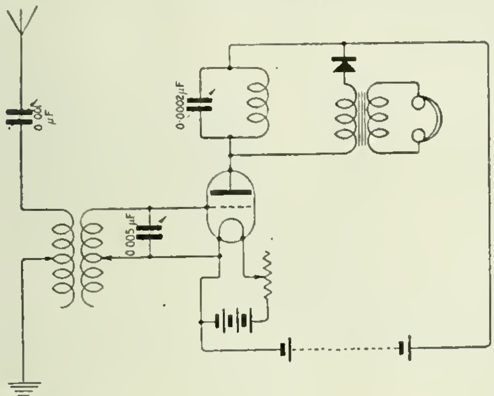


Fig. 3.

"**D.H.**" **(Nottingham)** *asks* (1) *Whose call letters are* **2 GR.** (2) *For particulars of the "spade" method of tuning by means of a fixed coil.*

(1) We regret we have no particulars of this station. (2) The method of tuning to which you refer makes use of a fixed coil, and a movable piece of copper plate. Changing the position of the plate changes the inductance of the coil.

"**A.B.**" **(Manchester)** *asks* (1) *Whether it is possible to hear the Dutch concerts on a three-valve set in his district.* (2) *If not, what we recommend.*

(1) and (2) The reception of this station is always rather uncertain at such distances, and can only be done by the use of critical reaction adjustment, with its attendant risks of radiation. In any case the results are not often good. If, as you say, you can get weak signals we should recommend you to add another L.F. valve, and at the same time take every possible precaution to increase the efficiency of your aerial.

"**W.V.H.**" **(Walthamstow)** *asks whether a certain three-valve set sketched is correct and suitable for the reception of the Dutch concerts.*

The circuit sketched is correct in its general lines, but is not likely to be efficient enough to give results with the Dutch station. Firstly it would be better to use a stage of H.F. amplification. Secondly, the use of a parallel A.T.C. is unnecessary and undesirable on such short wavelengths. And thirdly, the use of reaction coupled directly back on to the aerial circuit in the manner shown leads to serious trouble from radiation, and is to be strongly deprecated.

"**B.M.G.**" **(Paddock Wood)** *asks* (1) *Whether he is allowed to use more wire for a frame aerial than he is for an outdoor aerial.* (2) *Whether he can use a 1″ spark coil for a transformer with a 200 ohm loud speaker.*

(1) We do not think that there is any restriction as to the amount of wire that may be used on a frame aerial. For short wavelengths the 100 allowed for an open aerial is quite sufficient for a frame, but for long waves a greater length of wire is generally used. (2) This coil cannot be used as it stands, as the windings will certainly not be correct. It might be made some use of by rewinding with a new primary of about 6 ozs. of No. 30, covered with a rewinding of the older thin wire. Whether this would be satisfactory depends on whether the old winding could be stripped without damage, and whether there is sufficient quantity of wire in it.

"**H.F.C.**" **(Wimbledon)** *asks for details for a frame aerial for use with an Armstrong super-regenerative circuit with a range of* 300-10,000 *metres, and whether loading coils can be used with such a frame.*

Your proposal to use an Armstrong circuit over such a range of wavelengths indicates that you have not grasped the principles under which it works, in which case you are extremely unlikely to obtain any useful results whatever with this exceedingly tricky circuit. It is only intended for and suitable for the reception of signals over a restricted band of short wavelengths, and we can assure you that the difficulties to be overcome under even these conditions are sufficiently formidable. The frame should be that normally suitable for say 300-600 metres, *e.g.*, 12 turns of about 3″ diameter. No loading coil will be necessary. See the articles by P. W. Harris in the issues of November 21st and 28th, 1922.

"**W.S.B.**" **(Daisy Bank).**—(1) Zincite and copper pyrites in combination is a well known and quite satisfactory variation of the perikon type of crystal. The term perikon is generally applied to the combination zincite-bornite. (2) The arrangement of your apparatus is quite correct, and we have no fault to find with the set, except perhaps that you would find it easier to tune on short wavelengths with coils of a less diameter. (3) The aerial circuit will tune to about 2,300 metres with the condenser in the parallel position, and probably about 1,000 metres with it in series with the A.T.I. The closed circuit will in any case tune to at least 3,000 metres.

"**C.L.**" **(Huddersfield)** *asks* (1) *Certain questions with regard to the permitted dimensions of an aerial.* (2) *The reason why on a certain occasion he heard European C.W. stations with his set adjusted in such a way that it could not possibly have been oscillating.* (3) *The best all-round valve for H.F. amplification with a filament battery of not more than 4 volts.*

(1) Post Office Form No. 43 states that the combined *height* and *length* shall not exceed 100 feet. (2) This was evidently due to your set having picked up some continuous oscillation all the time, either from a local receiver in a state of oscillation, or possibly from a harmonic of the spacing wave of some arc station standing by at the time. (3) Impossible to say. Most valves by the foremost makers have some specially good points, and we cannot undertake to discriminate between the brands.

"H.W.C.M." (Clapham).—(1) With "Q" valves the plate voltage should be about 40 for detecting with a potentiometer, without extra volts, 60-200 for most purposes of amplification, and about 200 in an oscillator. (2) There is very little to choose. Personally we have a slight preference for the potentiometer method with these valves. (3) For the inductance of lattice wound coils the following rather formidable looking formula gives fairly good approximations to the correct result. In actual practice its use will not be found to present any great difficulty:—

$$L \text{ mhs} = \frac{1}{1{,}000} \cdot \frac{4\pi^2 a^2 N^2}{b + c + R} \quad F_1 \quad F_2$$

where a = mean radius of the winding
b = axial length of coil
c = thickness of winding — all in cms.
R outer radius
N = total number of turns

$$F_1 = \frac{10b + 12c + 2R}{10b + 10c + 1{\cdot}4R}$$

and $F_2 = 0{\cdot}5 \log_{10} \left(100 + \dfrac{14R}{2b + 3c}\right)$

"1MI" (Huddersfield).—(1) Almost any valve in use at the present time will detect efficiently with 60 volts on the plate. A French type valve would, among others, be very suitable. (2) The circuit of Fig. 4, page 739, September 2nd issue, is of the type specified. This circuit has a switch for cutting out the note magnifier valves; this may of course be omitted if desired. (3) At present we do not think you will get anything, but you should get Manchester and probably Newcastle when the stations in these towns come into operation. (4) We do not understand the results you describe. It is quite likely that signals from ships will be less strong than those from the higher powered long wave stations. The crackling effect may be due to tram interference, which is often found to be troublesome on some wavelengths and not on others.

"FUZZ" (Glasgow) *asks for data for the construction of a five-valve set, saying nothing about the purpose he wishes to use it for, or giving any other information.*

These columns are intended for helping readers with specific difficulties, and lack of space, etc., prevents us from undertaking the complete design of complicated sets for individual readers. You will find a diagram of a very good type of set in Fig. 4, page 706, August 26th issue. For details of the construction of the various parts see recent articles on the construction of sets, as the construction of condensers, coils, transformers, etc., is very much the same whatever set they are to be used on.

"K.D." (Manchester).—The wiring of the four-valve set as shown in the issues of July and August to which you refer is correct, and the replies to which you draw our attention are answers to meet the requirements of correspondents. The diagram in Fig. 4, page 508, is also correct, and if you wire your set according to this diagram you may be sure the connections are correct.

"D.C.R." (Egham).—(1) All right, but we do not think that you will get permission to use reaction in this way. (2) See Fig. 3, page 738, September 2nd issue. (3) Yes; both windings are intended to be of the same wire. (4) Gauges are approximately No. 36, 44 and 42 S.W.G.

"J.W.W." (Essex) *asks for a diagram of a valve and crystal combination.*

See Fig. 4.

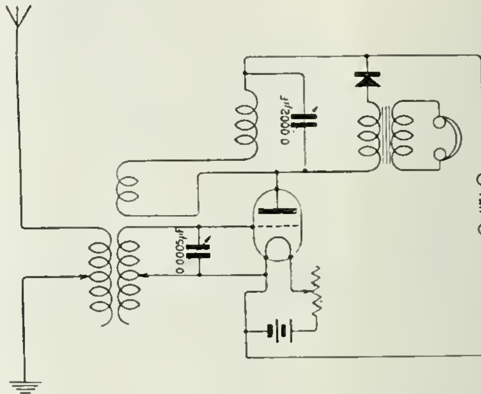


Fig. 4.

"H.H.S." (Yorks).—You will require several basket coils to use in conjunction with a tuning condenser of maximum value 0·0003 mfds. We suggest you use 8 coils, making coils of 40, 80 and 150 turns for the shorter wavelengths, and then adding coils in series for the longer wavelengths. The exact values cannot be given, as the inductance of basket coils varies greatly with the method of making, and tightness of winding. A resistance of 50,000 w. is quite suitable for use in the anode circuit of a H.F. amplifying valve, but you may secure a little greater amplification if you use a 70,000 w. resistance. The H.F. voltage should be increased to allow for the voltage drop in the resistance. The potential variations which occur at the anode of the H.F. amplifying valve should be applied to the grid of the following valve by joining a condenser between the anode and grid. A grid leak is connected between the filament and grid of this valve to provide the grid with a mean potential which is suitable for the best operation of the valve. We suggest you use basket coils for the reaction coil, and you will probably find a coil a little smaller than the anode coil is quite suitable. When receiving longer wavelengths, inductance should be connected in series with the reaction coil.

SHARE MARKET REPORT

Prices as we go to press on November 10th, are:—

Marconi Ordinary	£2	4	9
,, Preference	2	3	1½
,, Inter. Marine.. ..	1	7	3
,, Canadian		10	6

Radio Corporation of America:—

Ordinary	19	9
Preference	14	0

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

No. 171 [No. 8 Vol. XI.] NOVEMBER 25TH, 1922. WEEKLY

Critical Tuning Devices.

SOME METHODS FOR OBTAINING FINE ADJUSTMENT.

UNDOUBTEDLY many experimenters, when tuning to weak telephony, have sometimes been annoyed to discover,

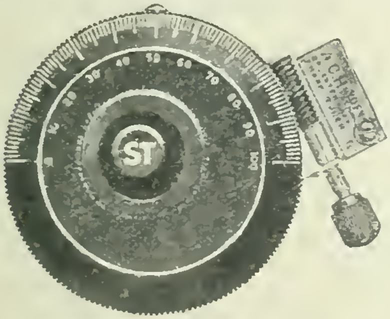


Fig. 1. An American device.

upon removing the hand from the tuning instrument, that signals decreased in strength or vanished entirely.

Many variable condensers and coil holders in use are of such a design as to permit of only coarse adjustment, while others are provided with separate vernier control. Those of the latter design are a step in the right direction, but they become somewhat tiresome in operation when rapid tuning is desired over a wide range. Without vernier adjustment it often happens that signals are entirely missed, owing to the rapid rate of change that is produced when operating the tuning instrument.

With regard to critical condenser adjustment, it is now becoming common practice to fit a worm or geared drive to the dial, or to a separate pinion. Fig. 1 shows a device which is now on the market, though when critical adjustment is not required, the worm spindle has to be swung out of use. Another arrangement is shown in Fig. 2, where by means of reduction gear, the small knob below the dial gives critical adjustment, whilst the large knob on the dial can be turned when it is desired to widely change the wavelength of reception.

Another scheme for providing critical condenser adjustment is to arrange separate control for a few of the moving plates. Fig. 3 shows a condenser so designed, where by withdrawing the knob the main plates of the condenser are disconnected from the moving spindle when the approximate adjustment has been obtained, whilst a few moving plates are still carried, and can be critically set by turning the knob.

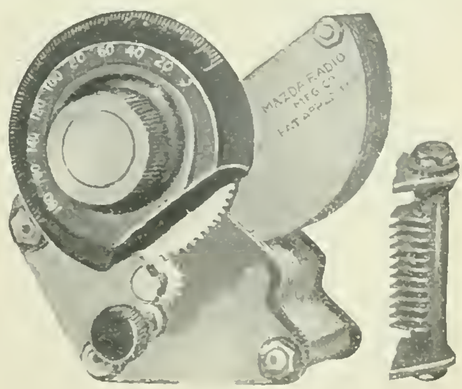


Fig. 2. Condenser with gearing.

To be of real use, the vernier device must permit of instant change from coarse to vernier

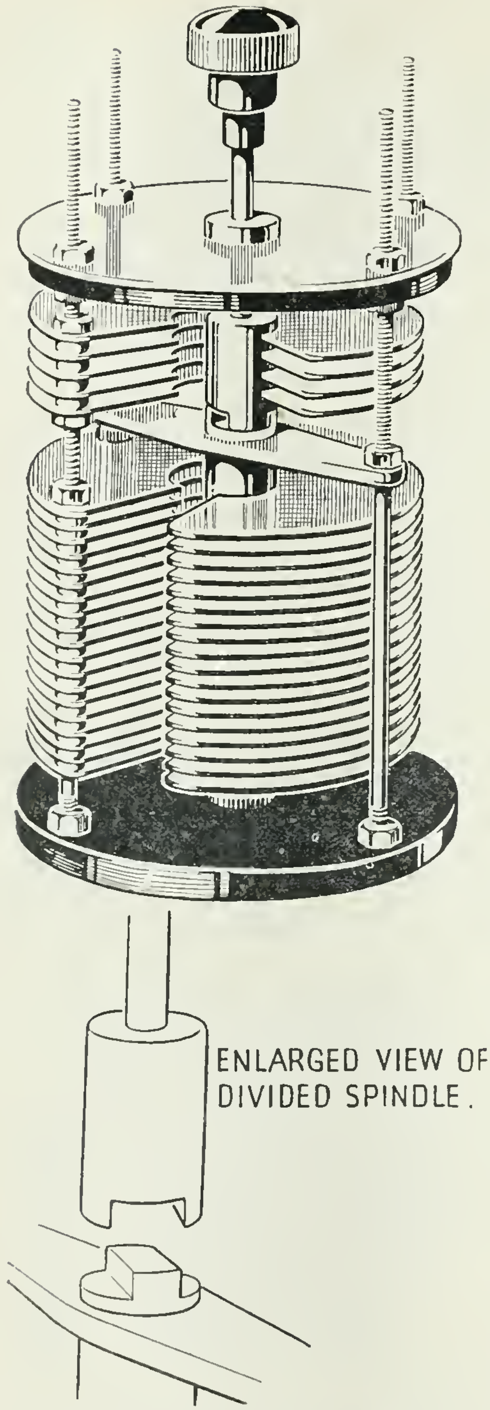


Fig. 3. A condenser in which provision is made for moving only a few of the plates.

control, and if possible, the design should permit of the change being made without resort to the operation of a third control. The fitments shown in Figs. 4 and 5 are assembled in such a way that the wheel D is only in friction contact with the spindle of the condenser, though this friction, whilst insufficient to prevent the condenser being adjusted when the wheel is held, has sufficient grip to revolve the plates when the worm wheel is revolved. The parts shown have been specially designed for use with the type of condenser which is usually fitted in the Mark III. tuners. The collar E, fits on the square spindle, whilst the wheel D, resting on this collar, has a clearance hole. A and C are washers, which

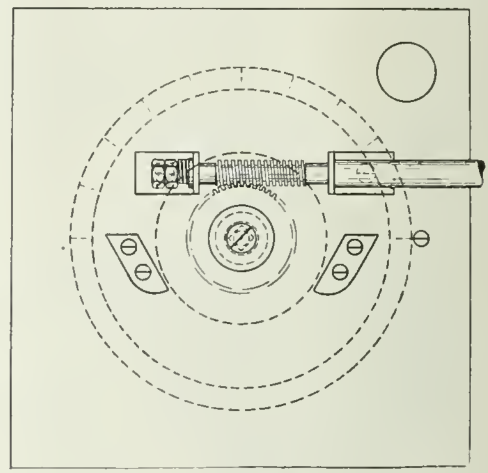


Fig. 4. Friction driven critical control designed by Mr. A. J. Bull. (Condenser dial removed.)

hold between them the spring washer B. The screw in the head of the condenser clamps these parts down on the spindle, slightly compressing the spring washer. This causes sufficient grip between the wheel D and the spindle, so that when the worm wheel revolves, the spindle of the condenser turns also.

For rapidly changing the setting, however, the friction is not so great as to impede the turning of the condenser spindle, whilst the wheel D remains in mesh with the stationary worm-wheel. Fig. 5 is another view of the same mechanism. The assembling of the parts beneath the dial of the condenser will of course raise it away from the top of the instrument, and consequently it is necessary to fit a screw, the slot in the head of which serves as an indicator for the calibrations on the dial.

This principle can with equal convenience be applied for the critical adjustment of tuning

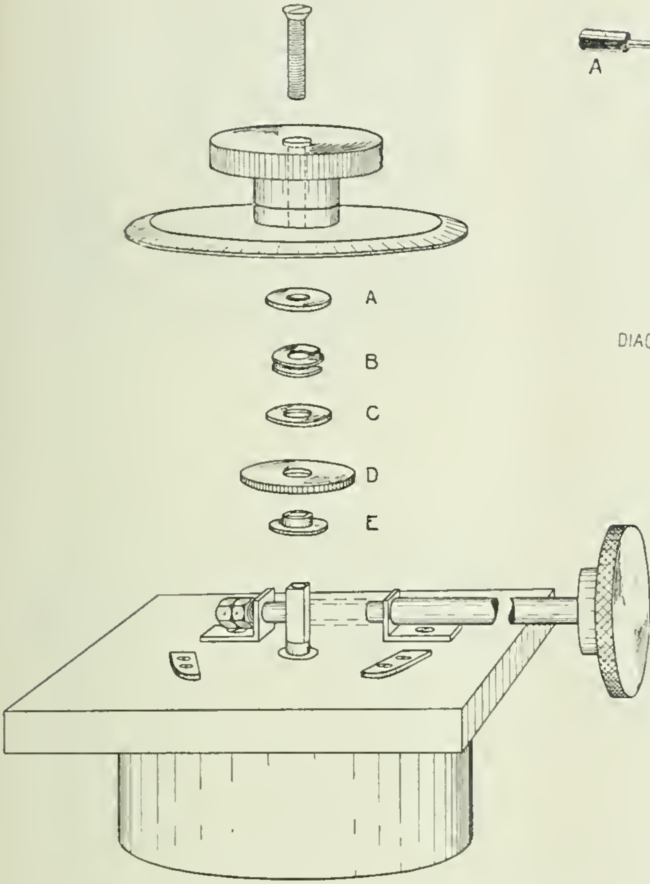


Fig. 5. Details for assembling a friction critical control.

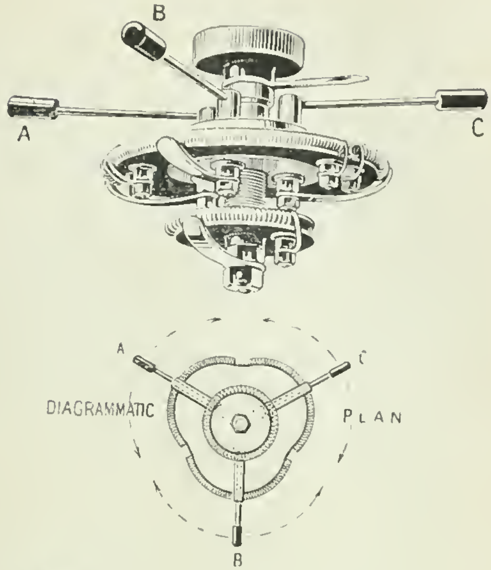


Fig. 7. Filament rheostat with separate critical control for three valves.

coils, mounted in the usual form of swing-about holder. Fig. 6 shows in detail the method of assembling the components on the spindles, and requires no further explanation. The coils can easily be pushed through a wide range, whilst when fine adjustment is required, the extension handles give a useful degree of critical control. Using this method of vernier adjustment, it is surprising how well

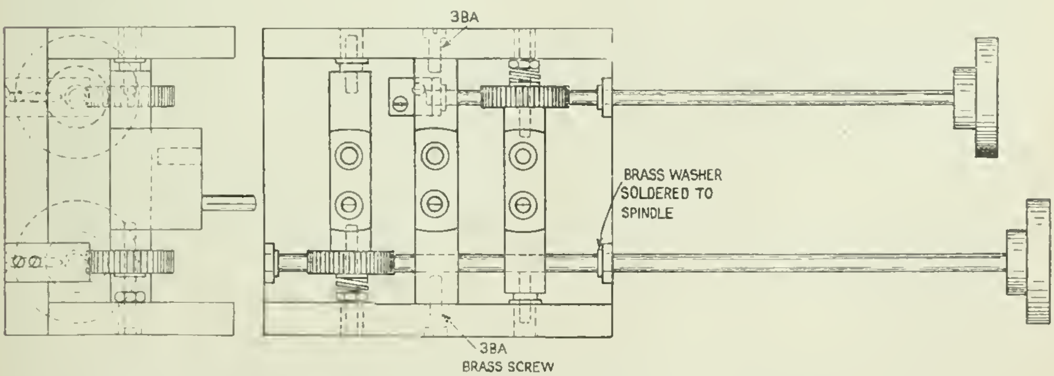


Fig. 6. Critical control for inductances with friction clip for wide movement.

many stations can be brought in, which without this device are so difficult to tune to, that their signals are quite unreadable.

Vernier adjustment has also been applied to filament current control—not perhaps so much in this country, where hard valves are available, but in America, where valves are less hard and critical rheostat control is necessary. Fig. 7 shows a novel form of rheostat intended for controlling the filaments of three valves. The main adjustment is obtained by turning the knob in the centre, whilst the extension handles each operate levers working on resistances which are connected separately in the valve filament circuits. This device is particularly useful when three similar valves are employed to function in different ways, such as high frequency amplifier, detector, and note magnifier.

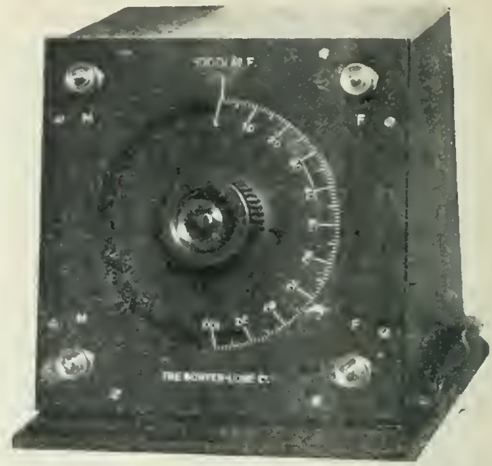


Fig. 8. The ebonite stem seen in the clips on the right can be put in mesh with teeth on the rim of the condenser.

The Wireless Society of London.

PRIZE COMPETITION.

At the last meeting of the Wireless Society of London, held on October 25th, the Chairman announced that it was proposed to offer prizes for the most efficient Armstrong super-regenerative circuit produced by a member of the Society or of an affiliated Society, and that conditions with regard to the competition would be issued later.

Two prizes are offered as follows :—

A first prize of £15, and a second prize of £10. The amount of these prizes is contributed by three members of the Society who prefer to remain anonymous.

The conditions for the competition are as follows :—

(1) In the award of the prizes the ruling of a sub-committee of the Wireless Society of London will be final.

(2) The instrument made up must not employ more than three valves, and the set must work on a loop aerial which should accompany the instrument when sent in for judging. A diagram of connections and a written report as to what the set claims to accomplish should accompany the instrument.

(3) The actual assembly of the apparatus to be carried out by the competitor.

(4) The competition to be open to members or associate members of the Wireless Society of London or members of an affiliated Society.

The closing date of the competition to be January 15th next. All apparatus to be sent to the Hon. Secretary of the Wireless Society of London.

(5) Each competitor may demonstrate his own set if he so desires, or may depute someone to do this for him, failing which the Committee will make their own tests according to the written instructions which accompany the set submitted.

In the tests to be conducted some constant source of transmission will be employed. The winner of the prize will be expected either to lecture, or prepare a lecture on the instrument, to be read before the Wireless Society of London, on which occasion the prize-winning instrument will be demonstrated.

In awarding the prizes the following points will be taken into consideration :—

(A) General design.

(B) Adjustment to maximum efficiency for four or five different ranges of wavelength from 200 to 600 metres in minimum time.

The names of those who desire to enter for this competition should be sent without delay, and in any case within a fortnight of the date of this announcement, to the Hon. Secretary, 32, Quex Road, West Hampstead, N.W.6.

History of The Wireless Society of London.

"Look into the seeds of time,
And say which grain will grow and which will not."
MACBETH.

THE Wireless Society of London now changes its name to the "Radio Society of Great Britain," and comes under Royal Patronage. We have represented to its founders that it is on occasions like this that one may legitimately look backward as well as forward, and we have asked them to revive their memories of the early days to indulge in retrospect for the benefit of our readers.

The first meeting was held on July 5th, 1913, at the house of Mr. René H. Klein, on his initiative, in West Hampstead. Mr. Klein was then a well-known wireless amateur who foresaw the difficulties which no doubt would arise through the lack of co-operation between amateurs, and more especially as to their position with regard to the Government regulations.

Mr. A. A. Campbell Swinton, F.R.S.
First President.

Among the five other gentlemen who were present were Mr. Leslie McMichael and Mr. L. F. Fogarty, A.M.I.E.E., who became Vice-Chairman and Hon. Treasurer respectively, whilst Mr. Klein assumed the Hon. Secretaryship. These three have held the offices ever since, save that Mr. Klein became a Vice-President in 1919, and Mr. McMichael took his place as Hon. Secretary; so if it is ever possible to speak of individuals as Founders of a great Institution created by the loyal and disinterested services of many influential men, to them must the honour be accorded.

The following announcement appeared in the *English Mechanic* of July 11th, 1913.

> THE LONDON WIRELESS CLUB
>
> At a meeting of wireless-telegraphy amateurs held on Saturday, the 5th inst., an association was formed, under the title of the London Wireless Club, having for its object the bringing together of all amateurs interested in wireless telegraphy and telephony. The need of such a club has been apparent for some time, and judging from the support promised and given, will no doubt prove a success. This meeting being of an informal nature, it was decided to elect a temporary honorary secretary and treasurer, leaving the proper election of the committee to the general meeting, which will be held early in September next. The honorary secretary will be glad to hear from amateurs intending to join the club as soon as possible, and will forward forms of application for membership. His address is Mr. H. Klein, Hon. Sec. (pro tem.), 18, Crediton-road, West Hampstead, N.W.

A similar notice appeared in the *Wireless World* for August 1913, and to these invitations there was considerable response, for among those that attended the next meeting or who sent in their names as would-be members were the following, who constituted the first Committee:—Mr. H. F. Brand, M.A., B.Sc.; Mr. E. W. Kitchen, A.M.Inst., C.E.; Mr. W. J. Fry; Mr. W. J. Shaw; and Mr. V. W. Delves Broughton and Mr. A. G. Hansard. Enterprising and ambitious for the success of the Society as these gentlemen were, it is doubtful whether in these first few months the great possibilities were quite realised; even the title then selected, "The London Wireless Club," indicated a domestic rather than a national policy. It was at the third meeting, held at Mr. Klein's house on September 13th, 1913, that Mr F. Hope-Jones, M.I.E.E., first appeared on the scene. He, in common with every first accession to the ranks, was impressed with the ability and enthusiasm of the group, and advocated a Society founded on a more ambitious scale than that of the Wireless Clubs then springing up all over the country, a Society which would secure the confidence of the authorities at St. Martin's le Grand, and capable of wresting from them a charter of freedom for the wireless amateur.

Fig 12.—The Siphon Pen, on the Right, tracing out in Morse Alphabet, the First Word—"Le"—of Commandant Ferrié's Message

The signals are photographically reproduced from the original tape record, which is slightly enlarged

Fig 13.—The Third Word—"Ferrié"—of the Message

Photographically reproduced from the original tape record, which is slightly reduced in size

Reproduction of a reprint of the first Presidential Address illustrating General Ferrié's Message.

With this object in view he suggested the appointment of men of eminence in the science of wireless telegraphy as Vice-Presidents, from whom a President should be selected, and advocated a change of name. These views proving acceptable, he was asked to become its Chairman and carry them into effect. His inventions in "electric clocks" had brought him in touch with a large circle of friends in the world of science, and he was then launching a campaign against the Post Office on his own account to secure freedom for the watch and clock maker to take the Paris time signals. Within a few weeks Vice-Presidencies were accepted by Dr. Silvanus Phillips Thompson, F.R.S., Sir John Macpherson Grant, Bart., Mr. Wm. Duddell, F.R.S. and Mr. Russell Clark, all now unhappily deceased during the War, but gratefully remembered for their prompt support. The Hon. Stuart P. Bouverie, Dr. W. H. Eccles, F.R.S., Dr. Erskine Murray, Col. Hippesley and Sir Charles Bright followed closely on their heels, as also did Prof. Fleming, F.R.S., Prof. Osborne Howe, Prof. Ernest Wilson, Prof. E. W. Marchant and Mr. S. G. Brown, F.R.S. The late Sir William Crookes F.R.S., became an honorary member and also Sir Oliver Lodge, F.R.S., while more recently the Society has been further honoured by Senatore Marconi accepting a similar position.

The Presidency was first offered to Dr. Silvanus P. Thompson, but he declined in view of the heavy burden of his other similar responsibilities. It was however, accepted by Mr. A. A. Campbell Swinton, F.R.S., and no better choice could have been made. He held the office for seven years, during four of which the Society was in a state of suspended animation owing to the War. When finally his resignation was accepted in January, 1921, he was presented with an illuminated address and by special resolution was made a member of the Committee for life. His handsome offices n Victoria Street are still most generously placed at the service of the Society for its Committee meetings. He created many valuable precedents,

General Ferrié, a Vice-President.

not the least important of which was that he was a *working* President, attending Committees as well as presiding at the monthly general meetings, and his successors have always done the same.

His first Presidential Address, given in the lecture hall of the Institution of Electrical Engineers on January 21st, 1914, will long be remembered, with its special wireless message of greeting transmitted from the Eiffel Tower by Commandant Ferrié (already a Vice-President of the Society), received on a syphon recorder, projected on to the screen by an epidioscope, and duly interrupted by Admiralty transmissions from Whitehall! The Rt. Hon. Sir Henry Norman, Bart., M.P., also addressed the large and distinguished company, and the Society may then be said to have been fairly launched upon its prosperous career.

ratus, as we know it, had not begun, club-rooms equipped with a first-class receiving set were considered essential. After somo hesitation, due to the fear of apparent alliance with a business firm, a generous offer from Mr. A. W. Gamage of rooms at 107, Hatton Garden, was accepted. An "Instrument Fund" was opened, and £100 quickly raised. The premises were furnished, equipped and opened before the close of the year 1913. Morse classes were held and expert advice on all technical matters was generally available, but the aerial was of course dismantled on the outbreak of war, and the instruments officially sealed up.

The Society may be justly proud of its war services. Its younger members, ready trained,

Group of Officers of the Society taken October 1919. *Back row (left to right), Mr. L. F. Fogarty, A.M.I.E.E., Mr. R. H. Klein, L.S.C., Mr. H. L. McMichael, Mr. M. Child, Mr. E. W. Kitchen, A.M.I.C.E. Front row. Dr. J. Erskine-Murray, M.I.E.E., Mr. A. A. Campbell Swinton, F.R.S., Admiral Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S., Mr. F. Hope-Jones, M.I.E.E.*

In the meantime, the best type of wireless amateur had been attracted. Among the earliest members were Dr. F. C. Knight, G. G. Blake, H. H. Harrison, Tingey *père et fils*, Philip Coursey, Maurice Child, W. H. Shortt, Leslie Miller, Basil Binyon, G. P. Mair, A. W. Sharman, A. E. Dean, Rickard Taylor, H. W. Scott, and H. R. Rivers-Moore, many of whom have since served on the Committee or in Offices, and have contributed to the Proceedings.

In those days when instruments were not so easily made and the manufacture of wireless appa-

flocked to the wireless units of the Navy, Army and Air Forces, which they served with distinction those who stayed at home set a good example by shutting down their own installations and offering their services in the detection of illicit installations. Assistance in the latter direction was not required, but practical help was given to several innocent victims of spy mania!

When it was desired to resume activities after the war, the authorities seemed reluctant to allow us to use our ears again, and it was not until July, 1919, that the Committee came together to formulate their plans for re-opening. They found that the valve had arrived, and the stay-at-homes envied the service men their knowledge of it.

One of the first matters taken in hand was the Affiliation of the Provincial and Suburban Societies. The direct advantages of affiliation from the point of view of the individual Provincial Society were not self-evident, and it was recognised that the success of the scheme depended upon public spirit and their recognition of the fact that union is strength. Fortunately this was not lacking. The immediate response was sufficient to justify calling the first Conference in February, 1920, when fifteen Societies were represented. Next year there were fifty affiliated, at the last Conference—the third—there were 78, and at the time of going to press there are upward of 120.

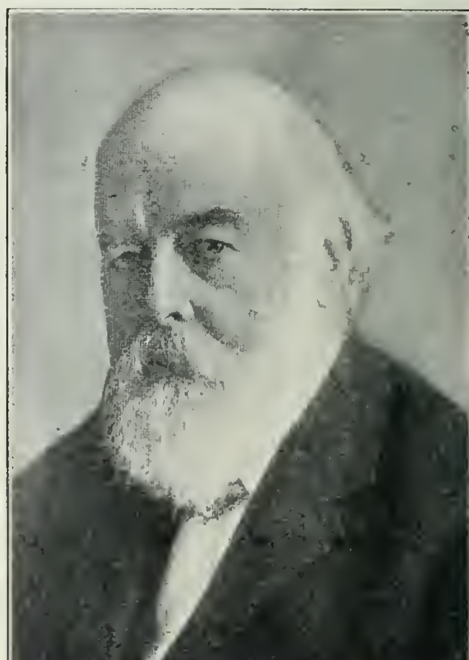
It has been and still is the one Parliament of the Wireless Amateur in this country, and it has

Senatore G. Marconi, G.C.V.O., LL.D., D.Sc., M.I.E.E., Honorary Member.

enabled the President to speak to the authorities in no uncertain voice in the demand for freedom, subject, of course, to reasonable control. They on their part have welcomed the representative voice, for it must be remembered, though the public do not see it, that the constant desire of the civil servant engaged in executive duties is to give all the freedom that can safely be granted, and in administrating such an indefinite law as the Telegraph Acts, to find out what is wanted and what can be given without detriment to important interests and services. Hence, a representative of the Postmaster General has always attended the Conferences, happily in the person of Captain

Dr. J. A. Fleming, F.R.S., a Vice-President.

F. A. Loring, R.N., one of the Vice-Presidents of the Society. It was assumed by some that the Conference would degenerate into indignation

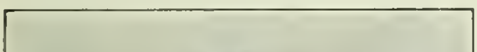


Sir Oliver Lodge, F.R.S., an Honorary Member.

meetings, but such fears have always evaporated in an atmosphere of sweet reasonableness.

H.R.H. The Prince of Wales, Patron of the Society.

The results have been achieved instead by peaceful penetration or by the iron hand in the velvet glove. Take for instance the origin of broadcasting. The lay press and public ought to be told that broadcasting has been in operation for three years in the form of transmissions by some dozens of amateurs, members of the Society, in all parts of the country. In the London district there have been few evenings in the week since 1920 without entertainment of some kind, so much so that the Society had to call together the holders of transmitting licences in the London District in July, 1921 in order to regulate their programmes to avoid interference. But all this was on low power, and in so far as it was broadcasting it was technically against the law. In March, 1921, the second Conference, held under the Presidency of Dr. J. Erskine Murray, asked that permission should be granted to the Marconi Company (who were ready and willing to do it) to transmit a weekly concert. A certain mental backwardness or lack of vision which we are accustomed to in Bureaucracies took six months to make up its mind about this request, and then refused the music. They were invited to face music of another kind, and did so with a good grace when the Secretary presented at St. Martin's le Grand on December 29th, 1921, the Broadcasting Petition signed by the Presidents of 63 Societies representing most of the amateurs in the country, and the Postmaster-General's representatives were told by the Chairman that "the Society's only constitutional means of access to Authority was through the Postmaster General, and it was their intention to urge their plea with all



Admiral of the Fleet Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S., President.

Major J. Erskine Murray, D.Sc., Past President, 1921.

the force of which they were capable consistent with the constitutional methods."

Mr. F. Hope-Jones, M.I.E.E., Chairman 1913 *to date.*

Within a fortnight permission was granted for Writtle to begin its Tuesday evening concerts, and three months later Mr. Kellaway made his broadcast announcement in the House of Commons.

Mr. L. F. Fogarty, Honorary Treasurer.

Yes, there is no doubt that the authorities have been "gingered up." There is equally no doubt that they like it. It is all a matter of how it is done. A reasonable demand, properly formulated and backed by a thoroughly representative body, strengthens the hands of the administrators against conservative influences; perhaps in this case the overcautious representations of the defensive services of the Realm.

The interviews at St. Martin's le Grand have always been of a most cordial nature, and the Committee have invariably been made to feel that the Society was valued by the Department as a means of control and as a channel for the expression of collective views. The Committee has felt it to be a great privilege to assist the Department in determining who were fit and proper persons to be granted licences. Membership of the Wireless Society of London or of an Affiliated Society has been accepted as *prima facie* evidence of fitness for a receiving licence, whilst the more difficult

Mr. R. H. Klein, Vice President, and Founder of the Society.

matter of transmitting licences has been dealt with by an Advisory Committee on technical qualifications consisting of Mr. Campbell Swinton, Dr. Eccles, Professor Howe and Professor Ernest Wilson.

But perhaps the greatest service that the Society has yet been able to render to the Government is in connection with the revision of the terms of transmitting licences. This question originated at the last Conference when wavelengths, working hours, and free communication were discussed, and Captain Loring stated that recommendations would be welcomed, indicating that they should be accompanied by an assurance that they represented also the views of the Provincial Societies. A Control Committee, consisting of Mr. Maurice Child, Mr. Klein, Mr. G. P. Mair, Mr. Frank Phillips and the Secretary, happened to be sitting at the time, and it fell to them to draft the recommendations. After consideration by the Main Committee they were submitted to the Committee of each one of the affiliated Societies and unanimously approved.

These recommendations may be cited as a typical example of the value of collective bargaining. They took a complete grip of the position of the amateur throughout the country, and basing their considerations on a broad view of the present condition and future congestion of the ether, the authors unfolded the anomolies and inconvenience of the existing licences whilst making practical suggestions which were shown to be to the benefit of the authorities as well as the individuals. So complete and forceful was this document that its recommendations were accepted *en bloc*, and it was the subject of unofficial, but none the less sincere commendation from individual members of the Wireless Board. Nothing short of a Conference of the Affiliated Societies could have given a mandate for such drastic recommendations and none but those accustomed to deal with such matters from a National point of view could have formulated them.

Mr. L. McMichael, Honorary Secretary.

It only remains to add that the Wireless Society of London has been welcomed in a very friendly way by the old established Societies and Institutions. The Institute of Civil Engineers and the Royal Society of Arts have granted the use of their lecture halls on many occasions, while the Institute of Electrical Engineers has never lost an opportunity of showing its goodwill. When the Wireless section of that Institution was being established, its first President, Dr. W. Eccles, F.R.S., attended the Committee Meetings of the Wireless Society of London in order to ensure that there should be no overlapping nor appearance of rivalry. The monthly meetings have always been held in their lecture hall since the building was recovered after the occupation of the Government.

A history can never be up to date, so no attempt will be made to deal with the current events under the Presidency of the Admiral of the Fleet Sir Henry Jackson, G.C.B., F.R.S. His distinguished services to the Society would require another chapter.

Tuned Anode Coils.

NOW that the use of the tuned anode system of high frequency amplification is gaining favour, the following two devices are of special interest.

Fig. 1 shows a spool designed by Mr. V. R. Mills, turned in ebonite, wth grooves for carrying the inductive winding. Threaded holes are made

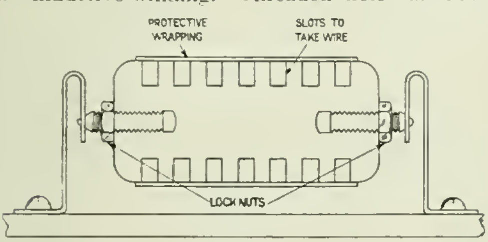


Fig. I.

in the ends to carry 3 BA screws, and lock nuts hold them secure. The ends of the windings are soldered to the screws, and a little spare solder is allowed to flow round the nuts. Spring connectors may be made from bronze spring or hard brass.

Very little experimental work is required to find a suitable number of turns for the various wavelengths. The number of turns in use need only be approximate, of course, as the inductance is bridged with a variable condenser having a maximum value of about 0·0001 mfds.

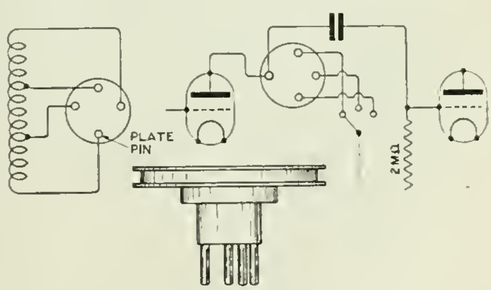


Fig. 2.

Fig. 2 shows a simple arrangement for substituting tuned anode in the place of intervalve transformers. Two tappings are taken out on the winding as it is put on, and the fitting of a three-way switch on the receiving instrument panel provides a tuned anode coil having a wide range.

Electrons, Electric Waves, and Wireless Telephony—VIII.

By Dr. J. A. Fleming, F.R.S.

The articles appearing under the above title are a reproduction, with some additions, of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

4.—The Periodic Law of Atomic Properties.

It was long ago pointed out by the English chemist Newlands, and the Russian chemist Mendelejeff, and by Lothar Meyer, that if the names of the elements are written down in the order of their atomic weights, the same kind of properties repeat themselves at regular intervals in the series.

It is now usual to arrange the elements in a table called the Periodic Series, which brings out these points clearly.

If we rule up a sheet of paper into nine columns and twelve rows, we can write in each of these spaces, or in nearly all of them, the names of the elements in order of their atomic weights, proceeding from left to right in each row and downwards in each column.* We then find that when arranged as shown in the table on p. 265, all the elements of similar character fall into the same column or group.

The atomic weight of hydrogen is 1·008, when that of oxygen is taken as equal to 16.

The columns are numbered 0 to 8. In column 0 we find all the elements like helium, argon, neon, etc., which are non-valent and do not form any chemical compounds. In column 1 we have the mono-valent highly electro-positive alkaline metals like lithium, sodium, potassium, etc. In column 7 the haloid elements, like fluorine, chlorine, bromine, iodine, and in column 8 certain groups of three metals.

At the end of the series we come to the radio-active elements, radium, thorium and uranium, this last being the heaviest atom, with an atomic weight of 238·2.

We can also attach to each element a number called its *Atomic Number*, given in italics in brackets in the table, which represents its numerical order of the elements in the series. The atomic number of hydrogen is 1 and that of uranium 92.

It is seen that at the beginning of the series the atomic weight is about double the atomic number, or at least differs only by zero or a small number. At the end of the series there is, however, a great difference between the atomic weight and double the atomic number.

Mr. Stephen Miall, in his little book on "The Structure of the Atom" (Benn Bros., London), has pointed out that the atomic weight w is related to the atomic number n in the manner expressed by the formula $w = 2n + b$, where b may be called the dead weight or ballast.

Van der Broek made the suggestion adopted now very generally, that the atomic number represents the resultant number of positive electrons in the nucleus, or what is the same thing, the number of planetary electrons circulating round it in a neutral atom.

Thus the nucleus of the helium atom consists of four positive electrons bound together by two negative electrons. The resulting positive charge is then 2 units. The atomic number of helium is two, and its atomic weight is 3·99 or nearly 4. It has two negative electrons which circulate round the nucleus. In this case the "ballast" weight is zero. In the case of uranium, however, the atomic number is 92, the atomic weight is 238·2. Hence the "ballast" is 54·2.

One important thing discovered is that the chemical properties of the atom are more closely related to the atomic number than to the atomic weight. In short, it is possible to

* The Table on next page has been taken from an article by Dr. Saul Dushman on "The Structure of the Atom" published in *The General Electric Review*.

MENDELEJEFF'S PERIODIC SYSTEM OF THE ELEMENTS

Containing Atomic Weights, Atomic Numbers and Isotopic Radioactive Elements

Group 0	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
- -	E_2O	EO	E_2O_3	EO_2	E_2O_5	EO_3	E_2O_7	EO_4
- -	- -	- -	- -	EH_4	EH_3	EH_2	EH	
He **3.99** *(2)*	H **1.008** *(1)* Li **6.94** *(3)*	Be* **9.1** *(4)*	B **11.00** *(5)*	C **12.00** *(6)*	N **14.01** *(7)*	O **16.00** *(8)*	F **19.0** *(9)*	
Ne_I **20.2** Ne_{II} **22** *(10)*	Na **23.00** *(11)*	Mg **24.32** *(12)*	Al **27.1** *(13)*	Si **28.3** *(14)*	P **31.04** *(15)*	S **32.07** *(16)*	Cl **35.46** *(17)*	
Ar **39.88** *(18)*	K **39.10** *(19)*	Ca **40.07** *(20)*	Sc **44.1** *(21)*	Ti **48.1** *(22)*	V **51.0** *(23)*	Cr **52.0** *(24)*	Mn **54.93** *(25)*	Fe **55.84** *(26)* Co **58.97** *(27)* Ni **58.68** *(28)*
	Cu **63.57** *(29)*	Zn **65.37** *(30)*	Ga **69.9** *(31)*	Ge **72.5** *(32)*	As **74.96** *(33)*	Se **79.2** *(34)*	Br **79.92** *(35)*	
Kr **82.92** *(36)*	Rb **85.45** *(37)*	Sr **87.63** *(38)*	Yt **89.0** *(39)*	Zr **90.6** *(40)*	Cb† **93.5** *(41)*	Mo **96.0** *(42)*	- *(43)*	Ru **101.7** *(44)* Rh **102.9** *(45)* Pd **106.7** *(46)*
	Ag **107.88** *(47)*	Cd **112.40** *(48)*	In **114.8** *(49)*	Sn **119.0** *(50)*	Sb **120.2** *(51)*	Te **127.5** *(52)*	I **126.92** *(53)*	
Xe **130.2** *(54)*	Cs **132.81** *(55)*	Ba **137.37** *(56)*	La **139.0** *(57)*	Ce **140.25** *(58)*				
		Pr **140.6** *(59)* Nd **144.3** *(60)*	- - *(61)* Sa **150.4** *(62)*	Eu **152.0** *(63)*				
		Gd **157.3** *(64)* Tb **159.2** *(65)*	Ho **163.5** *(66)* Ds **162.5** *(67)*	Er **167.4** *(68)*				
		Tm_I *(69)* Tm_{II} *(70)* **168.5**	Yb‡ **172.0** *(71)* Lu **174.0** *(72)*		Ta **181.5** *(73)*	W **184.0** *(74)*	- *(75)*	Os **190.9** *(76)* Ir **193.1** *(77)* Pt **195.2** *(78)*
	Au **197.2** *(79)*	Hg **200.6** *(80)*	*(81)* Tl **204.0** Ac D **207.2** Th D **208.2** Ra C_2 **210.2**	*(82)* Pb **207.15** Ra D **210.2** Ac B **211.2** Th B **212.2** Th D_2 **208.2** Ra B **214.2** Ra D_2 **210.2**	*(83)* Bi **208.0** Ra E **210.2** Ac C **211.2** Th C_1 **212.2** Ra C **214.2**	*(84)* Ra F **210.2** Ac C_1 **211.2** Ac A **215.2** Th C_2 **212.2** Th A **216.2** Ra C_1 **214.2** Ra A **218.2**	- *(85)*	
(86) AcEm **219.2** ThEm **220.2** RaEm **222.2**	- *(87)*	*(88)* AcX **223.2** Th X **224.2** Ra **226.2** Mes Th_1 **228.2**	*(89)* Ac **227.2** Mes Th_2 **228.2**	*(90)* Rd Ac **227.2** Rd Th **228.2** Io **230.2** Th **232.2** Ux_1 **234.2**	Ux_2 **234.2** *(91)*	*(92)* U_{II} **234.2** U_I **238.2**		

* Be = Gl
† Cb = Nb
‡ Neoytterbium = 173.5

Atomic Weights listed in Bold figures.
Atomic Numbers listed in *Italics* in parentheses.

have atoms of identical chemical properties but different atomic weights. These atoms have been named by Professor Soddy *isotopes.* Thus there appear to be several different kinds of atoms of the metal lead of slightly different atomic weights, but all having the atomic number 82 and all the same chemical properties.

It was long ago suggested by Prout that all atoms were built up of multiples of a certain primordial element, and hence that atomic weights should all be integer multiples of some unit. As, however, analytical chemistry progressed it was found that this was not the case. Enormous skill and knowledge have been brought to bear of late years upon the determination of the atomic weights and it has been found that Prout's hypothesis is not supported by facts.

Take, for instance, the atomic weight of chlorine, which is 35·46, when that of oxygen is 16. The weight of the atom chiefly resides as we have seen in the positive electron, and there must be an integer number of these positive electrons in the nucleus. The suggestion has therefore been made that there are two kinds of chlorine atom or two isotopes, one with atomic weight of 35, and the other with an atomic weight of 37. They both have the same chemical properties and ordinary chlorine gas is a mixture of these two kinds of chlorine atoms in such proportions that the average atomic weight is 35·46.

The explanation of this may lie in the fact that small variations in the ballast weight of the atom may take place without variation in the atomic properties. Thus the atomic number of chlorine is 17. One kind of chlorine atom has an atomic weight of $35 = 2 \times 17 + 1$ and the other isotope is $37 = 2 \times 17 + 3$, and 1,300 atoms of ordinary chlorine gas comprise about 1,000 atoms weighing 35 and 300 weighing 37 units, equivalent to 1,300 in all, weighing 35·46 on an average.

It is a singular fact that taking the oxygen atom to weigh 16, the following atoms have nearly exact interger atomic weights, helium = 4, carbon = 12, nitrogen = 14, fluorine = 19, sodium = 23, phosphorus = 31, sulphur = 32, arsenic = 75, iodine = 127, and cœsium = 133.

On the other hand, Dr. Aston, of Cambridge, working with improved methods originated by Sir Joseph Thomson, has determined with great exactness that the following elements comprise two isotopes: lithium of atomic weight 6 and 7, boron 10 and 11, neon 20 and 22, chlorine 35 and 37, argon 36 and 40, potassium 39 and 41, bromine 79 and 81. Whilst krypton, tin, xenon, mercury, magnesium and lead, have many more than two isotopes.

It appears quite clear therefore that the atomic number which gives us the total number of negative electrons circulating round the nucleus in the neutral atom is the determining factor in the chemical behaviour of the atom. It is now considered that these planetary electrons are arranged in rings or shells, one outside the other.

Thus in the carbon atom of atomic number 6, there are six resultant positive units of charge in the nucleus and two shells or rings of planetary negative electrons, the inner containing two and the outer layer four negative electrons, making six electrons in all. In the oxygen atom there are eight electrons in all, viz., 4, 2, and 2 in three shells, and in the sulphur atom there are 16 in all, arranged in four shells of 8, 4, 2 and 2, reckoning from within outwards.

The electrons in these shells or zones are in rapid rotation round the nucleus, but the different groups do not necessarily all revolve in the same direction nor in the same plane.

The outer shell or layer of negative electrons in the atom is that which chiefly determines the type of chemical compound formed with other atoms and these are termed the *valency electrons.* Some of these valency electrons are easily detached in the case of the metallic atoms. In a mass of metal, say, copper, there are, therefore, free electrons which are jumping about from atom to atom and moving in the inter-atomic spaces with a velocity of approximately 50 miles per second.

5.—Electric Conductivity and Electric Currents.

These free electrons bestow upon the metal its electric conductivity because when an electromotive force, due say to a Voltaic cell, is applied to the metal, these free negative electrons are caused to drift or move as a whole towards the positive end of the conductor.

The electrons have superimposed upon their irregular motion a drift in one direction, just as a swarm of gnats, in which each insect is flying hither and thither in an irregular manner, might be blown as a whole down a street by a gentle wind. This drift of electrons constitutes what we call an electric current.

Hence our usual convention as to the direction of the electric current in a conductor is wrong. We commonly say that the direction of the current in a wire is the direction of movement of positive electricity in the wire. But, in fact, there is no movement of positive electricity, only a drift of negative electrons in one direction in the wire. Hence all our usual mnemonic rules involving the direction of the current and that of the embracing magnetic field require to be restated and reversed.

A negative electron revolving in an orbit is therefore equivalent to an electric current and produces a magnetic field. Hence atoms in which the negative electrons revolve in the same direction and nearly in the same plane, will exhibit magnetic polarity, and this may account for the magnetic properties of the oxygen and iron and nickel atoms.

6.—Radio Activity.

A brief reference must then be made to the special qualities of the so-called radio-active elements, of which the most remarkable is the element radium.

It is found that certain of the atoms of high atomic number break up spontaneously and gradually are transformed into atoms of lower atomic number and weight. In the case of an atom like uranium, of atomic weight 238·2, the nucleus is a very bulky thing relatively to that of the hydrogen atom, which, according to a prevalent view, consists simply of a single positive electron, with a single negative electron revolving round it. The uranium atom, on the other hand, has 92 planetary electrons, and 92 effective and probably about 240 actual positive electrons packed into its nucleus, and perhaps about 148 negative electrons as well.

As the planetary electrons revolve round the nucleus they may set up strains in it or tidal actions, which may increase to such a point that the nucleus breaks up. When this is the case, we have thrown off from it either one or more negative electrons called β-particles or else one or more helium nuclei called α-particles. The helium nucleus consists of a group of four positive electrons and two negative electrons, having thus two effective positive charges. These six electrons must be bound together very tightly because the helium nucleus appears to be a remarkably permanent and indestructible article.

When the nucleus is ruptured or broken up these α and β-particles are shot off with immense velocity approximately to that of light waves, viz., 300,000 kilometres per second. In addition to this the impact of a β-particle against other molecules gives rise to the production of certain very short electromagnetic waves called γ-rays, which are like the X-rays in properties.

The atoms of which the nuclei can break up in this way are called *radio-active* elements. Prominent amongst them are radium itself, thorium and uranium, all of which are atoms of large atomic weight and relatively bulky or heavy nuclei.

We all know that when a heavy flywheel is in rapid rotation it contains a store of energy measured by half the product of its so-called moment of inertia and the square of its angular velocity.

If the flywheel bursts, the fragments are flung away far and wide, generally with disastrous results. In the same manner when the nucleus of a radio-active atom breaks up its α and β-particles are hurled away with such enormous velocity that they break up or ionise other atoms in their neighbourhood. The nucleus may therefore be in extremely rapid rotation.

The break up of a radio-active nucleus, however, is not exactly like the bursting of a flywheel. It proceeds by many stages and the various intermediate atoms which are successfully formed have " lives " of very different duration, varying from a few minutes to many thousands of years.

Thus for instance, beginning with the atom of uranium, with atomic weight 238·5, its average life is 5,000 million years. It throws off an α-particle, thus reducing its atom weight by four units, to 234·5, and is then transformed into a substance called uranium X_1. This, however, only lasts a few days (about 25) and is then transformed into uranium X_2. The latter gives off a β-particle, which does not sensibly alter the atomic weight, and is thus transformed into a far more permanent atom called uranium II, which has a life of about two million years. This, by the loss of two successive α-particles thus becomes ionium and finally radium, with an atomic weight of 226·5. This in turn gives off a gaseous " emanation," which has an atomic weight of 222·5, and is often called niton. Finally, by further losses of α and β-particles, this last substance is transformed into metallic lead, with an atomic weight of 206·5.

There is another chain or series of atomic transformations starting from uranium II which, in the end, also yields lead, but with an atomic weight of 210. Finally, from the thorium atom, there are a series of descendants ending also in lead, with an atomic weight of 208. Hence the lead atom exists in several isotopic forms, and there are atoms, all of which, chemically speaking, are lead, but have different atomic weights. Accordingly, some part at least of the atomic weight of lead, viz., that over and above twice its atomic number, which is 82, has no influence on the chemical properties, for all these varieties of lead atom have the same atomic number.

Thus, in a certain sense, the dreams of the old alchemists have been realised. Although we have not been able to transform lead into gold, as they hoped, we now know that the element uranium is slowly and spontaneously changed into radium and finally into lead.

It appears therefore as if the nuclei of all atoms are built up in part of the extremely permanent helium nuclei, held together in some way by negative electrons, into a very compact mass. Possibly also free positive electrons or hydrogen nuclei may be present as well.

From certain experiments made by bombarding nitrogen and oxygen gas with α-particles, Sir Ernest Rutherford has shown that nuclei or atoms of an atomic weight of three carrying two, or it may be one, positive electric charges, are liberated. It seems as if these nuclei were composed of three positive electrons, held together by one negative electron or perhaps two.

It has been long known that the atomic weights of many elements which are integers can be represented by the general formula $w = 4n$ or $w = 4n + 3$, where n is some integer. This seems to support the view that the atomic nuclei in these cases are built up of helium nuclei of mass four and of the unnamed nuclei of mass three, the atomic number being then given by $a = 2n$ or $2n + 1$.

Harkins has suggested that all atomic nuclei are built up of hydrogen nuclei, helium nuclei, and the above unnamed nucleus of mass three, but having one positive charge and not two.

When the helium nuclei or α-particles are expelled from the disrupted nucleus of a radio-active atom, they are flung off with velocities which may be of the order of 20,000 kilometres per second, or, say, 12,000 miles per second, a velocity which would take them round the earth in two seconds. Since the mass of a helium nucleus or α-particle is about four times that of a hydrogen atom, or, say, nearly 6×10^{-24} of a gram, the energy of the α-particle is about

$$\frac{1}{2}\ \frac{6}{10^{21}}\ 4 \times 10^{18} = 12 \times 10^{-6}$$

ergs, or, say, 12 microergs.

On the other hand, the β-particles are thrown off from radio-active atoms with a velocity of about 0·9 of that of light, or, say, 270,000 kilometres per second. Since, however, the mass of an electron is only 9×10^{-28} gram, we have the kinetic energy of a β-particle given by

$$\frac{1}{2}\ \frac{9}{10^{28}} \left(\frac{9}{10} \times 3 \times 10^{10}\right)^2 = \frac{1}{3} \times 10^{-6} \text{ nearly}$$

or nearly one-third of a microerg. Therefore the single α-particle has 30 to 40 times the kinetic energy of the single β-particle.

In consequence of their very small size and of the very porous or open structure of atoms generally, the chances of a β-particle being stopped when fired through a volume of air, is much smaller than that of the larger α-particles. The β-particles scarcely lose half their velocity in passing through a thickness of air of one metre, whereas the α-particles are stopped completely by a few centimetres.

Owing to the very open or skeleton structure of atoms, which has already been mentioned, it is possible for the α-particles to pass through thin sheets of metal, but the β-particles can pass through plates of several millimetres, or even inches, in thickness.

In the passage of the particle it will come into close proximity with other atoms of the metal plate and be deflected from its path. Thus an α-particle may come close to some other atomic nucleus and will then whirl round it and be flung off in a hyperbolic path just as a comet is affected when passing round the sun. Similarly a β-particle will be deflected by atomic electrons.

When an α-particle strikes a screen covered with fluorescent material, such as zinc blende, its impact gives rise to a tiny flash of light which can be observed through a lens or microscope. This fact was utilised by Sir William Crookes in the construction of an instrument he called a *spinthariscope*, in which a minute fragment of a radium salt on the head of a pin was held near a small fluorescent screen and the little flashes due to the bombardment of this target by the α-particles was observed through a lens.

Sir Ernest Rutherford and many other investigators have made use of this method in a highly ingenious manner to determine a maximum limit to the size of the nucleus of atoms by calculations made from observations of the deflection of an α-particle by a thin plate of metal.

By bombarding molecules of hydrogen gas in this manner with α-particles, it has been found that the centres of the hydrogen and helium nuclei must approach within a distance of $1{\cdot}7 \times 10^{-13}$ centimetre. Hence the sum of the radii of these nuclei must be if anything *less* than the above number.

We can conclude, therefore, that the diameter of a single positive electron such as forms probably the nucleus of a hydrogen atom, is *less* than $0{\cdot}8 \times 10^{-13}$ centimetre. Now this is less than the diameter of a negative electron. Moreover, since we know the mass of the hydrogen nucleus, which is $1{\cdot}66 \times 10^{-21}$ gram, we see that the density of the hydrogen nucleus or positive electron must be of the order of 7×10^{15}, an enormous number when compared with the mean density of atoms themselves, or masses of matter.

Hence we arrive at the conclusion that atoms are very open or porous structures, but the particles, viz., the positive and negative electrons of which they are made, have a stupendous density.

From experiments made by the deflection of α-particles in passing through sheets of various metals, Sir Ernest Rutherford has concluded that the diameters of the nuclei of atoms are of the order of 10^{-12} centimetre, or one billionth part of a centimetre.

(*To be continued.*)

Of Interest to Inventors—"Licences of Right" Patents.

By a BARRISTER-AT-LAW.

IT has always been a matter of difficulty for what may be termed the non-professional inventor, once he has succeeded in passing his specification safely through the Patent Office, to find a suitable channel through which he can either dispose of his patent rights or in some way or other get his invention manufactured and marketed.

In practice there are many reasons which may operate to prevent the proper exploitation, even of a really meritorious invention. The fact that it will supply a long-felt want, or that it will enable a given article to be produced more efficiently or economically, is by no means a sure passport to commercial success.

For example, a manufacturer who, say, has recently laid down expensive plant to produce an article of a given design is approached by an inventor with plans for the production of a better article at a less cost. If the patentee is a poor man, or one who does not know the ropes, he may sell his patent rights for some quite inadequate sum. The purchaser promptly "pigeonholes" the patent. He will not make the improved article himself, for it involves the scrapping and replacement of his new machines, and he is now in a position to prevent anyone else from making it under the penalty of infringement.

This is a great injustice to the inventor, who naturally wants to see his idea upon the market where it will earn him royalties. He has probably stipulated for some return on each article made or sold, but unless he has been very wary he will find himself without any remedy should the purchaser actually decline to manufacture.

There are many instances of such "blocking" methods in which patents are maintained by one firm simply and solely to *prevent* some other firm from putting the article upon the market. The holder of such a patent adopts a dog-in-the-manger policy. He will not make himself, because it pays him better not to do so, and he abuses the monopoly grant he holds by forbidding others to manufacture.

The consuming public in general are, perhaps, the greatest sufferers in such circumstances. They have the right to expect that the system of protecting invention by Letters Patent shall result in a meritorious invention being at once utilised and marketed. The inventor is an asset to the community only so far as he succeeds in producing something that fulfils a want, either in the form of a new or improved commodity, or by the more economical production of an article already in use.

This form of abuse therefore strikes at the very roots of the Patent System. The State does not give a monopoly grant in order that it shall be bottled up to suit certain vested interests.

The Patents Act of 1919 is very clear on this point. It says very distinctly and specifically, "Patents for new inventions are granted not only to encourage invention but to secure that new inventions shall so far as possible *be worked on a commercial scale* in the United Kingdom without delay."

In an attempt to prevent such abuses the Patents Act in question has created what is in effect a new kind of Letters Patent, which possesses certain advantages over the ordinary grant. It is intended more particularly to serve those non-professional inventors who neither possess the necessary capital to market their own ideas nor have direct access to interested manufacturers.

The new form of patent is distinguished from the ordinary grant by being labelled or endorsed "Licences of Right." The procedure, so far as obtaining the grant is concerned, is presisely the same as before, and the initial stamp fees are identical, *i.e.*, £5 up to and including the sealing fee. When the grant has been sealed, it may be endorsed "Licences of Right" on the payment of a single further fee of £1.

This endorsement is a formal notification to all concerned that the invention so protected may be manufactured under licence, which can be obtained from the patentee *as a matter of right*. The terms of the licence involve, of course, the payment of a reasonable royalty to the inventor. In the case of dispute between the patentee and a would-be licensee, the points at issue are referred to the arbitration of the Comptroller of the Patent Office, who is directed by the Act to decide them in accordance with the guiding principles that the inventor is to secure the maximum reward consistent with the largest possible manufacture within the United Kingdom.

There may, of course, be more than one licensee, but since there is always the Comptroller of the Patent Office as referee, the grant of subsequent licences must be made on such terms as are equitable and fair to the interests of existing licensees, and at the same time must not endanger an adequate return in the shape of royalties to the inventor.

When a thoroughly sound invention is thus, as it were, advertised in the open market, it is fairly certain to attract the scrutiny of interested manufacturers. Each knows that he may get a licence to work, simply by agreeing to pay a reasonable royalty, and will hesitate to lose an opportunity that may be seized by a competing firm. Naturally the first-comer will get the better terms.

Obviously it is impossible for anyone to "bottle up" such a patent so as to prevent it from getting on the market.

Once a patent has been labelled "Licences of Right" it is only liable to pay half the normal renewal fees, which means a saving of more than £60 spread over the full term of 16 years. This represents a considerable sum to the inventor of small means.

Finally it is by no means an uncommon thing for a "poor" inventor to find his patent rights filched from him simply because he has not the necessary means to fight an action for infringement in the High Courts. In the case, however, of a Licence of Right Patent, the interests of the licensees are involved just as much as those of the patentee, and all parties will join forces in resisting any such attempts upon their common property.

The Transatlantic Tests.

INVITATION TO CONTRIBUTE TO THE PRIZE FUND.

On the last occasion of the Transatlantic Tests, when British amateurs were successful in the reception of American amateur transmissions, prizes were offered by a number of manufacturers of wireless apparatus in this country. The names of those firms contributing to these awards were published in various issues of this journal, and the conditions under which the prizes were offered were stipulated by the firms individually.

Now that further tests are shortly to be conducted, manufacturers are again invited to contribute, should they desire to do so, to the prize fund which is being started.

Manufacturers are specially asked to interest themselves in these tests, whether in the matter of offering prizes or by giving their support in other directions.

At the present time most interests are naturally concentrated on the question of the development of the industry springing up as a direct result of broadcasting. The work of the scientific amateur should not suffer eclipse on this account, but rather a keener public interest should be felt in any such enterprise as that contemplated in the forthcoming transatlantic tests.

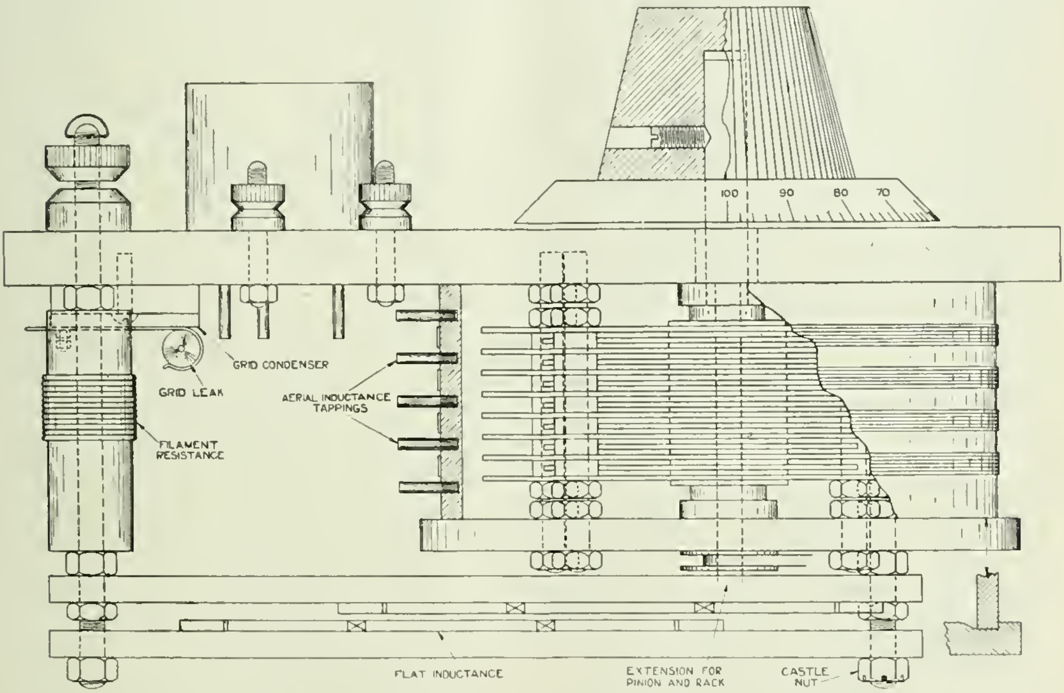
Experimental Station Design

(*Continued from page* 130, *October* 28, 1922.)

XVI.—A SINGLE VALVE BROADCAST RECEIVER.

THE regulations of the Post Office permit of the use of reaction for broadcast reception, providing that the plate circuit inductance is only loosely coupled to the aerial circuit, so that the oscillations which are set up are of so small an amplitude that interference is considered to be negligible. In order that the inexperienced user, who is unacquainted with the interference effects produced by tight reaction coupling, may not operate his receiving apparatus in a way that depends entirely upon the constants of the aerial to which the instrument is connected.

Of course, the tuning range of the instrument is limited, and the reaction coupling that is provided must be suitable for the band of wavelengths on which reception is desired. It is found in practice however, that the extent of reaction coupling needs to be altered as the value of the capacity in the aerial tuning circuit is changed. If the full advantage of the use of reaction is to be obtained, an



Suggested Design for a Single Valve Broadcast Receiver. The condenser spindle may be extended to carry a pinion to engage on rackwork to increase reaction coupling as the capacity of the tuning condenser advances.

is likely to spoil reception at near-by stations, the Post Office state that reaction coupling to the aerial circuit, when provided, must be fixed, and arranged in such a manner that it cannot be varied by the user without dismantling his receiver. To fulfil these requirements in a receiver that may be connected to an aerial having a wide range capacity value, and for use on aerials of all dimensions, presents many difficulties, as the extent of reaction coupling that can safely be used arrangement by which the extent of reaction coupling is automatically altered as the value of the aerial tuning condenser increases, may partly serve as a solution of these difficulties. In practice such an arrangement presents many difficulties. The desired increase in reaction coupling does not vary proportionately as the value of the condenser is increased to vary through a given range of wavelengths. The only way to accomplish this is to so shape the condenser plates that the capacity variation for a given turning of the condenser spindle gives a suitable amount of movement for increasing the reaction coupling. The stem of the condenser is then of course extended, and a portion of the aerial inductance is moved in the field of the reaction coil. Referring to the diagram, this arrangement can be provided by extending the spindle to a plate carrying the flat inductance. This inductance would be moved over the reaction inductance by rack work as the condenser spindle is turned. A suitable setting depending upon the capacity of the aerial circuit would be obtained when installing the instrument by disengaging the rack work and sliding the inductances to the required position, or alternatively the stationary inductance might be slipped along to the desired extent.

Here it might be pointed out that the degree of reaction coupling of course depends upon the amplitude of the currents produced in the plate circuit, which in turn varies with the type of valve employed, filament birghtness, and the value of the high tension battery. It is presumed that with receiving instruments of this sort, the type of valve to be used will be specified, and also the variety of high tension battery of definite voltage. In instruments of this sort it becomes essential, of course, that the filament current cannot be varied by the user, and consequently fixed filament resistance must be provided for use on a particular voltage. The filament resistance is shown wound on an ebonite, fibre or china tube held on one of the rods which support the platform carrying the flat inductances. This rod may also serve as a stem for the aerial terminal, and for bringing the aerial connection through to the base of the instrument, for connecting to one of the flat inductances. Another similar terminal arranged symmetrically on the other side of the instrument should also carry a piece of ebonite, on which may be wound, non-inductively, about 400 turns of No. 38 single silk-covered "Eureka" wire. This non-inductive resistance is shunted across the aerial circuit, and tends to make the point of oscillation less critical. To provide for differences in aerial length, the loading aerial inductance, which is wound on a tube which forms a cover for the variable condenser, is tapped out, so that connection can be made to the most suitable point on the inductance at the time of installing the instrument, to give the broadcasting wavelength by a mid-position setting of the condenser scale. The value of the aerial tuning condenser should not exceed 0.00025 mfds. The circuit to which the instrument is wired is that usually employed for single-valve reacting receivers, excepting, of course, that the aerial circuit is shunted with the resistance as stated above.

So many difficulties are encountered in designing an efficient single - valve non-radiating receiver which is not provided with variable reaction coupling, that it is probably wise to entirely abandon the use of reaction in a single-valve receiving set. The usual type of British valve, when used as a detector without reaction, is usually very little better than a crystal, and hence it is probable that the only application of a single valve is that of a note amplifier following a crystal detector.

It is with satisfaction that we learn that reaction may be used in single-valve broadcast receiving apparatus; but until the problem as to a method of using fixed reaction has been solved, the privilege is of little value. The Post Office, whilst giving authority for the use of reaction, should lay down some standard or specified test which could be applied, so that the manufacturer may know whether the apparatus that he is designing is likely to meet with official approval.

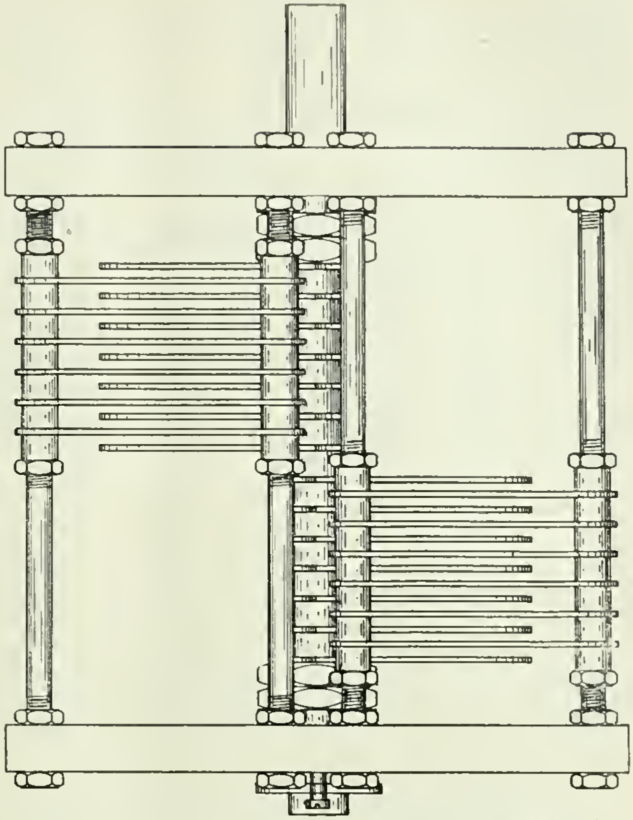
XVII.—AN IMPROVEMENT IN THE USE OF A TUNED ANODE CIRCUIT.

The use of the tuned anode system of high frequency amplification brings with it the difficulty of adjusting a number of circuits simultaneously. This difficulty is a serious one, and unless each circuit is carefully tuned with a wavemeter, the efficiency of the receiver is considerably impaired. The difficulty increases with the number of tuned anode circuits in use, though even with only one such circuit, rapid tuning is by no means simple.

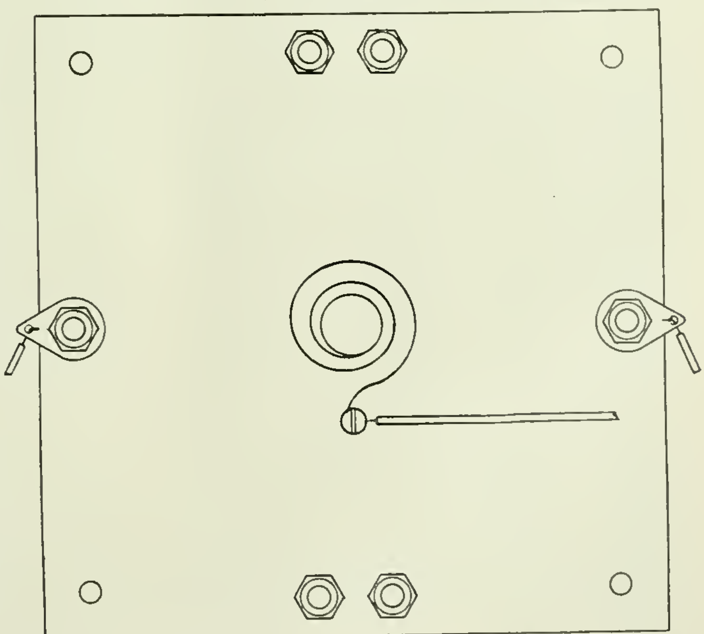
It is the general practice, when using this system of high frequency amplification, to use a secondary inductance in the aerial circuit. Now, if this inductance is of identical value to the inductance inserted in the plate circuit of the first valve, it follows that the condenser which bridges its ends must be of the same value as that used for bridging the anode coil, and consequently the two condensers must be adjusted together. The accompanying diagram represents a condenser built with its moving plates divided on to two sides of a common spindle, whilst the two sets of fixed plates are insulated from one another as indicated in the view of the under side.

This condenser consists of two sections, each of which gives precisely similar values. The spindle is connected in the circuit to the H.T. +, whilst one set of plates is joined to the grid end of the closed circuit coil, and the other set of fixed plates to the plate of the first valve. This method of connecting up necessitates the use of a suitable grid condenser and leak in the grid lead. Great care must be taken in building up a condenser of this sort to ensure that all of the moving plates are centrally spaced between the fixed ones, as even one plate a little out of place will considerably increase the capacity. With care it is possible to build up a pair of condenser units similar to the one described, and to couple the spindles together for the purpose of tuning a number of high frequency tuned anode coils. Alternatively one double condenser can be used for tuning two anode inductances, whilst a separate single condenser may be used for tuning the aerial closed circuit. This single condenser should have an ebonite coupling with the spindle of the double condenser, if it is not desired to use a grid condenser and leak with the first valve.

It is essential that the inductances with which these condensers are connected should have equivalent values, and with short wave working this is quite a simple matter if the inductances are wound as single layers on an ebonite former.

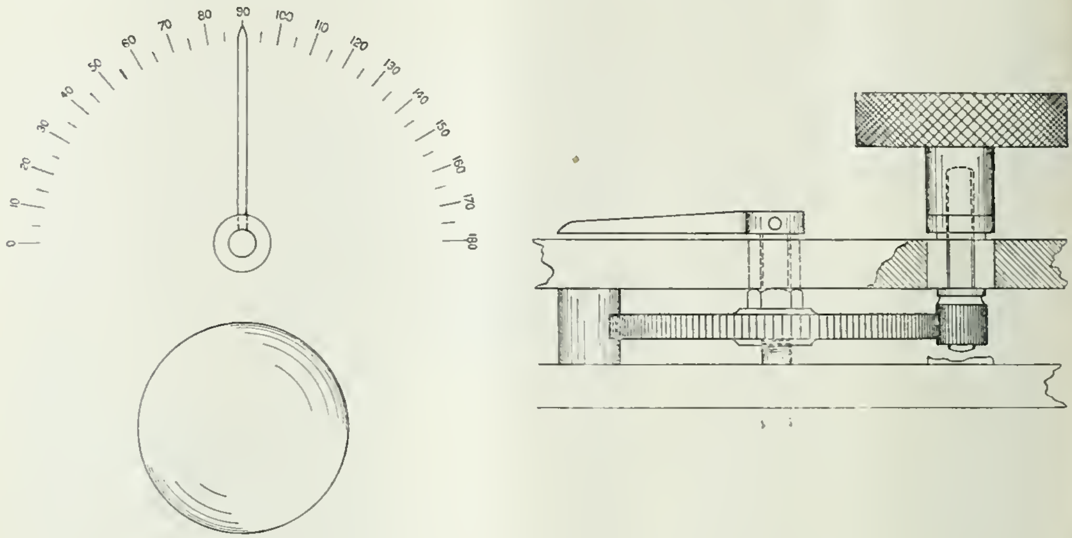


Variable Condenser for Tuning Two Circuits simultaneously.



End View, showing Connections to Spindle and separate Fixed Plates.

For critically adjusting the condenser, it is helpful to adopt some such arrangement as any excessive friction that may occur on the bearings when two condensers are coupled



Geared Condenser Control to revolve coupled Condensers.

shown above. As well as providing the critical tuning usually necessary in high frequency circuits, this arrangement a'so overcomes together, and perhaps very slightly out of alignment. F.H.H.

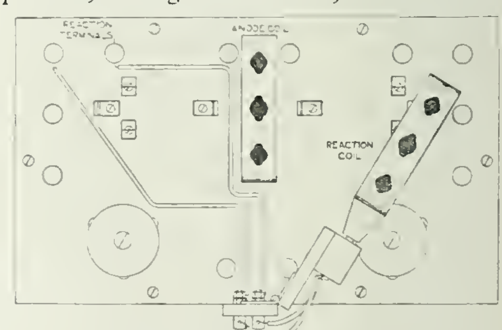
Further Notes on a Four-Valve Station

HOW TO COMPLY WITH THE LATEST P.M.G. REGULATIONS.

By Percy W. Harris.

In some recent articles contributed to this magazine (beginning July 15th last) the present writer described in detail the construction of a four-valve receiving set embodying a tuning unit, a H.F. amplifying and detecting unit, and a two-valve note-magnifying unit. Provision was made for single-circuit tuning with reaction coupling to the aerial, and for two-circuit tuning with similar reaction.

At the time when this set was designed the Postmaster General's regulations regarding reaction were scarcely defined. Many of these four-valve sets have been constructed by readers and no doubt are being used with the reaction coil acting on a loosely coupled secondary. This method, however, is liable to cause interference in the immediate vicinity of the station. The present article describes a simple method by which the reaction coil can be made to act on the anode coil behind the first valve, thus limiting the extent of radiation. At the same time the rapid change from stand-by to tune is still possible, tuning is facilitated, and C.W. can



Pivoted coil holder in position.

be received by the autodyne method, with either direct or inductive coupling to the aerial. In short, the set retains its efficiency, while complying with the latest regulations of the Postmaster-General.

Very little constructional work is necessary, and there is no interference with existing connectings or fittings. Briefly, the method consists in fixing a support to the front of the H.F. and amplifying unit, the support carrying a hinged piece which in turn carries a standard coil plug. Into this plug a suitable plug-in coil is fitted and can be swung nearer to or farther away from the anode coil on which it reacts. No new coils are needed, as one simply transfers the reaction coil form the tuner to the new fitting. The materials needed are one standard coil plug, two terminals, one hinge, and some odd strips of ebonite from the scrap-box. Wood can be used instead of ebonite for the main support, if preferred. Ebonite, however, looks well, and is recommended to those who like their set to have a well-finished appearance.

First cut a strip of $\frac{1}{4}$-inch ebonite to the dimensions shown in the diagram. Then cut a further strip of the same width, but $1\frac{7}{8}$ ins. long. Obtain from the ironmonger one brass hinge (as used for bureau flaps), one inch wide and $\frac{3}{4}$ in. across when folded. It should be of the type with parallel sides.

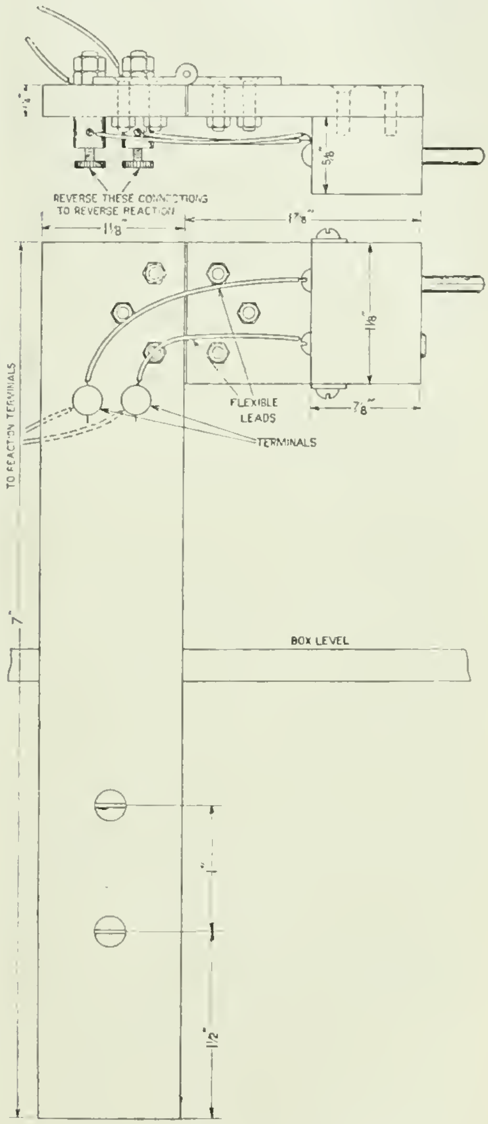
Drill the support and the swinging arm each with three clearance holes for 6 BA metal screws, $\frac{7}{16}$ in. long. Fit the hinge with these screws and secure them at the back with suitable nuts, as shown. The plug should next be secured to the swinging arm by two 6 BA metal screws about $\frac{1}{4}$ in. long, clearance holes being drilled in the arm and tapped holes in the ebonite of the plug. Drill holes also in the support for the two terminals and fit them with nuts.

In the lower portion of the upright support drill two countersunk holes to take a pair of wood screws. These will secure the upright to the wood of the box.

The upright should not be screwed to the box until the rest of the device is finished, as then it can be placed easily by plugging in any suitable coil and moving it about until the correct point is found If the swinging coil extends too far forward, a slip of wood should be inserted between the upright and the box. It will stand up about three and a half inches above the top of the box. Stiff wire can be used from reaction terminals to support terminals, and flexible leads from the latter to the coil plug.

The smaller diagram shows the top of the H.F. amplifying and detecting unit, with the new device in place. If desired, an extension handle can be fitted to facilitate moving the coil, but in practice it does not seem necessary.

The writer strongly recommends this form of reaction to all who have made up the four-valve set. It is easy to manipulate, is efficient and is also simple to construct. As it now stands, the set is proof that one can comply with all the P.M.G. regulations, in letter and in spirit, without losing that efficiency we all aim to attain.



Details of construction of bracket and arm.

The Transatlantic Communications

FURTHER INFORMATION.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

From the latest information received from America in connection with these tests, it appears that even greater enthusiasm is being shown there on this occasion than last year. As has already been announced, in these columns, the American Radio Relay League has imposed stiffer conditions this year for their transmitters. They have stipulated that in order to qualify for an individual transmission period in the final tests, transmitting stations must have signalled over a range of at least 1,200 miles. These preliminary tests were held at the end of last month and a few British amateurs have reported reception of signals from some of the American stations during these tests. This result gives hope for the success of the main tests next month.

Reception From America.

The main transmission tests from the United States will continue for 10 nights and will last from midnight, G.M.T., to 6 a.m., on each occasion. This 6-hour period will be divided up into a "free-for-all" period lasting for 2½ hours commencing at midnight, followed by individual transmission periods for the remaining 3½ hours. The "free-for-all" period will be divided up into shorter periods which will be allocated to the various districts of the United States and Canada, much as was done last year. Before the commencement of the tests, details will be published of these time allocations, as a guide to listeners in this country.

The wavelengths to be used during each of the individual transmission periods will also be published as soon as they are received from the American Radio Relay League; but should they reach this country too late for publication in this way, they will be circulated by post to all amateurs who have registered their names with the writer as desirous of listening-in for the signals.

Daily Reports.

Through the kindness of Marconi's Wireless Telegraph Co., and the Radio Corporation of America, arrangements have been made for the transmission at 0700 G.M.T. each morning during the tests of a report addressed to the "American Radio Relay League," giving details of any receptions that are reported here. In order to enable these reports to be prepared by the Sub-Committee of the Wireless Society, which is making the necessary arrangements, every amateur hearing signals is requested to report their reception immediately by telegraph or telephone to the writer. Such reports will be verified by comparison with the special code letters which will be sent over by the American Radio Relay League, before inclusion in the daily reports.

These daily reports will be sent by Carnarvon MUU at 0700 G.M.T. on a wavelength of 14,200 metres, at approximately 12 words per minute, and will be repeated five minutes later by New Brunswick WII.

Similar arrangements have been made by the French Transatlantic Signals Committee for the daily transmission of reports of the reception of American signals by French amateurs. These reports will also be addressed to the American Radio Relay League and will be sent by Sainte Assise Radio Station at approximately 0710 G.M.T. on a wavelength of 15,000 metres. They will be repeated five minutes later by Marion station, in the United States.

During the transmission tests to America from this country and from France, similar daily reports will be made by the A.R.R.L. from New Brunswick Station, WII, on a wavelength of 13,600 metres, at 2000 G.M.T. (8.0 pm.). These reports will be addressed to "Coursey, London," and will be repeated by Carnarvon MUU on a wavelength of 14,200 metres five minutes after reception there.

All wireless amateurs in the country will therefore be able to follow the progress of the tests from day to day by listening in to these transmissions from Carnarvon at 0700, and from Sainte Assize at 0710 G.M.T., during the reception tests here, and to the Carnarvon reports at 2000 G.M.T. during the transmission tests from this side.

Special Testing Signals.

In order to help listeners here to adjust their sets to the maximum sensitivity arrangements have been made for the transmission each evening of special testing signals from a station near London on a low power and using wavelengths approximately covering the band to be used by the Americans.

These signals will be sent on wavelengths of 200, 230, 275 and 325 metres, commencing at 2000 (8 p.m.) on Thursday, November 23rd. The signals will be in the following form :—

"TEST TEST TEST de 2 VK 2 VK 2 VK. XXXXXXX ———— XX. WAVE-LENGTH . . . . . METRES."

The transmission on each wavelength will last for 10 minutes, and the change over from one wavelength to the next in the above order will be made as quickly as possible, so that the transmissions will be as follows :—

From 8 p.m. to 8·10 p.m. on 200 metres.
From 8·15 p.m. to 8·25 p.m. on 230 metres.
From 8·30 p.m. to 8.40 p.m. on 275 metres.
From 8·45 p.m. to 8·55 p.m. on 325 metres.

A low power will be used for transmission in order to make the signals a real test of the receiving apparatus. Reports of the reception of these signals are invited, particularly in order to compare the relative transmission qualities of the various wavelengths. These transmissions will not take place on Saturday and Sunday unless otherwise announced on Friday, November, 24th These test signals will continue until the evening of December 11th.

Transmissions from Europe.

These transmissions from Europe will be made from this country and from France. They will extend from December 22nd to December 31st inclussive and will last from midnight to 6.00 a.m. in each case. Three hours each night have been allocated to the British transmitters, and three to the French, the periods alternating on successive nights, commencing with British transmissions from midnight to 0300 on December 22nd, followed by French transmissions from 0300 to 0600 on the same night. The next night the French will have the first three hours, and the British the second period; and so on alternately. This arrangement should give a very fair distribution of the transmitting periods to the two countries.

In order to meet the desires of many of the ordinary low powered transmitters here, it has been decided to reserve the first half-hour of both British transmission periods for a "free for all" transmission, during which any licensed transmitting station in Great Britain may transmit on their licensed power and wavelength without registration in any way. These calls should simply be in the form of "TEST TEST TEST the call letters, 3 lines." repeated as often as desired. These transmissions should preferably all be made on the shorter licensed wavelengths in the 150 to 200 metres band.

To those transmitting stations which comply with the conditions recently announced in these columns, and have registered their names with the writer, special individual transmitting periods will be allocated, with special code letters to be used. Details of what is to be transmitted by these stations will be forwarded by post shortly before the commencement of the transmission tests.

Avoidance of Interference.

It is hoped that every amateur in the country will co-operate to make these tests a success by avoidance of interference during the periods of listening for American signals between December 12th and 21st. Not only should transmitters be kept quiet after midnight between these dates, but receiving sets also should not be used so as to avoid jamming other listeners in the vicinity. In particular also all those who intend to listen for the signals are urged to take every possible precaution against radiation from their signals by using a separate heterodyne far removed from the aerial circuit, in the manner that has already been outlined in recent issues of the *Wireless World and Radio Review*.

Notes.

London University Union.

On November 7th, Lord Haldane opened the University Union. A wireless concert was part of the programme.

Broadcasting in Argentina.

Transmissions from the Coliseo Theatre, Buenos Aires, have been greatly increased in power. An Italian Company recently rendered "The Geisha," which was an excellent transmission and highly appreciated by the wireless enthusiasts and others who listened in. The number of amateur transmissions in the Buenos Aires district has increased and now some commercial firms give regular transmissions. A suggestion has been made that British apparatus might find a market in Argentina.

550 Pairs of 'Phones Used at one Reception.

When the Finchley and District Wireless Society listened in to the Lord Mayor of Bristol's broadcast speech, two halls were used and 550 pairs of 'phones were used. The reception was effected on an indoor aerial. A demonstration and lecture was part of the programme, and loud speakers were used.

A Boys' Club Station.

A small receiving station has been established at St. Michael's Schools, Buckingham Palace Road, for the benefit of St. Michael's Boys' Club.

Local Demonstration at Gt. Crosby.

Mr. S. Frith, founder of the Liverpool Wireless Association, assisted by Messrs. J. A. Barton and C. Pellak, conducted a demonstration at a Bazaar at St. Luke's Church, Gt. Crosby. A temporary aerial had been erected. Mr. J. Jardine, Hall Road, transmitted excellent telephony and telegraphy.

French and North African Meteorological Services.

The following changes and additions have been made in the French and North African Meteorological Services, with effect from October 15th last:—

Eiffel Tower **(FL)** daily transmissions.—1. The French collective (synoptic report) messages at 0220, 0820, 1420 and 1920 G.M.T. are now sent on a 7,300 m. wave (C.W.). 2. The International collective report (including American stations) is now sent at 1005 G.M.T. on 2600 m. spark. 3. Additional reports (synoptic) from European and North African stations, and from ships in the Atlantic, are now sent out at 0400, 1600, 2100 G.M.T., wavelength 7,300 m. C.W. 4. "Agricultural meteors" are now sent daily at 0640, 1115, 1710, 2210 G.M.T. by telephony on 2,600 m.

Nantes **(UA)**.—A meteorological report giving the general situation in North America, the Atlantic and Western Europe, with probable changes, is now sent at 1230 G.M.T. on 2,800 m. spark.

Médiouna **(CNM)**. — Observations from five stations in Morocco, sent at 0845, 1430, 1945 G.M.T., on 5000 m. C.W.

Oran **(FUK)**.—Messages at 0300, 0900, 1445, 2000 G.M.T. Now sent on a wave of 3,500 m. c.w. instead of 3300 m. C.W.

Bizerta **(FUA)**.—Messages at 0315, 0920, 1520, 2020 on 5,150 m. C.W.

Transmissions of Telephony by the Eiffel Tower.

The following transmissions of telephony by the Eiffel Tower Station now take place on a wavelength of 2,600 metres:—

G.M.T.

0640 Weather forecasts, by districts, for France.
1115 Reports of General Meteorological situation, General Forecasts, and forecasts for Winds on French Coasts.
1710 General Forecast by Districts.
2210 General Meteorological Report, General Forecasts, Forecast of Winds for the French Coasts.
1720 After the forecast message (1710) a Radio Concert is transmitted.

Commencing on November 25th the 1710 transmission and the Concert at 1720 will be changed as regards times to 1820 and 1830 hours respectively. The duration of the Radio Concert is half an hour maximum..

Change of Address.

Messrs. Burndept, Ltd., have removed their Leeds Offices to larger premises at London Assurance House, Bond Place, Leeds.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—Recently I suspected that the dual amplification (two-valve and crystal) circuit I was using was not as efficient as it ought to be. The circuit in use is described by me in *The Wireless World and Radio Review* of May 27th, 1922.

As a test for sensitiveness I tried on October 15th to receive **PCGG** on my 4-ft. frame with 17 turns, in order to compare the strength with the strength I used to get a year ago. **PCGG** was so loud that it was just audible all over the room with the telephones hooked on to the trumpet. This was so encouraging that I changed over to the single valve dual and crystal circuit (described in the issue of *The Wireless World and Radio Review* previously referred to), and succeeded in receiving **PCGG** with only a single valve.

To make sure that the reception on October 15th was not a freak, I repeated the experiment to-day, and again received **PCGG** on the frame quite easily with a single valve, so loud that even the voice of the speaker could be recognised.

On the 100-ft. aerial, using the two valve dual and crystal circuit plus one valve note magnifier, and hanging the loud speaker out of the window, **PCGG's** music was audible 100 yards from the loud speaker.

It would be interesting to know if the above results are records or not.

London, S.E.23.

P. G. A. H. Voigt.

To the Editor of The Wireless World and Radio Review.

Sir,—I notice in your current issue some details of transmission from English amateurs being heard at Nice. If it is of any interest, we have been working regularly for some weeks, to a man at Geneva, who reports signals very strong, audible all over the room. Current in aerial from 0·75 to 0·9 ampere. Receiver, three valves (detector and two note magnifiers). Also received very strong in Paris on a single valve, the aerial there being very short and badly screened by high buildings all round.

H. H. T. Burbury (2 AW).

To the Editor of The Wireless World and Radio Review.

Sir,—As a Wireless amateur who has been very much interested in and derived considerable pleasure and mental profit from the telephonic transmissions of **FL**, and in pursuance of an idea which had been in my mind for several months, I wrote to General Ferrié on the 25th October, suggesting that it would be a fine thing if he could see his way to grant permission for a wireless Commemoration Service to be transmitted from the famous station on the evening of Armistice Day, November 11th, so that the wireless amateurs of the Allies, with their circles of friends—ex-Service and civilian—could join in simultaneous homage to the great ones who gave their lives for freedom in 1914-1918.

With the suggestion, I send a proposed programme.

I was delighted to receive a kind letter from the General, under date of 31st October, expressing his warm approval of the idea and conveying the intimation that he would communicate with Commandant Jullien, Chief of the Eiffel Tower Wireless Service.

On the 10th inst., I received a letter from Commandant Jullien in which he intimated that he would be happy to organise the transmission which would commence at 21·30, but unfortunately, the intimation came too late for announcement in the *Wireless World and Radio Review.*

I presume that many of your readers were, like myself, privileged to join in the fine wireless service which was transmitted, and trust that I echo the wishes and sentiments of them all when I express the wish that the service, which one might characterise as of international character and significance, will be only the first of a series.

Vernon I. N. Williams.

To the Editor of The Wireless World and Radio Review.

Sir,—I see in the last issue of the *Wireless World and Radio Review* that Mr. Deloy has heard several British amateurs—using an aerial wire of 160 metres.

As I wrote it to the owner, Mr. Burbury of Wakefield, I hear the station **2 AW** very easily with the following apparatus: aerial 20 metres long, *steel* wire (0.6 m.m. diameter) well under the level of the surrounding roofs.

My set is home-made and consists of a Reinartz Tuner (modified) or an ordinary regenerative receiver (tuned plate circuit), and *only one detecting valve* (French "Metal").

Mr. Burbury told me his output is only 0.9 in the aerial.

I very often hear British amateurs on telegraphy and telephony but they are hardly readable, due to very marked fading. (My station is located in the centre of Paris and a big railway station is between England and my aerial—fading due to smoke ?).

So, you see that the reception in France of British amateurs transmissions is not such a difficult job.

Paris.

J. Perroux, Eng. E.S.E.

To the Editor of The Wireless World and Radio Review.

Sir,—I am very happy to give you the following report of reception of British amateurs.

My receiving set consists of :

Aerial loop 2.50 metres × 2 metres consisting of *one* turn of 12/10 copper wire, variable condenser 0.0005 mfds., Detector valve with reaction coil and note magnifying valve.

40 volts high tension battery was used and no filament rheostat or grid potentiometer.

The telephones are "Ducietet" make. On November 1st, between 8 p.m. and 9 p.m. I could hear **2 KF**, who came in very loud and clear, and **2 NM**, **2 AF**, **2 AW** (telegraphy).

On November 5th, **2 DO** (not very constant.)

I would be very much obliged to you if you would congratulate the British amateurs I heard so well. I am situated in the centre of Paris, between a great number of very high buildings and without any external aerial, on the first floor of the house.

I hope to answer the British amateurs in a few weeks, and I look forward to the opportunity of speaking to them by telegraphy and telephony.

P. BUTEY.

Paris,
November 7th, 1922.

Wireless Society of London Accounts.

The Treasurer of the Wireless Society of London states that the account and receipt books are closed for annual audit until December 1st. He is, therefore, unable to answer queries relating thereto until after that date.

Calendar of Current Events

Friday, November 24th.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
At 8 p.m. Demonstration of "Burndept Apparatus," by Messrs. Townend and Phillips.

WIRELESS SOCIETY OF HULL AND DISTRICT.
At 7.30 p.m. Sale of Surplus Apparatus at the Signal Corps H.Q., Park Street.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
Lecture on "The Armstrong Super-Regenerative Receiver," by Mr. C. E. Morris.

SMETHWICK WIRELESS SOCIETY.
Lecture on "Alternating Current Applied to Generating Stations," by Mr. R. H. Parker.

Saturday, November 25th.

THE RADIO SOCIETY OF HIGHGATE.
At 7.30 to 11.30 p.m. At the Gate House, Highgate, N.6. Radio Dance. Fancy dress optional. Prizes. Tickets 7s. 6d. (double 12s. 6d.).

Sunday, November 26th.

Daily Mail Concert from the Hague. 3 to 5 p.m.

Monday, November 27th.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. Mellor.

Tuesday, November 28th.

Transmission of Telephony at 8 p.m. on 400 metres, by **2 MT** Writtle.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.
Lecture on "Elements of Alternating Current Theory," by Mr. E. W. Pinney.

Wednesday, November 29th.

MALVERN WIRELESS SOCIETY.
Lecture on "Electrostatics and Condensers."

EDINBURGH AND DISTRICT RADIO SOCIETY.
At 8 p.m. At R.S.S.A. Hall. Lecture on "Some Notable Inventions," by Mr. J. S. Smith.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.
Demonstration of Reception at Y.M.C.A., Union Street.

Thursday, November 30th.

HACKNEY AND DISTRICT RADIO SOCIETY.
At Y.M.C.A., Mare Street. Lecture on "Electrical Units and Ohms Law," by Mr. F. G. Francis.

OLDHAM LYCEUM WIRELESS SOCIETY.
Lecture on "Amplifier Characteristics," by Mr. A. T. Howes, of Manchester.

LUTON WIRELESS SOCIETY.
At 8 p.m. At Hitchin Road Boy's School. Lecture on "Valves," by Mr. R. Cox.

Daily Mail Concert from the Hague 8 to 9 p.m.

DERBY WIRELESS CLUB.
At 7.30 p.m. At "The Court," Alvaston. Informal Meeting.

ILFORD AND DISTRICT RADIO SOCIETY.
Lecture on "Reaction and how to keep within the P.M.G.'s Restrictions," by Mr. J. F. Payne.

Friday, December 1st.

BRADFORD WIRELESS SOCIETY.
At 5, Randallwell Street. Lecture by Mr. Liardet.

MANCHESTER WIRELESS SOCIETY.
At 7.30 p.m. At Houldsworth Hall. Lecture on "Radio Measurements and Measuring Instruments," by Mr. Bertram Hoyle, M.Sc.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
At 7 p.m. Lecture on "Construction of Condensers—Fixed and Variable," by Mr. S. Kniveton.

NEWCASTLE AND DISTRICT AMATEUR WIRELESS ASSOCIATION.
At 7.15 p.m. At Engineering Theatre, Armstrong College. Lecture on "Some Observations on Distortion in Wireless Telephony," by Mr. W. Owen.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
Lecture on "Common Faults in Receiving Circuits," by Mr. A. H. Norman.

Saturday, December 2nd.

CROYDON WIRELESS AND PHYSICAL SOCIETY.
At 7.30 p.m. Annual General Meeting and lecture on "Small Rectifiers for Charging from A.C."

Books Received

DIRECTION AND POSITION FINDING BY WIRELESS. By R. Keen, B.Eng.(Hons.). (London: *The Wireless Press, Ltd.*, 12/13, Henrietta Street, W.C.2. Illustrated. Price 9s.net.)

WIRELESS: POPULAR AND CONCISE. By Lt.-Col. C. G. Chetwode Crawley, R.M.A. (London: Hutchinson & Co., Paternoster Row, E.C. Illustrated. 92 pp. Price 1s. 6d. net. $7\frac{3}{4}'' \times 5''$.)

WIRELESS TELEPHONY SIMPLY EXPLAINED. By R. W. Hallows. (London: C. Arthur Pearson, Ltd., Henrietta Street, W.C.2. Illustrated. 125 pp. Price 2s. 6d. nett. $7\frac{1}{4}'' \times 4\frac{3}{4}''$.)

Official List of Radio Stations of Canada.

We have just received from the Radio Telegraph Service, Department of Marine and Fisheries, Ottawa, a copy of the official list of radio stations of Canada.

This list includes not only the commercial stations, but also all amateur experimental stations and broadcasting stations, and, in addition, it contains particulars of the procedure of working of direction-finding stations, together with a list of International Morse Code abbreviations.

Supplements to this list can be obtained by filling in a postcard with accompanies each book. Being of the loose-leaf pattern, these supplements can easily be added from time to time as they are issued.

The price of the list is 5s., and copies are obtainable from the publishers of this journal.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Wireless Society of London.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Walthamstow Amateur Radio Club.*

Hon. Secretary, Mr. R. H. Cook, 30, Ulverstone Road, Walthamstow, E.17.

On October 15th, Mr. Nickless, **2 KT**, gave a very successful demonstration of telephony reception on his five-valve set with loud speaker.

2 LO came through splendidly, as did also **2 ON**, who kindly transmitted music and speech for this occasion. At the end of the demonstration Mr. Nickless replied to many questions.

Mr. A. J. Smith gave a lecture the week previous on "Alternating Current and the Thermionic Valve" ably assisted by Mr. Allen, he cleared up many debateable points.

The Club is now affiliated to the Wireless Society of London and membership is steadily increasing. The Club was originally formed on October 1st, 1920.

Hackney and District Radio Society.*

Hon. Secretary, Mr. E. R. Walker, 48, Dagmar Road, Hackney, E.9.

An informal meeting was held at the new headquarters (the Y.M.C.A., Mare Street, Hackney, E.8), on November 2nd. The first unit of the Society's wireless set, made entirely by amateurs of the Club, was installed. It permits of the use of valve or crystal detection. Further units are in the course of preparation. With the aid of a three-valve Mark III L.F. amplifier, kindly lent by a member, telephony was very well received. The Society's set is as far as possible being built by means of contributions in the form of money or apparatus.

On November 9th, a special General Meeting was held.

On November 16th a debate on valves and crystals took place between Mr. Valins and Mr. Bell.

Mr. F. G. Francis will lecture on "Electrical Units and Ohms Law" on November 30th. Visitors are cordially invited.

Luton Wireless Society.*

Hon. Secretary, Mr. W. F. Neal, Hitchin Road Boys' School, Luton.

The third winter session was opened on October 5th by a public lecture and demonstration by Mr. W. B. Cole, of Marconi Company, on "Modern Wireless Telegraphy and Telephony," and a large public hall was filled. The Mayor of Luton was Chairman. Lantern slides were used. During the evening telephony and music were received and highly appreciated.

A Practical Class for instruction and experiment is held fortnightly under the direction of Messrs. A. E. King, F. W. Pellant, and the Hon. Secretary, a workshop being available on the premises through the courtesy of the local Education Authority. A single valve receiver is being constructed and experiments on different circuits, etc., are conducted.

On October 19th Messrs. B. & A. Wireless Company, of St. Albans, exhibited and demonstrated with a Burndept Ultra 4.

The second monthly lecture was given by Mr. C. S. Dunham, of the Wireless Society of London, on "H.F. Transformers and Couplings." This lecture was one of the most technical and instructive the Society has had the pleasure to hear. Very excellent results were heard on a three-valve receiver.

Morse practice under the direction of Mr. R. H. Cox, precedes all meetings from 7.30 to 8 p.m.

By an amendment to the rules, membership is forfeited when the annual subscription of 5s. is one month overdue. Membership increases steadily, new apparatus has been added to the club set, and a loud speaker is now available for members' private use.

Radio Experimental Association. (Nottingham and District).*

Hon. Secretary, Mr. D. F. Robinson, 99, Musters Road, West Bridgford, Nottingham.

At the new headquarters, Bennett's Garage, on November 2nd, Mr. Thornton occupied the chair, and Mr. Carpenter lectured on "The Valve as a Detector," assisted by Mr. Ford, who demonstrated.

Mr. Carpenter dealt with spark transmission, spark rectification, and the valve as a detector. Experiments were made with potentials applied to the grid, also various values of grid leaks and condensers, using Marconi-Osram "R" type and Mullard "Ora" valves.

Meetings are held every Thursday.

Borough of Tynemouth Y.M.C.A. Radio and Scientific Society.*

Hon. Secretary, Mr. Geo. J. S. Littlefield, 37, Borough Road, North Shields.

The third session opened on October 2nd, when the Hon. Secretary gave a short talk on "Aerial Construction." He described the different kinds of aerials in use and explained why certain types were to be preferred for given conditions. He showed specimens of various kinds of insulators and wires, and gave a great deal of valuable information to beginners. A number of questions were asked and answered.

On October 9th, Mr. W. G. Dixon, of the Newcastle and District Amateur Wireless Association was to have lectured, but owing to unforeseen circumstances was unable to do so. Mr. Littlefield stepped into the breach and gave a very interesting talk on the "Sterling No. I Aircraft Transmitter." The instrument was described in detail.

The lecture was followed by an interesting practical demonstration.

Mr. Scott demonstrated the "Ducon" appliance.

On October 16th, Mr. E. C. Lythgoe gave an exceedingly interesting talk on "Trench Communication." He described and illustrated with blackboard sketches, the various means employed during the war for maintaining communication between the front line trenches and headquarters. A hearty vote of thanks was accorded Mr. Lythgoe.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The tenth general meeting was held at the Erith Technical Institute, on November 3rd.

Recommendations of the Committee meeting held on October 31st were confirmed, viz.:—That ladies should be admitted as members of the Society on the same terms as gentlemen members, and that "Broadcast" members should be included at a reduced subscription.

It was decided to purchase a loud speaker. The equipment engineer was asked to proceed with the construction of a wavemeter.

Mr. S. G. Meadows delivered his paper on "The Electron Theory as Applied to the Thermionic Valve." The lecturer dealt with the structure of the molecule, and of the atom according to the now generally accepted electron theory, demonstrating his points as he went along on suitable apparatus.

At the conclusion of the lecture, the Chairman (Mr. T. E. Morriss) added a few appropriate remarks and accorded a vote of thanks for such an interesting and instructive paper.

Coventry and District Wireless Association.*

At the Club Rooms, 128, Much Park Street, on November 1st, Mr. Sidley, the President, gave a short address on general subjects connected with wireless telegraphy, which was followed by discussion.

Mr. Sidley appealed to all members using reactance to revise their circuits. The only permissible arrangement was, he said, to couple the reactance coil with a secondary coil of a closed circuit inductively coupled to the aerial coil. He offered to deal with any difficulties which might present themselves to members in converting their apparatus to the standard permissible form.

Mr. Sidley referred to his experiments in "wired wireless."

These remarks led to some interesting discussions.

Considerable interest was shown in the President's remarks upon apparatus embodying the Armstrong regenerative principle, and it was hoped to give fuller particulars of this apparatus at a subsequent meeting. Discussion on the use of frame aerials followed.

Manchester Wireless Society.*

Hon. Secretary, Mr. Y. W. P. Evans, 2, Parkside Road, Princess Road, Manchester.

A very interesting lecture was given by Mr. P. C. Stephens on "Electricity, Past and Future," in which he dealt with electrical progress from its earliest inception. An interesting discussion followed.

On November 1st, Mr. Y. W. P. Evans gave the first of his series of elementary lectures and dealt thoroughly with simple crystal circuits and also combinations of crystal and valve.

All technical matter was entirely eliminated and the various actions explained in everyday language, suitable for those just taking up wireless experimenting.

The high power transmitting valves for the transatlantic tests have been received and are being tested preparatory to erection. Four special tests with a 1-kW. spark set are being carried out on each Sunday morning in November from 1 a.m. to 7 a.m., G.M.T., the actual transmission being for a duration of the first 15 minutes in each hour. Call letter, **5 MS.**

Extraordinary results are being obtained with the Society's 10-watt set, and the benefit thus gained will be used in conjunction with American tests.

A special section of the Society is being devoted to "Broadcasters," for whom lectures are being arranged at a special fee, with a view to training them to become real experimenters.

East London Radio Society.*

Hon. Secretary, Mr. W. G. Simmonds, 60, East Ferry Road, E.14.

On October 17th Mr. Keens was unable to give the second half of his lecture on "Coils," being unavoidably absent, and October 24th was fixed for this event. Members listened in to **2 MT** and other transmitters. **2 FQ** was received very well.

Mr. W. C. Wells explained the Society's apparatus in detail to new members and visitors. Visitors are welcomed on Tuesdays and Fridays, from 7.30 p.m. to 10 p.m.

Fulham and Chelsea Amateur Radio and Social Society.*

Hon. Secretary, Mr. W. Wood, 48, Hamble Street, Fulham, S.W. 6.

A satisfactory and instructive meeting was held on October 31st.

The Secretary gave a lecture on "Elementary Inductance," and Mr. Whitts, assisted by the Secretary, gave an explanation of the cause of "dead spots" found in different countries. A hearty vote of thanks was passed to the Secretary.

A reception set for the use of the Society is in course of construction, and the necessary licence applied for.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

An informal meeting was held on November 3rd. A discussion took place on the "Evils of the Oscillating Valve." The principal speakers were Mr. A. Liardet and Mr. J. Bever, who both dealt very ably with the subject and explained the various methods by which "howling" could be avoided. Questions were invited and ably dealt with.

Arrangements are now in progress for the Society's Exhibition, which is to be held in January. Any firms desirous of exhibiting should communicate as early as possible with the Organising Secretary, Mr. N. Whiteley, 8, Warrels Terrace, Bramley, Leeds. All applications for space will be promptly dealt with.

Sutton and District Wireless Society.*

Hon. Secretary, Mr. E. A. Pywell, Stanley Lodge, Rosebery Road, Cheam, Surrey.

The Society is now affiliated with the Wireless Society of London, and the membership is steadily increasing.

At the meeting held on November 1st, the President, the Rev. F. C. Lees, gave an interesting account of his experiences with a Mark III* tuner in conjunction with a high frequency amplifier and tuned anode coupling, with which he obtained some very remarkable results.

An attractive programme is being arranged for the winter months, and it is hoped that a good attendance will result.

Bishop's Stortford and District Amateur Wireless Association.*

Hon. Secretary, Mr. J. Cooper, Halfacres, Bishop's Stortford.

The monthly meeting was held at the Institute, Bishop's Stortford, on November 3rd, the Vice-President, Councillor E. F. Cooper, occupying the chair. The President, Mr. W. A. Field, gave an address on "Aerials." Various types of aerials were described and shown in diagram, and their erection, construction, capacity, directional properties, etc., dealt with. The materials best suited for the purpose were indicated, and methods of jointing demonstrated. Specimens of the best types of insulators were passed round for inspection, and a special form of lead-in tubing shown.

The Chairman announced that the Society had become affiliated with the Wireless Society of London. A vote of thanks was accorded Mr. Field.

General meetings are held on the last Friday in every month.

Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, A.C.G.I., B.Sc., 49, Cholmeley Park, Highgate, N.6.

Mr. L. Grinstead, on October 20th, lectured on "Valve Characteristics and Design," illustrating by means of characteristic curves.

On October 27th a paper was read by Mr. S. Croneen on "The Magnavox Equipment." The general features and internal construction of the loud speaker and amplifier were described.

A lecture on "A Simple Wavelength Calculator" was given by Mr. F. Stanley on November 3rd. This calculator is in the form of a chart which shows at a glance the solution of the expression

$$\lambda = 1{,}885 \sqrt{CL}$$

There are still a few tickets left for the Radio Dance (see Calendar).

Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

On November 3rd the broadcast speech of the Lord Mayor of Bristol was received. Two halls were used, one holding 300 people and the other 250. The Marconi Telegraph Company sent a representative with apparatus, and the Stirling Telephone Company supplied two Magnavox loud speakers. Mr. Turner, of Regent Street Polytechnic, conducted the demonstration, giving two lectures, one before and one after. Every person present had a pair of 'phones, the wiring being entirely done by members. A Marconiphone U.2. and a Marconi amplifier were used in conjunction with an indoor aerial for the reception. The Society met on November 6th, when Mr. Grinstead, of the Mullard Radio Company, lectured on "The Valve and its Applications."

Southend and District Wireless Club.*

Hon. Secretary, Mr. C. G. Jackson, Lynncroft, Leigh Hall Road, Leigh-on-Sea.

Meetings are held every Friday at 8 p.m. at 51, Princes Street. On October 6th, Mr. Mayer (**2 LZ**) lectured on the "Elimination of Reradiation." He pointed out the trouble caused by the careless use of reaction, and explained that the three-circuit tuner may reduce interference considerably provided the reaction coil is coupled to the secondary.

At a subsequent meeting Mr. Mayer gave a lecture on "The Reinartz Tuner."

Mr. R. Brockbank gave a very interesting discourse on "Valves and their Characteristics" at the meeting held on October 27th. The lecturer showed how the characteristics were obtained, and explained their use.

Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

Under the auspices of the above Society, demonstrations of wireless telephony were given in aid of Church Funds at the Seven King's Baptist Church, on November 2nd, 3rd, and 4th. Telephony was successfully received from Marconi House, **2 ON** and **2 JX**. The loud speaker was loaned by Messrs. Radio Instruments, and the necessary batteries by Messrs. Fullers.

Bedford Physical and Radio Society.*

Hon. Secretary, Mr. C. W. Clarabut, 194, Castle Road, Bedford.

Meetings were held as follows:—

May 27th. Mr. R. W. L. Phillips was Chairman. The name of the Society was decided upon. It was then proposed by Mr. Craddock and seconded by Mr. Tearle, that Mr. R. S. Allen be asked to be President.

The following officers were then elected:—Vice-Presidents: Messrs. L. Bolton, Willmer Phillips, C. W. Hansel, R. W. L. Phillips. Hon. Secretary, Mr. C. W. Clarabut; Hon. Treasurer, Mr. C. E. Craddock; Committee: Messrs. B. F. Skinner, R. T. Rolfe, P. S. Hudswell, W. S. Pyrah, L. G. Noble, W. S. Tearle, A. H. Mackley, P. H. S. Kempton.

The subscription was fixed at 10s. per annum.

It was resolved: That the Society should meet fortnightly on such day or days as may be fixed at a later meeting; That the Society be devoted entirely to radio work for the present; That the Society be affiliated to the Wireless Society of London; That Mr. R. W. L. Phillips be deputed to approach Messrs. Wilton & Co., with a view to their abandoning the project of a new club, and the intending members joining this existing Society.

A vote of thanks was passed to Mr. Phillips.

June 24th, 1922. The Rev. H. W. Evans took the chair.

The minutes of the meeting held May 27th were confirmed and signed. The rules were taken as read, and unanimously approved. An amendment that S.1., Rule 3, be altered to include ladies as members, was lost.

It was resolved that a lecture and demonstration be arranged for July 11th, admittance to be by invitation tickets.

A lecture and demonstration by Captain H. Anthony Hankey, of Marconi's Wireless Telegraph Company, Ltd., took place on July 11th in the Bedford Modern School. Over 400 were present. A special concert was received from **2 LO**, also music from **2 MT**. The lecturer used his own apparatus. The President, Mr. R. S. Allen, proposed a vote of thanks to the lecturer, which was seconded by Sir George Royle, O.B.E.

There were 48 members present on July 25th. Mr. R. W. Phillips took the chair. Mr. W. S. Pyrah and Mr. W. S. Tearle lectured on tuning and elementary valve practice. Mr. C. W. Clarabut transmitted musical items from his experimental station **2 WD**.

Hoylake, West Kirby and District Wireless Association.

Hon. Secretary, Mr. Roper Brattan, 14, Kirby Park, West Kirby.

A general meeting was held on October 23rd, at the Green Lodge Hotel, Hoylake. In the unavoidable absence of Mr. Welding, the chair was taken by Mr. S. Evans, Technical Adviser to the Association, who announced in the course of his opening address that a stage of H.F. amplification, designed by Mr. Brattan, was being added by the Committee to the three-valve set then in use, and it was hoped that this would be in action by the next meeting.

Mr. Roper Brattan, with the aid of blackboard diagrams, then gave a very helpful list of various symbols used in wireless work, together with a particularly clear explanation of the variometer type of tuning and of crystal and single valve sets. Specimens of the latest Marconi valves were very kindly loaned by a member for inspection.

A vote of thanks was accorded the lecturer. Individual difficulties were then dealt with, a member's inductance coil being discussed and valuable improvements suggested by Mr. Brattan.

Newton-in-Makerfield and District Radio Society.

Hon. Secretary and Treasurer, Mr. R. W. Mayhew, 220, Earle Street, Earlestown.

A meeting took place in the All Saints' Mission Room, Crow Lane, Newton - le - Willows, on October 25th, Mr. Goff being in the chair.

The Chairman reported success in obtaining the use of a room in the Newton-le-Willows Cricket Pavilion for the winter months, and that the weekly meetings would commence there on Wednesday, November 8th, at 7.30 p.m. A discussion followed as to the programme, and Mr. Norman, the Vice-President of the Society, kindly consented to give a short address on "The General Principles of the Theory of Wireless Telegraphy and Telephony," and Mr. Goff a short address on "The Various Types of Circuits Suitable for Beginners' Use."

Mr. Smith gave an informative speech on "Wireless Licences," and pointed out that there were two kinds, the Experimental and the Broadcasting, and dwelt on the fact that in the case of the latter no changing of the circuit could be contemplated, and a ready-built set must be purchased made by a firm associated with the Broadcasting Company. He strongly advised all members to apply for experimental licences, by the possession of which they would be able to make their own sets and experiment with different circuits. Mr. Newall gave his personal experience in the matter of experimental licences and correspondence he had had with the Postmaster-General on the subject of aerials.

Mr. Goff gave a brief idea of the capabilities of one or two types of circuits, and said the Broadcasting Station would be open at Manchester very shortly, and should be received quite well on a good crystal set.

New members were enrolled.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

The opening night of the above Society was held on Tuesday, November 21st, at 8 p.m., at 36, Hamilton Square (top floor), Birkenhead. A demonstration of telephony was given, and various parts of radio apparatus belonging to members were exhibited and demonstrated.

Application forms for membership were handed round during the meeting. Affiliation to the Wireless Society of London is being applied for. Subscriptions are: 10s. for members over 18, 5s. for members under 18, and 2s. 6d. for lady members. All subscriptions should be sent direct to the Hon. Treasurer, Mr. G. A. King, 17, Kingsland Road, Birkenhead.

Hartlepools and District Wireless Society.

Hon. Secretary, Mr. Robert L. Howey, 33, Grange Road, West Hartlepool.

On October 10th a very interesting lecture was given on "Wireless Control," by Mr. G. Wenn. A model ship contructed by Mr. Wenn was used to demonstrate. This ship was built and worked nearly fourteen years ago.

The lecturer also mentioned the wireless control of airships.

Mr. Patterson, President of the Society, proposed a hearty vote of thanks to Mr. Wenn, and congratulated him upon building his model ship.

The proposal was carried with applause.

An interesting syllabus of lectures and events has been prepared for the coming winter.

The Society asks for lecturers.

Manchester Radio Scientific Society.

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

The Annual General Meeting was held on October 13th, Mr. G. G. Boullen being in the chair. After the minutes of the last annual general meeting, October 19th, 1921, had been read and passed, the Secretary gave his report of the year's work, and also read some correspondence of the Wireless Society of London. Questions on the subject matter were then invited and duly answered. The meeting proceeded with the revision of rules, and also discussed the question of how to meet the coming wireless boom. The election of officers for the forthcoming session was taken in hand, and the following gentlemen were re-elected:—Chairman, Mr. G. G. Boullen; Hon. Secretary, Mr. H. D. Whitehouse; Hon. Treasurer, Mr. J. R. Halliwell; Press Secretary, Mr. J. W. Hand.

An ordinary meeting was held on October 25th. The minutes of the annual general and the last ordinary meeting were read and passed, the new rules formulated coming into force. Four new members were duly elected. Suggestions were received by the Committee for the holding of meetings weekly instead of fortnightly as hitherto, every alternate Wednesday being left open for new members, especially those just beginning, to receive help and advice from older experimenters. The Society is laying itself out to assist the newcomers, and hopes that interested people will not fail to communicate with the Secretary. Mr. J. R. Halliwell then gave "His Impressions of the All-British Wireless Exhibition," which proved of great interest. The lecturer concluded with a frame aerial demonstration, using a three-valve set. The Metropolitan Vickers Station, Manchester (2 ZY) came through very well.

Bromley Radio and Experimental Society.

Hon. Secretary, Mr J. Furgusson-Croome, Gowrie, Wendover Road, Bromley, Kent.

A meeting was held on November 1st at the Club-room, Ex-Service Men's Club, London Road (permanent headquarters). Meetings will be held on Mondays, at 7.30 p.m. An interesting lecture or demonstration has been arranged for every meeting this year.

The Secretary introduced Mr. L. Stopes (Chairman of the Society), who gave an instructive and interesting lecture on "Primary Cells and Accumulators." A representative collection of cells kindly loaned by Messrs. Siemens Bros., of Woolwich, showed the practical application of the lecturer's remarks.

Plymouth Wireless and Scientific Society.

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

A joint meeting of the Society and of the Junior Institute of Engineers was held on October 31st. A lecture was given by Mr. G. H. Lock on "Wireless Reception." The lecturer referred to the pioneer work of Carl Hertz, Branley and others. The principles of tuning were explained, and the magnetic and crystal detectors dealt with. The Edison effect, the Fleming two-electrode valve, and, ultimately, the three-electrode valve followed. A typical characteristic curve was shown, and the rectifying and amplifying points explained. Magnetic reaction and the reception of continuous waves completed the lecture. A demonstration followed, during which, by means of a seven-valve set, the lecturer was able to illustrate the principles of "beat" reception.

Ealing and District Radio Society.

Hon. Secretary, Mr. W. F. Clark, 52, Uxbridge Road, Ealing, W.5.

The new series of lectures has proved to be a valuable asset in attracting new members. On October 27th, the Society unanimously decided to forward a protest to the responsible authorities against the inadequate representation that the wireless experimenter has received at the meetings of the British Broadcasting Company held recently. They asked that the position of the *bona fide* wireless experimenter be more explicitly defined.

Sale, Altrincham, and District Radio Society.

Hon. Secretary, Mr. H. Fowler, Alston, Old Hall Road, Sale.

A Society has now been formed with headquarters at the Reform Club, Sale. It is proposed to form a ladies' section and also a junior section.

Portsmouth and District Amateur Wireless Society.

Hon. Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

The fortnightly business meeting was held on November 1st. There was a fair attendance. Discussions took up considerable time, and the lecture by Mr. Harrold on "Wireless Telegraphy, Telephony Broadcasting," had to be curtailed.

Mr. Harrold is a master of his subject. He conveyed to the members the system of the earliest forms of transmitters. A hearty vote of thanks was accorded the lecturer.

Croydon Wireless and Physical Society.

Hon. Secretary, Mr. B. Clapp, "Meadmoor," Brighton Road, Purley.

At the Central Polytechnic, Croydon, on November 4th, Mr. S. H. Naylor lectured on "Hints to the Student and Teacher of Wireless Telegraphy." Mr. Naylor explained the easiest ways to study the subject, and emphasised his points with several analogies and demonstrations with simple models.

A keen discussion then followed, and the meeting terminated with a hearty vote of thanks to Mr. Naylor.

The next meeting, which will take place on Saturday, December 2nd, at 7.30 p.m., being the annual general meeting, it is requested that all members will endeavour to be present. There will be a lecture on "Small Rectifiers for Charging from A.C."

Wembley Wireless Society.

Hon. Secretary, Mr. W. R. Mickelwright, 10, Westbury Avenue, Alperton, Wembley, Middlesex.

On November 2nd, Mr. H. E. Comben gave a most interesting lecture on "Inductance and Capacity," and demonstrated with analogous mechanical apparatus. On November 9th, Mr. H. E. Wallis lectured on "Tuning and Tuners," and on November 16th members queries and difficulties were dealt with in a general discussion. The Society now has over 80 members, and a Junior Section has just been formed for the education and assistance of boys starting wireless. The age limit is 12 to 16 years.

A social evening is being arranged for Dec. 8th.

Plymouth Wireless and Scientific Society.

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

At a meeting of the above, held on November 7th at Plymouth Chambers, a lecture on "High Frequency Amplification" was given by Mr. L. J. Voss. Starting with a lucid explanation of the amplifying region of the characteristic curve of a normal valve, the lecturer proceeded to describe the various methods of communicating the amplified impulses to the grid of the succeeding valve.

Seven new members were elected, bringing the present total membership up to forty-two.

Thames Valley Radio and Physical Association

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

Meetings now take place every fortnight at the Hut, Wigan Institute (one minute from Mortlake Station, L.S.W.R.) and interesting lectures are given each evening. Morse code is taught and through the kindness of several members, a four-valve set will shortly be installed.

Major-General Shaw and Dr. Mackintosh have just consented to become Vice-Presidents.

Broadcasting is specially catered for and every help given to beginners.

Trafalgar Wireless Society.

Hon. Secretary, Mr. F. H. Stanlake, Trafalgar Hotel, Greenwich, S.E.10.

The eighth weekly meeting took place on October 30th, at the above address. It was decided to proceed with the erection of an aerial and receiving apparatus for demonstration purposes. Mr. R. J. Stanley, the Society's instructor, gave a lecture entitled "Valve Reception and Amplification," which proved exceptionally interesting and instructive to beginners. Amateurs are welcomed every Tuesday evening at 8 p.m.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each questions should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, The Wireless World and Radio Review, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of* 1s., *or* 3s. 6d. *for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"E.S.W." (Manor Park) *asks* (1) *For a circuit employing* 1 *H.F. valve, crystal detector, and* 1 *note magnifier.* (2) *Which coils are the best to use in a circuit of this type.*

(1) See Fig. 1. The tuned anode method of H.F. amplifying is employed, and the crystal detector and L.F. transformer is connected across the anode and reaction coil, in order that the maximum amount of potential is available for the input circuit of the note magnifier. (2) You will find it very convenient to use a three-coil holder for the tuning and reaction coils, and for the anode coils we suggest plug-in honeycomb coils.

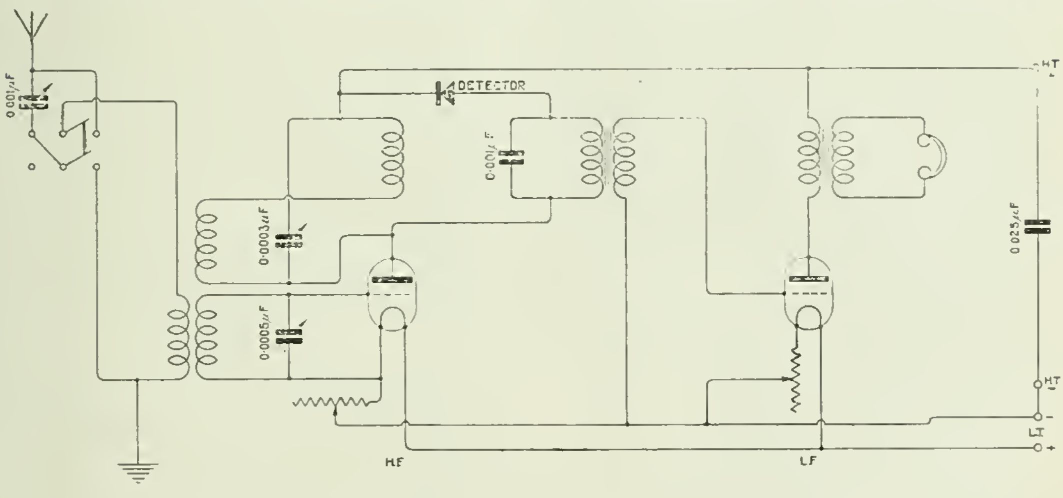


Fig. 1.

"A.W." (Harrogate)—We are afraid you cannot wind the transformer core to deal with 1 kW. if the frequency of supply is 50 cycles and the voltage is 200 volts. To ensure a reasonably small no load current you will require 600 turns of No. 18 D.C.C. wire, and this winding would more than fill up the window area available.

We suggest you use a transformer core with an area of cross section about 4 square inches, and if you would send us further particulars, we shall be pleased to calculate a suitable winding. We do not think you will be able to pass a current of over 2 amperes through the rectifier, and the safe voltage across each is about 40 volts. We suggest you connect four 200 volt 50 candle-power carbon filament lamps in parallel, and join the rectifier output in series with the lamps.

"B.H.R.S." (London) *asks* (1) *For a criticism of a set.* (2) *If it will respond to telephony.* (3) *The capacity of the variable condenser.* (4) *The wavelength of* **2 LO** *under various conditions.*

(1) The circuit is all right, except that 50 megohms is much too high for an anode resistance. It should be of the order of 50,000 ohms. Also, the leak resistance of the second valve should be taken to the filament of the valve instead of back to the plate of the first valve as shown. The choke coil in the anode of the second valve is not really necessary. (2) Yes, but as we have repeatedly pointed out, it is undesirable to use a parallel condenser on such short wavelengths. (3) The condenser should be about 0·0005 mfds. (4) The wavelength used by this station is always 360 metres. It is not changed at different hours of the day, as you appear to suppose.

"SEEKER" (Holloway) *asks for criticism of circuit submitted, and whether it is covered by patents.*

The circuit submitted is quite correct, and of course is covered by patents.

"J.F.E." (Cape Verde Isles) *asks* (1) *For criticism of transmitting circuit submitted.* (2) *Range.* (3) *If set could easily be altered to transmit telegraphy.*

(1) We do not care for the arrangement. (See Fig. 2. (2) The range would be about 25 miles under the best conditions. (3) Unfortunately you have not much apparatus at your disposal, and we suggest you couple the microphone and a few turns of wire to the aerial inductance, or you could tap the microphone across a portion of the A.T.I.

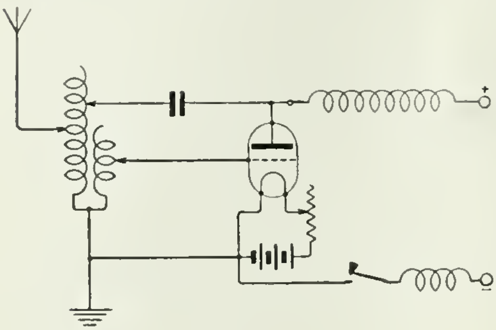


Fig. 2.

"FRAME AERIAL" (Leicester).—We suggest you employ the first aerial arrangement. It would be better if you could use an outdoor aerial, but you should receive signals with the proposed arrangement, although another H.F. valve will be required to make the signals of satisfactory strength. We think a three-valve set, using 1 H.F., 1 detector and 1 L.F. valves, will be required, and a suitable diagram is Fig. 4, page 147, October 28th issue.

"SPARKS" (Swansea) *is about to build a five valve amplifier set, and asks for an efficient wiring diagram.*

You will be able to obtain back numbers of this journal from the Mail Order Department, The Wireless Press, Ltd., 13, Henrietta Street, London, and we think you will experience no difficulty in choosing a circuit using five valves.

"A.B." (Bloomsbury) *asks whether it is possible to obtain five-electrode valves such as described in Mr. Prangnell's article in our issue of June 24th last, and, if so, where they can be bought.*

We believe it is possible to get these valves, and we suggest you write to the valve manufacturers.

"H.R.B." (Holloway) *asks* (1) *For correct values of condensers C2 and C3 described on page 714 of our September 2nd issue.* (2) *Whether a low temperature valve would be suitable for the super-regenerative circuit.*

(1) See reply to "A.R.T." (Derby) *below.* (2) Low temperature valves are useless for this purpose. It is always better to use the valves for which the set is designed. Full constructional articles have appeared in the issues of October 21st and 28th.

"A.R.T." (Derby) *asks* (1) *Correct values of condensers described on page 714 of our issue of September 2nd.* (2) *Whether inductance coil having 600 turns of S.W.G. wire round 3½″ tube, and reactance having 145 turns of 30 S.W.G. will give good results.* (3) *Criticism of arrangement.* (4) *Whether his circuit is likely to receive sanction from the Post Office.*

(1) The correct value for the condenser is 0·0005 mfds. (2) The values proposed for L and L2 will do very nicely. (3) The proposed arrangement will not give any results. The loop should consist of 12 or 14 turns, spaced ¼″ on a 3′ former. (4) The loop is small, and although there may be oscillating energy in it, the energy radiated will be small. Considerable skill and experience is necessary before you can hope to successfully make satisfactory use of the Armstrong super-regenerative circuit. (4) We cannot say whether the Post Office will grant you permission to use this circuit.

"G.N.W.B." (Wisbech) *asks questions about a transmitter.* (1) *Capacity of condensers.* (2) *Resistance of grid leak.* (3) *Size of frame aerial for 400 metres.*

(1) Grid condenser, A = 0·002 mfds. Tuning condenser B = maximum value 0·001 mfd. By-pass condenser C = 0·001 mfd. (2) The grid leak resistance should be about 30,000 w. (3) A suitable frame aerial for your purpose would consist of 12 turns of No. 16 wire, spaced ¼ in., wound on a frame 4 feet square.

"J.B.B." (Wolverhampton) *asks* (1) *For criticism of his circuit.* (2) *The best ratio of L.F. transformer windings.* (3) *Best values of H.T. voltage.*

(1) The diagram submitted is correct, except that the reaction terminals should be between the anode and L.F. transformer primary. (2) The best ratio for L.F. intervalve transformers is 1 to 2 or 1 to 3. A high ratio transformer is useless if the primary impedance is low. (3) We suggest you use 60 volts, but you can alter this value if a little experimenting shows another voltage is suitable.

"MACK" (Brixton).—To connect up the amplifier to your single valve set, take out the telephones, connect the input transformer in the plate circuit of the single valve. If you have any difficulty, consult the diagrams which have recently appeared showing low frequency valves connected together.

"P.B." (Blackheath).—(1) The suggested values are quite correct. (2) The disadvantage of a semi-aperiodic coil is tuning is broadened. (3) The first arrangement is better, and you should adjust the distance yourself, finding by experiment the most suitable position. (4) No condenser is required across the reaction coil, but a few tappings will be useful. We suggest you wind 60 turns of No. 38 D.S.C. wire.

"E.T-B." (Malta).—(1) The number of turns of wire in the H.F. transformer is too low, and we suggest you make the transformers described in the issues of September 2nd, 16th and 23rd. For wavelengths above about 2,000 metres it is more convenient to use the resistance-capacity method. (2) The manufacturers do not publish the amplification factor of the valves to which you refer. (3) A full constructional article appeared in the issues of October 21st and 28th.

"A.S." (Southport) *asks certain questions about a crystal set.*

(1) About ½ lb. will be sufficient for the purpose. (2) The coil described will easily tune the circuit up to 4,000 metres with the value given below for the parallel condenser. (3) No. 1, 0·001 mfds.; No. 2, 0·0005 mfds.; No. 3, 0·002 mfds. (4) The circuit shown is quite good for a simple set. Somewhat better results would of course be obtained with a loose coupler, but this is by no means essential.

"J.M.P." (Euston).—(1) The type of set sketched is not at all efficient. Apart from various details, the arrangement of the crystal is almost useless. If used, it should be connected into the circuit as shown in Fig. 1, page 670, August 19th, and many other cases. Any ordinary receiving valve will be all right for this circuit. (2) There is no definite formula to determine the relation between the tuning coil and the reaction coil. The size of the latter depends chiefly on the electrical constants of the aerial, particularly its resistance, and those of the valve. (3) For a closed circuit wavelength in metres $= 1885\sqrt{L \text{ mhys } C \text{ mfds.}}$ For an aerial circuit, in which the capacity of the aerial itself has to be reckoned with, the formulæ are not so simple. Formulæ applicable to a variety of cases will be found in various text-books, notably Nottage's "Calculation of Inductance and Capacity." (4) Apply to the Wireless Press, Ltd., for a full list of their publications.

"J.G." (Edinburgh).—(1) A circuit of the type sketched should work quite satisfactorily on all wavelengths, and those that you should be able to obtain are therefore only limited by the set of slab coils which you possess. (2) This behaviour is not very unusual. Coupling up the aerial adds damping to the circuits, which may quite possibly be sufficient to extinguish oscillations. All the evidence points to your aerial having rather a high resistance, and you should endeavour to improve this. (3) The wavelengths with the smaller condenser will be in each case approximately 4/5ths of the values with the larger condenser. (4) The only alteration necessary to improve results on wavelengths as short as are projected for broadcasting is the substitution of a series condenser for that shown in parallel with the A.T.I.

"C.M.L." (Deal) *asks* (1) *If successful results could be obtained in London with a loud speaker attached to a two-valve set.* (2) *What is the cost of a transmitting licence.*

(1) Such a combination should give quite useful results on **2 LO**, and possibly on amateur stations in the immediate neighbourhood, but it should not be expected to give loud speech from a large number of stations. The valves should preferably be used as detector followed by a stage of L.F. amplification. (2) £1 per annum.

"ENQUIRER" (London) *asks* (1) *Why it is that wireless signals have a greater range at night than they have in the daytime.* (2) *Where he can find an explanation of the phenomenon.*

(1) The generally accepted explanation is that during the day the upper layers of the atmosphere are in a state of disturbance owing to the action of the sun's rays. At night this disturbance no longer exists, and the upper layers settle down into more or less level strata, which have the property of reflecting back to the earth a great part of the signals which are dissipated and lost in the upper regions of the air during the day. A fuller treatment of this point will be found in most good text-books, and in particular the new book on directional wireless by Keen, recently published by the Wireless Press, Ltd.

"P.G." (Ireland).—(1) You should have as good a chance of getting this station with the set you mention as with anything on the market, but we doubt whether the reception is possible at the distance. (2) You might get Paris, and probably the broadcasting stations in the West of England when these come into operation.

"L.C.J.B." (Ealing) *asks* (1) *For a criticism of two sets.* (2) *Approximate current consumption of an "Ora" valve.* (3) *What the range of the sets mentioned above will be.* (4) *If either of the circuits are capable of receiving* **2 MT** *and the Dutch concerts.*

(1) The single valve set is all right except for the facts which we have to call attention to in nearly 50 per cent. of the criticisms which we give, viz., use of a parallel condenser on short waves is inefficient, and reaction back on to the aerial leads to serious radiation. The crystal arrangement in the other set is useless (see Fig. 3, page 537, July 22nd issue). (2) About ½ ampere. (3) They will not be allowed in the form shown. With reaction suitably modified they will give telephonic ranges of approximately 30 and 50 miles. Telegraphic ranges depend entirely on the power of the transmitting station.

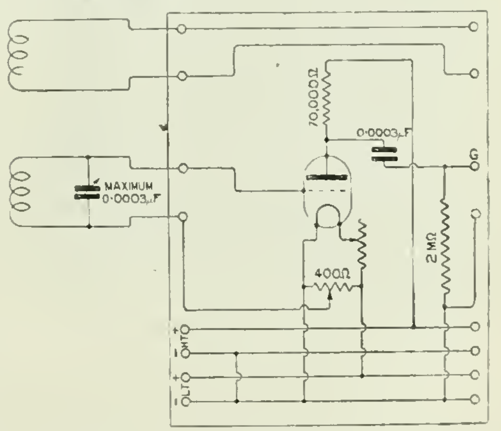


Fig. 3.

"ARUNDEL" (Liversedge) *asks* (1) *Whether circuit submitted will be approved by the Post Office.* (2) *Criticism of circuits.* (3) *Circuit for 440 m. wave spark transmitter using motor spark coil.* (4) *For circuit*

(1) We do not think the Post Office will approve this circuit. The values suggested are correct. (2) The circuit (*a*) is better than circuit (*b*), because interference can be reduced. (3) We cannot give you details for a spark transmitter without further particulars. (4) See Fig. 3.

"J.S.F." (S.E.24).—The variometer which the author of the articles describing a super-regenerative receiver used was a simple variometer of American pattern. We suggest you write to manufacturers who advertise American pattern wireless components in the columns of this journal, stating your requirements.

"COUE" (Peebles) *asks* (1) *For criticism of his aerial and receiving set.*

(1) The aerial is quite suitable, and is in a very favourable position. The sketch of your receiving set submitted shows several wrong connections, and we suggest you rewire the set, using Fig. 4. The V.24 valves are clearly marked, and you should be sure to fit them to the valve holders correctly.

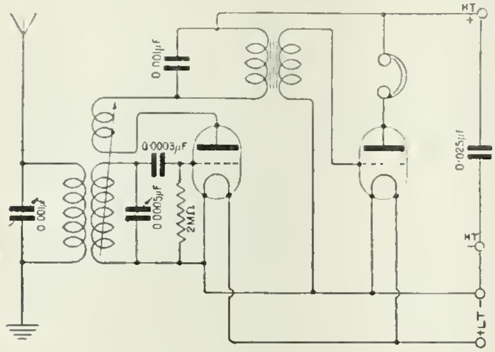


Fig. 4.

"INTERFERENCE" (Sheffield).—(1), (2) and (3). See recent issues. A good method is to use the reaction coil coupled with the anode coil, or secondary coil of the H.F. transformer. Several diagrams have been given, and you should choose one which suits your requirements.

"S.F.W." (Berwickshire).—(1) We suggest you use a four-valve set, 2 H.F., 1 detector, and 1 L.F. valve, as shown in Fig. 3, page 111, October 21st issue. (2) You will be able to make up a list of parts required, and estimate the cost yourself. (3) Your suggestion is correct, and we think if you make up the set as shown in page 111 you will be satisfied with the results. (4) We cannot say, but you should protect yourself by purchasing guaranteed apparatus from firms of standing. See our advertisement pages, and make a careful selection.

"A.C.R." (Twickenham).—(1) It is better to wire up your set with tinned copper wire, and not use the lighting flex. (2) When receiving short waves you should cut out a good deal of the reaction coil. Your reaction coil is apparently made for use on long waves, and you will not, therefore, require such a large reaction coil when receiving short wavelengths.

"J.A.P." (Yorkshire) *asks* (1) *The number of plates required for a variable condenser of capacity 0·001 mfd., 0·0005 mfd. and 0·0003 mfds. The moving plates are 2½″ diameter, 0·028″ thick, and spacing washers 0·125″.* (2) *The capacities of condensers he has constructed.*

(1) You will require 93 plates for the 0·001 mfd. condenser, 47 for the 0·0005 mfd. and 29 for the 0·0003 mfd. (2) The condensers you have made will have capacities of 0·0005 mfd., 0·0003 mfd., and 0·00006 mfd.

"BUZZ" (Bexhill-on-Sea) *asks* (1) *How to add a valve to the circuit given to* **"W.V." (Fulham),** *September 19th issue.* (2) *What are suitable condenser values.* (3) *Whether the above circuit is capable of energising the aerial circuit.*

(1) We suggest you add one H.F. valve, using the tuned anode method of coupling. See Figs. 4 and 5, page 147, October 28th issue. (2) Suitable valves for the condensers are marked in the above figures. (3) The circuit referred to is capable of energising the aerial, and you will notice in Fig. 4, page 147, October 28th issue, the reaction coil is not coupled to the closed circuit, but to the tuned anode coil. Energy cannot be radiated to any serious extent from the aerial circuit when this arrangement is used.

"MAGNUS SPES" (Hornsey) *asks for a criticism of his circuit submitted.*

The proposed arrangement is quite suitable, and the connections are correct. The reaction coil may consist of 100 turns of No. 40 S.S.C. wire. Should you wish to receive long wavelength signals, you may find it necessary to add a small coil in series with the reaction coil.

"H.C.P." (Kent).—We suggest you abandon the scheme and use a normal method of switching. It is very bad practice to include jacks in H.F. circuits, unless the jacks are specially constructed to possess low capacity. Why not use the method of connecting shown on page 883, September 30th issue.

"W.G.P." (E.11) *asks us to criticise the diagram of connections submitted.*

The general arrangement of the apparatus is satisfactory, but we do not care for the method of using reaction. The reaction coil should couple with the anode coil of the first valve. You would also find it better to use a closed circuit. The circuit is easier to operate when the grid leak is joined to the + L.T.

"REGULAR READER" (Birmingham) *asks* (1) *For criticism of circuit submitted.* (2) *The capacity of a variable condenser.* (3) *Whether the condenser will give fine tuning.* (4) *Whether the electric light will affect reception.*

(1) The circuit connections are correct, but we suggest you couple the reaction coil to the secondary of the H.F. transformer. (2) and (3) Unfortunately you do not give us sufficient particulars to enable us to calculate the capacity, but the condenser probably has a capacity of 0.0003 mfds., and therefore is suitable for fine tuning. (4) The supply, if direct current, will not affect reception, but if A.C., you may hear a disagreeable hum which will be difficult to remove.

SHARE MARKET REPORT

Prices as we go to press on November 17th, are :—

Marconi Ordinary	£2	6	3
,, Preference	2	0	3
,, Inter. Marine	1	7	0
,, Canadian		9	0

Radio Corporation of America :—

Ordinary	18	0
Preference	13	3

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE WIRELESS SOCIETY OF LONDON

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Conversion of the Townshend Wavemeter

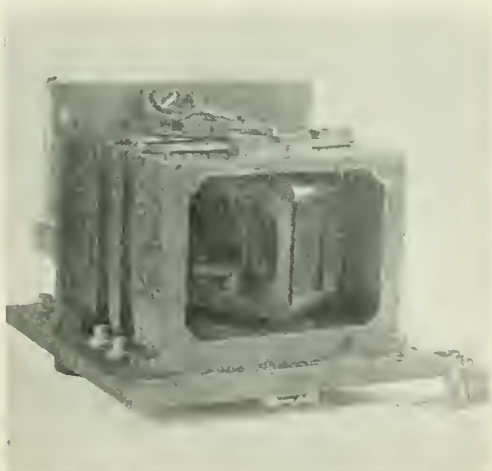
EXTENSION OF RANGE TO SHORT WAVELENGTHS

By B. E. Alston.

THIS article is intended to be of use to those amateurs who possess a Townshend Wavemeter. The normal range of this instrument is from 4,000 to 300 metres. This is effected by (1) plugging in an extra condenser across the condenser which is in parallel with the variometer, and (2) by switching the variometer coils in series or in parallel. Now, if a switch could be provided to cut out the existing condenser across the variometer, then the instrument would give much lower readings. This

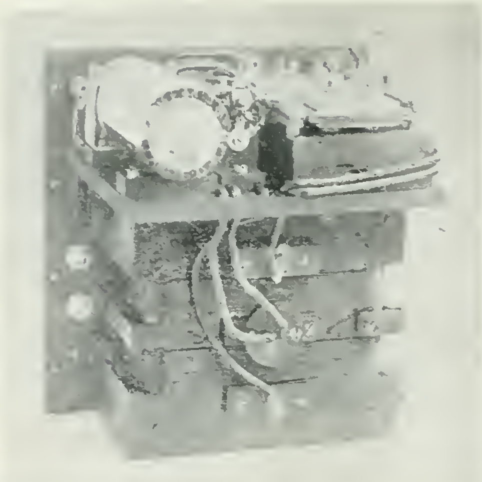
The Townshend Wavemeter.

can be done by using the right-hand plug sockets. In the diagram overleaf, figure (*a*), will be seen the front condenser (the one permanently across the variometer) with four wires connected to one end of it. These four wires are disconnected from the condenser, soldered together, and a lead from the join taken to one of the right-hand plug



Interior, showing Variometer.

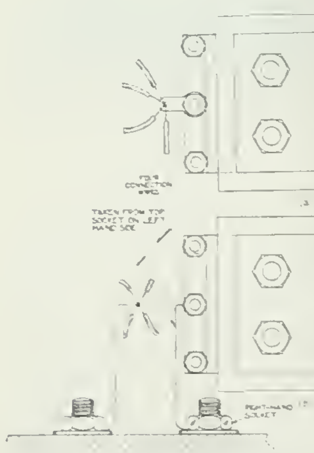
sockets. The condenser terminal is then connected by a lead to the other plug socket. Then, when the plug is in the sockets, the condenser is in circuit and everything as originally arranged. If the plug is left out however, the condenser is disconnected, and the instrument will read down to about 90 metres. This rearrangement is shown in figure (*b*). A rough calibration chart is given. This will be approximately constant for all instruments, due to their standardised manufacture.



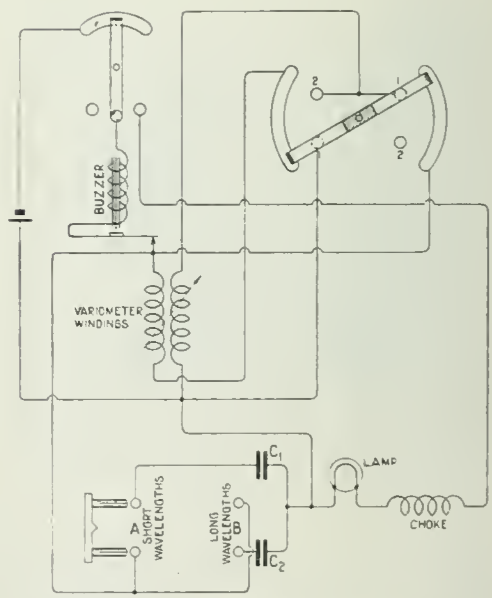
Interior view from the back, showing variometer stationary winding, cell, buzzer, and fixed value condensers. The sockets on the left are those to which leads are joined in converting the wavemeter for use on short wavelengths.

The upper condenser on the right-hand side carries the four leads.

Of course, when the plug is in the left-hand sockets—for the higher wavelengths—a short-circuiting plug should be left in the right-hand sockets to put the condenser in circuit, otherwise all the readings above 1,000 metres will be incorrect. The instrument was calibrated against a Sullivan Wavemeter for the 300–100 metres range.



Method of transferring the condenser connections.



Circuit diagram of the Converted Wavemeter.

Wavelength.	Switch.	Scale reading.
300 m.	2	570
275 m.		525
250 m.		480
225 m.		420
200 m.		360
175 m.	1	580
150 m.		500
125 m.		460
100 m.		420

A calibration curve can be drawn from these figures and preferably fixed on the back of the instrument and varnished over to preserve.

Revolving Coil Holder

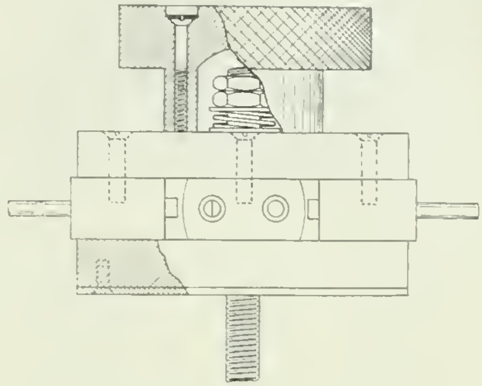
A Device for Rapidly Changing Tuning Coils.

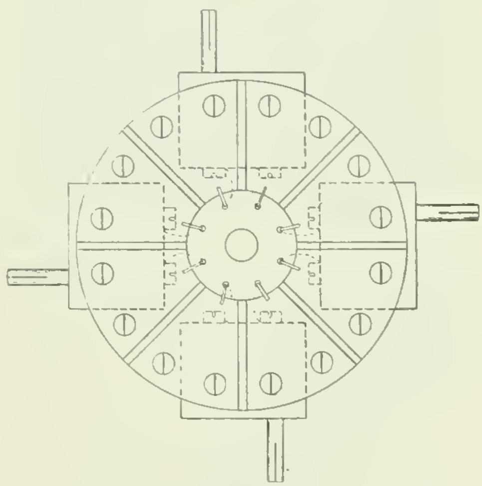
The coil holder, designed from a principle suggested by Mr. W. Lee, provides a very convenient method for rapidly interchanging tuning inductances and also varying the extent of coupling. Referring to the adjoining diagram, the coils are carried in the mounts which are held between ebonite plates, the lower one having on the under side, metal segments. These segments are cut from a plate, screwed or pinned and soldered to the ebonite.

The coil holders and plates are held down to a base by means of a spindle and spring washer, so that spring contacts, similar in pattern to those adopted in bayonet type lamp holders recessed in the base, may make reliable contact with the segments.

The fixed inductance to which the revolving coils are coupled is arranged on the base so that minimum coupling is provided as soon as the contacts throw the movable coil in circuit. Further turning of the knob then tightens the coupling to the required degree. Critical coupling may be effected by arranging limited movement to the coil attached to the base and operated through reduction gearing. Better still perhaps, is to clamp a toothed wheel of a slightly larger diameter than the top plate, under the spring washer, so that it only has a friction grip on the plate, the friction being insufficient to hold the plate when the wheel is locked, yet when the wheel is turned by a small pinion the plate also revolves. With a few modifications, the driving wheel for critical adjustment may be mounted below the coil holders to facilitate the setting up of the small pinion or worm wheel with its spindle.

Two rotating holders, each designed to carry four or more coils assembled side by side, can be employed for rapidly changing the





inductance coils in circuit in a tuner or receiver, the coils and holders being inside the instrument, one having a spindle extended on to the front of the panel. If it is desired that both revolving holders shall turn together, they may be fitted with toothed wheels, and coupled together with a third wheel, to which is fitted the operating spindle and knob.

The Johnsen-Rahbek Loud Speaking Amplifier.

By S G. Crowder, Grad. I.E.E.

FOR the benefit of amateurs who wish to utilise the tremendous degree of amplification offered by a suitable design of loud speaker, employing the principle of the electrostatic adhesive effect of metal and mineral, a description here of a cheap, efficient and easily made instrument will not be amiss.

This adhesive effect due to the Danish engineers, Johnsen and Rahbek, and whose apparatus was demonstrated at the Institution of Electrical Engineers some time ago, has been fully described by Mr. P. R. Coursey in his articles on "Loud Speaking Telephones."*

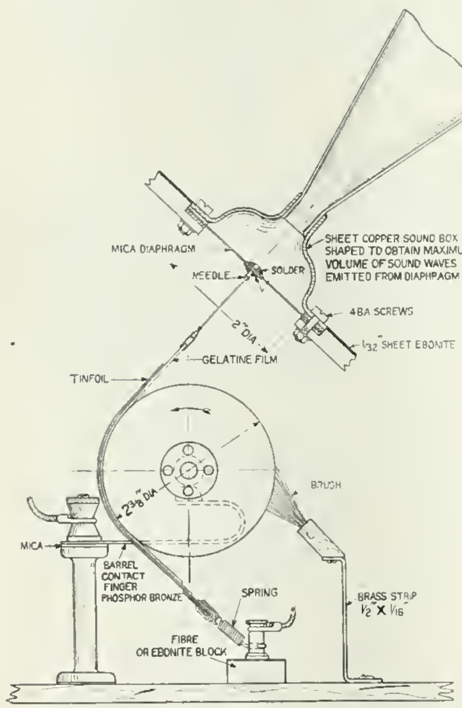


Fig. 1. Details of drum, band and diaphragm.

A recent article in this journal by Mr. F. H. Haynes† described an arrangement whereby agate was used in the construction of the cylinder, which is, of course, an ideal proposition, but it is likely to become rather expensive to the bulk of amateurs.

I will therefore endeavour to give a description of a comparatively cheap loud-speaking amplifier which I have made, giving excellent results. The cylinder in this instance is of brass and made up of No. 14 S.W.G. tube sweated on to two end flanges forming spigots and the whole turned up in the lathe dead true as shown in Fig. 2. It is of course

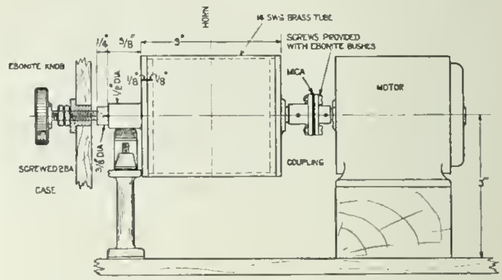


Fig. 2. Method of driving cylinder.

essential that the surface of the cylinder be absolutely free from blemishes or scratches, and should be highly polished. One end of this cylinder is supported and revolves in an adjustable gimbal bearing, to minimise friction, and the other end direct coupled to a small electric motor provided with a variable resistance. Care must be taken to properly insulate the coupling by a disc of ebonite. The barrel and motor are centred and properly aligned, the latter being fixed to the base by a small block of wood.

The semi-conductor in this case is flexible gelatine film cut from an ordinary developed photographic film, $2\frac{1}{2}$ in. wide by about 4 in. long, with the "image" side removed if desired with hot water. This is coated on the outer surface by a metallic electrode made from two or three sheets of "condenser" tinfoil, free from pinholes, cut to within $\frac{1}{8}$ in. of each edge of film, laid together and ironed flat and smooth and fixed to the film with amyl acetate solution (Fig. 3).

One end of this band is now joined by a thread of twisted silk or catgut to a round diaphragm made up from a disc $2\frac{7}{8}$ in. diameter,

* *Wireless World*, Vol. IX., pp. 225, 256, 289, 311, 371.

† *Wireless World and Radio Review*, Vol. X., p. 159.

of clear ruby mica wedged between two metal rings. In the centre of the disc is fixed a sewing needle with moderate size eye, cut down to about $\frac{3}{8}$ in.; this is inserted into a hole bored in the disc. A small copper foil washer is placed on each side of the disc round the needle, and a blob of solder dropped over it, as shown in Fig. 1.

After securing one end of the band by the thread to the needle, the band itself is wrapped round a portion of the periphery of the cylinder, gelatine in contact with the brass, and secured at the other end by two light wire springs to maintain band in tension, and to allow for the electrostatic friction caused by the difference of potential between band and cylinder. These springs may be conveniently connected to input terminals for the polarising voltage. As it is essential to keep the cylinder free from

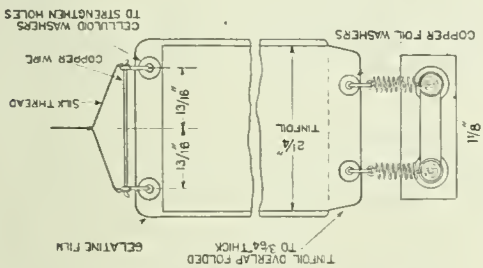


Fig. 3. The friction band showing method of attaching the ends.

dust of any sort, a brush should be provided to bear on the surface as it rotates. This can be conveniently made from several camel hair brushes, the hairs being extracted and arranged flat and glued into a slotted wooden support, inclined to the sides of cylinder, the brush being slightly less in length than the latter.

The contact finger for the polarising voltage to the cylinder is made from a phosphor bronze strip 4 in. by $\frac{1}{2}$ in. to one end of which is soldered a small pad of copper gauze, curved on the surface and smoothed off with a file. This end is bent as shown in Fig. 1 to form a springy contact on to the shaft of the cylinder to ensure constant contact. The opposite end is drilled and secured by a nut and terminal on a small brass pedestal. The whole is then mounted inside a suitable case, which can be made quite cheaply, the shape being left to individual taste, providing the band covers a fair portion of the surface of the barrel. The diaphragm itself is fitted in the top of the case over which is mounted a small gramophone horn, having a suitable flange on the narrow end. Fixing the horn is effected by passing four 4 BA screws through the flange and diaphragm rings.

In the instrument described the diaphragm and horn are mounted on a removable sliding

Fig. 4. The complete Loud Speaker.

panel, thus enabling the apparatus to be used to record signals on a moving tape, by attaching a thread, which originally moved the diaphragm to a syphon recorder.

Fig. 4 is a photograph of the finished instrument fitted with a selector switch used as a potentiometer regulator for the motor.

The brass tube seen projecting from the front of the instrument is purely an experimental addition, in an unfinished state, to record photographically, both telephonic and telegraphic impulses. Suitable terminals are provided for connection to microphone or step-up transformers. A 1 in. spark coil was utilised to perform the functions of the

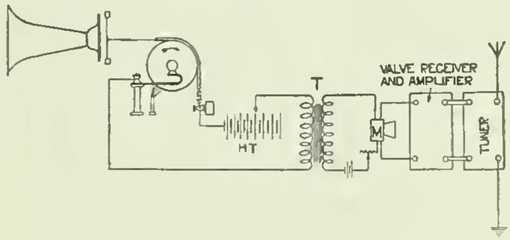


Fig. 5. Circuit of loud speaker. M is a microphone relay or receiver coupled to microphone.

latter, the contacts being screwed tight; tumbler switch and terminals for motor are also provided.

The back of the case is provided with a hinged glass door, for easy access and inspection of the instrument while in operation.

The suitable circuit is shown in Fig. 5.

The polarising voltage in this instance is derived from the usual H.T. battery supplying the anode voltage to the valves.

Electrons, Electric Waves, and Wireless Telephony—IX.

By Dr. J. A. Fleming, F.R.S.

7.—Electromagnetic Radiation and the Quantum Theory.

Before we can proceed to explain the manner in which the vibrations of electrons, atomic nuclei and atoms or molecules give rise to a vast gamut of electromagnetic waves stretching from the shortest X-rays up to the longest known dark heat rays, and beyond these the Hertzian and the wireless waves, we shall have to attempt the task of elucidating the nature of the so-called Quantum Theory or hypothesis introduced into physics by Professor Max Planck about the year 1901, which has opened a new chapter in the development of physical ideas.

It will be necessary to preface explanations by some definitions of terms and words used in the science of mechanics.

An important physical conception is that of *Energy*. Energy is defined as the ability to do *Work*, and this last is a technical term meaning the displacement of a material substance against some force which resists that displacement. Thus, if we lift up a weight against the force of gravity, we do work in this sense of the word. The work is measured by the product of the displacement and the force, each reckoned in certain consistent units. Thus if we lift up a mass weighing 10 lbs. to a height of 10 feet, we do work against gravity to the extent of 10×10 *foot-pounds*. The time taken in doing the work does not affect its numerical value. Thus in the above example the work done is 100 foot-lbs., whether the mass is lifted very slowly or very quickly. When the substance has been so lifted up against the force of gravity it is said to have potential energy or energy of position to the extent of 100 foot-lbs.

There are many ways in which such potential energy can be accumulated. For instance, by bending or stretching a spring, by pumping up water to an elevated cistern, or electrically, by charging with electricity a condenser or Leyden Jar. In all cases the work or energy is measured by the product of two factors, viz., a displacement and a force, a quantity of water and a height through which it is lifted, or a quantity of electricity and the mean potential to which it is raised.

The rate at which work is done is called *Power*. Thus, if we lift up a mass of 550 pounds weight a height of one foot in one second, we do work of 550 foot pounds at a rate called *One Horse Power*, which, however, has nothing to do with a horse.

Energy also can exist in the form of a mass in motion or some equivalent. In this case it is called *Kinetic or Motional Energy*. It is then measured by half the product of the mass and the square of its velocity.

The reason for this is as follows :—

Force is defined as any agency which changes the momentum of a body. The momentum is defined as the product of the mass and the velocity. The force is measured by the rate at which it changes momentum or by the momentum added per second.

Thus if a body of mass m grams has a velocity denoted by v_1 centimetres per second and after a short time t seconds, during which it is acted upon by a force f, acquires a velocity v_2, then the force f is measured by the difference $(mv_2 - mv_1)/t$, because this is the time rate of change of its momentum. During this time its velocity has changed from v_1 to v_2 and if this has taken place uniformly, the distance or space moved over by the body is $\frac{1}{2}(v_1 + v_2) \times t$. The work done is then the product of force and displacement or is

$$W = \frac{(mv_2 - mv_1)}{t} \times \frac{(v_2 + v_1)}{2} \times t = \tfrac{1}{2}mv_2^2 - \tfrac{1}{2}mv_1^2$$

This shows that the work done on a mass m in increasing its velocity from v_1 to v_2 is the change in the quantity $\frac{1}{2}mv^2 = T$, called the kinetic energy.

The above statement may be regarded as valid in accordance with Newton's Laws of Motion and his doctrine of absolute space and time. The searching analysis to which the ideas of space, time, and motion have been submitted by Einstein and his followers have, however, shown the necessity for modification in our fundamental conceptions. The basis on which these new views have arisen was the inference made from the experiments of Michelson and Morley, and from other observations, which demonstrated clearly that the velocity of a ray of light is independent of the motion of the source of light or of the observer, and in fact is the same for every frame of reference. The velocity of light is therefore a fundamental constant of nature. It is always and everywhere 300,000 kilometres per second or very close thereto. We denote this velocity by the letter c.

Experience also shows us that our statements about the facts of nature have in general identical form whether we refer them to one frame of reference or to another in uniform relative motion with respect to it. Thus, if a scientific man had a laboratory on board a ship and made measurements of the time of vibration of a certain pendulum or the space fallen through in one second by a released ball, he would find exactly the same numerical results whether the ship was at rest in harbour or moving smoothly and uniformly over the sea at any speed. This is called by Einstein the *restricted principle of relativity*.

In accordance with this theory, which, however, is by no means universally accepted, it can be shown that the kinetic energy of a mass m moving uniformly with a velocity v should be given by the expression

$mc^2\left\{1 - \frac{v^2}{c^2}\right\}^{-\frac{1}{2}}$ where c is the constant velocity of light. If v is small compared with c the energy is equal to $mc^2 + \frac{1}{2}mv^2$. Hence we see that even if a mass is at rest with reference to a certain frame of reference it is not therefore destitute of kinetic energy.

Furthermore, it can be shown that if an amount of energy E in the form, say, of heat is given to a body of mass m without altering its velocity of translational motion v, its energy is increased by an amount $\frac{E}{\left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}}}$, and therefore its total energy is expressible as—

$$\frac{\left(m + \frac{E}{c^2}\right)c^2}{\sqrt{1 - v^2/c^2}}$$

This implies that the apparent mass m is increased by an amount E/c^2 by the addition of the energy E. This seems to suggest that what we call the mass of a body is only a manifestation of energy of a certain kind, possibly some form of spinning or rotational energy, and that the indestructibility of Energy and of Matter are only two different aspects of the same fact.

As long as the velocity of translation of a mass is small compared with that of light the increase in its kinetic energy, which results from giving it a velocity v, is expressed by $\frac{1}{2}mv^2 = T$, and this, in ordinary classical theory, is taken to be its kinetic energy, although the theory of Relativity shows that it is not the whole of it. There is in addition, in connection with a mass m a concealed or latent kinetic energy measured by mc^2, even when that body is at rest with respect to the framework of reference considered.

Suppose then that a massive body like a planet is moving along a certain path with a certain kinetic energy at each point. Let us suppose the path divided up into little elements of length, each denoted by the symbol ds, and let each element of length be described in a short time, denoted by dt. Then the velocity of the body in each little stage is measured by the quotient ds/dt and the kinetic energy by $\frac{1}{2}m\left(\frac{ds}{dt}\right)^2$, if we call the mass m.

If we multiply the mean kinetic energy during each element of motion by the time dt taken to describe it, we obtain the product

$\frac{1}{2}m\left(\frac{ds}{dt}\right)^2 dt$ or $\frac{1}{2}m\frac{ds}{dt}\,ds$ or $\frac{1}{2}mvds$.

If we obtain these products for each little element of the path and then add them all together or integrate over the whole path, we obtain a result called the *Action* of the body.

It appears that there is a certain kind of equivalence between the product of a small quantity of energy stored up or existing for a long time, and that of a larger quantity of energy for a relatively shorter time, provided the product of energy and time of action is constant.

What may be called the value of the energy for physical purposes or the opportunity of using or transforming a certain amount of this energy is not merely measured by its numerical amount, but by the product of its amount and the time it is available.

Thus, to give an analogy, there is a certain sense in which a small salary guaranteed for a number of years may be the equivalent of a larger salary guaranteed only for a lesser time, viz., when the product of salary and years is the same in each case. It appears then that in physical phenomena and changes the all important matter is the totality of the Action. In a large class of physical phenomena the spontaneous operations always take place in nature in such a manner that the Action expended is the least possible.

This principle of Least Action is of very wide application in dynamics. Thus, a planet moves in its orbit round the sun along a path such that the Action in going from one point to another is the least possible. There is a corresponding principle of Least Time in optics. A ray of light moves through a medium with a velocity which is inversely as the index of refraction (denoted by μ) of that medium. Hence the time of travelling over an element of path ds is the product μds. The path of a ray of light through a series of transparent media is always such as to make the sum of the elementary products μds a minimum.

The important innovation introduced by Planck in 1901, in connection with radiation phenomena, was the idea that Action is discrete in nature and that there exists what may be called an *atom of action*, or least possible indivisible amount of it.

We cannot explain why this should be the case. We have seen that electricity is also atomic in structure and that there exists an atom of electricity called the electron, equal to $4{\cdot}77 \times 10^{-10}$ of an electrostatic unit or to 16×10^{-20} of a coulomb or ampere-second, which is indivisible. All charges of electricity must be in integer multiples of this electron unit. We can have them in millions or billions, but we cannot have a fraction of a unit or of an electron.

In the same way Planck has shown that radiation of energy can only take place in integer multiples of a very small unit of Action which is equal to $6{\cdot}547 \times 10^{-27}$ erg-seconds. This means $\frac{6547}{10^{30}}$ of an erg of energy lasting for one second or one erg lasting for the same fraction of a second. The reader may be reminded that one erg is the work done when a force of one dyne acts through a distance of one centimetre.

The *weight* of a mass of one gram is nearly 981 dynes. The above unit of action is an extremely small one and we need take no account of the atomicity of action in large scale dynamics, but only when we are dealing with atoms singly.

Planck has particularly applied this view of the atomicity of action to the discussion of the problem of radiation of electromagnetic waves by electrons and atoms. When a solid body, say, a mass of carbon or metal, is raised to a high temperature, its atoms and electrons are thrown into a state of rapid vibration. Planck calls these vibrators oscillators.

If we consider a single electron moving to and fro along a straight line with a vibratory motion, we see that its velocity is changing at every instant, and therefore in accordance with explanations already given, the electron is sending out vibrations along its electrolines or lines of electric force; in other words it is radiating energy. It is very easy to prove that in the case of an electron oscillating in one line like the bob of a long pendulum, the Action in one period is the product of the mean energy of motion and the periodic time. Also that the energy radiated per period is a definite fraction of the oscillating energy. If T is the time of one complete vibration, and if in that time an amount of energy denoted by E is radiated, then the Action is the product of E and T reckoned in ergs and seconds.

Planck then says that the product of E and T, or $E \times T$, must be an exact integer multiple of the unit of action which is denoted by h ($= 6{\cdot}55 \times 10^{-27}$ erg-seconds). Therefore we have the equation $ET = mh$ where m is some integer. But if the frequency of the oscillations or number per second is n, then $n = 1/T$ and $E = mnh$. Accordingly, radiation of energy appears to take place in integer multiples of a unit of energy equal to the product nh. This unit is called a *Quantum* and is denoted by the Greek letter ϵ.

Planck's fundamental equation is then

$$\epsilon = nh.$$

The reader should carefully notice that the magnitude of this quantum of energy (ϵ) is not constant but is proportional to the frequency n. It is the atom or element of Action denoted by h which is invariable in magnitude.

The upshot of all the above is as follows: If there are a number of little oscillators or vibrating electrons which vibrate with different frequencies, like pendulums of different lengths, some moving fast and some slow, or with high frequency and low frequency, then each of these electric oscillators is radiating energy but they can only radiate this energy in whole quanta and the size of the quantum radiated in each case is proportional to the frequency.

In an incandescent body the electrons and atoms which constitute the oscillators, do not all possess the same energy of vibration, any more than the molecules of a gas have the same velocity. The speeds of the gas molecules and also the energies of the oscillators are distributed according to Maxwell's law, as already explained, and according to a similar law the energy is distributed between oscillators having the same frequency.

Let us consider then the condition of things in a mass of incandescent metal or carbon. We have atoms and electrons which can vibrate in very various periods depending on their mass and the elastic constraint to which they are subjected by the attractions and repulsions of neighbouring electrons. Moreover they are vibrating with different amplitudes, or in other words have different amounts of energy associated with them. We may, in imagination, divide these oscillators into groups arranged progressively according to the frequency of their oscillations, and each group of similar frequency may be considered as divided into sub-groups, which have similar amounts of oscillatory energy, but the sub-groups arranged in order of increasing energy content. Each of these oscillators is sending out electromagnetic waves of identical frequency and of various amplitudes. This electric radiation constitutes the light, heat and actinic radiation of the incandescent body. If then we send a thin beam of this radiation through a prism or defraction grating, these rays of different frequencies are differently refracted and spread out into a spectrum when received on a screen.

As regards those waves, the wavelengths of which lie between 0·395 μ and 0·76 μ, or, say, 3,950 Angström units to 7,600 A.U., these have the power of stimulating the retina of our eyes and exciting the sensation of light. the short waves creating a sensation of violet light and the larger red light. It is, however, well known that there is a range of ultra-violet light or invisible rays of wavelengths lying between about 250 A.U. and 4,000 A.U., which can impress a photographic sensitive plate, but not our eyes. Again, there is a range of longer ultra-red or so-called dark heat rays, extending in wavelength from 0·8 μ to about 300 μ, all the waves in which cannot affect our eyes but can heat a sensitive thermometer.

Suppose then that we form a spectrum, that is, expand the complex many-frequency radiation from an incandescent body, such as the light and heat from an electric arc lamp or from the sun, into a spectrum or band of radiation, every strip of which is formed by waves of one particular wavelength. Let us place across this band a blackened platinum wire. This wire will absorb all the energy at that point and be heated thereby. We can determine the temperature of the wire by the increase in electric resistance that then takes place. So used this wire is called a bolometer wire and it enables us to measure the energy associated with the waves of each particular radiation from the least unto the greatest wavelength (see Fig. 46).

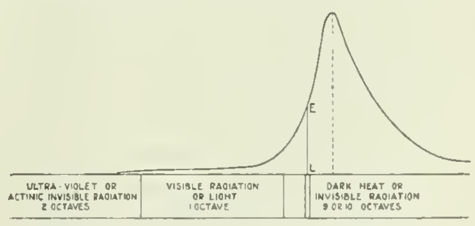


Fig. 46. Radiation energy curve for the spectrum of visible and invisible radiation. The height of the ordinate of the curve at any point is a measure of the energy of the radiation at that point.

When this measurement is made we find that the waves of very large wavelengths or very small frequency have little or no energy and that as the frequency increases the energy of radiation increases also, but not indefinitely. It increases up to a certain wavelength of maximum energy and then begins to fall off again, so that the waves of very high frequency have also small energy associated with them.

We can thus plot a radiation energy density curve in terms of wavelength or frequency, as in Fig. 46.

When we attempt to account for this form of this curve, and especially for the fact that it has a maximum ordinate for a certain wavelength, difficulties are found. As long as we assume that energy can be radiated continuously, that is in any amount per second from each oscillator, theory shows that the radiation energy should increase rapidly with the frequency so that oscillators of high frequency should radiate very much more energy than those of low frequencies, whereas in the normal spectrum it is found that the waves of very high frequency have small energy as well as the waves of very low frequency.

Planck's theory of energy quanta was devised therefore originally to meet this difficulty and to enable a formula to be found which will express or predetermine the curve of radiation energy along the spectrum. This it has done very successfully.

He assumes, as we have seen, that energy is not radiated continuously by the oscillators, but comes out, so to speak, in gushes or quanta, the size of the quantum being in the case of every oscillator proportional to its frequency of oscillation or number of vibrations per second. Hence for the high frequency oscillators the quantum will be large and the probability that any particular oscillator or many such oscillators will have this amount of energy at disposal is small. Hence the total energy contribution of the high frequency oscillators is small. On the other hand, the quantum for the low frequency oscillators is small and therefore nearly every one is capable of giving it, but then, owing to the smallness of the unit, the total energy contribution is again small. But for oscillators of medium frequency the total contribution may be, and is, much larger. Hence we get for a certain wavelength a maximum energy radiation.

We might give an illustration as follows :—

Suppose that a collection was being made in a church or in a number of churches for some charitable object, say, hospitals. Imagine that in one church the clergyman announced that no person must give a donation of more or less than £5. The chance of there being many persons present who had that amount in their pockets and were willing to give it in one lump sum might be small and hence the total offertory would be small also, comprising perhaps only one or two such donations.

On the other hand, imagine that in another church the minister announced that no person must put more or less than one penny in the plate. Nearly everyone would be able to give this coin, but the unit being small, the total offertory would again be small. If, however, an intermediate sum, say, one shilling or one half-crown, was announced as the sum which was to be the donation unit, a large number of the congregation would be able to give this amount and hence the total offertory would be much larger than in the extreme cases in which the unit of donation was either one penny or five pounds. By this ingenious idea Planck was able to find a formula which when represented graphically, exactly agrees with the experimentally determined curve of radiation energy distribution in the spectrum, and no one had previously been able to achieve this result.

Nevertheless, Planck's theory seems to necessitate certain assumptions which are rather forced. We have no proof that in an incandescent body there are oscillators of every possible frequency, in short, oscillators of an infinite number of frequencies. Also it is difficult to form any clear idea why Action should be atomic in structure unless Space and Time are also in discrete indivisible units.

In the spectrum there are, however, an infinite number of rays of different frequency and wavelength, extending from the longest dark heat rays yet observed of wavelength about 200 to 300 μ, to the shortest ultra-violet rays of about $0 \cdot 1$ μ in wavelength. Moreover, the spectrum may be said to extend to infinity in both directions, for beyond the longest dark heat waves we have the Hertzian and wireless waves to be considered in our next chapter, and beyond and below the shortest ultra-violet waves we have the X-ray waves.

A way out of this difficulty has, however, been suggested as follows : The process of radiation in an incandescent body probably consists in the creation of sudden groups of complex vibrations of finite duration, caused by the impact of electrons against atoms, and these last in turn are set in vibration as a whole and in their component electrons. These complex vibrations may by Fourier's theorem, already explained, be regarded as made up of a large group of simple harmonic vibrations each of different frequencies.

Since the complex groups of vibrations which can thus be analysed are not produced simultaneously and in step or phase or absolute agreement with each other, we have in fact sent out from the incandescent body an infinite number of trains of complex vibrations which are built up of an infinite number of component harmonic vibrations and the prism or diffraction grating separates these out from one another and spaces them in order of wavelength or frequency in the observed spectrum of the radiation.

8.—Atomic Energy and its Release.

The previous explanations will have made it clear that the nucleus of the atom in which its gravitative mass chiefly resides is a structure which is probably built up of helium and hydrogen nuclei and of unnamed nuclei of mass three times that of the hydrogen nucleus, which are powerfully held together by negative electrons into a very compact mass. The helium nucleus in particular seems to be a very strong structure.

It appears that a very large amount of energy has to be put into the ultimate ingredients, viz., the positive and negative electrons, to bind them together in this extremely firm manner, so as to make a very small but exceedingly dense mass of matter about 10^{-12} or 10^{-13} of a centimetre in diameter. We might regard the nucleus as a sort of clock-spring which has been coiled up very tightly by the exertion of energy and then bound in some manner not easily released. If, however, certain kinds of atomic nuclei such as those of nitrogen are bombarded by α-particles, the nucleus is disrupted and its approximate constituents, viz., helium and hydrogen nuclei, are flung out with great velocity.

This, and the phenomena of radio-activity, has suggested that we have in the nuclei of atoms an enormous store of energy which in some way we may be able to release.

At the present time, if we set on one side the not very large stores of water power which are often in very sparsely inhabited places, the chief sources of potential energies lie in the stores of coal and oil in the earth's crust. But the oil represents but a fraction of the energy stored up in the coal or to be obtained by burning the coal. Hence we may say that the chief source of power in the world is the potential energy of its stores of coal.

Nevertheless, the increasing cost of raising and transporting it, owing to the increase in the cost of labour, creates the hope that in some way the human race may be able to tap this almost illimitable store of atomic energy. The prospects, however, at present are not very bright. Such small achievements in direction which have been accomplished have required the expenditure of the expensive element radium.

Having regard to the fact that the atom is probably a wholly electrical structure, it may perhaps be possible to break it up by means of suitable high frequency electric oscillations to the study of which we shall next direct attention.

(To be continued.)

Inductance Coils for Short Wavelengths:

The Considerations for Good Design.

The aim when building an inductance coil is to procure a maximum of inductance with a minimum of self-capacity and resistance. These two latter qualities are unnecessary for the operation of the coil, and are properties of the coil by accident. Since it is desirable that the properties of a circuit (capacity, inductance and resistance) be under the control of the experimenter, that coil which possesses least self-capacity and resistance is the better coil, as the following considerations will show.

The self-capacity of the coil may be considered as in parallel with the coil. The combination then has a natural wavelength, determined by the magnitude of the L and C of the coil.

When a tuning condenser is joined across the inductance, the self-capacity is added to that of the tuning condenser. With the condenser set at its maximum value, the addition of the coil capacity is not of much account in producing a longer wavelength, since it forms but a small proportion of the capacity in the circuit. When, however, the tuning condenser is set near its minimum value, the self-capacity of the coil forms a large percentage of the total capacity in the circuit, and it cannot be neglected. If the self-capacity, and the capacity of the condenser are equal, the wavelength is 1·4 times that which it would be if no self-capacity were present. The tuning range of the coil and variable condenser has therefore suffered reduction, which is a serious matter, as more coils are required to cover the wavelength range.

Another harmful effect is manifest when the coil is in series with an E.M.F. A smaller current will flow in the coil than if the same E.M.F. were set up by induction from a neighbouring coil. The apparent resistance has increased. The apparent inductance will likewise change when the frequency of the E.M.F. changes.

In practice coils are often provided with tappings for convenience. The portion of the coil not in use, however, is still influenced by the field set up by the remainder. If the frequency of the circuit of which a section of the coil forms part, is high, a considerable amount of energy may be absorbed in the unused portion, especially so if its natural period is close to that of the energising circuit. Further, the circuit may possess several natural frequencies, which to be sure is quite undesirable when we are receiving signals, as it would not be possible to tune out signals with wavelengths near that of the one desired.

Self-capacity and resistance are therefore definitely harmful. They can be reduced by careful design.

The former upon which the wire is wound should be perfectly dry, and no more material than is necessary for mechanical support should be used. Cardboard should be avoided. Big claims have been made for the use of Litzendraht. It has been shown that high frequency resistance of a well constructed coil of Litzendraht is greater at 300 metres than for a similar coil of ordinary D.C.C. copper wire. Litzendraht is difficult to handle and to solder. If the whole of the strands are not continuous, through damage to the wire, or poor soldering, the direct current resistance will exceed that of a similar length and area of solid wire. Furthermore, a few disconnected strands enormously increase the self-capacity and high frequency resistance of the coil. Coils constructed of this wire often change their characteristics for the worse after being in service for a time. The fine strands, often made brittle while being cleaned preparatory to soldering, are apt to break off at the soldered connection during the life of the coil.

Solid copper wire is cheaper to purchase than Litzendraht, but the experimenter may fear no inferior results if the following points are borne in mind.

The copper wire should have a covering of double cotton and be of heavy gauge, consistent with the dimensions of the coil. No. 20 or 22 is suitable for short wave aerial coils. The double cotton covering ensures good spacing between turns. The coil when wound must be thoroughly dried in an oven, and then impregnated with paraffin wax or shellac. The function of the wax or shellac is to prevent the absorption of moisture by the cotton, and any excess over the quantity required for this serves no useful purpose, but increases the losses and self-capacity.

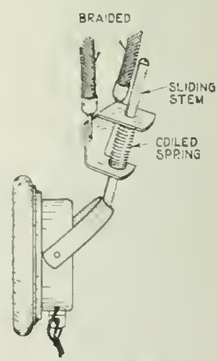
The end connections should be brought straight out from the coil, and not be brought out from the same end.

Coils should be broken up into sections to minimise dead-end losses, or better still, a number of coils should be made for use with different wave ranges.

The self-capacity of a coil is independent of its length. The inductance of a coil, containing a given length of wire, is a maximum when the diameter is 2·45 times its length, although this ratio may be considerably departed from without serious change in the ratio length of wire to inductance. W. J.

ADJUSTABLE HEADBAND.

The accompanying figure shows a device for giving adjustment to headgear telephone receivers, in order that they may fit tightly and comfortably to the ears. The headband consists of two covered spring pieces, terminating on plates which make friction contact with the stems which carry the receivers, thus avoiding screws which are liable to become entangled with the hair.



Adjustable headband made by the Automatic Telephone Manufacturing Co., Ltd.

A Syphon Recorder of Simple Design.

By W. Winkler

THE syphon recorder which it is proposed to describe in the following article will no doubt appeal to amateurs on account of its simplicity of construction which is at the same time combined with a high degree of efficiency. This may be gauged from the specimens of records which are given in illustration of its capabilities (Fig. 1).

The cost of this recorder is trifling, since almost everything required for its construction is already in the possession of almost every amateur.

At the present time there is ample scope for experiment in the reception of high speed transmissions since so many of the high power stations now conduct their traffic by automatic systems.

With this recorder and a three or four-valve receiver (or one or two valves and a Brown relay) good reproduction can be obtained from most of the high power European stations. At slow speeds such as 30 words a minute recording can be done with ease, whilst speeds up to 100 words a minute can be recorded with delicate adjustment.

The apparatus has been produced after a very considerable amount of experiment and the simplicity of the whole arrangement can be gathered from the photograph Fig. 2.

The principle consists in the employment of a Brown telephone (" A " Type) with an extension arm fitted to the reed as shown in Fig. 3 to form a relay. The telephone is operâted directly by the signals from the receiver. Each dot or dash gives a short or long buzz at this relay, thus causing a temporary increase in the average resistance at the relay contacts. This variation in the resistance at the relay contacts is sufficient to serve our purpose and is much more easily obtained than a definite make or break contact. To eliminate sparking, a 200-ohm non-inductive resistance is shunted across the contacts of the relay.

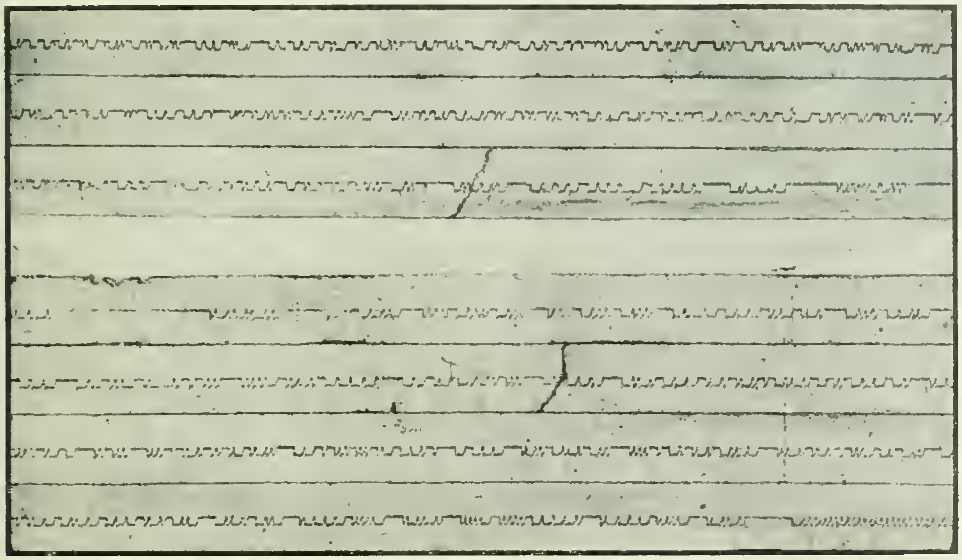


Fig. 1. Specimens of Tape taken with the Recorder.

The pen movement is operated by the use of a Post Office buzzer magnet and a light steel armature fixed at one end arranged as on the average electric bell, bearing a short length of silver capillary tube (Fig. 3). This armature is normally under gentle but decided tension away from the pole ends.

The silver tube is held by means of solder to the armature and is shaped so that one end dips below the surface of the link in the pot (which is located as nearly over the axis of the armature as possible) and the other end rests on the paper strip at a perpendicular angle.

A second-hand gramophone motor is used as the motive power for drawing the paper tape, and guide pulleys are provided, that near the pen being adjustable for height so as to enable the pressure of the pen on the paper to be varied.

The method of operating the recorder is as follows.

The "Phone" relay is adjusted by setting the magnet position relative to the reed by the adjusting screw in the usual manner. Next the fixed contact on the relay is advanced until the circuit is *just* closed on "No signals." On the fineness of this adjustment depends the working of the instrument, and if set for

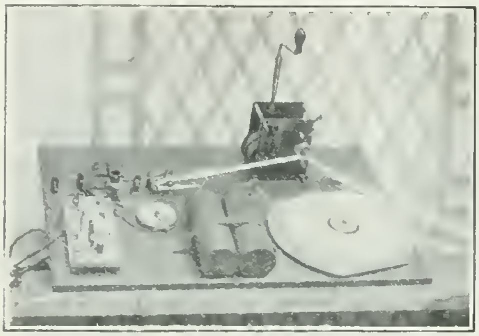


Fig. 2. The complete apparatus.

weak signals it will work well on strong signals, as these can always be reduced without trouble. The local circuit current (1·5 volts, 10-ohm magnet) is switched on and the armature is drawn over to the magnet poles.

As stated above, signals will cause vibrations at the contacts of the relay, thus reducing the current in the local circuit and releasing the armature. As soon as each signal ceases the armature and pen return to their normal positions, thus giving an undulating record of the received signals.

The extension fitted on the "Brown" phone reed is made of very thin brass sheet 0·003 ins. thick, bent U shape. This gives a light rigid arm, at the same time causing the naturally aperiodic reed to lose this quality. The result of this is that the recorder becomes most sensitive to a note of a certain pitch, and can be used with good results in spite of serious jamming, being able to pick out a note of one particular frequency.

It was found that an excursion of about 1/16 in. only, at the pen point was required to give clear readable signals.

An item which gave considerable trouble was the ink. One naturally wishes to have an instrument which can be put into operation at a few moments notice. Morse inker ink was useless and ordinary inks dried in the pot and the pen, leaving an annoying sediment. The final effort yielded splendid results, and it has now been standing for 7 to 8 months and only requires the addition of a few drops of water occasionally. The mixture consists of $1\frac{1}{2}$ ozs. glycerine and about as much Eosin as one can heap on a threepenny piece.

When the recorder is not in use a small empty pot should be left below the extremity of the pen, and the paper removed, as the pen will slowly syphon the ink from the pot, though only at the rate of about one drop in 24 hours.

It will be noticed that in operation this ink does not dry very rapidly on the tape, but this is no great disadvantage when one takes a little care.

The two dry cells of $1\frac{1}{2}$ volts each shown in the photograph (Fig. 2) are not used in series. One acts merely as a stand-by and has not yet been used except during preliminary experiments. It was soon found to be quite unnecessary.

With the above remarks for guidance, a very efficient recorder can be made without any expensive or intricate material. It could be improved in several points of detail, as for

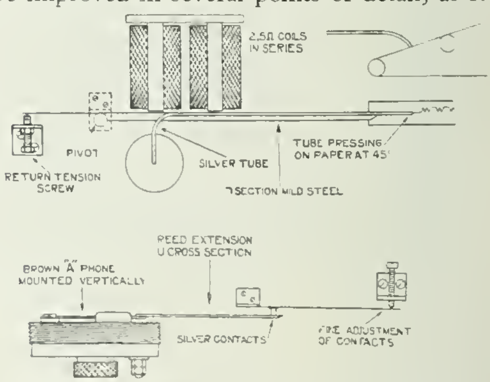


Fig. 3, Details of some of the parts.

example in the mounting of the phone relay, which should be much more rigid. When more time is available some of these improvements will be embodied. Many parts of the apparatus are just thrown together in order that one might make observations on their behaviour under different circumstances.

For the benefit of those who have not experienced it, I would mention that there is a great fascination in watching a pen recording Morse at a speed of, say, 100 words per minute.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Wanstead Wireless Society.*

Hon. Secretary, Mr. A. B. Firman, 18, Clavering Road, Wanstead Park, E.12.

A very successful meeting of the Society was held on November 9th, when a very interesting lecture on "Crystal Sets" was given by Mr. Wilson. The Marconi concert was particularly well received on a loud speaker, distortion being negligible, and tone and clarity perfect.

The President, Mr. Platt, arranged to continue his course of lectures on November 16th.

Borough of Tynemouth Y.M.C.A. Radio and Scientific Society.*

Hon. Secretary, Mr. G. J. S. Littlefield, 37, Borough Road, North Shields.

On October 26th a special meeting was held at which Mr. Illing, of the Sterling Telephone Company of Newcastle, gave a practical demonstration of the "Magnavox" loud speaker and three-valve power amplifier. There was a splendid attendance, including many members of the Whitley Bay and Monkseaton Wireless Society.

A Chase Radio five-valve unit set, kindly loaned by Messrs. Kennedy and Scott, provided many signals, which were passed on to a senior Magnavox *via* the three-valve power amplifier. Mr. Illing showed and used a special type of transmitter which was pressed against the side of the larynx instead of being held near the mouth. In using it the words were formed in the usual way, but not actually spoken, the reproduction being obtained by the vibrations of the vocal cords affecting the microphone.

A vote of thanks was accorded Mr. Illing and Messrs. Kennedy and Scott.

Oldham Lyceum Wireless Society.*

Hon. Secretary, Mr. Graham Halbert, 16, South Hill Street, Oldham.

The annual meeting and election of officers for the year 1922-23 was held on November 2nd.

The following officers were elected: President, Mr. H. Stott; Chairman, Mr. I. P. Holden; Vice-Chairman, Mr. H. D. Marsland; Hon. Secretary, Mr. G. Halbert; Hon. Treasurer, Mr. J. Holden.

The winter session, which commenced at the beginning of October, promises to be a great success. The following lectures have been given:—"Elementary Theory of Wireless Transmission and Reception," by Mr. G. Halbert; "Wireless Receiving Apparatus," by Mr. I. P. Holden, Chairman; "Wireless Reception with Reference to Valves," by Mr. J. R. Halliwell, of Manchester.

Bedford Physical and Radio Society*

Hon. Secretary, Mr. C. W. Clarabut, 194, Castle Road, Bedford.

Meetings were held as follows:—

On July 27th 35 members were present. PCGG was received, but the results were inferior to those obtained on his previously lower power.

At meeting on September 6th, 29 members were present. Dr. J. B. Willmer Phillips took the chair. It was resolved that future meetings be held fortnightly, recurring on Saturday and Wednesday alternately.

An interesting discussion took place on the various circuits, with their attendant advantages and disadvantages. Messrs. Pyrah, Mercier, and the Hon. Secretary took the leading parts.

Mr. R. W. L. Phillips took the chair on September 16th. 28 members were present. Mr. C. W. Clarabut gave a lecture on Radio Symbols, after which several members gave their experiences with their receiving sets.

Malvern Wireless Society.

Hon. Secretary, Mr. N. H. Gwynn Jones, Burford House, Gt. Malvern.

A good attendance marked the opening of the Society's first meeting on October 25th at the Drill Hall, when a lecture was given by Mr. L. H. Mansell on "The History and Progress of Wireless."

He touched upon the earliest discoveries of Hertz, Marconi's early experiments and the rapid strides which have since been made. Pioneer apparatus, including coherers, crystals, etc., were exhibited.

An excellent demonstration was given with the help of another member, Mr. M. Jeynes, on Mr. Mansell's five-valve set and Magnavox loud speaker.

Mr. R. Green then gave a talk on the easiest way of learning Morse. Great interest was displayed by the lady members present.

Mr. Mansell-Moullin, F.C.S., the Society's Vice-President, was heartily welcomed.

Both lecturers were accorded an enthusiastic reception.

The Society has had an aerial and fittings presented to them by Messrs. L. H. Mansell and M. Jeynes, and hopes to have a set of apparatus at an early date.

Meetings are to be held each Wednesday evening at 8 p.m. at the Society's headquarters at the Drill Hall, Albert Road.

On Nov. 8th, the third lecture was given by Mr. M. Jeynes, on "Aerials and Earths."

The fourth lecture was given on November 15th, by Mr. L. H. Mansell, entitled "D.C. Electricity." It was to be regretted that the attendance was not better, for it was a lecture that few beginners should have missed.

A vote of thanks was accorded Mr. Mansell. Membership is now 60.

Streatham Radio Society.*

Five new members were elected on November 8th. Mr. A. G. Wood was elected Asst. Secretary.

A lecture was given by Mr. A. G. Wood on "Tuned Anode Circuits."

The next lecture meeting will be held on December 13th, when Mr. C. H. Roddis will give a demonstration and lecture on "Transmission and Reception of Infra-Red Rays."

Cheltenham and District Wireless Association*

Hon. Secretary, Mr. Eric Cole, A.R.I.B.A., 28, Milton Road, Cheltenham.

On November 7th the Association held its first public demonstration at the concert hall of the United Services Club, Cheltenham.

The demonstration was attended by a large audience, and was an experimental one arranged by the club members.

Mr. W. G. H. Brown kindly arranged to transmit speech and gramophone selections from his station **5 BK.**

The transmission was received on a five-valve set loaned by members and a Magnavox loud speaker lent by Messrs. Dunn & Co.

The Association holds lectures and demonstrations every Monday evening at 7 p.m., and hope shortly to have their own set in operation. A series of interesting and instructive lectures is arranged for the ensuing winter session.

Smethwick Wireless Society.*

Hon. Secretary, Mr. R. H. Parker, F.C.S., Radio House, Wilson Road, Smethwick, Staffs.

On Friday, October 27th, an interesting lecture was given by the technical adviser, Mr. C. Grew, on the "Super-Regenerative Circuit," followed by a demonstration, on apparatus of his own make, which was very excellently made. A hearty vote of thanks was accorded to Mr. Grew, who reciprocated. The Committee are endeavouring to form a syllabus of lectures and demonstrations.

The President, Mr. R. W. Hutchinson, has promised to give three lectures.

On November 24th, Mr. R. H. Parker will lecture on "Alternating Currents Applied to Generating Stations." It is also hoped to give a public demonstration at a convenient date.

Glasgow and District Radio Club.*

Hon. Secretary, Mr. W. Yuill, 93, Holm Street, Glasgow.

At a meeting held in the Club-room, 200, Buchanan Street, Mr. Pick lectured on "Some Set." The set, on view during the evening, had seven valves, three H.F. detector and three L.F., each valve being controlled separately. Mr. Turner and Mr. Carlisle led the questions. Strong signals were received from a number of home and Continental stations.

A hearty vote of thanks to Mr. Pick brought the meeting to a close.

Fulham and Chelsea Amateur Radio and Social Society.*

Hon. Secretary, Mr. R. Wood, 48, Hamble Street, Fulham, S.W.6.

The attendance on November 7th was again very satisfactory, and with the aid of a five-valve set loaned by one of the members a pleasant and instructive evening was attempted, but owing to severe disturbances from a local generator it was found impossible at the time to get at all clear signals.

Mr. Whitts in the meantime read and lectured from one of R. D. Bangay's books; this was heartily appreciated.

Special precautions will be taken with the Society's receiving set to insure it against all disturbances. This set is now in the course of construction by the members themselves.

Clapham Park Wireless Society.*

Hon. Secretary, Mr. J. C. Elvy, 3, Fontenoy Road, Bedford Hill, S.W.12.

The tenth general meeting held at headquarters, 67, Balham High Road, on November 1st, was well attended. Mr, A. E. Radburn was again elected Chairman for the evening.

Hon. Secretary reported having received necessary information from Hon. Secretary of the Wireless Society of London preparatory to affiliation, and has replied in accordance, anticipating an early fusion.

A letter was received from Mr. J. Ayres—2 QD portable transmitting station—drawing attention to misleading report in Wireless Press relative to the writer's demonstration at the sixth meeting of the Society on October 4th last. The Hon. Secretary is most anxious to correct this report by stating that the whole apparatus was provided by Mr. J. Ayres for both transmitting and "listening-in." Mr. J. A. Daniels said that at the last moment the "Magnavox" apparatus he had promised to bring along was not available. Mr. J. A. Daniels' explanation thus cleared the matter up, the Hon. Secretary undertaking that the correction should appear in press columns, expressed his regrets.

Further new members were elected. The Chairman then called upon Mr. C. D. Richardson to continue his lecture of October 18th, 1922, which he did with the aid of apparatus he had brought for demonstrational purposes, including an old Mark III set.

His remarks were suitably illustrated.

The opportunity was seized by several present to "listen in" on the apparatus Mr. C. D. Richardson had brought with him, when coupled up to Society's aerial.

The Hon. Secretary points out that membership is rapidly approaching the figure beyond which new entrants will be called upon to pay an additional 2s. 6d. entrance fee to the yearly subscription of 7s. 6d.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

At Headquarters, Fulham House, Putney Bridge, on November 10th, a letter was read in reference to the Amateur Transmissions to America, and it was proposed to let the technical committee deal with this as they have the arrangement of the Society's apparatus.

A letter was read from Captain Ian Fraser, of St. Dunstans, thanking the Society for the assistance to the blinded soldiers and sailors.

During a discussion Mr. Wooding fitted up his six-valve unit panel set. A series of experimental tests were made with English, Dutch and American valves.

Ilkley and District Wireless Society.*

Hon. Secretary, Mr. E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

On November 6th Mr. E. Dobson took the chair. The President, Dr. J. B. Whitfield, lectured on "The Relation Supposed to Exist Between Electricity and Matter." He gave an interesting demonstration of the action of electronic emissions, by means of a very fine X-ray outfit, specially brought for the occasion.

Ealing and District Radio Society.*

Hon. Secretary, Mr. W. F. Clark, 52, Uxbridge Road, Ealing, W. 5.

Several important changes have taken place with regard to the future of the Society and a special meeting was convened for Tuesday, October 10th, 1922 to consider the following arrangements: (1) It has been decided that the old headquarters at Westfield House were not quite suitable as a permanent meeting place from several points of view, and having had a most generous offer from the Directors of the London Radio College, 82, High Street, Brentford (opposite Half-acre) to the effect that they are prepared to let the Society have the use of the lecture hall, telegraph room for buzzer practice, use of existing aerial, and all other conveniences (storage for bicycles, etc.) for a most moderate rental in order to encourage the Society, the meeting unanimously decided to accept their kindly offer. (2) Meetings will in future be held on Friday evenings from 7.30 to 10 p.m. in order to meet the wishes of the majority of members; the acquisition of the new premises has already given a considerable fillip to the membership numbers. (3) In view of the fact that the new headquarters are in a fresh locality, it has been felt that the old name was hardly applicable on account of the attendance of members from surrounding boroughs: it was therefore decided to adopt the name of the "Ealing and District Radio Society."

On Friday, October 20th, the syllabus of lectures commenced with a lecture by Mr. Watton entitled "Accumulators, the care and construction of." and following weekly: "H.T. Batteries," "Condensers, their functions and characteristics," "Symbols and Diagrams as used in Wireless," "A single valve receiving set, construction and cost," "Crystals and Crystal Detectors," "Coils: Slab, Basket, Duolateral, etc., their construction and efficiency."

These lectures will prove to be very useful, especially to those who are novices in the new science, and it is hoped that all members will encourage (by their attendance as often as possible) those gentlemen who are endeavouring to make the Society a real success.

Beginners disposed to join, yet who feel their lack of knowledge, will be made welcome and their needs specially catered for. Prospective members have the option of attending one meeting without obligation to join. Application forms may be obtained from the Secretary, or at any ordinary meeting of the Society at the College.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

At the Erith Technical Institute, on November 10th, the eleventh general meeting was held.

Mr. H. H. Smith gave his paper on "The Properties of Crystals." Some very fine specimens were exhibited. During the lecture some bismuth was melted in a crucible, and allowed to cool; afterwards the crucible was broken in two, showing the bismuth re-crystalised.

Mr. Smith received a vote of thanks. It is hoped to continue tests on double crystals at the next meeting.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

At headquarters on November 1st, Mr. Boullen in the chair, it was resolved that meetings be held weekly for the present, every alternate night being devoted to assisting beginners. Several new members were elected and suggestions were invited for lectures.

Mr. J. R. Halliwell gave a short talk on "Broadcasting, with Special Reference to the Amateur's Position." He received a very hearty vote of thanks.

On November 16th Mr. G. G. Boullen was again in the chair. One new member was elected. Mr. J. W. Hand opened a discussion on "The Construction of Wireless Sets," with special reference to the three-valve set in operation at the meeting.

A demonstration of telephony reception from 2 ZY (Metro-Vick, Manchester) followed. Mr. J. Kemp, who had very kindly brought the gear to the meeting, proceeded to deal with constructional details, such as working ebonite, winding coils, etc. A vote of thanks was passed to Messrs. Hand and Kemp.

Hackney and District Radio Society.*

Hon. Secretary, Mr. E. R. Walker, 48, Dagmar Road, Hackney, E.9.

A special general meeting was held at headquarters, the Y.M.C.A., Mare Street, on November 9th, Mr. Harry A. Epton, the Chairman, presiding. There was an attendance of over 50, including six new members.

A letter from the Wireless Society of London with regard to the position of amateurs under the new broadcasting regulations was read, and the Wireless Society's reply was considered satisfactory.

It was decided to institute two classes of members, viz., senior members (18 years of age and over) and junior members (under 18), the senior members to pay an entrance fee of 5s. and an annual subscription of 10s., and the juniors to pay 2s. 6d. and 5s. respectively, in place of the present flat rate of 3s. 6d. per member per quarter, irrespective of age; this new rule to commence from January 1st, 1923.

It was also decided to hold the annual meeting in January instead of in July, and that nominations for the officers and committee should be closed a week before the annual meeting.

It was felt that efforts should be made to obtain lecturers from outside sources, and the Chairman was requested to communicate with the national society and other bodies with a view to this end.

At another meeting at the headquarters, Y.M.C.A., Mare Street, Hackney, on November 16th, the Chairman, Mr. H. A. Epton, presided. A hearty vote of congratulation was passed to Sir Arthur Lever, Patron of the Society, on his election as M.P. for Central Hackney.

Two home-made sets of three valves each, loaned by members, were used with a Brown's loud speaker. The London broadcast programme was received.

A spirited discussion took place on valves *v.* crystals between Mr. Valins and Mr. Bell.

The Radio Club, Argentino.

Secretary, Señor Eduardo F. Jacky, Buenos Aires.

At the celebration of the Club's first anniversary the following officials were elected:—Honorary President, Capt. Luis F. Orlandini (Navy): President, Señor Ezequiel P. Paz; Vice-President, Señor Teodoro Bellocq; Secretary, Señor Eduardo F. Jacky; Assistant Secretary, Señor Roberto del Rio; Treasurer, Señor Horacio G. Larreta. Members of Committee: Señors José Canals, Adrian B. Jones, Dr. Guillermo Rojo, Ovidio F. Carpinacci, F. Sauce and Jorge M. Delfino.

There are now nearly 400 members, and very shortly new and larger premises are to be taken.

Lambeth Field Club and Morley College Scientific Society.

(Physics and Wireless Section).

Hon. Secretary, Mr. F. W. Ling, Physics Laboratory, Morley College, Waterloo Bridge Road, S.E.1.

Mr. R. F. Cosser lectured on November 11th on "The Making of a Two-Valve Set." He dealt with the tools necessary for making the set, material, valves, etc.

Southampton and District Wireless Society.

Hon. Secretary, Mr. T. H. Cutler, 24, Floating Bridge Road, Southampton.

A record attendance of members was recorded on November 9th at the Kingsland Assembly Room, both Presidents of the Society, namely Major-Gen. Sir Ivor Phillips and the Rt. Hon. Dudley Ward, being present. Both gave a short speech. Mr. Goodall transmitted a concert which was splendidly received. Later Mr. Goodall called up both the Presidents to wish them every success at the forthcoming election. The result of the Single Valve Competition was Mr. Spear first prize and Mr. Wainborough second prize. The prizes were given and presented by Dr. MacDougall.

South Shields and District Radio Club.

Hon. Secretary, Mr. J. A. Smith, 66, Salmon Street, South Shields.

The eighth meeting was held on November 7th in the Liberal Club Buildings, Ocean Road, South Shields (temporary headquarters).

The Chairman reported that the Club's application for a transmission licence had been acknowledged.

A new aerial has been erected and tried. Telephony was heard from broadcasting stations at London and Manchester, and the experimental station of the Chase Radio Company, Newcastle.

A two-valve resistance coupled set, of home construction, was next demonstrated by a member.

The next meeting was held on November 24th, when a lecture on "Valve and Crystal Detectors" was given by Mr. Moore, Instructor in Wireless Telegraphy, South Shields Marine School.

Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

The chair was taken by Mr. H. J. Pugh on November 3rd, 1922; a successful raffle took place in aid of general funds for Society apparatus. The winner, ticket holder 142, received a crystal set complete, valued £5 10s. The Treasurer received a substantial sum on behalf of the Society.

An interesting lecture was given by Mr. H. J. Pugh, who demonstrated a crystal detector and two-valve amplifier. Several new members were elected.

The Wireless Society of Winchester.

Hon. Secretary, Mr. Albert Parsons, 65, Cromwell Road, Winchester.

"Lower House Sale Rooms" have been opened for the Society by very kind permission of Mr. Wm. Tanner, to whom the rooms belong. Meetings are held on Tuesday evenings, although the club-rooms will be open every night to members. The present membership is very satisfactory.

The Secretary would be very pleased to hear of any amateur who hears the call **2 MM** (Mr. Cecil C. A. Hines, Twyford) giving particulars, etc., of position, time and conditions.

The following officers have been elected temporarily:—Chairman, Mr. S. R. Humby; Vice-Chairman, Mr. W. E. Smith; Treasurer, Mr. P. A. Gibbs. It was decided that the Committee should consist of all members, and should a certain problem remain unsolved, a special Committee consisting of five full members be elected for the purpose.

Fees have been fixed, viz., full members, 10s. 6d.; associate members, 7s. 6d.; country members, 5s. 6d.; with no entrance fee.

Cambridge University Wireless Society.

Hon. Secretary, Mr. J. B. Hickman, 4, Rose Crescent, Cambridge.

The first meeting of the Michaelmas term was held on October 12th, 1922, in the Engineering Laboratory. The following officers were elected for the ensuing year:—President, Mr. F. S. Thompson, Peter House; Hon. Secretary, Mr. J. B. Hickman, Gonville and Caius College; Treasurer, Mr. F. P. Best, Gonville and Caius College.

On October 27th, the Hon. Secretary read a paper to the Society entitled "Wireless as a Prime Communication in the Field." The paper dealt with a scheme of wireless communication that was used during the operations in Ireland in 1921. The chief interest of the paper was that it described a scheme in which wireless, for the first time perhaps in military history, occupied the first place.

On November 1st, Mr. E. V. Appleton, M.A., St. John's College, delivered a most interesting lecture on the measurement of signal strength. The substance of the paper was a description of some original work carried out by the author on a method of measurement of signals which was suggested by some observations of Dr. Vincent on the behaviour of two oscillating coupled circuits. It was found, if there were two oscillating circuits, one oscillating strongly, the other weakly, that in the neighbourhood of synchronous oscillation, the stronger oscillation forced the weaker oscillation. The lecturer drew attention to the fact in the phenomenon of the silent space, that the beat frequency did not decrease in a linear fashion. This was due to the forcing. The lecturer then went on to describe the method he used. The strength of signal was measured by the silent space—the bigger the silent space the stronger the signal. The actual strength could be calculated from a formula embodying the length of the silent space, the capacity of the aerial and the impressed E.M.F. from the heterodyne. The E.M.F. was measured with a Moullin voltmeter, and the experiments carried out with an autodyne single valve receiver. Very satisfactory results have been obtained in observing the signals from Ongar at Cambridge. An interesting discussion followed, and a very hearty vote of thanks was passed to the lecturer.

Manchester Wireless Society.*

The annual general meeting was held in the Council Chamber, Houldsworth Hall, Deansgate, on November 10th. Mr. McKernan was in the chair. Reports of the Secretary and Treasurer were presented. The total number of members to date was 189 as compared with 107 for the end of the previous year.

After introducing the new Chairman, Mr. Barraclough, Mr. McKernan was given a rousing applause from the members in recognition of his splendid service.

Mr. Barraclough read the following appointments for the ensuing year :—First Past President, Mr. J. Hollingworth, M.A. President, Dr. Stanley Hodgson, M.D. Vice Presidents : Messrs. E. Blake, J. H. Brown, W. W. Burnham, G. E. Duveen, M.A., H. Green, S. R. Mullard, M.B.E., F. Phillips, J. C. A. Reid, J. C. Wrigley. Vice-Chairman, Mr. W. R. Anderson. Mr. Evans was again unanimously elected Hon. Secretary, and Mr. W. H. Lamb Hon. Treasurer.

The ballot papers which had been distributed by post were then collected and scrutineers appointed to count the votes. An interval was allowed for discussion, after which the result of the voting was announced as follows. These members will form the Committee for the next year of office : Messrs. E. G. Davies, A. G. Gregory, R. Hallam, H. L. Holt, F. Taylor, B. L. Stephenson. Mr. R. Dawson and Mr. J. J. Burne were appointed Auditors. It was resolved to ask the Committee to collect information as to the suitability of forming branches of the Society. An entirely separate branch to provide elementary lectures is being formed for broadcast licensees. The Committee were empowered to draw up the necessary rules.

Lady members' subscriptions were fixed at 10s. 6d. per annum inclusive of entrance fee. Amendments to rules were discussed. With regard to the Transatlantic Station Mr. Evans announced that a special test on 1 k.W. spark had already been carried out on Sunday, November 5th, and a further attempt on C.W. on November 12th, 19th and 26th, the first on 500 watts and the last two on 1 k.W. The reception of these unofficial tests was carried out by the A.R.R.L., and the special station for reporting results was **2 FP**.

On November 13th the Society gave a lecture and demonstration in aid of the Manchester and Salford Hospital Saturday Fund. The lecturer was Mr. Evans and the demonstration arrangements were very successfully carried out by Mr. W. C. Barraclough and his two sons.

Southwark Wireless Telephony Association.

Hon. Secretary, Mr. W. Helps, King's Hall, London Road, S.E.1.

The first meeting of the month was held at headquarters, on October 1st, when Messrs. A. O. Gibbons and Winstone gave a very instructive lecture, illustrated by slides, on "Elementary Wireless." Interesting discussion followed. A vote of thanks to the lecturers concluded the meeting.

The second meeting of the month was held on October 15th, when Mr. Dibben gave a lecturette on the functions of a condenser, also aerials and their faults, followed by discussion. After the vote of thanks to the lecturer, the Secretary reminded members that it was desired that they would all do their best to make the wireless concert, arranged to help the funds of King's College Hospital, a financial success : special transmissions had been arranged, and Mr. W. F. Hurndall was giving the hall entirely free. Tickets cost a shilling, and the concert commences at 7.15 p.m. on November 5th.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. Arthur I. Dabbs, 315, High Road, Ponders End, N.

Two new members were elected at Headquarters, The Falcon Inn, South Street, Ponders End, on November 9th.

After discussion on general business, the Society's set was brought into operation, and one or two amateur transmissions came in well on the loud speaker. At 9 o'clock some excellent musical items from Marconi House were enjoyed. After the concert the rest of the evening was spent in general discussion, and endeavours to straighten out the licence question.

A small library and certain articles of apparatus are now available for loan to any of the members.

Reading Radio Research Society.

Hon. Secretary, Mr. J. J. Baker, Broadway Buildings, Reading.

The first meeting of the winter session was held at the University College, Reading, on November 7th, when, ater electing the officers for the current year, a very interesting lecture was given by Mr. W. Atkins on "The Working of Telephones."

A licence for a receiving set has been applied for and it is hoped to shortly erect an aerial at the University College for demonstration at future meetings, which will, of course, also be useful for scientific purposes in connection with the University itself.

It is hoped to organise in the near future a conversazione and a sale of parts among the members, but further particulars will be announced later.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. Moore, 175, Leanesden Road, Watford.

The formation of the above Society is now complete, and a programme of lectures, demonstrations, etc., is in course of preparation.

A meeting was held at headquarters, The National Schools, Watford, on November 6th, the principle item being a lecture by Mr. C. S. Hall on "Honeycomb Coils," and the construction of the machine for winding them.

A miniature crystal set made by Mr. Bevan was used in conjunction with two basket coils, and gave excellent results.

The club-room is open each Monday and Friday evening from 7 till 10.

Plymouth Wireless and Scientific Society.

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

Mr. E. W. Penney lectured on "Valves and Valve Receiving Circuits" on November 14th. He dealt with the electron theory, more particularly in its application to valve working. Later he gave a clear exposition of grid rectification, the action of the grid condenser and leak being explained in a simple and satisfactory manner. The lecture was concluded on November 29th.

Notes

The Birmingham Broadcasting Station.

"Listeners-in" had a pleasant surprise on Wednesday, November 15th, when they received the Birmingham Broadcasting Station for the first time. The station had been previously installed in the London offices of The Western Electric Co., Norfolk Street, W.C.2. Instructions were received on Friday, November 10th, to transfer the station temporarily to the works of The General Electric Co., at Witton, Birmingham. The set was therefore dismantled and conveyed to Witton by Lorry, arriving there on the afternoon of Sunday, November 12th, and installation was commenced immediately under the direction of Western Electric Engineers, and with labour supplied by the courtesy of The General Electric Co. In a short time a small army of painters, carpenters, wiremen, etc., were busy installing the apparatus and the antenna, and decorating the rooms. By 4 o'clock on Wednesday afternoon, November 15th, the station was ready, and after an hour's preliminary testing, commenced serious operations. A concert was transmitted from 5 p.m. until 11, and afterwards election results were broadcasted until 1 a.m. From the first, the transmission was excellent—a fact which is attested from all parts of the country.

The Western Electric Broadcasting Set is designed to deliver about 500 watts of radio frequency power to the antenna. It has a rated range of 100 miles, which means that satisfactory operation may be expected at this distance when using an average valve set comprising, say, a single detecting tube with reaction, and the usual aerial. It should, of course, be borne in mind that it is impossible to state the range with accuracy, since this is affected by so many factors—the transmitting antenna, the type of efficiency of receiving equipment used, the absorption between the two stations, etc. When conditions are favourable—at night time, for instance—the broadcasting station will be heard in suitable sets at very much greater distances.

Automatic Wireless Transmission at Sea.

The Marconi International Marine Company, Ltd., installed on board the White Star liner *Majestic* high speed automatic transmitting apparatus. Hitherto only hand transmission has been used by wireless operators at sea, but the amount of traffic has recently grown so enormously on the *Majestic* that it has been found necessary to introduce automatic working. The *Majestic* is the first liner to be fitted in this way. The maximum speed of the automatic apparatus used is 240 words per minute.

O.T.C. Wireless Instruction.

Army Council Instructions provide for a course in wireless telegraphy for officers and cadet non-commissioned officers of the Senior and Junior Divisions during the Christmas vacation at the Signal Training Centre, Maresfield, from January 2nd to 13th. Applications must reach the Secretary (S.D.3.B.), the War Office, Whitehall, London, not later than December 4th.

Bickendorf Aerodrome W/T Station.

An Air Ministry Notice to Airmen states that a temporary W/T Station has been opened at Bickendorf Aerodrome, Cologne. Particulars of the service rendered by this station are:—(*a*) Call Signal: GEK. (*b*) Hours of service: 0900-1600 G.M.T. (*c*) Wavelengths and routines: (i) 900 metres. R/T communication with aircraft. A short range station is employed on this wave and is manned only when aircraft are expected. (ii) 1,400 metres. Route Traffic with Air Ministry (**GFA**) and with Brussels (**OPVH**). Receiving Watch on this wavelength is interrupted when transmission is taking place as laid down in paragraphs *c* (i) and *c* (iii) of this Notice. (iii) 1,680 metres. Meteorological broadcasting. The station broadcasts a meteorological report at the following times: 0915, 1015, 1115, 1215, 1315, 1415, 1515 G.M.T. Notice to Airmen 43 of 1922 is amplified accordingly.

Duet by Mr. John Huntington and Miss Olive Sturgess. Mr. R. Stauton Jefferies, A.R.C.M., at the piano. The much discussed chimes are in the background.

A Souvenir.

Described as "A Souvenir of a Historic Event," a concise and highly interesting booklet has been prepared by Marconi's Wireless Telegraph Co., Ltd., which contains the message transmitted by H.R.H. the Prince of Wales to the Boy Scouts on October 7th. A description of the transmitting arrangements and reports of the receptions giving the town, distance, name, kind of receiver and comments are given. Each person who sent a report to Marconi House is to receive a copy, and a special copy bound in vellum has been sent to His Royal Highness, who has expressed great interest in the reports.

Proposed Society at Horwich (Bolton).

Particulars of the proposed Wireless Society for Horwich (near Bolton) may be obtained from Mr. P. Ashurst, 51, Mary Street East, of that town.

Slight Change in Wavelength of 2 LO.

It is announced that the wavelength of **2 LO** has been changed to 369 metres, in order to avoid interference which was previously experienced. This change although so slight appears to have accomplished its purpose.

CORRESPONDENCE.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—It may interest 2 JZ to know that I received his C.W., on about 200 metres, strongly on Saturday and Sunday evening, using 1 valve, and telephony on Sunday evening on the same wavelengths. I could just read the latter, there being little jamming at the time. My aerial is 100 ft. long, and average height is about 27 ft.

Nearly all my set is home constructed, including tuning coils (duolateral).

Bedford.

November 6th. J. HEATON ARMSTRONG.

PERSONAL.

The Council of the Institution of Electrical Engineers of London at the last meeting announced that Dr. J. A. Fleming, F.R.S., had been unanimously elected an Honorary Member of the Institution. Dr. Fleming has accepted the invitation to give the Fourteenth Kelvin Lecture to the Institution next May. The Royal Society of Arts recently awarded him one of their Silver Medals for the Fifth Henry Trueman Wood Lecture he gave to them on November 23rd, 1921, on "The Coming of Age of Long Distance Wireless Telegraphy and Some of Its Scientific Problems."

Radio Society of Great Britain.

AT the meeting of the Radio Society of Great Britain (late Wireless Society of London) held on Wednesday, November 22nd, the following were elected to membership of the Society :—

C. Creswick Atkinson, E. Dawson Ostermeyer, Clifford Rattray, George Smith Lindenholme, George F. Taylor, John Barnard, Matthew Marshall, James W. Allen, Edward C. Leach, Archibald J. Maitland, John A. Partridge, Fred A. Bourne, Anthony E. Chester, Walter O. Bentley, George G. Welsh, John Bates, Percy R. Fairclough, Cyril G. Webster, Maurice H. Saffer, Y. W. P. Evans, Richard H. Wagner, H. T. P. Gee, Frederick W. Walter, Kenyon Secretan, Clifford W. Andrews, Conrad J. Beck, S. E. Mackeown, Fred H. Robinson, Major Reginald Beckett, A.M.I.C.E., Capt. H. C. J. A. R. West, R.N., Thomas Watson, William A. Ward, L. Howard Flanders, Reginald G. Waller, John S. Pallister, Albert E. Bowyer Lowe, John Hall Rider, M.I.E.E., Arthur E. Morris, Ettore Bellini, D.Sc., E. W. Kent, A. C. Cockburn, M.I.E.E., Leonard M. Robinson (Lieut., R.N.), George G. Jack, Percy C. Kidner.

The following were elected Associate Members :—

Francis W. Laing, Isabel C. Fogarty, John W. Boys.

The following Wireless Clubs and Societies were accepted for Affiliation :—

Thames Valley Radio and Physical Association, Morley College Scientific Society (Wireless Section) Grimsby and District Radio Society, The Leys School Wireless Society (Cambridge), Darwen Wireless Society, Clapham Park Wireless Society, Huddersfield Radio Society, Loughborough College Wireless Society, Barnsley and District Wireless Association, Rhyl and District Amateur Wireless Society, Ealing and District Radio Society, Tottenham Wireless Society, Bromley Radio and Experimental Society (Kent), Boots' Radio Society (Nottingham), Hereford and District Radio and Scientific Society, Powysland Radio and Scientific Society (Welshpool), Birkbeck College Wireless Society, Newbury and District Wireless Club, Harrogate and District Radio Society, Malvern Wireless Society.

THE EFFECT OF UNDERGROUND METAL WORK ON RADIO DIRECTION FINDERS.

FURTHER to the discussion on the above subject which was brought before the meeting of the Wireless Society of London on October 25th, 1922, by Mr. R. L. Smith-Rose, M.Sc., Mr. J. F. Stanley, B.Sc., says :—

"I notice in *The Wireless World and Radio Review* of November 11th that reference was made at a meeting of the Wireless Society of London to the experiments of Mr. Umberto Bianchi, an Italian inventor, who claims to have devised a system to detect underground mineral deposits. I had the pleasure of meeting Mr. Bianchi some months ago, and I was present at a demonstration given by him to a gathering of mining engineers at the Royal School of Mines. I subsequently had the opportunity of carrying out some experimental work in this direction myself, with very encouraging results. In one of these tests, carried out in the goods yard of the City and Guilds Engineering College, I was able to trace out the course of an iron drainpipe, the existence of which I was totally ignorant of at the time.

"I may say that the method employed does not depend on the errors in the observed readings of a direction finder, as in the experiments of Messrs. Smith-Rose and Barfield, but on the deflection of an electro-magnetic field due to the presence of a deposit of conductive mineral. By this method it is claimed that the depth and shape of any mineral deposit can be very accurately estimated, and from my own observations and experiments I think the method will be widely used in the future."

A New Club.

From Mr. D. H. Brayne, of 29, Rutland Park, Willesden Green, N.W.2, we learn that a movement has been made to form a Wireless Society in Cricklewood and Brondesbury, under the auspices of the Willesden Polytechnic Electrical Engineering Society.

The Society is open to both sexes, and an inaugural meeting was held on November 25th. Enquiries may be sent to Mr. Brayne.

Calendar of Current Events

Friday, December 1st.

BRADFORD WIRELESS SOCIETY.

At 5, Randallwell Street. Lecture by Mr. Liardet.

MANCHESTER WIRELESS SOCIETY.

At 7.30 p.m. At Houldsworth Hall. Lecture on "Radio Measurements and Measuring Instruments," by Mr. Bertram Hoyle, M.Sc.

NEWCASTLE AND DISTRICT AMATEUR WIRELESS ASSOCIATION.

At 7.15 p.m. At Engineering Theatre, Armstrong College. Lecture on "Some Observations on Distortion in Wireless Telephony," by Mr. W. Owen.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "Common Faults in Receiving Circuits," by Mr. A. H. Norman.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

At 7 p.m. Exhibition of apparatus and demonstration of telephony at the Blenheim Institute. Also the following day at 3 p.m.

Saturday, December 2nd.

CROYDON WIRELESS AND PHYSICAL SOCIETY.

At 7.30 p.m. Annual General Meeting and lecture on "Small Rectifiers for Charging from A.C."

Sunday, December 3rd.

3–5 p.m. *Daily Mail* Concert from PCGG, The Hague, on 1,050 metres.

Monday, December 4th.

9.20–10.20 p.m. Dutch Concert, PCGG, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road. Lecture on "Magnetism," by Mr. W. E. Kersey.

Tuesday, December 5th.

WEST LONDON WIRELESS AND EXPERIMENTAL ASSOCIATION.

At 7 p.m. At Acton and Chiswick Polytechnic, Bath Road, Chiswick, W.4. Annual General Meeting.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.

Special competition. Details at the meeting.

Wednesday, December 6th.

INSTITUTE OF ELECTRICAL ENGINEERS. (WIRELESS SECTION.)

At 6 p.m. At Victoria Embankment. Meeting.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.

At 111, Station Road, Redhill. Lecture on "Gadgets," by Mr. Clarke.

PORTSMOUTH AND DISTRICT AMATEUR WIRELESS SOCIETY.

Social evening and demonstration. Special transmission from Eiffel Tower.

MALVERN WIRELESS SOCIETY.

Lecture on "A.C. and Oscillatory Currents," by Mr. L. H. Mansell.

EDINBURGH AND DISTRICT RADIO SOCIETY.

At 8 p.m. At Headquarters. Business meeting and lecture on "A Syphon Recorder for W/T," by Mr. W. Winkler.

Thursday, December 7th.

At 9.20–10.20 p.m. Dutch Concert from The Hague on 1,050 metres.

LUTON WIRELESS SOCIETY.

At 8 p.m. At Hitchin Road Boys' School. Practical Work and Experiments.

DERBY WIRELESS CLUB.

At 7.30 p.m. At "The Court," Alvaston. Lecture on "Rubber," by Mr. E. H. Tawn.

HACKNEY AND DISTRICT RADIO SOCIETY.

Lecture on "Insulating Materials," by Mr. Sanford.

NEWPORT AND DISTRICT RADIO CLUB.

Public Wireless Concert.

Friday, December 8th.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

At 7 p.m. Lecture and Demonstration on "Recording Apparatus," by Mr. A. M. Bage.

Meeting of Transmitting Licence Holders.

A further meeting of transmitting licence holders in the London area has been called for Thursday, November 30th, at 6 p.m., at the Waldorf Hotel, Aldwych, W.C. The committee appointed at the last meeting will present their report.

The British Radio Manufacturers' and Traders' Association.

On November 20th a meeting, called by the Radio Association, was held at the Hotel Cecil. It appears that the purpose of the meeting was to appoint a committee for a Trade Section of the Association.

After Prof. A. M. Low and Colonel L'Estrange Malone had explained this object members of a second body present—the Wireless Manufacturers' and Traders' Association—protested that they had a committee which had been waiting for six weeks to meet the Radio Association.

After a lively discussion the Secretary of the Traders Association virtually took the meeting out of the hands of the Radio Association, and an entirely new association was formed in less than ten minutes. Members of both the other organisations were recommended to join it at once.

The name of the new association is The British Radio Manufacturer's and Traders' Association, and the address of the Organisation is Dundee House, 15, Eastcheap, E.C.3.

The Wireless Society of London

A MECHANICAL MODEL ILLUSTRATING THE ACTION OF THE THREE-ELECTRODE VALVE.*

By G. G. BLAKE, M.I.E.E., A.Inst.P.

IN a paper which I read before this Society on March 22nd, 1922, I mentioned a mechanical model, which I had constructed to illustrate the action of the three-electrode valve.

Fig. 1 shows the model as it then was. The plate current of the valve is represented by a metal spring, in the centre of which is a small disc of metal, which represents the grid voltage of the valve. Through the centre of the spring and disc, a piece of thread passes, this is stretched on a frame. The frame is supported by springs from above and below. When it is made to oscillate up and down, its movements may be said to represent the incoming oscillations from a distant transmitting station.

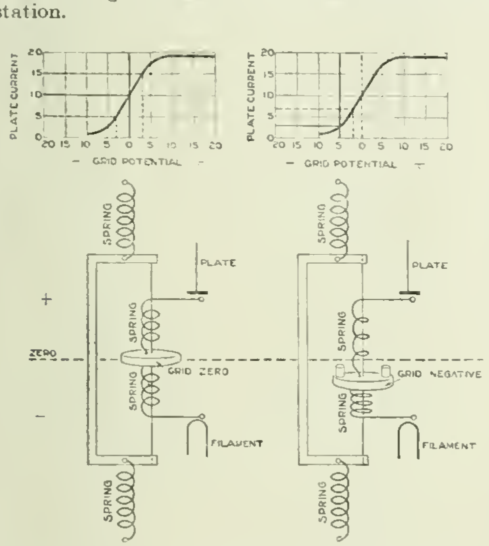


Fig. 1.

The thread, as it rubs up and down against the hole in the disc through which it passes, will cause the grid disc to oscillate above and below the zero line, shown in Fig. 1, representing either increase or decrease of grid voltage and plate current.

The left-hand diagram shows the grid functioning at the centre of the characteristic curve of the valve (see curve on left-hand top corner of the figure). In this case the grid disc will oscillate to an equal distance below and above zero line.

If we make the grid of the valve more negative, the right-hand side of Fig. 1 represents the condition of affairs. In this case small weights have been placed on the grid disc to bring it below the zero line, and to represent a negative charge, when the incoming oscillations (represented by the oscillatory movements of the thread) act on the grid. The negative pulse has little or no effect, as the plate spring is already compressed; but the positive half of the oscillation takes effect on the grid and increases the plate current. We are now working at the lower bend of the curve represented at the right-hand upper corner of the slide.

The compressed condition of the plate spring below the grid gives us a method of visualising the increased density of electrons in the space charge of the valve.

I have recently made several improvements in the construction and applications of this model, which I thought might be of interest to this Society.

Fig. 2 is a photograph of the model in its latest form, which you see before you on the lecture table.

Fig. 3 is a lettered diagram of the model, a brief description of which will, I think, help to make its use more easily understood. The incoming oscillations are represented by the movement up and down of two arrows, painted red and white, to represent the positive and negative half of each oscillation.

In place of the cotton thread in the old model, a metal rod R passes up through the centre of the spring and disc G. To this rod the before-mentioned arrows are attached. At the bottom of the rod is a small wheel W which rests on the rim of a second and larger wheel X acting as an eccentric. When rotated by means of a handle H the rod moves up and down through the grid disc G. There is a screw adjustment on this disc (not shown on the figure) to enable us to arrange for the rod to rub more or less lightly against the disc, as it oscillates (representing weak or tight coupling).

The filament and plate are represented by two metal tubes A and B, which hold the plate current spring V. These two tubes can be raised or lowered to represent alterations in the filament voltage and plate voltage. Both are fitted with pointers and scales, indicating the actual voltages which have been worked out from the curves taken from a valve. By means of this model we can repeat all our experiments and show the various readings obtained in the plate current when filament voltage or plate voltage are altered. The plate scale is shown at the top left-hand side of the model, and reads from 33 to 54 volts, and filament scale is at the bottom left-hand side of the model, and reads from 3·5 to 4 volts.

The scale on the right-hand side represents the grid potential and the pointer can be set, either at the same potential as the filament, *i.e.*, at zero, or up to 6 volts positive, if it is raised, or down to 6 volts negative if it is lowered.

The amount of plate current at any moment is indicated by the pointer on the grid disc G on plate current scale S, which reads from zero to 2 mA.

It will be noticed that the plate current scale is attached to the plate tube B, and moves up and down with it.

The following experiments can be mechanically illustrated. (Fig. 4.)

* A paper read before the Radio Society of Great Britain (late Wireless Society of London) on Wednesday, Nov. 22nd, 1922.

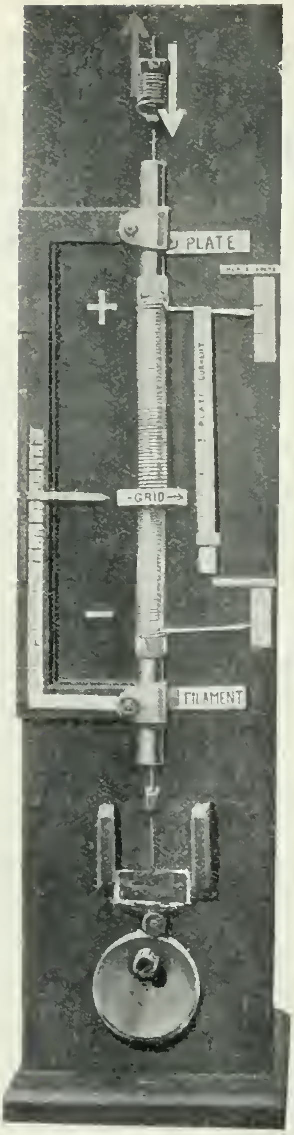


Fig. 2. Photograph of the Mechanical Model.

(A). To illustrate the effect of received oscillations upon the plate current when valve is functioning near centre of straight portion of its curve.

Set grid disc at zero potential Set plate at 33 volts. Set filament at 3·5 volts	A steady current of 0·8 mA. now passes through the valve.

The positive phase of each incoming oscillation produces an increase of 3 volts grid potential. and the negative half oscillation causes a drop to 3 volts negative.

This causes a rise and fall in the plate current between nearly zero and 1·25 mA., so that each half oscillation produces an equal and opposite effect.

(B). To illustrate the effect of the received oscillations upon the plate current when valve is functioning at the lower end of its characteristic curve.

Plate voltage and filament voltage remaining the same, make the grid 3 volts negative by setting grid disc (and pointer) at —3 volts.	No current passes through the valve.

The positive half of the oscillation increases the plate current and the negative half does not decrease it.

(C). To illustrate the valve functioning at the upper end of its characteristic curve.

Plate and filament current remaining constant increase the grid potential to 3 volts positive by raising grid disc (and grid potential pointer).	Plate current now reads 1·5 mA.

The negative phase now diminishes the plate current but the positive phase does not increase it.

(D). To show the effect of an increase of filament voltage on the functioning of the valve.

Set filament at 4 volts. Set grid at zero. Keep plate volts constant.	Plate current now reads about 0·8 mA.

It will now be seen that the valve functions at the lower end of its curve.

The positive half of each oscillation increases the plate current and the negative pulse does not diminish the plate current.

If we look upon the turns of the plate current spring as representing electrons, we shall see that we have made the space charge above the filament more dense and caused our valve to function at the bottom of its curve. To overcome this the filament voltage would either have to be reduced or the plate voltage increased, in order to remove the space charge.

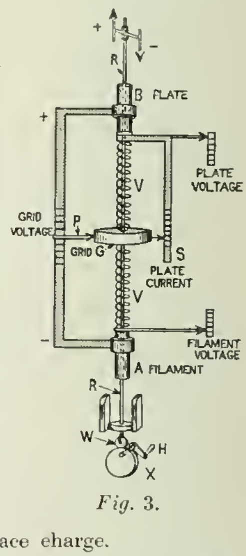


Fig. 3.

(E). To show that an increased plate voltage will cause a valve to function at its upper bend.

Set plate at 54 volts. Set filament at 3·5 volts. with grid at zero potential.	Plate current reads 1·5 mA.

The negative half of the incoming oscillation now reduces the plate current and the positive half oscillation does not increase it, showing that

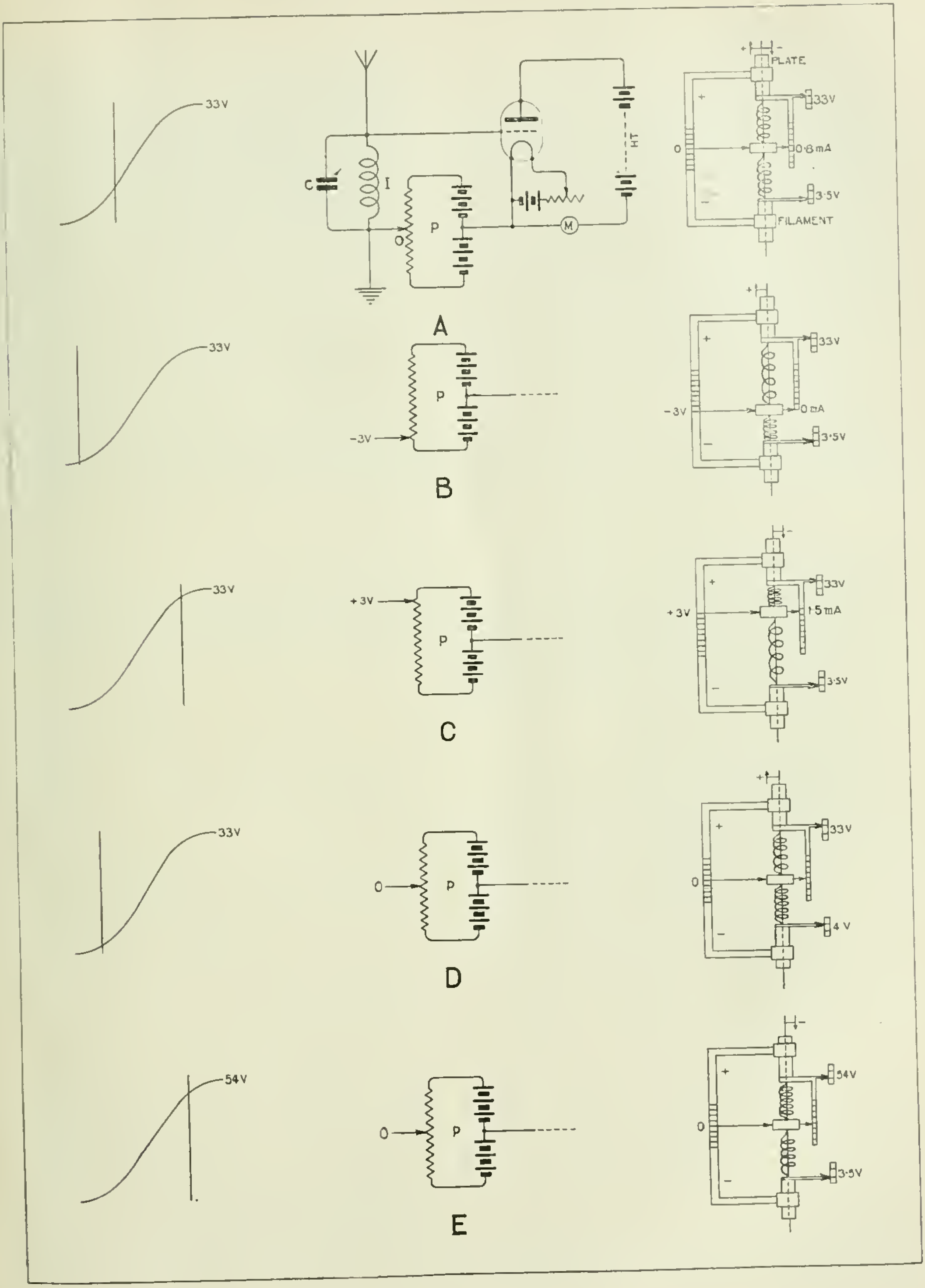

33V
C
I
O
P
HT
M
+
PLATE
33V
0
0·8 mA
3·5V
−
FILAMENT
A
33V
P
−3V
+
33V
−3V
0 mA
3·5V
−
B
33V
+3V
P
+
33V
+3V
1·5 mA
3·5V
−
C
33V
0
P
+
33V
0
4 V
−
D
54V
0
P
+
54V
0
3·5V
−
E

Fig. **4.**

we now have a sufficient positive potential on the plate to cope with all the electrons from the filament, and have reached saturation point.

I explained Fig. 5 in my last paper, showing the amount of amplification obtained by increase of grid voltage as against increase of plate current. We can also show the amplification factor of the valve by means of our model.

As the model now stands with grid at zero, and plate at 54 volts, we get a plate current of 1·5 mA.

If we now decrease the plate voltage to 33 volts, we shall reduce our plate current, when grid is at zero to 0·8 mA.

We can, however, bring the plate current up to 1·5 mA. again by increasing the grid voltage by only 3 volts positive.

So we see that an increase of 3 volts on the grid is equal to an increase of 21 volts on the plate; by employing the grid we have obtained a sevenfold amplification.

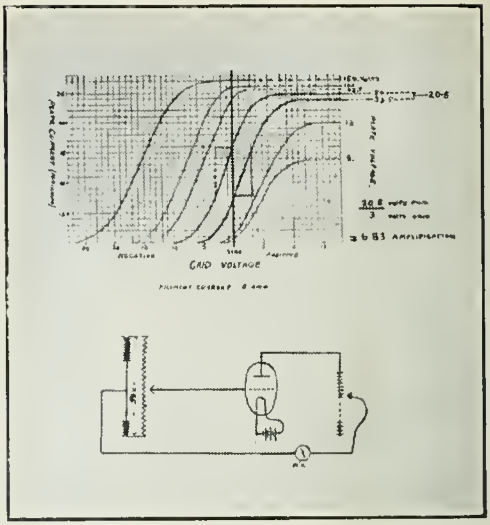


Fig. 5.

Manchester Wireless Society Transatlantic Tests.

For the information of those interested, the call letters of the 1k.W. station are **5 MS**, and the transmissions take place at 1 a.m. to 1.15 a.m. each Sunday, repeating the message at 2, 3, 4, 5 and 6 a.m. Reports will be welcomed by the Hon. Secretary.

Sunday, November 19th. At 1 a.m. the members commenced a special series of tests with a 1,000 watt valve transmitter, calling **2 FP** and **I AW**, two American amateur stations. Transmission lasted for 15 minutes and consisted of test messages referring to the work in hand. These were repeated every hour until 6 a.m., the intervening 45 minutes of each hour being devoted to listening for replies from the above-mentioned stations. The power was derived from D.C. generators, in series, with a total output of 2,500 volts, and using two 450 watt Marconi valves, a maximum radiation of 12 amps was attained on the last transmission.

As regards the reception, although 23 American amateur stations were registered, there was no acknowledgement of our transmissions. One special record was an amateur as far west as California, who was only using about 750 watts and radiating about 7 amps. The number of stations heard in one period of listening compares favourably with the results obtained with the special station erected by Mr. Paul Godfrey in Scotland last winter, and certainly reflects great credit on the gentleman who designed the receiver, and also on the work of the members who designed and erected the aerial.

Cables are being exchanged between the American Radio Relay League and the Society with a view to boosting up the enthusiasm which has been aroused on both sides of the Atlantic, and the Manchester amateurs are working day and night improving their apparatus with a view to eventually establishing direct interchange of messages, to be followed by a special test of telephony, subject to the approval of the P.M.G.

Another test was held on November 26th.

Further Colliery Experiments.

Mr. A. Trevelyan Lee (**2 DJ**) experimented recently with Mr. S. Grimwood Taylor (**2 IX**) at the Denby Colliery, near Derby.

Tests were made early in October. A temporary single wire aerial was erected at the top of two ladders, with a bare copper wire lying on the ground for an earth. One set was placed in a tub, lined with boards, and sent down the shaft. The aerial down below was suspended from the roof with string. Communication was immediately established with the station at the colliery office on top, speech and gramophone music coming through loudly and distinctly. This station was about 100 yards from the foot of the shaft. The tub was then pushed along the rails for about a mile, and communication was again easily established, but the signals from below were less clear. Mr. Lee said he understood that the strata above the coal consisted of iron deposits in nodule form.

The power employed did not exceed 5 watts, and was derived from one of Newton's Bros. generators, working off a 12-volt accumulator. One of the sets used choke control and the other grid control. Three valves were used for reception, one being the resistance-capacity coupling (long wave type) and the other tuned choke and L.F. The wavelength was 440 metres.

During discussion at the Derby Wireless Club it was suggested that a much longer wave might be found more satisfactory, and it was understood that this had been found to be so in submarine work.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, The Wireless World and Radio Review, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of* 1s., *or* 3s. 6d. *for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"C.M.S." (Finchley) *asks* (1) *What are the advantages and disadvantages of capacity reaction compared with magnetic reaction.* (2) *Can capacity reaction be used in such a manner that the aerial circuit will not radiate.* (3) *and* (4) *For a diagram using capacity reaction.*

(1) It is easier as a rule to obtain reaction effects using a reaction coil, but when the resistance capacity method of H.F. amplification is used it is often convenient to use the capacity reaction method. The reaction condenser generally has a maximum capacity of 0·0001 mfds., and is connected between the grid and plate of the 1st and 3rd or 2nd and 4th valve. (2) You could arrange the capacity reaction between the grid of the 2nd and the plate of the 4th valves. (3) See Fig. 1. (4) See recent issues.

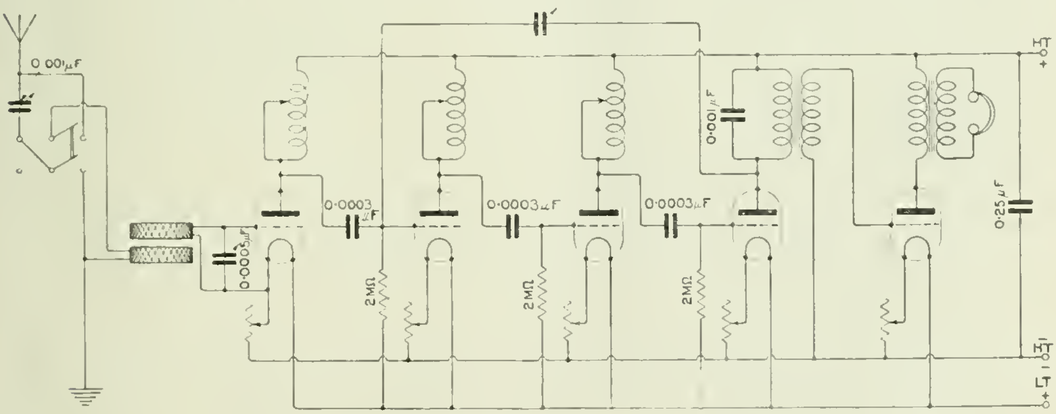


Fig. 1.

"A.T.G." (Peckham) *asks* (1) *For criticism of his circuit.* (2) *Whether we can suggest improvements.* (3) *Whether the values are correct.* (4) *Whether the provision of a switch to cut out reaction will enable him to secure the P.O. permission to use the set.*

(1) (2) and (3) The diagram is quite correct. The filament battery should be 6 volts, and the H.T. variable up to 75 volts. The grid condenser should be 0·0003 mfds., and grid leak 2 meghoms. A fixed condenser of 0·001 mfds. should be connected across the telephones, and a variable condenser with a maximum capacity of 0·0002 mfds. should be used to tune the primary of the H.F. transformer. (4) We do not think so.

"H.K." (Malden).—You could use plug-in honeycomb coils, or if you prefer, wind cylindrical coils yourself. The A.T.I. could be 5″ diameter and 8″ long, full of No. 22 D.C.C. The closed circuit inductance could be 4″ diameter by 8″ long, full of No. 26 D.C.C. The tuned anode coil and the reaction coil should be of the plug-in type, and you could experiment and find the best values yourself. About four sets of coils are required. The intervalve transformer should be made up exactly as described in the issue of August 19th, 1922. The core is 2¼″ long, 7/16″ diameter, and is bent over the windings. The total length of the core is 10″. The primary winding is of No. 46 S.S.C. and is wound on until the diameter is 13/16″, and the secondary winding of the same wire is wound over the primary until the diameter is 1¾″. See page 659, 19th August, 1922.

"A.D." (Manchester).—(1) The method is not "roundabout" as you suggest. Oscillations are maintained by the mutual coupling of L2 and L3. It is immaterial which coil is in the grid and which is in the anode, and also in which circuit the tuning condenser is placed. The theory of the oscillation is almost the same in each case. Oscillations having been set up, it is almost immaterial which of the coils is used for transferring them to the aerial circuit. (2) Eccles' "Continuous Wave Telegraphy" is probably the best theoretical book for your purpose. It does not contain any very heavy mathematics, but is by no means an elementary work. (3) Only the Post Office can say whether you are qualified for an experimenter's licence.

"T.A.L-D." (Woking) *asks for a diagram of a set to fulfil certain conditions.* (2) *If the set will receive certain stations.* (3) *If a certain make of slab coils could be used in place of honeycombs.* (4) *What is the lowest wavelength used.*

(1) See the diagram (Fig. 2). (2) **PCGG** probably, **2 MT** and **FL** certainly, but **8 AB** very doubtful. (3) If desired, but slab coils are considerably less efficient than true honeycombs. (4) The lowest value used for ordinary purposes is about 150 metres, but a certain amount of special work is done on wavelengths of about 10 metres. This involves the use of highly specialised methods, and it must be regarded as almost impossible for an amateur to listen in on such work.

"INTERESTED" (New York) *asks* (1) *The most convenient method of converting a B.T.H. set for short wavelength reception.* (2) *For a description of R.A.F. transmitting and receiving telephony set.* (3) *For description of his machine, of which particulars are supplied.*

(1) We suggest you communicate with the manufacturers of this receiving set. (2) We cannot undertake to provide a description of a complete wireless outfit in these columns. (3) The machine is probably a rotary transformer. A 12-volt accumulator should be connected to the low tension side of the machine. This supply also energises the field. The H.T. output is taken from the brushes connected to the H.T. commutator, and the machine will deliver about 1,200 volts D.C. The H.T. commutator probably has a far greater number of commutator bars than the L.T.

"G.E." (Morecambe). We have examined the circuits submitted, and we prefer circuit No. 1. The grid condenser should be 0·0003 mfds., and the grid leak 2 megohms. The closed circuit inductance is of course tuned with a variable condenser of 0·0005 mfds. maximum value. We suggest you connect a fixed condenser of 0·001 mfds. across the L.F. transformer in the detector valve circuit, and another of 0·025 mfds. across the H.T. battery. You may find it very much better to use a 6-volt accumulator instead of the 4-volt shown.

"WEENIE" (Colchester) *asks* (1) *and* (2) *For a criticism of his circuits submitted.* (3) *Whether the circuits will function on short wavelengths.*

(1) The circuit is quite suitable provided you handle the reaction properly. (2) In the second circuit no reaction is used, but this does not mean you cannot receive telephony. (3) Each circuit is suitable for the reception of short wave telephony, but we prefer circuit No. 1.

"LESLIE" (Mitcham) (1) *Submits a sample of wire and asks whether it is suitable for use in a short wave coil.* (2) *and* (3) *For particulars of a long wave tuner.*

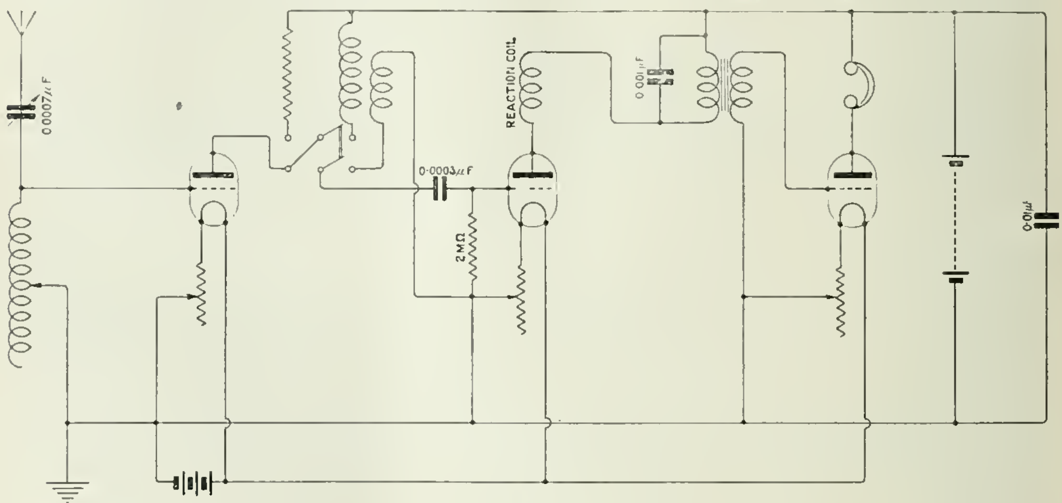


Fig. 2.

(1) The wire submitted is No. 31 S.W.G., D.S.C., and is therefore too fine for use in a short wave coil. We suggest you wind a coil 4″ × 4″ of No. 22 D.C.C., taking six tappings. (2) and (3) For the long wavelength coil we suggest you wind a former 6″ diameter and 10″ long full of No. 26 D.C.C. taking about 12 tappings. You should use a 0·001 mfd. variable condenser in series with the short wave coil for tuning short wavelengths, and then connect the condenser in parallel with the large coil for tuning long wavelengths. The reaction coil could be a coil of No. 26 D.C.C. 3″ diameter and 5″ long with 3 tappings. As you suggest, you could connect the long-wave coil in series with the short-wave coil when you wish to receive very long wavelengths.

"INTERESSE" (Brussels) *refers to the Armstrong receiver described in the October 21st and 28th issues for* (1) *Particulars of the variometer used in the Armstrong super-regenerative circuit.* (2) *Values of* 200, 1,250 *and* 1,500 *turns D.L. coils, and if single layer coils have to be secured in any particular position.* (3) *What is the wavelength range of the set described.*

(1) The stator of the variometer is made in two parts, each part is $4\frac{15}{16}''$ square and $1\frac{1}{8}''$ long.

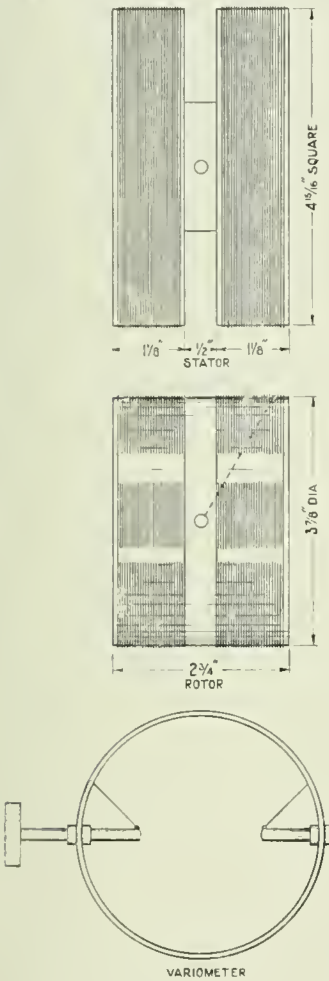


Fig. 3.

and 26 turns of No. 22 D.C.C. are wound on each half. The rotor is $3\frac{7}{8}''$ diameter and $2\frac{3}{4}''$ long, and each side is wound with 27 turns of No. 22 D.C.C. wire. The shaft of the rotor is made in two parts; one part is secured to each side of the rotor. The rotor connections are taken one to each shaft, and springs connect the shaft with terminals. The inductance of this variometer is 31 mhs. at minimum, and 538 mhs. at maximum. (See Fig. 3.) (2) The approximate inductances are :—200 turns = 2,600 mhs.; 1,250 turns = 10,000 mhs.; 1,500 turns = 15,600 mhs. Single and multi-layer coils could of course be constructed to have those inductances. (3) The coils should be fixed in the exact positions indicated in the article, and it is always better when constructing sets according to a description given in the Journal, to follow out all instructions precisely. (4) The wavelength range of the set is about 300 to 700 metres.

"P.S." (France) *asks* (1) *For a list of the proposed British broadcasting stations and their hours of working.* (2) *Whether the Armstrong super-regenerative circuit is suitable for receiving* 2,600 *metres.*

(1) It is proposed broadcasting stations shall be located in London, Plymouth, Cardiff, Manchester, Glasgow, Birmingham. (2) The Armstrong regenerative circuit as described in recent issues of this journal is only suitable for receiving short wavelengths. See reply to "**INTERESSE" (Brussels).**

"L.H." (Huddersfield).—To construct a variometer making use of the scheme described on page 130, you will need two cards cut to the design shown, wound with coils all in the same direction. The two inside ends of two opposite coils on each card are joined together, which now leaves four ends for the two cards. Two of these ends are joined together, and the other two are terminals of the variometer. Be very careful with regard to direction of winding. The four coils on the two cards must oppose each other when in the short wave position, and assist when turned through 180 degrees.

"C.E.H." (Birmingham).—We regret we cannot tell you the capacity of the condenser without a knowledge of the size of the plates and spacing washers. If the moving plates are $2\frac{3}{4}''$ diameter and 20 S.W.G. thick, and the spacing washers are $\frac{1}{8}''$, the capacity will be 0·0004 mfds. We think you would be permitted to use the reaction coil coupled with the aerial coil when using the electric light main, but you should first of all communicate with the Electric Light Company. The microphone is quite suitable, and usually three dry cells or a 4-volt accumulator will provide sufficient energy.

"R.J.G." (Leighton Buzzard).—We suggest you use a number of each of the stampings, building them up until the core is roughly circular in cross section. The core should be $\frac{1}{2}''$ in diameter. The two sections of stampings should butt one against the other, and should be firmly held together after the winding is completed. A bobbin should be made which will just slide over the central core, and the primary winding should consist of No. 46 S.S.C. wire wound for one-third the window space, and the secondary should be wound with the same wire and fill the remaining space. It is not necessary to treat stampings with shellac. The stampings are already insulated sufficiently well with paper.

"W.L.M." (Belfast).—The proposed arrangement will not be satisfactory, because no provision is made for breaking the filament circuits of the valves not in use; neither can the secondary of an intervalve transformer work efficiently when connected to the input circuit of a valve, or to the telephones. Unless the jacks possess small capacity, losses will occur in the H.F. circuit, and in any case it is better to use switches with widely spaced contacts.

"**ANTODYNE**" **(Huddersfield)** *asks* (1) *For criticism of his circuit.* (2) *The cause of poor results.* (3) *How to add one H.F. valve.*

(1) and (2) The diagram of connections is correct, but it would be better if you used a secondary circuit. The A.T.C. should be connected in series with the A.T.I. when receiving short wavelength signals, and as you hear nothing except when the A.T.C. and A.T.I. are in parallel, the value of the A.T.I. is wrong. A suitable coil for short wavelength reception would be a coil of No. 22 D.C.C. wound on a former 4″ diameter and 5″ long. The secondary would be a coil of No. 26 D.C.C. wound on a coil of 3″ diameter and 5″ long. It must be remembered that a single valve working as a detector does not give results much superior to those obtained when a good crystal combination is used. (3) See Fig. 4.

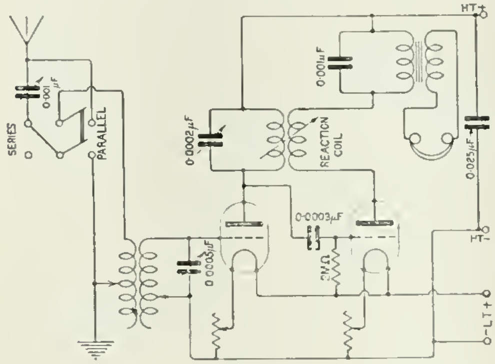


Fig. 4.

"**BRADD**" **(Fulham)** *asks for a diagram of a two-valve set.*

See reply to "**ANTODYNE**" **(Huddersfield)** above.

"**W.D.**" **(Lewes)**.—As you suggest, the terminal immediately below the H.T. terminal should be the L.T.+ (page 144, October 28th issue, referred to). If a common L.T. battery is used when other units are connected, the H.T.− connection should be made to the L.T.− instead of the L.T.+ as shown.

"**F.B.**" **(Sheffield)**.—We have examined the diagram of connections and find it correct. We assume the fixed condenser joined across the transformer primary has a capacity of about 0·001 mfd. The values of the components are suitable, but we do not think you can expect the valve to produce better results than a crystal when used as a detector. We suggest you use the crystal as a detector and the valve as a note magnifier.

"**A.R.E.**" **(Rugby)**.—Oscillations will be set up in a circuit containing a valve when the output and input circuits are coupled, and the energy supplied from the plate circuit to the grid circuit is sufficient to make the effective resistance of the grid circuit negative. If the valve is just on the point of generating oscillations, a slight circuit adjustment will probably cause oscillations to commence. If however, the circuit is quite steady, *e.g.*, due to the presence of a damping current in the input circuit, the coupling between plate and grid may be increased without sudden oscillations being generated. When using the tuned anode arrangement, the grid condenser and leak are joined to + L.T. to provide this grid current.

"**T.M.**" **(Salford)**.—We have examined the printed diagram submitted, and it is quite wrong. In the first place, a single filament resistance is shown controlling the temperature of two filaments, which is not very satisfactory. As different valves, even of the same type and make, require different filament currents in order to get the best from the valve, we suggest you use a filament resistance for each. The second error is, the telephones are joined in series with the primary of the transformer connected in the anode circuit of the second valve. This is quite wrong of course. Another point is the reaction coil is coupled with the secondary circuit inductance. Holders of the broadcast licence are not permitted to use a circuit of this type, and it is better for experimenters to employ reaction coupled between the first and second valves. It is useless to expect good results on short wavelengths when the A.T.C. and A.T.I. are in parallel. They should be in series. A number of circuits have recently been given in this journal, showing the connections of H.F. and L.F. valves, and we recommend you to adopt the tuned anode method of H.F. amplification, and couple the reaction coil to the anode coil. Better results are obtainable than when the H.F. transformer method is used. Articles showing the construction of H.F. transformer and H.F. anode coils are given in the issues of September 2nd, 16th and 30th.

"**S.M.**" **(London)**.—(1) We suggest you construct one of the many receiving sets described in this journal at different times. A very good set is that described in the issues of August 26th and September 2nd, entitled "A Broadcast Receiver," by Bull. (2) You will not experience any difficulty if the aerial is built away from the roof. It should be as high and long as possible, consistent with the Post Office regulations.

"**SPARKS**" **(Wembley)** *asks* (1) *How to increase the wave range of the set described on page 554, July 29th issue.* (2) *The maximum capacity of variable condensers.*

(1) It is simply necessary to connect larger coils in the aerial circuit, and make proportional alterations to the dimensions of coils L_1 and L_2. (2) The capacity of the small condenser is 0·00063 mfd., and the capacity of the large condenser is 0·0017 mfd.

"**NEW READER**" **(Sunderland)**.—(1) The aerial could have about 80 turns, the closed circuit coil 100, and the reaction coil 100 turns, No. 22 S.S.C. (2) To tune up to 1,100 metres you would require a number of basket coils connected together, and to avoid this we suggest you wind honeycomb coils. Try 60 turns of No. 22 on a 2½″ former. (3) The bobbin should be wound with 160 turns each for primary and secondary You may find it necessary to experiment a little to find the optimum value.

"SPARKS" (Bradford) *has trouble with his crystal set, and asks for advice.*

We have examined the connections submitted, and we suggest you tune the aerial circuit with a 0·001 mfds. variable condenser, and the closed circuit with a variable condenser of 0·0005 mfds. The H.T.C. should be in series with the H.T.I. when short wavelengths are being received; otherwise the set is correctly connected. For the short wavelength range we suggest you wind an aerial coil of No. 26 D.C.C. 4½″ diameter and 6″ ong, taking 10 tappings, and the closed circuit coil may consist of a coil 4″ × 6″ of No. 26 D.C.C. with tappings. The wavelength range of your present set is from about 300 metres to 3,000 metres.

"H.T.C." (Epsom) *submits a list of apparatus in his possession, and asks for a suitable two-valve diagram.*

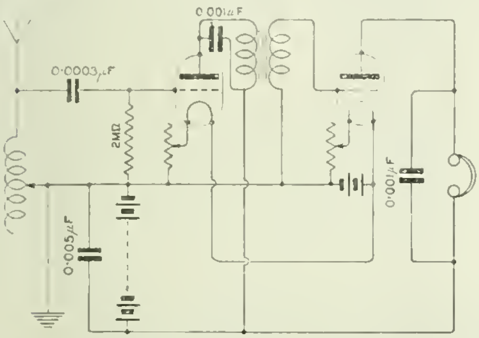


Fig. 5.

(1) See Fig. 5. (2) We suggest you use the two basket coils in the aerial circuit and the single basket coil and variometer in the closed circuit. (3) The method of construction proposed is quite suitable, and we suggest you wind 6 coils of No. 26 D.C.C., each coil having 40 turns. The wire should be wound side by side and spaced ⅛″. (4) We cannot say which is the primary or secondary winding of the transformer, and you must test for yourself, or write to the makers for information.

"F.R.H." (Barnwood) *asks* (1) *For criticism of his set.* (2) *For particulars of construction of telephone transformer.* (3) *Whether certain valves will work together.* (4) *Size of sample of wire submitted.*

(1) The connections are correct. The reaction coil should be coupled to the closed circuit coil. (2) A suitable open circuit telephone transformer may be constructed with the following materials: Coil 3″ long, ½″ diameter. Primary winding, 3 ozs of No. 44 S.S.C., secondary winding 3 ozs. No. 34 S.S.C. The primary winding is wound on the core first, and the secondary is insulated from the primary with two or three sheets of thin paper. (3) The valves mentioned will work together, (4) Sample of wire is No. 44 D.S.C. copper.

"J.L.K." (Croydon) *is building a valve transmitter and asks for criticism of set and other questions.*

We do not care for the proposed scheme of connections, and we suggest you see the reply to **"T.S.F." (Herne Hill)**, page 806, September 16th, 1922.

"E.E." (Cambridge) *refers to the one-valve Armstrong super-regenerative circuit, and asks* (1) *Size of slabs to replace honeycombs shown.* (2) *Whether a loose coupler may be used.* (3) *Particulars of choke.* (4) *If an "Ora" valve is suitable.*

(1) We suggest you wire the slab coils with the same number of turns and the same mean diameter as the honeycomb coils. (2) The loose coupler is quite suitable for this purpose. (3) The choke could be an intervalve transformer with the windings connected in series, or you could rewind the transformers with No. 38 S.S.C. wire. An alternative would be to wind 5,000 turns of No. 38 S.C.C. wire on an iron wire core, ½″ diameter and 3″ long. (4) "R" valves give good results. Use 80 volts on the plate.

"A.E.W." (Wilts) *asks* (1) *Whether his method of connecting up the components is satisfactory.* (2) *Does the set comply with the regulations.*

(1) We have examined the diagram of your set submitted, and it is correct. You may not be able to receive **2 MT** and **2 LO** because the tuning arrangements will not tune down to this wavelength, and as we have no particulars of your coils you will have to satisfy yourself as to their suitability. We suggest you reconnect your set, using the diagram on page 147, October 28th issue. (2) If you hold an experimenter's licence the circuit should not be objected to. However, reaction cannot take place if you use the diagram given above.

"G.W.B." (Kent) *asks for advice.*

We think the cracking noise which you hear is due to loose or broken connections. If the H.T. battery is old it will cause the set to be noisy. You should carefully examine the whole outfit. The diagram submitted is correct.

"O.F.B." (Northampton) *asks* (1) *For criticism of his set.* (2) *The value of capacities used.* (3) *For dimensions of coils.* (4) *Voltage of L.T. and H.T. batteries.*

(1) The diagram of connections is correct except that the A.T.C. is omitted. We expect this is a clerical error. The A.T.C. should have a maximum value of 0·0012 mfds., and should be in series with the A.T.I. when receiving short wavelengths. The anode tuning condenser should have a maximum value of 0·0002 mfds. The grid condenser should be 0.0003 mfds., and the by-pass condenser across the telephones should be 0·001 mfds. (2) You will have to experiment and determine the best valves for yourself. The primary and secondary of the H.F. transformer should be about the same dimensions, and you might commence with a winding of 80 turns. The reaction coil should be about the same size as the secondary of the transformer. (4) Use a 6-volt L.T. battery, and 70-volt H.T.

"E.H.T." (Buxton).—(1) The diagram is correct, and if you hold an experimenter's licence, would no doubt be approved by the Post Office. (2) The capacity of a fixed condenser if two plates (3″ × 3″), separated with a 0·002″ sheet of mica, is about 0·0075 mfds. (3) The sample of wire submitted is No. 26 D.C.C. We cannot say the wavelengths of your basket coils, as the inductance of a basket coil varies so much with the method of wiring, spreading, etc. However, probably they will take from 300 to 550 metres. (4) The telephone transformer could consist of the following:—1½″ diameter 3″ long of iron wires, primary 3 ozs. No. 44 S.S.C.; secondary, 4 ozs. No. 34 S.S.C.

"H.G.K." (Bucks) *wishes to wind a number of cylindrical coils to tune from 600 to 30,000 metres.*

We suggest for the shorter wavelengths you join the A.T.C. and A.T.I. in series. The A.T.I. could be a winding of No. 22 D.C.C. on a former 4″ diameter and 5″ long, with 8 tappings. The secondary could be of No. 22 D.C.C. on a former 3½″ diameter and 5″ long with 5 tappings. The next largest coil may be a winding of No. 26 D.C.C., 4″ diameter and 7″ long, with 10 tappings, and the secondary of No. 28 D.C.C., 3½″ diameter and 8″ long, with 6 tappings. The largest coil may be of No. 28 D.C.C., 6″ diameter and 10″ long, with 18 tappings, and the secondary of No. 30 D.C.C., 5½″ diameter and 12″ long, with 8 tappings.

"F.S." (Kent) *submits particulars of his set and asks for criticisms.*

The proposed arrangement is suitable, but it would be better to connect the A.T.C. and A.T.I. in series when receiving short wavelengths. The variable condenser which tunes the anode coil should have a maximum value of 0·0002 mfds. The results obtained for a circuit of this description are quite satisfactory, and reaction effects are under proper control. The circuit is, we think, likely to meet with the approval of the Post Office. The A.T.I. could be a 120-turn coil with mean diameter of 2½″, and the anode and reaction coils could each be a 100-turn coil.

"H.H.Mc.M." (Manchester).—With reference to page 706, August 26th issue, reply to **"W.G.B.G."** the reaction coil may consist of 100 turns of No. 40 S.S.C. copper wire with a mean diameter of 2″. When receiving longer wavelengths more inductance will be required, and this may be added in the form of separate coils which do not have to be coupled. You may certainly use resistance wire for the H.F. transformer. The result will be, tuning is broader, and the wavelength range for given dimensions will be slightly greater than if copper wire is used. We cannot give precise values for the winding of H.F. transformers, but you should remember when experimenting, 600 turns for both primary and secondary wound on a tube 1⅛″ diameter gives an optimum wavelength of 600 metres. We suggest you see the articles on "Experimental Station Design" in the issues of September 2nd, 16th and 30th. The primary winding may be tuned with an air dielectric condenser of maximum value 0·0002 mfds. We do not think you will find it necessary to use a condenser in conjunction with the reaction coil, but if any difficulty is experienced in obtaining reaction effects, a small condenser may be used. The stampings are quite suitable for use as the core of a L.F. transformer. The coil should be built up until the depth is ⅝″. The primary winding should be of No. 44 S.S.C. copper wire, and be wound until the depth of winding is ⅜″, and the secondary should be No. 46 S.S.C. copper wire, wound over the primary to a depth of ½″. When using the resistance capacity method of H.F. coupling, the reaction coil should be coupled to the closed circuit coil. The resistances are best purchased, and should have a value preferably about 80,000 ohms. The second valve is coupled to the third by the reactance capacity method. The reactance coil and tuning condenser are proportioned so as to tune with the wavelength of the signal. It is an advantage to use potentiometer control, as if the set is oscillating an adjustment can be made to stop the oscillations. We suggest one for controlling the grid potential of the first two valves. The valves will be satisfactory, and the aerial is good.

"F.W." (Birmingham) *asks for criticism of his set and advice.*

It is essential for the secondary circuit to be tuned with the primary circuit, and a tuning condenser is therefore necessary. The fact of hearing loud pops in the receiver when the aerial terminal is touched indicates the set is oscillating, and you should reverse the connection of the reaction coil. The alteration in the connections of H.T. — to the L.T. is necessary, of course, in view of the fact that the remainder of your apparatus is so connected. To determine the correct adjustments, it would be very helpful if you use a wavemeter fitted with a buzzer.

"C.E.D." (Ipswich) *refers to the Armstrong super-regenerative circuit, and asks whether it is necessary to line the case with tinfoil.*

We do not consider it necessary to line the interior of the instrument case with tinfoil. By so doing you may remove a little interference, but it is hardly necessary to make this refinement. The tube, as you suggest, is 3″ diameter and 4″ long. You will of course only use the set when connected to a frame aerial.

"J.A.R." (Manchester) *asks* (1) *Whether bichromate cells will be useful for heating valve filaments* (2) *For a diagram of the simplest valve set.* (3) *Why he does not receive short wavelength signals while he gets long wavelength signals.*

(1) These cells are hardly suitable because the potential falls off rapidly after a little use. (2) We suggest you see Fig. 7, page 217, November 11th issue. Fig. 2, page 183, November 4th issue, and Fig. 2, page 145, October 28th issue. (3) We suggest the tuning arrangements are not correct. If the A.T.C., is 0·001 mfds., and is in series with A.T.I., the A.T.I. may consist of a coil of No. 22 D.C.C. 3″ diameter and 5″ long, with tappings.

"SAPPER" (Swanage).—The coils will tune from 200 metres to 1,500 metres, the condenser being used in series when receiving on short wavelengths and in parallel when signals on longer wavelengths are being received.

SHARE MARKET REPORT

Prices as we go to press on November 24th, are :—

Marconi Ordinary	£2	4	9
,, Preference	2	2	6
,, Inter. Marine	1	7	3
,, Canadian		9	9

Radio Corporation of America :—

Ordinary	17	6
Preference	13	7½

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

No. 173 [No. 10 Vol. XI.] DECEMBER 9TH, 1922. WEEKLY

The Spark Transmitting System of the Eiffel Tower

By E. M. Deloraine, Ing., E.P.C.I.

IN a recent issue* the valve transmitter of the Eiffel Tower was described. This set has however been modified, and at the time of writing, a group of two radio transmitters has been installed in order to obtain a power of about 4 kW. in the antenna.

This article is devoted to the well-known spark transmitter, and gives a general description, while a subsequent article gives details of a recent modification of the transmitter, involving the introduction of a synchronous auxiliary rotary spark-gap. Before entering upon this description however, it should be mentioned that there are four systems of transmission that are used in turn. They are :—

(1) The Valve Transmitter already described.

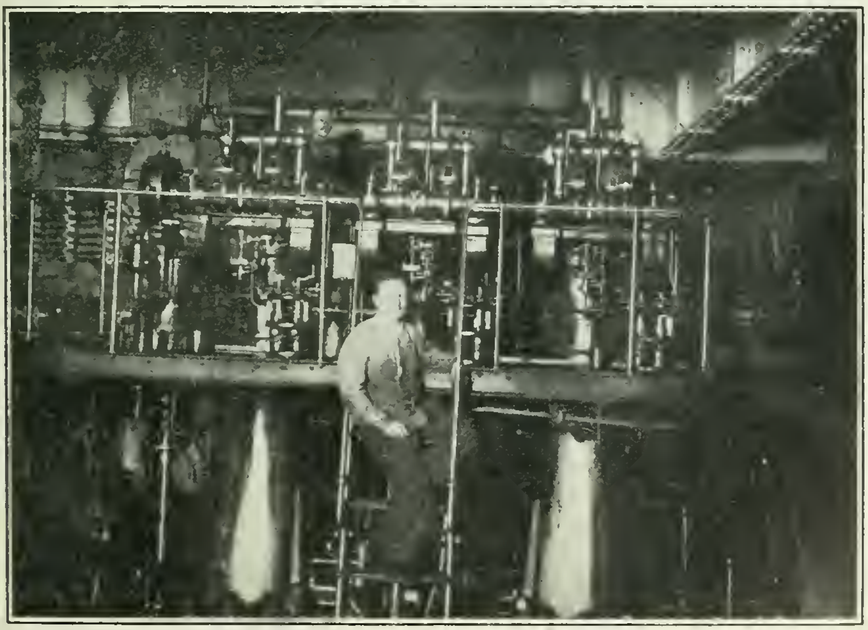


Fig. 1. The 240-H.P. Diesel Engine.

The author will not attempt for the present to give particulars of that installation, but will continue the description of the Eiffel Tower Radio Station.

**The Wireless World and Radio Review*, July 10, 1922.

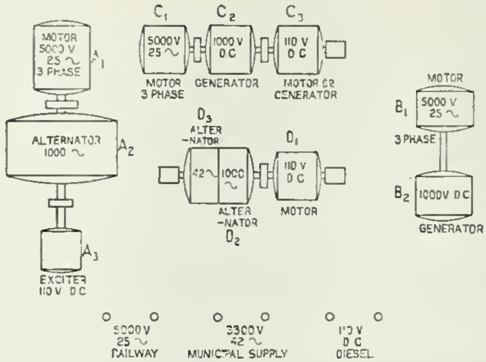


Fig. 2. Diagram showing position of machines.

(2) The Spark Transmitter, which is the subject of the present article.

(3) A Poulsen Arc Set.

(4) A High Frequency Alternator.

Power Supply.

In arranging for a supply of power, the first consideration has been to avoid, as far as possible, all risks of an enforced interruption in the transmission. Electrical energy is required for use in the following forms :—

(1) Monophase Alternating Current at 1,000 cycles for the Spark System.

(2) Direct Current at 1,000 volts for the Poulsen arcs.

(3) Monophase Alternating Current at 220 volts and 42 cycles for the operation of the air compressors mentioned below.

Fig. 3. 300-kW. Generator which supplies energy for the Transmitter at 500 volts and 1,000 cycles.

Electrical energy is also required for lighting. There are two outside sources of power, viz. :—

(1) *A Three-Phase Supply*, taken from the State Electric Railway at an effective voltage of 5,000 and a periodicity of 25 cycles. This is the cheapest source of power, and it is consequently used whenever possible.

(2) *A Monophase Supply*, taken from the main municipal circuit at 3,300 effective volts and 42 cycles. It is stepped down by a transformer to 220 volts for the power

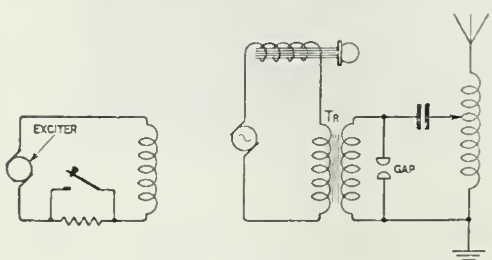


Fig. 4. The Transmitter circuit.

circuits and to 110 volts for the lighting circuits.

As a precaution against any emergency that might arise, a supply of direct current may be generated in the station itself. For this purpose there are four motor-generator sets, located in the base of the Tower, the whole, when working simultaneously, being capable of delivering 300 kW. at 110 volts. A 240-H.P. Diesel engine (Fig. 1) constitutes the main unit, and drives by means of a belt a dynamo of corresponding power. The engine is of the vertical type with three cylinders, the fuel is fed through the pistons, and starting is effected by means of compressed air in one of the cylinders. The other three units are driven with water-gas.

Fig. 2 indicates the positions of the machines in the Power Room, and it will be seen that they have been arranged in four groups, all the machines of any one group being on the same shaft. Group A consists of a motor, A , that may be driven by the 5,000 volts three-phase supply, and two other machines A_2 and A . The latter, when driven by A_1 provides a field current for A_2 which generates A.C. at 1,000 cycles. Group B consists of a motor B_1 which is designed for use on the three-phase supply, and which drives B_2, a direct current generator at 1,000 volts. In group C, we have again a three-phase motor C_1 and a 1,000-volt D.C. generator C_2, but we have, in addition, a D.C. generator C_3. The latter functions as a motor, when connected to the D.C. supply, but may be coupled as a generator to D_1, when C_1 is being driven by the three-phase supply. D_1 serves to drive D_2, and D_3, the former being a substitute for A_2, and the latter being utilised to generate 220 volts at 42 cycles, should the municipal supply fail. The many different ways in which the groups of machines may be coupled so as to obtain electrical energy in the three forms mentioned above, do not require further elaboration.

Fig. 5. Asynchronous 3-phase motor coupled to 500-kW. Generator which feeds the Spark Transmitter.

OTHER SOURCES OF POWER.

In addition to the above we may mention a storage battery of 300 ampere-hours at 110 volts and an air compressor. Practically all the signalling circuits are supplied from the former, while the latter is used to work the pneumatic relays and to provide an air-blast to remove dust from the machines.

THE SPARK SYSTEM.

As is well-known, the Spark System of Wireless Telegraphy comprises three main circuits as follows (Fig. 4) :—

(1) A low-voltage and low-frequency circuit, comprising :—

(a) An alternator for supplying energy

to the set. The alternator is of a special design, as it is essential to use a frequency between 500 and 2,000 cycles to obtain a musical spark. Further, it is desirable to use a high inductance since the alternator is practically short-circuited during the passage of each spark.

(*b*) The primary of a step-up transformer.

(*c*) A variable inductance, so adjusted that the natural frequency of the circuit is slightly higher than that of the alternator, this being the best way to avoid a sudden increase of current when the spark passes. By this means also, an automatic regulation of alternator speed is obtained, for when the speed increases slightly the load increases considerably as the frequency approaches more closely to the resonant frequency, this increased load checking the increase in speed.

(2) A high-voltage circuit, which may be divided into a low frequency circuit and a high frequency circuit, and comprises :—

(*a*) The secondary of a step-up transformer. This is necessary in order to obtain sufficient energy in the condenser. The end coils of this transformer must be very well insulated as they act as choke coils for the high-frequency current.

(*b*) A spark-gap across the secondary winding of the transformer. This permits the energy to accumulate in the condenser and the voltage to increase, until the gap breaks down.

(*c*) A condenser, which must be capable of handling a very large amount of energy without overheating or breakdown.

(*d*) A small inductance in series with the condenser which constitutes an oscillating circuit resonant at radio frequency. This inductance is magnetically coupled to the aerial circuit.

When the spark passes across the gap, it permits an oscillatory discharge of the condenser at radio frequency through the coupling inductance, the high frequency energy being transferred thence to the antenna.

(3) The antenna circuit or radiating circuit which works only at radio frequency.

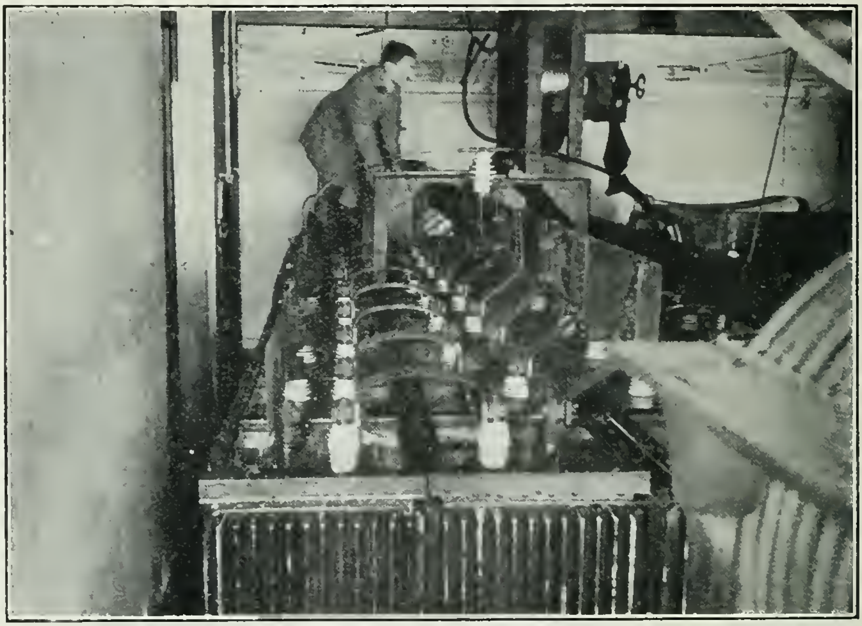


Fig. 6. The Transmitting Condensers. Total capacity 0·55 mfds. and designed to employ 70,000 volts.

Supply of the Spark System.

The Spark System of transmission requires monophase alternating current at 1,000 cycles per second. It is fed by either of the alternators shown in Figs. 4 or 5. Fig. 4 shows an alternator made by the "S.A.C.M." (Société Alsacienne de Construction Mécaniques) of 300 kW. and 500 volts, able to supply 600 amperes at 833 revolutions per minute. The motor, as explained before, is a 370 H.P.

D.C. machine with a normal current of 2,500 amperes. Fig. 5 refers to the group, known as "éclairage électrique," which is driven by an asynchronous three-phase motor of 350 H.P. under a pressure of 5,000 volts. It delivers 500 kW. at 900 volts and operates at 500 r.p.m.

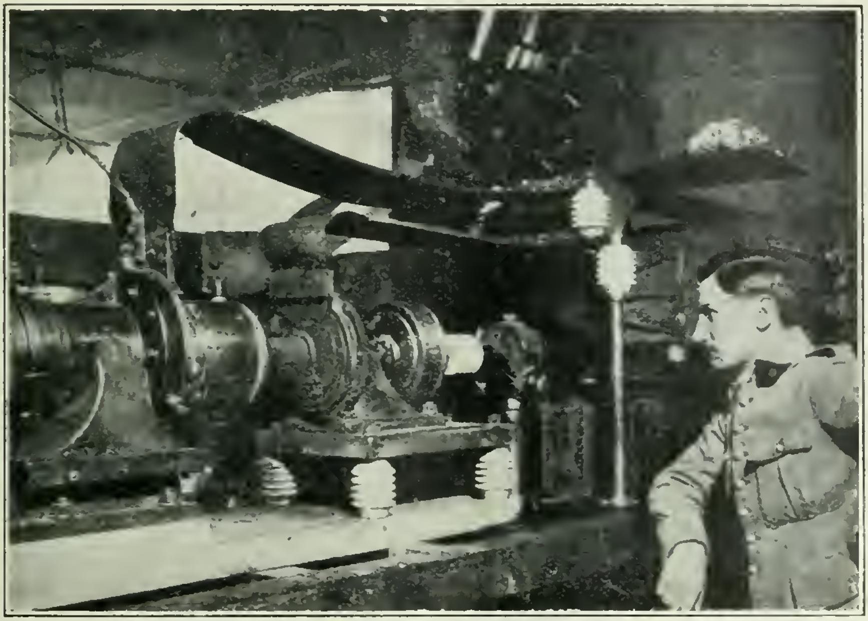


Fig. 7. Spark-Gap, with revolving eccentric electrode.

The field current is supplied either from the bus bars at 110 volts or by an exciter on the main shaft, as seen in Fig. 5.

Two step-up transformers are working in connection with the two alternators, the first one being of 950 kW., ratio 16 to 1, primary 1,500 volts, 630 amperes; secondary 24,000 volts 50 amps.; the second one 810 kW., ratio 20 to 1, primary 1,500 volts, 630 amperes; secondary 30,000 volts 27 amperes.

The oscillatory circuit includes a number of condensers having a total capacity of 0.55 mfds. On account, however, of the high pressure (70,000 volts) to which they are subjected, these condensers must be of special construction. They are made of flat aluminium sheets, separated by glass plates, and immersed in corrugated oil tanks (Fig. 6), the corrugation being advisable in order to facilitate the dissipation of the heat generated by dielectric losses. The condenser units, each of which has a capacity of 0.05 mfd. are connected in series parallel.

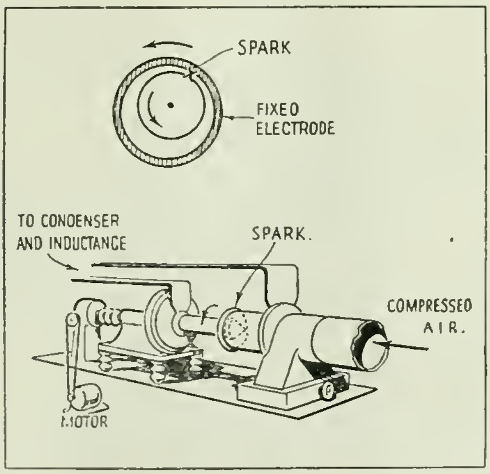


Fig. 8.

A form of spark-gap in use employs as one electrode, a cylindrical tube of pure copper, inside which a second electrode revolves eccentrically (Figs. 7 and 8). The latter has a mushroom shape and its movement displaces the points on the electrodes, at which sparking takes place. The object of this displacement is to prevent excessive heating of any point of the electrodes, as this might lead to arcing across the spark-gap. Furthermore, further cooling is effected by an air blast, which is directed from a 30 H.P. air compressor on to the spark (Fig 9). The gap, which is ordinarily $\frac{3}{8}$-inch, may be varied between limits without interrupting transmission.

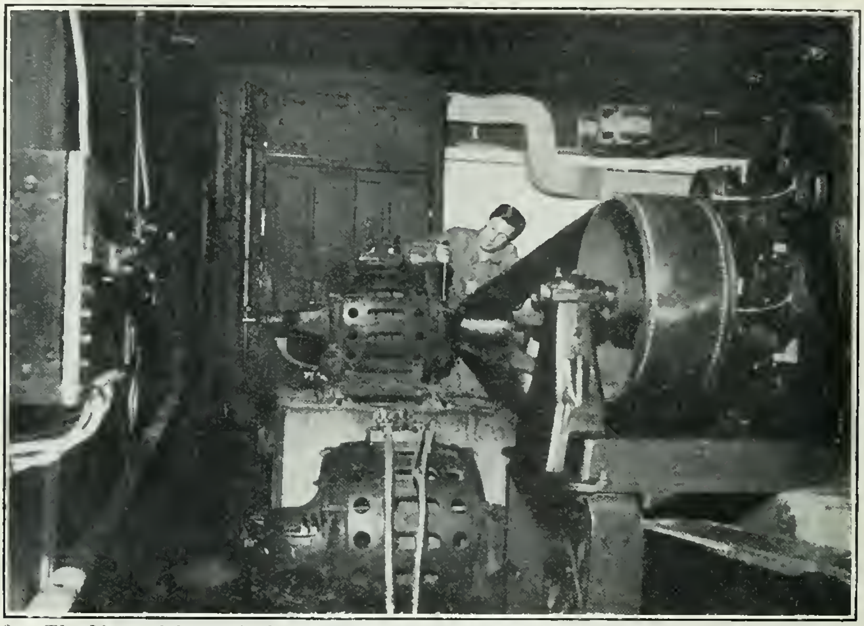


Fig. 9. The Motor-driven Air Compressor which produces the Air Blast for cooling the Spark-Gap.

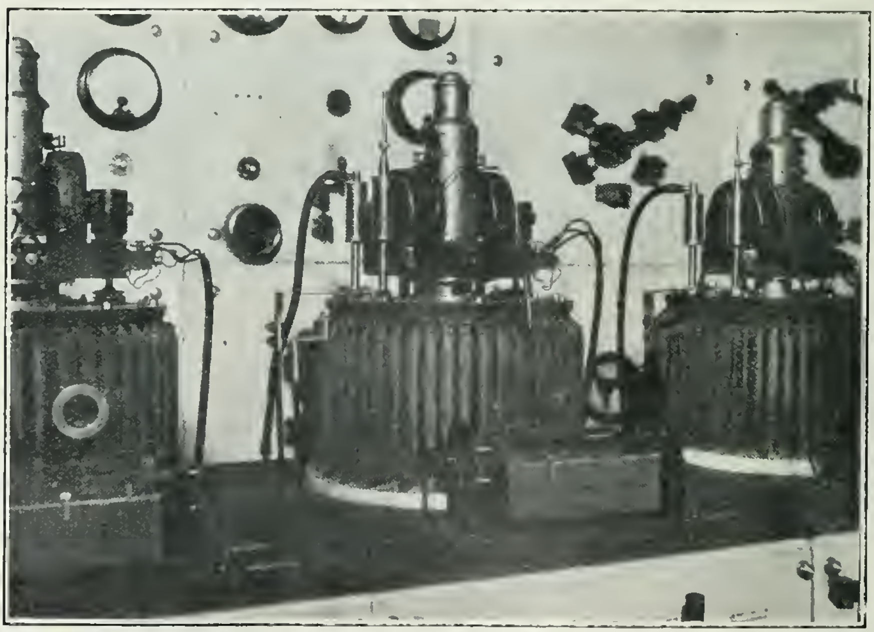


Fig. 10. Mercury circuit breakers, which interrupt the excitation current of the Alternator for signalling.

The self-inductance of the oscillator circuit is a part of the direct coupling to the antenna circuit, which comprises four turns of very large copper tape (See Fig. 6). The antenna inductance is made of a brass pipe of 40 turns of one yard diameter. The range of wavelengths is from 2,200 to 3,600 metres, the normal length being 2,600 metres. The antenna current is 80 amperes and the frequency of the sparks 500, *i.e.*, one spark for every two periods of the alternator.

The signalling is done by varying the excitation current of the alternator. For this purpose the use of a mercury turbine is necessitated by the difficulty in obtaining a good and rapid, though repeated, make and break of a current of about 150 amperes, as metallic contacts would soon be burnt up, the closing of the circuit by means of the key results in a big increase of exciting current with consequent production of sparks across the spark-gap.

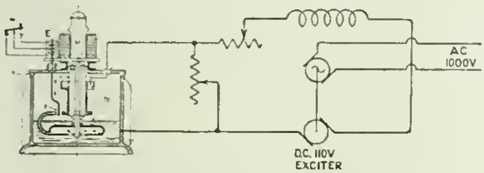
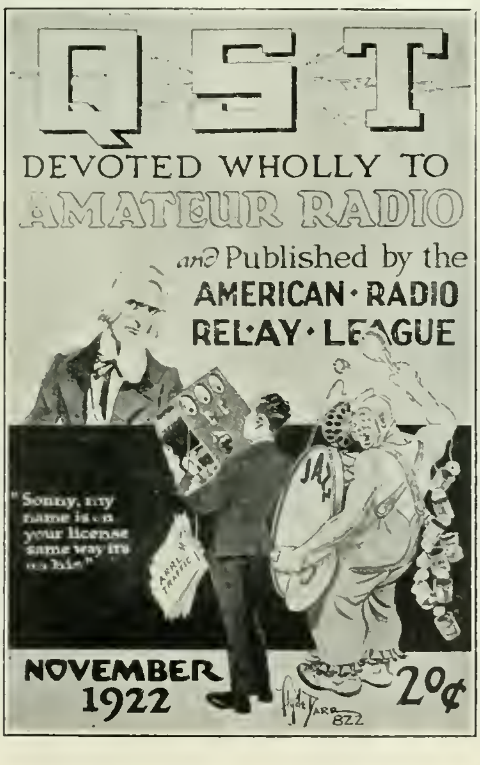


Fig. 11. Circuit Breaker for Signalling.

Fig. 11 gives a schematic diagram of the device. A centrifugal pump C, driven by a vertical electric motor M, compresses mercury at the bottom of a metallic tank (Fig. 10), and projects it horizontally on to a bronze ring, revolving with the motor and connected to a terminal insulated from the tank. A shutter P, which moves up and down, allows the mercury to pass when it is up, and obstructs its passage in the down position. When the mercury flows past, it makes metallic contact between the bronze ring and the tank itself, and the resistance is short-circuited. When the shutter is down, the mercury falls back into the tank. The function of this device is now, perhaps, somewhat plainer. The sparks, which occur when the circuit is broken, exist between the mercury column and the bronze ring. The former is prevented from oxidation by the precaution of having an atmosphere of coal gas in the tank. As the bronze ring revolves as mentioned above, the spark occurs at different points. This prevents overheating, which would soon destroy any stationary electrode. The Morse key is set in a 110 volt D.C. circuit and actuates the shutter by means of a coil in this circuit.

Broadcasting and the Experimenter in America.

We make no apology for reproducing on this page the cover of the November issue of the American Amateur journal, *Q.S.T.* We feel sure that readers will appreciate all that this cover design embodies.



For many months past amateurs in America have viewed with the deepest concern the enormous increase in the activities of broadcasting stations, fearing that the time would come when experimenters would find it impossible to make room for themselves in the jazz-echoing aether. *Q.S.T.* in its cover design encourages the amateur not to be despondent. The American Government, in the person of Uncle Sam, is reminding the amateur that his rights are just as well guarded and cared for as the privileges which have been given to the broadcasters.

Let the assurance of the American Amateur be felt by the British Amateur who should never entertain the fear that he will be let down by the British Post Office under whose authority his licence has been issued.

The British Amateur too is disposed to feel uneasy lest his opportunities for Experimental work should be seriously handicapped in order to make way for Broadcasting in this country.

A Design for a Coil Holder

By Allandale.

HAVING bought a number of honeycomb coils recently, it was necessary to obtain a coil-holder.

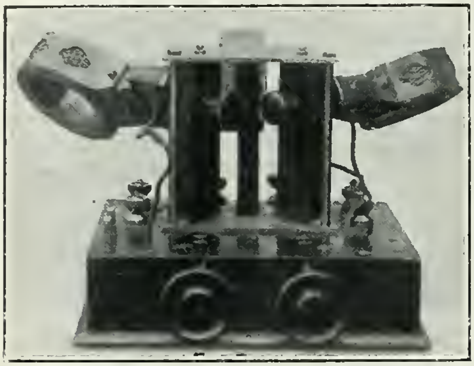


Fig. 1.

This seemed to be a piece of apparatus well within the ability of an amateur to construct, as a great knowledge of wireless is not required.

I therefore decided to make one, and the result is shown in the photographs Figs. 1, 2, and 3, while Fig. 4 shows the underside with the bottom removed.

It will be seen that it is constructed to carry three coils, the outside ones having the ordinary opening movement and in addition a turning movement to assist in fine tuning.

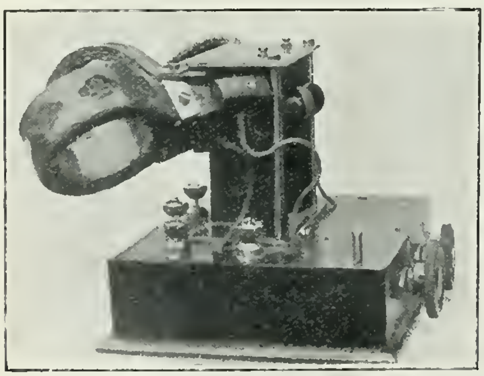


Fig. 2.

The most difficult parts to make are the coil-holder sockets, these have to be made accurately to 9/16 in. centres for the De Forest type of coil and are shown in detail in Fig. 5.

I have no doubt, if any trouble is found in making these, that the coil fitting sold for mounting could easily be adapted by cutting off the back screws and fastening the flexible leads to the screws used for securing the fibre band, as these are screwed into the sockets.

It will be seen in Fig. 5 that the ebonite is $\frac{1}{2}$ in. thick × 1$\frac{7}{8}$ ins. long × 1$\frac{1}{8}$ ins. wide, with the ends rounded. Two holes 5/16 in. diameter are drilled $\frac{3}{4}$ in. deep at 9/16 in. centres into which two pieces of brass are fitted drilled 3/16 in. diameter, $\frac{1}{2}$ in. deep for the ordinary De Forest type of coil, or if Burndept coils are used the centres should be 15 millimetres instead of 9/16 in.

Two holes are tapped to take No. 6 screws through the side of the ebonite into the solid end of the sockets to connect the flexible wires to the sockets.

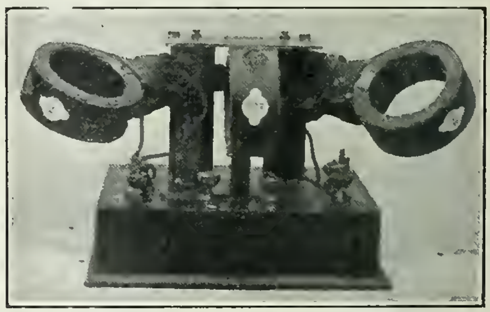


Fig. 3.

In the stand shown in the photographs the wires were passed through holes in the ebonite and soldered to the ends of the sockets; a little shellac was put on the sockets before they were pressed into the holes in the ebonite. In this case the holes must be drilled at the end of the socket hole.

To carry these holders a brass plate 3/32 in. thick is provided of the same size as the ebonite, and secured by two No. 4 BA countersunk screws; in the centre of this a hole is drilled and tapped 2 BA to receive the reduced end of a 3/16 in spindle, which enters the ebonite $\frac{1}{4}$ in. and is prevented from unscrewing by a 1/16 in. brass pin being passed through the ebonite and spindle.

The plain part of the spindle is 11/16 in. long, and is reduced and screwed No. 2 BA for a further 7/16 in. to take a Government pattern insulated terminal head.

The stand itself has an ebonite base 7 ins. $\times$ 5 ins. $\times$ ¼ in. thick as shown in Figs. 7 and 9. This carries all the different parts and terminals, and is fitted in a mahogany box with a ⅛-in. margin round. The box is 2 ins. deep with a 5/16-in. bottom secured by screws.

Two brass plates 3/32 in. thick, $3\frac{7}{8} \times 2\frac{1}{4}$ ins. (Figs. 7 and 9) are required to form the top and bottom and form the centres in which the uprights are held. Two holes for the 3/16-in. pillars are drilled to take No. 4 BA screws, the plates are then bolted together with two bolts and the edges filed up true and square.

The rest of the holes can now be drilled while the plates are fastened together so that the positions of the holes in the two plates will correspond.

The holes for the moving uprights are drilled

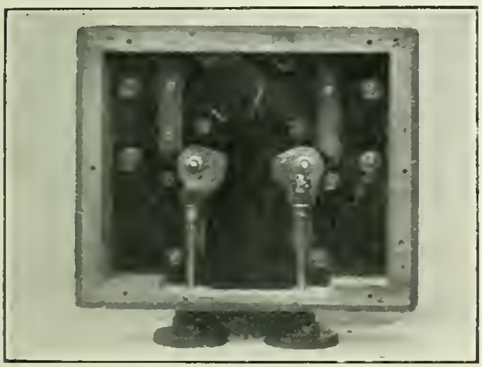


Fig. 4.

for No. 4 BA tapping, but those in the lower plate will require to be reamered out to 3/16 in. to take the bottom centre. The two holes in the top plate are tapped 4 BA and are provided with pointed centre pin and lock nut.

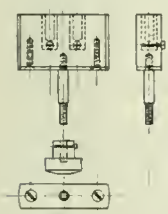


Fig. 5.

The plates are then separated and fastened on to a wood block with brass shoe brads, filed smooth, then polished with fine emery and oil and lacquered.

Two 3/16 in. diameter pillars are required with the ends reduced and screwed No. 4 BA, the lower ends being left long enough to pass through the ebonite with nut and washer underneath and to serve for fastening the whole to the base as shown in Fig. 9.

The uprights to carry the coil-holders already described can be made next, and these are shown in Fig. 6. They are ⅞ in. $\times$ ½ in. $\times$ $3\frac{9}{16}$ in. long. A small piece of 3/16 in. brass rod 7/16 in. long is screwed into the top and countersunk to take the pointed end of the pointed centre; the bottom has a piece of 3/16-in. brass rod screwed in and left projecting 1 in. A little shellac is put on the thread before the rod is screwed home and this prevents it working loose, a 3/16 in. brass washer is put on this rod and forms a bearing preventing the upright rubbing on the brass bottom plate.

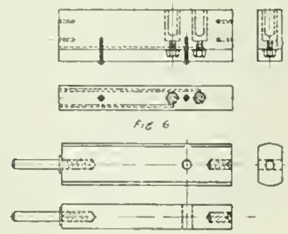


Fig. 6.

The centre upright, shown in Fig. 6 carries the two coil sockets, but in this case the sockets have screwed ends and pass through the ebonite, being fastened with nuts to which connecting wires are attached. The wires may be soldered to the ends. Two saw-cuts down the back as shown receive the No. 18 D.C.C. wire to connect to the centre terminals and are covered in with a piece of ¼-in. ebonite secured by

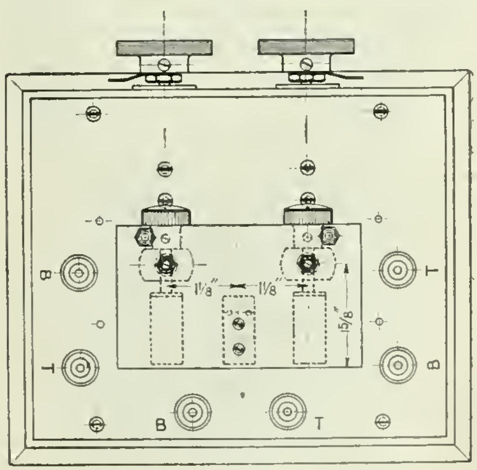


Fig. 7.

two No. 8 BA round-headed screws. Insulating tubing is slipped over the lower end of these wires and saw-cuts are enlarged at the lower end to allow it to pass ¼ in. up where the ebonite secures it, the tube guards against any leakage where the wires pass through the brass plate. This piece is secured to the top and bottom plates with 4 countersunk No. 6 BA brass screws and with the 3/16 in. brass pillars bind the plates together to form a support for the two movable uprights.

The 3/16 in. spindle on the socket holders (Fig. 5) is put through the 3/16 in. hole drilled

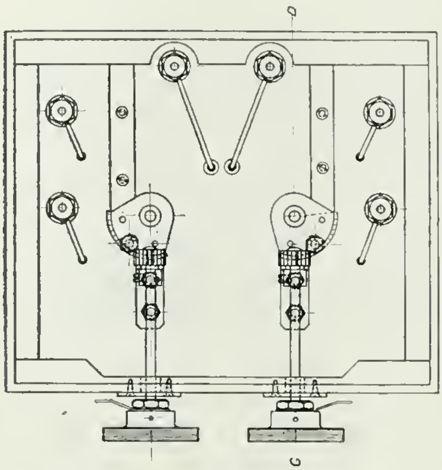


Fig. 8.

in the centre of the movable uprights with a phosphor bronze spring washer between and the insulated terminal screwed up until the holder can be turned but without being too loose; a No. 8 screw in the side of the terminal head prevents unscrewing.

The two flexible wires secured on the outside of the socket holders are passed through the small holes in the ebonite top and secured to the terminals at the sides, care being taken to allow enough slack to admit of socket holder movement.

In Fig. 7 the terminals T and B respectively indicate the top and bottom sockets.

When assembled, this completes the top part of the coil holder. To move the outside uprights I secured a " Meccano " crown wheel of 50 teeth and two pinion wheels of 20 teeth, the crown wheel I cut in 3 equal parts with a hack saw (but two parts would be better) and riveted a piece of sheet brass 1/16 in. thick shaped as shown in Figs 8 and 9, to take a new centre-piece made from $\frac{3}{8}$-in brass rod 7/16 in. long and bored 3/16 in. diameter hole.

This was a lot of trouble and I should advise the purchase of two crown wheels which would only require the centre hole enlarging to 3/16 in. or the brass rod in the upright could be made less in diameter to fit the wheels.

In either case the crown wheel or segment is secured to the pin on the upright by a 3/32 in. set screw through the side of the boss.

Each pinion is mounted on a piece of 3/16 in. brass rod reduced to fit and either secured with a 3/32 set screw or the end of the shaft and riveted over.

An inside bearing is made from a piece of 3/32 in. sheet brass 7/16 in. wide, bent at right angles and secured to the ebonite top by two countersunk No. 4 BA screws and nuts.

A " Meccano " collar bored out to 3/16 in. and placed up to this bearing keeps the pinion in place.

The shafts are carried through the back of the coil stand, the ends being screwed 2 BA to take an ebonite knob $1\frac{1}{2}$ in. diameter, a pointer being provided made from 1/32 in. brass and secured to the knob by a No. 8 BA countersunk screw.

To prevent this knob from unscrewing in use a No. 8 BA screw is put through the boss and shaft. If desired, a scale can be put on the front to indicate the position of the coils.

A small oval brass plate 1/16 in. thick is secured to the frame with two $\frac{3}{8}$-in. No. 3 wood screws to carry the front end of the shaft.

The bottom of the case is put on with screws since the shafts have to be assembled after the ebonite top is secured in position.

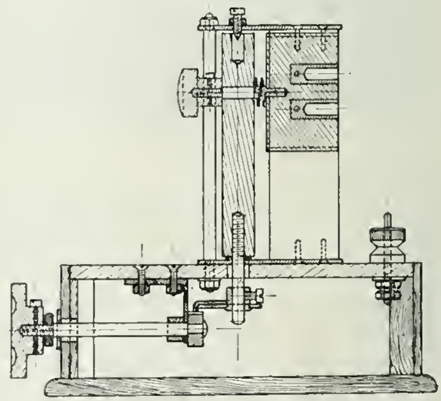


Fig. 9.

The coils are shown in the drawings with $1\frac{1}{8}$ in. between centres as it is found that with 1 in. centres some of the coils will not come together owing to small defects in winding. This could be reduced to $1\frac{1}{16}$ in. if desired.

To avoid capacity effects from the hands, the coil stand could be fixed on a bracket and the centres of the uprights carried down to the operating board.

Electrons, Electric Waves, and Wireless Telephony—X.

By Dr. J. A. Fleming, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

V.—THE PRODUCTION AND DETECTION OF LONG ELECTRIC WAVES.

1.—Electric Oscillations.

As already stated, we have reasons for believing that in metals, carbon, or other substances which are conductors of electricity, there are free electrons which are moving irregularly with very high speeds in the interstices of the atoms of matter, or jumping from atom to atom.

Conductive materials such as metals are built up of atoms which easily lose one or more electrons from their outer shells or orbits. These detachable electrons are called the *valency* electrons, and it is probably one or more of these that become free to roam about in the inter-atomic spaces.

From certain facts we can infer that in a metal there are about as many free electrons as there are atoms in any given volume. In those substances we call non-conductors but which Faraday appropriately named *dielectrics*, such as glass, ebonite, paraffin wax, mica or shellac, the number of free electrons is very small, but under the action of electric force certain of the electrons in the atomic orbits or structure can be displaced or strained elastically, so that when the electric force is removed they spring back to their old positions in the atoms.

We can thus cause in metals and conductors generally, by means of electric force, a drift of the free electrons which is called an electric current, but in dielectrics we can only produce an electron displacement or strain. The drift motion of the electrons in the case of the electric current creates, as we have seen, a magnetic force which is distributed round the conductor in closed lines embracing it. In the case of a straight wire conveying an electric current with return wire at a considerable distance, the lines of embracing magnetic force due to the drifting electrons are circles whose centres are in the wire and whose planes are perpendicular to it.

In considering this effect called electric displacement in dielectrics, Clerk Maxwell, whose scientific thought on this subject was epoch-making in its importance, saw that it would be logical to conclude that an electric displacement *whilst it was being made or removed* was equivalent to an electric current and should therefore produce a magnetic field in the same way as does a conduction current in conductors. We have then to distinguish between conduction currents and displacement currents in one sense, but in another they are quite identical and both involve the production of a magnetic force or field embracing the current.

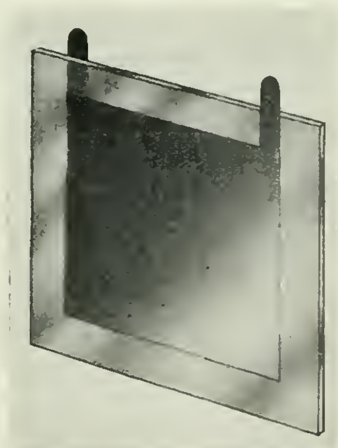


Fig. 47. A Leyden Pane or Electrical Condenser, consisting of a sheet of glass or other dielectric partly covered on both sides with tin foil or sheet meta.

Let us next consider a compound circuit comprising a sheet or layer of dielectric, say glass contained between two sheets of metal, made in fact like a sandwich, the meat being the glass and the two slices of bread the metal sheets. Such an arrangement is called a condenser or Leyden pane (see Fig. 47).

Suppose we give to one sheet of metal a charge of negative electricity. This implies that we force into it an excessive number of free electrons over and above those naturally present in it.

Owing to their mutual repulsion the result is that the displaceable or mobile electrons in the sheet of glass are all strained or displaced as far as possible away from this electron super-charged metal plate. Also the free electrons in the other metal plate move as far away as possible from the super-charged plate. If this extra electron charge has been given by an electrical machine or by a battery, it implies that at the opposite pole of this battery or electrical machine there is a deficit of electrons. Hence if we connect this last named pole with that plate of the condenser which has not been charged with extra electrons, a number of electrons equal to the excess in the other plate will return to the battery or electrical machine, whilst the plate itself is left with a deficiency of free electrons.

As regards the condenser the state then is, that in one metal plate there is an excess of free electrons, in the other plate a deficit and in the intermediate dielectric plate of glass the mobile electrons are strained or displaced from their normal positions in their atoms, and this elastic displacement represents a store of potential energy, just as does a stretched or bent steel spring. The condenser is then said to be charged or have energy stored up in it. The energy of that charge is measured by half the product of the charge, reckoned in extra electrons, of one plate and the potential difference or voltage between the two plates.

The reader should note that in electrical phenomena the potential difference of two points is the exact analogue of the temperature difference in thermal or heat phenomena, and of difference of level or pressure in the case of hydraulic effects or flow of water.

In the next place let us suppose that the two metal plates of the condenser are connected by a metal wire. The result is that electrons begin to drift through this wire from the plate which has an excess of them to the plate which has a deficiency of them, and at the same time the electrons in the dielectric or glass plate which are strained or displaced, begin to return to their normal positions. The return of electrons is, however, not merely by a uni-directional motion.

Suppose that instead of connecting by a wire two conductors having respectively an excess and a deficit of electrons in them, we were connecting by a wide pipe, in which was a tap suddenly opened, two vessels, in one of which there was an excess of air under pressure, and in the other a partial vacuum or deficit of air. On opening the tap the air in the full vessel would rush over into the empty one, but owing to the mass or inertia of the air it would at first overrush and then rush back again and equilibrium of pressure would only be established after a series of to and fro rushes of air each less than the last. These are called aerial oscillations.

In exactly the same manner, if we connect suddenly the two plates of a charged condenser, the electron equilibrium or equality is only established after a series of rapid movements of electrons to and fro in the wire which gradually die away. These are called *electric oscillations* and are in fact brief currents of electricity alternately in one direction and then in the opposite, which decrease at each reversal. This is termed a damped train of electric oscillations. It can be represented by the ordinates or heights of a periodic but decrescent curve, as in Fig. 48, in which horizontal distances represent time and vertical distances the current in the connecting wire.

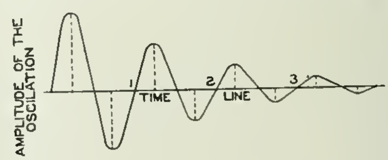


Fig. 48. A Graph or delineation of a damped electric oscillation.

There are then two terms which must be defined as regards the condenser and the connecting wire and these are *capacity* and *inductance*.

If we wished to measure in a certain way the capacity of an airtight vessel we might state it as the weight or quantity of air that the vessel would hold when pumped full up to one atmosphere of pressure or, say, 14½ lbs. per square inch. In the same manner we define the electrical capacity of a condenser as the quantity of electricity it holds when the potential difference of its plates is one volt or one unit.

The exact relation between the quantity of electricity Q or number of excess electrons in the negative plate, the potential or pressure difference V of the plates and the capacity C is expressed by the equation.

$$C = \frac{Q}{V}$$

or numerically, capacity is measured by quantity divided by voltage. The consistent units in which these things are measured are, voltage in volts, quantity in coulombs, and capacity in farads. As, however, the capacity of a condenser of one farad is extremely large, its millionth part, called a *microfarad*, is usually taken as the unit of capacity. We have seen that the quantity called a coulomb is equal to six million billion electrons; so that a condenser has a capacity of one microfarad when, if six billion excess electrons are put on one plate the potential difference of the plates becomes one volt or about 2/3rds of that of the poles of a single dry Leclanche battery cell.

In the next place as regards the wire with which we connect the plates of the condenser. It has two special qualities which can be measured in appropriate units. These are, first, resistance, and secondly, inductance. The electric resistance of a conductor is that quality of it in virtue of which the electric current energy is converted into heat in the wire.

Now this heat consists in part in the energy of irregular motion of the free electrons in the wire, and the electric current is the regular or uni-directional drift or movement of the free electrons in the wire, which is superimposed on the irregular motion.

As the electrons are struggling along in one direction in the wire under the guidance and pressure of the electromotive force urging them, they are continually bumping up against the atoms of the metal and against one another and having their own course changed and some of the energy of their drift or regular motion converted into energy of irregular motion or heat.

The greater this irregular motion, that is, the higher the temperature of the wire, the less in general is the effect of the electromotive force in producing a uni-directional drift. This means to say that for a given electromotive force the current is less; in other words, the electrical resistance is greater.

On the other hand, the lower the temperature of the wire the less is the irregular motion of the free electrons and the greater is the uni-directional drift under a given electromotive force. Hence the electric resistance of pure metals is found to decrease with fall of temperature.

The matter is, however, a little more complicated than the above statements imply. We may regard these free electrons in the metal as the molecules of a kind of gas, and, as in the case of gas molecules, their irregular velocities are different, some moving fast and some slow. The velocity is distributed in accordance with Maxwell's law for gas molecules and the electrons have a certain mean free path between collisions with each other and with the atoms. It is only during the time of this mean free path that the impressed electromotive force is able to act upon them and impose the drift motion in one direction, which constitutes the electric current.

If we call N the number of electrons per cubic centimetre and u the drift velocity of each parallel to the axis of the wire and X the electric force acting on the electron, then the electric current I per square centimetre is measured by the product Neu. If t is the time between two collisions and m the mass of each electron, then the drift velocity acquired in the free time between two collisions is $\frac{1}{2} X \frac{e}{m} t = u$ Again, if l is the mean free path and v is the average irregular velocity of the electron, we may take l to be equal to the product vt, and if the drift velocity u is small compared with v, then the current I is given by the equation

$$I = \frac{1}{2} \frac{NXe^2lv}{2mv^2}$$

But mv^2 is twice the kinetic energy of the electron due to the irregular motion.

If we regard these free electrons as forming a kind of gas, then from the kinetic theory of gases we know that the average energy of a gas molecule is proportional to the absolute temperature T, that is, to the temperature measured from the absolute zero, which is 273° below zero centigrade.

Hence, to convert temperatures measured on the centigrade scale into absolute temperatures, we add 273° to them if the centigrade temperature is above zero centigrade, viz., the melting point of ice, and if the centigrade temperature is below zero centigrade we subtract it numerically from 273° to obtain the absolute temperature.

Thus $+15°C = 288°$ abs.,
but $-180° C = 93°$ abs.

If then we consider the same holds good for the free electrons, we see from the previous equation that the ratio of electric force X to current I, which is a measure of the electric resistance of the cubic centimetre of the metal, is proportional to the absolute temperature, and therefore falls with it.

Experiments made in 1893 by the author, in conjunction with Sir James Dewar, showed that in the case of pure metals when cooled in liquid air to about 80° absolute, there was a fall in electric resistance approximately proportional to the decrease in absolute temperature, but other experiments made subsequently by Sir James Dewar with liquid Hydrogen, giving low temperatures, and later on at still lower temperatures by Prof. H. Kamerlirigh Onnes of Leyden, in Holland, with liquid Helium at a temperature of about 4° absolute, showed that the resistance of pure metals at very low temperatures does not decrease continually according to the same law. For many metals the electrical resistance tends to a minimum constant value at temperatures near the absolute zero. On the other hand, in the case of certain metals in a state of great purity such as mercury, tin, thallium and lead, the electric resistance at temperatures near 5° absolute suddenly falls from a finite value to a nearly zero value. Thus, in the case of lead at about 7° absolute the resistance very suddenly decreases, and at a temperature of 2·45° absolute its electrical resistance is only 50-millionths of that which it has at 273° absolute, or at 0° centigrade, the melting point of ice. In this condition the metal becomes, as Onnes calls it, a *super-conductor*. In this state very large currents may be passed through the intensely cooled metallic wire without creating in it any heat, because it has little or no resistance.

Moreover, if a powerful magnetic field is made to traverse a ring of lead in the state of super-conductivity and then is withdrawn, an electric current, called an induced current, is generated in the ring which lasts for several hours, whereas at normal temperatures it would not last more than a fraction of a second.

A wire, which is a conductor of electricity, possesses, however, another quality called *inductance*, also due to the properties of these little free electrons which swarm in it. We know that a heavy object such as a motor-car or railway train, when once set in motion cannot be instantly stopped. In consequence of its mass (m) and velocity (v) it possesses, as already experienced, kinetic energy measured by $\frac{1}{2}mv^2$. This energy has to be used up in overcoming friction or some resistance, or in doing some form of work before the velocity can be reduced to zero. We have seen also that an electron in motion posseses electric mass, and hence when in motion has a store of kinetic energy.

Accordingly an electric current in a conductor, which is a procession of electrons moving together in one direction, acts as if it were a massive body, and cannot be instantly started or arrested. If i is the current in a conductor at any instant, then the energy stored up by it in the form of an electromagnetic field is measured by the quantity $\frac{1}{2}Li^2$ where L is called the inductance or electric inertia of the circuit.

The current energy depends upon two factors, viz., the current i and the inductance L, just as the kinetic energy of a moving mass depends upon the mass m and the velocity v.

By analogy we can see that if the electric current energy $\frac{1}{2}Li^2$ corresponds to motional energy $\frac{1}{2}mv^2$, then the product Li corresponds to mv or to the momentum of the moving body. The product of inductance L and current i is called the *electric momentum*. Again we have shown that when a mass is set in motion by a force, the latter is measured by the rate at which it produces or destroys momentum. Hence again by analogy, when an electric current is changing, the electromotive force corresponding to this change must be measured by the time rate of change of the electric momentum or of Li. It can be shown that this electric momentum is a measure of the number of its own lines of magnetic force which are self-linked with the circuit.

It is convenient to denote the rate at which a quantity is changing with time by a *dot* put over the letter which denotes the quantity itself. Thus if P stands for the population of a country at any moment, $\dot{P}$ stands for the rate at which it is increasing, and $-\dot{P}$ for the rate at which it is decreasing by births, deaths, and immigration or emigration.

Let us return then to the consideration of the case of the charged condenser which is discharged by connecting its plates by a wire. The instant the plates of the condenser are joined by the wire a current begins in it which is a flow of electrons. These electrons come out of the condenser plate which is charged with extra electrons. Let q be the quantity of electricity represented by these electrons, then $-\dot{q}$ denotes the rate at which they are decreasing, and this is the same as the rate at which they are flowing through the wire, which is the current x in that wire. But if C is the capacity of the condenser and v the voltage or potential difference of the plates, then $Cv = q$ and $-\dot{q} = x$ where $-\dot{q}$ denotes the time rate of decrease of the condenser charge.

But we have seen that when the current is changing the product $L\dot{x}$ denotes the effective electromotive force or voltage corresponding to that change. Therefore we must have $L\dot{x} = v$ and combining this with the previous equation we have a relation between the current x and its rate of rate of change expressed by the equation

$$-LC\ddot{x} = x \quad \text{or} \quad \ddot{x} + \frac{1}{LC}x = o$$

where $\ddot{x}$ denotes the *rate of rate of change* of x.

It has also been pointed out that when a charged condenser is discharging through a wire of very small or negligible resistance the discharge is oscillatory, that is, consists in a flow of electricity or movement of electrons backwards and forwards in the wire.

It is important to obtain an expression for the number of these oscillations per second in terms of the quantities L and C.

Whenever we meet with a mathematical expression or equation of the type $\ddot{x} + Ax = o$ it always means the x is something which fluctuates in a manner similar to the motion of the bob of a very long pendulum, or which executes a simple harmonic motion like the prong of a tuning fork.

We must therefore obtain a mathematical expression for the time of vibration of a simple pendulum consisting of a small bob of mass m hung at the end of a slender rod or wire of length l.

When such a mass swings or vibrates about a point like a pendulum the product of the mass m and the square of the length l of the rod or ml^2 is called the *moment of inertia* of the arrangement.

If the pendulum at any moment during its swing is deflected from the vertical through a *small* angle θ, then the rate at which this angle is changing with time, denoted by $\dot{\theta}$, is called the *angular velocity*. The product of the moment of inertia and angular velocity or $ml^2\dot{\theta}$ is called the *angular momentum*. The rate at which the angular momentum is changing, denoted by $ml^2\ddot{\theta}$, is a measure of the *torque* or couple causing or retarding rotation.

But we can obtain another expression for this torque or couple as follows :—The couple causing oscillation is the product of the length of the pendulum l and the resolved part of the weight of the bob at right angles to the length, viz., $mg \, Sin \, \theta$, where g is the acceleration produced by gravity. If, however, the angle of displacement is small, then in place of $Sin \, \theta$ we can write θ, and the torque is $mgl\theta$. Equating the two expressions for this torque, viz. :—

$$ml^2\ddot{\theta} = mgl\theta$$

we have $\ddot{\theta} = \frac{g}{l}\theta$

It will be seen that this expression for the angle of deflection of the vibrating pendulum at any instant is of exactly the same type as that for the current in the case of the discharging condensers, viz., $\ddot{x} = \frac{1}{LC}x$, only for the pendulum the quotient g/l takes the place of $1/LC$ for the condenser.

We can now obtain an expression for the time of vibration as follows: When the pendulum is at the extremity of its swing, it is for the moment at rest and its potential energy is measured by the product of the mean torque and the angle of extreme displacement or by $\frac{1}{2}mlg\theta^2$.

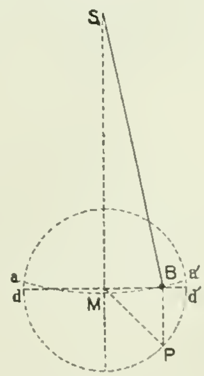


Fig. 49. Diagrammatic representation of the swing of a bob of a pendulum.

But if s is the semi arc of displacement or the distance of swing on either side, then $s = l\theta$, so that the potential energy is measured by the value of $\frac{1}{2}m\frac{g}{l}s^2$.

Again, if we describe a circle with centre at the mid point M of the swing and radius equal to the swing (see Fig. 49), and suppose that a point P in this circle moves round it with a uniform velocity equal to the velocity of the bob at the middle point of its swing, then it is easy to see that the displacement of the bob at any instant is given by the projection of this point on the diameter of this circle, and if the swing is small this diameter, dd^1 of this circle coincides nearly with the arc aa^1 of vibration. Hence, if T is the time of one complete revolution of this point P, T is also the time of one complete oscillation of the pendulum.

The velocity of the bob at the lowest point of its swing where it is a maximum is therefore expressed by $2\pi s/T$, where π is the circular constant 3·1415 . . . or ratio of diameter of the circle to its circumference. Hence the maximum kinetic energy of the pendulum must be equal to $\frac{1}{2}m\,\frac{4\pi^2 s^2}{T^2}$ and this must by the principle of conservation of energy be equal to the maximum potential energy at the extremity of its swing, viz., $\frac{1}{2}m\frac{g}{l}s^2$. Therefore we have

$$\frac{4\pi^2}{T^2} = \frac{g}{l} \quad \text{or} \quad T = 2\pi\sqrt{\frac{l}{g}}$$

as an expression for the time of vibration.

If we represent the reciprocal of T or the number of swings per second or per unit of time by the letter n, then this is also called the *frequency* of the oscillations, and from the above equation we have for the simple pendulum

$$n = \frac{1}{2\pi}\sqrt{\frac{g}{l}}$$

A little thought will then make it evident that since the previous discussion has shown that $1/LC$ for the condenser circuit corresponds to g/l for the pendulum, the frequency of the oscillations of a condenser of capacity C discharging through a wire of low resistance and of inductance L is given by the expresson

$$n = \frac{1}{2\pi\sqrt{LC}}$$

To make use of this formula in practice we have to measure C and L in appropriate units. In wireless telegraphy and telephony condensers are used the capacity of which it is convenient to measure in *microfarads*. Also the inductances of coils of wire employed are conveniently measured in units called *millihenrys*.

To create oscillations in such a condenser circuit, one mode is to cut the discharging wire at some place and furnish the ends with polished metal balls called spark balls, placed about one or two millimetres or so apart. The other ends of the two wires are connected permanently with the condenser plates (see Fig. 50). We then connect these balls with the terminals of an electrical machine or induction coil in operation; the plates of the condenser will be charged, one as already explained, will have an excess of negative electrons forced into it, and the other will have a deficit.

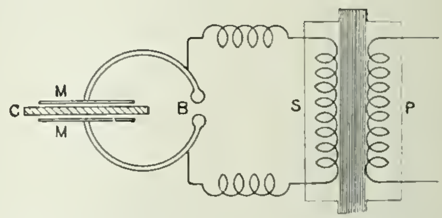


Fig. 50. Arrangement for producing electric oscillations.
S P Induction Coil.
B Spark Balls.
C Condenser.
MM Metal plates of Condenser.

The small air gap between the spark balls remains a perfect insulator until the electron pressure has reached a certain voltage, depending on the distance between the balls. At this point electrons burst out of the negative ball and by their impact they ionise the air molecules or liberate from them electrons by collision. The ionized air is a conductor of electricity and hence at that instant the balls are as good as put in contact and the discharge circuit is completed. The electric oscillations of the condenser electrons then take place as already described, and as these oscillations die gradually away the air between the spark balls resumes its insulating power. The process then repeats itself and we have a series of groups of die-away oscillations called trains of damped oscillations.

In a later section we shall describe the manner in which oscillations called undamped or continuous oscillations can be created.

To give some idea of what these units mean we can say that the electrical capacity of a Leyden jar, formed with a glass bottle or jar of about a pint in capacity, might be somewhere about one-thousandth of a microfarad. The electrical capacity of the whole earth considered as a spherical conductor insulated in space is only about 800 microfarads. The capacity of a mile of submarine cable is about one-third of a microfarad.

If we make our measurements in these units the formula for the frequency of oscillation in a condenser circuit takes the following form :

$$n\left(\begin{matrix}\textit{oscillations}\\ \textit{per second}\end{matrix}\right)=\frac{5{,}000}{\sqrt{C\left(\begin{matrix}\textit{in}\\ \textit{microfarads}\end{matrix}\right)\times L\left(\begin{matrix}\textit{in}\\ \textit{millihenrys}\end{matrix}\right)}}$$

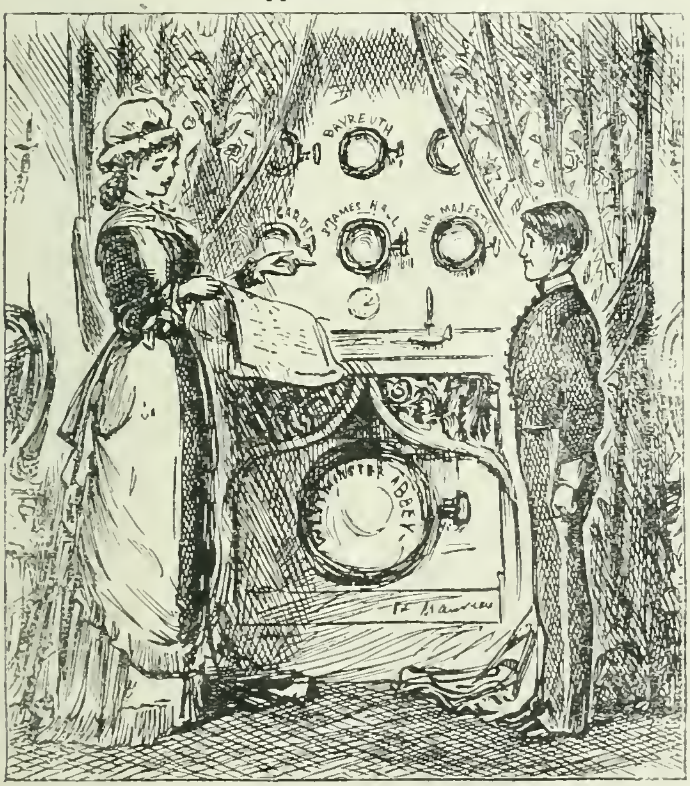
Thus, for instance, if we had a charged Leyden jar having a capacity of 1 500th of a microfarad and discharged it through a yard or two of connecting wire, which might have an inductance, say, of 1 500th millihenry, the frequency by the above formula would be $2\frac{1}{2}$ millions. This means that the time of one complete oscillation current would be four ten-millionths of a second.

A circuit of this kind is called an oscillatory circuit and every such circuit has a natural time of vibration in which its electric charge oscillates when disturbed just as every pendulum of a given length has its own natural time of vibration if it is set swinging.

(To be continued.)

History Repeats Itself.

This illustration appeared in "Punch's Almanack" for 1878, dated December 14th, 1877. At the time the telephone was a novelty, and the illustration is an imaginative idea on the part of the artist of what might be expected of the telephone.



Musical Mistress of House ("on hospitable thoughts intent").—"Now, recollect, Robert, at a Quarter to Nine turn on 'Voi che Sapete' from Covent Garden; at Ten let in the Stringed Quartette from St. James's Hall; and at Eleven turn the last Quartette from 'Rigolletto' full on. But mind you close one tap before opening the other!"

Buttons.—"Yes Mum"

The picture is surprisingly applicable at the present time to wireless broadcasting, and particularly apt is the caution to "Buttons" to be sure to "close one tap before opening the other!" One might almost imagine that the artist had been privileged to peep into the future and gather his inspiration from one of the wireless cabinet sets *de luxe* now advertised!

Even the tuning devices are all there, and the suggestion of the inclusion of a clock on the panel is one which might well be followed by manufacturers who study the appearance of their products.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

Mr. W. C. Ramshaw occupied the chair on November 17th. New members were elected, bringing the number up to 145.

Mr. Eskdale lectured on "Direction Finding." His remarks were illustrated by means of a cinema film entitled "Wonders of Wireless," which was kindly loaned by the Marconi Company.

A hearty vote of thanks was accorded to the Marconi Company.

Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

On November 16th Mr. A. E. Gregory again lectured on the "Elementary Principles of the Valve."

Characteristic curves, and the method of obtaining them, were fully explained by means of diagrams.

Questions were asked and answered. Mr. Gregory was heartily congratulated on the lucid way in which he dealt with a most difficult subject.

Durham City and District Wireless Club.*

Hon. Secretary, Mr. Geo. Barnard, 3, Sowerby Street, Saeriston, Durham.

The fourteenth meeting was held on October 27th, and the fifteenth meeting on November 3rd. At the latter, Mr. F. Sargent, Chairman, lectured on "Is Planetary Communication Possible?"

On November 10th the sixteenth meeting was devoted chiefly to Morse, Mr. R. W. Rushworth being in charge.

The seventeenth meeting took place on November 17th. The attendance was very large, the districts being especially well represented. Mr. Geo. Barnard lectured on "The Thermionic Valve." He used large coloured diagrams. Every statement was proved mathematically and graphically. The lecture lasted two hours. Hearty applause was given.

Two new members were elected. By a unanimous vote Mr. H. Pratt of Crook was elected to the Vice-Presidency, and accepted.

The announcement that Mr. J. A. Dawson, M.A., Director of Education, has accepted the position of President of the Society was received with much applause.

The new receiving station is well under way.

Hamilton and District Radio Society.*

Hon. Secretary, Mr. James McKillop, 22, Dalziel Street, Hamilton.

On November 17th, Mr. James Brown lectured on the Society's detecting panel (now under construction). He commenced by drawing a diagram on the blackboard, and traced each circuit separately. At the conclusion of his lecture, the President called for a vote of thanks for Mr. Brown and intimated that Mr. Brown would give further lectures on the high frequency and note magnifying units in the near future.

North London Wireless Association.*

Hon. Secretary, Mr. V. J. Hinkley, Northern Polytechnic, Holloway, N. 1.

At the meeting on November 15th, Mr. Hill lectured on the "Telephone System, External Working." Although the subject dealt with was not strictly "Radio" it proved of great interest to the members.

On November 20th, Mr. H. Norman Wilson lectured on the "Construction of Telephones." Mr. Wilson gave full details of the construction of his telephones, which he had made, and passed them round for inspection. The workmanship was excellent and Mr. Wilson is to be congratulated on his skill and patience. Mr. Angel afterwards explained further points in connection with magnetising telephone magnets.

Mr. Hinkley gave several very interesting demonstrations.

There is a special section for juniors up to the age of 18 years, at 5s. per annum. Ladies are invited to join the Association.

Bristol and District Wireless Association.*

Hon. Secretary, Mr. L. F. White, 10, Priory Road, Knowle, Bristol.

A meeting was held on November 3rd, in the Physics Lecture Theatre, University of Bristol, with Mr. A. E. Mitchell in the chair.

Messrs. T. W. Higgs, K. E. Wallace, W. J. Burnell, W. Foster, E. C. Jenkins and W. Brierley were elected as members of the Association. Mr. Thomas W. Brown lectured on "The Reproduction and Amplification of Gramophone Music and its relationship to Broadcasting." He demonstrated with an Edison Gem Phonograph with horns of varied materials. A Magnavox used with a gramophone by means of the special microphone attachment produced an enormous volume of sound, perfectly clear and free from distortion.

The meeting concluded with a hearty vote of thanks to the lecturer.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 18, Melford Road, S.E.22.

It was intended to give the Vice-President, Sir Fred. Hall, K.B.E., D.S.O., wireless assistance in connection with the General Election. Permission not having been received, the project had regretfully to be abandoned; but late in the afternoon of the polling day a telephone message was received that the petition was granted, and that formal permission would follow. With the Secretary's three-valve set, supplemented by batteries, amplifiers, and a loud speaker kindly loaned by Messrs. Mitchell, of Rye Lane, all the results broadcasted by **2 LO** were made known.

Wireless Society of Hull and District.*

Hon. Secretary, 79, Balfour Street, Holderness Road.

The monthly lecture was delivered on November 15th, on "Calculation of Capacity." The author, Mr. Hy. Strong, being absent, the Chairman read the paper. A vote of thanks was passed to the writer and the Chairman.

Mr. G. H. Strong (President) occupied the chair, and during the evening the suggested alterations to the constitution of the Wireless Society of London were read, and those members present were in favour of the Hull Society taking such a name as The Radio Society of Great Britain (Hull and District Branch) if necessary. The matter, however, was adjourned.

Meetings of the Society are held on the second Monday and fourth Friday in each month at the headquarters of the Signal Corps in Park Street (entrance in Corporation Field), at 7.30 p.m.

Edinburgh and District Radio Society.*

Hon. Secretary, Mr. W. Winkler, 9, Ettrick Road, Edinburgh.

Mr. A Boyd Anderson, F.B.E.A., lectured on November 15th, emphasising the need of an international language now that wireless is becoming so general. Esperanto, he said, was the simplest possible system to master, and would, if universally adopted, aid very largely in furthering business and promoting a better feeling between nations.

Mr. J. Smith, the Chairman, supported the lecturer. He advised the members of the Society to give the subject their serious attention.

Several members spoke, mostly with enthusiasm, on the subject of the many advantages of Esperanto.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

A paper by Mr. W. F. Ellis on "Valve Control" was given on November 17th. Special interest was aroused by the Magnatron, which is a peculiar type of diode, in which the electron emission from the filament is controlled entirely by a current-carrying solenoid surrounding the tube.

A vote of thanks was passed to Mr. Ellis.

A discussion ensued. The equipment engineer having fixed up the new Magnavox loud speaker, the meeting listened to **2 LO.**

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

At the Grammar School, Leeds, on November 3rd, a lecture was given on "Inductance Coils for all Wavelengths," by the Hon. Secretary. The subject of inductance was examined thoroughly from the practical side.

A general meeting was held on November 10th, Mr. A. F. Carter taking the chair. An exhibition of apparatus with telephony demonstrations is to be held at an early date. Mr. G. P. Kendall (Vice-President) gave a paper on "Some Gadgets of a Faddist." Many gadgets, including smoothing devices for rough anode potential, shock protectors, variometers, use of potentiometer for regenerative purposes, plugs and jacks, etc., were described.

After the discussion, Mr. H. F. Yardley proposed a vote of thanks to Mr. Kendall.

Mr. A. M. Bage (President) was elected Chairman at the next general meeting.

Liverpool Wireless Society.*

Hon. Secretary, Mr. C. L. Lyons, 76, Old Hall Street, Liverpool (Tele. 4641 Cent.).

At the Royal Institution, Colquitt Street, Liverpool, on November 16th, Mr. E. B. Grindrod in the chair, there was a record attendance. Eight new members were elected. The membership has now grown to 116.

A demonstration was given by the Hon. Treasurer, Mr. J. H. Swift, who brought to the meeting his home-made five-valve receiver.

Apparatus was lent for the evening by Messrs. Pulford Bros., Liverpool. With the assistance of Mr. A. W. Robinson excellent results were obtained. A special transmission was given by **2 ZY** Manchester, and both the speech and the musical items were very loudly and clearly received. The Birmingham Broadcasting Station (**2 ZP**) was also picked up very clearly. Some little trouble was caused by interference from the Seaforth G.P.O. Station.

Votes of thanks were passed in favour of Mr. Swift and Mr. E. G. Bush, who very kindly acted as Acting Secretary during the Hon. Secretary's unavoidable absence. The next meeting was called for November 30th. Meetings during December will be held on the 14th and 28th.

Aberdeen and District Wireless Society.*

Joint Secretary, Mr. James S. Duthie, 148, Forest Avenue, Aberdeen.

The fifth meeting for this session was held in the Grammar School on November 10th, Dr. Fyvie presiding. Mr. W. W. Inder lectured on "An Outline of the Principles of Transmission and Reception of Wireless Telegraphy."

The detection of signals by valves was left over for consideration to a future occasion.

On the motion of Mr. Shearer a very hearty vote of thanks was accorded to Mr. Inder.

Bromley Radio and Experimental Society.*

Hon. Secretary, Mr. J. F. Croome, 26, Wendover Road, Bromley, Kent.

Mr. Allen demonstrated his five-valve receiving set on November 13th.

During the evening some dozen books were given or promised to the club library, and the Committee appeal to all members to give at least one volume so as to get together a useful and representative collection.

Clapham Park Wireless Society.*

Hon. Secretary, Mr. J. C. Elvy, 3, Fontenoy Road, Bedford Hill, S.W.12.

The eleventh meeting was held at headquarters, 67, Balham High Road, at 7.30 p.m. on November 8th, Mr. A. E. Radburn presiding.

A single valve panel made by Mr. C. A. Daniels was presented to the Society. A set of headphones also was presented by Mr. M. P. Prout, Hon. Treasurer.

The Chairman read a letter received by the Hon. Secretary from Mr. F. H. Haynes, of *The Wireless World and Radio Review*, consenting to be present at this meeting to participate in a general discussion on Wireless.

This was followed up by a direct request from the Chairman that Mr. F. H. Haynes give the lead off for the evening, which that gentleman graciously consented to do.

Having become already acquainted with each other at the meeting a fortnight previous, those present took every advantage to keep up a running fire of questions, which Mr. F. H. Haynes readily answered in his characteristic, pleasing manner. On the whole it proved a very successful evening, Mr. F. H. Haynes having endured the attack of two hours duration.

After a hearty vote of thanks had been accorded Mr. Haynes, the Chairman switched on to another point of interest to all wireless enthusiasts, namely, the proposed inauguration of a competing Society —"The Radio Association," of 9, Southampton Buildings.

He read out the rules and objects of the Association, and after a brief discussion it was unanimously pronounced that the competitive Association should not receive recognition in any way whatsoever, the Clapham Park Wireless Society being assured that their interests were safely in the hands

An Exhibition Stand at Gloucester.

of the older established body, The Wireless Society of London (now Radio Society of Great Britain). Membership is increasing.

Walthamstow Amateur Radio Society.*

Hon. Secretary, Mr. R. H. Cooke, Ulverston Road, Walthamstow, E.17.

On November 8th, before a well-attended meeting, Mr. Allen, President, gave a fine lecture on "The Thermionic Valve and How it Works." Many diagrams were used.

On November 15th, Mr. Cooke, Secretary, gave a lecture, illustrated by diagrams, on "Radiating and Non-radiating Circuits." The lecturer very clearly demonstrated how to "howl" and how not to howl. He also drew out several non-radiating circuits, including circuits conforming to the P.M.G.'s regulations. A vote of thanks was accorded the lecturer.

London County Council Radio Society.*

Hon. Secretary, Mr. H. W. Fuller, Room 38, County Hall, Westminster Bridge, S.E.1.

Some three months ago, at the County Hall, the formation of this Society took place. It was decided to approach the Council for permission to erect an aerial; to seek affiliation with the Wireless Society of London (now the Radio Society of Great Britain), and to endeavour to interest not only the staff, but also the Council, in the possibilities of wireless. It can now be claimed that all the Society set out to do has been done.

An aerial has been erected upon County Hall, the entire work being carried out by members of the Society. Affiliation with the Radio Society of Great Britain has been completed; the Society is now 50 strong; and finally, the Council itself has been interested enough to attend a demonstration.

On November 21st, from 5 p.m. onwards, members of the Council gathered in the large committee room of the County Hall to listen to a special concert transmitted from the London station of the British Broadcasting Company. The reception was made upon a home-made detector panel, the tuner being loaned by Messrs. Burndept, Ltd., and the loud speaker and amplifier by the Sterling Telephone Company. The Council listened with great pleasure.

The Society set out to be educational, and its great feature is that the majority of the members are beginners in radio science, learning the A.B.C. of the subject from lectures given by the Hon. Secretary, and from practical classes held by other members of the Society.

Glevum (Gloucester) Radio and Scientific Society.*

Hon. Secretary, Mr. Sidney A. Bird, 13, Central Road, Gloucester.

The stand shown in the photograph was the Society's contribution to an exhibition held by the Association of Science and Art Societies, Gloucester, with which the Glevum Society is affiliated. Telephony was transmitted by Mr. Mayall (Chairman), from St. Paul's Road, which was distinctly heard through a Brown's loud speaker, by the crowd of visitors around the stand, which the following firms assisted to make a success: Messrs. Browns, Ltd., Radio Components, Ltd., C. F. Elwell, Ltd., The Ever Ready Co., Ltd. and the Dubilier Condenser Co., Ltd. The Ever Ready Co. presented H.T. batteries for the week's demonstrations.

Cardiff and South Wales Wireless Society.*

Hon. Secretary, Mr. P. O'Sullivan, 37, Colum Road, Cardiff.

A general meeting was held at the new headquarters, The Engineers' Institute, Park Place, Cardiff, on November 9th. Mr. Norman M. Drysdale, Vice-President, took the chair.

A vote of thanks was accorded Mr. W. Emlyn Owen upon his offering a six-volt, hundred amp. accumulator as a gift to the Society.

A vote of thanks was passed to Mr. W. H. Franklin for loaning a five-valve receiving set for six months or longer.

Mr. E. Ogden lectured on "Points for every Radio Experimenter."

Many questions were put to the lecturer, and discussions arose. A hearty vote of thanks was accorded the lecturer.

Bedford Physical and Radio Society.*

The address of the Hon. Secretary of this Society is "Beechcroft," Beverley Crescent, Bedford.

Thames Valley Radio and Physical Association

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

On November 9th, at the Hut, Wigan Institute, a special meeting took place at which Mr. G. G. Blake gave his Presidential address with lecture, lantern slides and experiments.

General Shaw introduced Mr. Blake to a large gathering, at which over 75 members and their friends were present.

The first time that this Association was called up by radio (October 17th, 1922, by **2 OM** and **2 JM**) was referred to.

Mr. Blake personally thanked the donors of the various parts presented to the Association for their set. Further contributions will be gladly received by the Technical Committee.

A hearty vote of thanks was accorded Mr. Blake. Six new members joined after the meeting.

Hartlepools and District Wireless Society.

Hon. Secretary, Mr. A. Brown, The Technical College, Hartlepool.

The second annual general business meeting was held in the Society's rooms, 11, Church Street, on November 7th, Mr. J. W. Patterson presiding over a record attendance. The Secretary reported on the year's progress. The Treasurer's report showed a substantial amount in hand. The following officers were elected for the ensuing year :— President, Mr. G. Wenn ; Vice-Presidents, Mr. J. W. Patterson, Mr. Marris and Mr. Horsely ; Secretary, Mr. A. Brown ; Treasurer, Mr. R. Howey ; Librarian, Mr. Forstad ; Committee, Messrs. Alton, Slack, Middleton and Laing ; Auditors, Messrs. Andas and Laing. It was agreed to secure new premises in the Technical College, and that the meeting might be changed to Fridays.

A social evening in the form of a whist drive and dance was held in St. Joseph's Assembly Rooms on November 8th, Mr. G. Wenn presiding. About 100 members and friends attended. The whist prizes were gracefully presented by Mrs. Jack Farmer. After supper dancing continued to the small hours of the morning.

Newport and District Radio Association.

At the fortnightly meeting on November 9th at the Memorial Hall, Queen's Hill, a paper on "Wireless Valves" was given by Mr. W. B. Edwards. A discussion followed.

An explanation of the amateur's position under the broadcasting rules was given by the Chairman (Mr. J. H. M. Wakefield), and it was felt that some action should be taken by the various Wireless Societies for protecting the interests of amateurs and experimenters.

Arrangements were made for a public wireless concert on December 7th.

Ealing and District Radio Society.

Hon. Secretary, Mr. W. F. Clark, 52, Uxbridge Road, Ealing, W.5.

The meetings of the Society are progressing favourably at the new headquarters, London Radio College, Brentford, and Mr. Rees, one of the College lecturers, lectured on November 10th on "Detectors and Amplifiers." The lecturer was obliged to postpone the second part of his lecture until a further date.

After the discussion and answering of questions a hearty vote of thanks was passed.

Northern Radio Society.

Temporary Hon. Secretary, Mr. C. V. Stead, 29, Stalebroke View, Chapeltown, Leeds.

On November 2nd, a meeting was called at Church Schools, Meanwood. Mr. Bull was elected Chairman. It was decided unanimously to form a Society. An election of officers took place. A Committee meeting was held on November 10th at Grove Mills, Meanwood, and a set of rules agreed upon subject to approval at the next general meeting. Mr. W. H. Turner was elected President, and thanked for his kind offer of the use of a room for future meetings.

The next general meeting was held on November 22nd, at Grove Mills, Meanwood. A special telephony demonstration was arranged.

The following are the officers of the Society :— President, Mr. W. H. Turner ; Vice-President, Mr. A. Bull ; Hon. Treasurer, Mr. H. Topp ; Hon. Secretary, Mr. C. V. Stead ; Hon. Technical Secretary, Mr. L. Parker ; Committee, Messrs. Walsworth, Warburton, Robson, Owen, H. L. Turner, Cooper, Whetton and C. Turner.

Finchley and District Wireless Society.

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

On November 8th and 9th a demonstration was given at a bazaar, when musical transmissions were received from **2 WP**, **5 CP**, Writtle (**2 MT**) and Marconi House.

Although there was a great deal of noise from a "fair" that was held overhead, and from a band at the other end of the hall, the transmissions were heard quite clear and loud from a Brown's loud speaker.

The Society have been fortunate to obtain the services of Mr. Read, of Messrs. Burndept, Ltd., who was to give a lantern lecture and demonstration on November 27th. The Society met on November 13th, when Mr. Wilck lectured on "The Characteristics of the Valve," and explained the uses of the condenser and grid leak. It has been decided to hold a dance on December 11th, the arrangements for which have now been completed. The making of the Society's wireless set, which is to be on the unit system, is now well in hand.

Streatham Radio Society (Streatham Hill College.)

Hon. Secretary, Mr. S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, S.W.16.

Mr. Bevan Swift gave the first of a series of lectures specially arranged for the younger amateur on November 15th. This series of lectures promises to be very successful.

Meetings will be held on the first, third and fourth Wednesdays of each month, the second Wednesday being the lecture night.

The lecture room is in the Streatham Hill College, the Principal of which has given kindly help to the Society which is greatly appreciated by all.

Trafalgar Wireless Society.

Hon. Secretary, Mr. F. H. Stanlake, 57, Amersham Vale, New Cross, S.E.14.

At the Trafalgar Hotel, Greenwich, on November 21st, the course of lectures by the Director of Instruction, Mr. R. J. Stanley, was continued, "Valve Reception" being the subject on this occasion.

The aerial is now available for members' use.

Oldham Lyceum Wireless Society.

Hon. Secretary, Mr. Graham Halbert, 16, South Hill Street, Oldham.

A lecture was given by Mr. J. Holden, on "Recording of Wireless Signals," on November 16th.

He went right back to the beginning of Wireless, and explained how a recorder could be used, and had been used with such old friends as coherers.

The whole of the lecture was illustrated by means of diagrams. The lecturer was thanked.

On November 30th Mr. A. T. Holmes, of Manchester, lectured on "Amplifier Characteristics."

Finsbury Technical College Wireless Society.

Hon. Secretary, Mr. H. Hall, Finsbury Technical College, Leonard Street, City Road, E.C.1.

In accordance with the desire expressed by many of the students of the Finsbury Technical College the above Society has been formed.

At a general meeting held on November 10th the following members of the College staff were elected as officers of the Society :—

President, Dr. Eccles, F.R.S., M.I.E.E. ; Vice-Presidents, Messrs. J. K. Catterson Smith, M.I.E.E., L. W. Phillips, A.M.I.E.E., R. A. Rinaldi and G. Parr. The following students were elected on the Committee :—Chairman, Mr. J. R. Mortlock ; Secretary, Mr. H. S. M. Hall ; Treasurer, Mr. B. Draper ; and Messrs. J. O. Mortlock, E. W. Roper and F. Joselin.

The rules, of which the following is a brief précis, were read, discussed and passed :—

(1) Members of the College only to be elegible for membership.

(2) Officers and committee to be elected annually as above.

(3) Entrance fee to be 2s. 6d. and subscription 1s. per month.

(4) Meetings to be held on alternate Thursdays at 4.30 p.m.

(5) Rules relating to papers read before the Society.

The meeting was then adjourned, arrangements for the next meeting being left in the hands of the Committee.

Portsmouth and District Amateur Wireless Society.

Hon. Secretary, Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

An interesting talk was given by Mr. R. G. R. Cole, on November 8th, on "Valves." He explained the two-electron and three-electron valves, and dealt with the action of the grid and plate. A hearty vote of thanks was given to Mr. Cole.

The usual fortnightly business meeting was held on November 15th, when new members were elected. After the meeting, a talk was given by Mr. Gall entitled "Advice to Amateurs."

The Association is hoping to hold a Social evening and exhibition on December 6th, and already General Ferrié, of Eiffel Tower, has promised to transmit telephony especially for the concert.

Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

Mr. H. J. Pugh in the chair at the meeting on November 13th, called upon Mr. J. R. Hunting to give his lecture on "Faults in Valve Circuits and How to Clear Them." The lecturer dealt in detail with single-valve sets and multi-valve sets.

A vote of thanks was tendered to the lecturer.

Taunton School Radio Society.

Hon. Secretary, Mr. H. W. Hamblin, Taunton School, Taunton.

Mr. I. C. Tyler occupied the chair on November 7th. Mr. Pean lectured on "The Functions of a Receiving Aerial." He illustrated the working by a number of interesting experiments.

On November 14th, with Mr. Pean in the chair, the Hon. Secretary lectured on "The Construction of a Crystal Receiver."

Stockton and District Amateur Wireless Society.

Hon. Secretary, Mr. W. F. Wood, 4, Berkely Square, Norton-on-Tees.

On November 9th, in the Malleable Workmen's Institute, Norton Road, Stockton-on-Tees, with Mr S. B. Butler in the chair, it was reported that an efficient receiving set was expected to be installed by the next general meeting. Great progress was reported as regards the increase of membership. The meeting was followed by a concert in which many friends kindly rendered assistance.

It is proposed that the next general meeting on December 4th be followed by a whist drive.

West London Wireless and Experimental Association.

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

Owing to the rapid increase in membership of the Association, the accommodation at the present headquarters is quite inadequate.

The Meeting night on Friday has not proved convenient for the majority of the members.

The Governors of the Acton and Chiswick Polytechnic, Bath Road, Chiswick, W. 4, have kindly offered the use of the large Art Room at that Institution, on Tuesday evenings, from 7 p.m. to 9.30 p.m. The offer has been accepted and the first meeting was held there on November 28th.

The Annual General Meeting is fixed for December 5th, at 7 p.m. when the election of officers for the ensuing year will take place.

Newton-in-Makerfield and District Radio Society.

Hon. Secretary, Mr. R. W. Mayhew, 220, Earle Street, Earlestown, Lancs.

The first weekly meeting was held at the Society's headquarters, Y.M.C.A., Bridge Steeet, Earlestown, on November 8th. The Vice-President, Mr. R. S. Norman, gave an address on wave-formation, and explained how an electro-magnetic wave was formed. He also gave detailed accounts of Hertz's original experiments. Mr. R. Goff, a member of the Committee, followed with a short address on "The Essentials of a Simple Wireless Receiving Apparatus." Buzzer practice was conducted by Mr. H. S. Grimshaw.

Wireless Society for Pudsey and District.

Hon. Secretary, Mr. W. G. A. Daniels, 21, The Wharrels Low Town, Pudsey, Nr. Leeds.

A Public Meeting was held to discuss the formation of the Society. It was well attended.

Mr. Wild was elected Chairman ; Mr. Daniels Secretary ; Mr. Dockray, Treasurer. Committee of Management : Messrs. Wilman, Housencroft, Sheard, and Pearson.

A Selective Five-Valve Amplifier.*

By Maurice Child.

THE amplifier which forms the subject of this paper is shown in Figs. 1 and 2. I would make it clear before I describe the instrument that there is no novelty as regards the principle upon which it works, but I think it possesses some features which are not usually found combined in one instrument, if at all, and I think that, inasmuch as an amplifier built on

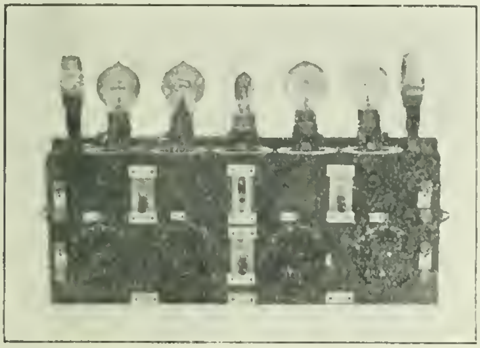


Fig. 1. The Five-Valve Amplifier.

these lines is suitable with certain modifications for the reception of the American amateur stations, that therefore it will be of interest to some here this evening.

The instrument has two valves for high frequency amplification with a switch for cutting out one of them if desired, one rectifier and two valves for low frequency magnification which can be independently cut in or out as occasion and circumstances warrant.

The H.F. amplifying valves are coupled by two tuned circuits of low ohmic resistance.

The diagram Fig. 3 shows the arrangement of the circuits.

Commencing from the left-hand side you will notice that the secondary of the tuner has its high potential end connected to the grid of No. 1 valve, and the low potential end to the negative of the accumulator battery.

The plate circuit of No. 1 valve includes an inductance coil which can be connected across either condenser No. 1 or No. 2 according to the position of the switch C.S.

The plate end of this inductance with its associated condenser is coupled to the grid of No. 2 valve through the condenser of 0·0003 mfds. marked C.1.

The grid of No. 2 valve is connected to the positive of the L.T. battery through a resistance of 2 megohms.

The plate circuit of No. 2 valve, as in the case of No. 1 valve, includes a second inductance which can preferably be of the same value as the first, which is placed across the condensers either 3 or 4 by C.S.2.

The switch which controls these condenser connections is a multiple one and changes both inductances with one movement to condensers 1 and 3 or 2 and 4.

This arrangement is particularly convenient for reception from two stations whose wavelengths differ by a few metres and so avoids continual re-tuning.

As an example: when the time comes for the sermon from one broadcasting station I can switch on the hymn of the other, *i.e.*, if the latter is preferred to the former, and the wavelength is different. I must confess, however, that this was not in my mind when I constructed the instrument.

Continuing by the diagram, the plate inductance of No. 2 valve is coupled to the detector valve No. 3 through another condenser of 0·0003 mfds. and the grid of this valve is connected to the positive of the L.T. battery through a resistance of 500,000 ohms.

The grid leaks are purposely of different values for the following reason. The detector valve rectifies by virtue of a certain amount of grid current flowing when the grid is impulsed in a positive sense. With two high frequency amplification stages in front, these currents are likely to be in general fairly strong and therefore the accumulating negative pulses may easily reach a value which may limit the rectification somewhat, and even set up oscillations when undesired. By obtaining an appreciable steady current flowing in the grid circuit, a useful damping is obtained. I have found that in the case of this amplifier with wavelength ranges of from 300 to 1,000 metres that the values given are about right.

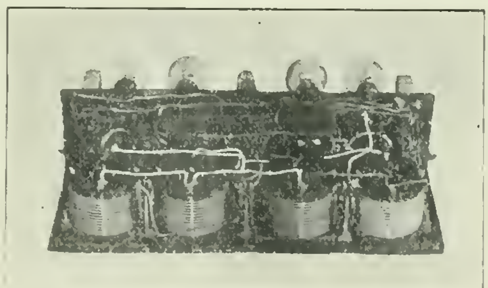


Fig. 2. The Amplifier, with case removed.

At 300 metres, however, if inductances to the order of 125,000 cms. are exceeded, the amplifier is very liable to self-oscillate, and therefore for shorter wavelengths than 300 metres I should expect to find that a value of 500,000 cms. for No. 2 valve, and 200,000 cms. for No. 3 valve would be more suitable.

The variable condensers are of 0·00035 mfds. capacity.

Turning now to the low frequency valves 4 and 5 there is nothing I think which calls for very much comment. The transformers are what is usually

* A paper read before the Radio Society of Great Britain on November 22nd, 1922.

called the army pattern. For their size they are very efficient, and for two stages of magnification with no more than 60 volts, good for speech—but cannot be recommended for dealing with strong currents with consequent higher voltages.

The outside secondary of No. 1 transformer, the inside secondary of No. 2 transformer, and the inside primary (or telephone winding) of the step-down telephone transformer are all joined to the negative of the L.T. battery.

I find that this arrangement with the transformers placed as close as they are in this amplifier avoids low frequency "howling."

Other minor points are (*a*) a 2 mfd. condenser across the H.T. battery, (*b*) a 0·005 condenser across the primary of the No. 1 transformer, (*c*) separate filament rheostats, (*d*) terminals for giving the grids of the valves 4 and 5 either extra or less negative potential according to particular circumstances by means of a potentiometer or dry cells. Ordinarily the latter are short of the wave emission of the former as on the circuit arrangements of the latter.

A telephony transmitter such as **2 WP** or **2 LO** is unsuitable for selective reception.

There is very little carrier wave relatively, and the emitted speech waves vary both as regards length and amplitude, consequently highly selective arrangements at the receiving station are unnecessary beyond a certain degree.

On the other hand, the elimination of arc "rustlings" and spark waves can be considerably expedited by the employment of extremely low resistance well-tuned loosely coupled circuits.

You will notice that I have fixed the plate circuit inductances at each end of the instrument, which is 18 ins. long, and they are wired up in such a way as to tend to neutralise each other in order to produce stability and non-oscillation. From centre to centre they are 16 ins. apart.

It is generally thought that it is a difficult matter to adjust an amplifier designed on these lines,

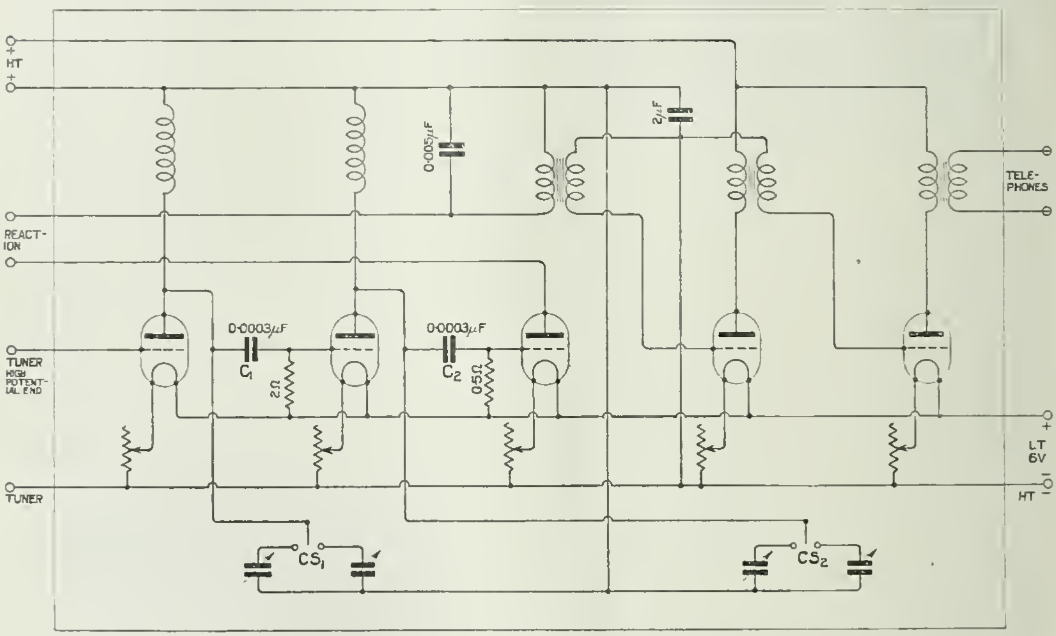


Fig. 3. Circuit Diagram, showing the method of employing the valves.

circuited. The H.F. and detector valves can have a different H.T. voltage to the L.F. valves as can be readily seen.

A diagram of the complete switching arrangements appears in Fig. 4. It will no doubt help to dissipate any latent enthusiasm some of you may be possessing for constructing an instrument on these lines.

The photograph Fig. 1 shows the external and Fig. 2 the internal view of the amplifier.

As this is not a paper on methods of obtaining selectivity, I will not enter into these except in so far as they relate to the instrument before you.

A high degree of selectivity as between transmitter and receiver depends as much on the character but in actual practice I do not find this to be the case.

In searching I generally employ valves No. 2 and 3, with 4 and 5 added if the signals are likely to be very weak.

The moment the signals are heard and brought to maximum with condensers 3 or 4, 1 switch in No. 1, and as the inductance of this valve's plate circuit is generally the same value a second or two finds the position of resonance with the corresponding condenser.

For ordinary work I do not use any reaction coil, but choose the coils which experience shows produces reasonable stability.

For long waves, the instrument can be used as a resistance or reactance coupled amplifier by inserting, in the plug sockets, attachments with the resistance coils fitted. In these cases the variable condensers are fixed at zero.

The question may arise as to why I adopted the circuits in their present compact form, since experience goes to show that the better separated the circuits are the quieter and more efficient the apparatus is.

My reply is firstly, that whilst it is true that well separated and distinct circuits are in general more effective, yet they suffer from the disadvantage of being more liable to influence, and be influenced by other apparatus that may be in operation close at hand, whereas when the circuits are arranged compactly, such influences are more easily controlled. Secondly, the space I have available for experimental apparatus is very limited. Thirdly, the particular circuits for the high frequency amplification, switching arrangements, etc., after considerable reflection seemed to offer the best all-round advantages, from the following points of view:—

Common H.T. and L.T. batteries with due regard to economy in the use of both according to signal strength.

Good selectivity if desired without the necessity of special reaction arrangements.

Easy alteration by means of inductive resistances or non-inductive resistances to render the high frequency amplification less critical in adjustment if required.

Absence of too many adjustments, thereby rendering the "picking up" of signals relatively simple.

In conclusion I wish to tender my thanks to Messrs. McMichael, Limited, for the loan of the tuner, the Amplion and batteries, and Mr. E. H. Jenkins, of the London Telegraph Training College, Limited, for the photographs.

As the instrument is largely my own work, I trust you will overlook any serious faults of mechanical construction.

(*A demonstration of the instrument was given after the lecture, a special transmission of telephony having been previously arranged.*)

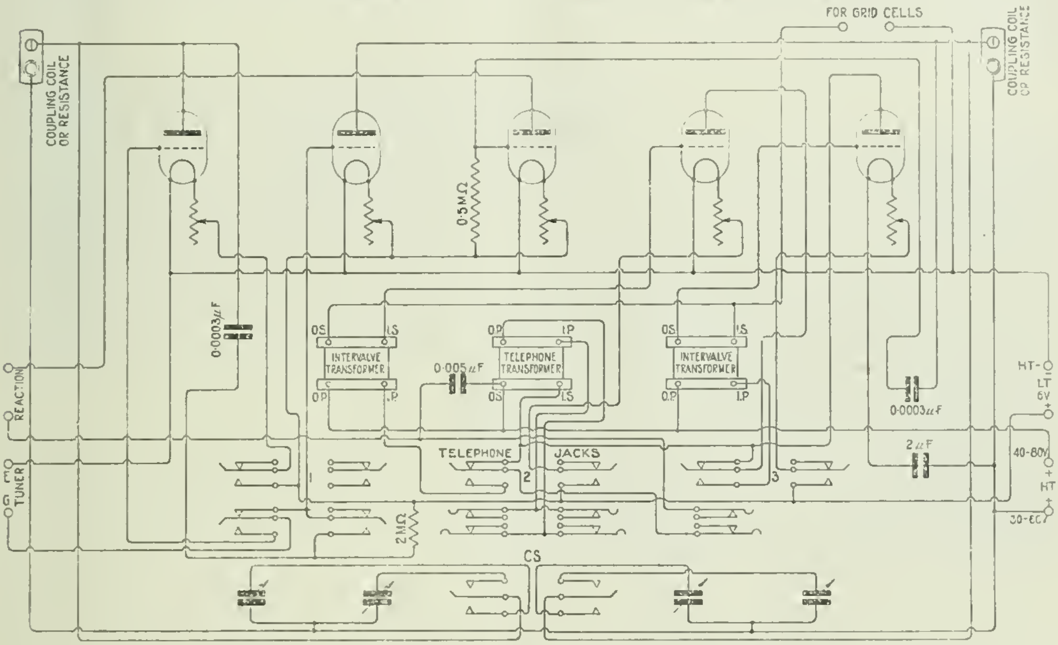


Fig. 4. Wiring Diagram, showing switching arrangements.

The next meeting of the Radio Society of Great Britain (formerly the Wireless Society of London) will be held on Wednesday, December 20th, at 6 p.m. at the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2.

Notes.

Sheffield University Appointment.

Mr. H. Lloyd, B.Eng., has been appointed Demonstrator in Wireless Telegraphy at Sheffield University.

Society Formed in Swansea.

Under the title of The Swansea and District Radio Experimental Society a new body of enthusiasts has been formed.

Geneva Wireless Exhibition Next Year.

At Geneva an international wireless exhibition is to be held early next April.

Sir John Cass Institute.

At the Sir John Cass Institute a wireless class is held.

Missionaries in Communication.

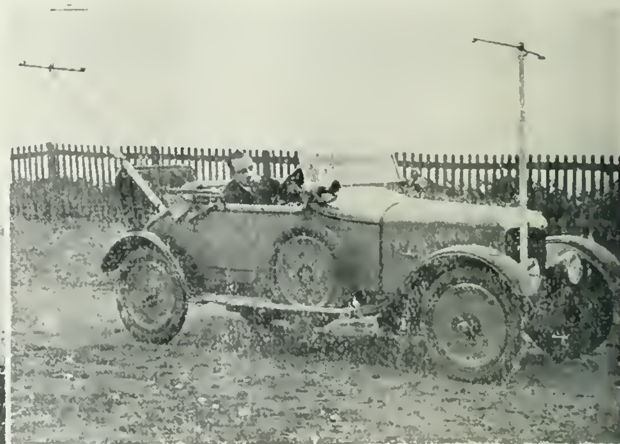
American missionaries in China who have hitherto been out of touch with their headquarters are installing radio apparatus.

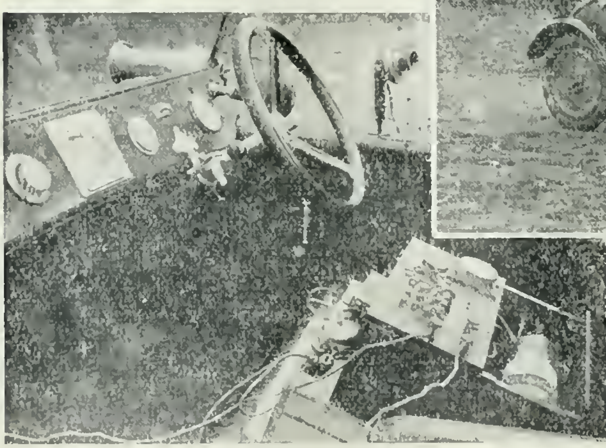
Wireless Co-operation at Sea.

Lecturing at the Dundee Technical College, Captain Brooke Smith, Marine Superintendent of the Meteorological Office, London, said that the essentials in a wireless report sent from a ship were firstly, the position of the ship; the barometer, corrected to sea level for a certain temperature and gravity; and the weather. It was absolutely essential to give the course and speed of the ship when broadcasting reports to other ships.

AUTOMOBILE EXPERIMENTS.

Mr. C. H. Gardner at Brooklands, with his car and apparatus aboard, with which successful transmissions were made during high speed on the track. Further experiments are to take place shortly.





Marconi R. Valves were used for transmitting. The receiver was of the four-valve type, 1 H.F., 1 detector and 2 note mags. On the car vibration caused a slight muffling of the speech.

Transmissions by Gramophones.

The Chairman of the Gramophone Company stated at a company meeting that the Board were satisfied that the present state of Radio science would not be likely to affect adversely the Company's business. The future might show influences upon the gramophone industry far other than prejudicial.

New Radio Concern in Belgium.

The formation in Brussels of the Société Belge Radio-Electrique is reported. We understand the share capital amounts to four million francs. The Société Générale de Belgique and other banks are interested.

"Ever Ready" Dividend.

"The Ever Ready Co." (Great Britain), Ltd., has declared an interim dividend at the rate of 7 per cent. per annum on both the preference and ordinary shares for the half-year ended September 30th, 1922.

Two Catalogues.

Two comprehensive catalogues have been issued by Messrs. R. Melhuish, Ltd., Fetter Lane, E.C. Also two new price sheets are now ready, one giving amendments to the woodworker's catalogue, and the other amendments to the metalworker's catalogue. The sheets are free to those who possess catalogues.

Northampton Polytechnic Prize Day.

Prize day at the Northampton Polytechnic Institute is December 1st. Dr. S. Z. de Ferranti will distribute the prizes at 7.30 p.m. There will be an organ recital preceding, and a conversazione for members and students following, to be continued also on the following day.

Police Installation.

Huddersfield Police Station is to have wireless apparatus installed, and members of the Force are to be instructed in its use.

Calendar of Current Events

Friday, December 8th.

Leeds and District Amateur Wireless Society.
At 7 p.m. Lecture and Demonstration on "Recording Apparatus," by Mr. A. M. Bage.

Belvedere and District Radio and Scientific Society.
Lecture on "Direction Finding," by Mr. G. N. Hurst.

Sunday, December 10th.

3-5 p.m. *Daily Mail* Concert from **PCGG** The Hague, on 1,050 metres.

Monday, December 11th.

9.20-10.20 p.m. Dutch Concert, **PCGG**, The Hague, on 1,050 metres.

Finchley and District Wireless Society.
Dance.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Lecture on "Elementary Valve Theory," by Mr. F. T. G. Townsend.

Manchester Wireless Society.
At 7.30 p.m. At Council Chambers, Houldsworth Hall. Elementary lecture No. 2, by Mr. Y. W. P. Evans.

Wireless Society of Hull and District.
At 7.30 p.m. At Signal Headquarters, Park Street. Paper by Mr. W. J. Nicholson on "Construction of Inductance Coils, Various Types."

Tuesday, December 12th.

Transmission of Telephony at 8 p.m., on 400 metres, by **2 MT** Writtle.

Wednesday, December 13th.

Streatham Radio Society.
At Streatham Hill College. Lecture and Demonstration on "Transmission and Reception of Infra Red Rays," by Mr. C. H. Roddis.

Malvern Wireless Society.
Lecture on "Tuning Wireless Sets."

Thursday, December 14th.

At 9.20-10.20 p.m. Dutch Concert from The Hague, **PCGG**, on 1,050 metres.

Hounslow and District Wireless Society.
At Headquarters, Council House, Treaty Road, Hounslow. Lecture on "Valves for the Beginner," by Mr. S. H. Nayler.

Ilford and District Radio Society.
Lecture by Mr. E. McT. Reece (of H. D. Butler & Co.).

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School, Luton. Exchange of Apparatus.

Derby Wireless Club.
At 7.30 p.m. At "The Court," Alvaston. Informal Meeting.

Hackney and District Radio Society.
Informal Meeting.

Friday, December 15th.

Bradford Wireless Society.
At 5, Randallwell Street, Bradford. Lecture by Mr. S. Davies (Dewsbury).

Belvedere and District Radio and Scientific Society.
Discussion on "The Difficulties Experienced by the Radio Amateur," opened by Mr. S. G. Meadows.

Leeds and District Amateur Wireless Society
At 7 p.m. At the Grammar School. Lecture by the Secretary, Mr. D. E. Pettigrew, on "Resistance, Inductance and Capacity in A.C. Circuits."

Durham City and District Wireless Club.
At 7.30 p.m. At the Y.M.C.A., Claypath. Lecture on "Wireless Telephony Transmitters Using Valves," by Mr. Geo. Barnard.

North-East Coast Institution of Engineers and Shipbuilders.
At 7.30 p.m. In the Lecture Theatre of the Literary and Philosophical Society, Newcastle-on-Tyne. Lecture on "Wireless Broadcasting and its Possibilities," by Mr. A. P. M. Fleming.

BROADCASTING PROGRAMMES.

Until further notice the following times will be observed for daily broadcast programmes :—

London : 6—6.30 p.m., News. 8—9 p.m., Music. 9—9.30 p.m., News. 9.30—10 p.m., Music. Wavelength 369 metres.

Manchester : 6—10 p.m., News and Music. Wavelength 385 metres.

Birmingham : 7—10 p.m., News and Music. Wavelength 425 metres.

Slight variations may occur and special transmissions take place from time to time.

BOOKS RECEIVED.

An Introduction to Radio. Vols. I and II. (New York : Wireless Press, Inc., 326, Broadway. Diagrams, 96 pp. (each). Price $1, two vols., in cardboard case, $5\frac{1}{4} \times 3\frac{5}{8}$.)

Cardiff Engineering Exhibition.

Mr. E. Ogden delivered an address on "Wireless Telephony" at a conference of engineers at the Engineers' Institute, Cardiff, during the Engineering Exhibition which has just taken place. The lecturer said that wireless was a matter of vibrations first and last, and wireless apparatus was constructed on the theory that every structure, had its vibratory motion. During the discussion Capt. T. Crompton, South Wales Post Office Superintendent engineer, referring to the regulations which had been made for amateurs, said a means had been devised of tracking down anyone who broke the regulations.

Proposed Society at Haslemere.

Mr. G. D. Frost, Fernden School, Haslemere, asks that communications in connection with a proposed Radio Society at Haslemere should be addressed to him.

A Berkhamsted Society Resolution.

We have been asked by the Secretary of the Berkhamsted Wireless Society to draw attention to the following resolution which was passed at a recent meeting :—

"That this representative meeting of the Society views with the gravest apprehension the inclusion of condition No. 2 on the Broadcast Licence, holding that it establishes a monopoly of the worst type ; that it is a menace to both the industrial and the scientific sides of wireless, and that it is a gross and unconstitutional interference with the liberty of the subject."

Radio Society of Great Britain.

(Formerly Wireless Society of London).

Report of Proceedings of the Fifty-First General Meeting held Nov. 22nd.

The fifty-first general meeting of the Radio Society of Great Britain (formerly the Wireless Society of London) was held on Wednesday, November 22nd, at 6 p.m., at the Institution of Electrical Engineers, London.

After the minutes of the previous meeting had been read and confirmed, the **President**, after referring to the list of 47 new members to be ballotted for and 20 newly affiliated Societies, said :—

Ladies and Gentlemen, this is a special general meeting. I suppose, using the ordinary company term, it would be called an extraordinary general meeting, and before we proceed to the lectures for the evening we have some resolutions to put before you which concern the Society only the members and associate members of the Society. The point is that we propose to change our name to the Radio Society of Great Britain, and I will ask Sir Charles Bright to put this forward.

Sir Charles Bright.

I have pleasure in being present at this meeting and am glad of the opportunity of giving my consent to the proposal to change the name of the Society. In the first place, as some of you perhaps know, His Royal Highness the Prince of Wales, when he expressed his willingness to become a Patron of the Society, said he understood that the name of the Society was to be changed to the Radio Society of Great Britain. Therefore my proposal is a definite resolution that the Wireless Society of London be in future known as the Radio Society of Great Britain. We have not yet got to the stage of calling ourselves The Radio Society of the British Empire, but no doubt the intention is that in time we should be represented in all parts of the Empire.

I want to say just a word or two about the history of the two names applied to the science and how they sprang up. The first name, the official name, was Radio. There was an International Radio Telegraphic Convention in the year 1905. Then there was a Radio Telegraphic Enquiry in the House of Commons in 1907, to enquire into whether Great Britain should join the International Radio Telegraphy Convention. Radio is the international name for a number of reasons. One reason is that the word "wireless" involves a word of more than one sense, and another good reason is that in the United States, where wireless is being developed more than in any other country, wireless is always talked about as "radiotelegraphy."

This change however, is sure to meet with opposition to some extent. It was perfectly natural that "wireless" telegraphy should be spoken of in a business way in the early days. The moment that Senatore Marconi (Mr. Marconi, as he was then) achieved those signals across the Atlantic the term "wireless" was used in contradistinction to cable telegraphy, to show that this could be done without wire at all. Now that radiotelegraphy is going to become so universally used as a result of broadcasting, the simultaneous communication between all parts of the Empire, is going to be enormously developed.

If "Radio" is to be our future name we should adopt the word "Radio" in everything, even although the last official committee would seem to be taking a retrograde step in calling itself The Wireless Telegraphy Committee.

Mr. E. H. Shaughnessy.

I have very much pleasure in seconding that the proposed alteration to the name and constitution of the Society should be adopted. With regard to the term "radio," Sir Charles Bright has fully explained the reason, or a good reason, why we should change the name. With respect to the latest Commission being called the Wireless Telegraphy Commission, it may be a retrograde step, but "wireless" is a popular term, and it will take time to kill. Moreover, the term "wireless," as applied to the Commission, was adopted some time back. In January of this year, at the Conference of Wireless Clubs and Societies, I suggested that the various bodies should no longer call themselves clubs. I made a remark about the "Harmonic Club," and suggested that some individuals sometimes only called themselves a club simply to draw attention to the harmonics from the various are stations of the Post Office. I am very glad to see that my suggestion on that occasion has fallen on fruitful soil. I further suggested that if they called themselves Radio Societies all over the country it would pave the way to having a British Radio Society. I see that that is also taking effect. I do not suppose anybody paid attention to what I said then, any more than you will now, but anyhow I am trying to get some credit out of it. The suggestion of your Committee that the Society should now be called the Radio Society of Great Britain is, I think, a very good one. The International or Inter-Allied Technical Conference last year in Paris were agreed that in the matter of nomenclature we should adopt the terms radiotelegraphy and radiotelephony rather than wireless, the advantage being that the terms are easily translated into French and other languages, and have been adopted by the Americans also.

There are other points to which a little attention might be given, and one is that the scope of the Radio Society of Great Britain should be widened ; that we should make room within our very large arms for those amateurs who are only beginning to be interested in the study of radiotelegraphy or radiotelephony, the suggestion that we have a new grade, a grade of Associates. By opening our arms in this way we hope to assist a very large number of people who will now take up ordinary broadcast receiving sets which are made and sold to them, and of which for some time they will be content to only turn the handles and get good signals or broadcast music.

There is not the slightest doubt about it that anybody who buys a broadcast receiving set will get good results. But he will get more than that, he will get an interest in radiotelephony—he will want to know more about it. He will first of all buy a crystal set, then perhaps a note magnifier, and for a time he will be entirely satisfied with the signals received. After a while he will become dissatisfied with the people who make these things. He will discover that these manufacturers are no good at all. There are quite a large number of them here, that is why I am saying it. He will turn round and say this is no good to me, I must have an experimenter's licence.

We hope, as the Radio Society of Great Britain, to bring these people here to this hall, to fill the halls of our branches and affiliated societies by getting them interested in the subject. We shall educate them, and give them, if necessary, a series of lectures which will gradually lead them into the path of rectitude in respect to non-interfering properties. Our own amateurs are just as bad in that way, I am sorry to say, and one has only to sit and listen now to find out how bad things really are.

But we do hope and trust that the old members—those who know all about the subject—will, by their good example, show these people that we are really an orderly crowd, and are not hooligans, although we are reputed to be such. We do want, nevertheless, to gather in the new comers and keep them with us, and a very large percentage of them we want to become in due course full members. I think, also, that everybody who has an experimental licence ought to be a member of some Society, either of some London or provincial Society, because if he is, he will get duly roasted if he misbehaves himself, and he will learn to appreciate that he is not the only person with a receiving set. At the present time you may be quite sure that the hundreds of thousands of people who buy sets for broadcast reception will go for you experimenters when they find their reception is interfered with, and you are making a warm place for yourselves by admitting them. Nevertheless, it is a right, proper and bold move, and I hope that this meeting will see its way clear to support the Committee and adopt the proposed changes which have been put before you.

The President.

Ladies and Gentlemen, it has been proposed and seconded that our name in future shall be the Radio Society of Great Britain, and that we shall admit Associates to the Society.

(*The resolutions were then put to the meeting and carried without dissent.*)

Mr. I. Davidson.

I do not know whether it is permissible to make any comments at this stage, after the proposing and seconding of that resolution. If I am in order in saying a few words, I will be grateful.

The President.

Please do so.

Mr. I. Davidson.

The illness that we are all suffering from of listening-in has become very, very contagious, to the benefit of a great number of men who have to make excuses for not going out at night, I am told. But we have, I believe, a far greater task in front of us. Although I have only been a member just as long as it has taken for the ink to dry, I have watched the Society for many years, and have been impressed from the outside point of view altogether. I feel that to-night you are taking a great step forward to broadcast the name of this Society all over the world, and I would like to throw out a suggestion. This Society has a work in front of it, in inciting men all over this country to give their brains and ambition to inventions which are going to keep the name of this country at the top of the tree so far as radio work is concerned. I suggest that this Society gives a medal every year, to be known by some name which can be coined for it. That medal need not necessarily be of gold studded with diamonds, but it can be the Radio Medal, and I venture to suggest that that medal will become one of the most coveted possessions of wireless men in this country. There are, as you know, many medals and prizes given all over the continents of Europe and America. One of the most celebrated is an ordinary bronze medal which carries with it a very great distinction, and I believe it is a medal presented to the men who find out the best things in connection with the petroleum business during the year. I do not wish to put this forward as a resolution. I feel that it is a matter which should be considered by the Committee and members of this Society.

The President.

I thank you very much for the suggestion, which shall certainly receive very careful attention.

We have here a gentleman from the United States, a member of this Society, Mr. Sleeper, well known in the United States for his connection with radiotelegraphy. I will ask if he would like to make any remarks.

Mr. M. B. Sleeper.

There is just one little matter that I would like to feel that I have brought up, and that is a correction of the idea that radio men here seem to have concerning broadcasting in the United States. Broadcasting was being discussed here when I was over last summer, and I do not think the discussion is over yet. I have been told by some of your men that the delay here is for the purpose of avoiding the chaos which has existed in the United States. I have been here for about ten days and I really do not know much more about radio conditions in England, at least so far as what can be done, than I did when I got here. I have found out much about the things which cannot be done here.

To give you an idea of what radio broadcasting is in the United States I may say that New York City, which, as you can imagine, is the centre not only of the broadcasting interest but of the manufacture of the bulk of the apparatus sold in the States. There are several thousand amateur transmitters in a radius of 25 miles of New York City.

We have at least half-a-dozen broadcasting stations of what we call high power. (We have no broadcasting stations of more than ½kW.)

The broadcasting stations open up when the stores do at 9 o'clock, and operate every hour, so as to give demonstrations in the stores round the country until the evening at 7 o'clock when the transmissions are continuous until 12 p.m. With an ordinary regenerative receiver and a two-step low frequency amplifier at least a dozen different stations giving different kinds of programmes can be heard separately without interference from any other station. More than that, if a man wants to entertain friends with popular music or vaudeville performances, he tunes to 360 metres. If his taste is somewhat more elevated, he changes to 400 metres and has classical music, lectures, and various things of an educational nature.

I had a letter, just before I came away, from a man in Texas who, using a regenerative receiver and two-stage low frequency amplifier, heard in one evening without interference 37 different stations in 25 different cities, from the Pacific coast to New York City. You can imagine that when it is possible to do things like that (and it is nothing exceptional) we have not really got the chaos that is talked about over here in England.

There is another thing which may interest you, especially in view of the fact that broadcasting here is supported largely by royalties paid by holders of broadcast receiving sets. We were selling enormous quantities of these complete sets, but now a return of sales shows that for every dollar's worth in complete sets ten dollars worth of parts are sold. In other words, our figures go to show that since the public became familiar with the operation of radio equipment they are either thoroughly interested, and have turned radio experimenters, or else they have tired of just the broadcasting itself and dropped radio altogether. My impression of the English mind is that it is much more receptive to experimental work than the American mind, and development will surely come in this direction just as it has in the States.

(*To be concluded.*)

New Records in Transatlantic Reception.

A REMARKABLE ACHIEVEMENT BY BRITISH RADIO AMATEURS.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

During the last few days reports have reached us of the reception in this country of telephony from American broadcasting stations. These receptions do not represent merely an isolated reception by one amateur only, but several simultaneous receptions in different parts of the country. The transmission conditions across the Atlantic during the week-end, November 26th to 27th, must have been exceptionally good for such complete reception as is indicated in one of the reports in particular to have been effected. This good transmission is also emphasised by the number of American amateur stations which were also fished up during the same period. Some particulars of these will be found set out below, under the report of the receptions of the preliminary tests recently conducted by the American Radio Relay League.

A summary of the reported receptions of American broadcasting stations follows :—

Chas. M. Denny (Babington, Cheshire), using a single-valve receiver :

> November 23rd. 0555 G.M.T., heard very clear telephony on 360-370 metres for a period of about half an hour, apparently of American origin.
>
> November 24th. 0100 to 0140 G.M.T. Signals from apparently the same station as above were again intercepted. These included three consecutive items of a musical programme : A humorous item by a comedian ; a long orchestral selection ; a dialogue between a comedian and a "coloured" gentleman.
>
> Transmission continued until 0630 of weaker strength. During this transmission another one sending a musical programme was faintly audible on a slightly shorter wavelength.

J. H. P. Ridley (South Norwood), using two H.F. valves, followed by a detector and one L.F. valve :

> November 26th, from 0105 to 0331 G.M.T. Signals were heard from "WJZ New York Broadcasting Station." [Note : Newark, the location of WJZ, has probably been mis-read as New York.—Ed.]. The entire programme between these hours was stated to have been heard and understood. Between 0300 and 0315 the strength of the signals increased very considerably, and they were eventually read 12 feet from the telephones.

E. H. Wilding (Wigan, Lancs), using a detector valve with three L.F. valves :

> November 27th, between 0130 and 0300 G.M.T., signals were heard from WJZ New Jersey. During the programme the following items were intercepted :—
>
> Organ recitals including notes on the life-history of several well-known composers, followed by extracts of their works on an organ.

By far the most complete report has been received from :—

R. E. Williams (Holyhead), using a detector valve with 2 L.F. valves, and coils temporarily and roughly joined up for a test :

> November 26th, 2340 G.M.T. to November 27th, 0324 G.M.T., a continuous programme from WJZ was intercepted. The following is an abbreviated summary of the main items of the programme which were reported :—

2340 (Nov. 26th) Speech just audible.
0015 (Nov. 27th) Speech, apparently historical.
(G.M.T.) "Napoleon was a great warrior . . . ." etc., followed by speech by a lady which was badly jammed.

Parts of a sermon were next heard, the speaker repeatedly emphasising the word "courage," in such phrases as "The Israelites passed through the Red Sea as by dry land—Courage !—and went through to the land of milk and honey—

0055 (Nov. 27th)	Courage!" Sermon ended with the words "God made man, and there is nothing wrong with anything God made. Good night."
0100	Overture, "Poet and Peasant," by ——— Organ Co., of New York City, followed by other very good items.
0139	"Land of Hope and Glory."
0158	End of orchestral performance.
0202	"WJZ WJZ Please stand by."
0205	Soprano solo with piano accompaniment.
0209	Soprano solo with piano accompaniment.
0211	Baritone solo.
0215	WJZ WJZ New York City. [Probably misread from Newark.—Ed.]
0217	Piano solo, "Kentucky Home."
0229	Soprano solo, piano accompaniment.
0233	Soprano solo, "Until" (received exceptionally well).
0237	Soprano solo, piano accompaniment.
0240	Baritone solo, piano accompaniment.
0243	Baritone solo, piano accompaniment.
0247	Speech or recitation.
0255 to 0330	Clock ticks—Arlington time signals.
0303	Speech, apparently weather report.
0307	Dramatic recitation.
0324	"This is WJZ WJZ . . . . . . Corporation—We are switching off. Good night."

It should be noted in connection with the above that the call letters WJZ have been variously misread as WJB, WJD and WJG. This difference probably arises from the American pronunciation of the letter "Z" as "Zee," not as "Zed," as it is usually called in this country. There seems little doubt, however, that WJZ is the correct call in each case.

THE TRANSATLANTIC TESTS.

Report of some Receptions of the Preliminary Tests.

As was announced in these columns a short time ago, preliminary tests were conducted by the American Radio Relay League between October 26th and November 4th, in connection with the Transatlantic tests which are to take place in December. These preliminary tests were intended to enable the American transmitting stations to determine definitely those of them which could transmit signals over at least 1,200 miles. Those stations which succeeded in these preliminary tests will be allotted individual transmission times in the main tests.

Several reports have been received from amateurs in this country showing that they have picked up some of the American stations during these tests. These reports may be summarised briefly as follows :—

C. L. Naylor (Shrewsbury).

Date.	*Time.*	*Stations heard.*	*Apparatus Used.*
Oct. 27th	0348	2 ZK	2 H.F. detector and 2 L.F. valves.
	0353	2 HJ	
Oct. 29th	0548	2 ZK	2 H.F. and detector, just audible on 1 H.F. and detector.
Oct. 29th	0553	2 AJL	2HF and detector.

All above transmissions were sending "Test Test Test de (call letters)" for 15-minute periods.

Aerial used—40 ft. long, 2 wires spaced 5ft. 6 ins. lead-in 20 ft. long, height at open end 35 ft.

W. R. Burne (Manchester).

Oct. 29th	0537	1 CX	
		Also an eighth district station but call letters jammed.	

J. H. D. Ridley (South Norwood).

Oct. 29th	0548-0601	2 ZK	1 H.F., detector, and 1 L.F.
Oct. 29th	0553	2 HJ	(Signals read 18 ins. from telephones.)
		Also a fifth district station, but call letters jammed.	
Oct. 31st	—	9 CTE	Same apparatus.

B. L. Stevenson (Manchester).

Oct. 28th	0210	5 AD (Doubtful)	2 H.F. detector, and 1 L.F.

Since the conclusion of the preliminary test sundry other reports have also been received of the reception of American amateur stations, of which the following may be quoted :—

Manchester Wireless Society.

Nov. 19th	23 American amateur stations heard.
Nov. 23rd	22 American amateur stations heard.
Nov. 26th	36 American amateur stations heard.

C. M. Denny (Cheshire).

Nov. 23rd	0555 0620	Continuous pianoforte selection, apparently of American origin. Wavelength, 360-370 metres.

F. W. Higgs and J. F. Hobbs (Bristol).

Nov. 26th	0400 0430	1 ZE, 2 AIM, 8 ATU (or 8 AX), 2 ,QR 8 BFM, 1 AFB, 2 AGC.	1 H.F., detector, and L.F. valves.

W. E. F. Corsham (London, N.W.10).

Nov. 26th	2345	2 AWF (working to 1 XM.	1 H.F., detector, and 2 L.F. valves.
Nov. 27th	0010	2 AWF (stronger and steadier than above).	Do.

J. H. D. Ridley (S. Norwood).

Nov. 26th	1 CMK 1 XU 2 AWL (calling 5 LV and 9 ZY) 2 LM 8 BPL (calling 4 XY) 8 ATF 8 AQO (calling SMS) 8 XAK (sending weather report) 9 LG	2 H.F., detector, and 1LF. valve.

B. L. Stevenson (Manchester).

Nov. 26th	1 AZW 1 BDI 1 CDO 1 CXX 1 ZE 2 AHO 2 CPD 2 EL 3 BG 4 FT 7 AQO 8 XE Also following probable (calls slightly uncertain) 2 CGU 2 CO 2 FP 4 BIJ 8 AJ 8 OT	2 H.F., detector, and 1 L.F. valves.

In the early mornings of November 23rd, 24th, 26th and 27th, American broadcast stations were picked up in this country by at least three amateurs as reported elsewhere in this article.

Final Details, concerning the Reception Tests from America.

The first part of the Transatlantic Communication Tests are due to commence a few days after the publication of this issue of *The Wireless World and Radio Review*. During ten nights, commencing at midnight, December 12th, the American and Canadian radio amateurs will transmit signals, which will be listened for by British, French and Dutch amateurs.

The six-hours signalling time from midnight each night will be divided up into 15-minute periods, some of which will be allocated to "free-for-all" signalling, and the remainder to individual transmissions. At the time of going to press the complete list of these transmissions, with their wavelengths, etc., has not yet been received from the American Radio Relay League, so that on receipt it will be circulated by post to all who have registered their names with the writer, as desirous of listening for these signals.

All others not specially listening for the signals are again urged not to use their sets (transmitting or receiving) during the times of the tests in order to lessen the interference. All actual listeners are again urged to avoid radiation from their aerials, since there is already so much interference on these short wavelengths from the harmonics of high power stations that all additional sources of interference need to be eliminated.

The success already achieved in picking up the preliminary tests of the Americans (as reported elsewhere in this issue) augurs well for the success of these main tests if the transmission conditions across the Atlantic prove at all favourable.

Everyone hearing signals which appear to be of American amateur origin is requested to send **full details,** including all code words, etc., at once to the writer of this note, whenever possible, by telegraph or telephone, so that reports may be sent back to America as expeditiously as possible, through the medium of the special daily transmissions, which have been arranged for Carnarvon, MUU, at 0700 G.M.T., each morning.

The codes to be used in these daily reports from Carnarvon, MUU (and by the French from Sainte Assise, UFT, at 0710 G.M.T. each morning), are set out below. In the case of any reports to the writer by telegraph, the English code below should also be used.

English (American).		*French.*	
A	Able	A	André
B	Boy	B	Berthe
C	Cast	C	Camille
D	Dog	D	Denise
E	Easy	E	Emile
F	Fox	F	François
G	George	G	Georges
H	Have	H	Henry
I	Item	I	Irène
J	Jug	J	Jeanne
K	King	K	Képi
L	Love	L	Louis
M	Mike	M	Marie
N	Nan	N	Noémi
O	Oboe	O	Octave
P	Pup	P	Pierre
Q	Quack	Q	Quimper
R	Ram	R	René
S	Sail	S	Suzanne
T	Tare	T	Thérèse
U	Unit	U	Ursule
V	Vice	V	Victor
W	Watch	W	Wagon
X	X-Ray	X	Xavier
Y	Yoke	Y	Yvonne
Z	Zed	Z	Zoé

These codes will be used in reporting all call letters of stations, using the appropriate words to replace the letters, thus :—

The call letters of the station 6BKV, for example, will be sent as—

Six Boy King Vice

in any reports from this country or from America ; and as

Six Berthe Képi Victor

in reports from France.

Transmissions from Europe.

The periods for these transmissions, which will be made between December 22nd and 31st, have now been arranged. Further particulars will be published next week, and all who have notified their names and signalling records will receive by post full particulars of the times of transmission and what is to be sent on each occasion. These details will be sent out a few days before the commencement of the transmission tests.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of* 1s., *or* 3s. 6d. *for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"GRID" (Kent).—We think you will experience no difficulty from induction if a frame aerial is used, and we suggest you use a five-valve set, 2 H.F., 1 detector, and 2 L.F. valves. Circuits are given in recent issues.

"W.G." (Sheffield).—(1) We suggest you cut out the lamp and make the connection directly with the set. No trouble is likely to be experienced. (2) It is immaterial whether the windings are wound on in opposite directions or in the same direction. If two wires are wound on together, of course they will both be in the same direction. It does not matter which you call the primary or secondary in this case.

"AMATEUR" (St. Albans) *asks* (1) *For criticism of his circuit.* (2) *What stations he should get.* (3) *How to add valves to his set.*

(1) It would be much better if you provided a switch to connect the A.T.C. and A.T.I. in series or parallel. The variable condenser in your sketch is marked 0·003. This should be 0·001 when in series. (2) You should hear broadcast stations, high power stations, and local amateur transmissions. (3) See Fig. 1.

"T.D." (Walthamstow) *asks for a diagram showing how to connect up four valves with switches.*

The diagram given on page 883, September 30th issue, gives the principle of switching, and you will have no difficulty in applying the principles to four valves.

"B" (Taunton).—We suggest you use transformers up to 2,000 metres or less, and above this use the resistance capacity method of H.F. amplification. However, if you prefer to use the H.F. transformer method for all wavelengths because of ease in operation, good results will still be obtained. (2) The proposed method of interlinking the switch handles is quite satisfactory, and you should experience no trouble in use. (3) See Fig. 3, page 839, September 23rd issue. (4) The station is probably working at high speed, and we cannot identify from your description the station to which you refer.

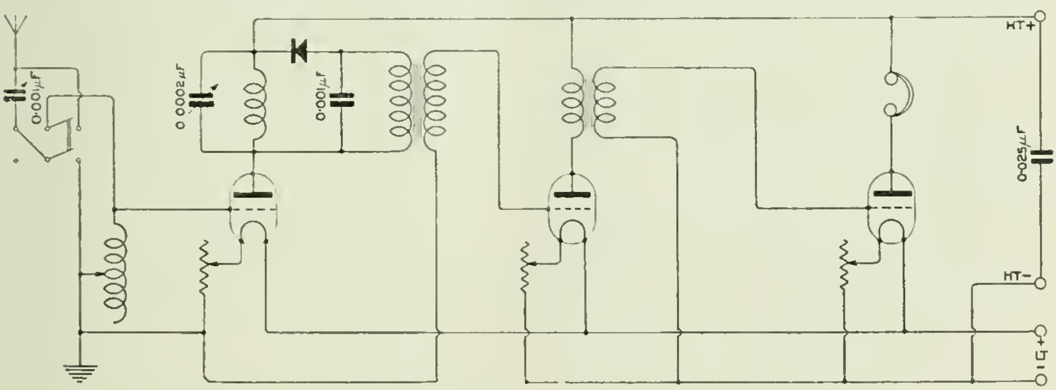


Fig. 1.

"H.W.C." (Bedford).—(1) The moving plates are usually connected to the earth side. (2) It is general to connect the headsets in parallel, but you may get a little better results if they are joined in series. (3) The construction of a variable condenser is described on page 583 August 5th issue. You will require 25 plates altogether.

"OMNIA VINCIT" (Huddersfield) *asks* (1) *The formula for calculating the capacity of cylindrical condensers.* (2) *Formula for calculating the capacity of plate condensers.* (3) *Gauge and covering of enclosed wire.* (4) *For criticism of his aerial.*

(1) If the distance between the cylinders is small compared with the radius, the capacity in cms. per unit length is $C \text{ cms} = \dfrac{\frac{1}{2}K}{\log_\epsilon \frac{r_2}{r_1}}$

when k_2 is the constant of the dielectric between cylinders and r_1 and r_2 are the radii of the inner and outer cylinders. (2) The capacity of a parallel plate condenser is given by C cms. $= \frac{NKA}{4\pi D}$ where N = the number of plates K = the dielectric constant, A = the area of one plate in sq. cms., and d = the distance between the plates in cms. (3) The sample of wire submitted is No. 44 S.W.G. enamel covered. (4) We prefer the second proposed arrangement, as the aerial will then be as long and high as circumstances permit.

"**P.T.H.**" **(Highgate)** *asks for a design of a two-valve panel.*

See Fig. 1, page 181, November 4th issue. As you only require the first two panels, the telephones should be connected across P.P. in place of the transformer. The basket coils are recommended side by side, with a ⅛" space between each, and simply take the place of the honeycomb coils shown in the figure. The panel in your possession is quite suitable if you add a few more terminals.

"**J.T.L.**" **(Anerley)** *refers to the reply to* "**C.B.**" **(Liverpool)** *in November 4th issue, and asks the size of the coil in the anode circuit.*

The coil to which you refer, together with the variable condenser connected across it, constituted a tuned anode, and is tuned approximately to the wavelength of the aerial circuit, therefore the coil should be about the same size as the aerial coil.

"**C.S.S.**" **(Co. Durham).** The brushes in the machine should be examined and sparking stopped. A large condenser of say, 2 mfd., should be connected across the mains, or better still, two should be joined in series and the centre connection joined to earth. If this does not reduce the noise, choke coils should be connected in the leads from the machine after the condensers.

"**P.D.**" **(Norfolk)** *asks several questions.*

(1) and (2) We are unable to state the times of transmissions. It must be remembered that this journal goes to press several days before the date of issue. (3) "B" goes to grid.

"**A.E.J.**" **(Acton)** *wishes to make a short wave tuner, and asks* (1) *and* (2) *The size of former and wire and number of tappings.* (3) *Particulars of the condensers.* (4) *Particulars of the reaction coil.*

(1) and (2) The A.T.I. may consist of a coil of No. 22 D.C.C. wound on a former 3" and 5" long, with 12 tappings. The C.C.I. may be a coil of No. 26 D.C.C. 2½" diameter and 6" long, with 6 tappings. (3) The A.T.C. should have a maximum value of 0·001 mfds. The fixed condenser across the telephone should have a value of 0·001 mfds. (4) The reaction coil may be 2" diameter and 4" long, full of No. 28 D.C.C. with 4 tappings.

"**G.H.**" **(Gothenburg)** *asks* (1) *For a design of a six-valve set using switches.* (2) *The number of turns to wind on a 2" former for H.F. transformer to tune from* 500 *to* 3,000 *metres.* (3) *How to connect a switch to provide a "tune" and "stand by" position.* (4) *Criticism of his loud-speaker.*

(1) The diagram on page 883, September 30th issue, shows the principle of switching, and this can be applied to any number of valves. (2) You will require coils of 250, 600 and 1,000 turns each. (3) See Fig. 2. (4) The principle of the loud speaker is correct, but you will probably find adjustments difficult to make, and we suggest you purchase one.

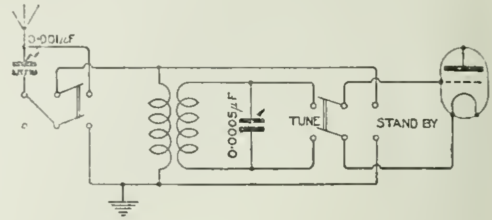


Fig. 2.

"**SUPER**" **(Blackpool).**—Yes. You may use the coil holder and duolateral coils in place of the coils shown in the article referred to.

"**H.M.**" **(Cheshire).**—(1) The reaction coil has a variable coupling with the tuning inductance and the tuning of coils L3 and L4 is carried out with the tuning condenser. (2) The frame aerial could consist of 15 turns of No. 18 D.C.C. wire wound on a former 3' square. The wires should be spaced ¼" and tappings should be taken to a switch. (3) The wavelength range of the set is approximately from 250 metres to 750 metres.

"**V.E.**" **(Lancaster).**—(1) The circuit is quite suitable if you propose receiving on long wavelengths, but of course the resistance capacity method of amplification is not a good one to apply when receiving on short wavelengths. We suggest you use the tuned anode method on short wavelengths and reserve the resistance capacity method for wavelengths above, say, 2,000 metres. The suggested values of components are correct.

"**SUPER**" **(Felixstowe)** *asks* (1) *For particulars of an iron choke.* (2) *Where he can obtain* 12,000 *ohms resistance.*

(1) The choke could very well consist of an old L.F. transformer rewound with No. 38 S.S.C., or you could construct one to the following dimensions:— Core, 3" long, ½" diameter; iron wire, winding 10,000 turns No. 34 and S.S.C. (2) You may be able to purchase a resistance of 12,000 ohms from one of the advertisers in this journal, or you could construct one yourself, using No. 38 Eureka resistance wire. You will require about 1,500 feet of wire.

"**C.E.L.**" **(Yorks).**—We think your queries are all answered in the concluding portion of the article to which you refer.

"**BELL-RINGER**" **(Walsall).**—(1) You cannot add another valve and crystal without using more apparatus, and in any case you will require more apparatus because the reaction coil is coupled to the aerial coil, which is very bad practice. (2) It would not be necessary to increase the H.T. voltage. (3) You will receive the stations named very well. We suggest you see the replies to querists whose problems are similar to your own.

"VARIO" (Merthyr) *asks* (1) *For particulars of a variometer.* (2) *For a diagram of connections.*

(1) Particulars of a variometer which is quite suitable for your purpose were given in reply to "INTERESSE" (Brussels). (2) See Fig. 3. You will not need to tap the variometer.

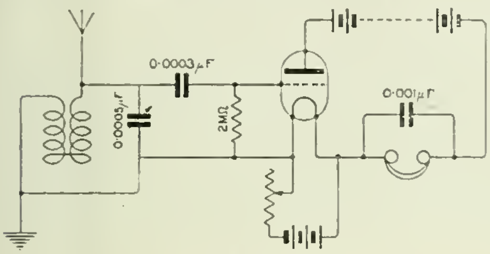


Fig. 3.

"TRAHTLOSE" (S.E.) *asks* (1) *Wavelength range of set.* (2) *Correct method of tuning in signals.* (3) *Wavelength range of set of coils.*

(1) The wavelength range is probably from 100 to 500 metres. (2) You should use one crystal combination at a time. With the switch in "stand-by" position, adjust the tuning condenser. When signals are heard, switch over to "closed circuit," and tune secondary to primary. (3) We think the wave range will be from 100 metres to 20,000 metres.

"NAUTA" (Plymouth) *asks* (1) *What licence is required before a receiving set can be installed in a yacht.* (2) *Whether a crystal set will be satisfactory.* (3) *Most suitable aerial.*

(1) We suggest you write to the Post Office, London, stating your requirements. (2) A crystal set will only give limited results, and we think for any results at all you will need valves. (3) The (*b*) scheme is the better arrangement, and we suggest you use 3 valves, 1 H.F., 1 detector and 1 L.F., using any of the recent three-valve circuits.

"EX R.N." (Chard) *asks* (1) *Whether* 3″ × 3″ *of No.* 20 *D.C.C. will give* 430 *metres with* 0·005 *mfd. in series.* (2) *Would the above coil give* 1,230 *metres with the condenser in parallel.* (3) *Would a coil* 2½″ × 1″ *of No.* 28 *D.C.C. give* 630 *metres with* 0·0005 *mfds. in parallel.* (4) *Whether his calculations are correct.*,

(1) The inductance of the coil is 300 microhenrys. The capacity in the circuit (0·0002 mfds. in series with 0·0015 mfds.) is about 0·00018 mfds. The wavelength, therefore, is about 460 metres. (2) It will give about 1,270 metres. (3) The inductance of this coil is 230 microhenrys with 0·0005 mfds. in parallel, the wavelength is 650 metres. (4) Your figures are roughly correct—near enough for practical purposes.

"W.N.G." (Dovercourt) *asks several questions about his set.*

(1) We suggest you abandon the single valve reaction circuit, as interference is so often caused when oscillatory energy is transferred to the aerial circuit. (2) Suitable valves have appeared in several recent issues, and you should choose whichever appears most suitable for your purpose. (3) "B.Q." is used in acknowledging a repetition, and is an operating signal employed by the companies concerned. (4) There is no single valve circuit which will give results without reaction equal to the results obtained with reaction.

"F.G.P." (Essex) *refers to the Armstrong super-regenerative circuit described in the issue of September 2nd, and asks several questions.*

(1) The arrangement you suggest will work, but when constructing a set of this description, it is better to follow the instructions exactly. (2) All coils do not require to have variable coupling with each other. (3) The correct value is 0·0005 mfds. (4) See recent replies.

"CALPO" (Gibraltar) *asks* (1) *Whether two coils are suitable.* (2) *The identical values of the coils.* (3) *and* (4) *The number of tappings and capacity of variable condensers.*

(1) The coils are quite suitable. (2) The induction of the coils is 7,000 microhenries and 11,000 microhenries. (3) and (4) We suggest you take 10 tappings from the primary coil and 6 from the secondary coil. The A.T.C. should have a maximum value of 0.001 mfds., and the secondary tuning condenser 0·0005 mfds.

"C.L.H." (Godalming) *asks* (1) *How to connect a switch to change from H.F. transformer to reactance capacity.* (2) *Where to couple the reaction when making use of an intervalve set.*

(1) It is the usual practice to connect the grid leak between grid and filament, and not to join the grid leak across the grid condenser as you suggest. A switching arrangement is given on page 129, October 28th issue. (2) The reaction coil should be coupled to the grid winding of the H.F. transformer coupling, the anode circuit of the first valve to the grid circuit of the second valve. Several diagrams have recently been given showing this method of coupling the reaction coil.

"OZONE" (London, W.) *asks questions about the four-valve set described by P. W. Harris in this journal.*

The author described a simple arrangement for coupling the reaction coil to the anode coil in the issue of November 25th, page 274.

"E.A." (Durban).—We suggest you wind a number of basket coils, the smaller coils having 60 turns and the larger 100 turns. About six will be required, and you should join them in series, taking the tappings to a switch.

"X.B.S." (Yorkshire) *asks* (1) *Whether a crystal detector can be fitted to the broadcast receiver described in the issue of August 26th.* (2) *The name of a firm who sells Litzendraht wire.*

(1) See Fig. 4. (2) We suggest you communicate with a firm of wire manufacturers.

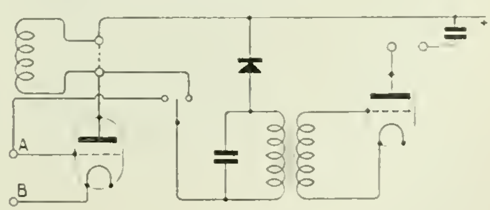


Fig. 4.

"W.S.F." (Ealing) *asks* (1) *How to obtain a supply of filament current or plate current from*

A.C. 50 cycles mains. (2) *If the A.C. supply will cause disturbances.*

(1) and (2) It is very difficult to utilise a 50 cycle A.C. supply for the anode and filament supply of a receiving set. The A.C. may be stepped down with a transformer for heating the filaments, and passed through rectifying valves, and a smoothing system for use as the anode supply, but the hum will be so serious that reception of signals will be practically impossible, and we do not recommend you to adopt this method.

"GATRA" (Finchley) *asks* (1) *How to modify the reaction arrangement on his set, and asks for particulars of short wave coils.* (2) *Whether a reduction in signal strength naturally follows the adoption of reaction coupled to the H.F. transformer.* (3) *Whether a Brown telephone relay can be used to work a Morse inker.*

(1) We suggest you wind a former 4″ diameter and 5″ long full of No. 22 D.C.C., and take 10 tappings for the aerial inductance. The closed circuit coil should slide in and out of the aerial coil, and may consist of a former 3″ diameter and 6″ long, wound full of No. 26 D.C.C. with 6 tappings. The A.T.C. and A.T.I. should be in series when tuning short wavelengths. The reaction coil, as you propose, should be made exactly as described in the article, "Experimental Station Design," September 2nd issue, page 717. (2) No reduction in signal strength will follow the adoption of this method of coupling the reaction coil, and the advantage is oscillating energy cannot be transferred to the aerial circuit. (3) Very probably you will be able to work a morse inker in the way suggested.

"C.W.H." (Wolverhampton) *asks* (1) *Gauge of sample of wire submitted, and whether it is suitable for wiring 120 ω. telephones.* (2) *For criticism of set.*

(1) The wire is No. 46 enamelled copper, and is too fine for the winding of a 120 ω. telephone transformer. (2) We consider a combination of 1 H.F. and 1 detector valves superior to the combination of valve and crystal to which you refer.

"C.M.K." (Staffs) *asks* (1) *If the circuit submitted is a good one.* (2) *If we will modify the circuit and include switches.* (3) *If certain coils are suitable.* (4) *If with his set he could use a loud-speaker.*

(1) The circuit submitted is correct. (2) We suggest you wire switches according to the diagram on page 883, September 30th issue. (3) The coils suggested will do very well. (4) You will amplify local amateur transmissions and broadcast stations sufficiently to usefully employ a loud-speaker. With reference to your final remarks, a large number of receiving sets, especially designed for use on broadcast wavelengths have recently been described in this journal.

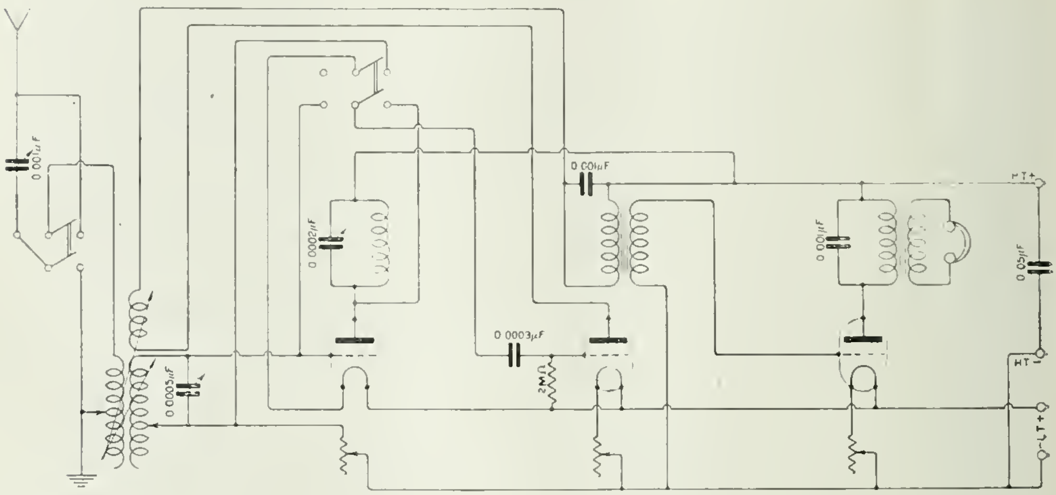


Fig. 5.

"W.G.P." (Birmingham).—A suitable arrangement is shown in Fig. 5. The switch is of the double pole change-over type. When in the right-hand position, the H.F. valve is connected in circuit, and is cut out of circuit completely when in the left-hand position.

SHARE MARKET REPORT

Prices as we go to press on December 1st, are :—

Marconi Ordinary	£2	4	0
,, Preference	2	1	0
,, Inter. Marine.. ..	1	7	0
,, Canadian		9	6

Radio Corporation of America :—

Ordinary	16	7½
Preference	13	0

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

No. 174 [No. 11 Vol. XI.] DECEMBER 16TH, 1922. WEEKLY

The Birmingham Broadcasting Station.

By E. M. Deloraine, Ing.E.P.C.I.

In a recent issue of *The Wireless World and Radio Review*, an announcement appeared to the effect that the Birmingham Broadcasting Station had started transmitting music, news, etc., on November 15th.

The radio equipment used has been designed and built by the Western Electric Co. It is for the present installed at the Witton Works of the General Electric Company, pending the selection of premises for the permanent station of the British Broadcasting Company in Birmingham.

Fig. 1.

The Western Electric Broadcasting Set is designed to deliver 500 watts of radio frequency power to the antenna. As there are some novel features in the design and arrangement of this set, a general description of the present installation may be of interest.

Power Supply.

The power supply is obtained from a three-unit motor generator set consisting of high and low voltage D.C. generators, coupled to a driving motor. The three units are mounted on a common base-plate. (Shown to the left in Fig. 2.)

The main supply is 460 volts D.C.; an automatic starter is used, and provides for starting and stopping by the mere operation of a press button. The driving motor develops 4 H.P. at a speed of 1,750 r.p.m.

The high voltage generator is a direct current shunt wound machine with two commutators designed to deliver continuously 1·25 amps. at 1,600 volts pressure. This is to supply the plate circuit of the transmitting valves. The field excitation current for the high voltage generator is supplied by the low voltage generator.

The low voltage generator is a direct current shunt wound machine, designed to deliver the filament current for the valves, *i.e.*, 28 amps at 14·5 volts pressure, plus the current for the excitation of the high voltage generator field. The low voltage generator is self-exciting and its potential is regulated by means of a field rheostat on the control panel. Both generators are designed so as to reduce to a minimum the commutator noises in the radio transmission.

Control Panel.

The control panel includes the voltmeters for the low and high tension generators, the switches for controlling the field circuit of the high voltage generator, the plate current supply, and the filament current supply. (Centre Fig. 2.)

A circuit breaker is also included in the plate current supply and works with an overload of 25 per cent.

Transmitting Unit.

The transmitting unit (shown to the right in Fig. 2) is essentially a generator of radio-frequency energy, with means for modulating this energy in accordance with the complex sound vibrations, which are translated into suitable alternating electric currents by means of a microphone and an amplifier. The oscillator comprises a tuned circuit with variable inductance and capacity and the energy is transferred to the antenna by indirect magnetic coupling. Variations of potential in phase with the plate current variations are impressed on the grid on account of the magnetic coupling between the plate and grid coils, thus causing this circuit under proper conditions to act as a generator of sustained oscillations.

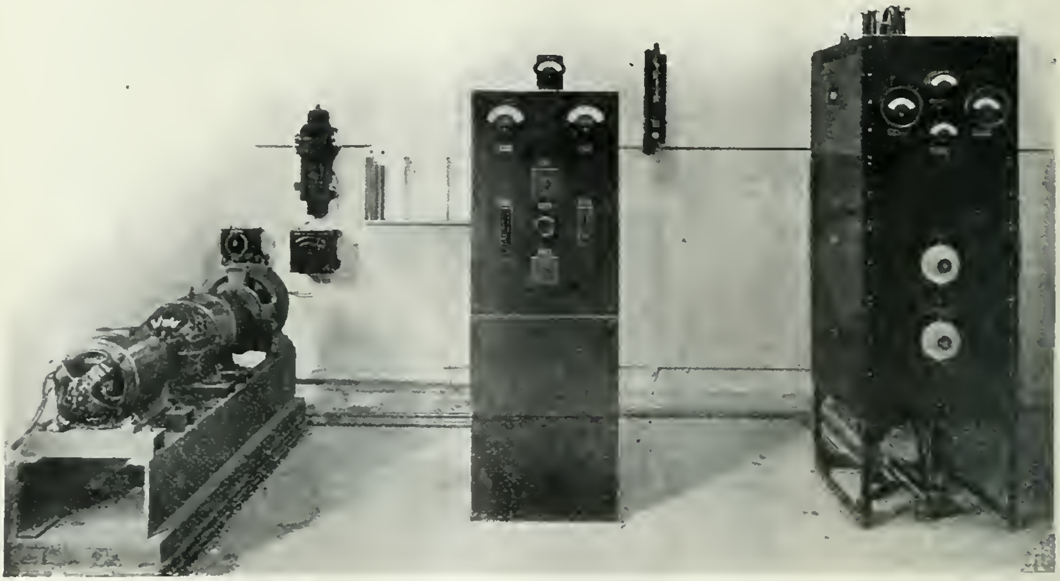


Fig. 2.

The frequency of the carrier wave is controlled by the value of the capacity and inductance in the oscillatory circuit, and the value of the variable inductance in the antenna circuit. This inductance is adjusted by means of a variometer, the movable coil serving at the same time to vary the coupling between the antenna circuit and the grid and plate circuits in such a manner as to ensure satisfactory operation throughout the frequency range for which the set is designed.

The vacuum tubes used for transmitting make use of an oxide-coated filament and have been described in *The Wireless World and Radio Review* for November 4th. The tubes are supplied at 1,600 volts plate potential;

each of them is able to deliver 250 watts of high frequency power. The filament current required is 6·25 amperes. The tube works at "saturation temperature," thus the output is independent between certain limits of the filament current. The very large amount of emitted electrons ensures also symmetrical and faithful modulation.

The grid circuit of the tubes is given a negative potential by means of a resistance connected between the negative terminal of the 1,600 volts generator and the filaments to ensure that the tubes will operate under the conditions most favourable for the prevention of distortion.

The plates are fed through an electric filter, made of series inductances and condensers in shunt, to eliminate commutator noises.

Studio.

The microphone or transmitter is located in the "Studio" (Fig. 3), the acoustic properties of which are very important. It is arranged so as to be entirely free from echo effect, a result which is obtained by draping the walls, and sometimes also the ceiling, with non-reflective material. The actual amount of draping required is determined by experiment. At the same time the acoustic damping must not be too great or the musical tones picked up by the microphone will lack brilliancy.

The floor is covered with a thick carpet. The studio is situated in a quiet part of the building and has been made reasonably soundproof, so as to exclude outside disturbances.

Proper placing of the performers is of the first importance. The distance between the artist and the microphone depends entirely upon the character of the voice or the instrument played, and considerable experience is required in order to obtain the best results. A speaker should stand from one to three feet from the microphone; in the case of singers or instrumentalists the question is much more complex.

A small switchboard is also installed in the studio and on this is mounted a switch for closing the final link in the microphone circuit. To facilitate the liaison between studio and apparatus room, a local telephone is installed, fitted with a lamp signal in the studio in place of a bell. When the radio set is ready for operation, in order to indicate in the studio that transmission may be commenced, the studio illumination is changed, warning those present that everything is in readiness, and that all conversation must cease. The change in illumination corresponds somewhat to the switching on of footlights in a regular theatre.

Fig. 3.

In view of the fact that the studio of a radio broadcasting station is really a stage upon which the artist appears, every sound being transmitted, this room cannot be used as a reception room. A separate comfortably furnished room is provided for waiting artistes.

Microphone and Speech Input Equipment.

The microphone (shown on the stand in Fig. 3) is specially designed to give a faithful reproduction of speech and music. As stated in a previous article, the range of frequencies involved in music is much greater than the practical range of speech frequencies. The volume of efficiency of the microphone is low, and it is necessary to increase considerably the magnitude of the voice frequency current before it is impressed upon the radio transmitting set.

The speech input amplifier (Fig. 1) is shown, mounted on an iron frame, and consists of a three-stage amplifier with suitable control for the current in the microphone, and in the different filaments, and permits also of a variation in the degree of coupling between the different tubes, and therefore of the control of the amount of amplification. The filament and microphonic currents are obtained from a storage battery with associated charging equipment.

To enable the operator to observe the loudness and quality of speech and music delivered to the radio transmitter, a loud speaking receiver, shown standing on the table in Fig. 1, is connected across the output terminals of the amplifier.

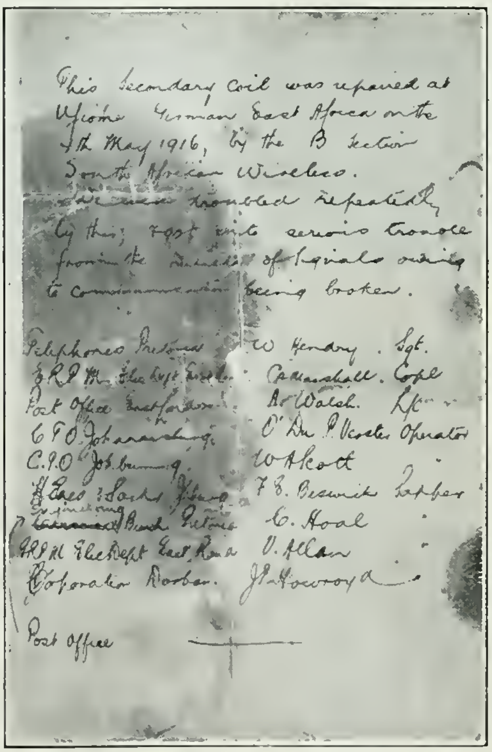
Aerial.

The aerial is installed between the flagstaff pole of a building and a pole on the roof of an adjacent building 80 ft. above the ground; the length of aerial wire between insulators is 110 ft. The aerial is four-wire, L type, the distance between parallel wires being 6 ft.

The wavelength is 420 metres. The antenna current is between 9 and 10 amperes.

It is important that the antenna should be properly guyed to prevent swinging, which, by causing a variation in the capacity of the aerial to ground, might cause a variation in the wavelength transmitted.

A War Relic


This Secondary Coil was repaired at Ufiome German East Africa on the 4th May 1916, by the B Section South African Wireless. We were troubled repeatedly by this; & got into serious trouble from the Director of Signals owing to communication being broken.

W. Hendry. Sgt.
C.A. Marshall. Cpl
A. Walsh. L/C
O'Du P. Verster Operator
W. A. Scott
F. E. Beswick Sapper
C. Hoal
V. Allan
J. P. Howroyd

Post Office

It may be of interest to the signatories of the document here reproduced to learn that the troublesome transformer at last has been rewound and is doing good service on a London telephony transmitting station.

The transformer came into my possession through the usual channels by which I obtain most of my wireless equipment, having been picked up for a few shillings at a well-known London auction room.

A preliminary test revealed a faulty section, and on breaking up the high-tension winding, the crumpled and somewhat charred relic was found. The transformer has been renovated and commenced a new lease of life, the severed turns of wire that interrupted communication in German East Africa having been thrown on the scrap-heap, and up to the present is working with entire satisfaction, and trying hard to redeem its past black record.

The document reads:

This Secondary coil was repaired at Ufiome, German East Africa, on the 4th May, 1916, *by the B Section, South African Wireless. We were troubled repeatedly by this, and got into serious trouble from the Director of Signals owing to communication being broken.*

And is signed by:—

W. Hendry (Sgt.), C.A.Marshall(Corpl.), A. Walsh (L/C.), Operators O'Du P. Verster and W. A. Scott, and Sappers F. E. Beswick, C. Hoal, V. Allan, and J. P. Howroyd. **2 DY.**

A Receiver-Amplifier for Short Waves.

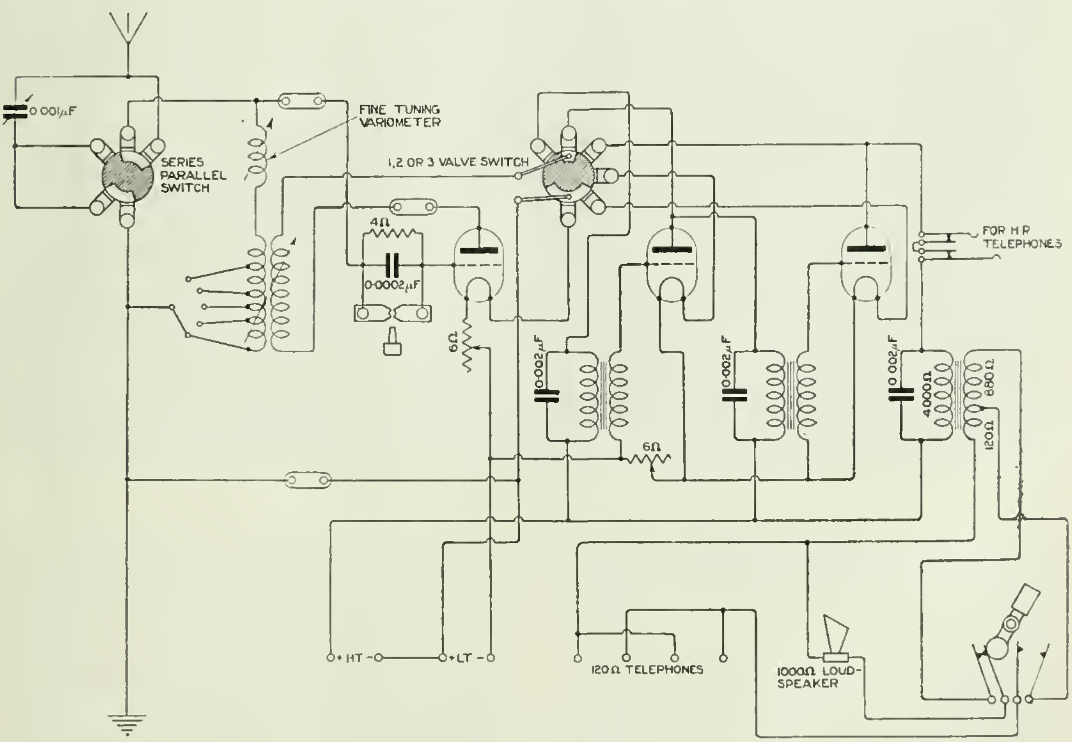
By Adrian B. Jones.

NOT having the experience necessary for the design of a receiver which would work efficiently over such a range of frequencies as from 200 to 20,000 metres, as advertised in some periodicals, without the introduction of complicated dead-end switches or coil-changing devices, I decided to restrict myself to the limited range of 160 to 1,200 metre waves.

The receiver was to be able to deal with telephony of short wavelength, say 200 to 400 metres, to be as simple as possible, so that conversations could be followed, necessitating the number of variables to be as few as possible. Wavelengths of 600 metres, for ships, and 950 for local time signals and news messages, were also to be received.

My station is situated only 20 miles from Buenos Aires, from whence the majority of transmissions emanate, so I had not to allow for the reception of very weak signals. Am-

Photograph showing Controls. The instrument is easily portable.

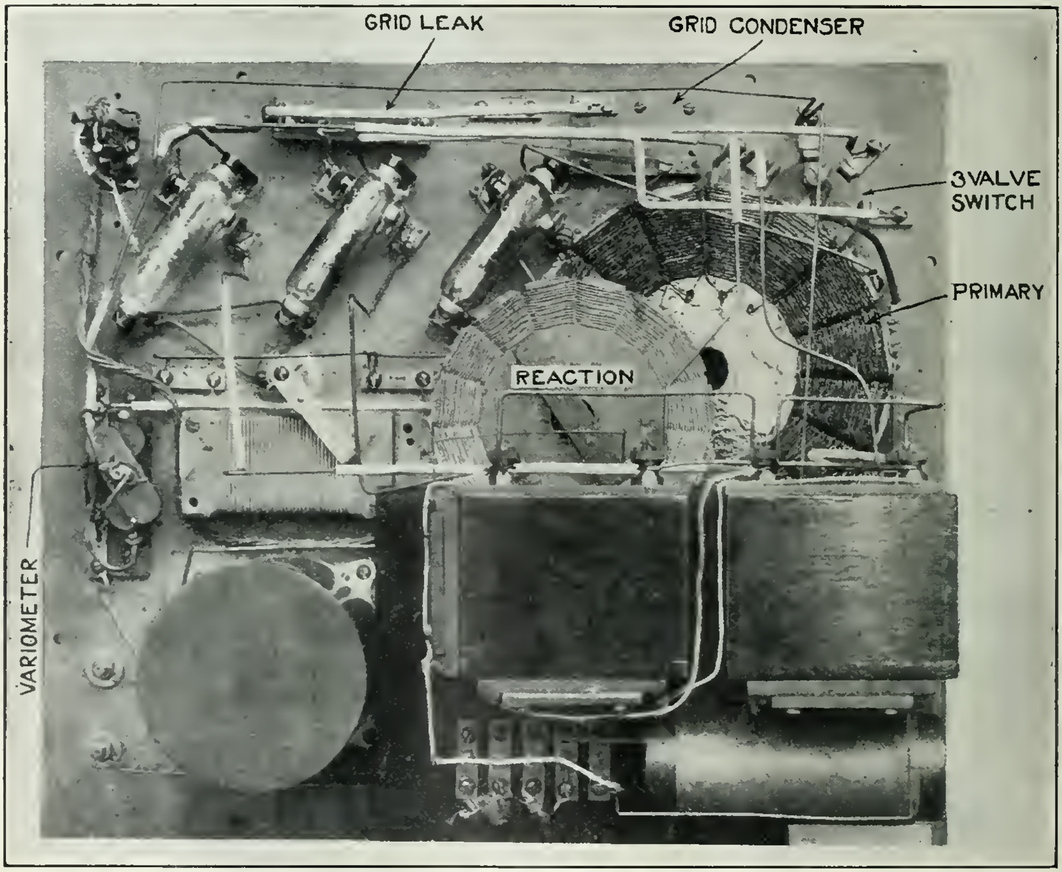


Circuit Diagram of the Short-Wave Receiver Amplifier.

plification would only be necessary when using a loud-speaker, or when several persons were listening with head-receivers. For the sake of simplicity, low-frequency amplification was resorted to, as over the fairly wide band of from 200 to 400 metres, high-frequency transformation is more involved.

The basic circuit is of the direct type with reaction, using regenerative amplification with grid current and leaky condenser rectification. This is not suitable for the reception of very weak telephony, as great distortion is very often produced when too much help is required from reaction, but if this assistance be not abused, the amount of undistorted amplification with one valve is remarkable. It is sometimes convenient to take comparatively little advantage of the regenerative amplification, but to switch in a second valve; this is specially noticed in the case of indifferent modulation at the transmission end.

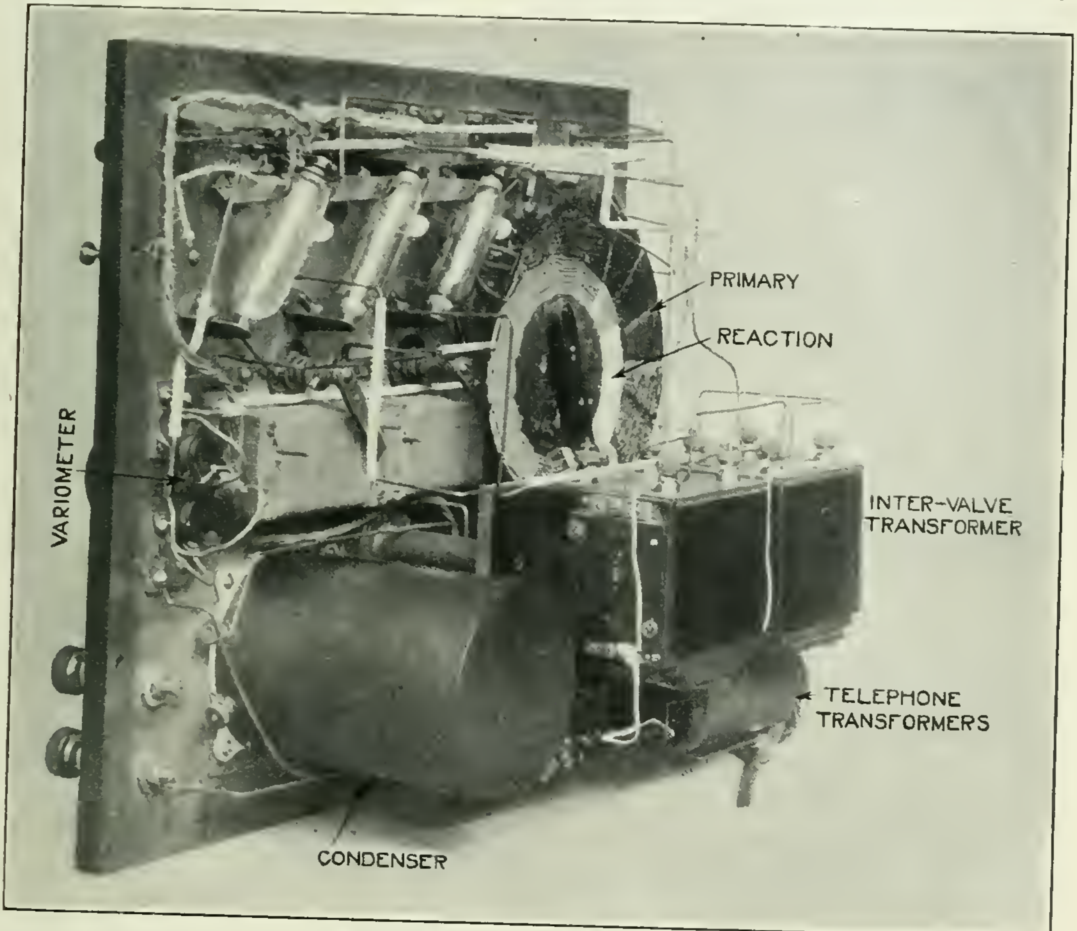
With regard to the type of tuning coil to use. I have tried concentric cylinders, cylinder and ball, and "spider web." The first has the curious effect that when the inside cylinder, usually the reactance, is moved out of the outer, the effect is as if one cylinder were attached to the other by an indiarubber strip, which at the critical point where reactance ceases, breaks. To produce reactance once more, one has to go a considerable distance back in order to pick up this broken strip, and then go ahead again. This is a disadvantage, and means loss of time—valuable in the case of following conversations. The cylinder and ball also has its defects; it seems to be difficult to obtain oscillation when on the first stud, *i.e.*, for very short waves, the coupling between the primary and the reaction cannot be made tight enough.



View of interior showing disposition of components.

The spider web possesses neither of these disadvantages; the reaction hiss is picked up exactly where left, and very tight coupling can be obtained for the shorter waves. In the particular instrument I am describing, a reduction gear of 5 to 1 has been provided (an idea of a friend of mine), the lateral displacement of the reaction coil being therefore very gradual. These coils can however be worked quite well using a direct moving arm, the gearing being a refinement, convenient job, and is also theoretically of less H.F. resistance than single wire. The first consideration seems to me to be of greater importance, for before one can construct a receiving instrument of such a perfect nature that the electrical qualities of the two wires can be appreciated, one has to be of a higher order than "an amateur instrument maker."

I have introduced a variometer fine tuning



Another view of the arrangement of the parts.

but not absolutely necessary. I have found that for short wave working, using these coils to open like a book, as pancake coils are used for long waves, is not satisfactory, fine adjustment being more difficult; with lateral movement a greater latitude is obtained. For winding these coils I have found No. 30 D.S.C. quite satisfactory. The best wire is of course Litzendraht; it is superior from a mechanical point of view, makes a very neat device in the primary, which is of great assistance in picking up weak telephony.

The valves used are of the "V 24" type, the detector having a 4-megohm leak with a condenser of about 0.0002 microfarads made to fit the leak by trial.

The telephone transformer is home-made with open core, and as will be noticed from the diagram, has two sections on the low tension side.

Electrons, Electric Waves and Wireless Telephony—XI.

By Dr. J. A. FLEMING, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

2.—Electric Radiation from Oscillatory Circuits.

It has already been explained that an electromagnetic wave is created when an electron suddenly changes its speed or is started or stopped in motion.

In the discharge wire of an oscillatory circuit, and also in the dielectric or insulator of the condenser, electrons are dancing backwards and forwards with great rapidity, whilst the oscillations are taking place. Hence an oscillatory current must create electric waves which may be regarded as vibrations propagated outwards along the lines of electric force proceeding from electrons.

If, however, we consider the kind of circuit just described in which the metal plates of the condenser are very near to each other and only separated by a thin sheet of dielectric, we shall see that when one plate has its largest charge of extra electrons and the other plate its greatest deficit, which happens twice at each complete oscillation, then, owing to the proximity of the plates, the lines of force which start from electrons nearly all terminate within a short distance upon positive ions or atoms which have lost an electron. Very few of these electrolines stretch far out into space. Hence, when vibrations are started along these electrolines by the sudden movements of the electrons, very few of these vibrations are propagated entirely away from the condenser. In other words, the arrangement radiates badly because it does not get rid of much of the stored energy in the form of electric vibrations or waves propagated along electrolines, which extend far into external space.

The oscillatory circuit above described is sometimes called a closed or nearly closed oscillatory circuit and it is a poor electric radiator.

In 1887, H. Hertz invented a type of oscillator which has very great radiative power. Instead of placing the condenser plates near together he placed them as far apart as possible by attaching them to the outer ends of two metal rods placed in line with each other, their inner ends being provided with spark balls in proximity to each other (see Fig. 51).

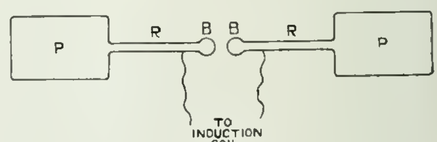


Fig. 51. *A Hertz Oscillator or Radiator.*
PP *Metal Plates.*
RR *Metal rods.*
BB *Spark balls.*

When these rods are connected to the terminals of an induction coil or electrical machine in operation, the plates are charged; one has an excess of free electrons, and is therefore negatively charged, and the other has a deficit, and is positively charged. When the electric pressure reaches a value determined by the length of the air gap between the balls, the conductivity of the air breaks down, it is ionized, a spark passes and electric oscillations take place, that is, free electrons vibrate backwards and forwards in the wire or rods.

If we consider the distribution of the lines of electric force (electrolines) proceeding from the electrons in the negatively charged side of the oscillator rods before the spark discharge takes place, it will be seen that a large proportion of these lines must stretch far out into space on all sides of the oscillator rods starting from the rods in a direction nearly at right angles to them (see Fig. 52).

When the spark discharge takes place the electrons crowded together in the supercharged (negative) rod begin to move suddenly towards the other deficiently charged rod so as to equalise the electron distribution or pressure.

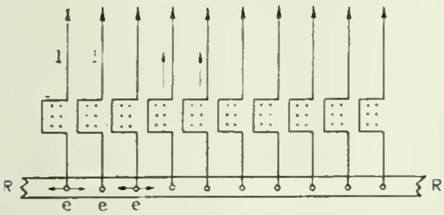


Fig. 52. Vibrations being propagated along electrolines (l) proceeding from electrons (e) in oscillation.

This sudden motion of the electrons produces a " kink " or bend or loop on the electrolines on account of the inertia of the latter as already explained in a previous section. The kinks on all the similarly directed electrolines run together into a transverse loop of electric force (see Fig. 52) which flies outwards in the direction of the electrolines.

The lateral motion of a line of electric force produces a magnetic force which is at right angles to the direction of the line of electric force and to that of its motion. Hence the moving loop of electric force is accompanied by moving loops or lines of magnetic force ; the end on view of these last named lines are represented by the *dots* in the diagram in Fig. 52.

This combination of lines of electric force and lines of magnetic force at right angles, both sets moving at right angles or perpendicularly to their own direction is called an *electric wave*.

This wave moves with a velocity of 300,000 kilometres per second in empty space or in air, which is the same as the velocity of light. Otherwise stated, its velocity is 1,000 million feet per second.

Twenty-two years before Hertz began his experiments, Maxwell, in 1865, had theoretically arrived at the conclusion that electric and magnetic forces were propagated through space, not instantly, but with the velocity of light, and had predicted the possible existence of electromagnetic waves, and given reasons for the opinion that visible light and therefore also radiant heat consist of electromagnetic waves of very short wavelength.

Maxwell had not, however, described any mode in which these long electromagnetic waves could be created or detected. The late Professor G. F. Fitzgerald suggested that Maxwell's electromagnetic waves might be created by the oscillatory discharge of a Leyden jar. He had also theoretically investigated the production of electromagnetic radiation by a high frequency alternating electric current in a closed loop of wire.

The late Professor D. E. Hughes had undoubtedly succeeded experimentally in generating Maxwell's electric waves, and what was more important he had empirically discovered a way of detecting them without clearly understanding what he was doing. Hughes' original apparatus is now exhibited in the Science and Art Museum at South Kensington, London.

Hertz invented a simple but not very sensitive method of detecting these Maxwell waves by using a circle of stiff wire, which was interrupted in one place by a small pair of spark balls (see Fig. 53), forming the earliest type of what is now called a *frame aerial.*

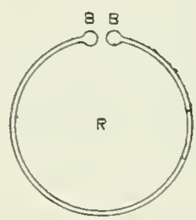


Fig. 53. A Hertz resonator ring.

Hertz used this " resonator " as he called it in the following manner. He placed at one station his open circuit oscillator (see Fig. 51) with its rods in a horizontal position. When this oscillator was in action it sent out electromagnetic waves in which the electric force was in a horizontal direction and on the axial line nearly parallel to the oscillator rods. Also the motion of these created magnetic force disposed in a vertical direction and in the same plane as the electric force. The resonator ring was then placed at a certain distance away from the oscillator with its plane vertical and its spark gap turned so that the line joining the resonator spark balls was parallel to the line joining the spark balls of the oscillator (see Fig. 54).

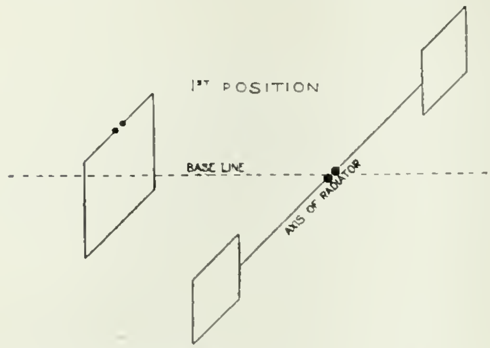
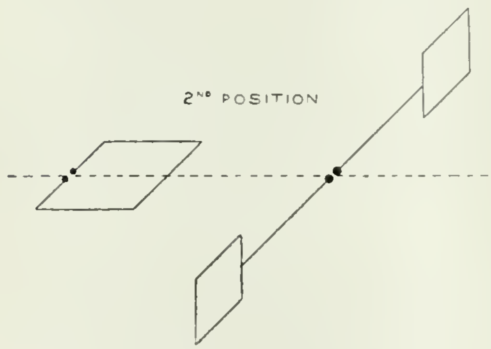
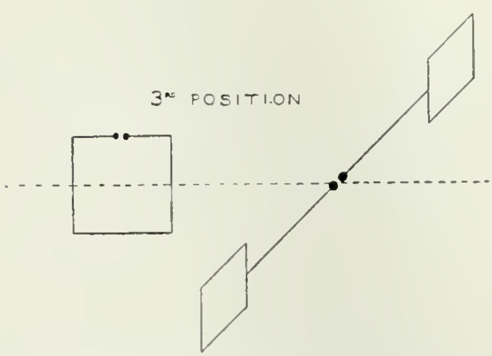


Fig. 54. (a) Sparks are seen at resonator balls when the oscillator is in action.



(b) No sparks seen at resonator balls when oscillator is in operation.



(c) No sparks seen at resonator balls when oscillator is in operation

Under these conditions small sparks are seen at the receiver balls. These are due to the fact that the lines of magnetic force of the electric wave sent out by the oscillator cut through the two sides of the resonator, but do not cut them simultaneously. The result is to produce in the circuit of the ring two opposite but unequal electromotive forces which create a current in the ring, and hence a spark at the resonator balls.

This effect needs a little further explanation, and we must therefore explain on the electron hypothesis the nature of the physical operations which produce the induction, as it is called, of electric currents.

Faraday's greatest experimental achievement was his discovery in the autumn days of 1831 that a magnet moved near to a conducting circuit in such manner that the lines of magnetic force proceeding from the poles of the magnet "cut across" the wire circuit.

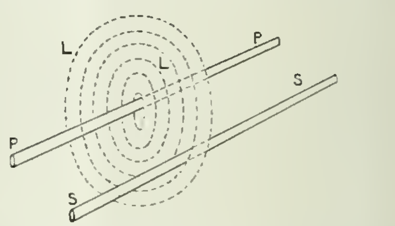


Fig. 55. A diagram showing the manner in which expanding lines of magnetic force round a primary circuit PP cut a secondary circuit SS

It is necessary to interpret this effect in terms of the electron theory. Consider two straight copper wires stretched parallel to each other (see Fig. 55). We have seen that an electric current consists in a procession of free electrons in the wire, which though agitated by an irregular motion, yet all struggle forwards in one direction. We have also pointed out that when an electron moves it creates circular lines of magnetic force which lie in planes perpendicular to its line of motion. Again it has been mentioned that these lines of force do not spring into existence suddenly at all distances from the electron but are gradually propagated outwards with the velocity of light just as the circular ripples produced on a pond by casting into it a stone, gradually expand outwards in circles of ever-increasing size (see Fig. 55).

Consider then the case when we start a direct current in a wire *PP*. The electrons in one of the wires then begin to drift forward.

The circular lines of magnetic force *LL*, which are thereby generated, grow out from the primary wire *PP*, enlarging gradually in size. These lines therefore in time "cut across" the other parallel wire *SS*.

In a previous section it has been pointed out that when a line of magnetic force moves parallel to itself it creates an electric force which is in a direction at right angles to the line of magnetic force and to the direction of motion of the latter.

We can memorise the relative directions by holding the forefinger, the thumb and the middle finger of the right-hand in directions mutually at right angles (see Fig. 56). Let the direction in which the forefinger points be the direction of the line of magnetic force, that means the direction in which the pole of a magnet which points to the earth's North Pole would be moved along it.

Since the secondary wire contains free electrons, the result is that as the lines of magnetic force generated by the motion of the electrons in the primary wire "cut across" the secondary wire, a momentary electric force will be created in it, which will move the free electrons in the secondary wire in the *opposite* direction to the movement of those in the primary wire. This is called an induced secondary current at "make." It only lasts for a short time, namely, whilst the circular expanding lines of magnetic force are taking up their permanent positions in space.

Suppose then that the current in the primary wire is stopped or that the drifting electrons in it are brought to rest. This implies that the magnetic field round the wire vanishes. It does not, however, vanish at all distances at the same instant, but the

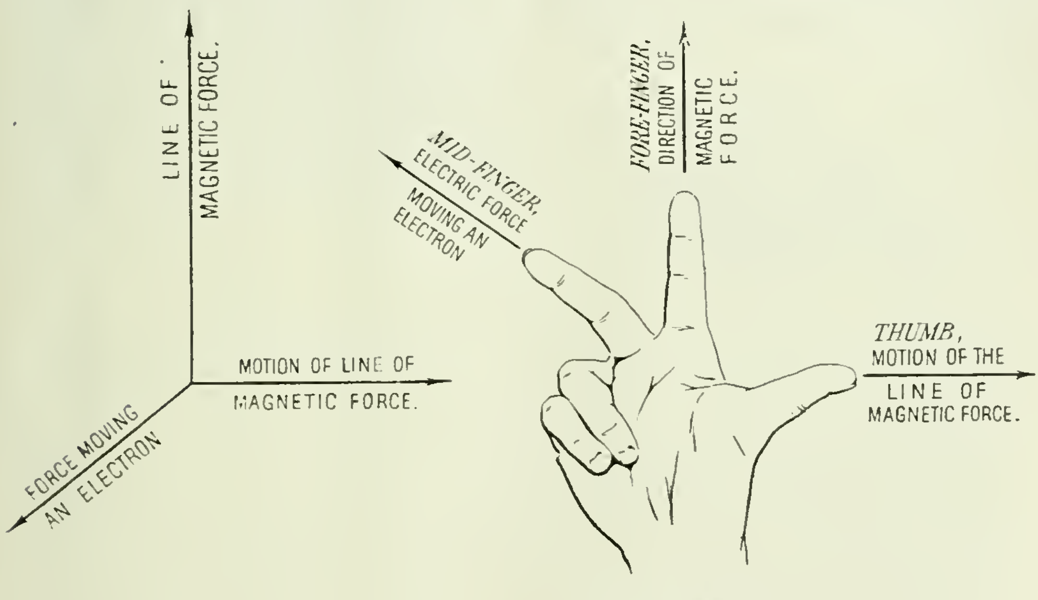


Fig. 56. The Fleming Right Hand Rule, connecting electric force, direction of flow of current and direction of motion lines of magnetic force.

Let the direction of the thumb represent the direction in which the aforesaid line of magnetic force is moving transversely to its own direction. Then the direction in which the middle finger points will be the direction in which a negative electron, in a conductor, across which this line of magnetic force moves, will be urged by the electric force created by the motion of the line of magnetic force.

circular embracing lines of magnetic force are, so to speak, sucked back into the wire. In so doing it will be evident that some of them again "cut across" the secondary circuit, but in an opposite direction to that in their outward course.

It will be clear then from the above explanations that the result of this contraction is to create a momentary electric force which drives the free electrons in the secondary wire in the *same* direction as that of the drift motion of the electrons in the primary wire. This is called the induced current at "break" of primary current.

It will be seen then that if the primary circuit is traversed by an alternating electric current, that is if the free electrons in the primary wire surge backwards and forwards like the ebb and flow of the tide in the mouth of a tidal river, the result will be to produce a similar alternating current in the secondary wire or surging motion of its free electrons which keeps in step with the primary current, but is always in an opposite direction as regards flow.

It is not necessary that the two wires should be straight; they may be both coiled in spiral fashion round a rod or tube of wood or insulating material, only then each wire must be covered with silk, cotton or enamel, to insulate the turns from each other (see Fig. 57).

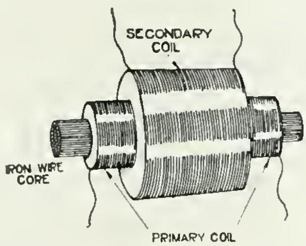


Fig. 57. An induction Coil consisting of two insulated wires wound round a bundle of fine iron wires as a core.

An arrangement of this kind is called an *Induction Coil* or *Transformer*.

When the alternating current is a low frequency current, viz., about 50 to 200 or so reversals of current per second, we can increase the effect by inserting in the tube on which the wires are coiled a bundle of fine iron wires called an iron core. In the case of high frequency current no iron core of the above kind is of advantage.

The induction of electric currents by moving magnets proceeds from similar causes. A permanent magnet, whether bar or horseshoe, carries about with it a field of magnetic force, the direction of the lines of which may be rendered evident in the well known manner by sprinkling iron filings upon a sheet of paper laid over the magnet (see Fig. 58).

If then the magnet is moved in any manner so that its lines of force "cut across" a conducting wire, the free electrons in the latter are urged in one direction along the wire for the same reasons as explained in the case of the expanding magnetic field of a primary wire.

This fact is the starting point for the construction of all forms of dynamo electric machines in which a current is generated by moving a coil of wire in a magnetic field of force.

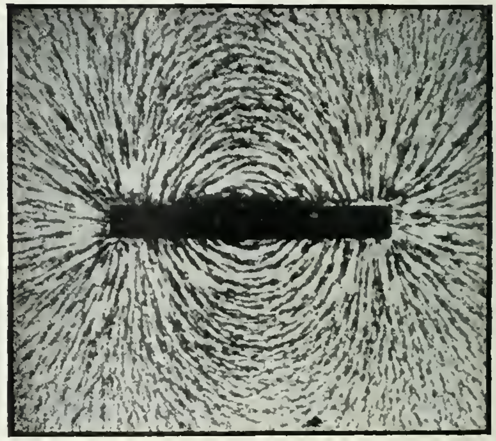


Fig. 58. Lines of Magnetic Force round a Bar Magnet delineated by sprinkling iron filings on a sheet of paper laid over the magnet.

The ordinary spark induction coil, so much used in Roentgen or X-ray work, consists of a bundle of fine iron wires which is wound over with a number of coils of cotton-covered copper wire through which passes the current from a battery which is rapidly interrupted or started and stopped by means of an appliance called a "break." Over this primary coil is wound in sections an immense length of very fine silk-covered copper wire called the secondary coil. When the primary coil is traversed by the primary current the lines of magnetic force due to it are linked with the secondary circuit or pass through it. When the primary current is suddenly stopped these lines contract or shrink up again into the primary circuit. In so doing they "cut through" the secondary circuit and create in it a very high electromotive force, urging the free electrons in the secondary circuit violently in one direction. So much so that they burst forth at one end of the secondary circuit and create a spark discharge.

The electric force or force moving the free electrons in the conducting wire is proportional to the product of the magnetic force (H) of the moving lines of magnetic force and to the velocity v of these lines resolved perpendicularly to the wire.

If the wire has a length l centimetres then the electromotive force produced by these lines cutting or crossing the wire is proportional to the triple product Hvl.

It does not matter whether the copper wire moves transversely to the field at rest, or whether the lines of magnetic force themselves move, as in the case of an electric wave, so as to cut across a stationary conducting wire. In both cases we have an induced electromotive force created.

We can now return to the consideration of the Hertz oscillator and its corresponding receiving circuit.

It has been explained that when the free electrons in the oscillator rods dance backwards and forwards with great rapidity, the result is to propagate outwards along the electrolines proceeding from the free electrons in them, " kinks " or vibrations which may be conceived to travel along the electrolines just as a " kink " or wave travels along a stretched cord fixed at one end when a sudden jerk is given at the other end.

The " kinks " produced simultaneously on a number of electrolines which are in the same direction run together into a travelling loop of electric force which moves with the speed of light in the direction of the electrolines and is accompanied by lines of magnetic force the directions of which are perpendicular to the electrolines and to the direction of motion of the latter (see Fig. 52).

Suppose next we set up at any distant place another oscillator exactly like the transmitting oscillator comprising two plates at the outer extremities of two rods placed in line and with a gap in the middle which can be bridged over by some form of conductor. Let this receiving circuit, as it is called, have its rods placed parallel to the rods of the transmitting oscillator. Being of the same form as the transmitter, this receiving circuit has the same natural time period of oscillation. In other words, it is " in tune " with the transmitter.

Hence, as the lines of magnetic force in the electric wave passing over it cut across the rods they will create in them an alternating electromotive force. If the receiving circuit is not in tune with the transmitter, the latter would produce very little effect in creating a current in the former. If, however, it is in tune, the repeated action of the incident waves will soon create an alternating current in the receiver.

The action is closely analogous to the effect of jumping upon a springy plank supported at the two ends like a bridge. The plank has mass and elastic resistance to bending. If a boy stands in the middle of the plank his weight causes it to bend slightly. The plank has, however, a natural time of oscillation. If the boy jumps up and down, but not in time with the natural period of oscillation of the plank, he will not produce much effect in increasing the deflection. If, however, he times his jumps so as to agree with the natural time period of flexural vibration of the plank, he will soon find that the bending of the plank at each jump becomes so large that it will probably be in danger of breaking. It is for this reason that a regiment of soldiers are generally ordered to " break step " on crossing a suspension bridge, because if it should so happen that the time period of their marching feet should agree with the natural period of flexural oscillation of the bridge, the safety of the structure might be endangered.

For the same reason we can set in strong oscillation a pendulum consisting of a massive bob suspended by a string by means of little puffs of air or feeble blows with a feather, provided we administer these impulses at intervals of time exactly equal to the natural time period of oscillation of the pendulum. This fact in its widest form covers the principle of the *resonance* of two vibrating bodies, and is of very great importance in connection with wireless telegraphy and telephony.

We have seen that when two circuits are adjacent to each other an alternating current in one circuit will induce an alternating current in the other circuit. Suppose these two circuits each consist of a condenser of a certain capacity C in series with a wire having a certain inductance L. The natural time period of the circuit is then, as we have shown, proportional to the square root of the product of the capacity of the condenser and the inductance of the wire or to $\sqrt{C.L.}$

This last is called the *oscillation constant* of the circuit.

If then the two circuits have equal oscillation constants, even though in one the capacity is large and the inductance small, whereas in the other the reverse is the case, these circuits will be in tune with each other, and if placed in proximity free oscillations created in one circuit will induce strong oscillations of equal frequency in the other circuit. It should be noted, however, that when a pendulum or other system capable of vibration receives a single blow or impulse it will, if then left to itself, vibrate in its own natural time period. So in the case of an electric oscillatory circuit, a single strong electromotive impulse due to an electric wave falling upon a properly-tuned receiving circuit will set it in prolonged oscillation provided that this receiving circuit is not too good a radiator.

Thus in the case of Hertz's original experiments, he used the transmitting rod oscillator above described, and a nearly closed receiving circuit made of a circle of wire with a small spark gap in it.

This rod oscillator is a very good radiator, and sends out all its accumulated electric energy in one or two vibrations at most.

On the other hand the closed receiving circuit is a very poor radiator, yet when struck by the electric waves from the transmitter it is set in prolonged oscillation, and there may even be 500 oscillations of current in it before they completely die away.

(To be continued.)

High Frequency Telephony over Power Transmission Lines.

Experiments recently conducted in Japan have resulted in the replacement of the existing telephone lines used for intercommunication between the power and sub-stations of the Ujigawa Electric Company by a system of high frequency telephony, using the power transmission lines themselves as conductors and successsful continuous operation is maintained over a distance of some 34 kilometres.

The power transmission lines have a pressure of 55,000 volts, 3 phase, and at points where it is desired to connect a telephone set to the lines, two horizontal antennæ, about 400 metres long, are disposed some two or three metres beneath the wires of the transmission line, one for transmission and one for reception.

Cabinet Telephony Set as installed at a sub-station.

Apparatus as depicted in the illustration is used on wavelengths of 1,700 and 1,000 metres to allow two conversations to be carried on from different points at the same time.

Excellent results have attended the operation of these installations, the disturbing factor *noise* as experienced with the original line installations being entirely eliminated. E. A. G.

The Radio Society of Great Britain.

PROCEEDINGS OF ORDINARY GENERAL MEETING, NOV. 22nd, 1922.

(*Concluded from page 350.*)

The President.

It has been proposed and seconded that this Society be now termed the Radio Society of Great Britain, that Associates be added to the membership, and that the amendments to the rules which have been circulated should be adopted for the present—they may require alteration later on—but until we do make the alterations, that these rules be adopted by the Society.

That concludes the special meeting. We will now come to the ordinary business of the meeting.

There is a letter from the Postmaster-General, which reads as follows :—

General Post Office,
London, E.C.1.
9th November, 1922.

Sir,—The Postmaster-General's attention has been drawn to the large and increasing number of transmissions, chiefly of music, from private experimental stations which are apparently not for purposes of bona-fide experiments, but for purposes of advertisement and entertainment. Such transmissions are contrary to the understanding on which the permits are granted, and not infrequently cause interference with genuine experimental work.

As the result of representations from the Wireless Society of London on behalf of Wireless Experimenters generally, the conditions of the grant of transmitting permits were relaxed. The great majority of the holders of experimental transmitting permits are members of the Wireless Society of London or of an affiliated Society, and the Postmaster-General would be glad if your Society would consider what steps they can take to make clear to the holders of such permits the necessity in the general interest of strict adherence to the conditions of their permits.

Failure to observe such conditions may not only involve the withdrawal of the particular permits, but will inevitably lead to a demand for the imposition of more stringent conditions generally.

(Signed) F. J. BROWN.
(*For the Secretary.*)

The Secretary,
Wireless Society of London.

We had anticipated that letter, and a meeting of transmitting licence holders had been held and certain resolutions passed which have been amplified by a sub-committee appointed at that meeting. The proposals of the sub-committee will be presented to the transmitting members at another meeting to be called shortly.

Another point I should like to make known is that the arrangements for the Transatlantic Tests are well in hand, and the London Electricity Supply Company have kindly allowed the Society the use of a 200 ft. chimney for an aerial. Operators who are willing to assist in the transmissions, and who do not mind sitting up between the long hours of midnight and 6 a.m., should give their names to the Hon. Secretary, or to Mr. Coursey. I hope those who are able will lend their assistance. I will ask Mr. Coursey to say a few words on the matter.

Mr. Coursey.

The sub-committee of the Society which has been handling the arrangements in this country for the forthcoming Transatlantic Amateur Communication Tests which are being organised by the American Radio Relay League, has met on several occasions. These tests are divided up into two sections—in the first the American and Canadian amateurs will transmit, and during the second European amateurs in France and Great Britain will try and signal back to the United States.

With regard to the latter part of the tests, as has already been announced, the sub-committee has had in hand some preliminary arrangements for the erection and operation of a special station in the neighbourhood of London, on behalf of the Wireless Society of London, but these preliminary arrangements have not been able to be completed as various unforeseen circumstances have arisen.

As these preliminary arrangements were not completely carried through, other arrangements are now well in hand for the operation of another special station.

(The arrangements for the tests as they exist to-day were then briefly outlined on the lines already published in these columns. *See pages* 276-277, *November 25th issue*).

There is only one other thing which I wish to mention in connection with these tests at the present moment, and that is to ask anyone who is not proposing to listen in to the tests to keep their receivers and transmitters quiet, in order that those who are listening in may have the best possible chance to hear the signals from the American stations, and also to make the request that those who are listening in do not radiate any energy from their aerials, but to employ a separate heterodyne for the C.W. signals, because not only in the first tests, but in last year's ones as well, many listeners here were badly jammed from that source. I would like to emphasise this point as much as possible, so that everyone possessing radio sets may try and keep them as quiet as possible during the test periods.

The President.

I think all members on both sides of the Atlantic who are taking part in these tests will be very thankful and grateful to Mr. Coursey and the Committee for the great amount of work they have put in in completing this organisation, and I sincerely hope that those who are listeners, and those who are not taking part in the tests will answer his appeal and not interfere with the others.

Mr. O. J. Carpenter is here to speak on behalf of St. Dunstan's, and to explain in what way our members may be able to assist those who were blinded in the war and now desire to interest themselves in wireless.

Mr. O. J. Carpenter.

I have been asked by Captain Ian Fraser, the blind Chairman of St. Dunstan's, who is at present visiting Germany, to make some remarks on his behalf regarding a scheme which has, I believe, the approval of our Committee.

Some time ago our President, Admiral Sir Henry Jackson, visited St. Dunstan's and had a long conversation with Captain Fraser, who is, by the way, one of the ablest amateur radio workers I have met. It was mentioned that a number of the St. Dunstan's men settled in various parts of the country were extremely interested in radio, and it was the suggestion of our President that this interest might be stimulated if these men were brought into touch with wireless societies in their particular districts. The Patron of our Society, H.R.H. The Prince of Wales, exhibited great interest in this proposal, and desired that it might be put into effect at the earliest moment.

Until the War, and the advent of St. Dunstan's, we looked upon a blinded individual as a poor, helpless being stricken by perhaps the hardest blow of Fate. You will note that I said "until the advent of St. Dunstan's," for the late Sir Arthur Pearson and his lieutenants changed this picture, and a visitor to St. Dunstan's, hearing the happy laughter of the men, noting the quiet contentment on their faces, and seeing the fruits of their industry, can agree with the spirit that would see "Nothing is here for tears" written across the portals. But I will not linger upon the work of this wonderful Institution—we all know what the splendid men and women controlling its destiny have done for our sightless soldiers and sailors.

Radio was introduced to St. Dunstan's by Captain Fraser some two and a half years ago. He visualised the time when broadcasting would come, and the gradually extending use of radiotelephony convinced him that one day it might link the blinded man with the happenings of the world. He has had to wait until to-day for the realisation of his dream.

A blinded man's hobbies are, of course, limited, but radio reception is one to which he can devote himself on something like equality with his fellow men. But he has to overcome certain initial difficulties; for instance, it is not possible for him to lay out and install his own aerial and earth system, and it is difficult for him to visualise the manipulation and functioning of apparatus he has never seen. It is not easy for him to acquire that preliminary grounding in the subject which is, to us, rendered fairly simple by means of diagrams and illustrated text.

It is here that members of the Wireless Society of London and its affiliated societies can render help by writing to the Headquarters of St. Dunstan's Work, Inner Circle, Regents Park, N.W., and offering to act as mentors to any blinded would-be radio enthusiasts in their districts.

One or two societies have already done this, and have, indeed, made the men honorary members of their circle.

Please remember that this is not a plea for monetary assistance, it is not a plea for charity; it is, in my opinion, a splendid opportunity to give of our knowledge to the Tommies and Jacks who gave their eyes for us.

The President.

I know the members of this Society are in full sympathy with this object, and I hope that the spirit will spread to our affiliated Societies in the provinces and round London, and that they will do their best to help. I have seen the men at St. Dunstan's, and have been struck with the happy spirit that pervades the men and all associated with them. I am sure that they have our sympathy, and will get practical knowledge and assistance from those who are connected with our Society.

I have the pleasure to announce that Sir Henry Norman, the Member for Blackburn, will take over the Presidency of this institution next January, and I think the Society and all of us are to be very much congratulated that he is willing to do so.

The next meeting, in December, is the Annual Meeting for the election of the officers and the Committee, consequently there are no vacancies. The same names will come forward next year, with the exception of myself, as before mentioned; but if any of the members of the Society wish to put anybody on the Committee, they are invited to send in names fourteen days before the next meeting.

I am sorry we have taken so much time away from our lecturers in this business meeting, but I will now ask Mr. Blake to read his paper on the "Mechanical Model Illustrating the Action of the Three-Electrode Valve,"* and also Mr. Maurice Child to give his paper on "A Five-Valve Selective Amplifier."†

These papers were then read, and in the absence of discussion, the President, after proposing a vote of thanks to the lecturers, announced that all the new members had been elected and societies accepted for affiliation,‡ and that the next meeting would be a meeting of the Radio Society of Great Britain, taking place before Christmas on Wednesday, December 20th.

Mr. E. H. Shaughnessy.

Mr. Chairman, before we go I should like to draw attention to the fact that we started the evening by changing the name of this Society to the Radio Society of Great Britain, and nearly every speaker since has been talking about wireless. There is one other thing, by the way, and that is that the official organ of the Society is *The Wireless World*. Could we persuade them to change their title? They have got half way there as *The Wireless World and Radio Review*—if they *must* have Wireless. Why not style the journal "The Radio Review and Wireless World."

The meeting adjourned at 7.45 p.m.

A New Company.

Wireless Service, Ltd., is a new company which has opened offices and showrooms at 2, Lower John Street, Piccadilly Circus, W.1. The products of leading manufacturers may be obtained from this establishment.

* See pp. 311-314, Dec. 2nd, 1922.
† See pp. 343-345, Dec. 9th, 1922.
‡ For list see p. 309, Dec. 2nd, 1922.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Newcastle and District Amateur Wireless Association.*

Hon. Secretary, Mr. Colin Bain, 51, Grainger Street, Newcastle-on-Tyne.

The following lectures have been given during the month of November :—"Theory of the Thermionic Valve," by Mr. Bain : "Short Wave Reception," by Mr. W. G. Dixon ; "The Chemistry of the Secondary Cell," by Mr. Urquhart ; "Balancing 'out' Tuning Devices," by Mr. Bain : "The Singing Arc," with demonstrations, by Dr. Thornton. The last lecture in the list was given in the lecture theatre of the Armstrong College. Members and friends of the local Societies were also present. The subject of the lecture, "The Singing Arc," proved to be a very much more interesting affair than many present had expected. After a short explanation of the principles involved, Dr. Thornton and his assistants demonstrated the astonishing properties of the arc as a producer of both simple and complicated sounds. A microphone was fitted in an adjoining room, and after the more elementary demonstrations were over, the arc was made to act as a loud speaker, reproducing loud speech and music (supplied by voice and a gramophone) all over the hall. The lecturer also used two arcs in series to increase the volume of the sounds. The audience were very much impressed by the weird effects shown, and a hearty vote of thanks was passed to the lecturer for a very instructive evening.

Tottenham Wireless Society.*

Hon. Secretary, Mr. R. A. Barker, 22, Broadwater Road, Bruce Grove, N.17.

At Bruce Grove Schools, Sperling Road, on November 22nd, a very interesting lecture on "Aerials" was given by Mr. Hall. A hearty vote of thanks was given to the lecturer for such an interesting evening.

A two-valve set was presented to the Society by Mr. Kaine-Fish, for which he was accorded a hearty vote of thanks. Business was discussed and several new members enrolled.

The Society is now forty-five strong, and has an interesting programme of lectures before it.

Ilkley and District Wireless Society.*

On November 20th, Mr. D. E. Pettigrew, Hon. Secretary of the Leeds and District Amateur Wireless Society, gave a lecture on "Maritime Radio Communication." He traced the development of wireless as applied to ship practice from the earliest experiments of Marconi. The utility of wireless as a means of communication between ships and from ship to shore was explained, and also the method of handling messages.

A hearty vote of thanks proposed by the Chairman, Dr. J. B. Whitfield, was unanimously accorded the lecturer.

Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, 49, Cholmeley Park, Highgate, N.6.

An interesting lecture was given on November 10th, by Mr. F. L. Hogg, on "The Armstrong Super-Regenerative Circuit." The theory of this circuit was carefully explained, and several diagrams were drawn on the board.

On November 17th Mr. H. Andrews, B.Sc., gave a description of his transmitting station (2 TA). The set was exhibited.

On November 24th, Mr. G. W. Sutton, B.Sc., gave the first of his lectures on "High Frequency Amplifiers." The advantages and disadvantages of resistance, reactance, tuned plate and transformer coupled amplifiers were discussed.

Mr. Sutton gave his second lecture on this subject on December 1st, when he began by describing the Lokap coil winder, and giving hints as to how to get the best results with the machine.

The Radio Dance organised by this Society and held at the Gate House Hotel, Highgate, on November 25th, was a phenomenal success, a large number of people from all parts of London being present. During the intervals between the dances the loud speaker was switched on, and thus the function was a combined dance and concert. During the evening several dances were danced to the orchestral selections from the London broadcasting station, and these items proved exceedingly popular. An indoor aerial and four valves were used.

The Corinium Wireless Society.*

Hon. Secretary, Rev. B. R. Keir Moilliet, The Old Vicarage, Cirencester.

The Society arranged a public lecture by Mr. Lawrence Johnson of Sheffield on November 11th. There was a good attendance, and the lecture was closely followed. The history of the development of Wireless Telegraphy was traced from the Hertz oscillator down to modern C.W. and Telephony. The lecture was illustrated by excellent lantern slides, and at 9 p.m. 2 LO kindly transmitted a special programme of music, the singing of Mr. Kenneth Ellis being particularly appreciated. Several new members have since joined the Society. After paying expenses, the balance of the proceeds is being sent to St. Dunstan's.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

On November 23rd, Mr. Bew demonstrated with his Burndept Set. Concerts were received from the British Broadcasting Company at Manchester and Birmingham. A hearty vote of thanks was accorded to Mr. Bew.

Amateur wireless reception in the district has received a great impetus this last week or so, owing to the British broadcasting stations having commenced their nightly programmes.

Blackpool and Fylde and Lytham Saint Annes Wireless Societies.*

Hon. Secretary, Mr. C. Sheffield Doeg, 6, Seventh Avenue, South Shore, Blackpool.

Important developments in connection with the above Societies were foreshadowed at the Second Annual General Meeting, held at the Café Waldorf, Church Street, Blackpool, on November 23rd. Colonel P. Warren, C.M.G., C.B.E., the President, presided.

The membership in November, 1921, was 84, at present it is 112. During the year various apparatus has been purchased and a branch has been opened for Lytham Saint Annes members.

The Treasurer's report showed balance brought forward from the previous year £10 4s. 11d. Subscriptions, entrance fees, donations, and income from the sale of badges amounted to £47 1s. 6d. At the end of the year there was a credit balance of £2 0s. 5d., but there were outstanding accounts against this, which would leave an adverse balance of £1 7s. 5d. But during the year component parts of instruments had been purchased at a cost of £13 1s. 4d., and the complete instruments were worth £20.

Mr. H. D. Collinge, the Chairman of committees, said they were considering a move to better quarters. They had secured a fine spacious room in the basement of the Hippodrome buildings adjoining the Billiard Hall, The Blackpool Entertainments (1920), Ltd., having met them in a very fair manner.

Colonel P. Warren, C.M.G., C.B.E., Postmaster of Blackpool, was re-elected President unanimously.

Other officers elected were: Vice-Presidents, Dr. W. H. Buckley; Messrs. W. R. Challinor, C. F. Critchley, C.C., J.P., J. F. Fish, L. H. Franceys, A. T. Liver, A. Shorrock and Dr. A. E. Iken, LL.D., B.Sc. (Director of Education to the Blackpool Corporation). Mr. C. Sheffield Doeg, Hon. General Secretary; Mr. L. R. Blackburn, Hon. Treasurer; Mr. A. R. Harrison, Hon. Organising Secretary (General Manager of the Hippodrome); Mr. H. Cross, Hon. Assistant Secretary; Mr. F. C. Hollingworth, Hon. Auditor; Mr. D. Worthington, Hon. Librarian; Mr. J. V. Potter, Hon. Engineer; Mr. J. F. Fish, Hon. Transmitter. Executive Committee in addition to above: Mr. and Mrs. H. D. Collinge, Messrs. W. A. Frost, and Miss M. Joule.

Mr. W. R. Burne of Sale was made a perpetual Hon. Vice-President.

In order to preserve the memory of the late Mr. H. H. Knowles, he was elected an Hon. Member deceased.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

At headquarters on November 24th, the Secretary gave a report of his visit to the General Meeting of the Radio Society of Great Britain.

Ex-Gunner Bates, a blinded soldier and a member of St. Dunstan's, an honorary member under the scheme to assist St. Dunstan's men, attended the meeting and was made very welcome. Several of the members have already made offers of assistance.

A proposal by the Whale Wireless Co. offering a prize for the best constructed piece of wireless apparatus made by an amateur was read and it was proposed to accept their very generous offer.

Mr. B. G. Calver gave a very long and interesting lecture on "Accumulators and Secondary Cells."

Wallasey Wireless and Experimental Society.*

Hon. Secretary, 106, Albion Street, New Brighton.

A highly successful meeting was held on October 25th.

The Chairman lectured on "Unit Systems, their Theory and Construction." Mr. Mason dealt very fully with an excellent set of his own construction, in which he placed the main condenser on the tuning panel, the set being so arranged that the number of units are reduced to a minimum without interfering with the elasticity of combination which is the main feature of unit construction.

The lecture was undoubtedly of the greatest possible service both to the advanced workers and the enthusiastic beginners.

A hearty vote of thanks to Mr. Mason was recorded.

A general committee meeting was called to discuss some important business brought forward by a member.

It was decided to proceed with the construction of an amplifying unit without delay. Some members very kindly offered component parts of the unit as gifts to the Society.

Manchester Wireless Society.*

Hon. Secretary, Mr. Y. W. P. Evans, 2, Parkside Road, Princess Road, Manchester.

November 26th. After having dismantled the transmitting set used the previous week for the transatlantic test, and substituted A.C. for D.C. supply the work of installing the transformers and rectifying valves was commenced on Saturday afternoon at 2 p.m., and the first tests were made at 11.50 p.m., everything working well. At 1 a.m. the circuit was still being adjusted and tuned, but insufficient radiation was reached to justify a call to **1 AW** and **2 FP**, the two American stations with whom the Society were working. At 2 a.m. a maximum radiation of about 9 amperes was registered, and a fifteen minutes call was given and repeated at 3 a.m. Several American amateur stations were heard working, and a few references were made to the transmissions which started the idea that they had been heard. A special survey was undertaken with the idea of getting the utmost output at the 4 a.m. transmission, and a few preliminary trials showed a little improvement and the call was commenced, but at two minutes past the hour the fuses were blown and after examination it was found that the transformer supplying one of the rectifying valves was shorting across the primary winding, which was all the more exasperating owing to the fact that one of the members had spent all Friday night winding this instrument. No spares being at hand, a desperate effort was made to overcome the difficulty by putting 5,000 volts A.C. direct on to the plates of the power valves. This method only gave a radiation of about three amps, but a call was made, and a list of stations received repeated. After listening in for another hour it was decided to abandon the tests until the following week. 36 stations were recorded, and these added to the 23 of the previous week and 22 on the 23rd, gave us a total of 81 stations for the week. Further tests are being made on December 17th, 24th and 31st, these having the approval of the P.M.G. Four or five American stations were recorded on a loud speaker.

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Moxborough Avenue, Chapeltown Road, Leeds.

An instructional meeting was held at the Grammar School, Leeds, on November 17th, the first part of a paper entitled "Inductance and Capacity" being given by Mr. W. G. Marshall. The elements of self-inductance and the important effects of the E.M.F. of self-induction in A.C. sets of high and low frequency, were thoroughly examined. Mr. Marshall was heartily thanked.

A general meeting was held at the Grammar School on November 24th, the President (Mr. A. M. Bage) taking the chair at 8 p.m. Mr. C. F. Phillips lectured on and demonstrated "Burndept" apparatus. The subject of amateur transatlantic tests was also touched upon.

A discussion took place and a vote of thanks accorded to Mr. C. F. Phillips.

Members have noted exceptionally bad fading of **2 LO** in the vicinity during the last few days.

Local amateurs are informed by this Society that shortly an organised "sorting out" of radiating receivers will commence in view of the occurrence of repeated exhibitions of chronic radiation from autodyne receivers.

East London Radio Society.*

Hon. Secretary, Mr. L. E. Lubbock, King George's Hall, East India Dock Road, Poplar.

Some 30 members attended on November 14th. The Vice-Chairman, Mr. A. J. Alexander, was in the chair.

Attention was given to **2 MT**. The opinion of the Society is that each transmission by this station is an improvement upon the last.

The Management Committee has received many requests from the newer members for a few more elementary lectures than have been recently given. In response to this request Mr. W. C. Wells lectured upon "The Construction of a Single Valve Panel." His lecture proved very instructive to those yet in the elementary stage, and very interesting to those already past that stage. The evening closed with votes of thanks to the lecturer and chairman at 10 p.m.

Although membership increases week by week, yet more will be welcome. The Society meets at the Lecture Hall, Woodstock Road, every Tuesday and Friday.

Wakefield and District Wireless Society.*

Hon. Secretary, Mr. E. Swale, 11, Thornes Road, Thornes, Wakefield.

On November 10th, Mr. Wigglesworth, Hon. Secretary of the Barnsley Wireless Society, gave an interesting paper entitled "A Universal Three Valve Set." The switching for various numbers of valves was explained and an attempt was made at demonstration; this, however, was not very successful owing to the inefficiency of the rough aerial. Permanent quarters are being established at the Technical School at once, where an efficient aerial will be erected and gear installed.

On November 17th, the President (Mr. H. H. T. Burbury) and his son brought apparatus and described what was to the members an entirely new circuit. On November 24th, two members, Mr. A. Cobbett and Mr. F. Wakefield, brought their sets and described them very lucidly.

The meetings of the Society will in future be held on Thursday evenings instead of Fridays.

Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 18, Melford Road, S.E.22.

On November 22nd there was a crowded and enthusiastic meeting.

The Secretary gave details of his work at Sir Frederick Hall's committee rooms on the previous Wednesday evening, and the Committee of members who had attended to the details of the Association's display and assistance at St. Saviour's Church at Herne Hill on the 16th, 17th and 18th, detailed their experiences.

Messrs. Hersey and Voigt discoursed on the subject of heterodyne and reaction circuits. Mr. Knight, the Chairman, discovered several very simple mechanical analogies, which he described with the aid of the blackboard, and Mr. Hunter exhibited and explained a very comprehensive wavemeter which he had constructed.

Plymouth Wireless and Scientific Society.

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

In the absence of Mr. Arberry through illness, Mr. Penney continued his lecture on "Valve Receiving Circuits." Dealing first with the difference in the reception of damped and continuous waves, the lecturer explained the heterodyne principle and beat reception. A very hearty vote of thanks was accorded to Mr. Penney.

On Wednesday, November 22nd, a demonstration of telegraphy and telephony was given at a Bazaar and Fête in aid of the funds of the Service Men's Y.M.C.A. With a seven-valve set and Magnavox, belonging to Mr. F. S. Heal, the 5.10 concert and weather report from Paris was made audible to a large audience. In the main hall of the building, through the kindness of Messrs. Tregilgas, Gundry, Brand and Lock, quite a good exhibition of modern wireless receiving apparatus was given.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. A. L. Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

At a general meeting of the above Club on November 24th, the following new officers were elected :—Hon. Treasurer, Mr. Matthews, Westgate, Frederick Road, Wylde Green, Birmingham; Hon. Secretary, Mr. A. L. Lancaster; Hon. Librarian, Mr. H. A. Jennings, Ladywood Road, Birmingham.

A vote of thanks for work done was unanimously passed to the retiring officers, and it was announced that the comprehensive programme is being arranged for the Session.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The fourteenth general meeting was held at headquarters (Erith Technical Institute) on November 24th. The Secretary read a document from the G.P.O. authorities on the status of the experimenter, as against that of the "broadcaster." Mr. T. E. Morriss gave an impression of his visit to the Wireless Society of London's Meeting, on November 22nd, and read a paper on "Amplification, orthodox and unorthodox."

Questions were postponed till the next meeting.

The equipment engineer connected up the receiving set and loud speaker, and **2 LO** was received clear and strong.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road Oxton, Birkenhead.

The Committee of the Radio Society of Birkenhead so far consists of the following:—Vice-President, Mr. W. Watts; Chairman, Mr. R. T. Goodyear, B.A.; Hon. Secretary, Mr. R. Watson; Hon. Treasurer, Mr. G. A. King; Technical Advisers, Mr. H. I. Hughes and Mr. B. Austin. Several other gentlemen have been asked to join the Committee, and the Secretary is awaiting their replies.

On the opening night, November 21st, there were about forty-five present, and a number of ladies attended. Mr. Watts, Vice-President, occupied the chair, and also lectured on "The Progress of Wireless." He referred to his first demonstration of wireless which he gave in the nineties, and how it was a complete failure owing to a wire in the induction coil being fused. However, the second demonstration which he gave at Wrexham in the same year was a magnificent success.

A demonstration of radio-telephony from the Manchester broadcasting station was given by Mr. Austin on his four-valve home-made set, and excellent telephony was made audible by means of a loud speaker lent by Mr. Hughes.

Meetings will take place every first and third Thursday.

South London Wireless and Scientific Club.

Hon. Secretary, Mr. W. G. Ansell, 69, Larcom Street, S.E.17.

At the meeting on November 20th, the chief item of interest was the welcoming back of the Chairman, Capt. de Villiers, who had been in the provinces seven weeks demonstrating his wireless controlled airship. He gave a discourse on the difficulties he had experienced in various towns in the arranging of suitable aerials, and the marked contrast in the results on aerials arranged under varying local conditions and his methods of overcoming same. He also outlined the various amateur stations he had seen, and related points of interest as given by the provincial amateurs in relation to transmission generally and London transmissions in particular; between the various transmitting stations and the results obtained when "listening in" from other towns. A long discussion followed on the various points.

The seven-valve set which is being made for the Society is almost complete.

Blackburn and District Radio and Scientific Society.

Hon. Secretary, Mr. E. A. Pollard, Spring Bank, Limefield, Blackburn.

In the Old Bull Hotel on November 17th, a Technical Committee was formed to whom all technical problems will be submitted.

A programme of lectures will be drawn up for the winter months and arrangements are to be made for members to visit places of general interest to them, including the broadcasting station at Manchester.

Members of the club will be divided into three sections, namely (1) Full members; (2) Associate members; (3) Persons under 16 years of age. This will comprise the junior section. The fees for membership are £1, 10s. and 5s. respectively.

Northampton and District Amateur Radio Society.

Hon. Secretary, Mr. S. H. Barber, M.B.E., 51, College Street, Northampton.

At the Exchange Cinema on November 21st, Mr. John Reid occupied the chair, and briefly outlined the history of the Society. He pointed out that already two successful meetings had been held, at which a provisional chairman and vice-chairman had been appointed, who had formulated the proposed rules and constitution of the Society. He acknowledged the services rendered by Mr. S. H. Barber as hon. secretary *pro tem.* and by Mr. A. E. Turville for his kindness in allowing the Committee to meet in his house. It was suggested to arrange a programme for the immediate winter months of a few lectures and demonstrations, which should be elementary. Capt. Tissington and Mr. Frank Turville had volunteered to be Morse tutors. The formation of the classes is in the hands of the Committee.

Mr. S. S. Barber read the recommended constitution and rules of the society, which were adopted. All persons over 18 years are admitted as full members for 10s. 6d., and under 18 as juniors at 5s. a year.

The election of officers resulted as follows: Hon. president, the Mayor of Northampton (Alderman C. Earl); chairman, Mr. J. Reid; Vice-Chairman, Mr. A. E. Turville; Hon. Secretary, Mr. S. H. Barber, M.B.E.; Hon. Treasurer, Mr. H. P. Howe; Committee, Messrs. Pinder, F. Turville, K. Cobb, Nightingale, Wood, Archer, Swann, Billson, Smith, and Tomlinson.

It was decided for the present to meet weekly on Mondays at the Exchange Cinema.

Ipswich and District Wireless Club.

Hon. Secretary, Mr. H. E. Barbrook, 46 Foundation Street, Ipswich.

Dr. S. A. Nottcut, B.A., LL.D., took the chair at the Annual Meeting on November 20th.

The Secretary's and Treasurer's report showed a small balance in hand. Headquarters are now settled at 55, Fonnereau Road.

The new constitution of the Society, is as follows: President, Dr. S. A. Notcutt, B.A., LL.D.; Vice-Presidents, Messrs. R. S. Lewis and F. Mellor; Secretary, Mr. H. E. Barbrook; Treasurer, Mr. F. A. Page.

Battersea and District Radio Society.

Hon. Secretary, Mr. Francis J. Lisney, 66, Newland Terrace, Queen's Road, S.W.8.

The first general meeting to discuss the formation of a Radio Society, was held at the Temperance Billiard Hall, Wandsworth Road, S.W.8., on November 24th. Being the first meeting, the number present was good, viz., 23. The following officers were elected:—Mr. G. W. Henley, Chairman; Mr. Francis J. Lisney, Hon. Secretary; Mr. W. F. Pope, Treasurer; Messrs. Wm. Oakley, G. P. Phillips, W. J. Houston, H. R. Howling, Committee.

Several resolutions were passed, which the Committee considered after the meeting, so as to bring into motion at the next meeting.

Mr. H. R. Howling promised to bring some apparatus to the next meeting.

No settled meeting programme has been arranged, until the Society has obtained permanent headquarters.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. Walter R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

The first meeting in the new headquarters was held on October 26th. It was proposed and carried that Rule 3 should be deleted. This rule stated that the membership should consist of Civil servants only. The Society now extends its invitation to all who are interested in Radio.

On November 3rd a meeting was held at headquarters, when Mr. W. D. Keiller (technical adviser to the Society) gave a lecture on "Simple Receiving Circuits," which was illustrated with blackboard sketches, and proved very helpful.

A meeting was held on November 10th, and an informal discussion took place and several knotty problems of members were solved.

On November 17th the weekly meeting was held, the Vice-President, Mr. A. Hinderlick, M.A., taking the chair. The President, Mr. W. E. F. Corsham, gave his Presidential address. He gave an interesting account of his experiences in communicating with American amateur stations, and said that he found that the best signals were received during bad stormy weather. In closing his address he said he would be transmitting on 210 metres at 10.30 a.m. for test purposes, and would be pleased to hear from members as to how they had received **2 UV**.

Following the President's address, Mr. W. D. Keiller gave his continued lecture on "Simple Receiving Circuits (Constructional Details)." This proved extremely interesting and helpful to new members. Both the President and Mr. W. D. Keiller were accorded votes of thanks.

On November 24th Mr. W. A. J. Smith gave a demonstration with a Mark III tuner which was kindly lent by the Vice-President, Mr. U. Beaton.

Several new members and associates have been enrolled.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. Arthur I. Dabbs, 315, High Road, Ponders End, N.

Arrangements were discussed on November 23rd for a series of lectures, and it was decided that the Secretary should commence lectures on the elementary theory and practice of wireless telegraphy and telephony at the next meeting.

A member brought up a home-made crystal set which was tested on the Society's aerial and was proved to be a success,

The Broadcasting programmes have given a spurt to the members' activities. Licence problems were discussed.

Finchley and District Wireless Society.

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

On November 27th the above Society met, when it was found that owing to pressure of business Messrs. Burndept, Ltd., were unable to give their promised lecture and demonstration. However, Mr. H. Trussler kindly brought up a single valve set which he demonstrated. He also exhibited some very novel filament resistances which have just been invented.

On December 11th the Society held its Carnival Dance. Members are still urgently needed, those interested in any way are asked to communicate with the Hon. Secretary.

Working Men's College Wireless Club.

Hon. Secretary, Mr. A. Fryatt, Working Men's College, Crowndale Road, N.W.

The above Club held its second annual wireless and X-ray exhibition on October 28th. Thanks were expressed to Mr. Burnham (**2 FQ**), Blackheath, for his kindness in transmitting a concert which was received very well, except when the X-ray coil was working, which interrupted reception slightly. Messrs. A. G. Wright & Co., of Kentish Town, were thanked for lending broadcasting apparatus and Messrs. S. G. Brown & Co. for the loan of a loud speaker.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. Moore, 175, Leavesden Road, Watford.

Meetings were held at headquarters, the National Schools, Watford, on November 27th and Wednesday, November 29th.

The principal item of interest at the former meeting was a lecture by Mr. Goodwin on "The Winding of Telephones and Transformers."

The lecturer dealt with the subject in a most able and interesting manner, and a vote of thanks, proposed by Mr. Foxen, was heartily accorded him.

The second meeting was made attractive by a lecture by the Hon. Treasurer, Mr. E. L. Leader on "The History of My Two-Valve Set." He explained the various circuits he had used and the results he had obtained on each. A hearty vote of thanks to Mr. Leader concluded the meeting.

Chorleywood and District Wireless Society.

Hon. Secretary, Mr. A. G. S. Richards, Hillbrow, Haddon Road, Chorleywood.

A very successful inaugural meeting of the Society was held on November 27th. Mr. W. Blake was elected Chairman and Mr. A. G. S. Richards was elected Secretary.

A committee has been formed consisting of the Chairman and Secretary, together with Messrs. Craske and Watkins, for the purpose of drawing up a programme.

The Society meets every Monday evening at the Secretary's residence, Hillbrow, Haddon Road, Chorleywood, and all interested are invited to communicate with him as above.

Scarborough and District Wireless Club.

Hon. Secretary, Mr. F. Bulmer, 4, Carlton Terrace, Scarborough.

The first annual meeting was held on December 1st at the Club's rooms, 38b, Falsgrave Road.

Dr. Rhodes took the chair. The meeting was well attended. The Hon. Secretary presented his annual report which was well received. The Hon. Treasurer reported a balance in the bank. It was resolved to remove the headquarters to a more central position.

A cordial vote of thanks was tendered to the retiring Hon. Secretary and Hon. Treasurer, which was suitably responded to.

A whist drive and dance was held on December 8th at Rowntree's Esplanade Café.

Radio Society of Tavistock.

Hon. Secretary (*pro tem.*), Mr. Albert E. Graves, 2, Parkwood Road, Tavistock.

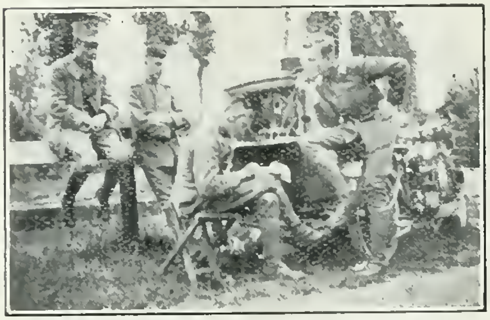
The above Society is in process of formation. Will any gentlemen who are interested, either beginners or experts, communicate with the Hon. Secretary.

Notes

Nice Heard on One Valve.

Mr. R. S. Elven, Hurst Lodge, Waverley Grove, Hendon, informs us that he received **8 AB** on November 30th, when that station was working to **8 AE** and **2 AW**. He used a single valve and separate heterodyne.

DUTCH PORTABLE SET.



The above photograph is contributed by Mr. E. A. Duitz and illustrates a Dutch portable field station in operation.

Reception and Transmission in Aeroplanes.

Captain W. G. R. Hinchcliffe maintained communication with Croydon at a distance of 275 miles, transmitting and receiving while piloting an aeroplane.

Wireless in School.

Bermondsey Guardians have agreed to install wireless apparatus at their Shirley Schools.

Wireless Controlled Aeroplane.

Promising results have been obtained from the experiments carried out at Etampes with aeroplanes controlled by wireless. Flights were made without a pilot, and also with a pilot, but using instead of the ordinary steering gear and engine control, the gyroscope stabiliser and the steering motors which will eventually be worked from the ground. The pilot was Captain Arbanère, and the experiments were carried out under the direction of MM. de Marcay, Bouche, and Percheron.

Canadian Broadcasting.

The executives of the Telephone Departments of the Western Provinces, including Alberta, have recommended that the Provincial Governments have control of Wireless Telephony. The recommendation, says *Canada*, is that stations be licensed by the Provincial Governments and that 50 per cent. of the licence fees go to the Dominion Government.

Swedish Broadcasting Company.

It is reported from Sweden that a broadcasting company is being formed.

New Marconi Director.

The Rt. Hon. F. G. Kellaway has been appointed a Director of Marconi's Wireless Telegraph Company, Limited.

New Chinese Stations.

American engineers arrived at Shanghaî last month with the object of constructing a high-power radio station, with sub-stations at Khabin, Pekin and Canton. The Chinese Government is issuing bonds to cover half the cost, and will obtain possession of the stations in twenty years.

Cunard Wireless Officers.

Operators in the service of the Cunard Steamship Company are to be graded as officers, and will be employed direct by the Company. Senior operators will wear two gold bands with a green band in between on each arm, and rank as second officers, navigating branch. Junior operators will wear one gold band with a green band on each arm.

Dr. D. Bernardo Pavloni, of Montecassino, at work in his laboratory. He is at present conducting researches on atmospheric disturbances.

Song in Esperanto Broadcast.

On December 8th **2 LO** broadcast a song in Esperanto. The Hackney and District Radio Society held a demonstration that evening and the Chairman, Mr. H. A. Epton, an Esperantist, lectured in that language.

The Transatlantic Tests.

ARRANGEMENTS FOR TRANSMISSION FROM THIS COUNTRY.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

By the time that this appears the first part of the Transatlantic Tests should be in progress. The second part, in which transmissions will be made from this country and from France to the American and Canadian amateurs, commences on December 21st-22nd, at midnight, and lasts until the 31st. As has already been announced in these columns, there will be a half-hour "free-for-all" period each night between the above-mentioned dates, the remainder of the time being allocated to the French transmissions and to individual transmission periods for those amateurs in this country who have qualified for them by previous long signalling ranges.

During the "free-for-all" periods any licensed amateur in this country may transmit if he wishes to do so. These transmissions should be made in the following form :

"**TEST TEST TEST DE** (Call letters 3 times) **GREAT BRITAIN,**" — • • • —

which should be repeated as often as necessary to fill the available time. Brief particulars of aerial current, etc., may be added if desired during the signalling period.

These "free-for-all" transmissions should preferably all be made on wavelengths between 180 and 200 metres, although 440 metres may also be used if desired. There will be a greater chance of being heard on the shorter wavelengths as the Americans will be listening most on those waves, but the American League have been advised that some of the "free-for-all" transmissions will be made on 440 metres.

Everyone who has not been allocated a special "individual" transmission period is asked to confine his signalling entirely to the above-mentioned "free-for-all" period of half-an-hour, so as to leave everything clear for the individual transmissions which follow.

The times of these "free-for-all" periods are as follows :—

TIME-TABLE OF "FREE-FOR-ALL" TRANSMISSION PERIODS.

Duration of each period = ½ hour.

December 22nd	Midnight to 0030 G.M.T.
,, 23rd	0300 to 0330 ,,
,, 24th	Midnight to 0030 ,,
,, 25th	0300 to 0330 ,,
,, 26th	Midnight to 0030 ,,
,, 27th	0300 to 0330 ,,
,, 28th	Midnight to 0030 ,,
,, 29th	0300 to 0330 ,,
,, 30th	Midnight to 0030 ,,
,, 31st	0300 to 0330 ,,

It should be remembered that in every case midnight is taken as belonging to the day just then commencing, and not to the previous day. Thus these transmission tests commence at midnight of December 21st-22nd, 1922.

The individual transmission periods will each be of 15 minutes' duration, and will continue for the 2½ hours immediately following the above "free-for-all" periods. Full particulars of what is to be transmitted during these special periods will be sent by post to the stations concerned a few days before the commencement of the transmissions. All transmitting stations who have sent in adequate records of signalling range have been allotted "individual" periods, and will be advised by post of this allocation.

Daily Reports.

The American Radio Relay League has arranged with the Radio Corporation of America and with Marconi's Wireless Telegraph Co. for daily reports of the reception of European stations in the United States or Canada to be transmitted by New Brunswick Radio Station (call letters **WII**) on a wavelength of 13600 metres at 2000 G.M.T. (*i.e.*, 8.0 p.m.) each day. These reports will be sent at hand speed and will be repeated by Carnarvon Station (call letters **MUU**) on 14200 metres immediately on receipt. Therefore, by listening-in to these reports from New Brunswick or Carnarvon, everyone will be able to follow the progress of the tests, and learn each day which of our stations have been heard. These reports will include particulars of the reception of any French stations as well, since the French will be transmitting for three hours on each of the nights mentioned in the above programme.

Christmas Greetings by Wireless.

The watchers for the Northern Exploration Company who are stationed about 600 miles from the North Pole are to receive specially transmitted messages at Christmas.

"Radioletter" Service.

The Radio Corporation of American has announced a service to London and Germany at a rate slightly higher than postage. The rate announced is six cents per word with no minimum requirement. A message may be filed any day in the week up to Saturday with the designation "Radioletter" or its abbreviation "RL" and it will be transmitted in time to reach London or Germany the following Monday morning. While registered code addresses are acceptable, the text of the message is restricted to plain language only. The new service is called the "Radioletter" Service.

The Radio Society of Great Britain

PROGRAMME FOR TRANSATLANTIC RECEPTION TESTS.

Duration of the Reception Tests.

Midnight to 0600 G.M.T., December 12th to 21st, 1922, inclusive.

Free-for-all Periods.

Midnight to 0230 G.M.T. each night, divided up into 15-minute periods which are allocated to each of the U.S. Radio Inspection districts in turn.

"Individual" Transmission Periods.

0230 to 0600 G.M.T. each night, divided up into 15-minute periods which are allocated in turn to 14 groups of stations. All the stations in each group will transmit simultaneously during their appropriate 15-minute period.

Code Words.

A special five-letter code word has been allocated to each of the stations transmitting during the "Individual Periods."

Number of Stations.

The Test Schedules of transmission which have just been received from America show that 324 U.S. Stations have qualified for the "individual" transmission periods, and these have been arranged into 14 groups—the number of stations included in each group which will be transmitting simultaneously during any one 15-minute period varying between 22 and 25 in different groups.

Nature of Transmissions.

Over 98 per cent. of the stations will be sending on C.W., therefore listen in for C.W. all the time.

All transmissions will be in the form of a call addressed to "TEST TEST TEST de (call letters)," repeated as often as may be necessary to fill the 15-minute periods. The special code words will also be sent during the "individual" transmission periods.

Wavelengths.

All stations, except thirteen special stations, will operate on wavelengths between 190 and 250 metres. Of these thirteen special stations, three will use 275 metres; two will use 325 metres, and eight will use 375 metres. The times of transmission of these special wavelength stations are set out in the programme overleaf:—

Reports.

Everyone hearing signals which apparently are of American amateur origin during these test transmissions is requested to communicate FULL DETAILS immediately to :—

Philip R. Coursey,
138, Muswell Hill Road,
London, N.10.

These reports should give exact times of the receptions, with details of the call letters, code words, etc., picked up, and should be forwarded either by letter or preferably by telegram, to the above address, or by telephone (except on Saturday and Sunday) to Hammersmith 1084 or to the *Wireless World* Offices, Gerrard 2807.

These reports are required quickly in order to avoid delay in preparing the text of the daily reports which are to be sent by Carnarvon Radio Station (call letters MUU) each morning at 0700 G.M.T. on a wavelength of 14,200 metres. These reports will be addressed to

"Schnell Radiocorp New York"

(Mr. F. H. Schnell being the Traffic Manager of the American Radio Relay League), and will be sent at hand speed. They will be repeated by New Brunswick (WII) on 13,600 metres immeditely afterwards. Reports of receptions of the American signals in France will be sent by Sainte Assise (UFT) on 14,300 metres, at 0710 G.M.T. each morning and will be repeated immediately afterwards by Marion (call letters WSO) on 11,500 metres.

PHILIP R. COURSEY,

On behalf of the Transatlantic Tests Sub-Committee of the Radio Society of Great Britain.

December 4th, 1922.

Programme of Transmissions from U.S.A. and Canada giving times of each group of transmissions for each night during the tests.

Nature of Transmissions	Wavelengths (metres).	December 12th. Time—G.M.T.	December 13th. Time—G.M.T.	December 14th. Time—G.M.T.	December 15th. Time—G.M.T.	December 16th. Time—G.M.T.	December 17th. Time—G.M.T.	December 18th. Time—G.M.T.	December 19th. Time—G.M.T.	December 20th. Time—G.M.T.	December 21st. Time—G.M.T.
Ten 15-minute "Free-for-all" periods	190 to 375	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230	0000 to 0230
23 Individual Transmissions . . 1 " " . .	190 to 250 375	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400
22 Individual Transmissions 1 " " 1 " " . .	190 to 250 275 375	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415
22 Individual Transmissions . . 1 " " 1 " " . .	190 to 250 275 325	0300 to 0315	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430
22 Individual Transmissions . 2 " " .	190 to 250 375	0315 to 0330	0300 to 0315	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445
22 Individual Transmissions . . 2 " " . .	190 to 250 375	0330 to 0345	0315 to 0330	0300 to 0315	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500
22 Individual Transmissions . 1 " " . 1 " " .	190 to 250 275 375	0345 to 0400	0330 to 0345	0315 to 0330	0300 to 0315	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515
23 Individual Transmissions . . 1 " " 1 " " .	190 to 250 325 375	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330	0300 to 0315	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545	0515 to 0530
22 Individual Transmissions .	190 to 250	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330	0330 to 0315	0245 to 0300	0230 to 0245	0545 to 0600	0530 to 0545
22 Individual Transmissions	190 to 250	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330	0300 to 0315	0245 to 0300	0230 to 0245	0545 to 0600
22 Individual Transmissions	190 to 250	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330	0300 to 0315	0245 to 0300	0230 to 0245
22 Individual Transmissions . .	190 to 250	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330	0300 to 0315	0245 to 0300
22 Individual Transmissions . .	190 to 250	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330	0300 to 0315
22 Individual Transmissions	190 to 250	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345	0315 to 0330
22 Individual Transmissions . .	190 to 250	0545 to 0600	0530 to 0545	0515 to 0530	0500 to 0515	0445 to 0500	0430 to 0445	0415 to 0430	0400 to 0415	0345 to 0400	0330 to 0345

NOTE.—Times are reckoned in Greenwich Mean Time (G.M.T.), midnight being shown as 0000 of the day just then beginning. Thus: the commencement of the Tests is at midnight of December 11th-12th, 1922.

NOTE.—Unfortunately the information from which the above table was compiled was not received from America until too late for inclusion in last week's issue. Consequently the tests have actually commenced as this issue appears. All those, however, who have entered for the tests have been circularised with this information through the post.—ED.

Calendar of Current Events

Friday, December 15th.

BRADFORD WIRELESS SOCIETY.
At 5, Randallwell Street, Bradford. Lecture by Mr. S. Davies (Dewsbury).

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
Discussion on "The Difficulties Experienced by the Radio Amateur," opened by Mr. S. G. Meadows.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
At 7 p.m. At the Grammar School. Lecture by the Secretary, Mr. D. E. Pettigrew, on "Resistance, Inductance and Capacity in A.C. Circuits."

DURHAM CITY AND DISTRICT WIRELESS CLUB.
At 7.30 p.m. At the Y.M.C.A., Claypath. Lecture on "Wireless Telephony Transmitters Using Valves," by Mr. Geo. Barnard.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.
At 7.30 p.m. In the Lecture Theatre of the Literary and Philosophical Society, Newcastle-on-Tyne. Lecture on "Wireless Broadcasting and its Possibilities," by Mr. A. P. M. Fleming.

MAIDSTONE AND DISTRICT RADIO SOCIETY.
At 8 p.m. At the Pavilion Athletic Ground, Maidstone. General Meeting.

WOOLWICH RADIO SOCIETY.
At 8 p.m. At Woolwich Polytechnic. Lecture and Demonstration on "Wireless Mast Construction," by Capt. C. T. Hughes, R.E.

Saturday, December 16th.

At 7.30 p.m. At Westfield House, Sunderland. Lecture on a "Propagation of Electro-Magnetic Waves," by Dr. J. A. Wilcken.

Sunday, December 17th.

3-5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, December 18th.

9.20-10.20 p.m. Dutch Concert, **PCGG**. The Hague, on 1,050 metres.

FINCHLEY AND DISTRICT WIRELESS SOCIETY.
Dance.

HORNSEY AND DISTRICT WIRELESS SOCIETY.
Demonstration and Lecture by Mr. Hodges.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55, Fonnereau Road. Open Meeting.

Tuesday, December 19th.

Transmission of Telephony at 8 p.m., on 400 metres, by **2 MT** Writtle.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.
Lecture to be given by Telephony, by Mr. Chipperfield from **2 MD**.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.
Question Night.

Wednesday, December 20th.

RADIO SOCIETY OF GREAT BRITAIN.
At 6 p.m. At the Institution of Electrical Engineers, Victoria Embankment. Annual General Meeting and Election of Officers. Paper on "Civil Airship Wireless during 1922," by Lieut. Duncan Sinclair (Air Ministry).

EDINBURGH AND DISTRICT RADIO SOCIETY.
At 8 p.m. At Headquarters. Lecture on "Soldering," by Mr. W. Todd. (No meetings on 27th and Jan. 3rd).

MANCHESTER WIRELESS SOCIETY.
At 7.30 p.m. At Houldsworth Hall. Discussion.

MALVERN WIRELESS SOCIETY.
Lecture on "Detection of Wireless Signals."

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.
At 111, Station Road, Redhill. Lecture on "Calculations."

Thursday, December 21st.

At 9.20-10.20 p.m. Dutch Concert from **PCGG** The Hague, on 1,050 metres.

DERBY WIRELESS CLUB.
At 7.30 p.m. At "The Court," Alvaston. Lecture on "Land Line Telephones," by Mr. F. V. Taylor.

HACKNEY AND DISTRICT RADIO SOCIETY.
Lecture and Demonstration on "Spark Coils and H.F. Currents (Tesla)," by Mr. A. Valins.

RADIO SOCIETY OF BIRKENHEAD.
At 8 p.m. At 36, Hamilton Square (top floor). General Meeting.

CARDIFF AND SOUTH WALES WIRELESS SOCIETY.
At 7.30 p.m. At the Engineers' Institute, Park Street, Cardiff. Lecture on "Direction Finding by Wireless," by Mr. K. Fawcett.

Friday, December 22nd.

WIRELESS SOCIETY OF HULL AND DISTRICT.
At 7.30 p.m. At Signal Corps Headquarters, Park Street. Questions and Answers.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Dinner.

Proposed Society for Bexley Heath.

Mr. L. W. Smith and Mr. J. P. Prangnell are endeavouring to form a Wireless Society in their district. Enquiries should be addressed to them at "The Chestnuts," Erith Road, Bexley Heath.

The Queen Listens-in.

Her Majesty the Queen, while visiting Harrod's Stores on a shopping tour, took the opportunity to listen-in at a wireless demonstration which was in progress at the time.

An Exhibition.

The third annual exhibition of the Chester Y.M.C.A. Society of Model and Experimental Engineers will be held in the Old Palace, Chester, on December 16th, from 2 to 10 p.m. Exhibits will include wireless apparatus and demonstrations in the reception of wireless telegraphy and telephony will be given with the aid of the Society's seven-valve set. Admission free.

5 HA Birkenhead.

The Hon. Secretary of the Radio Society of Birkenhead, Mr. R. Watson, has been registered as a transmitter. His call letters are **5 HA**, wavelength 150-200 (spark, C.W. and telephony). He has a fixed wave of 440 metres for C.W. and telephony only.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"W.N.G." (Dovercourt) *asks (1) Whether, when a circuit using the usual reaction arrangements is oscillating, energy is being radiated. (2) How to know when the set is radiating energy. (3) Whether, when the reaction coil is tightly coupled and a howling is heard in the receivers when receiving a signal, energy is being radiated. (4) Whether the wavelength of the energy being radiated is the same as the wavelength of the signal being received.*

(1) Energy is certainly being radiated when the set is oscillating and the reaction coil is coupled to either the closed or open circuit inductances. (2) If radiation is taking place, touching the aerial terminal will cause a loud pop in the receivers. (3) When the set is oscillating and the reaction coil is coupled with the aerial or closed circuit inductances, you may be sure energy is being radiated and all listeners in within a radius of probably five miles are being disturbed and annoyed. (4) The energy is radiated on a wavelength close to that of the signal which is being received, and other experimenters who are listening to the same transmissions as yourself are being seriously interfered with.

"F.H.B." (Liverpool) *asks (1) For a diagram of a three-valve set using switches. (2) and (3) For particulars of L.F. transformer. (4) For particulars of H.F. transformer.*

(1) We suggest you use the circuit on page 883, September 30th issue. (2) and (3) The L.F. transformer should be constructed exactly as described on page 659, August 19th issue. (4) Make up a number of plug-in type H.F. transformers. Suitable values are: bobbin $2\frac{1}{4}''$ to $3''$ diameter, with 50, 100, 250, 400, 650, 1,000 and 2,500 turns for primary and secondary.

"MARCUS" (Dublin) *asks for criticism of his circuit, which is used for amplifying small sounds.*

The proposed arrangement is correct, but we think you will not get satisfactory results unless you employ five valves. The telephones which are shown connected in the plate circuit of the valve should be of the high resistance type; 4,000 ω. would be suitable.

"R.A.L." (Middlesex) *asks for a diagram of a single circuit crystal receiver.*

See Fig. 1. Coarse tuning is effected with the coarse tuning switch, and fine adjustments are made with the fine tuning switch. To receive long wavelengths a coil should be inserted at the point marked in the figure. The winding should be of No. 24 D.C.C. on a former $3''$ diameter.

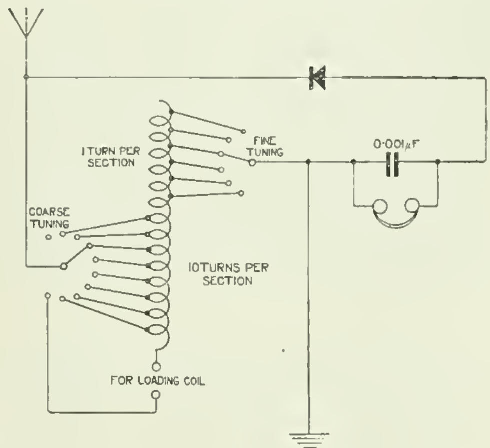


Fig. 1.

"L.C.K." (Essex) *asks (1) For particulars of a telephone transformer. (2) For particulars of a transformer to couple a crystal detector with the input circuit of a valve. (3) Size of former potentiometer.*

(1) The bobbin proposed is much too small. We suggest you make the core $\frac{1}{2}''$ diameter and $3''$ long. The primary could consist of 3 ozs. of No 44 S.S.C. wire wound on first, and the secondary 4 ozs. of No. 34 S.S.C. (2) The transformer may consist of a core $\frac{1}{2}''$ diameter and $3''$ long. The primary winding may be $1\frac{1}{2}$ ozs. No. 44 S.S.C., and the secondary 4 ozs. of No. 44 S.S.C. (3) If the potentiometer is to have a resistance of 250 ω, and No. 36 gauge German silver wire is to be used, the winding length should be $6''$ and the former $\frac{1}{2}''$ diameter.

"INDUCTANCE" (Stockwell).—(1) We suggest you make up six basket coils for the A.T.I. Each coil may consist of 40 turns of No. 26 D.C.C. wire with a mean diameter of 2½″. The reaction coil may consist of four such coils. These should be connected in series and the tappings brought out to a switch. Each coil should be spaced ⅛″ to reduce self capacity. (2) The capacity of the condenser is about 0·0006 mfds.

"AERIAL" (Huddersfield), *asks* (1) *For advice as to his aerial.* (2) *What telephony he will receive using a single valve set.* (3) *Whether he will require a buzzer to adjust the crystal if he uses a H.F. valve and crystal combination.*

(1) The proposed arrangement, 30 degs. with the telephone wires, is better. (2) You may expect to hear the local amateur transmission and broadcast transmissions. (3) The buzzer will not be useful. We suggest you connect up according to Fig. 2, page 183, November 4th issue. The 0·0005 mfd. variable condenser is quite suitable.

"D.C.B." (Sheffield) *asks* (1) *Whether a tapped coil may be used for the anode coil of a H.F. valve.* (2) *Whether better results are obtained when an anode resistance is used.* (3) *What H.T. volts to use.* (4) *Whether a 2 mfd. fixed condenser is too large to connect across the H.T.*

(1) You may, of course, use a tapped coil in the anode circuit of a H.F. connected valve, or you could use several plug-in coils. The coil should be tuned with a variable condenser of maximum value 0·0002 mfds. (2) For wavelengths above 2,000 metres we suggest you use the résistance or capacity method of H.F. coupling. (3) A suitable anode resistance would be one of 80,000 ohms and as this is the approximate resistance of the valve the H.T. volts should be about doubled. (4) A fixed condenser of about 2 mfds. is not too large, but you should be quite sure it is able to withstand the H.T. potential.

"H.T.L." (S.E.7) *asks* (1) *For particulars of the construction of an intervalve transformer.* (2) *For particulars of the construction of a telephone transformer.*

(1) The core should consist of a bundle of iron wires 9½″ long, built up to a diameter of 7/16″. The cheeks are 2″ diameter and 7/16″ thick. The cheeks have four small holes for the ends of the coils. In one cheek drill holes ¼″ and ½″ from the centre, and in the other the holes are 9/16″ and ⅞″ for the centre. One edge of each cheek is bevelled, and they are mounted 2″ apart on the coil. Two layers of empire cloth are wrapped on the core and the primary winding of No. 46 S.S.C. is wound on until the diameter is 13/16″. Three layers of empire cloth are wound over the winding, and the secondary winding of No. 46 S.S.C. is wound until the diameter is 1¾″. Five layers of wire in all are required. The transformer is completed by turning back and fastening the ends of the core. (2) The telephone transformer is made in a similar manner, but the secondary wire is 4 ozs. of No. 34 S.S.C.

"G.I.E." (Pontypridd).—It would require a great deal of space to describe each of the types of coil to which you refer, and the whole subject is very fully dealt with in "The Radio Experimenter's Handbook," by Coursey. A pancake coil is constructed by winding wire in and out of a single row of pegs fastened to a cylindrical former. A lattice winding is a winding wound on a cylindrical former, and the wire crosses from side to side several times during one turn, and only one turn is wound per layer. The honeycomb coil is similar to the lattice coil, but the wire passes from one side to the other in about half the circumference, and then passes back again to the first face, arriving there a small distance to one side of the starting point. The winding is carried on until one layer is completed, when the next wire lies directly over the first turn in the first layer. The wires are spaced, because they cross over the turns in the first layer. The duolateral coil is a special form of honeycomb coil, in which alternate layers lie exactly over one another. A uniwave coil is a coil in which the wire is given a back and forward motion while being wound, and is a machine-wound coil.

"H.L.P." (Salop).—When choosing a suitable L.F. intervalve transformer, there are several considerations which should be borne in mind. Generally, a transformer is a power operated device, and its function when connected in a valve circuit is (1) the primary winding should be designed so that the maximum amount of energy is available for transferring to the secondary winding, and (2) the ratio of windings should be such that the highest voltage is impressed across the input of the next valve. Condition (1) demands that the impedance of the transformer is approximately equal to the plate-filament impedance of the valve to which it is connected. This can only be secured when a large number of turns are used for the primary winding. Condition (2) is fulfilled when the secondary consists of the largest number of turns, consistent with the voltage produced across it. The number of turns which can be effectively used in this winding is limited by the self-capacity. The turns ratio of the windings is not always a sure guide, neither is it safe to pay too much attention to the resistance of the windings. Resistance is an evil, but unfortunately it is always rather high, as the windings must be of very fine wire. It can only serve as a guide when comparing transformers of similar dimensions. Other points to consider are the current carrying capacity of the windings, and the insulation. A good ratio of primary to secondary turns is 1-2. The best transformers are generally the most expensive, and you should purchase from a firm of wireless engineers with a good reputation. You should be able to decide on the type of H.F. transformer yourself. If you use plug-in H.F. transformers, there is the trouble of having a number of transformers, and the difficulty of tuning in; on the other hand, tapped self-tuned transformers are not so efficient, but are much more convenient especially when several H.F. stages are in use. A large number of circuits have recently been given, and you should have no difficulty in choosing one to suit your requirements. The accumulators you have purchased are quite suitable.

"W.H.D." (Yorks).—We suggest you see the articles dealing with the Armstrong super-regenerative circuit which appeared in our issues of October 21st and 28th. When constructing a receiver of this type, the spacing of the components requires much care and experimenting, and to commence with, anyhow, it is better to follow the instructions given.

"J.B." (Nottingham) *asks* (1) *Whether the core in his possession is suitable for use in a choke.* (2) *Referring to Fig. 3, page 714, September 2nd issue, are coils L_3 and L_4 coupled.* (3) *Using this circuit, what results should he expect, using a frame aerial.* (4) *What valves are the best in a circuit of this type.*

(1) The core is quite suitable, and you should wind 5,000 turns of No. 38 S.S.C. wire. (2) These coils are coupled, but the position of the coils is a very important matter, and you should be careful to see the position of the coils is such that best results are secured. (3) Very good results are obtainable. Of course, you will not connect the set to an open type aerial. (4) "R" type valves give very good results.

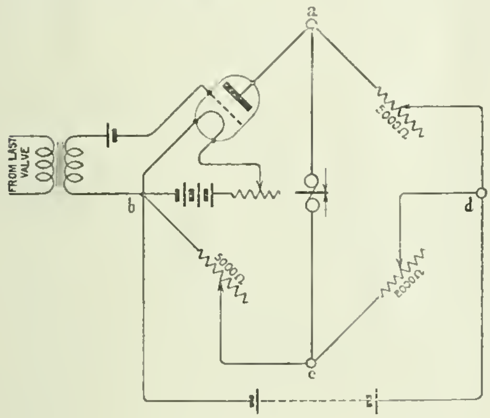


Fig. 2.

"SPARKS R.E." (Yorkshire).—We suggest you use the A.T.C. in series with the A.T.I. and add a few more turns to the reaction coil. As you remark, the aerial is very long for short-wave reception, and we suggest you try the set on a shorter aerial.

"F.P." (London).—(1) The correct values are, A.T.C., 0·001 mfds., anode tuning condenser 0·0002 mfds., grid condenser, 0·0003 mfds., grid leak 2mw., by-pass condenser, 0·001 mfds. (2) Duolateral coils are quite suitable. (3) The telephones should be of the H.R. type, or alternatively you could use a telephone transformer and L.R. telephones. (4) You would hear broadcast stations, high-powered stations, and amateur transmissions.

"R.D.C." (Middlesex).—The tellurium should be arranged in a similar manner to the steel of a carborundum detector, and the zincite would take the place of the carborundum.

"SUTHERLAND" (Cape Town) *asks for criticism of his set.*

The proposed arrangement is suitable, but the grid condenser should be 0·0003 mfds., and the L.R. telephones should not be connected directly in the anode circuit of the last valve. Either a telephone transformer must be used, or H.R. telephones must be employed. The reaction coil should be connected with the anode, and then the L.F. transformer. We think the intervalve transformer would be better if the primary winding consisted of 8,000 ohms, and the secondary 11,000 ohms.

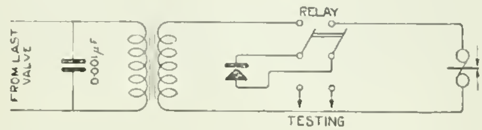


Fig. 3.

"W.B." (Somerset) *has a Siemens relay and wishes to record signals.*

The simplest method is to connect the relay as shown in Fig. 3, it being understood that signals have been rectified and amplified at L.F. The double pole throw-over-switch is shown connected for the purpose of testing the crystal. Another method with which very good results are possible is indicated in Fig. 2. The resistances AD and BC are variable in steps of 1,000 ohms, and the resistance CD in 100 ohms steps.

"GWENTELEPHONY" (Mon.).—(1) The proposed addition is quite suitable, and you should not experience any trouble in the construction or use of the receiver. (2) The variometer is not suitable for such a wide range of wavelengths, and we suggest the best thing to do is to wind the formers full of No. 22 D.C.C. wire and add a cylindrical tapped coil in series.

"B.B.B.H." (Blackheath) *asks whether he can work a Siemens relay from a three-valve set.*

The Siemens relay will operate with 0·1 milliampere and therefore will work well when connected to a three-valve set. The set should be arranged, two H.F. and one detector, and the relay should be joined in the output circuit of the detector valve.

"REJECTED" (Rotherham).—We suggest you abandon the arrangement, and use a normal system. A carefully adjusted normal circuit will give results which will satisfy your requirements.

"H.R.H." (Worcester).—(1) Several diagrams are given in recent issues, and you should have no difficulty in making a choice, bearing in mind the components in your possession. (2) The H.F. transformers should be provided with tappings, and the reaction coil may couple with the grid winding. We suggest you use a number of basket coils, each coil having 40 turns with a mean diameter of $2\frac{1}{2}''$.

"N.H.A." (Epsom) *asks* (1) *How to construct various fixed condensers.* (2) *Whether he may use a certain set.*

(1) As the condensers are of large capacity, we suggest you use the foils 10″ × 5″. The dielectric should be special waxed paper, and as each piece of paper is placed in position, wax should be poured over the paper. If a hot iron is passed firmly over it the excess of wax can be removed and the dielectric will be firmly fixed to the foils. Each piece of paper should be examined in front of a strong light for flaws. For 2 mfds. use 221 foils with an overlap 8″ × 5″. For 1 mfd. use 111 foils. The 0·5 mfd. condenser should have 57 foils. (2) If you have an experimenter's licence we think there will be no objection to the use of the receiving set referred to. You will, of course, exercise great care in order that no energy may be radiated from the aerial.

"R.J.G." (Leighton Buzzard) *asks* (1) *If reaction is permitted by the P.M.G.* (2) *What range of wavelengths will the American short wave tuner cover with a single valve or three valves.* (3) *For a circuit using 1 H.F. rectifying and 1 L.F. valve, with this tuner.*

(1) We do not think the P.O. would grant a licence to use the tuner employing the circuit to which you refer. (2) The wavelength range is stated on page 281, June 3rd issue, to be 100 metres to 400 metres, and if you have constructed the set exactly as described, you should tune over this wavelength range. We do not recommend you to add valves to this tuner, and suggest you use a round circuit. A number of three-valve diagrams have recently been given, one of which you should select and connect your tuner up accordingly. (3) A circuit which meets your requirements is given on page 883, September 30th issue. We cannot give precise instructions for building H.F. transformers which will tune from 150 to 3,000 metres. Suitable designs for short wavelengths are given in the issues of September 2nd and September 16th. To increase the wavelength range to 2,600 metres, we suggest you wind an 80-turn basket coil on a 2½″ former with No. 26 S.S.C. wire; you will probably require three in series wound quite close together.

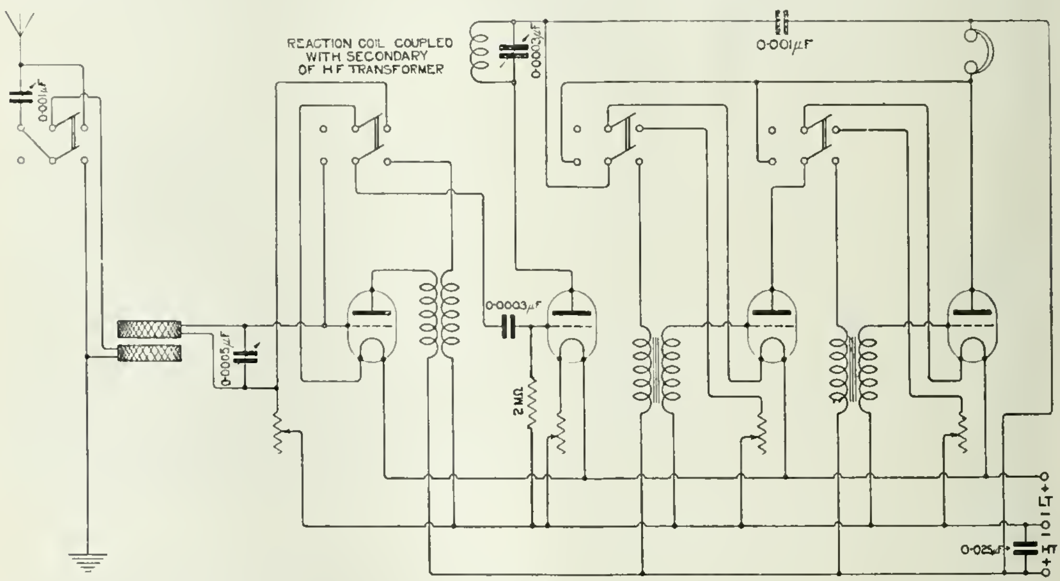


Fig. 4.

"D.D." (Ipswich) *asks* (1) *For a diagram of a four-valve circuit showing how switches are connected.* (2) *For particulars of the transformers.*

(1) See Fig. 4. (2) See recent replies.

"HANTS" (Hants) *asks* (1) *If his circuit is efficient.* (2) *Whether connections are correct.* (3) *Value of condenser across primary of H.F. transformers.* (4) *If his aerial is good.*

(1) The arrangement is quite good. Using one filament resistance will not affect results a great deal. (2) The diagram of the back of the panel is correct. (3) The tuning condenser should have a maximum value of 0·0002 mfds. when receiving short wavelengths, but a little larger condenser may be used without loss of efficiency when long waves are being received. (4) You will of course get results, but the results would be much improved by increasing the height of the aerial at the 10″ end. Why not fasten a pole to the wall and so raise the aerial wires.

"G.F.P." (Birmingham) *asks* (1) *The specific inductive capacity of transformer oil.* (2) *Whether this oil would be suitable dielectric for variable condensers.* (3) *Whether placing coils near the condenser will affect the capacity of the condenser.*

(1) The specific inductive capacity of transformer oil is approximately 2·2. (2) This oil would be quite suitable as the dielectric of a variable condenser, but you should take care no moisture is present in the oil. (3) No harmful effects will result, and the interaction will be nil.

"W.Z.K." (South Africa) *has a spark transmitter, and asks* (1) *Why tuning is so broad.* (2) *Whether the set is reasonably efficient.* (3) *Whether increasing the dimensions of his aerial will ensure greater range.*

(1) The reason for the flatness of tuning is the arrangement of the circuit. We suggest you use a coupled circuit, and provide for the degree of coupling to be variable. The coupling required is small. (2) The above alteration will increase the efficiency of the transmitter. (3) The proposed alteration in the dimensions of the aerial will improve the range, but you should also pay a good deal of attention to providing a really good earth.

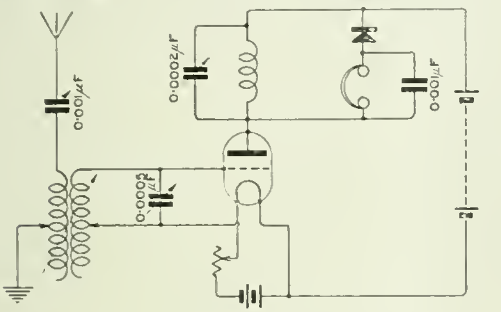


Fig. 5.

"MOULIN" (Kent) *asks for a circuit showing the connections of a crystal and valve.*

Fig. 6 shows the connections of a crystal with valve connected as note magnifier, and Fig. 5 shows the valve connected as a H.F. amplifier with the crystal as rectifier. The latter arrangement will probably give you louder signals.

"W.J.B." (Treharris) *asks* (1) *How to modify his set in order that he may receive short wavelengths.*

We suggest you leave the tuner of the set unaltered, and connect special coils for short wavelength reception. The primary coil may be of No. 22 D.C.C. wound on a former 3" diameter and 4" long, with about 8 tappings. The secondary coil could consist of a coil of No. 26 D.C.C. on former $2\frac{1}{2}$" diameter and 4" long. The 0·00045 mfd. variable condenser should be used for tuning the secondary coil, and the aerial tuning condenser may have a maximum value of 0·001 mfds.

"W.A.M." (Aberdeenshire) *asks for criticism of his set.*

(1) The diagram is correct except that the H.T. supply for the 2nd and 3rd valves is fed through the primary circuit of the telephone transformer. The arrangement for the use of valves is quite satisfactory since you wish to use a loud speaker, but if you should find that the signals are weak, add another H.F. connected valve. (2) The station referred to transmitted with increased power about the time mentioned in your letter. (3) The tuning coils and condensers are satisfactory, but you will probably notice an improvement in the signal strength if the A.T.C. and A.T.I. were joined in series when receiving short wavelengths. (4) The choke may consist of 3,000 turns of No. 38 S.S.C. wire, $\frac{1}{2}$" diameter and 3" long.

"H.L." (Stamford Hill). (1) The addition of a tuning condenser (29 plate is suitable) will make tuning easier and will also permit of more selective tuning. (2) The range will be approximately doubled.

"R.B.W." (Gillingham) *asks* (1) *and* (2) *Size and number of plates required for a condenser of 0·0005 mfd. maximum capacity.* (3) *The weight and size of wire to use in the construction of the inductance used in the Armstrong regenerative circuit.* (4) *Which is wound first—the primary or secondary winding.*

(1) and (2) If the moving plates are of No. 20 S.W.G. and $2\frac{5}{16}$" in diameter, and the spacing washers are $\frac{3}{32}$" thick, 10 fixed and 11 moving will be suitable. (3) Details of the construction of a super-regenerative receiver are given in the issues of October 21st and 28th. (4) The primary winding should be wound on first; then two or three layers of paper, and finally the secondary winding.

"INTERESTED" (Eastbourne) *asks* (1) *For criticism of his receiver.* (2) *The advantage in using a three-coil holder instead of a two-coil holder.* (3) *How to increase the range of his tuning coils.* (4) *Cause of howling.*

(1) and (4) When receiving on short wavelengths it is better to connect the A.T.C. and A.T.I. in series. The reaction coil is coupled directly with the A.T.I. When this method of reaction is used, and the set oscillates, you may be sure energy

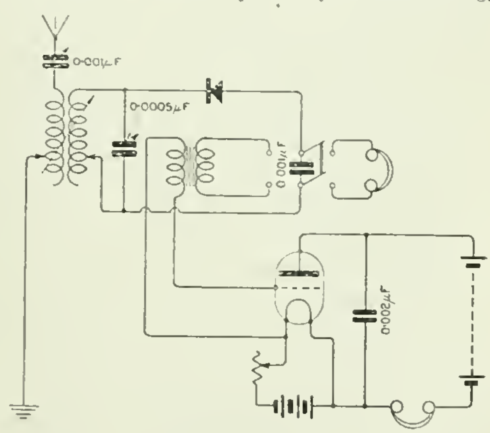


Fig. 6.

is being radiated and interference is caused to your neighbours who are receiving. The cause of the howling is due to the reaction, and you should reduce the size of the reaction coil, or better still, use reaction in any of the ways described in recent issues, so that energy is not transferred to the aerial circuit. (2) The advantage of using a three-coil holder lies in the use of one coil as the A.T.I., the fixed coil as the C.C.I., and the third coil as the reaction coil. Selective tuning and a voltage step up from the aerial to the closed circuit is possible. (3) We suggest you wind a number of basket coils, each coil having 60 turns, and join them in series, the connections of the coils being brought to a switch. The coils should be spaced with $\frac{1}{8}$" distance pieces to reduce the self-capacity.

"FLUFFY" (London, W.6.) *asks whether certain condensers in his possession are suitable for use in the receiver described on page 281, June 3rd issue.*

The condenser values are not suitable, and we suggest you use a condenser with the value given in the article to which you refer. The aerial and earth connections are made to the terminals marked "aerial" and "earth." Additional telephones are connected across the telephones in use, that is, the additional telephones are connected to the terminals to which the telephones which you are now using are joined.

"S.E.D." (Rotherham) *asks for particulars of a frame aerial suitable for general purposes.*

We suggest you use a frame 5 ft. square with 20 turns, spaced ½ in. Tappings should be taken off to a switch, and the frame aerial should be tuned with a variable condenser.

"H.W.M." (Huddersfield).—The proposed circuit submitted is not quite correct. The filament grid circuit of the first valve should include the whole of the aerial tuning inductance, as shown in Fig. 7. The coil A may consist of a winding of No. 30 D.S.C. wire wound on a former 3″ diameter and 5″ long. The winding should be tapped at about 15 points.

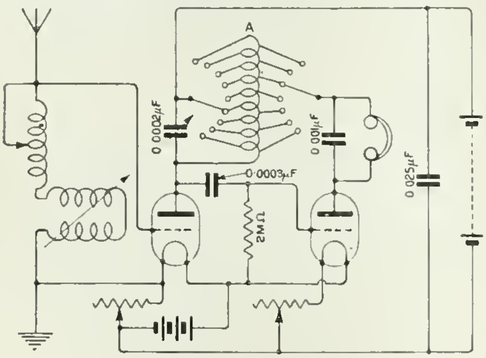


Fig. 7.

"D.A." (Hampton) *asks for criticism of circuit.*

The proposed circuit is quite suitable except a fixed condenser of 0·001 mfds. should be connected across the telephones. We suggest you couple the reaction coil to the secondary of the H.F. transformer, as described in the issue of September 30th.

"N.D." (Cheshire) *asks for criticism of circuit.*

The proposed arrangement is quite correct, and the switching arrangements will be quite suitable. If however, you prefer switching of the valve filaments when the valve circuit is cut out, we suggest you see the circuit given on page 883, September 30th issue. The condensers have values as follows:—(1) A.T.C., 0·001 mfd. maximum. (2) C.C.C., 0·0005 mfd. maximum. (3) Grid condenser, 0·0003 mfd. fixed. (4) By-pass condenser, 0·001 mfd. fixed. (5) By-pass condenser, 0·001 mfd. fixed. The circuit would probably be permitted if you have an experimental licence. L.T. should be 6 volts and H.T. 60 volts.

"J.J.T." (Birmingham) *asks* (1) *and* (2) *The number of turns to wind for reaction coil and secondary coil.* (3) *The specific inductive capacity of celluloid.*

(1) and (2) The reaction coil should be 50 turns wound on the 2″ former, and the secondary coil should be 70 turns. It is necessary to tune the aerial and closed circuits, and it will therefore be necessary to change the secondary coil when the aerial coil is charged. (3) The specific inductance capacity of celluloid is from 7 to 10.

"B.M." (Mansfield).—(1) and (2) Lists of commercial transmitting stations and amateur transmitters appear regularly in the journal, and a copy may be obtained from the publishers, The Wireless Press, Ltd., 12-13, Henrietta Street, London. (3) You should receive the Hague Concerts very well.

"R.M.R." (Hants) *asks questions about his circuit.*

The circuit resembles the Armstrong super-regenerative circuit, but we suggest you work in either of the Armstrong circuits which have been published in this journal. The location, as well as the values of the components, largely determines the behaviour of the receiver, and unless you are very well acquainted with the principles of a circuit of this kind, we think you will be well advised to follow the constructional articles of October 21st and 28th exactly.

"W.D.J." (Liverpool).—We would refer you to the constructional articles which appeared in the issues of October 21st and 28th.

"E.W.B." (Dundee) *asks* (1) *Whether the Armstrong super-regenerative set will receive broadcasting from Glasgow and Aberdeen.* (2) *Are various coils coupled.* (3) *What are the dimensions of an iron choke to have* 1 *henry of inductance.* (4) *Whether a loop aerial is satisfactory.*

(1) The set referred to will receive broadcasting, but it should be remembered no sets which cause oscillations to be produced in the aerial circuit are permitted to be used for broadcast reception. (2) The coupling of the various coils is a very important matter which requires close attention. It is better to follow out precisely the instructions for building. (3) The iron core choke could be an intervalve transformer, or you could wind an iron wire core ½″ diameter and 2″ long with 5,000 turns of No. 38 S.S.C. (4) The Armstrong super-regenerative receiver should always be used in conjunction with a loop aerial, otherwise interference will be caused to neighbouring receiving stations. The P.O. do not authorise the use of an Armstrong circuit or broadcast wavelength, even when connected to a small frame aerial.

SHARE MARKET REPORT

Prices as we go to press on December 8th, are:—

Marconi Ordinary	£2	2	6
,, Preference	2	0	0
,, Inter. Marine.. ..	1	6	0
,, Canadian		9	5¼

Radio Corporation of America:—

Ordinary	16	0
Preference	13	0

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 175 [No. 12. Vol. XI.] DECEMBER 23RD, 1922. WEEKLY

The London Station of the British Broadcasting Company.

By R. H. White.

POWER is derived from the Electric Supply Co.'s mains, which in this case is at a pressure of 200 volts D.C. Arrangements are made so that the supply may be changed over from the ordinary supply network, to the London theatre supply main, thus being assured of two separate and distinct sources. The direct current is taken through a switchboard and so to a 10 H.P. direct current motor which is directly coupled to a 6 kW. single phase, 300 cycle alternator. This alternator supplies power at 500 volts A.C., thus providing an ample margin for any increase in power which may be authorised at a later date, the present power being $1\frac{1}{2}$ kW. to the oscillation valve. The motor alternator sets are also in duplicate, and are arranged so that a single throw-over switch disconnects one set and connects the other. Arranged on the wall above these sets are two remote control automatic starters which are operated from the wireless room at the top of the building. The alternating current from these sets is taken by cable to the top of the building, where it is supplied to the primary of a 6 kW. transformer, which again has a second transformer installed beside it with a change over switch so that either transformer may be used. The secondary windings of these transformers gives a normal working potential of 22,500 volts, and they are connected to a high tension link board so that either transformer may be connected to the wireless transmitter.

The Aerial of the London Broadcasting Station (2 LO).

We now come to the actual wireless transmitter, which consists of four separate panels as shown in the photograph. Each panel is mounted in a frame entirely enclosed in plate glass or metal, so that all the apparatus mounted within the frame is thoroughly protected from dust. Special ventilation is provided for the valves and this protection also prevents the danger of electrical shock to persons having access to the wireless room.

The first of these panels is for accommodating the rectifying apparatus, and its function is to convert the alternating current into direct current at a pressure of approximately 10,000 volts.

The method by which this function is performed is that now common to wireless practice and is attained by the use of two thermionic rectifying valves. The filaments of these valves are lighted from a highly insulated transformer, the primary of which is connected to the 500 volt alternating current supply through a variable inductance, and also through a compensating inductance. The function of the former is to regulate the filament voltage, whilst that of the latter is to compensate for line drop when the power load is thrown on to the line. This is accomplished by means of an automatic switch which short circuits the compensating inductance the moment the load is switched on. The secondary winding of each power transformer has a central connection which is joined to the earth of the wireless system. The two ends of the secondary winding are joined to the anodes of the two rectifying valves. The filaments of these two valves become the positive high tension direct current pole of the wireless circuit.

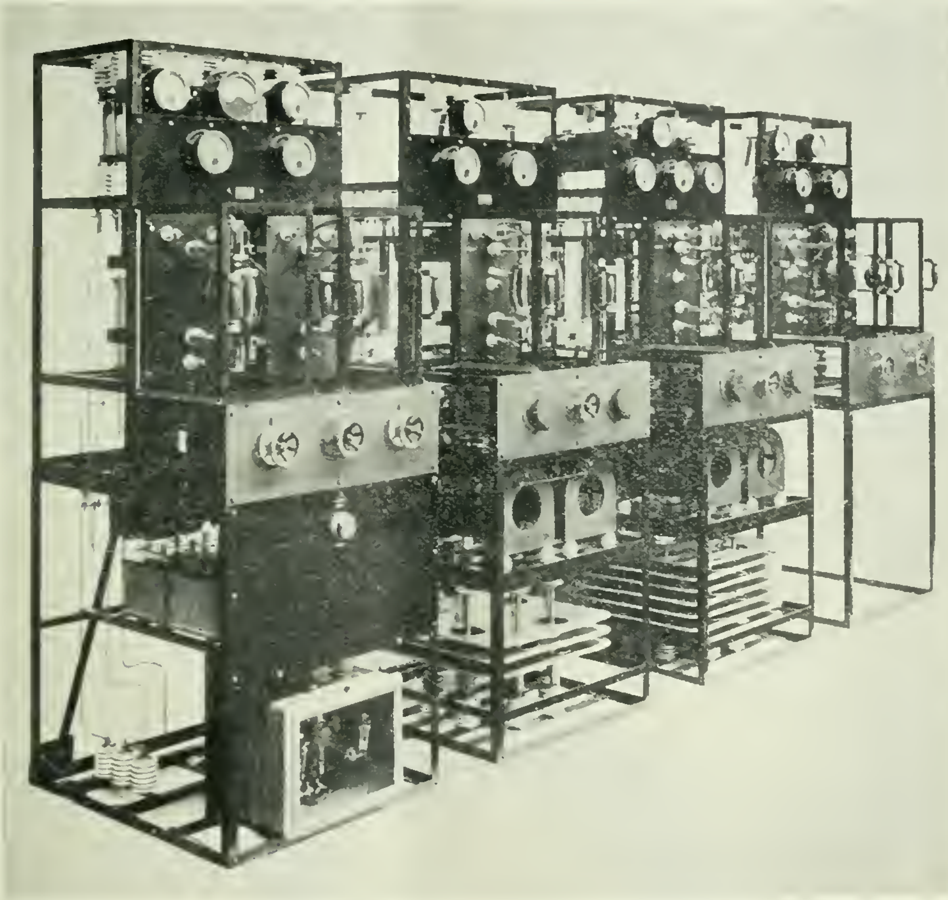
As soon as the alternating voltage is applied to the rectifier lighting transformer the filaments are lighted and the alternating current is applied to the rectifier anodes. The current will pass through the rectifying valves in one direction only, alternating first through one and then through the other at the frequency of the alternator, *i.e.*, 300 times per second through each valve, and in such a manner that both sides of the alternating wave are rectified, so that we have a unidirectional current having a ripple on it of 600 per second. This current is then applied to the smoothing or filtering system, which consists of a large condenser connected between the earth and the positive direct current pole. This condenser tends to smooth out the ripple which is on the top of the direct current. The current after passing through this condenser has to flow through a large iron-cored inductance, and so to a second smoothing condenser of a similar capacity to the former. By the time the current leaves the second condenser it is to all intents and purposes a smooth direct current, and is in fact, far smoother than the current which would be obtained from a direct current generator, as such current has always a certain amount of ripple caused by commutation and also an irregularity caused by slight brush-sparking. Directly connected across the last condenser is a very high resistance with a voltmeter in series with it. This voltmeter serves two purposes—firstly it measures direct current voltage and secondly it automatically discharges the condensers after the current has been interrupted. This prevents danger from shock which would occur if this leak were not connected. The high tension direct current passes through a milliammeter and so to the second panel.

The second panel consists of an oscillatory circuit which in this instance is called the drive oscillator. The circuit is one which is common to most wireless transmitters and consists of a closed circuit composed of an inductance and condenser, one end of the inductance and one end of condenser being connected to earth, whilst the high potential end of the condenser is connected to the anode of the oscillating valve, and the grid of the same valve is inductively coupled to the same inductance. The grid is also connected to earth through a high resistance across which is a small condenser. The anode of this valve is fed from the positive high tension direct current, from the positive busbar through a milliammeter, whilst the valve filament is connected—one end to the negative ear h busbar and the other through a variable resistance to the positive low tension busbar. These two busbars, *i.e.*, positive and negative low tension, are continuous throughout the drive panel as well as the amplifier panel, which we are about to consider, and the modulator panel. They are connected by means of a switchboard to a low tension accumulator battery of 40 volts and 330 ampere hour capacity.

The next panel to be considered is the amplifier panel, and this panel is in many respects identical with the drive panel. In it are mounted a closed oscillating circuit consisting of an inductance and capacity, one end of the condenser and one end of the inductance being connected to the earth busbar as in the drive panel. Connected to the high potential end of the inductance is the anode of the second valve which in its turn is again fed from the high tension busbar, whilst its grid is connected back to the drive panel, and is there taken through an inductance which is coupled to the oscillating circuit of that panel. At the same time this grid is connected to another inductance which is coupled to the closed oscillating circuit of the amplifier. We thus have a transmitting valve the grid potential of which is controlled from two sources, *i.e.*, the drive or the amplifier. The setting of these two reaction coils is of considerable importance, and should be so arranged that the grid is maintained in a state of varying potential by the oscillator, whilst the other reaction coil which is coupled to the amplifier is used merely to stabilise this action.

In the positive high tension lead to this valve is inserted a large inductance which is known as a speech choke, and it is by means of this choke that the potential to the anode of the oscillating valve is varied. Each variation is carried through to the aerial and this superimposes on the carrier wave from the aerial a complex ripple corresponding to the speech modulation. The aerial circuit is also connected in this panel and consists of an aerial terminal and variable inductance known as the aerial variometer and a coupling coil which is coupled inductively to the primary oscillating circuit. The end of this coil is connected through an aerial ammeter to the negative earth busbar.

We now come to the modulator panel which consists of two valves—the first of which is the control valve, whilst the second is the sub-control valve. Both these valves are lighted from the common low tension busbars which, as already mentioned, are connected to the low tension accumulator battery. The anode of the first valve is connected through the high resistance and through a protective choke to the speech choke, which is also connected to the positive high tension busbar. The grid of this valve is connected through a resistance to the negative busbar and also through a condenser to the anode of the second valve. This valve also takes its high tension current for the anode through a resistance and the protector choke from the positive high tension busbar, whilst its grid is connected through a transformer to the negative



The Type of Transmitting Apparatus employed at the London Broadcasting Station.

busbar. The primary of this transformer is connected to the microphone in the Concert Room. When the microphone is spoken or sung into, the variation in its resistance produced by the voice causes a variation of the current flowing through the speech transformer, and causes a varying potential on the grid of the sub-control valve which in its turn causes a still larger variation on the grid of the main contiol valve, whilst this varies the anode potential of the amplifier valve, thus causing a speech ripple on the top of the carrier wave which is being radiated from the aerial.

The aerial of 2 LO consists of two cage or sausage type aerials, each of which have four wires, stretched between two masts which are nearly 50 feet above the roof, and approximately 100 feet apart. The lead roof of the building, the steel framework and the lightning conductors are bonded together to form a common earth for the system.

The Concert Room has received special attention, and although not ideal from the acoustic point of view, has been brought as near perfection as is possible by means of curtains suspended away from all the walls and hanging from the ceiling, whilst a thick carpet covers the floor. The microphone is arranged near the centre of the room in such a manner that it picks up the sound from the various instruments which are grouped around it at distances which have been found to be correct, in order that no one instrument may predominate over the others.

Other special facilities which are already in use, or are contemplated, consist of a private line direct to Reuters, so that the latest news may be received whilst transmission is actually in progress, and it is hoped that a line may be connected direct with the Greenwich Observatory so that time signals may be radiated.

The photograph of the transmitter shows the four panels in the order mentioned. The left-hand one is the rectifier, which turns the alternating current into high tension direct current. The second panel is the drive oscillator, the third is the amplifier, whilst the fourth is the modulator panel.

The Station has a normal working range of seventy-five miles for reception on a two-valve set, but has been favourably reported on from as far away as Lerwick in the Shetland Islands—a distance of 550 miles, where Mr. Charles Coutts reports receiving its transmission on a single valve.

A Multilayer Inductance Coil.

THE CONSTRUCTION OF A ROBUST COIL HAVING VERY LOW SELF CAPACITY.

By C. E. Wheeler.

The serious experimenter occasionally requires a multilayer coil of exceptionaly low self-capacity, and the writer proposes to give details of one form which was intended to be covered by a patent, but which however, was dropped whilst in the provisional stage.

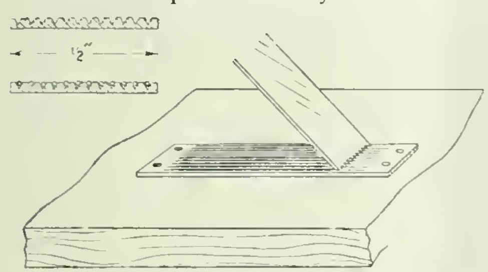
Briefly, it consists of a coil wound in such a way that the individual turns and layers of wire are almost entirely separated by an air space. Further, that when complete, it is hermetically sealed.

Low Capacity Coil sealed in celluloid container.

The method of construction adopted needs no particular skill — the principal requisite being a little patience. The exercise of the latter quality results in the production of a multilayer inductance coil having electrical properties probably as yet unequalled from a radio point of view.

The accompanying detailed illustration is almost self-explanatory, and for those who desire to make a few coils for themselves, the following particulars are given. Celluloid (the non-explosive variety) 40 and 20 mils thick shou'd be obtained. The 40-mil material should be "loaded," and white celluloid will serve admirably. The 20-mil celluloid should preferably be transparent. These two items can be bought in sheets about the same size as foolscap paper. One or two ozs. of acetone, some 26 S.W.G. copper wire, silk or enamelled, and a 20-to-the-inch outside thread chaser are also required. All these materials are inexpensive, and the cost per coil need not therefore exceed a few pence.

The first operation should be to temporarily fix a sheet of 40-mil celluloid upon a flat surface, and with the aid of any convenient straightedge as a guide, the chaser is drawn down the sheet parallel to one edge several times until grooves made by the chaser teeth are deep enough to accommodate the wire. The straightedge should be removed after a few distinct scores have been made. These will, in themselves, be sufficient guide for completion. The correct depth can easily be ascertained



Making the grooves in celluloid with a chaser.

by placing a small piece of wire into a groove and putting a flat article upon the strip and noting whether the wire beds down satisfactorily. When the grooving process has been completed, the strip can be broken off the sheet and is then ready to be cut up into small pieces about $\frac{1}{8}$ in. long. This is easily accomplished in the following manner. The grooved strip is laid on a flat surface, and at intervals of $\frac{1}{8}$ in. a sharp carpenter's chisel, somewhat wider than the strip, is firmly pressed upon the grooved side of the celluloid. It is not desirable to force the chisel right through—the only thing necessary is to make cut marks upon it at intervals all the way along. Then with a small pair of flat-nosed pliers the strip can be broken up at the cut marks into the small pieces previously referred to The object of these small grooved pieces is for the purpose of separating the turns and layers of wire uniformly as will be seen in the illustration.

The next requisite is a short length of tube of ebonite or, preferably, celluloid. In the latter case two pieces will be required 40 mils thick, and the same width as the grooved strips. One of these should be a little longer than the other, and in order to form a short length of tube the following method is advised. A piece of metal tube, 5 or 6 ins. long and 2 ins. in diameter is procured, and the shorter of the two pieces of celluloid is made to encircle the metal tube and held in position by tightly binding with ordinary cotton tape. The whole is then plunged into a basin of hot water for about a minute, and then withdrawn. When cold the tape is unwound and the second piece of celluloid tied upon the first and plunged again into the hot water. These operations complete the forming of the tube rings. The next step is to place the smaller ring within the other with their joints 180 degrees apart. A turn of tape will be required to hold them closely together, and then a few drops of acetone is applied to the edges of the rings. This liquid will cause them to adhere and form one substantial ring or short length of tube. This ring can now be mounted in a chuck or other suitable winding device, and scratch marks made upon its periphery 36 degrees apart; the circumference of the tube will be divided into 10 equal parts.* Now 10 small grooved strips are neatly secured with a drop of acetone at each division and the winding of the first layer commenced. On completion of this layer, another set of 10 grooved strips is placed upon the first set and each secured as before. The wire at the end of the first layer is then carried *across* the coil, and the second layer proceeded with. In this connection it may be as well to mention that the operator should consistently wind all coils in one direction.

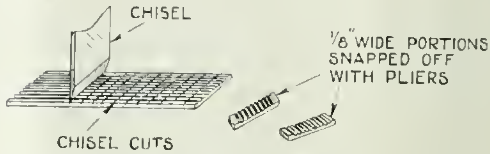
From this description a coil can be wound for any desired inductance. The final operations consist of enclosing the coil. Two circular discs of 20-mil celluloid, a little larger than the outside diameter of the coil are prepared, also a strip of the same material the width of the grooved strips and half an inch longer than the outer circumference.

* This operation can easily be effected with dividers if necessary.

Two small holes are made in the latter to allow for the ends of the winding to be externally available for connections. This strip is held securely around the coil by one or two turns of tape, and where the ends of the celluloid overlap a spot or two of acetone is applied. In a few minutes the tape can be removed. The coil is then laid on one of the circular discs and a few drops of acetone introduced at the inner and outer circumferences. After a few minutes have elapsed the celluloid covering the hollow part of the coil can be cut away with a small sharp knife. The coil is then turned over and the remaining disc fixed in a similar manner.

Owing to the great rapidity with which acetone evaporates when exposed to air, it will be found particularly advantageous to dissolve a little celluloid in some of this liquid and thus slow up evaporation. This solution however, should only be used for fixing grooved pieces one upon another. In all cases the acetone and acetone solution should be applied with a small camel-hair brush.

Most 20-to-the-inch outside chasers will give nine grooves, and in cases where more than this number are required it is quite a simple matter to shift the chaser to one side in order to obtain any desired number of grooves.



Cutting off the spacing pieces.

It should be noted that celluloid can be easily and accurately cut into strips. First mark off the widths, and using a metal straight-edge score a line with the point of a sharp pocket knife. It will then be possible, by bending, to break away the strip. In fact this operation very much resembles glass cutting.

Concerning the Experimental Licence.

At the present time there is a good deal of uncertainty regarding the experimental licence and the conditions under which it is granted.

The purpose of the following article is to endeavour to explain the situation. Our own interpretation of the position will be given and in doing so perhaps some helpful suggestions may be put forward for the guidance of those who wish to avail themselves of the privileges which an experimental licence carries with it.

Prior to the introduction of broadcasting and the broadcast licence, the position was, of course, quite simple. Anyone who wished to conduct experiments in wireless applied for an experimental licence through the General Post Office, and obtained it with very little difficulty. At that time the authorities were not so seriously concerned with the question of radiation from oscillating receivers, since for the most part the radiation which took place interfered only with other amateur stations, and naturally this was no particular concern of the authorities who were only called upon to intervene when interference with commercial or Government stations was reported.

With the introduction of Broadcasting, however, a very different situation arose. The Post Office immediately became responsible for seeing that the Broadcasting Service was not spoilt for those who paid for apparatus and licences to avail themselves of it. That the service would have been spoilt there is little doubt if the restriction that broadcast receivers should be *incapable* of oscillation had not been imposed. Judging from experience, especially in the London area, it is doubtful if even this restriction has entirely averted the danger.

In view of these circumstances it is not surprising that, when the issue of broadcast licences commenced, it became quite a difficult matter to obtain an experimental licence. Here we see the Post Office in a rather difficult position, for on the one hand it has pledged itself to take care of the interests both of the broadcast licensee and of the firms who jointly, as the British Broadcasting Company, were to undertake the broadcasting service; whilst on the other hand those who applied for experimental licences were clamouring for the same facilities to be granted to them as had been given to others who had applied for experimental licences at an earlier date.

From our own observations it appears that the course lately adopted by the authorities has been something in the nature of a compromise. At the time of writing, experimental licences are certainly being granted on a more generous scale, but with the essential stipulation that the experimental set, when used on broadcasting wavelengths, must be so arranged as to be *incapable* of oscillation. This is a matter of fundamental importance, but we believe that if this one condition is faithfully fulfilled by the licence holder, then the Authorities will put no obstacle in the way of the man who wishes to experiment or construct his own set.

The majority of those who at the present time are applying for experimental licences, are not in quite the same position as those who made application for such licences prior to broadcasting. It would be absurd for anyone to suppose that broadcasting itself has not provided a very considerable additional attraction for those who take up wireless as a hobby. Probably for every ten applications for an experimental licence before broadcasting came into existence, there are now at least fifty. One cannot help feeling that a great number of these applicants, with perhaps a little knowledge of wireless, do not, at any rate at the moment, desire to conduct actual experimental work, but on the other hand they do wish to have facilities given them for constructing their own apparatus, and to have the satisfaction of knowing that the results they obtain are mainly the result of their own individual skill in making apparatus or assembling parts.

For the man who takes an interest in hobbies, far more enjoyment can be obtained from a set of home construction than from a receiver of fool-proof pattern purchased complete.

Having assured ourselves, therefore, that the Authorities are not likely to withhold an experimental licence from those who actually wish to make their own sets, it is perhaps as well to consider what is likely to be accepted as a definition of a "home-made" set.

First of all, it should be quite apparent that the assembling of units which simply require the terminals connecting together, does not constitute making a set; on the other hand we think it would be absurd to stipulate that in a home-made set every part should be of home construction. There are such units of apparatus as valves, telephones, filament resistances, intervalve transformers, valve holders, and so forth, many of which would be beyond the scope of even the most advanced amateur to construct, whilst other parts scarcely justify the time which it would take to make them when they can be purchased for a reasonable sum from dealers in wireless apparatus. It should be safe to assume, therefore, that the inclusion of parts of this nature in "home-made" apparatus would not be an obstacle to obtaining an experimental licence.

In view of these remarks the particulars asked for under para. 4 of the Post Office Experimental License form seem to call for some modification. This paragraph reads :—

Particulars of the nature and objects of the experiments which it is desired to conduct with the apparatus.

In the case of many applicants for licenses this part of the form cannot be honestly filled up, yet an attempt to do so would probably always be made in the fear that otherwise the application would be rejected. In fact, the position with regard to the issue of experimental licences has been so altered as a result of the introduction of broadcasting that it seems to us there is every occasion for the Post Office Authorities to consider seriously the question of issuing an additional type of licence which would be a stepping-stone between a broadcast licence and the experimental licence which carries such full privileges as the holders of such licences now enjoy. By this it is meant to suggest that the additional licence might entitle the holder to construct for himself a specific set, the details of which, together with a circuit diagram, could be called for by the Post Office to accompany the form of application for the licence. After having held such a licence for a reasonable period of time, the next step might be to apply for a full experimental licence which could be granted by the Post Office with a feeling of greater security than is possible at the present time, when in some cases no guarantee at all can be obtained of the applicant's acquaintance with wireless.

In conclusion, the suggestion is made that when under the present regulations, application is made for an experimental licence, unless the applicant can give very definite particulars as to qualifications, he should accompany his application with full details of the set which he proposes to make, or give reference to say, a constructional article in *The Wireless World and Radio Review* which he desires to follow. Such information we feel sure would be a very valuable guide to the Post Office authorities in making their decision, and would probably be an important factor in speeding up the issue of the licence. H. S. P.

Electrons, Electric Waves, and Wireless Telephony—XII.

By Dr. J. A. Fleming, F.R.S.

3.—Detection of Electric Waves.

It will be clear, then, that to detect electric waves passing through space we have to place at that point an oscillatory circuit which is generally of the open circuit or rod type, which must have the capacity of its two parts with respect to each other and the inductance of its rod or wire so adjusted that the natural period of oscillation of the oscillator agrees with that of the wave to be detected. Next, that oscillator must be placed with its rods parallel to the direction of the electric force in the wave. If it is a nearly closed or loop receiving circuit, its plane must be coincident with that in which the electric force component of the wave lies.

The incident electric waves then produce in this receiving circuit a feeble oscillatory current of the same type as that in the transmitting circuit.

To complete the detection we have furthermore to associate the receiving circuit with some device called a *detector*, which is in effect a very sensitive kind of ammeter or voltmeter for detecting high frequency electric currents, and enables us to detect the presence in the receiving circuit of a very feeble electric oscillation.

There are only two types of such detector at present much used, viz., the crystal detector and the thermionic valve detector, but we shall mention first the coherer, as this form of detector enables us to show with great ease many of the properties of electric waves which are illustrative of wave phenomena in general.

It had been known for a long period of time that metallic filings formed a conductor of a peculiar kind, and that a glass tube loosely filled with such metallic filings had a conductivity which varied in a very irregular manner.

Professor E. Branly, of Paris, drew attention in 1890 to the fact that an electric spark taking place near such a tube of loose metallic filings caused a sudden increase in its electric conductivity. The same thing appears to have been noticed previously in 1887 or 1888, by Professor D. E. Hughes, the inventor of the microphone.

Sir Oliver Lodge observed in 1893 the improved conductivity a loose or microphonic metallic contact produced when an electric oscillation passed through the contact and named the device a *coherer*.

Without entering into historical developments we may say that the coherer in the form given to it by Marconi, consists of a very minute quantity of metal filings, preferably nickel, with a small percentage of silver, which is contained between two silver plugs included in a glass tube.

The tube is exhausted of its air. The plugs are connected to two platinum wires sealed through the glass.

For certain laboratory and experimental purposes the author has used with advantage another form made as follows: A small ebonite box, like a little pill-box, has two nickel or silver wires passed through holes in the sides so that the wires are not quite in line (see Fig. 59). The wires where they pass through the box must be parallel to each other and about two millimetres or not more than 1/12th of an inch apart. They must otherwise rest on the flat bottom of the box. A very small quantity of fine clean nickel filings is then laid between them and this quantity has to be adjusted until the greatest sensitiveness is obtained. The length of wire which projects beyond the box on each side is about three inches. A little stopper of ebonite is provided to close the top of the box. The two wires and the filings connecting them are joined in series with a single dry voltaic cell, and with the wire circuit of a device called a *relay*.

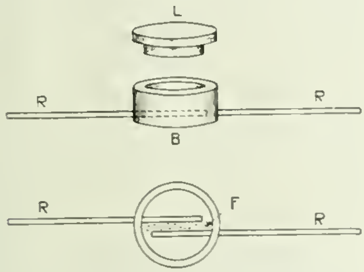


Fig. 59. A type of coherer used by the Author in Hertzian wave experiments.
RR Metal wires.
B Ebonite box.
F Nickel filings between the wires in the box.

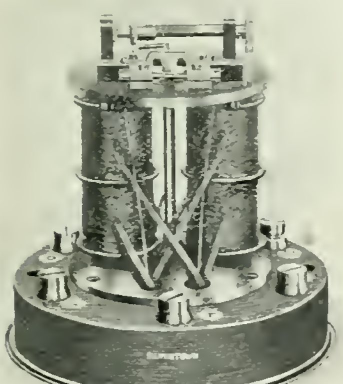
A relay consists of a pair of soft or pure iron bars round which are coiled many convolutions of fine silk-covered copper wire, through which the electric current from the battery cell can be sent. The iron then becomes a magnet and the arrangement is called an electromagnet. When the iron bars are thus magnetised, which can be done sufficiently with a very feeble electric current, the poles of the electromagnets are caused to attract a pivotted piece of soft iron (see Fig. 60), called an armature, and pull it over against a metal stud which effects a contact and completes another electric circuit, which contains a more powerful battery of many cells and some instrument such as an incandescent lamp, an electric bell, or a printing telegraph instrument, which can give a visible, audible or legible signal. The relay is therefore a device by which the starting or stopping of a very feeble electric current can cause another very much stronger electric current to be also started or stopped.

Let us suppose then that we have two metal rods each a few inches long, placed in line with polished metal balls on their inner ends, with a small spark gap between them, so as to form a Hertzian oscillator.

It is desirable that this oscillator should be contained in a metal box with one end open (see Figs. 61 and 62).

By means of an induction coil or electrical machine, electric sparks are created between the balls. This results, as already explained, in the production of electric oscillations in the rods and in radiation of electric waves from them.

The wavelength of the waves radiated is approximately twice the overall length of the



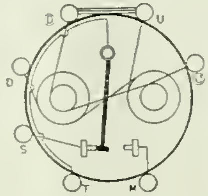
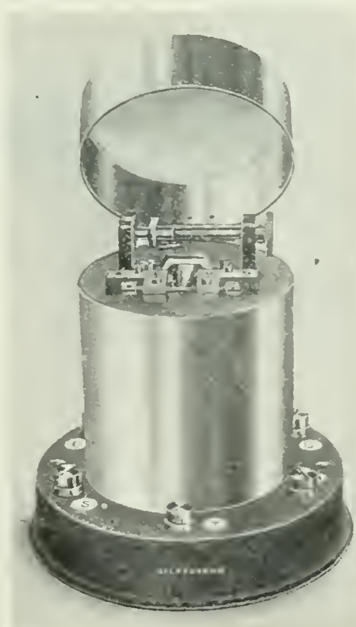


Fig. 60. A telegraph relay with outer case removed.



A telegraph relay.

two rods. Hence to obtain short Hertzian waves, that is, not more than a few centimetres in wavelength, the spark balls and the rods must not exceed in length half the desired wavelength.

It is necessary to connect these rods to the spark producing appliance, which is generally a small induction coil, through tightly wound up spirals of indiarubber-covered wire, called choking coils. The object of this is to hinder the electric oscillations generated in them from passing back into the induction coil. Another precaution is to have the spark balls highly polished, as this helps to produce that suddenness of the electric discharge which is a necessary condition for creating electric waves.

The receiving arrangements, comprising the metallic filings, coherer, and the extended wires, are placed in another metal box, open at one end, the two boxes being arranged with open ends facing each other and at a little distance, and the oscillator rods parallel to the collecting wires of the receiver (see Fig. 62).

It is very important that the wires which lead away from the coherer to the relay and voltaic cell and from the relay to the indicating device, whether lamp or bell, should be enclosed in a metal tube and all joints made tight. The object of this is to prevent the electric waves radiated from the transmitter affecting the coherer otherwise than by entering the open mouth of the receiver box.

To control the emission of waves from the transmitter it is necessary to insert in the primary circuit of the spark-producing coil a

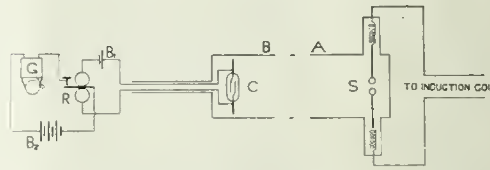


Fig. 61. Apparatus for experiments with short Hertzian electric waves.
S Oscillator rods in open mouth box A.
C Coherer in box B.
R Relay.
G Electric bell.

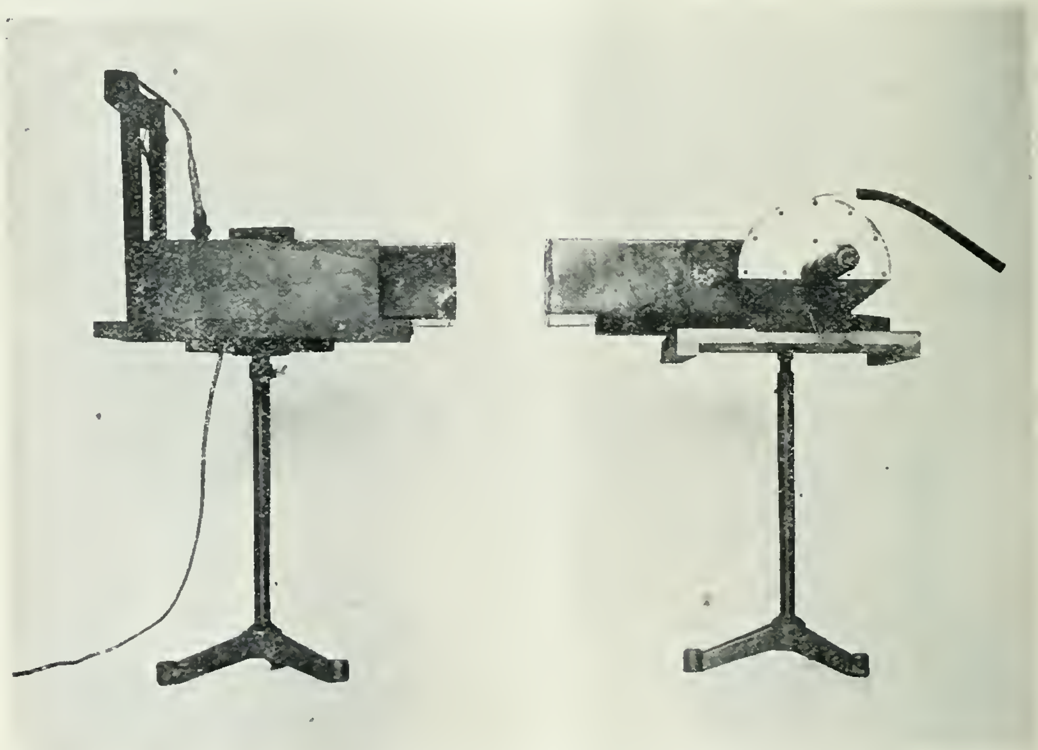


Fig. 62. General view of the Author's apparatus for showing experiments with short electric waves illustrating their similarity to light waves and the opacity or transparency of various substances.

switch or key so that we can create a spark of short duration between the spark balls by closing this switch for an instant.

A train of electric waves having a wavelength of a few inches then emerges from the open mouth of the transmitter box and enters that of the receiver or coherer box. These waves set up electric oscillations in the collecting wires, which causes the metal filings in the box to become highly conductive. The metal particles cling or cohere together. The voltaic cell in series then sends a current through them and through the relay, which in turn operates the detecting device and lights up the indicating lamp or rings the electric bell. This signal then shows that an electric wave has entered the receiving box. If we stop the transmitter spark and give the coherer box a smart tap or blow, this causes the metallic filings to cohere or fall back again into a badly conducting condition and the indicator lamp then goes out or the bell stops ringing.

Provided with this apparatus we can then demonstrate a number of the interesting properties of electric waves having a wavelength of a few inches.

In the first place if we hold between the transmitter and receiver boxes a sheet of metal, even a sheet of tin foil or silvered paper we find that the metal is opaque to these waves, and that the receiver is not affected.

The reason is because the electric waves falling on the metal sheet set up in it oscillatory electric currents, and these are exactly in opposite phase ; that means moving in opposite directions to the currents in the oscillator rods which generate the waves. These currents in the metal sheet in turn create waves which, however, being in opposite phase, just nullify the effect of the incident waves on the receiver.

All good conductors are therefore opaque to this type of electric wave.

On the other hand bad conductors are transparent. If we hold a sheet of glass, ebonite or even a thick plank of dry wood between the oscillator and the detector, these electric waves are found to pass through it quite easily.

They pass also through many folds of dry cloth. If, however, the cloth is made wet, even a wet duster will do, it is found to be opaque to them. For this reason the human body, hand, or head, are also opaque, and stop these electric waves on account of the water in the tissues. A number of interesting experiments may be made with flat glass bottles about 6 inches square and an inch in thickness. It will be found that the empty bottle is quite transparent to these waves. If filled with water it is quite opaque. If filled with paraffin oil, olive oil, turpentine or other insulating liquid it is found to be transparent.

Methylated spirit is transparent if quite free from water, but the water-adulterated mixture is semi opaque.

We learn from these experiments that, generally speaking, good conductors are opaque to long electric waves, and good insulators transparent.

Fig. 63. A grid formed by winding wires round a wooden frame.

This is not the case so strictly speaking for the very short electric waves which constitute visible light. In the latter case many aqueous solutions of salts called electrolytes, because they can be decomposed by an electric current, are transparent to light, and yet are good conductors. The reason is because in light waves we are dealing with electric displacement currents which are reversed hundreds of billions of times per second, and many substances which are good conductors for low frequency currents are not good conductors for such extra high frequency currents. Another interesting experiment can be shown with a grid of wire. If we wind copper wire round a wood frame so as to lay a number of parallel wires about half an inch apart across the frame in one direction (see Fig 63), we find that this grid is opaque to the electric radiation when the frame is held between the receiver and transmitter with the grid wires parallel to the oscillator rods, but is transparent when it is turned into a position such that the wires are perpendicular to the oscillator rods, the plane of the frame in both cases being perpendicular to the line joining the spark balls and the coherer.

The reason is because in the former case electric currents are set up by the electric waves in the grid wires, and in the latter case they are not

The waves emitted are therefore said to be plane polarised; that means the vibrations are confined to one particular plane. This is the case with light waves when they have been transmitted through certain crystals such as tourmaline.

We can next exhibit the reflection and refraction of these invisible electric waves, and show that they behave like waves of light.

If we turn the transmitter and receiver boxes with their open ends in nearly the same direction, but placed not quite near each other, it is possible to find positions in which the emitted waves do not enter the receiver box and affect the coherer. If, however, we hold a sheet of metal we can reflect the invisible electric beam into the mouth of the receiver box and so affect the coherer.

Moreover, we can do the same thing with a wet duster, and also with the grid of wires provided we hold the grid in such a position that its wires lie in the same plane as the rods of the oscillator.

We shall see later on in speaking of wireless telephony that we can in this manner construct reflectors for electric waves which are not very cumbersome or costly, and especially do not offer much surface to wind.

We can also refract or bend the direction of these waves by means of prisms made of paraffin wax (see Fig. 64).

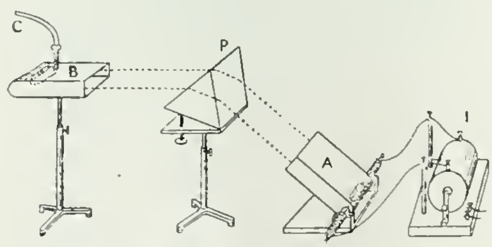


Fig. 64. An experiment with the apparatus shown in Fig. 62 to illustrate the refraction of short electric waves by a paraffin prism.

Again it is possible to produce, as Hertz did, interference effects and to cause two sets of waves to augment or to destroy each other just as in the case with waves on water or waves in air.

In short, we can exhibit with this invisible electric radiation similar phenomena to those with which we are so familiar in the case of light, viz., opacity, transparency, reflection, refraction, polarisation, and interference. Great experimentalists, following Hertz's initiative, have therefore built up a body of irrefutable proof that in this invisible electric radiation of long wavelength we are dealing with an agency identical in nature with light, except that it cannot affect our eyes but can only influence certain artificial eyes called aerials and detectors.

This is perhaps the best place to mention the range of these known and also of the unknown wavelengths which are comprised by this electric radiation. It will be convenient to adopt a term from the science of music and call an *octave* of radiation all those waves which are included between a certain particular wavelength and a wavelength of exactly double or else half that length.

We may, then, compare the electric waves of different frequency, extending over a great range, with the keyboard of some large organ in which each key corresponds to a different wavelength. In the case of an organ a compass of eight or nine octaves includes all the range of musical sounds, but in the case of electric waves we are acquainted with wavelengths extending over nearly 50 octaves, ranging from the longest ætherеal billows of 20,000 metres in wavelength down to the tiny ripples of less than 1 Angström unit in wavelength which constitute a certain class of X-ray.

Beginning, then, with the longest electric waves, we can say that the range of wavelength of waves used in wireless telegraphy and telephony extend from 20,000 metres to 10 metres, or, say, over 11 octaves of wireless waves. Then beneath these we have the Hertzian waves which range from about 10 metres to 5 centimetres in wavelength, or, again, about 11 octaves.

Beneath these we have a range of electric waves from about 5 centimetres in wavelength to 0·3 millimetres, or about 8 octaves of radiation, which has not yet been created and are therefore unknown.

Again below these, we find the dark heat-waves stretching from 300 microns (μ) or $\frac{1}{3}$ of a millimetre in wavelength to about 0·8μ or 8,000 Angström units (A.U.). These 7 or 8 octaves of radiation can make themselves evident by their heating action on sensitive thermometers, but do not affect our eyes as light. Extending in wavelength merely 1 octave from $0{\cdot}8\mu$ to $0{\cdot}4\mu$ in wavelength, we have that small range of electric waves which can affect the human eye as light. Beyond the violet rays there is a range of 3 or 4 octaves or more of invisible light, which cannot affect our eyes but can impress a photographic plate, and produce other effects. These are called the ultra violet waves, and their wavelengths extend from about 4,000 A.U. down to perhaps 500 A.U. or less.

Below these there is another gap of unknown or unproduced wavelengths, and then we come to the region of X-rays and Y-rays, which are electric waves with wavelength of the order of 1 A.U. or less.

We are therefore acquainted with the properties of a vast gamut of electric waves with, however, two gaps in it of unknown waves, but covering on the whole about 50 octaves of radiation. For all we know there may be in the economy of nature waves of still greater or still less wavelength as yet unproduced.

(*To be continued.*)

Distributing Problems of Radio Manufacturers.

By M. B. Sleeper.

In the following article Mr. Sleeper describes some of the difficulties which were experienced in America in the process of establishing the wireless indus'ry on a sound footing.

ALTHOUGH the experiences of radio manufacturers in England may differ from the series of events which have taken place during the first year of broadcasting here, the general outline will probably be the same. Possibly some of the very expensive errors made by the majority of our manufacturers and dealers that have almost paralysed the industry may be worth relating.

Last Christmas the demands of the public upon the dealers were such that they were operating on the daily deliveries from the manufacturers. The latter, sensing a great increase in business, bent all their efforts to enlarge their facilities. New companies sprang into existence, in the main duplicating the products of existing concerns. The newcomers found plenty of orders, because the dealers knew that, of whatever they ordered, only a small part would be delivered. We call it "pyramiding" orders.

For example, a dealer who could sell a thousand rheostats a month ordered two thousand from each of six companies, with the idea that the total of the partial deliveries might make up that amount. Because of this phantom of demand, manufacturers lost their perspective and tried to get on an immediate delivery basis. In the meantime business developed so rapidly that, when they could deliver a thousand rheostats the dealer could sell ten thousand. Moreover, new stores opened up by the hundred, and a certain amount of goods had to be turned out to supply each one.

Jobbers also jumped into radio, bringing with them the question of jobbers' discounts. Many of them, instead of selling to the stores, took advantage of the jobbers' discounts, but sold directly to consumers. Department stores, one after another, opened radio departments, complicating matters by asking for jobbers' discounts. Moreover, machine shops and "cellar factories" made trouble by offering jobbers' discounts to the retail stores. Radio stores included, by the way, ironmongers, chemists, tailors' shops, millinery stores, shoe stores, sporting goods and clothing shops, stationery stores, garden implement houses, motor car accessory shops, garages—in fact, almost any kind of place selling to the public.

Before this time we had had no real jobbers, and no one could definitely define a radio jobber anyway. As a result many manufacturers sold in large quantities to stores whose purchases on credit were really not justified by their normal credit rating. Then however, their turnover was so rapid that they could easily pay their bills and—here is where the trouble came—they were allowed to continually increase the size of their orders.

In May the crash came. The production of established manufacturers, plus that of the newcomers, reached the demand, and the consumers' purchases fell off slightly. Immediately orders were cancelled right and left. A little later goods were returned to the manufacturers. Retailers stopped paying their bills.

The effect was first felt by new manufacturers who had ordered materials in huge quantities, for theirs were the first orders to be cancelled. As a result, they had no accounts receivable to cover their accounts payable. They had not had time to establish themselves in the minds of the public, nor had they advertised extensively. One after another closed shop in rapid succession.

During July and August the strain was felt by the older concerns, for both orders and collections fell off to almost nothing. Since they sold directly to retailers instead of putting orders through jobbers of high financial standing, they found trade connections, built up at great expense, of no further value. Many retailers, finding business poor during the summer, quickly disposed of their stocks, but showed no interest in paying their bills, because, having made money during the period of great demand, they decided to go back to their old business, that of selling medicine, clothes, shoes, or whatever it was.

This autumn, orders have been very slow at first where, ordinarily, things are in full swing by the middle of September. This was due to the fact that many stores were still stocked with last spring's purchases and the public was waiting for the end of the unreasonably warm weather we were experiencing. Some retailers could not and others would not pay bills dating back to April and May until trade resumed. In the meantime many manufacturers who kept up production right through the summer, in preparation for autumn demands, had not been able to finance themselves, and had gone under. This has put on the market a tremendous amount of merchandise at sacrifice prices. In many cases goods are offered at one-fourth their advertised prices.

All this has benefited, in a way, those who are able to stay in business, though the lessons learned have been dreadfully costly. Credit relations between material supply houses and manufacturers, as well as with the banks, have been strained, often creating a lack of confidences in the manufacturer at a time when he needs the greatest assistance.

A word about discounts may be of interest. Discounts to retailers have been established at 25 and 30 per cent., sometimes running to $33\frac{1}{3}$ per cent. Jobbers are allowed 40 per cent., and distributors who cover the territory of several jobbers are given 50 per cent. Distributors have been necessary here because the United States is too large to be covered from one central office. In England, on the other hand, the population is sufficiently concentrated that this necessary evil may not be needed.

Comparatively little of the autumn business is being handled directly with the retailers. Such orders are now filled by shipping the order to the jobber who covers the city where that retailer is located. The goods are billed to the jobber who, of course, has demonstrated his financial standing prior to his appointment. Such distribution has been achieved that the fraction of direct mail orders from the consumer is very small. Manufacturers generally try to sidestep mail orders by advertising that their goods can be purchased in the local stores.

It has not been my intention in the foregoing paragraphs to paint a black picture of the radio situation here as a prophecy of conditions in England. On the contrary, my desire in preparing these notes was to present a rough outline of our experience with the hope that from them some helpful ideas might be obtained by the English manufacturers in whose work I have always been interested, and for whose products, particularly after my visit during the summer, I have the highest regard.

Compact Short-Wave Receiver.

Embodying the tuning principle described in a constructional article in this Journal,* Mr. E. G. Nurse has built this compact crystal receiving set, which he states gives very

satisfactory results. Tuning is effected by moving the relative positions of two flat coils connected in series As will be seen, a cigar-box is used as a container for the parts.

* Page 329, June 10th, 1922.

Experimental Station Design.

XVIII.—A 10-WATT C.W. AND TELEPHONY TRANSMITTER.

THIS low power transmitter is designed to embody a minimum of parts and to be operated efficiently with the smallest number of adjustments. Consequently, as will be seen, the anode of the oscillator valve is connected directly to the aerial inductance instead of making use of loose coupled circuits. Such an arrangement is usually quite satisfactory for telephony transmission where considerable damping is introduced, though may cause complications when the H.T. is derived from a source having a potential above earth. It might be mentioned here that where public supply mains are in any way connected in the high tension circuit it is advisable to connect condensers having fixed values greater than 0·005 mfds. in both aerial and earth leads, for although one main may be earthed at the power station it will develop a difference of potential to earth at the experimenter's premises owing to its resistance and the heavy currents that may be flowing.

The components embodied in this set may be wired up to the particular principle most favoured by the experimenter, but the parts shown include those necessary for the various arrangements for different methods of transmission.

The panel, owing to its size and the number of instruments it has to support, should have a thickness of at least $\frac{3}{8}$ in. Its other dimensions will depend upon the particular makes of the components selected, and the one shown measures 13 ins. by $8\frac{1}{2}$ ins. The former for the aerial circuit inductance consists of a piece of ebonite tube having an external diameter of $3\frac{1}{4}$ ins., and a wall thickness of about $\frac{1}{8}$ in to $\frac{3}{16}$ in. It is attached to the panel by two brackets made from $\frac{3}{8}$ in. ebonite sheet and shaped to fit to the face of the tube.

Two 4 BA screws at each end of the tube will secure it to the brackets while 3 BA screws are used to attach the brackets to the panel. A smaller ebonite former is required to rotate inside the aerial circuit former to carry the grid circuit inductance. This should have an external diameter and length of each 2 ins. It is mounted on a spindle which has one bearing in the ebonite panel and the other in the aerial circuit former on the side most distant from the panel. The side of the former which is nearer to the panel has, of course, a clearance hole. More precise details for fitting up this former were given on page 866, in September 30th, 1922, issue. The spindle is fitted with knob and dial to indicate the setting of the grid circuit coupling.

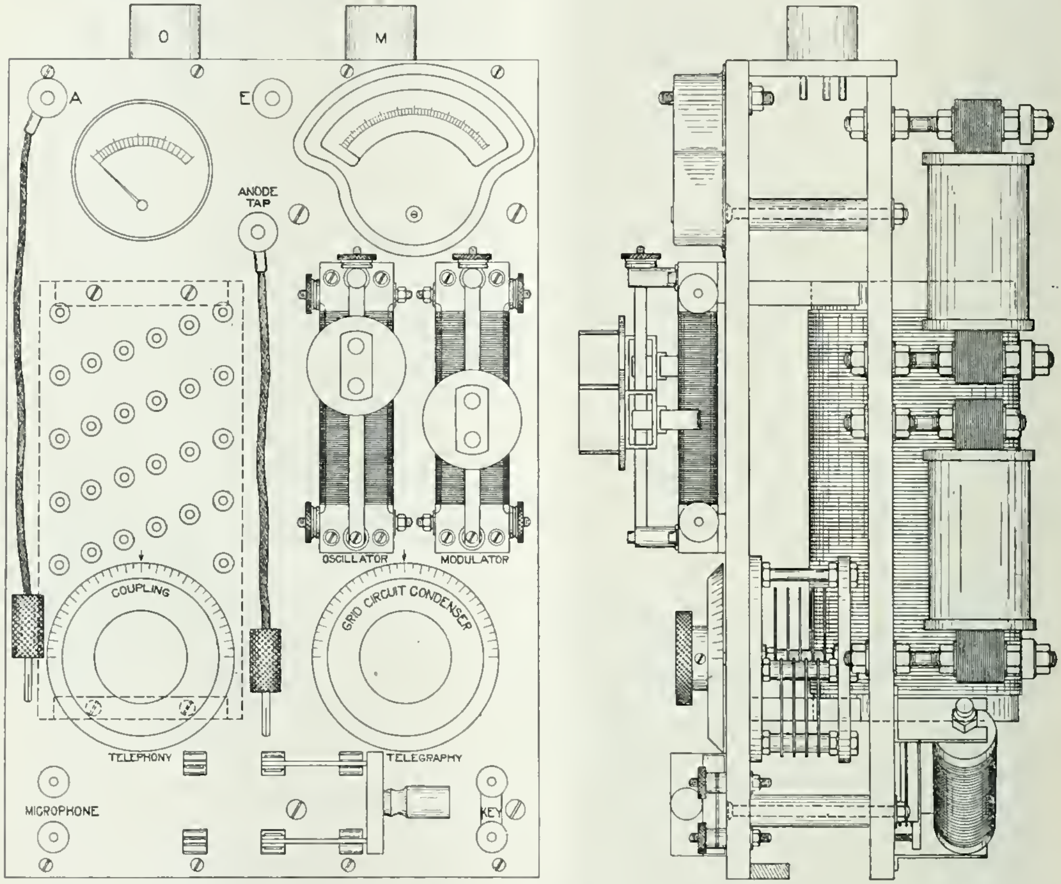
The winding of the aerial circuit inductance depends upon the dimensions and resistance of the aerial circuit. A small aerial will necessitate the inclusion of many turns to produce a wavelength of 440 metres, whilst a high resistance aerial will also require a large number of turns in order that the anode tap may include sufficient inductance to excite the aerial circuit. Most experimenters are now, however, devoting their attention to wavelengths between 150 and 200 metres owing to the inauguration of broadcasting. For these short wavelengths a special aerial must be erected, and a vertical single wire 50 or 60 ft. in length serves very well; or better still, a vertical iron pipe standing on an insulating base and guyed with well insulated and split up stay wires is very useful for short wave experiments in both transmitting and receiving, as no capacity fluctuations occur as in the case of a wire aerial, due to swinging. For short wavelengths, and with a special aerial, the aerial inductance may be wound with insulated strip wire such as is used for winding transformers, and having a width of about $\frac{1}{8}$ in. and a suitable thickness, say No. 26 S.W.G. The turns should be spaced by either leaving a small gap of about $\frac{1}{16}$ in. between the turns as they are put on, or winding on with the wire and between the turns a piece of thin twine. For the longer wavelength of 440 metres with an aerial approximately the dimensions specified by the Post Office, the inductance may be wound with No. 18 D.C.C.

Every turn should be tapped out to a socket on the front of the panel. If none of the usual types of socket are available, single valve stems may be used for the purpose. Plugs must be provided to fit these sockets for tuning the aerial and connecting the anode tap.

The grid circuit former should be wound with No. 22 D.S.C., and the exact number of turns required must be found by experiment after the grid circuit condenser has been built up. The tuning condenser should be put in a mid position and connected across the inductance with a crystal detector and telephones, and then by means of a buzzer wavemeter set to the normal wavelength on which it is desired to transmit, the number of turns may be adjusted.

Spacing washers of more than the usual thickness should be used for building up the grid circuit tuning condenser in order to provide for greater spacing between the plates.

A suitable value for the grid leak will depend upon the type of valve used, and two or three leaks should be constructed so that one having the most suitable value can be employed. An approximate value is 10,000 ohms, and it should be made up by winding No. 40 D.S.C. "Eureka" or other resistance wire, non-inductively on a short piece of 1-in. ebonite rod, as shown immediately below the transformers in the diagram illustrating the back



Front and Side views of C.W. and Telephony Transmitter. Scale ⅓ full size.

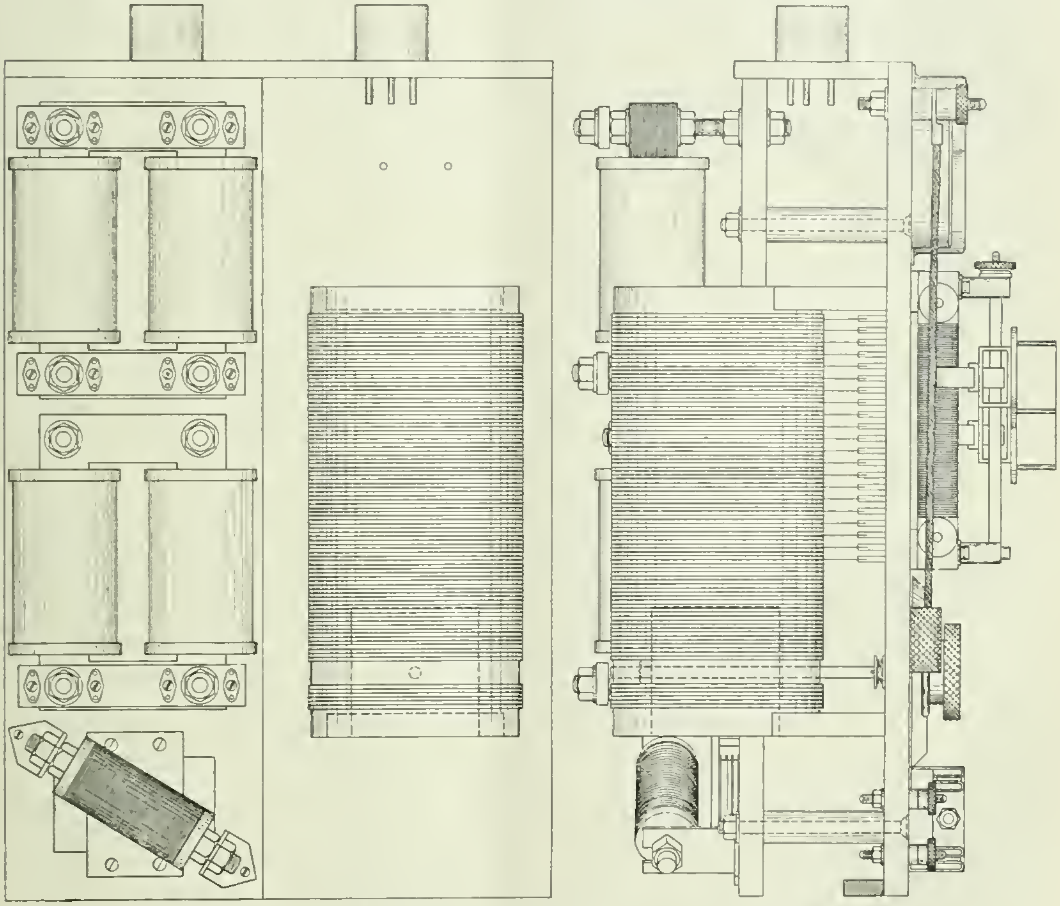
The capacity of this condenser need not exceed 0·0002 mfds. if the transmitter is to be used only on one wavelength.

The grid condenser which has a value of 0·002 mfds. must be built to withstand higher potentials than the type of condenser used in receiving circuits. If mica 2/1,000 in. thick is used for building up this condenser, then it is best made in three sections mounted together and connected in series.

view. The ebonite rod should be revolved, and the wire run on from two reels, the starting ends being joined together. The weight of wire required to produce a given resistance can be calculated and adjusted on the reels before winding is commenced. Another method of winding the leak, and one not so liable to breakdown, is to wind on from one reel only making reversals at intervals. For instance, wind on a single layer for a quarter of an inch, and then cover this with another layer in the same direction. Loop the wire and for the same number of revolutions, as may readily be determined when using a treadle lathe, by counting the number of times the treadle is operated, wind on two more layers over the first two. Make a number of sections side by side along the former similar to the one just produced, and by this method the potential is distributed.

suitable, and occupy small space considering the high potentials which they are designed to withstand. This condenser can probably be mounted immediately behind the variable resistances.

The high frequency choke coil also is not shown. It may be mounted immediately behind the aerial circuit ammeter. It should consist of a single layer of No. 28 D.C.C. on a 2-in ebonite former $2\frac{1}{2}$ ins. in length.



Rear and side views. The wiring and parts liable to confuse the drawing have been omitted.

The condenser in the anode lead has not been introduced into the diagrams as the type selected will depend upon the materials the experimenter may have to hand. It should be designed to withstand a potential of at least 5,000 volts, and may be built up of a number of mica dielectric condensers clamped together and connected in series and buried in good quality insulating wax. Dubilier condensers are, of course, particularly

The iron core choke coil is the lower one in the back view of the panel. Its core is built up from $\frac{3}{4}$-in. iron strip, and the corners are interleaved, thus, if the sides are 3 ins. by $4\frac{1}{2}$ ins. then the strips will need to be cut to $2\frac{1}{4}$ ins. and $3\frac{3}{4}$ ins. If the strips are held together by bolts through the corners, then clearance holes must be made for the bolts in order that they may be wrapped with mica or thin fibre so as to avoid putting the plates in electrical contact. Mica or fibre washers should be placed under the nuts, and one side of all the strips should be given a thin coat of varnish or enamel. Unless good tools are available it may be difficult to neatly drill the corners, in which case the ends may be clamped together between $\frac{1}{8}$-in. thick, brass plates. Strips of ebonite are arranged to carry the connecting tags for soldered connections. The bobbins, having a length of $2\frac{1}{2}$ ins. and a diameter of $1\frac{1}{2}$ ins., are wound full with No. 30 S.S.C., a piece of thin paper being placed between each layer.

The microphone transformer is of similar dimensions to the choke coil, but each bobbin has a primary winding of four layers of No. 26 D.S.C., and a secondary of No. 38 S.S.C., with insulation between layers. Each winding is brought out on to separate tags so that if desired the primary or secondary windings may be paralleled.

The usual type of sparking coil may be employed to replace this transformer when its contacts are screwed up. The secondary winding of a similar coil may be used as a choke.

The selection of the microphone is left to the experimenter, but the "solid back" types as used by the Post Office, and which can be obtained from the telephone manufacturing companies, are specially recommended.

The filament resistances should be capable of passing 4 amperes without heating, and the type illustrated is particularly convenient.

A milliammeter is connected in the H.T. + lead, and should read up to 50 or 100 milliamps and should be of the moving coil variety.

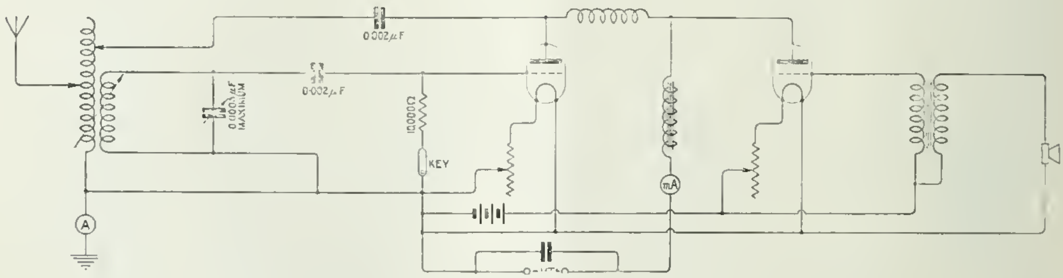
A hot wire ammeter having a full scale reading of 0.5 amperes is required in the aerial circuit.

Valve holders are, of course, needed for oscillator and modulator. The valves may be either A T. 15, 30 or 40X, according to the power used. The use of valves rated to dissipate more energy than that normally used are recommended.

A switch is shown on the front of the panel for working either telegraphy or telephony. This switch is not essential, as when working telegraphy it is only necessary to remove the modulator valve and break the microphone circuit. It is intended that one lever of the switch transfers the grid connection of the second valve to the grid of the oscillator valve, whilst the other transfers the modulator valve plate to the oscillator plate lead, thus throwing the valves in parallel.

The terminals for the filament battery and the high tension supply may be arranged at the back of the instrument. The H.T. may be derived either from a D.C. high voltage generator or by stepping up from a high periodicity A.C. supply and using rectifying valves. An instrument making use of the latter method will be described in the next article under this heading.

F. H. H.



Transmitter Circuit making use of the "Choke Control" method of modulation.

ELEMENTARY INSTRUCTIONAL LECTURE.

An experimental Lecture dealing with the Principles of Radiotelephony, and primarily intended for Associates of the Radio Society of Great Britain, will be given by G. G. Blake, M.I.E.E., A.Inst.P., at the Institution of Electrical Engineers on January 12th, at 6.30 p.m. Tickets will be sent to Associates. All interested are invited, and tickets can be obtained by sending a stamped and addressed envelope to Mr. Leslie McMichael, Hon. Secretary, The Radio Society of Great Britain, 32, Quex Road, West Hampstead, N.W.6.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

On November 28th the above Society held several experiments with regard to the reception of broadcast music, etc., to which many of the leading local scientific gentlemen were invited.

The experiments, which proved highly successful, were made on crystal and valve sets, including an Armstrong super-regenerative set, telephony and music being distinctly heard with the use of the frame aerial, a loud speaker being employed.

The usual Wednesday meeting held on the 29th took the form of five to ten-minute papers given by members on any subject pertaining to "Wireless," some very practical hints being given by Mr. E. Blakemore and Mr. W. Harvey-Marston.

North London Wireless Association.*

Hon. Secretary, Mr. V. J. Hinkley, Northern Polytechnic Institute, Holloway Road, N.7.

At a meeting of the Association, held on November 27th, Mr. F. S. Angel gave his third paper on "The Elementary Principles of Radio Telephony."

Mr. Angel gave an explanation of the general principles of wave-motion, using various analogies to illustrate his points. Two mechanical lantern slides, one for showing transverse and the other longitudinal vibrations, were on loan from the Physics Department.

A discussion took place, from which it was apparent that the lecture had been followed with a great amount of interest.

Hackney and District Radio Society.*

Hon. Secretary, Mr. E. R. Walker, 48, Dagmar Road, London, E.9. (Stamped addressed envelope should accompany enquiries.)

On November 30th it was stated that the lecturer for the evening, Mr. J. W. Francis, who had promised to lecture on "Electrical Units," was unfortunately ill, and the meeting was therefore given over to informal discussion. Various sets of apparatus were exhibited and demonstrated, 2 LO and Birmingham coming in quite clearly. A small neatly-made crystal set was also exhibited, made by a young member of the Y.M.C.A. section of the Society. The Vice-Chairman promised to award a prize to the Y.M.C.A. member making the best crystal set by Christmas.

The Chairman announced that the Mayor of Hackney had agreed to become the first President of the Society, and Sir Arthur Lever, the new M.P. for Central Hackney, the first Patron.

Full details of the subscriptions to the Society appeared in *The Wireless World and Radio Review*, on December 2nd.

Sutton and District Wireless Society.*

Hon. Secretary, Mr. E. A. Pywell, Stanley Lodge, Rosebery Road, Cheam, Surrey.

At the meeting held on November 29th, 1922, one of the members, Mr. J. F. L. Corkett, B.Sc., gave a very interesting lecture on "The Wireless Service During the War." This was illustrated with lantern slides, kindly lent for the occasion by Marconi's Wireless Telegraph Co., Ltd. At the close, he was accorded a hearty vote of thanks.

Meetings will in future be held on the second and fourth Wednesdays in the month at the same time and place as previously, namely, 8-10 p.m at the Adult School, Benhill Avenue.

There are now 36 members.

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

An Exhibition of Apparatus and Demonstration of Wireless Telephony was held on December 1st and 2nd. A large display of members' apparatus was on view.

A general meeting was held on December 8th at the Grammar School, Mr. G. P. Kendall, B.Sc. (Vice-President) being in the chair. A lecture on and demonstration of "Recording Apparatus" was given by the President.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

On December 4th Mr. A. H. Norman lectured on "Common Faults in Receiving Circuits." He gave reasons for many of the extraneous noises heard in the 'phones, which tends to make wireless reception uncomfortable, and explained how they may be eliminated.

The Secretary mentioned that the time allotted for questions was not sufficient, so a special evening had been arranged for a discussion on "The Difficulties Experienced by the Wireless Amateur."

Cardiff and South Wales Wireless Society.*

Hon. Secretary, Mr. P. O'Sullivan, 37, Colum Road, Cardiff.

A general meeting of the Society was held at Headquarters, The Engineers' Institute, Park Place, Cardiff, on November 23rd, Mr. E. Ogden presiding.

A letter was read from Commander J. R. Schofield, accepting the office of Presidency of the Society for the year 1922-23.

Mr. Alex Lawrence, who recently left this country in order to take up a position in Persia, wrote resigning from the Committee of the Society. The Secretary commented upon the excellent work Mr. Lawrence had performed whilst he had been with the Society. It was decided that the Secretary write Mr. Lawrence thanking him for all the kindnesses he had rendered in the past, and wishing him every success on his new adventure.

Mr. Norman M. Drysdale lectured on "Radio Telephony." Mr. Drysdale concluded his lecture by having cast on the screen a picture of the transmitting apparatus used at Marconi House.

Many questions arose out of the lecture, a lengthy discussion taking place on the "Heaviside Layer."

Thames Valley Radio and Physical Association.*

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

It was announced on December 1st that Mr. Becker, M.P., had accepted Vice-Presidency, and that the Association had become affiliated to the Radio Society of Great Britain.

Major-General Shaw was thanked for his gift of a blackboard.

Meetings are to be held weekly in future, alternate weeks to be informal and formal. Mintues are not to be read at the informal meetings.

Mr. Blake gave an elementary lecture on "Broadcasting, the Ether and other Experiments."

A vote of thanks was proposed to Mr. C. Wilson for his generous gift of 12 valves. Forty members and 15 visitors were present, and two new members joined.

Southport Wireless Society.*

Hon. Secretary, Mr. E. R. W. Field.

The third annual meeting was held on December 5th. The Secretary, Mr. R. Brown, reported that the last year had been most successful. The membership had more than doubled, and there was a substantial cash balance in hand. The election of officers resulted as follows:—President, Mr. Taylor; Chairman, Mr. R. Brown; Secretary and Treasurer, Mr. E. R. W. Field; Committee, Messrs. A. Stock, R. Wilde, Capt. F. C. Poulton, O.B.E.

Mr. Field referred to the death of the Vice-President, Colonel A. D. Lomas. It was unanimously agreed not to fill the vacancy for a year, as a mark of esteem for Colonel Lomas. A "hot-pot" supper followed. The programme for the ensuing year was announced, and a vote of thanks to the retiring Secretary, Mr. R. Brown, closed the meeting.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

Mr. A. Leardet lectured on "High Frequency Amplification" on December 1st.

The Society has purchased a "Lokap" coil winding machine, which will be installed in the instrument room.

Redhill and District Y.M.C.A. Wireless Society.*

Hon. Secretary, Mr. J. S. B. Clarke.

A Committee meeting was held on November 29th, when it was decided that a "Gadget" competition, and a sale of "Junk" should be held on December 20th.

Gadgets to be submitted to Mr. Johnson, Y.M.C.A., Station Road, Redhill, before that date.

The Club held an open night on December 13th, when Mr. Pope lectured and demonstrated.

Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

Mr. G. G. Boullen occupied the chair on November 22nd. Mr. Holmes lectured on "The Armstrong Super-Regenerative Circuit." Afterwards a frame aerial demonstration was given, **2 ZY** Manchester being heard quite distinctly. A hearty vote of thanks to Mr. Holmes was passed.

On November 29th Mr. G. G. Boullen took the chair. New members were elected. Mr. J. R. Halliwell opened a discussion on "Broadcasting."

Ramsgate, Broadstairs and District Wireless Society.*

Joint Hon. Secretaries, Mr. F. Harrison, "Rochester Cottage," St. Lawrence (Ramsgate), Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs (Broadstairs and District).

On October 21st, Mr. F. Harrison gave a very entertaining and practical lecture on "Valves," kindly bringing various types to illustrate. He was accorded a hearty vote of thanks. The next weekly lecture was given by Mr. P. F. Weeks, M.B.E., who chose for the benefit of the younger members, "A Simple Crystal Set and its Construction," and brought one of his own sets for the members to examine.

A "Question Night" was held the following week. The Society is erecting a two-valve set.

The death of two Vice-Presidents, Mr. W. G. Riddle, and Mr. Charles F. Grossmith, is regretted.

The Society have now permanent headquarters at the Y.M.C.A., Ramsgate, where they will meet every Tuesday.

Mr. W. Ford Wells, of "Wykeham," Broadstairs, has been elected as a Vice-President.

The membership is increasing slowly but surely.

Wireless Society of Hull and District.*

Secretary's address, 79, Balfour Street, Hull.

A departure from the usual programme was made at the bi-monthly meeting on November 24th, when the evening was devoted to a sale of members' surplus apparatus. Mr. Henry Strong was in the chair. Five new members were elected and a vote of thanks passed to the D.P. Battery Co., of Bakewell, for the gift of a volume for the Society's library. There was a good show of apparatus; the attendance was large.

Buzzer practice will take place at 7 p.m. at each meeting. The Society meets on the second Monday and fourth Friday in each month.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

Mr. F. T. Jones read a short paper on "The Abuse of Reaction," on November 30th, at the Y.M.C.A., Hanley. Mr. Jones clearly illustrated some methods of overcoming reaction difficulty, and a lively discussion followed.

It has been decided to construct a multivalve receiver for the use of the club, and a committee, consisting of Messrs. Bew, Clarke, Steel and Whalley was elected for that purpose. The set will be constructed on Thursday evenings in the clubroom.

Mr. Bew's Morse code competition prize was won by Mr. Warburton.

Oldham Lyceum Wireless Society.*

Mr. A. T. Holmes, of Manchester, lectured on "Amplifier Characteristics." He dealt non-technically with the problem of the best form and combination of different amplifiers.

Mr. I. P. Holden, Chairman, thanked the lecturer.

Manchester Wireless Society.*

Hon. Secretary, Mr. Y. W. P. Evans, 2, Parkside Road, Princess Road, Manchester.

A discussion was held on November 22nd on the various difficulties met with by the members in the reception of telegraphy and telephony. Much of the talk centred around the broadcasting transmissions, particularly with regard to the Manchester station, which, by general consent, was considered of a very low standard, inasmuch that it could be received on all wavelengths, and was very detrimental to amateur transmitting experiments.

Friday, December 1st, Mr. Bertram Hoyle, M.Sc., lectured on "Radio Frequency Measurements."

The temporary arrangement of the circuit as used at the transmitting station for the transatlantic tests on Sunday, November 23rd, was replaced on December 2nd for a more efficient one by mounting the valves, switches, meters, etc., on a specially prepared panel measuring about six feet by eight, erected on insulators. This work was commenced on Saturday afternoon at 3 p.m., and completed at 11.30 p.m. A preliminary test was made to ensure the connections being O.K., and at 1 a.m. the final tuning of the set was carried out. Owing to a slight error in the transformer adjustment of the power valve filament one valve was burnt out and the spare valve had been loaned for exhibition. The spare valve arrived at 2.30 a.m. Meantime a test had been carried out on the one valve, resulting in excellent re-radiation, and this, coupled with the second, gave a fairly good output, which, by means of a few extra adjustments was increased considerably, and finally, at 5, 6 and 7 a.m., the set was worked at its maximum efficiency with the material in hand. The reception was very poor indeed owing to local conditions, with the result that only about three American amateur stations were heard. **8 AQO** (N.Y. District) was heard calling Manchester **(5 MS)**, but the reply was not answered, and experiments ceased at 7.30 a.m. Further tests will be made on December 24th and 31st.

Clapham Park Wireless Society.*

The fourteenth general meeting was held at headquarters, 67, Balham High Road, at 7.30 p.m. on Wednesday, November 29th, 1922.

Mr. A. E. Radburn was elected Chairman.

After the minutes of the last meeting had been read and corrected, the Hon. Secretary announced that he had received a letter of November 24th, 1922, notifying that the C.P.W.S. had been accepted for affiliation, and enclosing tickets of admission for members to monthly meetings.

After election of new members, Mr. Sinclair confirmed his arrangement to provide a speaker from the Radio Association on December 6th.

Mr. Oswald J. Carpenter, of the Marconi Scientific Instrument Company, was then called upon to give his promised lantern lecture, for which purpose the Hon. Secretary had secured the gracious loan of an arc lantern from Mr. Will Day of the Wireless establishment in Lisle Street, Leicester Square, and Mr. M. P. Prout, the Hon. Treasurer, had made all necessary structural alterations and fitments to install in readiness, Mr. Reitz kindly offering to operate lantern. Mr. Carpenter devoted the major portion of the evening to a discourse on "High Frequency Radio and Audio Amplification," with the aid of blackboard and chalk, answering several questions, and concluding the evening with a few lantern slides relating to popular wireless and Marconi history.

A hearty vote of thanks was accorded to Mr. Carpenter, also to Mr. Will Day for the loan of the lantern and sheet for projection purposes, which he graciously allowed the Hon. Secretary to collect and deliver for the occasion. Also to Mr. F. H. Reitz, who proved himself a most capable operator, and to the Hon. Treasurer, who is such a valuable and material asset to the Society.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. A. Leslie Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

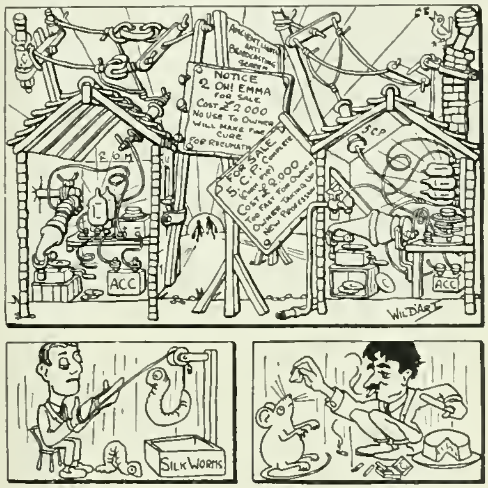
At the regular fortnightly meeting, held at Digbeth Institute, Birmingham, on December 1st, a very fine four-valve set was shown by the President, Dr. J. R. Ratcliffe. The set was home-made, but the workmanship throughout was very fine and was much admired. Excellent results were obtained, and a very interesting discussion ensued.

The next meeting was held on December 15th.

Hounslow and District Wireless Society.*

Hon. Secretary, Mr. A. J. Rolfe, 20, Standard Road, Hounslow.

Membership is increasing. A series of lectures has been arranged with well-known lecturers.



A hint from the Hounslow Society to **2 OM** *and* **5 CP.**

On November 9th, Mr. Sydney H. Nayler, lectured on "Wireless for the Beginner." On November 23rd, Mr. Emery lectured on "Constructional Details of a Tuned Set." On November 30th, Lieut. H. S. Walker lectured on "High Frequency Amplification."

A library has been started.

Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

After the general business was disposed of on December 1st, Mr. Houstoun gave his experiences and described some wiring experiments he had made with the four-electrode valve. He promised to give a demonstration at an early meeting.

Mr. Calver described the results of trials he had made of various Armstrong circuits as published, and also he mentioned that he had wired up a new circuit which gave good results, and that at an early date he would let the members have full details.

The Society propose to hold a public exhibition and demonstration as soon as the necessary arrangements can be completed.

At a meeting on December 8th it was proposed that at future meetings visitors should be allowed to take part in the discussions after the general business.

Mr. Calver brought in a very compact portable three-valve set.

Halifax Wireless Club and Radio Scientific Society.*

On November 22nd Mr. J. R. Halliwell of Manchester lectured on the amateur's position with regard to reaction and broadcasting. On November 29th the Treasurer, Mr. J. R. Clay, gave a paper on "The Armstrong Circuit."

An "Elementary Mutual Instruction Evening" was held on December 6th, the object being to provide a medium whereby those members lacking in experience might meet informally, those possessing more experience and profit thereby.

Mr. J. G. Jackson, B.Sc., of Sheffield, on December 13th, lectured on "The Electron."

Members joining after December 31st pay half subscriptions only.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

On December 5th Mr. C. Dyson was Chairman owing to the unavoidable absence of the President.

Mr. George Newby, of the "Flactem Works," Halifax, gave an address on "Valves and Valve Circuits."

Mr. Newby, responding to a vote of thanks, said he would be very pleased to give another lecture in the New Year. The Hon. Secretary, Mr. C. Dyson, spoke on the subject of "Oscillating Valves," and asked everyone to assist in helping to prevent re-radiation. Three new members were enrolled.

Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

A Carnival Dance was held on December 11th. The Society has now to change its club-room; this has upset arrangements, but it is hoped to put matters right by the New Year.

Attendance is dropping off. An appeal is sent to all members that they will attend as often as they can.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting on December 7th, the first portion of the multivalve receiver, which it was decided to construct, was assembled and tested, prior to being permanently mounted. British Broadcasting stations were clearly heard. One high frequency amplifying valve and a detector valve were used.

Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8. Two meetings were held on November 27th and December 1st. Mr. H. J. Pugh was in the chair.

On the first occasion a "Dutch Auction Sale" took place. There was a large and varied collection of articles for sale. Everybody was satisfied, even the Treasurer.

Mr. C. R. Webster gave a demonstration with a two-valve set and loud speaker on December 1st.

Plymouth Wireless and Scientific Society.

Hon. Secretary, Mr. G. H. Lock, 9, Ryder Road, Stoke, Devonport.

Mr. E. W. Penney lectured on "Amplification," on November 28th, and on December 5th started a course of lectures which will be continued fortnightly and will probably last for six months. The whole range of wireless theory will be gone through.

Oxford and District Amateur Radio Society.

Hon. Secretary, Miss P. I. Thomas, 119, Iffley Road, Oxford.

The third meeting of the Society was held on November 31st, when Mr. R. W. Hardisty, of Trinity College, Oxford, was unanimously elected President.

The following is a list of the officers of the Society: Chairman, Mr. B. A. Canning; Treasurer, Mr. J. Pigott; Secretary, Miss Thomas; Committee, Messrs. V. Whitehead and Russell.

The Society is fortunate in having two gentlemen who hold the P.M.G. Certificate as Morse Instructors.

The Chairman announced that the necessary information had been forwarded to the Radio Society of Great Britain so that the affiliation with that Society might be completed.

Progress is rapidly being made with the Society headquarters, and by the New Year it is hoped to commence work in earnest.

The Secretary would be pleased to forward the Society rules to any lady or gentleman interested in wireless.

Wireless Society of Winchester.

Hon. Secretary, Mr. Albert Parsons, 65, Cromwell Road, Winchester.

The last three meetings have proved of great interest to the members, the first being in the form of a discussion opened by Mr. S. R. Humby on "The Principles of Wireless Telegrapby." Mr. Humby mentioned the work of bygone pioneers, Faraday, Maxwell, Hertz and others and Marconi.

The next topic was introduced by Mr. Earle, "The Construction of the Induction Coil." The lecture was appreciated by all present. The third event was a lecture on the "Microphone," by Mr. Gibbs, who kindly consented to take the place of Mr. Watson, who was to have lectured. Mr. Gibbs ably provided appropriate answers to questions.

Coventry and District Wireless Association.

Hon. Secretary, Mr. H. H. Thompson, 44, Northumberland Road, Coventry.

This Association has been revived. Permanent officers are elected and a definite programme arranged.

A general meeting was held at 128, Much Park Street, Coventry. It was then decided that a meeting should take place every Wednesday evening at 7.30 p.m., when business matters, lectures and other instructive items could be dealt with, and further, that the club-room should also be open every Tuesday evening for an informal gathering of members and friends, when the club's apparatus would be at their disposal. A receiving set specially constructed by members will soon be ready.

A "Questions and Answers" evening has been arranged.

On November 29th, the Chairman, advising a series of technical lectures, volunteered to give a lecture at least once each month.

It is proposed to give every assistance to members desirous of obtaining licences.

Northampton and District Amateur Radio Society.

Hon. Secretary, Mr. H. Barber, M.B.E., College Street, Northampton.

A lecture was given by Capt. Tissington on "Radio Transmission and Reception," on Monday, November 27th. He dealt with the theoretical side of his subject, from an elementary standpoint.

Questions were put into the question box, to be dealt with at a "Question and Answers Night."

Morse classes under Capt. Tissington and Mr. F. Turville were arranged.

On December 4th, at the Exchange Assembly Rooms, Mr. J. Reid presiding, a lecture entitled "Elementary Principles of a Single Valve Set" was given by the Vice-Chairman, Mr. A. E. Turville, who devoted himself mainly to the instruction of members who had little or no experience in wireless experiment.

After discussion, the lecturer connected up the apparatus referred to, and demonstrated by receiving music from Birmingham and London, using an indoor aerial. There were 70 members present.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

The second general meeting took place on December 7th. At the buzzer class held by Mr. McKinlay, about eighteen members attended. One lady member was present.

Mr. Hughes occupied the chair. Mr. Waygood lectured on "Transformers." Telephony from 2 ZY was received on Mr. Austin's set. Another meeting was held on the 21st, when Mr. A. P. Hill lectured on "Continuous Waves and their application to Telegraphy and Telephony."

Kingston and District Radio Society.

Mr. J. C. C. Berry, 57, High Street, Hampton Wick.

At a meeting on December 7th Mr. Carpenter tendered his resignation as Secretary owing to pressure of business.

Mr. J. C. C. Berry was unanimously appointed as Secretary, and a ballot was taken when Mr. F. P. Sexton was elected President with a Committee of five.

It was decided that steps be taken to affiliate with the Radio Society of Great Britain, and a programme of lectures and demonstrations be drawn up beginning with a lecture on "The Selection of an Aerial System," by Mr. R. Older.

The Headquarters of the Society are at 45, Surbiton Road, Kingston-on-Thames (entrance in Southsea Road).

Manx Radio Society.

Hon. Secretary, Mr. J. P. Johnson, 16, Hildesley Road, Douglas, I.O.M.

This Society was inaugurated at a meeting held at 19, Hawarden Avenue, Douglas. The following officers were elected :— Chairman, Mr. H. Colebourn ; Secretary, Mr. J. P. Johnson ; Committee, Messrs. Vick, Gelling, Downward, Axon, Craine, and Hinton.

The Committee was instructed to formulate a policy, frame rules, enquire for suitable quarters, and report to a general meeting to be called as soon as practicable.

Sunderland Wireless and Scientific Association.

Hon. Secretary, Mr. A. Richardson, Westfield House, Sunderland.

A lecture was given on December 16th by Dr. J. A. Wilcken on "Propagation of Electro-Magnetic Waves."

The Association is now situated at Westfield House.

Malvern Wireless Society.

Hon. Secretary, Mr. N. H. Gwynn Jones, Burford House, Worcester Road, Malvern.

On November 29th Mr. N. H. Gwynn Jones lectured on "Electrostatics and Condensers."

A vote of thanks was accorded the lecturer.

On December 20th a public demonstration took place at the Society's headquarters. The occasion marked the welcome of Mr. Dyson Perrins as President of the Society. A silver collection was made on behalf of local charities.

Walthamstow Amateur Radio Society.

Hon. Secretary, Mr. R. H. Cook, 49, Ulverston Road, Walthamstow, E.17.

The Society's three-valve set with loud speaker was used on November 22nd to demonstrate broadcasting reception by Mr. Webb. Very good results were obtained, the set working splendidly.

On November 29th the evening was spent on the general business of the Society for the month, and a discussion on "High and Low Frequency Amplification." The discussion was opened by the President, Mr. Allen. Several members gave their experiences with both circuits, and much useful knowledge was gained by the other members present. An elementary class has been formed and started on December 6th, Mr. Cook acting as lecturer and demonstrator.

Hull Technical College Wireless and Scientific Club.

Hon. Secretary, Mr. W. R. Bingham, 46, Auckland Avenue, Newland, Hull.

A new club was formed on November 7th in the Hull Technical College. There were about 30 students present. Capt. W. E. Dennis was unanimously elected President ; Mr. Perkins, Chairman ; Mr. W. R. Bingham, Hon. Secretary ; Mr. Mould, Treasurer. It was proposed that the President should write to the Postmaster-General for an experimental licence by which a number of interesting experiments could be performed with a set kindly lent by Capt. Dennis. On November 14th Mr. Perkins lectured on "Induction Coils." Capt. Dennis gave one on November 21st on the "Construction of a Spark Transmitter," and Mr. Reeder gave another on November 28th on "Wave Motion." A hearty vote of thanks was passed for the lecturers.

Redditch and District Radio Society.

Hon. Secretary, Mr. A. W. Reeves, The Elms, Alvechurch, near Redditch.

At a meeting on December 1st, at the Temperance Hall, Redditch, details of the proposed installation of a two-valve receiver were again discussed. The outside equipment has been erected.

The Society has about 25 members. Lectures are being arranged. Morse practice is carried out. A public demonstration was arranged for December 13th.

Experimental Transmissions in the London Area.

TWO meetings have been held recently to discuss the situation with regard to experimental transmissions in the London area. These meetings were convened by the Radio Society of Great Britain (late Wireless Society of London). The first meeting was held at the Institution of Electrical Engineers, when a committee composed of the following gentlemen was appointed to consider the question and prepare a report :—

Major H. Hamilton, D.S.O., Major H. C. Parker, Captain R. Tingey, Mr. M. Child, Mr. H. S. Walker, Mr. W. K. Alford, Mr. O. J. Carpenter, Mr. F. Phillips, Mr. L.McMichael (*Hon. Secretary*).

The report was submitted at a further meeting held at the Waldorf Hotel on November 13th, when the decisions arrived at by the Committee were all accepted by the meeting, at which there were about 80 transmitting licence holders present.

The decisions arrived at with regard to experimental transmissions were as follows :—

(1) It is agreed that a voluntary arrangement to be made to stop broadcast music except where special permission has been obtained from the G.P.O. in which case this should be stated before, during, and after the transmissions. Music transmissions (either gramophone or otherwise) not exceeding five minutes in duration to be permitted for testing purposes, and a total transmission at one time of not more than ten minutes—with a total transmission of four such periods (40 minutes) in all, during any one evening from 6 to 11 p.m.—other hours of the day being free except that the five minutes limit of music transmission shall apply.

(2) These arrangements only to apply to working on the 440 metre wavelength.

(3) Holders of transmitting licences are reminded of the terms of their licence whereby they must use their call sign before and after each transmission.

(4) The use of spark transmissions by amateurs on all wavelengths should be abolished and tonic train on 440 metres wavelength.

Major Hamilton further proposed that a Committee be formed to assist those using experimental transmitting licences, and to generally consider matters affecting them. This Committee to be a sub-Committee of the Radio Society of Great Britain. It was suggested that the Committee be composed of three persons holding high power transmitting licences, three holding small power transmitting licences, and three holding receiving licences, and that out of these nine members not more than three should be engaged in the trade.

Notes

R.A.F. Wireless Officers' Reunion Dinner.

Group-Captain Warrington Morris presided over the annual gathering of officers and ex-officers of the R.A.F. Wireless Training School, held at the Holborn Restaurant.

Speaking of the vital importance of wireless communication in modern warfare, Wing-Commander J. B. Bowen paid a warm tribute to the work at present being done in Mesopotamia by the wireless personnel, frequently in the teeth of overwhelming difficulties.

A Royal Air Force Wireless Function.

He welcomed the advent of broadcasting, and was particularly impressed by the extraordinary enthusiasm shown by the average amateur experimenter. Such men were a credit to the country and their skill and experience would form a national asset in time of need.

Any ex-officers of the school who may desire to attend the next reunion should communicate with the Commandant, at Flowerdown, Winchester.

Port Elizabeth Wireless Development.

The Port Elizabeth Chamber of Commerce is booming wireless telegraphy and telephony in South Africa, says the *British and South African Export Gazette*. Negotiations for the installation of a wireless telephone broadcasting station for disseminating commerical information are well advanced. Meanwhile, interest in wireless in both the Union and Rhodesia grows apace, and such organisations as the Wireless Section of the South African Institute of Electrical Engineers, the Radio Society of South Africa, and a Wireless School recently opened in Bulawayo, are educating the public to the uses of the science.

Duty on Apparatus for South Africa.

Wireless telegraph apparatus, including broadcasting sets, on entering the Union of South Africa, is subjected to duty of 20 per cent. *ad valorem.* A rebate of 3 per cent. is allowed in the case of British goods.

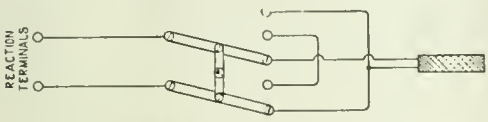
Reception of American Broadcasting Stations.

Reports of Reception of Telephony from American Broadcasting Stations are so numerous that it has not been possible to analyse them for publication in this issue. Details will be given as early as possible.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—I am sending you the enclosed photograph of a three-valve amplifier, constructed from details given by Mr. Bull in *The Wireless World and Radio Review* lately. It is made exactly to the instructions, and works very well, two valves being sufficient for the present broadcasting on M-O "R2" detecting, and M-O "R1" L.F. amplifying.



A switch mounted on top of coil holders.

There is one addition, that is the switch mounted on the top of the coil holders; it is inserted between the reaction terminals and reaction coil; it is a double pole switch with both blades linked together; it enables the current in the reaction coil to be reversed and also to cut the coil out if required, instead of the link as suggested in Mr. Bull's article. Above is a rough sketch of the connections.

W. H. Dennis.

Goodmayes, Ilford.

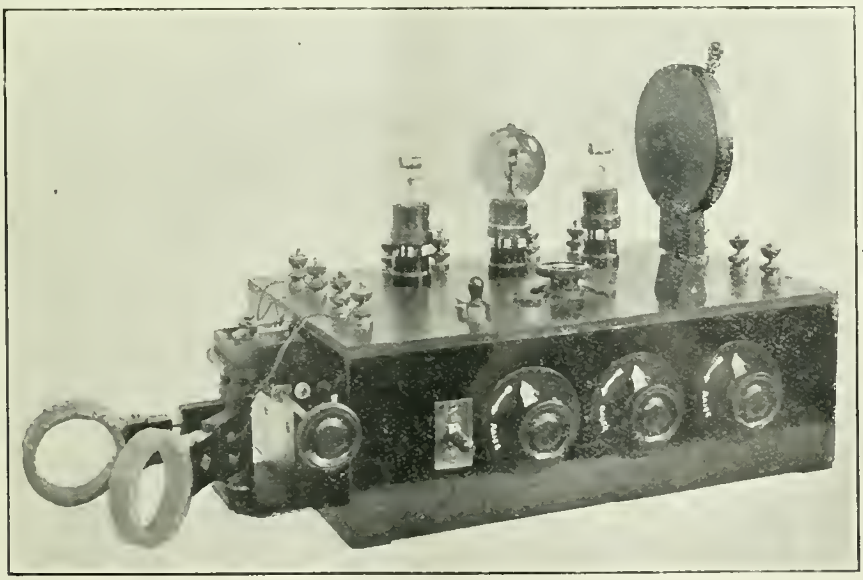
Book Review

Direction and Position Finding by Wireless. By R. Keen, B.Eng. (Hons.). London: *The Wireless Press, Ltd.*, 12/13, Henrietta Street, W.C.2. Illustrated. Price 9s. net.)

The subject of wireless direction finding has had up to the present but scanty attention paid to it by writers of text-books. This is, no doubt, chiefly because its specialised nature requires more than a general acquaintance with the methods and practice of the art. The writer of the present book has evidently had not only a very thorough practical experience of the technicalities of the subject, but has spent considerable time in pondering over its theoretical aspects and in acquiring detailed knowledge from original sources of the progress in this branch of wireless telephony.

The book contains eleven chapters very clearly printed and arranged, and is illustrated with 254 excellent diagrams and photographs. An introduction of an historical nature is followed by a treatment of the theory of direction finding. In this chapter and from henceforward, though not neglecting to explain and briefly describe the other systems, the author pays special attention to the Bellini-Tosi system of direction finding as developed by the Marconi Company, and in three later chapters which respectively describe ship, shore and aircraft installations, very full details are given of this Company's apparatus for these three purposes. This chapter is followed by one on the fault-clearing and maintenance of D.F. sets employing the Bellini-Tosi system.

A chapter on maps discusses the use of specially prepared charts (*e.g.*, the gnomonic projection) for the simplification of the plotting of bearings, and



A Three-valve Amplifier constructed from details given in an article published in this Journal by Mr. A. J. Bull (p. 677, issue August 26th).

Books Received

Discoveries and Inventions of the Twentieth Century. By Edward Cressy. Second edition. (London: George Routlegde & Sons, Ltd. Price 12s. 6d. net. 458 pp. 8¾ by 6".)

also shows clearly how the Mercator's projection may be employed without error for this purpose. This is followed by a chapter on Position Finding, which gives much interesting and useful information on the use of direction finders on ships and on shore as a means of navigation. Here, as in other parts of the book, the author makes free use of illustrations and of numerical examples to assist his description. With these chapters the last in the book entitled "Notes on Field and Nautical Astronomy" may be conveniently classified. It contains complete explanatory instructions with examples for solving a number of practical problems in navigation and survey work by astronomical methods. The information in these three chapters is extremely useful from the point of view of D.F. work existing as it has up to the present only in scattered form throughout many different publications. Chapter 6 is devoted to the discussion of the freak errors occurring in practice, especially of those known as "Night Effect."

As regards the matter contained in the book there is very little to criticise. The author seems to suggest throughout the book, however, and notably on page 49, that the rotating frame systems are recognisedly inferior as practical working systems to the Bellini-Tosi system, thus giving a somewhat false impression of the actual state of affairs. For, at the present time the rotating coil D.F. system is probably used on a larger scale than the Bellini-Tosi system ; while from all other points of view it is quite an open question as to which of the rival systems is the best. By specialising to such an extent on the Bellini-Tosi system the author has enabled his book to fulfil the dual function of a general text-book and of a handbook on this system for operators and engineers. It cannot but be regretted, however, that more attention has not been paid to similar descriptions of the rotating frame systems. The very complete bibliography, upon which the author is to be congratulated, would have supplied some information on this matter, and the book would probably have gained in breadth of interest by sacrificing the chapter on valve amplifiers for a detailed description of, say, the American Navy apparatus.

In his chapter on "Night Effect," the author shows himself to be a staunch advocate of the "Heaviside-Layer" theory. By means of close reasoning and a number of diagrams he shows clearly how the phenomena of signal fading and variations of bearing of any extent can be explained by means of the downward reflected ray from this hypothetical layer. Several methods are indicated which avowedly eliminate night errors, the most interesting—and the one to which most attention is paid by the author—being the ingenious method due to G. W. Wright, which produces a heart-shaped polar reception curve. Even this, however, is not claimed to constitute a practical method of direction finding, and the satisfactory solution of the problem appears still to be undiscovered.

In conclusion the author has undoubtedly produced a thoroughly well-written book, and one for which there was much need, and no serious student of modern direction finding can afford to be without this extremely reliable guide.

R. L. Smith-Rose.

Calendar of Current Events

Friday, December 22nd.

Wireless Society of Hull and District.
At 7.30 p.m. At Signal Corps Headquarters, Park Street. Questions and Answers.

Leeds and District Amateur Wireless Society.
Dinner.

Sunday, December 24th.

3-5 p.m. *Daily Mail* Concert from **PCGG**,* The Hague, on 1,050 metres.

Monday, December 25th.

9.20-10.20 p.m. Dutch Concert, **PCGG**,* The Hague, on 1,050 metres.

Thursday, December 28th.

At 9.20-10.20 p.m. Dutch Concert from **PCGG**,* The Hague, on 1,050 metres.

Hackney and District Radio Society.
Informal meeting.

Derby Wireless Club.
Informal meeting.

Ilford and District Radio Society.
Lecture by Mr. E. E. Hale on "Current Supply for Valves."

Friday, December 29th.

Bradford Wireless Society.
At 5, Randallwell Street, Bradford. Annual Meeting.

Christmas Programmes.

At the time of going to press no special arrangements had been made by those responsible for broadcasting with regard to the Christmas holidays.

A New Store.

Pettigrew and Merriman, Ltd., 122-124, Tooley Street, S.E.1., announce that they are opening a retail store and demonstration room at 54, Gracechurch Street, E.C.3. A technical wireless engineer will be in attendance to give advice.

Dutch Reception of 8 GS.

Mr. K. C. Van Ryn, Delft, Holland, reports having received **8 GS** (200 metres) very clearly up to 25 metres from the telephones on a five-valve set (two H.F. and two L.F.).

Reception by Crystal at 180 Miles.

Mr. Maurice A. R. Horspool, Hon. Secretary of the Wireless and Scientific Society of Bridlington, reports that he has received **2 LO** on a crystal receiver at a distance of 180 miles. The receiver was made by the Wainwright Manufacturing Co., Ltd. Brown's 'phones were used, and the crystal was Silicon.

British Amateurs heard at Nice.

Reception of the following British Amateurs is recorded by M. Léon Deloy (**8 AB**), of the Radio Club de la Côte D'Azur, Nice :—**2 FQ** ; **2 OM** ; **2 CV** ; **2 ON** ; **2 DM** ; **2 JZ** ; **2 KF** ; **2 OD** ; **2 FP** ; **2 XI** ; **2 AW** ; **2 LG** ; **5 MS** ; **2 KV** ; **2 NM**. All these stations were received on a single valve with the exception of **2 FQ**. At the time **2 FQ** was received three low frequency valves were being used after the detector and signals could be heard ten metres from the telephones.

* At the time of going to press the transmissions from **PCGG** were expected to take place as usual during the holidays.

The Transatlantic Tests

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

AT the time of writing, reports are just beginning to arrive of the receptions of the American transmissions during the first night of the Transatlantic Tests. Reports have already been received from several parts of this country and also from Holland showing that several U.S. amateurs have "got over," their signals with the special code words allotted to them having been received and verified by the copy of the transmission schedule which was sent to the Radio Society of Great Britain by the American Radio Relay League.

The text of the first report transmitted by Carnarvon on December 13th, at 0700 G.M.T. is as follows :—

Text of Radiogram sent to the American Radio Relay League, December 13*th*, 1922, *at* 0700 *G.M.T.*

To: SCHNELL RADIOCORP NEWYORK

FOLLOWING HEARD DECEMBER TWELFTH CODES AND TIMES CORRECT ONE BOY GEORGE FOX ONE YOKE KING TWO EASY LOVE TWO GEORGE KING TWO NAN ZED TWO XRAY ABLE PUP TWO ZED KING TWO ZED LOVE THREE ZED WATCH EIGHT ABLE QUACK OBOE EIGHT ABLE WATCH PUP STOP FREE FOR ALL TWO BOY MIKE LOVE TWO LOVE YOKE TWO NAN ZED TWO ZED KING THREE BOY GEORGE TARE THREE HAVE GEORGE THREE ZED YOKE FOUR FOX BOY FOUR OBOE ITEM FOUR ZED SAIL FOUR ZED WATCH STOP FOLLOWING NOT TO SCHEDULE TWO ZED SAIL THREE XRAY MIKE FOUR BOY XRAY FOUR OBOE ITEM SEVEN PUP OBOE EIGHT GEORGE QUACK STOP ALSO PHONE TWO ZED KING STOP CONGRATULATIONS — COURSEY

This indicates that during the "Individual transmission" periods signals complete with correct code letters were picked up from the following U.S. stations :—

1 BGF ; 1 YK ; 2 EL ; 2 GK ; 2 NZ ; 2 XAP ; 2 ZK ; 2 ZL ; 3 ZW ; 8 AQO ; 8 AWP.

And also that during the "free-for-all" transmission periods the following stations were heard, signalling "Test, Test, Test" at their correct times in accordance with the prearranged schedule :—

2 BML ; 2 LK ; 2 NZ ; 2 ZK ; 3 BGT ; 3 HG ; 3 ZY ; 4 FB ; 4 OI ; 4 ZS ; 4 ZW.

Calls from the following stations were also reported, but have not been verified by the schedule. The stations concerned were, however, probably engaged in their ordinary routine traffic communication :—

2 ZS ; 3 XM ; 4 BX ; 4 OI ; 7 PO ; 8 GQ.

One receiver in this country also reported hearing 2 ZK, using his radiophone transmitter, followed by the "Test" calls and his code letters in Morse.

This report for the first day's reception tests shows a very marked improvement as compared with last year's Tests, as was to be expected in view of the many reports that have been received lately of the reception of U.S. amateur signals in this country, as well as the reception of American broadcasting stations.

Further reports of receptions during the remainder of the Tests will be published in these columns in due course.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed " Questions and Answers," Editor, The Wireless World and Radio Review, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the " Questions and Answers " coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a " nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"W.R.H." (Oldham) *asks* (1) *For criticism of his set.* (2) *The values of the condensers connected across the L.F. transformers.* (3) *The best turn ratio for L.F. transformers.*

(1) The proposed arrangement is suitable, but you would probably secure louder signals if the valves were connected, 1 H.F., 1 detector, and 1 L.F. The switching arrangement is correct, although the valves not in use will still have their filaments connected with the L.T. battery. The switching arrangement shown on page 886, September 30th issue, should help you, and we think you cannot do better than adopt this scheme yourself. (2) The fixed condensers have a value of 0·001 mfds., and are necessary for good operation. (3) The turn ration of the L.F. intervalve transformer should be 2 or 3 to 1.

"W.A.W." (Hull) *asks for a design of a four-valve resistance capacity coupled circuit.*

See Fig. 1. Suitable values are marked in. You would find " R " type valves quite suitable. The amplifier will only be suitable for reception on wavelengths above 2,000 metres.

"G.E.B." (Manchester) *asks* (1) *For particulars of intervalve and telephone transformers.* (2) *Where a connection from the condenser in a diagram on page 43 is taken to.* (3) *Questions about reaction.* (4) *The resistance per yard of No. 36 Eureka wire.*

(1) The construction of an intervalve transformer was described in the issue of August 19th. The telephone transformer may be made as follows :—Coil of iron wire, ½″ diameter and 3″ long ; primary winding, 3 ozs. of No. 44 S.S.C. ; Secondary winding, 4 ozs. of No. 34 S.S.C. (2) The connection is taken from the condenser to the end of the transformer which is connected to + H.T. (3) We do not advise you to adopt the proposed arrangement. If you couple the reaction coil to the anode circuit of the first H.F. valve, reaction effects can always be obtained. (4) 14·8 ohms per yard.

"F.B.T." (E.11) *asks* (1) *For a good two-valve circuit for telephony.* (2) *What is the best form of inductance for short wave work.* (3) *Why the Post Office only allow 100 ft. of wire to be used in a single wire circuit.*

(1) See diagram on page 841, September 23rd issue. (2) Without doubt the most efficient coils for short wave work are single layer coils. (3) The Post Office limits the length of a single wire aerial to 100 ft. in order to reduce the evil effects of radiation when experimenters accidentally set up oscillations in the aerial circuit. The P.O. may however, grant permission for the use of a longer aerial for the purpose of carrying out specific experiments.

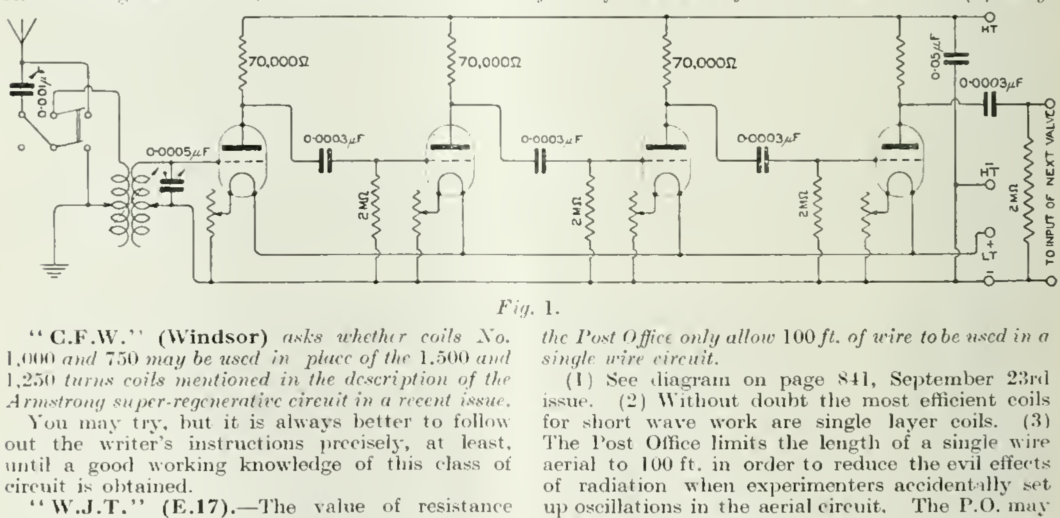


Fig. 1.

"C.F.W." (Windsor) *asks whether coils No. 1,000 and 750 may be used in place of the 1,500 and 1,250 turns coils mentioned in the description of the Armstrong super-regenerative circuit in a recent issue.*

You may try, but it is always better to follow out the writer's instructions precisely, at least, until a good working knowledge of this class of circuit is obtained.

"W.J.T." (E.17).—The value of resistance R_1 is about 2,000 ohms, and R_2 5,000 ohms. The voltage of battery B is roughly 100 volts, or the same as B_2.

"R.A.B." (Bristol) *asks* (1) *For a two-valve circuit employing H.F. amplification.* (2) *Whether a loss of signal strength results from coupling the reaction coil to the H.F. transformer instead of the aerial circuit.* (3) *Are better results possible from a 3-coil holder than from a 2-coil holder when a single valve is used.* (4) *For a diagram showing the connections of a 3-coil holder to a single valve.*

(1) See Fig. 2. (2) A loss of efficiency will not result, as explained in several previous issues of our journal. (3) Better results are possible since tuning adjustments may be finer, and it is

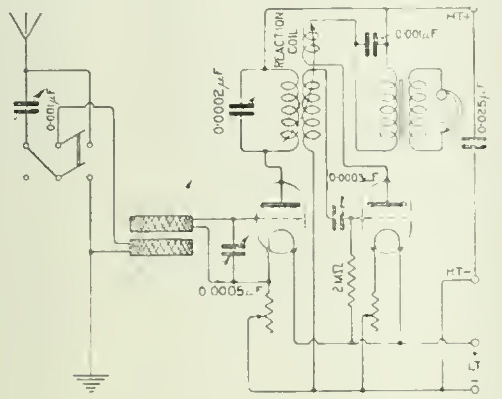


Fig. 2.

possible to obtain a voltage step-up from the aerial to the closed circuit. (4) See Fig. 3. This circuit however, is not to be recommended since it is so easy to set up oscillations in the aerial circuit—to the annoyance of your neighbours who may be listening-in.

"A.F.W.M." (Portsmouth).—To receive broadcast transmissions you will require a small coil of No. 22 D.C.C. wire. The former may be 3″ diameter and 4″ long, and 8 tappings should be taken off one end, then take a tapping off at every eighth turn

"R.C." (Harrow) *asks* (1) *Whether diagram submitted is correct.* (2) *If we can suggest improvements.* (3) *Whether he should hear broadcasting transmissions.* (4) *Suitable values of L.T. and H.T. for "Ora" type valve.*

(1) and (2) The proposed arrangement will not give signals, because the grid filament circuit is shunted with a condenser. Several diagrams have recently been given indicating the correct method of connecting a crystal detector and an L.F. valve. (3) We think you should, provided the set is properly wired. (4) Use 6 volts L.T. with a filament resistance of about 7 ohms. The H.T. may be 45 volts.

"J.W." (Romford) (1) *Submits a diagram of his set and asks for a criticism.* (2) *Dimensions of loose coupler to tune from* 100 *to* 2,000 *metres.* (3) *Values of condensers.* (4) *Dimensions of anode inductance and reaction coil.*

(1) The proposed arrangement is satisfactory, but you would be able to use fewer switches by adopting the switching scheme shown on page 883, September 30th issue. (2) The aerial coil should be a winding of No. 22 D.C.C. wound on a former 4″ diameter and 6″ long, with 10 tappings. The closed circuit coil may be a coil of No. 26 D.C.C. wound on a former 3½″ diameter and 6″ long with 6 tappings. A switch to connect the A.T.I. and A.T.C. in series or parallel will prove of great help. (3) The A.T.C. = 0·001 mfd. maximum, C.C.C. = 0·0005 mfds. maximum, grid condenser = 0·0003 mfds. fixed. By-pass condensers are 0·001 mfds. fixed. H.T. battery by-pass condenser has usually a capacity of from 0·01 mfds. up to 0·5 mfds. The anode tuning condenser may have a maximum value of 0·0002 mfds. (4) The anode coil may consist of a winding of No. 32 D.C.C. on a coil 2½″ diameter and 5″ long, with 10 tappings, and the reaction coil 100 turns of No. 38 S.S.C. on a former 3″ diameter.

"FILAMENT" (Penarth) *asks* (1) *For criticism of set, diagram of which is submitted.* (2) *Whether the capacity of a Dewar switch will seriously affect results when connected in the H.F. circuit.* (3) *Whether cleaning his aerial will increase its efficiency.*

(1) The proposed arrangement is very suitable indeed, and the wiring is quite correct. (2) We think you will find no serious losses occur if the components of the switch are well spaced. Such switches, however, are expensive, and you may prefer to use small double pole throw-over switches, which are quite satisfactory and relatively cheap. (3) You could, of course, haul down the aerial and clean it, but the increase in efficiency will probably not be noticeable. It is better to employ stranded enamelled conductors when the aerial is so situated that corrosion quickly takes place.

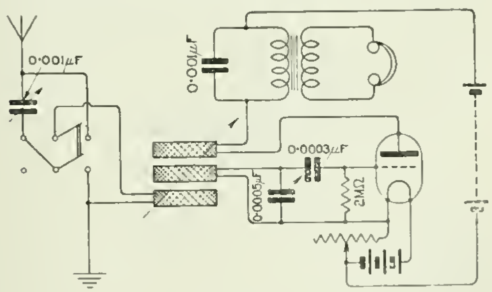


Fig. 3.

"W.P." (Seven Kings).—H.F. transformer design is explained in the issues of September 2nd and 16th. If you wish to wind the cylindrical H.F. transformer for 300-450 metres described on page 717 of September 2nd issue, wind 450 turns of No. 40 S.S.C. copper wire on a cylindrical former 1⅛″ diameter. The windings are both wound in the same direction, and the leads which terminate at one end are connected with grid and plate.

"BEGINNER" (Walthamstow) *asks us to provide a wiring diagram for a panel which he proposes to place on the market; whether any patents are infringed, and what action to take with the Post Office.*

We cannot undertake to provide this information. This section of the journal is devoted to the needs of amateurs and experimenters. See the note at the head of this section.

"H.S." (Stretford).—We suggest you construct the H.F. transformer described in the issue of September 23rd, page 828. The wavelength range of this transformer, when using a 0·0001 mfd. tuning condenser, is from 350 to 1,000 metres. If you desire to use plug-in type H.F. transformers for all wavelengths, we suggest you wind seven transformers, using ebonite formers 2¼″ to 3″ outside diameter, with a groove ⅛″ to ¼″ wide and ⅛″ to ½″ deep, winding the following turns: 50 100, 250, 400, 650, 1,000 and 2,500 turns. The primary and secondary windings should have equal turns.

"PERPLEXED" (Forest Gate) *asks* (1) *Whether the tuned anode method of coupling is suitable for use over all wavelengths.* (2) *For a circuit using 2 H.F., 1 detector, and 1 L.F. valves with arrangements for cutting out valves.*

(1) The tuned anode method of high frequency amplification is suitable for use over all wavelengths. On short wavelengths the tuning condenser should have a maximum value not exceeding 0·0002 mfds., but on the longer wavelengths this condenser may conveniently have a maximum value of 0·0004 mfds. (2) See Fig. 4. As you have not submitted particulars of the switches you propose to adopt in this circuit, we have shown ordinary double pole throw-over switches connected.

"R.H.M." (Shepherd's Bush).—The anode reactance should have a value of about 70,000 ohms, and should be capable of carrying a current of a few milliamperes. The proposed arrangement is quite suitable, but it will probably not be necessary to use cells in the grid of the first valve. A potentiometer is not essential, but you would find one useful to control the potentials of the grid of the H.F. valve. The anode voltage should be much higher when resistances are in the anode circuit, and we suggest 65 volts as a suitable value, and 6 volts for the filament. The apparatus does not conform with the P.O. regulations. When receiving on short wavelengths the reaction coil should be coupled with the secondary of the H.F. transformer. When you wish to receive long wavelengths, the arrangement proposed is quite suitable.

"H.W.A." (Cheltenham).—The Armstrong super-regenerative circuit is specially intended for use on a frame aerial, and if used on an outside aerial would cause serious interference with other experimenters. The values given for the various components in the description which appears in our issues of October 21st and 28th are especially applicable for use with a frame aerial, and if you intend to use this apparatus with an outside aerial for experimental purposes, you will have to make a number of tests for yourself to determine the necessary values for the components Several descriptions of the Armstrong super-regenerative circuit have appeared in our issues for many weeks past, and most of the circuits given make use, of course, of only two valves. The set described by Mr. Harris in our recent issues has a note magnifier in order to extend the range of its use as advocated. We understand that the Post Office will not sanction the use of the Armstrong circuit on Broadcasting wavelengths even when connected to a small frame aerial.

"F.G.S." (Hornsey).—The A.T.I. of the transmitter could consist of a coil 40 turns of No. 16 D.C.C. wire wound on a former 5″ diameter and 8″ long. We suggest you take tappings at every eighth turn, and also take a few tappings at every other turn at the aerial end of the inductance. The reaction coil may consist of 80 turns of No. 22 D.C.C. wire wound on a former 4″ diameter. You will probably have to experiment a little and find the best value of reaction coupling.

"W.T." (Holloway).—The proposed arrangement is correct. The fixed condensers have the following values:—

20 foils 2½″ × 1¼″ mica 0·002″ × 0·053 mfds.
6 foils 1¾″ × 1″ mica 0·002″ × 0·0079 mfds.
3 foils 1¾″ × 2″ mica 0·002″ × 0·0032 mfds.

The 0·001 mfd. fixed condenser may consist of 3 foils with an overlap of 1″ × ½″ mica 0·002″ thick. The 0·0005 mfd. fixed condenser may consist of 3 foils 1¼″ × ½″ with mica 0·002″ thick. The above are the theoretical values, and will not be correct unless the plates of the condenser are held very tightly together so that the dielectric may be considered as all mica.

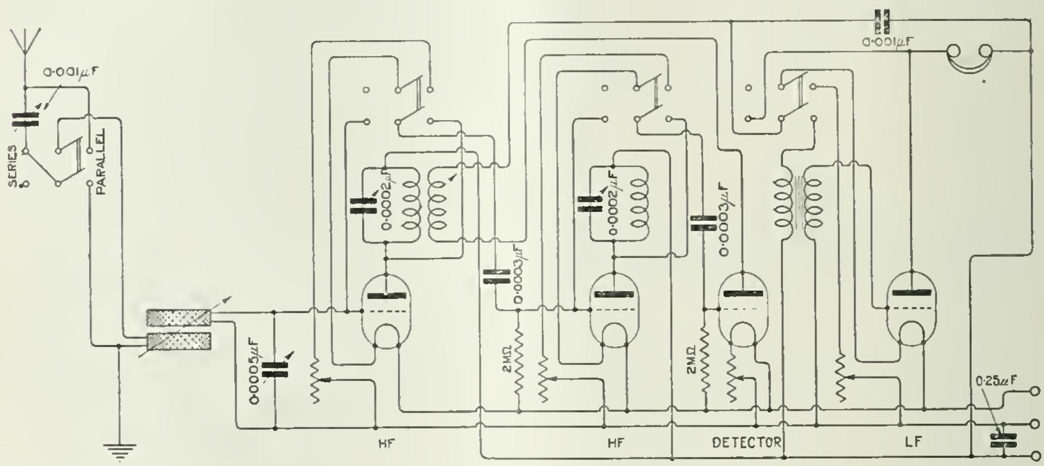


Fig. 4.

"M.V." (Belgium).—The circuit given on page 883, September 30th issue, and the coil system to which you refer, will be quite suitable for the reception of short wave telephony. L.F. transformers usually have a ratio of 1 to 2 or 1 to 3, and it is better to use a small ratio and have a large primary impedance, than to have a large ratio transformer with a low primary impedance. The telephone transformer should have a high impedance primary, and the secondary should be wound to match the impedance of the telephone receivers. When using low resistance telephones, the secondary has a low impedance. Pin type H.F. transformers are quite suitable in a circuit of this kind, and the primary winding could be tuned with a variable condenser of 0·0002 mfd. maximum value. A 0·0005 mfd. variable condenser is useful for tuning the reaction coil, and while it may not always be required, probably you will find it useful on occasions. The H.F. transformers in your possession will probably tune to 1,000 metres, and while they are quite useful, you will get better results when using the plug-in type H.F. transformer. We understand from your figure that the aerial is 26 feet high. The aerial could, with advantage, be raised another 30 feet. We suggest you construct the H.F. transformer, particulars of which are given in the articles on "Experimental Station Design," which appeared in the issues of September 2nd and 16th.

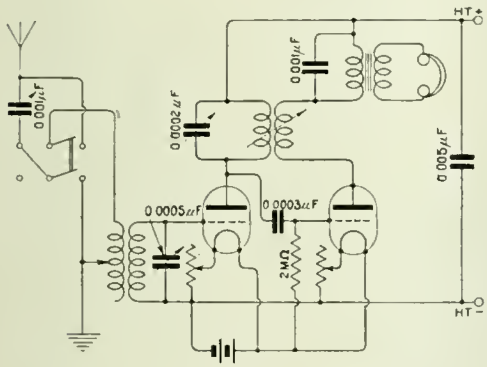


Fig. 5.

"J.E.H." (Herts) *asks for a three-valve circuit using an H.F. transformer.*

(1) See Fig. 5. The primary and secondary windings could consist of a number of basket coils connected in series. The coils should be spaced with ⅛″ insulating distance pieces, and tappings taken to switches. The anode and reaction coils could also consist of basket coils. The values of condensers, etc., are marked in. A switch is provided for joining the A.T.C. in series or parallel with the A.T.I. The A.T.C. and A.T.I. should be in series when receiving short wavelengths.

"R.R." (Paris).—The Armstrong super-regenerative circuit is described in the issues of October 21st and 28th, and your difficulties will probably disappear when you have read the second and concluding portion of the article. A suitable variometer would have as its rotor a ball 5″ diameter, and the stator would be correspondingly larger. A two-pile winding has just less than four times the inductance of a single layer winding of the same mean diameter and length.

To cover a wavelength of 150 to 25,000 metres, using a tuning condenser of 0·0005 mfds., would require a coil with a maximum inductance of 360 millihenries. If you could use a larger condenser, say 0·0015 mfds., the coil would need an inductance of only 120 millihenries, which is a much more reasonable proposition. We suggest a five-pile winding, and a coil 5″ diameter and 6″ long, using No. 24 D.S.C. wire. You will need at least 15 tappings.

"W.B." (Wellington).—The circuit given on page 474, October 29th, 1921, is quite suitable, and very good results are obtainable. The oscillation transformer has two secondaries, and the potentials are applied to valves connected one in each side of the Wheatstone bridge.

"W.H.S." (Wimbledon).—We do not recommend the use of plugs and jacks in H.F. circuits, but the circuit arrangement submitted, making use of plugs and jacks, is correct apart from the connections marked in. The proposed arrangement shows the reaction coil coupled with the aerial coil. Unless very great care is used, energy will be transferred to the aerial circuit. We prefer to couple the reaction coil to a secondary circuit, or better still, to the H.F. transformer connected between the anode of the first valve and grid of the second. The H.F. transformers are suitable, but you may find it better to tune each primary winding with a small condenser consisting of two moving and three fixed plates. We consider the primary winding of the L.F. transformers has too few turns, and we think you should use at least 6,000 turns in the primary. The grid condenser should be 0·0003 mfds. Condensers F1, 2 and 3, across the L.F. transformers, should have a capacity of 0·001 mfd. The valves and telephones suggested are quite suitable.

"K.K.P." (Cambridge).—The proposed arrangement is not very suitable, because the presence of an inductance coil in series with the loop limits the size of the loop, and therefore the amount of energy picked up. A better arrangement would be to use a larger loop, and tune the loop with a small variable condenser. A condenser with a maximum capacity of 0·0003 mfds. is suitable provided tappings are taken from the loop. We suggest you use a frame 5′ square, with 10 turns of wire spaced ¼″ apart, and take 5 tappings.

"CHAKOO" (Brentford) *asks wavelength of loose-coupled tuner.*

The tuning wavelength range of your coils when connected to the aerial will be from about 150 metres to 800 metres.

"S.M." (Bristol) *asks several questions concerning a "Broadcast Receiver" by Bull, described in the issues of August 26th and September 2nd.*

(1) Provided you employ suitable inductions, you should be able to tune up to 25,000 metres. (2) You will find the plug-in type of transformer quite suitable. (3) "R" type valves are quite suitable for use in this amplifier. (4) The A.T.C. may have a maximum value of 0·00015 mfds., and the closed circuit tuning condenser 0·0005 mfds.

"L.B." (S.E.3) *asks (1) The correct value of grid leak. (2) Why best results are obtained when the filament resistance is short-circuited. (3) Whether PCGG should be received using a single valve set. (4) Any suggestions for the improvement of his set, particulars of which are submitted.*

(1) You will find 2 megohms a suitable value of leak resistance. (2) Probably the use of a 4-volt filament battery is the reason. We suggest you use 6 volts with the resistance. (3) We do not think so. (4) We suggest you increase the anode potential to 60 volts, otherwise the set is correct.

"ULTRA V" (Durham) *asks (1) For a circuit utilising components in his possession. (2) From what distance he should receive signals using a loop aerial. (3) Dimensions of a loop aerial. (4) The correct H.T. volts.*

(1) See diagrams given in recent issues. (2) Without detailed knowledge of your set we cannot say. (3) We suggest a frame 4′ square wound with 15 turns of No. 18 D.C.C. The turns should be spaced a little and four tappings be taken. (4) With "R" type valve about 60 volts.

"M.G.K." (Greenock).—The figure to which you refer shows the method of connecting a tuned anode H.F. valve with a detector valve. The tuned anode winding may be a coil of No. 30 S.S.C. wound on a former 2½″ diameter and 6″ long with 16 tappings. This circuit should be tuned to the wavelength of the signals received. When the two valves are connected to form a 1 detector and 1 L.F. combination, there are less adjustments to be made, but signals will not be so loud as with the H.F. and detector connected valves. The advantage of using a telephone transformer and low resistance telephones over the use of high resistance telephones connected directly in the anode circuit lies not so much in any difference in signal strength, but in the robustness of the former arrangement. The high resistance telephone windings are of very fine wire, and the insulation is easily destroyed.

"E.N." (Kent) *has difficulty in getting an iron choke, inductance about 1 henry, made up and asks for particulars.*

We think any firm of electrical engineers would gladly undertake to make this choke for you. The choke is quite simply constructed. It may consist of a bundle of iron wire with a diameter of ½″, upon which is wound 2,000 turns of No. 36 S.S.C. wire. If you have a small intervalve transformer, you could connect the two windings in series and use that, or if you have an old intervalve transformer which is damaged, you could rewind it with the No. 36 S.S.C. wire. The value of this choke is not critical.

"H.W." (N.1).—The diagram on page 883 September 30th issue, indicates the method of connecting up 5 valves with switches to cut in or out valves as required. Double pole throw over or the Dewar type of switch is suitable. The H.F. transformers will, we assume, be already mounted as indicated in the sketch submitted. It is then only necessary to join them in circuit as indicated by your sketch.

"L.F. ICI" (Kilmarnock) *asks (1) and (2) where he can obtain particulars of the construction of a Marconi receiver. (3) Where to obtain particulars of the construction of a 3-valve set.*

(1) and (2). We have no particulars of the construction of this type of receiver, and we suggest you build a tuner yourself. The A.T.C. should have a maximum value of about 0.001 mfds. The A.T.I. could be a coil 4″ diameter and 8″ long wound full of No. 24 D.C.C. wire with 18 tappings. The secondary coil could be a winding of No. 28 D.C.C., 3½″ diameter and 9″ long, with 12 tappings, and is tuned with a condenser of 0.0005 mfds. maximum capacity. (3) The construction of a 4-valve set is described in the issues of July 15th and 22nd, and November 25th, and you will be able to easily modify the receiver so that 3 valves are used.

"AERIAL" (Chiswick) *asks (1) For a diagram for crystal set. (2) How far it will receive speech. (3) The crystal to use.*

(1) See Fig. 6. The A.T.I. could consist of a coil 5″ diameter and 6″ long, wound full of No. 22 D.C.C., with 12 tappings. (2) With careful adjustments the range will probably be 15 miles from a broadcast station. (3) We suggest you use a perikon detector.

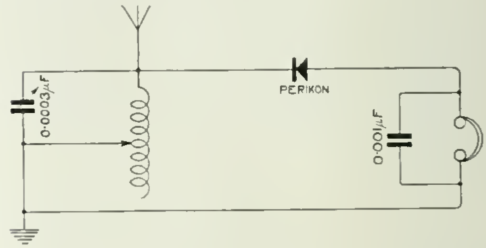


Fig. 6.

"J.S." (E.C.1). The frame aerial may consist of a frame 4′ square, upon which is wound 15 turns of No. 18 D.C.C. wire, spaced ¼″ apart. Five tappings should be taken to the switch for rough tuning. We consider the units in your possession sufficient to operate a loud speaker satisfactorily. The term microfarad means one-millionth of a farad. The farad is the unit of capacity, and a condenser has a capacity of one farad when it is charged to a potential of one volt by one ampere. The call "CQ" means all stations. When a station is transmitting and the call "CQ" is made, all stations are invited to listen in.

SHARE MARKET REPORT

Prices as we go to press on December 15th, are:—

Marconi Ordinary	.. ..	£2	2	9
,, Preference	.. ..	1	19	6
,, Debentures	.. ..	101	15	0
,, Inter. Marine	.. ..	1	6	0
,, Canadian	.. ..		9	4½

Radio Corporation of America:—

Ordinary	.. .. ..	15	9
Preference	.. .. ..	13	6

THE

WIRELESS WORLD

AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 176 [No. 13. Vol. XI.] DECEMBER 30TH, 1922. WEEKLY

The Manchester Broadcasting Station

A DESCRIPTION OF THE INSTALLATION.

THE station is situated in the Research Department of the Works of the Metropolitan-Vickers Co., Ltd., Trafford Park, Manchester. The company is technically very closely associated with the pioneers of broadcasting, the Westinghouse E. and M. Company of America, and claim to have at their disposal the whole of the experience and technical knowledge of that company.

The broadcasting station is at present being operated each evening from 6 p.m. until 10 p.m., and it is anticipated that transmissions will shortly commence on Sundays. Great care is exercised in the selection of suitable programmes and the choice of artistes. It is found that artistes with a good reputation for ordinary stage and concert work are not necessarily successful from the point of view of broadcasting, and it is anticipated the demand will be met sooner or later with the provision of training schools where the peculiar technique necessary may be acquired.

Fig. 1. The power plant of **2 ZY.**

The power for the radio transmitting set is supplied by a small generator in the works power-house at 440 volts, 50 cycles, 3 phase, and this is employed to drive a triple set consisting of an induction motor, high tension direct-current generator and exciter (see Fig. 1). The high tension generator is rated at 2·5 kW. at 5,000 volts, and runs at 1,500 R.P.M. The full load current is therefore 0·5 amperes. The exciter is a small direct-current generator, and supplies the field of the high tension generator through a potentiometer type field regulator. This enables stable adjustments to be obtained even down to very low voltages which are occasionally required for test and experimental purposes.

Two of these sets are installed, and a complete change-over of drive and supply can be effected in emergency by throwing over a single switch from one side to the other. Suitable filter circuits are provided at the high tension generator to receive the commutator ripple.

The transmitter panel was installed by the Radio Communication Co. of London, and employs four Mullard 0-500 valves and one Mullard 0-150 valve (Fig. 2). The high tension D.C. supply is applied at 5,000 volts directly to the anodes of the valves, and suitable protective gear is provided to protect the generating set against short circuits. A trip-switch can be seen above and to the right of the operator's table.

The lower operating handles in the set control the grid excitation and tuning. The second row control the filament heating circuit.

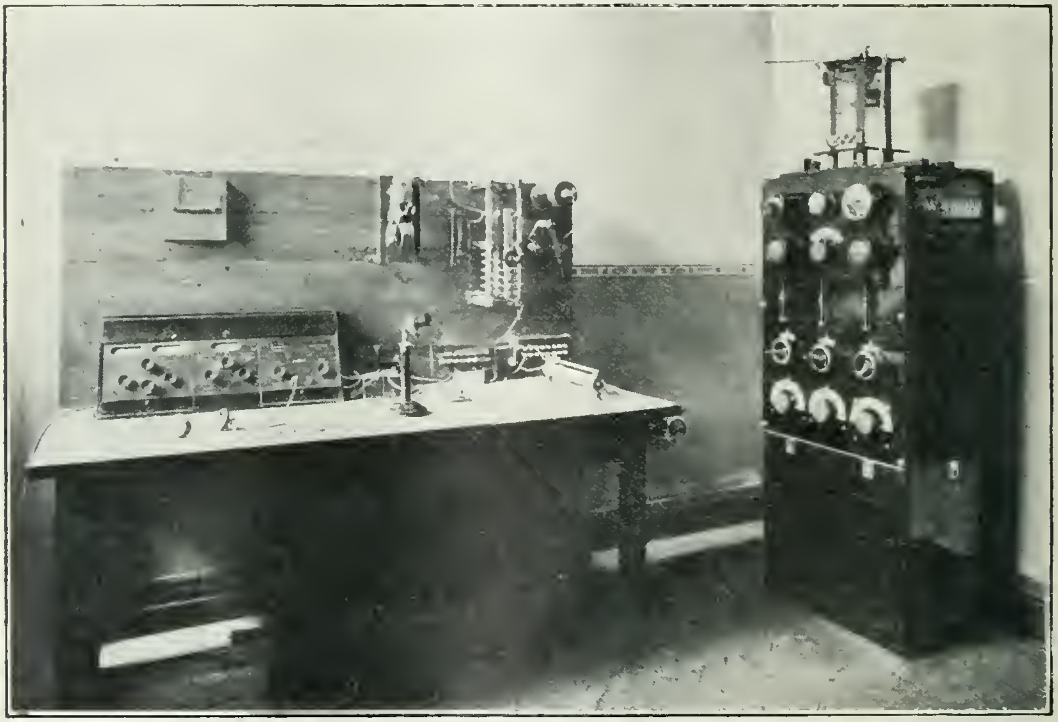


Fig. 2. The transmitting panel and listening-in arrangement.

Referring to Fig. 1, the two power sets are located one on each side of the control panel. The generator is the centre machine, and the induction motor, which is rated at $5\frac{1}{2}$ H.P., is the first machine. The rear machine is the exciter.

The throw-over switch to transfer the main and starting gear from one set to the other is the lower switch on the panel. In the centre is the starting and overload gear, and the upper switch is the high tension switch for connecting the supply to the transmitter.

Suitable ammeters and voltmeters are mounted on the upper portion of the panel. The aerial lead-in may be seen fastened to an insulator on the top of the operating table. A fuse is included in the circuit. The A.T.I. is the coil situated at the top of the panel, and the grid excitation coil may be seen secured to the top of the A.T.I. The coupling is varied by rotating the grid coil through pulleys and string. A special listening station is provided at Hale, seven miles away from Trafford Park, so that the character of the modulation can be checked. The filaments of the transmitting valves are heated from a 30-volt battery of accumulators.

The studio (Fig. 3) is accommodated in a spacious room adjoining the transmitting room. The walls are draped with suitable hangings, and the floor has been carpeted to avoid the resonance and echo encountered from the floor and walls of ordinary rooms. The equipment comprises a Steinway grand piano with a Welte player attachment, a new Edison gramophone of the latest diamond-disc type, and an Aeolian Vocalion Graduola special microphone is used. A distribution board is used to switch on the microphone required, and the sounds picked up are given a preliminary amplification in the studio, and further amplification is given in the transmitting room before the amplified currents are impressed on the aerial. The distribution switch and three-valve amplifier are seen secured to the wall of the studio.

The aerial used is of the cage type, and is suspended between the top of the water-tower and the highest point of the main works building. The lead-in is taken from the

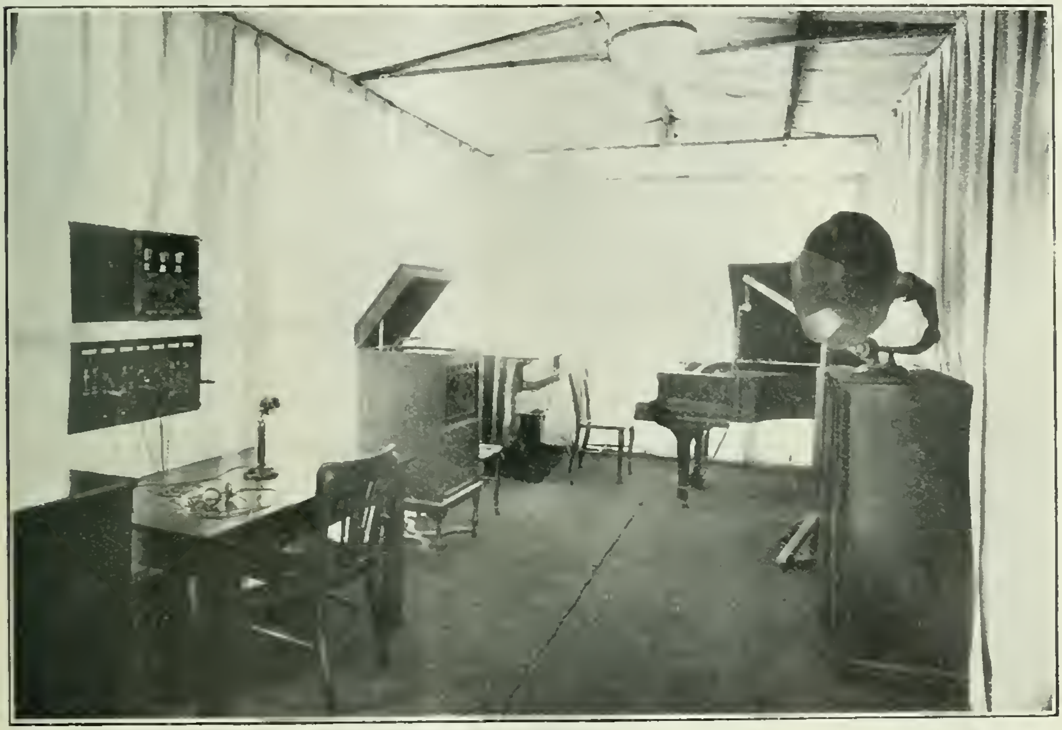


Fig. 3. The studio of 2 ZY.

cabinet gramophone. The studio is connected with the transmitting room by multicore cables which may be used for microphone or other control circuits, these latter being run in separate cable to avoid inductive interference. The music and speech from the studio is picked up by microphone or other suitable apparatus supported on convenient stands and placed in the correct position relative to the source of sound. The ordinary Post Office solid-back type of microphone is used for all purposes with the exception of transmissions from the piano, for which a centre of the main aerial and drops into one of the research laboratories. Each cage has six wires supported by suitable loops, the average height being 160 ft. An earth connection is used.

The station has worked since its inception on 800 watts, and an aerial current of 5 amperes is obtained. It is hoped to increase the power almost immediately to 1·5 kW., the full power for which the station is licensed.

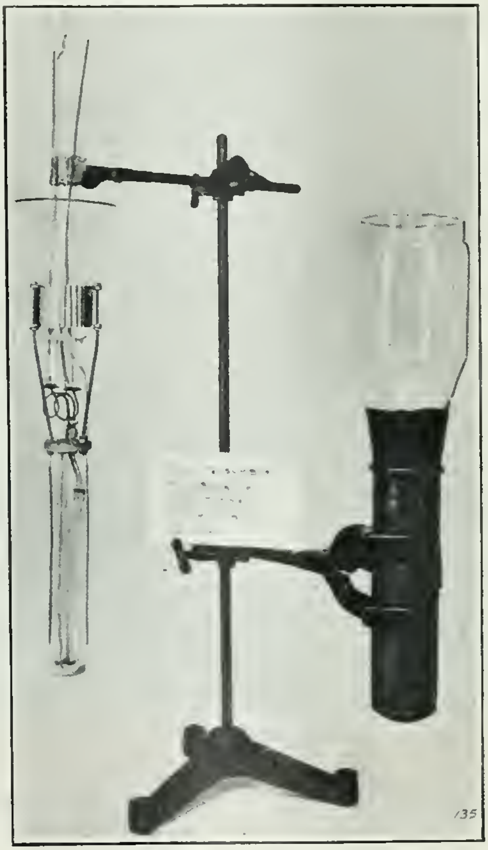
Because of the experimental nature of the station, further technical details are not yet available for publication.

Exhibition of 10-kW. Vacuum Tubes.

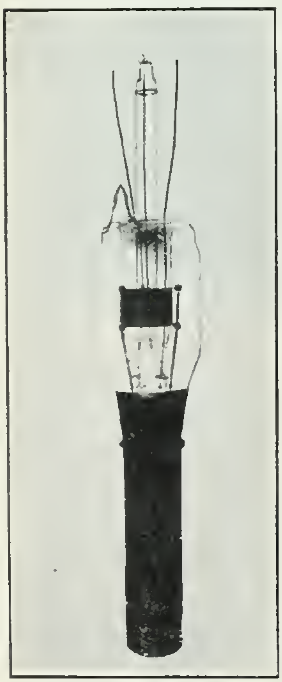
Before the meeting of the Institution of Electrical Engineers last week, an exhibition of 10-kW. Vacuum Tubes was given by the President. The vacuum tubes shown are, of course, recent developments of the original thermionic rectifying valve, made by Dr. Fleming.

The large 10-kW. valves are used for radio transmission, and are of two types, the rectifier (2 electrodes) and the oscillator or amplifier (3 electrodes). A special feature of these valves is the water-cooled anode, consisting of a copper tube, which is fused to the glass bulb by means of a special copper-glass seal. This joint is gas tight, and is unaffected by the heating and cooling occurring both during manufacture and operation. When in service the tube is mounted so that the anode is surrounded by a metal jacket through which cooling water circulates.

Above: *Valve inserted in water circulated cooling jacket.*



Centre: *Filament Grid and Anode of 10-kW. Transmitting Valve before assembly.*



Below: *A complete 10-kW. Transmitting Valve.*

A further exhibit showed the detailed assembly of the filament, grid and anode, the nature of the copper-glass joint upon the latter being readily seen.

The following are the characteristics of the 10-kW. tube:—Normal filament current, 24·5 amperes; normal filament voltage, 32; normal plate voltage, 10,000; power taken by valve (including losses in valve), 15 kW.; and output power delivered, 10 kW.

Chemical Rectifiers for Plate Voltage Supply.

By E. H. Robinson (2 VW).

Undoubtedly the greatest problem that faces the amateur when he starts using thermionic valves for reception or transmission is that of obtaining a cheap but reliable source of high tension current. Where electric lighting mains are laid on it is cheaper to derive one's H.T. from this source than to buy dry batteries, especially when more than one hundred volts is required. The use of D.C. mains has been dealt with in a recent issue of the *Wireless World and Radio Review*,* and as many municipal lighting supplies are alternating current I shall confine my remarks to the use of the latter. In the writer's opinion the man who has access to A.C. is much better off than the man who has D.C. at 200 volts, because A.C. can be transformed up or down without serious loss to any desired voltage. With D.C., on the other hand, one cannot obtain more than the supply voltage, and to obtain less it is necessary to insert wasteful resistances or potential dividers.

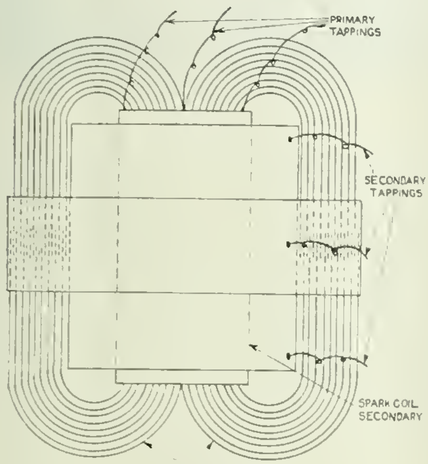


Fig. 1.

The device which I am about to describe is cheap to make and will give a smooth current of 50-100 milliamperes at voltages from 500 downwards, suitable for transmission or for receiving amplifiers.

* June 17th, 1922, p. 343.

Transformer.

Almost any type will do as long as the primary is suited to the voltage of the A.C. mains and the secondary gives an effective voltage a little higher than the required high tension voltage. As both periodicity and voltage vary considerably in different localities it is impossible to give specific values for the windings of the transformer. The writer's transformer, which works off 40 volts at 90 cycles, is made out of an old $\frac{3}{4}$-in. spark coil. The original primary was removed and another inserted consisting of 1 lb. of 20 gauge D.C.C. copper wire wound neatly on a core made up of 30 flat strips, $\frac{3}{4}$ in. by 14 ins., cut from ordinary tinplate (tinned iron). After insertion of the primary the strips were bent over, as shown in Fig. 1, to form a closed magnetic circuit. As a matter of fact it was found necessary to unwind some of the secondary from the *inside* in order to make a space large enough to accommodate the primary. This was easy enough as the secondary had been wound in layers separated by waxed paper and not in sections. There are tappings on both primary and secondary so that a large range of voltages is obtained from 1,000 volts downwards. The transformer is fairly efficient considering its simplicity and cheapness.

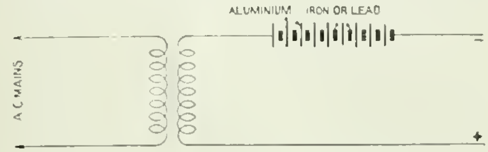


Fig. 2.

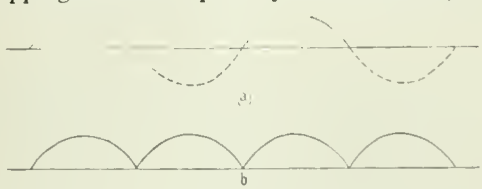


Fig. 3.

Rectifier.

The action of the rectifier depends on the well-known fact that an electrolytic cell containing an aluminium electrode and an iron one dipping into a saturated solution of ammonium phosphate will allow current to pass from iron to aluminium but not in the

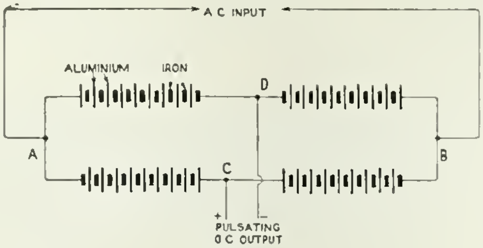


Fig. 4.

reverse direction, provided that the alternating E.M.F. applied to the cell does not exceed about 80 volts. If therefore we wish to suppress one half of the cycle of A.C. at say 500 volts, we must use a unit of about six such cells in series. Such an arrangement is shown in Fig. 2, but the resulting current would consist of unidirectional pulses, as shown in Fig. 3a by the thick-lined humps, with inactive periods between them. Half-cycle rectification is somewhat difficult to render smooth by means of chokes and condensers; fortunately however we can, by a slight elaboration of the rectifier,

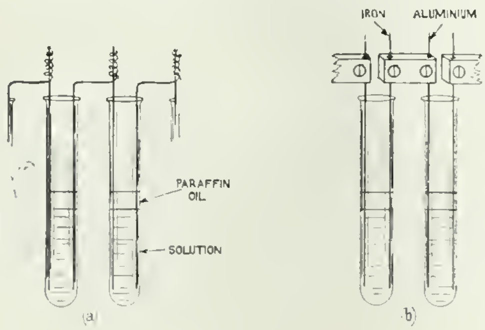


Fig. 5.

utilise the suppressed portion indicated by the dotted lines in Fig. 3a and obtain in the output circuit a pulsating unidirectional current of the nature indicated in Fig. 3b. The arrangement of the cells is shown in Fig. 4. There are four units of several cells each, and it will be seen that if an alternating electromotive force is applied at A and B the output at points C and D will have a constant polarity, C always being positive and D negative.

As the currents required in valve work are very small, usually only a few milliamps, the rectifier cells may be quite small. The writer's own rectifier is made up of 24 test-tubes 5 ins. long by $\frac{5}{8}$ ins. diameter, each about half-filled with a saturated solution of ammonium phosphate. The electrodes are simply 16 gauge aluminium wire and 16 gauge galvanised iron wire respectively, dipping about one inch below the surface of the electrolyte, this giving ample electrode surface for ordinary purposes. The experimenter is advised however to use 16 gauge tin or lead fuse wire in place of the iron wire as the latter, although perfectly satisfactory while it lasts, becomes eaten away after continued use. Connection between electrodes in successive cells has been made as shown in Fig. 5a by

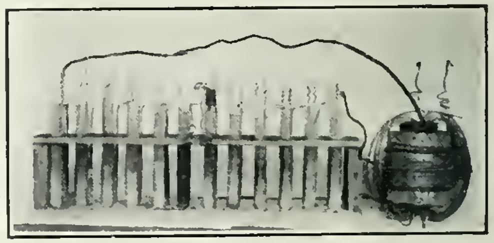


Fig. 6.

bending the iron wire into the shape indicated, inserting one end of the aluminium wire into the spiral portion and hammering the joint on a flat surface so that the iron wire nips the aluminium firmly. In view of the fact that the electrodes need renewing occasionally, the arrangement in Fig. 5b would be more satisfactory; here the short brass connectors with set-screws will allow any electrode to be replaced in a moment. The whole rectifier is mounted in a wooden test-tube rack, such as may be seen in any chemical laboratory, and occupies an overall space 3 ins. × 14 ins. base by 7 ins. high. Fig. 6 shows the general arrangement. This rectifier is designed to give four or five hundred volts for transmission,

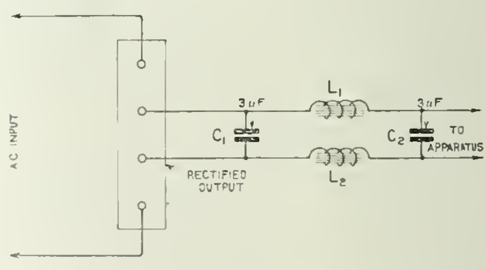


Fig. 7.

but for receiving purposes where voltages of only about 30-90 are required fewer cells may be used; four groups of 3 cells each will be more than sufficient.

Smoothing out A.C. Ripple.

In order to render the pulsating D.C. obtained from the rectifier suitable for ordinary purposes it is necessary to convert it into a continuous and uniform flow of current, otherwise there would be a terrific hum in the phones in the case of a receiver, or in the emitted carrier-wave in the case of a transmitter. This is effected by passing the current into a 3-mfd. condenser C_1 (Fig. 7), thence through chokes L_1 and L_2 of two or three henries inductance each, and into another 3-mfd. condenser C_2. From C_2 leads are taken to the valve circuits. L_1 and L_2 may be the secondaries of two small induction coils. The writer is using the secondaries of two old Ford ignition coils which were picked up cheap, the usual core consisting of a bundle of soft iron wires being retained. With such a smoothing device it is practically impossible to get A.C. ripple in the output, even with half-cycle rectification. The condensers C_1

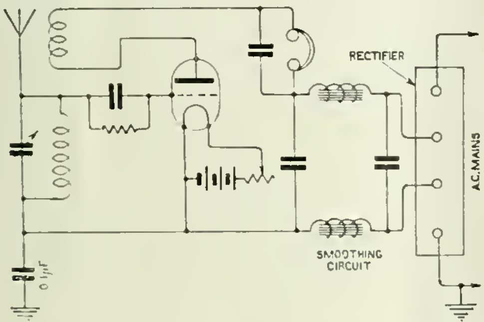


Fig. 8.

and C_2 may be of the Mansbridge rolled type which can be bought very cheaply. The construction of a smoothing unit was described in the article referred to earlier.

Miscellaneous Details.

Various details should be attended to in order to get the best results. First, the electrolyte should be a saturated solution of *pure* ammonium phosphate. The "commercial" product is cheaper and will work, though less efficiently. A copious sludge may form after a few days' use, but the presence of this does not seem to matter. Sodium bicarbonate and borax are often recommended as substitutes for ammonium phosphate, but though very cheap they are in the writer's experience inferior, and it is better to pay twice as much and use ammonium phosphate. Ammonium molybdate is stated to be the best electrolyte,

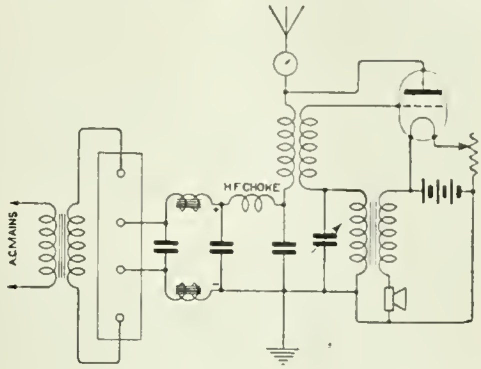


Fig. 9.

but as its cost is prohibitive the writer has not tried it.

A good plan is to float half an inch of paraffin oil on top of the electrolyte. This prevents "creeping" of the salt in solution, retards evaporation, improves insulation and lessens corrosion of the aluminium just where it enters the solution.

In connection with the use of Mansbridge condensers I ought to add a word of warning, particularly to those who intend to use several hundred volts across them. Always light your valve filaments before switching on input in to H.T. supply; if the H.T. is switched on with the filaments out an excessive potential may build up across the condenser and break down the dielectric. Mansbridge condensers will stand 500 volts, but not much more, and if higher voltages are contemplated, then each 3-mfd. condenser will have to be replaced by two 6-mfd. ones in series. Breakdowns are indicated by a crackling noise in the condenser.

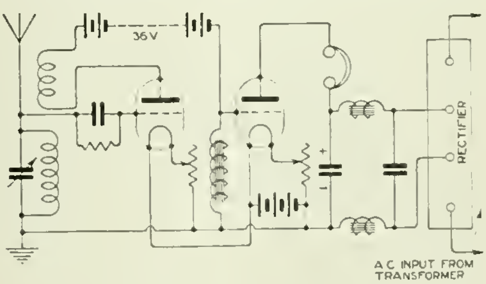


Fig. 10.

It may occur to the reader that where voltages not exceeding 100 or so are required the transformer could be dispensed with and the rectifier worked direct off the mains; but here a difficulty arises as one side of the mains is always earthed. If, as is usual, a part of the valve circuit is connected directly to earth, half the rectifier becomes short-circuited and rendered inoperative. This trouble however may be overcome by inserting a fixed condenser in the earth lead of the set as shown in Fig. 8. A transformer (not auto-coupled) is preferable, as it is safer and gives greater flexibility of adjustment of voltage.

Results Obtained.

The rectifier described above has been used both for receiving and transmitting with very satisfactory results. The telephony transmitter circuit is shown in Fig. 9. When the filament is lit with an accumulator the carrier wave is absolutely free from ripple and several other stations report that the C.W. is as pure as if dry cells were being used for H.T. The transmitter is capable of putting over 0.3 amps. into a 30-ft. (double) aerial on a wavelength of 400 metres. If the filament is lit off 6 volts A.C. a slight ripple is introduced.

When receiving I sometimes use my power valve (an A.T. 40) as a note magnifier as shown in Fig. 10. An ordinary 36-volt battery is used on the detecting valve (an R) and 300-400 volts from the rectifier and the amplifier. The form of coupling between the two valves seems to give less distortion of received telephony than transformer coupling. The choke L may be a pair of high resistance phones or the secondary of an ignition coil. Absolutely no A.C. hum is detectable in the telephones and the magnification of signals which are fairly strong in the first place is enormous.

I claim the following advantages of the chemical over the thermionic rectifier for A.C. rectification :—

(1) Much cheaper to install (mine cost me only a few shillings).

(2) Cheaper to run as there are no filaments to light.

(3) Less fragile.

(4) Much less resistance to currents in the right direction, consequently less loss in potential than with a thermionic valve.

A freshly made up set of cells should work without requiring attention for a month or two, according to the duty it has to perform.

N.B.—I do not wish to be responsible for the untimely electrocution of any innocent reader, so I will add a warning about H.T. transformers. Although an H.T. transformer such as I have described does not give such high maximum potentials as, say, a 2-in. spark coil, it is capable of delivering through the human body much larger currents and must be treated with respect accordingly. The H.T. side must be well insulated and nothing connected to it should be touched without first making sure that the input current is switched off. It is advisable to switch off the current feed to the transformer primary, prior to the valve filaments, first to avoid breakdown of the Mansbridge condensers, and secondly to ensure that the condensers are discharged before touching the apparatus. Also make sure that the primary windings are suited to the mains off which they are to work.

ELEMENTARY INSTRUCTIONAL LECTURE.

An experimental Lecture dealing with the Principles of Radiotelephony, and primarily intended for Associates of the Radio Society of Great Britain, will be given by G. G. Blake, M.I.E.E., A.Inst.P., at the Institution of Electrical Engineers on January 12th, at 6.30 p.m. Tickets will be sent to Associates. All interested are invited, and tickets can be obtained by sending a stamped and addressed envelope to Mr. Leslie McMichael, Hon. Secretary, The Radio Society of Great Britain, 32, Quex Road, West Hampstead, N.W.6.

Electrons, Electric Waves, and Wireless Telephony—XIII.

By Dr. J. A. Fleming, F.R.S.

4.—Production and Detection of Electric Waves of Great Wavelength.

Our next step must be to explain the manner in which electric waves of much longer wavelength than those employed in the above experiments can be created and detected. Especially is it necessary to describe the method of generating the type of electric wave employed in wireless telephony.

It will be convenient to begin with a description and explanation of an instrument called a thermionic valve, because this is used not only to create but to detect these electric waves of great wavelength.

It has been mentioned already in speaking of the free electrons in conducting materials that these atoms of electricity are in constant irregular motion in the inter-atomic spaces. Part at any rate of the sensible heat contained in any substance which gives it what we call its temperature, is due to the energy of motion of these free electrons.

According to a certain theory called the theory of equipartition of energy, these free electrons should have the same average kinetic energy as gas atoms would have at the same temperature. We have seen that the root mean square (R.M.S.) value of the velocity of molecules of oxygen gas is nearly 461 metres per second, and since the atom of oxygen is 16 times heavier than the atom of hydrogen, the R.M.S. velocity of hydrogen molecules is $\sqrt{16} \times 461 = 1844$ metres per second. But a negative electron has a mass of about 1/1,700th of that of a hydrogen atom. Hence the R.M.S. velocity of the free electrons in a conductor should be

$\sqrt{1700} \times 1844 = 41 \times 1844 = 75604$ metres per second, or nearly 47 miles per second.

If the temperature of the conductor is raised this electronic velocity will be increased, being nearly proportional to the square root of the absolute temperature; that is, the temperature reckoned from -273° centigrade. If then the temperature is very high, the velocity of some of the free electrons may become so great that those near the surface of the material are flung off from it.

This, indeed, is what happens when a wire, say, of tungsten is heated to a bright incandescence in a high vacuum, as in the case of the filament of an incandescent electric lamp. It must be remembered, however, that every electron which escapes leaves behind it a chemical atom deprived of an electron, and therefore having a positive electric charge of equal amount. Hence unless we supply from some source electrons equal to those that escape, the metal, if insulated, would soon acquire such a high positive potential as to hold back more electrons from escaping. This emission of electrons, due to high temperature, is called *thermionic emission*.

In order that it may take place continuously, we have to surround the incandescent metal with a metal enclosure and to connect the positive terminal of a battery to this sheath or plate, and the negative pole to the hot filament (see Fig. 65).

The arrangement then that is necessary is to construct an ordinary high vacuum incandescent electric lamp, having a straight or loop filament (F), preferably made of drawn tungsten wire, because that material has a very high melting point and will bear heating to 2,000° C. or 2,500° C. without risk of fusion (see Fig. 61).

Around this filament but not touching it, is a metal cylinder (*P*), made of sheet nickel, which is fastened to a platinum wire (*A*), sealed airtight through the glass bulb. With such an appliance it is very easy to show that an incandescent metal filament in a vacuum is giving off negative electricity by the following experiment (see Fig. 65.).

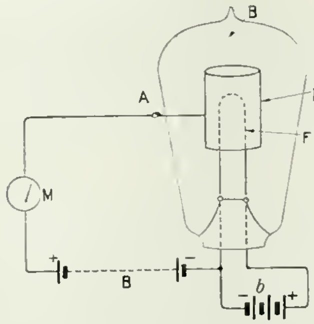


Fig. 65. A Fleming Oscillation Valve.

Provide a gold leaf electroscope, consisting of a pair of gold leaf slips contained in a glass bell jar. Connect the terminal of this with the metal cylinder of a valve. Give to the gold leaves and metal cylinder a charge of negative electricity by means of an ebonite rod, rubbed with flannel. If the filament of the valve is not incandescent the gold leaves should remain diverged, that is, the system should retain an electric charge of negative electrons.

If then we make the filament incandescent by passing an electric current through it, we shall find that the negative charge is still retained by the cylinder and gold leaves.

If, however, we give to them a charge of positive electricity by means of a warm glass rod rubbed with silk, the filament being cold or not incandescent, we shall find that the system still retains that charge provided the insulation is good. The moment that the filament is made incandescent by passing a current through it, the gold leaves of the electroscope collapse, showing that a charge of positive electricity is instantly removed from the cylinder. This can only be due to the emission of negative electrons from the incandescent filament. It is convenient to make the filament of such a length that it is rendered incandescent by the current f om a storage battery of two to six cells or, say, 4 to 12 volts.

If then we connect the positive pole of another separate voltaic battery to the terminal of the metal cylinder, technically termed the plate, and the negative pole to the negative terminal of the filament, and if we insert in that circuit an instrument called a milliammeter, for detecting and measuring electric currents, we find a current, that is a stream of electrons moving, inside the bulb from the hot filament to the metal cylinder. This is called the *thermionic current.*

Since the stream can only flow when the cylinder is positively electrified and the filament negatively electrified, because the filament can only emit negative electrons, the device enables us to permit electrons to move in a circuit only in one direction. Hence it was named by the author in 1904, who so used it for the first time, an *oscillation valve*, and it is now commonly called a *Thermionic valve.*

The great use of it proved to be to convert high frequency alternating currents of electricity into unidirectional or direct currents. If in place of the battery we connect the plate of the valve with the filament through a circuit outside the valve which contains some source of alternating electromotive force or high frequency oscillations, then it will be evident that when the electromotive force is in such a direction as to make the cylinder or plate positive, an electron current will flow from the filament, but when the plate is negative it will keep the electrons from coming out of the filament. Therefore the electron current is always in one direction through this external circuit or plate circuit as it is called. The high frequency alternating current is then said to be *rectified* by the valve, when used as follows :—

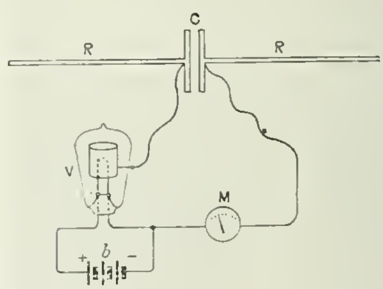


Fig. 66. RR. Rod resonator.
C. Condenser.
V. Oscillation valve.
M. Galvanometer or Milliammeter.

Let there be two metal rods placed in line with each other in a region through which electric waves are passing, and let these rods be placed with their lengths parallel to the direction of the electric force in the incident waves and let their total overall length be adjusted so that it is about 2¼ times the wave-length. In other words, let the natural frequency of oscillation of the whole rod be adjusted to be equal to the wave frequency (see Fig. 66). Then let these be inserted between the rods, a circuit comprising an oscillation valve as above described, and also a sensitive galvanometer, which is an instrument for detecting a direct electric current. If then an electric wave falls on the receiving rods it will create electric oscillations in them, but the thermionic valve will only allow the currents in one direction to pass and to affect the galvanometer.

If the electric waves are produced by spark discharges in a transmitter, as expalined in a previous section, then these waves and the oscillations they produce in the recieving rods come in little groups with intervals of silence. These are called *damped trains of oscillations.* When rectified by a Fleming valve they are then converted into little gushes of electricity, all in one direction, which come at intervals of time equal to the intervals between the spark discharges.

We can then employ as the detecting instrument a telephone receiver, made as explained in the next section.

A telephone does not permit the passage of a high frequency current through it, but it is caused to emit sound if an interrupted direct current is sent through it, having the frequency of the interruptions between, say, 100 and 10,000. Accordingly, on listening to the telephone receiver when it is joined in series with the plate circuit of a thermionic valve, in which a series of damped electric oscillations are being created, we hear a musical sound as long as the groups of oscillations continue. The frequency of this sound is the same as the frequency of the groups of oscillations, that is, of the sparks creating them.

An improvement on the original single cylinder or two-electrode valve was effected by the interposition of another cylinder of metal gauze, or a spiral of metal wire between the filament and the cylinder of solid metal. This gauze or spiral cylinder is technically termed a *grid*, and a thermionic valve with a cylinder (plate) and grid is called a three-electrode valve (see Fig. 67).

This triple-electrode valve is remarkable for the astonishing number of ways in which it may be used to detect as well as create electric oscillations. We shall first briefly describe its use as a detector of feeble damped electric oscillations, which come in groups or trains.

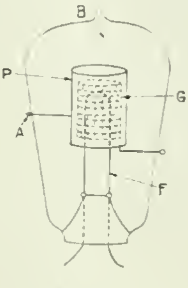


Fig. 67. A three-electrode Thermionic Valve.

For this purpose we connect the negative terminal of a voltaic battery *B*, say, of 40 or 50 cells to one terminal of the filament of a valve, which we shall assume has a filament rendered incandescent by a small separate battery *b* of three cells (see Fig. 68). The latter is called the filament heating battery,

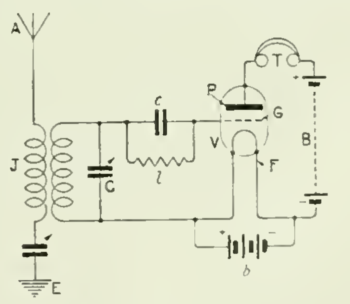


Fig. 68. One method of using a Thermionic Valve to detect damped electric oscillations set up in an aerial A.

and the former the plate battery. This last has its positive terminal connected to the cylinder or plate of the valve and the circuits of a receiving telephone receiver *T* are included in this circuit; the terminals of the telephone are usually also connected to the plates of a small condenser.

In the next place the grid is connected to one terminal of a small condenser *c*, called the grid condenser, and this condenser has its terminals also connected by a very high resistance *l*, called the grid leak, which often consists of a piece of ebonite on which has been rubbed some plumbago or so-called black lead.

The second terminal of the condenser is connected through one coil of an induction coil with the filament of the valve, the other circuit of this induction coil being included in the circuit in which oscillations are generated by the electric waves to be detected. On the other hand the filament of the valve and one terminal of the grid condenser can be connected to the receiving aerial wire as shown in Fig. 64.

The operation then is as follows. When electric waves fall on the receiving or aerial wire they create in it oscillations, and these in turn charge the receiving condenser in one direction or the opposite, and this causes the grid to be charged with electricity either positive or negative. Again the battery in the plate circuit is causing a stream of electrons to issue from the filament, and these make their way to the plate by passing through the interstices or holes in the grid.

If the grid is negatively electrified, which means if there are negative electrons on it, then, owing to the mutual repulsion of electrons of like kind, these prevent the electrons from the filament from passing through the grid to reach the plate. If, however, the grid becomes positively electrified by the oscillations from the aerial, then the negative electrons from the filament neutralise that positive charge. Hence the effect of the oscillations in the receiving wires is to cause the plate-current or flow of electrons from the filament to be reduced, and therefore to check the current through the telephone. It is then necessary to provide a means by which the negative charge on the grid can be continually removed. This is achieved by the grid leak, which is a very high resistance of several million ohms put across the terminals of the grid condenser. This leak brings the grid back to a neutral condition between the arrival of each group of waves. If then these waves are produced by a spark transmitter of the Hertzian type, the impact of each group on the receiving wire causes a sudden decrease in the thermionic current flowing through the telephone, and this, as explained in the next section, causes the telephone to emit a sharp brief sound. If then the groups of waves continue to arrive, these sounds run together into a musical note of the same frequency as the spark of the discharger.

By making these sparks endure for various periods of time, short or longer in accordance with a certain code of alphabetic signals, the auditor listening in at the receiving telephone will hear sounds of corresponding duration and can spell out the letters received. In this manner wireless telegraphy on the spark system is accomplished.

Before we can discuss other methods of employing this triple electrode valve for detecting feeble electric oscillations it will be necessary to explain briefly the nature of its *characteristic curve.*

We insert in the external plate circuit of a thermionic valve a battery with negative pole connected to the filament and an instrument called a milliammeter for measuring small electric currents by the deflection of an indicating needle over a divided scale. These currents are conveniently measured in terms of a unit called a milliampere, which is one thousandth part of an ampere, or about one-tenth of the current through an ordinary 200-volt incandescent lamp.

We then make arrangements for giving to the grid a positive or negative potential by means of a battery of varying number of cells.

Let us begin with the grid in a neutral or unelectrified condition, viz., at zero potential.

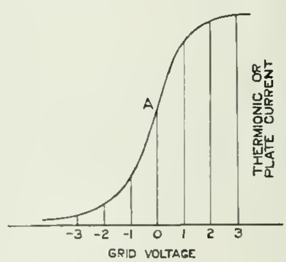


Fig. 69. A characteristic curve of a Three-electrode Thermionic Valve.

The thermionic current or flow of electrons from the filament has then a certain strength, called the normal strength, when reckoned in milliamperes. This current of negative electrons flows from the filament, through the grid to the plate or cylinder of the valve, and then back through the external circuit and the milliammeters to the filament. We can represent this current by the length of a vertical line *OA* drawn perpendicularly to a horizontal line on which we mark off lengths proportional to the voltage of the grid (see Fig. 69). If then we make the grid slightly negative, say by 1, 2, 3, volts, etc., we shall find that the plate or thermionic current gradually decreases, and this may be represented by lines of decreasing height drawn at equal intervals of distance to the left of the central normal line. If we make the grid positive by 1, 2, 3 volts respectively, we find that the plate current increases, but not indefinitely. It reaches soon a maximum value which cannot be exceeded. The plate current is then said to be *saturated.* If we join the tops of the vertical lines denoting the plate currents we obtain a curve called the plate-grid *characteristic curve* of the valve.

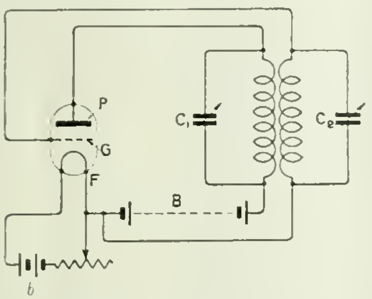


Fig. 70. Method of using a Thermionic Valve to create undamped electric oscillations. P. Plate of valve. G. Grid. F. Filament. B. Plate battery. b. Filament battery.

We see, therefore, that if we give the grid a certain positive voltage corresponding to the point at which the curve just begins to bend over, and if we superimpose on this steady voltage an alternating high frequency voltage due to an oscillation, the plate current cannot be much increased when the latter voltage is positive, but it is decreased when the alternating voltage becomes negative.

Hence the superposition of an alternating voltage on the grid then always decreases the plate current and causes a telephone in that circuit to emit a sound which is a musical or continuous sound if the oscillations take place in intermittent groups.

The above methods of using the three-electrode valve as a detector apply only to that class of electric waves in which the waves arrive in little groups or trains with interspa es of silence between the groups; in other words, to the reception of trains of damped electric waves.

On the other hand, in the great bulk of wireless telegraphy and entirely in wireless telephony, we make use of *continuous waves* (C.W.), which continue without interruption except in so far as they are deliberately interrupted or varied in amplitude to make the signals or speech sounds.

We have then to explain how these continuous waves are detected, but must preface this explanation by a description of the manner in which this three-electrode valve can be used to generate electric oscillations, which of late years had become of enormous importance.

It has been explained that if the grid potential varies from positive to negative by removing from or adding to it excess electrons, the plate current or stream of electrons from the filament will also vary, increasing when the grid is positive and decreasing when it is negative.

Hence if we cause the grid to alternate in potential it will make the plate current also fluctuate in such fashion as to be equivalent to the superposition of an alternating current on a direct current.

If we insert in the plate circuit the primary coil of an induction coil, then the terminals of its secondary circuit will provide an alternating voltage which exactly imitates in wave from the alternating potential of the grid, but can be made to have much greater amplitude.

A little thought will make it evident that if we couple back the terminals of the secondary circuit of this induction respectively to the grid and the filament in the right direction, we can cause variations in the plate current to give the grid the proper alternating voltage to sustain those variations in the plate current, so that the apparatus continues to operate to produce high frequency continuous oscillations in the plate circuit.

We have it in our power to control the frequency of these oscillations by putting condensers C_1, C_2, of suitable capacity across the terminals of the primary and secondary circuits of the induction coil, these circuits being tuned to the same frequency (see Fig. 70).

We are able therefore to use the valve as a generator of undamped oscillations and it has the property of creating electric oscillations, the wave form of which is exactly a simple periodic curve like the sound wave form of a tuning fork or open organ pipe gently blown. Moreover, we can harness together a number of these generator valves so as to employ a battery of them to create very large oscillatory currents of any required frequency and simple or pure wave form.

Generator valves are now made for this purpose, which have glass or silica bulbs about the size of a football, and 50 or 60 of these valves can be arranged on panels to create very large high frequency currents.

The illustration Fig. 71 shows such a large valve panel as is used in the great Marconi Wireless Telegraph station near Carnarvon, on the flank of Snowdon, for world-wide wireless telegraphy.

Another discovery of great practical value in connection with this subject was that if the grid and the plate circuit are coupled together inductively, as above described, but if the primary and secondary circuits in the plate and grid circuits respectively are placed so far apart that they are just, but not quite, on the point of generating self-sustained oscillations, the system becomes very sensitive to the effect of any additional electric impulses produced by incident electric waves. The valve is put into a condition in which it is just on the point of self-oscillation and the effect of the feeblest waves of the frequency for which its circuits are tuned will then be to create oscillations as long as the waves are arriving. This is called *regenerative coupling.*

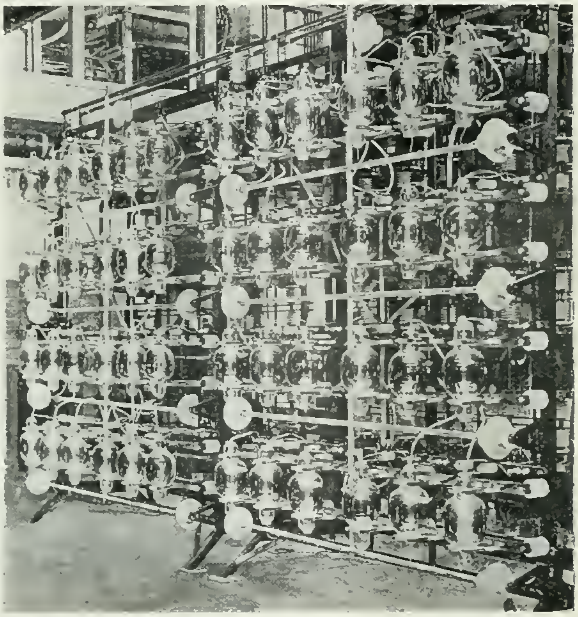


Fig. 71. Valve Transmitting Panel at Marconi Station near Carnarvon.

We shall discuss its special application in connection with wireless telephony in a later section. Meanwhile it is important to notice that the thermionic valve has an exceedingly valuable use as an *amplifier* of oscillations of high or low frequency.

We have pointed out that any variations in the electric potential of the grid are accompanied by corresponding variations in the plate current.

Suppose we insert in the plate circuit one coil of a transformer consisting of two insulated wires, one superimposed on the other, the two wires being wound on one bobbin or tube. In addition, we insert in the plate circuit a battery B with its positive pole connected to the plate and its negative pole to the filament (see Fig. 72).

If now we apply to the grid a feeble alternating electromotive force, this will make the grid alternately positive and negative in potential. This will, as above explained, cause the plate current to fluctuate, and this current passing through the primary coil of the transformer T_2 will create a secondary electromotive force in the adjacent coil which can be made by suitable proportioning of the circuits to have the same frequency, but much greater amplitude than the electromotive force (E.M.F.) applied to the grid. It may in fact have an amplitude of 5 or 10 times as great. Thus if the E.M.F. applied to the grid varies from $+1$ volt to -1 volt, and has therefore an R.M.S. value of about 0·707 volt, the E.M.F. on the secondary terminals of the plate transformer may have an R.M.S. value of 5 or 10 times greater.

The thermionic valve is then said to amplify voltage 5 or 10 times.

It is then obvious that we can apply this amplified E.M.F. to cause fluctuations in the potential of the grid of a second valve similarly equipped with a transformer in its plate circuit, and so amplify a second stage again, say 5 or 10 times. Likewise a third valve may be used, and the result is a magnification of potential by three valves, which is, say, $10 \times 10 \times 10$ that of a single valve (see Fig. 73).

This arrangement of three valves coupled by transformers is called a *three-stage amplifier.* There is hardly any limit to the degree of amplification obtainable in this manner by a number of valves in series.

We can not only amplify the high frequency oscillations called *radio-amplification*, but we can amplify the rectified groups of damped oscillations which have a low frequency, and this is called *audio-amplification.*

The great achievements of modern wireless telegraphy, such as the transmission of radio messages to the antipodes and their detection at distances of 10,000 or 12,000 miles, are altogether and entirely due to the invention of the thermionic valve and to the power it has given us of amplifying to any extent extraordinarily feeble electric oscillations produced in aerial receiving wires by electric waves. Before concluding this section a brief reference must be made to the use of *crystal rectifiers* as a means of detecting feeble electric oscillations.

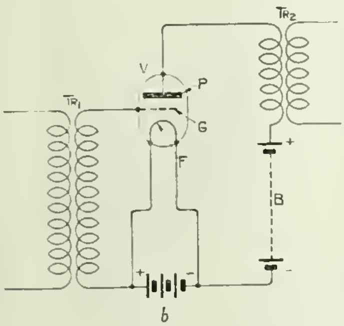


Fig. 72. A valve amplifier circuit with transformer couplings.

It has been found that certain crystals possess the power of conducting electricity better in one direction than in the opposite; that is to say, in certain directions through the crystal there is an unsymmetrical conductivity. This is particularly marked, as first shown by General Dunwoody in the United States, in crystals of carborundum. This material is a highly crystalline compound of carbon and silicon, chemically called a carbide of silicon, and made in an electric furnace by heating to a very high temperature a mixture of powdered coke and sand. Certain of these crystals of carborundum, if mounted between metal clips or supports, are found to offer less resistance in one direction than in the opposite to an electric current. Hence such a crystal, when inserted in a circuit in which electric oscillations are produced, rectifies them or converts them into a direct current just as does the two-electrode or Fleming thermionic valve. Groups of electric oscillations can thus be rectified into intermittent gushes of electricity in one direction and thus affect a telephone receiver.

We are not able to say exactly at the present time what is the reason for this curious lopsided electric conductivity in certain crystals, but it must depend upon an asymmetry of structure. The same property is possessed by a native sulphide of molybdenum called molybdenite, as found by Professor G. W. Pierce.

Also the contact point of many pairs of crystals or minerals has the same property.

If we place in contact a piece of zincite which is a natural oxide of zinc, and a piece of chalcopyrite, otherwise called copper pyrites, which is a sulphide of copper and iron, it is found that certain contact places have a rectifying power upon electric oscillations.

Again the contact point of a bit of plumbago (black lead pencil) and galena or sulphide of lead has a similar rectifying power. These crystals or contacts can therefore be used in series with a telephone receiver to rectify or convert into direct currents groups of electric oscillations These then become audible as sounds in a telephone receiver, which are either continuous sounds cut up into Morse code signals in wireless telegraphy, or speech sounds as explained further on in wireless telephony.

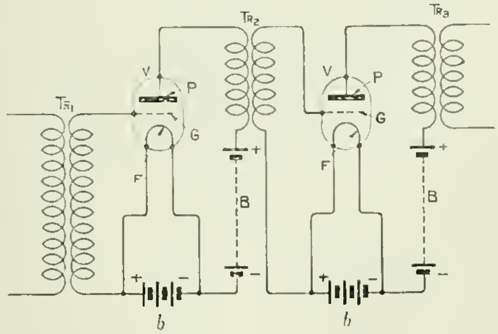


Fig. 73. Arrangement of two Thermionic valves coupled in series by induction coils to amplify electric oscillations.

In the common crystal receiving sets now being sold for broadcasting wireless telegraphy, the crystal is a specially treated piece of galena, and against it is pressed a flexible copper wire called a "cat whisker."

(*To be continued*)

Civil Airship Wireless in 1921.*

By Lieut. Duncan Sinclair.

It is my proposal to discuss in a simple manner certain of the experimental flights carried out by the airships R.33 and R.36 during last year, the nature of the wireless work performed upon these flights and some of the results derived therefrom. There is hardly one of you here present who will not perhaps remember the frequent passage of these two colossal aircraft over the Metropolis at various times of the day and night during that spring and summer, and I feel I shall not be straying far from the path of truth by saying that several of your members spent sleepless but somewhat enjoyable nights listening to us. Of those inhabitants of certain districts unconcerned with the magic charms of wireless, or the mysteries of aerial navigation by methods of D.F., I almost prefer to remain silent. To them our advent meant nothing more than a midnight display of fireworks, no doubt strongly reminiscent of those war days when other airships were their visitors. Doubtless with our navigation lights, our searchlights, and our rockets we interested them in the earlier visits, but later our nocturnal flights aroused but little sympathy. As I say, they knew not the redeeming feature of wireless. The only man who to my certain knowledge cared either for our goings or our comings throughout the programme, and who, I suppose, was not a wireless man, was a policeman on duty in Trafalgar Square. I saw him with binoculars one or two fine nights when we came over, always near the same lamp. But perhaps he considered us just mere night birds after all.

Airships, as far as the Fighting Services were concerned, were crowded out in the latter part of 1920, owing to lack of funds, and plans were shortly afterwards set on foot to determine their utility from the commercial standpoint. The large airship station at Pulham St. Mary, Norfolk, to which I referred in my previous paper before this Society last year, was re-commissioned with a Civil staff, and in November special W/T operators were picked for duty at Pulham and in the air. The winter months were spent in effecting the necessary alterations to the existing ground station, in installing radiotelephonic apparatus, in carrying out the major portion of the work on the new D.F. station, and in preparing the sets for the ships.

Careful plans were being laid with a view to running the ships to Malta and possibly on to Egypt, and a considerable amount of work was performed in erecting the "mooring-mast," a novel idea, to the design of Major Scott of trans-Atlantic fame, for mooring out and landing this type of aircraft which was later to prove so eminently satisfactory.

March found the preparations for the commencement of serious experimental flights complete. From now onward the work of the wireless section can be said to be divided in two directions. There was firstly the question of furnishing the flying personnel on either ships with the necessary communication facilities to the ground, and with D.F. navigation aids. Secondly there was the work of determining, by actual experiment, the factors of communication which would govern the operation of an airship service upon a commercial basis; the limitations particular to the different classes of wireless signalling, the safe working ranges by day and night, and even peculiarities appearing during flight. All were important questions.

Five airships were actually in commission during the year 1921, R.33, R.34, R.36, R.38 and R.80. The untimely end of R.34 will no doubt be remembered, though perhaps not so well as the awful disaster which culminated in the destruction of R.38 over the Humber, with the loss of so many gallant and valuable lives, lives which could ill be spared at a time when airships needed every conceivable assistance to prevent them from being abandoned altogether as a type of aircraft. To all intents and purposes the men who died so nobly that day represented the cream of British airship initiative and enterprise, and their loss weighed heavily in the final shelving of the lighter-than-air craft. It is a tragic thought.

R 33 riding at the mast with the special D.F. platform slung.

The ships with which we are concerned at present are R.33 and R.36 (or, to give them their civil designations, G-FAAG and G-FAAF respectively), and, bearing in mind that the flying taking place from Pulham was of an experimental nature, let us consider briefly first of all the more important flights which were made.

(I) R.33 (G-FAAG). March 17th-18th (night flight).

Ship left mast at 11 p.m. in very rough weather. There was a wind of some 30 knots blowing, and it was raining heavily. The object was to test the lighting arrangements for night flying at Croydon,

* A paper read before the Radio Society of Great Britain on Wednesday, December 20th, 1922.

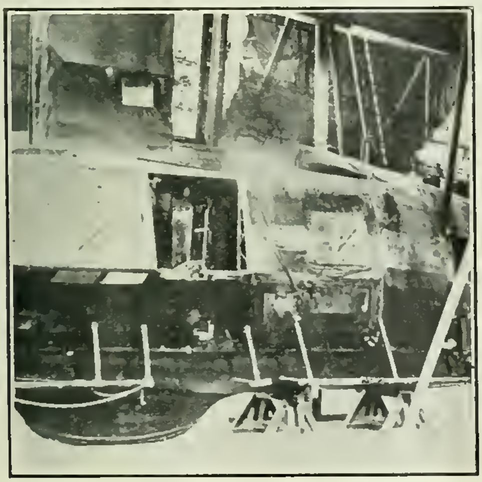
for which place a course was shaped. R/T communication was established with Pulham and then with Croydon. Progress was very slow owing to the head wind, and bearings given frequently by Croydon enabled the ship to keep on her course. The light at Croydon was eventually seen at 0545 from some 30 miles away at a height of 1,000 feet. After reporting this fact by R/T, the ship turned and made for home, reaching there in under two hours. This time, compared with seven hours on the downward trip, will give some idea of the weather conditions.

(II) R.33. April 29th-30th (night flight).

This flight was made for the same purpose, viz., survey of lights at Croydon, Lympne and St. Inglevert, and was a much more satisfactory trip. The route was from Pulham to St. Inglevert, back to a little way off Dover, and then up the North Sea to Southwold and in to Pulham. R/T communication was used with Pulham, Croydon and Lympne, and maintained throughout the flight. A few gramophone records were transmitted by Pulham during the flight, and the *Evening News*, in reporting this fact, unconsciously gave a very faithful forecast of the present broadcasting scheme. This music was perfectly received in the ship whilst over Gris Nez. The night was exceptionally fine, and D.F. bearings were checked by the navigator with satisfactory results.

(III) R.33. May 31st-June 1st (Derby Traffic Control).

As will doubtless be remembered by listeners-in on these two days, the combination of airship and



The wireless car of L71, the ex-German airship, showing the main aerial insulator.

wireless telephony proved an enormous success for traffic control work. The slightest stoppage could be immediately seen on any road from the ship, and the quickness with which the information was given to the controlling authority by R/T always prevented a slight stoppage from developing into a very serious block. The flight of May 31st was a practice for the following day—Derby Day. Upon this day the ship was in constant R/T and W/T communication for 13 hours, dealing with some 1,190 words of traffic control messages, and not the slightest delay or trouble was experienced. In fact, it proved a very satisfactory day's work for all concerned.

(IV) R.33. July 5th and 6th.

This flight was a complete survey of the air routes. The route followed was from Pulham, *via* Croydon, Lympne, St. Inglevert, Abbeville to Paris, thence *via* St. Quentin, Cambrai, Valenciennes and Mons to Brussels, and on to Antwerp,

The D.F. gondola.

Ghent and Ostend, and across the North Sea to Pulham. R/T communication was established with Croydon, Lympne, St. Inglevert, Le Bourget, Brussels and Pulham, and the ship remained in W/T communication with Pulham and Air Ministry during whole flight. D.F. check bearings were taken as usual and passed to ship by Pulham and Croydon.

(V) R.33. July 2nd.

A further successful traffic control flight in connection with the R.A.F. Pageant at Hendon.

(VI) R.36.

The first important flight of this ship after leaving dock, where minor repairs had been effected, was some eight hundred miles *via* Croydon, Lympne, N.W. coast of France, down Channel to Land's End, across to the Bristol Channel and home *via* Bath. R/T communication was maintained almost throughout except when the ship was over Cornwall and then W/T was used. On this flight D.F. was entirely responsible for bringing the ship home. When some 50 miles S.W. of Pulham, the ship veered from her course to such an extent that she became uncertain of her position. It was a very dark night, and more or less overcast, so a D.F. course was requested and given by Pulham. Within two hours of flying on courses given by Pulham, the ship was seen approaching the station from the S.E. The first thing seen from the ship were the red lights at the wireless mast-heads.

(VII) R.36. June 14th.

This flight was for traffic control purposes at Ascot, and the police, having benefited by the Derby Day experience, there was not quite so much actual traffic work. As, however, some thirty newspaper correspondents were carried on this trip, the wireless installation was kept extremely busy with press messages.

Of these flights I shall touch upon numbers IV and VI as being the most suitable examples for detailed consideration. They were carried out in each case during the light and dark periods of the twenty-four hours over many conditions of country; over both land and water, and during changing states of weather. In the former instance, more-

R/T Generators and Switchboard R33.

over, we are dealing with R.33, and in the latter with R.36. The area covered during the two flights comprises the whole of the Southern coast of England and a large proportion of the coasts of Northern France and Belgium, together with a not inconsiderable amount of territory, so that the tests to which the D.F. service were submitted were quite severe ones.

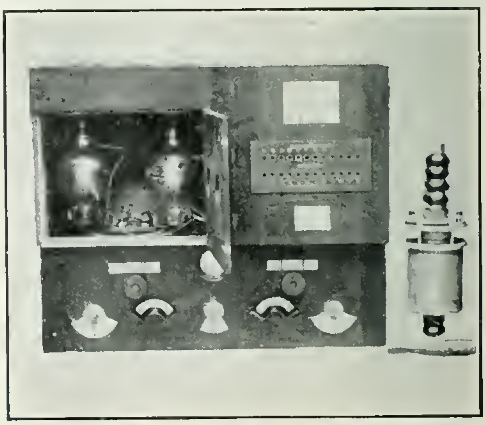
In order to gain a clearer conception of the nature of these trials it may be as well first of all to consider some of the main points underlying D.F. work. The system used throughout the airship programme was of the Bellini-Tosi type. As is probably well known, this system depends in its action upon the varying effect of the oncoming wave front upon two vertically placed triangular loop aerials situated at right angles to one another. Each loop is divided at the mid point of the base of the triangles, and the leads are taken to the opposite ends of small fixed coils also placed at right angles to each other, and in the same planes as their respective loops. A third coil, known as the search coil, is placed within these two, and is capable of rotation through 360°. The local electromagnetic field produced by the received signal gives rise to the usual oscillatory currents in both the fixed coils, which latter set up two local magnetic fields having a resultant. This resultant is dependent for its direction upon the direction of the azimuth of the transmitting station, or, in other words, upon the direction of the great circle running through both stations.

When the rotating coil windings are perpendicular to the resultant field the maximum effect is produced in them, and any detecting device connected to the coil will at this point register stronger signals than in any other position.

A pointer suitably attached will indicate a direction on either side of the coil in which the transmitting station lies. In its simplest form such a piece of apparatus does not show *which* side of the receiving station the transmitter is located. At 90° either side of these "maxima," as they are known, it is obvious that there will be points at which the receiving signal will be at its weakest strength. These are called the "minima."

It is comparatively easier to judge, while rotating the coil, the points at which the signals are weakest than those at which they are strongest, and, as a result, all bearings to which I shall refer were read as minima. By the addition of a suitable value of resistance in the "search-coil-detector" circuit of this type of D.F. receiver it is now possible to reduce one of these minima more than the opposite one, and so to determine the actual direction of a transmitting station as distinct from the line in which it lies on either side of the receiver. This is but a minor point, however, and does not actually bear upon our present considerations.

To ensure good reception the dimensions of the aerial must not be too small; and therefore it is preferable that the reception for direction finding purposes should be carried out on the ground, since, in the air, space is limited, and excessive weight must be avoided. It is by no means impossible to work a D.F. instrument on either an airship or an aeroplane, but at present the instruments would necessarily be on a smaller scale than similar apparatus on the ground; and furthermore, the degree of accuracy in determining the exact bearings from time to time would not be of so high an order. The aircraft, therefore, were equipped with standard combined C.W. and R/T sets, leaving all the D.F. work to the two ground stations.



Main W/T Transmitter R36.

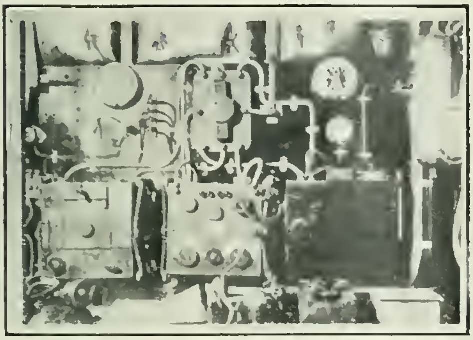
It is known that the earth's electric and magnetic fields have no appreciable effect upon the passage of electric waves, but that certain electric and magnetic manifestations can produce modifications. Variations of atmospheric inductivity and permeability, or in the degree of ionisation; changes in geological and geographical structure, and local disturbing influences, are among the more important sources of error in direction finding wireless, but even these do not entirely explain all the disturbances experienced.

Broadly speaking, errors may be classified under two headings :—

(*a*) Those due to constant phenomena which can be accurately or semi-accurately corrected and allowed for : and

(*b*) Those due to inconstant phenomena, which vary from time to time, and for which no allowance can be made.

In the former class the most easy cases to deal



Internal view of R36 wireless cabin.

with are those of permanent features surrounding the D.F. station, and for which a steady correction can be made in the different quadrants. Absorption and screening effects due to soil of a poor conducting nature, or to large masses of matter, fall into this class, as do also the effects of reflection and refraction due to magnetic deposits, large metal sheds, houses, trees, and even railway lines.

Under the second group are met much greater difficulties. One is compelled to consider the influence upon waves passing along coast lines, alternately over land and water, over mountain ranges and a hundred and one other geographical features dependent upon the relative position of airship and ground station ; and to consider the variations due to clouds, to thunder, to daylight and darkness, to fog and many similar matters. While these effects bear very largely indeed upon our errors we are yet almost more concerned with those which occur in the atmosphere itself.

The velocity at which a wave can travel at different heights above the earth's surface is doubtless not a constant figure. It has been shown that a reduction of inductivity occurs with a reduction of gaseous density at increased altitudes, thereby assisting electro-magnetic waves to follow the earth's curvature. And so there must be other disturbing influences at work in free space, and we are entitled to expect further sources of error. Should the alteration of the various properties increase the velocity of propagation as the height above the surface of the ground increases, then an initially vertical wave-front will tend to bend forward and downward, and at the same time it is conceivable that similar influences may effect the wave-front in a horizontal plane, giving rise to changes of direction along the surface itself. Uncondensed water vapour is known to change the inductivity of the air, and therefore to cause small deflections, so that we can account for unreliability in bearings during damp weather, in the neighbourhood of clouds and during fogs.

In our concluding remarks we shall return to these matters, but for the moment we must pass on to what happened on the two particular flights chosen for consideration.

Two tables of comparisons have been drawn up and are shown in Figs. 1 and 2 :—

Fig. 1.

R.33. Paris, Brussels, Antwerp Flight (July 5-6, 1921).

Time.	Ship's Position.	Croydon Error.	Pulham Error.
0012	(a)	0°	½°
0613	(b)	1½°	2°
0710	(c)	1°	1°
0800	(d)	0°	0°
0903	(e)	0°	0°
1452½	(f)	1½°	1°
1639	(g)	0°	0°

Fig. 2.

R.36. Ushant Lizard Flight.

Time.	Ship's Position.	Croydon Error.	Pulham Error.
2340	(h)	2°	2°
0033	(i)	2°	1°
0232	(l)	0°	1°
0840	(n)	1°	1°
1235	(p)	½°	1°
1335	(r)	1°	2°
1434	(s)	1°	1½°
1939	(t)	1°	1°
2230	(u)	0°	0°
2258	(v)	0°	0°

In the map showing the route followed in each flight (Fig. 3) the positions of the ship, at the times when the bearings were taken, are inserted as (a), (b), (c), etc., to correspond with the lettering in the second columns of Figs. 1 and 2.

Turning to Fig. 1, let us consider each position given and the bearings in each case from Croydon to Pulham.

At 12 minutes past midnight, when darkness was complete, we get an error of half a degree from Pulham and a completely accurate bearing from Croydon. It is observed that the Croydon bearing is taken completely overland while the Pulham bearing runs along and over the Essex and Kent coasts. Our error in this case is without doubt due to the coastline effect.

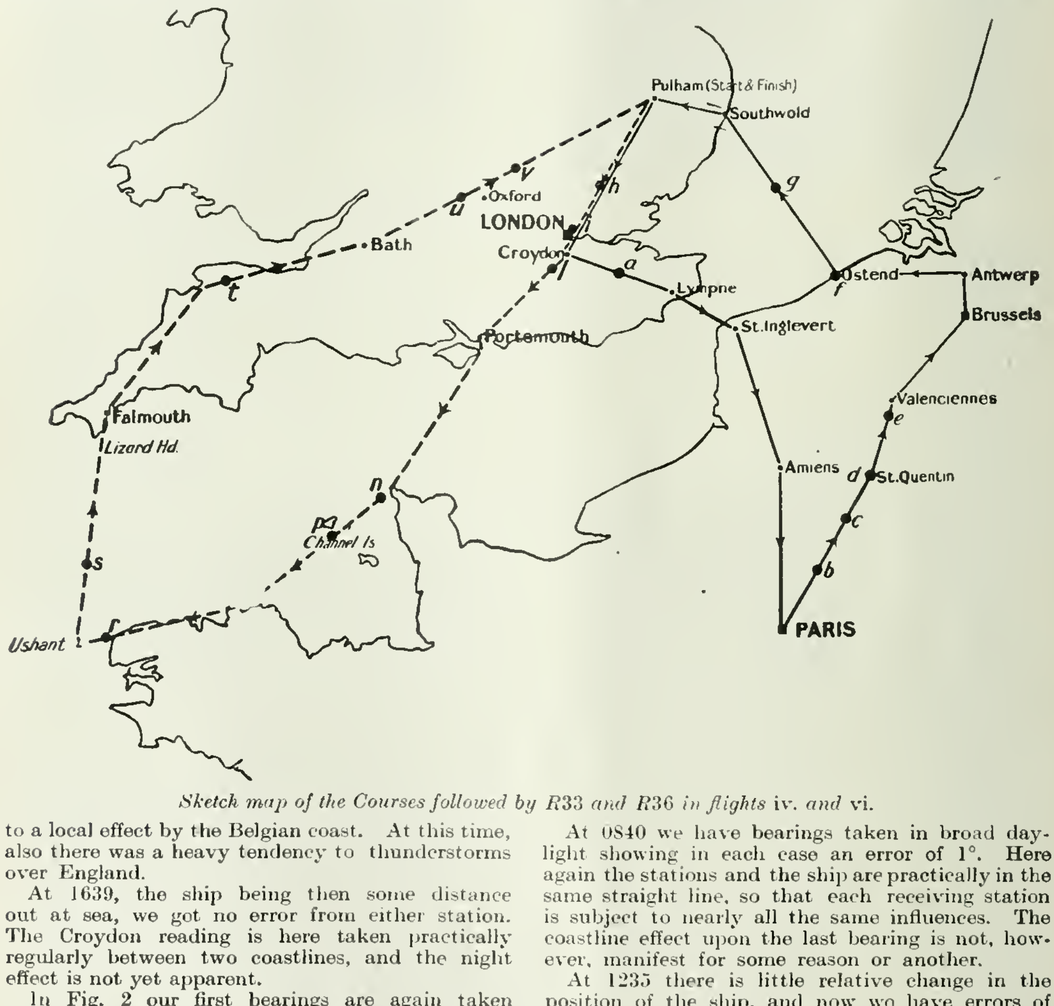
At 0613 day had finished breaking, and here we have an error of 2° on the part of Pulham. This bearing was taken probably before the atmosphere had reached any stable condition, and in addition the wave had passed over two coastlines and in close proximity to a third, and over some considerable distance of land. The Croydon bearing had passed over two coastlines only, and there is a smaller error of 1½°.

At 0710 the position of the ship was comparatively little changed, but we got a smaller error from each D.F. station. The general electrical conditions had become more settled. Practically an hour later, with but a small relative movement on the part of the ship, we find no errors at all, both bearings being dead accurate; so that it is now quite likely that conditions for the day have become normal.

At 0903, the ship being just south-west of Valenciennes, there is again no error on the part of either station. There are no abnormal outstanding features in the country between this point and the two receiving stations.

Six hours later the ship is in the vicinity of Ostend, and here we get an error of 1° from Pulham and an error of $1\frac{1}{2}$° from Croydon, the latter attributable, no doubt, to the passage of the wave along the North Kent coast, and perhaps in a less degree very acute angle as to [illegible]ting almost impossible. At nearly midnight we get errors of 2° and 1° from each station. In this connection it is of great interest to remark that on more than one occasion, when flying in these vicinities, errors have been experienced. On one occasion the speech from Croydon as heard in the ship's cabin, very loud at one moment, died suddenly away and for nearly a minute reception was impossible. At a later date, also during the night, a similar effect was observed from Pulham's signals. In each case the receiver was known to be in perfect working order, so that it would seem that there is some localised absorption effect present.

At 0232 we have an error of 1° from Pulham only, this bearing being taken for a long distance practically parallel to the Suffolk and Essex coastlines.



Sketch map of the Courses followed by R33 and R36 in flights iv. *and* vi.

to a local effect by the Belgian coast. At this time, also there was a heavy tendency to thunderstorms over England.

At 1639, the ship being then some distance out at sea, we got no error from either station. The Croydon reading is here taken practically regularly between two coastlines, and the night effect is not yet apparent.

In Fig. 2 our first bearings are again taken some time after nightfall, and the first two or three are difficult to plot because the ship and the two stations are to all intents and purposes in the same straight line. A cross-bearing is, therefore, unreliable because the two lines intersect at such a

At 0840 we have bearings taken in broad daylight showing in each case an error of 1°. Here again the stations and the ship are practically in the same straight line, so that each receiving station is subject to nearly all the same influences. The coastline effect upon the last bearing is not, however, manifest for some reason or another.

At 1235 there is little relative change in the position of the ship, and now we have errors of $\frac{1}{2}$° and 1°, probably due to the decreased influence of the French mainland.

At 1335 we have an error of 2° by Pulham and 1° by Croydon. This bearing is taken at a point practically remote from the influences of any large coastline, ...n's error is doubtless due to some British coastal effect. Pulham's reading, though subject to the same general influences, is taken over a greater distance, which may account for the increased error of 1°.

At 1434 we have an error of 1½° by Pulham and 1° by Croydon, a result in conformity with the one obtained an hour previously.

At 1939 there is an error of 1° from each station, very likely due in both cases to the Bristol Channel coast.

Our remaining bearings are accurate ones, and are taken entirely overland.

What inferences can we draw then from these data? Firstly we have definite distortions apparent along a coastline, or alternately over land and water. Other conditions being equal, the greater the distance between the ship and the coast the less the error. There is, then, a difference between the velocity of the wave over the surface of the ground and over the surface of the sea, and it would appear that the rate of motion is slower inland than over the water, resulting in a tendency for the wave to change direction from sea and shore.

Secondly, the conductivity of the ether varies with the change from daylight to darkness. During the transitionary period, twilight, the accurate determination of a bearing becomes unreliable and sometimes impossible. At one or two periods at which bearings were attempted by the ground stations a complete absence of any minimum was found, and no appreciable difference could be noted between the received signal strengths at any position of the search coil. Again, at other times the received signal became so weak as to be practically inaudible. A method of correction for such variations is extremely difficult to find because we have yet to discover to what causes the errors are due. It has been suggested that the waves are subjected to processes of diffraction, or breaking up by ionised layers, but the true state of affairs has yet to be thoroughly investigated.

It will be noted that generally speaking the errors occuring have the least value when the ships were flying head-on to the stations, while the maximum errors occurred when the ships were transmitting beam bearings. At the greatest distances between ships and stations the variations appear greatest, or, in other words, the error varies directly as the distance.

A trailing aerial of some 300 feet was used in all these transmissions from the ship, so that some slight directional effect may have been present, but it may have been so small as to make but little difference in the majority of cases. It would be interesting to observe the results which would be obtained with an aerial of a fixed type having no directional value, for it is not unlikely that with a decrease of any directive transmission effect a decrease would occur in the D.F. error.

Most of the larger errors, again, were obtained when the ships were flying at a height above the normal (2,000 feet), at which these flights were performed, so that it could be reasonably suggested, though not actually proved, that the errors are different at different altitudes.

Atmospheric electrical effects, fog, thunder, rain and other clouds, give rise to errors, which vary according to the size and distance of the disturbing element. It might be suggested that such factors having electrical capacity and frequencies of their own, would have more effect on certain wavelengths than on others, and therefore, that the D.F. bearings taken of two similar simultaneous transmissions, but on different wavelengths, would differ from each other.

Detuning or inaccurate transmissions appear to have no effect upon the magnitude of the error.

To condense our conclusions still further we may say that :—

1. Bearings should not be regarded as being of a high order of accuracy during the periods of twilight and dawn.

2. Greater difficulty is experienced in obtaining accurate bearings during the night than during the day.

3. Great care must be taken in obtaining bearings over coastlines, particularly in cases where the wave is moving in a direction parallel to the coastline.

4. Aircraft bearings may be expected to vary with the aircraft's course, distance and height.

In addition to this work the question of taking D.F. bearings upon the ships themselves was considered. In some respects, particularly when flying over those parts where few D.F. stations exist, it would be more satisfactory to reverse the system which we have hitherto considered, and, using the transmission of an ordinary ground wireless station, take a bearing of that station from the air. To do this it is necessary to carry direction-finding apparatus as part of the airship's wireless equipment. It will be appreciated that the majority of work carried out by the airship wireless operator will be at fairly long ranges, so that the fitting of frame aerials is almost out of the question unless we include amplification of a very high order. The field for investigation, therefore, lies in the direction of an adaptation of the Bellini-Tosi method. Both methods, however, were tried. The first step taken was to fix a rotating frame aerial in the keel of the ship, but it was found that the errors due to the large masses of metal forming the girders and general structure of the ship itself, were prohibitive. It therefore became imperative to place the frame aerial outside the keel, and a considerable number of positions were tried, but errors, due to the ship, were still very troublesome. Then the question arose of installing the coil at some point remote from the ship, and various plans were discussed, the outcome of which was the suspension of a platform below the ship and hanging in mid air. The arrangement was tried, with the ship riding at the mast; and at a distance of some 60 feet below the envelope it was found possible to obtain reliable bearings. For flying purposes, however, it was manifest that such an arrangement could not be used. A small gondola was designed totally enclosing operator and instruments, which succeeded in pursuing a reasonably steady course through the air to allow of useful bearings being taken from it while the ship was in flight.

Before any further work could be completed in this direction, however, the airship programme came to an abrupt conclusion.

Experiments with the Bellini-Tosi type of apparatus were carried on along different lines. Two loop aerials, of a similar form to those used at the ground stations, were dropped beneath the ship.

Here again the work was interrupted when the airships ceased flying.

And here, for the time being at any rate, commercial wireless work on airships stands.

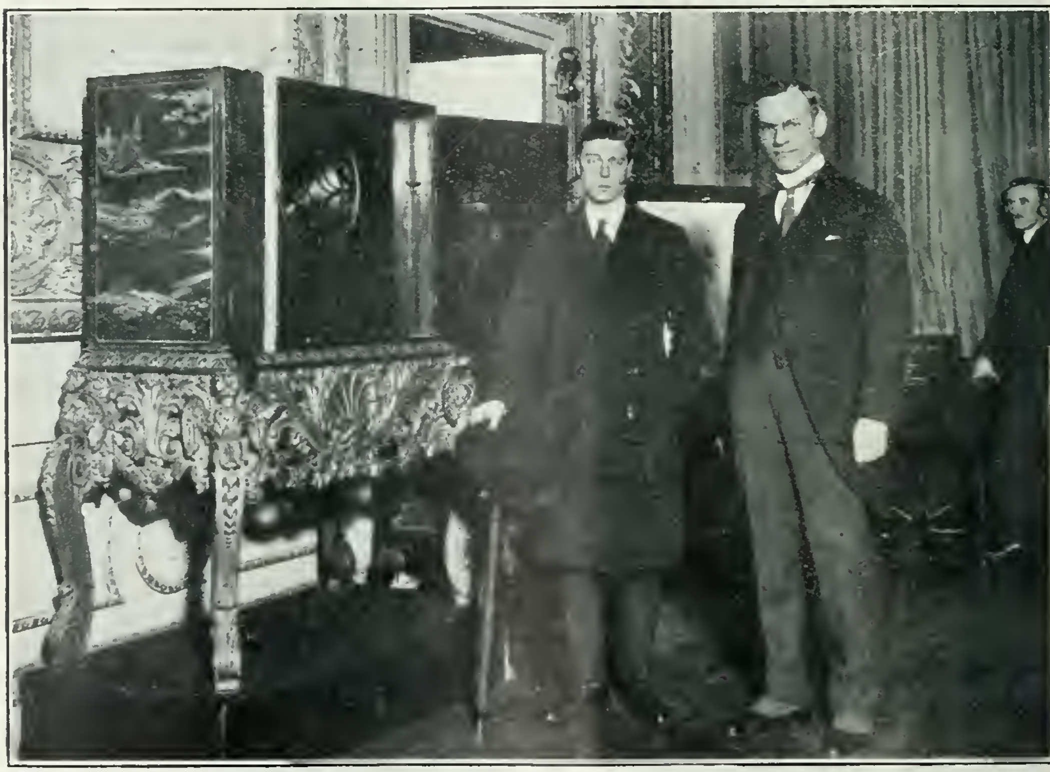
Should the airship ever appear in the sky again as either a weapon of warfare or for more peaceful commercial enterprise, there is no doubt that a wide field for experiment will be reopened to the aircraft wireless engineer.

Were I to attempt to describe all the wireless work that was carried out I should not finish my remarks this evening, but suffice it to state that beyond this D.F. programme there were some most interesting results obtained both in telegraphic and telephonic work which promised reliable commercial communication should occasion ever make the demand.

Before concluding my paper I feel it proper to take a quite unique opportunity which has been afforded me this evening. Recently an important step was taken in changing the name of this Society from that of the Wireless Society of London, a name which it has borne for quite a number of years. The alteration, of course, speaks for itself, and is a tangible result of the very large and useful part taken by the British amateur in helping to develop the science of Radio. If I am permitted to claim the honour of having been one of the early members in the days of its infancy before the Great War, I feel I can now also claim the additional honour of having been the one first called upon to read a paper before the "Radio Society of Great Britain," and in doing so I am more than glad to take such an opportunity of wishing it many years of well merited success.

Greeting for the Prince of Wales.

The Prince of Wales, Patron of the Radio Society of Great Britain, received a message from Sir William Noble, Chairman of the British Broadcasting Company, during his visit to Devonshire House. His Royal Highness is the President of the Hospitals of London Combined Appeal, on behalf of which cause Devonshire House is being used. One of the attractions at Devonshire House is radio concerts, and Sir William Noble's message was transmitted by wireless from Marconi House and received by the Prince in the salon. On behalf of the whole wireless industry Sir William wished the Prince of Wales "a long life of happiness and continued leadership of this country's thought in clean sportsmanship, sympathy with the unfortunate, and high ideals in all life's problems."



Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Clapham Park Wireless Society.*

The fifteenth general meeting was held at headquarters, 67, Balham High Road, at 7.30 p.m. on Wednesday, December 6th, 1922.

Mr. A. E. Radburn was elected Chairman.

The Chairman called upon Mr. Moir, of the Radio Association, Organiser, of 44, Great Russell Street, Head Offices, London, W.C.1., to ventilate the objects and aims of his Association, and explain advantages to the C.P.W.S. of affiliating therewith.

Mr. Moir touched upon the plight of the experimenter and manufacturer under the proposed B.B.C. The speaker outlined the aims of the Association, after which many questions were asked, giving rise to a lively discussion.

Mr. Sinclair proposed and Mr. Brierley seconded a hearty vote of thanks to the speaker, who suitably replied in appreciation.

Finally Mr. C. D. Richardson kindly offered to be in attendance with his apparatus on Wednesday afternoon, December 13th, with the Hon. Treasurer, and see what could be done with actual "listening-in." Mr. R. H. J. McCue, Mr. Hurst, and Mr. Radburn also offering their services.

It was agreed that the meeting of December 13th would be the last for the present year, the following meeting to take place on the first Wednesday in the New Year, January 3rd, 1923.

The Hon. Secretary then announced that Mr. Brierley having intimated to the Hon. Treasurer his having to probably postpone his demonstration on December 13th, the Hon. Secretary acting, as he thought in the interests of the C.P.W.S., deemed it advisable to make tentative arrangements for a Radio Society of Great Britain representative to place before the Society the advantages of affiliation with them.

Mr. Prout proposed and Mr. R. McCue seconded that the Hon. Secretary's action be confirmed, and that the Radio Society of Great Britain representative be invited.

Newport and District Radio Association.*

Hon. Secretary, Mr. E. R. Brown, 92, Corporation Road, Newport.

A very successful wireless concert, transmitted by Captain C. H. Bailey (Vice-president), was given at the Temperance Hall, Newport, on December 7th. Alderman Dr. McGinn presided. A film also was shown.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

At the meeting on December 8th a lecture was given by Mr. G. N. Hurst, A.M.I.E.E., on "Directional Wireless." Electrical and magnetic components were simply explained. The properties of a loop aerial were investigated, and the radiophare was described. Questions were replied to.

During the last half hour **2 LO** was received on the Society's apparatus.

Sheffield and District Wireless Society.*

Hon. Secretary, Mr. L. H. Crowther, A.M.I.E.E., 18, Linden Avenue, Woodseats, Sheffield.

At a meeting on December 1st, Mr. H. Lloyd, the Chairman of the Technical Committee, constructed before the audience a four-valve receiving set. Each part, as completed, was passed round for inspection, and the workmanship, down to the finest detail, received general commendation.

The first two panels having been completed, the set was connected to the Society's aerial, and broadcasting from Manchester Station was received. The four valves were then connected up. Mr. Lloyd presented the set to the Society for their own use.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

On December 12th, Mr. T. Brooke in the chair, and about 40 members present, an interesting lecture on "Wireless Telephony and Systems of Modulation" was given by Mr. J. Beever **(2 QK)**, of the Bradford Wireless Society. The various systems of transmitting circuits and their control were described.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

An Exhibition of wireless sets was held on December 13th, the chief objects being to show the various efforts made by members at building their own sets.

The Chairman, Mr. H. H. Speke, in announcing the prizewinners, paid a high tribute to the individual interest and ability of all the exhibitors.

Newcastle and District Amateur Wireless Association.*

Hon. Secretary, Mr. Colin Bain, 51, Grainger Street, Newcastle-on-Tyne.

After the business of the meeting had been dealt with on December 4th, the Chairman, Dr. Smallwood, presented to Mr. W. G. Dixon a smoker's cabinet, which had been subscribed for by the members in acknowledgement of recent active efforts on behalf of the Society. Mr. Dixon replied.

At the meeting on December 11th, a resolution was passed in protest to "Clause 2" of the Broadcasting Licence, and the hope was expressed that this clause would be altered, at least as far as imported apparatus required by those holding experimental licences was concerned.

Notice was given by the Secretary that at a later meeting it would be moved that the word "Wireless" should be deleted from the Society's title, and the word "Radio" should be substituted for it.

West London Wireless and Experimental Association.*

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

Mr. C. A. Hillyer gave a paper on "Measuring Instruments. Part I," on November 10th. With the aid of blackboard diagrams, various types were described.

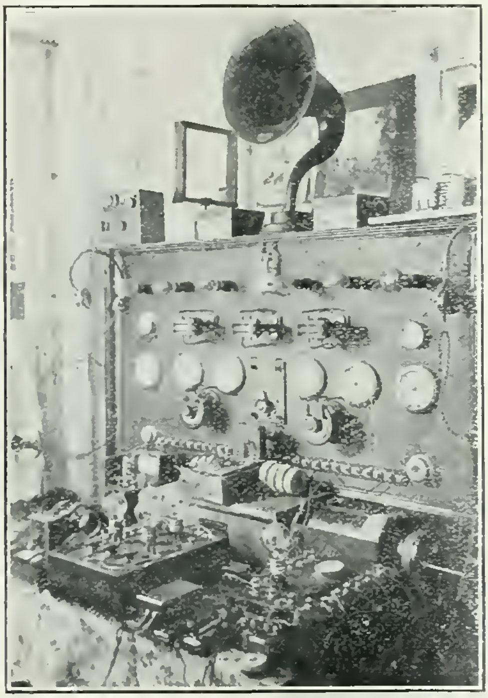
On November 24th, Mr. C. A. Hillyer gave Part II of his paper.

Wireless Society of Hull and District.*

Secretary's address: 79, Balfour Street, Hull.

Mr. J. Nicholson, on December 11th, lectured on the "Construction of Various Types of Inductance Coils." He touched upon the Phillips Rejector Circuit, and this caused some discussion.

Mr. Hy. Strong (Acting Vice-President) occupied the chair.



Mr. E. Jones' Station 2 TZ at Offerton, Stockport.

Sutton and District Wireless Society.*

Hon. Secretary, Mr. E. A. Pywell, Stanley Lodge, Rosebery Road, Cheam.

Meetings are now held on the second and fourth Wednesdays in the month from 8 to 10 p.m. at the Adult School, Benhill Avenue, Sutton.

At the meeting on December 13th, Mr. C. H. P. Nutter gave a very interesting talk on the T.F. three-valve receiver. It was hoped that on December 27th Mr. Ely would be able to give a lecture on X-ray work.

On Thursday, December 14th, a successful demonstration of wireless reception was given and during the evening over 150 people were able to enjoy music transmitted from London, Birmingham and Manchester.

Sunderland Wireless and Scientific Association.*

Hon. Secretary, Mr. A. Richardson, Westfield House, Sunderland.

On December 16th, Mr. A. J. C. Davis, of Marconi's Wireless Telegraph Company, lectured on "Wireless Direction Finding." The lecture was amply illustrated by excellent slides.

The meeting heartily carried the motion of thanks to the lecturer proposed by Mr. Gibbons.

Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

This Society, which has made rapid strides of late and whose membership is steadily increasing, has now, unfortunately, to change its headquarters. Members are asked to remember not to attend until they hear from the Secretary as to where the new headquarters will be.

The Society has a very attractive programme for the new year; several lectures and demonstrations have been arranged.

Portsmouth and District Amateur Wireless Association.

Hon. Secretary, Mr. S. G. Hogg, 9, Pelham Road, Southsea.

To close the year's activities, the above Association gave a very pleasant social evening and wireless exhibition to the members and their friends on December 6th. By kind permission of General Ferrié, of Paris, a special concert was transmitted on that date. Mr. Stevenson demonstrated Wireless Control.

On December 13th, the club held its annual meeting with a re-election of officers. Mr. J. H. C. Harrold, A.M.I.R.E., was elected President of the club for the forthcoming year, with Mr. S. J. Beckett as Vice-President. Mr. Gall was re-elected Treasurer. The new Secretary of the Association is Mr. S. G. Hogg. The club hopes to start the new year in more commodious premises in Fratton Road, Portsmouth, but all enquiries may be sent to the Hon. Secretary at the address above. It was decided at this meeting that the club should apply for affiliation to the Radio Society of Great Britain.

Guildford and District Wireless Society.

Hon. Secretary, Mr. Rowland T. Bailey, 46, High Street, Guildford.

More commodious and central rooms have been acquired at 148, High Street, Guildford, and with the help of members generally it is hoped to much improve the Society's "set," and establish a library.

On December 11th, Mr. W. C. Dolton, M.I.E.E., lectured on "The Thermionic Valve." Several different types of valve were exhibited, and explained.

The meeting on December 18th was open for general discussion. This meeting was the last in the old headquarters.

Warrington Radio Association.

Hon. Secretary, Mr. J. Barton, 266, Lovely Lane, Warrington.

A meeting was held on December 14th in Atkinson's Café, Bridge Street. The proceedings were informal. Mr. W. H. Taylor (Vice-Chairman) pointed out that Warrington and District was capable of supporting a large and prosperous Society. He then discussed the installation and maintenance of an aerial.

Mr. Oscar Harris, the Hon. Treasurer, gave a short address.

Horwich Radio Society.

Hon. Secretary, Mr. P. Ashurst, 51, Mary Street, E. Horwich, Nr. Bolton.

A meeting at 91, Lee Lane, Horwich, on December 5th, decided to form a Society under the above title. The subscription was fixed at 10s. per annum and 2s. 6d. entrance fee for gentlemen and 5s. per annum and 2s. 6d. entrance fee for ladies. The age limit was fixed at 18 years of age. The following were elected to office: Chairman, Mr. P. Fairclough; Hon. Treasurer, Mr. C. Holt; Hon. Secretary, Mr. P. Ashurst. A sub-committee was formed to view a room in The Reform Club with a view to renting it.

At the next meeting it was decided to accept a room in The Reform Club for use as a club-room, and all members were asked to give their support in cleaning and fitting up the room.

The following were elected to office:—Vice-Chairman, Mr. Marshall; and Room Secretary, Mr. Isherwood.

Cowes District Radio and Research Society.

Hon. Secretary, Mr. L. Ingram, 1, Mill Hill Road, Cowes.

On and after January 1st, 1923, the Headquarters of this Society will he at the Gloster Restaurant, High Street, West Cowes.

"Experiences of Field Wireless during the Late War," was the subject of a talk given by Mr. Hartridge on November 1st.

Mr. Mugliston lectured on "The Principles of Tuning" on November 8th. "The Elementary Principles of Wireless" was the subject of a lecture by the Hon. Vice-President, Mr. A. Taylor on November 15th. A lecture on "X-Rays, its Developments and Uses," was given by Mr. Wallace, A.M.I.E.E., a Vice-President, followed by a practical demonstration.

Membership subscription to this Society is 7s. 6d. per annum.

Leeds Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. N. Whiteley, Wireless Section, Y.M.C.A., Albion Place, Leeds.

At a general meeting on December 11th, it was unanimously decided to form a society for the study of wireless matters under the above title.

The chair was taken by Mr. H. Mills, the General Secretary of the Leeds Y.M.C.A., who explained the attitude of the Council towards the formation of such a society. Questions were invited and answered. Mr. Mills then retired, and Mr. N. Whiteley was elected chairman pro tem.

The following officers were duly elected:—President, Mr. J. C. Innes (Chairman of Y.M.C.A. Council) and successive Chairman; Hon. Secretary, Mr. N. Whiteley; Assistant Secretary and Treasurer, Mr. F. Hirst; Committee, Messrs. Parker, Boocock, Mayne, and Cooper. It was decided to leave the appointment of Vice-President open for the time being. It was decided that meetings be held at the Y.M.C.A. at 7.30 p.m. weekly on Mondays; section subscription to be 2s. 6d. per annum; application for an experimental licence be proceeded with immediately; Rules be formulated by the Committee and put before a general meeting at an early date. At the conclusion of the business several members were enrolled. Mr. R. H. Toynbee was elected Chairman for the meeting on December 18th.

Burnham, Highbridge and District Wireless Society.

Hon. Secretary, Mr. L. Lott, 52, High Street, Burnham-on-Sea.

The Technical Education Authorities have granted the use of a room at the Technical Institute, Burnham-on-Sea, for the holding of meetings. Papers have been given and considerable progress made. The single valve Armstrong super circuit was demonstrated, and a visit paid to the home station of the Hon. Secretary, when a full muster of members turned up.

Pudsey and District Wireless Society.

Hon. Secretary, Mr. W. G. A. Daniels. "The Wharrels," Low Town, Pudsey, near Leeds.

On December 11th a demonstration of telephony reception was given by Mr. Wild at the Society's temporary club-room. The transmissions from the Manchester broadcasting station **2 ZY** were received on a loud speaker.

Several new members were elected after the meeting.

Southend and District Wireless Club.

Hon. Secretary, Mr. R. L. When, 4, Wimborne Road, Southend-on-Sea.

On December 8th a lantern lecture was given by Mr. A. C. Hugh on "Development in Radio Telegraphy." Lantern slides were kindly lent by the Marconi Company. A general discussion followed each slide shown.

The Chairman, Mr. Plaistowe, announced that several of the members had undertaken to construct a Johnsen-Rahbek loud speaker, and were requiring material, which members readily offered to supply. Mr. Mayer (**2 LZ**) offered to lend apparatus for a demonstration at the next meeting.

Ashton-under-Lyne and District Radio Society.

Hon. Secretary, Mr. James Hy. Marshall, 22, Warrington Street, Ashton-under-Lyne.

An enthusiastic meeting of wireless workers at Livesey's Café, on December 11th, decided to form a Radio Society, every person present becoming a member. Others unable to be present brought up the first membership to 40.

The following provisional officers were appointed: President, Dr. Bleasdale; Secretary, Mr. J. H. Marshall; Assistant Secretary, Mr. Sidney Buckley; Treasurer, Mr. H. Draycott; Committee, Messrs. Goldthorpe, Etchells, Davies, Ashworth, Cropper, Morois; Technical Adviser, Mr. Leslie Gordon.

Notes

The British Broadcasting Company, Ltd.

This Company has been incorporated for the purpose of instituting and conducting the broadcast wireless service, and was duly registered on December 15th. Lord Gainford has consented to be chairman of the Company. The head office will be in the buildings of the Institution of Electrical Engineers, Savoy Street, W.C.

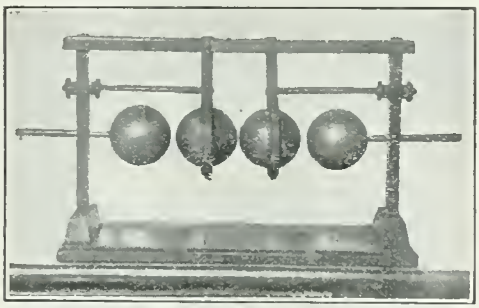
Cardiff Broadcasting Station.

We understand that the British Broadcasting Company's offer to rent rooms at the Eldon Road Works has been accepted by the Cardiff Electricity Committee. The purpose of the tenancy, we understand, is for the broadcasting station for that area.

A Selective Five-Valve Amplifier.

In the paper read by Mr. Maurice Child before the Radio Society of Great Britain, and reported on page 343 of our issue of December 9th, a reference was made to the most suitable values for the leak resistances in the grid circuits of the H.F. valves. Mr. Childs wishes it to be added that the values of these leaks should be of the order of 500,000 ohms for the second valve, and 200,000 ohms for the third valve, in order to limit the tendency to self oscillate.

The photographer who produced the illustrations in that article was Mr. P. H. Jenkins.



The above photograph is of interest. It illustrates an early spark gap used in early experiments with the Marconi system. The apparatus is now in the museum at the General Post Office.

Scandinavian W/T Rates Reduced.

At the Conference of Telegraph Delegates from Denmark, Norway and Sweden, held at Copenhagen, it was decided to reduce wireless telegraph rates from coastal stations from February, 1923.

Transatlantic Tests.

Since the commencement of the reception tests of the signals transmitted in America, reports have come to hand daily, indicating good reception of a large number of American stations.

London Broadcasting Station.

In the description of the London Broadcasting Station in our issue of December 23rd, it was omitted to mention that the apparatus was designed and installed by Marconi's Wireless Telegraph Company, Ltd.

Calendar of Current Events

Friday, December 29th.

BRADFORD WIRELESS SOCIETY.

At 5, Randallwell Street, Bradford. Annual Meeting.

Sunday, December 31st.

3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, January 1st.

9.20-10.20 p.m. Dutch Concert, **PCGG**. The Hague, on, 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road. Lecture on "Primary Batteries," by Mr. Bird.

Tuesday, January 2nd.

Transmission of Telephony at 8 p.m., on 400 metres, by **2 MT** Writtle.

Wednesday, January 3rd.

REDHILL AND DISTRICT Y.M.C.A. WIRELESS SOCIETY.

At 111, Station Road, Redhill. Lecture on "Direction Finding."

MALVERN WIRELESS SOCIETY.

Lecture on "Valve Amplification."

PHYSICAL SOCIETY OF LONDON AND THE OPTICAL SOCIETY.

At the Imperial College of Science, South Kensington. Annual Exhibition. Members of the Radio Society of Great Britain are invited. (Also on following day.)

Thursday, January 4th.

At 9.20-10.20 p.m. Dutch Concert from **PCGG**,* The Hague, on 1,050 metres.

MANCHESTER WIRELESS SOCIETY.

At 7 p.m. At the Council Chamber, Houldsworth Hall. Lecture on "Screening Effects on Aerials," by Mr. B. L. Stephenson.

HACKNEY AND DISTRICT RADIO SOCIETY.

Annual General Meeting.

HOUNSLOW AND DISTRICT WIRELESS SOCIETY.

At Headquarters, Council House, Treaty Road, Hounslow. Lecture on "Wireless—Pastime and Professional," by Mr. S. H. Nayler.

Friday, January 5th.

EDINBURGH AND DISTRICT RADIO SOCIETY.

Lecture on "Capacity and Inductance," by Prof. F. G. Baily, M.A.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

General Meeting. Lecture on "Transmission of Photographs by Wireless," by Mr. T. Brown Thomson.

Communication with Aeroplanes.

An Air Ministry notice to airmen, respecting alternative cross-channel air route weather reports, states:—1. When bad weather conditions prevail on the normal air route between Croydon and the Channel, reports from certain stations on an alternative route are now available at Croydon and Lympne for communication to pilots of machines in flight. 2. The places for which information is available at these times are the Isle of Grain, North Foreland and Deal.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—Now that the use of the 440 metre wave is curtailed for amateur use by advent of broadcasting, I thought it would interest your readers to hear that very good results can be obtained on the lower band 150-200 metres. During last week I have read the following stations:—**2 FP, 2 JZ, 2 LZ, 2 OD**, all strength 7, and telephony from **2 ON**, strength 5, all between 150-200 metres.

The nearest of these is over 200 miles, and **2 JZ** is over 500.

For this reception only two valves were used, one tuned anode and detector, with aerial of four wires. Length 40 ft., mean height, 35 ft. Due North and South.

34, Coldrenick Street, Plymouth. E. W. Penney.

To the Editor of The Wireless World and Radio Review.

Sir,—There is a considerable amount of apprehension existing amongst amateurs and others experimenting with the Armstrong Super-regenerative circuits in conjunction with frame aerials, with regard to the possibility of radiation of a somewhat powerful nature.

In the middle of October I made a series of experiments with a three-valve Armstrong regenerative receiver employing A.T. 40 valves with an anode potential of 400 volts, using a frame two feet square.

This arrangement, as will be realised, gave rise to considerably strong harmonics, but did not cause any interference whatsoever at the station of Mr. Aubrey Garnett, which is situated 200 yards from my house, while working on the same wavelength at the same time.

December 4th, 1922. W. K. Alford.

British Empire Exhibition (1924).

Radio telegraphy and telephony will be provided for in the list of exhibits at the forthcoming British Empire Exhibition (1924) to be held at Wembley Park from April to October, 1924. Group XIV Classes 35 and 36 are defined as follows:—

Telephony, Class 36.—Telephone instruments, transmitters, receivers, and accessories: testing and protective appliances; manual and automatic switching equipment; speech amplifiers and telephone repeaters.

"Carrier Wave" and wireless telephony; telephone multiple cables and loading coils.

Telegraphy, Class 37.—Apparatus and accessories; hand-worked telegraphs: Wheatstone automatic transmitters and receivers; machine and type printing telegraphs; high speed repeaters.

Wireless telegraphy.

Line construction material and appliances; submarine cables.

Ebonite is included in Group XXIX, Class 89. Military telegraphy and telephony are placed in Group XLIII, Classes 137 and 138.

The offices of the promoters of the exhibition are at 16, Hobart Place, S.W.1.

Book Review

Wireless Telephony for All. By Lawrence M. Cockaday. (London: *Herbert Jenkins, Ltd.*)

Considering the enormous interest which America displays in amateur wireless, it is only to be expected that she should contribute freely to the literature of the subject. The English amateur, no less enlightened than the American "ham,"* nevertheless welcomes a really good American book about his hobby as warmly as he accepted the co-operation of "the other side" in making the broad Atlantic a mere standing jump for amateur wireless transmitters.

In the book under review, which Mr. Herbert Jenkins has produced very attractively and sells at a reasonable price, we recognise a tone to which the heart warms, that of the fellow who wants to share a good idea with anybody who is not too high and mighty to listen. Mr. Cockaday is a most companionable person, to judge by his book and its frontispiece, which reveals him in his den amidst a glorious collection of apparatus.

This book, which is just the very thing for the beginner who is perhaps entering the game by the door of "broadcasting," presents a simple and lucid explanation of the principles of wireless telephony, and includes enough practical matter to enable the reader to make a start, without being too much like a handbook for amateur carpenters.

One hesitates to criticise in detail a work so good as a whole, but for the sake of future editions we ought to point to page 24 and suggest that the author might well explain what a fundamental difference exists between the nature of sound waves and aether waves.

I do not think that many engineers in this country—or even in America—will agree with Mr. Cockaday's opinion that in inventing the regenerative circuit Armstrong "has contributed what is universally acclaimed the greatest and most important invention since wireless was first conceived." I defy anybody to give the date of that event, but I should say that Senatore Marconi's humble inventions were made somewhat later and that the thermionic valve is incontrovertibly the most important post-Marconi invention.

E. B.

New Catalogues

Messrs. Ward and Goldstone, Frederick Road, Pendleton, Manchester. List No. A/24. (Wireless Section, pp. 51-61.) Also pamphlet relating to Broadcasting Receiving Sets.

Wireless Fog Signals.

On the invitation of the Northern Lights Commissioners a party of representative officials visited Inchkeith, Firth of Forth, to attend a demonstration of wireless beam fog signals conducted by the Marconi Wireless Telegraph Co., Ltd. The apparatus consists of a reflector, which revolves and gives the bearing in which it is pointing. Experiments were carried out over a range of about nine miles, and proved satisfactory.

*In the States a "ham" is to amateur wireless what a "fan" is to baseball, but he is more practical and less vocal.

The Problem of Aerial Insulation and a New Type of Aerial Insulator.

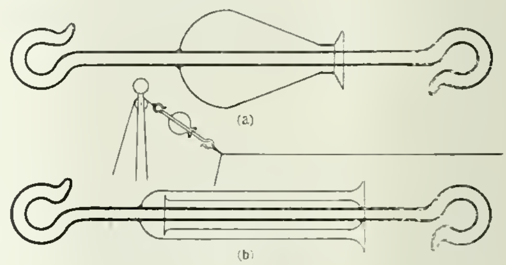
By H. P. Waran, M.A., Ph.D. (Cantab), F. Inst. P.

THE problem of insulating the aerial perfectly is beset with a great many difficulties, and every experimenter begins to realise sooner or later that the insulation provided by some insulators on the market is far from perfect. Even though all of them appear satisfactory enough for the purpose at the beginning, the difficult atmospheric conditions of the open air leads to a rapid deterioration of the insulation within a few weeks or days in a busy smoky industrial locality. The ordinary porcelain insulators of the reel, egg or shell type, afford too short a resistance path to be effective, and are often known to fail on account of even a mere film of water in wet weather. But a greater source of trouble arises from the gradual deposit of smoke and dust from the dirty atmosphere of busy cities, and even a very thin film of it suffices to conduct away the high tension and high frequency currents used in wireless.

The various types of ebonite and composition insulators are, in a sense, inferior to the porcelain insulators for more than one reason. Substances of the nature of ebonite are all well known to lose their insulating property on long exposure to light in the open air. They are good enough when used indoors, and even then their surface ought to be unpolished and kept rough and fresh by the periodical application of emery paper if a high state of insulation is to be maintained. If used outside, smoke and dust get lodged on their surface more readily than on porcelain, and there is not even the hope of a good heavy rain being able to wash it off. Thus, even though some of these when used in series and when periodically taken down and kept clean are found good enough in receiving aerials, they are never satisfactory enough to stand the high tension of transmitting aerials without considerable leakage and loss of efficiency.

Glass of suitable composition as an insulator is sometimes superior to ebonite, porcelain, or other material, and when properly designed seems to provide almost perfect insulation. The principal points to be attended to in the design of an insulator for high tension and high frequency currents are: (1) The resistance path across the insulator must be as long as possible. (2) The resistance path along the surface must be covered and protected as far as practicable from external influences of the weather and the atmosphere. (3) It should have the requisite tensile strength.

Designed on these scientific lines a new table blown-glass insulator has been recently introduced into the wireless market.* The two types in which the insulators are now being made are illustrated in Fig. (*a*), (*b*). The



Sketches of the Insulators described.

insulator is simply a stout walled long glass tube bent into hooks at either end, the central portion of this stem being almost completely encircled by a bulb sealed on to the stem. In the second type there are two such protecting jackets turned in opposite ways, and they are made cylindrical instead of being spherical. In such an insulator the resistance path along the surface is over a foot, even in the smaller sizes, and the central region being completely jacketed by the bulb, is kept clean and free from deposits of smoke, dust or films of moisture, and thus ensures perfect insulation, even in the worst of weathers and localities. Further, even the slight deposit over the highly glazed exterior surface gets readily washed away quite clean at the first rain. Thus a single one of these insulators provides a better insulation than half-a-dozen or more of the other types used in series. Though it is very light it is quite strong and able to stand the strain coming over any average sized outdoor aerial.

Some misgivings may be felt at the fragile nature of the glass. But what an aerial insulator should have is good tensile strength and not ability to stand kicks on its side. In this it is in no way inferior to porcelain or other composition, and all that it requires is only a little careful handling when putting it up, and when once up in the air it would look after itself.

* Messrs. Baird & Tatlock, Hatton Garden, London, E.C.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6) Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of* 1*s., or* 3*s.* 6*d. for a maximum of four questions. (7) Four questions is the maximum which may be sent in at one time.*

"F.S." (Nottingham).—The proposed arrangement is suitable, but as you get poor results, we assume the H.F. transformer is not satisfactory. Several designs for H.F. transformers have been given in recent issues, and we think you should have no difficulty in determining whether or not the H.F. transformer in use has suitable constants.

"G.R." (E.6) *asks us to reproduce Fig. 2, page* 880, *September 30th issue, with the addition of switches for controlling the number of valves in circuit.*

See Fig. 1. The figure shows double-pole double-throw switches connected.

"J.L.R." (Glasgow) *cannot erect an outdoor aerial, and asks* (1) *Which is the best type of indoor aerial to use.* (2) *Are valve circuits made tunable.* (3) *How is one to know whether the first valve of a three-valve set (one H.F., one detector, one L.F.) is operating as H.F. amplifier and not as a detector.*

(1) We suggest you use a loop aerial consisting of a 4′ square frame wound with 12 turns of No. 18 D.C.C. wire spaced ¼″ apart. (2) H.F. valve circuits are usually tunable, but L.F. are not. (3) By using a suitable filament heating current and H.T. battery voltage. The detector valve has its grid circuit specially designed for rectification.

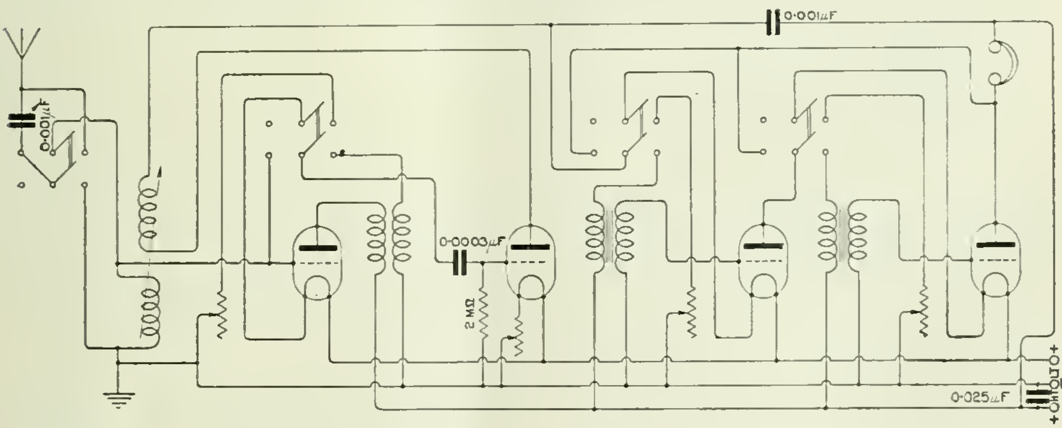


Fig. 1.

"BLACK" (Lowestoft).—(1) The reaction coil should be coupled with the anode coil, and may consist of 100 turns of No. 40 S.S.C. wire on a former 2½″ diameter. For the longer wavelengths, coils may be added in series if required. (2) If you wish to conduct experiments, you should apply for an experimenter's licence, stating the nature of the proposed experiments. (3) We think you will have no difficulty in hearing the broadcast transmission when using a three-valve receiver.

"M.P.B." (Gironde) *asks* (1) *Whether the index to Volume X. has been issued yet.* (2) *The gauge of wire to use in tuning coils.* (3) *Particulars of the variometer used in the Armstrong super-regenerative circuit.*

(1) The index to Volume X. is now ready, price 8d. (2) We suggest you employ No. 26 D.S.C., and wind the coils on a former 2″ diameter. (3) Full particulars have been given to **"INTERESSE" (Brussels)** page 317, December 2nd issue.

"W.B." (Liverpool) *asks for a diagram of a four-valve set.*

The diagram of a four-valve set on page 880, September 30th issue, is quite suitable for the purpose you suggest. The aerial tuning condenser is 0·001 mfd. The H.F. transformer tuning condenser should have a maximum value of 0·0002 mfds., grid condenser, 0·0003 mfds., grid leak resistance, 2 megohms, L.F. transformer by-pass condenser, 0·001 mfds., H.T. battery by-pass condenser, 0·05 mfds. The aerial tuning inductance may be a tapped coil, 4″ diameter and 4″ long, wound with No. 22 D.C.C. with 12 tappings. For the long wavelengths a coil 4″ × 8″ of No. 26 D.C.C. may be used, with 12 tappings. The H.F. transformer may be of the plug-in type or a tapped coil would perhaps give less trouble in operation. If the mean diameter of the transformer is 1⅝″, 120 turns of No. 28 D.C.C. for primary and secondary will be suitable for operation over a wavelength range of 300-470 metres. For higher wavelengths more turns will be required. As you probably have back numbers of this journal by you, we suggest you examine the articles on "Experimental Station Design," which appeared in the issues of September 2nd and 16th. A variable H.F. transformer which may meet your requirements is described on pages 828, September 23rd issue.

"J.J.R." (Atlantic Fleet) *submits a list of components in his possession and asks for a suitable circuit.*

See Fig. 2. The values of the condensers are indicated in the figure. The aerial inductance may be a coil of No. 22 D.C.C. wire wound on a former 5″ diameter and 8″ long with 18 tappings. The secondary inductance may consist of a coil of No. 26 D.C.C. wire, wound on a former 4″ diameter and 9″ long. The reaction coil may consist of 100 turns of No. 28 D.C.C. on a former 3″ diameter. We suggest you employ a 6-volt accumulator for heating the filament, and a 60-volt H.T. battery for the plate circuits. The telephones are not suitable for direct connection in the plate circuit. A telephone transformer should be used, and if necessary, the telephones rewound with No. 36 S.S.C. copper wire.

"H.W.E." (Charlton).—It is not correct to state the length of the lead in should be as short as possible. The lead in should be as direct as possible, and if the wire for the aerial runs straight down to the lead in tube on the ground floor it is not possible to make improvements. The wires which connect from the instrument to the lead in should be as short as possible, and the lead to earth should also be as short as convenient. We consider the 50′ double wire aerial is the best arrangement, but we do not think it will be wise to connect two aerials to the same mast. Serious interference is likely to result, especially when valve receivers are used. Should you undertake transmission experiments at any time, it will be practically impossible for your neighbours to tune out your transmission.

"ANODE" (Manchester) *asks* (1) *Whether the suggested switching arrangement, particulars of which are submitted, is suitable.* (2) *For particulars of a five-valve set using stud switches to cut in or out any valve.*

(1) The proposed arrangement is not very satisfactory, because although the switches transfer the anode circuits, the filament and grid circuits remain connected. It would also be better if you used a switch in the aerial circuit to join the A.T.I. and A.T.C. in series or parallel. (2) You will obtain very satisfactory results by adopting the scheme shown on page 883, September 30th issue.

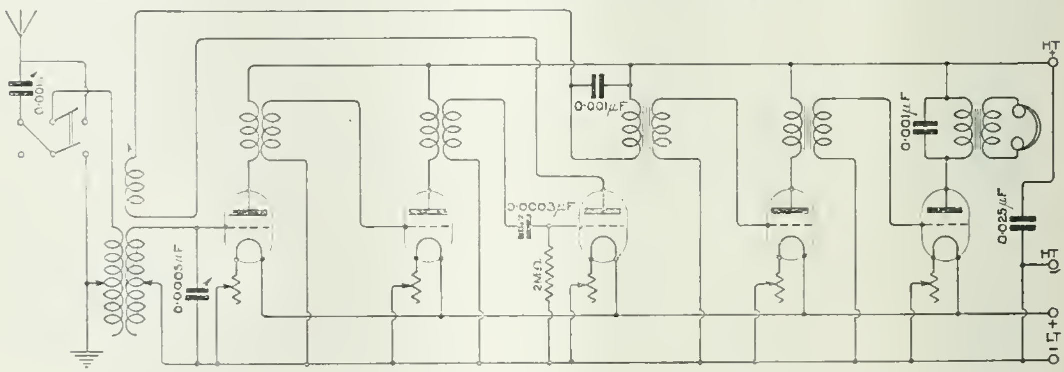


Fig. 2.

"J.S.H." (Manchester) *submits a diagram for criticism.*

The circuit submitted is not very suitable, and it is doubtful whether it would function at all. We suggest you adhere to the original arrangement. The coils L_3 and L_4 should not be coupled to any extent, and you should determine by experiment their best positions.

"REBOS" (Hull) *asks* (1) *For a diagram of a H.F. valve and crystal detector combination.* (2) *The values of the components.* (3) *What stations will be heard.*

(1) The circuit given in reply to a correspondent in a recent issue will suit your purpose very well. (2) The values are marked in the figure. (3) You will probably hear telephony transmissions, ship stations, and high power transmissions.

"OMEGA" (Hants.).—A suitable transformer for your purpose would consist of an iron wire core 3″ long and ½″ diameter, with a primary winding of 250 turns of No. 22 S.S.C. The secondary could consist of 12,000 turns of No. 44 S.S.C.

"D.A." (Hampton).—We suggest you examine the set for loose connections, and make certain the grid leak is quite good. We assume the H.T. battery is not run down.

"J.R.S." (Keighley) *submits a diagram and asks* (1) *Whether the anode coils should be changeable* (2) *Whether the reaction coil should be coupled with the anode coil of the H.F. valve.* (3) *How to connect switches.*

(1) The proposed arrangement is quite suitable. The anode coils are tuned with a variable condenser of maximum value 0·0002 mfds., and you will therefore require a set of coils if you wish to cover a wide range of wavelengths. The two anode coils should be of the same value, since then the condenser settings will be similar when receiving signals. (2) As you suggest, the reaction coil should be coupled with the anode circuit of the H.F. valve. (3) The switching arrangements shown in recent issues can be directly applied to your set

"A.L.W." (Sheffield).—It is not necessary to use a secondary circuit if you prefer to reduce the circuit adjustments at the expense of a little loss of selectivity. It is a matter upon which you can please yourself, in so far that the holder of an experimenter's licence is assumed to have sufficient knowledge of wireless to be able to control the degree of reaction himself, and not to set up

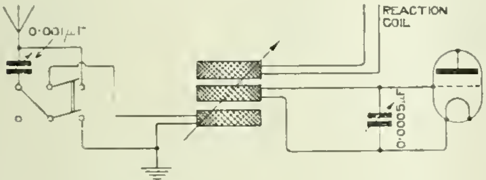


Fig. 3.

oscillations in the aerial circuit. The reaction coil, when coupled to the secondary circuit, is capable of setting up oscillations in the aerial circuit with an amplitude as great as when the reaction coil and aerial coil are coupled. However, the gain in selectivity is worth while, and the connections are made as indicated in Fig. 3. The proposed lay-out is quite suitable, and the addition of the third coil does not make any difference to the circuit apart from the change indicated in (1).

"A.M." (Colchester) *asks* (1) *Will overhead tram wires, running parallel to his aerial, affect reception.* (2) *If it is possible to amplify The Hague concerts sufficiently with five-valves to operate a loud speaker.* (3) *Will a 100′ single wire aerial be better.* (4) *Is a water-pipe earth good.*

(1) and (3) We suggest you run the aerial wires at right angles to the tram lines, if possible, and as far away as it is convenient. A single wire aerial will probably give results superior to a double wire aerial. To reduce the noises, we think you had better reduce the number of L.F. connected valves and use H.F. instead. (2) We think five valves will provide sufficient amplification to operate a loud speaker. (4) Yes, if care is taken to make the connection good.

"PUZZLED" (Burton-on-Trent) *asks for criticism of his set, particulars of which are submitted.*

The connections are not quite correct, unfortunately. The reaction coil should be connected between the anode and L.F. transformer instead of between H.T.+ and L.F. transformer, and it would be better to disconnect the second valve entirely when the telephones are connected to the first valve. In any case signals will not be very satisfactory when one valve is used, because it cannot be expected that a transformer built to work between the output and input circuit of valves will work equally well between the output of the valve and the telephones. The transformers are not wound properly. We suggest you rewind them, using 10,000 turns of No. 44 S.S.C. wire for the primary, and 15,000 turns of No. 46 S.S.C. wire for the secondary. The telephone transformers may consist of 10,000 turns of No. 44 S.S.C. for the primary, and 2,000 turns of No. 36 S.S.C. for the secondary. With these alterations the signal strength will be greatly improved. The tappings from the H.F. transformers may be taken out to a switch, and it is convenient to leave small sections unwound at the tapping points in the case of cylindrical coils.

"A.H.S." (Southsea) *submits particulars of his receiver and asks for criticism.*

The wires enclosed are: (A) No. 29 S.S.C.; (B) No. 26 S.S.C.; (C) No. 36 S.S.C. The aerial and closed circuit tuning arragements appear to be correct and should be satisfactory, although it is often better to make the filament connection to L.T.− instead of L.T.+. Until telephony is actually heard, we suggest you connect wire A to the H.T.+ instead of to the slider. The anode circuit tuning will still be quite critical, but the adjustment will be less difficult. Reaction effects do not greatly help when receiving telephony transmission from commercial stations. We do not think you have sufficient wire in the L.F. transformer. To obtain good results, it is necessary to use a large number of turns of fine wire, otherwise amplification and the quality of speech suffer. We suggest you rewind the primary with 8,000 turns of No. 44 S.S.C. copper wire, and the secondary with 16,000 turns of No. 46 S.S.C. copper wire. If you find it inconvenient to count turns, we suggest you wind ⅓ the winding depth for the primary, and the remaining ⅔ for the secondary. It is often an advantage to use lower volts on the anode of the detector valve.

"PUP" (Gorleston) *asks* (1) *For criticism of set.* (2) *How to tune out a local high-power transmitting station.* (3) *How to secure fine tuning in the anode circuit of the valve.*

(1) The diagram submitted is correct. (2) We suggest you employ a secondary circuit consisting of a coil and condenser. The coil should consist of a winding of No. 28 D.S.C. on a former 3½″ diameter, 7″ long with 7 tappings. The tuning condenser may have a maximum value of 0·0005 mfds. (3) We suggest you join a three-plate condenser across the aerial condenser for fine tuning, and connect another with small plates across the 0·0002 mfds. condenser in the H.F. transformer circuit. Extension handles will probably have to be fitted.

"A.J." (Middlesex) *Submits a diagram cut out of a recent issue and asks whether it is suitable for his purpose.*

Coils A and B form the H.F. transformer, and coil C is the reaction coil which is coupled to B. These coils are not coupled to the A.T.I. or closed circuit coils. If you are beginning wireless reception, we suggest you omit the secondary circuit. The H.F. transformer may be connected exactly as described in the articles on "Experimental Station Design" in the issues of September 2nd, 16th and 30th.

"W.B.H." (Swansea).—The method of connecting the apparatus is indicated in Fig. 4. We suggest you employ tapped self-tuned H.F. transformers for all wavelengths. This arrangement gives good results with a minimum of adjustment. A telephone transformer is not necessary when the telephones have a high resistance. When low resistance telephones or loud-speaker is used, however, a telephone with a ratio of 5 : 1 is required. We would draw your attention to the note at the head of the Questions and Answers column of this journal regarding replies by post.

is connected across the aerial for fine tuning. A 0·0005 variable condenser is suitable, and the smaller the value of this condenser, the louder will the signals be. The size given is the best for wavelengths in the neighbourhood of 300 to 400 metres. Increasing the size does not result in any increase of signal strength—the number of turns is reduced. However, the signals obtained when a frame aerial is used are rather less than when an ordinary outdoor aerial is used, and if you require the loudest signals, there is nothing superior to the outdoor aerial. A good outdoor aerial would be 70′ long and 30′ high. It is very convenient to mount the frame so that it may be rotated, as the frame has very decided directional properties.

"A.M." (Herts.). We suggest you wind at least four coils for short wave work. We cannot say what wavelength range exactly will be covered, as it is not possible to predict accurately the inductance of the coils. The coils may consist of 40, 60, 85 and 110 turns. The smaller coil should be used in the aerial circuit and the next larger in the closed circuit. A two-coil holder is quite suitable for this purpose.

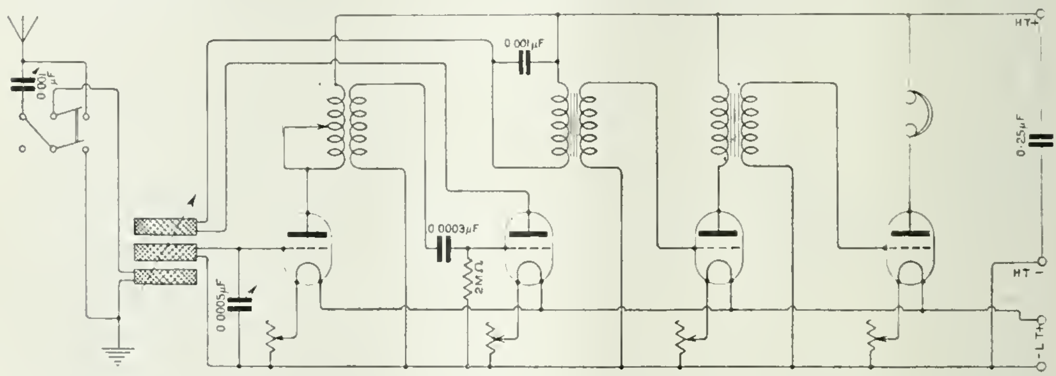


Fig. 4.

"W.A." (Belfast) *asks for the amount of wire, using that in his possession, for an intervalve and telephone transformer.*

The former, sketch of which is submitted, may be wound with 30, 50, 80, 110, 140, 200 and 250 turns of wire. For the first four coils we suggest you use No. 28 S.C.C., and for the remainder No. 32 may be used. We think you will find this number will cover the wavelength range required. The reaction coil may consist of 80 turns of No. 36 S.S.C. wire, and probably one coil will be suitable for this range of wavelength. For the high frequency transformer we suggest you wind 3 ozs. of No. 38 for the primary winding, and 3 ozs. of No. 42 for the secondary winding. The telephone transformer may consist of 3 ozs. of No. 38 for the primary and 3 ozs. of No. 34 for the secondary. The proposed arrangement submitted is quite suitable.

"W.S." (Eastbourne). We suggest you build a frame aerial having 4′ sides, winding upon it 12 turns of No. 18 D.C.C. wire spaced ¼″. Five tappings should be brought down to a switch for coarse tuning, and a small variable condenser

"A.S.A." (Bletchley).—A person wishing to use home-made gear is regarded by the Post Office as an experimenter, though if the aim of the individual is not to have any serious interest in the technicalities of the science, he is required by the Postmaster General to purchase made-up apparatus, owing to his non-acquaintance with the subject, and in order that he may not cause interference by the use of an incorrectly designed receiver. We understand all applications will be dealt with according to the merits of the case, and you should therefore apply for an experimenter's licence.

"G.W." (Highbury) *asks* (1) *Whether the circuit submitted is the best for his purpose.*

The proposed arrangement is very suitable indeed, although you may find it necessary to include a variable condenser in the aerial circuit. We think you will require a H.T. battery of 45 volts and a L.T. battery of 6 volts.

"R.B." (Enfield).—The theoretical diagram is given on page 15, April 1st issue, and you will notice the circuit is quite straightforward.

"A.S.H." (Penge) *asks several questions concerning his set.*

If unacquainted with the principles of the set you are making, it is always better to follow out the writer's instructions precisely. Changes which you consider small will very likely cause the set to be a failure. The grid leak resistance should be 2 megohms, and the grid condenser 0·0003 mfds.

"AREN" (Scotland) *asks us to criticise the diagram submitted.*

The proposed arrangement is quite suitable but you may experience difficulty in preventing the circuit oscillating. A condenser of 0·01 mfds. capacity should be connected across the H.T. battery. The aerial and closed circuits may, as you suggest, consist of variometers, in which case tuning condensers may be dispensed with. Suitable values of tuning condensers are A.T.C. = 0·001 mfd. maximum value, C.C.C. = 0·0005 mfd. maximum value. Anode tuning condenser = 0·0002 mfds. maximum value in each case. The blocking condenser may have a value of 0·001 mfds.

"D.P." (Birmingham) *asks for a diagram using four H.F. transformer connected valves and one detector valve.*

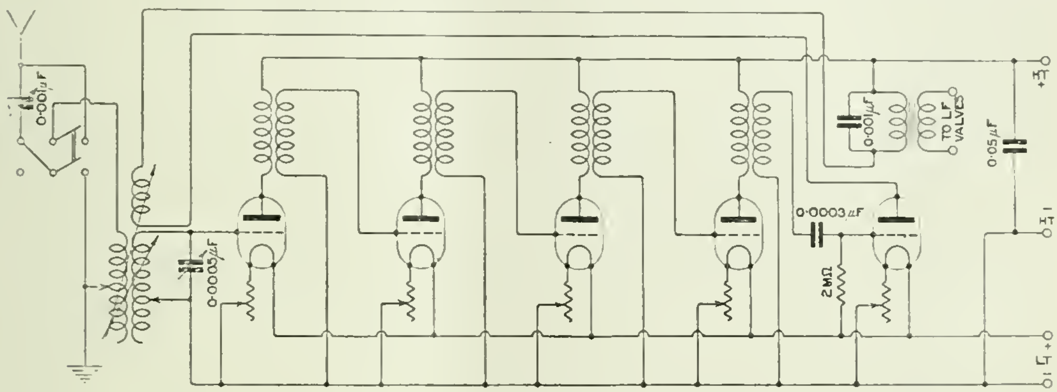


Fig. 5.

See Fig. 5. Suitable values are indicated. A number of H.F. transformers will be necessary. These may be wound with No. 40 S.S.C. wire on a 1½″ ebonite rod, and have the following values :— 180 turns each, up to 300 metres ; 600 turns each, up to 600 metres ; 1,300 turns each, up to 1,000 metres. For 1,500 metres use a 2″ ebonite tube and wind 800 turns, and for 3,000 metres wind 1,400 turns.

"JEDDAK" (Cambridge) *asks* (1) *For criticism of circuit submitted.* (2) *Whether any alterations are suggested.* (3) *For a diagram showing the connections of* 3 *valves without intervalve transformers.* (4) *Wavelength range of set.*

(1) and (2) We suggest you abandon the arrangement. The resistance capacity method of coupling H.F. valves is only suitable for long wave work—say above 2,000 metres—because at lower wavelengths the capacity present in the circuit acts as a shutter to the resistance and the amplification is accordingly reduced. (3) and (4) See replies to recent correspondents.

"E.F." (Peckham) *asks for values of components used in a 2-valve receiver.*

These values have been repeatedly given in recent issues of this journal.

"H.L.L." (Newcastle) *refers to Fig.* 10, *page* 743, *September 2nd issue, and asks what alteration to make to reduce the likelihood of generating oscillations in the aerial circuit.*

It is only necessary to couple the reaction coil with the H.F. intervalve transformer instead of with the aerial tuning inductance as indicated in the articles on "Experimental Station Design" which appeared in the issues of September 2nd, 16th and 30th.

"E.J.P." (Fulham) *refers to the reply given to* **"C.W.A." (Wandsworth Common)** *in the issue of August 5th and asks* (1) *For particulars of a transformer which will deliver* 400 *volts across each half of the secondary winding.* (2) *What voltage will then be available at the oscillating valve anodes.* (3) *Whether a choke (particulars of which are given), is suitable.*

(1) The primary winding may consist of 200 turns of No. 20 D.C.C. on an iron core 4″ long with a cross section of 2 × 2″ The second winding should consist of a winding of No. 28 D.C.C. each half having 800 turns. The choke should be connected in series with primary. (2) Approximately 500 volts depending largely upon the rectifying valves used and the adjustments of the circuit. (3) The choke is suitable, but would be better if it had 4 or 5 tappings.

"A.E.M." (St. Leonards).—We suggest you use a Siemens relay which may be purchased from a dealer in ex-Government wireless stores. The issues of October 29th and November 12th, 1921, contain information which should be of sufficient assistance to you in your experiments with recording apparatus.

"MAGNETITE" (Birmingham) *wishes to add a L.F. panel to his set, and asks how the connections are made.*

As you have not, unfortunately, given us particulars of the panels you are using, we cannot give a wiring diagram, but we think you should have no difficulty after looking through a few recent issues.

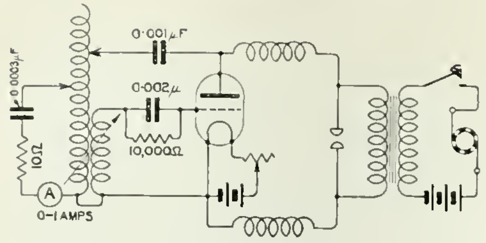


Fig. 6.

"S.W.B." (Manchester).—The artificial aerial may consist simply of a condenser, resistance, and the tuning inductance. No other inductance is required. The resistance could be 10 ohms, which is a fair estimate of the average resistance of an amateur transmitting aerial, and could consist of 10 yards of No. 22 Eureka wire. The capacity may be a 0·0003 mfds. condenser capable of withstanding 2,000 volts, and able to carry about 1 ampere without excessive heating. The diagram given in Fig. 6 indicates a good transmitter scheme. Values are marked in, and it should be remembered the condensers should all be built to withstand the sudden application of high potentials. We do not expect your transmissions would be heard at more than a few hundred yards, and this would appear to be the object of the Post Office in restricting the use of the set to a dummy antenna. The best adjustment of the interrupter brushes is that which gives least sparking, and for this purpose one of the brushes should be movable. The interrupter circuit will probably carry a heavy current, and large capacity accumulators should be used. If the insulation between the primary and secondary of the transformer is good, and the cells are insulated from earth, the filament potential may be tapped off the battery supplying this primary circuit.

"S.F.W." (Berwickshire) *asks* (1) *How many valves he will require to receive the Dutch concerts and Transatlantic stations.* (2) *What should be the maximum price of the set.* (3) *Whether more than two stages of H.F. amplification are difficult to handle.*

(1) We suggest you make up a three-valve set, using one high frequency detector and one note magnifying valve. The method of coupling the high frequency valve with the detector is known as the reactance capacity method. The anode circuit of the high frequency valve should be in proportion, so that it can be tuned over the same range of wavelengths as the aerial circuit. We refer you to Fig. 2, page 145, October 28th issue. (2) Until one has experience, the manipulation of two high frequency valves is something of a difficulty, but as the above circuit only makes use of one, we think you will experience no trouble. (3) We think you will have no difficulty in estimating the cost of the set yourself after a study of the advertisements in this journal.

"MELLT" (Carnarvonshire) *asks* (1) *How many basket coils to use in a H.F. transformer to tune up to 2,000 metres.* (2) *Whether basket coils may be used as reaction coils.* (3) *The dimensions of L.F. intervalve transformer.*

(1) We suggest you wind say six basket coils, each coil consisting of 40 turns of No. 38 S.S.C. copper wire with a mean diameter of 3″. The primary should be tuned with a variable condenser of maximum value 0·0002 mfds. (2) Basket coils may be used as a reaction coil, 60 turns of No. 38 S.S.C. wound on a former with a mean diameter of 3″ being suitable. (3) The construction of a L.F. intervalve transformer was fully described in the issue of August 19th. Use the No. 42 S.S.C. wire for this purpose.

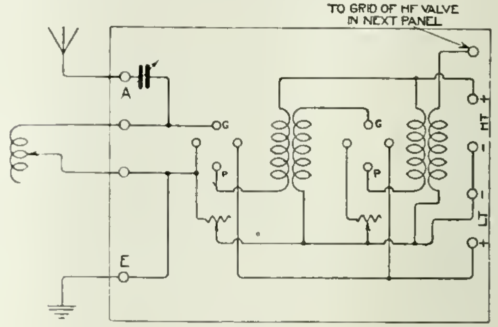


Fig. 7.

"EBONITE" (Southampton) *asks* (1) *For a diagram of a panel incorporating 2 H.F. connected valves.* (2) *Why he does not hear broadcast telephony transmissions.*

(1) See Fig. 7. You will require two small variable condensers as illustrated in the figure. (2) We think you should hear the transmissions with your present arrangement, and we suggest your tuning arrangements do not permit you to tune down to the wavelength. The A.T.C. and A.T.I. should be connected in series, and you should use a small tuning coil. A winding of No. 22 D.C.C. on a former 4″ in diameter and 4″ long with 6 tappings would be suitable. The construction of a H.F. transformer which is suitable for short wavelengths, is given in the issues of September 2nd and 16th, under "Experimental Station Design."

SHARE MARKET REPORT

Prices as we go to press on December 21st, are:—

		£	s.	d.
Marconi Ordinary	.. ..	£2	4	4½
,, Preference	.. ..	2	0	0
,, Debentures	.. ..	102	5	0
,, Inter. Marine	.. ..	1	5	7½
,, Canadian	.. ..		9	4½
Radio Corporation of America :—				
Ordinary	.. .. ..		15	10½
Preference	.. .. ..		13	3

MARCONI INTERNATIONAL MARINE DIVIDEND.

The Marconi International Marine Communication Company, Limited, announce an interim dividend of 5 per cent. less income tax upon the issued capital of the Company. This dividend will be payable on January 8th, 1923, to shareholders registered on December 19th, 1922, and to holders of Share Warrants to Bearer. The Transfer Books will be closed from December 20th to December 26th, 1922, inclusive.

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

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Some Modern Developments in Duplex Telephony

By Captain P. P. Eckersley of 2 MT.

Introduction.—Definition.

DUPLEX Telephony is in this article taken to mean any system of wireless telephony in which the usual send-receive switch is done away with.

There are thus two types of Duplex telephony, one which may be termed true Duplex, and the other partial Duplex.

In the true Duplex system, the apparatus approximates in performance to the ordinary wired telephone of daily and blasphemous use. In the partial Duplex system, the participants in the conversation cannot break in one upon the other, in fact simultaneous reception and transmission is impossible.

The Uses of Duplex Telephony.

I think all who have been much associated with wireless telephony will agree that the send-receive switch is a nuisance, and may lead to confusion in the hands of neophytes, but that once mastered, the rapid exchange of messages becomes quite a simple matter.

Duplex therefore scores in the matter of foolproofness in operation, but this is counterbalanced by the extra technical complication sometimes involved.

Personally I think the real use of duplex telephony is for installation either as an adjunct or as replacement to the ordinary wired telephone.

Thus there are many places where it is costly or impracticable to lay telephone cables, or again, a stretch of sea or impassable country may form a barrier between two ordinary telephone networks, and here the wireless link may often replace a trunk line.

The Inherent Problem.

The reason why it is so much more difficult to do duplex by wireless than by ordinary wired telephone, is the fact that the ratio of the power of the transmitter to the sensitivity of the receiver is in the former case so much greater than in the latter. In the wireless case the ratio of transmitted power to receiver sensitivity may be of the order of 10,000 times greater than in the ordinary wired telephone case, and it is extremely difficult therefore to eliminate or balance out the effect of the relatively powerful transmitter.

Principles of Solution.

In the past inventors have been at pains to solve the problem along two main lines :—

(*a*) Only to radiate power from the transmitting aerial while speaking ; or

(*b*) To make the receiver so selective that it is not interfered with by the presence of the local transmitter ; or

(*a*) and (*b*) Combined partially.

In (*a*) the problem is concerned practically entirely with the transmitter.

In (*b*) the transmitter is standard and only the receiver circuits present any novelty.

The former system of duplex where aerial current is produced only when speaking, involves the use of so-called "quiescent aerial transmitters," the latter system involves the use of "protected receiver systems."

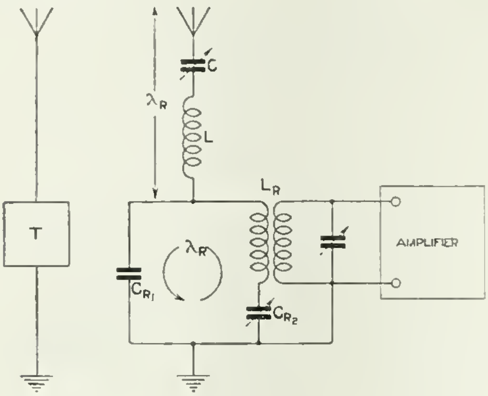


Fig. 1.

The quiescent aerial transmitter gives the inventor the opportunity of doing duplex on one wavelength (a great advantage for group communication as will be seen later), but it usually nullifies the possibility of doing true duplex, unless most elaborate arrangements are resorted to.

The Aerial System.

It must be obvious that the protected receiver system becomes more simple if there are two separate aerials, one for receiving and one for transmitting, and becomes more and more easy of solution for a given power of transmitter, the further the aerials are separated one from the other.

There is thus the further distinction in duplex systems of two aerial systems or single aerial systems.

Having now defined the various possible principles of solution, it may be interesting to go into more detail under headings as defined above.

Quiescent Aerial Systems.

The conclusion I have come to as regards quiescent aerial systems is that "the game is not worth the candle." The achievement of a simple quiescent aerial system that gives good speech is very difficult, and if one is so clever or lucky as to hit upon such a system, the problem of the receiver still remains if true duplex is wanted, and partial duplex scores very little over the ordinary simplex system.

The whole problem lies in arranging a system where the aerial oscillations are only present when speaking, and in getting good intelligible speech out of such a system.

It is hardly within the scope of this article to go into great detail as regards quiescent aerial systems, because the modern methods of solution do not involve such arrangements.

Captain Round has pointed out however, that in many quiescent systems only one half of the voice disturbance is used, and this results in the oscillations in the aerial being constantly stopped and started again. Now there is no insurance that the high frequency phases in one burst of voice controlled oscillations will be the same as in the next burst, and the resulting disturbance is so "phase jumbled" as to produce bad speech in the receiving system.

The solution of the problem is to supply independent drive or master oscillator, but even then there is the trouble of "threshold voltage," *i.e.*, the feebler electrical disturbances failing to produce any oscillations at all.

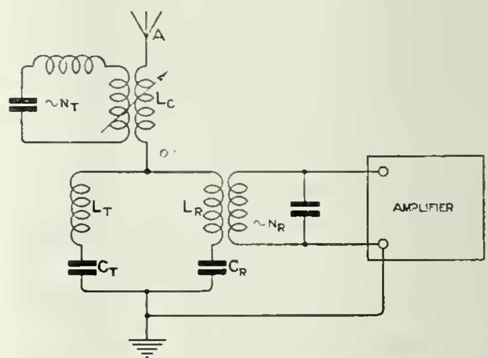
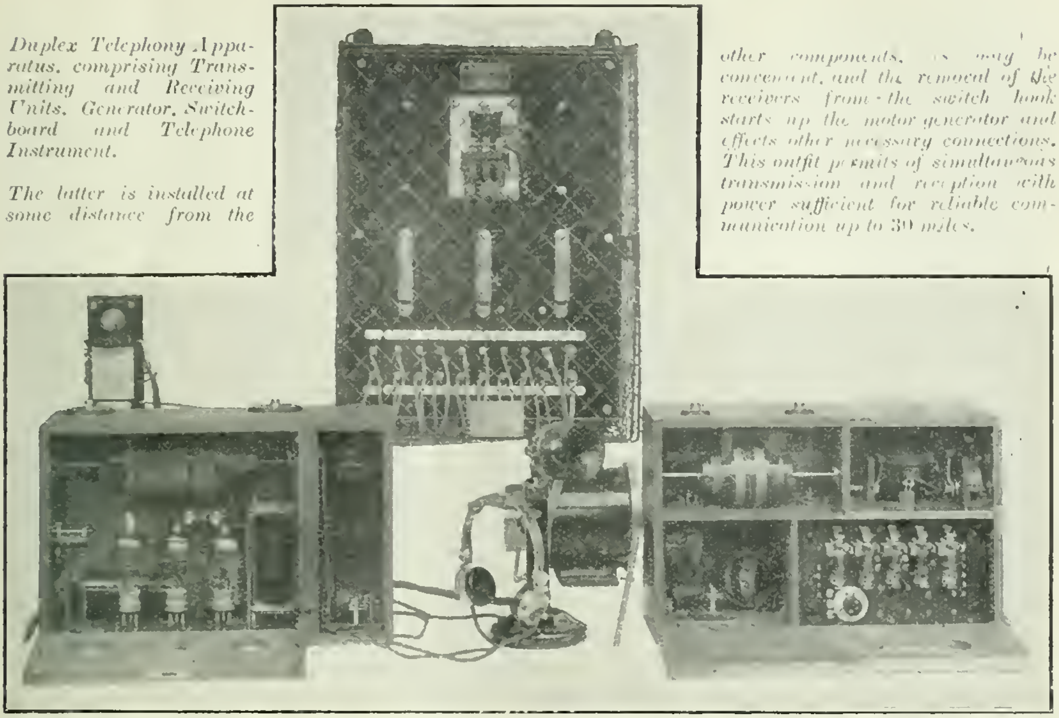


Fig. 2.

For a full discussion of quiescent aerial systems the reader is referred to a paper by the author, read before the Institution of Electrical Engineers, Vol. 58, No. 292, dated July, 1920.

Protected Receiver Systems. Two Wavelengths, Two Aerials.

It has been pointed out that with protected receiver systems true duplex is possible. But this involves the use of two wavelengths, one for receiving and one for transmitting, because the protection to the receiver is nearly always wholly bound up in its being tuned



Duplex Telephony Apparatus, comprising Transmitting and Receiving Units, Generator, Switchboard and Telephone Instrument.

The latter is installed at some distance from the other components, as may be convenient, and the removal of the receivers from the switch hook starts up the motor generator and effects other necessary connections. This outfit permits of simultaneous transmission and reception with power sufficient for reliable communication up to 30 miles.

Photo: Courtesy Marconi's Wireless Telegraph Company, Ltd.

to a wavelength different from that of the near-by powerful transmitter.

Let us first take the case where two wavelengths are being used, and also two aerials.

The whole problem now lies in making the receiver ultra-selective to one particular wave only, and thus some simple form of loose coupling arrangement is necessary.

One form of protected receiver system is shown in Fig. 1. This involves the use of a rejector system.

Thus T represents any form of telephone

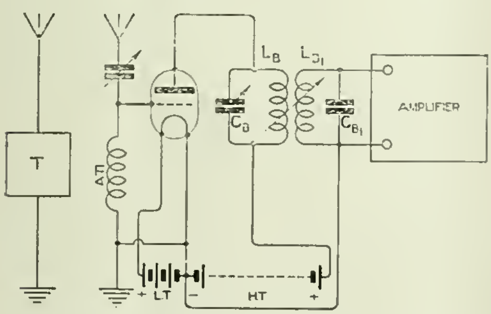


Fig 3.

transmitter oscillating in any normal manner, connected to its own aerial A_T and producing a disturbance of wavelength λ_T. Now the receiving aerial is connected through an inductance L and tuning condenser C, and this part of the aerial system is tuned to a wavelength λ_R. This tuned circuit "stands" on another tuned circuit C_{R_1} C_{R_2} and L_R. C_{R_1} is a large condenser and the circuit C_{R_1} C_{R_2} L_R is tuned to a wavelength λ_R also. If disturbances of λ_R fall on the aerial, the circuit C_{R_1} C_{R_2} L_R is set into oscillation, being in fact electrostatically coupled to the aerial system A_R C_L, the degree of coupling being determined by the value of the condenser C_{R_1}. By making C_{R_1} large, the looseness of coupling is greater. But the effect of the local transmitter is to produce oscillations in the aerial A_R of frequency N_T, these oscillations being less and less in magnitude the more λ_R differs from λ_T. These forced oscillations have two paths to earth, one through the condenser C_{R_1}, the other through the inductance and condenser C_{R_2} and L_{R_2}, and it is obvious that the impedance of the pure condenser path is much less than the inductance capacity path. Thus nearly all the forced oscillations are diverted from the inductance L_R which can therefore be connected to some form of amplifier as shown, which will still be sensitive in spite of the relatively near-by and powerful transmitter.

I have worked this system with about $\frac{1}{2}$ amp. in the transmitting aerial, and a separation of wavelengths of about 15 per cent. with success. The two aerials ran parallel about 5 feet apart, and were run on each side of a 5-ft. spreader on a 30-ft. mast. The amplifier consisted of an audion and two note magnifiers; no high frequency amplification could be used. The value of the condenser C_{R_1} might be of the order of 0·003.

This system has a very limited application, because the direct effect of the local oscillations has to be carefully screened, and because the rejector system is apt to reduce the sensitivity of the receiver.

I have given this as a typical example of a protected receiver system for small powers for two aerials and two wavelengths.

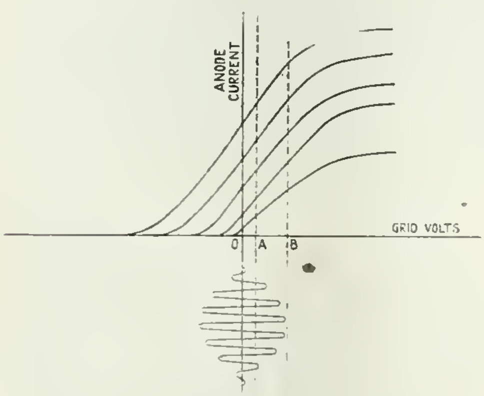


Fig. 4.

Two Wavelengths and Single Aerial.

It is very often important to use a single aerial, as for instance on aeroplanes, or where space is very limited.

In Fig. 2 is given a two-wavelength single aerial system. Here the path to earth is branched, and the aerial is in fact given two natural periods.

Let L_C be the common inductance, and L_T C_T be inductance and capacity in one branch and L_R C_R be the inductance and capacity of the other branch.

Suppose a closed circuit to be oscillating at a frequency N_T, and to be coupled to the common aerial inductance L_C as shown. Now let L_C be adjusted so that if connected between aerial and earth the system has a natural frequency N_T. Also let the product of L_T and C_T be so arranged that they too have together a natural frequency N_T. Then if the aerial be connected through L_C L_T and C_T to earth, the whole system will have a natural frequency N_T and will be in resonance with the closed circuit. Thus currents will be set up in the aerial which will flow through L_C L_T and C_T and will be almost entirely confined to the path L_T C_T provided L_R C_R does not equal L_T C_T, since the point O is a node of potential to currents of frequency N_T.

Thus the closed circuit may be made to oscillate powerfully, and the aerial A L_C L_T C_T will form an ordinary transmitting system. But again the aerial with L_T L_R C_R will form a receiving system of another natural period N_R, and will be sensitive to disturbances of wavelength λ_R, and what is more, nearly all the received currents will pass down L_R C_R, this path being of relatively low impedance to the received currents to the path L_T C_T.

Thus we have the condition of nearly all the transmitted currents passing down the leg L_T C_T and nearly all the received currents passing down the leg C_R L_R, provided the correct adjustments are made.

This obviously gives a duplex system, and this can be used with success for small powers up to perhaps 0·5 amps. in the common aerial, using an audion and two note magnifying amplifier. Again, however, the disadvantage of the system is that the *direct effect* of the local transmitter may prejudice the performance of the amplifier, especially if the latter embodies high frequency magnification.

It is essential to cut down the *resistance* of the inductance L_T, because the higher this resistance the more current will be forced into the leg L_R C_R, but if the resistance is cut down by cutting down the inductance, the sensitivity of the receiving system will be prejudiced, since O is *not* a node of potential to the receiving system. One is thus between the devil and the deep sea, and the problem lies in making a given inductance of low resistance, not always an easy matter.

The Beat Wavelength Method.

The above systems, and many permutations and combinations of them, had a very limited application up to a certain point, but they have been entirely superseded by using the beat wavelength system, which is the outcome of the beat method of reception, and was first applied by Franklin in his experiments on duplex telephony.

Everyone is probably aware of the usual method of receiving continuous wave by heterodyne. Briefly, of course, the continuous wave is received normally, and another disturbance of slightly different wavelength is superimposed upon it to produce audible beats.

The frequency of the beat is determined by the difference in frequency of the two disturbances producing the beat frequency or

$$N_b = \pm n_1 \pm n_2$$

Where N_b is the beat frequency.

n_1 is the received frequency.

n_2 is the superposed frequency.

It will be realised then that N_b can be made to have a value much greater than audibility, in fact if we have two wavelengths, one of 400 metres and the other of 300 metres beating, the beat *wavelength* will be 1,200 metres, which is, of course, an inaudible frequency.

This principle has been used for the solution of duplex telephony.

Consider Fig. 3 where T is a transmitter close to a receiving system. Suppose the transmitter is radiating a wavelength of 300 metres, and the receiver is receiving a wavelength of 350 metres.

Now the receiver has two frequencies superimposed in the aerial system, one of 10^6 per sec. (300 metres) and the other of $0{\cdot}8575 \times 10^6$ sec. (350 metres). There will thus be beats set up in the aerial circuit of frequency $(10^6 - 0{\cdot}8575 \times 10^6) = 0{\cdot}1425 \times 10^6$ or of a wavelength 2,100 metres. These beats, to be detected, must of course first be rectified, and to this end the receiver must be arranged as shown, with a rectifying valve V_R connected across the A.T.I. of the receiver, and a circuit L_B C_B in the anode of the rectifier, tuned to a frequency $0{\cdot}1425 \times 10^6$ or a wavelength of 2,100 metres. Now the amplifier can be made sensitive to 2,100 metres and *not* to 300 metres, and so will experience no "wipe out" from the local powerful transmitter; or at least the wipe out will be very small compared to what it would have been had the amplifier had to have been sensitive to 350 metres, and not to 300. Thus if a circuit L_{B_1} C_{B_1} is connected across the amplifier terminals, and is coupled to L_B C_B, a duplex system of considerable sensitivity and robustness is achieved, for if the received signal is modulated telephonically, obviously the intensity of the beat will be modulated in the same way.

In fact, summing up, provided the forced oscillations from the transmitter are not strong enough to prejudice the performance of the valve V_R as a rectifier, and provided the amplifier is given a measure of selectivity so that it is sensitive to long waves of the order of 2,000 metres, and not to short waves of the order of 300 metres, then true duplex working is achieved.

It will be realised also that the amount of the forced oscillation can be a good deal greater than would be the case were V_R the first valve of an ordinary amplifier. To get good rectification, the amplitude of one half of this oscillation can have any value between OA and OB in Fig. 4, which represents an ordinary valve characteristic. Anywhere between A and B the peak of the oscillation lies on the straight part of the curve, and the little extra received oscillation rides on the peak of the forced oscillation or later falls into the trough, producing, always provided the peak of the big oscillation lies between A and B, perfect rectification.

SIDE TONE.

While on this point, the question of side tone may be profitably discussed. By side tone is meant the sounds produced in the receiving 'phones by the effect of the voice modulation of the near-by transmitter.

It might at first be imagined that the voice modulation of the powerful near-by transmitter would produce heavy side tone, but this is not actually the case.

For consider again Fig. 4. The effect of the modulation might be to cause the forced oscillation peaks to be increased and decreased in intensity between values OA and OB, that is along the straight part of the curve. Now in this case the rectified component will be unchanged, since the amount of the oscillations in the beat wavelength circuits depends (always provided the main oscillations do not change any more than from A to B) simply and solely upon the magnitude of the received oscillations, riding on the crests of the forced oscillations. This amount is unchanged therefore by the modulation of the near-by transmitter, provided this does not exceed a certain amount.

But if the modulation of the transmitter exceeds a certain amount, and the peaks travel up beyond saturation or down to the bottom bend of the characteristic, heavy side tones are produced because the effective steepness of the characteristic curve is changed.

Thus by proper adjustments the amount of side tone may be given any value.

Description of a Typical Installation.

In a certain typical duplex installation of this sort the transmitter is arranged to transmit on any wave between 400 and 300 metres, and its power is 50 watts input. The circuits of the transmitter are absolutely standard, and any well-known form of speech control circuits may be employed.

The receiver is in principle exactly as outlined above. Thus the aerial circuit embodies a coupled circuit receiving system similar to that illustrated in Fig. 3.

The beat wavelength rectifier has a grid leak, the function of which is automatically to adjust the intensity of the forced oscillations from the local transmitter to a value consonant with good rectification.

The beat wavelengths circuits are arranged so that the primary (in circuit with the anode of the rectifier) has a fairly large condenser and relatively small inductance (this to shunt any forced oscillations), while the secondary has a large inductance and small condenser to give voltage step-up.

The amplifier is sensitive to long wavelengths only, and has two H.F. magnifications, a detector and one note magnifier. The transmitter and receiver are arranged in separate boxes, and are installed about six feet apart to get over direct wipe out and induction effects.

There is a remote control attachment consisting of a pedestal microphone and head telephones, and this may be installed up to 50 feet away from the instrument boxes. Lifting the head telephones from the hook on the pedestal microphone lights all valves, starts up the transmitter generator, and all is ready for communication.

Thus all the user is confronted with is the microphone and telephone apparatus, which can of course be installed in the house, while the other apparatus can be installed anywhere conveniently, in an outhouse or garage for instance.

The aerials are 30 feet high, and are hung on two masts as shown in Fig. 5, and are simply really two L aerials.

The guaranteed range of the installation under good conditions to give R9+ speech is about 30 miles.

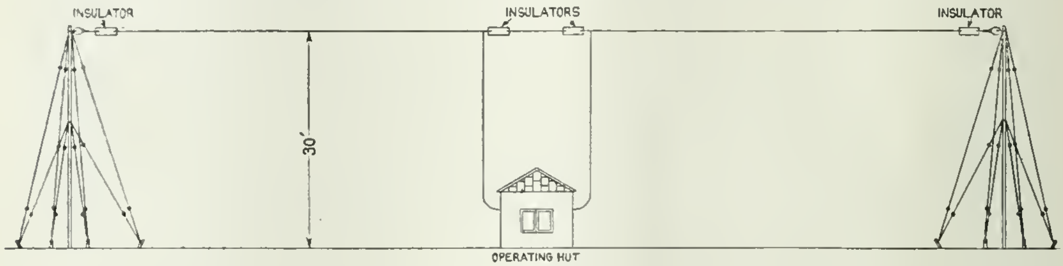


Fig. 5.

Group Communication.

It will be realised that for group communication the use of a two wavelength system involves a definite difficulty. If there are only two stations, of course, the wavelengths need never be changed. If, however, there are three stations, obviously one pair of stations cannot inter-communicate.

This has been overcome by arranging relays which, when energised, invert the transmitted and received wave of any installation. (Obviously the beat wavelength remains constant.)

Thus *all* stations stand-bi on the same wave. On wishing to call up, however, any given station energises his relays and transmits on the stand-bi wavelength and receives on the other wavelength. This overcomes all difficulty. Thus on each microphone and telephone unit there is a switch marked " close for call," and all this does is to energise relays which change over the wavelengths as indicated, when it is desired to initiate a call.

The whole apparatus therefore approximates in performance to an ordinary party line telephone without calling bell. Anyone listening-in, however, to another conversation will only hear half what is said, unless he is clever enough with his " call " switch and constantly changes waves as one or the other side of the conversation is desired to be heard. Such malicious listening-in, however, involves expenditure of battery power, and might deter certain people.

A calling bell can be added to the apparatus, and standing-bi would involve the use of a separate heterodyne to reproduce the effect of the near-by transmitter, which obviously cannot be allowed to oscillate continuously.

A photograph of the installation is given on page 457.

SINGLE AERIAL SYSTEM WITH THE BEAT METHOD

Consider again the circuit of Fig. 2. Obviously the beat method helps enormously in this case. The receiving leg L_R C_R has in it two frequencies N_T and N_R, which beat to produce the long wavelength which can be amplified without being wiped out by the frequency N_T. Furthermore, and herein lies the whole ingenuity of the arrangement, thanks to the fact that O is nodal to the transmitted oscillations, and forced oscillations in L_R C_R will be commensurate with the received oscillations, and so the method is successful.

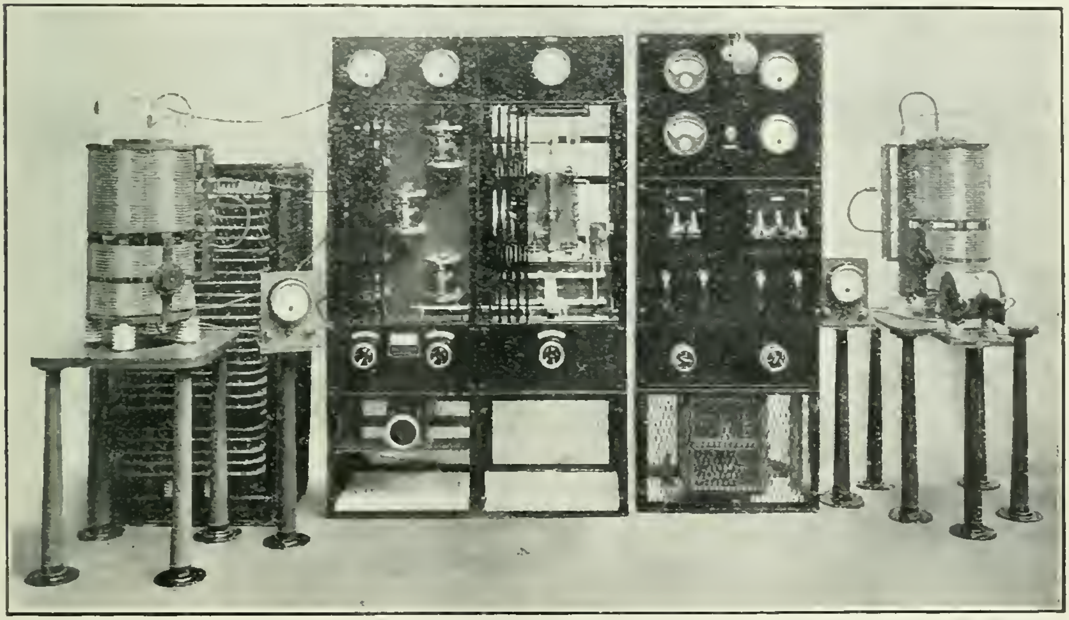
I have actually used this circuit and have obtained good duplex working with as much as 5 *amperes in the same aerial*, that is receiving the desired signal.

This circuit is obviously very useful for aeroplane working.

TWO AERIALS AND TWO WAVELENGTHS FOR LARGER POWERS.

The same duplex system can be used with greater or less separation of aerials and wavelengths, depending upon the power. Obviously also in certain cases it will be possible to use a separate heterodyne and not the heterodyne effect of the near-by transmitter.

COMMERCIAL 3 kW. C.W. TELEGRAPH TRANSMITTER.



Marconi type valve transmitter. The power panel is on the right, and the rectifier and oscillator valve panel in the centre. The air dielectric condenser is enclosed in a cage on the left. Tuning inductances are on either side.

ELEMENTARY INSTRUCTIONAL LECTURE.

An experimental Lectnre dealing with the Principles of Radiotelephony, and primarily intended for Associates of the Radio Society of Great Britain, will be given by Mr. G. G. Blake, M.I.E.E., A.Inst.P., at the Institution of Electrical Engineers on January 12th, at 6.30 p.m. Tickets will be sent to Associates. All interested are invited, and tickets can be obtained by sending a stamped and addressed envelope to Mr. Leslie McMichael, Hon. Secretary, The Radio Society of Great Britain, 32, Qnex Road, West Hampstead, N.W.6.

A Five-Valve Experimental Receiver

By Ralph W. H. Bloxam.

PERUSAL of the Questions and Answers columns of *The Wireless World and Radio Review* each week indicates that there are many who are desirous of practical constructional details and designs for experimental receivers, so that the writer begs to offer a description of his set, in the hope that it may suggest lines on which to work, to some, at any rate, of the many seeking information.

No very special features are claimed for this instrument, but it incorporates one or two novel "gadgets"—if I may be permitted to use a term beloved of the ardent wireless enthusiast—which may be of help and interest alike to the dyed-in-the-wool "ham" (an apt American term for the radio "old stager"), or the beginner

Although an experimenter, and constantly trying out various new ideas and arrangements, the writer has a passion for neatness and order in the matter of instruments, their disposal on the operating table, connecting wires, etc., a fad, perhaps, but one that possibly has saved many burnt-out valves, shorted H.T. batteries, etc., so that throughout, the aim has been to preserve a neat appearance and yet be able easily to carry out experimental alterations in the coupling of valves, circuit arrangements, values of various components, etc. Partly for appearance, but mainly for economy of space and accessibility, the sloping front cabinet type of instrument has been adopted.

Cabinet.

The cabinet is of French polished mahogany ½ in. thickness throughout. Dovetailing is employed in the construction. The following are the dimensions: 16 ins. long by 10 ins. high by 4 ins. deep at the top, 6 ins. deep at the bottom. It is provided with a removable back, sliding vertically upwards in guides, so that it is an easy matter to get at the internal connections without having to remove the ebonite panel from the front, with the attendant unscrewing that this would entail.

Panel.

The panel is of ¼-in. ebonite 16⅛ ins. by 10 ins., which was procured cut to rough size. The edges were filed to size, bevelled

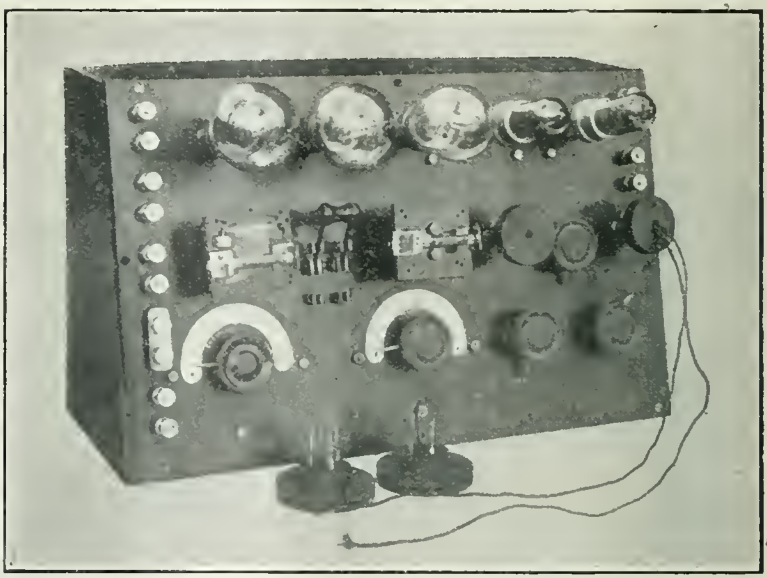


Fig. 1. Front view showing interchangeable H.F. intervalve coupling and arrangement of controls, valves, and terminals.

and polished, while held in the vice, after the centres for all holes had been marked off. Here a word of warning to the unwary. The writer once traced an obscure case of "no signals" to the fact that the gentleman in question had marked off centres with heavy pencil lines, thus providing high resistance leaks all over the panel. A scriber should be used, the lines being scratched lightly, on the reverse side of the panel of course. The edges, and finally the face side of the panel, were polished with bathbrick and oil, a little oil being rubbed on to a piece of flannel smeared lightly with the powdered bathbrick and then applied to the ebonite with plenty of "elbow grease" until all scratches are removed. The final polish is applied with a perfectly dry and clean flannel. No more bathbrick and oil should be used than is absolutely necessary.

Valve Couplings.

Having heard and read the praises of other experimenters on their particular fancies for the four well-known methods of intervalve coupling, namely, "high frequency transformer," "tuned anode," "resistance capacity" and "low frequency transformer"—and combinations of these, the set was designed so that any of these couplings could be readily used at will, and quickly changed, in order to allow of comparison on a given signal reception. Many amateurs do not appear to realise how easily these changes can be accomplished.

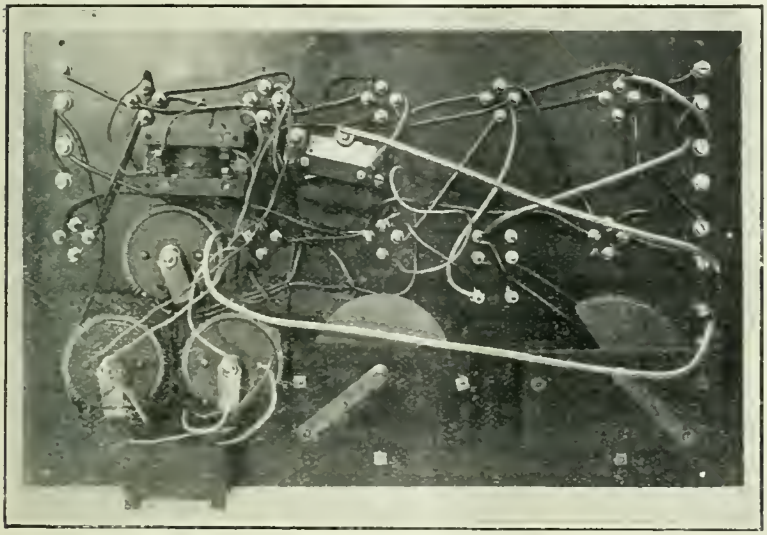


Fig. 2. The interior.

The diagram of connections (Fig 4) shows at W and X the "R" valve sockets providing the means for coupling between the first and second, and the second and third valves, while Fig. 3 shows at A, B, C and D, the four usual methods of coupling between valves—respectively, "resistance capacity," "tuned anode," "H.F. transformer" and "L.F. transformer." Immediately below, at A_1, B_1, C_1, D_1, are shown the connections required on the plugs to couple the valves in that particular manner, the plugs being of course provided with "R" valve pins to fit the sockets W and X. A short study of Fig. 3 will show that it is simply a matter of bringing four leads—from "plate" and "+H.T.," and "grid" and "negative filament" of the two valves to be coupled—to a suitable socket. Receivers fitted with "R" valve holders to take H.F. "plug-in" transformers provide all that is necessary. It is essential however to ascertain the exact order of internal connections of the four legs or sockets. It should be pointed out here that in the receiver described, the coupling between the first and second, and the second and third valves only, can be altered in this way, the last two valves being permanently low frequency transformer coupled. The extra two valves are added for loud speaker working. If desired, however, all intervalve couplings could be arranged for interchanging, as will be readily seen, the only requisites being additional plugs, sockets and tuning condensers. Normally, however, two high frequency valves will be found sufficient for the average experimenter to work with. In the case of resistance capacity and tuned anode plugs, these are made of $\frac{3}{16}$-in. sheet ebonite $2\frac{1}{2}$ ins. square. Four valve pins (these can be purchased from dealers) are tapped into the ebonite at corresponding positions to the usual pins at the base of the "R" type valve. Connections are taken through small holes drilled close to the corresponding pin, and the wires soldered, or if desired, may be held under a nut.

The coupling condensers are made as follows:—Four plates 1 in. square with "tabs" $\frac{3}{4}$ in. by $\frac{1}{4}$ in. are laid with alternate "tabs" to each side in the usual manner. The dielectric consists of mica (the writer has also used thin paraffin waxed paper) 0·002 in. thick, the whole being bound with strips of waxed paper, and covered with a strip of empire cloth for neatness. The plates are made of thin sheet brass, 0·007 in. thickness. The tabs are bent double with connecting wires between, and soldered It has been found that the value of these condensers is not critical. The resistances used are of the "pencil" form mounted between clips, so that they may be readily interchanged. Resistances of 50,000 ohms are used for short wavelengths (up to 2,000 metres). Above 2,000 metres 80,000 ohms has been found most satisfactory. It is not advisable to attempt to make these resistances, as the commercial article of well-known make will be found most satisfactory, being constant in value and free from parasitic noises. For the "tuned anode" circuit plugs, condensers were made as described for resistance-capacity coupling. The coils were made in the form of a "hank" wound on a 2-ins. diameter former, the coil being wound up with cotton when complete. Sixty-four turns of No. 33 S.W.G. D.S.C. wire was found satisfactory for 300 to 500 metres range. Honeycomb coils were also used, ten layers on the former to be described, being found correct for the above wavelengths.

With similar plugs, "reactance-capacity" coupling may be employed. Coils for these should be wound with silk-covered resistance wire of about 36 S.W.G. The resonance peak is thereby flattened as compared with that obtained with the "tuned anode" coil. While somewhat getting over the difficulty of tuning the circuit, this arrangement reduces the amplification slightly.

High frequency transformers were purchased. Some were also made, 60 turns of 40 S.W.G. D.S.C. wire being found correct for 300 to 700 metres, the former being $2\frac{1}{16}$ in. diameter, and having a slot $\frac{1}{8}$ in. wide by $\frac{1}{4}$ in. deep, primary separated from secondary by a layer of silk ribbon.

For L.F. transformer coupling the "primary" and "secondary" of an intervalve transformer are connected to a four-pin plug for insertion in "W" or "X" (Fig. 4).

VALVE SWITCHING.

Reference to the diagram of connections (Fig. 4) will show the method adopted in order to use as required, three only, or the whole five valves. Connection from the 'phone transformer (external to the instrument) is made to a two-pin plug. It is only necessary to insert this plug across the two "filament" legs of the socket "Y" in order to connect the 'phone transformer between the plate of the third valve and positive H.T. A "fixed" 'phone condenser will be seen connected across these legs. It will be seen that the primary of the intervalve transformer is connected across the "grid" and the "plate" legs of this socket.

In order to operate five valves, a special plug is inserted in the socket "Z," the "grid" and the "plate" pins being each connected to a filament pin as shown dotted at "Y." Thus the transformer "primary" is now connected between the plate of the third valve and positive H.T. in the place of the 'phone transformer. The two-pin 'phone transformer plug is now inserted in the socket "Z" connecting the primary between the plate of the fifth valve and +H.T. The filament rheostat for the fourth and fifth valves is now switched "on." Dewar switches could be used for this switching operation if required, although of course slightly more costly.

The whole of the construction of the set was carried out with a few simple tools—a

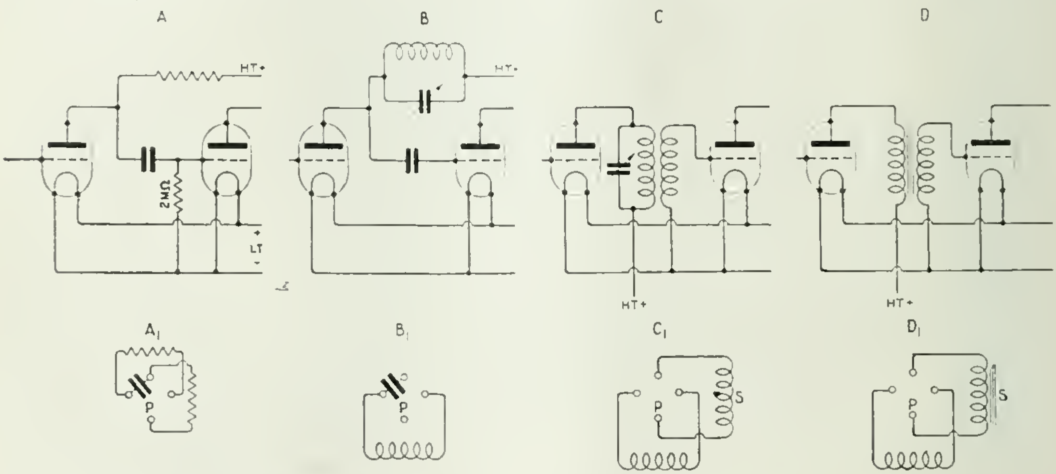


Fig. 3. The four usual systems of intervalve coupling and the method of connecting up valve sockets to effect either arrangement.

breast drill being perhaps chief amongst them, and with the exception of filing the ebonite panel, was all done on a kitchen table.

Fig. 1 shows the photograph of the front of the instrument, while Fig. 2 shows the rear of the panel.

The two H.F. condensers have each seven fixed and six moving vanes—capacity approximately 0·00025 mfds.

"Series-parallel" switch for A.T.C. (connected externally to the instrument) is seen in Fig. 1 between the coupling sockets.

Filament rheostats are provided for first two, the third, and the fourth and fifth valves.

At the top left-hand side of the panel (Fig. 1) will be seen five pairs of terminals. These are respectively, from the top downwards: aerial and earth, A.T. inductance, reaction to plate of first valve, reaction to plate of third valve, variable condenser (A.T.C.), The four terminals at the right of the panel are for connection of H.T. and accumulator. Reference to Fig. 2 will show that the plate circuit connections are brought out well clear of the connections to the grid circuits, in order to minimise capacity effects.

Tuning coils are of "honeycomb" pattern, hand wound, the former used being 2 ins. diameter and having 21 pins on each side. The width of the coils is 1 in. Three are used at a time in the coil stand, one being A.T.I., one the C.C.I., and the third the reaction. For inductance 6½ ins. or seven layers will be found suitable for 350 to 800 metres range with "series" A.T.C., the reaction having about eighteen layers. This information is given for the guidance of those who wish to make similar coils, and the writer assures them it is *well* worth while. These coils are of extremely low self capacity, provided no more shellac is used than is necessary to hold them firmly together.

In conclusion, a few words as to experience in working this set on the 400 metres wavelength particularly.

H.F. transformer coupling gives very fair results, but requires careful and somewhat critical adjustment of the H.F. tuning condensers. Two makes of transformers, and also home-made ones were tried. Tuned anode coupling requires extremely critical tuning when using the honeycomb coils, but is somewhat more flexible when using the small hank coils. Signal strength is much greater than with H.F. transformer coupling. Resistance capacity has been found by far the most satisfactory, being more stable, and no adjustment being required.

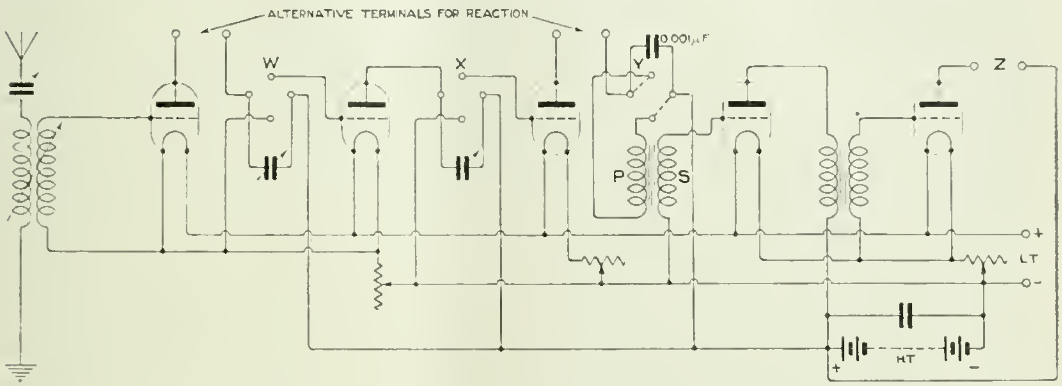


Fig. 4. Circuit diagram of the Experimental Receiver.

As regards signal strength, it is far superior to H.F. transformer, and is hardly perceptibly weaker than with the tuned anode circuit coupling. Also clearest results are obtained with this coupling on telephony, the only disadvantage being the higher H.T. voltage necessary, 70 to 100 volts being used. Owing to the difficulty of tuning when using the transformer or tuned anode coupling, it is almost impossible to follow a conversation between two stations on slightly different wavelengths, and is therefore only useful on a prolonged transmission. The writer has not personally tried it, but a friend of his reports successful working with resistance coupling on 200 metres, having heard **2 JZ** (Aberdeen) here—24 miles east of London. The writer is well aware of the revolutionary statement which he has made, as theoretically, resistance coupling on short wavelengths (below 1,000 metres) is not efficient.

Electrons, Electric Waves and Wireless Telephony—XIV.

By Dr. J. A. FLEMING, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

VI.—TELEPHONY AND SPEECH TRANSMISSION.

1. Nature of Articulate Sounds.

BEFORE we can discuss the application of the scientific facts and principles previously described in the development of practical wireless telephony it will be desirable to preface it by a little further consideration of the physical nature of articulate sounds and some description of the instruments employed in the transformation of the energy of aerial vibrations involved into or from correspondingly varying electric current energy.

It has been explained that aerial waves consist in a state of compression at some point in the air, associated with an accompanying state of rarefaction, which states are not stationary at one place, but are propagated through the air with a velocity of about 1,100 ft. per second at ordinary temperatures. The production of these compressional and rarefactional regions is the result of oscillatory movements of the air particles moving to and fro along the line of propagation of the wave. If the motion of the air molecule resembles that of the bob of a long pendulum it is called a simple harmonic or simple periodic motion. The corresponding aerial waves are called simple harmonic waves, and the sensation they produce when acting on the human ear is that of a pure or simple tone such as that given out by a tuning fork or open organ pipe gently blown.

We have also explained that the oscillatory motion of the air particle may be of a more complicated nature, such that the displacement of the particle or the air pressure at any point and at various times, can only be represented by the ordinates or heights of a complex curve called the wave-form curve, the horizontal distances representing the flow of *time*. The wave form of a pure musical tone, or simple harmonic wave, is a curve called a *sine curve* (see Fig. 74).

It has been mentioned that, however complicated or irregular a wave form curve may be, it can always be imitated by adding together the ordinates of suitably placed simple harmonic curves of various amplitudes and of wave-length in the ratio of 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, etc., or some selection of such waves.

These last are called the harmonic constituents of the complex curve.

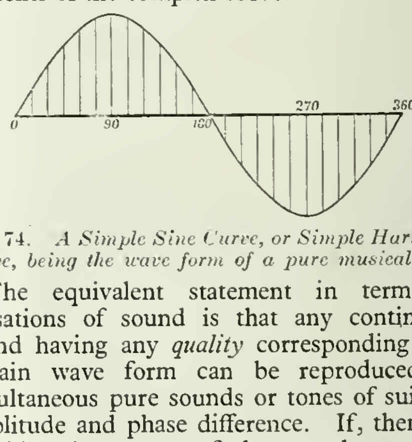


Fig. 74. A Simple Sine Curve, or Simple Harmonic Curve, being the wave form of a pure musical tone.

The equivalent statement in terms of sensations of sound is that any continuous sound having any *quality* corresponding to a certain wave form can be reproduced by simultaneous pure sounds or tones of suitable amplitude and phase difference. If, then, we consider the nature of the sounds made in articulate speech we find that very broadly they may be divided into two classes, viz., (i) Continuous sounds, which are uttered by placing the mouth cavity, lips and tongue, in certain positions, and then forcing air out from the lungs. These sounds can be emitted as long as the breath lasts.

If we except certain sibilant hissing or rolling sounds, such as those indicated by the letters *s*, *sh*, *th* and *r*, we may call the remaining continuous sounds *vowel sounds*. In every language there are a large number of such sounds of different *quality*, and therefore, physically speaking, different wave forms. In English there are about 19 or 20 sounds which are expressed by different modes of sounding the so-called vowel letters *a*, *e*, *i*, *o*, *u*, or combinations of them, such as *au*, *ou*, *ei*, *æ*, *œ*, etc.

Then we have also (ii) discontinuous or consonantal sounds, which for the most part are various abrupt modes of beginning or ending the utterance of a vowel sound. All spoken languages are made up of certain vocal elements called *syllables*, which, combined together or alone, make *words*. A syllable comprises generally a vowel sound, which may be begun or ended with a consonantal sound or some other continuous sound of short duration. Physically speaking, and outside of ourselves, such syllabic sounds consist in short trains of damped aerial waves of complex wave form and of a certain amplitude and wave-length, determining the loudness and pitch of the sound, the said trains being begun or ended, perhaps, in an abrupt or irregular manner corresponding to the consonant. The acquirement of a language consists in learning to associate particular vocal sounds, or groups of them, with certain objects, actions, or ideas.

The art of speech consists in being able to so control the vocal organs, larynx, lips, tongue, mouth cavity, breath, as to create the types of air wave trains which are by custom associated with certain ideas, things, actions, or wants. The human ear, by education, acquires an extraordinary power of distinguishing between the wave forms of aerial waves which strike the tympanum, and noting the manner in which this wave train begins and ends. If, for instance, we pronounce the monosyllabic words *day*, *die*, *do*, *dough*, or *tea*, *tie*, *too*, *toe*, we are, in fact, creating short rapidly damped wave trains of aerial waves differing somewhat in wave form and in the manner in which the wave train begins. Each of these words is associated in our minds with a thing or idea, and a *word* is therefore a more or less complicated sound of a certain finite duration and wave form which, when made, raises in the mind of a hearer an idea or conception similar to that in the mind of the speaker.

In order that the word shall be correctly interpreted by the hearer, it is necessary that it shall be uttered with sufficient *loudness* and sufficient *clearness*. This implies that the sound waves must have adequate *amplitude* and sufficiently well defined *wave form* both in the terminal and medial portions of the wave train. The proper pronunciation of the terminal consonants in each syllable is important. Far too many people mumble or clip their words or run them together in speaking.

It is astonishing how few of those whose trade it is to speak in public, such as clergymen, barristers and politicians, are properly trained in the art of elocution.

2. Telephone Transmitters.

The problem of transmitting speech to a distance, that is, the art of telephony, consists in arranging means by which the aerial vibrations constituting speech sounds which are uttered at one place can be reproduced at a distant place with sufficient amplitude and correctness of wave form to be heard and understood

Although various attempts and suggestions for the solution of this problem had been made, no one had completely solved it until Alexander Graham Bell invented, in 1875, the speaking telephone, and this, coupled with the inventions of Edison, Hughes and others, as regards the carbon microphone transmitter, gave us practical telephony capable of operation in everyday life. Except in matters of detail, it is remarkable that the fundamental principles of the apparatus remain to-day what they were forty-six years ago.

Bell realised at a very early stage in his experiments that to achieve telephony by the aid of an electric current, the current in the wire must vary in strength with time exactly in accordance with the variations in air pressure made by the voice of the speaker at a point near his mouth. This means that the current must be an undulatory current.

Bell's solution of the problem of telephony was a remarkable stroke of genius, involving as it did the production of a novel yet most simple appliance which could act both as transmitter and receiver. He placed on the pole of a bar, or poles of a horseshoe-shaped permanent magnet, soft iron pole pieces wound over with insulated wire. Very near to these pole pieces was fixed a circular flexible disc of thin iron about $2\frac{1}{4}$ ins. in diameter (see Fig. 75). When the coils of wire are traversed by a fluctuating electric current the magnetic poles are either weakened or strengthened a little. The disc, or diaphragm, as it is called, is therefore cupped, or bent in a little more, or else springs back suddenly. The amplitude of motion of the centre of the diaphragm is in any case extremely small, never exceeding 1/100th of a millimetre, yet the blow it inflicts on the air is sufficient to create an air wave, and therefore an audible sound, and the movements of the disc respond so quickly to changes in the current that the receiver can impress upon the air waves of a complex wave form which yield intelligible speech sounds.

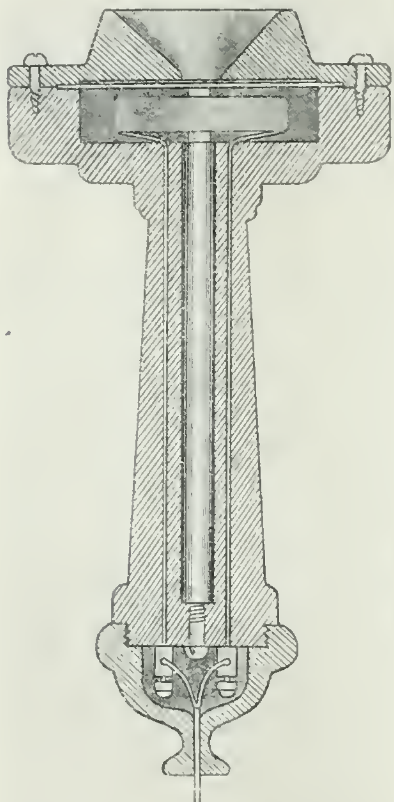


Fig. 75. Section of a Bell Magneto Telephone.

On the other hand, if we speak to the diaphragm the changes of air pressure made by the speech waves against the disc press it in or out. When the iron disc is moved nearer to the magnet poles it increases the pole strength slightly, and this creates an induced electric current in the surrounding coils of insulated wire, the variation in which copies to a certain extent the motion of the disc.

Hence, if two similar telephones have their coils joined by a pair of transmitting wires, speech made against the diaphragm of one telephone is faintly repeated by the diaphragm of the other, and the arrangement conveys audible speech to a distance.

It was, however, soon found that although the above-described Bell telephone is a remarkably good speech reproducer, it is not very effective as a transmitter, and it was soon replaced in this respect by the carbon microphone resulting from the discoveries and inventions of Edison and of Hughes.

In this transmitter the movements of the disc or diaphragm created by the speech sounds is made to compress more or less some granules of graphite or hard conductive carbon, and this pressure varies the electric conductivity of the mass of granules. Hence, if this carbon forms part of the electric circuit of a voltaic battery, changes of current will take place in that circuit corresponding to the movements of the diaphragm.

Without entering into details of development we may describe one or two modern microphone transmitters as used in telephony, both with wire circuits and in wireless telephony as well.

In its usual form one of them is termed a "solid back" transmitter. It was invented by Mr. A. C. White in America. It comprises an ebonite trumpet-shaped mouthpiece, which may be replaced by a large metal cone, the function of which is to collect the sound waves and converge them on to a thin circular diaphragm or disc of aluminium, about $2\frac{1}{2}$ ins. in diameter, and about 1/50 in. in thickness. This diaphragm is clamped at the edges between rubber rings, and the speech waves collected by the mouthpiece or trumpet set the disc in vibration, pressing it inwards in concave form to an extent which depends on the amplitude of the sound wave and on the wave form of the latter, or else causing it to bulge out again. Behind this diaphragm is a small flat circular metal box carried on a rigid cross arm. The bottom of this box is covered with a thin disc of hard carbon like a wafer. The lid or top of the box is a thin mica disc, to the inside of which is clamped a similar hard carbon disc. There is a very shallow space between the two carbon discs, which is partly filled with small granules of graphitic carbon or coke (see Fig. 76). Wires are connected to the two carbon discs, and the centre of the mica diaphragm is connected by a metal screw with the centre of the aluminium diaphragm. Hence, when the latter is set in vibration by the speaking voice it causes a similar movement of the top carbon disc, and the carbon granules are more or less squeezed together, and their electrical resistance varied in the same manner as the movements of the outer diaphragm.

The electrical resistance of the carbon granules may be about 30 ohms in their normal condition, and it falls in resistance under the influence of the compression due to speech waves, but the actual variation of resistance in telephonic work is not more than about 5 or 10 ohms above or below the normal.

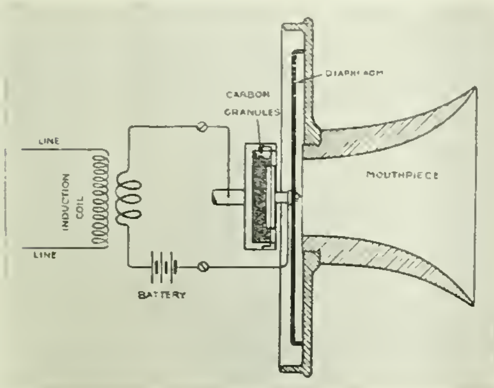


Fig. 76. A solid back granular Carbon Microphone Transmitter.

Another successful form of carbon transmitter is the Ericsson (see Fig. 77). In this

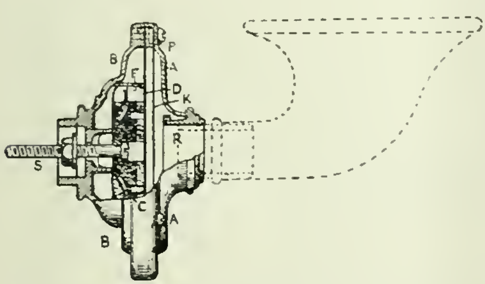


Fig. 77. An Ericsson Carbon Microphone Transmitter.

case the diaphragm which is acted upon by the speech sounds is a thin carbon disc 2.5 ins. in diameter and 0.04 in. in thickness. Behind this diaphragm is a carbon block, and a small interspace between the two is filled with small carbon granules. These are prevented from falling out by means of a ring of felt which encloses the circular carbon block. The normal resistance of this transmitter is 100 ohms, and it varies in operation between 50 and 170 ohms.

A trumpet-shaped mouthpiece is used to collect the sound waves and converge them on the diaphragm, and between the inner end of this trumpet and the carbon diaphragm is a disc of oiled silk to keep the moisture of the breath from entering the microphone chamber. In most carbon granule microphones trouble sometimes arises from the "packing" of the granules, and from the sticking together of these granules, either due to moisture from the breath entering the granule chamber or from heat produced by the current.

The slight compressions due to speech movements of the diaphragm then fail to make the necessary variations in resistance. Great ingenuity has therefore been expended in the invention of liquid microphones, such as those of Q. Majorana and J. Vanni, or by using continually renewed supplies of carbon granules as in the falling carbon powder microphone of Marzi. Nevertheless, the only type of telephone transmitter which has obtained extensive use in practical telephony is the carbon granule microphone.

In arrangements for wireless telephony employed before the application of the thermionic valve as a generator of continuous waves, it was necessary to modulate rather large currents of 5 or 10 amperes by a microphone transmitter.

The carbon granule telephone transmitters in ordinary use, such as those above-described, will not operate satisfactorily with more than about half an ampere of current passing through them. Hence many arrangements were suggested for using a number of transmitters in parallel or together, but it is extremely difficult to secure an equal division of current between the instruments so that all the microphones shall take an equal share of the duty of modulating it. These arrangements need not be described, as they are now rendered unnecessary by the powers and remarkable properties of the thermionic valve as described later on. It is, however, necessary in nearly all cases to associate with the microphone an induction coil for the following reasons.

The variation in resistance of the carbon granule microphone is, in general, only a fraction of its normal resistance, which may be from 30 to 100 ohms. Suppose, then, that such a microphone, in series with a few cells of a battery, is placed in a circuit which has a much higher electrical resistance than the microphone itself. It will be evident that any variation in resistance of the microphone produced by speech made against the diaphragm will only vary the total resistance of the circuit by a much smaller percentage than that by which the resistance of the carbon microphone itself is varied (see Fig. 78).

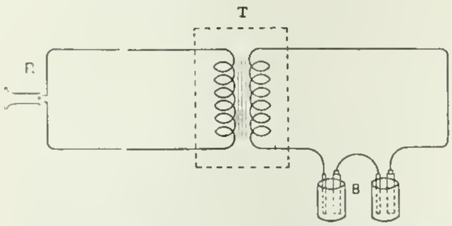


Fig. 78. A diagram illustrating a simple telephone circuit. M is the carbon microphone transmitter. B is the battery, T the telephone induction coil, and R is the receiving telephone.

This difficulty is overcome by the use of an induction coil as first suggested by Edison. We provide a small induction coil T, consisting of two insulated wires wound over a small bundle of iron wires (see Fig. 78). The resistance of one primary wire may be about 1 ohm, and the resistance of the other, or secondary wire, may be about 25 ohms. If, then, we join in series the primary wire and the carbon microphone M and a battery B of a few low resistance cells, it will be evident that any variation in the resistance of the carbon microphone due to vibrations of its diaphragm will create variations in the current flowing through the circuit of nearly equal percentage to the variations in microphone resistance. Then any changes in the current flowing through the primary wire of the induction coil will create corresponding variations in the electromotive force induced in the secondary wire.

The line wires are attached in ordinary wire telephony to the terminals of this secondary circuit, so that the current transmitted is an induced current, and this passes through the receiver telephone R at the listening end.

In the case of wireless telephony, as will be explained later on, the secondary electromotive force is used to vary the potential of the grid of a thermionic valve called a control valve.

A method which avoids the use of an induction coil is to join a number of microphone transmitters in series so that they are all equally affected by the voice, but the total resistance variation is then the sum of the variations of each microphone separately.

The construction of the Bell magneto-receiving telephone has been the subject of numerous improvements in details of construction. In place of a single steel bar magnet as originally used, two bar magnets made of tungsten steel are used, which are fixed parallel to each other at a little distance apart, and connected at one end by an iron distance piece. Or else an elongated horse-shoe magnet is employed (see Fig. 79). On

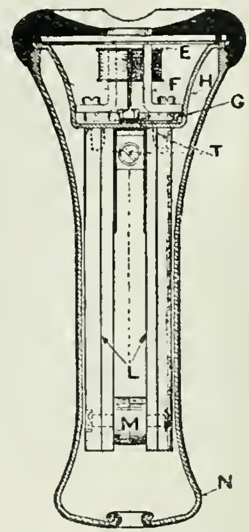


Fig. 79. British Post Office type of Magneto Telephone receiver.

the free outer poles are fixed L-shaped soft iron pole pieces on which coils of insulated wire are wound. The magnets are contained in a non-magnetic metal tube, which is wider at the outer end. On this outer end is fixed a thin disc made of a steel called "Stalloy," which contains about 2.75 per cent. of silicon. This steel disc is about $2\frac{1}{4}$ ins. in diameter, and 1/100th in. in thickness. This diaphragm is so fixed that there is an interspace of about 0.016 in., or about 1/60th of an inch between the flat ends of the pole pieces and the inner surface of the metal disc. The lines of magnetic force which spring from one pole of the magnet pass across this air gap through the iron diaphragm, and back across the air gap to the other magnet pole. The circular diaphragm is therefore sucked or cupped in at the centre, due to the magnetic pull of these poles. If, then, an electric current is sent through the coils of wire wound on the pole pieces it will either increase or else weaken this attraction. If we call H the magnetic force due to the magnet alone, and h the magnetic force due to the current in the coils, then the force can vary from $H+h$ to $H-h$, according to the direction of the current. The attraction or pull on the diaphragm varies as the square of the magnetic force or flux, as it should be called, and hence the attractive force varies between $(H+h^2)$ and $(H-h^2)$. The difference is 4 Hh, and hence depends on H as well as h. It is therefore important to have magnets in the receiver as strong as possible. The material generally used for them is steel containing 5 or 6 per cent. of tungsten, and 1 or 2 per cent. of chromium. The finished magnets are made very hard by quenching from a red heat in ice-cooled water to give them the power of retaining magnetism. Recently a type of steel has been invented at Sheffield called *cobaltcrom*, containing about 15 per cent. of cobalt and 15 per cent. of chromium. It has a much higher magnetic coercive force than tungsten steel. Moreover, it stores up about double the magnetic energy for the same volume of metal.

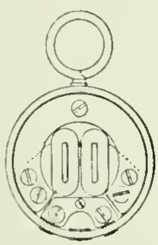


Fig. 80. Watch form of Magneto-Telephone receiver with the diaphragm removed to show the magnet and the coils.

It has the great advantage that it does not require hardening from a red heat in a liquid, and hence the finished magnets are not so liable to be warped out of shape in quenching.

It is important that the small air gap between the magnet poles and the diaphragm should remain of perfectly constant width. The coils of wire wound on the soft iron pole-pieces are made of fine silk-covered copper wire, and may be of resistance between 60 ohms and 4,000, according to the purposes for which the receiver is used.

In wireless telephony the type of receiver generally employed is called a double head telephone. It has two receivers of watch-shape, attached by flexible joints to a steel or aluminium head-band, which passes over the top of the operator's head and holds the two receivers against the ears.

The receivers are in circular watch-shaped cases, made of ebonite or aluminium (see Fig. 80). The magnets are flat rings of steel, with L-shaped soft iron pole pieces screwed to them, on which are wound rectangular shaped coils of extremely fine silk-covered copper wire (No. 40, or even No. 60, standard wire gauge), so as to obtain a very high resistance of 2,000 to 4,000 ohms. The two receivers on the headband have their coil circuits in parallel (see Fig. 81).

Fig. 81. Double head telephone receiver with spring head band (S. G. Brown).

In the case of loud-speaking receivers the construction is the same as in the portable receivers, but the magnets and diaphragms are larger, and a trumpet-shaped sound projector, like the horn of a gramophone, is attached. A very good example of this type of instrument is the loud speaker of Mr. S. G. Brown, by which telephonic speech can be heard by several hundred persons at once in a large theatre (see Fig. 82).

Fig. 82. Loud speaking Telephone of S. G. Brown.

Mr. Brown has also invented very excellent forms of double head telephones which are in extensive use for wireless telegraphy and telephony. He has devised a form of aluminium head-band and self-adjusting swivel receiver holders which are comfortable to wear on the head, and by which the receivers are kept gently pressed against the ears (see Fig. 81). The electrical construction of the receivers, as used for wireless telegraphy, is somewhat different to the standard magneto pattern. In place of an iron diaphragm there is an iron reed, or strip of iron, the natural vibration frequency of which can be adjusted by a screw within limits. To this is screwed an aluminium diaphragm, which is coned and spun into a special fitment, which is covered by an ebonite cap with holes in the centre (see Fig. 83). The resonance frequency of this receiver can therefore be adjusted to suit the musical note of the wireless signals in telegraphy.

In the case of receivers for wireless telephony this adjustment is not required, but the resonance frequency is adjusted to agree with the mean or standard telephone frequency, generally about 800 or 900 cycles per second. The coils of receivers for wireless telephony in use with valve or crystal receiving sets are now always wound with a direct current resistance of about 4,000 ohms.

Fig. 83. Interior Construction of the resonance telephone receiver of S. G. Brown, showing the vibrating steel reed.

(*To be continued*)

The Transatlantic Transmitting Station 5 WS on View.

THE transmitting station 5 WS, erected by the Radio Society of Great Britain for the Transatlantic Tests, will no doubt be of particular interest to members of the Society, especially in view of the success reported on page 478 of this issue. It has therefore been decided to open the station to visitors who are members of the Society or of affiliated societies on January 8th, 9th and 10th, from 2 p.m. to 7.30 p.m. Between the hours of 6.30 p.m. and 7.30 p.m. on each of these three days it is hoped to show the station running.

The station is located at the Electric Power Station of the County of London Electric Supply Company at Wandsworth. A building to house the apparatus and the use of the site for the aerial has very kindly been loaned by the Company, and in this connection it is desired to take the opportunity of mentioning that in previous announcements the name of the Company has been incorrectly given. It is hoped that all who can do so will visit the station.

The site is not ar from Wandsworth Bridge and Wandsworth station, and the address of the power station is The Causeway, Wandsworth.

Readers are reminded that an experimental lecture on the Elementary Principles of Radio Telephony will be given by Mr. G. G. Blake, M.I.E.E., on January 12th, at 6.30 p.m., at the Institution of Electrical Engineers. This lecture has been specially arranged by the Radio Society of Great Britain for the benefit of Associates of the Society and others new to wireless. Tickets for admission may be obtained on application to the Hon. Secretary, 31, Quex Road, W. Hampstead, N.W.6.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Glasgow and District Radio Club.*

Hon. Secretary, Mr. W. Yuill, 93, Holm Street, Glasgow.

Membership is now well over 200. On November 16th Captain Norman Turner lectured on his army experiences.

Mr. McLennan, on November 30th, lectured on the "Elementary Principles of Wireless Communication." He treated the subject practically from the beginning in as simple terms as possible, and this was no doubt one of the most instructive lectures of the season.

On December 14th, Mr. A. F. Gray, another Vice-President, demonstrated a two-valve set which he had constructed.

The next meeting was on December 21st, and was an open night. As the matter of fading in connection with transmissions of telephony from the broadcast stations has been causing club members a considerable amount of trouble, six members had arranged to listen in specially to the full programme of Manchester broadcasting station on a particular night. These reports are being tabulated by Mr. Pick, of the Committee, who has kindly consented to open a discussion on this subject.

On January 11th, 1923, a lecture on "Grid Potentials" will be given by Mr. Pick.

Hackney and District Radio Society.*

Hon. Secretary, Mr. E. R. Walker, 48, Dagmar Road, E.9. (*Letters only.*)

On December 14th, at the Y.M.C.A., Mare Street, Hackney, the Vice-Chairman, Mr. Cunningham, presided. A very interesting discussion took place on radio subjects in general. The Secretary, Mr. Walker, invited questions and replied.

New members are joining. On January 1st, 1923, the new subscriptions came into force, as follows:—Senior members (18 years of age and over), 10s. per annum, entrance fee 5s.; junior members (under 18), 5s., entrance fee 2s. 6d. New members and visitors are always welcome, especially ladies.

"High Frequency Currents and Tesla Coils" was the title of lecture by Mr. A. Valins on December 21st. Experiments were carried out in darkness in order to show the best effect.

Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere Kent.

The evening of December 15th was devoted to a discussion, led by Mr. S. G. Meadows, on "The Difficulties Experienced by the Radio Amateur."

This being the first whole evening given to discussion, the Secretary acquainted the meeting with the rules governing discussions.

At 9.45 p.m. the Marconi concert was tuned-in. It was proposed to make discussions a regular feature, and to set aside one evening in each month for this purpose.

Durham City and District Wireless Club.*

Hon. Secretary, Mr. Geo. Barnard, 3, Sowerby Street, Sacriston, Durham.

There was a large and varied programme on December 15th. Mr. Geo. Barnard lectured on "Transmitters Using Valves." The Chairman, Mr. F. Sargent, F.R.A.S., then commenced the question period. A special three-valve circuit submitted by Mr. Chapelon was criticised. The arrangement was entirely new to all the members, and it has been decided to bring the circuit up again at some future meeting.

Apparatus brought by Mr. Clarke and Mr. Renney was inspected.

New members are welcome every Friday night at 7.30 p.m. in the Y.M.C.A., Claypath, Durham.

Smethwick Wireless Society.*

Hon. Secretary, Mr. R. H. Parker, F.C.S., Radio House, Wilson Road, Smethwick, Staffs.

A meeting on December 8th unanimously decided to hold a series of public demonstrations of telephony during the following week. Those responsible were accorded a hearty vote of thanks by the members at a meeting on December 15th.

The Society has purchased several books with a view to forming a library. Mr. C. M. Kay was appointed librarian.

On January 12th the Society opens with a general meeting.

The President, Mr. R. W. Hutchinson, M.Sc., A.M.I.E.E., F.R.G.S., F.G.I., will give his presidential address on January 19th. Also Mr. Harry Garrett, B.Sc. and Mr. J. Stoney, B.Sc., A.M.I.M.E., (Vice-Presidents), have promised to give lectures. There is an excellent syllabus arranged for the 1923 session.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

On December 6th, a short paper was given by Mr. G. W. Jones. This was a continuation of the previous week's meeting at which members gave five to ten-minute papers on any wireless subject.

Southend and District Radio Society.*

Hon. Secretary, Mr. A. L. When, 4, Wimborne Road, Southend-on-Sea.

A meeting was held at the Technical Institute on December 15th. A lecture was given by Mr. Percy Barnes on "Cathodic Bombardment." He demonstrated by means of X-ray apparatus. A lecture and demonstration on the Reinartz tuner with two valves note magnification was also given by Mr. F. A. Mayer.

It has been decided to alter the name of the Society from Southend and District Wireless Club to Southend and District Radio Society.

West London Wireless and Experimental Association.*

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

The third annual general meeting was held on December 5th.

The President, Mr. George Oxford, said that the membership had more than doubled its number since the last annual meeting. He thanked the Vice-President, Mr. F. E. Studt, for the very hard and instructive work he had done during the past session, and presented to him, on behalf of the Association, a case of pipes.

The Secretary gave a short outline of the work accomplished by the Association and its members during the past year.

The various reports having been received, the following appointments were made :—President, Mr. George Oxford ; Vice-Presidents, Mr. F. E. Studt and Mr. F. O. Read ; Hon. Secretary, Mr. H. W. Cotton ; Hon. Treasurer, Mr. A. Labram ; Instrument Steward, Mr. A. P. Dobson ; Librarians, Messrs. C. and R. Hillyer ; Committee, Messrs. J. F. Bruce, R. Cole, T. L. Mullings, L. Shepherd, W. T. Fair, and P. Harms. The following gentlemen were also elected as the Association's delegates to attend the meetings of the Radio Society of Great Britain :—Messrs. F. E. Studt, J. F. Bruce, L. Shepherd and A. P. Dobson. Alterations to rules were next proceeded with, the principal alteration being the reduction of the annual subscription to fifteen shillings.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

A meeting was held in the club-room, Randall-well Street, on December 15th. Mr. W. C. Ramshaw was in the chair. A demonstration on broadcasting apparatus was given by Messrs. Garlick and Robertshaw, Leeds and Bradford representatives of the Metropolitan Vickers Electrical Co., Ltd., respectively. The Manchester broadcasting station was tuned in and good signals obtained.

The next meeting on December 29th was the annual general meeting of the Society, when the election of officers and committee took place.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting on December 21st, the construction of the Tuner for the Society's multivalve receiver was proceeded with. A coil holder and a variable condenser was assembled and several inductance coils were wound.

A programme of lectures for next quarter has been arranged.

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

An Instructional Meeting was held on December 15th at the Grammar School. Mr. S. Kniveton, F.R. Met. Soc., lectured on "Construction of Condensers"—Fixed and Variable.

Announcements were made relating to transatlantic amateur communications ; five members had received broadcast and/or amateur transmissions up to date. In two cases reception was effected with single valve receivers.

Paddington Wireless and Scientific Society.

Hon. Secretary, Mr. L. Bland Flagg, 61, Burlington Road, Bayswater, W.2.

At the General Meeting held on December 14th, the President, Mr. A. G. Cook, M.A., A.M.I.E.E., took the chair.

A discussion took place as to the advisability of admitting into the Society experimenters and enthusiasts not already members of the Paddington Technical Institute. It was moved by Mr. A. Hoban and seconded by Mr. G. Turton that Rule 3 which refers to the admission of members, be altered and extended to cover this arrangement.

Mr. G. Turton informed the Meeting that whilst listening in for American amateurs he had, on three different occasions, heard very fair music and speech on a wavelength approximating that of **WJZ** between 1 a.m. and 3 a.m. but had been unable to get call signals. It was decided that the Society should confirm this as soon as possible.

A short lecture was given by the Hon. Secretary on the "Elwell Plug and Jack System."

Derby Wireless Club.

Hon. Secretary, Mr. R. Osborne, The Limes, Chellaston, Derby.

The Annual General Meeting was held on December 28th, at 35, St. Mary's Gate, Derby.

The following business was enacted : Officers for the New Year were elected, the Secretary's Report and Balance Sheet was presented ; arrangements were made for spring session ; affiliation with the Radio Society of Great Britain was discussed.

Dewsbury and District Wireless Society.

Hon. Secretary, Mr. F. Gomersall, 1, Ashworth Tce, Dewsbury.

The First Annual Meeting of the Dewsbury and District Wireless Society was held on December 7th. The President, Mr. S. S. Davies, gave a good report of the year's working. The Membership now totals over 60. Mr. S. S. Davies was re-elected President and Mr. J. T. Foggo was re-elected Vice-President. The Secretary, Mr. Horsfall, retired, and Mr. F. Gomersall, A.S.A.A., was elected in his stead. The new Treasurer is M. F. Dransfield, B.Sc.

A Coffee Supper was held on December 21st, in the Society's rooms in Church Street. During the evening the transmissions from Manchester Broadcasting Station were received.

Kingston and District Radio Society.

Hon. Secretary, Mr. J. C. C. Berry, 57, High Street, Hampton Wick, Middlesex.

Mr. F. P. Sexton (President) was in the chair on December 13th. It was decided that the making up of the club set be commenced the following week. Mr. J. Scheire kindly promised to supply the components of the first panel. The Chairman announced that, as previously arranged, Mr. R. C. Older would lecture on "The Selection of an Aerial System."

Prospective members are welcomed weekly at 45, Surbiton Road, Kingston.

Leeds Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. N. Whiteley, 8, Warrels Terrace, Bramley, Leeds.

On December 18th, Mr. R. Toynbee took the chair. Mr. N. Whiteley lectured on "Wireless in the Mercantile Marine." The lecture was illustrated by lantern slides.

A demonstration licence having been obtained, the lecture was followed by an exhibition and demonstration of apparatus.

Mr. G. Boocock was elected Chairman for the meeting on January 1st.

The Hon. Secretary will be glad to hear from anyone interested in the Society, but points out that intending members must already be members of the Y.M.C.A., or on joining the Wireless Society must become members of the Y.M.C.A.

Birmingham Experimental Wireless Club.

Hon. Secretary, Mr. A. Leslie Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

Mr. Dore lectured on "Primary Batteries"; this was particularly devoted to the Leclanche dry cells.

Redditch and District Radio Society.

Hon. Secretary, Mr. A. W. Reeves, M.I.M.E., The Elms, Alvechurch.

A public demonstration and exhibition was held in the Temperance Hall, Redditch, on December 13th, and proved a great success. The Rev. S. Maddock presided, and the demonstration was given by Mr. Reeves and Mr. Entwistle, both of the Western Electric Co. The Birmingham concert party gave an excellent programme from Witton. The meeting was overcrowded.

At the meeting on December 15th, several new members were elected. The next meeting was arranged for January 5th, 1923, when it was hoped to proceed with the series of lectures that had been unavoidably postponed.

It is hoped to give a further radio demonstration in January, the proceeds of which will be handed to the Unemployment Relief Fund.

Heckmondwike and District Wireless Society.

Hon. Secretary, Mr. P. Hanson, Longfield Road, Heckmondwike.

Mr. Denison, of Halifax, opened the session with a lecture on "Latest Developments in Wireless Telephony."

An exhibition held at the headquarters on November 10th and 11th proved very successful. An excellent display of apparatus was made by the sixteen exhibitors. Special transmissions of telephony were made by **2 AW**, **2 LA**, **2 KD**, **2 UZ** and **2 KQ**. A large number of people visited the exhibition, and the result shows a clear £24 10s.

A lecture and demonstration was given on November 21st by Mr. Liardet, of Bradford, who dealt with the subject of high frequency amplification.

Mr. Eskdale, of Bradford, visited the Society and lectured on "Wireless and Direction Finding as Applied to Aircraft," illustrated by lantern slides.

Maidstone and District Radio Society.

Hon. Secretary, Mr. H. T. Cogger, "Romleigh," Postley Road, Maidstone, Kent.

A general meeting was held at headquarters, The Pavilion, Athletic Ground, Maidstone, on December 15th, with the object of forming a radio society in the district. The number present was 21, and the meeting was very successful. Mr. F. Guy Monckton occupied the chair and the following officers were elected:—President, Mr. G. Foster Clark; Vice-Presidents, Lt.-Col. Winter, Major Craig, Messrs. J. N. Deakin, F. Guy Monckton, W. J. Sharp and W. A. Stevens; Chairman, Mr. F. Guy Monckton; Vice-Chairman, Mr. J. S. Welsh; Hon. Secretary, Mr. H. T. Cogger; Hon. Treasurer, Mr. E. Winterhalter; Committee, Messrs. S. B. Balcombe, P. T. Bishop, V. Lyle, W. J. Saveall, D. F. See and A. Styles.

Rules of the Society were read and adopted. Members' subscriptions were fixed at 10s. per annum and 2s. 6d. entrance fee. Associate Members' (under 16 years of age) subscription, 5s. and 2s. 6d. entrance fee.

It was decided to meet weekly on Tuesdays from 7 p.m. to 10 p.m. The first of such meetings to be held on January 9th, 1923.

Harrogate and District Radio Society.

Joint Hon. Secretaries, Mr. F. Pecks and Mr. J. L. Wood, Central Club Rooms, Beulah Street, Harrogate.

Meetings of this Society are held on Tuesday and Friday of each week at 8 p.m.

Several members are at present working on the Society's four-valve set, and hope to have it completed early in the New Year.

Pudsey and District Wireless Society.

Hon. Secretary, Mr. W. G. A. Daniels.

On December 14th last, in the club-room, a very considerable amount of business was transacted. It was decided that the Society should become affiliated with the Radio Society of Great Britain. Mr. Knapton moved to that effect and was seconded by Mr. Sheard; the motion was carried.

It was also proposed that the Society should have a receiving installation, and a subscription list was contributed to liberally.

In future the meetings will be held at the Mechanics' Institute, Robin Lane, Pudsey, on the first and third Mondays in the month.

Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Davy, 134, Inderwick Road, Hornsey, N.8.

A very successful meeting took place on December 11th; a fair proportion of the members attended.

Mr. H. Davy acted as chairman. Mr. Fleet demonstrated with a three-valve amplifier of his own construction. The reception of **2 LO, PCGG** and **2 WP** were enjoyed. A fair amount of howling from other amateurs in the district was noticeable; probably non-members of a Society, otherwise they would know better.

On December 15th Mr. H. Davy did not lecture on "Frame Aerials and Direction Finding."

It was decided that the next meeting be held on January 5th.

Civil Airship Wireless during 1921

DISCUSSION ON THE PAPER READ BEFORE THE RADIO SOCIETY OF GREAT BRITAIN BY LIEUT. DUNCAN SINCLAIR.*

The President.

Mr. Sinclair has given us an extremely interesting lecture, of the highest scientific value. I will just ask one or two questions which I should like cleared up. I would like to know how the errors are calculated; whether they calculate them on the airship, or at Croydon or Pulham. The error is very slight, but nevertheless means a distance of a great many miles. I should also like to ask whether there were many other observations taken between the times of those recorded in the paper, and if so, were they good observations, or had they errors?

This paper indicates clearly that good navigation has been effected in the air. I should like to ask if in the air you get night errors of 10, 20 or 30 degrees which are comparable to those on land. It is a very important point from a scientific point of view.

It looks also, from what Mr. Sinclair says, that you have a quadrantal error in transmission as well as in reception, but when it comes to an error of 2° maximum, can you attribute it to that? You might well have an error of two degrees without being a quadrantal error.

Mr. J. Scott-Taggart.

There are one or two points which interested me, and about which I would like to have a little further information if possible. I too wondered how Lieutenant Sinclair was able to determine the errors at different points along his flight. Of course, if he were over Paris he would know where he was—but on some of the flights, particularly the one over Cornwall and past the Channel Islands, there is only a very small proportion of the flight on which it would be possible to get accurate determinations of the position of the airship: and yet we find in his report detailed accounts of the errors at hours at which obviously the airship was over sea. Perhaps he can give us particulars of how he determined the accurate position, within one degree, of the airship. I would also like to ask whether the bearings were taken on telephony, tonic train, or C.W. On the longest range he informs us that telephony could not be heard, so I presume the bearings were taken on C.W., and owing to the difficulties which always attend the taking of bearings on continuous waves, I would like to know what precautions were taken, and what special apparatus, if any, was employed. I would also like to ask him whether he noticed any variation in the strength of signals over land and sea—whether he noticed the strength over the sea, and whether it remained appreciably the same over land.

Another point which occurred to me was the relative strength of signals during the night hours as compared with the ordinary daylight hours. I should imagine that the signals were considerably stronger at night.

In conclusion, I think that we should all be grateful to Mr. Sinclair for reading his paper tonight, because the chief thing which it does show is that navigation by D.F. methods is something essentially practicable.

Lieut. Duncan Sinclair.

Our President has raised some very important and quite natural points in connection with the paper, and so has Mr. Scott-Taggart. Let me run through them in the order in which they were asked. Firstly, how do we know what these errors were? How did we get at the errors? Were they calculated aboard? The answer is that they were calculated aboard, and they were done in two ways. Firstly, whenever circumstances permitted, the position of the ship was known to one of two navigating officers, or sometimes by both, from a direct observation of the point over which we were flying. That is a simple matter, I think you will agree. Then, the point upon which Mr. Scott-Taggart lays stress: How do we determine our errors over the water. These were determined by a consideration of the position as given to the Wireless Staff by the Navigating Staff, and when I say that we had two certificated and qualified aerial navigators aboard (one of whom was also a very excellent marine navigator), I think we need cast no aspersions upon the accuracy of the positions as they were given to me in the ship. Many other observations were taken on these flights, and I have purposely, in order to reduce the length of what would otherwise be a very long paper, missed out about two-thirds of the bearings, leaving only those which are comparatively simple to deal with. I may say, however, that those which I have missed out have not been missed out with any intention of slurring them over. They are all of a similar nature, and give us just similar results. There is one which shows an error of 18° actually, but I am inclined to think that that error is due to a personal error on the part of the man who took the bearing: in fact, that has afterwards been almost conclusively proved to be the case.

Then Admiral Sir Henry Jackson asks, are the night errors in the air of a nature of 20° or 30° comparable with those on the ground. Well, I think that although we do not get errors of such magnitude, yet our results generally speaking are of a very similar nature to those experienced by people working marine direction finding, as it is always bearing in mind that we have special conditions in the air with which to contend, and bearing in mind that we have work of almost a pioneer nature to do.

I think, relating to the fourth question, that our quadrantal error occurs both in transmission and in reception: but we must remember that there is a lot of work yet to be done on the airship programme itself.

* See pp. 436-442 of issue of Dec. 30th, 1922.

Now with regard to Mr. Scott-Taggart's question on bearings taken on radio-telephony, tonic train, or pure C.W. transmission. We never used it. The only transmissions which were made were telephony and C.W. In the case of the telephonic transmissions, broadly speaking our telephony transmissions ended at P in the chart (page 440, December 30th issue) or thereabouts, and at T or thereabouts in the case of the continental flight, and they were continuous in the case of the continental flight. However, a programme was laid down for these trips, which involved the taking of bearings both by radio-telephony and by continuous wave. Our programme was to work on radio-telephony normally. At certain hours we shifted the wavelength from 900 metres, upon which we were working the radio-telephony, to 1,400 metres, on which we worked C.W. Of these two types of transmission I personally have noticed no particular variations in the bearings taken. Perhaps, if we are ever privileged to have airships again in the air with which to carry on experiments as far as wireless is concerned, I may be able to answer that question at some later date. We must remember, I think, that in all these programmes we had to squeeze in our wireless work. The consideration firstly was to prove that the airship, apart from being an article of warfare, could be of definite commercial value, and though we did a considerable amount of wireless work, yet we had to squeeze it in with the ordinary routine which was being carried out.

There was no special apparatus employed. As far as I have noticed, there is not any marked difference in the signal strength over land and sea.

We had just ordinary wireless apparatus to use, and perhaps that is not sufficiently sensitive to answer the question whether the signals at night were stronger than those during the day, but as far as I know, I think they are slightly stronger at night.

The Radio Society of Great Britain

The 52nd Ordinary General Meeting of the Society was held on Wednesday, December 20th, at 6 p.m., at the Institution of Electrical Engineers. After the minutes of the previous meeting had been read and confirmed, the President said :—

Before calling on the lecturer to deliver his lecture this evening, there is some formal business.

I announced at the last meeting that Sir Henry Norman was going to be our President next year. He now much regrets he has had to cancel this arrangement, owing to the great pressure of political and other business which he has before him. The Chairman only received this information last evening.

The principal business is to re-elect the officers of the Society. You have before you a list of the Committee of the Society. No other names have been put forward, and I therefore take it that these members have your approval.

The next matter to consider is the balance sheet, and I will ask the Treasurer to make a brief statement on the subject.

Mr. L. F. Fogarty (Hon. Treasurer).

The account submitted herewith is in respect of the ninth year of the Society's activities.

I desire to remind members that the account takes the form of a Cash Statement, and therefore indicates the actual income and the total of the expenditure items for the period under review.

It will be observed that the most important item is that for printing and distributing the Journal. With a view to greater economy the Committee has given special attention to this point and has decided that the Journal shall be published half yearly in future, a change from which considerable saving is expected.

The account shows that the expenditure exceeded income by £34 1s. 4d., and in consequence the balance carried forward this year is less than in the previous accounting period.

In view of the extended work which the Society is now called upon to perform I am of the opinion that it is very desirable that the income should exceed expenditure by a reasonable amount, in order to provide for any emergency that may arise.

Members can facilitate the Committee's work in this direction by paying subscriptions promptly and as early in the year as possible, for if every member and affiliated Society will make a point of so doing, the Committee will be able to meet the present expenditure out of income, and perhaps at the same time carry over a small surplus to reserve.

Members can assist in consolidating the financial position by introducing new members whenever possible.

CASH STATEMENT.

For Year ending October, 1922.

Dr.	£	*s.*	*d.*
To Balance brought forward, October, 1921	213	0	7
.. Subscriptions	407	18	8
.. Suspense Account	1	8	6
	£622	7	9

Cr.	£	*s.*	*d.*
By Printing and Distribution of Journal	228	6	3
.. Printing List of Members and Book of Rules	13	15	0
,, Hire of Lecture Hall and Refreshments at Meetings	63	10	1
.. Printing and Stationery	33	10	6
,, Furniture Storage, Rent and Removal	16	9	0
,, Postages and Clerical Assistance	79	0	11
.. Purchase of Filing Cabinets ..	5	19	7
,, Sundries, Cheque Books, Rubber Stamp, etc.	1	8	8
	442	0	0
Balance in Bank	180	7	9
	£622	7	9

The item shown under Suspense Account represents money paid into the Society's bank account and for which receipts had not been written at the date when the books were closed for audit.

I should like to take this opportunity of thanking Mr. John Ockleshaw, F.C.A., for auditing the accounts, and for help in the preparation of the Statement. As honorary auditor, Mr. Ockleshaw has performed this responsible task since the formation of the Society in 1913.

After the cash statement had been duly approved by the meeting a vote of thanks was accorded to Mr. John Ockleshaw for his services as Honorary Auditor.

Mr. F. Hope-Jones.

There is one other pleasant duty at the end of each financial year, and that is to thank our most hospitable hosts, the Institution of Electrical Engineers, for so kindly granting us the use of this excellent lecture hall. They have always been good friends to this Society, and I believe we should have met here continuously since the Society was formed had the Government not commandeered the building during the war. I have great pleasure in proposing a vote of thanks to the Institution of Electrical Engineers for their kindness in granting us the use of this hall. (Applause.)

The President.

I will now ask Mr. Duncan Sinclair to give us his lecture on "Civil Airship Wireless in 1921."

(For a full report of the lecture, see pages 436 to 442 of December 30th issue, and for report of discussion, see page 476 of this issue.)

At the conclusion of the discussion the President announced that the following had been elected to membership of the Society :—

Members.—Bernard J. Littledale, Jack Louis Goldsman, Oswald Western, Wm. Edward Allen, Rowland Ed. Baldry, Thos. Dixon Ridley, John Stanley Rowe, Josiah Alexandre, A. G. Seaman, Rowland William Leader, Percival Alphonse Ward, Wm. Robert Gough, Eric Ashwell Rogers, Charles E. A. Hall, Capt. Simon Orde, Harold Annison, Vivian Ernest Thomas Swain, John Augustine Elliott, Capt. Ian Fraser.

Associate Members.—Robert Henry Herbert, Patrick Edwin Alexandre.

It was also announced that the following Societies had been accepted for affiliation :—

The Maidenhead and District Wireless Society, North Lincs Wireless Society, Ackworth School Wireless Society, Falkirk and District Radio Society, The Oxford and District Amateur Radio Society, Colwyn Bay Llandudno and District Radio Association, Blackburn and District Radio and Scientific Society, The Port Talbot Amateur Radio Society, The Newton-on-Ayr Wireless Society.

Continuing the **President** said :—

I think you would like to know that a great many American stations are being received in England.

A wireless message has also been received by Mr. R. H. Ridley from an American station conveying this message : "Merry Christmas, happy New Year, and good luck to you in your tests."

A lecture of an elementary nature will be given here by Mr. G. G. Blake, at 6.30 p.m., on January 12th. It is for Associates and those who do not profess to have any great wireless knowledge, but all are invited—not necessarily only those who are members of this Society, but all who are interested in broadcasting.

Tickets without charge will be issued by the Honorary Secretary to anyone desirous of attending.

The next meeting will be on the fourth Wednesday in January—the Annual Conference in the afternoon, and a Presidential address, we hope, in the evening.

The meeting adjourned at 7.40 p.m.

The Transatlantic Tests

CONGRATULATIONS ON SUCCESS OF BRITISH AMATEUR TRANSMITTERS.

In connection with the Transatlantic Tests of which particulars have already been given in this publication, the following wireless message has been received by Mr. P. R. Coursey, who has organised the tests on this side, from Mr. F. H. Schnell, the Traffic Manager of the American Radio Relay League :

PLEASE ACCEPT HEARTY CONGRATULATIONS OF AMERICAN AND CANADIAN AMATEURS ON WONDERFUL SUCCESS BRITISH AMATEURS PERFECT SCORE OF RECEPTION DURING TEN NIGHTS SCHNELL.

A detailed report of these receptions will be published in these pages as soon as it is possible to summarise the results of competitors from the very large amount of matter available.

At the same time it is hoped to publish a report of the receptions of American Broadcast Telephony transmissions. An enormous number of such reports have been received, and whilst the majority relate to the reception of WJZ, a number of other stations are represented.

Notes

Dr. W. H. Eccles to be President of the Radio Society of Great Britain.

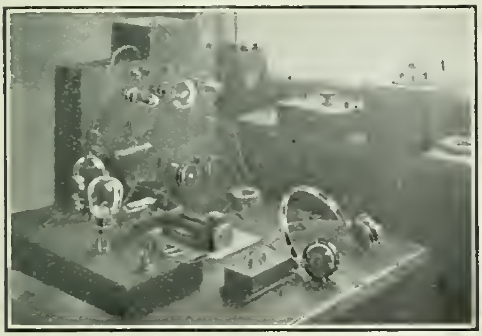
Dr. W. H. Eccles, A.R.C.S., M.I.E.E., has accepted the Presidency of the Radio Society in succession to Admiral of the Fleet Sir Henry B. Jackson, who retired from that office at the conclusion of 1922. Dr. Eccles was previously for many years a Vice-President of the Society, and has been Chairman of the Wireless Section of the Institution of Electrical Engineers.

Birmingham Broadcasting Station New Call Sign.

The new call sign of the Birmingham broadcasting station is **5 IT**.

Club at King's Norton.

Messrs. Morris and Smith, 5, Kingsley Road, King's Norton, Birmingham, intend commencing a wireless club in their district. Application for membership should be addressed directly to them.



The above set, belonging to Mr. N. Hendry of Newcastle-on-Tyne, consists of 2 H.F., 1 Detector, 3 L.F. valves, with switches for cutting out valves to desired degree of amplification. Mr. Hendry gets **WII, WQK, WCI** *and* **NSS.**

Proposed "Feltham, Ashford and District Radio Club."

Persons interested in the formation of a Club in the Feltham and Ashford district are invited to communicate with Mr. Nettleton. "St. Albans," Feltham, Middlesex, or with Mr. H. G. Moss, 48, High Street, Feltham.

Campaign Against Oscillating Valves.

The method adopted by the Halifax Wireless Club of helping to minimise the nuisance caused by amateurs who allow oscillating valves to interfere with other people's reception is education. A small book has been prepared, which may be obtained for the sum of sixpence, in which a selection of diagrams is given, together with practical suggestions.

Broadcasting a Prize Fight.

In the article by Mr. Sleeper in our issue of September 9th, 1922, the broadcasting in the United States of a prize fight between Dempsey and Carpentier was referred to. It was stated that the arrangements had been carried out by the Westinghouse Company. Our American contemporary, *The Wireless Age*, advises us that the arrangements were carried out on that occasion by *The Wireless Age* and the Radio Corporation of America.

Apparatus for French Schooners.

It is reported that 200 French fishing schooners are to be equipped with radio apparatus ranging from ¼ to 1 kW. capacity.

New Company in Belgium.

La Société Belge Radio-Electrique has been formed in Brussels with a capital of four million francs. This new Company is associated with several well-known concerns, including Marconi's Wireless Telegraph Company, Ltd., and La Compagnie Générale de Télégraphie Sans Fil.

President of the Radio Corporation of America.

The new President of the Radio Corporation of America is Major-General J. G. Harbord. He succeeds Mr. E. J. Nally, who was recently appointed Managing Director of International relations, with headquarters in Paris.

Removal.

We are advised that owing to a considerable increase in business Messrs. Radio Components, Ltd., have moved to larger and more commodious premises at 19, Rathbone Place, Oxford Street, W.1, to which address all further enquiries should be sent.

Dimensions of Mica Dielectric Condensers.

The following table was compiled by Mr. Burdis, a member of the Newcastle and District Amateur Wireless Association, and included in a paper which he read before that Association. It shows the necessary data in a most convenient form, and should prove of great value to experimenters who constantly wish to make up fixed condensers to a given value. It should be borne in mind that the values are based on the use of best ruby mica as the dielectric.

DIELECTRIC.—MICA 0·002″.

No. of Plates	Sizes of Plates. Cms.			
	2×1	3×1	4×1	4×2
2	·0002	·0003	·0004	·0008
3	·0004	·0006	·0008	·0016
4	·0006	·0009	·0012	·0024
5	·0008	·0012	·0016	·0032
6	·001	·0015	·0018	·004
7	·0012	·0018	·0024	·0048
8	·0014	·0021	·0028	·0056
9	·0016	·0024	·0032	·0064
10	·0018	·0027	·0036	·0072
11	·002	·003	·004	·008
12	·0022	·0033	·0044	·0088

Half the thickness of mica doubles the capacity, and *vice versa*.

Calendar of Current Events

Friday, January 5th.

Edinburgh and District Radio Society.
Lecture on "Capacity and Inductance," by Prof. F. G. Baily, M.A.

Leeds and District Amateur Wireless Society.
General Meeting. Lecture on "Transmission of Photographs by Wireless," by Mr. T. Brown Thomson.

Sheffield and District Wireless Society.
At 7.30 p.m. Lecture on "Design and Construction of an Amateur Receiving Station," by Mr. Brindley.

Sunday, January 7th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, January 8th.

9.20-10.20 p.m. Dutch Concert, **PCGG**, The Hague, on, 1,050 metres.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Lecture on "Wireless in Camp," by Mr. C. H. Brace.

Wireless Society of Hull and District.
At 7.30 p.m. At Signal Corps H.Q., Park Street. Lecture on "The Construction of Fixed and Variable Condensers," by Mr. G. H. Strong (President).

Tuesday, January 9th.

Transmission of Telephony at 8 p.m., on 400 metres, by 2MT, Writtle.

Wednesday, January 10th.

Malvern Wireless Society.
Lecture on "Transformer Coupling and Tuned Anode."

Halifax Wireless Club.
Lecture on "A.C. Circuits, Motors and Switchgear," by Mr. M. F. Farrar.

Edinburgh and District Radio Society.
At 8 p.m. At R.S.S.A. Hall. Business Meeting. Lecture on "Multiplex Telegraphy," by Mr. W. P. Morris.

Thursday January 11th.

At 9.20-10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Edinburgh and District Radio Society.
Visit to *Scotsman* Building. Conducted by Mr. W. P. Morris.

Glasgow and District Radio Club.
Lecture on "Grid Potentials," by Mr. Pick.

Ilford and District Radio Society.
Lecture on "Elementary Electrostatics," by Mr. F. C. Grover.

Oldham Lyceum Wireless Society.
Lecture on "Amplification with reference to High Frequency," by Mr. J. R. Halliwell, of Manchester.

Dewsbury and District Wireless Society.
Lecture by Mr. Denison of Halifax.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School. Lecture by Mr. S. Moody, A.M.I.E.E.

Friday, January 12th.

Sheffield and District Wireless Society.
At 7.30 p.m. Elementary Class.

Leeds and District Amateur Wireless Society.
Lecture on "Some Apparatus Used in Telegraphy," by Mr. R. E. Timms (Hon. Treasurer).

Belvedere and District Radio and Scientific Society.
Lecture on "Construction of H.F. Amplifier," by Mr. S. Burman.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—We have been hearing a good deal lately about the reception of wireless signals from transmitting stations a great distance off.

In this connection I have been making a few experiments, except that, in my case, I have reduced the size of the frame coil which is used as an aerial, and the following result may be of interest.

The Birmingham Broadcasting Station speech was received on a frame aerial $2\frac{3}{4}$ ins. diameter; it was in fact the "B" coil of Messrs. Gambrell's "Efficiency Coils."

This with a 1-jar condenser in parallel formed the primary circuit, this was coupled to a secondary circuit comprised of Gambrell "C" Coil, and a 1-jar condenser in parallel.

No H.F. valves were in use. One rectifying valve and two note magnifying valves only.

The speech received was very clear and every word could be understood. It was of course not very loud—strength 6 on the usual scale of Morse signal strength.

Yours truly,
N. H. Hamilton.

5, Cranley Gardens, London, S.W.7.
December 13th, 1922.

To the Editor of The Wireless World and Radio Review.

Sir,—We notice in the issue of your journal dated 16th inst., you state that the wireless operators employed by this Company are graded as officers, and that a senior operator ranks with a second officer. We would point out that wireless operators in this Company's vessels are members of the Company's staff and are therefore accorded treatment and status similar to that of other of our officials. This does not necessarily make them officers.

With regard to the uniform, we would mention that we have a system of grading and that each grade has its own distinguishing marks. Operators are posted to vessels by grades—the grade of operators so posted being dependent upon the class to which a vessel belongs. It does not therefore follow that a first operator will wear two gold bands.

In view of the fact that your journal is read by the majority of wireless operators, we shall be glad if you will kindly publish the above in order that misunderstandings will not arise.

Yours faithfully,
The Cunard Steam Ship Company, Ltd.,
H. L. Serjeant,
Wireless Superintendent.

Cunard Building, Liverpool.
December 18th, 1922.

Book Received

The Practical Engineer Electrical Pocket Book and Diary, 1923 edition. (London: *Oxford Technical Publications*, 1 and 2, Bedford Street, W.C.2. Price, cloth, 2s. 6d. net. Pluvinsin, 3s. net.

The Paris "Radiola" Concerts.

THE accompanying photograph (Fig. 1) shows the apparatus used for the transmissions of the Paris "Radiola" Concerts.

The first Radiola Concert transmission took place on November 6th, from the offices of the Société Française Radio-electrique, at 79, Boulevard Haussmann, Paris. The studio of this station is located in a room which has the walls specially draped in order to keep out external noises.

The actual location of the transmitter is on the banks of the Seine, near the towns of Neuilly and Levallois-Perret. The wavelength of the transmissions is 1,565 metres, and the power 2 kilowatts in the aerial.

The transmitting apparatus which is shown in Fig. 1 comprises three metal cabinets of similar appearance. From left to right these cabinets contain (1) modulating valves; (2) the rectifying valves for transforming into continuous current the alternating current with which they are fed; (3) the oscillator valves producing the high frequency current. The fourth cabinet which is shown on the right contains the inductances for controlling the wavelength of the aerial. The aerial consists of five wires supported by the two metal towers of 65 metres each shown in Fig. 2, but at the time this photograph was taken, the present aerial had not been erected.

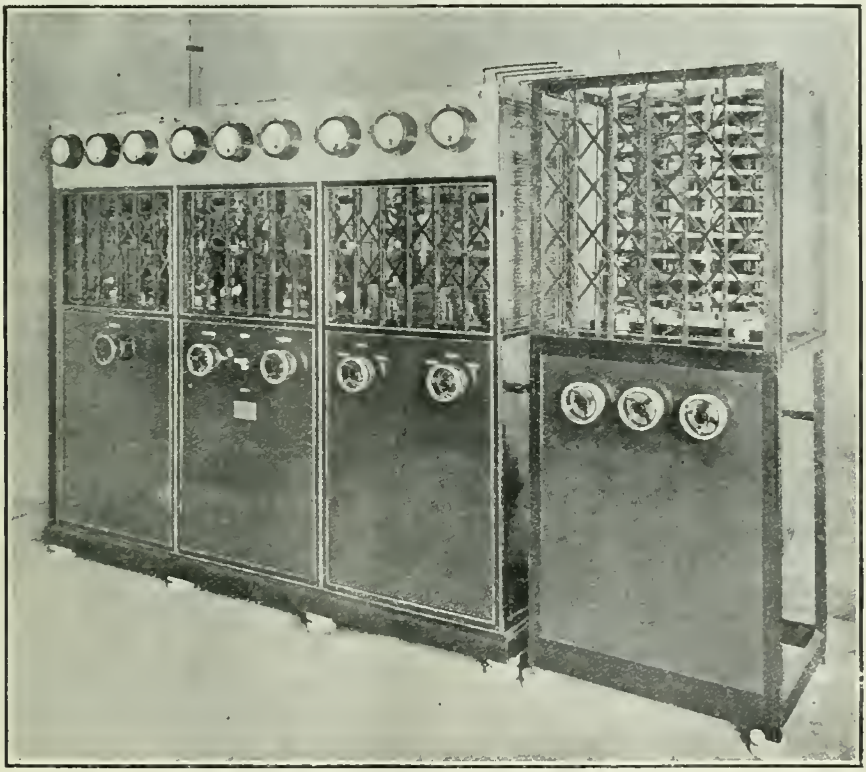


Fig. 1. The valve telephony transmitter of the "Radiola" Concerts.

The lead-in is taken from the further mast and is led down to the building in which the transmitter is installed.

The concerts take place daily from 8.45 to 10 p.m., and are contributed to by many of the most celebrated French artistes.

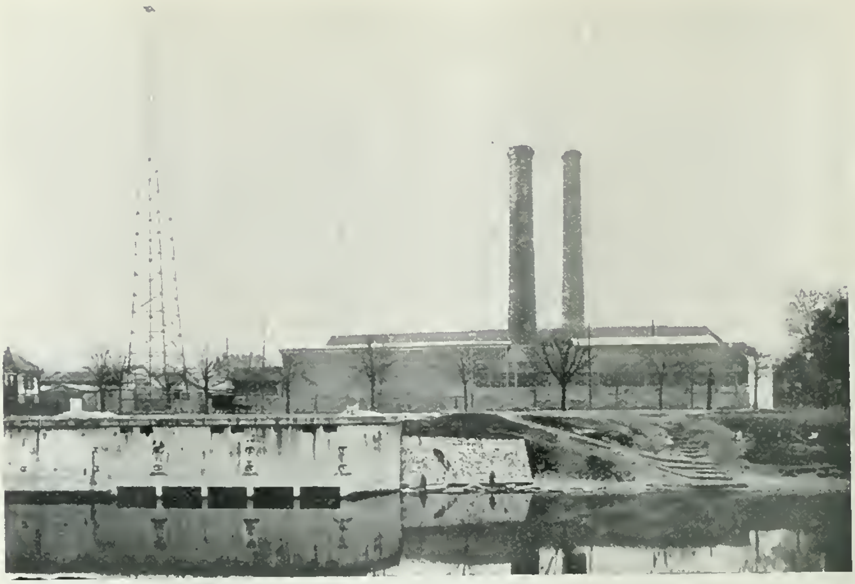


Fig. 2. The Masts supporting the Aerial of the "Radiola" Concerts Transmitter at Levallois.

Post Office Statement on Broadcasting.

The following is the text of a statement issued on December 21st from the General Post Office:—

From representations which have reached the Postmaster-General it appears that the conditions under which wireless receiving apparatus is licensed in connection with the broadcasting scheme are not fully understood.

As indicated in the broadcast receiving licence (which is now obtainable at any Head or Branch Post Office) apparatus used under this licence must bear the trade mark of the British Broadcasting Company.

This Company is an association of wireless manufacturers who have combined to erect stations for broadcast transmission under a licence from the Postmaster-General extending for a period of two years, during which they have undertaken to maintain regular and satisfactory programmes of music and other matter. Membership of the Company is open to any bona fide British manufacturer of wireless apparatus upon the purchase of at least one £1 share in the Company, and the lodging of a deposit of £50 as security for the proper performance of the conditions of membership. One of these conditions is the payment to the Company of a moderate royalty on sets of apparatus sold by the manufacturer to the public, as a contribution towards the expense involved in the erection and maintenance of suitable transmitting stations and the maintenance of regular programmes.

In view of these arrangements, which have been formulated both in the interests of the users of the receiving apparatus and of British manufacturers generally, the Postmaster-General has agreed that sets used under the broadcast licences shall be limited to types submitted for approval by members of the Company, and that for a period of two years apparatus made only in this country shall be sold by them, with the exception of certain parts which, for the present, are confined to batteries, accumulators and outside aerial equipment.

The trade mark of the Broadcasting Company indicates that the apparatus is of a type approved by the Post Office as conforming to the technical requirements necessary to prevent interference. This approval does not, however, imply a guarantee of the efficiency or workmanship of any particular set.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12 13, *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"B.G.D." (East Ham) *submits a sample of wire, and asks* (1) *Whether it is suitable for the secondary of a telephone transformer.* (2) *For particulars of the primary winding.*

(1) The sample of wire submitted is No. 38 D.S.C., and could be used as the secondary winding. (2) The primary winding may consist of 10,000 turns of No. 44 S.S.C. copper wire, and is wound on first.

"F.A.M." (Coventry) *submits a diagram, and asks* (1) *For criticism.* (2) *Is the tuned anode method of H.F. coupling efficient when receiving long wavelengths.* (3) *Which is the best of the proposed arrangements.*

(3) The resistance capacity method of coupling H.F. valves is quite suitable when receiving on wavelengths over 2,000 metres, and requires no adjustments, but the tuned H.F. transformer method will probably give louder signals if the additional adjustments are not objected to.

"JAYPEE" (Lancs.) *asks* (1) *Whether he will be granted a broadcast licence, having constructed his own set, or whether he can have his set marked B.B.C.* (2) *How many plates of a particular pattern are required to give a variable condenser of maximum value* 0·001 *mfds. and* 0·0005 *mfds.*

(1) A person wishing to use apparatus which he has constructed himself is regarded by the Post Office as an experimenter, though if the aim of the individual is not to have any serious interest in the technicalities of the science, he is compelled by the Postmaster General to purchase made-up apparatus, owing to his non-acquaintance with the subject, in order that he may not cause interference by the use of an incorrectly designed receiver. (2) The 0·001 mfds. condenser will require a total of 63 plates, and the 0·0005 condenser should have 33.

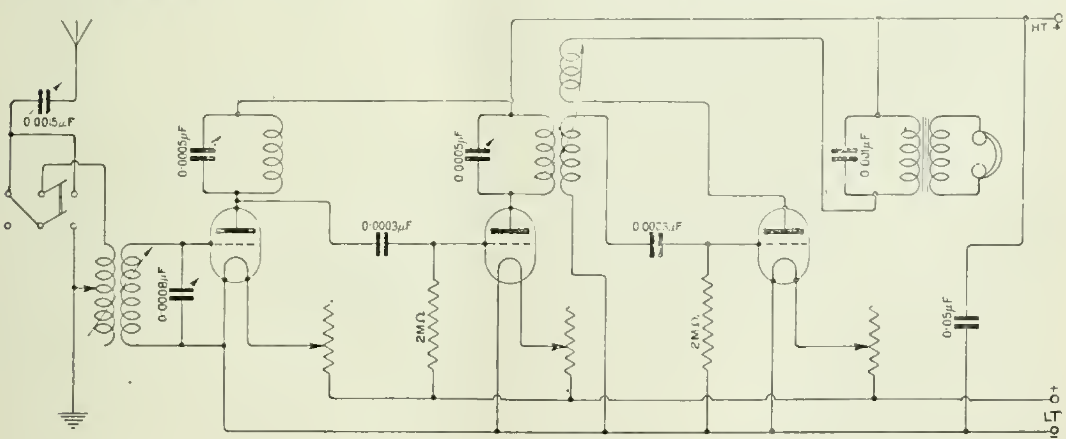


Fig. 1.

(1) The single valve circuit is correct, but the three-valve circuit contains several errors. See Fig. 1. Suitable values are indicated in the figure. (2) The tuned anode method of H.F. coupling is quite efficient over the whole wavelength range, provided suitable values of coil and condenser are used. When receiving long wavelength signals the anode tuning condenser may have maximum value of 0·0005 mfds. without loss of signal strength.

"ULTRA FIXED" (Rugby) *asks* (1) *For a diagram of a choke control for a telephony transmitter.* (2) *The windings for the telephone transmitter described in the issue of June 3rd.* (3) *How to use reaction in such a manner that oscillating energy will not be transferred to the aerial.*

(1) See Fig. 2. The aerial coil may have 40 turns of No. 8 copper wire wound to fill a former 7″ in diameter and 12″ long. The closed coil may be 30 turns of No. 12 copper wire on a former 5″ in

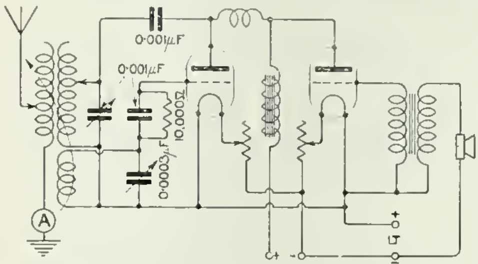


Fig. 2.

diameter and 10″ long. The condenser should be oil insulated, and have a maximum capacity of about 0.001 mfds. The grid coupling coil may consist of a winding of No. 22 D.C.C. on a former 3½″ in diameter and 2″ long. (2) The windings given are for about 1,000 metres. We suggest you halve the number of turns in the windings. (3) The reaction coil could be coupled with the anode coil of the first valve as described in a recent issue of this journal.

"J.S." (E.C.).—It is quite possible to light the filaments of your receiving valves from the alternating current supply mains using a "step-down" transformer, but we consider you would have an objectional hum in the receivers. As an alternative you could purchase a rectifying apparatus, which however is rather expensive, and would probably cost more than you are prepared to spend. We think probably the most satisfactory arrangement would be the purchase of a set of accumulators possessing a larger ampere hour capacity. We suggest the use of a 60 actual ampere hour capacity accumulator. The cost will then be much less than that of the alternating current supply arrangement, and the results would be far more satisfactory.

"G.J." (Highgate) *asks which of several diagrams is best for his purpose.*

We consider the diagram Fig. 4, on page 36, is the most useful for your purpose. The H.F. valve is coupled to the detector valve by means of a tuned transformer, and the anode of the second valve contains a tuned anode coil. This arrangement will work very well provided suitable values of components are used in the set. The proposed winding for the H.F. transformer is suitable, but that for the L.F. transformer is not quite satisfactory. The primary winding should consist of 10,000 turns of No. 34 S.S.C. wire, and the secondary should consist of 15,000 turns of No. 46 S.S.C. wire.

"G.A.W." (W.1.) *asks for a diagram of a 2-valve receiver.*

A suitable diagram of a two-valve set is given on page 217, November 11th issue. A switch may be connected in the aerial circuit for connecting the aerial tuning condenser and aerial tuning inductance in series or parallel. It is better to have them in series when receiving short wavelengths. The first valve is coupled with the second valve by means of a tuned anode condenser and leak. In the anode circuit of the second valve is a reaction coil and telephone transformer. The reaction coil is coupled with the tuned anode coil. Using this method of reaction, it is not possible to easily set up oscillations in the aerial circuit. Very good results are possible from a set of this description.

"R.G." (Antwerp) *asks for constructional details of L.F. intervalve and telephone transformers.*

We would refer you to the constructional article which appeared in the issue of August 19th. The wire used is No. 46 S.S.C., which has a diameter of 0.0610 mm. The telephone transformer may have a secondary winding of No. 36 S.S.C. (diameter = 0·1930 mm.) and should fill up the whole winding space.

"NIB" (Liverpool) *asks* (1) *The sizes and material of samples of wire submitted.* (2) *The resistance of an "Ora" valve.* (3) *For a circuit using crystal rectifier and two valves.* (4) *The range of the set.*

(1) Sample 1 is No. 30 S.W.G. copper wire enamel covered.
,, 2 ,, No. 38 ,, ,, ,, ,,
,, 3 ,, No. 31 ,, ,, ,, ,,
,, 4 ,, No. 30 ,, copper wire D.S.C.

(2) The anode filament impedance depends upon

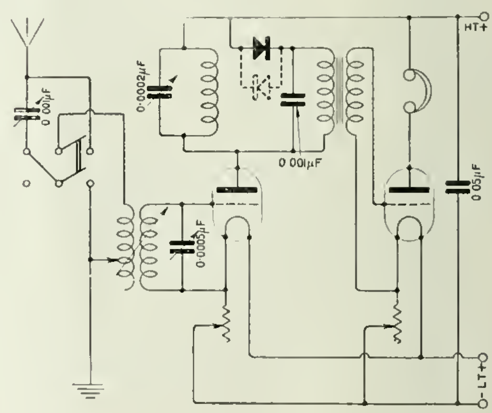


Fig. 3.

the filament emission and plate and grid potentials, and therefore varies greatly while in use. An average value is 45,000 ohms. (3) See Fig. 3. The tuned anode method of H.F. amplification is used, and the potentials are passed on by the crystal through the L.F. transformer. (4) You will hear local amateur transmissions, ship stations, high power transmitting stations, and broadcast telephony.

"**ROGO**" **(Eccles)** *has a 4″ former wound with No. 22 D.C.C., and asks* (1) *What wavelengths are covered, using a 0·0005 mfds. tuning condenser.* (2) *The size of a suitable reaction coil.* (3) *Whether the circuit on page 615, August 12th issue, is suitable for broadcast reception.*

(1) Tap at	10th turn	80 to	220 metres.
	20th ,,	130 ,,	400 ,,
	30th ,,	210 ,,	550 ,,
	40th ,,	250 ,,	670 ,,
	50th ,,	300 ,,	800 ,,
	100th ,,	350 ,,	1,250 ,,
	150th ,,	400 ,,	1,600 ,,

(2) A suitable reaction coil would be a winding of 80 turns of No. 28 D.C.C. on a former 3″ diameter with 3 tappings. (3) The circuit referred to is suitable for this purpose.

"**L.W.**" **(Brighton)** *submits a wiring diagram and asks* (1) *For a theoretical diagram.* (2) *and* (3) *Whether the Post Office will allow him to use this circuit.*

(1) See Fig. 2. (2) The use of a circuit which may cause oscillations to be set up in the aerial circuit is not permitted by the regulations.

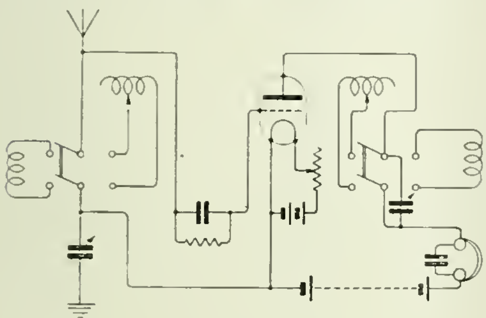


Fig. 2.

"**E.D.**" **(Sheffield)** *asks* (1) *The inductance of certain honeycomb coils.* (2) *How to use the coils.* (3) *The capacity of fixed condensers, particulars of which are submitted.* (4) *The issues in which appeared descriptions of H.F. and L.F. transformers.*

(1) Unfortunately you have not given us the essential dimensions of the coils in question, and we cannot therefore calculate their inductance values. We would refer you to the reply given to "**H.W.C.M.**" **(Clapham)**, page 252, November 18th issue. (2) The reaction coil should be the smallest, the aerial coil of the intermediate size, and the closed circuit coil the largest. (3)

The capacity of (1) = 0·00018 mfd.
,, ,, ,, (2) = 0·0005 mfd.
,, ,, ,, (3) = 0·0015 mfd.

Condenser (2) would be suitable for use as a grid condenser. (4) The issues are: August 19th, September 2nd, September 16th and September 30th.

"**J.B.C.**" **(London, W.C.2)** *asks for a design of a H.F. transformer.*

A H.F. transformer suitable for your purpose is described in the issue of September 23rd, page 828. Full constructional particulars are given in this article, and you should experience no difficulty in the construction of the transformer.

"**POWER**" **(Ireland)** *asks* (1) *Whether the circuit given on page 880, September 30th issue, is suitable.* (2) *Whether good telephony reception should be possible from London, Paris and The Hague.* (3) *Whether a three-coil holder is suitable for mounting the H.F. transformer and reaction coil.* (4) *For particulars of the construction of the L.F. intervalve transformer.*

(1) This circuit is quite suitable for your purpose, but we recommend the reaction coil be coupled with the secondary winding of the H.F. transformer. (2) You should hear transmissions from the stations mentioned without any great difficulty. (3) A three-coil holder is very suitable for the purpose. The centre coil should be the secondary winding of the H.F. transformer and the reaction coil an outside coil. The primary and secondary coils should have approximately an equal number of turns, although sometimes it is possible to utilise a few per cent. more turns in the secondary winding. (4) The design for a L.F. transformer was dealt with in the issue of August 19th, page 659. Briefly, the core consists of iron wire, and is 9½″ long by 7/18″ diameter. The cheeks are 7/16″ thick and 2″ diameter, and are mounted 2″ apart. The primary winding of No. 46 S.S.C. is wound on until the diameter is 13/16″ and the secondary winding is put on over this until the diameter is 1¾″. A total of 5 ozs. of No. 46 S.S.C. copper wire is used, and the turn ratio nearly 1 : 2.

"**E.A.W.**" **(France)** *asks* (1) *Whether the diagram given on page 840, September 23rd issue, is suitable for receiving the Dutch Concerts.* (2) *Whether a tuning condenser is required in the aerial circuit.* (3) *The size of coils suitable for receiving British broadcasting.*

(1) The circuit referred to is suitable, but we suggest you use an aerial and closed circuit. (2) It will be better to use a 0·001 mfd. variable condenser in the aerial circuit, and a 0·0005 mfds. tuning condenser in the closed circuit. (3) The aerial coil could consist of a winding of No. 22 D.C.C. on a former 4″ diameter and 4″ long with 10 tappings, and the closed circuit coil will be a winding of No. 26 D.C.C. 3″ diameter and 4″ long.

"**W.S.F.**" **(Staffs.)** *holds an experimental licence and asks whether he must modify his single valve set, which at present uses reaction coupled to the aerial circuit.*

The use of a receiver of this type during broadcasting is permitted, provided the user holds an experimenter's licence, it being a condition that the holder shall not allow his receiver to set up oscillations in the aerial circuit. We suggest you abandon the reaction arrangement, or reconstruct the set according to information which may be obtained from several recent issues.

"**K.B.**" **(Hucknall)** *asks* (1) *How many turns to wind on an iron core to give about 1 henry of inductance.* (2) *Dimensions of a coil with inductance of 5 millihenries.* (3) *The gauge of wire to use in 1,250 and 1,500 turns duolateral coils.* (4) *How to make a resistance of 12,000 ohms*

(1) We suggest 3,000 turns of No. 38 D.S.C. copper wire. (2) The coil could be a winding of No. 32 S.S.C., 5″ long and 3″ diameter. (3) We suggest No. 28 D.C.C. (4) The resistance could conveniently be made of a coil containing 500 yards of No. 38 Eureka wire.

"PUZZLED" (Evesham) *submits particulars of his set and asks* (1) *Does this set conform with the Post Office regulations.* (2) *Is the H.F. transformer suitable for all wavelengths.* (3) *Why speech is not clear.* (4) *Whether* **PCGG** *should be heard.*

(1) If you hold an experimenter's licence, the circuit is suitable. The fact of holding an experimental licence indicates that the Post Office consider you to possess a sufficient knowledge of wireless to handle the reaction in such a manner that interference is not caused. (2) One H.F. transformer, unless tapped, will not be suitable for all wavelengths. Unfortunately you do not give particulars of the H.F. transformer in use, therefore we cannot estimate the wavelength range over which it could be used. (3) Speech is not clear, probably because of bad adjustments. (4) You may hear this station when the set is properly adjusted.

"CYMRU" (Swansea) *asks for a diagram of a four-valve set, with the values of the condensers.*

See Fig. 3. The values of condensers are marked. With a set of this description you should be able to amplify signals sufficiently to operate a loud speaker. The reason you are unable to tune below 600 metres is because the tuning coils are too large, or the tuning condenser is in parallel. You should try connecting the tuning condenser in series, and if you cannot reduce the wavelengths sufficiently, use a smaller coil.

"W.H.P." (Manchester) *asks* (1) *The dimensions of circuit condensers having capacities* 0·01 *mfds.,* 0·001 *mfds., and* 0·0002 *mfds.* (2) *Which is better, H.R. telephones, or a telephone transformer and L.R. telephones.* (3) *Where to purchase clips to hold "V24" valves.*

(1) Assuming the thickness of the mica is 0·005 cms. (22 mils)

0·01 = 15 foils, overlap = 4 × 2 cms.
0·001 = 7 ,, ,, = 2 × 1 ,,
0·0002 = 2 ,, ,, = 2 × 1 ,,

(2) It is better to use a telephone transformer and L.R. telephones when connection is desired to a valve set. (3) Clips can be purchased from wireless dealers.

"P.S.B." (Walsall) *submits a diagram of his set and asks* (1) *For a diagram showing another H.F. valve connected.* (2) *Details of winding for H.F. transformer.* (3) *Number of turns to wind in coils.* (4) *Whether samples of wire submitted are suitable.*

(1) See Fig. 1, page 249, November 18th issue. (2) We suggest you make the transformer exactly as described in the issues of September 2nd and 16th. (3) and (4) The samples of wire submitted are (1) No. 28 D.S.C. copper, and (2) No. 38 D.S.C. copper. Using the No. 28 D.S.C., wind coils ½″ wide of 30, 50, 70 and 100 turns on a former 2½″ diameter.

"RADIO" (Southport) *asks* (1) *The dimensions of a coil for broadcasting.* (2) *Why he hears C.W. stations with no earth connection.* (3) *Whether a certain arrangement will be suitable for reception.*

(1) The coil could be constructed of No. 22 D.C.C. wire on a former 8″ diameter and 4″ long, with 8 tappings. (2) We cannot say without a knowledge of your set. If the transmitting station is near by, you would not need an earth connection, or perhaps you are using a small value condenser in the earth lead. (3) The arrangement proposed will work as you suggest, but why not use one of the normal arrangements described in recent issues?

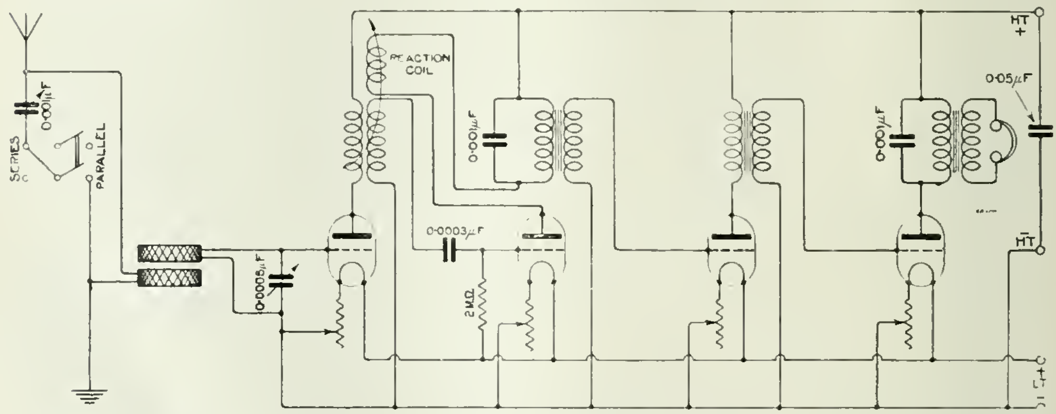


Fig. 3.

"H.L.S." (United States).—A Venner time switch may be purchased from Venner Time Switches, Ltd., 45, Horseferry Road, London, S.W.1. We cannot say where "R" type valves may be purchased in France, but the manufacturers in this country are the M.O. Valve Co., Brook Green, Hammersmith, London, W., to whom you should apply for further information. The circuit given on page 435, July 1st issue, is a good three-valve Reinartz tuner circuit, and suitable values are: A.T.C., maximum value 0·0015 mfd.; C.C.C., 0·0005 mfd.; anode condenser first valve, 0·0003 mfd.; grid condenser, 0·0002 mfd. The coils may have dimensions similar to those described in the issue of May 13th. Good signals should be obtained when the set is connected to a frame aerial, the strength of course depending upon the power of the transmitting station.

"A.N.W." (Kent). We suggest you modify the set according to the Fig. 4. The coupling between the coils G and Q will then provide for reaction. The coil E, as you suggest, is a choke coil, and is connected across the aerial and earth for the purpose of preventing the tuning condenser accumulating a charge of electricity through the aerial becoming charged with atmospheric electricity. We suggest you leave it connected in circuit. The intervalve transformer shown in the note magnifier panel should have a ratio of primary to secondary turns of 2 or 2½ : 1, therefore we do not think you will find any use for the 20 : 1 ratio L.F. transformer.

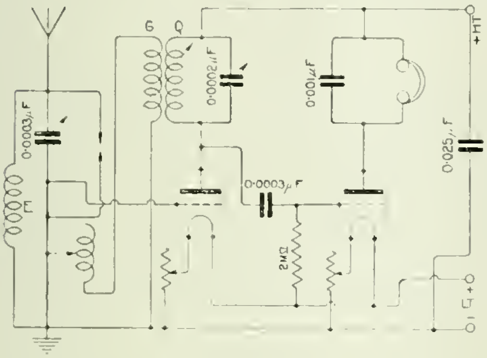


Fig. 4.

Fig. 5 indicates the method of connecting up the two-valve telephony transmitter, using the choke control method. The choke D may consist of 3,000 turns of No. 36 S.S.C. wire on an iron core ½″ diameter and 4″ long, the core being closed. The coil B is an H.F. choke, and may consist of a winding of No. 36 S.S.C. wire on an ebonite former 1″ diameter and 4″ long. Resistance E should have a high value of the order of 0·5 mehogms. If a buzzer and key is inserted in place of the microphone, the transmission will be tonic train or interrupted C.W.

"M.H.W." (Yorks).—We quite agree with your remarks concerning the operation of the two valve set when the first filament is disconnected. While the circuit will work under these conditions, it is quite obvious that no one will attempt to build the set including a capacity of the order of 5 cms. between the secondary circuit and the grid circuit of the second valve, because signals would be very much distorted, and adjustments would be very difficult to make. When the two valves are working together in a proper manner, the only effect which the capacity between the grid and plate can have is that it is added to that provided by the anode tuning condenser. Since there is no coupling between the aerial circuit and circuit containing the amplifier energy, it is not possible for oscillating energy to be transferred to the aerial circuit. The only current which flows in the closed circuit is the grid current, which is so small that it results in a very small oscillatory current in the aerial circuit. If you have had experience with capacity reaction, you will understand that a small reaction coupling of the order of 5 centimetres produces little effect.

"H.E.P." (Birmingham) *submits a diagram of his receiver and asks for our advice. He cannot tune out local transmissions in favour of long distance transmissions on similar wavelengths.*

We have examined the diagram of your set submitted to us, and we think the interference experienced will be quite eliminated by using a 3 coil holder or 3 coil tuner. The secondary circuit should then be connected to the filament and grid of the first valve.

In addition you will find a great improvement results when the aerial tuning condenser is connected in series with the aerial tuning inductance. You may find it convenient to connect a double pole throw-over switch in the aerial circuit for the purpose of connecting the A.T.C. and A.T.I. in series or parallel. Interfering stations may be tuned out by adjusting the coupling between the aerial tuning inductance and the closed circuit inductance, and by fine tuning.

"W.T." (Birmingham) *submits a diagram of his receiving set and asks our advice.*

We have examined the connections of your set submitted, and they are correct with the exception that no provision is made for joining the aerial tuning condenser in series or parallel with the aerial tuning inductance. When receiving short wavelengths, it is better to connect them in series. As you hold an experimenter's licence, we think you should use a three-coil holder. The centre coil should be the closed circuit inductance, and the outer coils would then be the aerial tuning coil and the reaction coil. The only alteration necessary would be the provision of a 0·001 mfd. tuning condenser in series with the aerial coil as shown. Terminals A and B would then connect with the closed circuit coil ; but we cannot definitely say why you are not getting good results, as we have

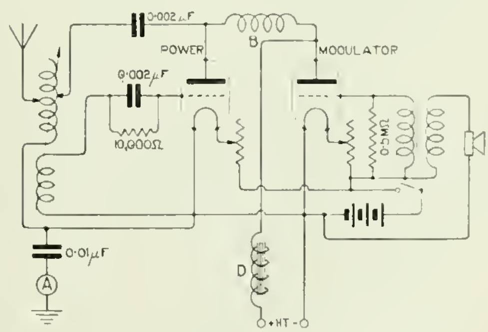


Fig. 5.

no knowledge of the transformers, grid condenser and leak used in the set. We suppose the telephone transformer is connected in the right direction ? The general scheme of connections, however, is quite correct. We think you should certainly secure better results than at present. We understand, as you hold an experimenter's licence, the Post Office will offer no objection to the use of this circuit.

"F.A.R." (Belgium) *asks in which issues the construction of H.F. transformers is described.*

A variable H.F. transformer is described in the issue of September 23rd, page 828. Short wavelength transformers are described in the issues of September 2nd and 16th.

"H.R." (Highgate) *asks* (1) *For a circuit of a two-valve Armstrong super-regenerative receiver.* (2) *Whether the H.T. can be taken from the 240 v. D.C. mains.* (3) *Whether the Armstrong circuit will give louder signals than a two-valve (1 detector and 1 L.F.) receiver.*

(1) See Fig. 6. Full particulars of the construction of an Armstrong super-regenerative receiver are given in the issues of October 21st and 28th. (2) See article entitled "Methods of Deriving Valve Current from Public Supply Mains," on page 344, June 17th, 1922. (3) We think you should certainly hear louder signals when using the Armstrong circuit. We would point out this receiver should only be used in conjunction with a frame aerial.

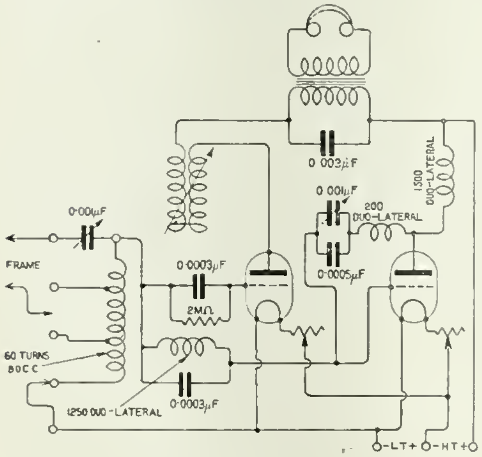


Fig. 6.

"C.P." (W.).—We suggest you do not use the glass condensers. Vernier condensers may consist of two fixed and one moving plates. The 0·0003 mfd. tuning condensers should consist of a total of 19 plates, and the 0·001 mfd. tuning condenser should have 61 plates. The capacity of two foils with an *overlap* of 2″×¾″, and mica 0·002″ thick, is 0·000844 mfds. The capacity shunted across the H.T. battery may have any value over 0·01 mfds. If the dielectric of the condenser referred to will withstand the H.F. potential, it is quite suitable. The secondary could be wound with No. 26 D.C.C. wire on the former 2½″ diameter and 4½″ long. Tappings should be taken at six points about equally spaced. It is not very satisfactory to rely upon tuning the secondary circuit by tappings only. The reaction coil could be a coil of No. 30 D.C.C. wire on a former 2″ diameter and 3″ long, with 3 tappings. The circuit will tune from 300 metres to 700 metres. With reference to the accumulators, we think you will find it better to keep them in condition by regular charging and discharging. The discharging can be carried out through a resistance wire and suitable taps.

"AJAX" (Leigh) *asks* (1) *What exactly is a "tuned anode."* (2) *Is it necessary to use a high frequency transformer when using a tuned anode.*

(2) When a valve is used as a voltage amplifier it is necessary to include in the anode circuit of a valve a circuit of high impedance. The higher this impedance, the higher will be the voltage amplification obtained from the valve. A convenient method of obtaining this is to use an inductance coil tuned with a condenser. When the anode circuit is tuned to the frequency of the incoming signal, the effective impedance in the circuit is resistive only, and a very high voltage variation takes place across the coil. The potential variations are transferred to the grid of the next valve through a condenser, and the grid of the valve is maintained at a suitable negative potential by connecting a leak resistance between the grid and one side of the filament. It is better to connect to the positive side of the filament, in order that a small grid current may flow and cause a little damping in the circuit. The effect of this damping can then generally be properly controlled by the use of reaction coupling to the anode coil. The anode tuning condenser should not have a valve exceeding 0·0002 mfds. when receiving short wavelengths, but when receiving longer wavelengths, this condenser may reach a maximum value of 0.0004 mfds. (2) It is apparent, therefore, that a high frequency transformer will not be required when the tuned anode method of high frequency amplification is employed. We would refer you to Fig. 1, page 249, November 18th issue. It will be seen the first valve has a tuned anode circuit, and the reaction coil is coupled with it.

SHARE MARKET REPORT.

Prices as we go to press on December 29th, are:—

Marconi Ordinary	£2	5	0
,, Preference	2	1	6
,, Debentures	102	0	0
,, Inter. Marine.. ..	1	3	0
,, Canadian		10	7½
Radio Corporation of America:—			
Ordinary		14	3
Preference		12	3

Marconi's Wireless Telegraph Company, Limited, Dividend.

The following dividends are announced:—

A Dividend of 7 per cent., less Income Tax, upon the 250,000 7 per cent. Cumulative Participating Preference Shares. An Interim Dividend of 5 per cent., less Income Tax, upon the 2,750,000 Ordinary Shares issued. These dividends will be payable on the 1st February next to shareholders registered on the 20th December, 1922, and to holders of share warrants to bearer. The Transfer Books will be closed from the 21st to the 27th December, 1922, inclusive.

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

No. 178 [No. 15 Vol. XI.] JANUARY 13th, 1923. Weekly

Low Frequency Amplification

A REVIEW OF THE DESIRABLE FEATURES TO BE FOUND IN TRANSFORMERS.

MAXIMUM power output is obtained from a valve when the impedance of the apparatus connected in the anode circuit is equal to the internal impedance of the valve. The output power, which is electrical energy modulated to give morse or telephone signals, may be required to energise the input circuit of another valve to secure further amplification, or to operate a telephone receiver or other device capable of response, and able to effect the senses in a manner necessary for the reception of intelligence. In the case of the valve, we require the input voltage to be as high as possible, since the amplifying valve is a voltage operated instrument. The telephone receiver (or other device) is of course energy operated, and its impedance, it should be noted, ought to be approximate with that of the circuit to which it is connected for maximum effect. Thus telephones possessing high impedance are connected in the anode circuit of a valve, or across the crystal detector, because the latter have high impedance.

It may be pointed out here that impedance (Z) is expressed in ohms, and is the equivalent resistance set up by the electrical properties of a circuit thus:

$$Z \text{ ohms} = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

where R = the ohmic resistance, $\omega = 2\pi \times$ frequency, L = inductance in henrys, and C = capacity in farads.

As the valve is amplifying low frequency currents, its self capacity will have little effect, and the plate filament impedance is resistive only. That is, it may be regarded as resistance only. The effective impedance of inductive apparatus such as a transformer, is composed of the primary impedance plus that due to the secondary and load transferred to the primary. The load resistance may be considered as in series with the primary impedance, while the losses due to charging or magnetising the apparatus should be considered in parallel with the primary impedance.

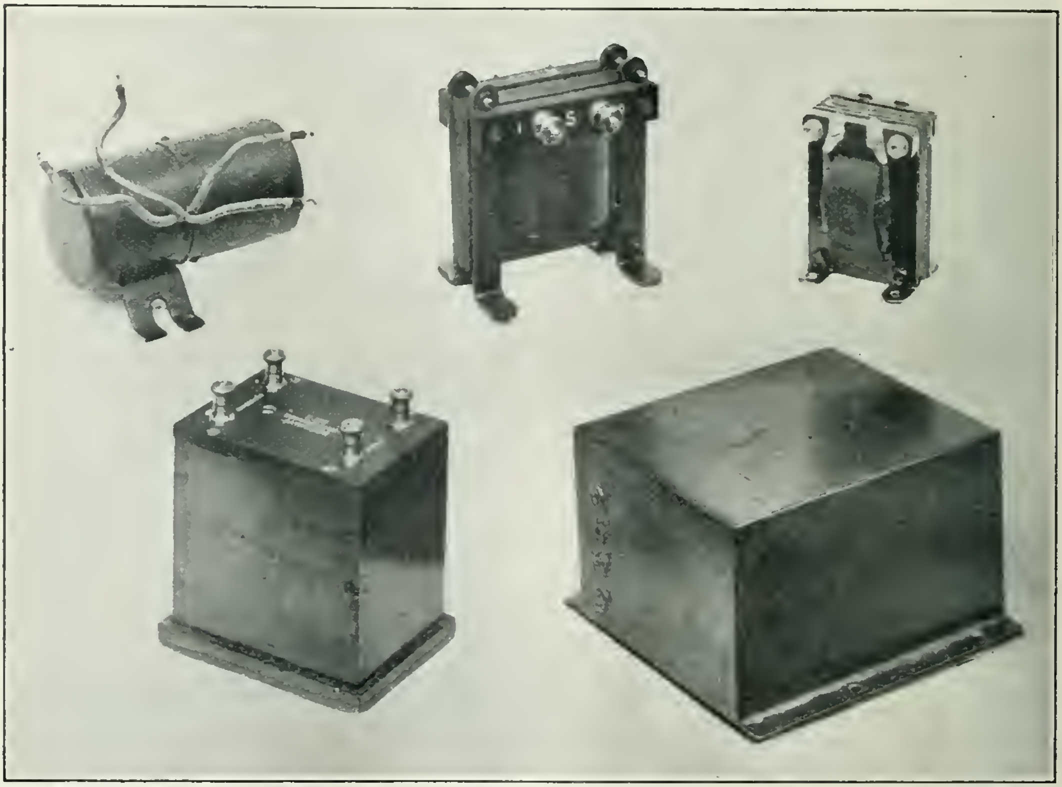
Due to the large difference in the internal impedance of the output and input circuit of a valve, it is essential for good amplification to use apparatus to match the impedances. A transformer is generally used for this purpose; and as the energy to be amplified is of audible frequency, the transformer should have an iron core.

It is now proper to consider the amplification per stage, which is defined as the ratio of the signal voltage applied to the second valve (V) to that applied to the first valve (v), that is $\frac{V}{v}$.

The consideration is complicated by the requirement of distortionless amplification. The latter demands (1) the anode current-grid voltage characteristic of the valve, be linear over the portion affected by the signal. (2) The effective impedance of the transformer be so high that all the frequencies present in the signal shall be equally dealt with. (3) Negligible grid current shall flow.

(1) This condition is met by ensuring the impedance in the anode circuit is sufficiently

great, and by proper adjustment of the filament heating, normal grid and anode potentials. To straighten out the characteristic curve sufficiently, the impedance connected in the anode circuit must be at least equal to that of the internal impedance of the valve. This demands a large number of turns of wire, with an iron core of large cross section. In addition, the transformer must be properly made for minimum iron losses and minimum leakage. The grid potential should be adjusted so that its mean potential lies in the centre of the anode current-grid voltage characteristic. The filament temperature and anode voltage must be sufficiently high to ensure saturation shall not occur, and the peaks of the signals cut off. (2) The transformer must be built to have a flat frequency characteristic over the range required by the proper design of the windings and magnetic circuit. This requirement is met with a large iron section and a large number of turns, due allowance being made for the normal anode current which is producing flux. (3) The normal grid voltage should be such as to ensure that the most positive portions of the signal shall not cause an appreciable current. If grid current were permitted to flow, distortion would be caused for two reasons: (*a*) current which should pass to the anode circuit is diverted to the grid, and (*b*) the input voltage is lowered, due to the drop across the secondary winding of the transformer. For these reasons it is necessary to connect one end of the secondary to the negative pole of the filament battery, or to include small dry cells in the circuit, connected to increase the negative potential of the grid.



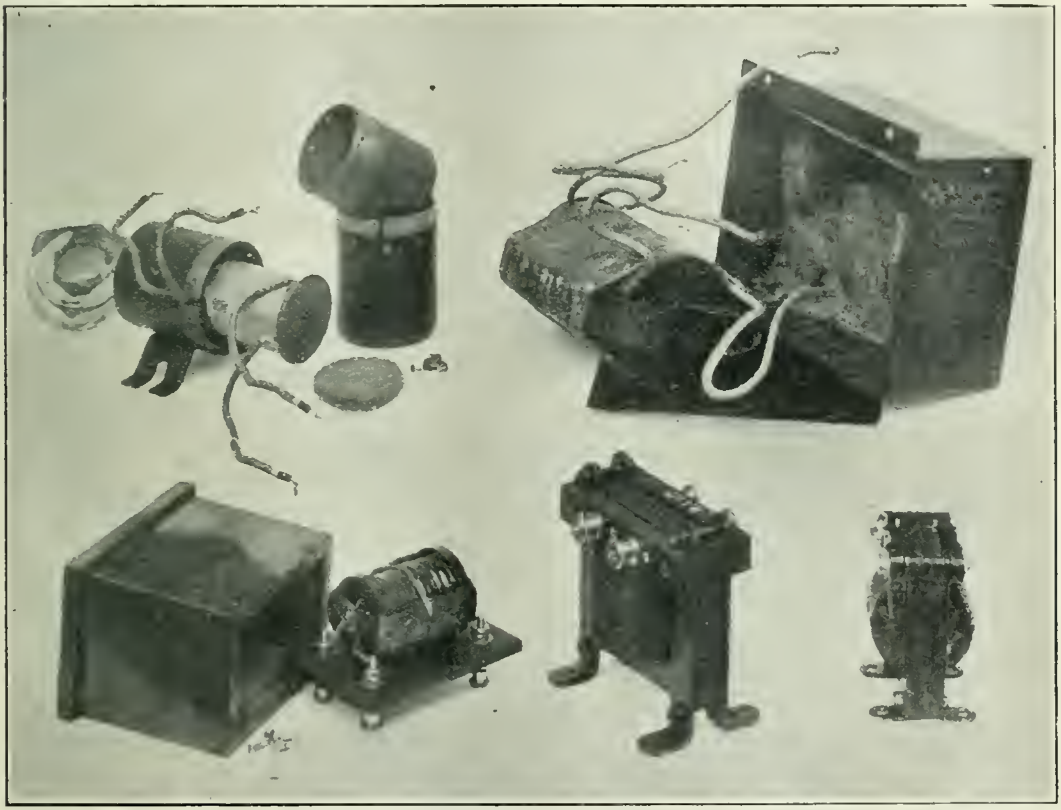
Examples of Low Frequency Transformers. The first Transformer in the upper row is a German Telephone Transformer, while the others are various types of Intervalve Transformers. It will be noticed that two of the Transformers are totally enclosed in metal screening cases.

To secure the maximum voltage per stage, the effective impedance of the primary of the transformer and output of the valve should be about equal, and the secondary winding should consist of as many turns as practicable, so that the largest voltage step-up is obtained.

Fortunately it is not necessary to match impedances exactly, and no great effort to this end should be made. The secondary voltage is limited through the self-capacity and resistance of the windings, and through magnetic leakage and iron losses. With careful design of the iron circuit, and the disposition of the windings, the losses due to the latter cause may be made negligible. The iron core should be made of laminations having high permeability and low losses. The transformers, to be small in size, are wound with a large number of turns of fine wire, and the resistance losses may be only reduced by increasing the size of the transformer, which is not economical. Self capacity is reduced by spacing the layers of the windings, and by choosing the right ratio of winding depth to winding length. The material used to impregnate the windings should be chosen to have the lowest specific-inductive capacity consistent with insulating and damp-proofing qualities. The secondary voltage is reduced by the charging current and by the magnetising current and leakage.

From the foregoing it will be understood the transformer primary will possess a large number of turns, and as it is not essential to match impedances exactly, the requirements for distortionless amplification should be met in preference to other desirable features.

The secondary winding consists of many more turns than the primary, but the number cannot be increased indefinitely, because beyond a certain point there is no increase in secondary voltage. When " R " type valves are used, a usual ratio is 1 to 4. The impedance of the valve may be varied by changing the filament current and high tension voltage, and by grid potential adjustments. It is therefore apparent that for good amplification, and in particular for minimum distortion, the transformer used to couple the detector valve and the next low frequency valve would



The types shown indicate a variety of methods for constructing the cores. A study of the relative dimensions is of interest. The Telephone Transformer has two shells, one of iron and the other copper.

have a very large primary winding. The ratio of a correctly designed transformer for this purpose would probably not exceed 1 to $1\frac{1}{2}$ or 2. The impedance of the last low frequency valve is very much less under normal working conditions than that of the detector valve, therefore the primary winding of the transformer in the anode circuit need not have so many turns, but the wire should be larger to carry the heavier current. High ratio transformers should be avoided. It is better to use a transformer with a large number of primary turns and a small ratio, than one with comparatively few primary turns and a high ratio. The latter transformer, like a number at present in the market, would result in a reduction instead of a step-up of voltage. A good transformer then, will be large, so that the windings will be able to carry the working currents without overheating and undue losses, and the insulation good.

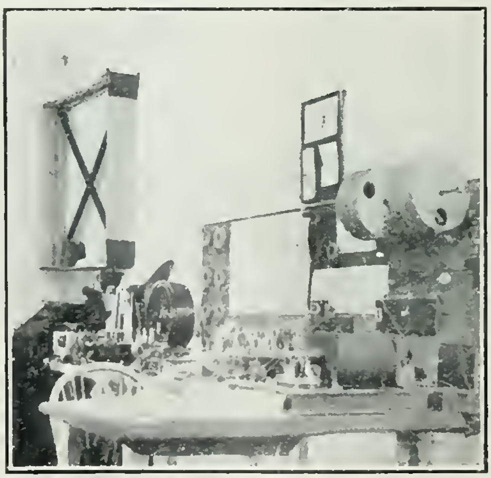
The iron core will have a large cross section for obvious reasons. The size, the current-carrying capacity of the windings, their insulation and their ratio are the points to be especially noticed when about to purchase low frequency transformers. A knowledge of the resistance of the windings is of little value as a guide unless one is comparing transformers of similar dimensions. When connecting transformers in circuit, it is as well to ensure the assistance of the capacity between the windings. If the windings are wound in the same direction, the beginning of the primary winding (I P) should be connected with + H.T., and the end of the primary winding (O P) with the plate. The beginning of the secondary winding (I S) should be connected with the grid, and O S with −L.T., but to prevent the low frequency amplifier setting up oscillations it is sometimes necessary to reverse the connections of the transformers. A common H.T. battery is largely used, and to prevent it through its internal resistance acting as a coupling between the transformers, it should be shunted with a large capacity condenser of the order of 2 to 4 mfds.

The reactance of a condenser of 2 mfds. to currents of a frequency of 800 cycles is of the order of 100 ohms. W.J.

The Downside School Wireless Station.

The station shown in the accompanying photograph, was erected by the Downside Wireless Society, a Society run entirely by the students.

The main receiver may be seen in the middle of the bench. The tuner consists of Burndept inductances and home-made condensers, while the amplifier is composed of four H.F. valves (Sullivan transformers being used), a rectifying valve, and one note magnifier, built in two sections, a two-valve H.F. panel and a four-valve amplifier-detector panel. To the left is a separate heterodyne of novel design, and a 10 watt transmitting valve. The transmitter has worked on more than one occasion with Crowborough in Sussex, a full 120 miles from Bath.



The Apparatus embodies many interesting features and is a fine example of a station arranged for the purpose of conducting experimental work.

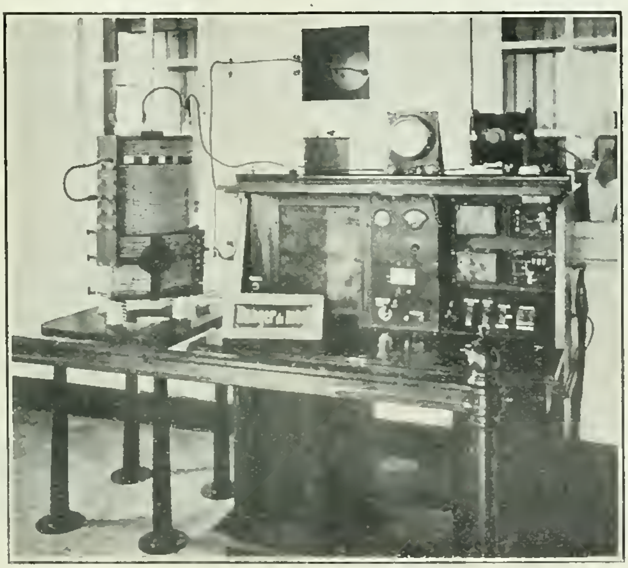
A two-wire aerial is used, having a mean height of 70 ft. The frame showing conspicuously in the photograph is also employed for reception, and gives very good results.

Of telephony amateurs received, 2 AZ (last year), 2 AW, and 2 BZ, are very good considering their distances, while 2 FL 2 AX, and others within a 25-mile radius are deafening.

General View. The Aerial and Transmitting Building are on the left and the Hangars on the right.

The Geneva Aerodrome Wireless Station

THE Geneva Aerodrome occupies a commanding position between the main range of the High Alps on the south and the subsidiary Jura Mountains on the north, the general direction of the lowlands lying between being north-east and south-west. The whole site was cleared and laid out by the unemployed of Geneva, who were also responsible for the erection on a very complete scale of the necessary buildings. These are up-to-date and comprise such accommodation as bedrooms for the pilots, including means for heating their clothes. The finished scheme forms a good example of a model aerodrome; it embraces many novel signs for attracting the attention of aviators, and is furnished with the latest instruments.



The 1.5-kW. Transmitter.

The wireless station constitutes a most important part of the equipment of the aerodrome. It provides facilities for efficient communication with aircraft, and with other ground stations and is fitted with a Marconi $1\frac{1}{2}$-kW. transmitter and a directional receiver. A distance of about 200 metres separates the two stations, the transmitter being remotely controlled from the receiving station.

Facilities exist for connection to land lines as required, but at the present time no land line voice amplifier is fitted although this can be arranged if desired by the local authorities.

The transmitter is situated in a building in the north-east corner of the aerodrome, the apparatus consisting of a Standard Marconi $1\frac{1}{2}$-kW. Cabinet Set, embodying a special A.T.I. fitted with a ratio tap in order to enable an earth screen to be employed. The receiver portion of the cabinet set has been removed and replaced by a relay panel and a local control unit panel. On the relay panel are fitted the various relays controlling the circuits, which are operated by a control panel situated in a distant receiving station, or alternatively by a local control unit mounted underneath the relay panel for testing purposes, or if it should be necessary at any time to operate the transmitter locally.

An additional sub-control attachment is provided for increasing the amplitude of the speech from the microphone, before being impressed on the grid of the main control valve in the cabinet set.

The aerial is supported on two 30-metre towers, and a ten-wire earth screen is employed.

The power mains from the local supply are led on to a rotary converter arranged to supply the correct output for driving a standard $1\frac{1}{2}$-kW. motor generator, supplying the necessary alternating current to the cabinet set, whilst an emergency petrol-electric gene-

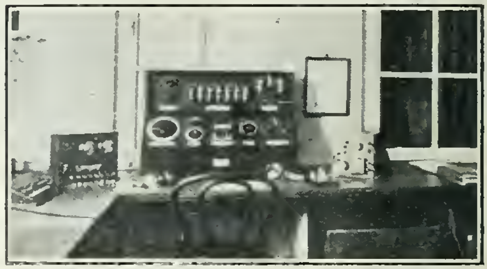
Aerial and Earth Screen Lead-in.

rating plant has also been installed for use in case of emergency.

This is situated in a building 200 metres south-west of the transmitter house and consists of a Marconi direction finding equipment, type 12A, the directional aerials for this station being supported on a 70-foot mast.

As mentioned, an operators' control panel has been installed which controls the functions of the transmitting station, viz., the starting up of the motor generator; the changing from "send" to "receive"; the selection of the type of transmission—telephony, C.W., telegraphy, tonic train—and the control of the necessary circuits for connecting through to the land lines. These functions are performed by a series of Kellog keys mounted on an appropriate panel.

Communication by telegraphy has been established between Geneva and Croydon, a distance of about 475 miles. The transmitting wave ranges are 900, 1,400, and 1,600 metres, and the receiving wave ranges are

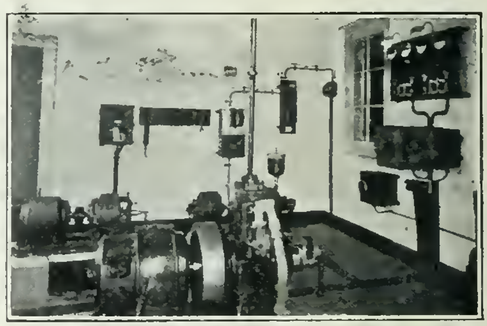


Receiving Apparatus. On the left are the Remote Control Keys of the Transmitter.

400-4,000 metres without heterodyne and 400-2,200 metres with heterodyne.

The receiver can be arranged for either all-round reception, "Sense," or normal directional reception.

It should be noted that an important advantage of this type of station lies in the almost instantaneous change-over from transmission



The Power Room.

to reception, thus allowing of efficient single-way working with any other telephone station possessing the same arrangements.

The operating conditions are ideal, as owing to the remote control arrangements, the noise of running machinery does not interfere with the satisfactory handling of traffic.

The Application of Loose Coupling to an Existing Single Circuit Set.

By G. G. BLAKE, M.I.E.E., A.Inst.P.

AT the present time the majority of amateurs are using tuners in which the reaction coil acts directly on to the A.T.I. In inexperienced hands this method of reception becomes a great annoyance to other stations in the neighbourhood. Owing to the fact that as soon as the reaction coil is brought too near to the A.T.I. oscillations are set up in the aerial, accompanied by radiation, it is almost impossible nowadays to hear the Dutch Concert through without having the music spoiled by innumerable squeaks and chirpings produced in this way by dozens of amateurs in one's neighbourhood.

The Post Office very properly wish to prevent this, and at one time they actually ceased to grant licences where the applicant sent in a diagram of his set showing reaction to A.T.I. They have recently withdrawn this restriction, as far as the experimental licence is concerned, excepting on broadcast wavelengths, and it behoves us, in our own and everybody else's interest, to be most careful not to make our aerials radiate.

In experienced hands reaction direct to the A.T.I. need not cause any trouble by radiation, but why should we adhere to the use of this method, when we have an alternative method, *i.e.*, "loose coupling," which has the following advantages :—

(1) Interference to neighbouring stations may be reduced.
(2) Greater selectivity is secured without loss of signal strength, when carefully tuned.
(3) Much lower plate voltage can be employed.
(4) Lower filament temperature can be used with consequent lengthened life of filament and less frequent charging of accumulators.
(5) The set receives much shorter wavelengths than was possible before.

I have carried out a number of experiments on loosely coupled circuits and the following information may perhaps be useful to many amateurs in converting their sets.

Fig. 1 shows the usual single valve " reaction to A.T.I. " connections which are causing so much trouble in the ether. These are so well known that no detailed explanation is required.

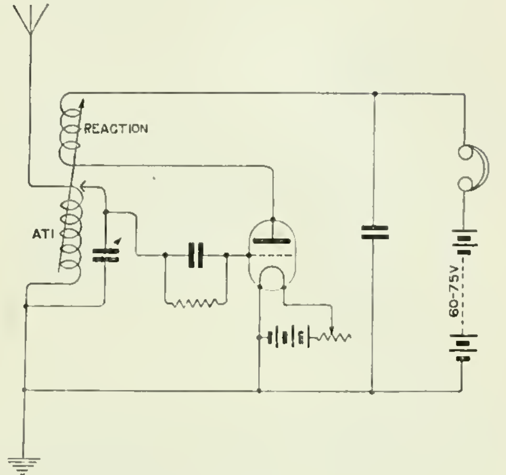


Fig. 1.

Fig. 2 shows the same set loosely coupled to a new A.T.I. tuned by a variable condenser, which may be connected either in series or parallel, according to the number of turns employed, and the range of wavelengths desired,

The coupling required is an extremely loose one, and I find that all that is necessary is to stand the new A.T.I. on the top or by the side of the existing set, without making any alteration at all thereto.

It makes little or no difference whether the old A.T.I., now called the secondary, is left connected to earth or not.

It will be noted that the H.T. now required to operate the set is much lower. I have succeeded in receiving ships comfortably with my new set, which has one valve as note magnifier in addition to the receiving valve, using H.T. of only twenty volts for the plate circuits of both the receiving and note magnifying valves.

To get results equal to, if not surpassing those obtained with the old " Reaction to A.T.I." connections, I find 30 volts H.T. the best.

I have received the Dutch Concert very nicely on this voltage and it is quite moderately audible on 15 volts.

The following results of a test made on 440 metres reception may be of interest.

Using the old "Reaction to A.T.I." connections, best signals were obtained with 60 volts H.T. and reaction ceased at 45 volts;

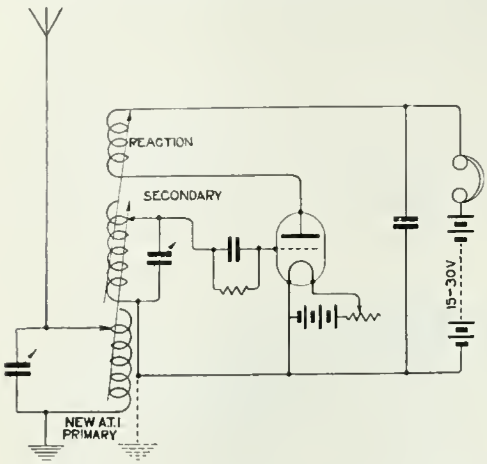


Fig 2.

signals were just audible on 15 volts. Using the same set as inductively coupled secondary to a separately tuned A.T.I., full efficiency was obtained with 30 volts H.T. and the set reacted on 15 volts, signals still being quite strong.

The fact of being able to operate our sets with a reduced plate voltage is not only an economy, but in itself reduces the risk of any serious radiation to a minimum. We no longer have such a large amount of energy available for the annoyance of our wireless friends.

Fig. 3 shows a photograph of my own set. I have fitted up my new A.T.I. and condenser in a small mahogany box, which stands on the top of my set. When placed in the position shown in the photograph, Fig. 3 (as indicated by an arrow), it is over the secondary inductance (the old A.T.I. of the set). This coupling is too tight, and in order to obtain the best results, I move it towards the other end of the box until the right degree of coupling is obtained.

A brief description of the rest of the photograph may be of interest. The panel on the left-hand side contains the controls of the transmitter. By means of a switch we can change over from telephony to C.W. or to tonic train, and I have designed the set to transmit with a voltage of only 220.

The space between the panels contains four "R" valves, one for transmission, one for modulation, one for receiving, and one for note magnification, and below this space is a change-over switch ("send to receive").

The right-hand panel contains all the usual receiving controls. The handle marked G.C. is a variable grid condenser which enables one to get fine adjustment of the amount of reaction without altering the tuning of the set. The Morse key is mounted on the front flap of the wooden case.

Now that I use my old A.T.I. as secondary inductance I find that to tune in any given station, it is necessary to search for it one stud higher up the secondary inductance than before, when it was employed as A.T.I.; so that stations which I used to tune in on Stud 1 now come in on Stud 2; this allows me to go down some 200 metres lower.

A few details of the new tuned A.T.I. may be useful. The inductance is wound with No. 18 double cotton covered wire on a cardboard former, 3 ins. in diameter, 144 turns with tappings at every twelfth turn, and this is tuned with a variable condenser having a capacity of 0·0005 mfd. A switch, not shown

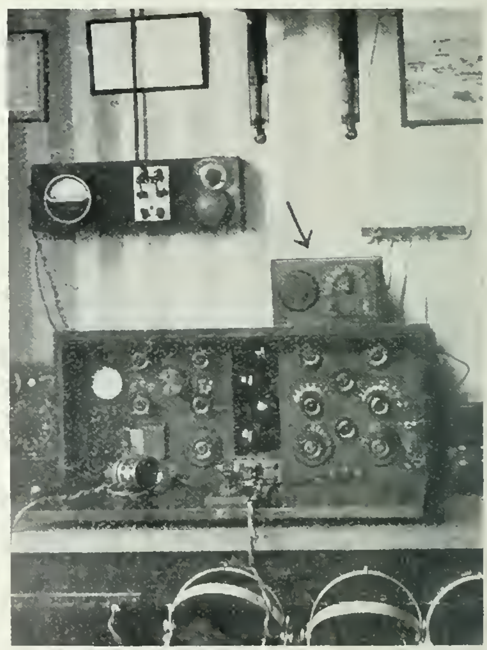


Fig. 3.

in figure, is used to connect the condenser either in series or in parallel with the inductance.

Another advantage can be reaped when employing this separate tuned A.T.I. circuit.

It is quite a simple matter to connect a crystal and phones across it, and so to use it independently of the valve set as a stand-by for reception of strong signals and telephony.

As the crystal detector also provides us with a very simple method of ascertaining if our aerial is radiating, a brief description may be useful.

Fig. 4 shows a valve set loosely coupled to a separate A.T.I. The A.T.I. is connected in parallel with a small variable condenser C_1 and (as a " stand by " for use when the valve set is not required for loud telephony and telegraphy), a crystal detector *D*, and a pair of high resistance telephones *T*, bridged with the usual blocking condenser C^1, are connected as shown. A switch *S* brings the detector into or out of action.

To ascertain if the aerial is radiating, the procedure for strong signals is as follows :—

(1) Having set a wavemeter to the wavelength of the station which we wish to receive, buzz it and tune the aerial circuit by adjusting the A.T.I. and variable condenser *C*. Then having picked up the signals with the crystal detector, cut it out of action by opening switch *S*.

(2) Next switch on valves, etc., and put the secondary circuit into action, taking care that the secondary inductance *I* is very loosely coupled to the A.T.I. (*i.e.*, at a considerable distance from it). Buzz wavemeter to the same wavelength as before and tune the secondary to the same wavelength by adjusting the closed circuit inductance and variable condenser C^2 and stop wavemeter buzzing.

(3) Tighten the coupling by placing the valve set nearer to the A.T.I. until incoming signals are clearly audible and leave set working.

(4) Switch on the crystal detector and receive signals on crystal once more.

(5) While still listening in with the crystal, commence to tighten up the coupling between the reaction coil *R* and the secondary inductance. A point will soon be reached where the signals heard from the crystal begin to increase. When this stage is reached it indicates that the aerial circuit is receiving energy from the secondary circuit and is beginning to radiate. The coupling must be reduced until no excess of signal strength is observable. When this adjustment is satisfactorily achieved, the crystal is switched out of action and the signals are heard on the secondary circuit. In order to receive them at their maximum strength it may be necessary to slightly reduce the capacity of condenser C_2, to allow for the slight increase of capacity introduced into the secondary circuit by the tightening of the coupling between the reaction coil and the secondary inductance.

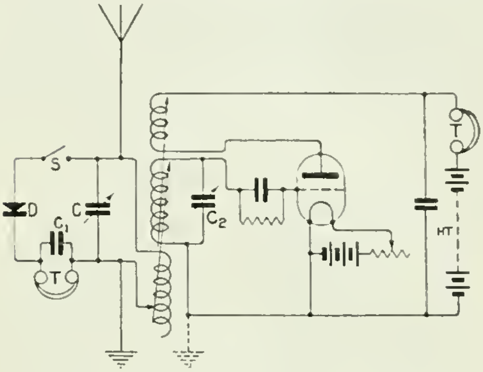
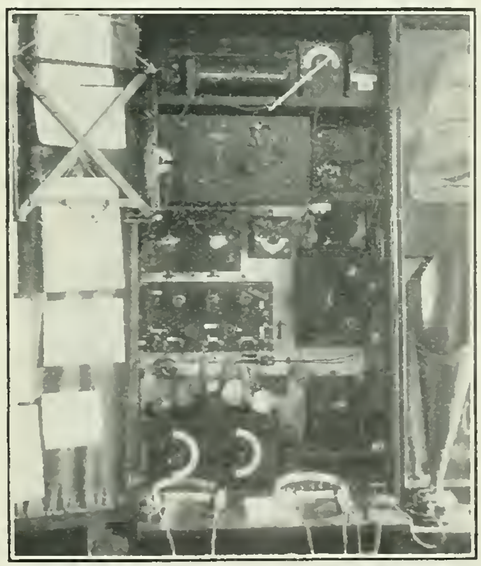


Fig. 4.

When it is desired to receive signals of too weak a strength to be heard with a crystal detector the procedure is practically the same, only in this case, when we wish to ascertain if our aerial is radiating, we must use the wavemeter all the time in making the tests with the crystal.

An Experimenter's Receiving Equipment.



This station comprising independent short and long wave sets with separate valve amplifiers, is that of Mr. Geo. F. Robinson, 9, Southgate, Sleaford, Lincs.

Electrons, Electric Waves and Wireless Telephony—XV.

By Dr. J. A. FLEMING, F.R.S.

VI.—TELEPHONY AND SPEECH TRANSMISSION.

3. Efficiency and Properties of the Telephone Receiver.

THE remarkable fact about a Bell magneto telephone is that the mere vibrations of a small flexible circular iron disc should be capable of impressing on the air waves having the very irregular wave form necessary to create speech sounds. When we consider the complicated nature of our own human organs of speech and the manner in which the larynx, throat muscles, variable mouth cavity, lips, tongue and teeth, are all brought into operation to create articulate sounds, it is wonderful that the mere to and fro motion of a small thin iron disc can do nearly the same thing in creating speech. Another striking thing is the very small electric currents which are capable of creating audible sounds in a telephone receiver, and the extremely small amplitude or extent of motion of the telephone diaphragm in creating such sounds. P. E. Shaw measured, in 1905, the amplitude of diaphragm motion for a just audible sound in a magneto receiver, and found it to be about one-fourteenth part of a millionth of a centimetre, or about one-thirty-fifth part of a millionth of an inch.

The diaphragm of a telephone has, however, a certain natural frequency to which it best responds. It resembles a violin string or harmonium reed in that there is no particular natural frequency at which it will vibrate and yield its fundamental note if it is struck and left to itself. This frequency is called its *resonance frequency*, and in telephones with iron diaphragms about 2 ins. in diameter and 1/50th in. thick, the resonance frequency is about 800 or 900. Hence, if we pass through the telephone coils an alternating electric current having this resonance frequency, the amplitude of motion of the diaphragm will be increased from 10 to 30 times when compared with that which it would have for the same current at a different frequency.

In connection with telephone work we require to give numerical values to the loudness of various sounds heard in the telephone. This is stated in terms of their *audibility*. If we pass an alternating current through a telephone of any frequency between, say, 100 and 2,000, we hear, on listening to the receiver, a more or less musical sound. If we apply across the terminals of the telephone a resistance called a shunt, which has no inductance, and gradually decrease this resistance, we shall at last reach a point at which the telephone sound is only just audible, because part of the current is shunted away from its coils. If the resistance of the telephone coils is R ohms, and the resistance of the shunt is then S ohms, then the *audibility* of the sound when the shunt is removed is expressed by the number $(R+S)/S$. Strictly speaking, we should say impedances and not resistances. Thus, suppose the telephone had an impedance of 100 ohms, and that we had to shunt the telephone with 2 ohms to just make the sound heard in the telephone inaudible to a normal ear, then the so-called audibility of that sound when the shunt is removed would be $102/2=51$.

Shaw found that if the audibility of a just perceptible sound is taken as unity, then the audibility of a loud sound would be about 1,400, and that of an overpowering sound 7,000 or more. Broadly speaking, we may say that the intensity of the sounds emitted may vary from 1, which denotes a just audible sound, to 1,000, which denotes a fairly loud sound.

The displacement or amplitude of motion of the diaphragm may vary from about half a micron ($= 5\times 10^{-5}$ cm.), which is about the wavelength of a ray of yellow light, to 8 or 10 microns, which is about 1/100th of a millimetre. Even in the case of loud telephonic sounds it is very small.

As regards the currents required to produce sounds of various audibilities, Werner Siemens long ago found that with a particular Bell telephone, the interruption of a current of 1/50,000th of a milliampere, when passed through the coils, caused the diaphragm to emit a just audible sound or tick. With more modern receivers the starting or stopping of a current of not more than 1/6th of the above could be detected. If, however, alternating currents are used, the current producing a just audible sound would depend upon whether the frequency of that current agreed with the telephone resonance frequency or not.

Another very remarkable quality of the magneto telephone is its astonishing inefficiency as an energy transforming device. We employ a magneto telephone to transform the energy of the varying electric currents sent through it into energy of aerial sound waves. But the fraction of the energy it so transforms is at most about 1/1,000th or 1/10th of 1 per cent., and, except at resonance frequency, may be only a few parts in 100,000.

The greater part of the electric power given to the coils of a telephone receiver is expended in producing heat in the wire coils and in the diaphragm, in mechanical work in bending the diaphragm and moving it to and fro, and in magnetic energy losses in it, and at most one or two parts in 1,000 of all the power applied is utilised in the production of the speech sound waves.

There is therefore a vast field for possible improvements, and it is curious that, with the exception of the hot wire telephone or Thermophone receiver of De Lange and O. Fischer, invented in Holland, there has been no great departure from the principles of Bell's invention made 47 years ago, although very considerable improvement has taken place in details and in manufacture.

Much research has also been conducted on the properties of the magneto telephone receiver. Many interesting monographs have been published by Prof. A. E. Kennelly and his associates in the Massachusetts Institute of Technology, U.S.A. Kennelly has made measurements, at various frequencies and with different receivers of standard types, of the true resistance, the reactance, and the impedance of the telephone coils.

In general the resistance of a telephone is reckoned as the resistance to direct currents. Thus we speak of a 60-ohm telephone, meaning one of which the coils measure 60 ohms with direct current. The speech currents are, however, alternating currents with a frequency varying from 100 to 2,000, and a mean value of about 800 or 900, corresponding to the resonance frequency of the telephone. The resistance R with high frequency currents is much greater, perhaps double or more, compared with the direct current resistance.

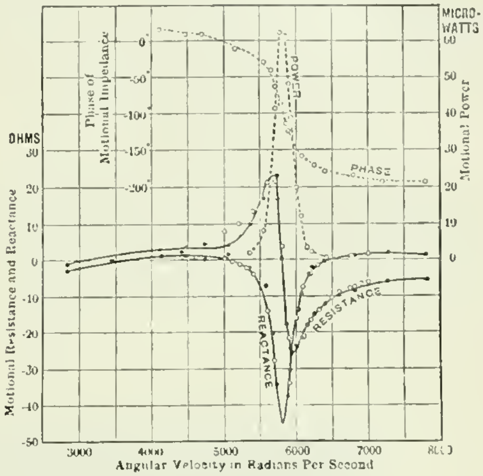


Fig. 84. Curves obtained by Dr. A. E. Kennelly for the Motional Resistance, Reactance and Power absorption of a Magneto-Telephone receiver. Note. The angular velocity signifies 6.28 times the frequency of the alternating current.

Again, if we measure the inductance L of the coils at any frequency n, then the product $2\pi nL = wL$ is called the *reactance* of the coils, and the quantity $\sqrt{R^2 + w^2L_2}$ is called the *impedance*.

If the resistance, reactance, and impedance of a telephone receiver are measured at the same frequency—first when the telephone is emitting sound, and secondly with the diaphragm clamped so that no sound is emitted—and if we subtract the second measurements from the first, the difference gives us the so-called *motional* resistance, reactance, and impedance of the telephone. If these are measured at different frequencies and the values plotted as the ordinates of a curve corresponding to the various frequencies as abscissæ, we obtain a set of interesting curves (see Fig. 84).

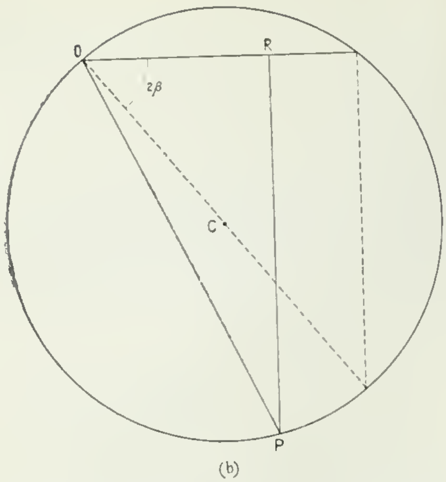


Fig. 85. Circle of motional impedance constructed by plotting the motional resistance horizontally OR and the motional resistance downwards vertically RP, the diameter of the circle measuring the impedance of the telephone.

The motional resistance at frequencies far from the resonance frequency is small, then it rises to a maximum, and then suddenly falls to zero at resonance, and passes to a negative maximum. The motional reactance is always negative and a maximum at resonance. The motional power is a maximum at resonance; that means when the frequency of the alternating current used in the measurement agrees with the natural frequency of the telephone diaphragm.

On the other hand, if we plot the motional resistance horizontally and the motional resistance downwards vertically (see Fig. 85), we obtain a circle called the *motional impedance circle*, the diameter of which measures the impedance of the telephone at resonance frequency. The angle which any chord of this circle makes with the horizontal line is called the *depression angle*, and this angle is double of the angle by which the magnetic flux in the telephone magnet lags behind the magnetising force.

(To be continued.)

Owing to the kindness of Mr. P. K. Morgan, who lent his apparatus for the occasion, the patients and nurses of the Middlesex Hospital were able to listen on December 23rd to Miss José Collins transmitting from 2 LO.

How to Make Use of the Scientific Time Signals.

By W. G. W. MITCHELL, B.Sc., F.R.A.S. F.R.Met.S.

WE shall now consider the rythmic beats or vernier time signals sent daily from Paris (FL), Bordeaux, Lyons and other stations.*

The purpose of the vernier time signals is to establish a standard of time measurement having the highest degree of accuracy possible over whole continents and ultimately over the whole earth. By this means very accurate determination of longitude may be made, for where a self-registering method of reception of vernier time signals is employed, an accuracy of the order of 1/1,000 sec. may be expected in the received signals. Now the problem of the determination of *exact* time over the globe, even if such an absolute standard was possible, ultimately resolves itself into the comparison of two standards. These two standards may be two clocks or a clock and a stellar transit, this latter being the passage of a given star across the meridian. But in any case the two standards have to be brought together for comparison, which necessitates the use of intermediary apparatus. All time errors are therefore, at the best, relative quantities, and when a discrepancy arises, the question of " bringing home the guilt " is a very intricate one. Furthermore, this limit of error, namely, 1/1,000 sec., is very near the limit of error of the astronomical observations upon which finally the transmission of exact standard time depends.

All time is measured by regularly recurring phenomena. Sidereal time or " star " time is therefore used throughout, in place of the more usual G.M.T. As this is usually a point of some difficulty, the reader is asked to consider carefully the following line of reasoning.

If we observe the sky at different intervals during the night, we find that the stars always maintain the same configurations relative to one another, but that their actual positions in the sky relative to the horizon are continually changing. Nevertheless, it is true that certain individual stars have a " proper motion " of their own. Such departures from the general direction of motion of the whole body of stars are extremely small, and require a lapse of centuries to give a measurable result. However, these stars having proper motions are not used as " clock stars," and so therefore do not enter into any of the results. With this exception, the stars appear to describe

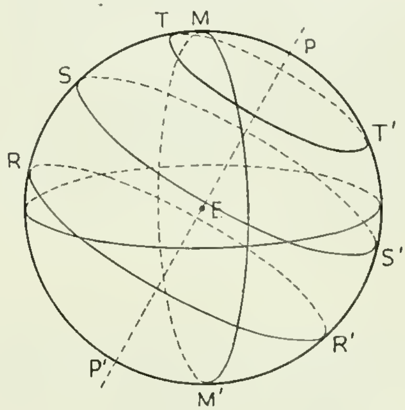


Fig. 1.

on the celestial sphere, circles (RR', SS', TT', Fig. 1), having a common pole (PP') very near to the Pole Star, and the revolutions are performed in the same period of time, namely about 23 hours 56 minutes of our ordinary time.

We may summarise the last paragraph into the following sentence :—

The earth rotates on its axis at a constant rate, and the time elapsing between successive passages of a star across any given meridian MM' is a sidereal day.

This is only one way of reckoning time and it is important to note that although clocks can be regulated to keep sidereal time, the system itself would be very inconvenient for general use. The phenomena of day and night (by which we roughly measure time) would bear no constant relation to the sidereal time system. For example, the time of noon would be 0h. on March 21st ; 6h. on June 21st ; 12h. on September 23rd ; and 18h. on December 22nd, Fig. 2 ; in other words, the

* Reference should be made to previous articles appearing in this magazine (July 1st, 15th and 29th last) for details of transmission times, wavelengths used, &c.

time of apparent noon would get later by 24 hours in the course of a year. A clock whose rate is uniform cannot however be regulated to keep solar time, which is the time shown by a sundial and is known as apparent time, because the length of the solar day is not quite invariable. In Fig. 2, E is the earth, PP′ the celestial poles, PSP′ a given meridian, RR′ the celestial equator, and ABCD the ecliptic or apparent

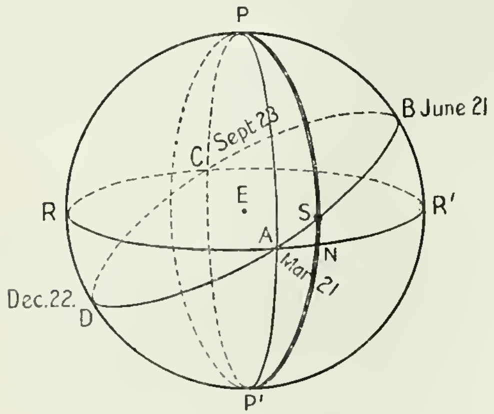


Fig. 2.

annual path traced out by the sun. We notice that the sun's position on the ecliptic is equal to its longitude, right ascension measured along the equator (RAR′C) on only four occasions during the year, namely on March 21st, June 21st, September 23rd and December 22nd. At other times this is not the case. For example, between March 21st and June 21st consider a position S of the sun on the ecliptic. AS is obviously greater than AN, *i.e.*, the sun's longitude is greater than its right ascension, and assuming S to move uniformly along the ecliptic, N will not increase quite uniformly ; in other words, the apparent solar day measured along AN will not be constant. There is a further cause in the want of uniformity which is due to the fact that the sun's motion along the ecliptic is not quite uniform. This is expressed in Keplar's second law of motion ; the rate of motion being everywhere such that the radius vector (*i.e.*, the line joining the earth to the sun) sweeps out equal areas in equal intervals of time. Hence, the length of the solar day is variable, and a clock cannot be regulated to always mark exactly oh. om. os. when the sun crosses the meridian. To obviate these two disadvantages another kind of time, called *Mean Time* has been introduced. This is the time indicated by clocks and used for all ordinary purposes. Mean time is defined by what is termed the " mean " sun, which is simply a point imagined to move round the equator (*not* the ecliptic) in such a way that intervals AN, etc., are of equal length. Greenwich Mean Time (G.M.T.) is reckoned from Greenwich noon, which is the passage of the " mean sun " across the meridian of Greenwich. Astronomical time is at present reckoned from midday, while the civil day, for the sake of convenience, is reckoned from midnight, but commencing on January 1st, 1925, G.M.T. will also be reckoned from midnight instead of midday.

The sidereal day is therefore the period of a complete revolution of the stars about the pole relative to the meridian and horizon. It is an invariable and at the same time easily measurable unit of time free from " fictitious mean suns," but it is inconvenient as a practical standard unit of time. Like the common day, it is divided up into 24 hours, and these are subdivided into 60 minutes of 60 seconds each. The astronomical clock as used in observatories always indicates sidereal time.

(2) The highest degree of accuracy attainable being the prime object of these signals, it is almost axiomatic that the observer desiring to make use of them should himself be in possession of a reliable clock. For example, a timepiece which gains or loses 1 minute a week or roughly 10 seconds a day would alter its error as much as 0·03 seconds during the series of rythmic beats. The " rate " of the chronometer in this case exceeds the accuracy aimed at. The essential problem is to bring together for comparison the transmitted beats and the beats of the local time-keeper. The method by which local time is conveyed to the telephones requires considerable care in order to get a good, clear, controllable " tick." For this purpose a microphone may be placed within the clock chamber, or alternatively direct contact may be established with the pendulum as suggested on page 478 of the issue of July 15th. Some considerable practice will be necessary in counting and recording the beats and coincidences, and it is suggested that a graphical method such as was employed with the ordinary time signals be employed in this case.

(3) The procedure adopted in sending out the signal is :—

(*a*) *Preliminary Tuning Signals.* During the first minute a series of trial signals are sent thus ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● etc.

Then for 50 seconds a series of calls — ● — ● — — — ● — ● — — ● — ● — followed by 10 seconds' silence.

(*b*) *The rhythmic beats* are sent during the next five minutes.

A series of 300 dots are transmitted, the spacing between successive dots being one beat of a clock adjusted so as to beat 50 times in 49 seconds of Greenwich sidereal time = 49/50 sidereal seconds = 44/45 mean time seconds (approximately). In this series of 300 dots, the 60th, 120th, 180th and 240th dots are suppressed in order to establish the indication for counting purposes.

(*c*) *Corrections.*

This series is heard at the Paris Observatory and compared with the standard sidereal clock by the coincidence method. The exact times of the first and last dots are transmitted the same day by FL immediately before the commencement of the ordinary semi-automatic time signals, at 1045 and 2245 (G.M.T.) as follows :—

Two groups of six figures each sent three times in succession and separated by the " break " sign. The hours are not sent in these groups.

Example :—

"Temps sidéral" — ● ● ● — 302653 351971
— ● ● ● — 302653 351971
— ● ● ● — 302653 351971

(4) *Reception of the Rhythmic beats.* This will be made clear by the following example of working :—

From the corrections above—

		h.	m.	s.
Signalled time of last dot	=	10	35	19·71
Signalled time of first dot	=	10	30	26·53
∴Time of whole series	=	0	4	53·18
	=	293·18 sec.		

∴Mean interval between successive dots .. = $\frac{293 \cdot 18}{299}$ sec.
= 0·9805 sec.

		h.	m.	s.
Mean of first three values in Col. 5 = chronometer time of first dot	=	10	38	47·81
Signalled time of first dot	=	10	30	26·53
∴Error by first three coincidences	=		8	21·28

(1) Chronometer time of coincidences (at whole sec.).	(2) Number of dot at which coincidence occurred.	(3) Number of intervals between *first* dot and coincidence.	(4) Column 3 multiplied by 0·9805 sec.	(5) Chronometer time of *first* dot (Col. 1 minus Col. 4).
h. m. s.			s.	h. m. s.
10 39 28	42	41	40·201	10 38 47·799
10 40 18	93	92	90·206	10 38 47·794
10 41 10	146	145	142·173	10 38 47·827
		Number of intervals between *last* dot and coincidence.		Chronometer time of *last dot* (Col. 1 plus Col. 4).
10 42 00	197	103	100·992	10 43 40·992
10 42 50	248	52	50·986	10 43 40·986
10 43 40	299	1	0·981	10 43 40·981

		h.	m.	s.
Mean of last three values in Col. 5 = chronometer time of last dot	=	10	43	40·99
Signalled time of last dot	=	10	35	19·71
∴Error by last three coincidences	=		8	21·28

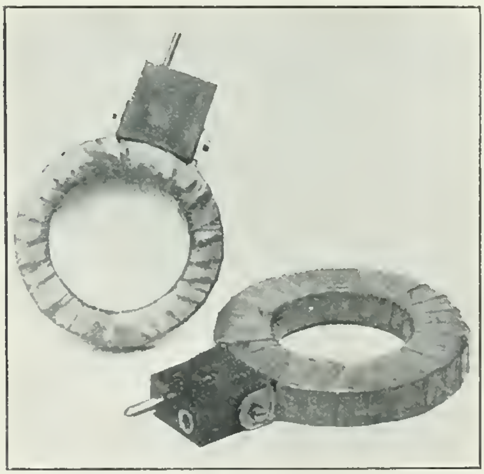
∴Local clock is 8m. 21·28s. *fast* on signalled time.

It will be apparent that by this means very accurate comparisons can be made. As the local clock or chronometer beats half seconds, coincidences between the two series of beats will occur generally at intervals of about 25 seconds apart, so that throughout the whole series 12 coincidences should occur. In practice it has been found better to disregard the half second beats of the local clock and to record every other coincidence, *i.e.*, those occurring at the whole seconds, as was done in the example given above.

The pendula employed in transmitting these signals have been illustrated in the issue of this magazine for July 29th. Although the pendula are kept adjusted so as to gain about 1 second in 50, this rate may vary slightly from day to day. It is therefore essential that the mean interval between the beats should be calculated each time the signals are taken. Again, in order to minimise the error due to the "rate" of the timepiece employed, the most accurate value will be obtained by using the first three coincidences to obtain the mean error at the time of the first dot, and the last three coincidences to obtain it at the time of the last dot and by finally taking the arithmetic mean between these values.

A New Type of Plug-in Coil.

The photograph shows the outward appearance of a new type of coil recently placed on the market. Numbers 1, 2, 3, 4 and 5 are wound pancake fashion with No. 18, 20, 20,

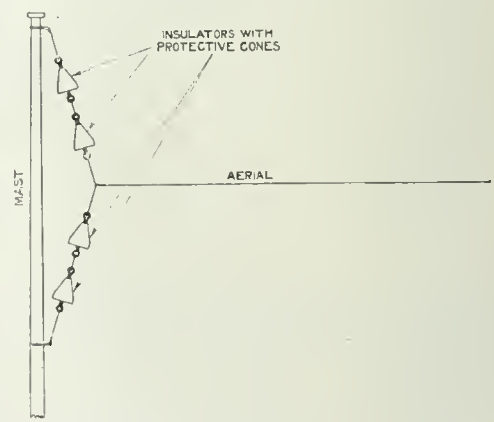


Two specimens of the new type coils made by the Rimar Coil Manufacturing Co.

24 and 24 S.W.G. wires respectively. The pancakes are made up into very solid and substantial coils without waxing or varnishing the wire at all. Numbers 1 to 3 are also supplied wound with 7/36 Litzendraht. The larger coils are cross-wound in such a manner that there are no cellular air spaces. As it has been found the self capacity of a cross-wound coil is to some extent a function of the coil width, these coils are wound about half an inch wide. The coils are fitted with machined ebonite plugs. The self capacity of the coils is low, and they are robust.

Suggestion for Arrangement of Insulators.

The accompanying illustration shows an arrangement suggested by Mr. G. H. Shaw for improving the efficiency of aerial insulators.



By so distributing the insulators, full advantage is taken of the shielding cones to protect the insulators themselves from the effect of rain.

The Theory of Resistance Amplification

By PAUL D. TYERS.

INTRODUCTION.

DURING the past few years the subject of resistance amplification has been dealt with in *The Wireless World*, either from a practical or mathematical aspect. The writer cannot call to mind any simple explanation of the principles involved, and it is assumed, therefore, that a non-mathematical consideration will be of interest to a number of readers. It should be remembered that resistances are utilised in conjunction with valves for a great many purposes other than those of amplification, and hence it is desirable that one should be fully acquainted with the mode of operation.

THE VALVE AS AN AMPLIFIER.

We may best understand the amplifying action of a three-electrode valve by referring to Figs. 1 and 2. Fig. 1 shows a typical curve such as would be obtained by plotting anode current against grid voltage in an ordinary hard valve. In Fig. 2 an oscillatory circuit

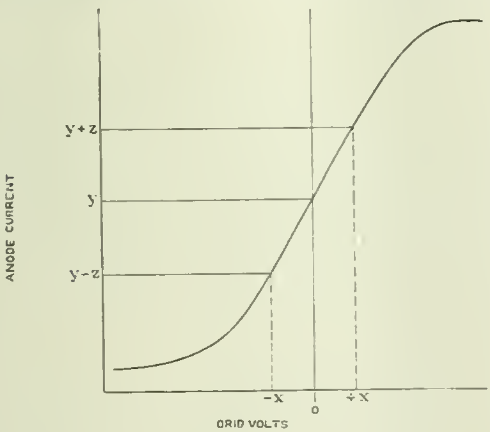


Fig. 1.

is connected across the grid G, and filament F, of a three-electrode valve V, which is supplied by the usual batteries B_1 and B_2. We will assume that the normal current flowing in the anode circuit is represented by y, Fig. 1, and it will be seen that this corresponds to approximately the mid-point of the straight part of the characteristic curve. Now it is desirable that this should be the value of the anode current when the grid voltage is zero. In practice this condition can be obtained by adjusting the potential on the anode, that is, by making the value of the anode battery variable, and also by adjusting the filament temperature.

Let it be assumed that oscillations are set up in the circuit L_1 C_1, such for example as would be the case if the circuit constituted an aerial tuning circuit of a wireless receiver. These oscillations will apply alternating potentials to the grid of the valve, thus rendering

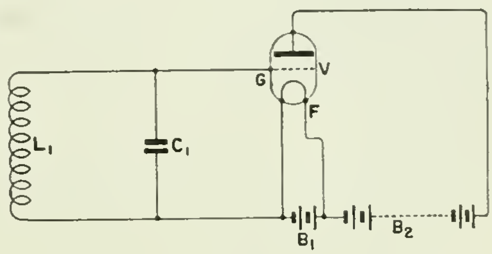


Fig. 2.

it alternatively positive and negative with respect to the filament. If we assume that the potentials are due to an undamped oscillation of symmetrical wave form, and if we neglect the damping of the grid circuit and other disturbing factors, we shall see that the positive potential communicated to the grid will be numerically equal to the negative potential. The actual value of the potential will be dependent on the strength of the oscillation.

By referring to Fig. 1 we can examine the effect of these potentials on the current in the anode circuit of the valve. We have previously assumed that the normal potential of the grid is zero, and that the corresponding anode current is represented by y, Fig. 1. We will suppose that the potentials applied to the grid are $+x$ and $-x$ respectively. We see that a potential of $+x$ on the grid causes the anode current to increase by a value z. Now since we have assumed that the positive potential is numerically equal to the negative potential, and also that the portion of the curve upon which the valve is working is a straight line, the potential $-x$ causes a decrease in the anode current of exactly z. Hence we see that theoretically the variations of the anode current are exactly proportional to the oscillations in the circuit L_1 C_1. It is obvious that these current variations may be made to control the grid potential of a subsequent valve, and moreover the potentials applied will be proportional to the current variations. Since we are now dealing with comparatively large currents, the potentials applied to a subsequent valve in a multi-valve amplifier are considerably greater than those applied to the original valve, and therefore an amplified effect is produced in the anode circuit of the second valve.

In a resistance amplifier, a resistance is inserted in the anode circuit of the first valve and the variations of the anode current produce varying potentials across the resistance, which are then applied to the grid and filament of the second valve. We may best understand this action by regarding the valve in a rather different light.

THE VALVE AS A VARIABLE RESISTANCE.

If we gradually increase the potential of the anode with respect to the filament we find that the anode current gradually increases, and similarly, if we increase the grid potential the anode current increases, as can be inferred from Fig. 1, provided, of course, the point of saturation is not reached. In other words, if the current through the same conductor varies it is equivalent to considering the conductor as a variable resistance. Hence for the purpose of our reasoning we may consider the anode circuit of a valve in a resistance amplifier to be composed of a fixed and a variable resistance, the anode filament path constituting the variable component. The anode resistance constitutes the fixed component, and it is the potentials produced across this which are applied to the next valve. We may best understand the production of these potentials by reference to Fig. 3.

A battery of voltage V is connected across a variable resistance AB in series with a fixed resistance BC. Let us examine the potential across the resistance BC. We will suppose that the resistance AB is equal to the resistance BC. Then the fall of potential V, along the path AC, will be distributed uniformly along AB and BC, and hence the potential across BC will be exactly half of V. Suppose now the resistance AB is lowered, the potential difference will still be V, but the distribution along the path AC will be altered. Since the value of AB has decreased there will be less volt drop along it, but since the total volt drop along the path AC is still V the potential difference across BC will increase. Similarly, if the resistance AB is increased, the potential across BC will be decreased. It can be shown that the greatest potential variations will be produced across BC when the resistance BC equals the resistance AB, and therefore the resistance of an anode resistance should be about equal to that of the valve with which it is used. Fig. 4 is really analogous with Fig. 3,

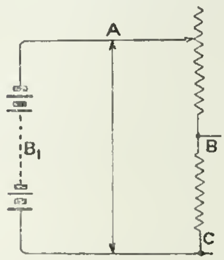


Fig. 3.

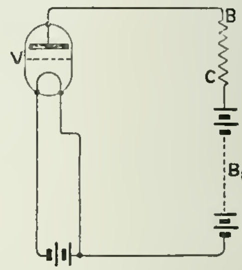


Fig. 4.

the variable resistance being replaced by the anode filament path of the valve, the value of which is varied by applying potentials to the grid.

A THEORETICAL AMPLIFIER.

We will now consider the circuit shown in Fig. 5, in which the potentials produced across the anode resistance BC are applied to a second valve, either for further amplification or rectification. The anode circuit of valve V_1 comprises the battery B_2, the resistance BC and the anode filament path. Normally a steady electronic current flows round this circuit, and in practice there will be a potential drop across BC of something of the order of 30 volts, due, of course, to the steady potential from the battery B_2. If the grid and filament of the valve V_2 were connected directly across the resistance BC, G_2 would be at a potential of about 30 volts, thus rendering V_2 inoperative. In order to prevent this we can insert either an opposing and balancing battery B_4, or if we wish to amplify pulsating or alternating currents we may insert a condenser.

Let us assume that G_1 is made positive by an oscillation in L_1 C_1. This potential will increase the anode current in V_1, or in other words, we can say that the resistance of the valve has decreased, as previously explained. The increased current through the resistance BC will naturally produce a greater potential across it. It might appear at first sight that the potential of G_2 would also become more positive. However, this is not the case, and we will understand this more readily if we regard the direction of the currents from the point of view of the electron theory. The increase of current in the anode circuit is due to an increase in the flow of electrons through the resistance from B to C. This means of course that the point B is now more negative with respect to C. Hence we see that by giving G_1 a positive potential, we give B a negative potential with respect to its former value. Since G_2 is connected to B the potential of G_2 is made negative with respect to its former value. The potentials produced across the resistance BC are very much greater than those due to the original oscillation and hence when they are applied to V_2 the variations in the anode current of this valve are considerably amplified.

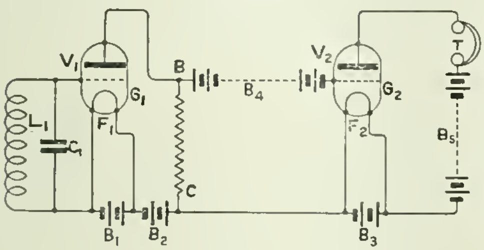


Fig. 5.

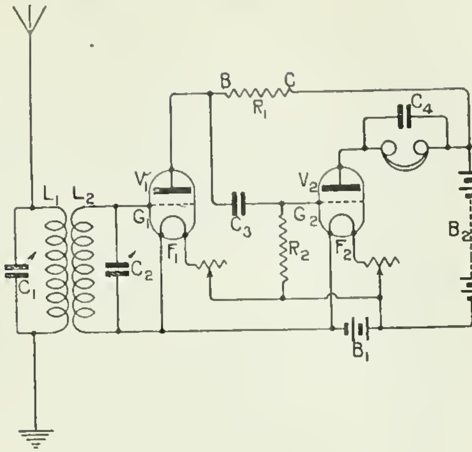


Fig. 6.

It is readily seen that when G_1 is made negative, the resistance of the valve increases, thereby decreasing the potential across BC and giving G_2 a positive potential. It is interesting to note that the current variations in the anode circuits of any two consecutive valves are theoretically in opposite phase relation, assuming of course, that they contain nothing but resistance. The circuit shown in Fig. 5 is really only of theoretical interest, but it serves to illustrate the principles involved. A practical arrangement is shown in Fig. 6, in which common batteries are employed, and the opposing grid battery is replaced by a condenser.

It should be remembered that the use of resistances in various circuits for various purposes is almost unlimited. However, in nearly every case the principle involved is fundamentally the same as that described above, and it would seem desirable, therefore, that every reader should be thoroughly acquainted with the subject, and it is hoped that these short notes will have served to remove any difficulties which may have existed.

ELEMENTARY INSTRUCTIONAL LECTURE.

An experimental Lecture dealing with the Principles of Radiotelephony, and primarily intended for Associates of the Radio Society of Great Britain, will be given by G. G. Blake, M.I.E.E., A.Inst.P., at the Institution of Electrical Engineers on January 12th, at 6.30 p.m. Tickets will be sent to Associates. All interested are invited, and tickets can be obtained by sending a stamped and addressed envelope to Mr. Leslie McMichael, Hon. Secretary, The Radio Society of Great Britain, 32, Quex Road, West Hampstead, N.W.6.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Woolwich Radio Society.*

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

At the monthly meeting held at the Woolwich Polytechnic on December 15th, Captain C. T. Hughes, R.E., read a paper and demonstrated on the "Construction of Aerial Masts." He showed how it was possible to construct a lattice mast, 50 ft. in height, at a total cost of £1 4s. 5d. By means of a model and photographs, he showed how Mr. W. T. James and he had constructed such a mast, with the simplest of tools, in eight hours.

Mr. Dowling acted as Chairman.

This Society meets every Wednesday at the Y.M.C.A., Thomas Street, Woolwich, from 7.30 p.m. to 10 p.m.

The annual general meeting will take place at the Woolwich Polytechnic on Friday, January 26th, 1923, at 8 p.m.

Cheltenham and District Wireless Association*

Hon. Secretary, Mr. E. Cole, A.R.I.B.A., 28, Milton Road, Cheltenham.

The first annual meeting was held at the headquarters, United Services Club, on December 29th, the chair being taken by Councillor Welstead in the absence of the President, Capt. Unwin, R.N.V.C.

The report showed that the Association now numbers 63 members, the average attendance at the weekly meetings being about 40.

Messrs. H. P. Brown, W. G. H. Brown **(5 BK)**, A. Moulder, R. Bloodworth and Capt. Jefford were re-elected on the committee, which was enlarged by the addition of Messrs. G. H. Ryland, S. Cox, F. Evans, C. Winters and F. Brunskill. Mr. H. Dean Poulton was re-elected Hon. Treasurer.

The new committee proposes to draw up a programme of lectures and demonstrations for the coming year, including if possible, a dance to radio music.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

The annual general meeting took place at headquarters on Friday, December 29th, at 8 p.m., the President, Mr. C. Wood, being in the chair.

The election of officers was proceeded with, Mr. A. Liardet being elected President for 1923, amidst general approval. The other new officers were as follows: Vice-Presidents, Mr. W. C. Ramshaw, Mr. A. Bever, Mr. Andrews; Hon. Secretary, Mr. J. Bever; Organising Secretary, Mr. N. Whiteley; Hon. Treasurer, Mr. E. Brown; Committee, Messrs. A. Barber, W. G. Daniels, N. Hammond, M. Eskdale.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

The annual meeting of the Society was held on December 20th, at which officers and committee were elected for the coming year, Mr. D. P. Baker being in the chair. Minor alterations in the rules were effected, and the financial statement was presented by the Treasurer, Mr. F. G. Redhead. Improvements where necessary were suggested, and an individual expression of opinion was given by most of the members present.

Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, E.7.

On December 19th, at headquarters, St. Mary's Parish Hall, High Road, Ilford, Mr. Reece, of Messrs. H. D. Butler & Co., lectured on "High Frequency Transformer Amplification." He explained the manufacture and working of various types.

A meeting was held on December 28th, with Mr. E. Nickless, A.M.I.E.E., as Chairman. Mr. E. E. Hall delivered a lecture on "Current Supply for Valves," and raised many interesting points which were fully discussed at question time.

Clapham Park Wireless Society.*

Hon. Secretary, Mr. J. C. Elvy, A.M.I.E.E., 12, Tavistock Street, Strand, W.C.2.

At the sixteenth general meeting of the Society, held on December 13th under the Chairmanship of Mr. A. L. Beadle, it was announced that a gift in shape of a 0·0005 variable condenser was presented by Messrs. R. and R. H. J. McCue, as a further contribution towards the Society's listening-in station. The Chairman appealed to members to assist in completing the set as soon as possible.

The efficiency of the Society's aerial was further discussed at some length, with the result that on the proposal of Mr. C. D. Richardson it was decided to approach the adjoining cinema with a view to securing an aerial support.

Mr. W. Brierley then gave a demonstration and an instructive lecture on the art of soldering and kindred subjects. He dealt with various metals and fluxes, advocating properly "killed" salts. Great stress was laid on the necessity for cleanliness of metals and soldering "bits," together with a good clean flame, preferably a bunsen gas flame. Likening soldering to the gumming of paper, he demonstrated with brass and copper strips, finally soldering the brass to steel strips.

He dealt with aluminium, impressing upon those present that "Aluminoid" and other aluminium solders were to be well rubbed into the aluminium under the oxidised surfaces of each piece with an old file. Aluminium solders consisted principally of zinc, a certain amount of phosphorous providing the flux.

Messrs. J. A. Daniells, C. D. Richardson, J. C. Elvy, A. H. James and R. H. J. McCue dealt with several important points in the course of a vigorous discussion. Objection was taken by some of the members who joined in the discussion to the use of salts, the main contention being that salts, being very slow in drying, were difficult to clean off, and that, especially in the case of small work, there was a risk of serious corrosion taking place.

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

On December 9th Mr. G. A. V. Sowter, B.Sc., gave a lecture on "Carrier Wave Telephony," this being a more correct term for what is often called "Wired Wireless." It was shown how ordinary telephony and telegraphy could be carried on simultaneously over the same wire, but if more than one telephony conversation is required, carrier waves must be used. The theory of this system was carefully explained, and diagrams of the circuits used were given. The practical difficulties, which limit the number of simultaneous conversations to about five or six for any given line, were explained, and in the course of a discussion after the lecture some experimental work in this direction by two or three members of the Society was brought to light.

An auction sale is being arranged to take place at the 1919 Club, Highgate, on Friday, January 19th, and it is hoped that members will send in all their old "junk." The Club set is being dismantled and rebuilt, and spare parts will be put up for sale.

Derby Wireless Club.*

Hon. Secretary, Mr. R. Osborne, "The Limes," Chellaston, Derby.

The annual general meeting of the Club was held on December 28th at 35, St. Mary's Gate.

In view of the increase in membership it was decided to form a junior and senior section, an arrangement which will be a distinct advantage to beginners. Facilities will also be given to those who wish to construct and test their own apparatus at the club headquarters, and for this purpose a Drummond lathe has been lent by one of the members. A Technical Committee was also formed to deal with difficulties experienced by members. The committee will, from time to time, carry out experiments with their own apparatus, and it is hoped that the data thus collected will be very useful to both beginners and the more experienced.

After a lengthy search the Committee have succeeded in obtaining a room in a central position, which will be used for all formal meetings. The present club-room at "The Court," Alvaston, will still be available for informal meetings and experimental work.

The following officers were elected for the coming year :—President, Mr. F. W. Shurlock, B.A. ; Vice-Presidents, Messrs. T. P. Wilmshurst, M.I.E.E., S. G. Taylor and J. J. Spencer. Chairman, Mr. A. T. Lee ; Hon. Press Secretary and Librarian, Mr. F. Harrison ; Committee, Messrs. E. F. Clark, B.Sc., M.A., A.M.I.E.E. ; E. V. R. Martin ; J. Lowe ; S. J. R. Allwood ; F. J. Cowlishaw ; F. J. Allen. Technical Committee : Messrs. F. J. Allen ; E. V. R. Martin ; E. F. Clark, B.Sc., M.A., A.M.I.E.E. ; R. F. Jolley.

Tottenham Wireless Society.*

Hon. Secretary, Mr. R. A. Barker, 22, Broadwater Road, Bruce Grove, N.17.

At a special general meeting held at Bruce Grove Schools on December 13th, the Provisional Committee and officers resigned, and offered themselves for re-election, permanent officers being then elected for the year 1922-23. Mr. Barratt acted as Chairman for the evening. As a result of the voting, the following officers were elected :—Chairman, Mr. F. Bourne ; Hon. Secretary, Mr. R. A. Barker ; Hon. Treasurer, Mr. Baker ; Committee, Messrs. Winter, Kaine-Fish, Bower and Honeybone.

It was decided that the Society should make its permanent headquarters at the Institute, 10, Bruce Grove, where a permanent aerial for the Society set could be erected. It was arranged that the Morse buzzer practice class should be held from 7.30 p.m. to 8 p.m., and that certificates for speed should be granted by the Society.

A very successful dance was held at the Municipal Hall on Friday, December 15th, when Mr. Capon very kindly lent his apparatus so that the company present could enjoy wireless music during the intervals. There was also a fine show of wireless instruments by Messrs. G. L. Wilson & Co., Ltd., of Tottenham.

The Society is now growing into an important one, and it is hoped that all prospective members will join as soon as possible, and take advantage of the next series of lectures.

Sheffield and District Wireless Society.*

Hon. Secretary, Mr. L. H. Crowther, A.M.I.E.E., 62, Bromwich Road, Sheffield.

The rapidly growing interest in wireless progress in Sheffield was amply demonstrated on New Year's Eve, when, at the invitation of Mr. F. Lloyd, President of the Sheffield and District Wireless Society (assisted by Mr. H. Lloyd), a number of prominent people united in making the wireless transmission of New Year messages an unqualified success. The transmission took place from Mr. Lloyd's experimental station (**2 UM**), Ventnor Place, Nether Edge, messages being sent by the Bishop of Sheffield (Dr. Hedley Burrows), the Rev. G. H. McNeal (Superintendent of the Sheffield Wesleyan Mission), Mr. Arthur Neal (ex-Parliamentary Secretary of the Ministry of Transport), Alderman A. Cattell (an ex-Lord Mayor), and Mr. Cecil Wilson (one of Sheffield's Labour M.P.'s.). Dr. Burrows, Mr. Lloyd announced, was believed to be the first English Bishop who had wished the citizens of any prominent city a happy New Year by wireless.

The Bishop, who confessed he had never before addressed an unseen audience, said he was impressed by the wonderful possibilities of the new discovery in spreading knowledge of all kinds.

Mr. H. L. Cooper (Editor of the *Yorkshire Telegraph and Star*), in proposing a vote of thanks to Mr. Lloyd, advised the members of the Society not to get rid of a President who had interested the Church and the State in Sheffield in wireless, and had even converted the local press.

Mr. Lloyd announced the receipt of telephone messages from the Lord Mayor (Alderman W. C. Fenton) and Col. Charles Clifford, asking him to express on their behalf greetings to the citizens of Sheffield.

The Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

At a crowded meeting held at headquarters on December 22nd, a large and interesting collection of wireless apparatus and parts made by the members was on view. These exhibits were to compete for prizes offered by B. C. Calver, Esq., and Bruce Houstoun, Esq., the first prize being a pair of Brown's 8,000 ohms telephones, the second a single valve panel. The exhibits covered a wide range of apparatus from coil holders to seven-valve sets.

The first prize went to Mr. Wooding for his very fine seven-valve unit set. Mr. Wooding gave a demonstration, and explained the various types of coils and transformers with which he had experimented. The second prize went to Mr. J. W. Dewhurst, who exhibited a fine example of short wave tuner with low frequency amplification. The design followed the latest American practice, and the workmanship was excellent.

At a meeting held on Friday, December 29th, details were discussed for the Society's Public Exhibition and Demonstration of Wireless Apparatus, to be held at the Fulham Town Hall.

Lowestoft and District Wireless Society.

Hon. Secretary, Mr. L. W. Burcham, "Gouzeacourt," Chestnut Avenue, Oulton Broad.

The Society's report of the work done during the last quarter is an interesting record of activity.

On October 10th a competition was held under the direction of Mr. H. Trent. The members were given components for the assembling of a single valve and a two-circuit crystal set, the winners being two associates of the Society.

On October 24th Mr. R. Giles lectured on "Land Line Telephony."

On November 7th Mr. H. C. Trent gave a lecture and demonstration on his telephony transmitter, communication being established with **2 MD.**

On November 21st Messrs. C. Garrood and L. Burcham gave a demonstration and lecture on "The Armstrong Regenerative Circuit."

On December 5th another competition was held, the items including (1) Soldering simple joints; (2) Reproduction of a two-valve L.F. receiver diagram; (3) Finding faults on a single valve panel. The prizes were awarded to associate members.

On December 19th Mr. C. Chipperfield gave a lecture from his station **2 MD**, and afterwards provided some music.

Warrington Radio Association.

Hon. Secretary, Mr. J. Barton, 266, Lovely Lane.

A meeting was held on December 28th at 7.30 p.m. in the Y.M.C.A., Market Gate, with the kind permission of Mr. Featherstone, the Secretary. Mr. F. V. L. Mathias was in the chair. The business of the Association having been dealt with, Mr. Nadin discussed the merits of H.F. and L.F. amplification, and answered a large number of questions regarding wireless generally. Subsequently the question of permanent quarters for the Association was inquired into, and there are strong reasons to believe that an arrangement with the local Y.M.C.A. is probable. The meeting terminated with the feeling that the future of the Association was distinctly rosy.

The Stratford-on-Avon and District Radio Society.

Hon. Secretary, Mr. Knight, Park Road, Stratford-on-Avon.

The eighth general meeting of this Society was held on Monday, January 1st, with Mr. Tompkins in the chair. After minutes had been passed, the question of building a Club unit set was discussed, and the Secretary was authorised to purchase the necessary material. As a result of several enquiries it was decided to admit lady members to the Society. The President, Captain West, R.N., has been successful in obtaining an experimental permit for the Society. Mr. F. A. Sleath has kindly consented to become a Vice-President, and has presented the Society with the first unit of the apparatus, in the form of a detector panel. The first annual general meeting is to be held on January 29th, 1923.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

On December 21st a meeting was held at headquarters, 36, Hamilton Square, Mr. H. I. Hughes (Technical Adviser) taking the chair.

Mr. Hill lectured on "H.F. Currents and their Application to Radio," illustrated by lantern slides kindly lent by Professor Marchant.

The chief object of Mr. Hill's lecture was to show the various ways in which oscillations could be set up in circuits, for the purposes of transmission.

A demonstration of telephony reception from Manchester and Birmingham broadcasting stations was given by Mr. Reade on his Marconi unit set.

Buzzer practice was held from 7.15 to 8 p.m.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. W. R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

At a meeting of the Society on December 1st, Messrs. W. D. Keiller and W. A. J. Smith explained and illustrated the working of a five-valve receiving set kindly lent by them for the occasion. There was another meeting on December 7th, when Mr. F. E. Wright gave a detailed lecture on "The Thermionic Valve," which was greatly appreciated.

On December 15th several small wireless parts were on exhibition, including a crystal receiving set and Mr. W. D. Keiller gave a lecture on condensers, explaining the method of calculating capacity.

Isle of Man Radio Society.

Hon. Secretaries, Mr. J. P. Johnson, 16, Hildesley Road, and Mr. J. S. Craine, 6, Belmont Terrace, Douglas.

At a meeting held on December 19th, after considerable discussion, the constitution of the Society was established. The following additional officers were appointed:—President, Mr. F. R. Grundey, B.Sc., F.C.S., Director of Education (I.O.M.); Joint Secretary, Mr. J. S. Craine; Treasurer, Mr. A. Gore; Committeeman, Mr. R. Cannell. An excellent syllabus has been arranged by the Committee who have entered upon their work with great enthusiasm.

Bournemouth Radio and Electrical Society.

Hon. Secretary, Mr. L. O. Sparks, "Maranoa," 3, Cotlands Road, Bournemouth.

The above Society has now been formed, and all those interested in wireless and electrical matters are invited to communicate with the Secretary.

Darwen Wireless Society.*

Hon. Secretary, Mr. T. H. Mather, 8, Hawkshaw Avenue, Darwen.

At the December meeting several new members were enrolled, with the result that the membership now exceeds 50. Rooms have been secured in the centre of the town and will shortly be ready for occupation as the headquarters of the Society.

Several prominent local gentlemen have rendered very active assistance to the Society, and it is hoped to commence a series of lectures for the less experienced members within the next few weeks. Many promises of apparatus have been made towards the receiving set now being installed, including a 4-valve panel and loud speaker.

New members will be welcomed and every assistance given them at the Society's rooms or on application to the Hon. Secretary.

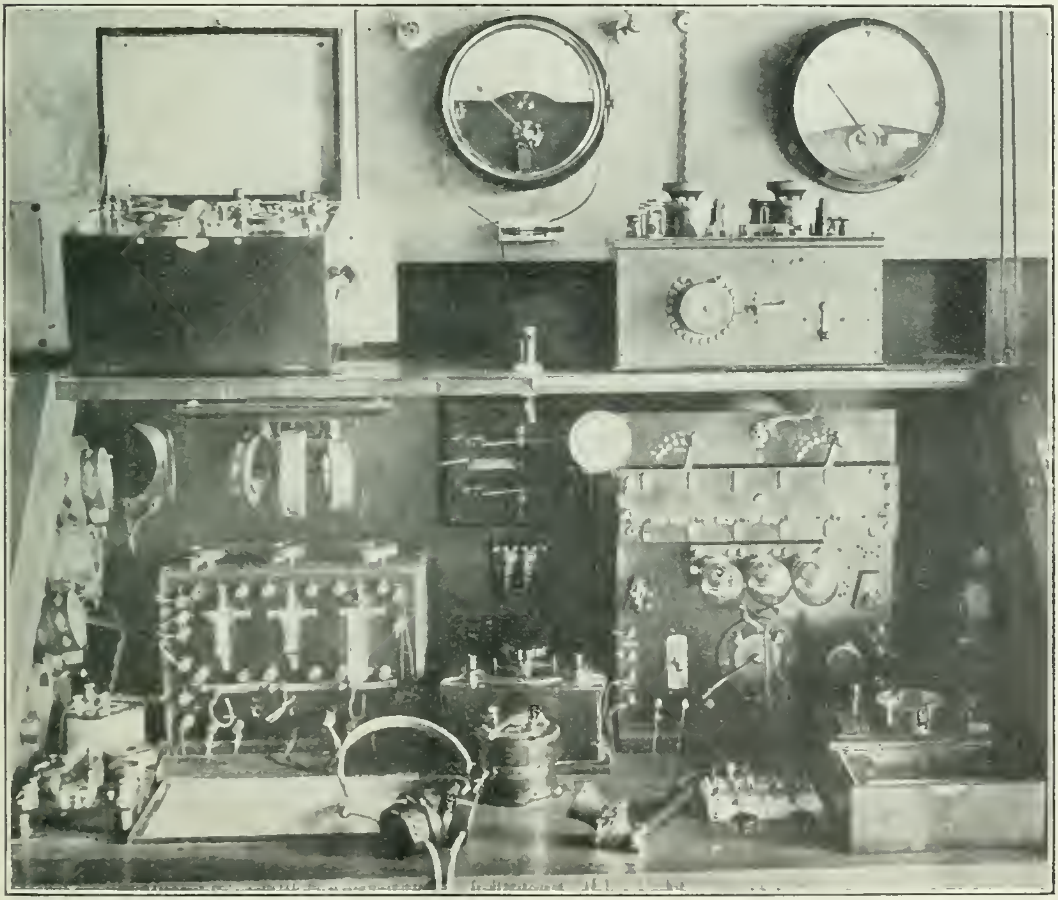
Felixstowe and District Radio Society.

The Society is still progressing, and more members have recently been enrolled. Instructive lectures by Messrs. Carter, Douthwaite and the Secretary have been given and greatly appreciated by the members.

A Club single-valve set has been made, and only awaits receipt of an experimental licence from the P.M.G. to be brought into use.

Abuse of reaction in the locality is a source of great annoyance, and the Society invites those responsible for the trouble to come along to the club-room and get a few hints on this subject from its technical members. The Society holds its meetings on Fridays from 7 to 10 p.m., at St. Andrew's Church Hall, Gainsboro' Road Felixstowe.

AN AUSTRALIAN EXPERIMENTAL STATION.



The station of Mr. C. Maclurcan at Sydney, N.S.W. Successful communication tests employing C.W. and Tonic Train have been carried out with S.S. "Montoro" at distances of 420 and 705 miles on power estimated as only 8·7 watts.

Notes

The Physical Society of London and the Optical Society. Annual Exhibition.

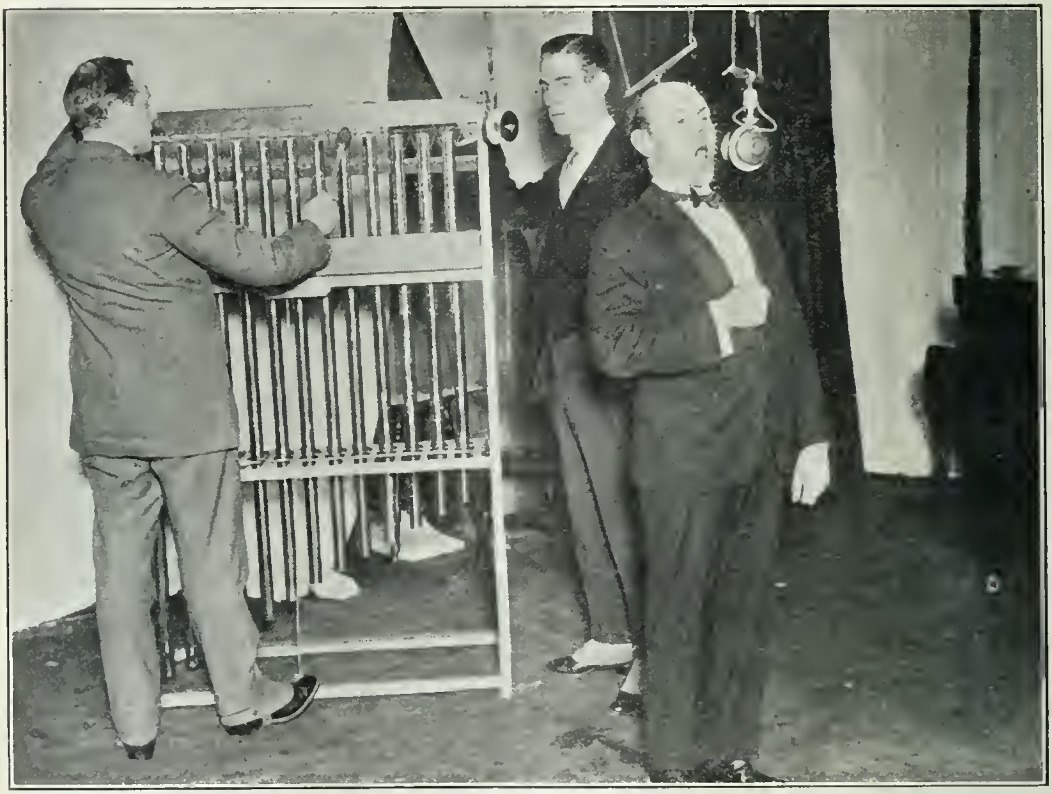
The thirteenth annual exhibition was held on Wednesday and Thursday, January 3rd and 4th, at the Imperial College of Science, South Kensington. Amongst the exhibits shown were several of wireless and allied inteiest. A description of some of these exhibits will appear in our next issue.

A Resignation.

The Managing Director of the Marconi Company of Canada, Mr. Arthur Hyatt Morse, has resigned from that office. He was formerly European Superintendent.

Misuse of Call Sign.

An amateur in Liverpool reports that his call sign **5 GB** is being used by another transmitter for spark transmissions, and it is hoped that by means of the publication of the fact the practice may cease.



Ringing in the New Year by Wireless at 2 LO. *Mr. Burrows (left), Mr. K. Ellis (right).*

New Wireless School.

At Rotherham a school for the study of wireless telegraphy and telephony is about to be opened. Mr. J. Willey, President of the Rotherham Radio Society, will be in charge.

Proposed Society for Keswick.

It is proposed to form a Wireless Society in Keswick and district, and Mr. H. Rhodes, of Ratcliffe Place, Keswick, will be glad to answer enquiries.

A Wireless Year Book for the Amateur.

Our publishers announce that this year, in addition to the well-known "Year Book of Wireless Telegraphy and Telephony," they are publishing for 1923 an amateur edition' particulars of which will be announced shortly. It is promised that this book will contain all the information which the amateur most needs at a very reasonable price. Amongst special features will be included a very up-to-date list of experimental transmitting stations.

Wireless at Merchant Venturers College.

Mr. W. A. Andrews, B.Sc., A.I.C., of the Institute of Radio Engineers, is to conduct a course of ten lectures at the Merchant Venturers Technical College, on "The Elementary Principles of Wireless Telephony." These lectures are given on Wednesday evenings, and commenced on January 10th. Mr. Andrews was head of the Cardiff Technical College, Department of Wireless Telegraphy.

Prize for Transatlantic Reception.

The Wireless World and Radio Review has received a communication from Messrs. Burndept, Ltd., to the effect that they are offering a prize of £10 to the first English amateur who is successful in the reception of the American Station, **WDAP**, of the Mid-West Radio Central Inc. This station now operates with 1 k.W. in the antenna and this will shortly be increased to 2½ k.W. The wavelength is 360 metres. For those who enter this competition the only stipulation made with regard to apparatus used is that not more than three stages of high frequency amplification shall be employed. The times of transmissions from **WDAP** are—

Tuesday and Thursday evenings, 10 p.m. to 1 a.m.
Saturdays, 10 p.m. to 2 a.m.
Sundays, 8.30 p.m. to 10.30 p.m.

It must of course be borne in mind that these times refer to the times of transmission in America, and must be corrected for times of reception in England.

A Change of Address.

Messrs. Leslie McMichael Ltd., have recently taken new offices and showrooms. Their showrooms are now at 179, Strand, W.C.2 (at the corner of Norfolk Street), and the Head Offices at Hastings House, Norfolk Street, W.C.2.

A New Magazine.

Under the title "Modern Wireless" there appears in the advertisment columns of this Journal the announcement of the first number of a new monthly wireless magazine to be published on January 15th by the Radio Press, Ltd. The editor is Mr. John Scott-Taggart, F.Inst.P., who has formerly contributed to *The Wireless World and Radio Review*, and is the author of publications particularly relating to the thermionic valve. In this connection he was at one time in charge of valve design at the Ediswan Lamp Works. He is in charge of the Patent Department of the Radio Communication Company, Ltd., and acts as patent adviser to C F. Elwell, Ltd., and the Mullard Radio Valve Company, Ltd.

Reception of Ongar (GLO) in Java.

The chief of the Radio Department, Bandoeng, Java, reports that having seen a description of the Marconi High Speed European Services in *The Wireless World and Radio Review* he listened in on the stated wavelength of 4,350 metres at 9 o'clock Central Java time, or 1340 G.M.T. In the latter part of the night the signals were quite strong on an aerial of only 45 ft. length and 15 ft. above ground with a two-valve set.

It is stated that the signals are audible almost every night, the distance being approximately 7,500 miles.

Death of a Pioneer of Wireless.

Sir John Gavey, who was for several years consulting engineer to the Post Office, and who was closely concerned with the installation of the first wireless telephone in this country, died on January 1st at the age of 80 years.

Christmas Eve Reception of American Stations.

The reception of broadcasting from American stations on Christmas Eve by Captain H. J. Round, of the Marconi Company, is of particular interest in view of the conditions under which the result was obtained. The aerial employed was a frame 2 ft. square. The rest of the apparatus consisted of a six-valve amplifier and double note amplifier, with Amplion loud speaker. At Captain Round's house at Muswell Hill, a pianoforte solo broadcasted from **WGY** (Schenectady, U.S.) was heard loudly through the loud speaker. Christmas carols were also received from America, and other speech which was of exceptional quality.

American Stations Received on December 21st.

Mr. J. H. D. Ridley, of Burndept, Limited, recorded on a Dictograph on the morning of December 21st the following American stations:— **1 CMK, WDAF** (Kansas City) and **WDAM** (New York City, Western Electric Co.).

Calendar of Current Events

Friday, January 12th.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. Elementary Class.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture on "Some Apparatus used in Telegraphy," by Mr. R. E. Timms (Hon. Treasurer).

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
Lecture on "Construction of H.F. Amplifier," by Mr. S. Burman.

Saturday, January 13th.

LAMBETH FIELD CLUB AND MORLEY COLLEGE SCIENTIFIC SOCIETY.
At 7.30 p.m. Practical night.

Sunday, January 14th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, January 15th.

ILKLEY AND DISTRICT WIRELESS SOCIETY.
At the Regent Café, Ilkley. At 7.30 p.m. General Meeting and Lecture by Mr. J. Croisdale on "The Armstrong Super-Regenerative Receiver."

MANCHESTER WIRELESS SOCIETY.
Lecture by Mr. A. G. Gregory on "Are Transmission."

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 55, Fonnereau Road. At 8 p.m.
9.20–10.20 p.m. Dutch Concert **PCGG**, The Hague, 1,050 metres.

Tuesday, January 16th.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.
At St. Margaret's Institute, Alexandra Road, Lowestoft. Public Demonstration and reception of broadcast music.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.
Meeting.
Transmission of Telephony at 8 p.m. on 400 metres, by **2 MT**, Writtle.

Wednesday, January 17th.

MALVERN WIRELESS SOCIETY.
Lecture: "Reaction and Heterodyne."

HALIFAX WIRELESS CLUB.
Elementary Instruction Evening.

EDINBURGH AND DISTRICT RADIO SOCIETY.
At the R.S.S.A. Lecture by Professor R. Wood on "Photography of Sound Vibrations," and Mr. C. N. Kemp, B.Sc., on "Properties of Selenium and Applications."

Thursday, January 18th.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.
At 7.30 p.m. Lecture by Mr. L. F. Fogarty, on "Rectifiers."

ILFORD AND DISTRICT RADIO SOCIETY.
Informal meeting.
At 9.20–10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Friday, January 19th.

THE RADIO SOCIETY OF HIGHGATE.
At the 1919 Club, South Grove, Highgate. At 7.45 p.m. Sale of apparatus.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture by Mr. H. F. Yardley,

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At the Department of Applied Science, St. Georges Square. At 7.30 p.m. Mr. Brookes on "Practical Construction of Wireless Apparatus."

Saturday, January 20th.

LAMBETH FIELD CLUB AND MORLEY COLLEGE SCIENTIFIC SOCIETY.
At 7.30 p.m. Lecture by Mr. J. J. Denton, A.M.I.E.E., on "Epochs in the Development of Wireless."

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company :—

London	2 LO	369	metres.
Birmingham	5 IT	420	,,
Manchester	2 ZY	385	,,
Newcastle	5 NO	400	,,

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I read with interest the article by Mr. E. H. Robinson on Chemical Rectifiers for plate voltage supply, in the current issue of *The Wireless World and Radio Review*. Having made a considerable number of experiments on similar lines I am convinced that it will ultimately be possible to operate a receiving set entirely from alternating current, using some form of rectifier.

The purpose of the present communication is to draw your attention to one or two improvements which can easily be added, and which are doubtlessly already known to your contributor. In the first place, by winding the transformer for a sufficiently high secondary voltage, and providing a middle point tap, it is possible to reduce by half the number of cells shown in his diagram Fig. 4. The transformer will cost a little more, but confers the advantage of reducing the number of cells which have to be renewed from time to time.

My own experience with ammonium phosphate has not been satisfactory, and I should be interested to know whether Mr. Robinson has any oscillograph curves taken on rectifiers using this solution. In any case this particular salt is very corrosive to brass fittings, such as are suggested in (*b*) Fig. 5. I recognise that the presence of a layer of paraffin oil will to a large extent restrict the evolution of corrosive fumes, but on the other hand this layer of paraffin can only be used on rectifiers run at extremely light loads, for any tendency towards heating up will bring in its train a chemical action between the solution and the paraffin which will destroy the rectifying properties of the former. For this reason I prefer to cover the aluminium electrode with an ebonite or rubber tube at the point where it enters the solution. Small rubber tubing similar to that used for bicycle valves is readily obtainable, and in my opinion is more convenient than the paraffin layer.

Dene Cottage, L. F. FOGARTY.
Ruislip, Middlesex.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"T.W.H." (Cockermouth) *submits a diagram and asks* (1) *Whether it is suitable.* (2) *How a series-parallel switch is connected.*

(1) The proposed wiring diagram is suitable, but there is no need to use two H.T. batteries. We have redrawn the circuit showing one H.T. battery. (See Fig. 1.) This also indicates how switching may be carried out. The switching controls the filament supply to the valves, as well as throwing over the grid connection. The Post Office regulations state that reaction should not be used for the broadcasting wavelengths while broadcasting is in progress, and the Post Office rely upon you to see that this regulation is adhered to. If you hold an experimenter's licence, the circuit is quite suitable, but care must be taken that reaction does not set up oscillations in the aerial circuit. To make sure of this you should couple the reaction coil with the anode coil of the first valve, in which case it is not possible to set up oscillations in the aerial circuit. (2) The figure shows how a series parallel switch may be connected to a tuner. Should you find any difficulty in manipulating the set, perhaps a stand-by and tune switch would be useful, and we have indicated the connections.

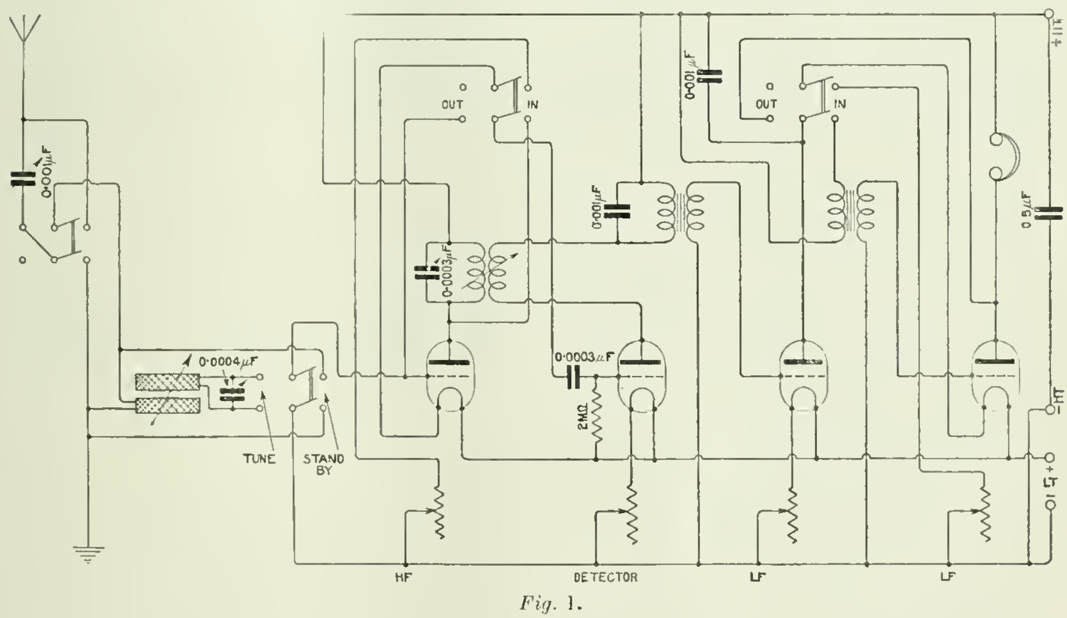


Fig. 1.

"W.H.L." (Larne) *submits a diagram and asks whether it will function as a combined autodyne detector and amplifier.*

The circuit is very unusual, and we do not think it would successfully perform the above functions. Why not try a standard arrangement of apparatus that you know will work well, and then experiment with other circuits.

"W.T." (N.7).—The coil in the anode circuit of the high frequency valve could be 3″ diameter and 4″ long, wound with No. 36 S.S.C. wire, and eight tappings could be taken, but it would be better if you constructed several coils and connected them in the anode circuit as required, otherwise you may experience trouble due to dead end effects, and almost certainly not secure the maximum amplification possible. This anode coil should be tuned with a condenser of 0·0002 mfds. maximum value when on short wavelengths—say up to 1,000 metres. On higher wavelengths, the maximum value of the condenser may be 0·0005 mfds. without seriously decreasing the efficiency of the arrangement. We do not think you would find a ball form of reaction coil suitable for use with the coil above mentioned, and we suggest you wind a tube 2″ diameter and 4″ long full of No. 36 S.S.C. wire with eight tappings for the coupling coil. The terminals marked 2 × 1 in the diagram to which you refer are for the purpose of adding extra inductance in the reaction coil circuit, in order to roughly tune that circuit, and you can make provision for the same purpose for use on the longer wavelengths. This arrangement involves the use of a large and cumbersome sliding reaction coil, and we suggest you connect the high frequency amplifier with reactance to the primary of the M.T.I. Although a variometer can be used for tuning the anode circuits of the H.F. valve, we consider it is more convenient in this case to use a tapped coil with the variable tuning condenser.

"E.C." (Doncaster).—The elimination of interference due to inductive disturbances is a difficult matter. We suggest you employ a frame aerial, with H.F. connected valves, and 1 detector valve. If you would care to communicate with us again on the subject, stating which transmissions you wish to receive, and if you are prepared to make the above alteration, we shall be pleased to furnish a diagram of connections. However, the arrangement indicated in Fig. 2 will meet your requirements. The values are marked in, and you will notice the positions of the grid leaks.

"V.J.T." (Woodside) *asks whether the short wave receiver described in the issue of June 3rd may be adapted for use with a crystal detector.*

The tuner referred to is quite suitable for use with a crystal detector. See Fig. 3. Tuning condensers will not now be required, as tuning may be effected with the variometer and fine tapping switch.

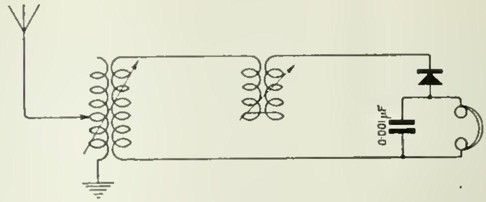


Fig. 3.

"A.K." (Sussex).—We do not think you will be able to satisfactorily use the alternating current supply in connection with the receiving set. The transformer will be expensive, and rectifying apparatus and a smoothing system would be necessary if reception is to be free from hum. We think the best plan would be for you to use an accumulator for heating the filament battery. If you cared, you could of course charge the accumulator yourself by means of any of the rectifiers now upon the market.

"T.S." (Bucks.) *asks for criticism of his set.*

The arrangements suggested are very practical, and quite suitable for the purpose which you intend to use them for. We suggest you use a series or parallel switch in the aerial circuit for joining the aerial condenser and aerial tuning inductance in series or parallel for short and long wavelengths respectively. The suggested alterations shown in sketch 2 are quite suitable, but the high tension voltage should normally exceed 30 volts. It is usual to use about 60 volts when 6 volts is applied to the filament circuit for use on the valves through a filament resistance.

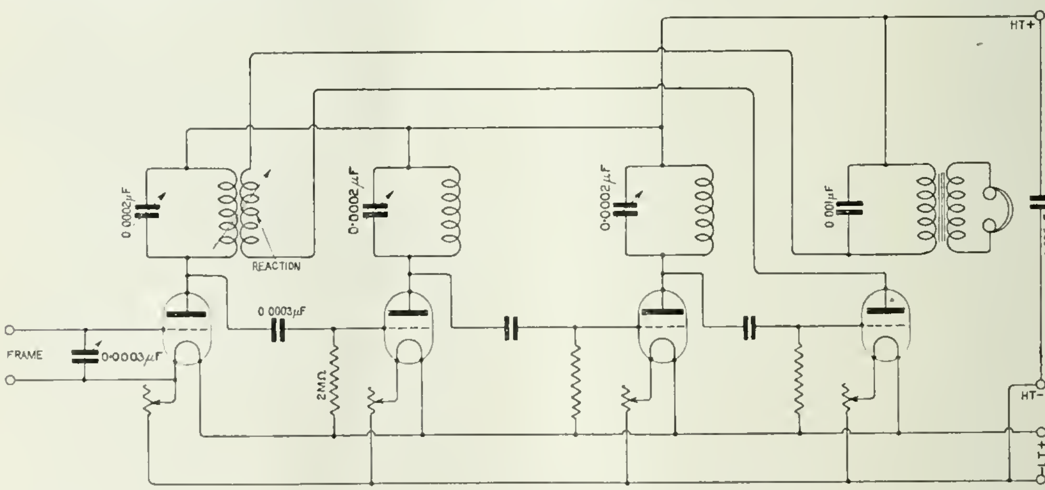


Fig. 2.

"CONTACT" (London, E.18) *asks* (1) *For a diagram of a six-valve set comprising 3 H.F., 1 detector, and 2 L.F. valves, with provision for plug-in transformers and resistance capacity coupling.* (2) *Whether a potentiometer is useful.* (3) *Whether a three-coil holder could be used alternatively with a two-coil tuner.* (4) *Whether it is better to gradually increase the H.T. volts instead of applying the full voltage suddenly to the apparatus.*

(1) and (2) See Fig. 4. The potentiometer is used to control the grid potential of the H.F. valves and is very useful. (3) The three-coil holder and the two-coil tuner can be used as required. It is doubtful however whether much benefit will be derived through this additional complication. (4) It would be better to do so if it could be arranged.

The method is simply to wind the reaction coil on a suitable former and fix it so that its coupling with the anode coil may be varied. A two-coil holder is sometimes used for the purpose, and sometimes a sliding coil is used. It is not good practice to join the condenser and inductance in parallel when receiving on short wavelengths. Should trouble due to interference be experienced at any time, it will be necessary to use a secondary circuit coupled to the aerial circuit. This is done by many users.

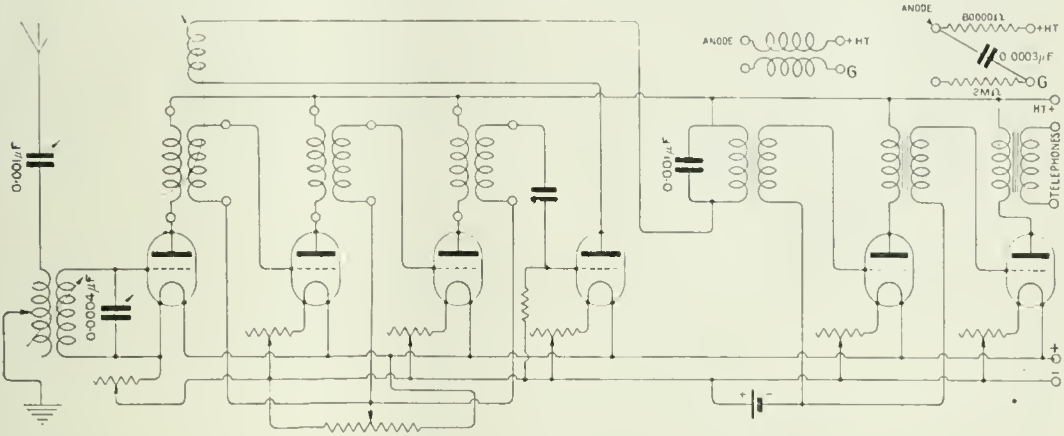


Fig. 4.

"E.S." (London, S.W.4) *asks* (1) *Whether diagram submitted is correct.* (2) *What is meant by "stand-by" and "tune switch."*

(1) The arrangement is not quite correct. The correct connections were given in a recent issue in reply to a correspondent. (2) A stand-by and tune switch is a double-pole throw over switch used to connect the aerial or the closed circuit to the grid and filament of the first valve. See Fig. 5.

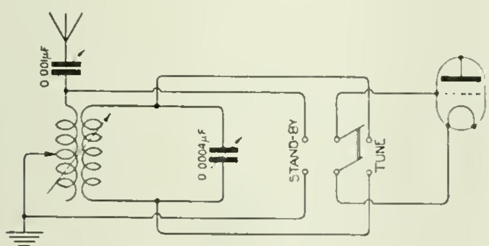


Fig. 5.

"E.C." (Penistone).—The diagram submitted is quite correct, with the exception that the reaction coil should be coupled with the tuned anode coil.

"J.W." (Glasgow).—The reaction coil which is coupled with the high frequency transformer or tuned anode may have a fixed value consisting of about 100 turns of No. 38 S.S.C. wire, in a former with a mean diameter of 2″. This winding does not need to be tuned, but it may be necessary when long wavelengths are being received to add a little more inductance in this circuit. This inductance may take the form of a tube 2″ in diameter and 6″ long, wound full of No 38 S.S.C. wire, with eight tappings. This coil should not couple with any other coil. It will be unnecessary for you to take steps to renew your licence. The Post Office will communicate with you shortly after the date on which your licence expires, and simply ask for a renewal of the fee.

"H.G." (S.W. 19) *submits particulars of his receiver and asks for advice.*

Coil A could consist of a winding of No. 30 D.C.C. wire on a former 4″ diameter and 8″ long, with 10 tappings. We think you will find it advisable to put 6 tappings in the reaction coil. In the diagram submitted no tuning condenser is shown in the secondary circuit. This should have a value of 0·0005 mfds., as you probably know.

"J.D." (Swansea).—The aerial which you have at the present time is quite suitable for use, but it would be better, if it were possible, to use a small aerial (say 60′ long and 30′ high) for the short wavelengths, and for the longer wavelengths the use of a larger aerial consisting of two wires each 60′ long and spaced 7′. However, quite good results are obtainable with only one aerial of medium size such as the one you describe.

"H.B." (Yorks) *asks* (1) *Whether a certain set would be permitted by the Post Office for use on broadcast wavelengths.* (2) *Would the apparatus, joined as in the sketch submitted, cause interference with other stations.* (3) *Is a person allowed to construct his existing apparatus to comply with the new broadcast regulations, or is he compelled to purchase a new set from a broadcasting company.* (4) *For a diagram of a four-valve circuit,*

(1) The circuit Fig. 2, page 880, September 30th issue, may be used provided you hold an experimenter's licence, and it will be for you to take care that oscillations are not set up on the aerial circuit over the broadcasting wavelengths while broadcasting is in progress. (2) The circuit submitted cannot cause energy to be set up in the aerial circuit, and will therefore be quite suitable for use. (3) A person wishing to use home-made gear is regarded by the Post Office as an experimenter, although if the aim of the individual is not to have any serious interest in the technicalities of the science, he is required by the Post Office to purchase made-up apparatus, owing to his non-acquaintance with the subject, in order that he may not cause serious interference by the use of an incorrectly designed receiver. The position of the experimenter has been clearly defined in recent issues. (4) See Fig. 6.

"A.C." (Southport).—We consider three 30-volt carbon filament lamps would burn out if connected to charge your accumulator, and it would be better for you to use four 50 candle-power carbon lamps in parallel and join them in series with your accumulator. Carbon lamps are used because they pass far more current for a given candle-power than metal filament lamps, and furthermore, are considerably cheaper. The lamps should be those normally used on a 220-volt circuit, and we should point out that the accumulator should be placed on a stand when charging, so that currents cannot leak to earth. As considerable heat will be generated by the lamps, it is better to make up a small framework with the lamps mounted. If you desire to charge the accumulators at a slower rate, a lamp may be easily taken out. Charging the accumulators at a slow rate does not do any harm, but on the contrary, considerably benefits them. The charging should be carried out in a regular manner.

"J.H." (W.C.1) *submits particulars of his unit system and asks* (1) *Whether it is suitable, and values of components.* (2) *Whether the A.T.I. is suitable, and if tappings are necessary.* (3) *Whether the windings of the anode and reaction coils are correct.*

(1) The tuning condenser, C_1, should have a maximum value of 0·001 mfds., and C_2, 0·0003 mfds. (2) We suggest you do not dispense with the tapped aerial coil, as better results will be obtainable with its use. (3) The anode windings are correct, and we suggest you adhere to the present arrangement, since it is efficient and easy to operate.

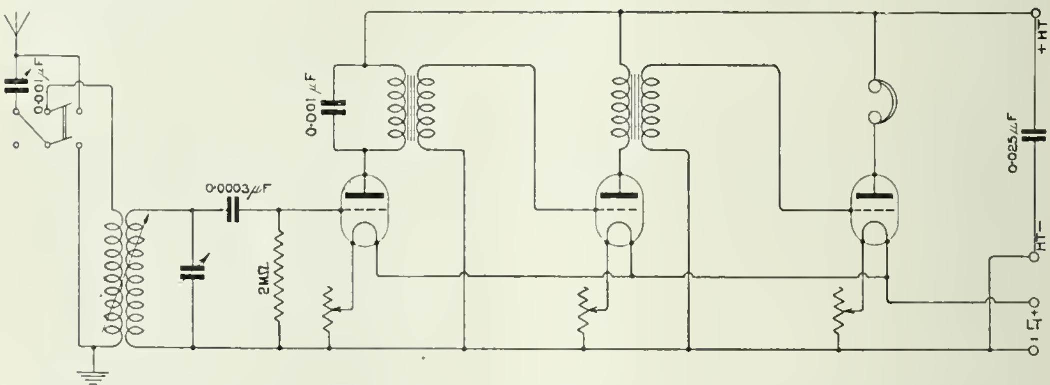


Fig. 6.

"C.M." (Lancs.).—We have examined the circuit submitted, and we think you had better try the tuning condenser in series with the tuning inductance when receiving short wavelengths, say of 600 metres. The remainder of the diagram appears to be correct. We cannot however help you much, as you have not given us particulars of the coils and condensers used in the circuit. The aerial tuning condenser should have a value of 0·001 mfd., and the closed circuit condenser 0·0005 mfds. The reaction condenser may have a value of 0·0002 mfd. The grid leak should have a value of 0·0003 mfds., and the leak resistance 2 megohms. If the condenser bridging the telephones and negative H.T. battery is of large value, we suggest you will have the connection so that only the battery is bridged by it. It would be better, we think, if you removed the switches from the circuit and rewired the set without them, until you find where the fault lies. We assume, of course, that the plug-in high frequency transformer tunes to the same wavelength as the aerial circuit.

"A.A.P." (Herts.) *asks which is better, to use high resistance apparatus directly in the anode circuit, or to use a transformer and low resistance apparatus.*

It is without doubt better to employ a telephone transformer and low resistance telephones or loud speaker than to connect high resistance apparatus directly in the anode circuit of the valve. High resistance apparatus is of course wound with very fine wire ; the winding is therefore delicate, and is very liable to be damaged by the continuous application of the anode voltage. The transformer, on the other hand, is easily insulated, and is able to withstand the anode voltage. In addition, capacity effect, due to changing the capacity of the telephones and leads, is absent.

"MEMBER" (South Shields) *asks* (1) *Why his set will not oscillate on wavelengths below* 600 *metres.* (2) *For suggestions.* (3) *An opinion on the set.*

(1) and (2) The reaction coil is not large enough to set up oscillation on low wavelengths. We suggest you add a few more turns, although we do not see why you do not couple the reaction coil with the tuned anode coil and so minimise radiation. The A.T.C. and A.T.I. should be in series when receiving short wavelengths, and you might incorporate a switch for this purpose. (3) The circuit is quite a standard one, but would be better with the modification suggested above. In addition we think you should connect the grid leak to +ve L.T. instead of —ve L.T.

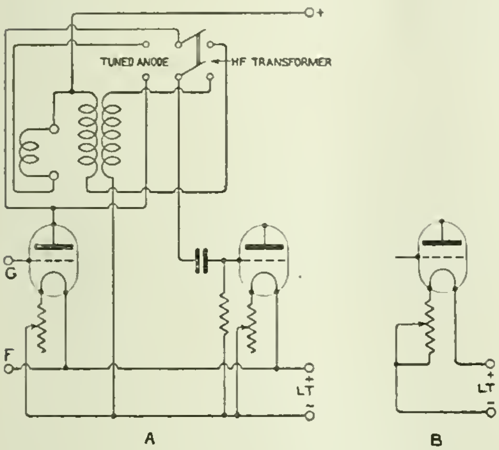


Fig. 7.

"F.B." (Southport).—The circuit may be arranged as indicated in Fig. 7 (A). The correct method of connecting the filament resistance is indicated in Fig. 7 (B). The resistance is connected in the L.T. negative lead, and it is an advantage, especially when using valves which take a heavy current, to connect the resistance and sliding contact together as shown. In this way, if the resistance occasionally breaks contract, the valve will still remain alight, as when a large current is being taken. As in the case of transmitting valves, the drop in the lead is considerable, and the reduction in this drop of potential due to one valve having its current supply suddenly taken off, results in a large increase in current through remaining valves. The alterations necessary to the amplifier referred to are outlined at the bottom of page 609, August 12th issue.

"V.G.C." (N.W.3.) *asks* (1) *The dimensions of a frame aerial for receiving over a wavelength range of* 300-1,000 *metres.* (2) *Whether* PCGG *may be received using this aerial and a four-valve set.* (3) *Whether a microphone amplifier may be used to operate a loud speaker.*

(1) A suitable frame would be 4′ 6″ square with 15 turns of No. 18 copper wire spaced ¼″. Five tappings should be taken to a switch. (2) We think with careful adjustments you will receive PCGG transmissions. (3) Yes, but a little experimental work will be necessary.

"HECTOR DEEN" (Surrey) *asks* (1) *The formula for calculating the inductance of a lattice coil.* (2) *How the turns are counted.* (3) *Whether empire cloth may be used to separate coils.* (4) *Whether* 18 *S.W.G. copper wire is as suitable for wiring as* 18 *S.W.G. tinned copper wire.*

(1) The formula for calculating the inductance of lattice coils is

$$L\,\text{mhy} = \frac{1}{1{,}000} \times \frac{4\pi^2 a^2 N^2}{b + c + R} \times F_1 \times F_2$$

$$\left.\begin{array}{l} a = \text{mean radius of the winding—} \\ b = \text{axial length of the winding} \\ c = \text{thickness of winding} \\ R = \text{outer radius} \\ N = \text{total number of turns} \\ F_1 = \dfrac{10b + 12c + 2R}{10b + 10c + 1{\cdot}4R} \\ \text{and } F_2 = 0{\cdot}5 \log_{10}\left(100 + \dfrac{14R}{2b + 3c}\right) \end{array}\right\} \text{in cms.}$$

(2) One turn is completed when the wire has travelled from the starting point back again to a point over the starting point. (3) Empire cloth is suitable for the purpose. (4) There is no great objection to the use of bare copper wire in place of the tinned copper wire.

"L.V." (S.W.) *asks for criticism of his set, diagram of which is submitted.*

We suggest you join the tuning condenser (maximum value 0·001 mfds.) in series with the aerial when receiving on short wavelengths. The coil may be a winding of No. 22 D.C.C. wire on a former 4″ diameter and 6″ long, with 12 tappings. The reaction coil could be a winding of No. 28 D.C.C. on a former 3″ diameter and 4″ long with 3 tappings. The circuit arrangement is correct, although you would probably find it advantageous to use a secondary circuit.

"RADIOMAD" (Salisbury) *asks* (1) *What results to expect when using a three-valve amplifier.* (2) *Whether an earth lead* 12′ *long will reduce the signal strength.* (3) *Whether the telephone leads may be increased to* 20′ *without bad results.* (4) *Suitable values of condensers for use in a three-valve set.*

(1) We cannot say, since the results depend so greatly upon the skill of the user, his location with respect to the transmitting stations, etc. Large amplification should of course be obtained. (2) The earth lead will not reduce signal strength to any great extent, although if you can reduce the length it will be better. (3) The leads may be lengthened, and probably no falling off in signal strength will result, provided a telephone transformer is used. (4) The values are given in many recent issues.

"F.W." (Oxford).—We suggest you do not construct the set referred to. For short wave work your coils are far too large, and the resistance capacity method of H.F. amplification is not suitable. The aerial coil may consist of a winding of No. 22 D.C.C. on a former 4″ diameter and 6″ long, and the secondary, a winding of No. 26 D.C.C. on a former 3″ diameter and 7″ long. We suggest you employ one of the many simple circuits which have been given in replies to other correspondents recently: for example, Fig. 4, page 288, November 25th issue; Fig. 3, page 251, November 18th issue; Fig. 7, page 217, November 11th issue.

"J.E.M." (Kent) *asks* (1) *For a diagram of the Armstrong super heterodyne circuit.* (2) *For suitable valves.* (3) *Whether this is a good circuit for long distance reception.*

(1) and (2) The diagram submitted is correct and is reproduced in Fig. 8. The tuner is of the normal type with the addition of a small coupling coil A, which could consist of 15 turns of No. 2 D.C.C. wound on a former 3″ diameter. A heterodyne wavemetre may be coupled to this coil by including in the wavemetre anode circuit a small coil (B.) Probably 10 turns of No. 26 D.C.C. wound on a former 2″ in diameter would be suitable. Wavemeter construction has been dealt with in recent issues, it being understood that a wavemeter is referred to here as a suitable oscillator. The addition of coil B will slightly change the calibration of the wavemeter. (3) This circuit is quite a good one, and good results are possible, especially when receiving the longer wave signals. When receiving the shorter wavelengths, difficulty is sometimes experienced due to slight wavelength changes, when the signals vary greatly in strength.

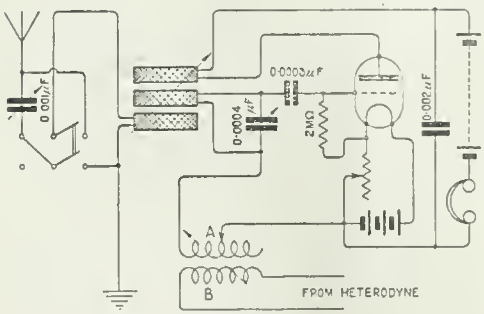


Fig. 8.

"D.S.K.R." (Glam.).—We think the trouble is due to a high resistance disconnection in the telephone circuit. You should test for this. If you join another pair of telephones in parallel you will be able to tell immediately which pair is faulty, or you could try short-circuiting each ear-piece separately while listening to signals with the other.

"DON BEER" (Southall).—The construction of dead-end switches has not been dealt with recently. A good form is indicated in Fig. 9.

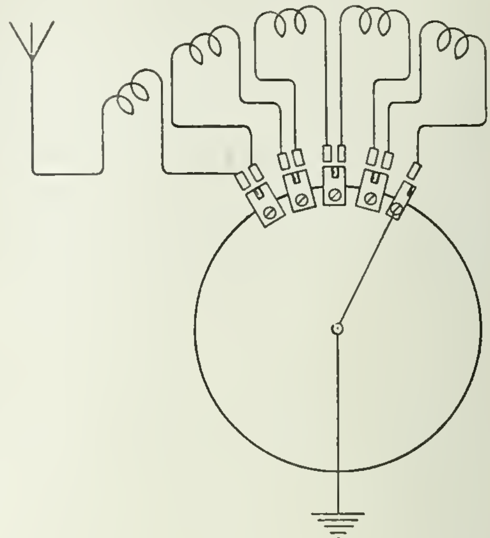


Fig. 9.

The rotor is of ebonite upon which a number of brass segments are fastened. The stator consists of a number of smaller segments properly spaced, and the rotor is mounted so that successive segments are bridged as more inductance is required.

"H.W.F." (Bristol) *has a transformer which, after fifteen minutes of load, is so hot that it cannot be handled.*

The only cure is to rewind the transformer, and we suggest you rewind the primary winding with 1,000 turns of No. 32 D.S.C. wire, and the secondary with 100 turns of No. 16 D.C.C. The core should be built up to a diameter of 1½″. An alternative arrangement would be to connect a choke consisting of 1,000 turns of No. 36 D.C.C. wire on a former 4″ long and ⅝″ in diameter, but in this case the secondary voltage would be considerably reduced. The whole trouble is due to lack of sufficient primary turns, or alternatively, too small a cross section of iron core.

SHARE MARKET REPORT

Prices as we go to press on January 5th, are :—

Marconi Ordinary ..	..	£2	6	6
,, Preference ..	..	2	0	0
,, Debenture ..	..	102	15	0
,, Inter. Marine	..	1	5	6
,, Canadian ..	..		11	6

Radio Corporation of America :—

Ordinary		16	3
Preference		13	4

THE
WIRELESS WORLD
AND RADIO REVIEW
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No. 179 [No. 16. Vol. XI.] JANUARY 20TH, 1923. WEEKLY

Valve Current from A.C. Mains

NOTES ON THE DERIVATION OF CURRENT FOR PLATE AND FILAMENT IN RECEIVING CIRCUITS.

By L. F. Fogarty, A.M.I.E.E.

GREAT increase in the number of receiving stations, and the advantage which would result from the suppression of accumulator batteries has directed the attention of many experimenters to endeavour to utilise the current from the public main, both for filament and plate circuits of receiving apparatus.

Early in 1919, M. Vallette, of Messrs. Ducretet, had developed and had in regular use an arrangement which furnished direct current to the plate circuit, operating from the mains at 100 volts alternating, and several three-valve H.F. amplifiers were constructed on this system.

This combination consisted of a small transformer T (Fig. 1), and one valve A. The transformer was equipped with two secondaries, S_1 and S_2, the first, S_1, furnishing a high voltage alternating current of which one phase was rectified by an ordinary three-electrode valve connected in the customary manner, and whose filament was supplied by energy taken from the additional low voltage secondary S_2. The choking coils L and the condensers C, when suitably chosen, form an energy storage system which ensures that the voltage available at the points M and N was continuous despite its pulsating nature at the points M_1N_1. This was the first satisfactory attempt to use alternating current for this purpose within the knowledge of the writer.

The same year Mr. Barthelemy took out a patent on behalf of the Société Indépendante de T.S.F. for an arrangement using alternating currents for filament heating, and having the object of overcoming the humming noises usually associated with any attempt to utilise this current in wireless work.

To reduce to a minimum the noises produced by the nature of the supply, it was proposed to bring what is usually known as the common or neutral point to a position electrically equidistant between the ends of the filament, as for example in the diagram Fig. 2, illustrating the so-called potentiometer method.

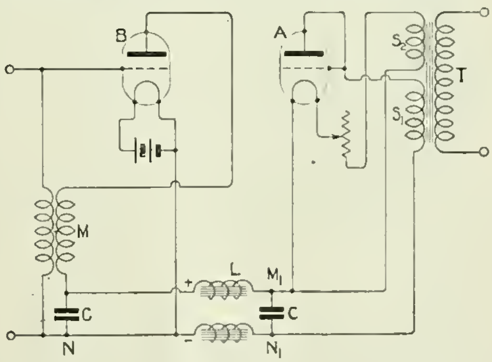


Fig. 1. Transformer with two secondaries, one of which supplies alternating current suitable for the filament heating of a rectifier valve, whilst the other provides current at a voltage, which after rectification provides H.T. for use with a simple receiver.

Immediately following this, M. Moye disclosed his ingenious solution of the problem which comprised a high frequency amplifier supplied entirely from alternating current (plate circuit supplied with H.T. rectified A.C. analogous to M. Vallette's method), and in which a galena crystal rectified the high frequency amplified currents.

The foregoing methods have been fully described by Dr. P. Corret in the course of a highly interesting article appearing in No. 15 of *T.S.F. Moderne*, and many French amateur experimenters using the information there made known have succeeded in producing very convenient and moderately efficient three to five stage amplifiers. It was found that in general these were more noisy than those whose energy was drawn from accumulators and dry cells.

The difficulties encountered in using amplifiers supplied from A.C. arise mainly from the fact that any attempt to make even moderate use of reaction for amplification will immediately set up self oscillations, and in addition the following inconveniences were experienced :—

1. A slow waxing and waning of strength in the received signals.

2. A humming sound at the supply frequency, which increases rapidly as the reaction is brought into use, and which becomes gravely inconvenient before the coupling of the reaction coil has become sufficiently close to give maximum amplification. It was therefore necessary to work far from the point of maximum amplification to obtain freedom from distortion and parasitic noises.

Experts were convinced that a more perfect solution of the problem could be found, and in fact the Société Ducretet, after a long period of study and experiment on a single valve receiver, was able to elucidate several obscure matters and published several alternative diagrams of suitable circuits. It appears that the central feature for success is the use of a valve having special patented characteristics.

They set up a single valve receiver in accordance with Fig. 3, comprising a tuned grid circuit, with a reaction coil B, a telephone in the plate circuit, and further arranged for the plate to be supplied from a true source of direct current such as dry cells, and the filament with alternating current by means of a transformer shunted by a resistance enabling access to be gained to the middle point of the filament potential.

Having set up and put into operation this arrangement a periodic humming noise of

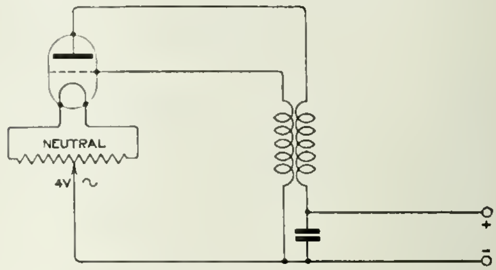


Fig. 2. Method of providing a neutral point by means of a potentiometer.

A.C. even with very loose coupling of the reaction circuit was still experienced, but on the other hand, and using the circuit shown, it is easy to see that this noise cannot be due to any L.F. inductive effects, and the conclusion therefore is that the noises heard in the telephone *are due to harmonic variation in the temperature of the filament during a complete A.C. cycle.*

If we now slowly bring into use the reactance coil B, we shall cause a roaring noise to be heard in the telephones, which will increase rapidly with the degree of coupling. This noise has its origin in the aforesaid temperature variation of the valve filament, as the varying plate current due to this cause is being amplified in the usual manner.

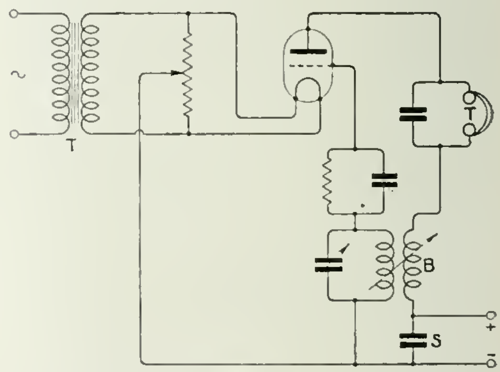


Fig. 3. A test circuit which demonstrates that the humming heard when heating a valve filament from an A.C. source, is due to variation in the temperature of the filament during the A.C. cycle.

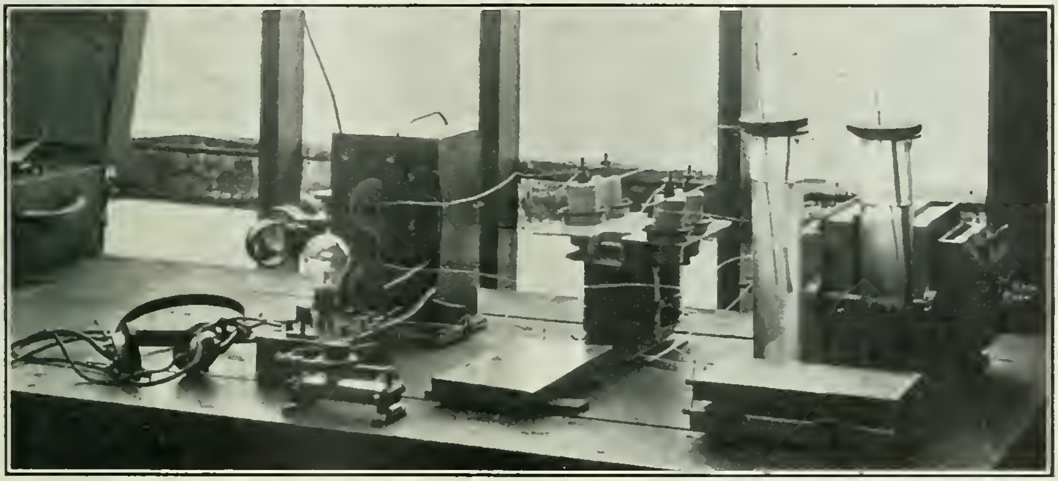
It is well known that the temperature of the filament controls to a considerable extent the conditions under which a valve will oscillate, and it is easy to imagine circumstances such that the valve only oscillates when the filament of the valve is at its maximum temperature, *i.e.*, when the voltage of the transformer T (Fig. 3) is at peak value, and equally that the valve stops oscillating when the filament temperature falls. Under the foregoing circumstances there will be produced in the circuits "chopped" trains of continuous waves of group frequency, not necessarily equal to that of the main alternating current supply to the filament.

The foregoing explains the distortion and variation in strength of signals received on these sets. For the degree of amplification obtained with a reaction coil varies very rapidly when nearing the point of oscillation, the temperature of the filament being constant; but if this latter varies and is sometimes high enough to oscillate, and at others too low, there will be set up periodic variation in the value of the amplified current produced of a frequency akin to that of the associated A.C. supply. This tends to explain the partial failure of M. Moye's ingenious method of rectifying the plate circuit current by a galena crystal.

The cause of the noise having been thus determined, it was easy to suggest various possible solutions, and trials were made with valves fitted with several filaments, each simultaneously heated by alternating currents differing in phase, special attention being given to a valve with two filaments supplied from two phase A.C. and another having a single filament heated with high frequency currents.

Ultimately the firm of Ducretet adopted a method which, whilst not necessarily the most perfect, was certainly the most practical, and took the form of a valve with a heavy filament of considerable heat storage capacity, and requiring 3 amperes at 2 volts. Such a filament is of great strength and durability as compared with the standard type, and a valve as described was covered by a French provisional patent No. 162570.

One of these special valves incorporated into the circuit shown in Fig. 3 resulted in an almost perfect avoidance of noise, for although a very slight humming persists it is negligible as compared with other noises, such as jamming, heterodyning, etc., and serves to show that variation of filament temperature still exists, but highly diminished in magnitude, for broadcast concert music can be excellently received, pure in tone, and with reaction amplification close to the point of oscillation.



Receiving apparatus making use of alternating current for heating the valve filament. The step-down transformer is in the centre, whilst on the right is an electrolytic rectifier arranged for supplying the H.T.

Where alternating current is available, the slight increase in energy consumption from 3 to 6 watts is of no importance as will readily be seen, for the current in the one case is taken from accumulators, and in the other from a public supply main.

Energy from the main will cost from 4d. to 6d. per 1,000 ampere hours, while from accumulators of the portable type the same energy would cost at least as many shillings. Therefore in addition to cheaper running costs we are enabled to dispense with the troublesome accumulator battery, and the bother of conveying same to the charging station at regular intervals.

From the experiments outlined above, experience has been gained and incorporated into a set shown in diagram Fig. 4. This receiver is entirely supplied with alternating current, but is arranged so that the usual high tension battery and accumulators may be substituted if and when desired.

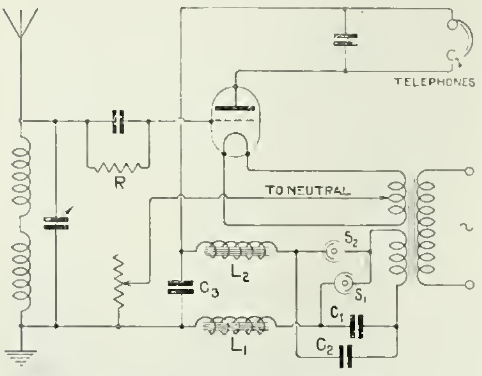


Fig. 4. Simple receiving circuit, deriving H.T. and L.T. from an alternating source.

The transformer was fitted into a separate box, and wound to provide 100 v. rectified continuous current to the plate, and 2 volts to the filament circuit of the valve. The main feature of the transformer box is the two minute sealed electrolytic cells, for rectifying the plate circuit supply.

Experience over some weeks has shown that the small rectifier cells have proved satisfactory in normal work, and in addition the cells are easily made, and can be replaced in a few seconds.

A considerable number of receivers of this kind are in use in France, and the Eiffel Tower telephony transmissions are regularly received even in the southern confines of that country.

Additional to the foregoing, it may be of interest to indicate an example of a two-valve amplifier operating on alternating current.

Suppose for example it is desired to amplify signals received on the crystal detector D, on Fig. 5. We can utilise for the first stage two valves V_1 and V_2, having equal characteristics, and a transformer T_1, with two secondaries S_1 and S_2 connected to the grids G_1 and G_2, in such a way that an oscillation in V_1 whilst making the grid G_1 positive, simultaneously makes grid G_2 negative. From this it follows that there will be an increase in the plate current of V_1, and a diminution of plate current in V_2.

Now, if we pass these two plate currents into the two primaries P_2 and P_3 of the transformer T_2, in such a way that the resultant oscillation transfered to secondary S_2 is the sum of the two oscillations, *i.e.*, that the flux produced by each D.C. plate current is in opposition, and that the two secondaries are alike, we can readily see that any disturbance of an alternating nature will produce equal and opposite effects, and the resultant flux will be zero. Therefore there will be no parasitic currents in the secondary S_2, but only those oscillations which it is desired to amplify.

The secondary S_2 may be connected to a further stage comprising a duplication of the above, but in such case the combined effect of the four valves would be equal to three only connected in the usual manner, and which is ordinarily considered as about the limiting number of stages for low frequency amplification.

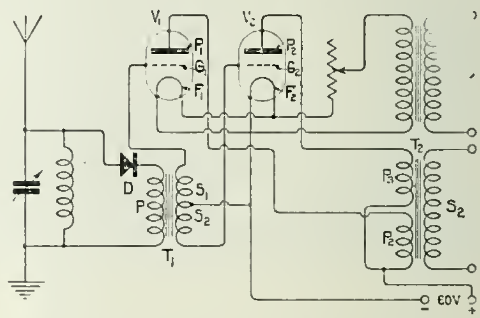
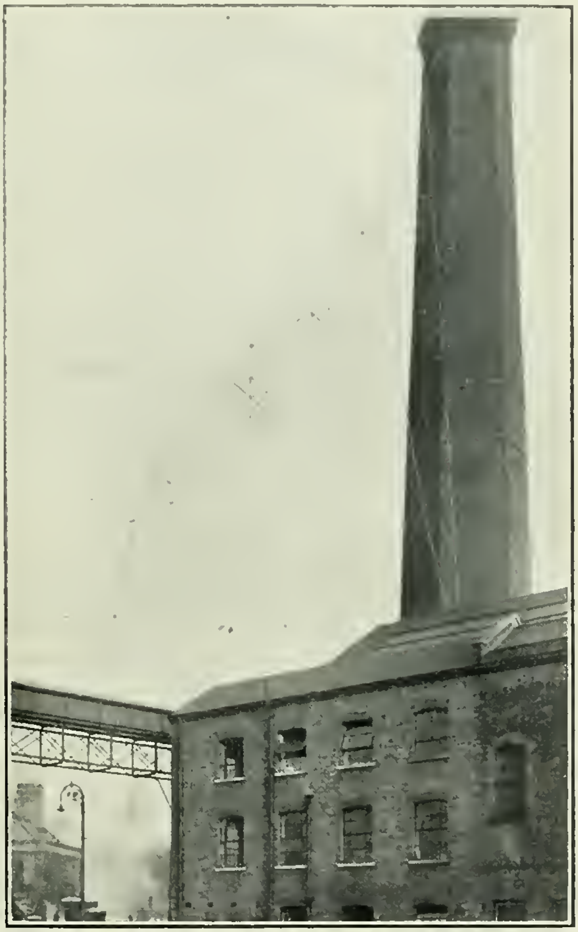


Fig. 5. Crystal and two magnifying valves employing A.C. for filament heating.

These notes have been prepared from a considerable series of experiments, on the lines indicated by many writers in the French technical press, and are contributed in the hope of stimulating keen amateurs in this country to continue these, as good and efficient receiving apparatus operated direct from the public supply will represent a considerable advance in the practical application of radio science.

The Erection of 5WS—The Radio Society's Special Station at Wandsworth.

By E. COURSEY, B.Sc.



The aerial attached to the chimney stack at the Wandsworth Generating Station. Part of the earthing system is attached to the iron framework seen on the left.

AS all readers of this journal are probably aware, the Transatlantic Radio Tests took place during the last month of 1922. In 1921 tests of the same nature were made from America, when signals were received by several amateurs on this side of the water, but this time tests were conducted in both directions. It could, of course, hardly be expected that the amateur stations complying with the ordinary Post Office regulations would be able to reach through to America from Great Britain, but for the period of the tests, viz., December 22nd to 31st, several special licenses were issued permitting the holders to use increased power, and to erect larger aerials. Amongst those so favoured was the Radio Society of Great Britain, which was represented by a specially appointed sub-committee, including Messrs. G. G. Blake, P. R. Coursey, N. Hamilton, N. Lee and C. F. Phillips, and these members were later joined by Mr. M. Child. Having no club rooms or regular transmitting station of any kind the first matter to be considered was a suitable location for the special station to which the call letters 5 WS were to be assigned. Several proposals were tentatively examined, but all proved impracticable, until Mr. Blake approached the Engineer of the Generating Station at Richmond, with a view to the possible use of a site at their station. Some such situation was desirable, since the provision of a suitable power supply was essential. While the Richmond engineers were themselves unable to help, they suggested that application should be made to the County of London Electric Supply Company. Mr. Bacon, the Chief Engineer, was therefore approached, and proved very sympathetic. Through his kindness the matter was put before the directors of the company and their consent to the use of a site quickly obtained. Permission was given for the use of a chimney stack of their Wandsworth Generating Station, to support the aerial. Mr. Bacon was also good enough to put the Committee in touch with the Metropolitan Water Board, who own property adjoining the generating station, a very conveniently situated small brick building belonging to the Board being discovered empty near the foot of the chimney. This building had been disused for some time, and although somewhat small, proved very suitable for the purpose of a transmitting station. The Metropolitan Water Board readily allowed its use by the Radio Society for the purpose of housing the apparatus, and as it was situated but a few yards from the base of the chimney stack of the generating station, and separated from it only by a narrow lane known as the Causeway, the erection of an almost vertical aerial was comparatively easy.

The next step was to obtain transmitting apparatus, and this might have proved a serious stumbling-block but for the generosity of manufacturers in lending parts. As the power licensed to American amateurs does not exceed 1 kilowatt, and as the special station put up in America during the tests in December, 1921, to send signals to Mr. Godley, used approximately this amount of power, it was desired to install an equipment of about the same output. To deal with this amount of energy large transmitting valves were necessary, and the M.O. Valve Company, Hammersmith, kindly consented to loan to the Society two T4. A power valves and two U2 rectifying valves, the presence of an A.C. supply rendering the use of rectifying valves preferable to the installation of a special H.T. D.C. generator.

Although as mentioned above, an A.C. supply of 220 volts, 50 cycles, was available from the generating station, the task of securing step-up transformers suitable for this supply did not prove easy, and a solution was eventually found in the use of a motor-driven generator delivering current at 350 cycles to two separate step-up transformers so that double-wave rectification could be employed. The step-up transformers for this frequency were each of $1\frac{1}{2}$ kilowatt output and were loaned by Messrs. R. M. Radio, Ltd. This firm also lent a 350 cycle rotary converter suitable for feeding the transformers. This machine, while primarily designed for a D.C. supply at 100 volts, was not directly suitable for use on the supply available and was therefore fitted with a pulley in lieu of the customary rotary spark (the machine being one of a type normally used for ships' spark radio installations) and was belt-driven from an induction motor run off the 50 cycle A.C. supply. This latter machine, together with its starter, switches and fuses for the circuit associated with it, was loaned by the Dubilier Condenser Company, Ltd.

Various inductances for use in the aerial and other circuits associated with the transmitting apparatus were loaned by the Radio Communication Company, Ltd., Leslie McMichael, Ltd., and Dubilier Condenser Company, Ltd. This last firm also supplied a number of condensers for use with the rectifying valves for smoothing out the rectified currents for the grid circuits of the oscillator valves and for the oscillation and aerial circuits, several of these being specially made up for the purpose.

Low tension supply for lighting the valve filaments was obtained partly from special transformers loaned by Mr. L. F. Fogarty, of the Zenith Manufacturing Company, Ltd., Willesden (who also supplied four adjustable filament resistances for the valves), and partly from an 18-volt accumulator battery, loaned by Messrs. Leslie McMichael, Ltd. Grid leak resistances of assorted values suitable for use with the oscillating valves were loaned by Messrs. Gambrell Brothers, Ltd. and by the Zenith Manufacturing Company, Ltd. Wire for the aerial was supplied by Leslie McMichael, Ltd., and the transmitting key and receiving set by Mr. M. Child.

Apart from the fitting of the pulley block at the top of the chimney stack and the fitting of a suitable halyard thereto, which was carried out by Messrs. Beaumont and Son, a firm of steeplejacks, the labour entailed in the erection of the station was entirely voluntary.

The aerial was a six-wire cage, having an overall length, including the lead-in wires, of approximately 160 feet. It was constructed by Messrs. Child, Manning and Hathaway, members of the Radio Society of Great Britain, E. Pickering, assistant to Mr. G. G. Blake, E. Trehearne, lent from the staff of the Dubilier Condenser Co., a rigger from the staff of Messrs. Burndept, Ltd., and a representative from Leslie McMichael, Ltd., who shared the labour on different days. The weather was fine during the erection of the aerial, but later turned very wet and stormy, and grave fears were entertained that the shrinkage of the ropes supporting the aerial might cause a catastrophe. Fortune favoured 5 WS, however, and even the terrific winds which blew from time to time during the tests left the aerial unharmed.

The apparatus was collected in the research laboratories of the Dubilier Condenser Co., Hammersmith, and on Saturday, December 16th, only five days before the tests were to begin, the assembling of the various parts was commenced. This part of the work was carried out by Messrs. Blake, Coursey and Trehearne during Saturday, Sunday and Monday, during which time a rough wooden framework was made to support the valves, filament resistances and transformers, with a switch controlling the latter. Difficulties in the insulation from earth of the filament circuits of the rectifying valves necessitated the temporary use of an accumulator battery supported on a wooden framework separated from the floor by four stoneware pots. After these arrangements had been made considerable time was devoted to adjusting the constants of the circuits so as to obtain as large an oscillatory current as possible at a wavelength approximating to 200 metres in a dummy aerial circuit, having a resistance of 5 to 6 ohms.

The apparatus was transported to the Wandsworth station by means of a motor van lent by Dubilier Condenser Co. on the afternoon of Tuesday, December 19th, and the evening was spent there by Messrs. Blake, Child, Coursey and Trehearne in getting the motors running, and so on. Late that night (or early next morning) the aerial circuit was joined up and some current obtained in that circuit. The current was not very large, but it was left to a subsequent time to increase it by readjustment of the various parts, the workers by this time feeling that they deserved a rest for what remained of the night.

No work was done at the station on Wednesday, December 20th, as there was a meeting of the Radio Society, but as the first transmissions were to take place at 2.45-3 a.m. on Friday morning, the 22nd, it was essential that all final arrangements should be made on Thursday evening. Accordingly the same four enthusiasts, together with Major Hamilton, assembled once more at Wandsworth on Thursday and after much persuasion the aerial current was increased to 3 amperes, which was thought sufficiently satisfactory for a start. During the period of the tests, however, various modifications and improvements were made from time to time with the result that the maximum current obtained was 4.3 amperes, representing nearly three-quarters of a kilowatt of high frequency energy in the aerial.

The British transmissions were arranged to take place between midnight and 3 a.m., and 3 a.m. and 6 a.m., on alternate nights. Owing to the extreme lateness of the times, it was, of course, necessary for the operators to be taken to the station by car, and Messrs. Klein, McMichael and Woodhams very kindly lent cars on different nights for this purpose. As the apparatus was put together rather roughly, owing to the shortage of time, it was necessary for one of the four who had been responsible for its arrangement to be present each night, in order to see that all was in order. They therefore took it in turns to attend, and on some nights were accompanied by Messrs. Maitland and White, members of the Radio Society, who were anxious to have a share in trying to "raise" America. On one or two occasions the key of the hut was not forthcoming at the proper moment, but fortunately such a trivial matter was not allowed to stand in the way of progress, as the intrepid scientists gained an entrance through a very small window. This minor discomfort, however, was eliminated on Christmas night. Through the kindness of the caretaker of the premises, a fire was laid each day in the cabin, so that those in charge each night were able to keep themselves warm.

The weather throughout the tests was very rough and wet, and fears were entertained for the safety of the aerial. Fortunately, however, no accidents occurred, and all the scheduled transmissions were duly accomplished. On the nights before and including Christmas, additional transmissions were made from 5 WS during the times allocated to 2 ON, which station was not used on those nights, owing to the absence of Major Parker. The Marconigram from Mr. Schnell the Traffic Manager of the American Radio Relay League, was anxiously awaited each day by the Committee, but sad to relate, the first two or three reports were most discouraging. However, the signals from 5 WS were reported as received on the other side of the Atlantic on the mornings of the 24th, 25th and 26th.

As a matter of interest, it may be stated that the aerial energy from 5 WS was greater than that put out by 1 BCG, the special station erected in America, during the 1921 tests, which was received by so many listeners over here. Although, on the whole, the results of reception on the American side are rather disappointing, yet it is gratifying to know that the station was received. A more detailed account of the number of Americans who heard 5 WS, with a description of the apparatus, etc., used, will be given when it has been received from America.

Electrons, Electric Waves and Wireless Telephony—XVI.

By Dr. J. A. FLEMING, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

VII.—THE PRINCIPLES OF WIRELESS TELEPHONY.

1.—PRODUCTION OF CONTINUOUS ELECTRIC WAVES.

IT is now possible to gather up the threads of all previous explanations and utilise them is making an exposition of the principles and mode of operation of the wireless telephone, which is certainly one of the most wonderful of all the achievements of technical science.

To conduct wireless telephony as contrasted with telephony with line wires, we have to replace the line wire by some agency which will enable us to transmit energy and yet permit us to employ the usual type of microphone transmitter and magneto-receiver used in ordinary telephony with wires at the sending and receiving stations. It has been found that we can do this by substituting for the connecting wire a stream of undamped or continuous high frequency electro magnetic waves. We must, then, first explain how these waves are created.

There is only one method practically employed at present in small plants, or those of moderate size, and that is by means of the thermionic valve. We have already explained that an incandescent tungsten filament in vacuo emits a torrent of electrons, and that these in the three-electrode valve make their way through the apertures of the surrounding grid and fall upon an anode or collecting plate. To make them do this the anode must be kept at a high positive potential so as to attract to it the negative electrons. This is done by means of a battery, dynamo, or other source of direct electromotive force. The anode must be connected to the filament by an external circuit which includes the above-mentioned source of electromotive force, but also a coil of wire called the plate circuit coil. This plate circuit coil has also its terminals connected to a condenser of a certain capacity, so that the coil and condenser, taken together, provide a circuit in which electric oscillations can take place with a certain natural frequency determined by the capacity of the condenser and the inductance of the coil in accordance with rules already given.

If, then, the grid is connected to the filament through another circuit which also includes a coil of wire, and if this last coil, called the grid circuit coil, is placed near to the plate circuit coil and in a certain position, any change in the current in the plate circuit coil will create an induced electromotive force in the grid circuit coil, and this in turn will alter the grid potential and charge the grid either negatively, that is put more electrons into it, or positively, that is take free electrons from it. When the grid is made negative it will reduce the electron stream flowing from the filament to the plate, and reduce the current in the external plate circuit or coil. By a proper mode of connection it is possible to make the changes of grid electrification of such sign and nature as to sustain the fluctuations of the plate current, which, in turn, by the mutual inductive action of the plate and grid coils, create the appropriate variations of grid potential.

The grid and plate coils are then said to be coupled for production of oscillations. The plate current then consists of a steady direct current, on which is superimposed an alternating current, or the plate current fluctuates in strength. The power required to produce these oscillations comes from the battery in the plate circuit, but the power is transformed from direct current (D.C.) power to alternating current (A.C.) power.

The action of the thermionic valve in this respect has been compared with a steam engine. The steady pressure of the steam is applied to push forward the piston, but to make the piston oscillate or move backwards and forwards alternately, the steam must be admitted to the cylinder by means of the slide valve, first on one side of the piston and then on the other. To make the engine self-acting we have to connect the slide valve by some mechanism with the piston so that motions of the piston move the slide valve in the proper manner to maintain the oscillations of the piston. The steam may be compared with the electrons emitted by the filament; the grid is analogous to the slide valve, and the external plate current to the motions of the piston.

The above analogy is, however, very imperfect, and a much better one is as follows : If we connect together in series a Bell magneto telephone, a carbon granule microphone transmitter, and a couple of cells of a battery, a current will flow through the carbon and through the coils of the telephone. If we hold the diaphragms of the transmitter and receiver near together the receiver will emit a shrill musical note, and continue to emit it as long as the two instruments are close together.

The reason is as follows. Small noises in the room set the diaphragm of the transmitter in vibration. This causes compression of the carbon granules, and in turn varies the current, and this makes the receiver emit a sound. This sound actuates the transmitter, and this again reacts on the receiver. Hence continuous sound waves are emitted by the system, and the power to produce them is drawn from the battery.

Just as this coupled receiver and transmitter generate low frequency oscillations of electric current in their circuit, so the coupled thermionic valve circuits react on each other and create high or low frequency electric oscillations in the plate circuit according to the capacity and inductance in the circuit. To radiate electromagnetic waves we have to utilise these oscillations to produce similar oscillations in an *aerial wire*, or radiative circuit. The simplest method, then, of producing undamped or continuous waves (C.W.) by a thermionic valve is by an arrangement as follows :—

Let V (see Fig. 86) be the valve of which P is the plate or anode cylinder, G the grid, and F the filament. Let B_1 be the battery which provides current for incandescing the filament, and r the regulating resistance. Let the grid be connected with the filament through a coil of wire L_2, called the grid coil, and let the plate P be connected with the filament through another coil L_1 and a key K and high voltage battery B_2 giving a voltage of 200 to 400 volts or more. The negative terminal of B_2 must be in connection with the filament. This battery B_2 must be shunted by a condenser C_2. The coil L_1 is also shunted by a condenser C_1. If the degree of coupling or closeness of the coils L_1, L_2 is adjusted, and the direction of their mutual inductance correct, then, as already explained, continuous oscillations will be set up in the circuit of L_1 which are superimposed upon the steady or direct current produced by the battery B_2. The frequency (n) of these oscillations will be determined by the capacity of the condenser C_1 and the inductance of the coil L_1 in such fashion that—

$$n = \frac{5033}{\sqrt{C_1 L_1}}$$

The capacity C_1 must be measured in microfarads or fractions of a microfarad, and L_1 must be measured in millihenrys, or fractions of a millihenry, and the square root of the numerical product of C_1 and L_1 divided into the number 5033.

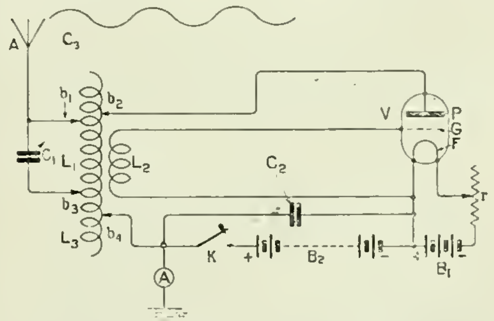
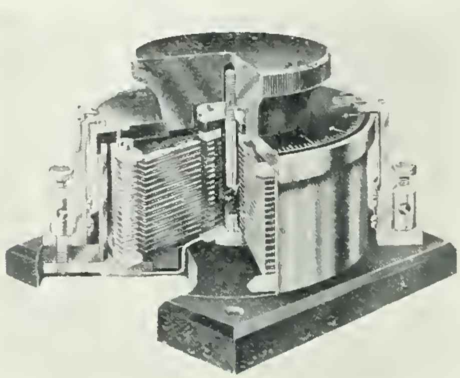


Fig. 86. Arrangement of Circuits for producing continuous electric waves (C.W.) by a thermionic valve.

The condenser C_1 is connected to the coil L_1 by sliding contacts b_1, b_3 so that the inductance L_1 can be varied. Also the condenser C_1 is an adjustable capacity indicated symbolically by the arrow crossing two parallel black lines.

In actual practice the coil L_1 is made by winding enamelled copper wire in close turns on an ebonite or fibre tube about 4 or 6 ins. in diameter. The enamel is then scraped or rubbed off a narrow strip parallel to the length of the cylinder, and enables rubbing contacts of brass to be slid along a bar and so make contacts at places b_1, b_2, b_3, b_4, as desired with the copper wire. The condenser C_1 is made of a number of semi-circular plates of aluminium spaced a little way apart, which are attached to an axis. These plates are so fixed that they can be turned to sandwich in, more or less, between a number of fixed semi-circular plates. The fixed and movable plates are the two plates of the condenser, and by rotating the movable plates so as to bring them more or less in between the fixed plates, the capacity of the condenser is varied (see Fig. 87).



By Courtesy of Marconi's Wireless Telegraph Co., Ltd

Fig. 87. An air condenser of variable capacity formed with a set of fixed semi-circular metal plates and similar movable plates, which latter can be brought more or less into proximity to the former by rotating the ebonite head of the axis carrying the movable plates. N.B.—Part of the condenser in this illustration is shown cut away so as to enable the structure to be seen and understood.

2. RADIATION OF CONTINUOUS WAVES.

We have next to make provision for using these oscillations to create continuous electric waves. We have seen that when high frequency oscillations are set up in a straight rod or wire with metal plates at the end, called a Hertzian oscillator, the result is to radiate electromagnetic waves which we have explained to be vibrations propagated along the electro-lines proceeding from the free electrons in the wire, the rapid to and fro movements of which are the electric oscillations in that wire.

This radiation is effected by connecting to the contact b_1 an aerial wire A, which consists of two or more copper wires which rise vertically into the air a certain height, and then run horizontally a certain distance, and are insulated at the far or free end (see Fig. 86). At the same time we connect another point b_4 on the inductance coil L_1 through a current-reading instrument A, called a hot wire ammeter, to a plate E sunk in the earth, or it may be the water-pipes of a building.

The aerial A has a certain electrical capacity with respect to the earth, and may be regarded, therefore, as another condenser joined across a section of the coil L_1 between the points b_1 and b_4. By suitably choosing the points of contact b_3 and b_4, we can tune together the oscillatory circuits composed respectively of the condenser of capacity C_1 and the section L_1 of the inductance coil, and also the capacity C_3 of the aerial and the section $L_1 + L_3$ of the inductance coil by making the adjustments so that the product C_1L_1 is equal to the product $C_3 (L_1 + L_1)$.

If, then, we close the key K, the battery B_2 will send a stream of electrons from the filament of the valve to the plate, and they will find their way back through the coil L_1. If the grid then becomes slightly negative the electron stream from the battery will be reduced, and by the inductive action of the coils L_1 and L_2 this reduction of plate current can be made to give the grid a slight positive charge, and this then increases the electron stream. Accordingly fluctuations are set up in the plate current. The object of the condenser C_2 shunted across the high voltage battery is to provide a path for the high frequency oscillations thus created in the plate circuit. The varying potential of the terminals of the condenser C_1 then sets up sympathetic oscillations in the aerial wire, and this results in electromagnetic waves being radiated from it in an uninterrupted stream. The ammeter A placed just above the earth plate E then indicates a steady high frequency current, which is called the aerial current.

In the actual apparatus the two coils L_1 and L_2 are wound on ebonite tubes or in flat spirals, and so arranged that they can be brought near to or separated from each other to vary the mutual inductance. This coupling must exceed a certain value if the oscillations are to be created by the thermionic valve and electric waves radiated from the aerial. We can determine the frequency of the oscillations when we know the wavelength required or used from the simple relation—

frequency $\times$ *wavelength* = *velocity of wave*.

The velocity of electromagnetic waves through air is nearly 300,000 kilometres per second. Hence, to produce a wave of 300 metres wavelength requires oscillations at the rate of one million per second in the aerial. The standard wavelengths for amateur wireless telephony and for "broadcasting" lie between 350 and 425 metres. Hence a 400 metres wave requires

750,000 oscillations per second in the aerial. Let us then suppose that we have set up at some place, an aerial and continuous wave (C.W.) generating valve plant, as above described. We can suppose it set in operation and to radiate continuous waves say of 400 metres wavelength. These waves are called the *carrier waves.*

Next, suppose we have at some other place a receiving station at which there is an aerial properly tuned to the wavelength of the wave sent out by the generating station, and that this receiving aerial is coupled to another closed oscillatory circuit comprising an inductance coil and a condenser with the capacity adjusted to tune it to the aerial circuit (see Fig. 88).

The waves from the transmitting station would strike the aerial of the receiving station and would set up in it feeble electric oscillations of the same frequency. These would generate other similar oscillations in the associated closed condenser circuit. The terminals of this last condenser would then alternate in potential alternately being positive and negative.

Suppose, next, that we connect to these condenser terminals to the plate of a two-electrode rectifying valve in series with a telephone, as in Fig. 88.

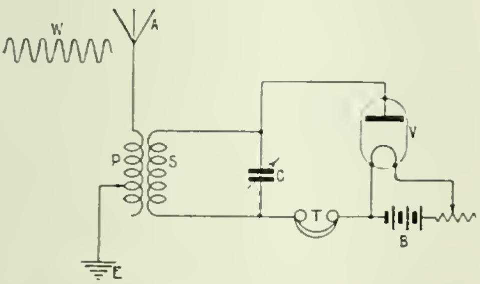


Fig. 88. Simple form of receiving circuit for Wireless Telephony. A is the aerial, P the aerial tuning coil, C is the tuning condenser and V a Fleming rectifying valve, T is the telephone. W represents the arriving carrier waves.

The valve when its filament is incandescent would permit negative electricity or electrons to pass from the filament to the plate inside the bulb, but not in the opposite direction. Hence, the telephone coils would be traversed by a steady unidirectional or direct current.

This kind of current produces no effect on the telephone except to create a slight "tick" or sound at the moment the steady current begins or ends. Suppose then that we insert in the external grid circuit of the valve in the transmitting apparatus the secondary circuit of a small telephone induction coil I (see Fig. 89), and in the primary circuit of the coil a carbon microphone M and battery B_3. If we speak to this microphone mouthpiece the result will be to create in the grid circuit a fluctuating electromotive force, which will have the wave form of the speech sound, and will have a low frequency or *audio-frequency* as it is called, because it falls within the limits of the frequencies used in audible speech.

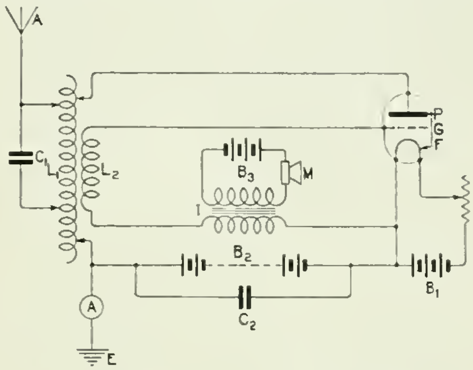


Fig. 89. Circuits of a simple form of wireless telephone transmitter showing the speaking microphone M coupled inductively through an induction coil I to the grid circuit L_2 of the thermionic valve.

The effect of this will be to increase or diminish the amplitude of the carrier waves radiated. In other words, the speech made to the carbon microphone M will modulate the amplitude or height of the carrier waves exactly in accordance with the frequency and wave form of the aerial vibrations made by the voice of the speaker.

Let us then consider what the effect of this will be on the receiving apparatus just described. Any increase or decrease in the amplitude of the carrier waves will increase or decrease in the same proportion the direct or rectified current which flows through the magneto telephone in series with the rectifying valve. Hence, if speech is made to the microphone transmitter inserted in the grid circuit of the transmitting valve, the current in the sending aerial, and the amplitude of the carrier waves and therefore the current through the Bell telephone in the receiving current, will vary or change in nearly the same manner as the changes of air pressure made by the voice of the speaker near the microphone.

(To be continued)

Note on Electro-Magnetic Screening.

By R. A. Watson Watt, B.Sc., F.Inst.P. and J. F. Herd, Member I.R.E.

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It is widely recognised, in a general way, that some part of the energy picked up by a radiotelegraphic receiver may enter the system otherwise than by the antenna, and that, notably in a receiver consisting of a frame antenna and a multistage amplifier, the amount of energy picked up by the amplifier and its accessories may be far from negligible. There does not however appear to be much published data from which the magnitude of such effects may be inferred. The results of some experiments, incidental to other work, may accordingly be of interest.

The Radio Research Board's Station at Aldershot, which is concerned with the investigation of atmospherics, is situated within a wavelength of another station handling high speed C.W. traffic on a power which, at the time of the experiments, was about 1½ kW. This station provided an admirable test for interference prevention. The general nature of the phenomenon in question was well shown by the following experiment, doubtless frequently carried out elsewhere.

The signals from the adjacent transmitting station were found to be nearly as strong on the amplifier system disconnected and with its input terminals short-circuited as on the normal arrangement, slightly detuned from the 1,650-metre wave, and with a "rejector" circuit in the grid lead. The frame was therefore detuned completely and the tests continued with the first grid terminal short-circuited to its filament terminal. The signals were still audible with the last two stages (L.F.) of amplification alone operative in the disconnected amplifier.

The amplifier, still short-circuited, was now placed, with its batteries, in a sheet-iron case at ground level. Signals were now inaudible so long as the telephone headgear was at the level of the amplifier, but the raising of the operator's head, with headgear in position, half a metre above the amplifier served to bring up readable signals. (It should be noted that throughout all the work to be described there was no heterodyne or autodyne oscillator, the signals in question being keying impulses and generator noise treated as "spark.") Signal strength increased rapidly as the observer raised his head still further, and very loud signals resulted from the observer standing on a stool, so that the telephones were some 2.2 metres above ground. A still further increase of signal strength was obtained if the observer stretched out his arms crosswise.

It appeared therefore, that a very important supply of energy was reaching the input end of the amplifier by stray capacities or other means from the "capacity aerial" formed by the output apparatus.

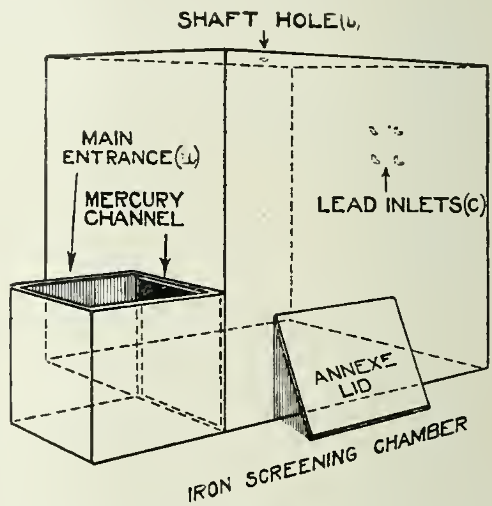


Fig. 1. The Screening Chamber.

It was accordingly decided to screen the whole of the apparatus, with the exception of the frame aerial, and to provide for carrying the screening to the extreme of practicability. The form of screening chamber adopted is shown in Fig. 1, and consists of a shell of sheet iron 0.063 cms. thick, with all joints between sheets turned outwards and autogenously welded by the oxy-acetylene process. The only breaks in the shell are (a) the main entrance for apparatus and observer; (b) 1½-in. hole in roof to admit driving shaft of a recorder; (c) four ½-in. holes to admit leads.

The main entrance (a) is provided in the form of a one-metre cube annexe welded to the main chamber, with a channel 1.25 cms. wide by 2.5 cms. deep round the top. Into this fits the flange of a lid of the same thickness of iron sheet, and the joint can be sealed by mercury in the channel.

The shaft hole (b) is similarly sealed by an annular channel of mercury, in which rotates a flanged cup carried on the driving shaft. Insulated leads passing through holes (c) are run through U tubes of iron welded into the shell, and also containing mercury.

The arrangement thus provides an almost continuous shell of iron, free from vertical orifices, and with several vertical channel walls subtending an angle of several degrees below all horizontal orifices. It might accordingly have been expected, a priori, that the filling of the seals with mercury would be an almost unnecessary refinement, as indeed proved to be the case.

The effectiveness of the screening was tested by observations on the local transmitter and on the Eiffel Tower signals. A frame antenna measuring 1.2 m. × 0.75 m. was tuned by an ebonite variable condenser, and directly coupled to an amplifier with five H.F. stages of amplification, resistance-capacity coupled, rectifier, and one L.F. stage, transformer coupled, with iron-screened transformer. Negative potential was applied to the last grid until signals were reduced to inaudibility or unreadability, and the voltage required accepted as a measure of the signal strength.

With whole apparatus in the open, 46 volts negative had to be applied to the seventh grid to reduce signals from either Aldershot or Eiffel Tower to practical inaudibility.

With the frame antenna in the open, but the amplifier and its accessories and all save a few centimetres of lead inside the screen, the voltages required to reduce signals to virtual inaudibility were 36-38 in the case of Aldershot, 34-36 for Paris.

With the frame inside the screening chamber but projecting halfway into the annexe, as in A, Fig 2, the lid being left off, Aldershot's signals were not noticeably altered, while Paris was now inaudible with about 30 volts negative. The frame remaining at A, the lid was closed but not mercury sealed. Paris was now completely inaudible without the application of negative potential, while Aldershot could be reduced to complete inaudibility by 6 to 8 volts.

Withdrawing the frame to position B, entirely within the main portion of the screening chamber, the lid being closed but unsealed, resulted in the complete elimination of signals from either source. Opening the lid by some 10 cms. gave signals from Aldershot which could be neutralised by 6 volts.

The amplification was now increased by the introduction of a further L.F. stage. This brought signals in the open to such a strength that they could not be neutralised by 100 volts negative on the eighth grid. With the lid of the annexe open, the frame was now placed in the positions C, D, E and F, Fig. 3, and observations made on Aldershot signals. The signal strengths were :—at C 12 volts, at D 30 volts, at E 10 volts, and at F 36 volts.

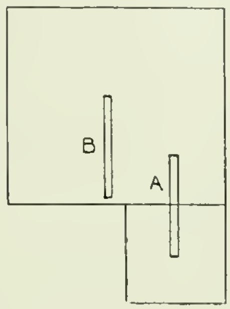


Fig. 2.

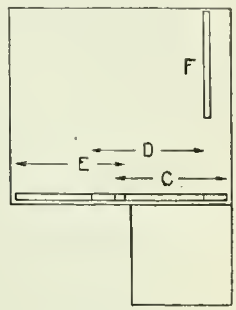


Fig. 3.

It will be noted that these results form a very pretty demonstration of the action of a frame antenna. Essentially the frame consists of two vertical antennæ, the two vertical sides of the frame, coupled in opposition. In position C both sides were insufficiently screened, and moderate signals resulted.

In position D however, one side was as favourably placed for reception as before, while the second was more effectively screened. Thus the opposition was between a well-screened and a badly-screened antenna ; the difference was not now, as in the normal case, merely due to the phase difference between the two opposed potential differences, but between two potential differences of very different magnitudes. Thus, although the two potential differences were less in the D position than at C, their difference, which determines the signal strength, was much greater, giving a 30 volt signal. At position E the screening had again approached equality for the two sides, and the signals fell to 10 volts.

Reverting to the principal experiment, it will be seen that an output signal voltage of 46 volts in the open fell to 36 volts when the amplifier gear was screened, and that practically complete screening was attained without mercury sealing.

Thus it may fairly be concluded that some 20 per cent. of the output voltage, or nearly 40 per cent. of the output energy was due to direct reception on the amplifier, its batteries, leads, and telephones. In considering this somewhat startling value, it must not be forgotten that it was attained under conditions which were not particularly favourable to direct reception by the gear.

The high frequency stages of the amplifier were resistance capacity coupled, the coupling resistances being of carbonised cellulose, so that there were very few possible linkages of the signal lines of force through inductive loops in the amplifier, such as might account for direct reception on a transformer-coupled amplifier. In the L.F. stages the transformers were cased in stout iron screens, cases and cores being connected to the common low potential terminal of the amplifier, so that again the design minimised direct reception. The amplifier was mounted on a table, some half-metre above ground, the accumulator H.T. and L.T. batteries being on the ground. The long lead (about 4 metres) of twisted lighting flex connecting the frame to the amplifier lay on the ground, while the amplifier was outside the screen, so that the diminution of signal strength on moving the amplifier into the screen is not to be accounted for by leakage through the earth capacity of this lead.

It must then be concluded that in all frame antenna work, especially for direction finding, very special care must be taken to ensure that the amplifier gear itself does not behave as a remarkably effective antenna. While circumstances and experimental conditions would not often justify a large screen such as that here described, a sheet-iron case to enclose the amplifier gear need not be bulky or costly and is most desirable.

The Exhibition of the Physical Society of London.

The annual exhibition of the Physical Society of London and the Optical Society, held at the Imperial College of Science and Technology, South Kensington, on January 3rd and 4th, presented a selection of apparatus of particular interest to those interested in radiotelegraphy and telephony, and in electrical matters generally.

The fine show of apparatus manufactured by the Cambridge and Paul Instrument Co., Ltd., included the Moullin voltmeter, designed to supply the need of a high frequency current instrument for low voltages which does not cause appreciable alteration in the constants of the circuit; the Eccles valve-maintained tuning fork for generating voltages and currents having amplitude and frequency suitable for use in measurements of the magnifying powers of amplifiers; and a reed hummer designed to produce oscillations of audio-frequency used in bridge-testing, the model shown being that approved and adopted by the British Post Office for telephonic measurements.

The products of the Concordia Electric Wire Co., Ltd., were represented by a selection of wires used for all electrical purposes and for wireless sets and aerials. The Dubilier condenser Company (1921), Ltd., exhibited several new types of condensers both for wireless and power line protection; and the Dubilier insulator specially designed for continuous wave wireless. Regarding the latter the manufacturers claim that it is unbreakable both mechanically and electrically.

The Edison Swan Electric Co., Ltd., had a collection of lamps manufactured by them including Neon lamps and W.T. valves. The firm of Adam Hilger, Ltd., of Camden Road, London, N.W., had assembled various types of optical and physical apparatus, among which their optical sonometer is of special interest, applicable as it is to the study of wave forms in connection with wireless telephony. The optical sonometer records the pressure variation caused by sound waves, and the instrument is so designed that the sound waves are received by a horn attached to a diaphragm, the inner face of which is platinised. Light from a suitable source is brought to a focus on the diaphragm, and the beam then brought to an intense point image upon a revolving drum provided with photographic paper. In this way a continuous record of the deflection of the diaphragm is obtained.

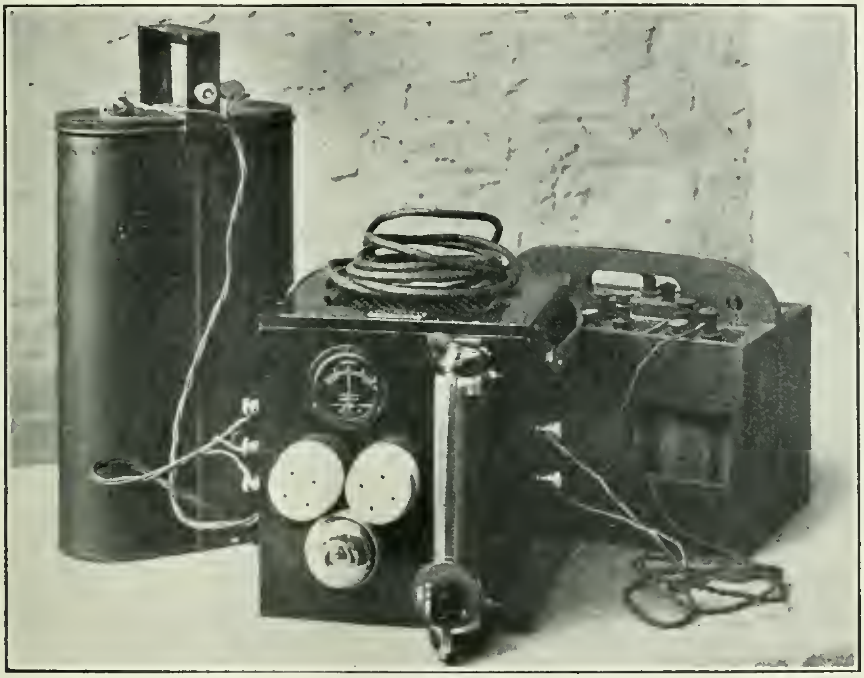
The numerous electrical exhibits of Messrs. Elliott Brothers (London), Ltd., mainly measuring and testing instruments, included their direct reading potentiometer in which a special feature is the high insulation obtained by the enclosure of all current-carrying parts.

Everett, Edgcumbe & Co., Ltd., of Hendon, provided a comprehensive display of electrical measuring and controlling instruments ranging from a 2-in. "Dwarf" pattern, specially adapted to wireless requirements, to a 200,000 volt voltmeter.

Evershed & Vignoles, Ltd., presented a series of insulation testing instruments. Gambrell Bros., Ltd., of Merton Road, London, S.W., exhibited models of their inductances, tuners, amplifiers and various components for experimental work. Igranic Electric Co., Ltd., of Bedford, were represented by exhibits of their inductance coils. Nalder Bros. & Thompson, Ltd., of Dalston, London, provided a selection of measuring and testing apparatus manufactured by them.

Among the apparatus shown by Negretti and Zambra, a useful little instrument for providing a forecast of the weather claimed attention. The weather forecaster may be had in a convenient form which has the size and appearance of a watch. Of the other portable forms, one is for use in conjunction with a barometer, whilst the other combines both barometer and forecaster in an instrument about 10 ins. in diameter. Among their other electrical exhibits, H. W. Sullivan, Ltd., provided a display of radio-telephony transmitters and receiving sets, and also their standard wavemeter (40 to 25,000 metres). The Zenith Manufacturing Company, of Willesden Green, London, exhibited resistances, rheostats, etc., and in particular their "Acdic" electrolytic rectifier which was shown under working conditions. This rectifier, it is claimed, possesses important advantages, being self-starting and entirely automatic in operation.

The Mullard Radio Valve Co., Ltd., of Balham, London, S.W., in addition to various accessories for wireless experimental work, including valve sockets, resistances, condensers and telephones, displayed a selection of transmitting and receiving valves.



Zenith Manufacturing Co. Electric Rectifier for charging accumulators from D.C. supply.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Cambridge University Wireless Society.*

Hon. Secretary, Mr. J. B. Hickman, 4, Rose Crescent, Cambridge.

On November 6th a paper was read to the Society by Flight Lieut. de Burgh, R.F.A., who dealt with the various methods of radio-goniometry. He described the loop, Bellini Tosi and the unilateral systems of direction finding, and also gave an account of directional work in connection with aircraft. The meeting closed with a discussion and a very hearty vote of thanks was passed to the lecturer.

On November 13th, Lieut. G. W. N. Cobbold, M.A., of the Signals Experimental Establishment, Woolwich, lectured to the Society. His paper was a description of a method of measurement of the constants of an aerial, *i.e.*, capacity, inductance and resistance. At the conclusion of the lecture this apparatus was shown working, and the constants of the small laboratory aerial were found.

On November 20th, Mr. T. Hollingworth, M.A., Peterhouse, of the National Physical Laboratory, Teddington, gave a most interesting lecture. The substance of his discourse was "The Application of Theory to Radio Practice." To some his remarks seemed rather pesimistic. He pointed out that although the pure mathematics and what it showed was always right, yet there were limits to the function of the mathematician. There were constants that were not constant, and other factors that might be put down and solved in a differential equation, yet actually in practice the result might be very far removed from what the theory would indicate. Pure mathematics gave the law, but the quantitative result could often not be obtained with any degree of accuracy. So the practical working had to be associated carefully with what the theory would show. The theoretical side must always be borne in mind, but its limitations must be intelligently noted, or there would be serious discrepancy.

The Thames Valley Radio and Physical Association.*

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

A meeting was held at the headquarters of the Association on January 4th, 1923, with Mr. C. Appleton-Smith in the chair. The minutes of the previous meeting being confirmed, the Chairman called upon Mr. Jocelyne to give his lecture on "Induction." With a series of experiments and liberal blackboard sketches, the lecture proved both interesting and instructive. At the end of the lecture questions were answered by Mr. Jocelyne, and a vote of thanks was accorded him for his work.

The Chairman then read out the list of dates on which the Technical Committee is to give Radio concerts to local hospitals, and the members were also informed of the lectures arranged for January and February. On this occasion ten new members were passed for membership, and 28 members and eight visitors were present.

On January 18th, Mr. Dowse will lecture on "Sound," and an exhibition of members' sets will be held on January 25th, 1923.

Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

A general meeting was held at the Grammar School on January 5th, Mr. W. G. Marshall being in the chair. The minutes of the previous meeting having been accepted and other business discharged, the Chairman called upon Mr. T. Brown Thomson to lecture upon the "Transmission of Photographs by Wireless."

The lecturer sketched the methods that have been used since 1847, paying particular attention to the efforts of Knudsen in 1908. Mr. Thomson expressed his belief that it would soon be possible to transmit an ordinary negative without the use of special plates, and advocated the use of undamped waves for such a transmission. Various methods of transmission using spark, arc, or valve were briefly considered, and arrangement of receiving apparatus examined.

A valuable discussion arose after the conclusion of the lecturer's remarks, there being some very original but quite practical remarks put forward. Synchronisation again received close discussion. The problems of atmospherical disturbances and harmonics of GBL were touched upon, but soon abandoned as they tended to dishearten the meeting.

Mr. Thomson was heartily thanked for his paper, and the meeting closed after Mr. J. O'Donohoe had been elected Chairman for the next meeting.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

A meeting of the Society was held at the Y.M.C.A., Hanley, on Thursday, January 4th, under the Chairmanship of Mr. Bew. After the ordinary business of the meeting was concluded a lecture was delivered by Mr. R. W. Steel, on "Sources of Electric Current." In the opening portion of his address he explained the nature of electricity by means of the Electron theory, and then proceeded to describe the various methods of producing electricity, classifying them under four main headings: Frictional, Chemical, Thermal and Dynamical.

A series of lectures has been arranged to take place on alternate Thursdays, the next of which will be given on Thursday, January 18th, by Mr. L. F. Fogarty (Treasurer, Radio Society of Great Britain), on "Rectifiers."

Wandsworth Wireless Society.*

Hon. Secretary, Mr. F. V. Copperwheat, Wandsworth Technical Institute, High Street, Wandsworth, S.W.18.

By the courtesy of Capt. E. S. Davis, members of the above Society were afforded an interesting evening on Wednesday, December 20th, at "The Pavilion," Marble Arch, better known probably as **2 BZ.**

On arrival, the party were admitted to the private theatre and several films of an educational character were shown, these being interspersed with broadcast music. During the changing of one of the films the opportunity was taken of recording wireless telephony and music on a dictaphone.

The announcement that loud speakers could be made out of tooth powder tins caused no small comment, but upon producing the instrument so named, and subjecting it to severe working conditions, those present had to admit that this was possible, at least as far as 2 XL was concerned.

The workshop was a source of envy to most of the visitors, as were some of the pieces of both amateur and professional apparatus displayed.

After partaking of refreshments kindly provided by their host, the party proceeded to inspect the Power House, with its generators, main distribution panels, air compressors and battery rooms. Altogether a more enjoyable evening would have been almost impossible, thanks to Capt. E. S. Davis, the organiser, Goldwyn Bray and Gaumont, Ltd., and The Marconi Wireless Telegraph Company, who kindly lent the films.

The Society has now commenced its new session and intending members should apply to the Secretary.

The North Lincs. Wireless Society.*

Hon. Secretary, Mr. N. Harrison, 323, Cleethorpes Road, Grimsby.

The Society held its first annual social gathering at the Japanese Café on January 3rd. There was a record attendance, about seventy sitting down to supper. Proceedings opened with a whist drive, followed by songs by Mr. Bentinck, and an excellent forty-five minutes magical entertainment.

Supper was followed by the presentation of prizes which in the ladies' case took the form of handkerchiefs, and in the gentleman's a wireless set. The President, Mr. E. H. Dutton, gave a short address outlining the growth and objects of the Society.

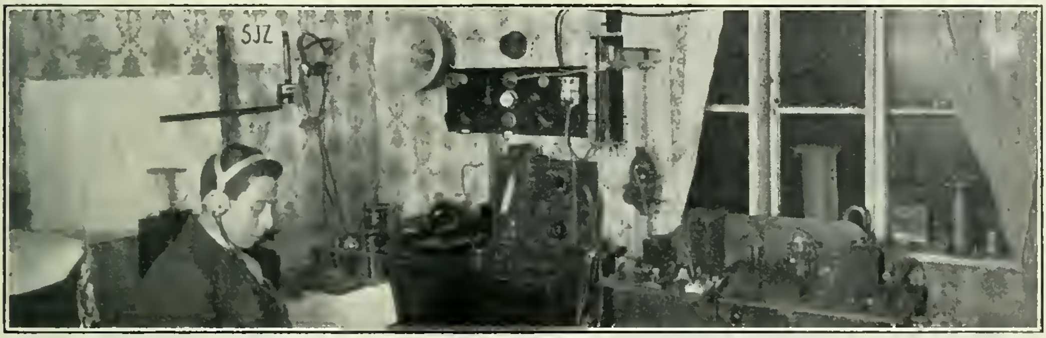
Oldham Amateur Radio Society.*

Hon. Secretary, Mr. W. Schofield, 92, Sharples Halt Street, Oldham.

The above Club has now been formed, and the following officers elected:—Chairman, Mr. J. Everett; Hon. Treasurer, Mr. H. Hinchcliffe; Instrument Steward, Mr. W. J. Potts; Librarian, Mr. J. O. Gardiner; Committee, Messrs. H. Humphrey, C. Mills and R. Grimshaw.

At the last meeting the Chairman, Mr. Everett, started a morse class which will be carried on during the first half-hour of each meeting. On the same occasion Mr. Humphrey gave a very clear and interesting explanation of electrical signs used in wireless circuits. At this meeting it was decided to begin upon the construction of a four-valve set.

The weekly meetings of the Society are held on Fridays at 8.30 p.m. At the next meeting to be held on Friday, January 12th, 1923, Mr. Everett will give a paper on "Aerial Construction," and on Friday, January 19th, Mr. Potts will lecture on "Electrical Units."



The amateur station of H. J. Cheney of Birmingham, **5 JZ.**

Southend and District Radio Society.*

Hon. Secretary, Mr. A. L. Whur, 4, Wimborne Road, Southend-on-Sea.

At the general meeting held at headquarters, 76, Queen's Road, Southend-on-Sea, Mr. H. Jagged gave a very interesting lecture on various small pieces of apparatus used in connection with wireless matters. The advantages and disadvantages of various kinds of coils and coil holders used for Wireless reception were discussed by the lecturer, who showed by means of drawings convenient methods of mounting coils and making plug-in H.F. transformers, resistances, tuned anode coils etc.

The Chairman, Mr. D. L. Plaistow, then spoke about a new permanent radio detector known as the Phonephane, and said that he hoped to have one shortly for experimental purposes and to be able to give a short lecture on it at a later date.

The Secretary would be pleased to hear from anyone in the district who is desirous of joining the Society.

Cowes District Radio and Research Society.*

Hon. Secretary, Mr. L. Ingram, 1, Mill Hill Road, Cowes, I.W.

At the headquarters on Wednesday, December 6th, two papers, one entitled "Some Scientific Aspects of Wireless," and the other "Freak Transmissions," were read by Mr. Ellis, the Vice-Chairman.

The Wembley Wireless Society.*

Hon. Secretary, Mr. W. R. Mickelwright, A.M.I.E.E., 10, Westbury Avenue, Alperton, Wembley, Middlesex.

On November 25th, about 30 members had the pleasure of visiting Northolt Transmitting Station by kind permission of Mr. Brown of the G.P.O.

The party were met by Mr. Evans and Mr. Wilson, who conducted the members over the station where the plant and apparatus was explained in detail. Great interest was displayed in the generating plant, switchboards, arc transmitters, valves, and receiving apparatus, and also the three 450 ft. masts and fan-shaped aerial.

Before leaving the President gave a brief address of thanks to the hosts for the cordial reception which they had so kindly given to the members of the Society.

Lectures have recently been given by Mr. H. W. Gregory on "The Inductive Effect of Iron," by Mr. B. J. Axten on "The Valve," by Mr. W. E. Wallis on "Notes on Circuits," and by Mr. H. W. Comben on "Inductance and Capacity."

The Society has now erected a new aerial mast, the better aerial enabling lecturers to demonstrate the merits of various apparatus, such as tuners, condensers, etc.

The social evening on December 8th, arranged by Messrs. Hawking and Lewis, with a committee, was a great success, over 100 members and friends being present. The Society's membership continues to increase, and the meetings become more interesting and instructive each week, as additions are made to the Society's apparatus and equipment.

On December 14th, Mr. B. J. Axten gave a lecture and demonstration on "The Oscillating Valve." Anti-radiation circuits were described, and the steps necessary to prevent radiation were demonstrated.

Mr. W. A. Robinson has presented the Society with a detector panel, and it is proposed to add stages of amplification to this, so that a loud speaker will always be available at the Thursday evening meetings.

It is thought that if other Societies would give beginners instruction on the correct use of their sets the interference caused by local amateurs would soon be eliminated.

Battersea and District Radio Society.

Hon. Secretary, Mr. F. J. Lisney, 66, Newland Terrace, Queen's Road, S.W. 8.

The first annual meeting of the Society was held at the headquarters, "The Invitation," Cairn's Road, S.W.11., on December 28th.

It was decided to hold two meetings a week, commencing on January 1st: Mondays, from 7.30 p.m., buzzer and experiments; Thursdays, 7 p.m. buzzer, 8 p.m. lectures and demonstrations.

An aerial has been erected, and the experimental three-valve panel is in hand. This panel will be drilled by Mr. Howling, and assembled on Thursday evenings, members making and winding coils where possible. The wiring will be of such a nature as to facilitate easy connections of any circuit or apparatus to be tested.

Subscriptions have now been fixed at 10s. per annum for seniors, and 5s. per annum for juniors (under 18), payable quarterly in advance; all new members to pay in addition an entrance fee of 1s.

Mr. Howling has promised to continue his weekly lectures and to supply apparatus until the experimental panel is finished. These lectures are particularly interesting to those building new sets, as all values and dimensions are plainly set out. Anyone willing to give a lecture or demonstration is asked to communicate with the Hon. Secretary.

All amateurs in the district are cordially invited to join the Society, and are assured of a continuance of instructive and entertaining meetings, full particulars of which can be obtained from the Secretary.

Norwich and District Radio Society.

Hon. Secretary, Mr. H. A. Greenfield, 160, Queen's Road, Norwich.

The inaugural meeting of this Society was held at the Y.M.C.A., St. Giles', Norwich, recently, and thirty-one members were enrolled. The Chairman, Capt. H. J. B. Hampson, in his opening remarks, said that in consequence of the strides that had been made in the science in radio, both during and since the war, many societies had sprung up, and although the number of those interesting themselves in the subject in Norwich was now considerable, there was as yet no radio society. In this Norwich was, he said, behind many less important provincial centres, and it was to remedy this that the meeting had been called.

The Chairman went on to outline the possible scope of a local society, and among other things mentioned lectures both of an elementary and more advanced nature in order to assist all to learn more concerning this subject.

Passing to the interference caused by the unskilled use of reaction, Captain Hampson said he thought that a society could do much to remove this nuisance by helping the inexperienced to acquire the knowledge necessary to handle their sets without causing disturbance to others.

Regarding affiliation to the Radio Society of Great Britain, the Chairman said that although this was in his opinion a very desirable thing, and one to be put into execution as soon as possible, he felt that the Society ought, perhaps, to become established before incurring the expense of this.

Mention was made of a Society mart at which members could exchange apparatus among themselves, of field days during the summer months and of the appeal recently broadcast from Marconi House by Captain Ivan Fraser of St. Dunstan's on behalf of the blind wireless amateur.

In conclusion the Chairman suggested that the annual subscription should be 10s. 6d., with a reduced subscription for schoolboys. The meeting then proceeded to the election of officers, with the result that Captain H. J. B. Hampson was elected President, and Mr. H. A. Greenfield Hon. Secretary and Treasurer, while the Committee was formed of the following gentlemen:—Messrs. K. H. A. Newhouse, J. G. Hayward, W. G. Hurrell, G. A. Rudd, A. P. Cooper, C. H. Moore and J. E. Nickson.

The Society had been fortunate in acquiring the use of a room at the Y.M.C.A. for weekly meetings as the result of the kind consideration accorded to them by the Y.M.C.A. Secretary, Mr. O. L. Whitmee. Meetings will be held weekly on Fridays at 8 p.m., to which all who are desirous of joining the Society are cordially invited.

Leeds Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. N. Whiteley, Wireless Section Y.M.C.A., Albion Place, Leeds.

A meeting was held on January 1st to discuss the rules of the Society and other business. It was decided to accept the room offered by Mr. Mills, which will be used as an experimental room and workshop, and it is hoped, providing the necessary grant is forthcoming, to install a four-valve receiving set. The set will be constructed and made by members themselves, and will provide a good opportunity for beginners to gain some practical experience.

A Technical Advisory Committee has been elected, consisting of Messrs. Whiteley, Parker and Boocock, who will also be responsible for the scheme in detail. Mr. G. Boocock was elected Chairman for the ensuing month.

British Wireless Relay League.

READERS will remember that in the issue of *The Wireless World and Radio Review* for August 26th, 1922, page 697, an announcement appeared regarding the formation, under the auspices of the Manchester Wireless Society, of a British Wireless Relay League which had the approval of the Postmaster-General.

The success of the Transatlantic Tests held this year, which, in America were organised by the American Radio Relay League, has naturally given a stimulus to the similar enterprise in this country, and consequently the following letter, which has been forwarded to the Secretaries of the wireless societies throughout Great Britain, will be of particular interest.

15/1/23.

DEAR SIR,—A meeting of the above League, which has the approval of the Postmaster-General, was held in Manchester on Thursday, January 11th, and it was decided to circularise the wireless societies of Great Britain with a view to obtaining their co-operation in the management and control of the League. In view of the recent enormous success of the Transatlantic Tests, it is desirable that every effort should be made to maintain the enthusiasm which has been shown in America, France, Holland and other countries, and, in the opinion of the promoters, this can only be done by enrolling all wireless experimenters in Great Britain. Mr. Pocock, Editor of *The Wireless World and Radio Review*, has been elected Hon. Secretary, and it was unanimously decided to adopt the *Wireless World and Radio Review* as the official organ of the League. A request has been forwarded to the Radio Society of Great Britain asking that the matter of the League be included on the Agenda at the Annual Conference to be held in London on January 24th, when a suitable membership has been attained. The question of districts will be discussed, and suggestions from all those interested will be appreciated. Amended rules are attached herewith.

Yours faithfully,

H. GREEN.

President.

It will be seen that the proposal is to bring up the question of a British League before the Annual Conference, which takes place on January 24th, and in order to ensure the success of the League, the heartiest co-operation of all societies and individual amateurs is necessary. The organisation and management of such a League is no longer a matter which can be directed by one Society alone, but this work must be undertaken by the co-operation of all the societies through some such means as the Conference of Wireless Societies, which it is now understood are to be held at more frequent intervals than annually as in the past.

The present officers of the League are :—*President*, Harold Green, A.M.I.E.E., A.M.I.M.inE.; *Traffic Manager*, Y. W. P. Evans; *Hon. Treasurer*, W. H. Lamb; *Hon. Secretary*, Hughs S. Pocock, The Offices of *The Wireless World and Radio Review*, 12-13, Henrietta Street, W.C.2.

The Tungar Rectifier

By A. Rushton, M.Sc., A.M.I.E.E.

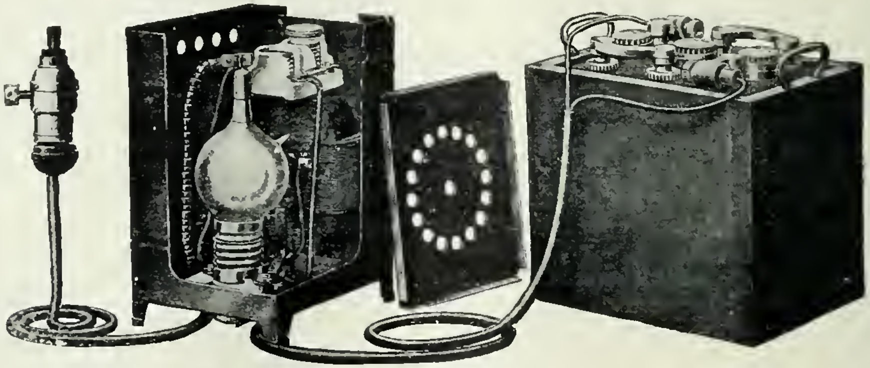
THE present article deals with the results and oscillograms obtained in an experiment performed on a B.T.H. Tungar rectifier used for charging secondary batteries. The Tungar rectifier is a self-contained device for changing alternating to direct current and transforming it down to the required voltage. Its chief parts comprise a bulb, or two-electrode valve (which performs the rectification), a transformer, a reactance in the larger sizes, a D.C. fuse plug and a bayonet adapter to fit the standard lampholder.

The bulb or valve is filled with argon and has two electrodes, a low voltage tungsten filament (the cathode) and a graphite electrode (the anode). The current can only flow through the valve from anode to cathode, that is, from the graphite electrode to the tungsten filament. Thus the valve acts as a rectifier and if supplied from an alternating current source, one half-wave is completely suppressed and a pulsating unidirectional current results. This valve action also has the important advantage of preventing the batteries from discharging back through the rectifier in the event of the alternating current supply being cut off for any reason.

The Tungar rectifier on which the present experiments were carried out was of the home garage type, 5 to 3 amperes, 7.5 to 15 volts D.C., the auto-transformer having primary tappings for 105, 115 and 125 volts at 60 cycles.

A diagram of connections is shown in Fig. 1.

The rectifier is suitable for charging 3 or 6 cells, according to the position of the D.C. fuse, for which two sockets are provided just under the cover. The charging current depends entirely upon the number of cells and the condition of charge. A 3-cell battery will take approximately 5 amperes, a 6 cell battery 3 amperes, and a 9 cell battery 1.5 amperes. Therefore, to use the rectifier, it is only necessary to connect the D.C. leads to the battery, taking care of polarity; insert the adapter in a convenient lampholder and turn on the switch.



By Courtesy of the British Thomson-Houston Co., Ltd.

Schematic view of the Tungar apparatus connected up to AC Supply and arranged to deliver accumulator charging current.

Tests were made at 60 and 83 cycles per second, the latter being the frequency on which the rectifier was to be used; the supply voltage being 105 volts in each case. The A.C. input was measured by means of ammeter, voltmeter and wattmeter. The rectifier was used to charge six accumulators, the direct current being measured by two ammeters, a moving-coil and a moving-iron, and the voltage by a moving-coil and a moving-iron voltmeter. The moving-coil instruments, of course, measure the true average value of the current and voltage, while the moving-irou instruments (the readings of which depend upon the square of the current through them)

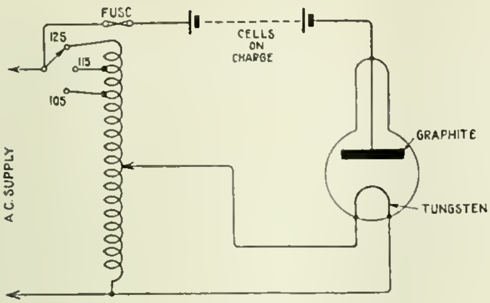


Fig. 1.

measure the equivalent or root mean square (R.M.S.) values.

the period, the negative half-wave being suppressed during the other half period. In Figs. 4 and 5 the positive half-wave of current occupies less than half the period, the charging

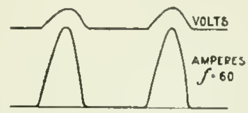


Fig. 4.

current being zero for more than half the time. This is caused by the back E.M.F. of the battery which prevents current flowing when the forward E.M.F. from the rectifier is less than the back E.M.F. of the battery. The effect of this and more particularly the

TABLE I.

Alternating.					Direct.				Oscillogram.
Frequency	Volts.	Amps.	Watts.	Power Factor	Average Volts.	R.M.S. Volts.	Average Amps.	R.M.S. Amps.	
60	105	0·58	55	0·90	11·7	18·8	—	—	Fig. 2
60	105	2·04	127	0·59	14·3	14·4	2·45	4·12	„ 3
83	105	0·56	55	0·93	11·0	18·4	—	—	„ 4
83	105	1·53	105	0·65	14·3	14·4	1·75	3·0	„ 5

N.B.—The tests on 83 cycles were made after those on 60 cycles.

Readings were also taken with the D.C. side of the rectifier open-circuited

The results obtained are given in Table 1.

By means of the Duddell high-frequency oscillograph, oscillograms were taken of the

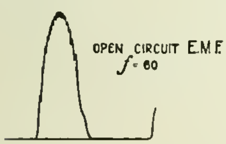


Fig. 2.

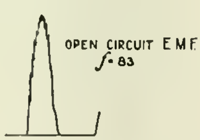


Fig. 3.

current and voltage supplied to the battery and of the voltage of the rectifier on open-circuit. These are shown in Figs. 2, 3, 4, and 5. In Figs. 2 and 3 (open circuit) the positive half-wave of voltage occupies half

suppression of the negative half-wave is to make the average current small compared with the maximum; thus in Figs. 4 and 5, the maximum is about 4 times the average

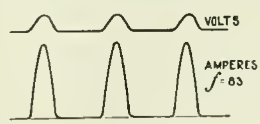


Fig. 5

current. The ripples which occur in the wave of open-circuit E.M.F. disappear as soon as a small current (0.2 amperes) is taken out of the rectifier. The ratio of the equivalent or R.M.S. value to average value is known as the form-factor of the wave, while the ratio of maximum to R.M.S. value is known as the crest factor. These values have been calculated and are entered in Table 2.

being found as the average height of the product of the current and voltage waves,

TABLE 2.

Oscillo-gram.	Fre-quency	Input Watts.	Output Watts.	Effi-ciency Per cent.	D.C. Volts.			D.C. Amperes.		
					Maxm.	Form factor	Crest factor	Maxm.	Form factor	Crest factor
Fig. 2	60	55	—	—	40·8	1·6	2·17	—	—	—
„ 3	60	127	39	30·7	16·8	1·0	1·17	9·35	1·68	2·27
„ 4	83	55	—	—	40·2	1·67	2·18	—	—	—
„ 5	83	105	30	28·6	16·3	1·0	1·13	7·35	1·71	2·45

The capacity of a battery depends upon the quantity of electricity stored, that is, upon $\int i\,d\,t$ where i is the current at any instant. If the current supplied to the battery is a varying one, as it is in this case, then the quantity stored equals $I_{av}\,t$, where I_{av} is the average value of the current during the time t. This is, of course, measured on a moving-coil instrument, and if a moving-iron instrument

By Courtesy of the British Thomson-Houston Co., Ltd.

The Tungar Battery Charger designed to give an output of about 2 amperes.

is used (as is often the case because of cheapness) quite an erroneous idea of the quantity supplied during the charge will be obtained.

In order to calculate the efficiency of the rectifier, it is necessary to know input and output in the same units. The power on both sides is not constant but pulsates about a certain mean value. The average input is measured on the wattmeter, the average output that is $\int_0^t i\,e\,d\,t$ From this the efficiency has been calculated. the results being given in Table 2.

As regards efficiency, the Tungar rectifier does not show up so well as, say, the mercury vapour rectifier, but it is cheaper in first cost. It is much more efficient than the method of charging cells off the 100 or 200 volt D.C. lighting mains, unless charging is only carried out when lighting is required.

When the supply is alternating current the Tungar rectifier should be most useful for charging small cells employed in wireless and other work.

The great points in favour of the Tungar rectifier are its simplicity and compactness. There is very little to go wrong and it can be left unattended for almost any period.

The above experiments were performed in the Electrical Engineering Department of the City and Guilds (Engineering) College, S.W.7, under the direction of Professor T. Mather, F.R.S., to whom the writer's thanks are due.

THE RADIO SOCIETY OF GREAT BRITAIN

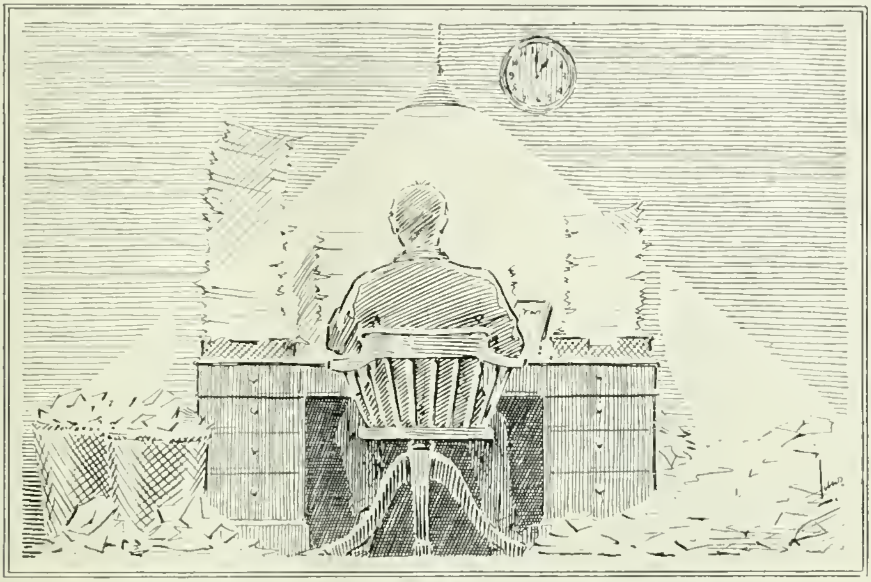
PRESIDENTIAL ADDRESS & ANNUAL CONFERENCE

On January 24th, at the Institution of Electrical Engineers, London, at 2.30 p.m.

The Transatlantic Tests

NOW that the Transatlantic Tests are over, a great keenness to know the results is bound to exist among all those who participated in and watched the progress of these experiments.

Owing to the enormous amount of work, however, which has fallen upon Mr. Philip R. Coursey, the organiser of the tests, we must exercise our patience, as the task with which he is confronted is a formidable one.



Any night since the Transatlantic Tests. Sorting out results.

The number of letters to be dealt with and the information contained therein to be extracted, is very great. He is devoting all his efforts to the completion of his report for publication at an early date, and it is hoped before very long to give full details of the results achieved. It is understood that the tabulated results up to the present have reached 106 pages of manuscript.

In the meantime it is interesting to read the following extracts from a letter which he has received from Mr. K. B. Warner, Secretary of the American Radio Relay League, who was responsible for making the necessary arrangements on the American side.

December 21*st*, 1922.

" . . . . Mr. Schnell has handed " me yours of November 29 . . . . . and it is " my pleasure to acknowledge.

" It has been so entirely awe inspiring to " receive the daily reports from your good " self and Dr. Corret that we are unable to " think intelligently about the matter at this " early date. Our expectations have been " so completely surpassed and the success " of your listeners has been so great that all " of our standards are swept away. We can " only say that to British and French amateur " radio is due the very highest commenda- " tion, and we offer our sincere congratulations.

" I suppose this will be the last eastbound " transmission test—your fellows have done " the thing so conclusively that there will be " no thrill in further attempts. Doubtless, " however, many of them will request " American stations to send at another time " for them to listen to, and I wish that you " would be at particular pains, if possible, " to point out that the transmission during " these tests has not represented any particular " departure from our routine amount of " transmitting, and that on any night in good " weather, particularly Saturday night, regard- " less of whether there are special tests or " not, the amateur air in the United States " is just as occupied as it has been during these " transatlantic tests. Your men should be " able to listen in at any time of any night " and hear American amateurs working **DX**.

" . . . .

"I wonder if you can imagine how interested "we are in the apparatus used by your amateurs "in the marvellous reception. Your results "proved that you have found the right com- "bination, and it is undoubtedly of an order "superior to what American amateur radio "is using. . . . .

"With renewed congratulations and ap- "preciation of your great help in our behalf, "I am . . . .

"K. B. Warner."

With reference to the suggestion in this letter that tests may now take place at any time regardless of specially organised arrangements, it should be noted that experimenters in this country have been hearing American amateur stations at other times than during the test periods. The remark with regard to the efficiency of British receiving apparatus are of interest.

With regard to the success of the transmissions from this side of the Atlantic already reported briefly in this Journal it is understood that full details have already been mailed, and will be available for publication in the next issue.

Notes.

A Lecture by Sir Oliver Lodge.

Sir Oliver Lodge will give a Silvanus Thompson Memorial Lecture at the Technical College, Leonard Street, E.C.2, on January 26th, at 7.30 p.m., on "The Basis of Wireless Communication." There will be interesting demonstrations in the laboratories and many pictures and instruments will be on view.

An Association of Radio Manufacturers.

An Association which already includes many of the principal British manufacturers of wireless apparatus has been formed for the purpose of taking up questions of common interest to the trade upon which united action may on occasion be desirable. The avowed objects of the Association, which is known as the National Association of Radio Manufacturers, are to straighten out the somewhat chaotic conditions at present obtaining in this new industry, but without exercising control as a "ring," and to establish fair and equitable conditions of trading. All manufacturers qualified for membership of the British Broadcasting Association are eligible for membership of the National Association of Radio Manufacturers.

Special Speech Transmission from America.

The Wireless World and Radio Review has been informed by Mr. W. J. Crampton that a special message to British Amateurs will be transmitted next Saturday night from America by Mr. Henry Edmunds, a well-known pioneer in electrical engineering, who is at present on a visit to America.

Mr. Crampton wrote to Mr. Edmunds to the effect that it would be of special interest if he could arrange to speak by wireless telephone from one of the American broadcasting stations, in view of the great interest which British amateurs are taking in the transmissions of **WJZ** and others. In reply the following message has been received :—

> "Through Courtesy American Telephone & next Saturday 9-10 p.m., American time speech 10 minutes from New York **WEAS** 400 metres from Henry Edmunds to Wireless Amateurs of England."

It is understood that the transmissions will be of 10 minutes duration ; from 9 to 9.10 and 10 to 10.10 p.m. American time, or 2 to 2.10 and 3 to 3.10 a.m. Sunday, British time.

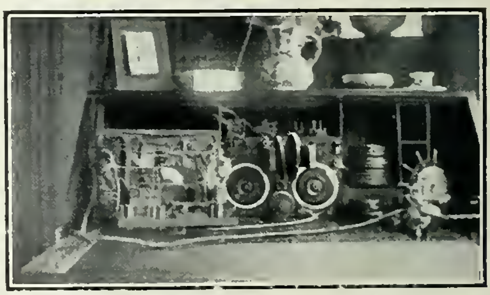
Any reports of the reception of this message will be cabled to America on Monday the 22nd inst., so that anyone receiving the message is requested to forward his report at once ; either to this office, or to Mr. W. J. Crampton direct at 73, Queen Victoria St., E.C.4.

Offices of the British Broadcasting Company.

The offices of the above Company are now located in Magnet House, Kingsway, London.

Broadcasting in Norway.

A comprehensive scheme for the development of wireless broadcasting in Norway is under consideration, and it is reported that the companies concerned propose to popularise the movement by providing receiving apparatus for hire by subscribers at an annual fee. Application has been made for leave to build a large radio-telephone station in Christiania in order to broadcast press exchange news and weather forecasts over the whole of Southern Norway.



The receiving station of Mr. A. N. Jackson Ley at Nottingham, which is ingeniously contained in a writing-desk.

Wireless Installations in France.

The French Under-Secretary for Posts and Telegraphs recently stated that about fifty thousand private wireless installations were in use in France.

Wireless Reception in a Motor-Car in Motion.

Some experiments made a short time ago by the Daimler Company in conjunction with Marconi's, showed that broadcast transmissions could be heard quite distinctly in a motor-car travelling at 20 miles an hour, the actual speed, of course, making no difference. The equipment was all contained in a neat case close to the near side arm rest, no aerials being visible.

Opera Broadcast.

The broadcasting of the actual performance of Grand Opera, an experiment hitherto unattempted, was accomplished with remarkable success on Monday, January 8th, and the nights following, when parts of the production at Covent Garden Opera House, of Mozart's "Magic Flute," and other operas, were transmitted from **2 LO**, the London broadcasting station.

This innovation was brought about by arrangement between the British Broadcasting Company and the British National Opera Company, with the assistance of the Covent Garden electrical engineer, Mr. W. J. Crampton, and the engineering staff of the General Post Office. Transmission from the theatre was effected by microphones placed midway between the stage and the auditorium, and connected by a specially installed underground cable to Marconi House, whence the music was broadcast. Reports of the reception of the operas have been entirely satisfactory, and testimony as to the purity and volume of the music has been forthcoming from many parts of the country. Contrary to expectation, the vocalists were heard more distinctly than the orchestra, although the presence of the instruments, even during solo passages, could always be detected. As was to be expected, the strength of the voices depended, to some extent, on the position of the singers in relation to the microphones, and the imaginative listener could thus locate the whereabouts of each performer.

Owing to the placing of the microphones it was possible to detect very clearly the usual sounds proceeding from the auditorium, the buzz of conversation, and the hand-clapping of applause being remarkably distinct. This enterprising series of experiments concluded with the close of the opera season, but in consequence of widespread public appreciation, it is hoped to carry out similar transmissions in the near future.

The Model Engineer Exhibition.

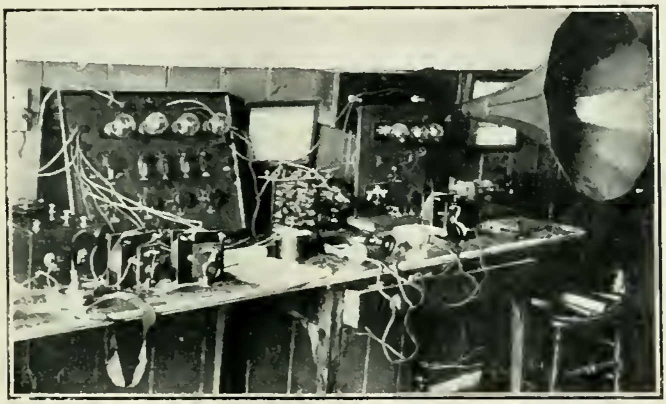
Among many other interesting features on view at the Model Engineer Exhibition recently held at the Royal Horticultural Hall, Westminster, was a display of wireless apparatus, and at frequent intervals during each day demonstrations were given. Exhibits of wireless apparatus and accessories for experimental work were shown by the following firms:—J. B. Bower & Co., Ltd., of Wimbledon; Wainwright Manufacturing Company, Ltd.; F. Yates & Sons, Ltd.; Grafton Electrical Company; A. W. Gamage, Ltd.; Peto Scott Co.; G. Z. Auckland & Son; Bowyer, Lowe Co., Ltd.; Leslie McMichael, Ltd.; M. W. Woods; Economic Electric, Ltd.

Proposed Wireless Societies.

It is proposed to form a wireless society in Pirbright and district. Mr. W. Day of the Gardens, Pirbright, Surrey, who has kindly consented to act as Secretary *pro tem*, will be pleased to hear from those interested. A radio society is also to be formed in Doncaster and district and all interested are invited to communicate with Mr. Ernest F. Brett, 51, Highfield Road, Doncaster.

Senator Marconi on the Transatlantic Experiments.

The recent successful experiments in Transatlantic wireless telegraphy, carried out by members of the Radio Society of Great Britain, were warmly commended by Senator Marconi in an interview with *The Times*. Referring to the suggestion, however, that in view of the short wavelength employed in the experiments (200 metres and a maximum power of one kilowatt and a half) the existing high power stations for long-distance communication were therefore unnecessary, Senator Marconi disagreed. These high power stations, he explained, using wavelengths up to 30,000 metres and power up to 350 kilowatts, were not unnecessary, because experience had shown that with shorter wavelengths and lower power a reliable service under certain atmospheric conditions could not be maintained. The experiments made by the Radio Society, he pointed out, were carried out in the winter months and in the early morning hours, when wireless transatlantic signalling was least difficult, though there was no satisfactory explanation for the phenomenon.



The amateur receiving station of Mr. B. H. Read of Brundall, Norwich.

Progress of the British Empire Exhibition.

In order to house the large number of exhibits of mechanical and electrical equipment and apparatus which has already been entered for the British Empire Exhibition, it has been found necessary to extend the Machinery Hall by the addition of about 70,000 square feet. The mechanical exhibits are being organised by the British Engineers' Association, and electrical exhibits by the British Electrical and Allied Manufacturers' Association.

2 LO Received at Coventry on Crystal Sets.

It is reported that members of the Coventry and District Wireless Association have been receiving from the London broadcasting station (**2 LO**) on simple receiving sets, in spite of the fact that these are usually considered to have a range of only 25 to 30 miles.

Calendar of Current Events

Friday, January 19th.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture on "The Armstrong Super-Regenerative Receiver," by Mr. H. F. Fardley, M.I.R.E.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture on "Practical Construction of Wireless Apparatus," by Mr. Brookes.

THE RADIO SOCIETY OF HIGHGATE.
At 7.45 p.m. At the 1919 Club, South Grove. Sale of apparatus.

OLDHAM AMATEUR RADIO SOCIETY.
At 8.30 p.m. "Electrical Units," by Mr. Potts.

Saturday, January 20th.

LAMBETH FIELD CLUB AND MORLEY COLLEGE SCIENTIFIC SOCIETY.
At 7.30 p.m. Lecture on "Epochs in the Development of Wireless," by Mr. J. J. Denton, A.M.I.E.E.

Sunday, January 21st.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, January 22nd.

9.20 to 10.20 p.m. Dutch Concert **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. S. Cork.

PUDSEY AND DISTRICT RADIO SOCIETY.
At the Mechanics' Institute. Ordinary meeting.

Tuesday, January 23rd.

Transmission of Telephony at 8 p.m. on 400 metres, by **2 MT**, Writtle.

Wednesday, January 24th.

ROYAL SOCIETY OF ARTS.
At 8 p.m. At John Street, Adelphi, W.C. Lecture on "The New Methods of Crystal Analysis and their Bearing on Pure and Applied Science." By Sir W. H. Bragg, F.R.S.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.
Lecture on "Short Wave Transmission and Reception," by Mr. P. Denison.

EDINBURGH AND DISTRICT RADIO SOCIETY.
At R.S.S.A. Hall. Lecture by J. G. W. Thompson.

MALVERN WIRELESS SOCIETY.
Lecture on "Telephones and Loud Speakers."

Thursday, January 25th.

ILFORD AND DISTRICT RADIO SOCIETY.
Lecture on "Wireless Waves and Harmonics."

LUTON WIRELESS SOCIETY.
At 8 p.m. At Hitchin Road Boys' School. Exhibit and Demonstration, by A. J. Wells.

DEWSBURY AND DISTRICT WIRELESS SOCIETY.
Lecture by Mr. Whiteley (Bradford).

HACKNEY AND DISTRICT RADIO SOCIETY
At the Y.M.C.A., Mare Street, E.8. Informal meeting.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Friday, January 26th.

RADIO SOCIETY OF HIGHGATE.
At 7.45 p.m. at the 1919 Club, South Grove. Lecture on "Direction Finding," by Mr. Wise.

MANCHESTER WIRELESS SOCIETY.
Discussion.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Instructional Meeting. Lecture on "Construction of Inter-Valve Transformers," by S. Kniveton.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Practical Demonstration.

Correspondence

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—Referring to the subject of The Armstrong Super-Regenerative Receiver, I find that the circuit recently given by Mr. Harris works very well, but I would suggest the following modifications :—

(1) The American broadcasting band of wavelengths is slightly under ours, and if the dimensions given by Mr. Harris are followed the condenser should be placed in shunt with the tuning coil instead of in series with the loop.

(2) The intermediate tappings are not required, as I find the minimum W.L. of coil as given about 340 metres.

(3) Vernier adjustments to the variable condensers are a big help, and on the oscillating valve rheostat an immense advantage.

(4) The inductance windings should be in the same direction as the variometer coils.

(5) Although some American writers state C.W. signals cannot be received well, I find no difficulty in their reception, in fact Morse signals were the first heard on this remarkable and tricky circuit.

E. R. W. FIELD.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I think your readers will be interested to learn that I have received a communication from Messrs. Reid, Sharman & Co., Solicitors to Captain Bolitho, informing me that Captain Bolitho is the inventor of the Super-Regenerative Circuit, and that the instrument built by me and described in *The Wireless World and Radio Review* of October 21st last, is covered by Captain Bolitho's patent, 156330.

PERCY W. HARRIS.

January 5th, 1923.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company :—

London	2 LO	369	metres.
Birmingham	5 IT	420	,,
Manchester	2 ZY	385	,,
Newcastle	5 NO	400	,,

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) *Each questions should be numbered and written on a separate sheet on one side of the paper, and addressed "Question and Answers," Editor,* THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise.* (2) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before.* (3) *Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions.* (4) *The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume."* (5) *In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"REDESIGNER" (Kent) *wishes to convert his set from one H.F., one detector, one L.F., to one detector, two L.F., and asks for diagram.*

We suggest you adhere to the old arrangement as we do not think the addition of one note-magnifying valve will compensate for the loss of one high frequency connected valve; but without knowledge of the three-valve circuit which you use, we cannot help you much, nor say why the results are unsatisfactory, but the arrangement of the detector and two-note magnifier set will be only limited by the tuning range of the aerial circuit. See Fig. 1.

"T.C.O." (Southport) *asks whether it is an advantage to use different anode potentials for valves which are used to function in different ways.*

The proposed method of applying the high tension voltage is correct. As a rule you will find that 70 volts are required on the low frequency valves, rather less on the detector valve, and some adjustment is required to obtain the best potential for the high frequency valves. These remarks assume the use of "R" type valves. The adjustment of H.T. potential is just as important as the adjustment of filament current.

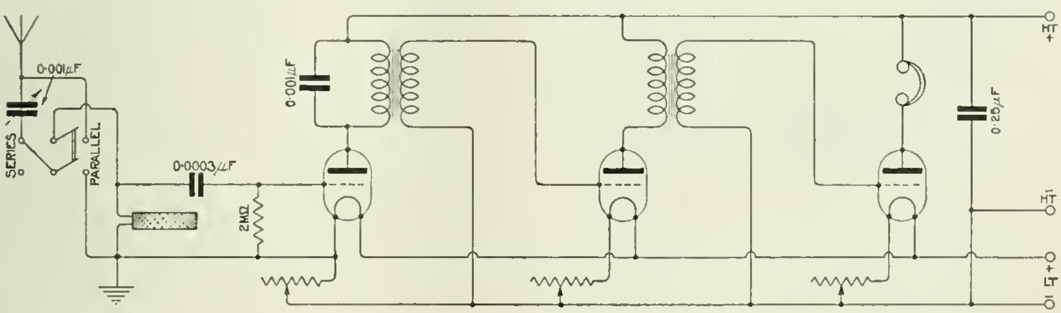


Fig. 1.

"R.H." (Herts.) *asks* (1) *For a diagram of a crystal valve circuit using a loose coupler.* (2) *For the values of various condensers.* (3) *For the position of the telephone transformer and particulars for making same.* (4) *Where to obtain constructional details of honeycomb, basket and slab coils.*

(1) We suggest you look through this section in recent issues when you will find a number of circuits using a crystal and a valve, and you will be able to choose one which meets your requirements. (2) The values of condensers are given in all recent issues. (3) The primary winding of the telephone transformer may consist of 3 ozs. of No. 44 S.S.C., and the secondary, 3 ozs. of No. 34 S.S.C. (4) The construction of coils is fully dealt with in Mr. Coursey's book entitled "Radio Experimenter's Handbook," price 3s. 6d., obtainable from the publishers, 13, Henrietta Street, W.C.2.

"RADIO KLOOFNEK" (Capetown) *has a single-valve set, and asks* (1) *Whether it is detrimental to the working of the set to run various leads from the instruments through a wooden table.* (2) *Whether it is possible to insert a microphone in the aerial circuit and transmit speech for a short distance.*

(1) The circuit is working very satisfactorily, and provided care is taken to properly insulate the leads, and their length is kept reasonably short, we do not think any loss of signal strength will occur through wiring the set on a wooden table. (2) We suggest you increase the filament heating battery to 6 volts, and the anode voltage to 70 volts. It would then be possible with a microphone inserted in the earth lead to transmit telephony for a short distance, provided the coupling between the grid and plate circuits is made very close.

"**B.D.**" **(Southsea)** *asks* (1) *For a diagram of a five-valve receiver for use on wavelengths up to* 2,500 *metres.* (2) *How could an external heterodyne be coupled with the receiver.* (3) *Would the arrangement operate a loud speaker.* (4) *How to make a H.F. intervalve transformer for receiving up to* 2,500 *metres.*

(1) See Fig. 2. A switch is connected in the aerial circuit to join the A.T.C. and A.T.I. in series or parallel for short or long wave reception, and a "tune-stand-by" switch is provided which will be found useful when tuning in. (2) A small coil consisting of a few turns is coupled to the anode coil in the second anode circuit; only a small coupling is required. The generator may be an ordinary heterodyne wavemeter with the coil connected in the anode circuit. When receiving short wavelengths you may find it an advantage to couple the first anode coil with the closed circuit coil. If the circuit oscillates rather easily, the connections to the filaments (A) should be changed from — ve to + ve. (3) You will be able to operate a loud speaker from this receiver. (4) H.F. transformers were described in the issues of September 2nd and 16th. The circuit given uses the tuned anode method of coupling as generally good results are easier to obtain, both from the operating and constructional points of view.

"**H.E.C.**" **(Surrey)** *submits a sample of wire and asks* (1) *Its size.* (2) *If it is suitable for intervalve transformer construction.* (3) *Whether it may be used to wind a telephone receiver.*

(1) The wire is No. 34 S.W.G., S.S.C. (2) The wire is rather heavy for this purpose. We suggest you use 3 ozs. of No. 44 S.S.C. for the primary, and 3 ozs. of No. 46 S.S.C. for the secondary. The telephone transformer may consist of a winding of 3 ozs. of No. 44 S.S.C. for the primary, and 3 ozs. of No. 34 S.S.C. for the secondary. (3) The telephones may be wound with No. 34 S.S.C. wire. The bobbins should be filled.

"**J.P.**" **(Preston).**—We suggest you employ a three-valve receiver, using one H.F., one detector, and one L.F. connected valves. We cannot name any particular manufacturer, but the firm you mention manufacture a unit system from which you could build up a three-valve set. However, the better plan is to consult the advertisements in this journal, and write for the catalogues issued by the manufacturers concerned and make a choice. Some firms have a good reputation for their products, and these are generally the most expensive. To purchase cheap apparatus is a false economy. The aerial is very satisfactory.

"**A.J.**" **(Middlesex).**—We consider the result you have obtained to be quite satisfactory. To obtain greater signal strength, we suggest you add one note magnifying valve, and if you wish to receive broadcasting from the broadcasting stations situated in the North of England or Scotland, we suggest you add one high frequency valve connected as indicated in the issue of September 2nd, page 717. The trouble which you experience is due to the series parallel switch, and is simply a matter of tuning. You do not give any particulars of your coil, so we are unable to definitely say whether this is the case. The series parallel switch is connected correctly. We cannot give a definite reason why the "R" valve works best with only 27 volts on the plate, but we consider it is probably due to the use of too low a filament voltage. Four volts are required as a rule across the valve filament, which means that a six-volt accumulator is required if you use a filament resistance.

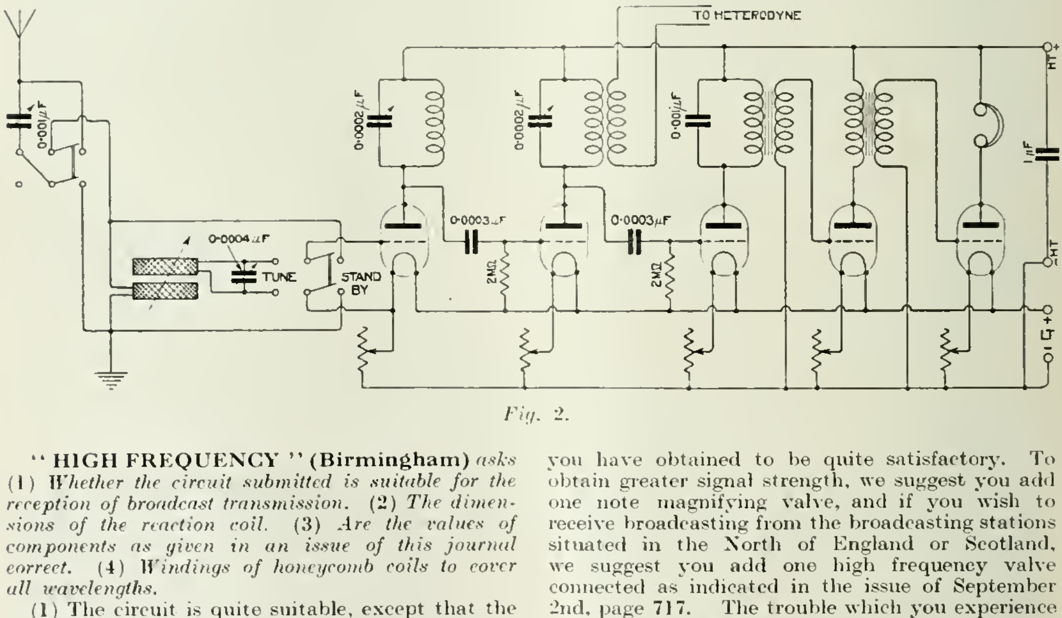


Fig. 2.

"**HIGH FREQUENCY**" **(Birmingham)** *asks* (1) *Whether the circuit submitted is suitable for the reception of broadcast transmission.* (2) *The dimensions of the reaction coil.* (3) *Are the values of components as given in an issue of this journal correct.* (4) *Windings of honeycomb coils to cover all wavelengths.*

(1) The circuit is quite suitable, except that the secondary circuit is not tuned with a variable condenser, which is probably a slip. (2) The reaction coil should consist of about 100 turns of No. 38 S.S.C., wound on a former with a diameter of 2″. When receiving long wave signals extra coils may be added in series with the reaction circuit. The reaction coil coupling should be variable. (3) The values given are correct. (4) You should wind about 12 coils, with turns from 40 to 2,500. For short wavelength work use coils with 40, 60, 95 and 130 turns. The formers may be 2″ diameter and 2″ wide.

"**A.B.**" **(Plymouth)** *asks for a diagram of a receiver which will operate a loud speaker when connected with a frame aerial.*

We suggest you use a receiver comprising two H.F., one detector, and two L.F. valves. The H.F. valves may be coupled by means of a tuned anode coil and a grid condenser and leak (fig. 3). The anode coil suggested is quite suitable. We suggest you employ a three-coil holder with a complete set of coils. The H.T. supply for the anodes of the valves should be adjustable: in general, valves which function as H.F. amplifiers do not require the same potential as those which function as an L.F. amplifier. For this purpose tapping leads are indicated. Suitable values of components are indicated, and it would be as well to purchase first-class apparatus. To purchase cheap, or apparatus made by a firm without a great deal of wireless experience, is a false economy. A switch is shewn for connecting the A.T.C. and A.T.I. in series or parallel, for short or long waves respectively, and another has the purpose of connecting either the aerial or closed circuit to the first valve. When tuning in, it is better to connect the aerial circuit to the valve, and after signals are heard, to change over to the closed circuit.

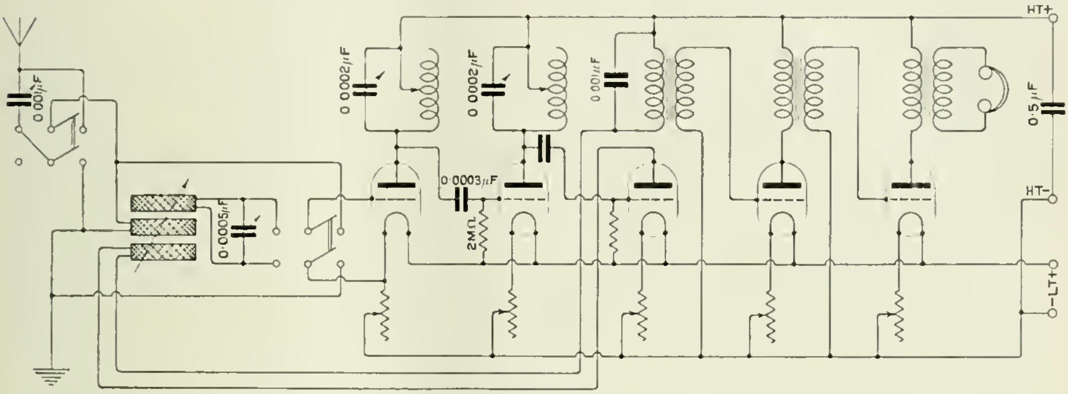


Fig. 3.

"**C.F.I.**" **(Hunts.).**—The aerial tuning inductance may consist of a winding of No. 28 D.C.C. wire, 5″ in diameter and 8″ long, and 16 tappings may be taken at equal intervals. The secondary circuit, which we assume will be tuned with a 0·0005 condenser, may consist of a winding 4″ in diameter and 10″ long, wound full of No. 32 D.C.C. Ten tappings should be taken from this winding at equal distances. Before winding, the former should be thoroughly dried, and after the winding is wound on the former, the whole should be dried out, and only a little insulating material, such as a good shellac, applied to prevent the absorption of moisture during use.

"**T.S.F.**" **(Hants.)** *asks* (1) *For the issue in which appears the diagram of a receiver suitable for receiving short and long wave telegraphy and telephony.* (2) *Whether a licence is necessary before he can use a receiving set.*

(1) The diagram given on page 316 of December 2nd issue will meet your requirements. The tuning inductance may consist of a winding 5″ in diameter and 8″ long, with 18 tappings. When receiving short wavelengths the high frequency intervalve transformer is used, and the reaction coil may be coupled to the secondary of this transformer. When receiving longer wavelengths, the reaction coil should be coupled with the aerial tuning inductance. The construction of intervalve transformers has been described in the issues of September 2nd and 16th. The anode resistance should have a value of the order of 80,000 ohms. (2) It is necessary to hold a licence before you conduct experiments with wireless reception, and you should apply to the Secretary, the Post Office, London.

"**WORRIED**" **(Yeovil)** *asks* (1) *Who is* **2 FQ**. (2) *Why his receiver, particulars of which are submitted, is noisy.* (3) *The name of the station which is transmitting speech daily on* 3,600 *metres.* (4) *What is the cause of the variation in atmospheric strength between the day and the night reception.*

(1) **2 FQ** is the call sign of Messrs. Burndept, Ltd., experimental station, Blackheath, London. A full list of the call signs of experimental and amateur transmitting stations may be obtained (price 6d.) from the Mail Order Dept., The Wireless Press, Ltd., 12 & 13, Henrietta Street, Strand, London, W.C.2. (2) We suggest you fit a filament resistance to control the filament current of each valve, and increase the L.T. voltage to 6 volts. As your H.T. battery has had considerable use, we think the trouble is due to cells becoming worn out; otherwise the circuit is correct. (3) We have no information of this station, although we believe a number of German stations are conducting telephony transmissions on a wavelength of 3,600 metres daily. (4) The whole question of atmospherics is very involved, and we cannot usefully discuss the question briefly, but we would refer you to any standard text-book on the subject.

"HOPEFUL" (Birmingham) *wishes to convert his one-valve receiver into a two-valve receiver, and asks* (1) *For a circuit showing one H.F. and one detector valve.* (2) *For particulars of windings of the coils.* (3) *Whether to tune the reaction coil.* (4) *Whether he may expect considerably better results from two valves.*

(1) See Fig. 4. Suitable values are marked in. (2) The aerial coil may consist of a winding 4" in diameter and 8" long, wound full of No. 22 D.C.C. The anode coil may consist of a winding

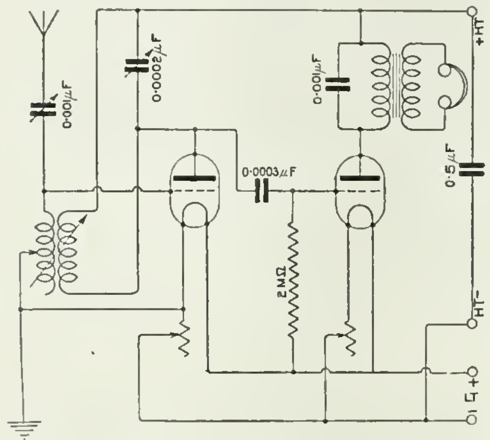


Fig. 4.

3" in diameter and 8" long, wound full of No. 28 D.C.C. (3) In this event the tuned anode coil acts as a reaction coil. (4) We think you will obtain much louder signals from this two-valve combination. We have made it as simple as possible and in such a manner that very few new components will be required.

"G.F." (Bermondsey) *asks for the connections of a valve detector to replace the crystal detector in his present set.*

See Fig. 5, page 76, October 14th issue. We suggest, however, that you use the single valve as a high frequency amplifier, and still make use of the crystal detector for rectification, and we would refer you to Fig. 2 on page 183, November 4th issue. The anode is tuned by means of a coil and tuning condenser. This method will give far better results than would be obtained from the use of the detector valve by itself.

"C.R." (Weybridge) *submits particulars of his receiver and asks* (1) *The correct method of joining a L.F. transformer.* (2) *For criticism of his receiver.*

(1) The correct method of joining a L.F. transformer is indicated in Figs. 3 and 4, page 215, November 11th issue. (2) The wiring diagram submitted is correct, with the exception of a condenser across the primary winding of the L.F. transformer. In addition, we think you should use higher anode volts, and very likely your valves are not satisfactory. Generally very superior results are obtained when "R" type valves are used. In this case it is better to use an anode potential of about 60 volts with a 6-volt battery connected across the filament in series with the filament resistance. The resistance should be about 7 ohms, and should be sufficient to reduce the filament current, so that there is no danger of the valves burning out. You will notice that we have connected the filament resistances in the negative lead, and the grid leak is connected directly between the grid and negative of the filament battery.

"R.G." (Som.) *refers to Fig. 5, page 216, and asks* (1) *For particulars of the anode tuning coils.* (2) *How to use a three-coil holder with this circuit.*

(1) The first three valves have each a tuned anode coil in the anode circuits, and each coil and condenser should be as alike as possible. Plug-in coils may be used, or tapped cylindrical coils are useful. The coil which is shown coupled to the anode coil of the first valve is the reaction coil, as may be seen from following out the diagram carefully. Coupling the reaction coil in this manner prevents the possibility of energy oscillations being set up in the aerial circuit. The anode coil should be made a little larger than the closed circuit coil. (2) The reaction coil may be plugged in the spare coil to either of the three coil holders, in which case care must be taken to prevent oscillating energy being set up in the aerial circuit. The position of the reaction coil in the diagram referred to is simply moved. The wiring remains the same. Alternatively you could cut out the reaction coil and couple the first tuned anode coil with the closed circuit coil.

"R.W." (Dundee) *asks* (1) *for a two-valve circuit, 1 H.F. and 1 detector, with a switch to disconnect one valve.* (2) *Whether a plate 5' × 2' 6" is suitable for use as an earth.*

(1) See Fig. 5. The tuned anode method of H.F. coupling is used. (2) This should provide a good earth.

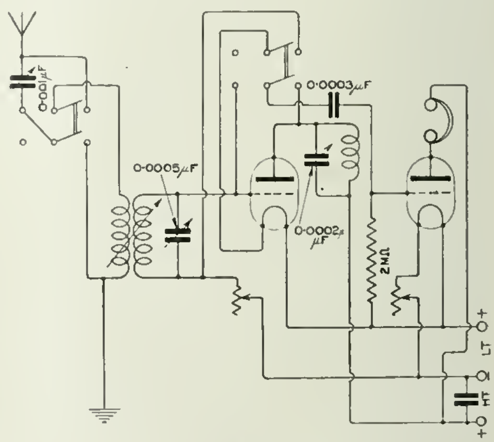


Fig. 5.

"A.G." (Salisbury).—The circuits referred to are good circuits for experimental purposes, but we think you would obtain greater selectivity and amplification by adopting an H.F. intervalve transformer connected in the usual manner. The transformer windings should be determined by experiment to give the greatest step-up in voltage, and as each winding is tuned with a variable condenser, the windings should be loosely coupled in order that tuning one circuit will not greatly change the tuning of the coupled circuits. For this purpose the transformer may consist of a cylinder 3½" diameter with a tapped winding. The secondary should be constructed so that it may slide into or out of the primary winding. The winding should be spaced, to reduce self capacity. Using the normal method of connection, the H.T. battery may be common to each anode circuit, although each circuit will require a different H.T. voltage. The circuits sketched are normal circuits, with the addition of variable coupling, the provision of which enables very selective tuning, and high amplification. Suitable valves are indicated. We think it is not advisable to use a common H.T. battery with the type of circuit submitted.

"L.J.V." (Devon) *asks* (1) *For data to enable him to construct a current limiter or barreter.* (2) *The explanation of a peculiarity experienced when using a crystal rectifier.* (3) *Whether it is correct to be guided by filament current or the voltage applied to the filaments.*

(1) We can give you very little data concerning the construction of the current limiter. The wire is of iron or special iron alloy, and is sealed into a tube which contains hydrogen to prevent the wire burning. The exact composition of the wire, and the pressure of hydrogen in the tube is probably only known to the manufacturers, and very little information is available for publication. (2) Without a knowledge of the circuit and disposition of the components of your receiver, we cannot state why the effects are noticed. We think you may be sure the crystal does not provide the explanation. (3) The emission from a given filament depends upon its temperature, which is determined by the heating current. During the life of the valve, the filament becomes thinner, and to maintain the emission, or what is the same thing, to maintain the heating current at its previous value, a higher voltage is required. Sending the same current through the valve in this manner to keep up the emission gives the filament a higher temperature, and its life is greatly reduced. The output of the valve may be maintained by increasing the filament voltage as the filament becomes old, but if long life of the valve is desired, the applied potential should be held constant, and the output be allowed to fall off. When using valves for reception, it is usual to be guided by the requirements of the circuit, irrespective of whether this results in the valve current being varied.

"EASTERN" (Norfolk) *asks* (1) *Whether diagram submitted is correct and suitable.* (2) *May reaction be obtained by using a two-coil holder, one coil being a reaction coil and the other forming a tuned anode coil of the first valve.* (3) *Whether an amplifier in his possession is suitable for use with the circuit in* (1) *above.* (4) *Whether proposed arrangement for long wave reception is suitable.*

(1) and (2) The diagram submitted is correct, but you will notice notification which appeared in the issue of November 18th. When tuned stand-by connections are provided, the reaction coil should be coupled with the aerial coil. It is better however to couple the reaction coil and anode coil together. Reaction effects are easily obtained, and the Post Office approve of this method of using reaction. (3) The amplifier in your possession may be used in conjunction with the tuner, in place of the telephones of the tuner. The input circuits of the amplifier should be connected, provided the H.T. is connected to the same side of the filament battery in each case: common H.T. and L.T. batteries may be used. (4) The grid condenser may with advantage be given a little larger capacity than when receiving on long wavelengths, and we suggest you try 0·0004 or 0·0005 mfds. The by-pass condensers may have the same value as for short wave reception. The grid leak will probably not require changing, although it is sometimes better to connect a little higher leak resistance, and we suggest 2 megohms.

"HETERODYNE" (South Wales). We do not think you will obtain any increase in output from your generator by joining the valves in parallel We suggest you increase the anode and filament voltage and tighten the coupling between the grid and plate circuit coils. However, the method of joining valves in parallel indicated by your sketch is correct.

"R.A." (Sussex) *asks for a practical test to determine whether the set is oscillating.*

A practical test of oscillation is to touch the grid condenser of the first valve while listening with the receivers. If the circuit is oscillating, a loud pop will be heard in the receivers when the connection is touched, and when the finger is removed. To stop the oscillations, the filament circuit and H.T. potential should be adjusted, and if the circuit persistently oscillates, the reaction coil should be reversed. It will also be better to connect the grid leak to the + ve L.T.

"E.C.H." (Doncaster) *is situated near a large 50 cycle power transformer and has difficulty in receiving signals due to the hum.*

It is a difficult matter to prevent hum when one is situated so closely to a large A.C. power unit. We find that the arrangement which is very effective in one case is useless in another case. However, we think you could make up a rough frame aerial and try the result. The hum which is heard in the telephones before the aerial is connected generally is not heard when signals are received. We suggest a frame aerial because the hum is often picked up by the earth lead having a small P.D. set up across it, and the removal of the outside aerial reduces the chances of inductive effects. Using H.F. valves in place of L.F. valves is generally a very effective method of reducing hum. Iron core transformers themselves pick up a considerable amount of L.F. energy due to the magnetic field set up by the transmission lines. As a final precaution, the set may be completely screened with tin foil, or a tin box, and the telephone and battery leads wrapped round with wire and earthed.

"G.R.W." (Watford) *proposes to construct a three-valve receiver to operate a loud speaker and asks the best arrangement to adopt, with diagram.*

The diagram (Fig. 1) on page 249, November 18th issue, shows the connections of one H.F., one detector and one L.F. coupled valves, and may be thoroughly recommended. The H.F. coupling makes use of a tuned anode, and grid condenser and leak. The anode coil and reaction coil may be mounted on a two-coil holder in a similar manner to the aerial and closed circuits. If the circuit tends to be unstable, you would find it helpful to connect the closed circuit between the grid and — L.T. and the leak resistance + L.T. If you are not accustomed to tuning, we suggest you connect a switch to connect the aerial circuit or the closed circuit to the input of the first valve. Then with the switch in the "stand-by" or aerial position, signals are tuned in. If the switch is now thrown over to the "tune" or closed circuit position, it is quite easy to alter to tune the secondary circuit to the aerial circuit.

"W.S.B." (Newport Pagnell) *sends us a sketch of his aerial and turns, and asks* (1) *Whether aerial arrangement is suitable.* (2) *How to add a H.F. connected valve to his crystal set.* (3) *How to connect the H.F. transformer tappings.*

(1) The proposed arrangement is quite suitable, and we consider you possess a good aerial. (2) and

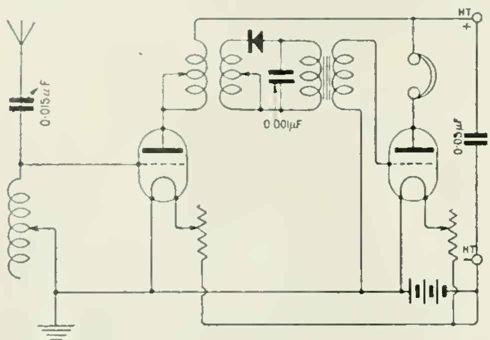


Fig. 6

(3) As you propose to purchase a tapped H.F. transformer, the manufacturer will supply you with a diagram showing how to connect it up. See Fig. 6.

"E.T." (Middlesex).—A broadcast licence is granted only to those persons who purchase apparatus bearing the stamp "B.B.C." The apparatus which bears this stamp has been passed by the Post Office, and is such that energy cannot be set oscillating in the aerial circuit. Persons who construct their own apparatus are not granted a broadcast licence, but an experimenter's licence, if it is considered that their qualifications are such that harmful effects will not result through the use of apparatus.

"E.C." (S.W.16).—(1) Celluloid labels may be fastened to ebonite with Prout's elastic glue. (2) There is no successful solvent of ebonite, but the surface of ebonite may be softened with carbon disulphide.

"K.H.F." (India) *submits a diagram and asks for criticism.*

The proposed arrangement is quite suitable provided single valves are used. It is not necessary neither is it of much assistance, to connect receiving valves in parallel for H.F. amplification.

"W.L.B." (Fulham).—See Fig. 7. Suitable values are marked in.

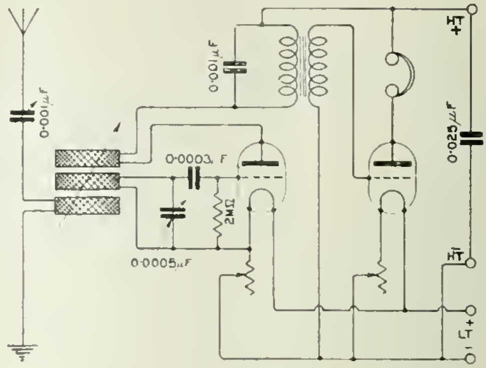


Fig. 7.

"E.B." (Medstead) *asks* (1) *For criticism of his receiver, particulars of which are submitted.* (2) *Whether we consider any alteration is necessary.* (3) *What stations he should receive.*

(1) and (2) The diagram submitted is quite suitable, although when receiving short wavelengths we suggest you connect the tuning condenser in series with the A.T.I. Without a knowledge of the size of your inductance coil, we cannot estimate the wavelength range of the set. The value of resistance given does not help us much, as the inductance coil does not possess resistance in any useful sense. (3) We think you will be able to hear the broadcast transmissions, and also the transmissions of local amateurs. You may, in addition, receive the transmissions from higher power long wave stations.

"H.K." (Gorleston-on-Sea).—(1) The set to which you refer will time from 250 to 650 metres. (2) No doubt the method of connecting the valves is patented, but you may test such circuits in your experimental work. (3) The H.T. battery may be 60 volts and the L.T. 6 volts. (4) We suggest you secure a bound volume of this journal for the half-year ending 30th September, 1922.

"C.G.B." (Wimbledon Park) *submits a diagram of connections and asks* (1) *For criticism of the proposed arrangement.* (2) *For particulars of a suitable reaction coil which is to be 4½" in diameter to couple into a tuned anode coil.* (3) *The approximate capacity of the aerial in microfarads.* (4) *What is the approximate relationship between the dimensions of the tuned anode coil and the reaction coil for short wave work.*

(1) The proposed arrangement is very suitable indeed, and is a standard circuit. (2) The reaction coil marked "R" in the diagram submitted may consist of 50 turns of No. 34 D.C.C. wound on a 4½" diameter former. Three tappings should be taken. (3) The approximate capacity of the aerial is 0·00025 mfds. (4) To obtain the correct reaction effects the dimensions of the reaction coil depend largely upon the tuning adjustments and upon the wiring of the receiver. In general the reaction coil will require approximately the same inductance as the tuned anode coil.

"**W.P.A.**" **(Congleton)** *asks* (1) *For criticism of his set.* (2) *For diagram of one-valve set.* (3) *Does the set comply with P.O. regulations.* (4) *For design of a three-valve set.*

(1) The diagram submitted shows no grid leak or aerial tuning condenser, otherwise it is correct. We suggest you use "R" type valves, 6 volts L.T. and 70 volts H.T. It is better to tune the aerial circuit with a condenser of 0·001 maximum capacity, that is, with a condenser made up of about 61 plates. A vernier three-plate condenser may be connected across it for fine tuning. The closed circuit tuning condenser and the inductance are quite suitable. (2) See Fig. 8. The figure indicates the method of connecting up one H.F. valve with one detector valve. The anode of the H.F. valve contains a coil and condenser which together tune to the wavelength of the signal. Suitable values are indicated. (3) The arrangement is permitted by the Post Office. (4) See figure. This circuit is Fig. 8 with a note magnifier added. From these two figures you will be able to add H.F. or L.F. connected valves as desired.

"**W.E.N.**" **(Lincoln)** *asks* (1) *How to prevent the noise which he hears in the receivers while receiving or when the aerial and earth are disconnected.* (2) *How many turns of No. 30 should be wound on a 2½″ former to provide reaction between wavelengths of 200 to 1,000 metres. The reaction coil is to be coupled to the H.F. transformer.* (3) *Is he correct in assuming that if a circuit is using 10 amps. at 60 volts, the watts absorbed in the circuit amount to 600.*

(1) We gather from your remarks that the trouble is due to induction from neighbouring mains. Provided the noise does not exist when the signals are being received, we think you have nothing to worry about. It is a difficult matter to remove the noise. We suggest that if possible you use a counterpoise in place of the earth connection, and also try screening the telephone leads by wrapping them round with soft iron wire connecting them with earth. (2) A suitable reaction coil would consist of 100 turns of No. 30 S.S.C. wound on a 2½″ former. We suggest you provide three tappings, as the amount of reaction required depends largely upon the wiring of your receiver. (3) The power absorbed by a direct current circuit in watts is equal to the voltage drop across the circuit, times the current flowing in the circuit, therefore the example quoted above is correct.

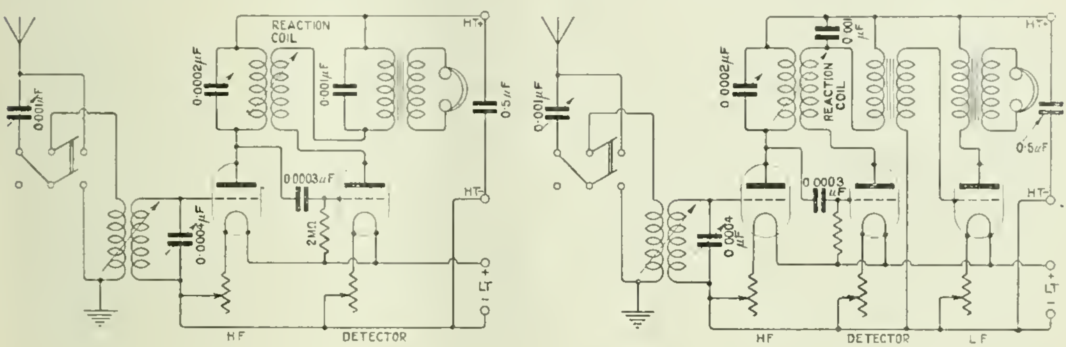


Fig. 8.

"**H.D.K.**" **(Clapham)** *asks* (1) *For the gauges of the samples of wire submitted.* (2) *Are any of the wires submitted of use in building a telephone transformer. Is the iron wire suitable for the core of a transformer.* (3) *For particulars to enable him to construct a telephone transformer.* (4) *Is there any good book published dealing with the construction of telephone transformers.*

(1) Particulars of the samples of wire submitted are as follows:—(*a*) 34 D.S.C. copper; (*b*) 38 S.S.C. copper; (*c*) 39 S.S.C. copper; (*d*) 37 S.S.C. copper; (*e*) 21 enamelled copper; (*f*) 18 bare copper; (*g*) Gauge 22 iron wire. (2) and (3) We suggest that for the primary winding of the telephone transformer you use No. 39 S.S.C. copper wire and for the secondary No. 34 S.S.C. wire. The core may be built up of the No. 22 iron wire. We suggest you build a core ½″ in diameter and 4″ long. The primary winding should be wound on first, and may consist of 4 ozs. of No. 39 S.S.C. wire. The secondary may consist of 2½ ozs. of No. 34. The high resistance telephones may be connected in series with the telephone transformer primary, and a third winding on the transformer is not recommended. (4) We do not know of a suitable publication to which you may be referred.

"**AMATEUR ELECTRIC**" **(Cheshire)** *submits a diagram of the connections of his receiver and asks* (1) *Whether the connections are correct.* (2) *The correct method of connecting L.F. valves.* (3) *How to add a H.F. panel, using the H.F. transformer method of amplification.*

(1) The connections of the unit system are not quite correct. We suggest you add a closed circuit, and a grid leak and condenser. Presumably the latter was omitted from the sketch in error. (2) Calling the beginning of the primary and secondary windings IP and IS respectively, when the two windings are wound in the same direction, IP is connected with + H.T. and IS with the grid. OP and OS are connected with plate and filament respectively. (3) See Fig. 5, page 113, October 21st issue.

"**H.A.**" **(Lancs.)** *asks* (1) *Which of two aerials will be better for short wavelength reception.* (2) *Whether the four-valve receiver described in the* *issues of July 15th, July 22nd and August 12th is suitable for the reception of broadcast transmissions.*

We suggest you use the single wire aerial which is 80′ long and 20′ high. (2) The receiver referred to is quite suitable, provided the reaction coil is coupled with the anode coil as shown in the issue of November 25th.

"G.F." (Ealing) *asks* (1) *Whether he may expect to satisfactorily operate a loud speaker from a two valve receiver—one detector and one low frequency.* (2) *Whether the arrangement, one H.F. valve, one crystal detector and one L.F. valve will provide sufficient signal strength to operate the loud speaker.*

(1) You will not be able to successfully operate the loud speaker from a two-valve receiver. (2) This arrangement will probably not provide sufficient signal strength for your purpose. We suggest you employ one H.F., one detector and two L.F. connected valves as given in Fig. 4, page 386, December 16th issue.

"L.J.N.K." (Rugby) *submits a diagram of connections and asks* (1) *Whether a receiver connected up in the manner indicated is liable to radiate energy.* (2) *Is it advisable to provide a reaction coil with inductive value similar to the tuning coil.* (3) *What power will operate a Weston relay.* (4) *Is the above relay suitable for operating a Syphon recorder.*

(1) The arrangement proposed will not radiate energy under ordinary circumstances, and may therefore be recommended. (2) The size of the reaction coil depends largely upon the construction of the receiver, and we suggest the reaction coil be provided with tappings. (3) The Weston relay will operate with a current of 0·2 milliamperes. (4) The Weston relay is suitable for slow speed recording purposes.

"H.B.F." (Liverpool) *submits a diagram of connections for our criticism.*

The proposed arrangement is fairly suitable. We suggest you connect a switch in the aerial circuit for connecting the condenser in series with the aerial tuning inductance when receiving short wavelengths. A vernier condenser is very useful in the aerial circuit. The grid condenser should have a value of 0·0003 mfds., and the grid-leak 2 megohms. A condenser of 1 mfd. should be connected across the H.T. battery. If the set tends to oscillate, the connections of the secondary of the H.F. transformers should be made between the grid and the + L.T.

"E.McK." (Glasgow) *submits a diagram of the receiver he proposes to build and asks* (1) *Should the H.F. transformer be mounted in such a manner that the reaction coil may be moved over it.* (2) *Is it necessary to tune the reaction coil.* (3) *Are the condensers having values* 0·0005 *mfds. and* 0·001 *mfds. suitable.* (4) *Will the receiver function efficiently on all wavelengths provided the tuning is properly carried out.*

(1) The reaction coil should be mounted so that it may swing near the H.F. transformer. We would refer you to the articles on "Experimental Station Design" in the issues of September 2nd and September 16th. (2) It is not necessary to tune the reaction coil, although in some cases it is helpful. We suggest you provide a tuning condenser of 0·0003 mfds. for this purpose. (3) The capacity of the variable condensers suggested is quite suitable. (4) The receiver should function efficiently providing the tuning is properly carried out.

"A.O.G." (Cornwall) *refers to the Armstrong super-regenerative circuit, and asks several questions.*

We are afraid you do not understand the principles underlying the operation of the Armstrong super-regenerative receiver. It is not possible to construct such a receiver having a maximum wavelength of 8,000 metres. In the suggested diagram there are a large number of errors, and in addition you propose to use it in conjunction with an ordinary open aerial. We suggest you abandon the idea of constructing this receiver; in any case it should not be used except with a loop aerial having 2′ sides.

"D.R.M." (Gt. Missenden) *asks* (1) *Whether we can refer him to a practical treatise on the design and construction of wireless receivers.* (2) *Whether it is possible to attend a college and take a complete course in radio engineering.*

(1) We are afraid we cannot recommend a book to meet your exact requirements, but you will be able to gain a great deal of information from the study of the standard wireless works. We suggest you consult the catalogue of books issued by The Wireless Press, Ltd., and make a choice yourself, as you will be able to judge matters, such as the price, better yourself. (2) It is quite possible to attend a college to take a complete course in radio engineering, and we suggest you communicate with the college nearest your home.

"J.W.C." (Wigan) *has a three-valve set, and is using "R" type valves. He asks whether the lists of components submitted is suitable.*

The dimensions and values of the components are quite suitable for your purpose. We cannot say what stations you will hear, but you may be sure you will hear the broadcasting stations, and of course those high-power stations to which you tune.

"J.S.F." (Herne Hill) *asks whether a capacity earth would be better in his circumstances than an earth connection.*

We consider you will obtain better results when an earth capacity is connected in place of the earth connection. The counterpoise may consist of three wires spaced 6′ apart run on insulators mounted on wooden posts 6′ high. The length of the counterpoise should be about 50 per cent. in excess of that of the aerial wires. The counterpoise should, of course, be well insulated from the earth.

SHARE MARKET REPORT

Prices as we go to press on January 13th, are:—

Marconi Ordinary	.. ..	£2 6 0
,, Preference	.. ..	2 0 0
,, Debentures	.. ..	103 10 0
,, Inter. Marine..	..	1 5 6
,, Canadian	.. ..	11 6

Radio Corporation of America:—

Ordinary	.. .. ..	16 6
Preference	.. .. ..	13 6

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

No. 180 [No. 17 VOL. XI.] JANUARY 27TH, 1923. WEEKLY

Frame Aerials in Radio Reception

A CONSIDERATION OF SOME OF THEIR PROPERTIES, WITH DATA FOR CONSTRUCTION.

BECAUSE the frame or loop aerial is a rather poor collector of energy from electro-magnetic waves as compared with the ordinary elevated type of aerial, its use has been very restricted until the advent of the thermionic valve and its development as an amplifier. Now, however, the frame aerial finds favour in many applications and may be equally as good for radio reception as elevated aerials, provided that additional amplification is available, whilst in addition, the frame aerial has many important advantages over other types.

One of the special advantages of the frame aerial is its directional properties. For the benefit of those not familiar with the theory of directional reception with frame aerials it may be mentioned that reception is strongest when the frame is in the same plane as the direction of the station being received, and that if the frame is rotated through 90° it will be noticed that the strength of the incoming signal is at a minimum since the frame is least sensitive in this position. A further movement through 90°, or 180° from the original position, brings back the strength again to maximum, since the frame is again in the plane of the direction of the station being received.

On account of these directional properties it is possible to use a frame aerial as a means of reducing or entirely eliminating interference from transmitting stations not in the same plane as the station which it is desired to receive. Thus, for instance, if a receiving station is in the vicinity of a powerful transmitter which normally causes interference, it may be possible, by employing a frame aerial, to eliminate this interference where reception of stations in a direction at right angles to the interfering station is concerned.

Similarly the frame aerial is now extensively used in the reception of commercial trans-atlantic signals, partly on account of the directional properties assisting in eliminating interference from other high power stations but largely because, as compared with elevated aerials, the frame aerial is less sensitive to atmospheric interference, which is one of the most serious problems of long distance commercial working.

Fig. 1 shows a photograph of a frame aerial of portable type with the tuning condenser mounted on the base.

In designing a frame aerial for amateur and experimental purposes some consideration should be given to the type of circuit to be employed with it. Theoretically it is desirable that the whole of the inductance of the tuning circuit should be included in the frame itself, in order that the maximum voltage may be obtained across the variable condenser in parallel with the frame aerial inductance, which is provided for tuning. This condenser should have a maximum value preferably not exceeding 0·001 mfds.

One of the most important papers on the subject of frame aerials and frame aerial design has been published in the *Journal of the Franklin Institute* and is due to A. S. Blatterman. In this paper, in considering the design of frame aerials, attention is especially drawn to the following points :—

(1) Best size of loop and number of turns for given wavelength.

(2) Effect of spacing the turns.

(3) Size and kind of wire.

(4) Insulation and its effect.

(5) Suitable value of the tuning condenser.

(6) Effect of proximity of the frame to walls, etc.

(7) Effect of dead-end turns in the frame inductance.

Brief conclusions are given below to consideration of these points :—

(1) Blatterman has shown that there is a best size of loop and number of turns for reception on a definite wavelength, and that for short wavelengths large frames of few turns are most suitable and smaller frames with a large number of turns for larger waves, whilst for the very long wavelengths it again becomes desirable to increase the size of the frame and reduce the number of turns.

(2) The spacing of the turns has been shown to be a matter of considerable importance. If the turns are wound close together the inductance value is increased but at the same time the resistance goes up. The most suitable spacing is where the resistance is kept as low as possible without a loss in the inductance value.

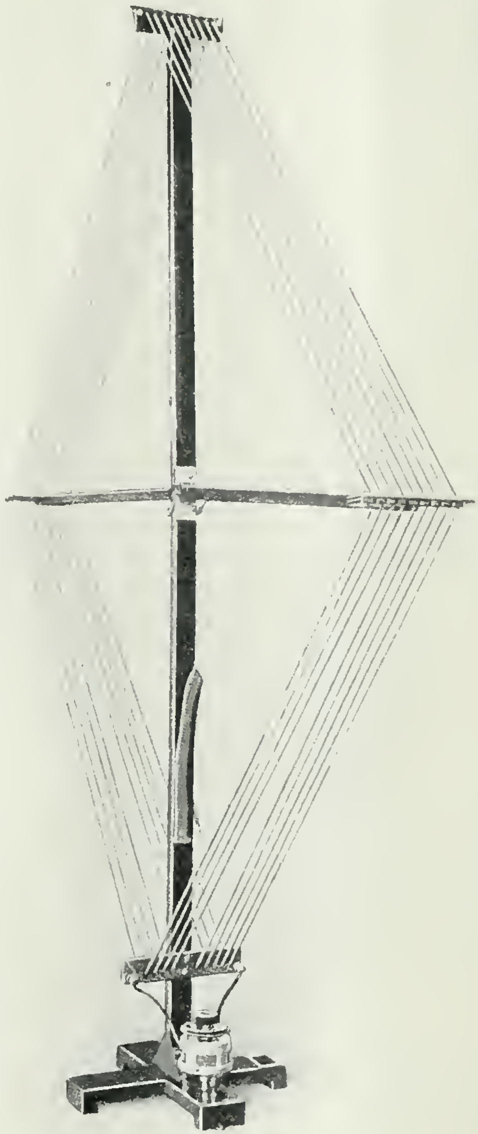


Fig. 1. A portable frame aerial with the tuning condenser mounted on the base.

(3) The size of the wire used does not, of course, have any effect on the wavelength range and the important point in choosing the wire is that it should have a low resistance. Wire of Nos. 22 to 14 gauge is suitable, whilst standard electric lighting flex is especially efficient and has the advantage that it is convenient to wind and being well insulated, the turns can be arranged to touch if desired.

(4) If the frame is closely wound then it is essential that the wire should be insulated, but with suitable spacing, bare wire may be employed.

(5) The tuning condenser used in conjunction with frame aerials should preferably not exceed a maximum value of 0·001 mfds.

(6) In use, a frame aerial should be kept at some distance from the walls of buildings, since proximity to such masses raises the effective resistance of the frame.

(7) It is preferable not to tap out the turns of a frame aerial inductance, since this method introduces dead - end turns on some adjustments. It is therefore better if possible to design the frame so that it covers the required range of wavelength without tappings.

The mechanical construction of a frame to carry the wires for a frame aerial is a matter which leaves much scope for individual ingenuity. There are several points to be remembered in designing the frame. The limitations of size, depending on the space available for installing it, is an important factor and it must be remembered that sufficient space must be allowed to permit the free rotation of the frame without fouling other apparatus, etc. It must be easy to rotate the frame, which should be held in rigidly secured bearings in order that it shall not be capable of swinging or swaying, as otherwise the strength of signals would be continually varying.

In making use of reaction with a frame aerial, different methods of procedure are available. A part of the inductance may be distinct from the frame and the reaction coil of the plate circuit coupled to it, or the reaction coil may form part of the frame itself. In this case it is best to arrange a second frame either hinged to the side of the main frame or pivoted within it. Figs. 2 and 3 are suggestions for the design of frame, to either of which reaction frames may be added. In Fig. 3 a suggestion is made for ebonite slots to receive the wire with which the frame is wound, and in this case bare wire, either stranded or of substantial diameter, may be used in place of insulated wire, since the slotted ebonite carriers will serve to separate the turns. In Fig. 3 the frame is wound as a helix, whilst in Fig. 2 the winding would take the more usual form of a solenoid. In Fig. 3 the method of rotating the frame would be by mounting it on a rod, for which purpose a guiding bracket and an upper bearing are provided, as shown. The frame shown in Fig. 2 is not arranged to rotate freely but would be required to be moved round to stand in the desired position.

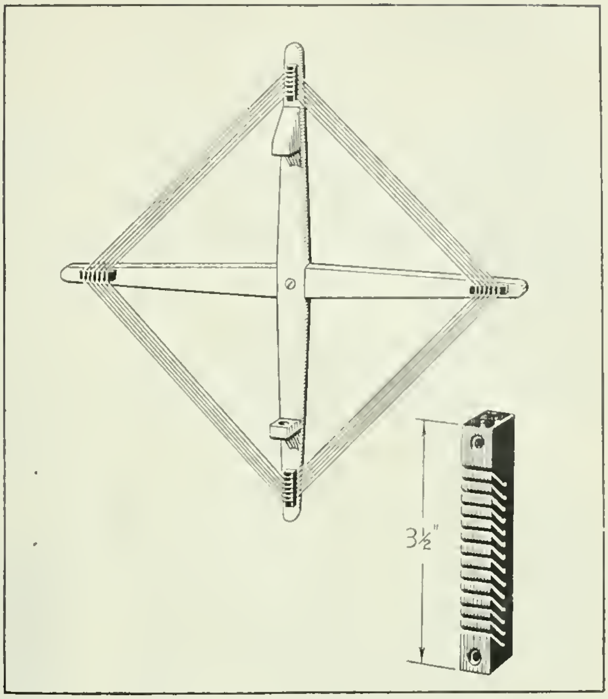


Fig 3. A design to carry bare wire spaced. This frame is rotatable.

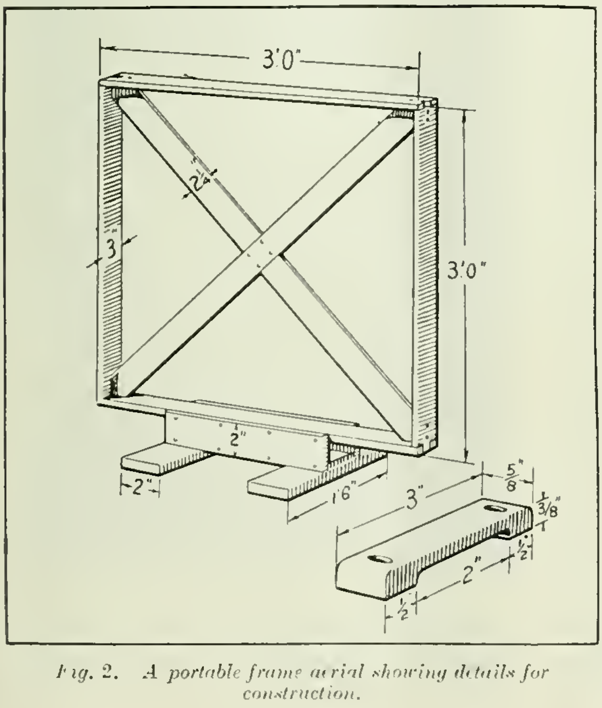


Fig. 2. A portable frame aerial showing details for construction.

A good deal of data regarding the number of turns required for different wavelength ranges has been published. The chart, Fig. 4, published in the *Journal of the Franklin Institute*, gives data on the best dimensions and number of turns for wavelengths up to 10,000 metres. Suppose that it is desired to design a frame for reception on 2,500 metres. From the chart we find the following as possible combinations :—

Size of Frame.	Turns.	Spacing.
4 feet	50	$\frac{1}{4}$ inch
6 feet	40	$\frac{7}{16}$ inch
10 feet	23	$\frac{3}{4}$ inch

If now we refer to the curves on the upper half of the chart we can find the "reception factor" which indicates which of these combinations is the most efficient on this wavelength :—

Size of Frame.	Reception Factor.
4 feet	6,400
6 feet	9,300
10 feet	8,600

From this it will be seen that the highest reception factor is with the 6-ft. frame and therefore this is the most suitable for use on 2,500 metres with the spacing given.

An interesting fact in connection with the design of loop aerials for definite wavelengths is that, where the same length of wire is used the inductance will give the same

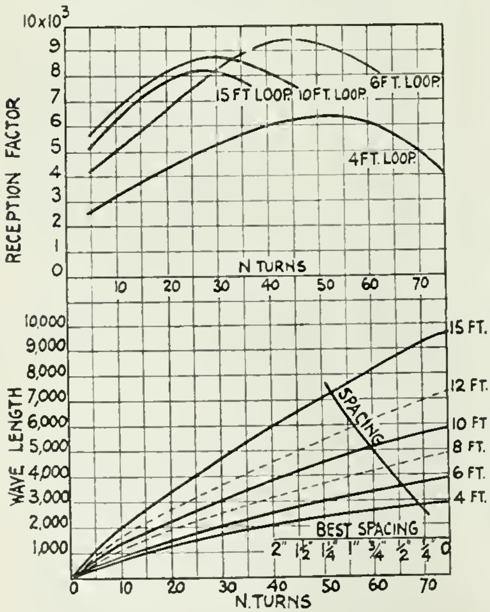


Fig. 4.

fundamental wavelength, irrespective of the size of frame, if suitable spacing is arranged. In illustration of this the following table is given, which appeared in a Radio pamphlet published by the U.S. Signal Corps.

Length of Side (feet).	Turns.	Spacing (inches)	Inductance (mhys)	Capacity (mfds)	Fundamental Wave-length (metres)
8	3	$\frac{1}{2}$	96	75	160
6	4	$\frac{1}{4}$	124	66	170
4	6	$\frac{1}{4}$	154	55	174
3	8	$\frac{1}{8}$	193	49	183

Since a 4-ft. frame is a convenient size for general purposes, the following table of wavelength ranges obtainable with tuning condensers of different values may be of value.

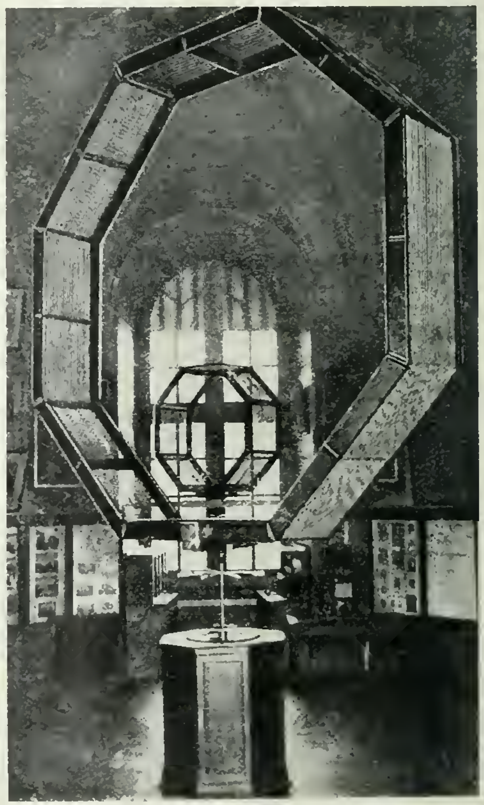


Fig. 5. A frame aerial in use at the Observatory, Paris.

Spacing of turns, $\frac{1}{2}$ inch. The wire used may be No. 22 D.C.C.

No. of turns.	Value of Parallel Condenser.					
	·00005	·0001	·0005	·001	·002	·003
1	—	65	128	178	250	310
3	130	155	290	400	550	675
6	230	380	500	710	1,000	1,200
12	430	490	920	1,250	1,700	2,050
24	760	880	1,600	2,100	3,000	3,600
48	1,550	1,775	3,150	4,300	6,000	7,000
72	2,200	2,650	4,800	6,400	8,800	11,000
120	3,930	4,500	7,900	10,000	14,700	17,700
240	7,600	9,000	15,650	20,500	27,200	32,900

Where it is desired to make use of ordinary electric lighting flex, the following data may be of value for reception on short wavelengths.

In this case the condenser employed has a maximum value of 0·001 mfds. and the turns are wound without spacing.

No. of turns.	Size of Frame.	Approximate Wavelength Range (metres).
4	4 feet sq.	200 to 650
6	3 feet sq.	250 to 750
9	2 feet sq.	330 to 850

The photograph (Fig. 5), is included as of interest. This illustrates a frame aerial in use at the Observatory, Paris, for the reception of weather reports transmitted locally. H.S.P.

Accumulator Charging from D.C. Mains

IT is now the general practice where direct current mains exist to charge filament heating accumulators, and also H.T. secondary batteries (if they are used), from them.

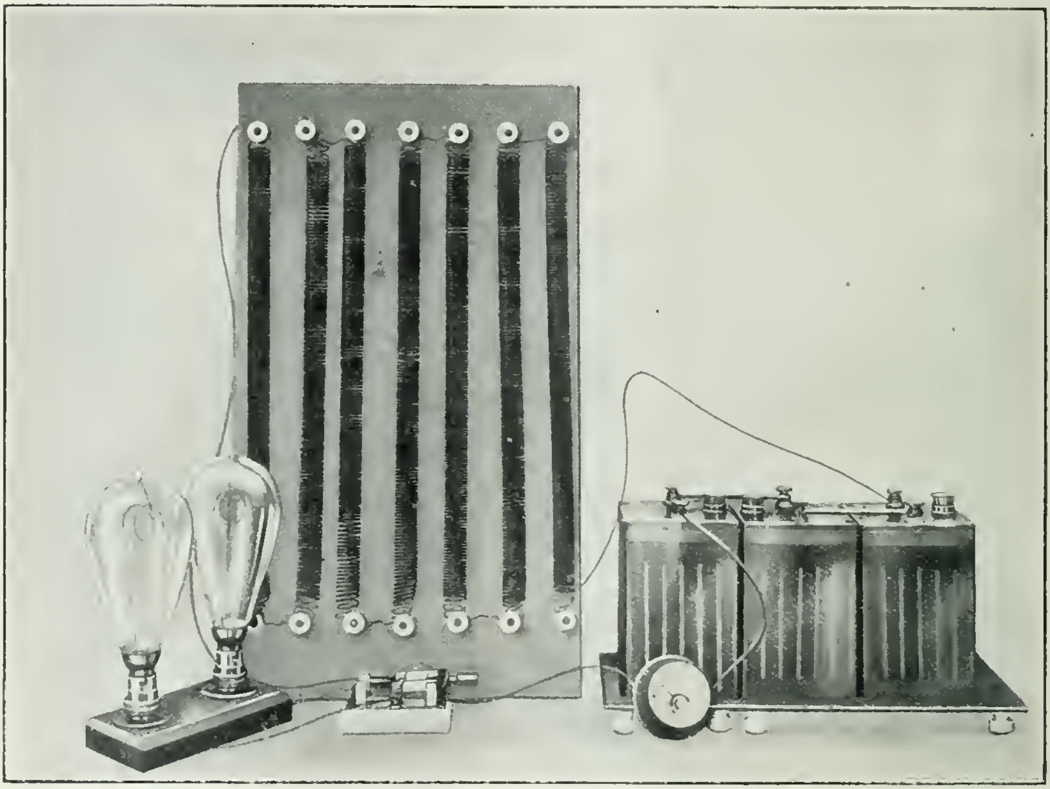
The process is quite simple, and the author trusts that a brief description of the method he employs is not out of place, as recently he was very much surprised to find the occupant of a house in which D.C. mains existed, laboriously transporting his accumulator to a garage half a mile away.

Public supply D.C. mains have voltages of between 100 and 250, and the dimensions of the resistance which has to be constructed will depend upon this voltage and the size of the accumulator to be charged. Large accumulators have a high charging rate, say of the order of 6 amperes. For smaller ones which are more generally used with wireless sets not employing more than three valves, the charging rate is about 2 to 3 amperes. It is always preferable to employ a low charging rate, provided of course that the accumulators are left in circuit for a sufficient length of time to ensure a full charge. A suitable charging rate is usually indicated on the label attached to the accumulator and with many types of accumulator may be taken as a figure representing one-tenth of the actual ampere hour capacity. To take an example, an accumulator may be rated at 40 ampere hours capacity, giving an actual discharge capacity of half this figure, that is 20 ampere hours. The charging rate for an accumulator of this size may be 2 amperes, consequently the duration of the charge, allowing for a moderate efficiency, should be about 13 hours.

To find the resistance value, which is measured in ohms, of a resistance suitable to restrict the charging current to 2 amperes, it is necessary to divide the supply voltage by the charging rate. Thus, if the supply mains have a voltage of 210, the resistance required must have a value of 105 ohms. Now to obtain this resistance one must make use of the special resistance wires on the market, such as "Eureka," "Contra," and many others. The makers of resistance wire will readily furnish such information as "resistance per yard," "yards per lb." and "current carrying capacity" for any given gauge. The gauge selected must be capable of carrying the required current without excessive heating, and then a simple calculation will show how many yards, and hence how many lbs. of wire will be required to produce a given resistance. This wire, which is somewhat springy, must be wound in the form of a number of spirals, and the best way of doing this is to wind it very tightly on a metal rod of about 1 in. in diameter, taking great care during winding that the turns do not slip loose, otherwise the finished coils will be rather uneven.

If the resistance wire is purchased from an electrical store, one can also obtain there a number of small china bobbin insulators having a diameter of about $\frac{7}{8}$ in. by $\frac{3}{4}$ in. to 1 in. deep, and furnished with a groove, and having a hole through the middle. These insulators are mounted as shown in the accompanying photograph on a piece of non-inflammable material such as stiff card asbestos, or better still, a material known as "Urolite." It is not possible to fix screws into these fireproof materials, consequently it is necessary to secure the china bobbins by means of small iron bolts.

lamp fitting, or a better plan still is to detach the rose at the ceiling and connect in an additional piece of flexible lead to the two points, and in addition to the two wires which pass down to the lamp. Switching on the current, and immersing the bared ends of this wire in a glass of water, a brisk effervescence on one of the leads will indicate that it is the negative. Great care must be taken, of course, that the two leads do not touch while the



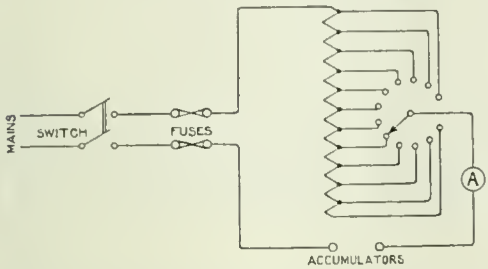
A Charging outfit made up to the description given. The Accumulators stand on an ebonite plate, supported by china bobbin insulators.

After mounting two rows of bobbins on to the fireproof board, the ends of the coils are twisted on to the bobbins, being themselves slightly stretched. The finishing end of one coil is connected to the beginning of the next so as to put the whole length of wire in circuit.

To bring the current from the mains on to the accumulator and charging board, an adaptor may be made use of, attached to a

current is on. The negative lead should be joined to the negative terminal of the battery, and the positive lead to one end of the resistance wire, whilst the other end of the resistance wire is taken to the positive of the battery.

An additional switch, of the type shown in the photograph, may be connected in circuit for completely disconnecting the charging arrangements from the mains. A small pattern ammeter connected in circuit also is a great advantage, as it not only indicates the charging rate, but also tells one at a glance whether the cells are on charge or not.



A circuit arranged for accumulator charging from D.C. mains. Provision is made by means of a twelve point switch for varying the amount of resistance in circuit, so that the charging rate can be adjusted according to the capacity of battery on charge.

A point of particular importance to be borne in mind is that the accumulators must be insulated from earth when connected to the mains, otherwise the effervescence during charging may cause the acid to froth over and thus connect the mains to earth. Not only may the results be serious to the accumulators on charge, but also, if they are in celluloid containers, there is a danger of fire. The enterprise of the experimenter may indicate to him that a leaden tray is just the thing to prevent the action of the frothing of the sulphuric acid from the cells on to the floor, or wherever they are standing, but he is cautioned against putting such an idea into practice as it is bound to result in a contact to earth of the supply mains through the conducting acid.

A special word of warning is also necessary with regard to the amount of current which it is safe to take from a house lighting circuit. Under ordinary conditions this should never be allowed to exceed 3½ amperes.

The charging of small accumulator cells of high voltage for use as H.T. batteries is best arranged through two lamps of the normal voltage of the supply circuit. One lamp is connected in each lead from the mains and the H.T. battery is joined across them. Thus the two lamps and the H.T. battery are in series.

When accumulator charging is finished, the circuit must not be broken by turning off the switch, or otherwise the battery will discharge again through other lamps which may be operated from that switch. It is necessary to break the leads passing to the charging outfit.

Accumulators are fully charged when the specific gravity has a value of about 1·250, and they are gassing freely. A good accumulator should not froth. The positive plates of a charged accumulator should be of a deep chocolate colour, and the negatives a whiteish-grey.

When charging one's own accumulators it is possible to keep them in very good trim and even to improve their condition on every charging. It is a good plan at the start to charge up the cells until they gas freely, and then tip away the acid and refill with pure sulphuric acid and distilled water made up to a gravity of precisely 1·250. This will ensure that the right range of gravities will be obtained during charge and discharge.

Never leave an accumulator in a run-down condition, and try to avoid charging when the cell is only partly discharged.

F.H.H

IDEAL HOME EXHIBITION.

Readers are advised that the Ideal Home Exhibition, organised by the *Daily Mail*, will be held at Olympia from March 1st to 24th.

An important section of the Exhibition has been allotted to the National Association of Radio Manufacturers, who are arranging for wireless exhibits and demonstrations on a very big scale.

Electrons, Electric Waves and Wireless Telephony—XVII.

By Dr. J. A. FLEMING, F.R.S.

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

3. Practical Forms of Wireless Telephone Apparatus.

In actual practice the apparatus is a little more complicated. The high voltage required for the plate of the transmitting valve is not always obtained from a battery but from a direct current dynamo, which gives a voltage of several hundred, or even a couple of thousand volts.

Then the modulation of the plate current is not accomplished by placing the microphone-induction coil in the grid circuit of the oscillating valve, but in that of another valve called the control valve.

Lastly, the high voltage of the plate of the generating valve need not be obtained from a direct current dynamo, but by rectifying a low frequency alternating current.

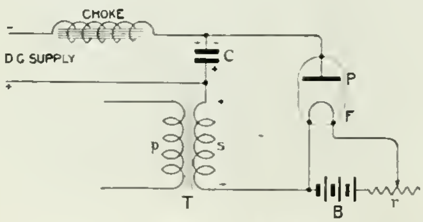


Fig. 90. Arrangement of circuits for rectifying an alternating current supplied from a transformer T by means of a Fleming valve and Condenser C.

These modifications will best be understood by the description of certain typical forms of wireless telephone transmitter in actual use.

It will perhaps be advisable first to explain the manner of using a two-electrode or Fleming valve to rectify high voltage alternating electromotive force, or change it to direct voltage.

If we connect to the plate *P* of a two-electrode valve one terminal of a condenser *C*, the other terminal of which is connected through the secondary coil *S* of an alternating current transformer *T* to the filament *F* of the valve (see Fig. 90), and if we supply the transformer with low frequency alternating current, then the plate of the condenser which is directly connected to the anode or metal cylinder of the valve will become charged with negative electricity.

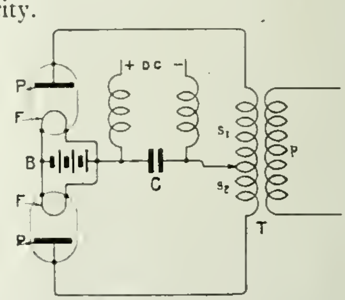


Fig. 91. Arrangement of circuits for rectifying both components of an alternating current supplied by a transformer T by means of two Fleming valves. The condenser C then supplies a direct current.

The reason is as follows. When the direction of the E.M.F. in the transformer circuit *s* is such as to make the plate *P* of the valve positively electrified, electrons are drawn out of the incandescent filament *F*, and neutralise this positive charge of the plate. The upper plate of the condenser *C* is then left negatively electrified. When the E.M.F. of the transformer reverses and the plate *P* becomes negative, it repels the escaping electrons and stops the emission from the filament. Hence, if the condenser *C* has a large capacity it will become a reservoir of electricity, and we can continually draw off from it a supply of negative electrons from its upper plate. As these electrons are supplied in gushes by the transformer, it is found advantageous to insert a spiral of insulated wire wound on a bundle of iron wires, called a choking coil or choker, as shown in Fig. 90. This serves to convert the intermittent gushes of electrons into a steady stream, which can be drawn off the *d c* terminals marked + and – .

In the above-described arrangement we only utilise and rectify every alternate phase, or half of the alternating current energy. By the use of two rectifying valves and a transformer with a connection to the centre of its secondary circuit, as shown in Fig. 91, we can rectify both phases, and convert all the alternating power of a transformer into direct current power. The two valves can have their

By Courtesy of Marconi's Wireless Telegraph Co., Ltd.

Fig. 92. Half-kilowatt Valve Transmitting Set for Wireless Telephone as arranged by Marconi's Wireless Telegraph Company, Ltd. The transmitting valves are shown in the centre panel and the receiving valves on the right-hand bottom panel.

filaments rendered incandescent by the same filament heating battery *B*. The reservoir condenser *C* has choke coils inserted in its exit wires marked *d.c.* + and –, and from these w can draw off direct current with a steady E.M.F.

The above appliances are all combined in the half-kilowatt wireless telephone cabinet designed by Marconi's Wireless Telegraph Company for radio-telephony. This consists of a cabinet in shape like a harmonium case or small piano, about 4 ft. high and wide, and 2 ft. deep. It contains all the transmitting and receiving gear effective for wireless telephony over a range of about 100 miles by day, but greater by night. This range corresponds to use with aerial wires of twin T type, 220 ft. long and 100 ft. high, with a natural wavelength of 360 metres. A view of the front and back of the cabinet is shown in Fig. 92.

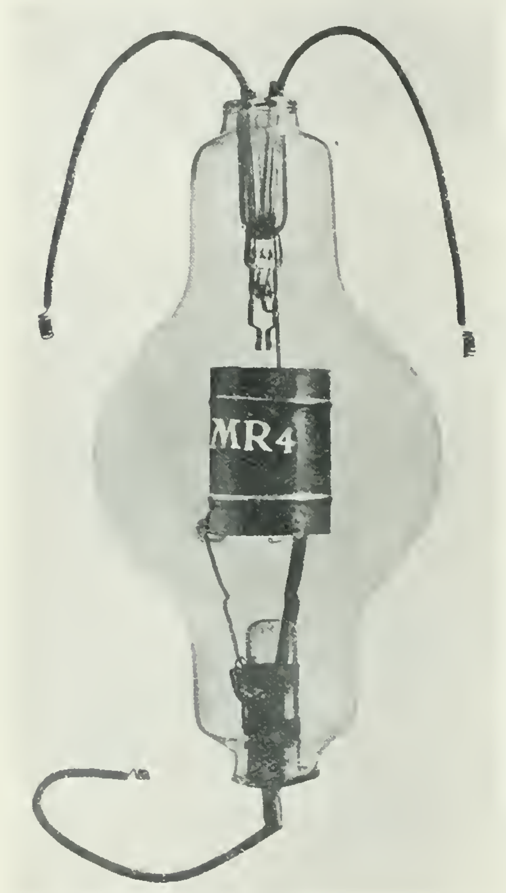
The transmitting part comprises three thermionic valves, two of three electrodes and one two-electrode rectifying valve. A picture of one of these valves is shown in Fig. 93.

In the actual transmitter, a view of which is shown in Fig. 92, one of the three-electrode valves is the power or generating valve ; the other is the control valve ; and the two-electrode valve is used for rectifying the alternate current supplied by a transformer in one of the lower cupboards, taking its primary current from a rotary converter, which transforms direct electric current into alternating current at a frequency of 150 cycles and 85 volts E.M.F.

The diagram of connections is shown in Fig. 94. It will be seen that the alternating current supply (A.C.) is fed into an alternating current transformer called the power transformer, and also into two smaller transformers which step down the voltage, and supply current at 12 volts for heating the filaments of the three valves. The electromotive force of the power transformer is rectified by the two-electrode valve on the right-hand side of the diagram, and used to charge two reservoir condensers connected to a smoothing choking coil, and these condensers supply a steady or direct high voltage to the plates or anodes of the two three-electrode valves on the left of the diagram.

The valve marked "power valve" has its plate and grid circuits coupled through a reaction coil, and high frequency oscillations are therefore created in the coil L_1, to the upper end of which is attached the aerial wave *A*, and its lower end to an earth plate. Continuous or undamped carrier waves are accordingly radiated from the aerial.

The amplitude of these waves is controlled by the microphone *M* in conjunction with the control valve (middle). It will be seen from the diagram that the grid of this control valve is connected to the secondary terminal of a transformer, in the primary circuit of which is a 3-cell battery and the carbon microphone *M*.

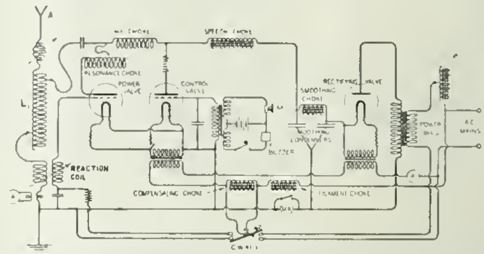


By courtesy of Marconi's Wireless Telegraph Co., Ltd.

Fig. 93. Large Three-electrode Transmitting Thermionic Valve for generating high frequency continuous currents.

On speaking to this microphone the electric potential of the grid of the control valve is varied in accordance with the wave form of the aerial speech waves, and this in turn fluctuates the plate or electron current in the control valve. These variations in the plate current are caused to affect in like manner the potential of the plate of the generating valve, and therefore the amplitude of the carrier waves emitted from the aerial. Accordingly we have the wave form of the speech sounds impressed upon the amplitude or height of the carrier waves and the transmitter affects in like manner the current in the distant receiver circuits.

This plant is designed to operate with wavelengths of 1,000 or 2,000 metres, and it is



By courtesy of Marconi's Wireless Telegraph Co., Ltd.

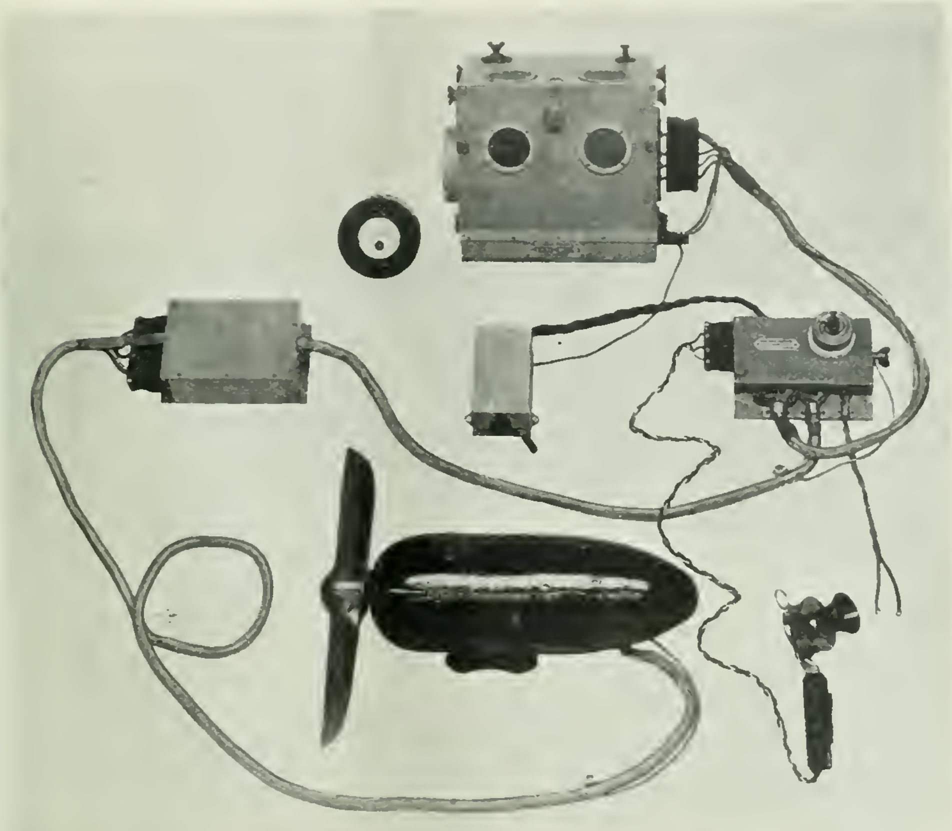
Fig. 94. Diagram of connections in the transmitter part of the half-kilowatt wireless telephone apparatus shown in Fig 90.

called a half-kilowatt plant because it employs about 500 watts in electric power to operate it. In more powerful transmitters the power valve is duplicated, or there may be three or more power valves, and two or more control valves. The necessary high voltage for the anodes or plates of these valves may be obtained from high voltage (1,000—2,000 volts) direct current dynamos, and in the case of aeroplanes the small high tension dynamo is driven by a little windscrew or windmill caused to rotate by the rush of the aeroplane through the air (see Fig. 95).

This dynamo may have two separate armatures, one providing a current of about 0.1 ampere at 1,500 volts for charging the valve anodes, and a low voltage armature providing a current of 5 amperes or so at 7 or 8 volts for incandescing the filaments of the valves.

An ingenious part of the equipment for aircraft in the aircraft plant of Marconi's Wireless Telegraph Company is the arrangement of remote control, in which all the valves and supply circuits of the transmitting part of the arrangement are brought into operation merely by pressing a switch on the handle of the speaking microphone, which is the only part the aeroplane pilot or observer need touch, or has within reach.

The layout of apparatus shown in Fig. 95 gives some idea of the apparatus as installed in an aeroplane. Connections are made by means of heavily insulated cables having plugs at their extremities, the instruments to which the connections have to be made being provided with sockets to receive them. The transmitter is similar to an ordinary telephone transmitter in shape, with the exception that there is no receiver attached, its place being taken by the head receiver telephones worn in the operator's cap.



By Courtesy of Marconi's Wireless Telegraph Co., Ltd.

Fig. 95. Aircraft Wireless Telephone set as made by Marconi's Wireless Telegraph Company. In the centre of the diagram at the bottom is shown the small direct current dynamo driven by a wind screw which supplies the high plate voltage for the generating valves.

(*To be continued*)

Elementary Lecture and Demonstration.

An Elementary Lecture entitled "Fundamental Principles of Radio Reception," with Experiments, will be given on Friday, February 16th, at 6.30 p.m., by Mr. Maurice Child at the Institution of Electrical Engineers, Victoria Embankment. This is the second of a series af Elementary Lectures arranged by the Radio Society of Great Britain.

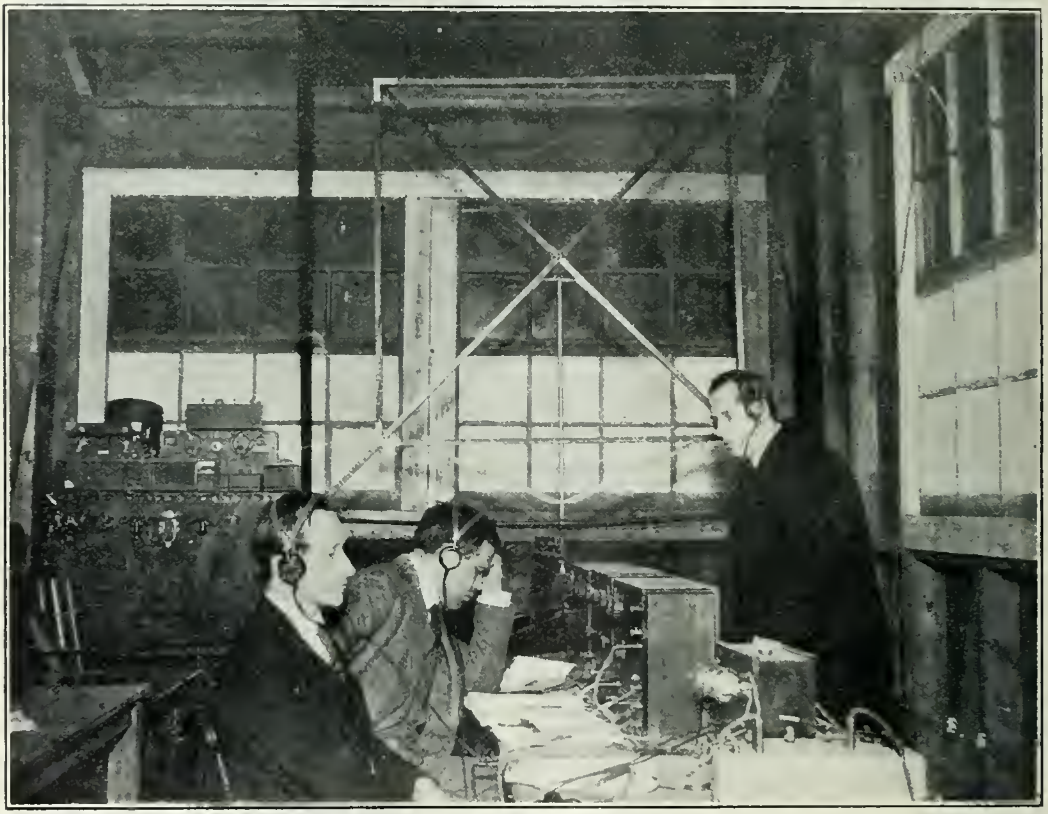
Transatlantic Radio Telephony

An advancement in the progress of long-range telephony was demonstrated in the early hours of Sunday morning, December 14th.

Arrangements were made for the reception in London of speech originating in New York, and those responsible for the execution of the programme are to be complimented on the success achieved.

be remembered that the American Telephone and Telegraph Company and the International Western Electric Company conducted Transatlantic telephony tests as long ago as October, 1915.

The transmitting apparatus, which was of the valve type, possessed many unique features. The speech currents from New York operated firstly a 300-watt oscillator modulator equip-



The frame aerial, having 6 ft. sides, and the apparatus with which the signals were received. Mr. Freiis, the Research Engineer, is in the centre.

A special transmitter was erected on Rocky Point, Long Island, and a wire connection made it possible for the speakers at 195, Broadway, New York City, to speak wirelessly from the Long Island Station to London.

The design of the apparatus used is due to the research work which has been carried out by the Radio Corporation of America and the American Telegraph and Telephone Company, in conjunction with the International Western Electric Company. It will

ment, and the energy derived was applied to an outfit of 5 Kw. energy, which in turn was coupled to the main transmitting plant having an output of 60 Kw. Special valves had to be employed to handle the large power. The wavelength was of the order of 57,000 kilocycles. The arrangement of the circuits was such that the carrier wave was suppressed at the transmitter and was reintroduced by oscillating apparatus attached to the receiving aerial. The first transmission took place at 2 o'clock on Sunday morning, and there was not the slightest hitch or delay in the reception in London of the words spoken in New York. Right from the start every word was easily intelligible to the sixty listeners who were witnessing the experiments. The modulation was usually good, and in spite of the accent of the American speakers, there was no difficulty in immediately understanding every word spoken.

The first message by Mr. H. B. Thayer, President of the American Company, was of about ten minutes duration, and it was interesting to note, owing to special cable facilities arranged by the Western Union Cable Company, that a report of the reception in London was placed into his hands while he was still speaking.

This speaker was followed by General J. J. Carty, who is Vice-President of the American Company, and although his voice may not have been so suitable for telephony transmission, it was remarkable clear, and readily understood. He spoke of the weather conditions prevailing throughout the day in New York, and referred in particular to the fact that there had been a sharp snowstorm.

As the experiments continued, the speakers on the American side became very confident of the successful reception in London. References were made by the speakers to gentlemen of their acquaintance known to be present at the London demonstration, and the familiar tone made it hard to realise that the distance which separated the stations was about 3,200 miles.

The transmission continued until about 4 a.m.

A photograph of the receiving apparatus is shown on the previous page, and it is interesting to note that the reception was carried out by means of a frame aerial having sides of only 6 ft. The frame was coupled to a valve oscillator generating a frequency equal to that of the transmitting station, and was followed by a series of high frequency, detector and low frequency amplifiers. Eight valves in all were used to actuate 60 pairs of telephone receivers, and in addition, arrangements were made for switching in a loud speaker. The results from the loud speaker were as satisfactory as those given by the telephones, and when the listeners were asked during the demonstration whether they would prefer to listen to the signals from telephones or a loud speaker, they voted for the latter, indicating that an instrument of this sort was capable of producing magnification without the introduction of unpleasant distortion. The success of the tests was primarily

Some of the gentlemen who witnessed the demonstration. Many other well-known Radio Scientists were present.

due to Mr. Nichols and Mr. Freiis, well-known American radio engineers, whilst the organisation and technical arrangements were in the hands of Mr. F. Gill of the International Western Electric Company.

Mr. H. W. Nichols, Ph.D., Research Engineer of the A.T. & T. Co., and Western Electric Co., Inc.

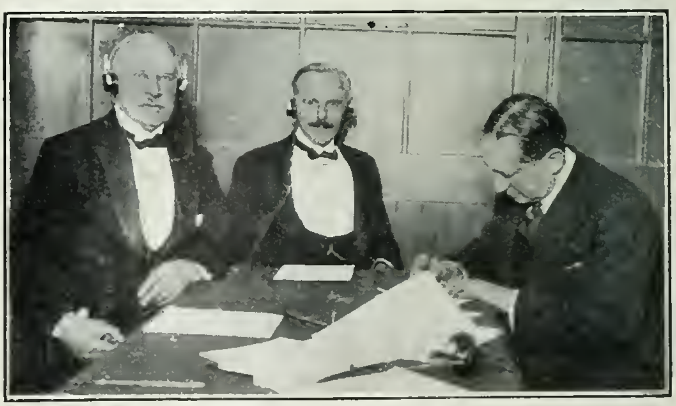
Among those present were :—

Senatore Marconi, Major Purves (Engineer-in-Chief of the Post Office), Sir Evelyne Murray (of the Post Office), Mr. Shaughnessy (of the Post Office Wireless Dept), Dr. Eccles, Mr. Godfrey Isaacs (of the Marconi Company), Mr. A. A. Campbell Swinton, Col. Blandy, and other prominent gentlemen closely associated with wireless telegraphy.

A test of this sort is of particular interest at a time like the present when so much attention is being given to Transatlantic radiotelephony. Many radio workers in this country have recently distinguished themselves by receiving the signals from American broadcasting stations, but this demonstration is perhaps of greater commendation in view of the fact that it was carried out according to a pre-arranged programme, and can in no way be regarded in the light of a freak. One must bear in mind, of course, that the power employed on this occasion was much in excess of that of the broadcasting stations, which,

Major Purves, Engineer-in-Chief of the G.P.O., who listened to the American Telephony.

although ensuring a greater range, embodies many problems in control and modulation. It is now only necessary to consider a Transatlantic telephony service from the point of view of costs to determine whether the results achieved can be placed at the disposal of the public.



Sir A. Shirley Benn, Sir Evelyne Murray and Senatore Marconi, receiving the message.

Wireless Club Reports

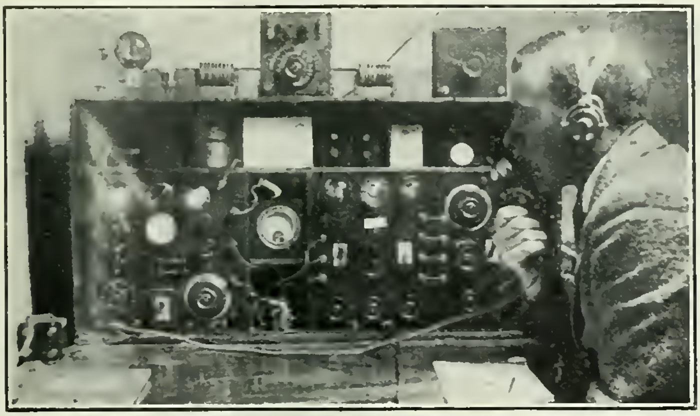
NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Sunderland Wireless and Scientific Association.*

Hon. Secretary, A. Richardson, Westfield House, Sunderland.

Two short lectures were delivered before the Association at Westfield House on Saturday, December 30th, by Mr. H. G. MacColl and Mr. Holroyd. Mr. MacColl, whose subject was "A Method of Using Several Receiving Sets on one Aerial," described a method whereby as many as twenty-five sets could be operated from one aerial. This method, which was introduced by Dr. Turner, of Cambridge, was a modification of the usual "tuned anode" circuit. The aerial circuit, however, was made aperiodic by replacing the usual tuning inductance by a high resistance of the order of 20,000 ohms, the various receiving sets being connected across this. Tuning was done exclusively in the anode circuit of the first valve of each set.



Station belonging to Mr. C. Creed Millar **(2 MG)** *at Bearsden, Scotland.*

Mr. Holroyd, lecturing on "Some War-time Experiences of a Wireless Operator," gave a very pleasing account of the various types of wireless apparatus used in the Navy during the War, and told some amusing anecdotes of the Maltese station at Rinella.

On Tuesday, January 2nd, the new club-rooms of the Association at Westfield House, were opened by Col. Lynn Marr. The suite of rooms includes a large lecture and experimental room, reading-room, Secretary's office and cloak-room.

The Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

The annual business meeting of the Leicestershire Radio and Scientific Society was held at headquarters, *The Leicester Mercury* office, on January 8th. Favourable progress was reported, and the Society has more than doubled its membership. The financial outlook also is more hopeful than it has yet been. A very hearty vote of thanks was accorded to the President, Mr. C. T. Atkinson, the Vice-President, Mr. H. E. Dyson, and the Committee for valuable services rendered. The officers for the current year are as follows:—Mr. C. T. Atkinson retains Presidency, and Mr. H. E. Dyson the Vice-Presidency; Treasurer, Mr. Rudkin: Messrs. Crawley and Pratt retain the offices of Hon. Joint Secretaries; the Committee consist of Messrs. Schofield, Miller and Challifour.

The business having been concluded, Mr. Bramall gave a short description of some of his apparatus, one very interesting feature of which was a condenser fitted with a vernier of his own design.

Hackney and District Radio Society.*

Hon. Secretary, Mr. C. Phillips, 247, Evering Road, N.16.

The annual meeting of the above Society was held at its headquarters, Y.M.C.A., Mare Street, Hackney, E.8., on Thursday, January 4th. The Chairman, Mr. H. A. Epton, presided over an attendance of some 50 members.

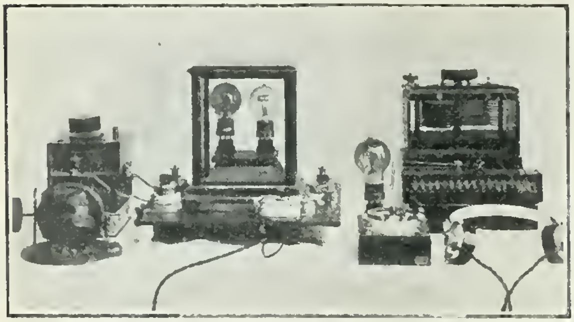
The Secretary presented a report of the Society's activities during the past year, and stated that the progress made had been very encouraging. The Treasurer presented the first balance sheet of the Society, which showed a cash balance of over £7, after having paid for the Society's set, which had been made by the Technical Committee.

The election of officers and committee for the coming year then took place, the Mayor of Hackney being re-elected unanimously as President, and Messrs. Epton, Cunningham, Jenkins, and Kiernan, as Chairman, Vice-President, Treasurer and Librarian respectively. The Secretary, Mr. E. R. Walker, preferring to assist the Society in a technical capacity in future, retired from the position of Secretary, and in his place was elected Mr. C. Phillips. Mr. Bell was elected Assistant Librarian. A new Committee was also elected, consisting of Messrs. Walker, Morgan, Wall, Valins and Sandford.

During the evening a competition was held for the best crystal set made by the Y.M.C.A. boy members of the Society, and the prize, a pair of R.I. telephones presented by the Vice-Chairman, was won by Mr. Haynes.

In view of the very valuable work which has been done by the retiring Secretary, who was also the founder of the Society, it was unanimously decided to make him a small presentation.

The Chairman announced that it was hoped shortly to arrange a social evening and public demonstration.



The two photographs on this page show some of the apparatus made by Mr. Robert Oxenham, of Pretoria, South Africa, for his experimental station. Above is shown a long-wave set and in the lower photograph a short-wave set and transmitting gear constructed mainly from odds and ends.

Croydon Wireless and Physical Society.*

Hon. Secretary, Mr. B. Clapp, A.M.I.R.E., "Meadmoor," Brighton Road, Purley.

A meeting of the Croydon Wireless and Physical Society was held on Saturday, January 6th, at the Central Polytechnic, Croydon, at which Lieut. D. Sinclair, of the Air Ministry, lectured on "The Signals Organisation of Our Airways."

In his lecture, which was followed with great interest by the members, Lieut. Sinclair explained very fully the methods by which the machines on the air routes are controlled, and their positions determined by radiotelephony. He said that the wavelength of 900 metres was now used exclusively for communication with aircraft. Any messages required to be sent from one aerodrome to another are transmitted either by radiotelegraphy *via* the Air Ministry (GFA) on a wavelength of 1,400 metres, or by private landline, whilst weather reports are sent by the Air Ministry on a 1,680 wavelength. Some excellent lantern slides were shown, illustrating the aerials and apparatus at the W/T stations at several of the aerodromes in England.

The lecture was followed by a discussion in which the members showed the interest with which they had followed the lecture, by the many pertinent questions which they put to the lecturer. The meeting terminated with a very hearty vote of thanks to Lieut. Sinclair.

The Hon. Secretary will be pleased to give particulars to any person desirous of joining the Society, and the Hon. Treasurer, Mr. E. E. Hart, 267, Lower Addiscombe Road, Croydon, will be glad to receive any outstanding subscriptions for the current year.

The Wireless Society of Winchester.

Hon. Secretary, Mr. Albert Parsons, 65, Cromwell Road, Winchester.

Mr. Bolt, at the last meeting before the Christmas holidays, explained his experiences as an amateur.

The Rt. Hon. The Earl of Northbrook has agreed to become President of the Society.

An experimental licence has been granted, and the erection of the aerial is now under discussion. Rules have been drawn up by a special Committee.

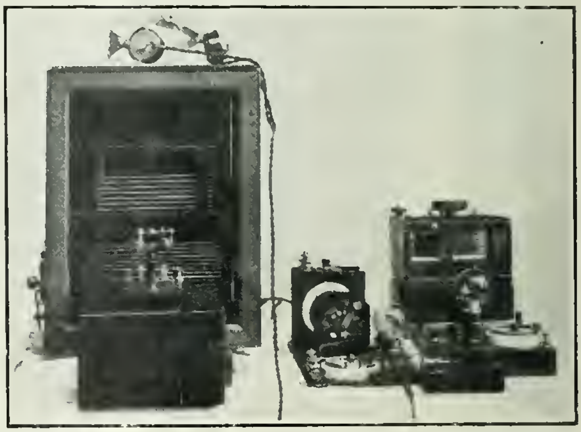
The following two meetings were arranged to be occupied by the Secretary, the subject being "How to Wind Coils."

Ipswich and District Wireless Club.

Hon. Secretary, Mr. H. E. Barbrook, 46, Foundation Street, Ipswich.

On Monday, January 8th, a very successful and interesting evening was spent at the Society's headquarters, 55, Fonnereau Road, when members enjoyed what will be known as the first demonstration of broadcasting Grand Opera by Wireless.

The club set was used for this occasion, with the addition of a two-valve note magnifier, a microphone amplifier and loud speaker, kindly lent by Mr. H. E.



Barbrook and Mr. Callender, thus enabling all present to "listen in" without the trouble of headphones.

Mr. Bird, with his customary vigour, was the operator for the evening, and having tuned in, 2 LO was picked up, the reception being very clear.

The opera transmitted was the "Magic Flute" and the tuning of the orchestra was clearly heard, as was also the tapping of the conductor's baton. The music and singing came through with very little distortion, although the words of the singers were rather difficult to follow.

The Hon. Secretary would be glad to hear from amateurs in the district who are likely to become members. He would also welcome catalogues and any literature which might be of interest to members.

Weston-super-Mare and District Radio Society.

Hon. Secretary, Mr. J. P. Gorton.

This newly-formed Society held its first semi-open meeting at the Church Institute on Wednesday, January 3rd, when Mr. O. J. Carpenter, A.M.I.R.E., delivered the inaugural lecture, Mr. F. W. Shearmur, Chairman of the Society, presiding.

The lecturer's object was to set forth some of the chief phenomena associated with the transmission and reception of wireless signals. Introducing the subject with a few remarks on the ether, Mr. Carpenter proceeded to deal with the transmission of signals through this medium, emphasising the importance of the little-understood Heaviside layer in transmission over long distances. Mr. Carpenter then dealt with Dr. Fleming's invention of the two-electrode thermionic valve, and its revolutionising development, the three-electrode valve.

He had been surprised, when listening-in at Weston stations, at the amount of interference due to the improper use of local regenerative receiving apparatus, and he hoped that the formation of the Society would lead to the acquirement of knowledge which would check this evil.

Dealing with short-wave reception, Mr. Carpenter paid tribute to the experimental work which had been carried out by Mr. J. P. Gorton, a local resident.

The lecture was concluded with explanatory comments on a number of limelight illustrations depicting the great Marconi stations and many types of apparatus.

At the close a vote of thanks was accorded the lecturer and Mr. W. Tucker, who had supplied and operated the limelight apparatus.

The list of officers of the new Society is as follows:—President, Mr. J. E. Norman, J.P.; Chairman, Mr. F. W. Shearmur; Hon. Secretary, Mr. J. P. Gorton; Asst. Hon. Secretary, Mr. S. Tucker; Hon. Treasurer, Mr. R. S. Wort.

Coventry and District Wireless Association.

Hon. Secretary, Mr. H. H. Thompson, 44, Northumberland Road, Coventry.

At a meeting of the Association at their rooms, 128, Much Park Street, on Wednesday, January 3rd, the first of a course of lectures on the principles of radio communication was given by Mr. A. H. Burnand, A.M.I.Mech.E., A.I.N.A., formerly a lecturer on Engineering at University College, Southampton. The subject was "Waves in Air and Aether," and the lecturer commenced by dealing with the mechanical details underlying wave motion, with particular reference to the elasticity of the medium and the mass and inertia of the moving particles. Sinusoidal waves were especially considered and illustrations were given of the nature of longitudinal and transverse waves.

Dealing with the velocity of waves in different media, the lecturer explained the relationship existing between wavelength, velocity, and periodicity in all media. In illustrating the manner in which the "carrier wave" employed for the radio transmission of speech behaves, an interesting analogy was given with reference to the "carrier wave" produced by breathing, and the modulation of this wave by the agency of the lips, tongue, and vocal chords to produce articulate speech. In connection with this, reference was made to the relatively low frequencies of sound waves comprising speech and musical reproduction, *i.e.*, from about 30 to 2,000 per second, whereas on a short wavelength, such as is employed for broadcasting, the frequency of the electro-magnetic waves is 700,000 per second, so that in the production of one wave of sound at a frequency of 1,000 there would take place 700 vibrations of the aether. The lecture concluded with an account of natural and forced vibrations, the vibrations of strings, fundamental and harmonic vibrations, and some elementary remarks on resonance.

The lecture was followed with the closest attention by the audience, and the subjects were handled with such clearness as to be easily comprehended by any who were not already familiar with the subjects.

On January 17th a lecture was given before the Association by Mr. Clinker, of the British Thompson Houston Co., Ltd.

Tottenham Wireless Society.

Hon. Secretary, Mr. R. A. Barker, 22, Broadwater Road, Bruce Grove, Tottenham, N.17.

A meeting of the Tottenham Wireless Society was held at the club-rooms, 10, Bruce Grove, Tottenham, on January 3rd. There was a very good attendance, and everyone enjoyed an excellent lecture by Mr. H. Winter on the subject of "Telephone Receivers."

The Society, which is rapidly growing in numbers and is proving of great help to the wireless experimenters in the district, is looking forward with confidence to a successful year. All those who wish to avail themselves of the lectures and the experience of other experimenters should apply to the Secretary, Mr. R. A. Barker, 22, Broadwater Road, Tottenham, N.17., for full particulars.

The Pudsey and District Radio Society.

Hon. Secretary, Mr. W. G. A. Daniels, 21, The Wharrels, Low Town, Pudsey, Leeds.

A meeting was held at the Mechanics' Institute on Monday, January 1st, Mr. F. Wild, the Chairman, presiding. There was a good attendance of members, and a number of new ones were elected.

In dealing with the correspondence the question of affiliation with the Radio Society of Great Britain was raised. The proposal to erect an aerial permanently at the Mechanics' Institute was also discussed and application has since been made to the P.M.G. for the necessary licence.

A very interesting lecture on Valves, and their application to wireless, both for reception and transmission, was given by the Secretary, and was very much appreciated by all members present, many of whom joined in the vigorous discussion which followed.

The Chairman made reference to a subscription list now open, and which has already been subscribed to for the purpose of providing the Society with a receiving set of its own.

All desirous of joining the Society should communicate with the Secretary.

Cowes District Radio and Research Society.*

Hon. Secretary, Mr. L. Ingram, 1, Mill Hill Road, Cowes.

The Society held its first meeting at the new headquarters, the Gloster Restaurant, on January 3rd, when Mr. Bullen's lecture, entitled "Electrical

Units," was thoroughly enjoyed. The lecturer dealt with his subject in a very capable manner illustrating his points with simple analogies and clearly stating his facts. Following the lecture, and at the request of one of the members, a single valve set was converted from a long-wave to a short-wave receiver, and **2LO** was tuned in satisfactorily. At the conclusion of the practical demonstration, the Chairman (Mr. E. P. Bartlett) urged the members if they had any difficulties with their sets, to being them before the Society.

At the meeting on January 10th, after the usual half-hourly morse practice, Mr. Ellis again favoured the Society with an excellent lecture entitled "Meteorological Reports." He gave a list of the various forecasts and weather reports, explained their particular uses, to whom they were addressed, and the times at which they were transmitted. The Old International Code used in these reports was explained in detail, and a specimen report was deciphered. The lecturer concluded with a summary of the systems employed by the various nations.

After the lecture the broadcasting stations were tuned in on Mr. Benzie's four-valve set, which he had kindly brought along for the purpose.

The committee hope that prospective new members will send for information to the Hon. Secretary.

Streatham Radio Society.*

Hon. Secretary, Mr. S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, Streatham, S.W.16.

The January meeting of the above Society was held at the headquarters, Streatham Hill College, on the 10th when an interesting lecture was given by Mr. Gibbon of the Post Office Engineering Staff, illustrated by a number of lantern slides. The lecturer gave much valuable information on the development of radio work and the slides showed several well-known stations. A demonstration followed the lecture, when an Ultra IV Receiving Set, kindly lent by Messrs. Burndept Ltd., was admirably handled by Mr. F. O. Reed, and the strains of Covent Garden Opera filled the room from an Amplion loud speaker.

A hearty vote of thanks was given at the conclusion of the meeting to Mr. Gibbon, Mr. Reed and Messrs. Burndept, Ltd., for the pleasant evening they had afforded. The lantern was lent and operated by Mr. King, Treasurer to the Society.

The first annual dinner of the Society will be held on February 14th.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N. 3.

The above Society met on Monday, January 8th, when it was decided to hold future meetings at St. Mary's Schools, Church End, Finchley. In future the meetings will be conducted as follows: 7 p.m., an elementary lecture on the first principles of Wireless Telegraphy and Telephony; 8 p.m., A demonstration and lecture of a more advanced character; 9.30 till 10 p.m., Two "buzzer" classes, one for the novice and the other for those who wish to improve their speed. It is hoped that members will attend more regularly in future. Members are still needed, and all those interested are invited to communicate with the Hon. Secretary.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

On January 10th, Mr. Burman read his paper on "High Frequency Amplifiers." He opened by explaining the meaning of the term "coupling." The three most common methods of high frequency coupling were then outlined, and the advantages of high frequency magnification were enumerated. The term "amplification factor" was made clear by means of blackboard sketches.

The resistance-capacity coupling was discussed. The efficiency of this system, depending on the value of the anode resistance, was explained by assuming the valve to be a simple varying resistance in series with the fixed anode resistance, and the variations in potential across the former, with the different values of anode resistance illustrated by numerical examples.

The tuned anode method of coupling followed, the lecturer pointing out the similarity of these two methods in many respects, and detailing the desirable features which the tuned anode possessed.

The meaning of "rejector" circuit was defined, and an elementary mathematical proof of certain statements made, was developed by the use of complex quantities. The result showed that in order to get maximum impedance at a given frequency, the capacity across the coil and the ohmic resistance of the coil must be a minimum, whereas the inductance should be as large as possible, consistent of course, with proper tuning. A circuit possessing these properties, it was explained, was very desirable from the point of view of selectivity, especially on "Broadcast" wavelengths, to reduce jamming from spark stations working close to the wavelength tuned in. The practical construction of an amplifier embodying these three systems of coupling will form the subject of a paper by the same lecturer, to be given before the Society shortly.

St. Barnabas' Wireless Club (Epsom).

Hon. Secretary, Mr. B. H. Hardy, "Oakhurst," 32, Pound Lane, Epsom.

The above Club gave a Wireless Demonstration at the St. Barnabas' Parish Room, Epsom, on Wednesday, January 10th, in aid of the proposed New Parish Hall.

Reception from Marconi House, including the opera "Pagliacci," was particularly loud and clear, and special thanks are due to one of the members, Mr. H. Penfold, whose four-valve receiving set was used on this occasion.

The Hall was filled to overflowing, and a collection at the door yielded a generous sum for the object mentioned. The demonstration was so successful in fact that it is proposed to give another at an early date.

There are a few vacancies for keen members, ladies or gentlemen, whether they possess any technical knowledge or not. The entrance fee, returnable, is 5s. and the subscription 1s. per month. Two series of lectures are being arranged to commence shortly, one for members who have no knowledge of wireless and the other for the advanced members.

The Club meets on Thursdays at 8 p.m., in the St. Barnabas' Parish Room, Hook Road, Epsom.

Electrostatic Capacity in Radio Circuits

By S. O. Pearson, B.Sc.

No doubt it has occurred to many amateur wireless experimenters that electrostatic capacity is used for two diametrically opposite purposes in radio work. For instance, telephones are usually shunted by a condenser to by-pass the high frequency component of the current, that is, to offer a path of low impedance to the high frequency component. On the other hand, the primary of a high frequency transformer is often shunted by a condenser in order to *increase* the impedance and so get the greatest possible potential difference across the circuit. To those who are not versed in the theory of electric circuits this would appear to be somewhat paradoxical; but it is quite consistent, and one of the objects of this article is to explain as clearly as possible what the conditions are under which capacity has these opposite effects.

The three constants of an electric circuit, namely *resistance*, *inductance* and *capacity*, are all present to some degree in every circuit; it is not possible in practice to obtain any one of these quantities without the presence of the other two. Every experimenter knows that an ordinary tuning inductance possesses not only resistance but also self capacity. In this case both the resistance and the self capacity are detrimental to efficient working but they cannot be entirely eliminated. It is not intended to dwell here upon the effects of resistance, inductance and capacity singly, but rather to consider their combined effect upon the relationship between pressure and current in a circuit.

Let us consider the impedance of an inductive coil having an inductance of L henries and a resistance of R ohms, but whose self capacity is negligible. When an alternating pressure of V volts at a frequency of f cycles per second is applied across the ends of the coil, then, neglecting self capacity, the current is given in amps by

$$A = \frac{V}{\sqrt{R^2 + \omega^2 L^2}}$$

where $\omega = 2\pi f$

and the Impedance

$$Z = V/A$$
$$= \sqrt{R^2 + \omega^2 L^2} \text{ ohms.} \quad . \quad . \quad . \quad (1)$$

This is the opposition which the circuit offers to the passage of an alternating current whose frequency is f cycles per second. The higher the frequency of the current the greater is the impedance and when we come to deal with radio frequencies the impedance of the circuit usually reaches a very high figure. A numerical example will make this clear.

Suppose the coil has an inductance of 1,000 microhenries (0.001 henry) and a resistance of 10 ohms, then at a frequency of 100,000 cycles per second, corresponding to a wavelength of 3,000 metres, the impedance is 628·4 ohms. This shows how small is the effect of the ohmic resistance in comparison

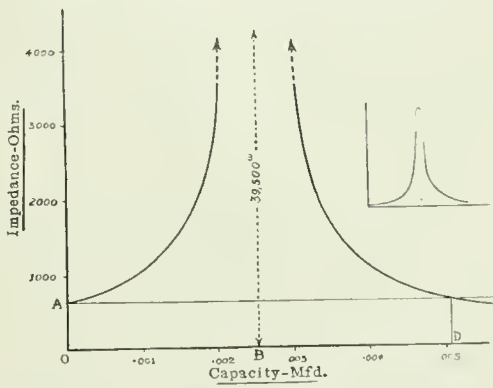


Fig. 1. Curve showing the relation between capacity and impedance. Inset: Full curve drawn to a smaller scale.

with that of the inductance at this high frequency; in fact if the resistance were neglected altogether an error of less than 0·01 per cent. would be involved. This is an interesting point and will be referred to again later.

If now the coil is shunted by a condenser of capacity C farads, the impedance of the circuit is given by

$$Z = \frac{1}{\sqrt{\left(\frac{R}{R^2 + \omega^2 L^2}\right)^2 + \left(\frac{\omega L}{R^2 + \omega^2 L^2} - \omega C\right)^2}} \quad . \quad . \quad . \quad (2)$$

using this expression to find the impedance of the circuit when the coil we considered above is shunted by a condenser of 0·002 microfarad we get $Z = 3·772$ ohms at 100,000 cycles per second. We saw that the unshunted coil had an impedance of 628·4 ohms at this frequency, so that the addition of the condenser in parallel has considerably increased the impedance of the circuit.

The impedances have been worked out for various values of C and plotted as a curve in Fig. 1. It will be noticed that the impedance increases as the capacity is increased up to a certain point and then begins to decrease again as the capacity is still further increased. Evidently then there is a critical value of the capacity which makes the impedance a maximum. From the graph we see that the impedance reaches its maximum value when the capacity is about 0.0025 microfarad.

On examination of equation (2) we see at once that the impedance has a maximum value when

$$\frac{\omega L}{R^2 + \omega^2 L^2} - \omega C = 0$$

or $$C = \frac{L}{R^2 + \omega^2 L^2} \text{ farads. . . . . . (3)}$$

At radio frequencies R is usually small compared with ωL and may be neglected without introducing any serious error.

Hence $C = L/\omega^2 L^2$

or $f = 1/2\pi\sqrt{LC}$, since $\omega = 2\pi f$.

This is the well-known formula for the resonance frequency of a circuit, but it must be borne in mind that this is only approximately correct when the circuit contains resistance. In this particular case we find that the impedance is greatest when the capacity is 0.00253 mfd. and that this maximum value of the impedance reaches the surprisingly high figure of 39.500 ohms. When the capacity is adjusted to this critical value the circuit is said to be *tuned* to a wavelength of 3,000 metres. It is when the circuit is thus tuned that its study is most interesting.

Let us find an expression for the impedance of the tuned circuit. When $C = L/(R^2 + \omega^2 L^2)$ the impedance of the circuit becomes

$$Z = \frac{1}{\dfrac{R}{R^2 + \omega^2 L^2}}$$

$$= \frac{R^2 + \omega^2 L^2}{R}$$

$$= L/CR \text{ ohms . . . . (4)}$$

This is a very simple expression but is very important and a great deal of valuable information can be obtained from it. It should be mentioned here that when a circuit is tuned in this manner the E.M.F. and current are exactly in phase (*see* vector diagram Fig. 2) and hence the circuit is acting as a non-inductive resistance of L/CR ohms. This is sometimes called the *equivalent non-inductive resistance* of the tuned circuit.

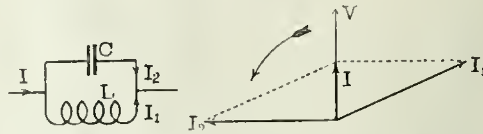


Fig. 2. Tuned circuit and Vector diagram.

When tuning a circuit to a certain wavelength or frequency the object in view is to arrange the circuit so as to offer the *greatest possible impedance* to the passage of a current of that frequency, but to offer low impedance to currents of any other frequency. This is where the ohmic resistance plays a very important part, since, as we have seen, the maximum impedance of a tuned circuit varies inversely as the ohmic resistance of the inductive coil and hence in any tuned circuit it is most essential that the resistance should be kept as low as possible. We saw previously that for an untuned inductive circuit the ohmic resistance had practically no effect at high frequencies, but it is just the reverse in a tuned circuit for it not only reduces the maximum value of the impedance in direct proportion, but what is worse, diminishes the sharpness of the tuning. In order to get selective tuning then, it is obviously very necessary to choose a coil with the lowest possible high frequency resistance, and this accounts for the use of " Litz " wire in high-class apparatus.

Further, we see that the maximum impedance of the tuned circuit is directly proportional to the ratio of inductance to capacity, so that L/C should be made as large as possible in order to obtain the greatest efficiency. It is very bad practice to shunt a small inductance by a large condenser in order to reach a certain wavelength; it is far better to increase the value of the inductance, but care must be taken that the resistance is not excessively increased at the same time, or no advantage will be obtained. The use of inductance coils wound with very thin wire should be avoided; much rather obtain an efficient circuit at the expense of compactness than the converse. The self capacity of an inductance coil is equivalent in effect to a condenser in parallel and therefore it is necessary that coils should be wound in such a manner as to reduce the self capacity to a minimum.

It is well worth noting what takes place when the capacity in parallel with the coil is increased beyond the critical value $L/(R^2+\omega^2L^2)$. Referring again to the impedance curve of Fig. 1, it will be observed that as the capacity is increased beyond the critical value represented by OB, the impedance of the circuit begins to diminish again; and when C is made infinitely large, equation (2) shows that the impedance of the circuit becomes infinitely small. Now the impedance of the unshunted coil was seen to be $\sqrt{(R^2+\omega^2L^2)}$, represented by OA in the graph, and obviously there must be some particular value of the capacity which will make the impedance again equal to that of the unshunted coil. This value is represented by OD in the figure and can be found analytically by equating expressions (1) and (2) above, from which we get

$$C = \frac{2L}{R^2 + \omega^2L^2} \quad \ldots\ldots\ldots\ldots (5)$$

which is just double the value required for maximum impedance. When the capacity is adjusted to this value the phase difference between the E.M.F. applied to the ends of the circuit and the current through the circuit is exactly the same as for the unshunted coil, but in the latter case the current leads the E.M.F. in phase, whereas in the former the current lagged behind the E.M.F. by the same angle, namely $\phi = \tan^{-1}\omega L/R$.

For all values of the capacity between $C = O$ and $C = 2L/(R^2 + \omega^2L^2)$ the resulting impedance of the circuit is greater than that of the coil alone. Hence when connecting a condenser in parallel with any inductive portion of a circuit in order to "by-pass" a current of a certain frequency, great care must be taken that the value of the capacity does not fall within these limits, or matters will be made worse instead of better. The capacity of the condenser should be at least eight or ten times the value required for resonance in order to act as an effective by-pass.

The Model Engineer Exhibition.

THE growing public interest in wireless and the consequent rapid development of the manufacturing industry was reflected in the arrangements of the recent exhibition organised by the *Model Engineer*, and held at the Horticultural Hall, Westminster, from January 5th to January 12th.

Second only perhaps to model railways, wireless equipment aroused the greatest share of the attention of the large number of visitors at the exhibition.

Messrs. F. Yates & Sons, Ltd., of 144, Church Street, Kensington, London, W.8., exhibited motors, dynamos, accumulators, general electrical accessories and a selection of wireless apparatus. The Grafton Electrical Co., of 54, Grafton Street, Tottenham Court Road, W.1, in addition to a range of wireless sets and components, displayed electric motors and dynamos, accumulators, batteries, electrical measuring instruments and other scientific apparatus. The Wainwright Manufacturing Co., Ltd., of 25, Victoria Street, London, S.W., were represented by an attractive display of wireless apparatus and accessories.

Messrs. A. W. Gamage, Ltd., showed a large and varied assortment of fittings and sets for wireless reception. The Peto Scott Co., of 64, High Holborn, London, displayed a selection of their specialities, including complete wireless sets and accessories. Messrs. G. Z. Auckland & Son, of 395, St. John Street, E.C., exhibited a large range of wireless apparatus manufactured by them, including receiving sets, amplifiers, accumulators and high tension batteries. Messrs. The Bowyer-Lowe Co., Ltd., of Letchworth, showed general wireless apparatus and parts.

The exhibits of Messrs. J. B. Bower & Co., Ltd., of Kingston Road, Wimbledon, consisted of crystal and valve sets, condensers, coils, and accessories. Messrs. Leslie McMichael, Ltd., of 179, Strand, London, W.C., exhibited wireless requisites of all kinds. Messrs. M. W. Woods, of 146, Bishopsgate, London, E.C., had on view a collection of their battery charging rectifiers, wireless transmitting generators, and receiving sets. Messrs. Economic Electric, Ltd., of 10, Fitzroy Square, London, W., displayed a large variety of scientific electric apparatus and components.

The prize in the competition for the construction of a variable condenser for wireless was awarded to Mr. C. F. Sayers.

Wireless Broadcasting of Opera from Covent Garden.

Described by W. J. Crampton, M.I.E.E., Member I.R.E.

The achievement of Broadcasting Opera from Covent Garden is a subject which is at the present time of extreme interest to everyone associated either with wireless telephony or attracted by the music alone. The following account given by Mr. W. J. Crampton, Consulting Engineer to the Royal Opera House, describes what led up to the undertaking of this enterprise.

IN response to many inquiries as to the methods adopted for transmitting the operas produced at Covent Garden Theatre, through the London Broadcasting

Photo . Elliott & Fry, Ltd.

Dame Melba whose support of British opera and interest in this enterprise have contributed so largely to the extraordinary success achieved.

Station (2 LO), I hope the following details will be of interest to those who nightly listened-in, many of whom have questioned as to how it has been carried into effect.

As Consulting Engineer to the Royal Opera House I fully realised that if some form of agreement could be arrived at between the Opera Company and The British Broadcasting Company, the public would materially benefit by enjoying at home the services of the artists and orchestra connected with the opera. I therefore approached those concerned, and the proposition met, I am pleased to say, with a quick response.

The Opera House is situated some 400 yards from the Broadcasting Company's Studios, and the first essential was the installation of metallic circuits to connect the buildings. The General Post Office staff rapidly laid, through their existing conduits, a lead-sheathed multiple telephone cable. One pair of wires in this cable is employed for telephones so that the engineers of the Opera House may communicate direct with the studio and notify the correct times to switch over. The engineer on the prompt side of the stage is also in a position to inform the transmitting station from time to time exactly what is about to take place, and also has direct communication with those in charge of the magnifying equipment situated in the basement of the theatre. Consequently the necessary direct communication is effected between all those responsible for the broadcasting arrangements.

A Western Electric microphone has been fixed in close proximity to the footlights on the stage, and this is connected to a three-valve amplifier in the basement of the theatre by a triple cable, which amplifier is in turn connected by means of the lead-sheathed telephone

Mr. W. J. Crampton.

cable, direct to the transformer in the Broadcasting Company's studios, and from the transformer connection is made to the transmitting control valve at the broadcasting station.

Reports which have come to hand from various distant receiving stations, including Edinburgh and Paris, are extremely gratifying. The clearness and purity of tone are all that can be desired.

We are indebted to the following gentlemen who, in the service of the British Broadcasting Company, have so ably assisted in the onerous duties necessary to the successful issue of this innovation :—

First and foremost, Mr. Burrows, Director of Programmes, who is so well known, and who very quickly appreciated the significance of the proposition.

Captain Lewis, his able assistant.

Mr. Stanton Jeffries, Musical Director of the Broadcasting Company, whose knowledge of music renders his services on the prompt side so valuable.

Mr. Rickard and Mr. Wright, who take charge of the amplifying equipment in the basement under the stage. Their's is by no means an envious position, controlling their portion of the apparatus down below the stage.

The G.P.O. Engineering Department, who so rapidly and efficiently installed the metallic lines between the buildings.

I am convinced, from reports received personally, that the transmissions have met with distinct appreciation, and believe it is the forerunner of greater development which will be, I am sure, taken full advantage of as it occurs, to maintain the interest of all those who have taken up wireless not only as a pleasant form of amusement, but also as an essential feature of our daily life.

Such transmissions as these should be the more readily appreciated by those who, through sickness or infirmity, are unable to attend the theatre itself, and those who having seen and heard the operas may have pleasant memories revived.

Notes.

The Institution of Electrical Engineers.

The paper to be given on January 26th, 1923, will be "The Wireless Telephone Service to the Bar Lightship at Liverpool," by Mr. E. A. Payne, and not as stated on the green meetings card of the Institution.

A Wireless and General Trade Exhibition.

A trade exhibition of which wireless apparatus will form an important feature is to be held at Northampton from March 19th to 24th. The motor trade and many other important industries of the Midland counties will be represented, and special railway facilities will be arranged in connection with all the principal towns of the Midland area. The wireless section will also include exhibits of electrical and lighting plant, and will be open to both manufacturers and their agents. The Hon. Secretary is Mr. J. H. Wilson, St. Katherine's Street, Northampton.

A New Radio Club.

A Radio Club has been formed by the staff and employees of the Sunbeam Motor Car Company, Ltd., of Wolverhampton, and a room has been placed at their disposal through the kindness of the Company. The inaugural meeting was held on January 18th, when the policy and aims of the Club were formulated.

A wireless society is also being formed at Winsford, Cheshire, and already over thirty names of persons interested in the movement have been received. Those who have not yet done so are requested to communicate with Mr. S. Oakes 188, Weaver Street, Winsford.

An Apology.

Wireless Installations, Limited, desire to tender apologies for their inability to despatch some of their Christmas orders with the usual promptness. The delay was occasioned by an unprecedented pressure of business which, however, has now been relieved.

Manchester Wireless Traders' Association.

The preliminary steps have been taken in the formation of an association to be called the Manchester Wireless Traders' Association, and a committee representative of the principal firms in the trade has already been elected.

Honour for a German Engineer.

Dr. Alexander Meissner, the well-known German engineer and investigator, has been awarded the degree of "Doctor Engineer" in recognition of his services and in particular his address on "The Evolution of the Methods of Transmission and Reception of Wireless Telegraphy," at the Annual Academic Celebration at the Munich Technical High School, on December 7th, 1922.

Broadcasting in Cuba and Porto Rico.

Operating with a range of 2,000 to 2,400 miles, two new stations have recently been opened in the West Indies at Cuba and Porto Rico respectively for broadcast services. The Cuban station is of 400 watts capacity, and operates on the 400 metre wave, while the Porto Rico station is of 250 watts capacity, its call letters are **WKAG** and the regulation announcements are made in English.

A Wireless Firm's New Branch.

The Stirling Telephone and Electric Co., Ltd., of Telephone House, Tottenham Court Road, London, have recently opened a branch at 14, St. Peter's Square, Manchester, where a range of their principal types of telephones and radio apparatus will in future be on exhibition.

Wireless Telegraphy for Rescue Work in Mines.

A series of tests was recently carried out at the experimental coal-mine of the United States Bureau of Mines in order to determine whether wireless telegraphy afforded the possibility of communication between rescuers and miners entombed following fires and explosions. It was shown in these experiments that signals could be distinctly heard through 50 feet of coal strata, although the audibility fell off rapidly as the distance was increased. It is thought that with longer wavelengths than those used (200 to 300 metres) absorption could be considerably reduced and this method of communication made practically effective at least under certain conditions. An account of amateur experimental work in this connection formed the subject of a note in the issue of the *Wireless World and Radio Review* for October 28th, 1922.

A Bibliography of Wireless Publications.

The predominating feature of the bi-monthly Bulletin issued by the Coventry Public Libraries Committee is a valuable bibliography of books and periodicals relating to wireless telegraphy and telephony. In a foreword to this section Sir Henry Noble, M.I.E.E., Chairman of the British Broadcasting Committee, refers to the extraordinary progress made in this branch of science during the last few years, and outlines the developments contemplated in "broadcasting."

Precision Standardisation of Radio Frequencies.

The United States Bureau of Standards has developed a very precise method of standardisation of radio wavelengths and frequencies. By the process used the frequency of radio waves is compared with that of an audible musical note, a tuning fork being mounted in such a way that it may be made to control the frequency of an oscillatory circuit. The frequency of another oscillatory circuit operating at much higher frequencies is then compared with it by means of a cathode-ray oscillograph. The latter instrument consists of the cathode-ray tube, a special kind of vacuum tube in which the narrow stream of electrons is subjected to the action of electric fields applied by the two alternating current generators. When neither generator is operating, the electrons impinging on the active screen at the end of the tube cause a single luminous spot. If one generator is connected the spot is deflected back and forth along the single line, horizontal or vertical, as the case may be, with such rapidity that it appears as a solid line. If both generators are applied simultaneously, the spot oscillates both horizontally and vertically, and appears in general as a blurred luminous rectangle. If however the frequencies of the two generators bear a simple ratio, such as four to one, the spot traverses and re-traverses a definite simple path, forming a figure by which the frequency ratio may be recognised. It has been found possible to compare frequency ratios as high as 21 to 1. The bureau is at present engaged in the standardisation of a high-precision standard wavemeter by this means. A tuning fork of known frequency, approximately 1,000 cycles per second, is used as the basis of the standardisation. A low-frequency generator is tuned to successive multiples of this frequency by means of the cathode-ray oscillograph, and corresponding settings of the wavemeter are obtained. A third generator is similarly tuned to multiples of these frequencies, and thus by successive stages the standardisation is extended to include frequencies as high as 5,000 kilo-cycles (60 metres). It is intended that this wavemeter be used as the basic standard for the standardisation of commercial wavemeters.

French Broadcasting Times.

The times of the wireless telephony transmissions from the Eiffel Tower and the Radiola Concerts are now given as follows:—Eiffel Tower (2,600 wave), 11.15 a.m., weather reports (duration 10 minutes); 6.20 p.m., weather reports and concert occupying about half an hour; 10.10 p.m., weather reports (duration 10 minutes). With regard to the Radiola Concerts (1,565 wave) the exact times are:—5.5 p.m., news items; 5.15 p.m., concert till 6 p.m.; 8.45 p.m., news items; 9 p.m., concert till 10 p.m.

Celebrating Australia Day from 2 LO.

Friday, January 26th, is Australia Day and it is understood that an appropriate programme has been arranged for broadcasting from **2 LO**, the British Broadcasting Company's London station. It is announced that the High Commissioner of Australia will broadcast an address. Australian talent will provide the musical entertainment and amongst those whom it is hoped will take part are:—Madame Ada Crossley (accompanied on the organ by Mr. Arthur Mason), Miss Florence Austral, Miss Gertrude Johnston, Messrs. Harold Williams, Malcolm, McEacharn, Alfred O'Shea, David Kennedy, Amadio, and the celebrated pianist, William Murdoch.

Amateur Wireless Prohibited in Sweden.

It would appear from reports received that owing to Government regulations in Sweden nothing has been done to stimulate popular interest in amateur radiotelephony. The use of wireless apparatus is controlled by the Royal Telegraph Board and though private firms may use it under licence they have not so far taken advantage of this right. Apparently there is only one firm in Sweden manufacturing radio apparatus and this is comparatively small. Swedish electrical dealers have been trying recently to obtain modification of the present regulation which forbids the use of radio apparatus by amateurs and there is little doubt that such a change would lead to a great expansion of the wireless trade in Sweden.

Books Received

The Radio Amateur's Handbook. By A. Frederick Collins. (London: *George G. Harrap & Co., Ltd.*, 330 pp., 8″ × 5½″. Illustrated. Price, 7s. 6d. net.)

Metal Turning Made Easy. (London: *Cassell & Co., Ltd.*, La Belle Sauvage, E.C.4. Illustrated. 152 pp. Price 1s. 6d net.)

Ideas for the Radio Experimenters' Laboratory. By M. B. Sleeper. (New York: *The Norman W. Henley Publishing Co.*, Price $75;

Reception of American Broadcasting Station

Particulars are given below of the reception in this country of certain of the American broadcasting stations. In addition to those below, many other reports have been received, though insufficient details have been supplied to conclude with certainty that the signals were of American origin. In many cases details of the reception of the broadcasting stations have been included in reports relating to the Transatlantic Tests, and particulars will be extracted and published as soon as all the correspondence relating to the tests has been dealt with.

Date: Nov.	Date: Dec.	Date: Jan.	Name.	Location.	Apparatus: HF	Apparatus: Detector V	Apparatus: Detector C	Apparatus: LF	Station Heard.
23									
24			C. M. Denny ..	Bebington, Ches.					
25			— Kelman ..	Guernsey, C.I. ..					WDY
26			R. J. H. D. Ridley of Burndept, Ltd.	Norwood, London					WJZ
26			E. H. Wilding ..	Wigan, Lancs. ..					WJD
	2		C. Keith Murray	Romsey, Hants ..					?
	2		W. R. Stainton ..	Leigh, Lancs. ..					WJZ
	3		do.	do.					WJZ
	3		F. W. Higgs ..	Bristol					WJZ
	8		W. B. Parker ..	Monkseaton, Northumberland					WJZ
	10		W. R. Stainton ..	Leigh, Lancs. ..					WJZ
	10		A. L. Gay ..	Darlington, Durham.					WJZ
	10		B. Gibson ..	Herne Bay ..					WJZ
	10		R. W. Galpin ..	Herne Bay ..					WJZ
	10		W. H. Webb ..	Manchester ..					WJZ
	10		C. Shearston ..	Portsmouth ..					WJZ
	10		A. H. Reade ..	Oxton, Birkenhead					WJZ
	10		N. C. Hardman ..	Manchester ..					WJZ
	10		J. W. Riddiough	Baildon, Yorks ..					WME
	10		Percy B. Todd ..	Lincoln					WJZ
	11		D. A. Brown ..	Birmingham ..					WJZ
	11		A. V. Chambers	Wimbledon, S.W.					WJZ
	11		H. Aitken ..	Salford					WJZ
	11		C. H. Nokes ..	Ripley, Surrey ..					WJZ
	12		A. E. D. Kennard	Wangford, Suffolk					WJZ
	14		A. S. Gosling ..	Nottingham ..					?
	14		C. S. Bishopp ..	Cullompton, Devon					?
	14		W. B. Parker ..	Monkseaton, Northumberland					?
	18		F. Harper-Shore	Farnborough, Hants.					WJZ
	18		W. R. Stainton ..	Leigh, Lancs. ..					WJZ
	19		C. M. Denny ..	Bebington, Cheshire. ..					WJZ
	19		J. H. Hill ..	Farnborough, Hants.					WJZ WBY
	20		O. F. Keurl ..	Bath					WEY
	20		H. S. Woolley ..	Nottingham ..					WDY
	20		Lott	Burnham-on-Sea					WJZ
	20		J. W. Partington	Camborne, Cornwall					WHI
	20		Nesbit Burns ..	Somerset ..					WJZ
	20		H. L. Bowen ..	Bath					?
	23		T. B. Trott ..	Plymouth ..					WJZ
	23		G. D. Adams ..	Pinner, Midx. ..					?
	23		G. P. Kendall ..	Leeds					WJZ
	24		A. Meredith ..	Shrewsbury ..					?
	24		A. Krause ..	Sutton Coldfield ..					WJZ
	24		R. C. Neale ..	Farnborough ..					WJZ
	25		J. Ashworth ..	Bolton					WJZ
	25		E. W. Null ..	Colchester ..					WDY

Date. Nov.	Dec.	Jan.	Name.	Location.	Apparatus. HF	Detector V	Detector C	LF	Station Heard.
	25		P. G. A. H. Voigt	London, S.E.23 ..	×				WJZ
	25		J. W. Partington	Camborne, Cornwall.					WGY WGY
	25		F. Williams ..	Acton, W.3 ..					?
	27		H. C. Gooding ..	Stowmarket ..	×	×		×	?
		2	H. R. Goodall ..	Southampton ..	×	×		× ×	?
		7	A. F. Baldry ..	Wembley, Midx.	×			×	WJZ
		8	W. R. Stainton ..	Leigh, Lancs. ..					WJY
		8	W. R. N. Ward ..	Teddington, Midx.		×		× ×	WJZ
		13	W. R. Stainton ..	Leigh, Lancs. ..					WGY
		13	W. B. Parker ..	Monkseaton, Northumberland	×	×			WJZ WDAC
		14	A. E. Berlyn ..	Birmingham ..	×	×			WJZ WZY WDAF
		16	V. M. Cartnell ..	Southport ..					WGY
		17	F. D. B. Cobb ..	Margate	×			× ×	WJZ
		17	W. D. Taylor ..	Sunderland ..					WJZ

Calendar of Current Events

Saturday, January 27th.

LAMBETH FIELD CLUB AND MORLEY COLLEGE SCIENTIFIC SOCIETY.

At 7.30 p.m. At the Physics Laboratory, Morley College, S.E.1. Practical night.

Sunday, January 28th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, January 29th.

9.20 to 10.20 p.m. Dutch Concert, **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. H. M. Campbell, A.M.I.E.E.

Tuesday, January 30th.

Transmission of Telephony at 8 p.m. on 400 metres, by **2 MT**, Writtle.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.

At St. Margaret's Institute, Alexandra Road. Lecture by Mr. F. E. Thirtle.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.

Meeting.

Wednesday, January 31st.

EDINBURGH AND DISTRICT RADIO SOCIETY.

At R.S.S.A. Hall. Lecture on "Amateur Research Work," by M. G. Scroggie, B.Sc.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.

Questions and Answers Evening.

COWES DISTRICT RADIO AND RESEARCH SOCIETY.

General Meeting.

Thursday, February 1st.

Silvanus Thompson Memorial Lecture. At the Technical College, Leonard Street, E.C.2. At 7.30 p.m. Sir Oliver Lodge, F.R.S., on "The Basis of Wireless Communication." In the Chair: Sir Charles Parsons, K.C.B.

LUTON WIRELESS SOCIETY.

At 8 p.m. At the Hitchin Road Boy's School. Practical Work and Experiments.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.

Lecture on "A Broadcasting Crystal Receiver," by Mr. T. R. Clark.

HACKNEY AND DISTRICT RADIO SOCIETY.

At the Y.M.C.A., Mare Street, E.8. Lecture on "Electrical Units and Ohm's Law." By Mr. Francis. At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Friday, February 2nd.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At the Dept. of Applied Science, St. George's Square.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

Lecture on "Vacuum Tubes: Their History and Phenomena." By Mr. E. M. Washington.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.

Lecture on "Reception of the Transatlantic Amateur Stations," by Mr. C. E. Morris.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	**2LO**	369 metres.
Birmingham	**5IT**	420 ,,
Manchester	**2ZY**	385 ,,
Newcastle	**5NO**	400 ,,

Questions and Answers

NOTE. This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules: (1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"VALVE" (Woolwich) *asks* (1) *Is he allowed to make up wireless components and wireless receiving sets.* (2) *Is it possible for him to become a member of the B.B.C.* (3) *What sum has to be paid down to become a member.*

(1) There is no reason why you should not manufacture wireless components and receivers, although, of course, the question of patents requires consideration. (2) and (3) We understand that any bona fide manufacturer may become a member of the B.B.C., and we suggest you communicate with the Secretary for further particulars.

"BORDER" (West Ham) *asks* (1) *Why a tuning arrangement, when connected up with one receiver, will not tune up to such a high wavelength as when connected up with a second receiver.* (2) *Why is it that when the tuning condenser is connected in series with the A.T.I. the signals are reduced in strength.* (3) *Would a receiver built up according to the diagram referred to generate oscillations in the aerial circuit.* (4) *Is it correct to use a 4-volt L.T. battery and 45-volt H.T. battery.*

(1) Without a more exact knowledge of the receiver we cannot say why the wavelength reached with one arrangement is less than with the other. We suggest you increase the capacity of the reaction condenser to 0·0002 mfds. (2) The aerial condenser should have a value of 0·001 mfd. If the capacity is too small, a reduction in the strength of signals may be expected, especially when you have a large capacity aerial. (3) The circuit referred to can certainly generate oscillations in the aerial circuit unless care is exercised. (4) It is generally better to employ a 6-volt L.T. battery and a 60-volt H.T. battery, so that sufficient energy is available.

"S.H." (Chorley) *submits a diagram of connections, and asks* (1) *Over what distance he may expect to hear signals.* (2) *Why, with a certain combination of coils, short wavelength signals are received.* (3) *Should the transmissions from* **2 LO** *and* **2 MT** *be audible using this receiver, the receiver being located just north of Manchester.* (4) *Should it be necessary to use a microphone amplifier in order to operate a loud speaker, or is it possible to use note magnifiers.*

(1) and (3) We suggest you cut out the 0·0005 mfd. tuning condenser which is connected across the A.T.I., but retain the 0·001 mfd. condenser which is in series. The primary of the high frequency transformer should be tuned with a small condenser having a maximum value of 0·0002 mfds., otherwise the diagram is correct. The range of the receiver of course depends upon the power of the transmitting station, but we consider you should hear the transmissions from **2 LO** and **2 MT** with careful tuning. (2) The peculiar tuning adjustments will no longer be necessary if the alterations suggested in (1) are acted upon. (4) A microphone amplifier may be used if desired, but a note magnifier will do equally as well.

"T.W.B." (West Dulwich) *submits a diagram of connections and asks* (1) *Whether he should receive the* **2 LO** *and Croydon transmissions.* (2) *What type of telephones to use.* (3) *What licence to obtain.* (4) *The correct method of tuning broadcast transmissions when a two-coil slider is used.*

(1) A variable condenser should be connected to the circuit as indicated in the diagram 2 submitted. The blocking condenser should have a value of 0·001 mfds. (2) We suggest you use the 8,000 ohm telephones with this receiver. (3) As you have constructed the receiver yourself, it will be necessary to obtain an experimental licence before you connect it with an aerial. (4) The slider connected to the secondary circuit should be moved so that it includes about a quarter of the coil in the circuit. The slider connected with earth should then be varied until signals are received. Fine tuning is carried out with the condenser.

"A.M." (Stowmarket) *submits a diagram of connections of his receiver, and asks whether it is a non-radiating circuit.*

As the reaction coil is coupled with the tuned anode winding, it is not likely that oscillating energy will be generated in the aerial circuit. In the diagram the grid leak is shown connected across the grid condenser, and as you are using a tuned anode coil, the + H.T. is connected through the grid leak with the grid of the detector valve. This is incorrect. The grid leak should be joined between the grid of the detector valve and its filament, generally to positive.

"**BULLER**" **(E.10)** *has two formers, and asks (1) What wire to wind on each, it being desired to use one for the A.T.I. and the other for the secondary circuit. (2) The number of tappings to be taken from each coil. (3) The approximate wavelength range covered.*

(1) and (2) We suggest you wind the former 4″ in diameter and 12″ long with No. 24 D.C.C., taking 20 tappings. The small coil can be used for the secondary circuit and should be wound with No. 28 D.C.C., and 12 tappings should be taken. (3) The wavelength range would depend upon the values of the tuning condensers used and the size of the aerial, but under normal conditions. The wavelength range would be from 200 to 10,000 metres.

"**NIL DESPERANDUM**" **(Southport)** *asks (1) The wavelength range of his set. (2) How many plates are required for various variable condensers. (3) Whether he can get back numbers.*

(1) The wavelength range is from about 300 metres to 5,000 metres. (2) The formula for calculating the capacity of variable condensers is:

$$K = \frac{0{\cdot}0885K(N-1)R^2}{t} \text{ m.mfds.}$$

N = total number of plates.
R = radius of moving plates, cms.
t = spacing, cms.

You will require 95 plates for 0·001 mfds., 49 plates for 0·0005 mfds., 21 plates for 0·0002 mfds., assuming the spacing washers are ⅛″ and the plates are 20 S.W.G. (3) You will be able to obtain back numbers from the Mail Order Dept., The Wireless Press, Ltd., 12-13, Henrietta Street, London, S.W.2

"**E.H.**" **(Middlesex)** *submits a list of apparatus in his possession and asks for a suitable circuit.*

The proposed arrangement of apparatus is quite suitable, and is the best which can be provided using a single valve. As a suggestion, why not use the valve as an H.F. amplifier, and a crystal as detector, as indicated in several recent issues. The tuning range of the coil is from 200 up to just over 1,000 metres. With the condenser in parallel, the range will be further increased up to about 2,500 metres.

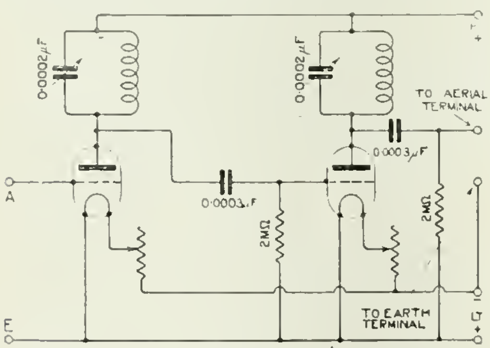


Fig. 1.

"**A.G.L.**" **(Sutton Coldfield)** *asks (1) Whether he can add 2 H.F. connected valves without altering the wiring of his present set. (2) For a suitable circuit.*

(1) and (2) You can add a panel containing 2 H.F. connected valves without disturbing the wiring of your present panel. See Fig. 1. Suitable valves are indicated.

"**CONSTANT READER**" **(Merioneth)** *submits particulars of components in his possession, and asks (1) What other parts are required to make his crystal set quite efficient. (2) What is the wavelength range obtained. (3) For a suitable circuit.*

(1) We suggest you use an aerial tuning condenser having a maximum value of 0·001 mfds., and a

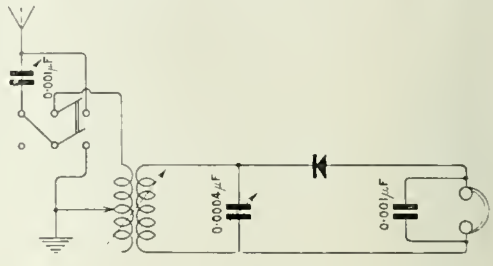


Fig. 2.

closed circuit tuning condenser with a value of 0·0004 mfds. (2) The wavelength range will depend partly upon the dimensions of your aerial, but will be approximately from 200 to 4,500 metres. (3) See Fig. 2.

"**H.C.G.**" **(Shepherd's Walk, N.1.)** *asks (1) Where to connect a switch in order to cut out the H.F. or L.F. valve as desired. (2) What is the resistance of the Western Electric marine loud speaker. (3) Would* **PCGG** *transmissions be received with a three-valve set using one H.F., one detector and one L.F. valve. (4) The aerial coil is of good size, and the reaction coil couples with it. What is a suitable size of reaction coil.*

(1) The method of switching is shown in Fig 1, page 449, in the issue of December 30th. (2) We regret we have no particulars regarding this instrument. (3) With careful tuning and adjustments we consider you should certainly hear the transmissions referred to. (4) When receiving short wavelengths it is sometimes necessary to use a reaction coil with more turns than the aerial coil, but when receiving the longer wavelength signals the reaction coil has generally fewer turns than the aerial coil. It is well to bear in mind when using reaction in this manner, the generation of oscillations in the aerial circuit causes interference with other experimenters in your neighbourhood. This interference is very unpleasant, and great care should be exercised to prevent the generation of oscillations.

"**H.**" **(Croydon)** *asks (1) What combination of valves is necessary to obtain the transmissions from Manchester, The Hague and Paris. It is desired to use a loud speaker. (2) Is it to be expected that the signal strength will be louder when a double circuit tuner is used instead of a single circuit tuner. (3) Which arrangement would give the least distortion —a microphone amplifier or a valve note magnifier.*

(1) We suggest you use a four-valve receiver comprising one high frequency, one detector and two L.F. valves. With a good aerial, signal strength should be sufficiently loud to operate

a loud speaker. If you are badly screened or if the aerial is low, we suggest you use two high frequency valves. The valves may be coupled by means of the tuned anode arrangement. (2) The object of a two-circuit tuner is not always to give increased signal strength, although it will slightly increase the signals on occasions. The great advantage is the gain in selectivity which may be obtained. It is generally worth while from this point of view alone to use a two-circuit tuner. (3) We do not think there is much to choose between the two methods of low frequency amplification, provided each is properly designed. The question of cost should be considered.

"R.B." (Newcastle) *asks for a diagram of a three-valve receiver showing the connections of a series-parallel switch, a tune stand-by switch, reaction coil reversing switch, and switches to cut out the high frequency and low frequency valves.*

See Fig. 3.

nected across the primary winding of the transformer connected in the anode circuit of the first valve. A similar condenser should be connected across the telephone transformer, or the telephones, if high resistance telephones are used.

"SAD" (Coventry).—As you have constructed your receiver yourself, you are not allowed to purchase a "Broadcast" licence, but you must satisfy the Post Office that you are a competent person and have some definite object in view before you will be granted an experimenter's licence. If you cannot satisfy the Post Office, you are required to purchase a receiver which bears the stamp of approval.

"J.C." (Banbury) *asks* (1) *Whether he is likely to radiate energy from the aerial when the reaction coil is coupled with the tuned anode coil.* (2) *How many turns of No. 24 D.C.C. wire wound on a 1½" former will be required to give the following*

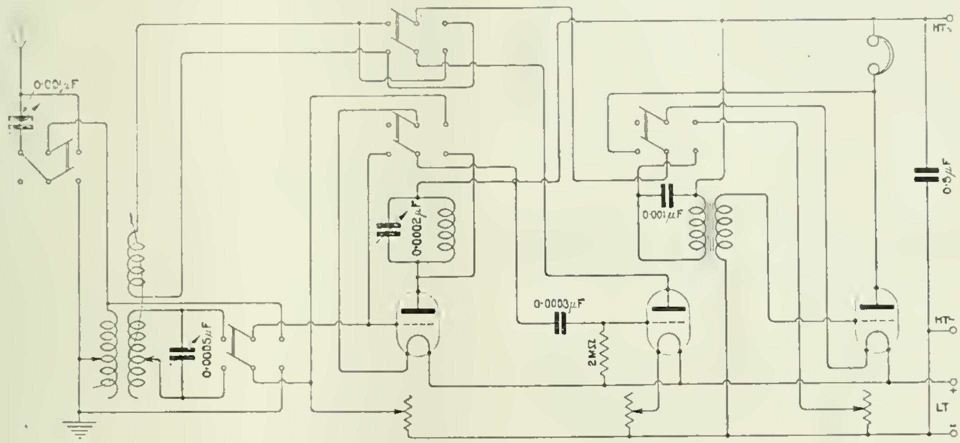


Fig. 3.

"E.J.B.R." (Northumberland) *refers to the receiver described on page 780 of the September 16th issue, and asks* (1) *What alterations are necessary to the reaction arrangements, in order that the circuit will be approved by the Post Office.* (2) *The correct method of joining up a high frequency transformer, which consists of two coils mounted closely together.*

(1) The only alteration necessary to the receiver is that the reaction coil should be coupled with the high frequency transformer instead of the aerial tuning inductance. (2) The coils which form your high frequency transformer are connected in exactly the same way as indicated in the diagram, but of course the coils are not marked "O.P." or "I.P." If suitable coils are used, the result should be as good as with the arrangement proposed in the article.

"H.A.C." (Norwich) *submits a diagram of his receiver and asks* (1) *Whether a condenser should be connected in the first valve circuit.*

A fixed condenser of 0·001 mfds should be con-

wavelengths, using a 0·00075 mfd. variable condenser:—350 to 450, 500 to 600, 900 to 1,085. (3) *How many turns of wire (a specimen of which is submitted) will be required for a high frequency transformer.*

(1) As the reaction coil is coupled with the tuned anode coil, it is hardly likely that you will generate oscillating energy in the aerial circuit. (2) To tune up to 450 metres, 75 turns of No. 24 D.C.C. wire should be wound on the 1½" diameter former. To tune up to 600 metres, 120 turns on the 1½" former, and to tune up to 1,085 metres, 272 turns will be required. (3) Each primary and secondary slot should be wound with 100 turns of the No. 38 S.S.C. wire, sample of which was submitted. The primary of the transformer should be tuned with a condenser having a maximum value of not more than 0·0002 mfds.

"J.B.A." (Dumfries) *submits a diagram and particulars of his receiver and asks* (1) *Why the addition of the high frequency connected valve does not increase the signal strength.* (2) *Why signals* *fade sometimes.* (3) *Whether the proposed transmitter is suitable.* (4) *Whether the power buzzer which he has by him will deliver 1,000 volts.*

(1) In the diagram submitted, the +H.T. lead connects with the anode winding of the first high frequency transformer, but with the grid winding of the second high frequency transformer, otherwise the circuit is correct. We suggest you use the tuned anode method of high frequency amplification. The anode winding should be tuned with a small condenser not exceeding 0·0002 mfds. A number of circuits have been given recently. (2) The fading experienced is probably due to the aerial swinging. As your aerial is a very long one, if the fading is not due to this cause, we suggest you examine the receiver, making sure the grid condensers and leaks are in good order. (3) The transmitter suggested should form a very suitable experimental transmitting set. We suggest you do not interfere with the side tone condenser. Wavelength adjustments should be made by changing the aerial inductance, if necessary, by reducing the horizontal length of the aerial. (4) The power buzzer connected as in the diagram submitted should provide an ample supply of high tension for the transmitter. The two choke coils shown in the diagram are essential to assist in smoothing out the pulsating high tension current. Two banks of Mansbridge type 2 mfd. condensers should be connected across the supply.

"B.J.L." (Dovercourt) *asks* (1) *For a diagram of a tuning panel to give selective tuning.* (2) *What are suitable values for the variable condensers.* (3) *How can one avoid capacity effects due to the hand.* (4) *Whether it is necessary to use different anode voltages for high frequency, detector, or L.F. connected valves.*

(1) See Fig. 4. The coils are all variably coupled together. The switch in the aerial circuit is to join the tuning condenser in series or parallel

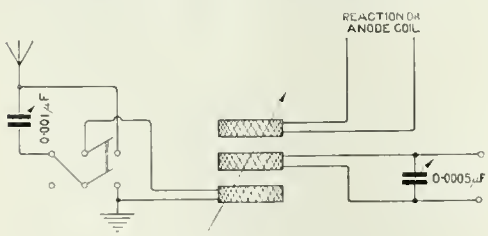


Fig. 4.

as required, and the secondary circuit is tuned with a variable condenser having a maximum value of 0·0005 mfds. When receiving short wavelength signals, it is not necessary to tune the reaction coil. (2) Suitable values for the condensers are indicated in the figure. (3) We suggest you fit an extension handle to the tuning condenser. You will find that adjustments of filament current and anode potential are necessary before good results are obtainable. (4) We suggest you use a common H.T. battery for the amplifier, and tap off, say, 15 volts for the high frequency and detector valves, and about 60 volts for the note magnifying valve.

"B.V.G." (Barnsbury) *asks for a diagram of a two-valve receiver which he can build out of components already in his possession.*

See Fig. 5.

"R.S." (Glasgow) *asks* (1) *Whether, when receiving, he is likely to be interfered with by power lines situated a short distance away.*

We have examined the sketch, showing the position of your aerial, and we think the interference, if any, will be slight. More trouble is

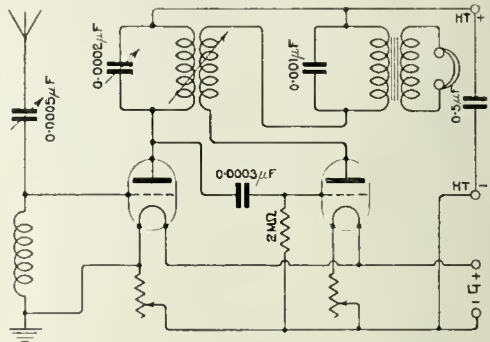


Fig. 5.

likely to be experienced by induced currents from the telegraph wires, and it would be better if you could run the aerial at an angle with the wires.

"G.A.P." (Huddersfield) *proposes to construct a two-valve receiver, and asks* (1) *What are suitable dimensions for the aerial tuning inductance, the anode inductance, and the reaction coil which is to couple with the anode coil.* (2) *What is the best coupling arrangement to provide for the anode and reaction coils.*

(1) As you wish to receive only short wavelength signals, the aerial coil may consist of a winding 4″ in diameter and 5″ long of No. 22 D.C.C. Ten tappings should be taken. The anode coil may consist of a winding 4″ in diameter and 4″ long of No. 30 D.C.C. with ten tappings. The reaction coil may be 3″ in diameter and 4″ long, with No. 34 S.S.C. wire, with four tappings. (2) The anode and reaction coils may be made after the manner of a loose coupler, the reaction coil sliding inside the anode coil. If it is desired, plug-in coils may be used, in which case a two-coil holder is useful.

"G.J.W." (Highgate) *wishes to construct a three-valve receiver, making use of a number of panels, and asks for a suitable diagram of connections.*

We would refer you to the diagram given on page 181, November 4th issue.

"H.P." (Abertillery) *asks which type of receiver would best suit his requirements.*

We suggest you construct an aerial 40 ft. high and 50 ft. long, as suggested. A single wire would be quite suitable. A four-valve receiver, comprising one high frequency, one detector, and two L.F. valves would be a good combination. We would refer you to the diagram, Fig. 1, page 515, January 13th issue.

"DETECTOR" (Rugby) *enquires* (1) *Whether a L.F. amplifier may be added to a crystal set.* (2) *The best crystal to use with a wire contact point.* (3) *How to tune with a two-slide tuner.* (4) *Whether a certain crystal combination is good.*

(1) An L.F. amplifier may certainly be connected to a crystal receiver, but we suggest you add a H.F. valve, then use the crystal detector, and finally amplify at L.F. Several circuits have recently appeared. (2) We suggest the use of silicon or synthetic galena. (3) We cannot give precise instructions on tuning. Why not join a Wireless Society, where the members will be only too pleased to assist you, or you would find the book, "Crystal Receivers for Broadcast Reception," by P. W. Harris, price 1s. 6d., very useful. (4) We cannot say, but you will find the crystals mentioned above give satisfactory results.

"ONE V. SUPER" (Walthamstow) *asks several questions about the Armstrong super-regenerative receiver described in the issue of September 2nd, and asks* (1) *May duolateral coils be used for L_1 and L_2.* (2) *What are the relative positions of the coils L_3 and L_4.* (3) *Can all the variable condensers have a maximum value of* 0·001 *mfds.* (4) *Particulars of choke coil.*

(1) Duolateral wound coils may be used in this circuit. (2) The relative positions of the coils L_3 and L_1 is a matter of importance, as you should change the positions of these coils until best results are obtained. (3) The variable condensers may all possess a maximum capacity of 0·001 mfds., but in this case the coils should be made of larger inductance. (4) An iron core choke can be made by winding 5,000 turns of No. 40 S.S.C. wire on an iron wire core 3″ long by ½″ diameter.

"A.H.H." (Keighley) *asks whether it is possible to charge accumulators from A.C. mains.*

It is quite possible to charge accumulators from A.C. mains provided apparatus for converting the alternating current into direct current is employed. Of course a motor generator may be used, the motor being driven by the alternating current of the generator delivering direct current, but for small installations it is better to install a rectifier such as the Tungar or the Homecharger. A description of the methods employed for charging accumulators from A.C. mains will appear in this journal in the near future.

"K.G.S." (W.5) *submits a diagram of his receiver and asks* (1) *Whether a set wired according to the diagram would generate oscillations in the aerial circuit.* (2) *Could the aerial coil, anode coil, and reaction coil, all be mounted in a three-coil holder.* (3) *Are Dewar switches suitable for use as a series parallel switch in the aerial circuit.*

(1) The diagram of connections submitted is quite suitable and will not generate oscillations in the aerial circuit. (2) No advantage would be gained by using a three-coil holder. The anode coil and reaction coil may be mounted in a two-coil holder away from the aerial coil. (3) This type of switch may be used if desired provided it is of the anti-capacity type. If the springs are spaced closely together the switch has a large capacity, and is not very suitable. An ordinary two-pole throw-over type switch is useful.

"IDDYUMPTY" (Grimsby) *asks* (1) *Why questions submitted a day or two before Christmas have not yet been answered.* (2) *Can we suggest any means of reducing interference experienced from stations transmitting morse signals. (The receiver comprises three valves—one H.F., one detector, and one L.F.)* (3) *Why is difficulty experienced in receiving telephony with the aerial tuning condenser and aerial tuning inductance in series.*

(1) As your letter containing queries was received just before Christmas, we do not think you can expect to receive replies to your queries in an issue before the date of your second letter, the first week in January. We would point out that a large number of queries are received, and some time must elapse between the date of receipt and the date of publication, as the queries are dealt with in rotation. (2) As you are employing a three-coil tuner with a tuned anode coil we think you should be able to tune out morse signals, especially if the anode coil is tuned with a variable condenser. However, a frame aerial may be used instead of an open aerial, and another H.F. valve connected to compensate for the reduction in signal strength caused by the change. The method of connecting H.F. valves is given in all issues of the journal. (3) No difficulty should be experienced in tuning-in signals with the aerial tuning condenser and inductance in series provided suitable values are used. The aerial tuning condenser should have a maximum value of 0·001 mfds., and the inductance will probably be larger than the closed circuit inductance. Too small a value of A.T.C. will result in very poor signal strength and tuning will be very difficult.

"W.H.G.C." (W.C.1) *asks* (1) *The dimensions of fixed condensers to give a capacity of* 0·001 *and* 0·0002 *mfds.* (2) *What former is used to calculate the capacity of fixed condensers.* (3) *Could a grid leak be made by drawing a line* 1¾″ *long with a hard graphite pencil upon a piece of suitable material.* (4) *Why are results, using an ex-Government telephone transformer marked* 15 75, *no better than when the receiver is used alone in the anode circuit.*

(1) The 0·001 mfd. condenser may have six plates, each having an overlap of 2 × 1 centimetres. The 0·0002 mfd. condenser may have two plates with an overlap of 2 × 1 centimetres, the mica in each case being 2 mills. thick. (2) The capacity C of a condenser $= \frac{0{\cdot}0885 kS\,(n-1)}{T}$

where k is the specific inductive capacity of the dielectric and varies between 5 and 8 for mica. S is the surface area of the metal foil which is overlapping, n is the total number of plates, and T equals the thickness of the dielectric in centimetres. The capacity is given in micro-micro-farads. (3) The grid leak constructed in the manner described has a certain amount of use, but it is better to purchase one, as they are quite inexpensive, and have a considerable life. (4) The telephone transformers referred to are not at all suitable for connecting in the anode circuit of a valve. A telephone transformer would have a ratio of the order of 1 to 5 or 6, and the primary winding would consist of about 5,000 turns of No. 42 S.S.C. wire.

"S.E.M." (Colchester) *asks* (1) *Whether the diagram submitted is correct.* (2) *How to reduce the noises induced by near-by electrical machinery.* (3) *When receiving short wavelength signals, is it better to connect the aerial tuning condenser in series or parallel with the aerial tuning inductance.* (4) *What are suitable values for the coupling condensers shown in the diagram referred to in question* (1).

(1) and (3) When receiving short wave transmissions, the aerial tuning condenser should be in series with the aerial tuning inductance. The connections are quite suitable for a low frequency amplifier. It would be better to use one high frequency connected valve to amplify the signals before they reach the detector valve. We suggest you convert the receiver to form a combination of one high frequency, one detector, and two low frequency valves. The function of the high frequency valve is to amplify the signals so that good operation of the detector valve may be obtained. (2) It is a very difficult matter to eliminate interference of the sort experienced. We suggest you screen the receiver and pay particular attention to the earth lead. The earth lead should be as short as possible and should make good contact with the ground. (4) The aerial tuning condenser may have a value of 0·001 mfd. The coupling condensers should have a value of 2 mfds., and the by-pass condensers 0·001 mfd.

"A.L." (Norway) *refers to the American short wave tuner described in the issue of June 3rd, 1922, and asks* (1) *How to convert the receiver so that it will receive continuous wave signals.* (2) *May the tuner be used for the reception of telephony.* (3) *What is the gauge and insulation of the samples of wire submitted.*

(1) To increase the wavelength range of this receiver, a tapped tuned anode coil may be inserted in each of the circuits according to the wavelength range which you wish to cover. If the coil in the anode circuit is coupled with the coil in the secondary circuit, you have an ordinary reaction circuit, and when the coupling is sufficiently tight, incoming C.W. signals may be received by the beat method. (2) The receiver is quite suitable for the reception of telephony without alteration. (3) The sample of smaller wire submitted is No. 44 S.W.G. S.S.C. The larger wire is No. 38 S.W.G. S.S.C. The No. 38 wire is suitable for winding a reaction coil.

"GREENHORN" (Notts.) *asks* (1) *Whether a loud speaker may be used in place of telephones without altering the arrangement of the receiver.* (2) *What resistance telephones would be used.* (3) *How many coils are required in his receiver.* (4) *Are Siemens Halske valves suitable for his receiver.*

(1) A loud speaker may be used without any alteration to the wiring of the receiver. The resistance of the loud speaker should be similar to that of the telephones which it replaces. (2) If a telephone transformer is used, low resistance telephones may be connected. If it is proposed to join the telephones directly in the anode circuit of the last valve they must have high resistance. 4,000 ohms is suitable for the latter case, and 60 for the former. (3) The number of coils required depends, of course, upon the range of wavelengths over which it is desired to receive signals. If you purchase these coils, care should be taken to purchase those which used in conjunction with the tuning condenser will give the desired range. (4) Siemens Halske valves may be employed in your receiver if desired, but we suggest the use of "R" type valves. An "R" type valve requires 60 volts for the anode, and 6 volts for the filament.

"C.B." (Clapham) *wishes to construct a number of basket coils with the materials in his possession which will enable him to tune up to 3,000 metres.*

We suggest you wind six coils, each having 50 turns, using the 2″ diameter former which you have by you. The 22 gauge wire is quite suitable. The coils should be connected in series and the tappings brought to a switch. The coils should be spaced about ⅛″, in order to keep down the self-capacity as far as possible.

"HOM DE OZZ" (Brighton) *asks* (1) *Why he hears the* **FL** *telephony transmissions on* 1,400 *metres as well as* 2,600 *metres.* (2) *Why other telephony transmissions are heard on a wavelength of* 340 *metres as well as* 1,565 *metres.* (3) *Why, with tapped anode reactances, it is often possible to get the best results when the switch arm is making contact on two studs simultaneously.*

(1) and (2) We cannot say the exact reason why you should hear the transmissions referred to on other than the correct wavelength. In all probability you are hearing a harmonic. (3) With a tapped anode reactance which is self-tuned, it is not possible that the natural period of the winding is the same as that of the signal. Moving the switch arm so that two studs are bridged at the same time brings the wavelength of the coil more nearly equal to that of the signal. If the coil were tuned with a variable condenser, it would not be found that better results are obtained with this adjustment.

"H.J.P." (Edmonton) *submits a diagram of his receiver and asks whether the switching arrangement is correct.*

The arrangement submitted is quite suitable for your purpose. When using reaction in the manner indicated in the sketch, care must be taken that oscillating energy is not transferred to the aerial circuit. The aerial tuning condenser should be connected in series with the aerial tuning inductance when receiving short wavelength signals.

SHARE MARKET REPORT

Prices as we go to press on January 19th, are.—

Marconi Ordinary		£2	6	0
,,	Preference	2	0	0
,,	Debentures	105	10	0
,,	Inter. Marine	1	9	0
,,	Canadian		10	9

Radio Corporation of America :—

Ordinary	16	6
Preference	13	8

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 181 [No. 18. VOL. XI.] FEBRUARY 3RD, 1923. WEEKLY

The Radio Conference

ON the afternoon of Wednesday, January 24th, at the Institution of Electrical Engineers, was held the Annual Conference of Societies affiliated with the Radio Society of Great Britain.

It sometimes happens that with a well-established event the circumstances under which it originated may be overlooked. It may therefore not be out of place to consider for a moment what led to the inauguration of the Annual Conference of Wireless Societies, particularly for the information of those who have only during the past year begun to interest themselves in wireless matters.

The Radio Society of Great Britain, in former years known as "The Wireless Society of London," had taken upon itself the work of representing the amateurs and experimenters of Great Britain, to voice their wishes and feelings wherever it was necessary to give expression to them. In fact, one of the objects of the Society is to act as the champion of the amateur and experimenter in this country in protecting his interests wherever such action is necessary.

The idea of affiliation of Provincial Societies to the London Society was the outcome of the endeavour to represent in one voice the opinion of the amateurs all over the country.

The conference of delegates from provincial societies with the officers of the Radio Society of Great Britain, was very naturally a part of the general affiliation scheme, and therefore these conferences may be regarded as the means adopted for feeling the pulse of the amateurs. These Conferences present the opportunity for an expression of opinion, not only to form a guide to the Radio Society of Great Britain in its policy, but also to arrive at decisions regarding any action which the amateurs as a collective body may wish to take. The Conference may be said to result in direct action, since the very purpose of the Conference is for the expression of opinions of amateurs as a body, and it would be unreasonable to suppose that a definite resolution passed by that Conference would not be put into effect at the earliest possible moment.

It is perhaps well to emphasise that this Annual Conference has no power to concern itself with the internal organisation or policy of either the Radio Society of Great Britain or of any of the societies affiliated, and represented at the Conference. Mention is made of this point since, for amongst the delegates from affiliated societies at the Conference just held, there was one who apparently misunderstood the purpose of the Conference, and supposed, until corrected, that the delegates from other societies were invited to make suggestions regarding internal affairs of individual societies.

The Conference on this occasion was even more fully attended than usual. No doubt this is partly due to the very considerable increase in public interest in wireless during the past year. It is somewhat surprising that, after so busy a year, the items on the agenda for discussion should not have been more numerous than was the case.

A report of the proceedings of the Conference will be published in this journal in due course, but it is perhaps of interest to summarise briefly the matters which claimed attention, and, with this object in view, they will be considered in the order in which they were dealt with. The Radio Society of Great Britain had felt for some time that the views of the provincial societies on matters of importance could perhaps be more adequately expressed if conferences were held at more frequent intervals than once a year, and with this object in mind, some tentative suggestions were circulated to the affiliated societies for their views in order that the matter might be discussed at the Conference.

The net result of the expression of these views, and the subsequent discussion at the Conference, indicated that the present arrangements were considered to be adequate for the time being, and many delegates spoke to the effect that their societies were well satisfied with the arrangements as they stood at present.

The next matter which was dealt with was the British Wireless Relay League. It will be remembered that in a recent issue of *The Wireless World and Radio Review* reference was made to the fact that the Manchester Wireless Society had requested that the subject of the British Wireless Relay League should be included on the agenda of the Conference in order that its organisation might be discussed and the way paved for fuller co-operation of all societies in the organisation of the League. The formation of such a League met with very considerable support from the delegates present at the Conference, and the Radio Society of Great Britain intimated its desire to associate itself with the development of the scheme. It was, however, pointed out that whereas in the U.S.A. the American Radio Relay League is a very large organisation formed expressly for the purpose of relaying messages from point to point, work of this nature would be more restricted in Great Britain. This is largely due to the fact that the area over which these transmissions are to be conducted is small in this country in comparison with the vast stretches of country in the United States of America. It was indicated, however, that a wider field was open, since co-operation in some such scheme had been invited by amateurs in France and elsewhere, and therefore, with the assistance of the American amateurs, and especially in view of the extraordinary success of the recent Transatlantic Tests, there appeared to be scope for the Relay League to develop on international lines.

Mr. P. R. Coursey who, as readers of this journal are aware, has conducted on this side the work of organising the Transatlantic Tests, indicated that there was much additional work which a Relay League could undertake beyond the mere relaying of messages, and his proposals will be given in the report of the Conference to be published later.

The subject of broadcasting was included on the agenda, and was divided under two headings: (1) How broadcasting affects the amateur licensed to transmit, and (2) the amateur licensed for experimental reception only. Many opinions were expressed on this subject, and it was generally recognised that the work of the amateur, particularly in experimental transmissions, had been considerably affected by the introduction of broadcasting, but at the same time it was realised that there were many compensations provided by broadcasting itself. In many cases of experimental work it was extremely valuable to have telephony transmissions on which one could rely, both as regards time and wavelength, and this was particularly useful in conducting experimental work with distortionless amplifiers, loud speakers, and other types of speech reproducing instruments.

Mr. Reith, General Manager of the British Broadcasting Company and a member of the Radio Society of Great Britain, was present and took upon himself to reply to some points which were raised. His remarks did much to clear up certain matters with regard to some of the difficulties which had arisen between the experimenter and the Broadcasting Company, and his clear statements satisfactorily defended the action of the Company. He emphasised the debt which the Broadcasting Company and the public generally owe to the work of the amateur and experimenter, and in his capacity as General Manager of the Broadcasting Company he assured the Conference that his Company, far from having any antagonistic feelings towards the activities of amateurs and experimenters generally, welcomed and valued their co-operation, and under no circumstances would the Broadcasting Company ever take any steps which would adversely affect the work of the experimenter.

For the first time in the history of these Conferences no special resolutions were passed, and no new proposals for the conduct of amateur activities were outlined. The first impression might be that on this account the Conference had not achieved so much as in past years, but on reflection one realises that it is a strong indication that there are no serious grievances to give voice to. It is of course realised by every amateur in the country that everything is not quite as it might be, but at the same time it is understood that, in all development and progress, perfection cannot be attained in the initial stages, and it behoves everyone to exercise reasonable patience and to contribute what he can to facilitate the tasks of others.

A Chat with "The Voice" at 2 LO.

AMIDST a sequence of telephone calls and visitors, Mr. Burrows was able to give *The Wireless World and Radio Review*, at Magnet House, Kingsway, the other afternoon, some ideas of his experiences to date.

"As broadcast wireless telephony goes, I suppose I can claim to be a veteran," he said. "My views on this subject were expressed in the *Year Book of Wireless Telegraphy*, 1918, and in an article written some months before. My first serious essay in this direction was a week's programme transmitted in North Atlantic at the end of July, 1920. The C.P.O.S. *Victorian* was then equipped with a 3-kilowatt telephony transmitter, and our concerts were heard at ranges up to 1,200 miles. As the *Victorian* was riding light, and I am not a good sailor, the voyage will remain long in my memory. The North Atlantic programmes were freely encored, ships from all points of the compass up to 600 or 800 miles 'chipping in' on 600 metres at the end of each item and passing an opinion. Needless to state, after the 1920 experience, it was somewhat irksome to have to sit tight in London and watch the growth of broadcasting in America.

Mr. A. R. Burrows whose voice at 2 LO is so familiar.
Copies of this picture can be obtained from the Publishers of The 'Wireless World. See announcement under Notes in this issue.

"We are hoping to show that England, though late, as usual, in starting systematically, will not be long in overtaking her rivals. By singular good fortune and with the collaboration of Mr. W. J. Crampton, the Covent Garden engineer, we were able to mark the opening of our official duties by arranging for the broadcasting of the excellent performances of Grand Opera by the British National Opera Company, Ltd., at Covent Garden. Mr. Crampton will be known to many of your readers as a most keen experimenter; his station has been heard, I understand, as far distant as Nice.

"Only an agreement amongst the principal members of the Broadcasting Company whereby the several companies sink their identity in the one title restrains me from mentioning those to whom we are particularly indebted for the technical success of the experiments. In view of the fact that we had no choice in the selection of sites for the two microphones employed, I think it may safely be classed amongst the most ambitious and most successful series of transmissions yet attempted on this or the other side of the Atlantic.

"The effect upon the British industry, I am told, has been very marked. This is very gratifying to one whose business it is to provide from behind the scenes such a standard of programme as will not merely maintain, but will intensify the interest now created.

"Have I had any unusual experiences to date? Yes, many of a most pleasant character, some amusing, and one or two sad. The most delightful, unquestionably, have been the numerous letters of appreciation, seasonable cards and gifts to charities, to my staff and myself from ' children of all ages.' We broadcasters have struck a world of live fairies, open-hearted folk quite apart from the world as presented in everyday life. I can assure you that no day is too long in which to work for such a community. I only wish it were possible, too, to reproduce some of the hundreds of letters expressing in ' baby language ' the delight our bedtime antics have given to the young folk.

" Wireless humour takes many forms. During the last week of Grand Opera we were threatened with shooting if we permitted interpolations during the performance of ' Valkyrie.' You noticed, perhaps, that there were no interpolations. This was not due to the threat, but to the fact that ' Valkyrie ' did not lend itself to such treatment.

" Amongst the humours of broadcasting we can class many amusing criticisms in prose and rhyme, not excepting letters sometimes suspiciously feminine in origin respecting the identity and domestic life of those who take part in the wireless programmes. The erroneous suggestion, too, that we have come under church influence in our decision not to broadcast during the hours of Divine worship, has caused many a smile amongst those concerned.

" Midway between humour and the pathetic are to be found such things as requests in all good faith that we should broadcast messages to the planetary system, or jam certain other stations alleged to be exerting a malign influence over those within range.

" A few days ago as I was leaving for lunch, a stranger requested an interview on an urgent matter. He approached me in a most business-like way, stated that despite the character of

" The Wireless Orchestra " at 2LO *poses for "The Wireless World." Standing on the right is Mr. Stanton Jeffries, Musical Director of the British Broadcasting Company.*

his story he would come to the point at once. Would I kindly broadcast without delay the fact that his wife and £40,000, their joint property, had just been abducted ?

" What are our plans for the future ? Well, the first business is to get all the necessary stations functioning. Cardiff is practically ready, and may start any day. Glasgow will have a station working before the end of March.

" Our ambition then will be to so ring the changes in the style of programme that every popular interest will be catered for at reasonable intervals. We hope to settle our programmes a week and possibly a fortnight ahead, so that listeners-in can adjust their several engagements so as to meet their wireless tastes. There is no form of entertainment under the sun that can claim the attention of its adherents seven nights a week and yet not surfeit them.

"Whilst the concert side of broadcasting will always have a strong appeal, I believe the permanence of this new development will depend rather on the manner in which the instructional and educational sides are developed. The wealth of romance yet untouched which lends itself peculiarly to treatment by wireless, is enormous; our task is to find persons capable of recognising the raw material, refining it, and able to present it in an attractive form.

"It may be taken for granted that the success of the Covent Garden experiment will lead to other equally important applications. We have shown that intricate musical sounds can be collected from a building without any interference with its structural or acoustic arrangements. How much less difficult should be the broadcasting by similar means of human speech, and how great the field here awaiting development.

"I would, however, ask indulgence in one respect. We are yet without permanent offices, owing to certain circumstances of a technical character. Until our new and permanent studio is ready, there are limitations upon our programmes which would not otherwise exist, difficulties which only arise when dealing with music on a large scale.

"*The Wireless World and Radio Review*, which I regard as specially catering for the experimenter, will perform a kindness if it permits me to express to those possessing transmitting licences, my high appreciation of the sacrifices which they must have made in foregoing transmission during broadcasting hours on the wavelength fringing the broadcasting band. No one is more sensitive than myself to the kindness of these experimenters, and I regret if in calling isolated defaulters to order, we may have attached to others in any one locality a suspicion that was unjustified. We would like the class of true experimenter to know that they have friends and not enemies in the staff of the British Broadcasting Company, who are appreciative of the fact that the progress made by Britain will be dependent to a marked degree upon the co-operation of all followers of this fascinating branch of applied science.

"Now I think it is time for a repetition of the old formula—except for this elaboration—2 LO, 5 IT, 2 ZY and 5 NO closing down."

EXAMINING BROADCAST INSTRUMENTS AT THE G.P.O.

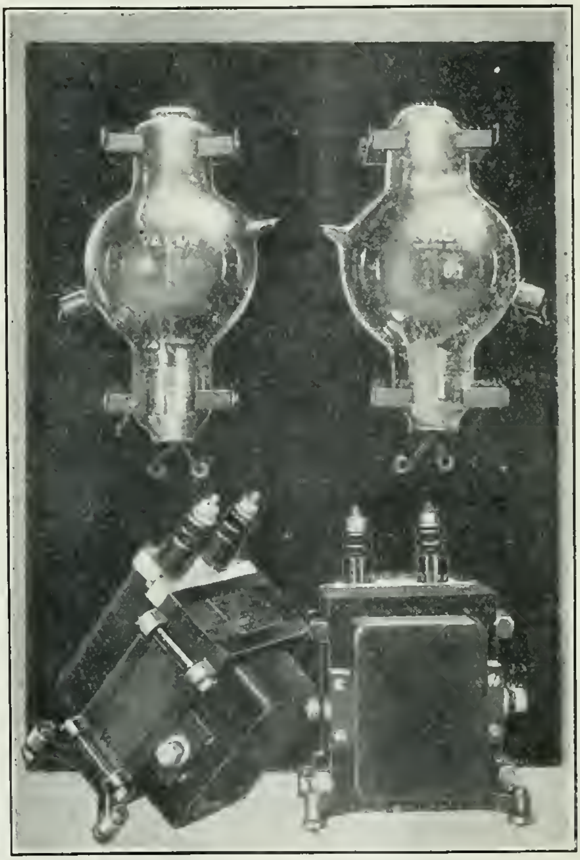
Some of the Apparatus submitted to the Post Office for approval by manufacturers of broadcast receiving equipments.

Experimental Station Design

XIX.—RECTIFIED H.T. FOR C.W. AND TELEPHONY TRANSMITTER.

IN the last instalment under this heading a description was given of the method of setting up a low power C.W. and telephony transmitter. The present article describes a method of obtaining the necessary high potential current required by such a transmitter, and is based on the principle of stepping up moderately high frequency alternating current and rectifying by means of suitable valves.

The first consideration is the transformer which provides the requisite current for heating the filaments of the rectifying valves. It is a low voltage transformer of course, but it is essential that very good insulation be provided between the primary and secondary, as the full high tension potential exists between these windings. Fig. 1 shows the general principles to be adopted in building up a transformer of this kind. Insulation is effected between the windings by means of an ebonite tube having a wall thickness of about $\frac{5}{64}$ in., whilst the secondary winding does not completely cover the primary winding in order to leave insulating surfaces at the ends. These surfaces can be further increased and insulation thus improved, if screw threads are cut upon them, the threads serving also for attaching the end cheeks of the secondary winding. Definite data as to the windings cannot be given, as it will depend upon the power and frequency to be employed, and must be estimated or calculated, final adjustment being made by experiment and the use of a series choke coil if required. The amount of iron employed in the design given is quite suitable for powers up to 100 watts on frequencies exceeding 250 cycles. The core wires of the two limbs are assembled centrally around the soft iron rod and are wrapped tightly together by means of a layer of adhesive insulating tape upon which the primary, which should be a wire having a double cotton covering, is wound. The end primary turns should be held in by means of tapes as was shown in the issue of September 30th last. Tape may also be wrapped over the primary winding, if necessary, in order to make the insulating tube fit tightly. The secondary winding is put on after the cheeks have been fitted in position, the end turns being secured by means of tapes as before. If the making of the screw threads is not convenient the cheeks may be held together by means of an insulating tube which fits over the top of them, and to which they are attached by a number of 6 BA screws. If



Rectifier Panel with a pair of step-up transformers, which when connected in series, provide a mid-point tap.

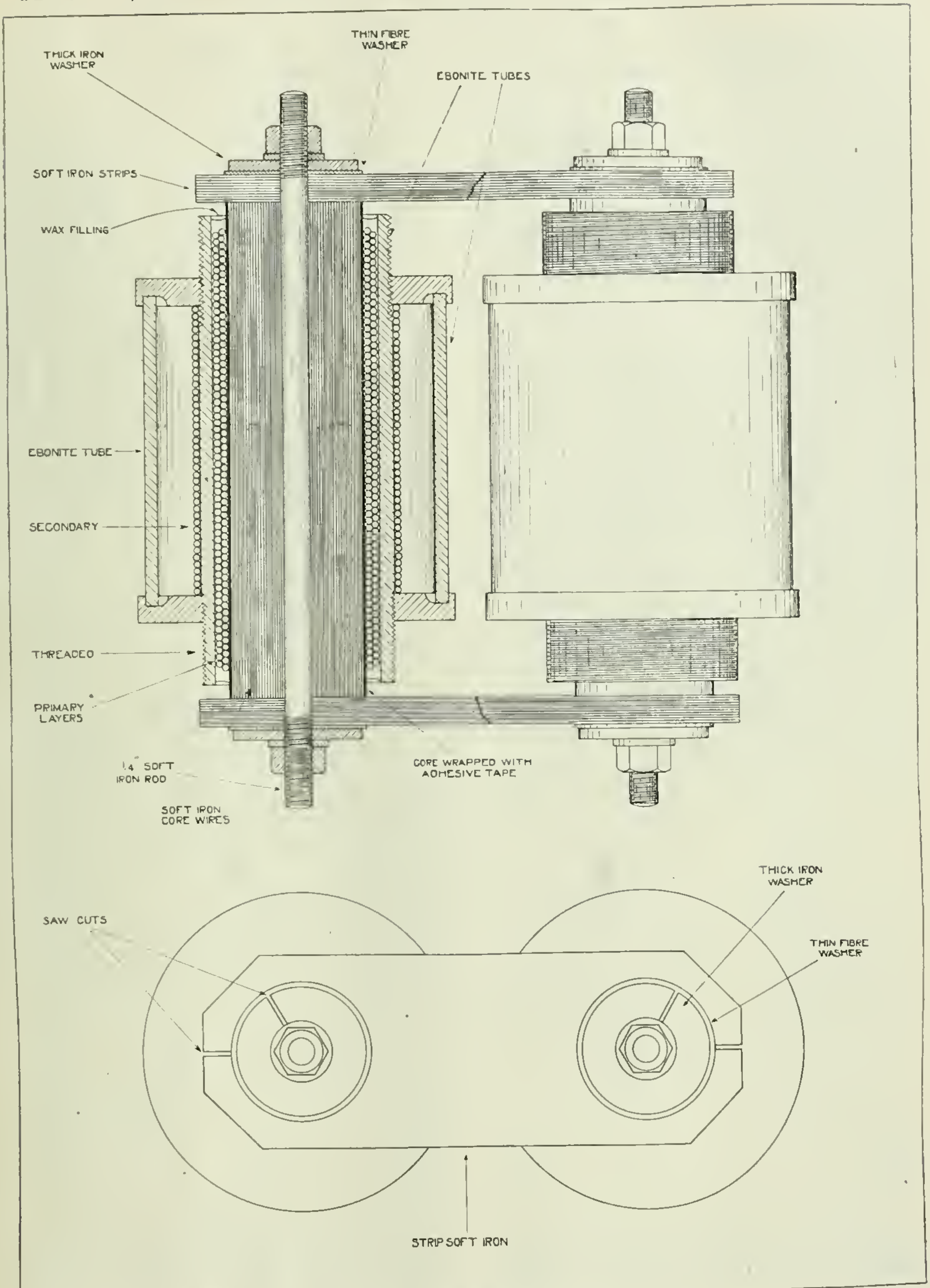


Fig. 1. Filament Heating Transformer. High insulation is provided between primary and secondary winding. Approximately half full size.

this latter arrangement is adopted the cheeks must be a good fit on the tube which covers the primary. With patience these cheeks may be made without a lathe by carefully filing down to scratch lines, and as the screw threads cannot be made without a lathe, it is assumed that a tube will be fitted over the cheeks and consequently the grooves on their inner faces will not be required. On the completion of the cores with the windings hot wax is run into the ends of the primary.

The end plates are cut from soft iron strip, which can easily be obtained in almost any width. Each plate is drilled in turn, and the saw cuts which are provided in order to minimise eddy current loss are made when the plates are clamped together in the vice. Stiff washers are placed under the end nuts, and in order to provide a little "give," thin fibre washers are arranged under them. There is no difficulty in assembling, if the core wires are all true to length, and there should be no difficulty in this respect as they can be purchased already cut to any exact inch.

A second transformer will be required to provide a step-up in potential. In outline it may be similar to the one described above except that the secondary winding will consist of a large number of turns of No. 30 or 32 S.W.G. single silk-covered wire. The secondary will consist of a number of flat disc windings about $\frac{1}{8}$ in. in width. These must be wound on a former consisting of spindle, spacing washer and two flat plates. A larger space must be given between the two limbs of this transformer in order to eliminate any chance of sparking across.

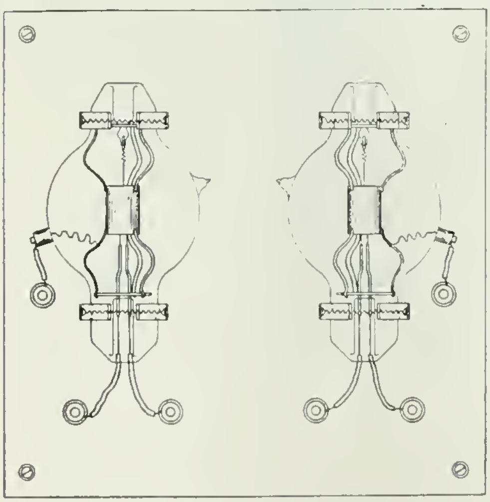


Fig. 2. Lay-out of Rectifier Panel.

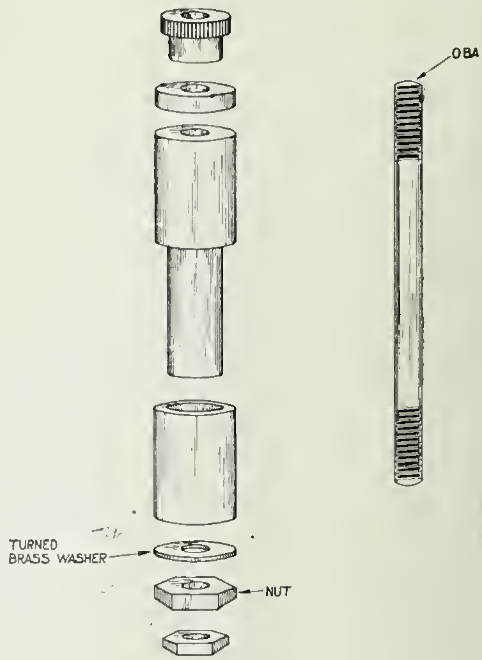


Fig. 3. Insulating Bushes.

The type of valve adopted for rectification obviously governs the design of the panel. The reader is recommended to adopt valves of liberal rating with regard to the power he proposes to use. The panel shown in Fig. 2 is arranged to carry valves rated up to 100 watts capacity, though they can be operated with a much smaller output. The panel is of polished slate, such as can be obtained from specialists in this class of work, and who advertise from time to time in this journal. Slate can be easily drilled with an ordinary morse drill and brace, though it should be remembered that the size of the hole will be slightly larger than the size of the drill with which it is made. This is important when making the holes which carry the ebonite bushes for the filament and plate leads. A design for these bushes is given in Fig. 3, being turned in ebonite. For simplicity ebonite tube $\frac{1}{2}$ in. in diameter, and having a $\frac{1}{4}$-in. hole, may be adopted, and the actual leads from the valves passed through these tubes, which must fit tightly in the holes made in the slate.

Holders for the valves are shown in Fig. 4, in which sufficient detail is included to show the method of construction. Fig. 5 is the circuit diagram of the rectifier. The condenser shown across the secondary of the plate current transformer may not be necessary, as will be shown by experiment, and in any case should not have a value exceeding 0·0003 μF. The other condensers which are for the purpose of smoothing out ripple, must, like the one just mentioned, be capable of standing high potentials, and consequently should consist of a number of mica condensers assembled together and connected in series. If the reader attempts to make condensers of this sort himself, he must select the best ruby mica for the purpose. If it has a thickness of 0·002 in. then four condensers in series should be suitable for voltages not exceeding 1,800. The capacity of these condensers will depend upon the frequency of the generator and for a frequency of 300 cycles condensers having a value of 0·2 μF will suffice. One is cautioned against operating the rectifier without taking a load. If this is done there is a great danger of breaking down the condensers. The choke coil shown between the condensers may have similar core construction to that adopted in Fig. 1, but possessing only one winding of No. 28 S.S.C. on each limb, and if these windings are well insulated from

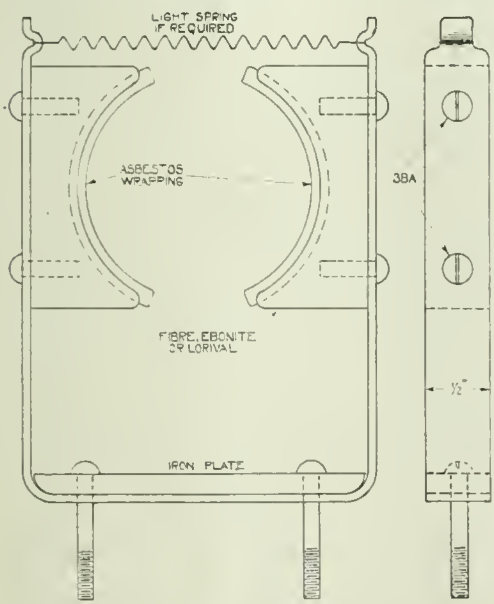


Fig. 4. Clips for supporting valves.

one another, better smoothing effects may be obtained by correcting one in each lead from the rectifier, making sure, by experiment, that they are correctly connected as to direction The outfit described above might appear to involve a big expenditure, but the reader

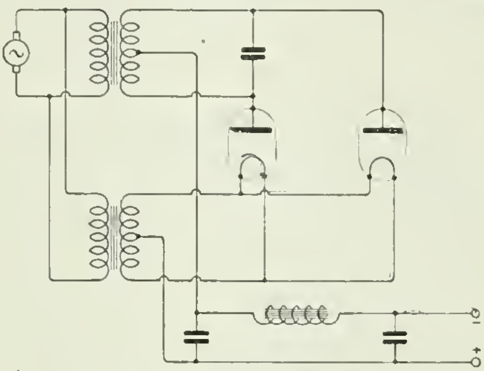


Fig. 5. Circuit of Rectifier.

whose purse is limited is reminded that there is still a great deal of second-hand high tension transformer apparatus on the market which is admirably suitable for stepping-up or choke purposes, or if rewound can be used for filament heating. Owing to the somewhat limited demand for this class of apparatus, the prices are by no means excessive. F. H. H.

Note.—Although it was the original intention in articles under this heading to give designs of special value to the beginner, departure has had to be made owing to the widespread demand for particulars of simple telephony transmitting apparatus. Now that the information has been placed on record, this space can in future issues be allotted to articles of a less advanced nature.

Dimensions of the Amateur Aerial

Although the regulations relating to dimensions of aerials permitted for amateur and broadcast reception purposes have been published in this Journal, and also frequently stated in replies to queries in the Questions and Answers columns, there still appears to exist some doubt on the matter. The maximum aerial length is stated as 100 feet, as measured from the far end of the aerial to the aerial terminal of the apparatus. Multiple aerials, consisting of a number of wires, each totalling 100 feet with the down lead, may be adopted, and from this point of view it would appear that when a "T" pattern aerial is employed, only one-half of the horizontal length is taken, in estimating an aerial arrangement conforming to the regulations.

Electrons, Electric Waves and Wireless Telephony—XVIII.

By Dr. J. A. FLEMING, F.R.S.

4. Reception of Wireless Telephonic Speech.

We have then to describe the arrangements in the practical receiving apparatus. The use of a single rectifying valve or a crystal in the receiving circuit as already described is only suitable for short ranges of 10 or 20 miles, or so, from fairly powerful transmitters. In actual wireless telephony over great ranges it is necessary to employ amplifying valves to magnify the oscillatory currents in the receiving circuits.

We have already explained that this amplification can take place on the high frequency currents set up in the aerial wire and associated circuits by the carrier waves, or it may be effected after rectification of the high frequency

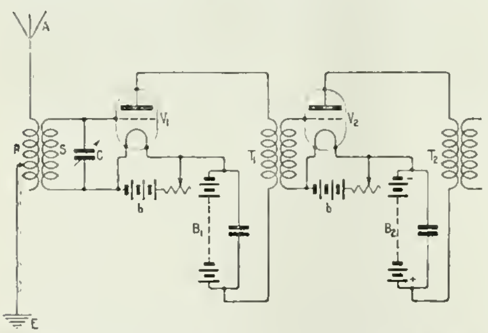


Fig. 96. Arrangement of two or more amplifying valves for magnifying the feeble oscillations in the aerial wire A. V_1, V_2, are the thermionic amplifiers T_1, T_2, the coupling transformers and B_1, B_2, the plate batteries.

currents into low frequency or speech frequency varying currents. The former is termed *radio-amplification* and the latter *audio-amplification.* In the case of radio-amplification the feeble currents set up by the carrier waves in the aerial wire *A* (see Fig. 96), are caused to induce other similar currents in an associated and tuned coupled circuit, comprising a condenser *C* and inductance coil *S*. A three-electrode valve has its grid and filament respectively connected to the terminals of the tuning condenser *C*.

The variations of potential thus produced in the grid cause similar changes in the plate current of that valve supplied by the high tension battery as already explained.

This plate current may include the primary coil of a transformer consisting merely of two insulated wires wound on a bobbin, but without any iron core.

The secondary circuit of this transformer may have its terminals connected respectively to the grid and filament of a second valve, and the same arrangements may be made for a third valve. If, then, the first valve and associated transformer magnify the grid-potential variations say 5 times, the coupling of two valves and transformers will magnify it 25 times, and a third set 125 times, and so on.

We can, in this manner use several amplifying valves for radio amplification.

If we employ two-coil transformers as shown in Fig. 96, we need then only one high tension battery or dynamo to supply the high potential for the anodes or plates of all the amplifying valves. It is then necessary to explain in the next place the methods by which the three-electrode valve operates as a detector of oscillations. The reader will bear in mind that the carrier electric waves which arrive from the sending station are high frequency electric waves of a certain wavelength and amplitude, or wave height. The effect of speaking to the microphone in the transmitting plant is to alter the amplitude of these waves, but not their wavelength. The amplitude varies in accordance with the wave form of the speech sound, so that we may say that the oscillations produced by the carrier waves in the receiving aerial consist of very rapid or high frequency electric currents, which also have slow or low frequency variations of amplitude superimposed. These slow variations of current correspond to the speech waves made at the sending end. The radio-amplification increases or magnifies these currents all in the same ratio.

We have then to impress these slow variations upon a receiving telephone. It would be no use, however, to insert a telephone receiver in the plate circuit of the last radio-amplifying valve, because a telephone receiver contains a coil of wire of many turns wound upon the iron pole pieces of a magnet. Such a circuit has a very large inductance, which means that rapid changes of current cannot take place in it. Hence the telephone coil will not permit the passage through it of a high frequency alternating current. It offers too much *impedance*, as it is called, to such a current. Moreover, the mean value of these high frequency oscillations of varying amplitude is constant. We have therefore to insert in the valve receiving arrangement a rectifying valve to change these high frequency currents of fluctuating strength or amplitude into pulsating electric currents always flowing in one direction. This can be done by taking advantage of the form of the characteristic curve of the valve.

It has already been explained that when we give to the plate or anode of the valve a positive potential, electrons are drawn away from the filament, and this electron stream is generally increased by giving the grid a still greater positive charge. There is, however, a limit to this electron current which is fixed by the temperature of the filament, and it cannot be increased beyond a certain amount at any given filament temperature. This limiting current is called the *saturation current* at that temperature. Corresponding to this saturation stage the characteristic curve has, therefore, a bend or change of direction. In the same manner, if we give the grid a gradually increasing negative charge, and thus steadily diminish the electron flow from the filament, we find the characteristic curve at the lower end bends over. Suppose, then, that we give the grid of a valve a negative potential, say about 4 volts compared with the filament, and then superimpose on this steady grid voltage a feeble high frequency alternating voltage. It will be clear that when the small alternating potential makes the grid negative, the thermionic current or electron stream from the filament cannot be much reduced because the grid has already been made strongly negative. When the alternating potential applied to the grid is positive, then the electron stream is sensibly increased. The result, then, of imposing a

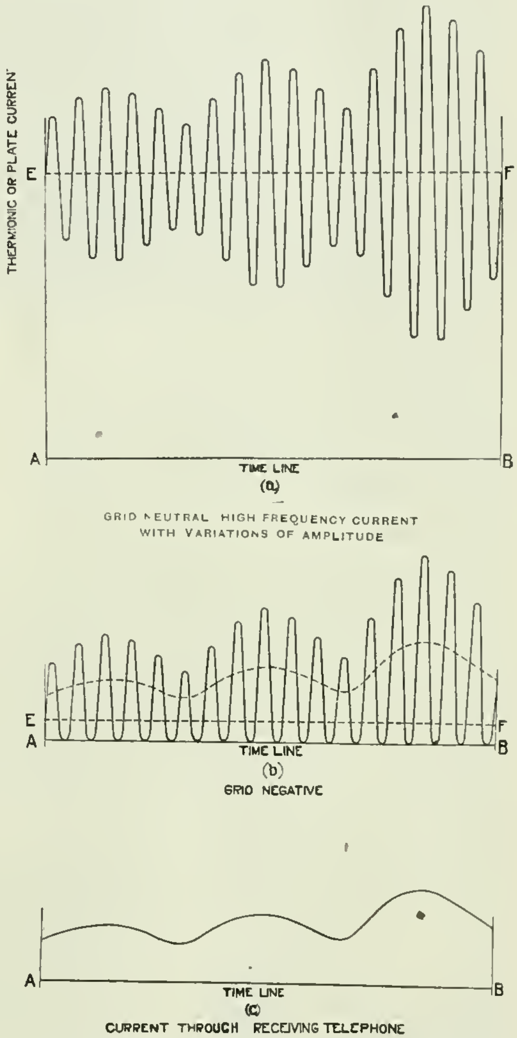


Fig. 97. Diagrammatic representation of rectification and the mean value of the rectified currents which operate the diaphragm of the telephone.

feeble alternating potential on the grid in addition to a steady negative potential is to increase on the whole the electron stream from the filament.

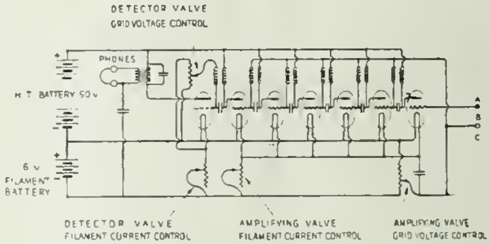
If, then, the alternating potential suffers changes of amplitude, as it does when the carrier electric waves are changed in height by speaking to the microphone in the transmitter, the electron stream of the detecting valve will experience similar increases in mean strength, although there are also rapid variations in the current. The actual changes produced in the currents will be best understood by a series of diagrams.

In Fig. 97 in the upper diagram (*a*) the ordinates of the curve represent the high frequency current in the receiving circuit as magnified by the radio-amplification. This current has low frequency variations of amplitude superimposed upon its high frequency, but the mean value of the current is always the same. The second diagram (*b*) shows the effect on this current of the detecting valve, the grid of which has a steady negative charge given to it. Since the electron current cannot then be much decreased, the effect of the additional negative charge given to the grid produced by the superimposed alternating potential is extremely small, but the effect of the positive charges is to increase the electron current.

The mean value of the current therefore fluctuates, as shown by the ordinates of the dotted line in diagram (*b*). If then the plate circuit of the detecting valve has included in it the coils of a receiving telephone, the rapid variations of current would produce no effect in the telephone, but the slow variations of the mean current cause the diaphragm of the telephone to vibrate, and its motions correspond to the slow or audio-variations in the amplitude of the carrier waves. Hence the receiving telephone will reproduce the speech sounds made to the transmitting microphone, the energy being conveyed by the carrier waves as above described. We can also employ one or more amplifying valves to increase the amplitude of the rectified low frequency speech current variations, which is termed audio-amplification.

For this purpose one or more three-electrode valves are placed after the detector valve, and have induction coils inter-connecting their grid and plate circuits exactly as in the case of the radio-amplifying valves. These induction coils or transformers may have cores composed of bundles of fine iron wires, which increases their effect, and has no disadvantage in the case of the transformation of low frequency oscillations. We can thus employ two or three audio-amplifying valves and put the telephone receiver in the plate circuit of the last valve, as shown in the diagram in Fig. 98.

A multiple valve receiver may therefore comprise two or three radio-amplifying valves, a detector valve, and one or two audio-amplifying valves. The Marconi Company have designed a seven-valve receiver, in which six of the valves are radio-amplifying, and the seventh and last valve the detector valve (see Fig. 99).



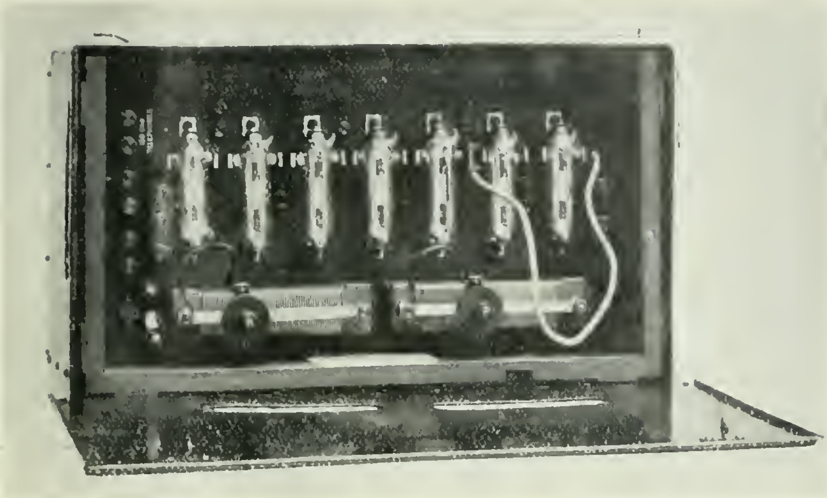
By Courtesy of M. W. T. Co., Ltd.

Fig. 98. Scheme of circuits of a seven-valve thermionic receiver with amplifying valves and detector or rectifying valve.

A simple form of valve-receiving circuit comprises a single detector valve, the grid of which is connected to one terminal of the tuning condenser in the receiving circuit, and also a single audio-amplifying valve with a telephone receiver in its plate circuit. The necessary negative potential is given to the grid of the detector valve by means of an arrangement called a *potentiometer*.

A long fine wire wound on a suitable support has its terminals connected to a few cells of a battery, which may be the filament heating battery. By means of a sliding contact we can connect a point on this wire to the grid, and by changing the position of this slider apply to the grid a negative potential, or two or three volts or more, as required, to bring the plate or electron current of the valve to that point on the characteristic curve which corresponds to the beginning of the lower bend of the curve.

In order that telephonic speech may be transmitted without distortion, it is essential that the radio-amplifying valves should have a characteristic curve which is nearly straight or flat in the central part. It is only under this condition that the complicated changes in the plate current will follow exactly the complicated changes in grid potential, and hence amplify without distorting the wave form of the

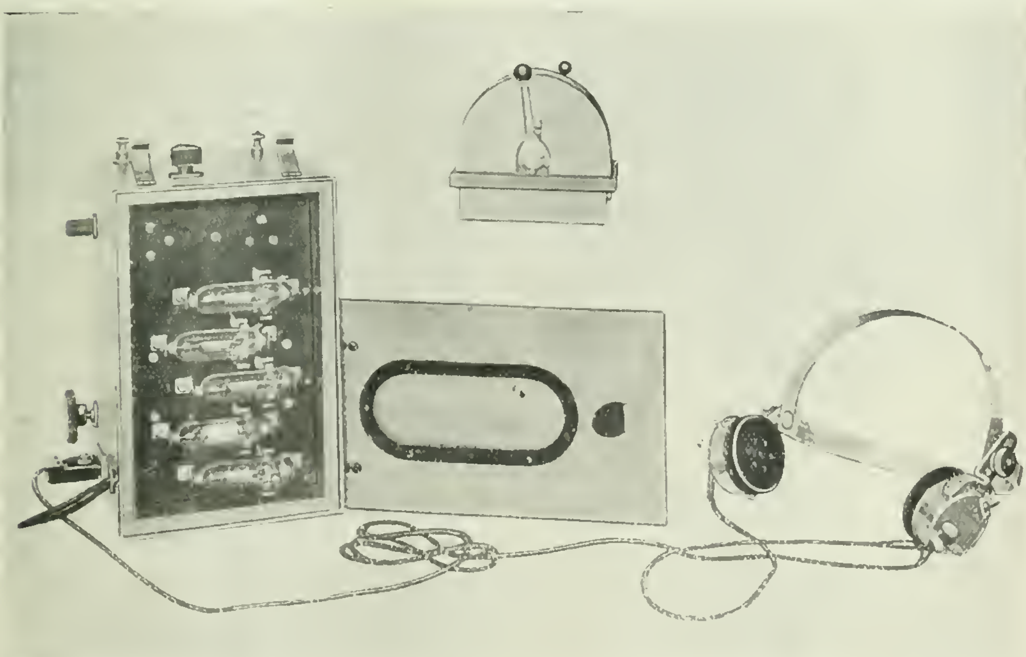


By courtesy of—M. W. T. Co., Ltd.

Fig. 99. A view of a seven-valve receiver as made by Marconi's Wireless Telegraph Company.

oscillatory currents. This result is achieved by certain precautions in the design of the amplifying valves.

We have already explained that in a valve transmitter for wireless telephony there must be a valve, the plate and grid circuits of which are coupled inductively to produce high frequency oscillations in the plate circuit and radiate carrier waves from an associated aerial as in Fig. 101. We have then to modulate the amplitude of these carrier waves by means of a carbon microphone in accordance with the



By courtesy of—M. W. T. Co., Ltd

Fig. 100. Aircraft receiving set comprising three high frequency amplifying valves, a detecting valve and one low frequency amplifying valve connected to the head telephones through an induction coil.

wave form of the speaking voice. One way of doing this is by coupling a microphone *M* inductively, that means by means of an inductance coil or transformer to the plate circuit of the generating valve as shown in Fig. 101. This method has disadvantages in practice.

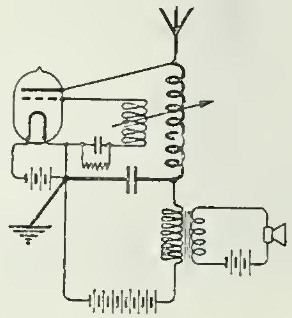


Fig. 101. Circuits of a simple form of Wireless telephone transmitter with the microphone M inductively connected to the plate circuit of the valve.

A better method of varying the amplitude of the carrier waves by means of the speech microphone has been called *choke control*. It has been found very suitable for the telephone transmitters of aeroplanes on account of its great simplicity.* It employs a power and a control valve, which both derive their filament heating and plate currents from the same low and high voltage batteries (see Fig. 102). The plate or anode of the control valve is connected to one end of a large inductance or choking coil having an iron core, marked *L* in the diagram. The high frequency currents set up in the aerial wire by the power valve cannot pass through this choking coil, but find their way to earth through a condenser *C*.

The steady or direct current from the high voltage battery marked H.T., can, however, pass through the choking coil. When speech is made to the microphone the potential of the grid of the control valve is varied, and also low frequency variations are produced in the plate current of the control valve. These changes of current strength produce large

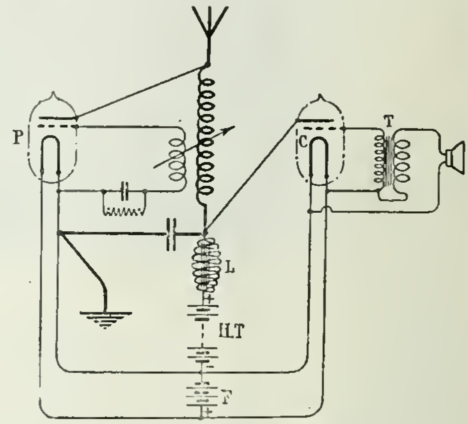


Fig. 102. Arrangement of circuits in a wireless telephone valve transmitter called a "choke control" because it employs a choking coil L or large inductance.

variations in the potential at the upper end of the choking coil *L*, which increase or diminish in a very marked and corresponding manner the plate current of the power valve. These surges react through the inductive coupling of the grid and plate circuit of the power valve upon the grid potentials. Hence the effect of speaking to the microphone is to make large percentage changes in the amplitude of the high frequency oscillations set up in the aerial, and therefore upon the amplitude of the radiated waves.

* See Major C. E. Prince, O.B.E., "Wireless Telephony on Aeroplanes."—*The Journal of the Institution of Electrical Engineers.* Vol. 58, p. 377. May, 1920.

(*To be continued*)

Elementary Lecture and Demonstration.

An Elementary Lecture entitled "Fundamental Principles of Radio Reception," with Experiments, will be given on Friday, February 16th, at 6.30 p.m., by Mr. Maurice Child at the Institution of Electrical Engineers, Victoria Embankment. This is the second of a series of Elementary Lectures arranged by the Radio Society of Great Britain.

Refinements in Receiving Circuits

IT is the object of the present note to bring out one or two points in connection with a valve receiver which make for louder and better quality signals. The diagram Fig. 1 gives the connections of the four-valve receiver.

The switch in the aerial circuit is for the purpose of connecting the aerial tuning condenser and inductance in series or parallel for short or long wave reception respectively. A small condenser, which may consist of two fixed and one moving plates, is connected for fine tuning.

The secondary circuit is connected one side with the grid and the other with the potentiometer. The potentiometer has a resistance of the order of 350 to 450 ohms. A two-coil holder is used to accommodate the anode inductance and reaction coil, and a throw-over switch is provided for the purpose of transferring the reaction connections from position A to B. When receiving broadcast transmissions, the reaction coil A should be used; when receiving longer wavelength signals, the switch may be moved to B, and a coil plugged into one of the three coil holders.

By operating the potentiometer, the potential of the grids of the first two valves may be varied for maximum signal strength.

If the receiver possesses an inherent tendency to oscillate easily, the grids may be made slightly positive, with the result that a small grid current will flow and tend to prevent the generation of oscillations.

The anode circuits are supplied with potential from the tapped H.T. battery, and generally 60 volts will be found best.

A large number of wireless enthusiasts are now using a loud speaker to render signals audible throughout a room. The loud speaker is a power operated instrument, and signals cannot be properly reproduced when there is insufficient power available. An ordinary "R" type valve is rarely used in a manner such that its full capacity is utilised.

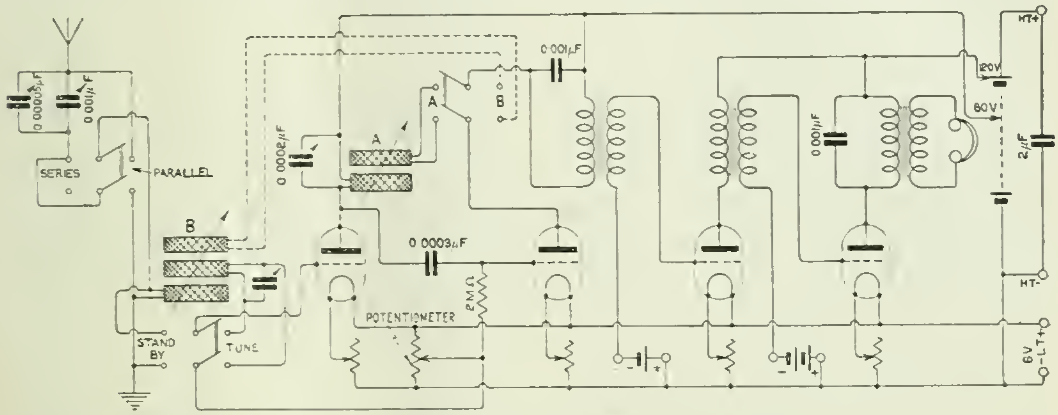


Fig. 1. A four-valve receiver embodying several refinements.

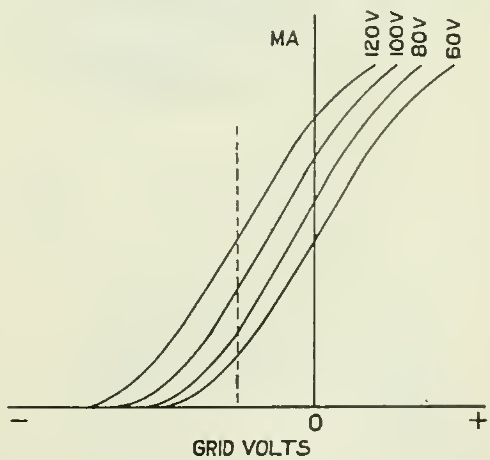


Fig. 2. Typical characteristic curves of a receiving valve.

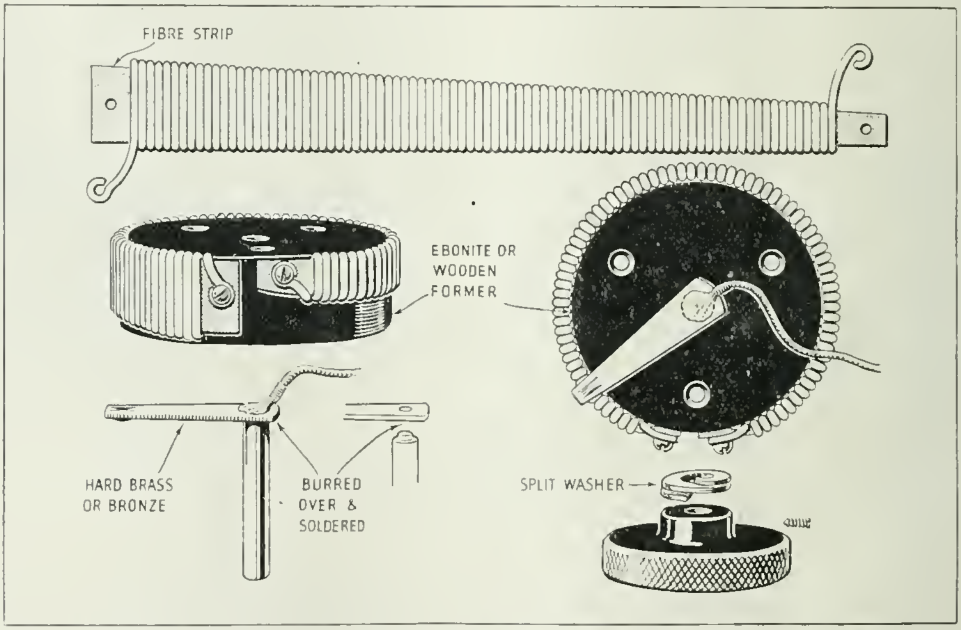
Referring to the figure, the last two valves are provided with a tapping plug, and voltages up to 120 may generally be safely used, provided good transformers are employed.

If characteristic curves showing the relationship between grid potential and anode current are examined, it will be found that increase in the anode potential moves the curve to the left. In Fig. 2 it will be seen the higher the H.T. voltage the further is the central point of the curve shifted from the line of zero potential, and a negative potential should be applied to the grid, otherwise the tops of the portion of signals to the right of the normal grid potential will be cut off.

A few grid cells are therefore shown connected in Fig. 1, for the purpose of preventing distortion, and to obtain the full output from the valve. Generally two or three dry cells are sufficient. To prevent saturation of the valve, the filament must be sufficiently heated. In general the filaments of the last two valves will be brighter than those of the previous valves, although the filament should be no brighter than is required by the signal. The life of a valve filament is greatly reduced by only a small increase in the temperature.

A Simple Type of Filament Resistance

THE accompanying drawings show a type of filament resistance which not only possesses some rather original features, but is also of a design which can easily be made up by the experimenter who does not possess elaborate workshop facilities.



Constructional details of rheostat, showing method of obtaining uniform current adjustment.

A special feature is that the former on which the resistance wire is wound is made to taper in order that the resistance change for a given movement of the adjusting knob may be uniform. It is thus possible to give the desired degree of critical adjustment just where it is wanted. For instance, if the wider portion of the resistance is thrown in circuit first, the percentage change in resistance value will be uniform as the sliding contact advances. When the filament is bright and the amount of resistance in circuit small, only a very slight change in resistance is required to cause a somewhat big change in the value of the current flowing, thus the end of the maximum current is made narrower.

The resistance wire should be about 22 gauge for controlling a single valve, and 20 gauge for two or three valves operated by a common rheostat. It should be wound on a piece of fibre of about 1/16 in. in thickness, carefully filed smooth at the edges, and if desired, file marks may be made for the purpose of holding the turns of resistance wire in position.

A cylindrical piece of wood or ebonite of about $1\frac{3}{4}$ ins. in diameter and $\frac{1}{2}$ in. thick, may be employed to support the resistance winding. The fibre with the wire wrapped upon it should be bent tightly round the former, and care must be taken to avoid breaking the fibre by giving too much bend at one point. It may be attached by two No. 5 by $\frac{1}{2}$ in. screws if the former is of wood, or by 4 BA screws if ebonite is used. These screws also serve to terminate the ends of the resistance wire.

The rubbing contact is made from a piece of phosphor-bronze spring, German silver, or hard brass. The end which makes contact with the resistance wire may be tapered in order that it may not short circuit too many turns, and if a bend is made so as to form a curved surface, the contact will have a smooth movement.

The spindle to which it is attached is reduced in diameter at its end by careful filing in order to present a shoulder. The small diameter portion is made to just pass through a hole in the contact arm, and then, by careful hammering, the spindle may be reverted to the arm.

Using a suitable flux, a wire may be soldered to the reverted end of the spindle for the purpose of making contact, and also to ensure a solid union between arm and spindle.

Other details of design will depend upon how the experimenter proposes to assemble the rheostat to his panel. If there is no objection to a number of screw heads appearing on the face of the instrument, three holes (tapped in the case of ebonite) are made in the former to which the resistance winding is attached. Alternatively, clearance holes may be made in this former, the panel itself being tapped to take the screws (probably 4 BA) which hold the former to the face of the panel.

The experimenter who does not desire to make use of tapped holes, can use long 4 BA screws with back nuts. The hole in the centre of the former being $\frac{1}{2}$ in. in length, will serve as an excellent bearing for the spindle, which should be a good fit. If a split bronze washer is placed on the face of the panel and held down by the knob, it will help to pull the spindle forward, and so ensure a satisfactory spring contact between the contact arm and the resistance wire. The knob may be held by means of a small grub screw, or threaded on to the spindle with lock nut.

This type of rheostat is of easy construction, and it may be adopted by the man who constructs his own apparatus, as a standard fitment.

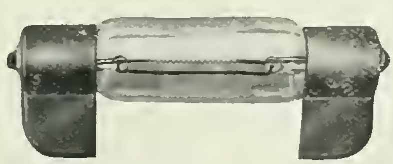
By increasing the diameter of the former, the length of the fibre strip this time having parallel edges, and winding with finer resistance wire, say No. 30 S.W.G., the same principle can be adopted for the construction of a reliable type of potentiometer.

Barretter Tubes.

A device of considerable interest to the experimenter, and largely used on the Continent, is shown in the adjoining photograph. It is a small tube with end connecting lugs and filled with hydrogen. In circuit between the lugs is a fine wire of a special alloy, the resistance of which rapidly increases with an increase of the current passing through it.

It will thus be seen that such a device, when connected in series with a valve filament, is very useful for limiting the amount of current that will pass, and consequently reduces the danger of burning it out.

These tubes are designed and rated to pass a given current, and the variation in current flow, over a wide range of battery potential is extremely small, so small in fact that the filament brightness may be relied upon to be of a given degree, irrespective of the battery voltage, within certain wide limits.



A familiar type of Barretter tube of foreign manufacture.

A Simple Reinartz Tuner.

THE article on the Reinartz tuner, which appeared in the May 13th, 1922, issue, fired the writer's ambition to make up one of these tuners. This has turned out so well that probably other readers may like to benefit by the experience gained.

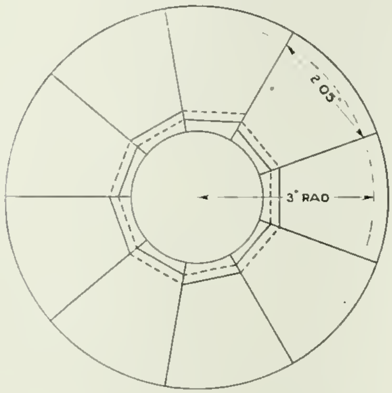


Fig. 1. Dimensions of card former.

First a coil was wound on a card, after the fashion described in "Experimental Station Design II," June 10th issue. A $\frac{1}{4}$ lb. of No. 26 D.C.C. was more than enough.

Lest anyone repeat an early error of the writer's, it should be remembered that the card must have an *odd* number of slots. Round a circle of 3 ins. radius, steps of 2·05 ins. produce nine equal divisions (other sizes in proportion).

The card actually used was of $3\frac{1}{4}$ ins. radius, and the slots were deep enough to start winding at $\frac{3}{4}$ ins. radius. The following procedure was gone through and reference should be made to Fig. 1 :—

Beginning, labelled "30"; wind 10 turns, tap and label "20"; wind 10 turns, tap and label "10"; next, 10 more turns, and then cut off and label "0" leaving enough wire to run to terminal "R.C. 1." Start afresh, labelling beginning "9"; 1 turn, label "8," and so on to "0" and leave enough wire to run to terminal "E and — T.C." Do *not* break the wire but wind on 24 more turns, label "24"; 6 more and label "30" and so on to 36, 42, 49 and 56.

The switch centre for the "24" to "56" tappings is connected to a terminal labelled "G.C."

The switch arm of the "0" to "9" tappings is connected to the terminal labelled "R.C.2" and that of the "0" to "30" tappings to a terminal labelled "P."

For telephony on 400 metres the tuner is ideal with two valves. When connected to an aerial of the usual amateur dimensions, and the three switches set at 56, 3 and 30; R.C. at about 0·00005 mfds., and C.C. at about 0·0001 mfds., the following come in very clearly at Shoeburyness, Essex :—2 MT, 2 LO, 2 IF, 2 ON and others.

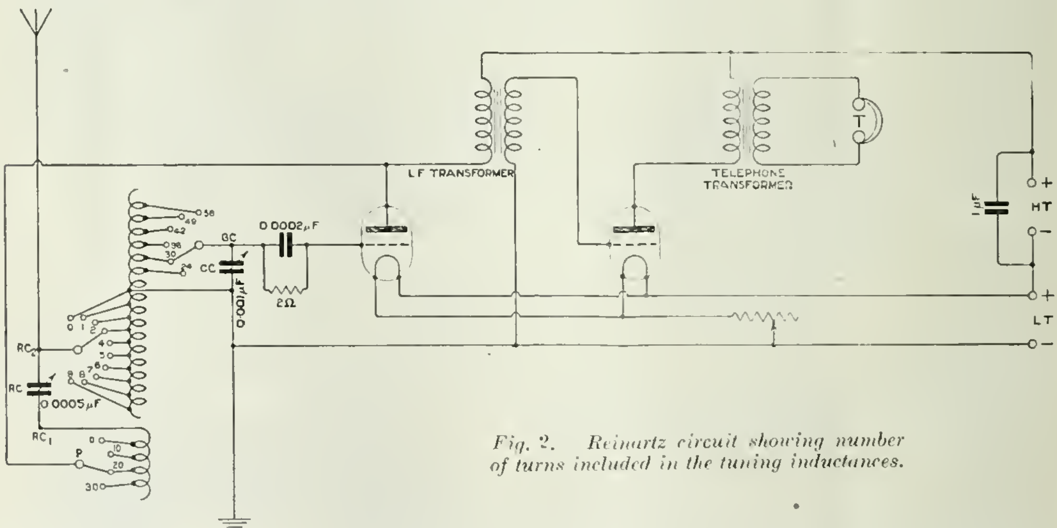


Fig. 2. Reinartz circuit showing number of turns included in the tuning inductances.

If speech is not clear, less reaction should be used.

A slight improvement has been made by adding a card (wound with 44 turns of No. 26 D.C.C. from ¾ in. to 1½ ins. radius) below the main card and connected in circuit at R.C. 1. Probably it would have been better to start the main card at 2 ins. radius, and wind the " 0 " to " 56 " turns on a second card, starting again at 2 ins. radius. This should make the addition of 44 turns to the " 0 to 30 " coil unnecessary.

The second valve is simply connected as shown in the diagram, Fig. 2.

Using the ordinary slab inductances it was found that the same circuit worked well up to 8,000 metres. No trial was made on higher wavelengths. Attention should be drawn to the fact that this circuit is liable to cause interference by radiation, though with a suitable adjustment of coupling of the plate circuit inductance and reaction condenser, the tendency to oscillate can be critically controlled.

The writer feels sure that he is not alone in being grateful for his introduction to the Reinartz tuner.

B. H. E.

The Ideal Home Exhibition

IN the last issue of *The Wireless World and Radio Review*, an announcement was made regarding the Ideal Home Exhibition.

This Exhibition, which is being organised by the *Daily Mai*, will be open from March 1st to 24th inclusive. It should be of special interest to those associated with wireless, since arrangements have been made for a section of the Exhibition to be devoted entirely to wireless exhibits, and every effort will be made to present wireless telephony to the public visiting the Exhibition in an attractive manner.

The organisers of the Exhibition have assigned to the National Association of Wireless Manufacturers the entire arrangements for the wireless section of the Ideal Home Exhibition, and the principal manufacturers of apparatus will be exhibiting. The interest of the wireless section will naturally centre around broadcasting, and for the special use of the wireless manufacturers there has been set apart a concert hall in the Exhibition with seating accommodation for 1,000, and here manufacturers will organise continuous free demonstrations of wireless telephony reception. Every opportunity will be given to the public to appreciate the value of wireless telephony in the home, and one feels confident that every visitor to the Exhibition will leave it with the impression that no home can be ideal unless the benefits to be derived from wireless telephony are taken advantage of.

The following is a list of some of the principal firms who will exhibit :—

Siemens Brothers & Co., Ltd.
Rogers, Foster & Howell, Ltd.
Igranic Electric Co., Ltd.
Radiophones, Ltd.
Marconi Scientific Inst., Co., Ltd.
Automatic Telephone Mfg., Co., Ltd., jointly with
Ashley Wireless Telephone Co., Ltd.
Dubilier Condenser Co. (1921), Ltd.
General Electric Co., Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
Radio Instruments, Ltd.
Telephone Mfg. Co., Ltd.
Western Electric Co., Ltd.
S. G. Brown, Ltd.
The Wireless Press, Ltd.
Radio Press, Ltd.
Fellows Magneto Co., Ltd.
British Thomson-Houston Co., Ltd.
L. McMichael, Ltd.
Electric Appliances Co., Ltd.
Tingey Wireless, Ltd.
Burndept, Ltd.
C. F. Elwell, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Radio Communication Co., Ltd.
Sterling Telephone & Electric Co., Ltd.
A. W. Gamage, Ltd.
H. Stanley Prince, Ltd.
General Radio Co.
Alfred Graham & Co.
L. A. Coomes & Co.
Tomlinson (London), Ltd.

It will therefore be seen that the Exhibition is strongly supported by wireless manufacturers, and there will undoubtedly be displayed the finest selection of wireless receiving apparatus in the world.

This will be the seventh Exhibition under the name of " The Ideal Home Exhibition," to be organised by the *Daily Mail*, and it is a matter of interest that so important a part should be played in the coming Exhibition by wireless telephony.

Wireless Club Reports

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Aberdeen and District Wireless Society.*

Hon. Joint Secretary, Mr. James S. Duthie, 148, Forest Avenue, Aberdeen.

During the month of December some very interesting lectures were given by members of this Society.

On December 8th, Mr. W. W. Inder, M.I.R.E., lectured on the valve, Mr. Robert Cumming presiding, and the lecturer was awarded a very hearty vote of thanks for his interesting and instructive lecture.

A beginning has been made with Morse practice under the tuition of different members of the Society.

On December 22nd a most interesting lecture was given by Mr. Newsam, manager of the Aberdeen Branch of Ediswan Electrical Company, on the construction, action, maintenance and care of accumulators. On the motion of the President, Dr. Fyvie, a cordial vote of thanks was accorded to the lecturer.

The Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

A meeting was held on January 11th at headquarters, St. Mary's Hall, Ilford. Mr. J. E. Nickless, A.M.I.E.E., occupying the chair.

Mr. Grover gave a very interesting lecture on "Elementary Electrostatics." The characteristic curves of two valves were also plotted and Mr. Grover explained the practical uses to which such data could be put.

On Thursday, January 18th, a successful Concert and Demonstration of Wireless Telegraphy was held.

Mr. L. L. Vizard operated his five-valve receiving set and signals were made audible to the whole of the audience by means of a loud speaker kindly lent by Messrs. Radio Instruments, Ltd.

Lambeth Field Club and Morley College Scientific Society.*

(Physics and Wireless Section.)

Hon. Secretary, Mr. F. W. Ling, Physics Laboratory, Morley College, Waterloo Road, S.E.1.

On Saturday, January 13th, the members of the above Society held their first practical evening of the year. The meeting was a great success, and plans for the making of the Society's receiving set were fully discussed.

Messrs. A. E. and V. C. Perry and the Secretary helped several members by explaining how they could make their sets, also giving diagrams of the wiring. Several experiments and demonstrations were given during the evening and a L.F. panel which was being made as a part of a unit set was on view.

The next practical evening was on Saturday, January 27th, when the work on the Society's set was begun.

The Secretary would be pleased to hear from persons interested in wireless.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

The above Society met on Monday, January 15th, when Mr. Wilck gave the first of his elementary lectures on "Electrostactics." This was followed by a descriptive lecture and demonstration of a Burndept "Ultra III" tuner, by Mr. Trussler, at which the concert from Marconi House was picked up and clearly heard all over the hall.

At the close of the meeting a committee meeting was held, and many points discussed, among these being broadcasting problems and the coming meeting of the Radio Society of Great Britain, to which the Society hoped to send three representatives.

Borough of Tynemouth Radio and Scientific Society.*

Hon. Secretary, Mr. J. S. Littlefield, 37, Borough Road, North Shields.

The Society's third annual Exhibition of wireless telegraph and telephone apparatus was held recently at the headquarters, Y.M.C.A. Buildings, North Shields.

The opening ceremony was performed by Councillor A. E. Hill, B.A., Vice-President of the Society, who congratulated the members upon the splendid results of their energies. Councillor Hill was supported by the Deputy Mayor of the Borough.

The Exhibition proved to be an unprecedented success, not only in the number of visitors, but also in the splendid array of exhibits, which were kindly lent by Messrs. Radio Communication Co., Ltd., Burndept Ltd., Mr. H. W. Sullivan, Western Electric Co., Ltd., North Eastern Instrument Co., "Chase Radio," and Radio Instruments, and in addition many members' exhibits.

The thanks of the Committee are due to all those who gave their valuable help in making the Exhibition such a success.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

An ordinary meeting of the Society was held on January 10th at headquarters. In the absence of the Chairman, Mr. J. R. Halliwell took the chair. A discussion was opened on the subject of "Broadcasting," and members present gave their views.

The next meeting of the above Society was held on Wednesday, January 17th, with Mr. Boullen in the chair. As no lecturer had been appointed, the meeting was thrown open to general discussion on wireless matters, and many interesting experiences of members were discussed, including the reception of Covent Garden Opera in Manchester.

Proposed Doncaster Radio Society.

It is proposed to form a Radio Society in the Doncaster district, and all those interested in wireless are invited to communicate with Mr. Ernest F. Brett, 51, Highfield Road, Doncaster.

The Warrington Radio Association.

Hon. Secretary, Mr. W. Whittaker, 68, School Brow, Warrington.

A meeting of the Warrington Radio Association was held in the Y.M.C.A. Lounge on Thursday, January 11th, Mr. F. V. L. Mathias presiding. A very interesting address was given by Mr. W. Whittaker on "Morse Reception" following which Mr. B. Nadin discussed "Hints on Set Making." Both speakers were accorded a hearty vote of thanks.

Before the meeting closed, the Hon. Secretary mentioned that the committee would spare no efforts to make the demonstration on January 25th a great success.

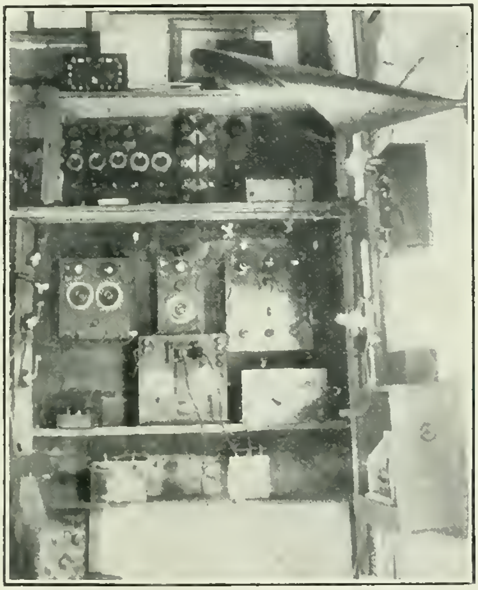
Birkenhead Radio Society.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton.

The fourth general meeting of the Birkenhead Radio Society was held at 36, Hamilton Square, on January 4th.

The chair was taken by Mr, Goodyear. After the usual morse practice, held from 7.15 to 8 p.m., a lecture on "Rectification" was given by Mr. Austin, one of the technical advisers of the Society. The lecture was given mainly for the junior members of the Club, of whom a good many were present. In the lecture given by Mr. Hill at the previous meeting, the production of high frequency oscillations was dealt with. Mr. Austin showed in his paper how these waves were rectified. He dealt with spark transmitters, showing first the action of a crystal in rectifying damped waves, and afterwards the action of a valve.

After the conclusion of this paper, the Chairman explained a few points which were likely to arise and give trouble to the younger members. Mr. Hughes then said, that if any of the members were in any difficulty with their apparatus either he or Mr. Austin would be only too pleased to give any assistance in their power.



Station of Mr. W. G. Fudger (The Picture Palace, Station Road, Godalming, Surrey). Since the photograph was taken the station has undergone considerable development.

Guildford and District Wireless Society.

Hon. Secretary, Mr. R. T. Bailey, 148, High Street, Guildford.

The above Society opened its new headquarters at 148, High Street, on Friday, January 12th, with a general meeting. Mr. S. G. Clarke was voted to the chair, as the Chairman, Ald. W. T. Patrick, J.P., was unavoidably absent. At the conclusion of business the members adjourned to a neighbouring café, where the Chairman (Ald. W. T. Patrick) had very kindly arranged for coffee to be provided.

The new rooms will very shortly be regularly open for members' use, and it is sincerely hoped all local amateurs will become members and avail themselves of the facilities which will be provided.

The Wireless Society of East Dorsetshire.

Hon. Secretary, Mr. E. T. Chapman, Associate I.R.E., Abbotsford, Serpentine Road, Poole, Dorset.

At a general meeting held in Wimborne Council Schools on Wednesday, January 17th, 1923, a unanimous decision was taken against the proposed amalgamation with the newly formed Bournemouth and District Radio and Electrical Society.

Meetings and instructional lectures are being held fortnightly in the Wimborne Council Schools on Wednesdays at 7 p.m., the date of the next meeting being therefore on February 7th. In the event of the rooms not being available on specified day, notice will be circularised by the Secretary.

Swansea and District Radio Experimental Society.

Hon. Secretary, Mr. Herbert T. Morgan, 218, Oxford Street, Swansea.

A very successful meeting of the above Society was held at headquarters, the Y.M.C.A., on Wednesday, January 10th, when a very interesting lecture and demonstration was given by Mr. D. W. Walters, of Gowerton, entitled "Hints on Tuning."

By permission of the Postmaster-General, an aerial was erected, and a wireless receiving set had been installed, and this was used by the lecturer for demonstration purposes.

The President of the Society, Capt. Hugh Vivian, occupied the chair, and gave a very encouraging address, prophesying a very bright future for the Society. Later in the evening, Continental telephony was listened to on a loud speaker.

The Society has a very interesting programme for the season, and all interested in wireless are invited to join.

Birmingham Experimental Wireless Club.

Hon. Secretary, Mr. A. Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

An instructive and enjoyable lecture was given before the above Club on January 12th by Mr. B. A. Matthews, the subject being "The Construction of Three-Valve Receivers." The lecturer gave a very successful demonstration with a three-valve set of his own construction, and the methods of wiring for various circuits were lucidly explained.

Mr. Matthews described his experiments with various circuits, and the means by which the apparatus had been evolved from the original single valve set by slow stages was of special interest to the new members present who are busily engaged on building sets of their own.

The North Essex Radio Society.

Hon. Secretary, Mr. F. T. Smith, Felsted, Essex.

Demonstrations and lectures organised by the above Society and conducted by the Secretary are being given in outlying districts in aid of charities. The last occasion was on Wednesday, January 3rd, when the hall at Felsted was crowded out, and a good sum resulted for the benefit of Dr. Barnardo's Homes.

The apparatus used on these occasions has been kindly lent by Mr. Gordon Castagnoli of Braintree. The audiences were much interested in the fact that the same instruments used for the demonstrations had also received American broadcasting, and some seemed desirous of continuing the performance until 1.30 a.m. on the chance of hearing **WJZ**.

Wanstead Wireless Society.

Hon. Secretary, Mr. A. B. Firman, 18, Clavering Road, Wanstead Park, E.12.

At the meeting of the society held on Thursday, January 11th, Mr. Hunt, B.Sc., a member of the Society, read an extremely interesting paper, his subject being the "Genesis of Wireless."

Aptly illustrated by descriptions of experiments and analogies, the lecture was much appreciated by all those present.

Members were reminded of Major Parker's visit to the Society on January 25th, when he delivered an extremely interesting lecture on "C.W. Oscillation and the Functions of Component Parts of a Receiving Set," and which was illustrated by lantern slides.

Meetings are held every Thursday evening at St. Gabriel's Church Hall, Aldersbrook Road, E.12., at 8 p.m.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. More, 175, Leavesden Road, Watford.

This Society has been very fortunate in securing the services, as lecturer, of Mr. Christie, late wireless instructor Royal Navy. His opening lectures, entitled "The Evolution of Wireless" and "Detectors," were followed on Friday, January 5th, by a lecture on the Fleming valve. He gave a brief survey of his previous lecture, describing the action of the coherer, the electrolytic detector, the magnetic detector and the crystal, finally bringing his audience to the two-electrode valve.

A most interesting and instructive lecture was concluded by some helpful hints on operating single valve sets, particular emphasis being laid on the control of reaction.

On Friday, January 12th, Mr. Christie, by special request, gave a lecture on the construction of receiving apparatus. He had brought a large number of home-made instruments, including basket coils, tuning stands, honeycomb coils and coil-winding machine, transformers, condensers and crystal detectors. The apparatus was splendidly constructed and Mr. Christie's excellent lecture was in keeping with the quality of his work. Subsequently the apparatus was passed round for inspection, and the lecturer answered several questions.

Members are reminded that the subscription for the current quarter is now due, and should be forwarded to the Hon. Treasurer as early as possible.

Eastern Enfield Wireless and Experimental Society.

Hon. Secretary, Mr. I. Dabbs, 315, High Road, Ponders End.

On Thursday, January 11th, an extraordinary general meeting of the above Society was held at the headquarters, the Falcon Inn, to discuss the programme for the present year.

After considerable discussion it was decided to have a programme of lectures and demonstrations of members' apparatus to commence next week.

The remainder of the time was devoted to general discussion, particularly on efficient earthing.

Wireless enthusiasts will be heartily welcomed at the Society headquarters any Thursday evening at 8 o'clock.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. Walter R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

On January 13th a meeting was held at headquarters, 21a, John Street, Theobalds Road, W.C.1., when the Secretary gave a lecture on "Primary and Secondary Cells."

The Society has obtained an experimental licence, and a crystal receiver with a three-valve amplifier has been purchased.

Several new members have recently been enrolled.

The Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Hyams, 188, Nelson Road, Hornsey, N.8.

A general meeting of the Society was held on Monday, January 8th, at 8 p.m. The present accommodation of the Society being considered unsuitable, it was decided to transfer the headquarters to the Queen's Hotel, Broadway Parade, Crouch End, where more comfortable accommodation has been arranged. In future, meetings will be held there each Monday at 8 p.m. Mr. W. L. Carter was elected Chairman, and Mr. H. Hyams elected Hon. Secretary.

Applications for membership will be welcomed and full particulars supplied by the Hon. Secretary.

The Tottenham Wireless Society.

Hon. Secretary, Mr. R. A. Barker, 22, Broadwater Road, Tottenham, N.17.

The chief feature of the meeting held on January 10th, 1923, at 10, Bruce Grove, Tottenham, was an excellent lecture by the Chairman, Mr. F. A. Bourne, on the subject of "Crystal Detectors." Mr. Bourne not only fully explained the theoretical side of the question, but also fully explained the construction of a crystal set that everyone could make for themselves.

Presentations were made to the Society of a crystal set, set of coils and coil holder, and a battery of accumulators. It is hoped shortly to give a demonstration on wireless subjects for the benefit of the local public.

At the last meeting held by the above Society a very interesting lantern lecture was given by Mr. R. A. Barker, who gave a short biography of Senatore Marconi and Dr. Fleming, two of the pioneers of wireless telegraphy, and showed a number of slides illustrating the history of wireless. All the slides were kindly lent by the Marconi Scientific Instrument Co., Ltd.

Nottingham and District Radio Experimental Association.

Hon. Secretary, Mr. D. F. Robinson, 99, Musters Road, West Bridgford, Nottingham.

A meeting was held on January 4th, at Bennett's Garage, Shakespeare Street, Nottingham, Mr. Thornton being the Chairman.

Mr. Gill occupied the evening by explaining and demonstrating with a five-valve set, constructed by himself, and all members present thoroughly appreciated his efforts. The remaining time was given up to listening to the Birmingham Broadcasting Station, and altogether a most enjoyable and interesting evening was spent.

A cordial invitation is given to all wireless enthusiasts not yet members of the Society to the meetings held each Thursday at 7.30 p.m.

The Wireless Society of Hull and District.

Hon. Secretary, Mr. H. Nightscales, 79, Balfour Street, Hull.

There was a large attendance of members at the meeting held on January 8th, when a lecture was given by Mr. Lax. Mr. Lax went deeply into the question of the action of valves as rectifiers and amplifiers, and explained the characteristic curves of the various makes of valves which are at present on the market, as well as pointing out their advantages and disadvantages. By the aid of blackboard diagrams he then gave his hearers some interesting and useful information about the various circuits at present in use in connection with valve receiving apparatus, and at the close, ably replied to a number of questions which had been asked.

On the proposition of the Chairman, Mr. G. H. Strong, and seconded by Mr. C. B. Snowdon, the lecturer was accorded a hearty vote of thanks for one of the best lectures yet given. This was supported by Messrs. J. Brazendale and W. J. Featherstone, and Mr. Lax in replying, promised to give a further lecture and practical demonstrations at some future date.

The officials of the Society are hoping to see every experimenter and listener-in in Hull and District a member of the Society. Would-be members will be welcomed at the club-room, at the Signal Corps headquarters in Park Street, on the second Monday and fourth Friday in each month.

Any wireless operators who happen to be in the port will be made welcome at the meetings of the Society.

Sutton and District Wireless Society.

Hon. Secretary, Mr. E. A. Pywell, "Stanley Lodge," Rosebery Road, Cheam, Surrey.

The annual general meeting of the Society was held on Wednesday, January 10th, 1923. Mr. D. C. W. Howard, B.Sc. has now been elected Chairman for the coming year, and owing to the large increase in the numbers of members since the last election, another member has been elected to the Committee. At the conclusion of the business proceedings, Mr. R. E. V. Ely gave a very interesting lecture on X-ray work and was accorded a hearty vote of thanks.

A series of short instructional lectures will be given by various members at meetings during the next three months, and it is hoped that these meetings will be well attended. All interested in radio work of any description are given a hearty welcone and those desirous of becoming members can obtain full particulars from the Hon. Sec.

Cheltenham and District Wireless Association.

Hon. Secretary, Mr. E. Cole, A.R.I.B.A., 28, Milton Road, Cheltenham.

At the weekly meeting of the Association on January 15th, Mr. A. Moulder gave a short lecture on "Non-Radiating Circuits," and also an extremely interesting account of his experiences during the war as a Naval wireless operator.

It was mentioned that several of the members have been successful in receiving parts of radio concerts transmitted from America.

After the lecture the members listened in on the Association's four-valve set to **5 IT**, the Birmingham Broadcast Station.

Oldham Amateur Radio Society.

Hon. Secretary, Mr. W. Schofield, 92, Sharples Hall Street.

On Friday, January 12th, an interesting lecture on "Aerial Construction" was given by the Chairman, Mr. J. Everett, who dealt with the subject in a very thorough manner. He explained how the aerial poles should be erected, and how the stays should be arranged to withstand the strain of the aerial. The precautions to be taken against leakages to earth were not forgotten, and Mr. Everett showed several effective ways of making joints with copper wires.

It is gratifying to be able to report a steady increase in the membership of the Society, and anyone desirous of joining should apply personally at 56, Bottom o' th' Moor, Oldham, any Friday evening at 8.30 p.m., when the weekly meeting is held.

Bexhill and District Radio Society.

Hon. Secretary, Mr. A. J. Hill, 15a, Sea Road, Bexhill-on-Sea.

A successful opening meeting of the above Society was held on January 9th, at 15a, Sea Road, Bexhill-on-Sea.

Mr. A. J. Hill opened the meeting by explaining the object of forming the Society, and Mr. L. E. Owen gave an address on "Wireless from the Popular Standpoint."

A Committee (*pro. tem.*) was formed, Mr. S. L. Taylor being elected Chairman.

The Wireless Society of Winchester.

Hon. Secretary, Mr. Albert Parsons, A.M.I.R.E., 65, Cromwell Road, Winchester.

The meetings held at Tower House since Christmas have been of a practical nature. The Secretary occupied two evenings by showing various methods of hand-coil winding.

Members having since wound their own coils speak of having obtained good results from them, especially the kind termed by the Secretary as the one, two, three or four diamond coil, which present very little self capacity.

The Society has now erected an aerial of the approved P.M.G. type, being 60 ft. high and 40 ft. long, in a position free from any screening.

By kind permission of Mr. R. Ayton, M.I.E.E., the members recently had an extremely interesting evening at the local power station. It was an opportune time in that shops, etc., were closing, and the demand for power decreasing, such that the closing down of one turbine and dynamo for the night was witnessed among other features.

Members spoke highly of the cleanliness of the station and of the efficient organisation.

An addition has been made to the rules of the Society to the effect that holders of broadcast licences are to be classed as Associate Members. Membership is still growing, and anyone desiring to join the Society may obtain particulars from the Secretary.

Notes.

Broadcasting and Experimental Licences.

Some dismay has been caused among owners of portable wireless receiving sets by the discovery that a licence does not entitle the holder to use his apparatus at any other place than that stated on the licence. This fact does not appear to have been stated specifically in any new regulation, but apparently the Post Office authorities expect literal observance of the terms of the broadcast licence. The official attitude is that this limitation of the movement of private wireless apparatus is necessary if the Post Office is to maintain control. Movement is permitted, however, to agents of wireless firms, bona fide lecturers and demonstrators, these exceptions being covered in most cases by so-called "pedlars' licences." The issue of "experimenters' licences" for those who wish to construct their own sets is temporarily held up pending the introduction of a new class of licence which is under consideration. It will be remembered that this course was first advocated by *The Wireless World and Radio Review* (page 395, December 23rd, 1922).

Developments in Canada.

The plans of the Marconi Company with regard to the development of wireless communications in Canada involve the erection of a powerful station at Vancouver, British Columbia, which is estimated to entail an expenditure of two million dollars. This station, it is said, will be one of the giant stations of the world, exceeding in power any other Marconi station at present in existence, and will in effect make Western Canada an important factor in world wireless communication, linking it up on one side with Australia and the Orient and on the other with Europe.

Group of Officers and Committee of the Radio Society of Great Britain. Back row (left to right): Maurice Child, Philip R. Coursey, G. G. Blake, A. Hambling, Hugh S. Pocock. Front row (left to right): C. F. Phillips, Major N. Hamilton, Leslie McMichael (Hon. Secretary), Admiral of the Fleet Sir Henry B. Jackson, G.C.B., F.R.S. (Retiring President); F. Hope-Jones (Chairman), and L. F. Fogarty (Hon. Treasurer).

"Annales des Postes" to Become a Monthly.

The *Annales des Postes, Télégraphes et Téléphones*, a bulletin of technical information issued by the French Ministry of Posts and Telegraphs, will appear in future each month, beginning with the January number. As a consequence the field which this valuable publication covers will be considerably increased. The annual subscription however will remain unaltered, viz., 24 francs for France and 27 francs for abroad.

Sir Oliver Lodge's Lecture on "Wireless Communication."

The Silvanus Thompson Memorial Lecture on "The Basis of Wireless Communication," to be delivered by Sir Oliver Lodge, F.R.S., at the Finsbury Technical College, Leonard Street, E.C.2, is to take place on Thursday, February 1st, and not on January 26th, as previously reported in the Press. Among the demonstrations to be given by old students after the lecture are the following:—Mr. Mordey, the oldest-known student, will show some effects of alternating magnetism; Prof. Coker will demonstrate the strains set up by cutting tools, as shown under polarised light; Prof. Desch will project microphotographs of various alloys. Prof. Eccles will show novel applications of the thermionic valve, and the ladies will be entertained by a wireless concert, the reception being arranged for by Mr. Franklin. The plant of the College will be operated by present students.

Reception of Eiffel Tower Weather Reports.

A Wireless operator at Eiffel Tower, when sending out his weather report a few days ago, requested the recipients to send him postcards. The response resulted in several mail bags containing over 56,000 postcards.

Photograph of Mr. A. R. Burrows.

Mr. A. R. Burrows, an interview with whom is reported in this issue, is now so well known in wireless circles that it is thought that many readers may like to have a copy of the photograph which appears on page 589 of this issue, where he is seen announcing at **2 LO.** Arrangements have therefore been made to supply readers with cabinet size silver prints of this photograph, unmounted, at the price of 9d. post free. Application, with remittance, should be made to the Editorial Offices of this Journal.

Wireless Communication and Trade.

A special committee of the Federation of British Industries has forwarded to the Prime Minister a resolution urging the Government immediately to grant facilities for the rapid development of long distance wireless communication, adding that they are strongly of the opinion that this would be best accomplished by private enterprise. A system of cheap wireless communication, they maintain, is essential to the trade of the country.

Broadcasting Stations in Great Britain.

The erection of the broadcasting station at the Port Dundas Corporation's Electricity Station at Glasgow has been begun, and it is expected that broadcasting will be commenced early in March. Cardiff broadcasting station is said to be practically complete, and should be ready to begin transmissions by the beginning of February.

The Growing Demand for Broadcast Licences.

The public interest in wireless as a result of the successful institution of broadcasting is growing rapidly, as indicated by the number of licences issued. At the time of going to press it was reported that some 10,000 licences had been issued by the Postmaster-General in the past week, whereas the total number of such licences issued in the month of December was only 6,000.

The Radio Society of Great Britain Presidential Address by Dr. W. H. Eccles, F.R.S.

A Presidential Address was delivered by Dr. W. H. Eccles, F.R.S., before the Radio Society of Great Britain on Wednesday, January 24th, at 6 p.m., at the Institution of Electrical Engineers. The address was directed to the stimulation of research by experiments, and an indication of some useful lines of investigation was given. Publication will be given to this address in due course.

A Wireless Club for Ceylon.

A correspondent writing from Colombo states that a wireless club has just been formed, and is receiving strong support throughout the island. Permission to use wireless has not yet been granted by the Ceylon Government, but it is confidently hoped that this obstacle will soon be removed.

Annual Dinner of the Radio Society of Great Britain.

The Annual Dinner of the Radio Society of Great Britain was held as previously announced at the Waldorf Hotel, on Wednesday, January 24th, at 8 p.m. About sixty persons were present, including many members of the Society and delegates from affiliated Societies who had attended the Annual Conference earlier in the day During the dinner it was the pleasant duty of the retiring President, Admiral of the Fleet Sir Henry B. Jackson, to make a presentation to Mr. and Mrs. Philip R. Coursey of a clock in commemoration of the successful transatlantic tests, 1922. The presentation was from the members of the Committee of the Society as a mark of appreciation of the work done by Mr. Coursey, assisted by Mrs. Coursey, in the organisation of the tests, and particularly the transmissions from this side of the Atlantic. An announcement was made on this occasion which will be of great importance to all members of the Society. It will be remembered that at the November meeting of the Society a member, Mr. I. Davidson, made the suggestion that the Society should give a wireless medal annually. This proposal has received the consideration of the Officers and Committee of the Society, and the announcement was made that the medal will be given each year for the most important British achievement during the year.

Insuring Wireless Sets.

The risk of damage to wireless apparatus and of personal injuries arising to third parties therefrom has naturally given rise to insurance schemes. The Liverpool Marine and General Insurance Company, Ltd., who claim to have been the first to have drawn up a contract of this kind to meet the requirements of private persons, issue policies to provide compensation for damage to the wireless apparatus itself and to indemnify the owner in respect of claims by third parties as a result of personal injury or damage to property. Under the arrangement of this Company a premium of 7s. 6d. insures apparatus up to £50 in value and covers third party damage up to £500 (any one accident), including damage to property belonging to or under the control of the insured. Wear and tear, however, and such mishaps as the burning out of valves through wrong connections, are not insurable.

Radio Stations in West Africa.

Some 250 posts have been actually opened or are under construction in French West Africa, and it is proposed soon to link up French Africa with the Soudan and Egypt.

Calendar of Current Events

Sunday, February 4th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, February 5th.

9.20 to 10.20 p.m. Dutch Concert, from **PCGG**, The Hague, on 1,050 metres.

Ipswich and District Wireless Society.

At 8 p.m. At 55, Fonnereau Road. Lecture on "Land Line Telephone Practice," by Mr. B. Waters.

The North London Wireless Association.
Lecture on "The Production of Oscillations by Means of the Neon Lamp," by Mr. E. H. Robinson.

Tuesday, February 6th.

Transmission of Telephony at 8 p.m. on 400 metres, by **2MT**, Writtle.

Royal Society of Arts.
At 4.30 p.m. At John Street, Adelphi, W.C. Lecture on "The Base Metal Resources of the British Empire," by Sir Richard Redmayne.

The Institution of Electrical Engineers.

At 7.0 p.m. At the Hotel Cecil, Strand, W.C. Annual Dinner and Reunion.

Wednesday, February 7th.

The Royal Society of Arts.

At 8 p.m. At John Street, Adelphi, W.C. Lecture on "Electrical Resistance Furnaces and their Uses," by Mr. C. R. Darling, F.Inst.P.

Institution of Electrical Engineers (Wireless Section).

At 6 p.m. At Savoy Place, Victoria Embankment, W.C.2. Experimental Demonstration. "The Measurement of the Electric Intensity of Received Radio Signals," by Mr. J. Hollingworth.

Manchester Wireless Society.
At 7.30 p.m. At Houldsworth Hall. Elementary Lecture No. 3. By Mr. Y. W. P. Evans.

Halifax Wireless Club and Radio Scientific Society.
At Clare Hall. Elementary Instruction Evening.

Edinburgh and District Radio Society.
At 8 p.m. At 117, George Street. Business Meeting. Lecture on "Wireless Transmission of Photographs," by Mr. F. Wyndham.

Tottenham Wireless Society.
Lecture on "Valves," by Mr. Kaine-Fish.

Thursday, February 8th.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Luton Wireless Society.

At 8 p.m. Visit to Electricity Works.

Ilford and District Radio Society
Lecture on "Accumulators," by Mr. C. G. Rope.
Hackney and District Radio Society.
At the Y.M.C.A., Mare Street, E.8. Informal meeting.

Friday, February 9th.

Sheffield and District Wireless Society.
At 7.30 p.m. At the Dept. of Applied Science. St. George's Square. Elementary Class.
Leeds and District Amateur Wireless Society.
Lecture (Part II) on "Inductance and Capacity." By Mr. W. G. Marshall.
Belvedere and District Radio Scientific Society.
Discussion on "Proposed Transmitting Apparatus," opened by Mr. S. Burman.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company :—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,

Cardiff (**5WA**), 395 metres, we understand is to be working by the time this issue appears.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—A remarkable phenomenon that has been observed at my station many times during the past 12 years, was again repeated on the morning of December 20th, between 1 a.m. and 2 a.m.

It was the day of the great gale, and the barometer at the time stood at 28.7.

As frequently happens during these storm periods, there was considerable rise and fall in strength of some of what might be termed the nearer distant coast stations, but more pronounced than usual.

I was intercepting on 600 metres, and both **GMH** (Malin Head) and **FFU** (Ushant) were at work, the former communicating with Cullercoats, and the latter with ships. The strength of both stations was varying from moderate to very loud, but the curious point is this: *immediately* the Ushant signals began to increase, the signals of Malin Head would fade away, and *vice versa*, just as if they were at each end of a see-saw.

These two stations *have always behaved in exactly the same way* during periods of waxing and waning, as heard in London.

After many years' close observation, this is the only instance of consistency with regard to this phenomenon that I have come across.

Unfortunately, these investigations require a skilled knowledge of morse and an intimate acquaintance with all coast stations within 1,500 miles, as they can only be made on the 600 metres wave, where a number of stations in different directions can be heard simultaneously.

It will be interesting to hear if the interception of American amateurs was good on this date.

B. S. T. Wallace,
P. O. Telegraphs.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed " Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the " Questions and Answers " coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every shee or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a " nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6)* **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** *(7) Four questions is the maximum which may be sent in at one time.*

" A.C.W." (Chelmsford) *submits a diagram of his receiver and asks for a diagram of connections showing the addition of two note magnifying valves.*

A diagram of connections is given in Fig. 1. Suitable values are indicated in the figure.

" J.J." (Glos.) *submits a diagram of connections of his receiver and asks (1) What wavelength range will the receiver cover, the A.T.I. being wound with wire similar to the sample submitted. (2) Is the circuit suitable. (3) Is it necessary to use a variable condenser in the circuit.*

(1) The sample of wire submitted is No. 22 enamelled copper wire, and with an average aerial the coil should tune from 200 to 3,000 metres. (2) The circuit is a very simple one, and is quite correct. (3) A variable condenser having a maximum capacity of 0·001 mfds. can be connected in series with the aerial. A small increase in signal strength may be expected.

" WAVY " (Sussex) *wishes to make a basket coil suitable for the broadcast transmissions, and asks for particulars.*

We suggest you wind 40 turns on a 2″ diameter former and use the aerial condenser in series. The reaction coil may consist of 30 turns on the same diameter former. The wire in your possession is fairly suitable, but it would be better to use No. 22 D.C.C.

" W.T." (Smethwick) *submits a diagram of his receiver and asks (1) Whether it is suitable, and (2) Suitable values for the high frequency transformer and reaction coil.*

(1) The diagram of connections is quite suitable although it is somewhat involved. (2) The primary, secondary and reaction coils may form part of a three-coil holder. If it is desired to use the plug-in type of high frequency transformer, the reaction coil may be made to rotate close to the top surface of the transformer. The battery required for the detector circuit may consist of two dry cells.

" A.F.W." (Morpeth) *asks (1) Is a potentiometer necessary to give the grid of the detector valve a suitable potential. (2) Is the circuit submitted and are the values given suitable. (3) Is a grid leak and condenser necessary.*

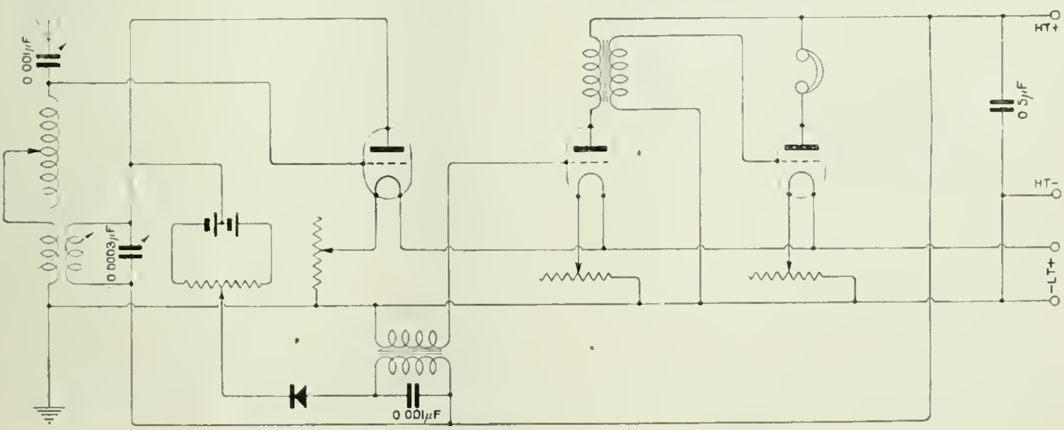


Fig. 1.

(1) It is not always necessary to use a potentiometer for controlling the grid potentials of valves. When a number of valves are used, there is an advantage in using a potentiometer, but with only a one-valve receiver, there would be no advantage gained. (2) We suggest you join the aerial condenser which has a maximum capacity of 0·001 mfds. in series with the aerial tuning inductance. A smaller inductance coil, which could be 4″ in diameter and 5″ long, wound full of No. 22 D.C.C. with 12 tappings, would be more suitable for short wavelength work than the large coil which you have at present. (3) A grid leak and condenser is necessary, and it would be better to connect a small fixed condenser across the telephone terminals. This condenser could be 0·001 mfd.

"D.N.B." (Beds).—(1) The wavelength of a frame aerial and condenser is calculated by the formula

$$\lambda = 1884\sqrt{LC}$$

where L is the inductance of the frame aerial in microhenries, and C is the capacity of the condenser in microfarads. Given the wavelength and the capacity, the value L may be calculated directly without difficulty. To increase the wavelength range of the aerial circuit you should add a few more turns and bring them to a switch for putting them in or out according to the wavelength desired. We suggest 18 turns, or you could increase the size of the frame to 4′ 6″, and use 15 turns with tappings. When using a frame aerial, it is generally better to use a number of H.F. valves, depending upon the stations whose transmissions you wish to receive. We suggest the use of 2 H.F., 1 detector, and 1 L.F. valves when the stations are rather far distant. For broadcast reception we think 1 H F. 1 detector and 1 L.F. connected valves will be quite suitable. (2) A suitable scheme of connections is given in Fig. 2. The first valve is connected as a H.F. amplifier. A crystal detector

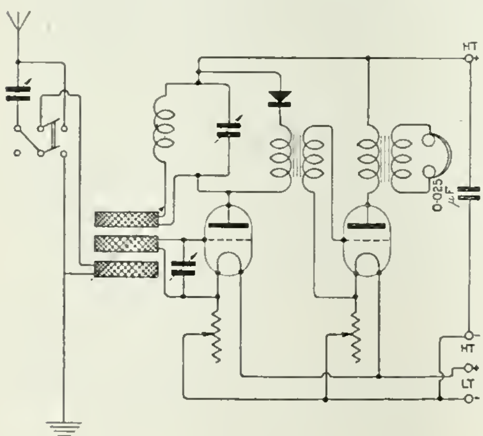


Fig. 2.

is joined across the anode circuit for rectification and the second valve is a note magnifier. The H.T. and L.T. potentials may be 60 volts and 6 volts respectively. The aerial tuning condenser has a maximum value of 0·001 mfds. and the closed circuit condenser 0·0005 mfds. The anode tuning condenser has a maximum value of 0·0002 mfds.

"W.B." (Barnsley) *asks for a diagram showing the connections of two H.F. valves with a crystal detector.*

See Fig. 3. Suitable values are indicated in the figure.

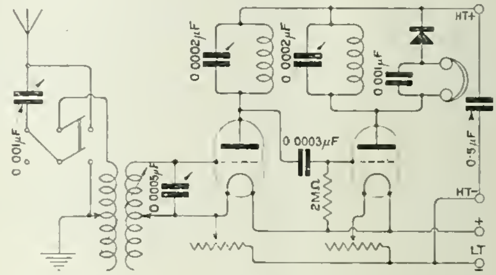


Fig. 3.

"C.W.R." (Kent) *submits a diagram of his receiver and asks (1) How to prevent oscillations being generated. The aerial coil and anode coil are widely separated. (2) How may the effects of A.C. lighting in the house be eliminated. (3) What type of receiver would the best for operating a loud speaker for the transmissions. (4) Why does placing an earthed body near the tuning condensers cause a greater wavelength change when receiving C.W. than when receiving spark signals.*

(1) It would be advisable to connect the potentiometer across the + and − L.T. The earth lead and one end of the grid leak could then be brought to the sliding point of the potentiometer and adjustments made to prevent the set oscillating. When the aerial and anode circuits are tuned to the same wavelength, oscillations are usually generated, and it is necessary to provide a small current in the grid circuit as a rule to prevent the oscillations. (2) Special attention should be paid to the lead-in aerial wire and the earth connection. The wires should be run well away from other bodies, and in the case of the earth wire, should be as short as possible and make connection with a good ground connection, which should not be used for any other purpose. The low frequency portion of the amplifier may be screened by being placed in a metal box. (3) We suggest you use one high frequency, one detector, and two L.F. connected valves for the reception of broadcasting. The signals could be sufficiently amplified with this combination to properly operate the loud speaker. (4) The reason why capacity effects are more noticeable when receiving C.W. signals is because C.W. signals are very much more sharply tuned than spark signals. Small changes in the capacity of the circuit, which cause small wavelength changes are thus more noticeable.

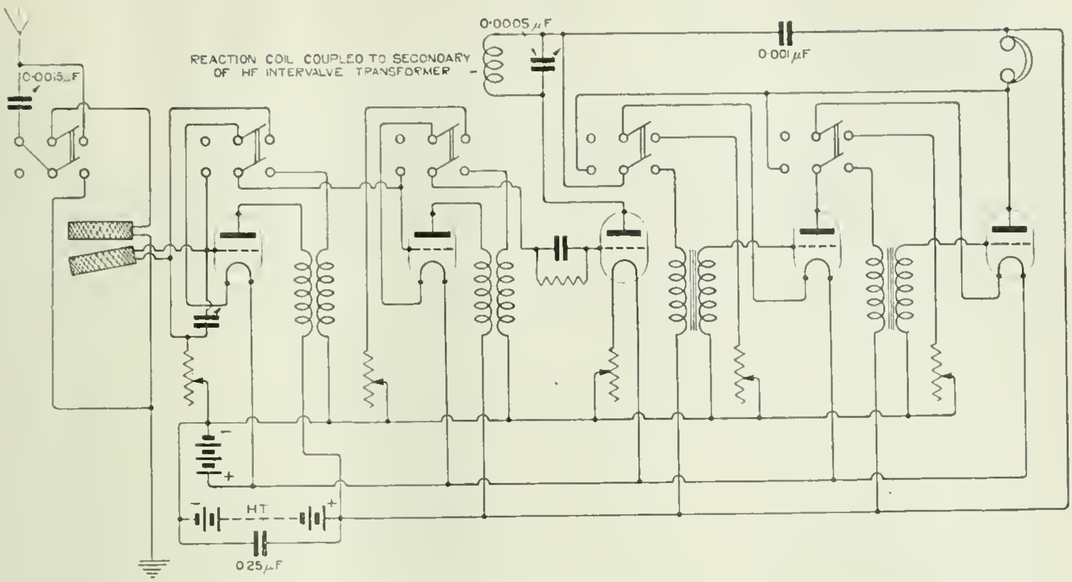


Fig. 4.

"J.B." (Sheffield) *asks for criticism of his set, particulars of which are submitted.*

The only modification required in the aerial circuit is that the tuning condenser will usually have to be connected in series instead of in parallel with the aerial tuning inductance. Fig. 4 indicates the method of connecting apparatus. We think you will require a five-valve set, but the sketch shows the switching arrangements in case you do not always require this number of valves to give signals of comfortable strength.

"S.F.W." (Berwickshire) *asks* (1) *Whether a "V.24" type valve is a good amplifying valve and a poor detecting valve.* (2) *If the "V.24" type valve is a poor rectifying valve, is there another valve having the general shape of "V.24" type valve which is a good rectifier.*

(1) The "V.24" type valve is a good amplifying valve, and is very useful for high frequency amplification. It is not such a good rectifying valve as other valves. (2) The "Q" type valve was specially designed for rectification, and is somewhat similar in shape to the "V.24" type valve.

"N.T." (Barrow-in-Furness) *submits particulars of his receiver and asks* (1) *Whether the circuit is suitable.* (2) *May Burndept type coils be used in place of the duolateral type coils in an Armstrong super-regenerative receiver.* (3) *Capacity of the variable condenser.* (4) *Whether it is necessary to get permission before one can erect an aerial across the street.*

(1) The proposed arrangement is fairly suitable although the reaction coil is coupled with the closed circuit coil, and unless care is exercised when making adjustments, oscillating energy will be transferred to the aerial circuit to the detriment of other people who are receiving. (2) Provided the inductance value of the Burndept coils is similar to the inductance value of the duolateral coils they may, of course, be used. (3) The capacity of the variable condenser is of the order of 0·0012 mfds. (4) You are obliged to secure the permission of the District Surveyor before you may erect an aerial across the street, but we believe there will be no objection provided the aerial is 30 feet above the street level.

"A.C.B." (E.15) *submits a diagram of a transmitting circuit, and asks for criticism.*

The circuit submitted is suitable, but you could hardly expect to get good telephone transmissions when using rectified 50 cycles alternating current, unless you have a very efficient smoothing system. The condenser across the secondary of the microphone transformer should be variable, as the adjustment of the condenser affects the quality of the speech transmitted.

"E.J.S." (Dorset) *asks advice as to the best method of erecting his aerial to avoid the power wires.*

We suggest you run the aerial at right angles to the power line, even although this means that the aerial must be 25′ above them. This construction would certainly be more satisfactory than the alternative arrangement.

"F.G.S." (N.8) *submits particulars of his receiver and asks for suitable sizes of A.T.I. and closed circuit inductance.*

The A.T.I. coil may consist of a winding 4″ long and 5″ in diameter, wound full of No. 22 D.C.C. Eight tappings should be taken, the first one after 1″ of winding, and the remainder may be equally spaced. The secondary circuit may consist of a winding 4″ in diameter and 5″ long, of No. 28 D.C.C., with eight tappings, equally spaced after the first 1½″ of winding.

"**E.L.**" **(Devonport)** *asks* (1) *For the weight of wire to use as a primary and secondary winding on L.F. transformer.* (2) *Is the proposed arrangement for winding a coil to be used in the anode circuit of the H.F. connected valve suitable.* (3) *Why is it that when listening to some transmissions the carrier wave is heard very strongly and the telephony rather weakly.* (4) *For a diagram showing the connections of a potentiometer connected to control the grid potentials of the H.F. valves.*

(1) The primary winding may consist of 3½ ozs. of the wire in your possession, and the secondary 5 ozs. of the same diameter wire. (2) The proposed

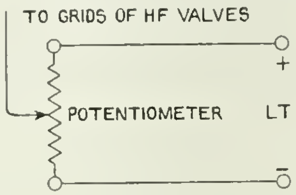


Fig. 5.

arrangement for building a coil to be used as a tuned anode coil is not very suitable. The self capacity of a coil constructed on the principle suggested would be very large indeed. We suggest you use an ordinary honeycomb winding. (3) The reason why you hear the carrier wave of the transmitting station very loudly and the telephony only faintly is due largely to the adjustment of the transmitting apparatus. Modulation is very incomplete, and the speech waves produce more or less a ripple upon the continuous waves transmitted. (4) The arrangement is given in Fig. 5. The grid connections are taken to the sliding contact of the potentiometer which is joined across the L.T. battery.

"**M.H.H.**" **(Birmingham)** *asks* (1) *For dimensions, gauge of wire, number of turns, and the number of tappings for a coil which will tune from* 200 *to* 2,000 *metres, with a* 0·0002 *mfds. tuning condenser.* (2) *For particulars of a suitable reaction coil to work with the above coil.* (3) *How much would the plate voltage be increased when resistance capacity coupling is used.*

(1) We suggest you make the coil 4″ in diameter and 7″ long, wound full of No. 32 D.C.C. Twenty tappings should be taken. (2) The reaction coil may consist of 150 turns wound on the 3″ diameter former which you have, with three tappings. (3) The high tension voltage should be approximately doubled, when a resistance of the order of 50,000 ohms is connected in the anode circuit.

"**F.S.R.**" **(Catford)** *asks* (1) *For a diagram of a three-valve receiver.* (2) *What is the natural wavelength of an aerial* 40′ *high and* 45′ *long.* (3) *What wavelength is obtainable when* 45 *turns of No.* 25 *D.C.C. from the basket coil are connected with the above aerial.* (4) *What is the capacity of a fixed condenser which consists of six plates of copper foil,* 1½″ × ¾″.

(1) See Fig. 5, page 356, December 9th issue. (2) The natural wavelength is of the order of 120 metres. (3) Without knowing the dimensions of the coil referred to, we cannot calculate its inductance and so get the wavelength to which it will tune when connected with the aerial mentioned in (2). The wavelength is probably 300 metres. (4) The capacity of the fixed condenser is roughly 0·006 mfds., but we cannot work it out exactly, as you have not given us sufficient particulars. We suggest you work this out for yourself. The capacity C mfds. of a fixed condenser is equal to

$$\frac{0{\cdot}0885\, KA\, (N-1)}{t}$$

where A equals the area of overlap in square centimetres.
K is the specific inductive capacity of the dielectric.
N is the total number of foils, and
T is the thickness of the dielectric in centimetres.

"**A.E.**" **(Ashby de la Zouch)** *submits particulars of a proposed arrangement and asks for criticism.*

The proposed arrangement for attaching the Skinderviken button to the receiver diaphragm is quite suitable, although a little experimental work will be necessary before the adjustments are correct. Four dry cells will provide sufficient current to energise the microphone and loud speaker. The low resistance telephone should have a resistance of the order of 60 ohms, otherwise a transformer should be used. On account of the steady direct current which will be flowing through the receivers, it will be well to reverse the connections to see that best results are being obtained.

"**H.G.**" **(N.W.6)** *asks which coils should be used when tuning in.*

When receiving broadcast transmissions, we suggest you use the No. 35 coil in the aerial circuit, No. 50 coil in the closed circuit, and No. 75 for reaction coil. It may be found the reaction coil is too large, in which case the No. 25 should be used. The amount of reaction required depends entirely upon the method of wiring up the set, and whether it has an inherent tendency to freely oscillate or not. The same ratio in general should be used throughout the range of wavelengths covered by the coils, although on higher wavelengths it will generally be found necessary to use a coil for the reaction circuit which is smaller than that used in the aerial circuit.

SHARE MARKET REPORT.

Prices as we go to press on January 26th, are :—

Marconi Ordinary	£2	10	0
,, Preference	2	4	0
,, Debentures	107	0	0
,, Inter. Marine ..	1	9	8
,, Canadian		11	0

Radio Corporation of America :—

Ordinary	16	0
Preference	13	6

THE WIRELESS WORLD AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

No. 182 [No. 19 Vol. XI.] FEBRUARY 10TH, 1923. WEEKLY

The Barrel Switch.

HOW TO USE IT IN WIRELESS CIRCUITS.

THE complicated circuits now so frequently adopted in wireless receiving work, bring about difficulties in the design of suitable switches necessary to make the required circuit changes.

The most reliable type of switch, carrying a number of contacts and capable of giving a variety of combinations is shown in Fig. 1. This type of switch is not receiving a great deal of attention in this country, probably because of the absence of a design embodying only few component parts.

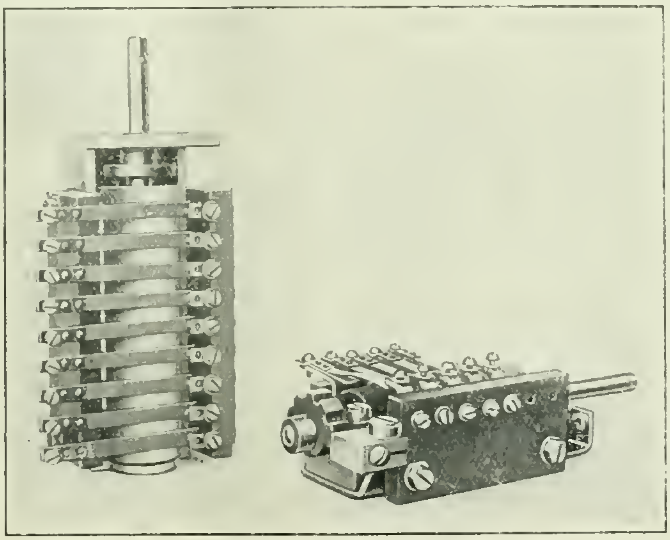


Fig. 1. A somewhat elaborate barrel switch capable of a variety of combinations.

Many types of switches are available, but most of them present difficulties with regard to the simultaneous changing of many circuits.

The mechanical construction of switches which have to carry a number of contact arms or make simultaneous contact at many points, must be so well carried out that they are necessarily costly.

A simple design suitable for experimental use is given in Fig. 2 and 3. It consists essentially of two ebonite plates which carry a number of contacts and held together by ebonite end pieces which serve as bearings for a revolving drum. On this a number of pegs are arranged for forcing the lower springs, when required, in contact with the upper ones.

In constructing a switch of this type, the first consideration is to procure suitable springy metal for making the contact pieces and it is necessary, as these springs may be required to remain bent for a long while, that the metal employed should have properties which can be relied upon to restore it to its original position. Phosphor bronze or German

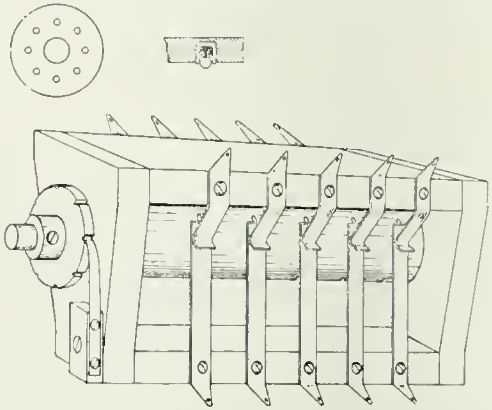


Fig. 2. A simple rotating switch.

silver of about No. 26 wire gauge should be adopted. The pieces are cut to length and drilled where required, and the tapering tag ends may be made by clipping or filing. The bends which are required can be made with round-nosed pliers in order to obviate an acute angle which is liable to cause a fracture after the contact pieces have been moved a few times. With this type of switch it is not essential that special non-oxidising contacts be adopted, as ample contact surface can easily be arranged, and fairly hard pressure can be made between the contacts. If it is thought advisable to fit special contacts, this can easily be arranged by drilling small holes in the spring pieces at the points of contact, and fitting in small pieces of silver wire, and hammering over. The design shown is fitted with a number of spring contacts on each side, so that many circuits may be changed out, but in certain cases it may be better to arrange contacts on one side only. Contacts should only be fitted at both sides when a large number of circuits have to be made or broken by a single movement of the operating handle. The spindle to which the operating handle is attached carries an ebonite cylinder, into which holes are drilled to carry small screw-in pegs. It is as well to drill a number of rows of holes in the cylinder and tap them so that the pegs can be inserted just where required, depending upon the circuit in which the switch is to be connected.

The best way of securing the ebonite cylinder to the spindle is by drilling a hole right through the centre and driving home a slightly tapered pin.

In order that the cylinder may move through a required distance from one change to the next, a disc of brass about 1 in. in diameter and $\frac{1}{8}$ in. thick may be secured by means of a grub screw to an extension on the spindle at the opposite end to the operating knob. The disc may have a number of slots cut around the circumference to which a spring can engage.

Alternatively, holes can be made in the face of the disc with the point of a large drill, and a ball may be pressed into the holes by a spring which is carried in the ebonite end plate. This arrangement will cause the spindle to revolve with a jerky motion, halting at each point at which a number of contacts are made.

The design shown in Fig. 1 is rather beyond the scope of many experimenters to make up. In principle it is of course similar to that just described, though it is perhaps more durable. Each of the springs is supported by a small brass bracket held to an ebonite support by a single screw and prevented from turning by being placed in a slot made in the ebonite. The other set of contacts are quite rigid, and consists of brass brackets held in slots in a piece of ebonite on the opposite side.

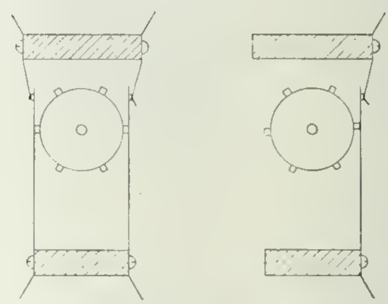


Fig. 3. Sectional view of simple barrel switches.

As it is lighter in operation, this type of switch may operate many more contacts than the one previously described, and as many as fifteen to twenty contacts may be arranged.

The cylinder which carries the pins is in this case about 1 in. in diameter, but if more positions are required, it may be extended to about $1\frac{1}{2}$ ins. It cannot be made larger than this, for any increase in diameter will decrease the curvature, and consequently the closeness of the studs will be limited

The switch shown in Fig. 4 is of American manufacture and embodies an arrangement by which, when contact is broken with one spring, it is made with an opposite one as it is forced outwards. This is particularly useful as it may be desirable that certain contacts are made in all but one position of the switch, and with the previous type it would be necessary under such circumstances to insert pins in the revolving cylinder nearly the whole way round.

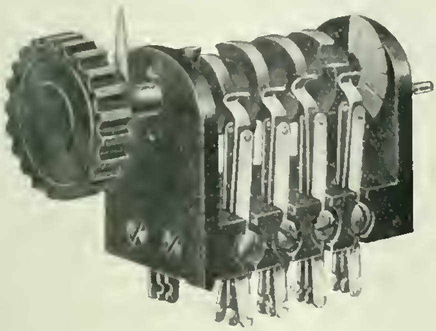


Fig. 4. A revolving switch of American manufacture.

Such a condition is required when switching in or out of circuit a number of valves. For instance, it would be necessary for the second valve filament current to be off in one position, whilst on in all other positions of the switch, which may be arranged for introducing the third, fourth or fifth valves, and so on.

One of the most useful applications of a switch of this sort, is for tapping out an inductance coil. It is possible, by means of a large number of contacts, to introduce inductance at either end of the coil so that the extent of coupling between the inductance which is being tapped and an adjoining one may remain at a suitable value, as the inductance value is changed. It is also possible to provide for short circuiting sections of the coil, such as is frequently the case when tuning to short wavelengths.

A barrel switch may be used to tap out simultaneously the tuned anode circuits of a multi-valve high frequency amplifier, and of course when used for switching any form of inductance, it may easily be arranged to avoid " dead-end " effects. There is no better way for switching multi-valve circuits than by means of the barrel type switch. It permits, if desired, the switching of grid circuits, which can scarcely be safely introduced with any other type of switch owing to insulation and capacity difficulties, and moreover, all the complicated operations, by introducing the required number of valves, may be effected by the turning of one handle. A switch of this kind is particularly suitable for making and breaking circuits as may be occasioned when changing over from receiving to transmitting apparatus, as one simple movement of a lever attached to the spindle can be made to change out a large number of circuits.

Barrel switches may be employed with advantage in the design of apparatus specially intended for broadcast reception, and be operated by persons not possessing a great knowledge of the principles of wireless reception. One handle may be arranged to revolve the cylinder, and in so doing change the proportions of inductance and capacity in the circuit in ratios which will produce the best results. The absence of contacts on the front of the instrument is another advantage particularly desirable in receivers of the broadcast type.

Further applications of the barrel switch will readily present themselves to the experimenter, and the designer of commercial type apparatus is reminded that such a switch might receive more attention now that wireless receiving circuits are becoming so involved.

Elementary Lecture and Demonstration.

An Elementary Lecture entitled " Fundamental Principles of Radio Reception," will be given on Friday, February 16th, at 6.30 p.m., by Mr. Maurice Child at the Institution of Electrical Engineers, Victoria Embankment. This is the second of a series of Elementary Lectures arranged by the Radio Society of Great Britain. An invitation to attend is extended to anyone interested.

General view of the Croydon Aerodome, the London Terminus of British Civil Air Routes.

The Applications of Wireless to Commercial Flying.

By "Aeraden."

TO the ever increasing number of amateurs in this country who so frequently listen-in to the conversations between the pilots and operators on the various air expresses and the traffic controllers on the ground, an explanation of what is actually going on will no doubt be welcome. They will be better in a position to appreciate the operation of an air route, and some of the problems which confront the aircraft radio-engineer to-day; and they will be enabled to comprehend the headway that has been made, at times against apparently insurmountable difficulties, since the close of the late war in building up, by wireless, a system of signalling which would form so valuable an aid towards establishing the airways on a basis at least comparable with those of the other methods of modern transport.

The average person, with little knowledge of the Morse code, who possesses a small receiving circuit will be most interested in the application of radiotelephony. The more enthusiastic amateur will want to know the ground which is being covered by the use of telegraphy. The more serious experimenter still will be looking for the technical applications of both branches of the work, and will expect to hear something of how aircraft are navigated by wireless.

Before remarking upon the adaptabilities of each of these three classes of wireless, it will be well to consider the factors governing them.

The modern passenger-carrying aircraft has an average cruising speed of 90-100 miles per hour, so that in the space of one minute it can have moved approximately a mile and a half. Under favourable weather conditions, when the pilot has an undisturbed view over many miles of country, this speed is such as to give the machine one of its chief advantages over other forms of transport, and it can continue its journey in perfect safety. Such a speed is not, however, either so fascinating or so useful when the air journey has to be carried out through low-lying clouds or mist, when the visibility is impaired, and it is not always possible to see distinguishing features and landmarks along the route. Sense of direction can become inaccurate, flying by compass difficult, and distance readily misjudged.

It is essential, therefore, that the most rapid means of communication possible must be arranged between the aircraft and ground stations, in order that navigational assistance, or other messages, may be passed to the pilot with the least delay.

Given that all enunciation is clear, and that signalling conditions are good, radiotelephony possesses every advantage over Morse signalling or radiotelegraphy, for fulfilling this condition of speedy communication. There is nothing faster than the spoken word, and provided it is not misunderstood, whole conversations can be exchanged between ground and air in the same time that it would take to telegraph a single sentence. Conditions for wireless signalling in the air are distinctly different from those on the ground. There is the noise of the engine, the rush of the air, the rattling of metallic parts and the hum of the wind in the struts and stays. The pilot has in addition several things other than wireless which require practically constant attention, and from his point of view alone, it is more desirable to listen to speech which he can almost subconsciously follow and memorise than to Morse signals.

Signalling between the terminal aerodromes of the routes, comprising the messages giving details of the arrivals and departures of the various aircraft and information relating to them, together with reports on weather conditions at different points, is the other big consideration for which provision has to be made. On a busy route, and every air route is comparatively busy to-day, there are many such messages. Here great accuracy is essential, but rapidity not quite of such importance, and telegraphy is employed. The scheme is divided under the two groups of traffic signalling and weather signalling, each group having its own particular wavelength. All the traffic messages are passed direct from one terminal point to the others on 1,400 metres, while 1,680 metres is the wave allocated for the dissemination of the appropriate meteorological data.

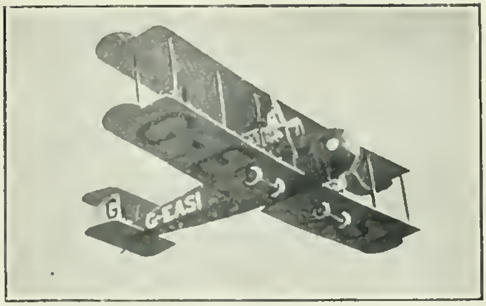
Assistance for navigation by direction finding methods is carried out on the wave upon which the aircraft communicate with the ground, and no doubt this wavelength is familiar to everyone who has ever heard the Croydon station. It is 900 metres.

The fundamental division the classes of work is, then, apparent.

Radiotelephony.

Bearing in mind that the application of radiotelephony on air routes is limited to conversations between aircraft and the ground stations, and, through the latter, the controlling staffs, let us consider its scope.

The airway is divided into lengths of no actual fixed mileage. The approximate



The "City of London." A similar machine flew the Atlantic from Newfoundland to Ireland in 15 hrs. 57 mins.

distance between any two ground stations happens, at the present time, to be in the vicinity of 100 miles, and a figure somewhat under this distance may be assumed to represent the greatest range at which aircraft will normally be required to converse with the different aerodrome stations. An aircraft equipped with transmission and reception apparatus, capable of ensuring certain working during any period of the flight and under any climatic condition, will therefore fulfil the requirement. The question of range is a difficult matter to decide, however, in connection with a known input energy. Range in transmission depends largely upon such factors as the enunciation of the speaker, which brings a very personal element into the matter. Cases have occurred where it has been impossible to understand the operator on a machine speaking only a few miles away, while, simultaneously, every word spoken by a pilot working an exactly similar instrument at a much greater distance has been heard perfectly. This is just as much a detrimental factor in radiotelephonic working as the development of a fault in the control or power circuits of the transmitting unit. Again, the range over which a given transmission can be intelligibly picked up varies considerably under different conditions. The pilot of the aircraft, apart from the disturbing noises already referred to, may be receiving on circuits which, owing to continuous shaking to which they may have been subjected, are experiencing interference from various sources ; or he may be flying in a neighbourhood of localised atmospheric disturbance. He may not even be getting the best out of his receiver, for he has not the opportunity of absolute concentration upon the task of accurate tuning that is afforded to the ground operator. As passenger-carrying aircraft increase in size and capacity, and as the present financial difficulties decrease, there is not the slightest doubt that it will be possible to employ operators in aircraft in precisely the same manner as they are at present employed in the Mercantile Marine. To-day, for reasons of general economy, the aircraft wireless operator exists practically entirely in imagination, and it is therefore a condition of the air pilot's licence that he should be capable of operating wireless in the air.

Range in this class of work can, then, be an elastic quantity and to ensure that every aircraft shall be in touch at the given maximum distance, the capability of the least efficient operator and aircraft set must be taken as the standard for that distance. At the same time matters must not be allowed to go to an extreme where excessive powers are employed for the desired range. Generally speaking, the ability of a given set in a given machine can be accurately gauged, and success therefore rests to a large extent in the hands of the man working it.

Interior of an Instone Air Liner showing the elaborate arrangements for the comfort of passengers.

In addition to enabling communication between ground and air to be effectively carried out, radiotelephony can in necessity permit of conversation between the personnel of different machines, an event which may be said to increase the factor of safety of the air route. Of the few accidents which have occurred since the inception of the London Continental Airways one at least might be said to be directly attributable to a lack of information on the part of the pilot, and, had full advantage been taken of the use of wireless, might possibly never have occurred at all. An organisation is now in force whereby in operating along a given route, an aircraft must fly at least 100 metres to the right of it, and if wishing to cross, must do so at right angles, thereafter keeping to a distance of some miles on the opposite side. The purpose of such a regulation is, naturally, to reduce whatever chances of collision exist to an absolute minimum; but it will occur to the mind that, even so, with the additional assistance of wireless, and with the ability, if necessary, to speak to any other aircraft in the vicinity, the journey can be carried out in a far more satisfactory fashion. A pilot in doubt, who knows that another scheduled machine should be in his neighbourhood, can readily call that machine on his telephone and determine the height at which it is flying, at the same time giving information concerning himself. Each can then fly to give the other sufficient clearance.

The direction in which telephony renders its two most important non-navigational aids to commercial flying, are in checking the passage of aircraft over sections of the airway, and in furnishing the air personnel with weather reports and forecasts.

As an example of the former, consider the case of an ordinary passenger machine, of registered number G-EABC, which leaves Croydon for Paris let us say at 1005. The departure of this aircraft is known, of course, to the Controller of the Air Port, and he has taken the necessary steps to advise the port of destination, Le Bourget, and, as necessary, the intermediate aerodromes—Lympne and St. Inglevert. The wireless stations along the route then are told that G-EABC is on its way between London and Paris. When well away from the ground the person operating the wireless on the machine releases his aerial and the long stranded wire, many feet in length and carrying a lead plummet of nearly a pound weight, hangs beneath the machine. Croydon is then called and a message of the form :—

"G-EABC London for Paris,"

is passed. That ground station may be fully aware of the fact, having probably already been advised by the Air Port Traffic Officer, but the process of calling the station and receiving its reply constitutes at least a suitable test for the wireless apparatus on the aircraft. The news of the receipt of this signal by Croydon is at once passed to Lympne by radiotelephony, as :—

"G-EABC left Croydon for Paris 1005,"

which signal is acknowledged by the latter station. When about 30 miles distant from Lympne the aircraft calls and reports :—

"G-EABC, London for Paris,"

which is duly acknowledged. And so the aircraft proceeds on its way, conversing, if possible, with the French stations in their own language, though, if the pilot or other person operating the telephone is unfamiliar with French, those stations can reply in English.

After G-EABC had once left Croydon, in the example under consideration, all communication with that machine would have been done through Croydon or Lympne on the 900 metre wave by telephony. Had the pilot wished to obtain information about the weather over the Channel or on the French side of the water he would have asked for the latest weather conditions in these districts when reporting himself to Lympne. Or, had it been known that it would be difficult or dangerous for him to continue the journey owing to very adverse weather at some portion of the route, he could have been called by the nearest ground station and ordered to land at a certain aerodrome. Abbreviated and long weather reports are made out hourly by each route aerodrome and exchanged with neighbouring aerodromes, so that any aircraft fitted for radiotelephonic working has merely to call the first aerodrome of any sector of the route that he is about to enter to learn exactly what weather he can expect in that sector. The abbreviated report gives him only a few important details, such as the visibility and height of the lowest cloud, while the long report furnishes him with a complete statement of current weather.

Had any trouble been experienced, or anything become necessary on the journey, he could have called a suitable station and informed the Traffic Officer of his requirements, and, upon landing some time later, any necessary arrangements would have been complete.

The chances of accident or loss of time on the airways due to negligence seem almost less than those upon the railways ; in fact, the percentage of fatal European accidents is apparently actually lower, comparatively speaking, on the former than on the latter. Perhaps flying is not so dangerous as some would have us believe ?

The routine of navigating aircraft by means of telephony will be discussed under the third section of this article, but there is one more application of the radiotelephone which is very important. At the present day telephony does not lend itself to more than a few simultaneous transmissions close together. The nature of a radiotelephonic transmission closely resembles that of the original spark system, and the desirable features of very sharp tuning, great selectivity and lack of mutual interference which are to be found in most C.W. systems do not exist. As a consequence but few telephony transmissions can usefully occur together without interfering with one another very seriously on a given wavelength, or on wavelengths of only a few kilocycles difference.

This latter application of radiotelephony, one which cannot, until such an objectionable drawback is eliminated be employed commercially, is known as "line-switching," and consists of connecting the ordinary line telephone system to the wireless circuits through a small exchange board, so that speech in one direction is relayed by radio. The advantages of such an arrangement are obvious. The manager of one of the aircraft firms can ring up the London Air Port, ask to speak to a certain pilot, and be told that he has already left for Paris, flying one of the regular expresses. If the matter is one of considerable urgency, he can be connected to the wireless station. The operator on watch can call the aircraft in question, and having established communication, switch the line telephone call through

Air Liner with Complement of Passengers about to leave the ground.

to the wireless, and manager and pilot can converse, the station operator changing from "send" to "receive" as requisite. Immediate "two-way" telephony by wireless, similar to that available on the line circuits, is not yet available, though it is probably but a matter of time before such an arrangement will be invented. It can be done now, but the apparatus necessary is as yet too cumbersome and costly to warrant its use on a commercial basis. Line switching will some day open up possibilities of additional comfort and security to the air traveller. It will become possible for the passenger on the larger aircraft to pick up the telephone in his private cabin and ask the wireless exchange on board for parctically any number for many hundred miles round. He will be connected by wireless to a local radiotelephone station, and from thence relayed by line or wireless to the exchange of the number required, and the conversation will proceed as normally as the modern line call. Business men will be able to continue their daily routine while flying across Europe or the Atlantic, for the wireless telephone will certainly be developed along lines giving greater privacy in conversation; untappable radiotelephony will by that time have come also. There is practically no limit to the extent of such calls, for wherever there is a radiotelephonic instrument installed it will be possible to include it in the system. It is not a wild flight of imagination to conceive the passenger on the aerial liner over mid-atlantic to be speaking to the passenger on the express roaring along the Canadian prairies.

Already music of an excellent quality can be picked up nightly on the simplest receiving sets, and so, in the most distant future, the orchestra heard at dinner in the air liner's saloon will be the one playing many miles away at some central broadcasting station. After three years of hard pioneer work commercial flying is nothing like the impossibility that it at one time seemed. The small existing wireless telephone gives a range between ground and air of something like 150 miles. Who knows what it will have done even within the next decade?

Some Simple Methods of Controlling L.F. Valves.

ONE often wishes to have easy control over the number of valves employed in a receiver, and if switching arrangements are included for this purpose, a number of arrangements are possible.

Thus it sometimes happens that one possesses several pairs of low resistance telephones, and it is desired to switch them in circuit as required. The arrangement is very simple, and is given in Fig. 1 on the next page.

If it is desired to switch in a pair of high resistance telephones, as well as those of low resistance, the connections given in Fig. 2 may be used. The H.R. telephones are connected with a plug, and the jack is so connected that, with the plug out, the telephone transformer is in circuit. When the plug is inserted the H.R. telephones are joined in series with the telephone transformer.

When it is desired to use H.R. telephones

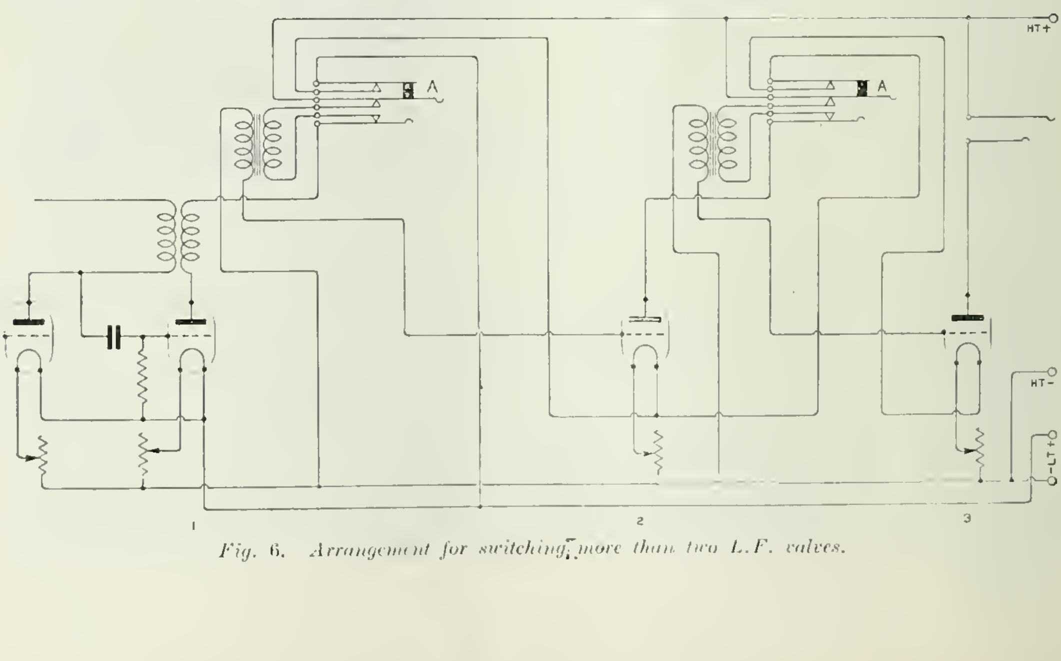
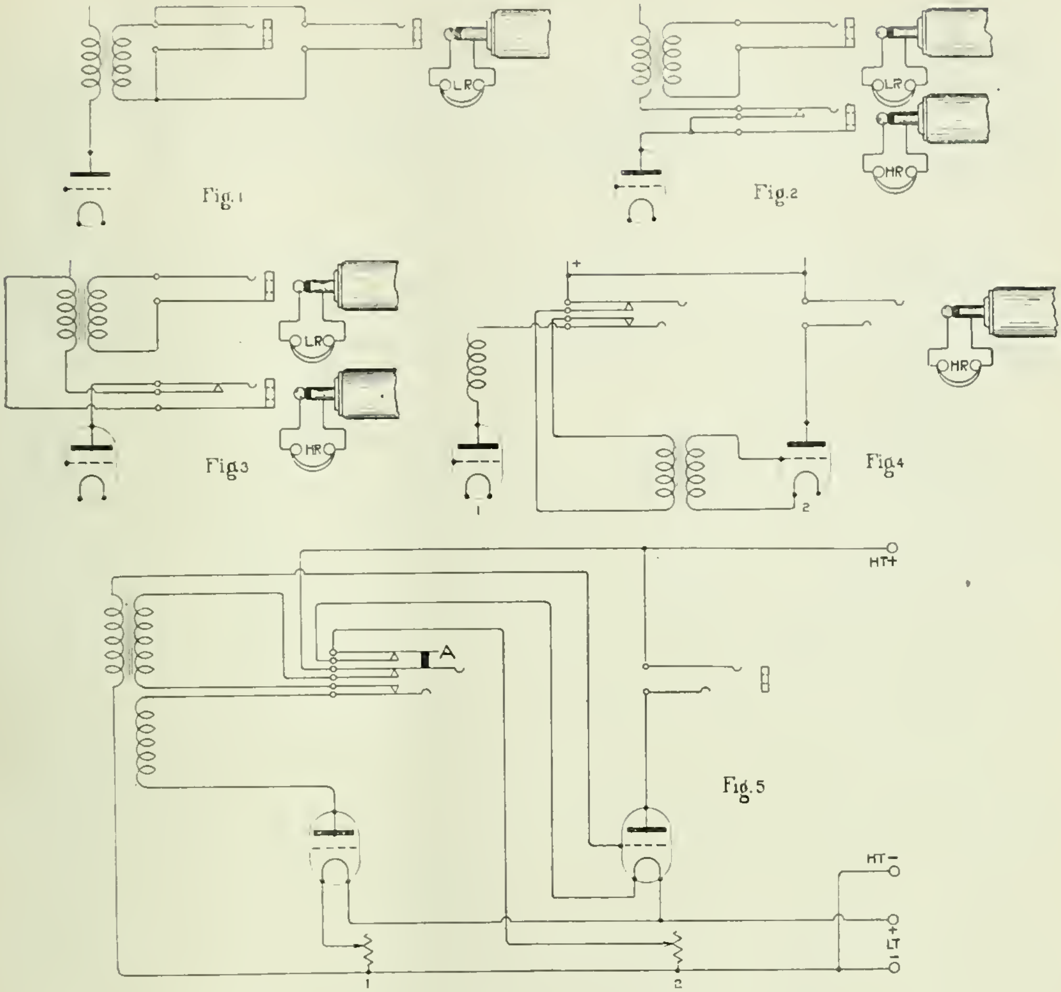


Fig. 6. Arrangement for switching more than two L.F. valves.



Figs. 1 to 5. Various arrangements for controlling L.F. Valves.

alone, the connections in Fig. 3 may be used. When the plug to which the H.R. telephones are connected is inserted, the telephone transformer is disconnected.

In Fig. 4 are given the connections for plugging the telephones into either L.F. valve circuit. With the plug in jack 1, the intervalve transformer primary winding is disconnected, and the anode circuit is complete through the H.R. telephones.

Of course the plug may have connected with it a telephone transformer and L.R. telephones if required. With the telephone plug in jack 2, the valve circuit 1 is connected. This arrangement does not provide control of the valve filaments, which is an undesirable feature. If two more spring contacts are provided, the circuit Fig. 5 may be arranged. Here the springs "A" control the filament current of valve 2, so that when the telephone plug is in the valve 1 circuit, the filament of valve 2 is disconnected.

A slightly different arrangement should be employed when there are more than two L.F. valves. The arrangement is given in Fig. 6. Here it will be noticed the jack employed is identical with that used in Fig. 5, but the main filament current lead is connected with springs "A." When the plug is engaging the springs of valve 1 circuit, the filaments of valves 2 and 3 are cut off.

W. J.

Electrons, Electric Waves and Wireless Telephony—XIX.

By Dr. J. A. FLEMING, F.R.S

The articles appearing under the above title are a reproduction with some additions of the Christmas Lectures on Electric Waves and Wireless Telephony given by Dr. J. A. Fleming, F.R.S., at the Royal Institution, London, in December and January, 1921-1922. The Wireless Press, Ltd., has been able to secure the serial rights of publication, and any subsequent re-publication.

5. Duplex Wireless Telephony.

Another matter of considerable importance in connection with wireless telephony is the arrangements necessary to allow the two correspondents to " cut in " and interrupt each other in course of a conversation. We know that when two people are conversing through a single speaking tube they have to be careful not to interrupt each other, for if both try to speak at once, or both listen at once, only confusion results. On the other hand, in the ordinary use of the exchange telephones we listen and speak at the same time. The listener can cut in with an interjection or question, or assure the speaker he is hearing, or ask for a word or sentence to be repeated. In the first forms of wireless telephony this cutting in was impossible. The aerial wire at each station had to be switched over from the transmitter to the receiver as required, and each correspondent had to be certain his distant colleague was ready to listen before he began to speak. This difficulty is to some extent obviated by the use of two slightly different wavelengths for sending and receiving, and the separation of the sending and receiving stations at each post by a certain distance. This was done in the case of the wireless telephone demonstrations across the North Sea conducted by Marconi's Wireless Telegraph Company between Southwold on the east coast of England and Landvoort, near Haarlem, in Holland, in 1921.

The distance between these places is 112 miles. At each place a transmitting and receiving station was established about 700 yards apart. Let us call these stations T_1 and R_1 in England, and T_2 and R_2 in Holland. The station T_1 telephones to station R_2 with a wave of 98 metres wavelength, and the station T_2 transmits to R_1 with a wave 94 metres wavelength. This difference of wavelength (4 metres) was found to be sufficient to prevent the transmitter " jamming " the near-by receiver on the same side. At each transmitting station there was a valve transmitter made as above described, and a transmitting aerial 18 metres high, in which was created an aerial current of 5—8 amperes, which was modulated by an ordinary telephone exchange microphone.

The total power taken up by the transmitter was about 5 kilowatts, and of this 10 per cent., or 0.5 kilowatt, was radiated from the aerial in the form of carrier waves. Underground wires were brought from the receiving station to the transmitting station, so that the actual speech and hearing on each side of the sea was conducted from one place, and the receiving valves could have their filament currents and high voltage circuits switched on from the speaking station. In this manner ordinary telephonic conversation was carried on perfectly.

The problem of duplex wireless telephony, meaning by that the ability of the two conversationalists to speak and hear at the same time and " cut in " as they please, cannot be considered as completely solved by the two-wave and separate station system, because such method could not be applied in the case of aeroplanes or ships for want of space. Accordingly the problem has engaged much attention. The difficulty of it will be realised when it is noted that in many cases where wireless telephony is of the utmost importance, as in speaking to or by aeroplanes from or to the ground station, only a single aerial is practicable on the aeroplane, and therefore the act of sending sets up strong oscillations in it, which, if they have access to the receiving apparatus tuned for the same frequency, may completely jam the latter and set it out of order. Hence the real problem is to find a method of connecting the receiving apparatus to the aerial in such a fashion that the strong oscillations set up on sending shall not have access to it.

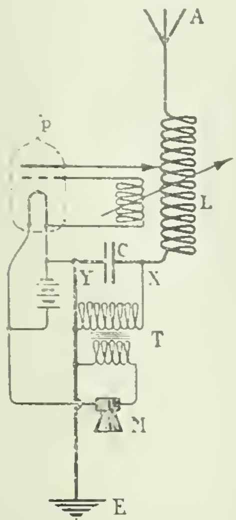


Fig. 103. A type of quiescent aerial with valve transmitter in which the microphone M supplies the plate voltage in the act of speaking.

One solution which has been suggested, but which is only an imperfect solution, is that often called the quiescent aerial. In this case the permanent high frequency oscillations are not maintained all the time in the sending aerial and modified in amplitude by the speech microphone on speaking, but the high electromotive in the plate circuit of the generating valve is applied only by the microphone when it is actually in operation by speech being made to it (see Figs. 103 and 104). The method, however, is not very successful unless a certain supplementary steady voltage is applied by a battery in the plate circuit of the generating valve. The reason for the imperfection is that the transformer in connection with the microphone takes a little time to build up the voltage in the plate circuit of the valve which is necessary to set up oscillations, and there is therefore a want of response unless there is a certain minimum of constantly maintained oscillations in the aerial, and the employment of these permanent oscillations defeats the very thing that it is desired to achieve, viz., the immunity of the receiver from the effect of the transmitter. We cannot, therefore, say that, as far as the confined space of aeroplanes is concerned, the problem of duplex telephony has been completely solved. As far as ground stations

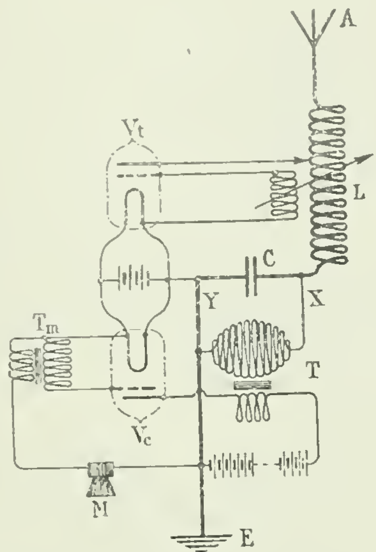


Fig. 104. A type of quiescent aerial with valve transmitter. The microphone M controls the supply of plate voltage in the transmitting valve V.

are concerned, it is worthy of notice that for not very great ranges with no very great differences in the wavelengths, for example, two wavelengths of 110 and 113 metres, and the transmitting and receiving stations only 100 yards apart, it has been found possible to conduct good duplex telephony.

6. DIRECTIONAL SHORT - WAVE WIRELESS TELEPHONY.

Another question of great practical interest in connection with wireless telephony is the employment of very short electric carrier waves of a wavelength of only 12 or 15 metres, and of reflecting mirrors to make a beam of electric radiation like an electric searchlight. This "wireless beam" limits the lateral spread of the waves so that it conduces to privacy of speech. We have already explained in the section dealing with Hertzian waves that these waves can be reflected like rays of light from suitable surfaces.

In the case of an electric searchlight the arc lamp is placed in the focus of a parabolic silvered glass mirror, and this reflects all the rays falling on it in a direction parallel to the axis of the parabola (see Fig. 105). In the same manner, if we bend a large sheet of metal round two formers of wood so as to make a

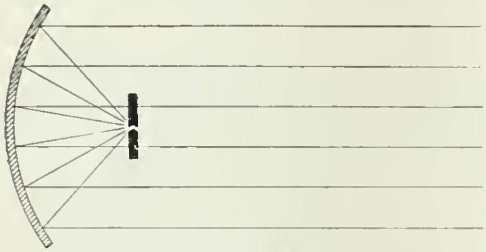


Fig. 105.

parabolic cylindric mirror, and place a Hertzian linear oscillator on the focal line of the mirror, then, provided the dimensions of the mirror are not small compared with the wavelength, we shall project a beam of electric radiation, or of Hertzian waves, parallel to the axis of the mirror.

Experiments of this kind were made many years ago by Hertz and other physicists, and in the early days of wireless telegraphy Senatore Marconi employed parabolic mirrors in the initial attempts to use Hertzian waves as a means of signalling.

It is not, however, very easy to produce continuous electromagnetic waves for the purposes of wireless telephony of wavelength much shorter than 10 to 15 metres. It is essential then that the dimensions of the mirror should be something of the order of 20 to 30 metres. If mirrors of solid metal were employed, these would not only be heavy to move, but would offer such surface to the wind that they would be dangerous to erect. It has been found, however, that if a number of wires are stretched parallel to each other on a frame, and at a small distance apart, this grid will reflect electric waves if the electric force in the wave is parallel to the direction of the wires.

Accordingly we can make a parabolic electric wave mirror which does not offer much surface to the wind as follows :—If we stretch a number

By Courtesy of M. W. T. Co., Ltd.

Fig. 106. The Parabolic Reflector at Inchkeith, Firth of Forth, Scotland, as used for directional short wave wireless telephony.

of wires parallel to each other round the edge of two frames of parabolic form placed at a distance, the wires being held in such positions that they lie on a parabolic sectioned surface, and if we place parallel to these wires, and on the focal line of the parabolic surface, a Hertzian linear oscillator, we can project a wireless beam (see Fig. 106). It is easy to construct such skeleton parabolic reflectors of considerable dimensions, and since the wavelength of the waves radiated from a linear oscillator, or two rods placed in line, is about twice the total length of the rods, we only require a linear oscillator of about 25 ft. or so in length to radiate electric waves of 15 metres wavelength.

Parabolic reflectors of this kind, with linear oscillators in their focal line, have been employed by Mr. C. S. Franklin in important experiments made for Marconi's Wireless Telegraph Company on directive short wave wireless telephony.* The carrier wave was 15 metres in wavelength, and the oscillations were generated by a couple of power thermionic valves having a power consumption of 700 watts, having 4,000 volts on their plate circuits, producing a plate current of 175 milliamperes. These valves created in a linear, or Hertzian oscillator, continuous oscillations of twenty million per second, and radiated a power of about 300 watts in the form of 15-metre electric waves. This oscillator was placed in the focal line of a skeleton wire parabolic mirror of about 30 metres aperture and a corresponding receiving aerial in the focal line of a similar reception mirror employed in reception by a usual amplifying valve detector

After some preliminary and successful experiments at Carnarvon, a site was chosen at Hendon, and another at Frankley, near Birmingham, in February, 1921. These stations are 97 miles apart. With this plant telephonic speech was well conducted. Measurements indicated that the energy received with the directive mirrors up was about 200 times greater than when the mirrors were not used. Also it was found that very decided limitation to the lateral spread of the waves was obtained, so that places much outside the line of transmission could not overhear the speech.

It is quite practicable to employ still shorter wavelengths of less energy. Carrier waves, even as short as 4 metres in length, have been used for such reflector transmission of telephonic speech over seven miles. It is expected that the employment of this "wireless beam" in nautical wireless telephony will prove to be of great utility in giving ships direction and location during fogs.

As these articles are intended to deal only with the elementary principles of the subject, and to be within the range of knowledge of the general reader or would-be amateur in wireless telephony, it is not possible or necessary to extend them to cover more highly technical matters, such as long distance wireless telephony or the influence on it of such factors as soil absorption or atmospheric disturbances, which are sufficiently treated in various text-books.

* For a full description of these experiments the reader is referred to *The Wireless World and Radio Review*, of May 20th, 1922, Vol. X, p. 219, and also to the Paper read by Mr. C. S. Franklin before *The Institution of Electrical Engineers*, May 3rd, 1922.

(*To be continued.*)

Ideal Home Exhibition.

The *Daily Mail* Ideal Home Exhibition will be held at Olympia from March 1st to 24th.

Manchester Wireless Exhibition.

The Manchester All-British Wireless Exhibition has been arranged to take place at Burlington Hall, Burlington Street, Manchester, from March 17th to 24th.

Wireless Club Reports.

NOTE. Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of the Stoke-on-Trent Wireless and Experimental Society on Thursday, January 18th, Mr. L. F. Fogarty, A.M.I.E.E. (Treasurer of the Radio Society of Great Britain), gave a lecture on "Rectifiers."

Mr. Fogarty described the principles of rectification, and illustrated various types of rectifiers. The Nodon valve, the Ferranti rectifier, the "Aedic" rectifier, the "Tungar" rectifier, and several other rectifiers were clearly explained at length, and comparisons drawn between them.

A "Tungar" rectifier, and an "Aedic" rectifier were shown under working conditions, while a rectifier of the vibrating type was on view.

Mr. Fogarty's kindness in coming down from London was fully appreciated, and a hearty vote of thanks was accorded on the motion of Mr. Steel, seconded by Mr. Whalley, and supported by the Chairman, Mr. F. Jenkinson.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Bramley, Bradford.

A meeting was held on Friday, January 12th, with the President, A. Liardet, Esq., in the chair.

After the business had been despatched several new members were elected, and the meeting was then thrown open for general discussion, questions which had been sent in to the Secretary previously being dealt with first.

The receiving set of Mr. J. S. Streeter, Observatory Road, Cape Town, one of the first among the enthusiastic band of amateurs in South Africa to receive the overseas stations.

This discussion was participated in by various members and was much enjoyed.

Subscriptions are now due and should be remitted without delay to the Hon. Treasurer, Mr. E. Brown, 8, Glenholme Road, Manningham, Bradford.

Those wishing to join the Society can obtain application forms on writing to the Secretary.

Harwich Radio Society.

Hon. Secretary, Mr. P. Ashurst, 51, Mary Street, East Horwich, near Bolton, Lancs.

A successful meeting of the above was held on January 16th, when a committee was formed comprising the following :—Mr. Rivis, Dr. Sewell, Messrs. C. Gray, Wynne Hopwood and F. Greenhalgh. It is hoped to hold future meetings in the club-room in the Reform Club as soon as the room is decorated. The arrangements for fixing the aerial over the club-room were left in the hands of Mr. Holt. Mr. Rivis delivered a lecture on "Aerials," which resulted in a lively discussion. The membership is increasing steadily.

The Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

The first meeting of the elementary section of the Leicestershire Radio Scientific Society was held on Monday, January 15th, 1923, at headquarters, the *Leicester Mercury* office, the chair being occupied by the Vice-President, Mr. H. E. Dyson. The inaugural address was delivered by the Chairman, who explained that the aims of the elementary branch of the Society were to foster an interest in Radio, to assist beginners and to furnish the parent Society with many enthusiastic and brilliant members. The President, Mr. C. T. Atkinson, followed with a lecture on "Elementary Wireless," which was highly commendable for its simplicity and lucidity. Illustrations and diagrams illumined the many points dealt with, and combined to make the lecture highly interesting and successful, and questions arising from the lecture were dealt with very thoroughly by the President. At the conclusion a hearty and unanimous vote of thanks was accorded the speaker.

The Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

At an instructional meeting held at the Grammar School on January 12th, the Hon. Treasurer lectured on "Some Apparatus Used in Telegraphy," paying particular attention to the Wheatstone bridge method of determining values of resistances and inductances, such as may be used in radio circuits. Insulation and ohmic resistance of an aerial system were considered, amongst many other very usual applications of the bridge for wireless purposes.

A general meeting was held at the Grammar School on January 19th, Mr. G. P. Kendall, B.Sc. (Vice-President) being in the chair. After the usual business had been discharged, the Chairman called upon Mr. H. F. Yardley, M.I.R.E., to give a paper and demonstration on "The Armstrong Super-regenerative Receiver."

The discussion which followed was keen and prolonged, many members relating their experiences and theories on the subject. Mr. J. Croysdale has been particularly successful with his circuit, having succeeded in raising U.S. broadcast and **8 AB** on a frame using two valves. The meeting was of the opinion that the radiation from the super-regenerative set was not nearly so bad as generally supposed, since the current limiting property of the valves would ensure that no excessive H.F. currents would flow in an ordinary aerial system, should such be used in place of a frame.

The Coventry and District Wireless Association.*

Hon. Secretary, Mr. T. Y. Fletcher, 60, Summerland Place, The Butts, Coventry.

Under the auspices of the above Association, an interesting and instructive lecture on the "Principles of Radio Telegraphy and Telephony," was delivered by Mr. Clinker, M.I.E.E., of the B.T.H. Works, Rugby, on January 17th, to an audience of well over two hundred people.

In introducing the lecturer, the Chairman, Mr. A. P. Young, O.B.E., M.I.E.E., M.I.A.E., told of the valuable pioneer work done by Mr. Clinker in radio-communication in all its phases, the results of which could be clearly seen and appreciated in all the apparatus which the lecturer demonstrated and explained.

Commencing with a lucid explanation of the basic laws relating to oscillation, it was shown by means of practical experiments and lantern slides exactly how these electro-magnetic oscillations which cause the wave motion in the ether are propagated, and passing on, the lecturer dealt with the various discoveries of the early pioneers of wireless and many other important points, chief among them being wavelength and tuning. "Direction Finding" by wireless was explained and demonstrated, and it was remarkable to note the precision with which the apparatus located the transmitting station, Leafield being the station in question.

At the conclusion a very hearty vote of thanks was accorded Mr. Clinker, after which members of the audience were able to inspect the apparatus at close quarters, whilst listening on a loud speaker to the Opera from Covent Garden.

The Wireless and Experimental Association.*

Hon. Secretary, Mr. G. Sutton, A.M.I.E.E.

The meeting of the Association at the Central Hall, Peckham, on Wednesday, January 17th, was mainly occupied by the consideration of the forthcoming meeting of the Radio Society of Great Britain and the election of delegates to attend that meeting to represent the Association.

Messrs. Knight, Joughin, Voigt and Webb were unanimously elected to attend the meeting, and the other members felt that their interests, and the interests of other amateurs in the vicinity were safe in their keeping. It was hoped that some means would be devised for making use of the Amateur Radio Associations in eliminating some of the valve noises which tend to spoil the enjoyment of the freedom of the ether. Communications with regard to membership and similar matters should be addressed to the Hon. Asst. Secretary, Mr. G. H. Horwood, 557, Lordship Lane, S.E.22.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

An enjoyable evening was spent at the Society's club-room on January 16th. The first part of the evening was spent in listening to the broadcasting concerts on a Gecophone broadcasting receiver and loud speaker, kindly lent for the occasion by Messrs. George Garton and Son, Market Place. The demonstration was by Mr. Lynn, of the General Electric Company, Ltd., of Leeds. Mr. J. A. Badham was

Chairman. The opera selections from the Covent Garden Opera, transmitted from Marconi House, were very clearly received. During the second part of the evening Mr. W. H. Hirst, of Huddersfield, lectured on "Esperanto as Applied to Wireless." The lecture was concluded by a conversation in Esperanto, which was translated into English by Mr. Darnell.

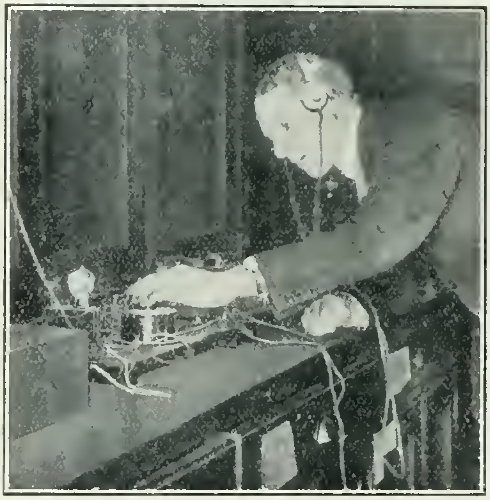
Bath Radio Club.

Hon. Secretary, Mr. Geo. J. Barron Curtis, 6, Pierrepont Street, Bath.

The above Club, although only a few months old, already possesses over seventy members, and is beginning to show signs of becoming one of the leading radio clubs in the west.

At the first meeting of the year, held at the Old Red House, New Bond Street, Bath, on Wednesday, January 17th, members spent a very interesting and instructive two hours.

Following the usual half-hour's buzzer practice, under the tuition of Mr. F. Bird **(2 KP)**, the Chairman, Mr. J. C. Young, made some very interesting announcements.



Testing apparatus at the Post Office intended for broadcast reception. Instruments are carefully examined as to the generation of oscillations. It must be remembered that approval of apparatus by the Post Office implies no endorsement of efficiency.

The first of these was to the effect that the following gentlemen had kindly consented to be Vice-Presidents of the Bath Radio Club: The Mayor of Bath (Alderman Cedric Chivers, J.P.), the Rev. Francis Hardy, M.A., Councillor A. H. W. Taylor, Messrs. F. C. Barber, E. Taylor, A. W. Cunninghame and W. S. Pearce.

The Chairman also intimated that the Club had been very fortunate in securing the services of Mr. Claude Wilcocks, of Warminster **(2 FL)** as Hon. Consulting Engineer.

Following the election of new members, a discussion ensued as to the advisability of adopting the Committee's proposal to hold a special social night in the near future to which ladies would be welcomed. The Chairman felt that the atmosphere of happy informality which would necessarily attend such a function would do much towards promoting that spirit of fellowship which the Committee are so anxious shall prevail at Club meetings. After a certain amount of opposition the proposal was carried.

Business over, the meeting settled down to enjoy an unusually capable lecture by Mr. L. E. R. Boxwell, of Bradford-on-Avon, Wilts. This lecture was the first of a series of six lectures which Mr. Boxwell will give to the Club, and which are intended to tell enthusiasts all they wish to know about their pet hobby in such a manner as to be perfectly comprehensible to the merest beginners.

A question-box was installed by means of which the Committee will deal with any questions which members may wish to be enlightened upon.

Bexleyheath and Welling Radio Society.

Hon. Secretary, Mr. J. O'Keefe, Spring Villas, Long Lane, Bexleyheath.

A meeting of the above Society was held on Thursday, January 18th, at 8 p.m., at the temporary headquarters, "The Hut," Welling, Mr. J. P. Pragnell being in the chair.

When the election of officers and committee took place, approximately thirty-five members were present.

The following officers and committee were elected for the present year:—President, Mr. W. Dickinson; Vice-Presidents, Mr. J. P. Pragnell and Mr. C. Haskell Thomas; Chairman, Mr. O. G. M. Atkins; Vice-Chairman, Mr. T. Griffiths; Hon. Treasurer, Mr. L. W. Smith; Assistant Hon. Secretary, Mr. C. Smith; Committee, Messrs. C. A. Beech, R. Forsdyke and J. Ripper.

The draft of the rules was passed and the amount of the yearly subscription decided, viz., 10s. 6d. per annum; Juniors 18 years and under to pay 5s. 6d. first half year and 5s. second half year.

Any wireless amateur or others wishing to join should write to the Chairman at "St. Aubyns," Burnell Avenue, Welling, or to the Hon. Secretary.

Meetings are held every Thursday at the temporary headquarters until further notice.

"The Hut," which has kindly been placed at the disposal of the Society (gratis) by Mr. Smith, High Street, Welling, is open Mondays, Tuesdays, Fridays and Saturdays, for the use of the members who wish to carry out experiments or to use as a workshop.

Norwich and District Radio Society.

Hon. Secretary, Mr. H. R. Greenfield, 160, Queen's Road, Norwich.

On Friday, December 19th, the above Society held its weekly meeting at the new headquarters, Bracondale House School, Bracondale, Norwich, by kind permission of the Principal, F. B. Williams, Esq.,

The Chairman of the Society, Capt. H. J. B. Hampson, in his opening remarks made mention of the excellent room that had been accorded to the Society, and asked for a vote of thanks to the Principal.

Mr. J. G. Hayward proposed, seconded by Mr. W. G. Hurrell, that the Society take immediate steps to become affiliated to The Radio Society of Great Britain.

During the evening Mr. J. G. Hayward gave an interesting lecture on "The Valve," and by the aid of the blackboard and chalk gave diagrams to show the function of each part.

At the last meeting the members were asked to bring along various sets or parts that they had made, and as a result much interesting data was obtained by members describing their experiences.

The Society is running a competition in the nature of an Aerial Hunt, the suggestion of Mr. C. H. Moore. The conditions are that members should find out the position of aerials erected in and around Norwich and report the discovery to the Secretary on postcards. The one who discovers most will be the winner. The first prize will be a valve kindly presented by Mr. J. G. Hayward, and the second prize an H.T. battery presented by Mr. C. H. Moore.

Hackney and District Radio Society.

Hon. Secretary, Mr. C. Phillips, 247, Evering Road, N.16. (*Letters only.*)

The weekly meeting of the Society took place on Thursday, January 18th, at the headquarters, Y.M.C.A., Mare Street, Hackney, E.8., when a good number of members were present. An interesting lecture on the Morse code was given by Mr. J. Wilson, an expert in telegraphy. At the close of his lecture, Mr. Wilson gave a preliminary lesson in Morse, and the Chairman announced that arrangements had been made to place the instruction on a proper basis. A half-hour lesson is to be given every week especially for beginners, and speed practice will also be given for others.

Although the Society has a fairly large membership, there are many Hackney residents with receiving sets who have not yet joined, and these are cordially invited to visit the Society. The new subscription came into force at the beginning of the year, and there is an appreciable reduction on the previous subscription.

The Society is greatly in need of outside lecturers on any subject connected directly or indirectly with Radio. Up to the present they have relied on members of the Society for this purpose. Anyone able and willing to give a lecture is requested to communicate with the Secretary. Expenses will be willingly paid.

It is hoped to organise in the near future a Social Evening and Exhibition of Radio Apparatus, particulars of which will be announced later.

Salisbury and District Radio Society.

Joint Hon. Secretaries, Messrs. H. F. Futcher and S. W. Johnson, 19, Fisherton Street, Salisbury.

This Society has now been formed, with Capt. J. E. Alcock as President and Sir James Macklin, Capt. A. E. Hussey, F. H.Trethowan, A. B. Randall, M.I.E.E., and his Worship the Mayor as Vice-Presidents, with headquarters at the Old Billiard Room, The Chough Hotel, Salisbury.

The inaugural meeting was held on Thursday, January 18th, when about 40 members and friends were present. Capt. J. E. Hobbs, of Wareham, gave an interesting and instructive description of a four-valve receiving set constructed by himself and using the tuned anode with reaction on the tuned anode coil, for which he claimed 20 per cent. extra efficiency over coupling the reaction coil to the A.T.I. as well as complying with the P.M.G. regulations, and making it impossible to interfere with anyone else by radiation. **2 LO**, **2 ZY** and **5 IT** were in turn successfully tuned in.

The Chairman, after proposing a vote of thanks to Capt. Hobbs, appealed to all interested in wireless to join the Society, the subscription being only 10s. Meetings are held every Thursday at 8 p.m.

The Thames Valley Radio and Physical Association.

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

A meeting of the Association took place on January 18th, Mr. G. Dowse being elected to the chair.

After the minutes were confirmed, the Hon. Secretary gave the meeting a report on the various local hospitals visited by members of the Association and the pleasure it gave to the patients of hearing the opera and concerts broadcasted by the B.B.C.

The association takes this opportunity of commending the idea to many other Societies who are near hospitals, as the trouble taken is well recompensed by the gratitude of those unable to hear such concerts by any other means.

The Chairman then called upon the lecturer to give his short address on "The Making of Radio Receivers," showing the members how, with a cigar box, two home-made basket coils and a crystal detector, he was able to receive perfectly **2 LO** on two sets of 'phones at the cost of a few shillings. He also showed a one-valve panel he had constructed on the lid of a cigar box, which left nothing to be desired in the workmanship and efficiency.

Mr. Dowse was heartily thanked for his lecture.

King's Norton and District Radio Society.

Hon. Secretary, Mr. Richard H. Price, 7, Hawthorn Road, King's Norton, Birmingham.

The first general meeting of the above Society was held at 8.p.m. on Thursday, January 18th, 1923, at Rowheath Farm, Selly Oak Road, King's Norton.

Eighteen members attended, and after considerable discussion, suitable rules were formulated, and the various officers and committeemen elected. Meetings of the Society are to be held regularly on alternate Wednesday evenings at 7 o'clock.

The Society has been fortunate in securing a room at Rowheath Farm, Selly Oak Road, for its meetings. A hearty welcome is extended to all enthusiasts living in the district. Full particulars may be obtained from the Secretary.

The Isle of Man Radio Society.

Joint Hon. Secretaries, Messrs. J. S. Craine, 6, Belmont Terrace, and J. P. Johnson, 16, Hildesley Road, Douglas.

A public meeting under the Chairmanship of the Society's President, Mr. F. R. Grundey, B.Sc., F.C.S., was held recently in St. Andrew's Schoolroom. The occasion was a demonstration and popular exposition of wireless by Messrs. E. H. Vick and A. L. Downward, and the extent of public interest in radio was evidenced by an attendance of probably some 250 people. It was hoped to render the Manchester Broadcast Concert audible to all present by means of a Magnavox loud speaker, but unfortunately a fault developed in the circuits just as proceedings were about to commence, and results entirely ceased. Later, however, the Magnavox found voice, and the last few news items and part of a musical item were heard.

A Broadcast Talk from a Wireless Pioneer.

Admiral Sir Henry B. Jackson discourses on the present position of wireless telephony and forecasts for the new method of communication an important future as an educative influence in civilised life.

A recent photograph of Sir Henry Jackson in his uniform as an Admiral of the Fleet.

THOSE who listened in to Broadcasting from 2 LO on the evening of Monday, the 29th January, will have enjoyed listening to a short discourse given by Admiral of the Fleet, Sir Henry B. Jackson.

Admiral Jackson is well-known as a pioneer in wireless work, and as President of the Radio Research Board. To readers of this journal he is perhaps better known as a President of the Radio Society of Great Britain, from which office he has just retired. Below is published, with the permission of Admiral Jackson, the address given from 2 LO.

" For one not habituated to addressing large but invisible audiences, the position I now occupy in front of this microphone is an important event in my daily life, especially as it is my first attempt to speak into a Radio telephone for other than experimental or testing purposes. Thinking of what to say on such an occasion has brought to my memory, for some inexplicable cause, an incident, entirely unconnected with Radio work, that occurred to me one night about twenty-five years ago, in which, however, I was a spectator only.

" I was serving as Naval Attaché to our Embassy in Paris at that time, but was visiting the Naval works in the vicinity of Nantes. Nantes has now an important Wireless Station whose URSI signals and call sign, UA, are probably well-known to some of those now listening to me this evening.

" There were strong demonstrations against the French Government at that time on account of the unfortunate ' Dreyfus Affair,' and I was amongst the crowd one evening in the streets of Nantes when their violent feelings almost caused a riot. Amongst the cries and yells from the mob, by far the most penetrating and most frequent were the words ' Conspuez Zola,' and ' A bas les Juifs ! '

" Mounted troops charged the mob to disperse them and eventually did so very effectually. I, willy nilly, found myself swept with many others down a side street, and eventually found peace and something else to think about, in an open space. Here on one side was a whitewashed hoarding on which a bright circle of light was being thrown from a large magic lantern erected on a stand near to it.

"Suddenly, the sheet depicted moving figures, and I found myself watching for the first time what are now familiarly known as the ' movies.' The images were somewhat blurred and slow in their movements, but they were an early example of an advertising ' stunt ' of the modern cinematograph. I think few of those present at this scene realised the enormous possibilities of development which have taken place in this industry since that date, and the influence it is now having on the character of many of those young people who spend so much of their time and pocket money at the picture palaces. Personally, I was much struck by the fidelity of this representation of moving life, which was better than I had thought possible at that date.

"There is in my opinion much that is in common between the cinema and the radio telephone, broadcasting speech and music. Different as they are in their methods of reproduction, yet they both depend for their existence on the electro-magnetic waves so thoughtfully provided by Nature. Both are popular means of entertaining large numbers of persons simultaneously at a moderate cost, and both are of educational value, because they can keep us informed of what has happened in distant places, whilst nearly everyone wants to know also how it is done. Those who manipulate apparatus must of necessity acquire this knowledge.

"The clarity of the tones now produced by radio telephony has already passed the stage of development of those shadowy 'movies' I saw that night in Nantes, and the modern cinematograph has probably neared perfection, at least in so far as black-and-white reproduction is concerned. These technical improvements are due to careful scientific and very practical research organised by those interested in commercial development.

"The cinema is now established as a successful business enterprise and may be left to its own efforts to maintain its popularity. It has an advantage in one respect over radio-telephony, in that it can use the electro-magnetic waves of light which are of a length which are not the subject of Government restriction.

Admiral Jackson carrying out experimental work with a special direction finding set in his laboratory, assisted by Lady Jackson.

"Radio telephony broadcasting had not yet had time to become a successful business enterprise, and is sadly restricted in the use of wavelengths it could but may not at present employ, for the reason that it has been forestalled by the previous Governmental allocation of most of these to its sister art of radio-telegraphy.

"The human ear, sensitive and flexible as it is, is also very greedy as to the band of sound wavelengths it requires for intelligible speech, compared with the band of lengths of E.M. waves required by the eye for perfect vision. These demands add to the difficulties of radio-telephony.

" In spite of these difficulties, the British Broadcasting Company have brought their apparatus and organisation to a high state of efficiency in a very short time, and it now rests with them, and with the radio enthusiasts who listen in, to get the public to accept broadcasting as part of their daily life, and so with a good word here and there, timely spoken by their supporters, help the Company to bring it up to a standard level with that of the cinema. Radio-telephony in no way clashes with the cinema, though both are dependent on the same laws of nature for the production of their two very different effects.

" The cinema appeals to the eye only, is reproducible at will, and may therefore be used again and again for years to come. The deaf can get as much pleasure from it as those with normal hearing. The exhibition of the pictures, however, is concentrated, and cannot be broadcasted from one central station like the radiotelephone.

" From broadcasting, however, the blind can get as much pleasure as those with the acutest vision, and this is, I venture to say, one good reason of itself for supporting broadcasting, so as to add to the brightness of the lives of those afflicted with blindness. Opinions probably differ as to which can give the most pleasure to the normal individual. It is really a question of whether *sight* or *hearing* affects our senses the most, and also, for the mass, whether concentrated or scattered audiences will prove to be the best paymasters.

" Personally, I incline to the view that radio-telephony should have the greatest effect of these two on our feelings. The most striking drama on the screen often seems forced and mechanical, and being generally only a staged piece, leaves *me* cold and unsatisfied.

" But the *voice* or *music* actually being produced at the moment by living beings can also convey their own feelings and affect ours, who are listening to them, and this sort of telepathy which passes between us is a much more potent factor in this matter than the mere sight of past actions and gestures.

" Only time will show which will get the ascendancy, but whichever it may be, I hope you will join with me in hoping that British broadcasting will advance, in much less than twenty-five years, as fast as that first cinema I saw in Nantes so long ago.

" In conclusion, I wish the British Broadcasting Company every success in their plucky effort to popularise this art, and with the energy, scientific skill, and commercial ability at their disposal, I feel sure of their ultimate prosperity. I hope those who have listened to me this evening will do what they can to help not only for them, but also for the general benefit of the community."

The Experimental Licence.

The position of the wireless experimenter with regard to the Post Office licence to receive signals is somewhat vague at the present time, and consequently the following list of conditions which accompany the issue of the form of licence now in use may be of interest.

1. The licensee shall not allow the station to be used for any purpose other than that of receiving messages.

2. The station shall be subject to the approval of the Postmaster General, and shall be open to inspection at all reasonable times by duly authorised officers of the Post Office.

3. The combined height and length of the external aerial shall not exceed 100 ft.

4. The station shall not be used in such a manner as to cause interference with other tations. In particular between the hours of 5 p.m. and 11 p.m. on weekdays and all day Sunday, any oscillating valve or valve circuit employing magnetic or electrostatic reaction must not be directly coupled to the aerial or the aerial secondary circuit over the range of wavelengths between 300 and 500 metres. The use of separate heterodyne circuits coupled to the aerial or aerial secondary circuit over the range of wavelengths between 300 and 500 metres is similarly restricted.

5. The licensee shall not divulge or allow to be divulged to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal) or make any use whatsoever of any message received by means of his apparatus, except messages in connection with his experiments received from another experimental station, time signals, musical performances, etc.

6. A fee of ten shillings is payable annually in advance so long as the licence remains in force. The period covered by the first payment expires as follows :—

If the licence is taken out during the three months ended ; 31st March—on the 31st December in the following year ; 30th June—On the 31st March in the following year ; 30th September—On the 30th June in the following year ; 31st December—On the 30th September in the following year.

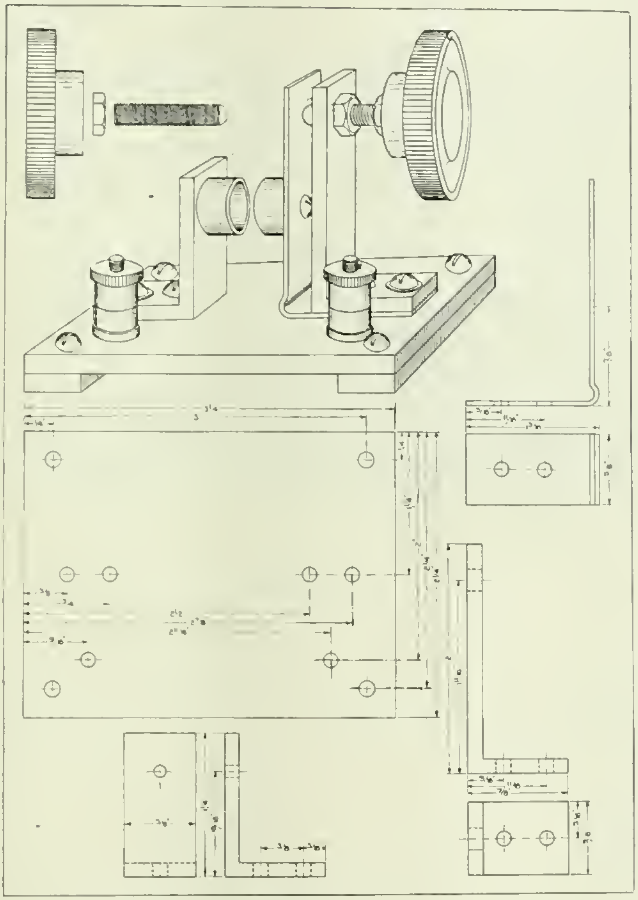
7. Any breach of the foregoing conditions will render it necessary for the permit to be cancelled.

Construction of a Crystal Detector.

A PAGE FOR THE BEGINNER.

THERE is considerable scope in the design of crystal detectors, and the extent of elaboration adopted will not necessarily produce greater signal strength, but only facilitate critical adjustment. Several designs have been put forward in the *Wireless World and Radio Review* from time to time, but that shown in the accompanying diagram is specially arranged to suit the inexperienced amateur, and may even be taken as a preliminary exercise in wireless instrument making.

The base and its under supports are made from polished ebonite sheet 3/16 in. in thickness, carefully cut to size with a fine-toothed tenon saw and filed true. The edges may be finished by rubbing on a piece of emery paper secured down to a flat surface. It should be the aim of the elementary worker to make all edges and faces at exact right angles to each other, and to ensure this, a small steel square should be frequently applied to the work. The location of the holes should be accurately plotted out by means of a centre punch, a dot being marked on the ebonite to act as a guide for the point of the drill. Drilling is carried out with a morse twist drill and hand brace. A piece of strip ebonite or hard wood clamped tightly behind the ebonite base piece will prevent fracturing at the back while drilling.



Dimensional Drawing of the Component Parts.

In order to obtain good insulation, it is desirable that the polished surfaces should be removed, and this can be done by rubbing the surfaces down with fine emery paper. If the rubbing is done in small circles, it is possible to produce a fine matt surface free from scratches.

The right angle supports are made from angle brass, such as can be bought from most ironmongers. If a piece about 2 in. or 3 in. in length is obtained, two supports can be easily made by sawing through at distances to provide the required width, leaving a small piece over which may be placed in the scrap box and prove very handy for some subsequent job.

Each piece should be filed clean and square prior to the marking out of the position of the holes for drilling. Centre punch marks should be made, of course, to guide the point of the drill. The upper hole in the longer bracket must be made sufficiently large to give clearance to the piece of 2 BA screw which passes through. A 2 BA nut is soldered over the hole so as to provide a thread. The surfaces to be soldered must be filed quite flat, and then treated with "killed salts," made by dissolving pieces of scrap zinc in strong hydrochloric acid. If the nut is held in position with a pair of pliers and the end of the bracket heated in a gas flame, it will be quite easy to make the solder run round the nut and fix it securely to the bracket. Any excess of solder can be shaken off while hot, and that which adheres to the surfaces can be removed by filing. The two brass pieces should be finished by rubbing down with emery cloth. A piece of emery cloth should be laid on the bench and the brass pieces drawn across it, whilst the less accessible faces can be rubbed with a file around which a piece of emery cloth is wrapped.

The spring piece is made from hard phosphor bronze, 1/16 in. in thickness and requires very little description except that it must be borne in mind that the bend should not be too sharp.

The crystal cups can easily be purchased with back screws. The knob also is of a type now on the market and has a threaded hole in the centre. The threaded portion can be sawn from a 2 BA screw and is held into the knob by means of a lock nut.

The most suitable crystals for use in this detector are zincite, which is dark red in colour, and copper pyrites, which has a greenish yellow metallic appearance.

The two crystals are secured in the cups by means of Wood's metal. This combination of crystals is known as the Perikon detector, which, in addition to being very stable, is simple to set to a sensitive adjustment.

Notes.

A Polish Honour for Senatore Marconi.

Senatore Marconi has been unanimously elected an Honorary Member of the Société des Radio-techniciens Polonais, and has accepted this honour.

French Stock Exchange Quotations to be Broadcast.

The Paris Bourse and exchange quotations, it is stated, are soon to be broadcast each day from Eiffel Tower.

Collaborators Wanted for Sheffield Experimenter.

Captain L. A. K. Halcomb, of South Dene, 106, Millhouses Lane, Sheffield, is anxious to get into touch with experimenters holding transmitting licences and living within about 60 miles of Sheffield, who would be willing to carry out some experimental work with him. He states that his station (**5 DN**) is licensed for 10 watts, and operates on a length of 200 metres using C.W. and telephony.

Week-end Wireless Service to United States.

Marconi's Wireless Telegraph Company announce that they have introduced a Week-end Wireless Letter Service to the United States at the rate of threepence per word without minimum. Telegrams sent by this service must reach Radio House, 2/12, Wilson Street, E.C.2, either by hand or post before midnight on Saturdays, and will be delivered in New York City on Monday by messenger. Week-end telegrams to destinations in the United States beyond New York City will be mailed without extra charge, but they must bear the full postal address.

Wireless Transmission of Letters.

The French Post Office, it is reported, has announced that after February 10th, "radio letters" will be accepted at all telegraph offices in France for transmission by wireless to the French colonies and certain foreign countries. The wireless rate will vary from 55 centimes (about 2d.) a word plus the ordinary postal rates.

The Wireless Dinner Club.

The second annual dinner of the British Wireless Dinner Club was held at the Trocadero Restaurant on January 27th, the President, Admiral Sir Henry Jackson being in the chair. About 130 members were present, the total membership being about 240. The organisation of the Club was discussed, and it was decided to broaden the qualification for membership, which at present is limited to those who were engaged as officers during the war in the services, so as to include all those who are actively interested in wireless engineering.

A Danish Experimenter Intercepts Communication between 2 KQ and 8 BM.

A correspondent writing from his station at Hellerup, near Copenhagen, reports that at 0920 (G.M.T.) on January 15th he heard communication between **2 KQ** and **8 BM.** His own station, he explains, is a four-valve set consisting of four parallel wires 32 ft. above the ground, the total amount of wire used in the aerial being 450 ft. **2 KQ**, the writer states, is one of the usual 10-watt stations, but **8 BM** was using one amp. in the aerial. The latter station's signals were loud enough to work the loud speaker over a fairly large room.

The New Broadcasting Stations.

The Cardiff station of the British Broadcasting Company, Limited, which it is hoped will be functioning by Monday, February 12th, will have the call letters "**5 WA**," and a wavelength of 395 metres. The Glasgow station of the British Broadcasting Company, which is expected to be in service about the middle of March, will have the call letters "**5 SC**" and a wavelength of 415 metres.

Silvanus Thompson Memorial Lecture.

On Thursday, February 1st, was held the first Silvanus Thompson Memorial Lecture at the Finsbury Technical College, with which the name of Dr. Silvanus Thompson was so long associated.

The first lecturer was Sir Oliver Lodge, F.R.S., who had been a close friend of Dr. Silvanus Thompson. Sir Oliver Lodge chose as the subject of his discourse "The Basis of Wireless Communication," and he traced the development of researches which ultimately resulted in the discovery of the possibilities of wireless as a means of communication.

The chair was taken by Sir Charles Parsons. Dr. W. A. Eccles, F.R.S., who is principal of the College, during the evening referred to the work of the lecturer and the Chairman, describing them as the "two immortals," one the immortal Physicist and the other the immortal Engineer.

The lecture was extremely well attended by an enthusiastic audience. Following the lecture was a demonstration and conversazione, whilst many water-colour paintings, the work of the late Dr. Silvanus Thompson, were exhibited.

Photo: E. O. Hoppé.

Sir Oliver Lodge, F.R.S., D.Sc., who gave the first Silvanus Thompson Memorial Lecture at Finsbury Technical College on February 1st.

Writtle Transmissions Discontinued.

It is announced that Writtle transmitting station has now been closed down by the Post Office authorities and consequently the usual Tuesday transmissions are no longer carried out.

The Manchester Wireless Exhibition.

The Manchester All-British Wireless Exhibition and Convention will open at the Burlington Hall, Burlington Street, Manchester, on Saturday, March 17th, and remain open until Saturday, March 24th. At this exhibition, which is being organised by Messrs. Bertram Day & Co., Ltd., of 10, Charing Cross, London, at the request of the Manchester Wireless Traders Association, radio apparatus and accessories of all kinds will be displayed and demonstrations arranged. In connection with the Exhibition it has also been decided to hold a Convention under the auspices of the Manchester Wireless Society.

Inspection of Wireless Licences.

A warning has been issued by the Post Office authorities that action will be taken against owners of wireless sets who have failed to take out the necessary Post Office licence. Different areas will be selected in turn, it is understood, and all sets inspected by members of the telephone engineering staff armed with the proper authority.

The Writtle Concerts and their Organiser.

Wireless amateurs and the "first 100,000" broadcast "listeners-in" will learn with regret that they will no longer be entertained by those inimitable burlesques and parodies from the Writtle wireless station which have been enjoyed so much each Tuesday evening during the last twelve months.

These transmissions, it will be remembered, were inaugurated by the Radio Society of Great Britain and affiliated Societies, and conducted through the courtesy of the Marconi Scientific Instrument Company, Limited, from their station at Writtle near Chelmsford, in February, 1922, to provide British amateurs with material for experimental purposes which had not previously been available in this country, and they proved to be of great value to the 12,000 amateurs who were interested in wireless before the broadcasting boom set in.

Captain P. P. Eckersley, who has contributed articles to this journal, is well known as the organiser of the Writtle transmissions. Readers will be interested to learn that he has been appointed Chief Engineer of the British Broadcasting Company, Limited.

Radio Society of Great Britain.

The following is a list of new members of the Society elected at the meeting held on January 24th:—Members: A. H. Baldry, E. C. Young, Charles H. Denny, Cecil Wilfred Clarabut, J. C. W. Reith, M.Sc., Major Frank Stanley Morgan, Stanley S. Dawes, J. Wright, A. C. Goddard, R. P. G. Denman, Charles Leazell, P. Charles Raphael, A. E. Basford, A. S. Brown. Associate Members: S. P. Beucher, Major Henry G. Harris, C. Percy Moss, H. Thorpe. The following Societies were accepted for affiliation: The Portsmouth and District Amateur Wireless Association, Norwich and District Radio Society, Ipswich and District

Wireless Club, Northampton and District Amateur Radio Society.

New Wireless Societies.

It is proposed to form in the Borough of Wednesbury a wireless society for experimenters and wireless enthusiasts, to be known as "The Wednesbury Wireless Society." An inaugural meeting will be held shortly, the date of which will be announced later.

All those interested are asked to communicate with Mr. J. H. Lavender, F.C.S., 49, Stafford Street, Wednesbury, as early as possible.

The Carlisle and District Radio Society has recently come into being, and already a strong committee has been appointed. The Hon. Secretary is Mr. Charles E. Crompton, 107, Warwick Road, Carlisle.

A Loud Speaker Used in the County Hall Experiments.

Owing to the acoustic difficulties experienced in the Council Chamber of the New County Hall, London, experiments have been carried out recently with the object of improving audibility. At a meeting at the County Hall, on January 30th, two microphones were arranged on the Clerk's table. The sounds were carried by wires and amplified by thermionic valves in the Press gallery, for the benefit of the reporters. The results, however, were not very satisfactory, partly owing to the conflict between the actual voice in the Council Chamber and the reproduced voice in the gallery; and partly to the fact that the valves amplified indiscriminately all the sounds received by the microphones.

Correspondence

In the first two letters of the following correspondence a phenomenon of particular interest at the present time is discussed by Dr. J. A. Fleming in the form of a reply to a suggestion put forward by Mr. Robert Tingey, whose letter appears below. The latter ventures an explanation of the successful use of low power which was one of the most striking features of the recent Transatlantic experiments. This explanation Dr. Fleming proceeds to criticise by analogy with waves in water and air. Dr. Fleming's plea for serious and systematic investigation of the problems involved will undoubtedly be endorsed by all wireless experimenters.

To the Editor of The Wireless World and Radio Review.

Sir,—I was interested in an article in *The Times* in connection with the transatlantic amateur wireless telegraphy and telephony. In this article it suggested that the authorities in connection with the transatlantic telegraphy were taking this low power communication very seriously. It is a fact that very much greater ranges are being done on short waves and low power than were done last year, and it is not entirely due to the increased efficiency of the apparatus and the experimenters, and I have, up to date, seen very few suggestions to account for this extraordinary improvement, for after all there is an enormous difference between 1,500 watts and 350,000 watts.

I would like to suggest that this increase in range is due to the enormous increase in the number of high power C.W. stations which are operating throughout the 24 hours, and that these long wave stations are in some way acting as carriers for the short waves, or perhaps putting the ether in a more suitable condition for the transference of the short waves. If there be anything in this suggestion, these low power stations are not getting over on their own power alone, but are, in some way effecting the high power transmission on whose power they are relying for their communication.

This might also account for the extraordinary fading effect which is being experienced from all broadcasting stations from a distance. The fact that the rhythm of the fading is regular seems to point to some bad interference such as these stations might cause. For this increased range is not entirely limited to communication with the United States; quite exceptional distances seem to be attained in the British Isles on single valve reception.

I have not seen this suggestion made before, and I trust it is worthy of criticism, and may form an interesting discussion.

If this theory be in any way correct, then should the high power stations cease, the low power communications would not be possible over such distances.

If this suggestion is worthy of further consideration, the Radio Society of Great Britain could make some very interesting tests by collecting data from various amateurs throughout Great Britain and noting the different effects in different areas on low amplification receiving sets.

Robert Tingey.

To the Editor of The Wireless World and Radio Review.

Sir,—I am afraid it would take more space than you can spare and more time than I can give just at present to comment fully upon the letter of Mr. W. R. Tingey. He raises some interesting questions, but it is, to say the least, doubtful whether his premises are sound or conclusions justified. It is a safe rule in seeking explanations of natural phenomena to make sure of the facts first before troubling about explanations. Mr. Tingey states with great confidence that "very much greater ranges are being done on short waves and less power than were done last year, and it is not entirely due to the increased efficiency of the apparatus and experimenters."

This is a very sweeping statement, and would, I think, require a large amount of careful, widespread quantitative measurement of signal strength to establish. We all know that extraordinary distances are covered at times by low power transmitters, but this freak transmission is a very different thing from a general and universal improvement in range with standard apparatus and experimentalists of equal skill. Until the fact of such improvement is established, it seems hardly worth while to try to invent explanations or to controvert the suggestions of Mr. Tingey.

It is difficult to understand what he means by "long waves acting as carriers for short waves" in connection with radio working. We do not find any such effect in studying waves on water or waves in air. Ripples do not travel further on an ocean surface tossed by storms into billows. The loud sounds of thunder, explosions, or the deep notes of a dozen brass bands would not enable a feeble whistle or shrill note to be heard at a greater distance.

Why, then, should long stray waves in the aether, 20,000 metres in wavelength, assist the propagation of the 300 or 400 metre wave allotted to amateurs ?

I do not wish to suggest that there are not causes at work promoting secular variation in signal strength. If observations on this matter had gone on long enough it is possible we might find that there are good and bad radio years, just as there are wet and dry summers, periods of sunspot, maximum and minimum, and good and bad harvests. But the first thing is to make sure of facts. This leads me then to make a suggestion. We have now an enormous number of competent, enthusiastic and scientific radio amateurs and workers all over the country, and radio societies and wireless clubs innumerable. The question is, can we not make better use of all this talent for combined scientific work and the advancement of knowledge, than by merely being content to listen-in for bed-time stories or broadcast concert music ? Would it not be possible to organise some programme of quantitative measurements on a wide scale on the subject of signal strength as received from certain broadcasting stations, and also a systematic study of atmospheric disturbances and the effects of locality ?

It was recently stated in *The Times* that London broadcast is better heard in Scotland than in Yorkshire, and that from Manchester better heard in Southampton than in London. Is this a fact definitely established ? If so, what is the reason ?

The broadcasting from fixed centres with standard transmitters, and with receivers scattered all over the country, makes it possible by suitable organisation to conduct invaluable team work in radio research. Let us hope that wireless broadcasting will not degenerate like the kinema and motion picture business into a mere amusement for the frivolous unscientific public, but that serious students may do serious work in connection with it.

The present Radio Society of Great Britain in London might find it possible to stimulate the provincial radio societies to unite in such work, and then perhaps might find it possible to hold an annual conference, something on the lines of the British Association Meeting, in various towns, once a year, where radio problems and results are described and discussed and wireless men and women might meet to exchange information and organise the new campaigns.

University College, London. J. A. Fleming.

To the Editor of The Wireless World and Radio Review.

Sir,—Now that International Amateur Radio communication is becoming an everyday affair, would it not be opportune to devise some means of distinguishing between stations located in different countries and having the same call letters ?

In an article which appeared in *L'Onde Electrique* of August, 1922, I proposed a plan to this effect and note that the American magazine "*Q.S.T.*" in its issue of December, discusses this plan at some length and puts forward some other interesting suggestions to the same effect.

What is the British amateur's point of view on this question ? Could it not be expressed by competent amateurs in the columns of your widely circulated magazine for the benefit of everybody ?

My plan is that when amateur stations use enough power to be likely to be heard abroad, they put the initial of their country before their call letters. Thus if anyone hears: "**F8AB** de **B2OD**," he will at once know that French **8AB** is being called by British **2OD**, while had he heard: "**A8AB** de **C2OD**," he would have immediately understood that he had picked up Canadian **2OD** calling American **8AB**

This seems to me the most practical solution of this problem, but no doubt there are many other good ways of dealing with it, and it would be very interesting to hear from those to whom they have occurred.

Leon Duloy.

"**F8AB**," Nice.

To the Editor of The Wireless World and Radio Review.

Sir,—I read with great interest a letter from your correspondent, Mr. L. F. Fogarty, in to-day's issue of *The Wireless World and Radio Review*, in which he says:—" I am convinced that it will ultimately be possible to operate a wireless receiving set entirely from alternating current, using some form of rectifier.

I have been experimenting for some considerable time in this direction and have come to the conclusion that the problem is to be solved by the direct use of alternating current rather than by rectification, since the necessary smoothing presents many difficulties. I am here referring, of course, to the filament current supply. No doubt the trouble could be overcome in part by the use of specially constructed valves, but this would not be of much use to the ordinary experimenter.

However, I am convinced that it should be possible to use ordinary valves with the filaments working direct from alternating current. In support of this view, I may say that for broadcast reception my receiver is operated entirely from alternating current. Once the receiver is correctly tuned and adjusted it is only necessary to connect it to the nearest lampholder, and switching on lights the filaments and also supplies the anode circuits with rectified and smoothed current. Little trouble is experienced with hum from a valve operating at radio frequency, but with detecting and audio frequency valves the problem is more difficult.

The results obtained, however, are encouraging, since the particular receiver employs low frequency amplification followed by a power amplifier. By placing one's ear to the mouth of the loud speaker it is possible to hear a slight amount of hum, but this is entirely drowned by the speech or music, the quality of which is not in any way affected. The circuits employed are more or less conventional, special arrangements being made to counteract the effects produced by the alternating current on the filaments.

Paul D. Tyers.

Calendar of Current Events

Thursday, February 8th.

9.20 to 10.20 p.m. Dutch Concert from **PCGG**. The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.

At 8 p.m. Visit to Electricity Works.

ILFORD AND DISTRICT RADIO SOCIETY.

Lecture on "Accumulators," by Mr. C. G. Rope.

HACKNEY AND DISTRICT RADIO SOCIETY.

At the Y.M.C.A., Mare Street, E.8. Informal Meeting.

Friday, February 9th.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At the Dept. of Applied Science. St. George's Square. Elementary Class.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

Lecture (Part II) on "Inductance and Capacity." By Mr. W. G. Marshall.

BELVEDERE AND DISTRICT RADIO SCIENTIFIC SOCIETY.

Discussion on Proposed Transmitting Apparatus, opened by Mr. S. Burman.

BIRMINGHAM EXPERIMENTAL WIRELESS CLUB.

At 7.45 p.m. General Discussion on Wireless Troubles and Difficulties.

Sunday, February 11th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**. The Hague, on 1,050 metres.

Monday, February 12th.

9.20 to 10.20 p.m. Dutch concert, **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. S. A. Notcutt, B.A., LL.D.

WIRELESS SOCIETY OF HULL AND DISTRICT.

At 7.30 p.m. At Signal Corps Headquarters. Park Street. Paper on "The Construction of a Single-valve Set and Note Magnifier," by Mr. J. Brazendale.

Tuesday, February 13th.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.

At St. Margaret's Institute, Alexandra Road. Lecture on "Accumulators," by Mr. C. H. Garrood.

Wednesday, February 14th.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.

At Clare Hall. Lecture by Mr. P. Denison.

EDINBURGH AND DISTRICT RADIO SOCIETY.

At 8 p.m. At Heriot-Watt College. Lecture on "Capacity and Inductance," by Professor F. G. Baily, M.A., D.Sc., M.I.E.E., F.R.S.E.

STREATHAM RADIO SOCIETY.

Annual Dinner.

Thursday, February 15th.

9.20 to 10.20 p.m. Dutch Concert, **PCGG**, The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.

At 8 p.m. At Hitchin Road Boys' School. Practical Work and Experiments.

MANCHESTER WIRELESS SOCIETY.

At 7.30 p.m. At Houldsworth Hall. Lecture by Mr. J. Hollingworth, M.A., B.Sc.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.

Lecture on "A Two-Valve Broadcasting Set." By Mr. F. T. Jones.

THE THAMES VALLEY RADIO AND PHYSICAL ASSOCIATION.

At 8 p.m. Lecture on "Valves and Their Manufacture," by Mr. J. Wade.

Friday, February 16th.

RADIO SOCIETY OF GREAT BRITAIN.

At 6.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment. Elementary Lecture (II), on "Fundamental Principles of Radio Reception," by Mr. Maurice Child.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Meeting.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.

Lecture on "The Design of a Tuner," by Mr. G. B. Kendall, B.Sc.

Saturday, February 17th.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.

At 6.30 p.m. At Holborn Restaurant. Newton Street, W.C.1. Annual dinner.

Monday, February 19th.

THE WALTON-ON-THAMES AND DISTRICT AMATEUR RADIO SOCIETY.

General Meeting at the Headquarters, St. Michael's, Burwood Park Road, Walton-on-Thames.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company ;—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,
Cardiff	5WA	395 ,,

The Cardiff station is expected to be working by about Monday, February 12th.

NEW CATALOGUES.

Messrs. J. H. Taylor and Company, Electrical Engineers, Macaulay Street, Huddersfield: Catalogue of receiving sets and parts, instrument wires, etc.

The Efandem Company, Limited, Electrical and Mechanical Engineers: Catalogue of patent spring clip connections for wireless apparatus.

BOOK RECEIVED.

THE RADIO YEAR BOOK. (London: *Sir Isaac Pitman & Sons, Ltd.*, Parker Street, Kingsway, W.C.2. Price 1s. 6d. net.)

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules: (1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** *(7) Four questions is the maximum which may be sent in at one time.*

"A.B." (Taunton) *refers to the diagram given on page 474, October 29th issue, 1921, and asks (1) How the circuit may be arranged so that connections may be made with the last transformer of his valve receiver. (2) How are the resistance coils of a Wheatstone bridge usually constructed. Are the two resistances of 10,000 ohms shown constructed after the manner of a potentiometer with a slider. (3) The gauge, size and quantity of resistance wire to make the resistances. (4) What voltage is required to satisfactorily operate a 10″ spark coil.*

(1) The arrangement given in Fig. 1 will meet your requirements. The diagram is slightly modified to the arrangement and works very well indeed. (2) and (3) The coils of a Wheatstone bridge are usually doubly wound. The windings are wound

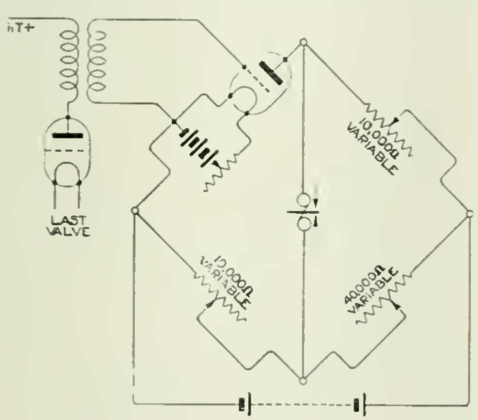


Fig. 1.

upon bobbins suitably mounted. The resistances shown in the diagram need not be continuously variable. The variation may be carried out with the aid of stud switches. We suggest you use No. 44 Eureka wire, which has a resistance of 2,800 ohms per 100 ft. (4) The voltage necessary for the successful operation of a 10″ spark coil varies slightly with different designs of coil, but we suggest you use 40 volts.

"R.W.S." (Manchester) *submits a diagram of his receiver and asks (1) Why the amplification is so small. (2) How to make tuning very selective.*

(1) The diagram of connections submitted is incorrect. The grid and filament of the first valve

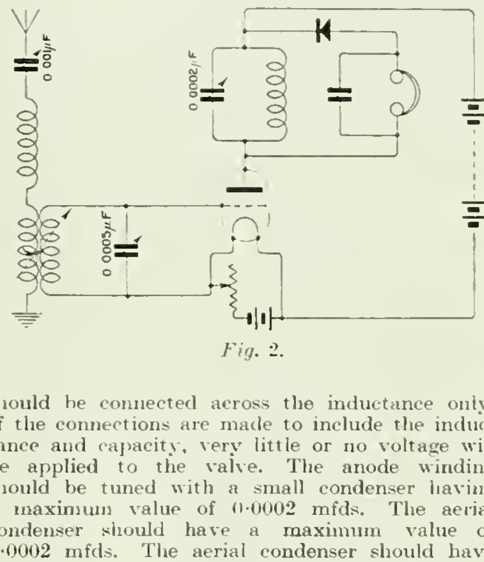


Fig. 2.

should be connected across the inductance only. If the connections are made to include the inductance and capacity, very little or no voltage will be applied to the valve. The anode winding should be tuned with a small condenser having a maximum value of 0·0002 mfds. The aerial condenser should have a maximum value of 0·0002 mfds. The aerial condenser should have a maximum value of 0·001 mfd. (2) We suggest you rewire the circuit according to Fig. 2. You will note that we have added a closed circuit comprising a coil and condenser. The condenser has a maximum value of 0·0005 mfds., and the coil should be similar in size to the aerial coil to which it is coupled.

"L.C.C.R." (N.13) *asks (1) For particulars of a number of tuning coils which will enable him to tune from 150 to 30,000 metres; the coils to be built upon the principle given on page 392 of the issue of December 23rd.*

We cannot give you precise instructions, because the inductance value of these coils depends essentially upon the spacing of the wires, but you should have no difficulty in building up a set yourself, experimentally determining the most suitable values. The inductance values of a set of honeycomb coils could be taken as a basis to work upon.

"**EXPERIMENTER**" **(Glasgow)** *submits a diagram of his receiver and asks* (1) *For criticism of the diagram.* (2) *For suitable values for the aerial, closed circuit, reaction coil, and anode coil.*

(1) The arrangement is quite suitable, except that it would be better to use a closed circuit, but the anode coil should of course be tuned with a small variable condenser having a maximum capacity of the order of 0·0002 mfds. (2) The tuning arrangements which you have at present should be quite suitable, but we suggest the closed circuit coil should have 40 turns on a 2″ diameter former, the No. 34 S.S.C. wire which you have by you being used. It would be better if you rewound all the coils, using heavier gauge wire No. 22 for the aerial circuit, No. 24 for the closed circuit, and No. 32 for the reaction coil and the anode coil.

"**G.W.S.**" **(Atherstone)** *submits a diagram of a crystal receiver which he has constructed, and asks* (1) *Whether he may expect to obtain an experimenter's licence.* (2) *Could it be altered and made suitable for the reception of broadcast wavelengths with the addition of valves.* (3) *Does the direction of the aerial affect the strength of signals received to any extent.* (4) *What is reaction.*

(1) In view of question (4), we do not think you would obtain an experimenter's licence.

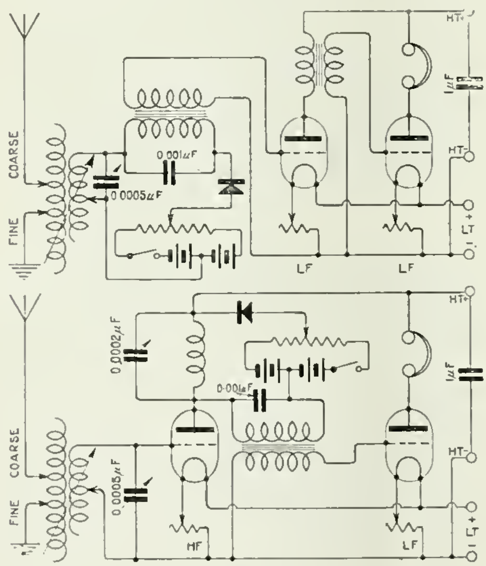


Fig. 3.

The experimental licence is granted to persons who in the opinion of the Post Office have sufficient knowledge to enable them to operate receiving apparatus without causing interference to other wireless users. Why not become a member of the local Wireless Society, where you would receive much help. (2) The receiver could easily be altered. In Fig. 3 the upper diagram shows how two note magnifiers are added to the receiver, and in the lower diagram one high frequency valve is connected with a crystal detector and note magnifier. (3) Outdoor aerials have slight directional properties. To receive the maximum strength

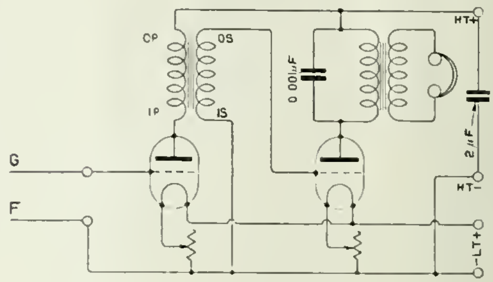


Fig. 4.

of signal, due consideration being paid to other factors, the lead-in end of the aerial should be nearest the transmitting station, and the direction of the horizontal portion of the aerial should point towards the transmitting station. (4) A valve is capable of amplifying, therefore more energy is available in the output circuit of the valve than is applied to the input. Reaction consists in transferring a small amount of the output energy to the input circuit, thus reinforcing the input signals. If reaction is carried too far, that is to say, if a large proportion of energy is transferred back to the input circuit, valves will generate oscillations, and if the input circuit is coupled with the aerial circuit, energy will be radiated.

"**VIC. E.**" **(Coventry)** *asks for a diagram of a two-valve low frequency amplifier.*

We would refer you to Fig. 4. The diagram is very straightforward and easy to follow.

"**A.J.**" **(Yorks)** *refers to the diagram on page 387 of December 16th issue, and asks* (1) *What is the dimension of the anode coil.* (2) *Is the anode coil a fixed inductance, or should it be tapped or inductively coupled with any other coil.* (3) *With the A.T.I. and C.C.I. of given dimensions, should it be possible to receive the broadcast transmissions.* (4) *What is the wavelength range of the station.*

(1) and (2) The anode coil X, together with the 0·0002 variable tuning condenser, should tune to the wavelength of the signals; that is, the coil X should have approximately twice as many turns with the same diameter as the closed circuit coil. The anode coil is fixed in position, and should not couple with any other coil in the receiver, otherwise regenerative effects would be obtained. (3) You should certainly receive the broadcast transmissions. (4) The wavelength range of your station is from about 200 to 8,000 metres.

"**A.S.P.**" **(London, E.C.3.)** *asks* (1) *For criticism of a proposed crystal set.* (2) *Whether a frame aerial may be used.* (3) *Whether he would get good results with a Reinartz tuner to tune up to*

8,000 *metres.* (4) *The best aerial which he can erect in his circumstances.*

(1) We suggest you build a set yourself and wire the components as indicated in Fig. 5. The aerial tuning inductance may consist of a winding of No. 22 D.C.C. on a former 4″ in diameter and 6″ long. The secondary tuning inductance may consist of a winding 3″ in diameter and 8″ long of No. 30 D.C.C. (2) It is useless to expect signals when the crystal set is connected with a frame aerial. We suggest you build an open aerial as advised in No. 4. (3) We suggest you do not build a Reinartz tuner, but a standard valve receiver. Particulars of many have appeared recently in these columns. (4) We suggest you secure a pole to the house and then erect a 35 ft. pole in the garden as suggested. The higher the aerial the better it will be for your purpose.

"H.C.H." (London, S.W.1.) *asks* (1) *For a diagram of a four-valve receiver using one H.F., one detector and two L.F. connected valves for a switch cut out of the first H.F. valve and provision for plug-in telephones into either of the L.F. valves.* (2) *What is the smallest current which will operate the P.O. telegraph relay.* (3) *The minimum number of valves required for recording Paris Spark signals.* (4) *Is a Brown adjustable telephone, rewound with No. 47 enamelled wire, useful for recording purposes as described in a recent issue of "The Wireless World and Radio Review."*

(1) The diagram given in Fig. 6 is quite suitable for your purpose. (2) The P.O. telegraph relay will operate well with a current of 0·2 milliampere. (3) We suggest you use a three-valve receiver for this purpose. (4) The arrangement suggested is quite suitable.

"H.W." (Manchester) *asks for advice regarding an experimenter's licence.*

We think your information concerning the conditions under which experimental licences are granted is incorrect. If you build your own set, you must possess an experimenter's licence. If the Post Office will not grant you an experimenter's licence, you are not allowed to use a receiver which you have built yourself, but must purchase one which bears the stamp B.B.C. If you hold an experimenter's licence, it is a condition that you shall not cause your receiver to oscillate while listening to the broadcasting transmissions.

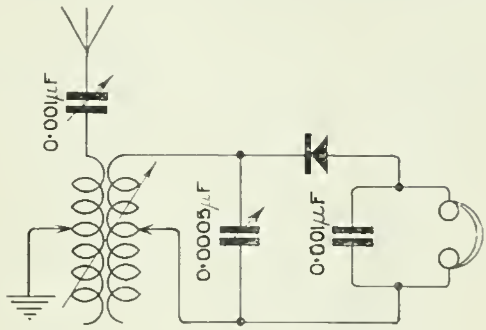


Fig. 5.

"R.W.McW." (Glasgow) *proposes to use a frame aerial and asks* (1) *Whether a three-valve receiver comprising one high frequency, one detector, and one L.F. connected valves would be useful.* (2) *Whether it would be better to use more valves.*

(1) We consider you will hear the local broadcasting stations using the three-valve set, but you will probably only faintly receive the transmissions from the more distant broadcasting stations, and we suggest that for good reception you add two high frequency connected valves. See circuit given on page 315, December 2nd issue. The frame in this case takes the place of the secondary tuning coil, and of course the aerial circuit is not required.

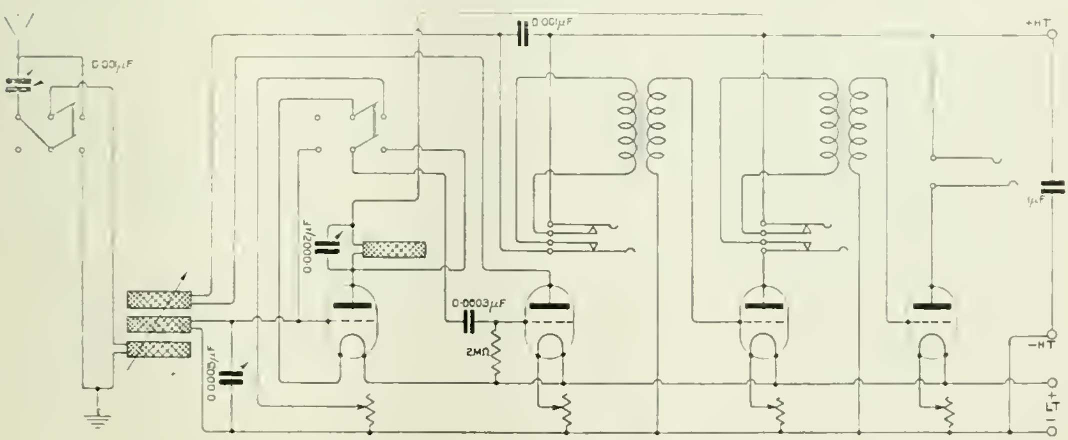


Fig. 6.

"D.G.K." (Herts) *asks* (1) *For a diagram of a five-valve receiver employing two H.F., one detector, and one L.F. connected valves. High resistance telephones are to be used, and it is desired* *to be able to switch on or off the valves as required.* (2) *What are the dimensions of the tinfoil plates of the fixed condensers to be used in the receiver.*

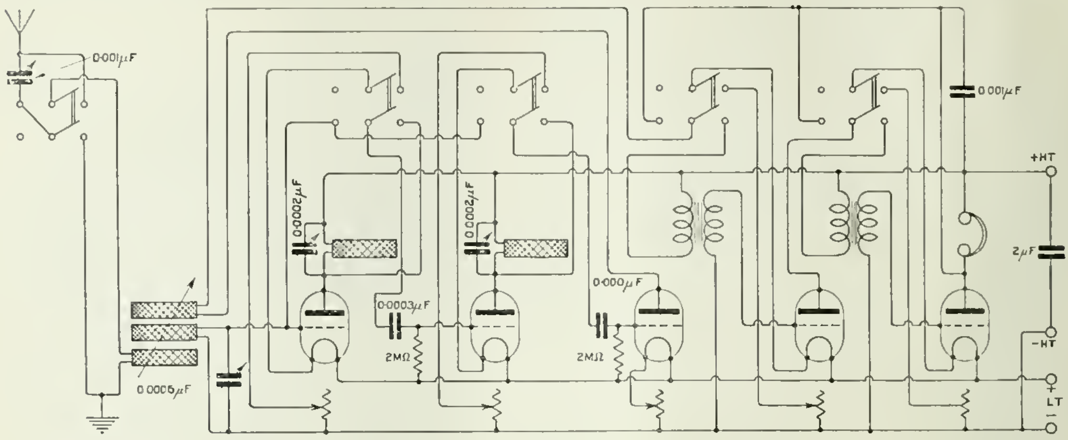


Fig. 7.

(3) *What are suitable capacities for the variable condensers.*

(1) A suitable diagram is given in Fig. 7. The tuned anode method of H.F. amplification is used. You will notice the grid-leak connections are made with + L.T. (2) 0·0003 mfd. condensers may consist of two plates with an overlap of 3 cm × 1 cm., the mica being 2 mils. thick. The 0·001 mfd. condenser may consist of six plates with an overlap of 2 cm. × 1 cm.; mica 2 mils. thick. (3) Suitable values for the variable condensers are indicated in the diagram.

(1) See Fig. 8. A number of arrangements similar to this have recently appeared. (2) The telephone transformer may consist of a bundle of soft iron wires built up to a diameter of ⅜″ and 5″ long. The primary winding may consist of 5,000 turns of No. 42 S.S.C. wire, and the secondary of 1,000 turns of No. 34.

"R.A.M." (Barrow-in-Furness) *asks the number of turns required in honeycomb coils to tune in conjunction with 0·00075 variable condenser over a wide wavelength range.*

We suggest you wind 25, 35, 50, 100, 200, 500, 750, 1,000, 1,250, and 1,500 turns. For the smaller coils we suggest you use No. 22 D.C.C., and for the larger coils No. 26 D.C.C.

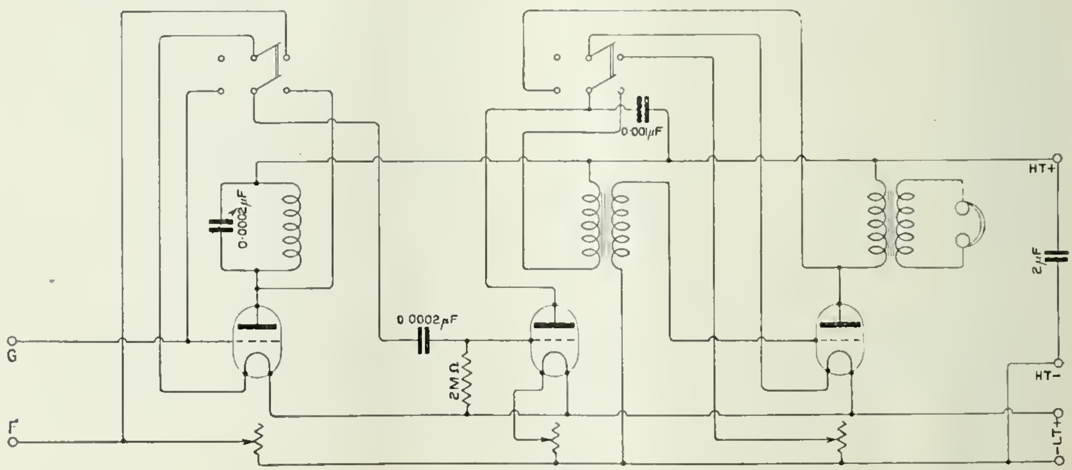


Fig. 8.

"W.A.T." (Sheffield) *refers to the broadcast receiver described in this journal and asks* (1) *For a diagram showing how two double pole throw switches can be connected.* (2) *How to construct a telephone transformer.*

"M.A.H." (London, S.E.24) *asks how to add a H.F. connected valve using a plug-in type transformer to his detector valve with switch for cutting in or out the H.F. valve.*

See Fig. 9. Suitable valves are indicated.

"F.A.M." (N.W.11) *asks* (1) *Whether it matters which way round the coils are connected in a three-coil holder.* (2) *Why is it signals appear quite as strong when no grid leak is used.*

(1) It does not greatly matter which way round the aerial and closed circuit coils are connected, and is not likely to set up oscillations in the aerial circuit if the reaction coil is coupled with the anode coil. If, however, the reaction and aerial coils are coupled together, you may be sure oscillations will be generated in the aerial circuit sometimes, and interference will be caused.

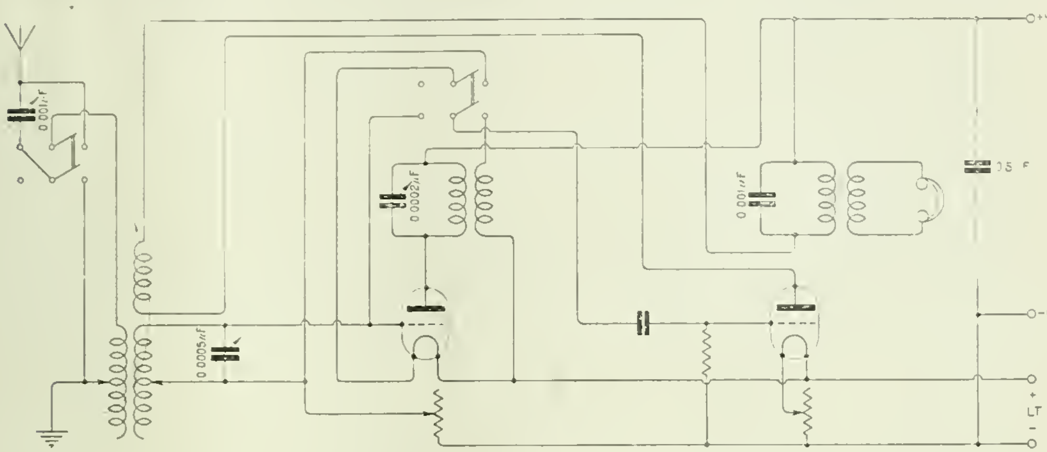


Fig. 9.

but it does matter which way the reaction coil is joined. With one connection, the current flowing in the reaction coil will assist that flowing in the closed circuit coil, and with the reverse connection it will oppose the closed circuit. (2) You probably have a leak or a low insulation between the grid and filament terminals of the valve. This may happen through poor ebonite, or because of pencil marks, dust, dirt, and so on. The back of the panel should be cleaned, and lines scratched round the various terminals to prevent surface leakage. It is not satisfactory to work without the grid leak, because one does not know the value of the leak resistance.

"Z.H." (Southall) *asks* (1) *What publication gives the definition of signal strength such as is used by a man reporting the reception of a certain station, strength R 6.* (2) *Is there any record of the smallest amount of power that has been amplified and received as a wireless signal.*

(1) The strength of signal referred to by R 6 is not a definite signal strength, in so far that it has no definite value. It is simply a convenient way of expressing a signal with an apparent intensity of a certain value. The signal strengths were referred to in this manner in the Army and Navy Signal Services, and convey sufficient meaning. (2) We have no record of the smallest amount of power that has been amplified and rendered audible by a valve receiver.

"N.B." (Lancs.) *asks* (1) *What size of duo-lateral coils would be required for British broadcasting.* (2) *Is the receiver (diagram of which is submitted) connected so that it is unlikely that oscillations would be generated in the aerial circuit.*

(1) We suggest you use Nos. 35, 50 and 75 duo-lateral coils. (2) The diagram submitted is quite suitable for the reception of broadcast transmissions

"E.T.W." (Lincoln) *asks* (1) *Suitable dimensions of an aerial tuning inductance.* (2) *A suitable secondary coil.* (3) *A suitable reaction coil.*

(1) The A.T.I. may be a coil 3″ in diameter, wound with No. 18 D.C.C. ; 144 turns may be used with tappings taken at every twelfth turn. (2) The secondary winding may be 2″ in diameter, and wound with 250 turns of No. 22 D.C.C., with five tappings. The reaction coil may be 2″ in diameter, and have a winding of 100 turns of No. 26 D.C.C.

"K.H.F." (India) *submits a diagram of his receiver and asks* (1) *Whether it is suitable.* (2) *Whether it is possible to reduce interference caused by a near-by power station.*

(1) We have examined the diagram of connections, and the connections are quite suitable. We would point out, however, that the inclusion of so many switches in the high frequency portion of a receiver is apt to seriously cut down the signal strength. (2) We suggest you use a frame aerial, or if you prefer to use the open aerial, to use the counterpoise in place of the earth. If trouble is still experienced, the low frequency portion of the amplifier should be screened by being placed in a metal box.

"E.J.M." (Derby) *asks* (1) *Whether the use of a Dewar type switch in the aerial circuit and as a stand-by switch, is likely to reduce signal strength.* (2) *Is the resistance capacity type of high frequency amplifier more efficient on long wavelengths than an impedance capacity amplifier.* (3) *Is* **8 AB** *transmitting. If so, at what times and on what wavelength.*

(1) Provided the switch springs are well spaced no serious losses are likely to occur, although the practice is not recommended. (2) When receiving very long wavelength signals, it is better to use the reactance capacity method of high frequency

amplification. (3) The French amateur station **8 AB** transmits at irregular intervals, and if you are interested in these transmissions, we suggest you communicate with him.

"E.J.P." (Kent) *asks* (1) *For a diagram of a two-valve receiver, comprising two high frequency valves with crystal detector.*

See the diagram Fig. 10. Suitable values for the condensers are indicated.

"N.E.K." (Belgium) *asks* (1) *Whether it is possible to replace high frequency transformers with tuning coils for reception up to 2,000 metres, and above that to use the resistance capacity method of high frequency amplification.* (2) *What values of inter-valve capacities should be used, the grid leak being 6 megohm.* (3) *What should be the H.T. voltage. "R" type valves are used.* (4) *Is it better to connect a low value capacity between the last high frequency and the rectifier grid.*

(1) We suggest you adopt the tuned anode method of coupling high frequency valves, up to a wavelength of 2,000 metres, above which use the resistance capacity method. (2) We suggest you employ coupling condensers of 0·0002 mfds. (3) The H.T. voltage applied to the high frequency valves should be of the order of 50 volts. The low frequency valves may have a much higher voltage, although in this case it is advisable to connect a few cells in the grid circuit, in order to ensure that the grids shall be sufficiently negative. When the anode resistances are used, the H.T. voltage should be increased to allow for the voltage drop through the resistance. (4) It is sometimes better to use a smaller coupling condenser between the last high frequency valve and the rectifying valve, but you should determine the best condensers by experiment.

"P.S.B." (Walsall) *submits particulars of his receiver, and asks for any suggestions.*

We suggest you use a different set of receiving coils when attempting to receive the London broadcast transmissions. It would be an advantage to tune the anode winding for the high frequency valve, and for this purpose a tuning condenser having a maximum value of 0·0002 mfds. should be used. In general, the smaller the value of this condenser the stronger will be the signals. The aerial tuning condenser is of suitable value, and all future adjustments should be made with the coils. We suggest you use "R" type valves with 45 volts on the anode of the high frequency and detector valves, and 60 volts on the anode of the L.F. connected valves.

"COIL" (Edinburgh) *submits particulars of the coils he has wound, and asks whether they have sufficient inductance to enable him to secure from 350 to 450 metres.*

We think the coils have sufficient inductance to enable you to tune over the required wavelength range, provided the aerial tuning condenser has a maximum capacity of 0·001 mfd., and the closed circuit contains a maximum value of 0·0004 mfds.

"G.E." (Cumberland) *refers to the figure of a former on page 130, October 28th issue, and asks how to connect the two windings.*

The winding should be connected in series, so that the two windings are wound in the same direction. The inductance will then be added. Alternatively, for smaller inductance value, the two windings may be connected in parallel.

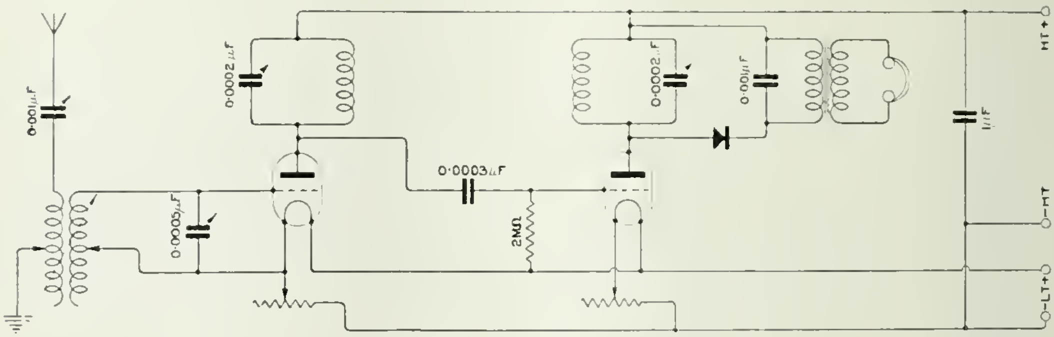


Fig. 10.

SHARE MARKET REPORT

Prices as we go to press on February 2nd, are :—

Marconi Ordinary	£2	12	6
,, Preference	2	3	9
,, Debentures	107	0	0
,, Inter. Marine ..	1	8	3
,, Canadian		11	3
Radio Corporation of America :			
Ordinary		15	0
Preference		13	3

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 183 [No. 20. VOL. XI.] FEBRUARY 17th, 1923. WEEKLY

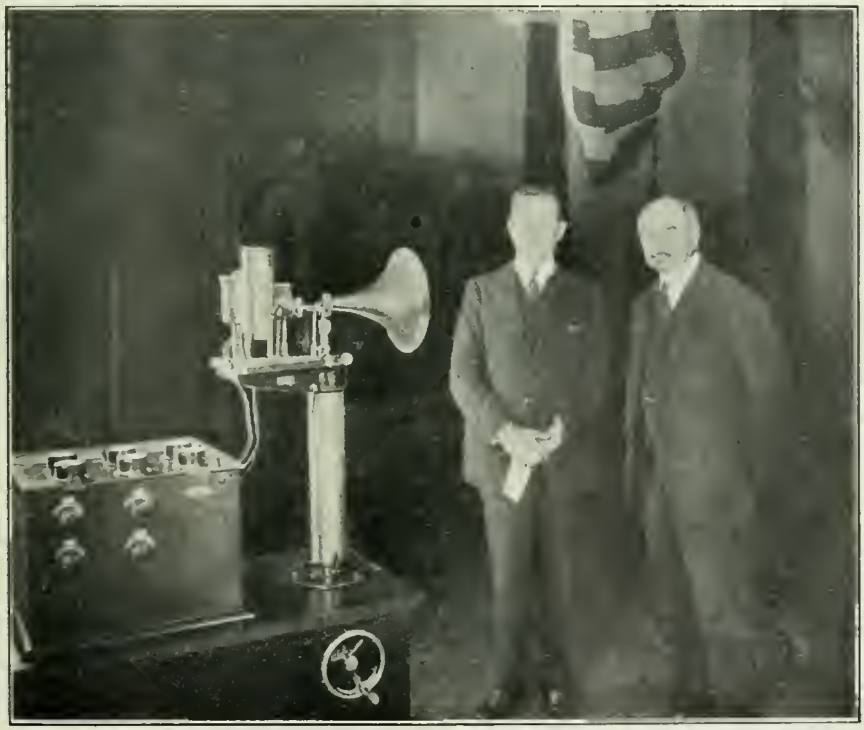
The American Broadcasting Station WGY

A description of this station is of special interest, as it is one of the American broadcasting stations frequently mentioned by British amateurs in their reports of Transatlantic broadcast reeeption.

THE accompanying description is intended to give some idea of the manner in which WGY, the General Electric Company's station at Schenectady, New York, operates.

The transmitting apparatus and the studio where the artists perform are not located in the same building, but are about three-fifths of a mile from each other.

The transmitting apparatus proper is located on the top floor of one of the factory buildings. A multiple tuned antenna has been erected

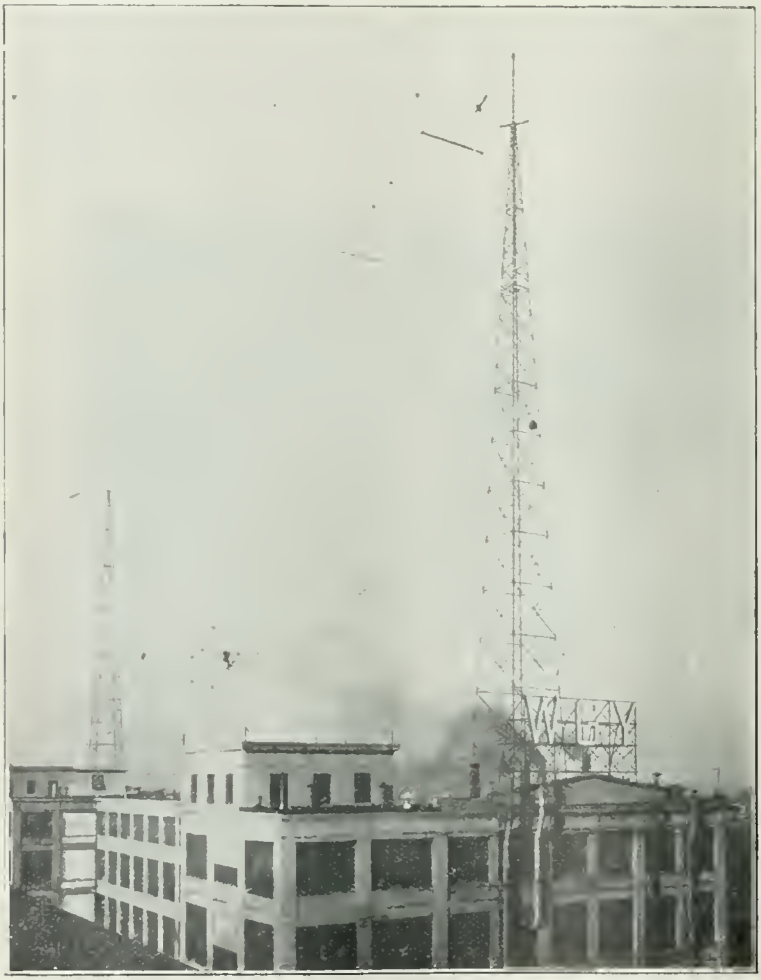


Senatore G. Marconi with Mr. E. W. Rice, Jr., Honorary Chairman of the Board of Directors of the General Electric Company, in the studio of WGY, from which Senatore Marconi delivered an address to the American people, speaking through the microphone on the left.

on the roof of this building. The antenna is 350 feet long and is supported at each end by a steel tower 180 feet high. A counterpoise system has also been installed a few feet above the roof. This consists of a network of wires that act as a " ground " for the antenna and results in a considerable decrease in the effective resistance of the whole antenna system.

The power supply for the transmitter is three phase, 60 cycles, at a potential of 110 volts. This source furnishes practically all the power for the entire equipment. Two types of vacuum tubes are used, namely, kenotrons or two element tubes and radiotrons or three element tubes. The filament of the kenotron is heated from the secondary of a step down transformer. A small direct current generator is used to supply the radiotron filaments.

The plate circuit of the radiotron power tube requires high voltage direct current at a potential of about 12,000 volts. This is obtained from the kenotrons which are connected through a suitable rectifying circuit to the secondary of the high voltage plate transformer. A filter system is connected in the rectifying circuit in order to remove the A.C. hum that would otherwise be present. The high voltage output of the kenotron rectifier then passes into the radiotron tubes, where by means of the proper oscillating circuits it is converted into radio frequency energy on a wavelength of 360 metres.



A general view of the antenna system of the American Broadcasting Station, WGY, *at Schenectady, N.Y.*

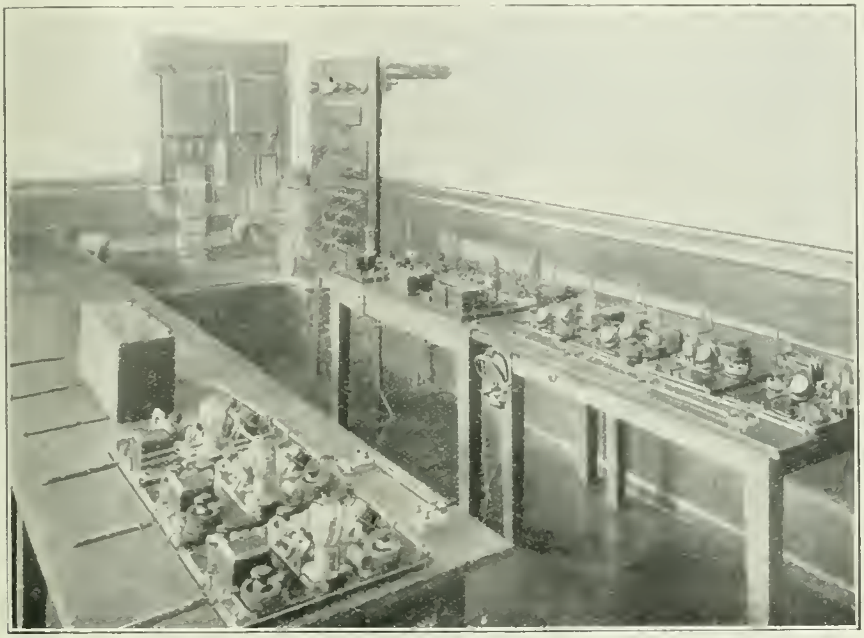
Three rooms are utilised at the studio, one being used as a reception room, one containing pianos, organs and other musical instruments, and the third containing the controlling and amplifying apparatus. The only apparatus located in the room where the artists perform are small microphones which are mounted on stands so that they may be placed in the best position for the particular selection to be broadcast. These microphones have been very carefully designed so that the true tone qualities of music, voice, etc., will be clearly reproduced. The minute current fluctuations set up in the microphones are then transferred to the apparatus room, where they pass to amplifiers. Various controls are provided on the amplifiers so that the degree of magnification may be varied at will.

The amplified current fluctuations are next transmitted over a pair of wires to the modulator tubes located in the transmitting station proper, which are so connected that they may control the antenna current by varying the plate potential impressed on the oscillator tubes. The censorship and supervision that is exercised over the broadcasting is of some interest. The studio director has at his disposal a control switch which cuts the microphones in or out of the circuit. As soon as this switch is closed a red lamp is illuminated, which warns those in the room that everything spoken will be transmitted to the invisible audience. The "censor," or man in charge of the amplifiers in the apparatus room, listens continually to the concert or selection being broadcast so that he may make any adjustments necessary to improve the tone quality of the transmission. The censor is also in telephonic communication with the transmitting equipment, keeping a constant watch on the operator, who in turn keeps a constant watch on his apparatus, and by means of an oscillograph can determine the amount of modulation which is taking place in the antenna circuit.

All circuit adjustments are, however, under the complete control of the censor and no changes are made without his consent.

It is interesting to note that this station has been listened to by a number of amateurs in this country, and in the issue of this journal for January 27th, on pp. 579 to 580, is given a list of some British stations which were successful in reception of American broadcasting. WGY is here mentioned as being heard by three amateurs, W. R. Stainton, Leigh, Lancs. ; J. W. Partington, Camborne, Cornwall ; and V. M. Cartnell, Southport. Other reports of reception have since been received from B. Caldwell, nr. Warrington, Lancs. ; Colin Sarbuck, nr. Wigan, Lancs. ; S. W. F. Cardell, Newquay, Cornwall ; R. S. Smith, Erdington, Birmingham ; and H. J. Jarrold, Norwich.

Other Broadcasting stations heard include WJZ, Newark, New Jersey ; WDY, Roselle Park, New Jersey ; WEY, Wichita, Kansas ; WDAC, Springfield, Illinois ; WDAF, Kansas City, Kansas ; WEAS, Washington, D.C. ; WIP, Philadelphia ; and WOR, Newark.



The Censor's room adjoining the studio. The Censor determines the quality of the music and directs the amplification necessary to carry the speech and music over wire lines to the transmission equipment three-fifths of a mile away.

The Antennæ.

THE TRANSMITTING STATION'S RADIATING SYSTEM.

IT is a matter for comment that while an experimenter will devote hours in making circuit adjustments in order to increase the current indicated by his aerial ammeter by a part of an ampere, little time or trouble is given to improving his radiating system—aerial, earth and counterpoise. From a consideration of the usual radiating structures it is apparent that in many cases great improvement is possible, and it is hoped in these notes to show why an improvement may be obtained and then to show the methods by which improvement may be achieved.

An antenna possesses resistance, capacity and inductance, and it is proposed to deal with resistance first.

Suppose we have a transmitter which is capable of putting 50 watts into the aerial circuit. The power radiated, which of course we desire to be as large a percentage of the 50 watts as possible, is equal to C^2R, where C is the current measured with a hot wire ammeter placed at the point of maximum current, *i.e.*, generally in the earth lead, and R is the radiation resistance. The radiation resistance in ohms is given by

$$1580 \left(\frac{h}{\lambda}\right)^2 \quad . \quad . \quad . \quad . \quad (1)$$

where h = the effective height of the aerial, and λ is the wavelength of the energy in metres. From this equation it will be noticed the radiation resistance is proportional to the effective height, and varies with the wavelength. Now the total resistance of the radiating system is R_T ohms, and is considerably greater than R. With an antenna of 25 ohms total resistance, the current will be $\sqrt{\frac{\text{watts}}{R_T}}$ which is in this case $\sqrt{2}$ or 1·41 amperes. If the radiation resistance for the wavelength of the energy is 3 ohms, the power radiated will be $C^2R = 6$ watts.

The efficiency of the antenna is $\frac{6}{50} \times 100\%$ $= 12\%$. The resistance values used here of course include that due to the tuning inductance and condenser if one is used.

The current received by an antenna is given by the formula $h_s I_s = \frac{\lambda d R I_r}{377 h_r}$ . . . (2)

where I_s = current in transmitting aerial in amperes.
I_r = current in receiving aerial in amperes.
h_s = effective height of transmitting aerial in kilometres.
h_r = effective height of receiving aerial in kilometres.
λ = wavelength in kilometres.
d = distance in kilometres.
R_T = total resistance of receiving circuit in ohms.

The formula may be re-written

$$\frac{h_s I_s}{\lambda} = \frac{d R I_r}{377 h_r} \quad . \quad . \quad . \quad (3)$$

Now $\frac{h_s I_s}{\lambda}$ concerns the transmitter, and it is at once evident that I_s which is the aerial current should be as high as possible, and as in the radiation resistance formula above, h_s should be large. The factor λ appears in the denominator of the expression, and it would seem at first sight that the shorter the wavelength the greater the received signal current, other factors remaining undisturbed; but this is not so on account of absorption, which is far more serious at short wavelength than long. Formula (3) is accurate for short distances, say up to 40 or 50 miles, but beyond that range the effects of absorption cannot be neglected, and the expression for the received current is reduced by a quantity determined by the nature of the intervening country and other factors.

It will be seen that it is desirable to make the ratio $\frac{R}{R_T}$ as great as possible, as in this way the antennæ current is larger, and a larger proportion of the power delivered to the antennæ is radiated. The difference between R_T and R, which is wasted, may be called R_w, and is made up of a number of components.

We have first of all the ohmic loss, due to the ohmic resistance of the aerial wires, lead-in, loading coil, and perhaps series condenser, and earth or counterpoise. The loss is manifest as heat, and is reduced by using conductors which have a low value of high frequency resistance. The second loss is due to dielectric absorption, and is brought about by imperfect dielectrics lying in the field of the antennæ. In addition we have losses due to eddy currents, leakage, and brush discharges.

Curves which may be drawn showing the variation of total resistance with wavelength, are similar to Fig. 1. The figure shows roughly how the resistances vary with wavelength. The copper loss, in which is included that due to eddy currents and skin effect, is slightly greater the higher the frequency, and is represented by curve (1). The loss due to imperfect dielectrics is proportional to the wavelength, the higher the wavelength the greater the loss, and is represented by curve (2). The radiation resistance is represented by curve (3), and it will be noticed, varies inversely as the wavelength. The total resistance is indicated by curve (4).

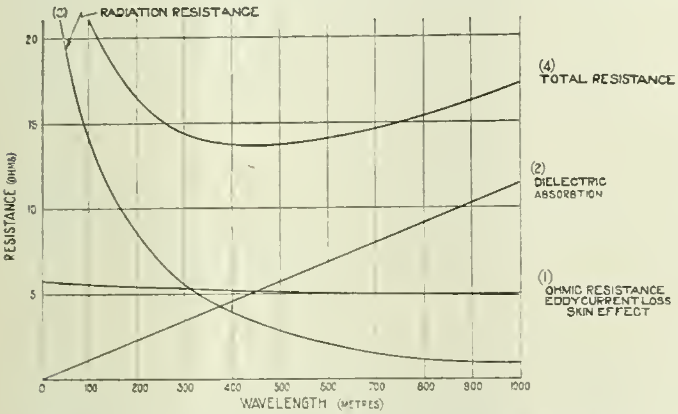


Fig. 1. The curves indicate the variation in antennæ resistance with wavelength. The sum of the magnitude of the resistances shown by curves 1, 2 and 3 at a given wavelength give the total antennæ resistance at that wavelength. In practice the total resistance only is measurable.

It is now proposed to deal with each source of resistance in turn and indicate, it is hoped, how the radiation efficiency may be increased.

From curve (1), it is seen that the high frequency resistance of the conductors used should be as low as possible, and in particular that due to poor contact with the earth. The wires used for the aerial should, when possible, be stranded, since the high frequency resistance of fine wires is not so greatly in excess of the direct current resistance as in the case of thick wires. A good conductor, though unfortunately expensive, consists of stranded copper woven round a central non-conducting core. The next best conductor is probably a stranded conductor of fine wires, the wires being properly woven so that each appears on the outside of the cable an equal number of times, and for those who cannot afford a great deal, ordinary stranded 7/18 copper. The wires should be enamelled to prevent corrosion, and the formation of a high resistance skin.

Proper attention should of course be given to the design of the loading coil and condensers when used.

The eddy current loss, which is caused by currents flowing in neighbouring conductors such as stay wires, metal masts, and the earth surface, may be reduced by inserting insulators in each end of the stay wires, mounting the mast upon an insulator, and by the provision of a really good earth and counterpoise. The construction of the aerial and lower capacity, which includes the earth and counterpoise, will be dealt with later. In general, losses due to the use of a metal mast may be neglected by the experimenter with a small station.

The lower capacity should be directly below the aerial wires, otherwise the earth below the aerial will be the cause of losses.

From curve (2) one should remember that such objects as trees, buildings, wooden masts, neighbouring walls, fences, and the insulators themselves are the cause of great losses. So far as possible the space around the aerial should be free from other objects, and care should be taken with the lead-in and lower capacity wires. The lead in should be as far removed from objects as practical, and ideally would leave the aerial and run directly to the lead-in insulator located in the roof of the building housing the transmitter. The lead-in is often a source of loss, particularly at the point of entry into the building.

The insulator should be large, so that the imperfect dielectric of the roof of the building is not the seat of losses.

The losses due to leakage and brush discharges also should be considered. Leakage may be reduced by the provision of good insulators with high dielectric strength. The design should be such that the surface is long and irregular, so that dampness and rain will not cause surface leakage.

The brush discharge is reducible by the use of large diameter wires, but is very seldom the cause of loss with amateur transmitting plant.

The radiation resistance (3), it is seen, varies with the wavelength, and it is desired to make this quantity as high as possible by good antenna design. From the equations it is seen the effective height of the antenna should be as great as possible. With an antenna of a given height, the effective height is raised by attention to the preceding points. All things considered, it appears that maximum energy will be radiated when the wavelength

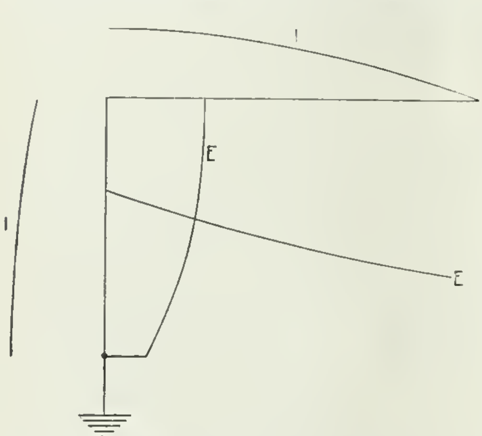


Fig. 2. The curves show the relative magnitude of the voltage and current along the unloaded antenna when oscillating.

used is of the order of 1·5 the natural wavelength. It is sometimes stated provision should be made for radiating at the natural wavelength of the aerial by connecting a series condenser to neutralise the effect of the added inductance which is essential for the transfer of energy from the oscillator to the aerial circuit. It does not seem to the writer that any advantage is gained, since the condensers generally used, besides being costly, are the seat of losses due to the ohmic resistance and dielectric loss.

The antenna, besides resistance, possesses capacity and inductance, and therefore a natural wavelength. The natural wavelength of a vertical antenna is a little over four times its length in metres. That of an inverted L aerial is from 4·4 to 4·8 times the length from the free end to the lower capacity, and that of a T type aerial is from 4·5 to 5·2 times the length measured from one free end to the centre point plus the length from this point to the lower capacity. In the case of the inverted L and T aerials, the capacity is largely due to the top portion, and the current in the down lead is almost uniform. It is not always satisfactory to calculate the capacity and inductance of the antenna on account of the dielectric present in its field, and the closeness of neighbouring buildings, etc. The capacity and natural wavelength may be measured, and it is then easy to find the inductance. It is pointed out here that lengthening the aerial wires increases the capacity and inductance, while putting more wires in parallel increases the capacity but reduces the inductance, the actual amount of variation depending upon the spacing of the wires. The wires should be preferably spaced six feet or more in the case of a flat-topped aerial. The increase in capacity is almost balanced by the reduction in inductance, so the natural wavelength remains unchanged or may be slightly increased.

The effect of loading an antenna is to change the wavelength at which it will radiate and the current and voltage distribution. When inductance is added the wavelength will be

$$\lambda = 1884\sqrt{\left(L+\frac{L_o}{3}\right)C_o}$$

where λ is in metres, L = added inductance in microhenries, L_o = the low frequency inductance of the antenna and ω the low frequency capacity in microfarads. The capacity C_o is assumed to be constant at all wavelengths, although actually it varies a little. The quantity L_o may be obtained from a knowledge of the natural wavelength, and the natural capacity C_o, and is obtained from the formula

$$\lambda = 1199\sqrt{L_oC_o}$$

It should be noticed that although two antennæ may have identical natural wavelengths one may have a larger capacity than the other, with the result that the addition of a given loading coil will result in the new wavelength being greater in the case of the aerial with the larger capacity. This is obvious from the wavelength formula.*

* The reader is referred to Circular No. 74 of the Bureau of Standards for further information dealing with the calculation of antennæ constants.

It is instructive to consider the voltage and current distribution in antennæ with a view to bringing out special points which should be borne in mind when constructing the antennæ.

The voltage and current distribution of an inverted L type antenna is given in Fig. 2.

The aerial is represented by the inverted L earthed at one end. The curves marked I represent the distribution of aerial current, its insulation should be such that it will safely withstand the voltage. The lead-in insulator obviously also requires to be able to withstand great potentials which it should be noticed may be greatly in excess of the voltage of the source of power. The line *a b* represents the pressure of the power supplied to the antenna, while *a c* represents that developed at the top of the coil.

In Fig. 3(ii) is indicated how the distribution

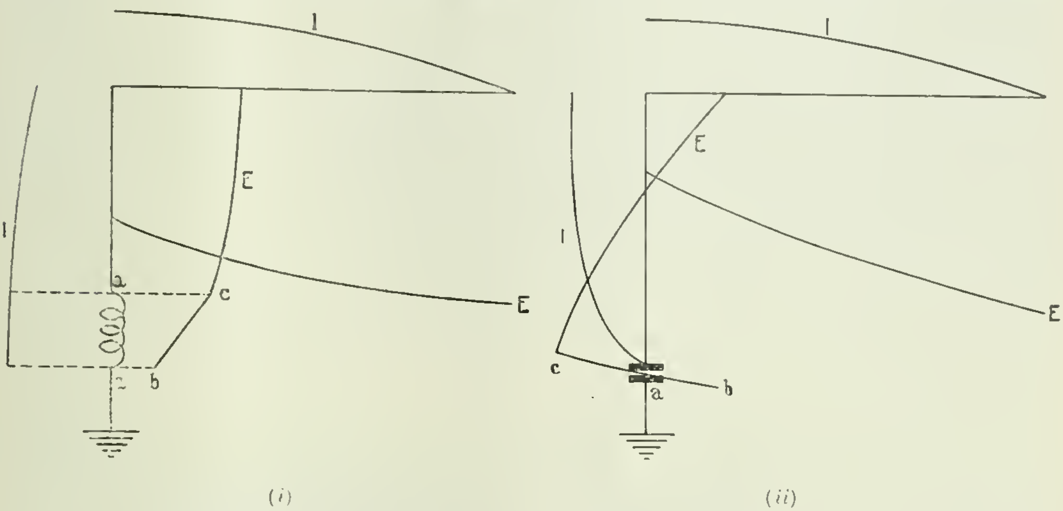


Fig. 3. The curves show the relative magnitude of the voltage and current when (i) the antenna is loaded with an inductance and (ii) loaded with capacity. The curves are instructive and should be examined.

the magnitude of the current being indicated by the distance from the line representing the antenna at the point considered. In the same manner the distance between the line representing the antenna and the curve marked E, indicates the magnitude of the voltage at the point considered.

It will be noticed the vertical portion has a nearly uniform current distribution, and the current falls off to zero at the free end. Here the voltage is a maximum, which emphasises the fact that great care should be taken with insulation at this point. When a series loading coil is connected, the conditions are roughly indicated in Fig. 3(*i*). It will be noticed the current in the coil is practically uniform, while the voltage across it is very high. The inductance should therefore be carefully designed to carry the current, and may be expected to change when capacity is inserted for the purpose of shortening the wavelength. It will be noticed the pressure *c a b* across the condenser may be very much greater than that applied as represented by *a b*.

The magnitude will depend upon the capacity of the series condenser and upon that of the antenna. If a relatively small value condenser is used the voltage developed may be expected to reach a high value. The point where the voltage curve E crosses the antenna line, called a potential node, depends entirely upon the ratio of the added capacity to that of the antenna. The larger the ratio, the lower down the aerial the potential node. It will be noticed the current has its maximum value at the potential node, and *vice versa*.

W.J.

(*To be concluded*)

An Experimental Single-Valve Receiver.

FOUR INSTRUMENTS COMBINED IN ONE.

By PERCY W. HARRIS.

THE beginner in wireless is frequently advised first of all to obtain a crystal receiver, so that he may learn the rudiments of the subject with the simplest apparatus, leaving the purchase of a more sensitive valve set to a later date when he feels more sure of his ground. There is much to commend in this advice, but the fact remains that few people relish having to abandon a set for which they have paid several pounds and spend still more money to start again with a complete valve installation. A discussion with a friend regarding this point led the writer to consider whether it would be simple to devise a small instrument that could be connected to existing crystal sets so as to allow the use of a valve. In thinking the matter over it was apparent that either high frequency or note magnification could be used.

To apply a note magnifier to an existing crystal set is of course a simple matter, as it is only necessary to attach the telephone terminals of the crystal set to the input terminals of the magnifying unit to obtain the desired result. Such an arrangement is satisfactory when the signals to be rectified by the crystal are already fairly strong, but the actual receiving range is not in any way increased by such an addition, as unless the signals are strong enough to pass the crystal they cannot be further magnified.

The other alternative is to precede the crystal by a high-frequency amplifying valve. This arrangement is far more satisfactory when the user is situated at some distance from the station he wishes to receive, as the signals can then be magnified up to a strength sufficient to pass the rectifying crystal. Strangely enough, high frequency units for attachment to existing crystal sets are rarely constructed by the amateur, although they offer an interesting field for experiment. The instrument described in this article is designed to precede any existing crystal receiver so that efficient high frequency amplification can be obtained over the whole broadcast band of wavelengths. With the addition of any good intervalve transformer it can be used for low frequency amplification after rectification, while it also forms a useful single valve receiver without reaction. The fourth use of this little

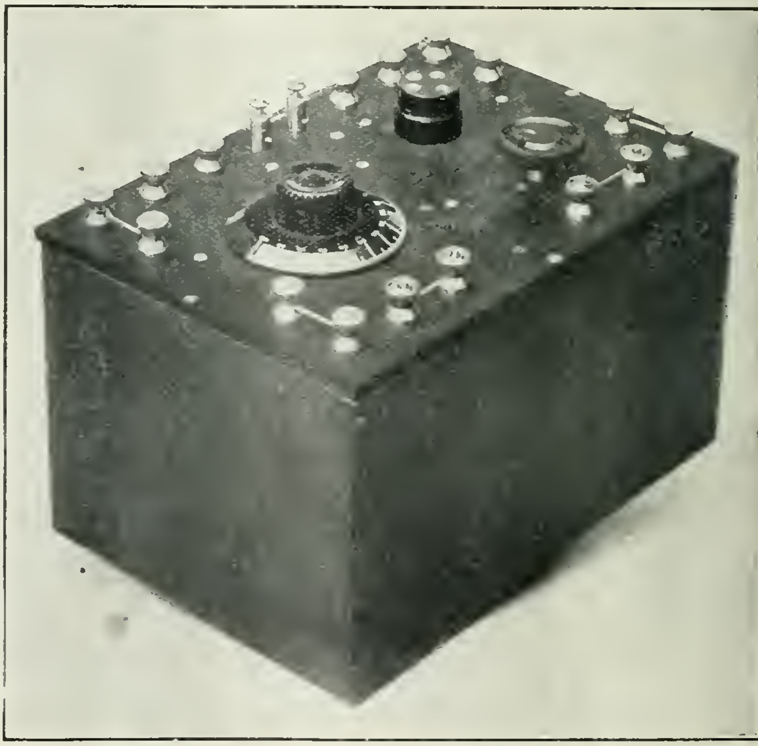


Fig. 1. Exterior view of the single-valve receiver.

instrument is as a short wave heterodyne, functioning from 100 to 225 metres or more.

Little need be said regarding the actual constructional work, as this is made clear in the photographs and diagrams. It will be noticed that tuning is effected by means of a variometer. This was purchased ready-made. Any variometer that will cover the broadcast band will do, but those who wish to construct it themselves will find the following data useful:—

Outer former, 4 ins. diameter ebonite tube.

Inner former, 3 ins. diameter ebonite tube.

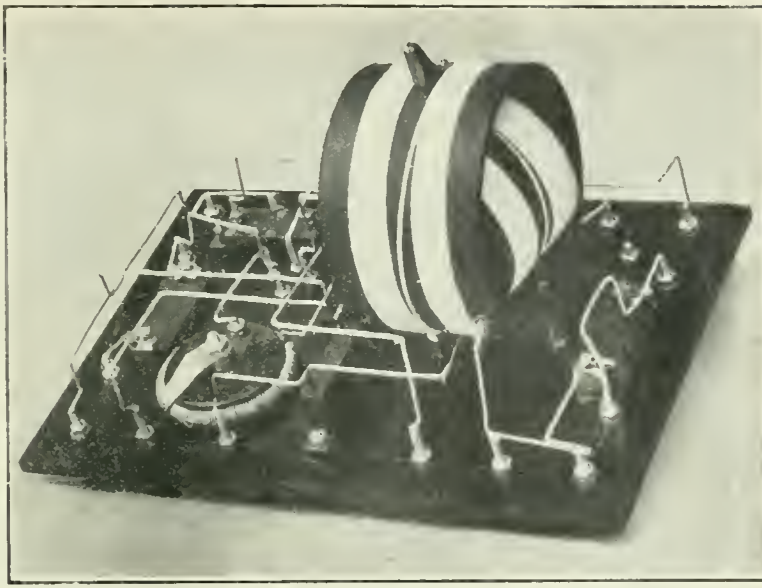


Fig. 2. Underside of panel showing method of wiring with stiff wire. Note: Since this photograph was taken the wiring has been slightly altered, and is now as in Fig. 4.

Outer former wound with 32 turns in two sets of 16 turns No. 22 double cotton covered wire. Separation between two sets of windings $\frac{3}{8}$ in.

Inner former wound with same number of turns in same way.

The rotor is carried on a split shaft to which the two ends of the inner winding are soldered. Contact with this shaft is made by means of rubbing spring contacts as shown. One end of the stator winding is connected to a terminal and the other *via* the spring contact to the shaft, the second spring contact making connection with the opposite end of the winding. The construction of a good variometer by the beginner is not easy, and in most cases a ready-made article is to be preferred.

A point of novelty in this instrument is the simple method of connecting a fixed condenser either in series or parallel. This method can be used equally effectively in any tuner. The writer does not remember having seen it described elsewhere, but it is certainly very convenient. Viewing the top of the panel, four terminals on the left will be seen. The two upper and the two lower can be joined with straps or wires. If when using the instrument as a single-valve receiver or a high frequency amplifier we open the top strap, connect the aerial to top terminal and the earth to the terminal immediately beneath it, leaving the lower strap in position, no condenser is in circuit. Opening the lower strap inserts a 0·0005 fixed condenser in series, while closing the top strap and connecting the earth to the bottom terminal (with the lower strap open) places this condenser in parallel with the variometer. The range of the particular instrument can thus be brought up to about a thousand metres. As the two middle terminals are connected together permanently, one may be dispensed with.

When used as a single valve receiver the strap short-circuiting the grid condenser is of course opened. A second alternative grid condenser is provided, and can be substituted by shorting the first and opening a strap across the second. This, however, is designed for other uses, as will be seen later.

If it is desired to use the instrument as a high frequency magnifier, the grid condensers are short-circuited and the crystal receiver connected to the upper right-hand terminals. The lower right-hand terminals are arranged so that when a strap is across them a 0·0003 mfd. condenser is connected across the output terminals. This value was chosen as it corresponds with the capacity of the average amateur aerial, thus allowing the usual adjustments

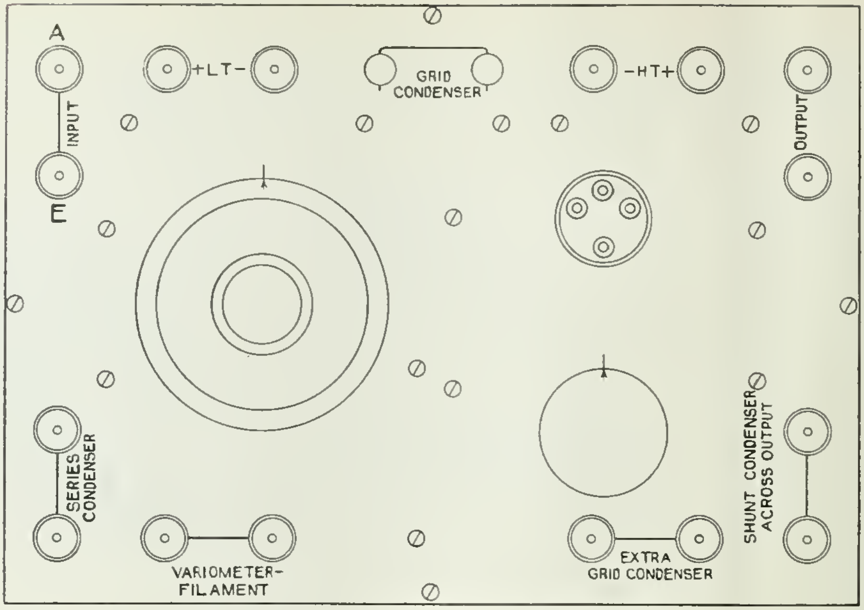


Fig. 3. Top of instrument showing terminal markings.

on the crystal receiver to be used If possible the inductance of the crystal tuner should be tuned to the wavelength desired without the use of this condenser. It is, however, very useful when the wavelength range of the crystal set is limited.

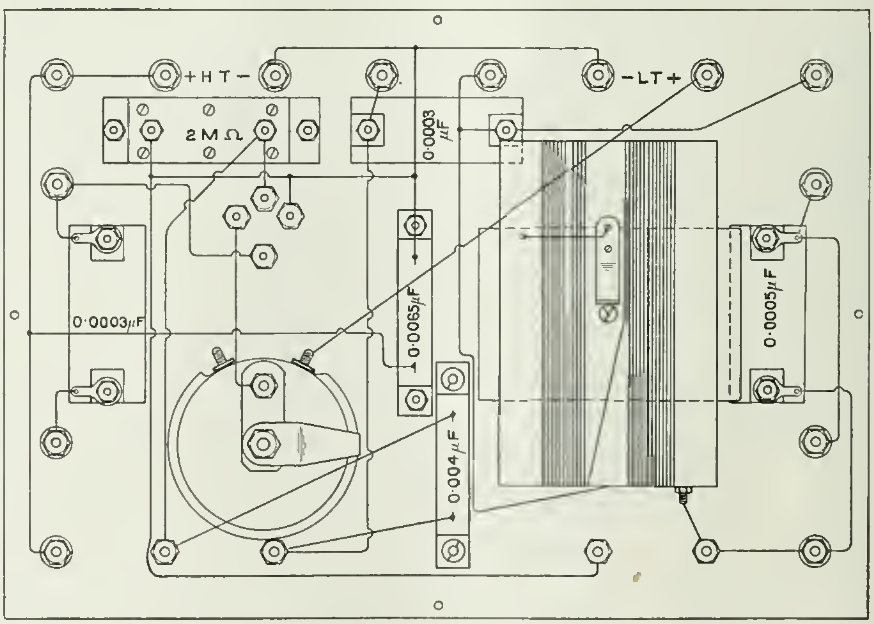


Fig. 4. Wiring diagram of the underside of panel.

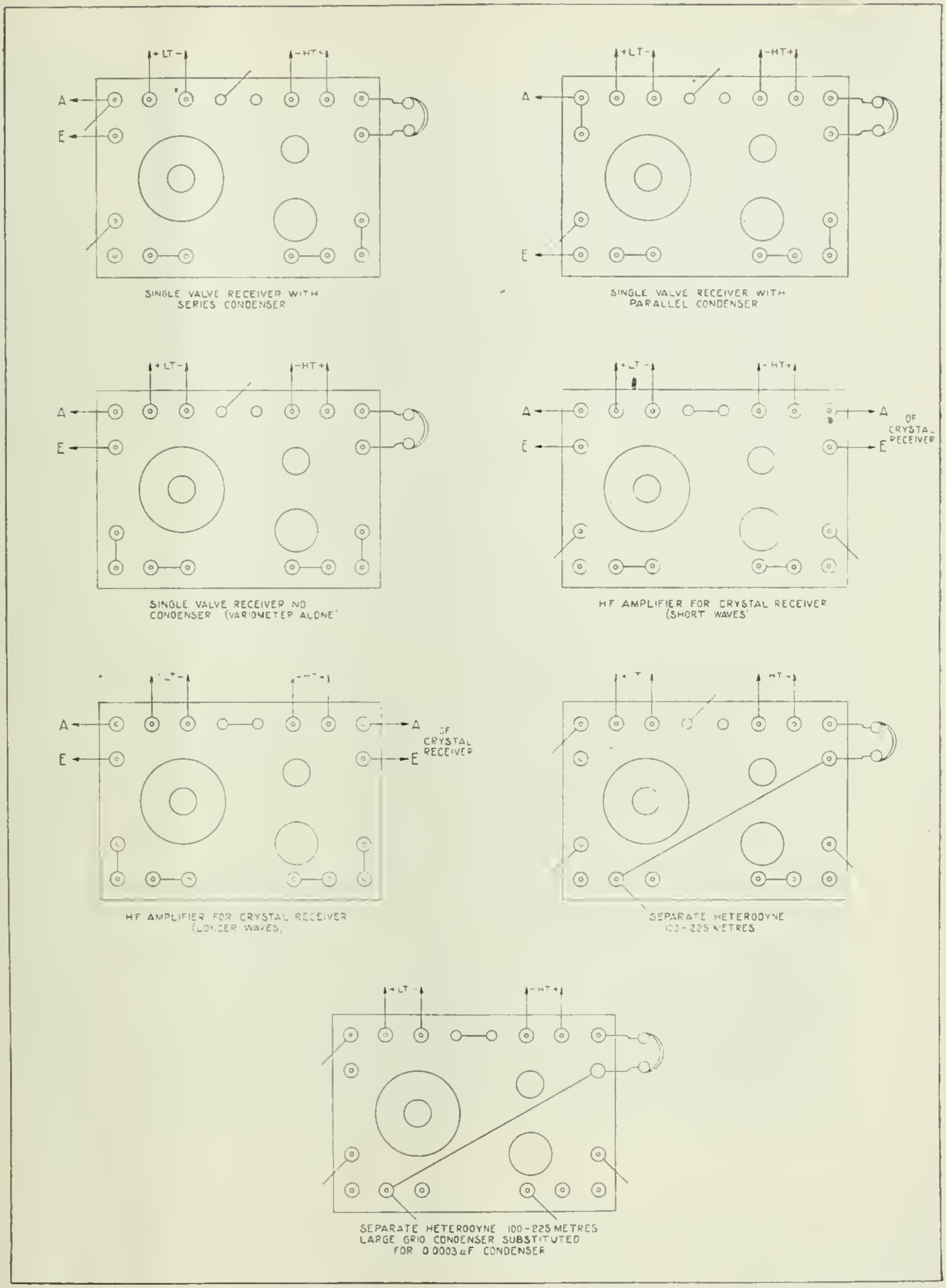


Fig. 5. Methods of connecting the instrument for various purposes.

To use this instrument as a note magnifier after rectification, the telephone terminals of the crystal set are connected to the input terminals of an intervalve transformer, while

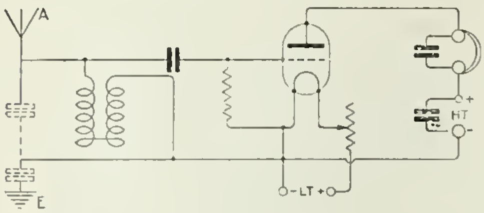


Fig. 6.

Theoretical diagram of set used as single-valve receiver.

the output terminals of the transformer are connected to the aerial terminal (strap open) and to the right-hand of the two terminals immediately beneath the variometer dial (strap open). The grid leak must be disconnected for this purpose. Terminals could have been provided to effect this disconnection, but as this use of the instrument is not often desired, they were not considered necessary. The grid leak is connected between the grid and the filament, and not across the grid condenser for a particular reason which will be seen in describing the heterodyne circuit.

The remaining use of this panel is as a separate heterodyne for short waves. The particular circuit is little used by amateurs in this country. It is known as the De Forest Ultraudion circuit, and is shown in the dia-

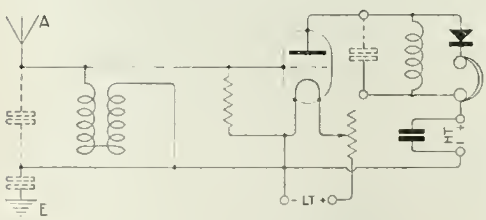


Fig. 7.

Theoretical diagram of set when used with crystal receiver as H.F. Amplifier.

gram. Unlike most circuits, connection is made from the variometer to the grid *and the plate,* not to the grid and the filament. If so connected, *leaving the phones in circuit and with the telephone shunting condenser cut off*, the set will oscillate freely, if not particularly vigorously, over the whole range of the variometer, using an R type with 60 volts on the plate. In the particular variometer the range is from 100 to 225 metres. If the valve is one which oscillates very readily, it is possible to use the 0·0005 mfd. aerial condenser in shunt, and thus increase the range considerably. However, the chief use of this heterodyne is round about 200 metres.

The grid condenser must be left in circuit when using this arrangement, so that the grid may be insulated from the plate voltage. For this reason the grid leak runs from grid to filament instead of across the grid condenser. The larger grid condenser was inserted to see what effect it would have used in this way. It is by no means essential, and the normal grid condenser functions quite satisfactorily.

Values are given for the various condensers actually used, these being available at the

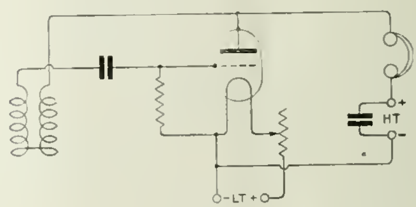
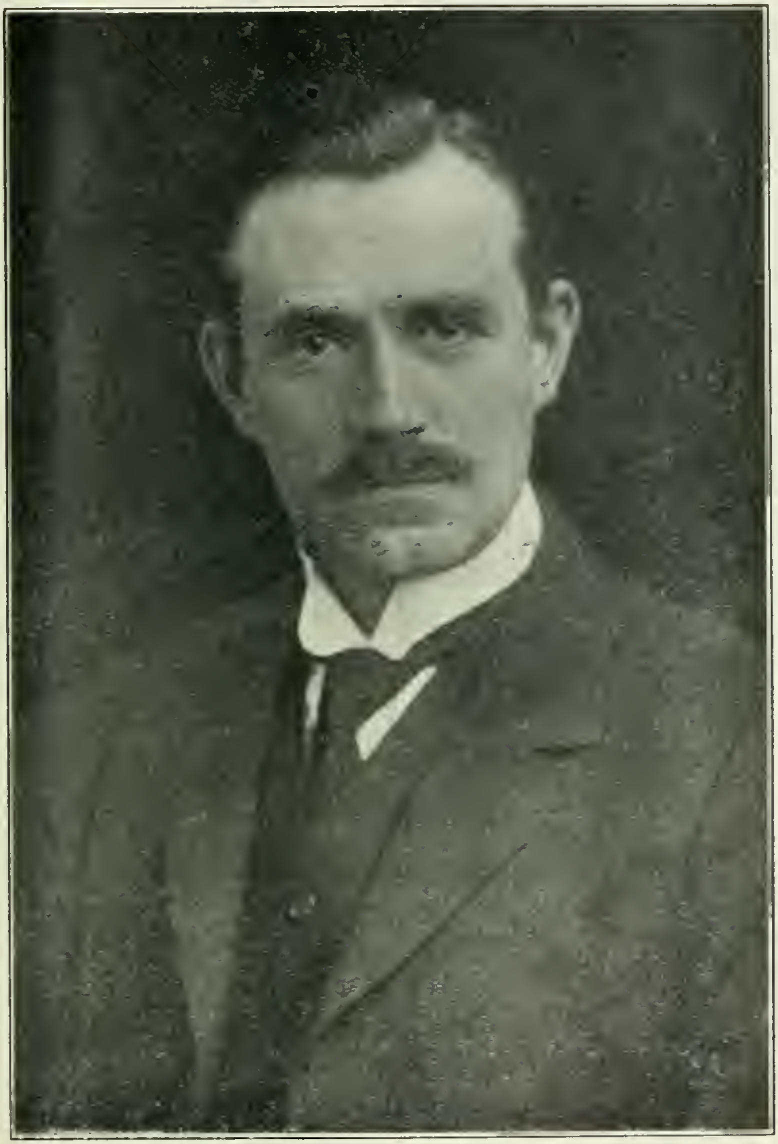


Fig. 8.

Theoretical diagram of set used as short wave heterodyne.

moment, but some may be altered without detriment to the working of the instrument. The aerial condenser can have a different value, and the condenser across the H.T. terminals can with advantage be larger. The shunt condenser across the output terminals should be kept at the value given, as this corresponds with the average aerial used. The additional grid condenser was the largest that happened to be available, and it would be interesting to experiment with several different values here.

Used on my own aerial as a H.F. stage in front of a single-slider crystal receiver, Birmingham can be heard distinctly, and on 600 metres the additional amplification is very considerable. No doubt readers will be able to find further uses for this little set, which in any case is handy to have available for experimental work.



Dr. W. H. ECCLES, F.R.S.
President of The Radio Society of Great Britain.

The Problem of Atmospherics and some Suggestions for Experimental Investigation*

By Dr. W. H. ECCLES, F.R.S.

It is my privilege, and duty also, to thank the Radio Society for the honour they have done me in inviting me to fill the chair. The previous occupants have been very distinguished men, and I feel it will be difficult to live up to their standard of strenuousness. The honour appeals to me especially because in this Society there are all types of lovers of wireless; there is the professional man, the scientific man, the commercial man, the experimentalist, and the person who merely uses wireless as a recreation; and there are also those who are not interested in wireless itself, but are interested in what it can give them—the "broadcasters." All these members are welcomed to this very catholic body, and therefore I think it gives the President of this Society a breadth of basis that no other society in wireless does give, no society in the world. This is especially true after the important change that has occurred this year in the name of the Society. As is usual in other cases of change of name, the implications are that alliances have been formed, that individual interests have been drawn nearer together than they were. The smaller wireless societies all over the country are now drawn somewhat closer than before, and a machinery is being built up by which a kind of parliament will sit under the auspices of the Radio Society; there they can make their complaints, their demands, their recommendations or suggestions.

Another important event in wireless as a whole has happened during the past year in the advent of broadcasting. Those of us who have been interested in wireless for many years, welcome the advent of broadcasting, and the proposals for more and more broadcasting, very cordially. Just as in other subjects, the greater the public interest taken in wireless the better for the subject. For one thing, the spread of knowledge is always beneficial. The number of people who will now be learning something real about wireless is augmenting extremely rapidly. Hitherto the powers of wireless have been very much exaggerated, for instance, in the ordinary press; but actual contact with wireless reception, which is being brought to the general public by broadcasting, cannot but help in showing the public what the limitations are, and will help to avoid the great disappointments which may occur by non-fulfilment of some of the promises that have been made with this wonderful subject of ours. Beside that, I think that this widening of the area of people interested in wireless which broadcasting has conferred, will undoubtedly enable the country to draw more persons of all ages into the stage of trying to invent, or trying to discover. It will help to get the boys with electrical minds into the right places, for I think there is no subject which teaches electricity so much as wireless, and there is no subject so important as electricity in our modern civilisation. For good or for bad, this modern civilisation of ours is becoming more and more electrical, and therefore we want more and more of our population trained electrically, and unless that is done, we, the nation, are sure to fall very much behind. I therefore think that it is of national importance to welcome the broadcaster, but at the same time it is also of national importance to make sure that the experimentalist retains the widest possible freedom for his receiving apparatus and his transmitter, and to ensure that there is no mutual interference between the two classes. They say that necessity is the mother of invention. I am not sure that I understand that, but I think I do know that research is the father of invention; and unless we can keep experimentation going with full vigour in this country, invention will be stifled. I remember that my old friend, Mr. Duddell, used sometimes to speak very despondently of the prospects of wireless in this country from the point of view of discovery and invention. It seemed to him, he used to say, that we were being far outdistanced in both discovery and invention, and that some vigorous campaign ought to be initiated to call the attention of the general public to this deplorable condition, as he called it. I have had that called to mind in recent months, in the progress of various visits I have made abroad. For instance, in America, during visits to a large number of stations—especially the big stations—it is noticeable that in these stations there is no invention of English origin of later date than 1904. The whole of the remaining inventions in the stations are non-English. The main inventions that we can see plainly in these stations are of course the Marconi elevated antennæ, which we may claim as partly English, and there is also the Lodge 1897 invention: and there is the Fleming valve of 1904. Except for these older inventions, we cut a very poor figure nationally in the American stations. In the French stations the same story can be told, and also in the Italian stations. I do not know what there is in the German stations, but I question if, excepting those inventions I have named, there are any English patents at all in use in any foreign-built stations. On the other hand, when you take the other side of the picture and visit a large English station, you find that there are certain English patents in use there, because of the natural fact that an inventor employed by the owner is specially favoured; but the great bulk of the inventions in use, even in an English station, Governmental or private, are of foreign origin. One might bring it home even more closely by mentioning the fact that the British Broadcasting Company's apparatus is largely of foreign invention;

* A Presidential address delivered before the Radio Society of Great Britain on Wednesday, January 24th, 1923.

and if you turn to your receiving apparatus, the same story must be told, with one or two exceptions, such as the Franklin back coupling patent, which has saved our face nationally to some extent.

Now that explains to you why I feel especially strongly that this Society ought to keep its policy fixed on free experimentation: that it ought to encourage its members to write and discuss as many papers as possible, to urge them to try and keep their apparatus and methods changing and moving; never being satisfied with the old; but always trying to improve or to find alternatives. If we can do that, we can till the national soil in such a way that from it there may sprout some man or men of genius who will restore our national prestige.

Now the first query occurring to many members of this Society who have not bothered to do much investigation or much invention will be the question. What shall we start upon? And I hope it will serve a useful purpose if I just run over two things that occur to me as problems capable of being handled with simple apparatus. There are innumerable openings, it seems to me, but I am going, in view of the fact that time is limited, to speak only of two of them. The first is the problem of atmospheric disturbance to wireless reception, and I am going to take it as an illustration of scientific investigation rather than from the point of view of invention. Then I will illustrate two or three simple possibilities to which I think future inventors and discoverers might turn as a beginning.

To deal with atmospherics first. What we must first do, I suppose, before recommending anybody to start work, is to summarise for them what has already been found out. It is always useful to know what has been done by your predecessors: it will at least save travelling over the same ground. Now a good deal has happened of recent years in connection with atmospherics, but I had better just point out that a good deal has been known about them since the very beginning of wireless telegraphy—in fact, before wireless telegraphy began, atmospherics were being received and remarked upon in laboratories. In 1895 people were tracking the storms over the continent of Europe by the aid of coherers. Later, the early wireless experimenters found their tape marked by blurred dot and dash signs in an irregular manner, and the cause of these markings was traced to be connected with thundery weather—thunderstorms passing across Europe, which caused more disturbance as they approached the observing station, and as they passed away less and less. So that it has been known for very many years that thundery weather causes atmospherics. But there are so many other possibilities that it is not right to say that all atmospherics are due to lightning. For instance, they might be due to the picking up of small meteorites, for these falling through the air and getting hot produce electric charges and discharges which will affect antennæ. There might also be violent electrical storms in the sun which could send "atmospherics" to us; and there might be (as the journalists thought a year or two ago) messages from Mars which might cause disturbances. These possibilities existed, and had to be gradually sifted out in the course of years.

One thing suggests that all atmospherics are due to lightning discharges near the surface of the earth. The statistics available show that the conditions giving good propagation of signals give rise also to many atmospherics as a rule, which seems to show that if the air is electrically clear, atmospherics can be gathered from a larger area, or in other words, the larger the area you can receive from, the more atmospherics there are to be picked up. This indicates that they are all lightning discharges relatively near the surface of the globe.

Another thing that points to the same fact is that long wave receiving apparatus is troubled more with atmospherics than short wave receiving apparatus in general. Now, it is well known that long waves do travel greater distances than short waves, which suggests that long wave atmospherics are often due to distant lightning discharges, and short wave ones due to near discharges.

But the matter has received a great amount of aid from the methods of directional reception which were developed during the war. The receiving frame with which one can point out the direction from which signals are coming, can also be used for detecting the direction from which atmospherics are coming; and particularly in America, a great deal of work has been done by direction finders with regard to atmospherics. To summarise the results briefly; on the Atlantic coast most of their atmospherics seem to come from the Allegheny mountains and from the Mexican mountains; on the Pacific coast they come mostly from the mountains quite near, and sometimes it is found in California that many are coming quite definitely from one mountain peak only a few hundred miles away. In Porto Rico, Austin has found that they come from the South American mountains and from Mexico. In France, a good deal of work was done in 1920 to 1922, and published about a year ago, in which storms were traced over Europe and the adjacent seas by the aid of direction finders, and it was proved that most of them were due to the front edge of cyclonic disturbances following their usual course across the continent.

Then again, there is the work of the Radio Research Board. Mr. Watt, working under the Radio Research Board, has analysed a great many of the statistics accumulated during the war from direction finding stations. When two or more stations reported that atmospherics were bad from a certain direction, the lines could be drawn on a chart, and the point of origin found. This enabled Mr. Watt to give a formula showing how the angle from which atmospherics come varies with the time of day and the season.

Well, there are a great many other observations; it would be tedious to enumerate them all; but this is the kind of conclusion to which I, in going through them, have been driven, and which I am going to suggest some of the members of this Society might gradually, as opportunity allows, carry through the testing stage. I will first generalise, and say that apparently all atmospherics of importance originate in mountainous areas, and especially where high land dips suddenly to the sea, as in Mexico, the Andes, the Rocky Mountains, and also in Central Africa, and in Western and Eastern Africa. All those produce very considerable atmospheric disturbances at certain times of day and at certain seasons, and from such observations as I have been able to collect, the striking thing is the influence of the position of the sun on the display of atmospherics. But suppose I take first our English summer season. Most of the atmospherics are local. They are due, as has long been known, to the sudden rising of moist air through unstable conditions of the atmosphere. When the air rises, it cools and expands, the moisture condenses, and in that process electrical effects occur which charge large masses of air, and these charged masses produce local atmospherics in discharging. I dare say you have heard the description of the English summer as three fine days and a thunderstorm? Well, this is fairly true, and in summer you will find that our atmospherics come from all sorts of directions, according to where the storms are moving. The only directions that do stand out prominently are the Vosges, the Alps, and perhaps the Pyrenees to some extent. There are days on which the atmospheric conditions are stable, when there is no thundery weather in Europe, and then atmospherics come from more distant places, usually somewhere in Africa. Consider, now, the spring or autumn season, when the sun travels along the equator. As it passes over India a certain amount of atmospherics is picked up in England, apparently from this west coast of India. As it gets nearer to Africa, the eastern African mountains and the Abyssinian mountains get to work, and the electrical discharges that occur there are also picked up. When the sun gets to the west side of Africa, the whole of the continent has been heated, and the air which begins to flow in from the Bight of Benin is forced to rise by the mountains, and you can pick up with your direction finder in England atmospherics from this part of Africa.

The next great maximum seems to be due to a time when the sun is fairly near the extreme western side of Africa, the mountains on this coast come into play, and the atmospherics appear to come from this direction. Later in the day there is a lull, but later still, when the sun has traversed South America, a lot of atmospherics come from the Andes and the Mexican mountains. They can be located by the ordinary direction finder so far as direction goes, but the distances they are from England, of course, cannot be determined. I am merely suggesting from what I have seen, that as the sun moves round the equator and warms the air on the land, the consequent meteorological phenomena produce atmospherics in England. This heating of the land areas has an enormous effect on signals, I may say. I was told, in fact, when I was in France a little while ago, that a station in the Argentine can receive signals from the American naval station in the Philippines during certain parts of the day from the easterly direction, that is the short way, namely, 165°. At another part of the day it receives from the opposite direction the longer way round the globe. A study of the times of the day when these phenomena occur shows that immediately the sun gets round to the Indian side of the globe, and begins to heat up the continent of Africa, the signals stop going across the continent of Africa and take the longer way round across the dark Pacific—it is a much longer way round, amounting to about 30 degrees. This shows that heated land has a great influence on the propagation of waves, and I am importing this little illustration to justify what I said about atmospherics. I may say, by the way, that in the Argentine the direction of atmospherics is mostly from Africa when the sun is over the South Atlantic, and is mostly from Central America when the sun has passed 20 or 30 degrees across the Pacific.

Consider now the season when the sun travels along the Tropic of Capricorn, that is our English winter. There are very few local atmospherics. The whole field is open for the observation of distant atmospherics. It is found that as the sun goes along the tropic, India sends a few atmospherics, while the high plateau north of the Rand, or perhaps the more northerly area, sends enormous quantities. The sun, when it comes over the west coast later in the day, causes that coast to come into operation, and later the South American mountains play their part; perhaps the Mexican also assist, and we may receive atmospherics from that direction. Thus the changes of season from winter to spring, etc., move the source of atmospherics, and it seems to be for that reason that the seasonal directions in atmospherics have been found. I am describing this theory in order to make the suggestion that those who have leisure to make directional observations of atmospherics would find here a very interesting subject of a scientific character, which of course has its bearing on the commercial operation of stations, but could be treated as a purely scientific problem here at home. This reminds me that one thing wanted very much for this purpose is an instrument which would record the direction from which atmospherics are coming. Suppose one has two equal frame or coil antennæ fixed in perpendicular vertical planes, with precisely similar detecting apparatus. Let the indicating apparatus be designed with a single pen capable of motion in two perpendicular directions by the respective receiving sets. An atmospheric perpendicular to one frame would be arranged to move the pen parallel to the other frame. Then, of course, the pen would move in an intermediate direction when the atmospherics were coming from any direction inclined to both frames.

I think it ought to be possible to develop an instrument which would write with a pen in this manner if one ignored the small atmospherics and only recorded the big ones. We should then have a sort of sundial operated by atmospherics produced by the progress of the sun along a parallel of latitude as it crossed the mountain chains and coastal lines of the globe.

Now that is one subject that occurred to me, and which I have treated very lightly, as a subject open for investigation by amateurs. Amateurs have already contributed a considerable amount to the work of the British Association Committee. A great deal of the information I have given you just now is the results of the analyses of the records made in various parts of the world by the amateurs who were working for the British Association in 1912, 1913 and 1914.

Now to come to quite a different matter, let me give an illustration of the kind of thing which could be done by amateurs in ordinary laboratory wireless in the course of the next two or three years. It has occurred to me that we have become slaves to the habit of using the Morse code, especially the Morse code with dots and dashes, and it seems to me to be worth while questioning whether dots and dashes are the best means of sending signals either under good conditions or through atmospheric disturbances. For instance, Bright's telegraphic apparatus which I remember seeing some thirty or forty years ago, used to have two bells in it. When a dot came, one bell – the right-hand bell – would ring, and when a dash came the left hand bell would ring. Of course, they did not use dots and dashes, they used lefts and rights, and the dot was just as long as the dash. It was simply a matter of the ear detecting a high note or a low one. Now I am told by expert telegraphists that that method of signalling was quicker than dots and dashes. It is obvious, besides, to the engineer that there must be less power expended in a code in which the dash is no longer than the dot. The present day heterodyne system of reception seems to lend itself remarkably fully to a scheme of that kind, and so I thought I would set up and listen to a piece of apparatus which would give me, instead of dots and dashes, a high note and a low note. I have on this table two simple oscillating sets which have come straight from my laboratory, so adjusted that one generator is a transmitter, the other a receiver. An extra coil is associated with the transmitter, so that when a key short circuits portions of it we get two notes. It seems to me that if two friends in wireless touch would set up such a system of signalling, they could find out by experiment whether it was quicker than longs and shorts, and whether it passed easily through atmospherics. Thus they might bring about a reform in the ordinary methods of wireless signalling. (*At this point a demonstration was given of this method of signalling, when two different notes were produced.*)

Someone to whom I was speaking about it thought that it would require a musical ear, and it is perhaps because it requires a musical ear that longs and shorts are used. I don't know if this next method, which I suggest as a possibility, requires a more musical ear. It is a three-note method in which the middle is the steady note. The higher frequency gives the dot, and the lower frequency gives the dash. Now *that* note is steady all the time the station is going, and the distant receiver will be tuned to that note. Now, if we move the key to the right you get a dot. A dot means a departure to the right, and a dash would mean a departure to the left, so that if you sound the letter A—dot and dash—it is a little tune. Now I find that I can learn these tunes faster than I can learn new combinations of longs and shorts. It takes a few months to learn to read fast longs and shorts, and only patient trial can decide whether this proposed code can be learned more quickly. If it is easier for the beginner to learn it may shorten the training of operators, and, best of all, there is a possibility that it gets through atmospherics better than the dot and dash method. This is a thing that could be very easily tried out by any two people who could arrange to co-operate on such a job. It is a thing that no commercial company would undertake to do because a commercial company does not like to disturb business by making a revolution in its method of transmission, and having to re-train all its operators. A commercial company will plod along with what it has got, so long as it is not forced by progress to change it. This is a thing which may necessarily have to be done by amateurs. That leads us on to other systems. It would cumber our table too much to bring the three-note system which I have tried over; but you *can* use three notes, and you can get a very short code with three notes. I mean that you do not need to have four efforts in letters such as L, which in Morse uses a dot, a dash, and two dots; but you can do everything with at most three efforts if you have a three-note system. But that requires a more musical ear than this last one.

The next thing that suggests itself to everyone is to use chords—that is to send two notes at once. To send two tones means that you are sending on two wavelengths, wavelengths which are only 5 metres apart in some of these cases, and it is very difficult to detect them except by the ear. The range of wavelength taken up is not so great as is usually monopolised by the spacing wave method, so that I do not think any objection arises to sending chords, except that very few people can identify chords rapidly. I suppose a little training—a little teaching—would enable a person to identify a sufficient number of chords to make up a code. But there is a system of chords that requires no musical ear for identification. At any rate, everybody I know, musical and unmusical, can identify the kind of chord I am going to suggest. I have known people who did not know "Home Sweet Home" from "God Save the King," who could distinguish the chords I am going to mention. These chords are called vowels. If you sound any note and then superimpose upon it a certain two frequencies, making a chord of three notes, then you get a vowel. I have a paper here, which was written quite recently by Sir Richard Paget, and he gives the combinations of notes that make the different vowels. I think he has taken the analysis of the vowels further than anyone else. Now it seems to me that it would be possible to transmit a vowel, and I therefore designed an electrical circuit, which I tried on Monday. It gave me two vowels quite well. It gave me the vowel "ah," and when I altered the setting it gave the German modified ü. I wanted to make other vowels before attempting to show it; and if one can succeed in making several vowels, and I think it is quite feasible to make any vowel by this system, it would be possible to signal by saying "a, o, oo," and so on, because any two vowels could represent any letter of the alphabet by a sort of biliteral cipher. The vowels can be produced either by the voice or by a machine. In that way you get a briefer system than those I have already mentioned. The vowels are easily recognised. In wireless telephony, for instance, it is the vowels which come through best. I dare say most of us have experienced on the ordinary telephone the annoyance of obtaining the wrong number. The number 4375 is asked for, and you get 4379. The thing that has misled the operator is the vowel in the five and nine; it is the vowel that carries, and the consonants cause all the confusion. If we could abolish consonants, and signal by a new vowel system, we might achieve something worth doing. I make this final suggestion as another illustration of something that could be accomplished by members of the Radio Society of Great Britain.

Electrons, Electric Waves and Wireless Telephony—XX.

By Dr. J. A. FLEMING, F.R.S.

7. WIRELESS TELEPHONE TRANSMITTERS.

We may in conclusion make a brief reference to the construction of large transmitters intended for broadcasting and to improvements in thermionic valves employed as generators of powerful oscillations. No other type of generator is at the present time so suitable for this purpose. High frequency oscillations of great power can be produced by dynamo machines called high frequency alternators, but the regulation of their speed which is necessary to produce carrier waves of perfectly constant wavelength and amplitude by them, requires some rather complicated apparatus, and it is not nearly so easy to modulate the amplitude by a speech microphone as is the case with the thermionic valve. Again, we can produce oscillations by means of an electric arc of a certain kind called a Poulsen arc, but this type of generator is liable to irregularities which, though not seriously disadvantageous to its use as a generator of oscillations for radiotelegraphy, are a decided impediment in the employment of it as a generator in wireless telephony.

The thermionic valve, on the other hand, gives or can be made to produce oscillations of perfectly pure simple harmonic wave form and therefore carrier waves of the same type.

Furthermore, the thermionic valve as a generator of oscillations is perfectly silent and the amplitude of the oscillations produced by it very easily controlled by the speech microphone. It is for all these reasons an ideal oscillation generator for wireless telephony.

We have already described in a previous section the manner in which the three-electrode valve is employed to create electric oscillations and these explanations need not be repeated here.*

There are, however, great differences in construction and power consumption between valves used as amplifiers and valves used as generators of oscillations, which must be explained. The valve as a generator must have a considerable output of power, that is, we must be able to draw off from the circuit connecting the plate or anode of the valve and the filament an amount of electrical power which is only limited by our requirements. This implies that the so-called plate current must be, relatively speaking, large.

But the internal resistance of the valve, that is, of the space between the filament and anode cylinder, is also large, amounting to some thousands of ohms, generally speaking. Hence it requires a high voltage to drive the required plate current across the vacuous space that is to compel the negative electrons to move away from the filament and through the apertures in the grid and strike the plate or cylinder.

Then again, this impact of torrents or millions of electrons bombarding the anode cylinder or plate heats it very quickly and may in fact soon make it red hot. Hence special construction is necessary to prevent this heat from cracking the glass or loosening the sealing-in wire which makes connection between the anode cylinder and the external plate circuit.

On referring back to Fig. 93, which shows the view of a large transmitting valve of a very usual type, it will be seen that there is a large glass bulb which may be even of the size and shape of a Rugby football, has two re-entrant glass tubes at the ends which are closed at the inner ends, and at the outer ends are sealed to the bulb.

Around these re-entrant tubes are clamped metal collars, one of which carries the large cylinder made of sheet nickel, which forms the anode, and the other of which in a similar manner carries the inner cylinder of nickel wire gauze which forms the grid of the valve. This latter re-entrant tube carries also the tungsten wire filament.

* See article XIII., *The Wireless World and Radio Review*, December 30, 1922 (page 433).

The current is conveyed to and from this filament by platinum wires sealed through the glass tube and similar platinum sealing-in wires are employed to connect the external circuits to the cylinder and the grid. The filament wires have to carry fairly large currents up to 10 or 20 amperes, but the sealing-in wire to the cylinder has only to carry currents from about one-tenth to one ampere or so, and the grid requires feeding with a much smaller current.

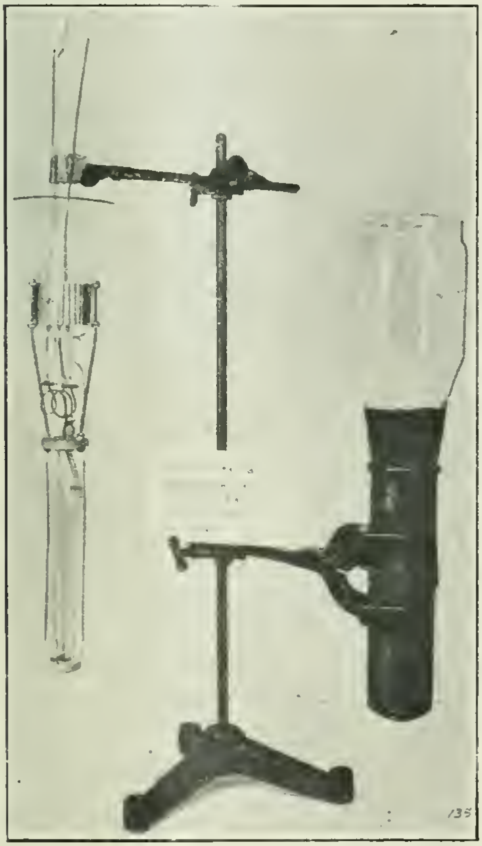


Fig. 107. The arrangement before sealing in the re-entrant glass tube carrying the filament and the grid.

The electron power is supplied to the valve in the form of direct current. Direct current at rather low voltage, 20-25 volts or so, is employed to incandesce the filament. Direct current at high voltage, 1,000 to 10,000 volts or so, is supplied to the plate circuit to create the electron stream. We then draw off from the plate circuit high frequency alternating current.

In large valves 70 to 80 per cent. of the power supplied can in this manner be recovered. The deficit is expended as heat in the valve. Hence a large valve yielding say 5 kilowatts or 7 horse power would take in 7 kilowatts or 10 horse power, and the difference or 2 kilowatts is transformed into heat.

This heat must be radiated, and therefore large valves get fairly hot. One of the problems connected with large valve manufacture is to obviate any danger from the cracking of the bulb, which is liable to happen with glass bulb valves.

It must be remembered that these valves have to be very highly exhausted of their air, in order that no sensible amount of air may be left to be ionised by the electrons emitted by the filament, for this would create positively electrified ions or molecules of oxygen or nitrogen which have lost an electron, and these would be attracted to the filament very strongly, and would bombard it and soon destroy it.

It would occupy too much space to describe the methods by which the extremely high vacuum required is made in these valves. One result of this, however, is to create a very great air pressure on the outside of the bulb which, in a large valve, may amount to two or three tons. Hence if such a valve breaks it generally does so with a rather startling explosive noise. Invention has therefore, of late years, been directed to the problem of constructing a high power valve which shall be less fragile and liable to accidents than a glass bulb valve. In other words, to make a valve which shall be more of an engineering job than the present glass bulb type.

It has been found possible to make the bulb of pure silica (flint) in place of glass. This material has so small an expansion with temperature that a silica bulb can be made red hot and then be plunged into cold water without cracking.

A still more important improvement, however, has come to us recently from the United States in the form of a thermionic valve of which the greater part of the bulb is formed of sheet copper. The copper not only forms part of the bulb but also constitutes the anode cylinder, and can be kept cool by cold water.

The foundation of this improvement is the technical discovery of a method of sealing copper to glass in such fashion that it does not crack away on cooling or subsequent heating

The reason the expensive metal platinum has hitherto been used for wires which must be sealed airtight through the wall of a glass bulb is that platinum possesses three essential qualities for this purpose. First, it has nearly the same coefficient of expansion with heat as lead glass. In the second place, hot platinum is "wetted" by molten glass; that is, sticks to it, and lastly, platinum is not oxidized when heated in a blowpipe flame, but retains a bright and clean metallic surface.

No other metal has been found which possesses all these properties, but the discovery was made some years ago that if copper is kept unoxidized in a flame containing reducing gases, it is when very hot "wetted" by molten glass, which sticks to it. Copper, however, has not the same coefficient of thermal expansion as glass and the only way to attach a copper tube to a glass tube of the same size is to give the copper a sharp knife edge.

If then a sort of copper thimble is made, closed at one end but with the edge of the open end made sharp like a knife, this thimble can be sealed airtight to a glass tube of the same diameter as the thimble, and the joint will not crack away in cooling and can be made vacuum-tight. The glass tube terminates in a re-entrant portion through which are sealed wires to which are sealed the wires which carry the ends of the filament of the valve and also the leading-in wire for the grid.

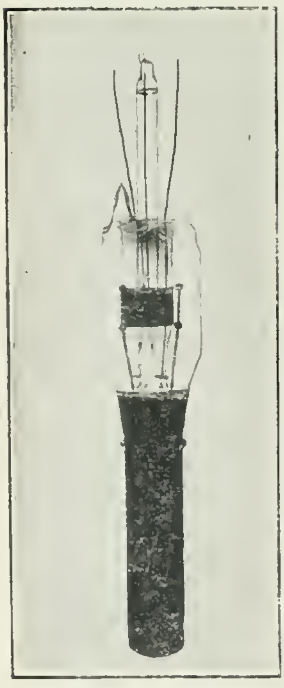


Fig. 108. The complete instrument.

Fig. 107 shows the arrangement before sealing in the re-entrant glass tube carrying the filament and the grid. Fig. 108 shows the completed instrument. The copper tube part (shown in black in the diagrams) forms at the same time the anode cylinder and also part of the bulb.

Externally it is surrounded by a water jacket, as shown in Fig. 109, by which it is kept cool by circulating water.

Fig. 109. The valve anode inserted in a water circulated cooling jacket.

Valves of this description, of a size to yield 10 and 20 kilowatts output or 14 horse power, have been already made, and valves to yield 100 or 150 kilowatts may soon be obtainable. At the present time broadcasting in connection with wireless telephony is conducted by large valve transmitters comprising a number of glass bulb valves, which are connected so that their plate currents are added together.

The high voltage required for the plate currents is obtained by rectifying by means of two-electrode valves as already explained, a low frequency alternating current of high voltage (7,000 to 10,000 volts). A single ordinary carbon microphone, such as is used in an ordinary wire telephone, is employed to modulate the grid potentials of one or more three-electrode valves called the control valves, and the correspondingly modulated plate current of the control valves which fluctuates in accordance with the wave form of the speech sounds made to the microphone, is employed to modulate the output current of the generator valves. The result is that the height or amplitude of the carrier waves radiated from the sending aerial fluctuates also in accordance with the speech currents sent through the microphone. We have already explained the manner in which these radiated waves create corresponding but much feebler currents in the receiving aerials, and are made to reproduce the speech sounds in the receiving telephones. The development of wireless telephony, and especially the public use of broadcasting, introduces a new factor into modern life which is bound in time to make its effect felt.

The purpose of these articles will have been fulfilled if the broad general principles of the art have been elucidated sufficiently for the instruction of the general reader.

Notes.

Automatic Wireless Reception at Sea.

The Cunarder *Berengaria* has been fitted out with the Creed apparatus for automatic reception and transmission of wireless messages which will thus appear continuously recorded on paper tape in ordinary Roman characters as in the familiar tape machine.

Wireless Telephony on Trains.

The successful reception of wireless telephony in motor cars travelling at high speed has already been demonstrated and experiments carried out recently show that even on express trains and in spite of tunnels and varying topography reception of wireless entertainments is now practicable. By an arrangement between the Marconi Company and the London, Midland and Scottish Railway Company, an experiment was carried out on the 5.30 p.m. express train from Euston to Liverpool on February the 6th. A special saloon was fitted up with outside and inside aerials, the former being merely a length of wire fixed temporarily on the roof of the train and, the latter an ordinary frame aerial. It was found, however, that the dynamo used for electric lighting on the train caused bad interference and the outside aerial had to be abandoned. Using the frame aerial, while travelling at between 60 and 70 miles an hour, at 6.12 an amateur transmitter was picked up, though his voice was rather faint. London was picked up about 50 miles out from Euston and at 7.30 the Birmingham Broadcasting station was received. The news bulletin and other broadcasting items, it is reported, were clearly heard throughout the journey and there was no noticeable interference from passing trains. The experiments were carried out by Captain G. R. Willans, manager of the Marconiphone Department, and Mr. G. S. Hagate, technical manager to Captain Willans, in the presence of Mr. J. D. Billington and Mr. C. N. Heath, who represented Mr. F. A. Cortez Leigh, of the Electrical Engineers' Office at Euston.

The wireless cabin of Alderman Fentum Phillips, of Guildford, in which an interesting feature is the unusual provision to ensure efficient insulation. The walls are insulated from the floor with felt. A cork carpet is laid on this flooring an inch thick, while the work benches are insulated by glass insulators filled with paraffin wax.

The Opening of Cardiff Broadcasting Station.

By the time this note appears if all goes well, the new station of the British Broadcasting Company at Cardiff will be in operation. This station to which the call letters 5 WA have been assigned, and which operates on a wavelength of 395 metres, is to be formally opened at 7.30 p.m. on Tuesday, January 13th, by the Mayor of Cardiff, who will officially inaugurate the service. The station will actually begin operations at 5 o'clock with a children's programme, followed by the weather report and a news bulletin Ordinarily at 7.30 the musical programme will begin, including operatic, instrumental and vocal music, and a Sunday programme will be given from 8.30 to 10 p.m. The opening of the Cardiff Station marks the completion of five of the eight stations contemplated in the original broadcasting scheme. The sixth will be opened at Glasgow on or about March 19th.

The Demand for Wireless Licences

An extraordinary increase in the number of licences issued by the Post Office has been noticed in the past few weeks. In November 3,000 licences for broadcast reception were issued, and in December 6,000. In a single week in January, nearly 10,000 licences were granted, and the estimated total for the month is placed at about 25,000. The applications for experimental licences are also showing a remarkable increase. In the last week of December 3,500 applications were received, while in January licences were issued at the rate of about 6,000 a week, and in the last week of that month the figure had risen to 11,000. Taking into account the number of licences already issued it is calculated that the total number of wireless sets now licensed is in the neighbourhood of 60,000.

The Amateur Experimenter's Licence.

In a recent letter to the London *Evening News*, Mr. Leslie McMichael, Hon. Secretary of the Radio Society of Great Britain,offered a suggestion to those amateur wireless enthusiasts who are anxious to construct their own sets, but are faced with the difficulty of furnishing the necessary evidence as to their fitness to hold the experimental licence issued by the Post Office. "Without laying down any hard and fast rules," Mr. McMichael says, "it would be strong *prima facie* evidence of genuine intention to do experimental work if the applicant could tell the G.P.O. that he had definitely joined either the special grade of Associates of the Radio Society of Great Britain or that he had joined one of the Affiliated Radio Clubs in Greater London or the Provinces, of which there are now some 150."

A Broadcasting Station for Dublin.

A wireless telephony transmitting station is shortly to be erected in Dublin. It will be entirely a Government enterprise and will probably be situated in Phœnix Park.

A Wireless Journal for the Trader.

An announcement of considerable interest, and we might add, importance, arises from the new venture of the proprietors of this journal, namely, the production of another weekly, to be known as *The Wireless and Allied Trades Review*. The first number will bear the date of March 3rd. It will be for the trade only, and we suggest that all readers of *The Wireless World and Radio Review* connected with the trade should make a point of obtaining a copy. This new journal will supply information relating to everything which affects the interest both of the manufacturer and the retailer.

An Impost on Wireless Apparatus for South Africa.

Wireless telegraph apparatus and broadcasting sets imported into South Africa are to be taxed 20 per cent. *ad valorem*, subject to a rebate of 3 per cent. *ad valorem* on the products of the British Empire.

Measuring Instruments for Wireless.

A folder entitled " Handy Instruments for Everyday Use," giving information for instrument users about its line of portable ammeters and voltmeters, which are especially well suited for radio testing, has recently been issued by the Westinghouse Electric and Manufacturing Company.

A World List of Scientific Periodicals.

Definite plans were made at a meeting of the Conjoint Board of Scientific Societies held on January 24th to prepare and issue a list of all scientific periodicals containing the results of original research. At present no accurate list of the many thousands of such periodicals written in many languages exists, and no single library contains even a large proportion of them. The list, which will probably be published before the end of the year, will be compiled by the Keeper of Printed Books, an official connected with the British Museum.

Australian Manufacturers' Association Formed.

Australian manufacturers of wireless instruments, traders and others interested have formed themselves into an association for the development of wireless in Australia. The first President is Mr. G. A. Taylor, who is a well-known figure in connection with wireless matters in the Commonwealth.

Wireless Heard on U.S. Tube Railways.

The New York correspondent of *The Times* reported recently that engineers of the Interborough Rapid Transit Company, with a receiving set only 18ins. long and 7 ins. wide and a loop aerial 4 ft. high, captured part of a concert being given in New York while their train was travelling at 40 miles an hour under the bottom of the East River. Later they caught the programme of the Kansas City broadcasting station 1,300 miles away. During most of the time the engineers heard with perfect clearness, though there was considerable interference by induction from passing trains and the motors in the train on which they were travelling.

The Imperial Wireless Chain Report.

The Cabinet Committee appointed recently to consider the question of the completion of the Imperial Wireless Chain have now finished their duties, and agreed upon their report which is ready to be presented to the Cabinet. It is understood that the report favours the employment of private enterprise for the undertaking.

A CORRECTION.

Electrostatic Capacity in Radio Circuits.

In the issue dated January 27th, on page 573, formula (2) should read :—

$$Z = \frac{1}{\sqrt{\left(\frac{R}{R^2 + \omega^2 L^2}\right)^2 + \left(\frac{\omega L}{R^2 + \omega^2 L^2} - \omega C\right)^2}} \quad \ldots (2)$$

and the last line of the same column should read :—

"we get $Z = 2992$ ohms at 100,000 cycles per . . . ."

BOOK REVIEW.

Metal Turning Made Easy. (London : *Cassell and Co., Ltd.*, La Bello Sauvage, E.C.4. pp. 152. 177 Illustrations. Price 1s. 6d. net.)

Belonging as it does to the well-known series of " Work " handbooks published by Cassells, this volume needs little in the way of introduction. "Metal Turning Made Easy " is a companion volume to " The Simple Lathe and Its Accessories," published a short time ago, and its object is to provide a handy, up-to-date guide to modern lathe work practice for the amateur's or the professional's workshop. The various operations of turning, boring, drilling, screw cutting, and gear cutting in the lathe, and the subsidiary processes connected with them are explained in detail in eleven chapters, and clearly illustrated by numerous drawings and photographs. It is evident, on even a cursory glance, that the information presented in this little volume is drawn from a fund of sound and practical experience. Among the subjects treated and not indicated by the title are the turning of scallops, ovals and curves ; turning ebonite ; and the measurement of turned and bored work. An index of subjects adds the finishing touches to an attractively produced volume.

BOOK RECEIVED.

The Simple Lathe and Its Accessories. (London : *Cassell & Co., Ltd.*, La Belle Sauvage, E.C.4. Illustrated. Price 1s. 6d net.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings o, Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

The Thames Valley Radio and Physical Association.*

Hon. Secretary, Mr. E. A. Rogers, 122, Wood Street, London, E.C.2.

A most enjoyable evening was spent with the staff and patients of Queen Mary's Hospital for Disabled Soldiers on Tuesday, January 23rd, at Roehampton.

On behalf of the Association, Messrs. Driver, Davy, Harris and Rogers took up the receiving set and gave one of the most perfect reproductions of the broadcasting concerts that have yet been heard, although they had to use a capacity earth in the room, owing to the strong hum received through the ordinary earth due to the many heavy electrical cables in the grounds. About 200 were present.

During an interval the Birmingham station was heard, in which the patients were thoroughly interested.

At 9 p.m. Mr. Appleton Smith, G.O.C. Pierrot troupe, introduced the members who were kindly adding to the enjoyment of the evening, viz., Miss Betty Southam, Miss Wrightson and Miss Sunley, whose personal attractions were only exceeded by the charming way they rendered their songs and parts, and Messrs. N. and A. Smith.

A group of the Uitenhage (South Africa) Radio Society with their receiving apparatus on the occasion of a recent field day.

The thanks of the Association are tendered to the above-mentioned ladies and gentlemen for helping to provide such excellent fare for the most worthy of our institutions, and to the manufacturers of the Easi-Fix aerial used.

Meetings take place at the Hut, Wigan Institute, every Thursday, at 8 p.m.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

The Society met at 8 p.m. on January 22nd, at St. Mary's Schools, when Mr. Campion demonstrated his home-made four-valve receiver. Very strong signals were received from **2 LO**, **2 OM**, and the Radiola near Paris, on a Brown's loud speaker and relay used in conjunction with Mr. Campion's set.

Mr. Trussler exhibited a small crystal receiver and a junior Marconiphone made by Mr. Brown.

Later the Committee met and discussed the final arrangements for the sending of the delegates to the Radio Society of Great Britain. The elementary Morse class was taken by Mr. Field twenty minutes before the close of the meeting.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The eighteenth general meeting of the Belvedere and District Radio and Scientific Society was held at the Erith Technical Institute on Friday, January 19th.

The Secretary read the minutes of the previous meeting, and reported that the official transmitting authority had arrived, and that the call signal allotted to this station is **5 OY**. The making of the various components is being proceeded with, and it is hoped that very shortly experimental C.W. and telephony transmission will take place from this station.

It is proposed shortly to hold a dinner as the first social function of the Society. Various items in connection with this were generally discussed at the meeting.

The next meeting of the Society was held on Friday, January 26th, when Mr. S. Burman read the second part of his paper on "High Frequency."

At the conclusion of the paper the Chairman (Mr. T. E. Morriss), after making a few appropriate remarks, passed a vote of thanks to Mr. Burman for his very interesting paper.

The Secretary gave a report on his visit to the annual conference of the Radio Society of Great Britain and Affiliated Societies, held in London on January 24th, where he and Mr. C. E. Morriss acted as delegates for the Society. He mentioned that no decision was arrived at with regard to the suggested quarterly Radio Conferences to be held in London and provincial centres.

The Ilford and District Radio Society.*

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

At a meeting held on January 25th, Mr. A. P. Welch lectured on "Wireless Waves and Harmonies." The lecturer dealt with the question of harmonics in a most able manner, and certainly cleared up some of the more obscure points relating to this subject. Mr. Welch also lectured on "Atmospherics," and dealt in particular with the "Heaviside Layer."

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

On Friday, January 12th, a lecture was given by Mr. J. F. Stanley on "The Historical Development of Radiographic and Radiophonical Communication." The early attempts at communication without wires were first described, and although these experiments had nothing to do with radio they were certainly wireless. The investigations of Hughes, Hertz, Maxwell and others were fully dealt with, and later on the work of Sir Oliver Lodge.

On January 13th, the occasion of the broadcasting of the opera "Faust," a public demonstration was given, and many people, on hearing the wonderful clearness of the words and music, decided to make wireless sets of their own.

On January 19th a very successful sale of apparatus was held. Several members brought along all their spare junk, and a brisk trade was done.

The West London Wireless and Experimental Association.*

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex.

The first meeting after the Christmas vacation was held on Tuesday, January 9th. Morse practice was taken by many present. Messrs. H. S. Walker **(2 OM)**, A. Pike **(2 YR)** and A. Rolfe, of the Hounslow and District Wireless Society, visited the meeting by invitation of the committee, for the purpose of talking over the "impossibility of carrying out amateur transmission and experimental work generally, during the hours of broadcasting, on the 440 metres wavelength." After hearing their views, it was decided to await further suggestions from their Society.

At a meeting held on January 16th, after the reading of various items of correspondence, the meeting was thrown open for general discussion to give the members present an opportunity of exchanging their views in connection with any experiments made during the last week or two.

It is hoped shortly to hold a social evening of entertainment, and the committee have left this in the hands of Mr. Mullings, who is sure to make the experiment a successful one, and further announcements will be made later in respect of this venture.

Several well-known lecturers and demonstrators have been approached in regard to demonstrating before this Association in the near future.

The Secretary will have much pleasure in replying to all applications as regards objects of and subscriptions to the Association, and it is hoped that possessors of the many new aerials appearing in the district will come forward for membership.

Walthamstow Amateur Radio Society.*

Hon. Secretary, Mr. R. H. Cooke, 49, Ulverston Road, E.17.

The Society, on Monday January 15th, gave a demonstration to the Walthamstow Literary and Debating Society, at the Hut, Y.M.C.A., Church Hill.

A crowded audience enjoyed radiotelephony from **2 LO** through Mr. Pearson's home-made three-valve set with loud speaker. Mr. Allan, of the Radio Society, answered many questions from the audience, as did Mr. Pearson and Mr. Trott. Councillor V. L. McEntee, the local M.P., and other local notabilities, were greatly interested in the apparatus displayed, and a host of new friends and many new members were made.

On Thursday, January 18th, Professor E. M. Baker, B.Sc., M.I.E.E., gave a lecture on "Telephony and Broadcast Reception." Members gathered in great force to hear what proved to be a splendid exposition of the theory and practice of radiotelephony. The lecturer spared no pains to make his points absolutely clear, both with diagrams and formulæ. The club is now well over 100 strong, and a very fine body of earnest workers are to be found in its ranks.

The Southend and District Radio Society.*

Hon. Secretary, Mr. A. L. Whur, 4, Wimborne Road, Southend-on-Sea.

On Friday, January 26th, 1923, at headquarters, 76, Queen's Road, Southend-on-Sea, a most interesting lecture was given by Mr. Percy Barnes, M.R.S., on "Transformers and Induction Coils." Various methods of making them and the uses to which they are put were explained by the lecturer.

Afterwards, a demonstration and lecture was given by Mr. A. C. Hugh, on his set, consisting of one H.F., tuned anode valve, one detector valve, and two L.F. valves, using a reaction coil coupled to the tuned anode valve. The concert at **2 LO** by Australian artists was received on the loud speaker.

The Chairman, Mr. D. L. Plaistowe, announced that the P.M.G. had granted the Society's application for a portable transmitting and receiving licence, and that the station call of the Society is **5 QK**. Arrangements will be made as soon as possible to make a portable experimental transmitting and receiving set.

Proposed Wireless Club for Wimbledon.

A wireless club is to be formed in Wimbledon. All those in the district who are interested in wireless are invited to communicate with C. G. Stokes, Esq., 6, Worple Avenue, Wimbledon, S.W.19, or E. W. Webb, Esq., 14, Denmark Avenue, Wimbledon, S.W.19.

The Liverpool Wireless Society.*

Hon. Secretary, Mr. G. H. Miller, 138, Belmont Road, Anfield, Liverpool.

The annual general meeting of the Liverpool Wireless Society was held at the Royal Institution, Colquit Street, Liverpool, on Thursday, January 25th, Mr. E. B. Grindrod occupying the chair.

The Secretary read a report of a special impromptu meeting of the Society, which met to discuss the question of a new and up-to-date receiver, and it was unanimously decided that the Society's present apparatus, being somewhat prehistoric (the Society having been established before the war), it was now urgently necessary to have a special "whip round" for the necessary funds. One of the members present very kindly offered to provide the greater portion of the necessary funds, and guaranteed a cheque for £50, which was handed over the following day. Promises were also made by the members present at this impromptu meeting to the extent of £23, and the Secretary was then instructed to write to the members not present inviting them to join in the subscription list. As an expression of appreciation of the generosity of the principal donor, Mr. C. R. Honiball, this gentleman was elected the first Honorary Life Member of the Society.

It was decided to put the receiver in hand without delay, and after some discussion the type was finally decided upon. This will be built by one of the members of the Society, and will comprise two H.F. valves, detector valve, and three L.F. valves. Separate controlling switches and filament rheostats are to be provided for each valve. Tuned anode H.F. coupling will be employed up to 2,600 metres, and resistance capacity from 2,000 to 25,000 metres. Provision will also be made so that the apparatus, by use of switches, can immediately be converted to plug-in tuned H.F. transformer coupling up to 2,600 metres. A three-coil tuning system will be employed, and the whole set will be of the very highest quality of construction possible, and will fit into a sloping mahogany cabinet, with drawers to lock up at the base to hold the necessary short-wave and duolateral coils, plug-in transformers, etc.

The election of officers for the present year then took place and there was no important change other than that of the position of Hon. Secretary, Mr. C. L. Lyons, who regretted that it would be impossible for him to offer himself for re-election. Mr. G. H. Miller was unanimously elected in his place. Votes of thanks were passed in favour of the retiring Hon. Secretary's efforts, and in favour of the new Secretary for accepting the appointment. Mr. N. D. B. Hyde declined to serve on the committee during 1923, and consequently retired, and Mr. C. R. Honiball was elected in his place. Mr. S. W. Philpott was also elected to serve on the committee as the representative of the broadcast licencees of the Society.

Cheltenham and District Wireless Association*

Hon. Secretary, Mr. Eric Cole, A.R.I.B.A., 28, Milton Road, Cheltenham.

At the weekly meeting of the Association on January 22nd, Mr. W. G. H. Brown (**5 BK**) gave an extremely interesting lecture on "Transmission," illustrated by blackboard sketches and diagrams, and some of his transmitting apparatus rigged up temporarily at the lecture hall.

He gave practical demonstrations of spark, tonic train, and C.W. transmission, and also lucidly explained telephony transmission, the various methods of modulation being made quite clear to members.

Mr. Brown also described his experiences listening for American broadcasts.

A vote of thanks was passed to the lecturer for an extremely instructive evening.

The Hon. Secretary pointed out at the conclusion of the meeting that subscriptions for 1923 were now due and should be paid to the Hon. Treasurer.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. A. L. Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

An interesting lecture specially designed for those just taking up wireless broadcasting, was delivered at the Digbeth Institute on January 26th, by Mr. Jennings, the subject being "The Working of Broadcasting Sets." Mr. Jennings ably traced in simple terms the theory of the electron and its bearing on modern wireless describing the propogation of magnetic waves and the means we have of reception both by crystal and valve apparatus. The object of tuning and the methods used and also the meaning of inductance and capacity were clearly explained.

The lecture was closely followed by the members present, and a hearty vote of thanks was passed to Mr. Jennings.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. B. Whitehouse, The Grotto Café, Manchester.

On Wednesday, January 24th, the Society, at the regular weekly meeting, was favoured by a visit from Mr. Bell, of the Metropolitan-Vickers Electrical Co., Ltd. (better known, perhaps, locally as Mr. "X" of **2 ZY**), who came down to discuss with the members the transmissions from the broadcasting station at Trafford Park.

The Hon. Treasurer, Mr. J. R. Halliwell, opened the discussion by explaining the reasons for inviting Mr. Bell. He said that the Society had felt for some time that co-operation between its members and the men of the Research Department of Metro-Vickers could not be anything else but beneficial to British broadcasting, and this feeling had prompted the invitation. Mr. Halliwell made some excellent criticisms of the transmissions, and desired it to be understood that everything he said was in the nature of constructive and not destructive criticism.

The Chairman, Mr. G. G. Boullen, then called on other members to continue, and several gentlemen gave their opinions and made suggestions whereby they thought the programmes could be improved. Certain members had been deputed to make careful observations of **2 ZY**'s strength, clearness, etc., over the preceding week's concerts. Mr. Lomas gave a very interesting account of his experiences in reception.

Mr. "X," who was received with much applause, then proceeded to deal with the many questions asked in a very able manner. He outlined some of the many problems which had to be solved and said that gradually they were being overcome. He then dealt briefly with the history of the station, and informed his audience that it had been erected and run chiefly by local men, and had been built up as it were from first principles.

Mr. J. E. Kemp then rose, and in proposing a vote of thanks, said that he felt the Society had been honoured by Mr. Bell's visit, and much good was bound to result from the interchange of ideas which had taken place. He further proposed that Mr. Bell be forthwith made an honorary member. These propositions were suitably seconded and passed unanimously.

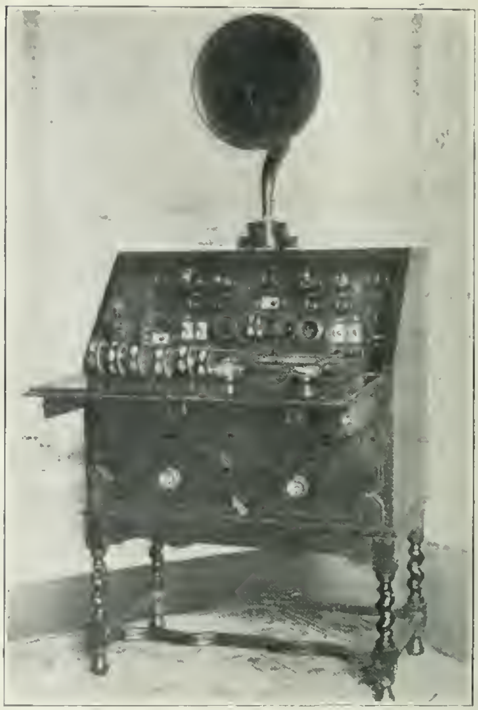
Meetings of the Society are held each Wednesday at 7 p.m. at the Grotto Café, Todd Street.

An Amateur-Built Cabinet Receiver.

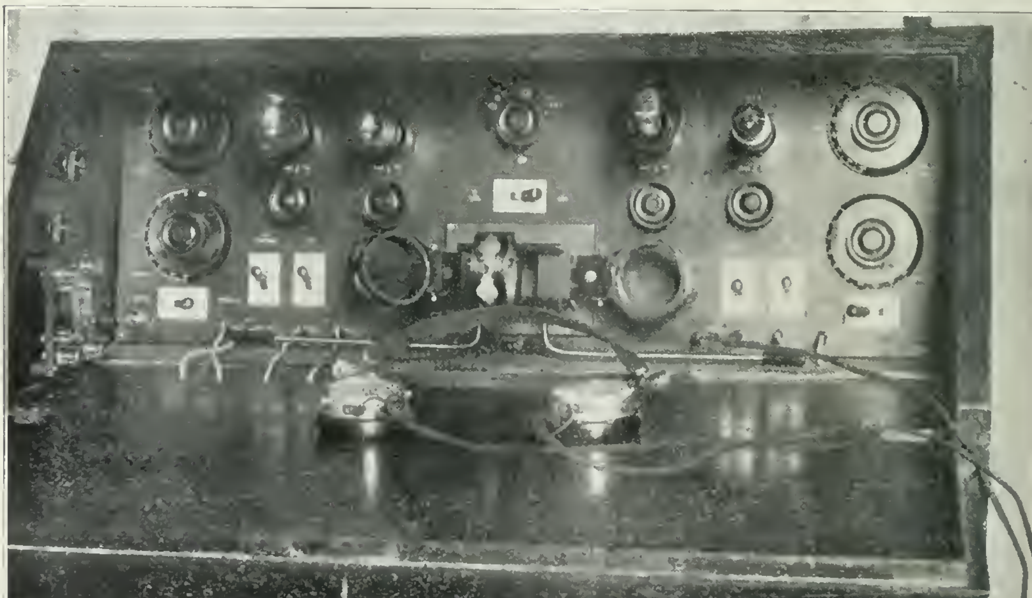
The accompanying photographs of the receiving equipment of Mr. A. G. Foster, of West Hampstead, indicate the degree of perfection that can be achieved by the amateur worker.

The apparatus, as will be seen, has been designed especially for experimental reception. Switches are suitably arranged for providing any combination of high and low frequency amplifying circuits The tuning range is covered by means of interchangeable plug-in coils and a series parallel aerial circuit switch. Extension handles from the coil holder bracket permit of critical coupling adjustment, and the tuning can be accomplished step by step as additional circuits are brought into operations by the key switch. Various types of valves are employed, according to the circuits in which they are connected.

The fine arrangement of the outfit not only greatly facilitates manipulation, but allows of the intrusion of the experimental apparatus into the drawing-room.



The Cabinet Receiver.



The Layout of the Apparatus.

Calendar of Current Events

Friday, February 16th.

RADIO SOCIETY OF GREAT BRITAIN.
At 6.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment. Elementary Lecture on "The Fundamental Principles of Radio Reception." By Mr. Maurice Child.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Meeting.

LEEDS AND DISTRICT AMATEUR WIRELFSS SOCIETY.
Lecture on "The Design of a Tuner." By Mr. G. B. Kendall, B.Sc.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
Lecture on "The Armstrong Super-Regenerative Receiver." By Mr. A. H. Norman.

Saturday, February 17th.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.
At 6.30 p.m. At Holborn Restaurant, Newton Street, W.C.1. Annual Dinner.

Sunday, February 18th.

At 3.5 p.m. *Daily Mail* Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, February 19th.

9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55 Fonnereau Road. Lecture on "A New Secondary Cell." By R. Walsh.

WALTON-ON-THAMES AND DISTRICT AMATEUR RADIO SOCIETY.
General Meeting at Headquarters, St. Michael's, Burwood Park Road.

Tuesday, February 20th.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.
Meeting.

EAST LONDON RADIO SOCIETY.
Meeting.

Wednesday, February 21st.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.
Elementary Mutual Instruction Evening.

EDINBURGH AND DISTRICT RADIO SOCIETY.
At 8 p.m. At R.S.S.A. Hall. Lecture on "Telecontrol." By R. Mr. Ogilvie Crombie.

SWANSEA AND DISTRICT RADIO EXPERIMENTAL SOCIETY.
Exhibition of Wireless Apparatus.

Thursday, February 22nd.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.
At 8 p.m. At Hitchin Road Boys' School. Exhibit and Demonstration. By Mr. F. Halstead.

ILFORD AND DISTRICT RADIO SOCIETY.
Demonstration of Reception. By Mr. C. H. Andrews.

HACKNEY AND DISTRICT RADIO SOCIETY.
Informal meeting and sale and exchange of wireless apparatus.

Friday, February 23rd.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Elementary Class.

MANCHESTER WIRELESS SOCIETY.
At 7.30 p.m. At Houldsworth Hall. Discussion.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
"Receivers and Loud Speakers." By Mr. A. M. Bage (President).

BIRMINGHAM EXPERIMENTAL WIRELESS CLUB.
At 7.45 p.m. Lecture on "Wireless Procedure."

HULL AND DISTRICT WIRELESS SOCIETY.
At the Memorial Institute Schoolroom, Dewsbury Street. Smoking Concert.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company ;—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,
Cardiff	5WA	395 ,,

The Cardiff station is expected to be working by about Monday, February 12th.

Correspondence.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

SIR,—I was much interested in an article by Mr. E. H. Robinson in a recent issue of your journal, recommending the use of a chemical rectifier in order to supply plate voltage for thermionic tubes. Chemical rectifiers have claimed a great deal of my attention during the last 38 years, but notwithstanding this long acquaintance I do not feel much affection for them as they are practically the most unreliable piece of electrical apparatus it is possible to come across.

I have used them in all ranges, from currents of a few milliamps. up to nearly 50 amps. I have used every known combination and chemical in connection with them but reliability has not been achieved.

The point I wish to make, however, is that in the first place the use of these rectifiers in connection with vacuum tubes dates back now some twenty-five years, when they were employed for a short time only to rectify high potentials in connection with induction coils ; secondly, that there is one very important point which Mr. Robinson has not mentioned in his article, namely, that in order to act as rectifiers, it is necessary to maintain their polarisation, and this can only be done by connecting them to the supply some time before they are required for use. Personally, with all my experience of such rectifiers, and though my supply is A.C., I prefer to feed my anodes with some reliable make of dry cell or H.T. accumulator

A. W. ISENTHAL.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, The Wireless World and Radio Review, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"**G.E.M.**" **(Essex)** *asks for a diagram of a three-valve receiver comprising one detector and two L.F. connected valves.*

The diagram is given in Fig. 1, and suitable values are indicated.

"**T.H.**" **(Scotland)** *submits particulars of his receiver and asks* (1) *for a suitable reaction coil.* (2) *for a suitable A.T.I.*

(1) As suggested, the reaction coil may be coupled with the coil L_2, and the method of coupling may be either with the aid of a sliding coil or a basket coil. If it is convenient, we suggest you use a sliding coil 2″ in diameter and 4″ long. This former may be wound full of No. 30 D.C.C. and three tappings may be taken. (2) The A.T.I. may consist of a winding 4″ in diameter and 6″ long, of No. 22 D.C.C., and six tappings may be taken. The secondary circuit may be 3″ in diameter and 6″ long, of No. 28 D.C.C., with six tappings. The aerial tuning condenser should have a maximum value of 0·001 mfds., and should be connected to join in series or parallel with the A.T.I. The closed circuit inductance is tuned with a condenser, having a maximum value of 0·0005 mfds. The proposed arrangement of A.T.I. and secondary coil is quite suitable.

"**E.D.**" **(Belgium)** *asks* (1) *For suitable intervalve transformer dimensions.* (2) *For particulars of a telephone transformer.*

(1) An intervalve transformer may consist of a winding of 3 ozs. of No. 42 S.S.C. wire for the primary, and 3 ozs. of No. 46 S.S.C. for the secondary. The core should be closed, and may consist of a bundle of iron wires built up to a diameter of ½″. The iron wires should be 18″ long and the cheeks should be spaced 3″ apart. The primary winding is wound on first. (2) The telephone transformer may consist of the primary winding of 3 ozs. of No. 42 S.S.C. wire, and the secondary of 3 ozs. of No. 34 S.S.C. copper wire. The core is constructed of a bundle of soft iron wires, built up to a diameter of ½″ and 4″ long. The core should be open, that is, the iron wire is not bent back over the transformer winding.

"**R.H.**" **(Nottingham)** *asks* (1) *For particulars of a microphone transformer.* (2) *For dimensions of a suitable choke coil.* (3) *For a suitable A.T.I. and reaction coil.* (4) *For the capacity of a suitable by-pass condenser.*

(1) A microphone transformer may consist of an iron core composed of a bundle of wires built up to a diameter of ½″, and 4″ long. The

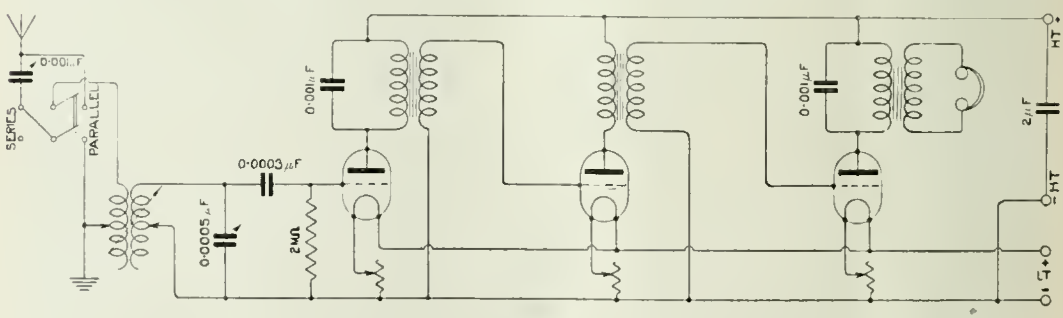


Fig. 1.

core should be left open. The primary winding may consist of 200 turns of No. 22 S.S.C. copper wire, and the secondary 10,000 turns of No. 36 S.S.C. wire. (2) The choke coil "B" should consist of a winding of 12,000 turns of No. 34 S.S.C. wire wound on an iron core having a diameter of 1½". The core should be practically closed. If the coil is built up of sheet stampings to form a closed circuit, it is better to put a very narrow saw-cut right through one limb of the stampings to break the magnetic circuit. If the core is built up of iron wires, the wires may be placed in contact on one half of the choke, and on the other half left slightly separated. (3) The aerial circuit should contain a winding of 30 turns of No. 12 gauge bare copper wire, and the winding should be spaced a distance equal to the thickness of the wire. About 35 turns wound on a former 5" in diameter will be suitable. The reaction coil may consist of a winding of No. 30 D.C.C. and consist of 80 turns wound on a former 3½" in diameter. (4) The condenser "D" should have a very small value and be capable of withstanding the H.T. potential. 0·0005 mfds. is generally quite suitable.

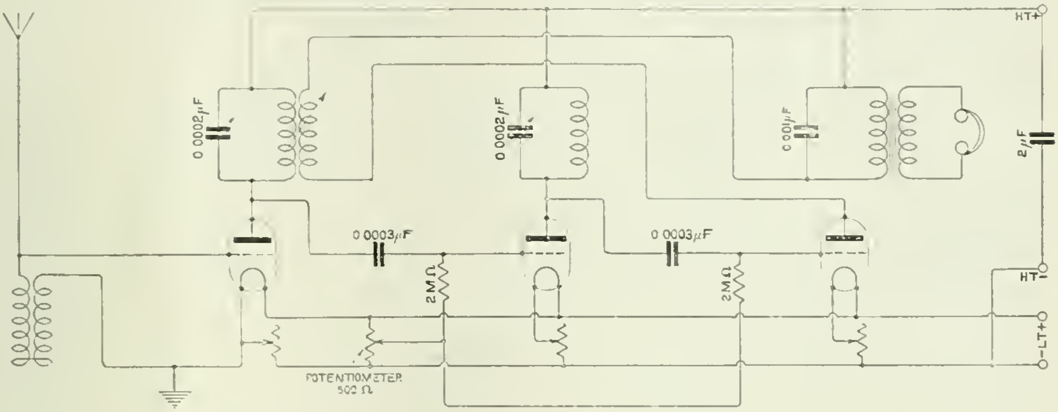


Fig. 2.

"BITTON" (Hove) *submits a diagram of his receiver and asks* (1) *How to connect a potentiometer to control two H.F. valves in the grid circuits, and for particulars of suitable grid and grid-leak values.* (2) *Why is it that, although signals are received very loudly when a variometer is used in the aerial circuit, the signals are weak when tuning coils and a series connected condenser are used.*

(1) A suitable diagram of connections is given in Fig. 2, and the values of the components are marked. (2) Without a knowledge of the tuning condensers and coils used we cannot say why there should be such a great difference in signal strength. Of course, better results should be obtained from the use of a variometer, but if the series condenser has a large maximum value, there should be no such great difference of signal strength noticeable.

"M.G." (Dorset).—It is a very difficult matter to determine the inductance of a duolateral coil by calculation. Factors such as the space between the turns of the wire due to the method of winding, as well as the dimensions of the coil, determine this value, and it is therefore not possible to accurately predict the precise inductance. The 600 turn coil should be wound with No. 24 D.C.C. wire. The 150 turn coil should be wound with No. 22 D.C.C., and the 100 turn coil is also wound with No. 22 D.C.C. wire. When the coils and the condenser are assembled, a certain amount of experimental work will be necessary in order to cover the range of wavelengths required. If, however, you wind the coils with a few more turns than given in the article to which you refer, you will have no difficulty. This is necessary in any case, because in all probability your tuning condenser would not be similar to the one which the writer of the article employed in his wavemeter.

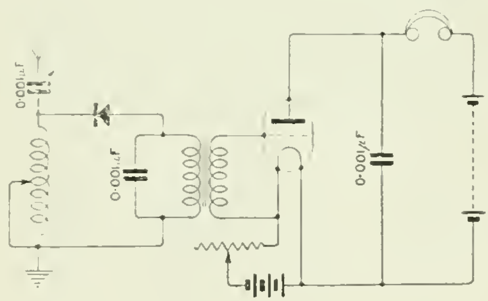


Fig 3.

"H.R." (S.E.7) *asks* (1) *For a suitable diagram showing the connections of a crystal detector with one low frequency magnifier.* (2) *Where may low current consumption valves be obtained.*

(1) See diagram Fig. 3. Suitable values are indicated in the diagram. (2) We suggest you communicate with the manufacturers of the valve in question, The Marconi-Osram Valve Company, Ltd., Osram Works, Brook Green, Hammersmith.

"**H.G.S.**" **(Leicester)** *asks* (1) *For a diagram of a receiver using the components which he has already by him.*

(1) The diagram is given in Fig. 4, and suitable values are indicated. The method of connecting the high frequency transformer is the same whether it is tapped or untapped.

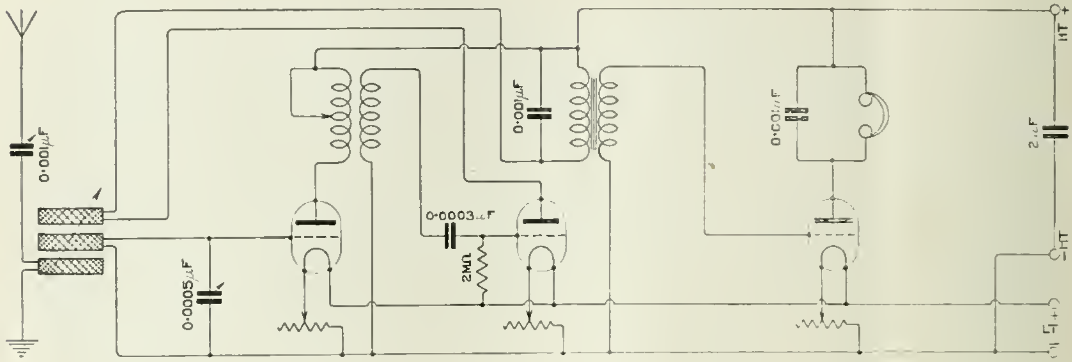


Fig. 4.

"**J.W.K.**" **(Middlesex)** *asks* (1) *For a diagram showing two L.F. valves added to a detector valve, with the values of the condensers.* (2) *Would the grid condenser and leak used at present be suitable for use with the new arrangement.* (3) *Should the Dutch Concerts be received with a receiver of this description.* (4) *How many plates are there in a* 0·0003 *mfd. variable condenser.*

(1) The diagram is given in Fig. 5, and suitable values for the condensers are indicated. (2) The grid condenser and leak used in your present receiver is quite suitable. (3) The addition of L.F. valves does not enable you to receive from greater distances. Low frequency valves magnify signals which are of sufficient strength to be efficiently rectified. To amplify very weak signals it is necessary to use one or two stages of high frequency amplification in the manner shown in many issues of this journal. (4) A 0·0003 mfd. variable condenser will have approximately fifteen plates, the number of plates of course being determined by the area of the plates and the spacing.

"**CATHODE**" **(Yorks)** *asks* (1) *For the wavelength range of a tuning coil, particulars of which are submitted.* (2) *Whether* 0·0003 *mfds. variable condenser is suitable for tuning.* (3) *For the dimensions of a suitable reaction coil.* (4) *Why it is not possible to receive telephony even though the carrier wave is strongly heard.*

(1) The wavelength range of the tuning coil when connected to the aerial, and the 0·0003 mfds. tuning condenser is from 200 to 6,000 metres. (2) The tuning condenser is quite suitable for tuning the aerial circuit. (3) The reaction coil may be $2\frac{1}{2}''$ in diameter and 5″ long wound full of No. 32 D.C.C. with three tappings. (4) The reason why you are unable to receive telephony transmissions is because too much reaction is used in the circuit. We suggest you reduce the reaction coil by half. You may be sure that when a circuit of the type described oscillates, energy is being transferred to the aerial circuit and interference is being caused to your neighbours.

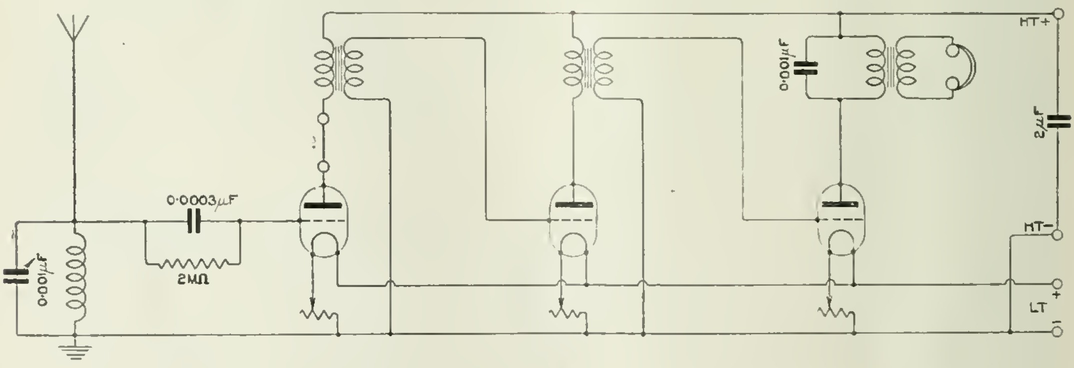


Fig. 5.

"**A.G.**" **(Folkestone)** *submits a diagram of his five-valve receiver and asks* (1) *Is the circuit correct.* (2) *Would a variable condenser across the reaction coil be an improvement.* (3) *Can we suggest any improvements.* (4) *Should he be able to receive* **PCGG** *transmissions.*

(1) The proposed circuit is not correct. The anode of the detector valve should be connected through the reaction coil to the primary of the low frequency transformer, and the low frequency transformer should be shunted with a 0·001 mfd. fixed condenser. We would point out that the telephones are joined so that the whole of the anode current from the valve passes through them. We assume this to be a clerical error. (2) A variable condenser connected across the reaction coil would be helpful, especially when receiving long wavelength signals. (3) We suggest you connect a switch in the aerial circuit for connecting the aerial tuning condenser in series or parallel with the aerial tuning inductance. A closed circuit is very useful and should be coupled with the aerial tuning inductance. It may be tuned with a 0·0005 mfd. condenser. It would be better to use a filament rheostat in the filament circuit of each valve, instead of using one to control the filament current of them all. (4) We consider you should have no difficulty in receiving **PCGG** transmissions.

"**A.D.La T.**" **(Yorkshire)** *submits a diagram of his receiver and asks* (1) *For criticism of circuit.* (2) *The most suitable way of connecting a separate heterodyne circuit for receiving long wavelength C.W. signals.* (3) *Is proposed arrangement for using reaction suitable when receiving short wavelength signals.* (4) *Why is 6 volts recommended for the L.T. battery when most valves operate with 4 volts across the filament.*

(1) We suggest you employ a reaction condenser with a maximum capacity of 0·00005 mfds. The aerial tuning condenser may have a maximum value of 0·001 mfd., and the closed circuit 0·0005 mfds. The primaries of the high frequency intervalve transformers should be tuned with a small variable condenser; one having a maximum capacity of 0·0002 mfds. would be suitable. The by-pass condenser labelled "B" may have a value of 0·0005 mfds. The remainder of the circuit is quite suitable. (2) We suggest you connect the heterodyne with the third high frequency transformer. The small coil from the heterodyne should be coupled with the secondary coil of the high frequency transformer. A very loose coupling will in all probability suffice. (3) The small reaction condenser should be connected with the grid of the second valve when receiving short wavelength signals. (4) It is generally necessary to use a 6-volt accumulator for the L.T. supply, since most valves operate best when the potential across the filaments is 4 volts. When the valve is old, a little over 4 volts is required, and in order to provide this voltage and also to allow for the voltage drop in the wiring and the filament resistances, it is necessary that the filament supply should be 6 volts.

"**CIRCUIT**" **(Co. Dublin)** *asks* (1) *How many yards of No. 50 S.S.C. copper wire are required for a resistance of 2,000 ohms, and what is approximately the weight of this wire.* (2) *How many yards of No. 47 S.S.C. wire are required to give a resistance of 2,000 ohms, and what is the approximate weight.* (3) *and* (4) *Which is the correct way of connecting the two windings of a telephone receiver together.*

(1) 200 feet of No. 50 copper wire gives a resistance of 2,000 ohms. The weight of 200 feet of this wire will be approximately 0·2 ozs. (2) 800 feet of No. 47 copper wire has approximately a resistance of 2,000 ohms. The weight is approximately 2·6 ozs. The No. 50 wire will just fill up the bobbin having the dimensions given. (3) and (4) The correct method of winding is indicated in your Fig. 1.

"**H.W.**" **(York)** *refers to a receiver described in the issues of September 16th and 23rd, and asks how it may be modified.*

We suggest you construct the receiver exactly as described in the articles referred to. It is not satisfactory to make alterations to a receiver before one has had experience with reception.

"**K.V.W.**" **(Devon)** *asks* (1) *For particulars of a variometer.* (2) *What is the Customs tax on imported French "R" type valves.* (3) *Whether a list of amateur transmitting stations is published.*

(1) A variometer was described on page 317 of the December 2nd issue, to which we would refer you for particulars. (2) We have no knowledge of the duty payable on imported French "R" type valves. (3) A very complete list of amateur transmitting licence holders is published by the Wireless Press, Ltd., and may be obtained from the Mail Order Department, The Wireless Press, Ltd., 12/13, Henrietta Street, London, W.C.2.

"**HALENDER**" **(E.17)** *asks* (1) *Whether he should use a telephone transformer in the anode circuit of the last valve of his valve receiver.* (2) *Which is the input side of a transformer.*

(1) Under the circumstances, we think it would be better if you connected the telephones directly in the anode circuit, and no serious harm will result. It is not very helpful to wind a transformer having a ratio of 1 to 1, as you suggest. (2) The input side of a transformer, when applied to an intervalve transformer, is the side which is connected in the anode circuit, and is labelled the primary. The output side of the transformer which is the secondary, is connected with the grid and filament, or the input circuit of the next valve.

"**H.T.S.**" **(Cornwall)** *submits a diagram and asks* (1) *For criticism.* (2) *Whether it would be approved by the P.O.* (3) *How to obtain an experimental licence.*

(1) The diagram submitted is quite suitable as no reaction is shown. (2) The P.O. would probably approve of a receiver wired according to this diagram. (3) We suggest you communicate with the Secretary of the G.P.O., London.

"**JOHN R.G.**" **(Oundle)** *asks* (1) *Whether aluminium is a suitable substance upon which to wind a variometer winding.* (2) *At what speed must a motor connected with the Johnsen Rahbek loud speaking amplifier rotate.*

(1) Aluminium is not suitable for the former of a variometer. The fact of its being insulated with wax paper will not make it suitable. We suggest you use dry wood or ebonite. (2) The best speed

for the motor of the Johnsen Rahbek loud speaker should be determined by experiment. The diameter of the agate cylinder is ⅝″. 30 revolutions a minute is suitable.

"RADIOMAD" (Salisbury) *submits particulars of his aerial, and asks whether it may be improved in any way.*

We suggest you erect a two-wire aerial at right-angles to the telephone wires; the length of the aerial will then be 45′. The aerial should be as high as possible.

"J.W.H.C." (Manchester) *asks* (1) *Why signals are as loud whether connected to earth or disconnected.* (2) *Why adding H.F. connected valves does not materially increase the signal strength.* (3) *What is the tuned anode method of high frequency amplification.* (4) *Is it possible to make a loud speaker with the aid of a microphone.*

(1) The reason why a connected or disconnected earth lead from your receiver does not affect the signal strength is because the earth lead is so long. We suggest you reduce the lead to 6′. Owing to your peculiar situation, however, we think you would find the signal strength improved by using a frame type aerial. The frame may be 4′ square wound with 10 turns of No. 18 D.C.C. The wire should be spaced ¼″ and the last five turns should be tapped and taken to a switch for coarse tuning. The two leads from the frame aerial will then go to the filament and grid connections of the first valve. The frame aerial should be tuned with a variable condenser having a maximum value not exceeding 0·0005 mfds. (2) With the modification suggested in (1), the addition of H.F. connected valves will greatly increase the signal strength provided the tuning in the anode circuit of the added valves is suitably carried out. (3) The tuned anode method of H.F. amplification employs a tuned coil in the anode circuit. When the tuned circuit has a frequency corresponding with that of the signal to be amplified, the impedance of the circuit is very high, consequently large potential variations are set up across it. These are transferred to the grid of the next valve through the grid condenser. The leak is connected between the grid and the filament to stabilise the normal grid potential. Many diagrams showing the methods of connecting high frequency valves by means of tuned anode coils, have been recently given: in particular we would refer you to page 601, February 3rd issue. (4) It is not always possible to construct a loud speaker. However, the receiver may be connected with one side of the microphone, the other side being secured to a rigid framework. The primary of the transformer and a few dry cells should be connected in series with the microphone and the transformer secondary connected with the telephones. See Microphone Amplifier on page 130, October 28th issue.

"C.F." (Northwood) *submits a diagram of connections and asks* (1) *For criticism.* (2) *Is the aerial (particulars of which are submitted) likely to be useful.* (3) *Is it necessary to secure adjustments for a portable receiver or will an ordinary experimental licence suffice.*

(1) The diagram of connections submitted is correct, and is quite a standard circuit. (2) The proposed aerial is not very suitable, and we think you would get far better results from a frame. The frame should be 4′ in diameter wound with 10 turns of No. 18 D.C.C. The wires should be spaced ¼″, and the last five turns brought to a switch. (3) When applying for an experimental licence, you are asked whether the receiver is to be portable or whether it is to be used as a fixed station. We therefore suggest that you apply to the G.P.O. for permission to use a portable receiver.

"W.G." (Durham) *asks how an intervalve transformer works.*

When a transformer is connected in a circuit, variations in the primary voltage are reproduced in the secondary circuit. If the primary voltage is an alternating voltage, the secondary circuit will deliver an alternating voltage. If the primary circuit contains a steady direct current, superimposed upon which is an alternating voltage, only the alternating voltage will appear in the secondary circuit, because the voltage of the secondary circuit is induced by the varying current producing a varying flux which cuts the secondary winding. A continuous current flowing through the primary circuit cannot cause a voltage across the secondary winding. The primary voltage and secondary voltage are 90° out of phase. When no load is connected to the secondary of the transformer and a voltage is applied to the primary, the current flowing in the primary circuit, which magnetises the primary winding, is 90° out of phase with the primary voltage: the current is lagging 90°. The secondary voltage is in phase with the magnetising current, and the phase of the secondary current is determined by the nature of the load upon the secondary. If the secondary winding is inductive, the secondary current will lag behind the secondary voltage. If the secondary circuit is purely resistance, the secondary current and voltage will be in phase. The primary current lags behind the applied voltage simply because of the predominance of inductance in the circuit. The lag of the current behind the voltage is in no way affected by the frequency of the applied voltage. The product of the volts and amperes measured in the D.C. circuit supplying energy to the valve gives the apparent watts in the circuit. The true watts would be given by the product of the reading of a hot wire ammeter and D.C. voltmeter. When the D.C. current is pulsating, the D.C. ammeter will indicate an average value, while the hot wire ammeter will indicate the R.M.S. value. The ratio between the apparent watts and the true watts depends upon the adjustment of the valve circuit.

SHARE MARKET REPORT.

Prices as we go to press on February 9th, are:—

Marconi Ordinary	£2	14	0
,, Preference	2	5	0
,, Debentures	107	0	0
,, Inter. Marino ..	1	9	0
,, Canadian		11	0
Radio Corporation of America:—			
Ordinary		15	6
Preference		13	0

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN.

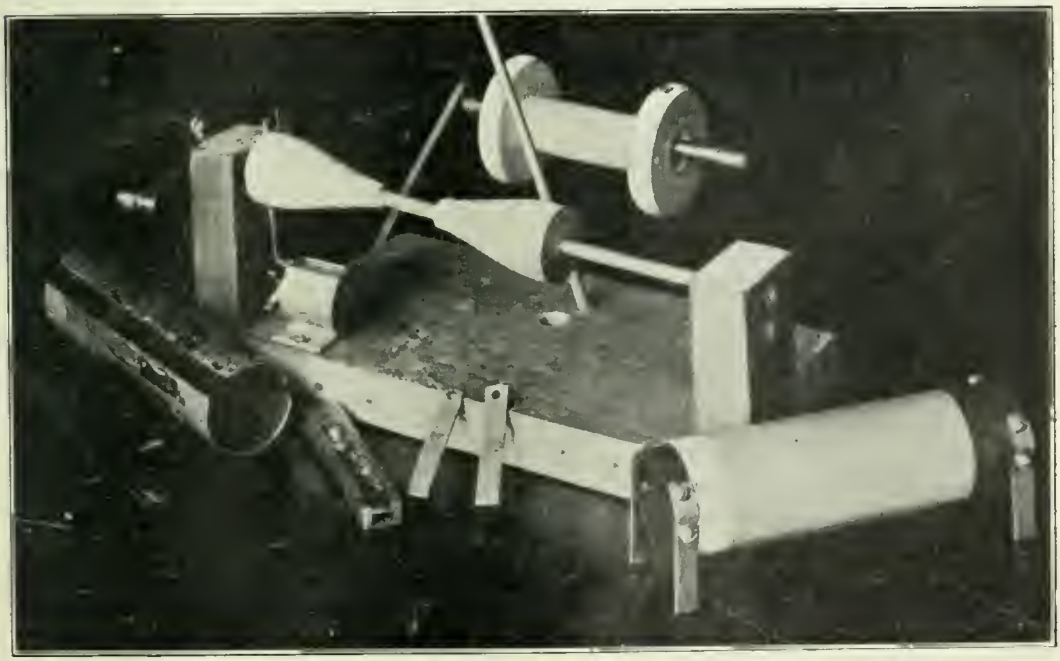
No. 184 [No. 21 Vol. XI.] FEBRUARY 24TH, 1923. WEEKLY

Semi-Aperiodic H.F. Transformers.

By J. H. Reeves, M.B.E.

THESE notes are the outcome of an attempt to build a multivalve H.F. amplifier to cover the broadcasting band and under. They formed the subject of a lecture given to the Kensington Radio Society.

The nature of the method was formed on the writer's experience in the use of a Marconi seven-valve amplifier Type 55D. The band claimed for this instrument runs from 1,500 metres to the upper limit. It was designed not so much for high efficiency per valve,



A photograph showing all the equipment necessary in constructing the transformers and a finished transformer on the right. Note the cyclometer mounted on the base to register the number of turns when winding. On the right are the jigs for cutting and drilling the ebonite tube and brass connectors.

but rather to give great ease of working over a wide range. It is a fact that this instrument has given good results down to 600 metres, and the writer's argument was that if an amplifier with optimum point in the neighbourhood of 4,000 metres will give good results down to 600 metres, what will be the result of constructing one on exactly similar lines with an optimum of 900 metres? The reader is forewarned that he may have to use one more valve, possibly two, than he would have to do in the case of a tuned reactance capacity, or of the multi-pointed self-tuned reactance capacity coupling, but on the other hand, if he wishes to use several H.F. valves in cascade, for instance for use with a small frame aerial, he will most probably agree that the cost of the extra battery power required is still outweighed by the elimination of that

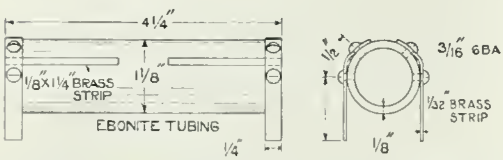


Fig. 1. The body carrying the transformer windings.

bugbear of the tuned anode multiple circuit, *i.e.*, its extreme liability to self oscillation.

The writer experimented with the popular four-pin type of disc transformer, but found against this the mechanical difficulty of making the body, and more particularly the difficulty of turning out three or more identical in electrical properties.

The type to be described is cheaper to make, irregularities in mechanical construction are unimportant, while with ease any number can be made almost identical electrically. The form requires a reconstruction of the panel, though by means of an adapter it can be used on a panel fitted with valve sockets, but an experiment will later be described from which it would appear that the capacity of the four pins and the four sockets, almost infinitesimal as they are, can produce markedly observable effects.

The transformer is of the two-layer cylindrical type, very tightly coupled, and wound with high resistance fine wire. The body is formed of tubing $1\frac{1}{8}$ in. diameter, walls $\frac{1}{8}$ in. thick and of length $4\frac{1}{4}$ ins. The writer used ebonite, but thinks possibly other material may be better electrically. This body is supported on four legs made from brass strip $\frac{1}{4}$ in. $\times$ $\frac{1}{32}$ in., and these are held in small spring clips of a type which has been advertised in this journal.

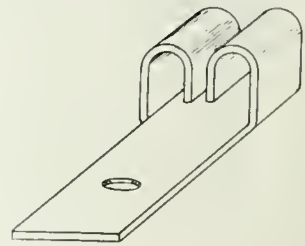


Fig. 2. Three clips to support the transformers.

The body is shown in Fig. 1. and the clip in Fig. 2. It will be seen that to the legs are soldered fine brass strips projecting along the body parallel to its axis. These may be of tinned wire, and form the base on which is soldered the winding wire. The length of these depends on whether the body is to be wound full (900 metres), about half full (400 metres), or with about 100 turns (200 metres).

The making of this body presents no great difficulty to one whose hands are skilful, but even to such the work is greatly facilitated by the use of two jigs, one to form the body (Fig. 3), the other the legs.

Jig 1.—The tube was rubbed smooth with fine emery cloth, oiled. A piece of fairly stout brass tubing was found of internal diameter

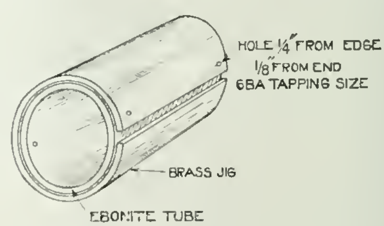


Fig. 3. The jig for the body.

just under $1\frac{1}{8}$ in. A length of $4\frac{3}{8}$ ins. was cut off, and the ends trued by a file or against an emery wheel, till the length was exactly $4\frac{1}{4}$ ins. This jig was then fixed in a large vice as nearly as the eye could gauge parallel to the jaws, and then, aided by one jaw as a guide, a longitudinal cut was made with a hack-saw which was thus closely parallel to the axis.

The edges of this cut were filed smooth, and then, slightly expanding the cut tube, it was slipped over the ebonite tube, which was then cut so that a small length projected at each end. The ebonite ends were now similarly trued to the guide of the brass surround. Next, at the same distance from one cut edge of the brass and $\frac{1}{8}$ in. from each

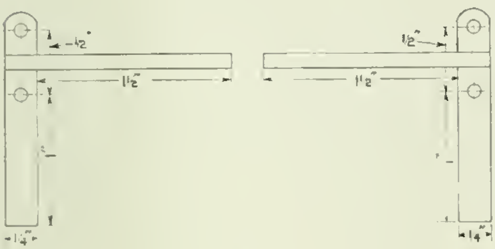


Fig. 4. The legs with arms soldered on.

end, two centre-punch marks were made, and at the opposite ends of the cross sectional diameter through these marks two others were made. Through these, four holes were drilled 6 BA. tapping size. The inner tube was pushed out by sliding over the main ebonite tube and the first body was ready, with the jig in position to make another.

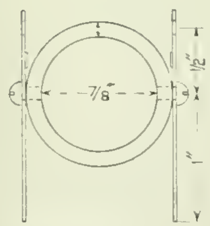


Fig. 5. End appearance with legs fitted.

Jig 2 (Fig. 4). This is to help make the legs identical. A full description is unnecessary and it is not difficult to construct from brass strip. It will be found that when the two holes have been drilled (6 BA clearance), the burr formed will prevent the finished legs from dropping out. A pair of small flat-nose pliers will get over this difficulty and for this reason the opening must be somewhat deeper than the $\frac{1}{32}$ in., the thickness of the leg, and the upper flap must be flexible. When one or two dozen legs have been made the ends are rounded or trued by file or emery wheel and the thin arms soldered on as in Fig 4.

To the body, four legs are now attached with screws 6 BA, 3/16 in. The end appearance now is as in Fig. 5.

The legs being carefully squared with the body, the top ends are bent round the circumference and the four remaining necessary holes are drilled and tapped 6 BA and screwed home. Any ends of the 3/16 in. screws which project internally are filed off, and the body is now ready for winding. For this a device is required as shown in Fig. 6, and in the photograph.

It may seem at first sight that this winding will be difficult. This is not the case and after a little practice a rate of about 100 turns per minute can be reached. In practice there is a little trouble in getting the first few turns to lie close together, but it is simpler to let this irregularity alone and when the coil is finished to press the erring turns into contact with the rest.

The next step is the testing and measurement of the transformer.

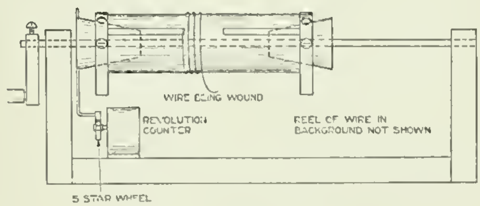


Fig 6. The winding device.

The method used gave results good enough to form a working basis. A small panel was put together of one H.F. and one detector valve. No connections were made beneath the panel except as regards L.T. battery and potentiometer, but all the terminals of the parts were brought up to the top so that changes of connections could be made easily.* The arrangement is shown in Fig. 7.

A buzzer wavemeter must be supposed to be some distance on the left. The transformer under test was put in the clips, a suitable coil was inserted on the left and its shunt

* Since this was written these transformers have been tested on another panel with very low capacity valves and the difference of the optimum wavelength far exceeded expectations. This shows the necessity of calibrating every transformer on the panel and with the valves with which it is to be used.

condenser placed at zero. The tuning condensers on the panel were disconnected. The wavemeter was now tuned in and the magnitude of the sound in the telephones was noted. The buzzer wavelength was now increased step by step and the receiver tuned in to each adjustment. If correct wavelengths had been selected the strength of signals rose fairly rapidly to a maximum and then with further increase of wavelength the strength began to fall away.

Maximum strength of signals should be accurately noted and if the assumption be correct that the energy of the oscillations were the same at all wavelengths—an assumption probably untrue—the result would give the absolute optimum point for each transformer, and the rates of falling off on either side of this point would give an estimate of the useful range over which the transformer could be used. Even if not absolutely correct, this method does give a useful and fairly close approximation. While certain of these measurements were being made another phenomenon was noted. Under a certain potentiometer adjustment the system broke into self oscillation *over a limited swing* of the tuning condenser, above and below which the buzzer note came through clearly. By careful manipulation of the potentiometer this swing could be limited to about 10 degrees and even less, and finally eliminated. The point of greatest ease of self-oscillation was credited as being that of the natural wavelength of the transformer in its setting, and the fact that various points as thus determined agreed well with the optimum point as found by the former method, seems to indicate that the respective theories are in the main accurate.

In this connection an interesting point was noted, and as this led to winding throughout with high resistance wire, it may be described. It was found that some coils would not oscillate under any adjustment of the potentiometer, so a reaction coil was brought into use and by its means, in conjuction with the potentiometer, the measurement by self oscillation could always be made. Now at the start both layers had been wound with fine copper, but as the band of efficient amplification proved very narrow, H.R. wire was substituted for the primary winding and two transformers were wound identical in number of turns, but in one the secondary was copper, in the other it was H.R. The latter was markedly more difficult to get to oscillate, but the efficiency of the former at optimum point, which was about the same, was somewhat higher. As the writer is prepared to sacrifice some efficiency in eliminating his great bugbear, oscillation, all secondaries are now wound with H.R.

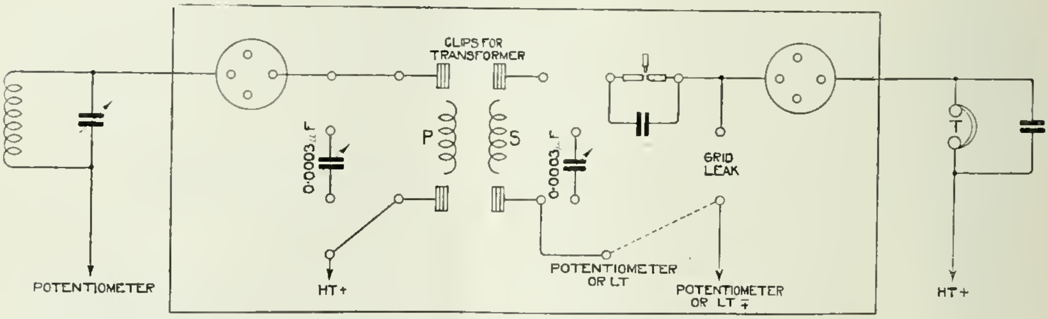


Fig. 7. The circuit used for testing wavelength ranges.

Another point which has been partially investigated is that of winding more turns on the secondary. The writer will in a further instalment of this article give numbers of turns, but he warns the reader that experiments will be related showing that even minute capacity effects may completely alter the optimum point of the same transformer used on two different panels, *e.g.*, one transformer adjusted on the writer's panel for work at 400 metres was found on a friend's panel to be at its best, and wonderfully good at that, on ship signals.

(To be concluded).

Making A Simple Crystal Receiver.

A CONSTRUCTIONAL ARTICLE FOR THE BEGINNER.

SIMPLICITY, without sacrificing efficiency, has been the foremost consideration in the design of this crystal receiving set, and the arrangement can be recommended as embodying the best principles of crystal reception.

The design is arranged so as not to be beyond the skill of the beginner, and to come within the scope of those without experience in wireless constructional work. It is intended for the man about to start in wireless, and who is desirous, in the first instance, of receiving broadcast.

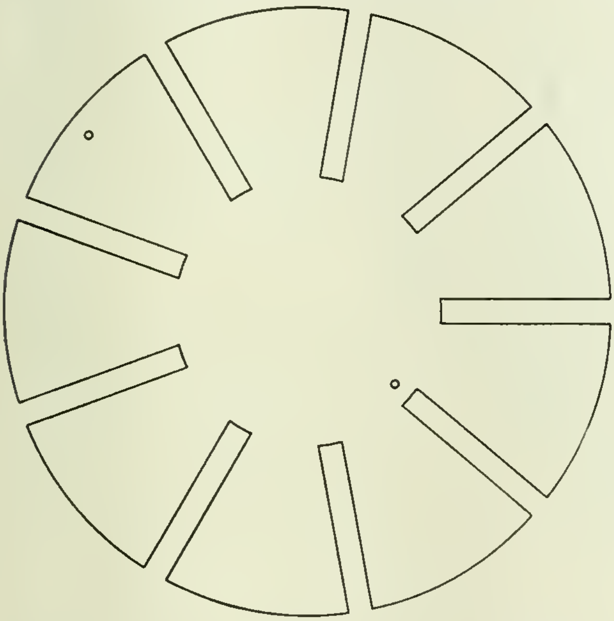


Fig. 1. The card on which the wire is wound. It is drawn exact full size.

The materials required are as follows :—

Piece of wood ½″ thick.
Polished ebonite sheet 1″ × 6″ × ¼″.
4 ozs. No. 26 D.C.C.
2 cards.
1 condenser 0·0003 microfarads.
1 „ 0·001 „
A crystal detector.
Shellac varnish (about 1 gill).
18 brass screws No. 4 × ⅝″ round-headed
6 brass screws No. 4 × ½″ countersunk heads.
3 „ „ No. 6 × 1¼″ round-headed.
4 4BA terminals with back nuts and washers.
2 lengths (nearly 1 yard each) of "Sistoflex" insulating tubing.
6 ft. No. 20 bare copper wire.

The total expenditure on materials should not exceed ten or twelve shillings.

The winding of the two inductances is the first step in the construction of the receiver. The dimensions of the coil on which the wire is wound appeared in an article on "Experimental Station Design," in *The Wireless World and Radio Review* of June 10th, 1922, and from which article Figs. 1 and 4 are reproduced. A card should be placed beneath Fig. 1, and all of the corner points pricked through so that it can be cut exactly to the shape indicated. It should be observed that an odd number of slots is employed. Care must be taken that the slots are not made too deep, for any cuts which are too long will considerably weaken the segments and probably cause them to break off during winding. Two holes are pricked through at the points shown, and by mounting the reel of wire on a spindle it is quite easy to wind the wire in and out of the slots until it resembles Fig. 4. The wire should be pulled quite tightly while winding, and the card flattened out from time to time as may be required. Two inductances will be needed. One of the inductances is attached to a strip of wood about 9 ins. long and ½ in. wide by ⅜ in. in thickness, by means of two of the ½ in. screws. A disc of cardboard is placed over the inductance prior to attaching it to the wooden arm so as to hold it securely, and reduce the liability to bend. Two small holes are drilled through the arm prior to securing the inductance, in order to pass the leads.

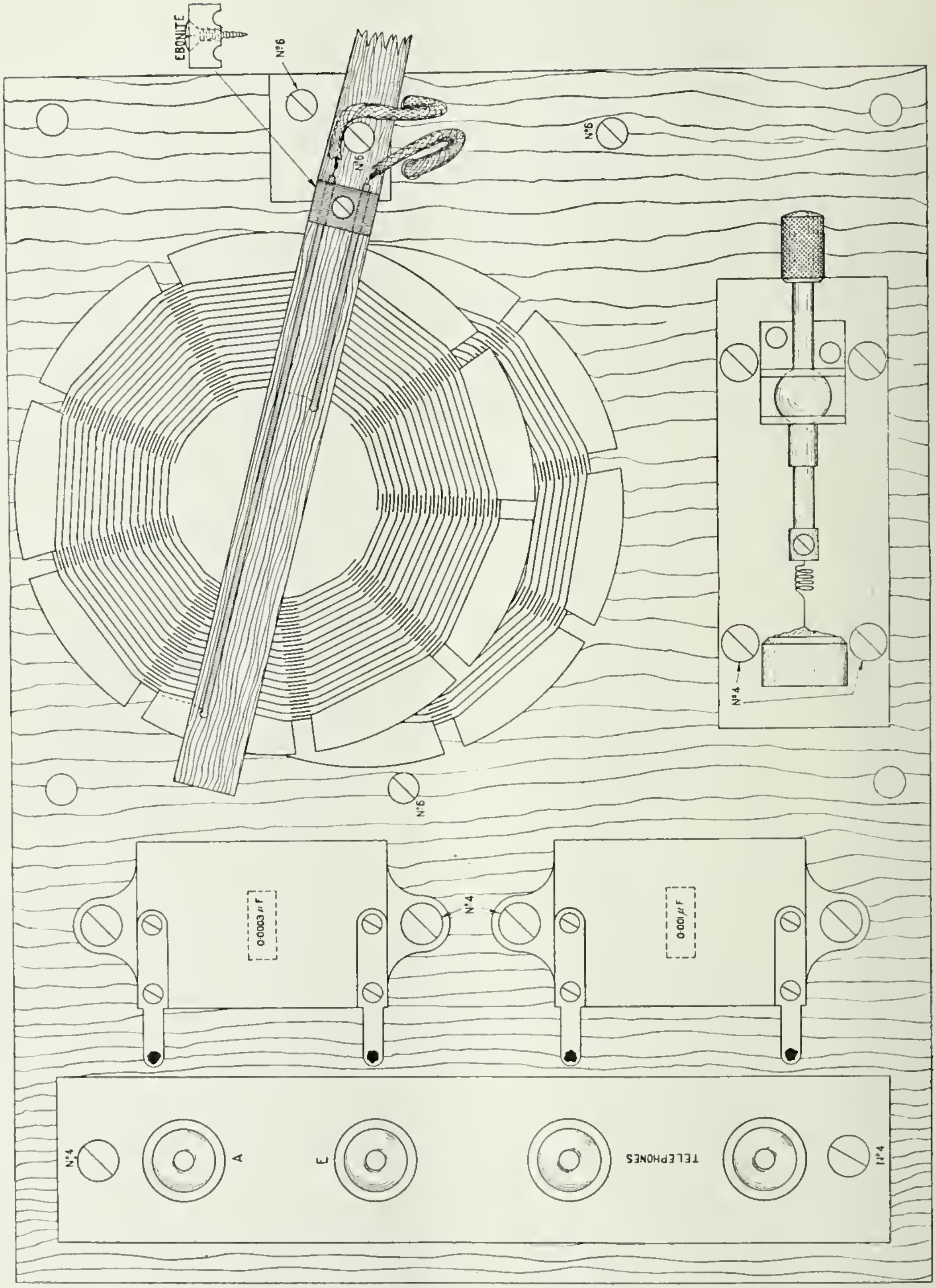


Fig. 2. The layout of the complete receiver.

It is just as well to mark out the positions for all the holes in the base and arm in the first instance and drill them, in order to reduce the chance of splitting, after which a coat of varnish will make the surface of the wood more durable and improve its insulating properties, which is particularly desirable where it is in contact with the inductances.

The terminal strip may next be constructed. The ebonite is sawn to size by marking it with a scratch line and cutting with a fine toothed saw. The edges may be finished by filing. Six holes are drilled at the points shown in Fig. 5 by means of a small hand brace and morse twist drill, and breaking away of the ebonite at the back may be avoided by drilling down on to a piece of hard wood and pressing the ebonite tightly in contact with it. To those unaccustomed to working in ebonite, it should be borne in mind that it is a fairly brittle substance, and must not be allowed to vibrate during sawing or filing, neither must it be subjected to heavy pressure while drilling.

The polished surface, which may possibly tend to destroy the insulating properties of the ebonite, may be removed by rubbing with emery cloth, and by careful treatment it is possible to give the ebonite a good matt surface which considerably improves the appearance. The terminals are held in position with back nuts.

If parts only are purchased for the crystal detector, it will be necessary to make up an ebonite piece for assembling it and insulating it from the main wooden base.

The dimensions of the base can be seen in Fig. 2, and the construction is left to the ingenuity of the reader according to his experience and the tools in his possession. It should be noted that the grain of the wood is parallel with the long slot, and cross pieces are arranged to reduce the chance of splitting. The wooden base may be rubbed down with glass paper and the corners given a slight rounding or bevelling, after which, treatment with shellac varnish will add to the appearance and insulation.

The method of assembling the components on the base is clearly indicated in Fig. 2. The lower inductance is secured to the surface of the board with three of the ½ in. screws, and the leads pass through the wood for wiring up. The wiring is shown in Fig. 6, and a wiring diagram representing the circuit in a form in which the connections of wireless apparatus is usually represented, is shown in Fig. 3.

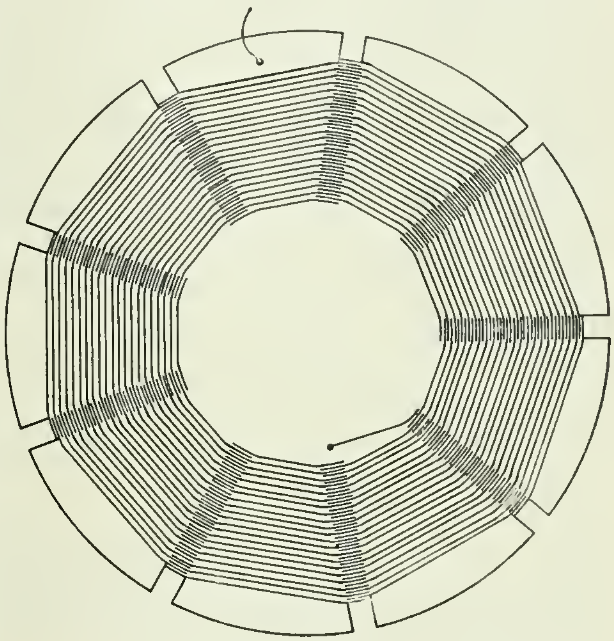


Fig. 4. A wound tuning coil.

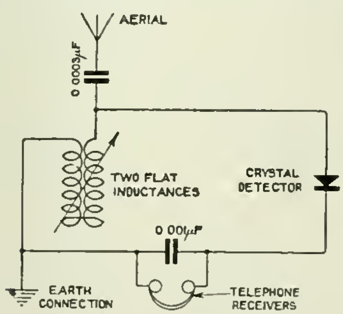


Fig. 3. Circuit Diagram.

A difficulty which the beginner will experience in operating a receiver of this sort, is the sensitive setting of the crystal detector. The best way of doing this is to arrange a buzzer and battery close to the receiver, and to vary the crystal detector until the buzz is loudly heard in the telephones.

Crystal receivers, although entirely satisfactory for broadcast reception, do not give very loud signals, and hence it is necessary for the highest grade of telephone receivers to be employed, and the beginner is strongly advised to procure those of reliable manufacture. A good test when purchasing telephone receivers is to moisten the tags and touch them together. If the receivers are really sensitive a strong click should be heard. The resistance of the receivers should be between 2,000 and 4,000 ohms.

Should the reader be unacquainted with the best method of erecting an aerial, he is referred to an article dealing very thoroughly with the subject which appeared in the issue of this journal of May 27th, 1922.

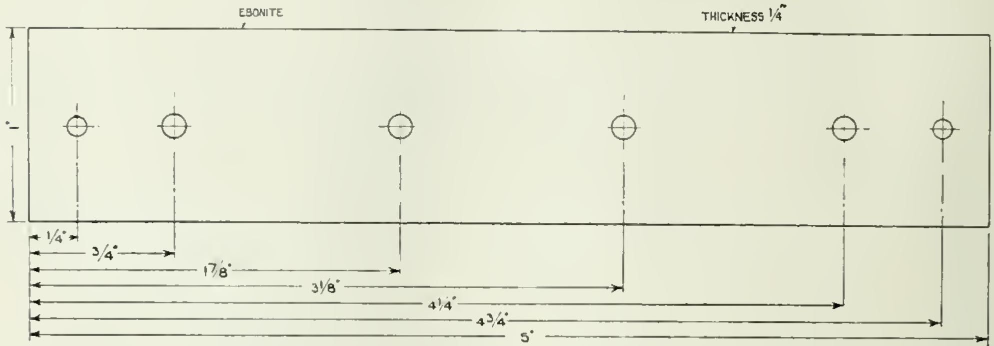


Fig. 5. The ebonite piece for mounting the terminals. The thickness is ¼".

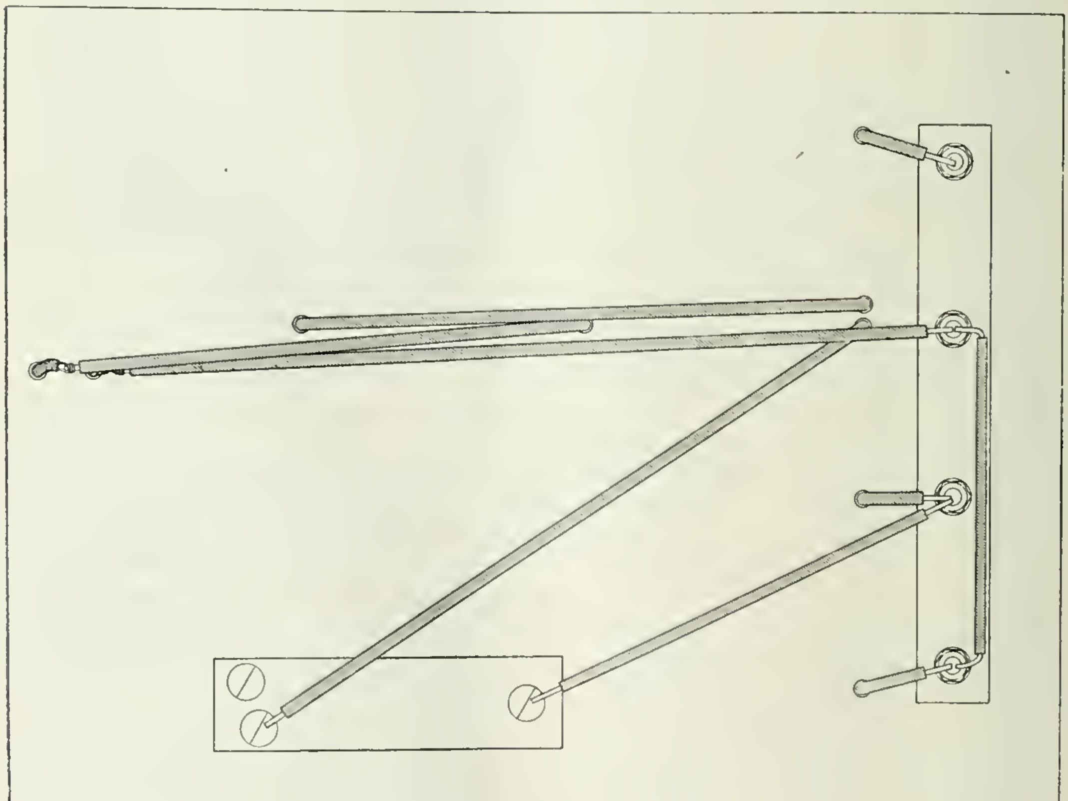


Fig. 6. Underside of receiver showing wiring.

Transatlantic Tests.

RESULTS OF BRITISH AND FRENCH TRANSMISSIONS, 1922.

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

As has already been announced in these columns, during the second part of the Transatlantic Tests between December 22nd and 31st, British and French radio amateurs transmitted test signals to America and Canada. All the British stations which were allocated special transmitting periods were given a code word in order to verify their receptions. The French transmitters also had code words, but arranged their three-hour periods as free-for-all times during which any of their transmitters were free to operate.

Some of the results of the American receptions were reported by radiogram *via* New Brunswick and Carnarvon during the tests. The texts of these messages as received are as follows :—

December 23rd.

"OUR STATIONS JAMMED NO SIGNALS REPORTED HEARD FROM ENGLAND OR FRANCE TWENTY SECOND. SCHNELL."

December 24th.

"HEARD TWO FOX ZED TWENTYTHIRD STOP OTHERS BADLY JAMMED BY OUR TRANSMITTERS STOP NO FRENCH SIGNALS REPORTED. SCHNELL."

December 25th.

"TWENTYFOURTH SIX AMATEURS REPORT FIVE WATCH SAIL CODE VERIFIED XMAS MESSAGE COPIED STOP ALSO NOUGHT ONE FIVE SIX GREENWICH FIVE SAIL WATCH THIRD* TRANSMITTING CODE ASSIGNED FIVE WATCH SAIL CONGRATULATIONS STOP NO FRENCH SIGNALS RECORDED. SCHNELL."

December 27th.

"ADDITIONAL TWENTYFIFTH HEARD FIVE WATCH SAIL CODE VERIFIED MESSAGE RECEIVED STOP TWENTYSIXTH HEARD FIVE WATCH SAIL STOP NO FRENCH SIGNALS. SCHNELL."

December 28th.

"ADDITIONAL REPORTS FIVE WATCH SAIL TWENTY FOUR AND TWENTYSIX CODE VERIFIED STOP TWENTYSEVEN FRENCH EIGHT ABLE BOY COMPENSATED WAVE PROBABLE. SCHNELL."

December 30th.

"NO BRITISH FRENCH SIGNALS TWENTYEIGHTH STOP TWO FOX ZED NO FRENCH TWENTYNINTH. SCHNELL."

December 31st.

"THIRTIETH FRENCH EIGHT ABLE BOY HEARD ONE HOUR STEADILY CODE VERIFIED NO BRITISH SIGNALS. SCHNELL."

* Probably a mistransmission for HEARD.

January 1st.

"THIRTYFIRST NO BRITISH OR FRENCH SIGNALS REPORTED FINAL REPORT TOMORROW.† SCHNELL."

From the above it will be noted that the reception of two British stations is reported in addition to one French, but the accuracy of some of these claimed receptions has been doubted, since the British station **2 FZ** was not in operation during the tests.

The official report of the receptions has, however, now been received from the traffic manager of the American Radio Relay League, under the following covering letter which may perhaps be of interest as throwing a little light upon the conditions under which the tests were carried on :—

To the Sub-Committee of
The Radio Society of Great Britain.

Gentlemen, we congratulate you !

The Transatlantic Tests were highly successful, and on behalf of the members of the American Radio Relay League, I beg to extend our cordial thanks for your superb co-operation in making the tests successful.

Your reception reports were far in excess of anything we had ever hoped to get from your amateurs. No one dared even dream of such splendid work. Our reception was badly jammed by our own stations, but we offer no alibis, your stations performed much better than ours in reception of signals. Our amateurs did not observe the periods of quiet air as we expected. As far as future Transatlantic Tests are concerned, we do not believe it will be necessary to repeat our transmission to you, as you have demonstrated beyond any question of doubt that you can copy our signals almost at will. However, we would like to have another chance at copying your signals at some future date. In that respect it is only fair to say that transmission on wavelengths of 440 metres is subjected to severe jamming from ship and shore stations which continually use that wave, and their sparks cause tremendous interference. We rather listen on wavelengths between 160 and 290 metres simply because wavelength bands above 290 metres are being used for some other service and interference is to be expected.

Before listing our reception reports by days, the following corrections are to be made :—

December 23rd, the reception of **2 PO** is reported. Can you verify transmission of any British station signing **2 PO** ?

December 25th, add reception of French **8 AB** and British **2 JZ.** We are under the impression that **2 JZ** in this particular case may have been British **2 FZ.**

December 26th, add reception of British **2 FZ.**

† NOTE.—No additional radio report was received.—P.R.C.

December 29th, cancel report of reception of British **2 FZ.**

December 31st, add reception British **5 WS.**

Cordially yours,
F. H. SCHNELL.
January 10th, 1923. *(Traffic Manager.)*

The corrections noted at the end of this letter are corrections to the above radiograms, which corrections were incorporated in the official report sent with the letter, and which reads as follows :—

TRANSATLANTIC AMATEUR RADIO TESTS, 1922.

Reception report by days, with call letters of receiving stations, types of receivers and tube equipment, and names and addresses of successful receiving stations.

December 22nd, 1922.

No signals reported (many of our transmitting stations were confused because of G.M.T., and therefore continued testing).

December 23rd, 1922.

G.M.T.	Heard	Heard by	Remarks.
0218	**2 FZ**	**9 DRR**	Sending "test." Wave about 200 metres. Receiver-super - regenerator and two-step A.F. amplifier.
0333	**2 FZ**	**3 HS**	Sending "test" (receiver - detector and one-step A.F. amplifier).
0345	**2 FZ**	**8 AMD**	Sending "test." Wave about 250 metres.
0400	**8 AB**	**8 FQ**	Receiver - detector and one-step A.F. amplifier. Wave about 240 metres.
?	**2 PO**	**8 FQ**	Wave about 180 metres.
?	**2 FZ**	**2 BML**	Also other British stations heard, but jammed by our transmitters.

December 24th, 1922.

G.M.T. (about)	Heard	Heard by	Remarks.
0156	**5 SW**	**1 RU**	(The writer listened at **1 RU** with the owner, and both of us distinctly heard the code letters **AFGCX** (assigned to **5 WS**) and the sign **5 SW** several times. Apparently the transmitting operator was confused. The signal was perfectly clear, steady and easily readable on regenerative tuner, detector and one-step A.F. amplifier. The manipulation at the transmitter was perfect machine-like precision.
0200	**5 WS**	**3 BEC**	Code verified.
0220	**5 WS**	**2 BBB**	Code verified. Wave about 215 metres. Receiver-Reinartz, and one detector tube.
0220	**5 WS**	**1 ANA**	Code verified. Message to American amateurs received. Beverage antenna, Reinartz tuner.
0230	**5 WS**	**1 XP**	Code verified. Three-step R.F. detector and one-step A.F. amplifier.
0230	**5 WS**	L. D. Warner.	Code verified. Wave 200 — 210 metres.
?	**5 WS**	**1 BFG**	Code verified.
?	**5 WS**	**1 BQD**	Code verified.
?	**5 WS**	**1 OR**	Code verified.

December 25th, 1922.

G.M.T.	Heard	Heard by	Remarks.
0150	**8 AB**	**8 FQ**	Wave 240 metres.
0435	**2 FZ**	**2 BSK**	Wave about 200 metres.
0435	**2 FZ**	**2 GK**	Wave about 200 metres. Receiver-Reinartz tuner, detector one - step A.F. amplifier.
0440	**2 FZ**	**8 FQ**	Wave about 200 metres.
0440	**2 JZ**	**8 FQ**	(Probably **2 FZ.**)
0445	**5 WS**	**1 ANA**	Code verified.

December 26th, 1922.

G.M.T.	Heard	Heard by	Remarks.
0025	**2 FZ**	**2 CQO**	Wave about 245 metres. Sending "V's." Receiver-Grebe Cr.9, detector and one-step A.F. amplifier.
0154	**5 WS**	**1 MO**	Sending "Radio Society of Great Britain." Receiver-regenerative tuner, detector and one-step A.F. amplifier. (K. B. Warner and the writer listening. Manipulation of transmitter not quite

G.M.T.	Heard	Heard by	Remarks.
			up to standard. Characters were hard to copy, although signal was good and steady.)
		December 27th, 1922.	
?	2 FZ	1 ANA	Fading in and out.
		December 28th, 1922.	
0432	?	1 ANA	Code unreadable o.c jamming.
		December 29th, 1922.	
—	—	—	No signals.
		December 30th, 1922.	
0310-0410	8 AB	C.A. Service.	Code verified. Wave about 190 metres. 25 cycle plate supply. Signals readable for 1 hour. Receiver - regenerative, detector and two-step A.F amplifier.
		December 31st, 1922.	
0453	5 WS	3 ADP	Detector.

Summary.

2 FZ Heard by	5 SW Heard by	5 WS Heard by	2 PO Heard by	2 JZ Heard by	8 AB Heard by
8 AMD	1 RU	1 BFG			
9 DRR		1 BQD	8 FQ	8 FQ	8 FQ
3 HS		1 OR			C.A.
2 BML		1 XP			Ser-
8 FQ		1 ANA			vice.
2 BSK		L. D. Warner.			
2 GK		3 BEC			
2 CQO		2 BBB			
1 ANA		1 MO			
		3 ADP			

Location of Receivers.

Call.	Name.	Adress.
1 ANA	R. B. Bourne	Chatham, Mass.
1 BFG	E. B. White	Belfast, Me.
1 BQD	G. M. Mathewson	Newport, R.I.
1 MO	F. H. Schnell	Hartford, Conn.
1 OR	Plymouth Radio Club.	Plymouth, Mass.
1 RU	R. S. Miner	Hartford, Conn.
1 XP	L. W. Bishop	Athol, Mass.
2 BBB	G. C. Engel	Ridgewood, N.J.
2 BML	H. H. Beverage	Riverhead, L.I.,N.Y.
2 BSK	E. St. John	Schenectady, N.Y.
2 GK	A. G. Kastenmayer	Schenectady, N.Y.
3 ADP	J. W. Burn,	Chester, Pa.
3 BEC	A. M. Young	Radnor, Pa.
3 HS	F. Kral	Washington, D.C.
8 AMD	E. L. Murrill	Lewisburg, W.Va.
8 FQ	F. A. Baumgarten	Pittsburg, Pa.
9 DRR	R. S. Rose	Marquette, Mich.
2 CQO	H. M. Zimmerman	Elizabeth, N.J.
	C. A. Service	South Manchester, Conn.
	L. D. Warner	Schenectady, N.Y.

(Signed) F. H. SCHNELL.

Since receiving this report enquiries have been made in order to ascertain if possible whether the reported reception of **2 FZ** could possibly have been receptions of some other British station having a call sign which might be misread as **2 FZ**, such, for instance, as **2 FQ** or **2 FP**, both of which stations were transmitting during the tests, but the times of these reported receptions do not apparently fit in at all with the times of any transmissions made from this side, and it can therefore only be concluded that some confusion has arisen in these receptions. Possibly the signals that have been reported in this manner may have really had their origin at an American transmitting station or else a transmitter has been employing an incorrect call sign.

The reported reception of **2 JZ** is also apparently in error, since **2 JZ** was unable to operate his station during every night of the tests and did not transmit any signals at all on the date reported.

No British station having the call letters **2 PO** was taking part in any of the individual transmissions in this country, and no station having these call letters can be traced in any of the published lists of British amateur transmitting stations.

It therefore appears that the only British station unquestionably heard in America with verified code words and other transmission was the special station of the Radio Society of Great Britain, **5 WS**, which was erected at Wandsworth for the tests, and that the only French station heard was **8 AB**, which is operated by M. Deloy, at Nice, France.

A general description of the erection of this special station, **5 WS**, has already been published.* and a technical description of the arrangement of the installation will be given shortly.

It is also of interest to know that two other reports have been received of the reception of the test signals sent out from this country, one report emanating from the operator of a vessel bound from New York to Europe, and the other from the operator of a station at Reykjavik, Iceland. These reports are as follows :—The ship operator was listening-in on a receiver using a single detecting valve, the fundamental wavelength of his relatively large ship aerial being reduced by means of a series condenser. Signals from **5 WS** were first heard on the morning of December 24th, when the vessel was 900 miles East of New York, and therefore approximately 2,500 miles West of London, taking a Great Circle measurement. On Christmas morning, at about 2,200 miles from London, **8 AB**, a French station, was heard, and signals from a British amateur station were intercepted, sending Christmas greetings, the call letters of this station being doubtful, but thought to be **2 SH**. It is interesting to note that this was probably the

Wireless World and Radio Review, Vol. XI, pp. 525-527, January 20th. 1923.

case, as **2 SH** located at Highgate, North London, was one of the British stations which was allotted an individual period during the tests. On the morning of the 26th, signals were again heard, including the code word **MUPZN**, which was apparently of British origin. This code word was the one allocated to British **2 OM** located at Brentford, Middlesex. At this time the vessel was approximately 1,900 miles from London. On the morning of December 27th, when the vessel was another 200 miles nearer England, signals from **5 WS** and **2 SH** were again copied. On the morning of December 28th **5 WS** was heard again by the vessel which was then another 200 miles nearer England. On December 30th, when still some 1,100 or 1,200 miles away, signals from the following British stations were heard :—

2 AW Wakefield, Yorkshire.
2 OM Brentford, Middlesex.
2 SH Highgate, London.
5 MS Manchester Wireless Society.
5 WS Radio Society of Great Britain.

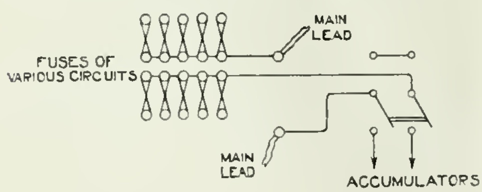
A French station **8 RRX** was also heard.

The operator at Reykjavik, Iceland, who was only able to listen-in on one or two nights, as the set was borrowed, reported that, using a single valve only, the signals from **5 WS** including the code word, were heard on December 24th, while later on the same morning the code word of **2 AW** was heard also.

Doubtless the American listeners had many sources of interference with as had also the British amateurs listening for their signals in the first part of the tests, and as several stations in this country had been granted by the Post Office special permission to use a transmitting power comparable with that employed by the American amateurs, the difference in the receptions in the two countries would seem probably to be due to the much greater use of radio-frequency amplification on this side. The general use of low-power transmitting stations in this country has doubtless been the cause of the development of the most sensitive type of receiver equipment suitable for the reception and amplification of short wavelength signals.

Accumulator Charging.

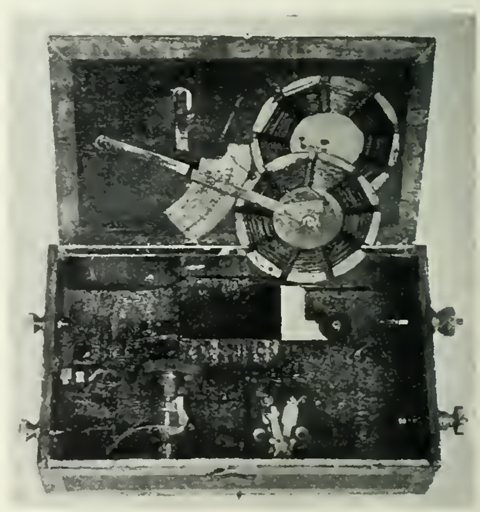
Where D.C. mains exist for house lighting it is possible to disconnect one of the main leads at the fuse-board and connect the accumulators to be charged in series with the supply. The lead which is at earth potential should be the one utilised, though the precaution should always be taken of well insulating the accumulators from earth, as a slight difference in potential may arise where a heavy current is passing along the mains.



This method of accumulator charging is costless and ensures a slow charging rate. The very slight diminution in the amount of light given out by the lamps in circuit is imperceptible. By means of a double-pole two position switch it is possible to connect the accumulators without interrupting the lighting. An article dealing with accumulator charging from D.C. mains appeared in the issue of January 27th, 1923.

Amateur Crystal Receiver.

A ve y simple yet effective receiver made up by a reader after studying an article in this



Official Crystal Receiving Set built in a cigar box and employing variometer tuning.

Jou nal. The p inciple is very similar to that employed in a constructional article for the beginner which appea s on another page.

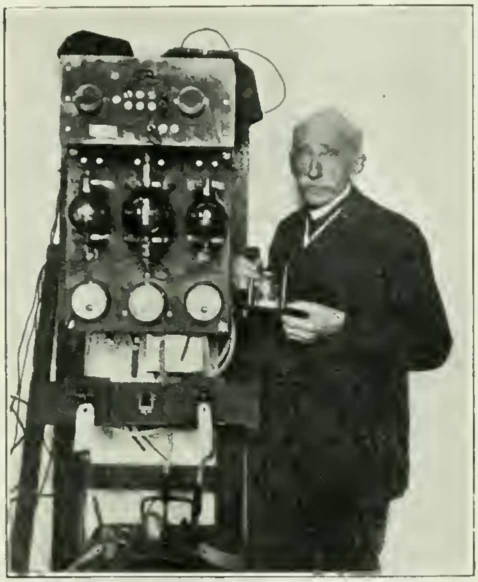
Dr. Fleming on the Thermionic Valve

A TALK BY THE INVENTOR ON ITS DEVELOPMENT AND ITS APPLICATION TO WIRELESS.

THE following is an address which was broadcasted from the London station of the British Broadcasting Company (2 LO) on the evening of February 16th by Dr. J. A. Fleming, F.R.S.

" Although it is my privilege at frequent intervals to address large audiences in scientific lectures, it is a new and interesting experience to speak by wireless telephony to an audience of hidden hearers scattered over a wide area, not one of whom can be seen or heard by the speaker. Wireless telephony is the very last word in the application of scientific knowledge to increase the convenience and pleasure of human life, and it is capable of being made a powerful impliment of popular education. Its development is entirely the result of the invention of a wonderful instrument, the thermionic valve, which is a veritable Aladdin's Lamp, annihilating distance and making all the world a theatre through which a single voice can reach. There are many to whom it is a sufficient pleasure merely to have music or speech from distant places laid on in their homes like gas or water for quiet enjoyment. They do not feel any curiosity to know how it is done or what were the stages of invention and discovery by which this modern miracle has been made possible. Others, however, are desirous to understand if possible, the means by which the astonishing feat is accomplished of listening-in without any wire connection to the singers at a distant opera or a concert performed perhaps hundreds of miles away.

" As the earliest stages in the invention of the wireless valve were made by me at University College, London, between 1889 and 1904, it may interest some of those who are now listening to these remarks of mine by means of valve receivers, to have some short account of the beginnings of that invention.



A recent photograph of Dr. J. A. Fleming, F.R.S.

" In 1882 the electric incandescent lamp so familiar to us all, was perfected by Edison and Swan. The first lamp consisted of a carbon filament or thread enclosed in a glass bulb from which all the air was pumped out. When an electric current was sent through the thread it glowed with a brilliant light. It was soon found that the bulb became blackened on the inside as the lamp was used, and the filament or thread was after a certain time burnt through at some place by excessive heating. In the course of my experience as scientific adviser of the Edison Electric Light Company, I noticed that in some lamps there was a clear line on the glass bulb on which no blackening took place, which indicated that the carbon particles had been shot off from the overheated point in the filament in straight lines. The undamaged half of the hairpin-shaped filament by intercepting this shower of carbon atoms caused a sort of shadow or line of no black deposit to be produced on the inner surface of the bulb. A little later on I found that these particles thus shot off were all electrified with so-called negative electricity, that is the kind of electricity produced by rubbing a stick of sealing wax with a bit of flannel.

" At that time it seemed that these charged particles were atoms of carbon, but we did not know then that chemical atoms are built up of still smaller particles called electrons.

" For the sake of those who are not scientific, a few things may be mentioned which are definitely established by countless experiments in modern chemistry. All material substances we know are composed of little particles called molecules. A molecule may be described as the smallest portion which has the distinctive qualities of that substance. Thus a molecule of table salt is the smallest possible part which has the properties of salt. But molecules in turn are built up of atoms of elementary substances. We are acquainted with about 82 different kinds of atoms, and little groups or bunches of these form all the vast variety of substances we know, just as little groups of selections of the 26 letters of the alphabet build up all the thousands of different words we write.

" It used to be thought that atoms were not capable of being divided. The very word atom comes from two Greek words signifying not able to be cut up. The great discovery was, however, made about 1898 or 1899, by Sir Joseph Thomson, the present Master of Trinity College, Cambridge, that chemical atoms of matter are built up of still smaller atoms of electricity called electrons, and it was soon found that the incandescent filament of an electric lamp is sending out vast numbers of these little electrons. An atom of matter is a very small thing—it would take about 25 million of them, put in a row like marbles, to make up the length of a single inch. But an electron is as much smaller than a chemical atom as a grain of dust is smaller than the dome of St. Paul's Cathedral.

" The next step of invention was made in 1904, when I placed around the filament of an electric lamp a cylinder of metal sealed inside the bulb, and found that a current of negative electricity could be sent from the filament to the cylinder but not in the opposite direction. This at once gave us a means for converting the feeble but rapid to-and-fro motions of electricity in an aerial wire, which are set up when electric waves from a distant transmitting station strike the aerial wires, into a current of electricity all in the same direction by including in the circuit such a lamp with cylinder round the filament. I therefore called the instrument a valve because it acts, as regards electricity, as a valve in a pump acts for air or water. It is now called a thermionic valve.

" Next a word must be said as to the processes of wireless telephony. At the transmitting station there are special kinds of valves called three-electrode or transmitting valves, which create in the aerial wires at the broadcasting station powerful to-and-fro or oscillatory or vibratory electric currents. These in turn create in all surrounding space effects called electric carrier waves, which fly out in all directions. At the broadcasting station there is also a device called the microphone, which picks up the sound of the speaker's voice or of the music and causes the carrier waves to be increased or diminished in amplitude or strength in accordance with the ever varying amplitude or pressure of the air waves of the speaking voice. When the modulated carrier waves strike the aerials of listeners they produce in them electric currents which are a feeble copy of those in the transmitting aerials. If, then, the receivers contain a rectifying valve or a crystal detector, these pulsatory currents are converted into a flow of electricity all in one direction through the receiving telephones, and this causes them to emit a sound of the kind made to the transmitting microphone.

" Subsequently to my invention of the two-electrode valve, De Forest, in America, introduced the grid or spiral of wire placed between the filament and the metal cylinder, which converted it into a so-called three-electrode valve. This enabled the valve to amplify electric oscillations as well as rectify or detect them. In its most recent types, which are the outcome of the work of many able inventors, the valve can perform three duties—it can detect electric vibrations, amplify or magnify them, and also create them, and it can truthfully be described as the master weapon of the radio engineer. Without it wireless telephony would be only the occasional feat of experts. With it wireless telephony has become the everyday amusement of thousands of amateurs in their own homes."

Radio Society of Great Britain.

At the next Meeting, to be held at 6 p.m. (tea at 5.30 p.m.) on Wednesday, February 2?th, at the Institution of Electrical Engineers, Mr. Philip R. Coursey will describe the Society's station used in the Transatlantic Tests.

The second of a series of lectures, especially arranged for associates, took place on February 16th, when Mr. Maurice Child gave an elementary lecture and demonstration. Much benefit can be derived from these attractive instructional lectures by those new to wireless. Associateship is open to all interested in the subject, and the annual subscription is five shillings.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Kensington Radio Society.*

Hon. Secretary, Mr. John Murchie, 2, Sterndale Road, West Kensington, W.14.

The annual meeting was held at headquarters on January 4th, when the Secretary presented a report of the Society's activities during the past year.

The new President, Mr. J. H. Reeves, M.B.E., gave an address and followed this up by a lecture on his experiments with the design of H.F. transformers for short wavelengths. Later, a most interesting discussion took place on the points raised.

The Hon. Secretary will be pleased to give particulars to any person desirous of joining the Society (whether in the possession of a broadcast or experimental licence).

Woolwich Radio Society.*

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

The annual meeting of the above Society was held at the Y.M.C.A., Woolwich, on Friday evening, January 26th, 1923, at 8 p.m. Captain C. T. Hughes, R.E., Vice-President, being in the chair. The minutes of the last annual meeting were read and confirmed. The balance carried forward was £5 15s. 1d.

The present officers submitted their resignations and the following were elected for 1923:—President, Captain C. T. Hughes, R. E.; Vice Presidents, Lt.-Col. K. E. Edgeworth, D.S.O., M.C., Mr. A. F. Hogg, M.A., F.C.S., Mr. A. Vinycomb, D.Sc., Mr. W. L. McPherson, B.Sc., Mr. W. T. James, Mr. Goldstone; Hon. Secretary, Mr. H. J. South.; Hon. Asst. Secretary, Mr. A. G. Beeson; Hon. Treasurer, Mr. G. Powling; Librarian, Mr. P. Smith; Custodians of Apparatus, Mr. M. A. G. Beeson and Mr. F. Cameron; Committee, Messrs. Houghton Frazer, Potter, F. W. Smith and Cameron.

Police Constable William Wooding of the Metropolitan Police Force with his home-made seven-valve set unit and four-valve amplifier on which he has received broadcast telephony from America.

A hearty vote of thanks was passed to all the gentlemen who had rendered valuable services during the year, and to Mr. Ellam and Mr. Morley for gifts of apparatus.

The result of the competition organised for the crystal set of home construction which was the most simple and efficient, was then announced. The first prize, a pair of Brown's H.R. telephones, was awarded to Master F. Edwards; the second prize, a W. & M. variable condenser, to Mr. G. Dowling; the third prize, a complete aerial, to Mr. F. W. Smith.

Intending members are welcomed at any weekly meeting on Wednesday evenings at 8 p.m., at the Y.M.C.A., Thomas Street, Woolwich.

The East London Radio Society.*

Hon. Secretary, Mr. S. D. Simmons, 60, East Ferry Road, London, E.14.

On Tuesday, January 30th, two interesting short lectures were given in the Lecture Hall, Woodstock Road, E.14, by Mr. A. J. Alexander and Mr. J. Keens.

Mr. Alexander gave a lucid description of a non-radiating two-valve (H.F. and Detector) set, from which he had had excellent results. He impressed upon the members the necessity for all amateurs holding experimental licences, to use some such circuit as this when conducting experiments during broadcasting hours.

Mr. J. Keens followed with very informative details as to the construction of an accumulator H.T. unit.

The Secretary of the Society will be pleased to hear from all amateurs in the district, and visitors to the Lecture Hall, Woodstock Road, E.14, will receive a cordial welcome any Tuesday or Friday evening after 7.30 p.m.

Ramsgate, Broadstairs and District Wireless Society.*

Joint Hon. Secretaries, Mr. F. Harrison, "Rochester Cottage," St. Lawrence, Ramsgate (Ramsgate), and Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs (Broadstairs and District).

During the month of February, Mr. James Hunt, who has been elected to the Committee, gave some very interesting lectures on "Transformers" with practical demonstrations. Mr. Hunt, who has evidently studied his subject with much care, has been keenly followed by the members week by week, and all state that much valuable information has been received. Mr. Hunt has been cordially thanked by the Society for the trouble and time he has devoted to making his lectures so lucid and instructive. The Society is pleased to state that Mr. Hunt has received with great clearness the American Concert transmitted on Saturday, January 20th, from **WJZ**, which included music and a speech on the "Ruhr Question" by a Mr. Abbott, the concert being transmitted from a Studio at 11, West 49th Street, New Jersey City.

The Society's membership shows an increase over that of last month, and the membership list is now nearing fifty. Mr. W. R. Greatwich of "St. Benets" Ramsgate, has been elected a Vice-President of the Society.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

An exceedingly interesting and instructive lecture was given to the above Society by the Vice-President, W. E. Fisher, Esq., D.Sc., on Wednesday, January 31st, entitled "Oscillations," a large number of wireless experimenters being present.

Dr. Fisher, in his discourse, treated the subject of oscillations from several standpoints, including those of sound and light, mentioning that most of our ideas on the subject have been evolved from sound, giving as illustrations the vibrations of a tuning fork or of a fiddle string, and explaining that the medium through which vibrations pass fixes the speed, also pointing out that the transmission of light across space proves that there is a medium.

The lecturer went on to say that we cannot have an electric current without an effect on space. Emphasis was laid on the fact that there was a marked resemblance between the transmitter and the receiver, and that good radiators were also good absorbers.

The theory of the wave motion was dealt with in a most scientific manner, showing why wireless waves differed from other kinds, and the reasons for the use of long and short wavelengths, etc.

The appreciation of the audience was shown by the applause and the thanks accorded to Dr. Fisher at the conclusion of the lecture.

Smethwick Wireless Society.*

Hon. Secretary, Mr. R. H. Parker, F.C.S., Radio House, Wilson Road, Smethwick, Staffs.

At a meeting held at the Society's headquarters on January 12th, the syllabus of forthcoming lectures was discussed, some sixteen lectures, visits and field days being arranged.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. Moore, 175, Leavesden Road, Watford.

On Friday, January 26th, the above Society made a break in the usual programme of lectures, and gave a wireless demonstration at headquarters, a four-valve set with Amplion loud speaker being kindly lent by Mr. Christie for the occasion.

The fact that the large room used by the Society was packed with visitors proves the popularity of the subject in the town.

Mr. Christie commenced proceedings at 8 p.m. with a general survey of the basic principles of wireless telephony. Later on **2 LO** was tuned in and music and speech were plainly audible all over the room.

In view of the popularity of this demonstration, the Society propose giving others in the near future.

Haileybury College Wireless Society.

Hon. Secretary, Mr. D. H. Carter.

This Society was formed last term (October, 1922) with Dr. Thomas, M.A., B.Sc., LL.B., Ph.D. as President; J. C. Yule, Esq., as Vice-President and Hon. Treasurer and D. H. Carter as Hon. Secretary. Other members of the Committee are Messrs. R. R. C. Armour, R. Griffith, C. H. Lankester, H. R. Mappin, J. B. Miller, and R. F. Wilson. The total membership for the greater part of last term was 87.

The object of the Society is educational, and with this end in view, lectures were held fortnightly last term; and this term an aerial is to be at the disposal of members, on which to use their own and the Society's apparatus.

Cricklewood Radio Club.

The first meeting of the above club in their new rooms at the old Billiard Hall, St. Peters' Church was held on February 3rd, at 8 p.m.

The Chairman, Mr. James C. Fisk, in opening the meeting, set forth briefly for the benefit of new members the objects of the club and promised attractions in the shape of lectures, experiments, and demonstrations each week. At 8.45 p.m., Mr. H. Stopher of the Technical Committee was called upon to give the first of a series of progressive lectures which proved to be very instructive.

The Wisbech and District Radio Society.

Hon. Secretary, Mr. A. Hopkin, 13, Victoria Road, Wisbech.

The above Society has been formed, and those interested who reside in the district are invited to join.

Swansea and District Radio Experimental Society.

Hon. Secretary, Mr. Herbert T. Morgan, 218, Oxford Street, Swansea.

On January 24th at their headquarters, the Y.M.C.A., a very interesting lecture on "The Thermionic Valve" was given by Mr. H. Mactaggart, of the General Electric Company.

He concluded his lecture by answering many questions and clearing up debatable points. The lecturer also referred to the four-electrode valve, and has promised a demonstration and lecture on this valve at an early date.

Leeds Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. N. Whiteley, Y.M.C.A., Albion Place, Leeds.

A meeting was held at headquarters at 7.45 p.m. on January 22nd, with Mr. G. Boocock in the chair. After the minutes of the previous meeting had been read and accepted, the Chairman called upon Mr. Toynbee to give his paper entitled "Accumulators, their Construction, Action and Treatment." Mr. Toynbee dealt with his subject in an exceedingly able manner, and at the close dealt with various questions asked regarding the Edison Nickel Cell, etc. The lecturer was thanked with much enthusiasm.

To stimulate an interest in telegraphy, Mr. Whiteley then gave an interesting description of commercial working, and announced the formation of a Morse class.

The meeting room has now been fitted up with all the necessary tools and appliances, and work has been commenced on the Society's four-valve set, so that operations can be commenced when the licence arrives.

The next meeting was held on January 29th, at 7.30 p.m., the chair being taken by Mr. G. Boocock. The evening was devoted to general discussion, one item, the proposed aerial, bringing forth a storm of suggestions. The club-room is situated in the basement of the building, and does not hold a very ideal position for the use of an outside aerial. Experiments will be made with frame aerials and also lighting mains.

Mr. R. H. Toynbee was elected Chairman for the ensuing month.

The following are the present arrangements:— Monday nights, at 7.30, lecture or discussion; Wednesday nights, at 7.30, workshop night and Morse class; Saturday afternoon and other times as required, workshop practice.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

A meeting of the Radio Society of Birkenhead took place on January 18th. Buzzer practice was held at 7.30, taken by Mr. McKinlay, a skilled operator, and at 8 p.m. the Chairman, Mr. King, called upon Mr. McKinlay to deliver a lecture on accumulators. The lecturer, in a very able manner, described the action and construction of an accumulator, showing the difference between the dry battery and the accumulator.

Mr. McKinlay has very kindly presented the Society with some excellent diagrams of various ship sets. A very lively discussion took place after the lecture, and many questions were asked as to the mysterious fading effect of 2 LO which is experienced in these parts.

Hoylake, West Kirby and District Wireless Association.

Hon. Secretary, Mr. J. D. Wood, 7, Grosvenor Road, Hoylake.

A general meeting was held at the Green Lodge Hotel, Hoylake, on January 22nd, when the chair was taken by the Vice-President, Mr. S. Evans, A.M.I.E.E. In the course of his opening remarks, Mr. Evans referred to the ladies' meeting held on February 5th, when through the courtesy of Mr. G. V. Wall, members and their lady friends were enabled to listen-in to a concert from one of the B.B. Company's stations. The Chairman then called upon Mr. Waygood, A.M.I.E.E., to give his lantern lecture on "Transformers."

The lecture, with its many excellent lantern views, was thoroughly appreciated by all present, a detailed and lucid exposition being given of the theory, construction, and evolution of the modern transformer. Among the lantern views of large transformers was one of a three-phase transformer weighing 2 tons 17 cwts., which is cooled by immersion in a tank containing 5 tons of oil. The terminals on this transformer measure 8 ft. in length and are built in the form of a condenser in order to cope with the pressure of 100,000 volts.

Questions were answered by Mr. Waygood at the conclusion of his very informative lecture. Mr. J. H. Harley proposed a vote of thanks, which was seconded by Mr. S. Evans, who also proposed a vote of thanks to Mr. S. H. Cocks for his handling of the lantern.

The Portsmouth and District Wireless Association.

Hon. Secretary, Mr. S. G. Hogg, 9, Pelham Road, Southsea.

Undoubtedly the best resolution this Association could have made to begin the New Year was its application for affiliation to the Radio Society of Great Britain.

At the annual meeting of the club held in December, Mr. J. H. C. Harrold, A.M.I.R.E., was elected President of the Club for the present year, and at the meeting of the Association held on January 24th Mr. Harrold delivered his Presidential address.

After returning thanks for his election as President, Mr. Harrold promised to do his utmost for the club, and be worthy of the honour of the Presidential Chair. He then gave a short address on wireless telegraphy in general, explaining the advancement that it had made. Upon request, the President then explained that a single aerial is preferable, but there are limits to the heights to which they may be erected. There was a tendency to erect them as high as possible, which, however, only increased the number of spark signals, and decreased the C.W. signals.

Meetings are held at the Club-rooms, situated at The John Pile Memorial Rooms, 44, Fratton Road, Portsmouth, on Wednesday evenings at 7.30 p.m.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 11, John William Street, Huddersfield.

An interesting evening was spent by the members of the Huddersfield Radio Society on Tuesday, January 23rd, in listening to Mr. J. L. Goss's explanation of the Society's receiving set. Mr. J. A. Badham occupied the chair, and there were about 30 members present.

Mr. Goss stated that the set had been designed and built by the technical committee. Three valves were employed, and provision was made for the addition of two more valves. The set was housed in a polished mahogany cabinet, and each valve was mounted on a separate panel, in order that any combination of circuits could be tested. The tuning unit was separate, and of the well-known three-coil type. This was designed and constructed by Mr. J. W. Jowett, of the technical committee. The moving of the tuning coils was operated by heavy brass gears, and all terminals, switches, and other fittings were nickel plated. The instruments worked exceedingly well, and Manchester broadcasting could be heard with the 'phones on the table.

A vote of thanks was proposed by Mr. P. Priest.

Durham City and District Wireless Club.*

Hon. Secretary, Mr. E. H. Chapelow, 2, Brierville, Durham.

At the meeting held on January 26th the Chairman announced that on account of business changes, Mr. G. Barnard had tendered his resignation. Pending the annual general meeting, the Committee have appointed Mr. E. H. Chapelow, of 2, Brierville, Durham, to succeed to the office. Mr. Chapelow is a well-known local citizen, and will commence his duties with the best wishes and active support of his club colleagues.

Mr. Chas. Donaldson, of the Postal Service, gave a lecture on the "Electron Theory." The lecturer gave much valuable information, and concluded by giving some very interesting illustrations of the uses to which "wireless" was put during the war. A hearty vote of thanks was accorded to Mr. Donaldson at the conclusion.

Radio Society of Wallasey.*

Hon. Secretary, Mr. C. D. M. Hamilton, 24, Vaughan Road, New Brighton.

The annual general meeting, held on December 20th, 1922, brought to a close a most successful session. The election of officials for 1923 was arranged, and the vacancies were filled as follows :— President, Mr. J. C. Mason ; Vice-President, Mr. F. Cowan ; Hon. Treasurer, Mr. W. F. Mills ; Hon. Secretary, Mr. C. D. M. Hamilton ; Assistant Hon. Secretary, Mr. W. Smith ; Committee, Messrs. Bellas, Martin, McBride, Taylor, Roscoe and Wood.

The Presidential address was delivered on December 27th, Mr. Mason selecting "Ohms Law" as the subject of a most interesting lecture.

January 3rd was an open night, the evening being devoted to the settlement of various difficulties advanced by the members.

Mr. Roberts very kindly gave a continuation of his lecture, "The Earth in the Aether and Unsolved Problems" on January 10th. As usual Mr. Roberts' lecture raised many points of interest which were discussed at length.

On January 16th a valuable lecture on "Direction Finding" was delivered by Mr. R. H. Taylor.

The Working Mens' College Wireless Club.

Hon. Secretary, Mr. A. Fryatt.

A dance was given by the above club on January 5th, 1923, to aid the club's funds, and thanks to the efforts of members of the College and their friends, it was a great success.

With the proceeds it is proposed to install a powerful receiving set, and to convert the present cabin into a cosy parlour in order that members can invite their friends to listen in on specified evenings to the broadcasted performances now being given by Marconi House and other stations in England.

The club greatly appreciated the broadcasting of the Covent Garden Opera, which was splendidly received.

All who wish further particulars of the Club are asked to communicate with the Secretary, at the Working Men's College, Crowndale Road, N.W.

The Hinckley and District Radio Society.

Hon. Secretary, Mr. W. Bliss, The Haven, Cleveland Road, Hinckley.

The recently formed Society held its first meeting on January 16th at the premises of Messrs. W. Ward & Son, who have placed a room at the disposal of the Society until suitable accommodation is forthcoming. Rules of the Society had previously been drawn up by the committee, and these were explained to the meeting and copies distributed.

The Secretary reported that several prominent gentlemen had been approached with a view to their election as Vice-Presidents, but there had not been time to receive replies.

The question of securing permanent premises was discussed, and the Secretary instructed to ascertain whether a room was available at the Grammar School. Several new members were enrolled, and it was decided to form a Morse class.

Meetings will be held on alternate Tuesdays.

St. Bride Radio and Experimental Society.

A meeting was held on Tuesday, January 9th, at St. Bride Foundation Institute, Bride Lane, E.C.4, when a Formation Committee was established to make preliminary arrangements, draft rules, etc. The Committee met again on Tuesday, January 23rd, and have now completed all the details necessary to place before a general meeting. This meeting, which will be held at a date in the near future, will be preceded by a short address and demonstration by an influential gentleman who has kindly consented to become President of the Society. Due notice will be given in the technical Press, but anyone interested should send his name to the Hon. Secretary at the above address, when notice of meeting will be posted.

Proposed Radio Club at Grays (Essex).

In connection with the proposed formation of a radio club for Grays and District, a meeting was held at the Victoria Hall, Grays, on February 1st. It is hoped that all wireless enthusiasts in the district, whether already possessors of sets or not, will communicate with Mr. L. Freeman, of the Empire Theatre, Grays, and help to make the club the success it already promises to become.

Notes.

The Opening Ceremony at 5 WA.

The opening of the new Cardiff Broadcasting station **5 WA**, and the formal inauguration of the Service, was performed by the Lord Mayor of Cardiff, Alderman Dr. J. J. Biggs, on the evening of Tuesday, February 13th.

The Progress of British Broadcasting.

With the addition of the Cardiff station **(5 WA)**, which was opened on February 13th, there are now five broadcasting stations in operation in Great Britain. The sixth will be the Glasgow station, which is expected to be opened on Monday, March 19th. This station will have the call letters **5 SC**, and will carry out transmissions on a wavelength of 415 metres. There is also some talk of establishing a station at Plymouth in accordance with the Postmaster General's original plan, but up to the present no decision has been reached.

The Mayor of Cardiff speaking into the microphone on the occasion of the opening of the Cardiff Broadcasting Station. Among those present are :—Sir William Noble, Lord Gainsford, Mr. Cory and Mr. J. C. W. Reith.

Reserve of Air Force Officers.

The Air Ministry announces a decision to expand the reserve of officers by the entry as officers of a number of ex-officers of the Flying Services and others with special qualifications for flying and technical duties. The Air Ministry is accordingly prepared to receive applications for enrolment from officers who served as pilots in the R.F.C., R.A.F. or R.N.A.S. in the war, and gentlemen qualified as civilian pilots or possessing technical qualifications, including wireless telegraphy and signals. Full details and forms of application may be obtained from the Secretary, Air Ministry, Kingsway, W.C.2.

Bamberger Broadcasting Station (WOR).

Experimental telephony transmissions will be made commencing at 12 p.m. (New York time) on February 23rd, with a view to bridging the Atlantic. A special concert is being arranged, and it is hoped on this occasion that reports of successful reception will be forthcoming from experimenters in Europe.

The 450 metre French Telephony.

L'Ecole Supérieure des Postes, Télégraphes et Téléphones de Paris, is conducting, from its technical laboratory, special telephonic transmissions. This laboratory conducts research work in all branches of wireless telegraphy and telephony. At the present time the experiments consist in trying out from the point of view of volume and quality all possible types of wireless telephone transmitters, and in order that these tests shall be as exhaustive as possible, transmissions of all kinds, such as speech, music, and songs, are included in the programmes. The transmissions take place regularly on Tuesday and Thursday evenings from 7.45 to 10 o'clock, and on Saturday afternoons from 4.30 to 7.30. The wavelength used is 450 metres with 500 watts in the antenna. The transmissions commenced on January 23rd last. Many reports are received in this country of these transmissions, whilst in Paris and neighbourhood reception is excellent on a crystal. This station is proposing to transmit lectures of an educational nature, which will undoubtedly be very much appreciated.

Four Broadcasting Stations Received on a Crystal Set.

A Burnham-on-Sea reader, Mr. L. Lott, using a Pericon crystal receiver only, has succeeded in hearing four of the five British Broadcasting Stations. Birmingham and Manchester, as would be expected, were heard loudest with Newcastle fainter, but as far as the music was concerned fairly distinct. These results were obtained by using a single-valve circuit with no reaction, and then changing over to the crystal. Another experimenter, Dr. Burns, President of the Burnham, Highridge and District Wireless Society has also been successful in receiving three of the five stations on a similar circuit.

Death of Professor Röntgen.

Professor Wilhelm von Röntgen, the well-known German physicist and discoverer of X-rays, has died at Munich at the age of 78. Röntgen was born at Lennep in Rhenish Prussia, and became Professor of Physics in the University of Würzburg in 1885. It was while carrying out some experiments with the Crookes tube that Röntgen discovered the existence of what he called "X"-rays,

Professor Wilhelm von Röntgen.

and which are now associated with his own name. It was readily perceived by Röntgen himself and many other physicists that his discovery must give a new turn to the then current view of the constitution of matter. Other workers correlated this and subsequent discoveries with their own observations in electrical science, and the movement may be said to have culminated in the epoch-making discoveries of Bragg and Rutherford and our present achievements in wireless telegraphy and telephony. The application of Röntgen rays to the treatment of disease is a familiar feature in present-day surgery and their use in the industries as a means of examining opaque bodies for internal structure and defects is extending rapidly.

Wireless Sets Wanted for Hospitals.

The good work carried on by the Alexandra Musical Society in providing entertainments for the wounded soldiers and sailors still in hospital and other sick persons in hospitals and sanatoria demands the greatest support and encouragement. Wireless entertainments have been successfully introduced, and have met with great appreciation and the President of the Alexandra Musical Society, The Rt. Hon. Lord Leigh, makes an appeal for gifts of wireless receiving sets for the hospitals of the West Midlands, etc. Firms willing to help in this direction should write to Mr. E. C. Thomas, 249, Albert Road, Aston, Birmingham.

Wireless Developments in Brazil.

Rapid developments in radiotelephony are expected to take place in Brazil with a consequent wide demand for receivers. Radio apparatus hitherto entering Brazil has mainly been of German or United States origin. Importers of wireless apparatus are at present required to obtain a special permit issued by the Department of Transportation and Public Works, but the Government has been approached upon the question of abolishing or modifying such restrictions so as to admit of a wider market for radio apparatus. A wireless service has been established between the Republics of Brazil and Mexico under treaties concluded between the two states. German enterprise, it is reported, is seeking to obtain a concession for the introduction into Mexico of radiotelephone broadcasting.

A party on the Euston to Liverpool express train listening to a broadcast entertainment. The experiment was carried out by Captain G. R. Willans, of the Marconi Company.

The Sterling Telephone Company's Booklet.

Publication No. 342 of the Sterling Telephone and Electric Co., Ltd., Tottenham House, Tottenham Court Road, London, is an illustrated catalogue of this well-know firm's radio receiving sets from crystal to multivalve.

A Leeds Firm's New Branch.

The British Wireless Supply Co., Ltd., of Leeds, has added to its branches showrooms at 64, Frith Street, Shaftesbury Avenue, London, where demonstrations are held daily, and a full line of the firm's manufactures can be examined. This concern has also opened a new experimental laboratory and test department at Virginia Mills, Leeds.

Messrs. Burndept's New Catalogue.

In the form of a well printed and artistic booklet, Messrs. Burndept, Limited, of Eastnor Works, Blackheath, S.E.3, have issued a catalogue of the amateur and experimental receiving equipment manufactured by them. Descriptive details and numerous illustrations make this publication, the price of which is 1s., an attractive and useful guide to all who are interested in wireless.

A Handy New Terminal.

The Birmingham Products Co., of 11, Summer Row, Birmingham, are manufacturing a new type of small terminal which is particularly useful in experimental work.

A Year Book for the Amateur and Experimenter.*

THE enormous increase in the serious interest taken in Wireless in all its branches has added to the ranks of the Amateur and Experimenter to such a degree that it was felt that a Year Book specially devoted to their interests was not only desirable but absolutely necessary. The publishers of *The Year-Book of Wireless Telegraphy and Telephony*,† have therefore filled the gap with a special edition devoted solely to these interests. Its 864 pages are chock-full of wireless interest arranged in a systematic and concise form facilitating easy reference to any Wireless Want.

In addition to the usual Year Book contents there is a complete Historical Survey of Wireless from its birth up to the present day, written by J. St. Vincent Pletts, a well-known authority on Wireless. A specially compiled section giving the Laws and Regulations of the countries of the world regarding Amateur, Experimental and Broadcast wireless shows at a glance the position of the Amateur, the Experimenter and the Broadcast Receiver, with regard to the laws of the particular country in which he is domiciled. A Directory of Wireless Traders, included at the end of this section, should prove of considerable value to those who wish to purchase either complete sets or accessories for making up their own instruments.

Every listener-in wants to know who and what the signals are that he is receiving; the Directory of the World's Wireless Stations, containing every known land, ship and air station, in conjunction with the specially drawn map section, printed in two colours, forms the most complete and detailed information yet published. Ready reference is obtained at a glance to any station from its call letters, or *vice versa*.

Similarly, a section containing the most up-to-date information on Hydrographic, Meteorological, Time and General Signals, with explanation and tabular transmission lists for every country of the world, enables any such signal to be recognised and decoded. The section has been prepared by W. G. W. Mitchell, whose articles in this journal have been so much appreciated.

Direction Finding is a subject of growing importance, and is taken care of in a special section where an instructive article by R. L. Smith-Rose is followed by the Regulations and Procedure in force for Direction Finding in the various countries of the world. "Recent Progress in Automatic Reception," "Aerials," "Valve Design and Manufacture," and "Multiple Aerial Arrangements," form the subject matter of the four special articles specially written for this Year Book. A complete Patent section, with an article on the Valve Patents of 1922 and British and American Patent Specifications for the past year, give the Patent situation to date.

Progress in Aviation Wireless has been consolidating during the past year, and an article by an official of the Air Ministry gives, in a clear and interesting manner, the position of Wireless in its relation to Civil Aviation. Much other useful information combines to form an Aviation Section.

Ready reference to data for necessary wireless calculations is difficult and involves, usually, perusal of several publications. A Useful Data Section giving Definitions, Foreign Equivalents, Useful Tables and Graphical Symbols for Wireless Diagrams, should do much to obviate this and bring to hand much that takes precious time to search for.

Company Notices, Biographies, Obituary Notices, a Literary Index, and a Code Section are self explanatory from their titles, and are more complete than has yet been possible to produce in the advance of the science and practice of Radio.

Mentioned last, but by no means least in importance, is the extensive Amateur and Experimental Section in which the Editor of *The Wireless World and Radio Review* gives a *résumé* of the Amateur and Experimental situation. This is followed by a Directory of the World's Wireless Societies, Call Signs and particulars of British and French Experimental Transmitting Stations, and a List of Regular Transmissions.

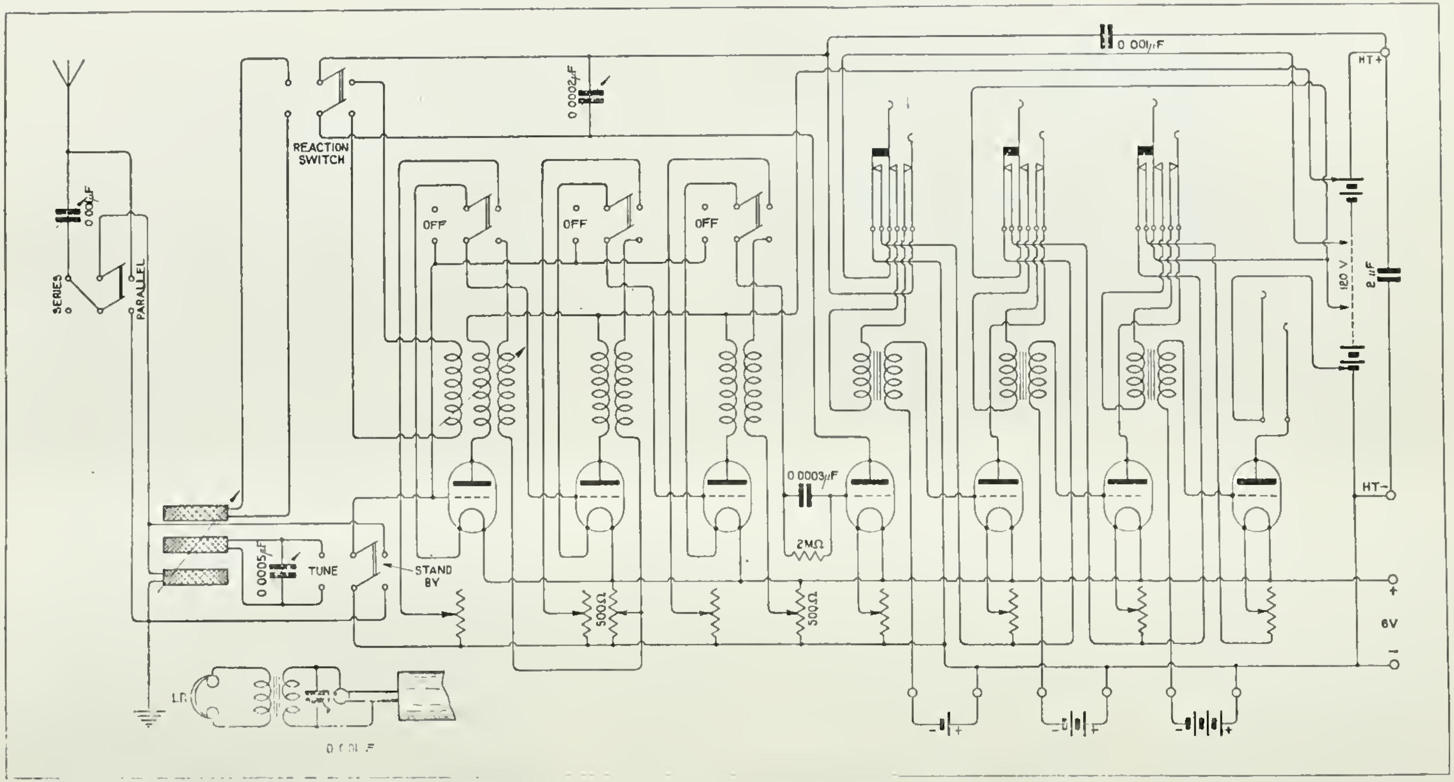
Every Wireless enthusiast should obtain a copy of this Year Book. By so doing he will save much anxious thought and render his experiments all the more interesting by reason of his having to hand reliable information for ready reference.

E. A. C.

* *The Year-Book of Wireless Telegraphy and Telephony.* 6s, nett. The Wireless Press, Ltd., 12-13, Henrietta Street, W.C.2.

† *The Year-Book of Wireless Telegraphy and Telephony.* 15s. nett. The Wireless Press, Ltd., 12-13, Henrietta Street, W.C.2.

CIRCUIT OF A SEVEN-VALVE RECEIVER.



The diagram gives the connections of a seven-valve receiver—three H.F. transformer coupled, detector and three L.F. stages. The aerial circuit has a series-parallel and a stand-by and tune switch to facilitate tuning. The number of H.F. stages in circuit may be varied by the double-pole, throw over switches. The normal grid-potential of these valves is variable with the potentiometer. The detector valve is always in circuit. With certain types of H.F. transformers, the primary windings are tuned with a variable condenser having a maximum value of 0·0002 mfds. The telephones are connected with a telephone transformer to a plug, which may be inserted in any of the jacks connected to the anode circuit of the L.F. valves. The H.T. voltage applied to different portions of the circuit is variable. Cells are connected in the grid circuits of L.F. stages to secure best operation. When valves are cut out by the operation of the switches, the filament circuits are disconnected. By means of the reaction switch, reaction may be obtained by coupling the reaction coil with either the secondary tuner coil, or with a H.F. transformer. The circuit should be of great assistance to those who wish to connect switches and jacks to a receiver. From a study of the diagram it should be an easy matter to provide for one's own particular requirements.

Radio Society of Great Britain.

REPORT OF ANNUAL CONFERENCE HELD ON JAN. 24th, 1923.

The Annual Conference of Wireless Societies affiliated to the Radio Society of Great Britain took place on Wednesday, January 24th, at 2.30 p.m. at the Institute of Electrical Engineers.

Admiral of the Fleet Sir Henry B. Jackson, retiring President, at the commencement of the proceedings took the chair in the absence of the President, Dr. W. H. Eccles, F.R.S., who was unavoidably absent. After the minutes of the last Annual Conference held on January 25th, 1922, had been read and confirmed,

Admiral Sir Henry Jackson, addressing the Conference, said :—

It gives me great pleasure again on behalf of the Radio Society of Great Britain to welcome the delegates from the affiliated societies, and I can only reiterate the views which I expressed last year and hope that the delegates will unhesitatingly give voice to their opinions. In the absence of our President, Dr. Eccles, I am taking the chair, but as I have to leave in less than an hour, I am going to ask our Chairman, Mr. Hope-Jones, to conduct the proceedings.

We have had a busy year, and we in the Society in London have done our best to meet the difficult situation we have been faced with. I hope you will bear in mind that in working for the good of all people interested in wireless, especially the amateur experimenters, the Society has done good and valuable work, and that in all matters we have had the interests of you all in front of us.

I will now ask Mr. Hope-Jones to take the chair and conduct the proceedings of this Conference.

Mr. F. Hope-Jones.

This is the fourth Annual Conference and it has been prepared for in the ordinary manner by circularising the various affiliated societies (of which there are now one hundred and twenty-five), with suggestions for the Agenda to be discussed. From that circular has of course arisen a very considerable mass of correspondence from the various Secretaries, particularly of those societies who either are too far off, or for other causes have been unable to send delegates. I think it is only fair that I should read some part at any rate of their letters, extracts from which will suggest matters for discussion which are not necessarily on the Agenda, and I desire that any subject within the range of our interests may be discussed if time permits.

You will see the first item on the Agenda is the better organisation of this Annual Conference, supposing it is thought to be desirable. In order to test the views of the Societies on this subject, and to encourage a free expression of opinion, we put forward the following suggestions, the first relating to the organisation of these Conferences as follows :—

1. Organisation of the Conferences :—

(*a*) That a General Committee be formed consisting of delegates from the Affiliated Societies, one delegate from each Society, and one additional delegate for every 50 members beyond the first 50 ; delegates from the Radio Society of Great Britain to attend in the same proportion.

(*b*) That this general Committee hold quarterly meetings alternatively in London and in some Provincial centre ; thus the meetings in one year might be in (1) London ; (2) say, Birmingham ; (3) London ; and (4) say, Leeds.

(*c*) Each meeting to elect its own Chairman and to select the rendezvous for the next alternate meeting.

(*d*) Instead of an Affiliation Fee of a guinea from each Society, it is proposed that each Affiliated Society shall pay in proportion to its membership, viz., 1s. per head.

(*e*) The Secretarial Expenses (hire of hall, etc. for the meetings of the General Committee), to be met by the Radio Society of Great Britain.

The Chairman then read extracts of letters on this subject from the Secretaries of the Societies at Leeds, Hounslow, North Shields, and Willesden, and announced that opinion revealed by this correspondence was practically unanimous against increase of subscription in the form of a *per capita* charge of 1s. per head—vulgarly and popularly spoken of as " a bob a nob."

I think (he continued) a slight increase of affiliated societies' subscriptions would be necessary and it can be done in another form.

The main question for you to consider is : Do you want a more frequent conference than one a year in January, as it has been held in the past ? If so, how many, and where ? And do you wish to endow it with authority and executive ability ? Personally I think the method has worked very well in the past by which you have the Committee of the Radio Society of Great Britain meeting frequently with their ears cocked up to catch the slightest whisper of what is wanted from any part of the country, in order to give effect to those wishes. So far, that to my mind has given us sufficiently close touch, but on the other hand, if it was thought that an executive authority of your own was desired, we are only too anxious to hear what your views are on any of these subjects comprised under the headings of item (1).

The meeting was then thrown open to the delegates.

Mr. H. A. Epton (Hackney and District Radio Society).

My Society has gone into this question, and I wrote a note giving our views, but perhaps I might put one or two before you. The first thing that we considered when we were discussing the question was this: What position will this General Committee, referred to in this item of the agenda, have in the Radio Society of Great Britain ? Will it be a supreme body or will it be only an advisory body ? I notice from the letter heading of the Society that there is a Committee. This is re-elected annually. I should like to know whether this proposed General Committee is to supersede that Committee now in existence, or whether it can only convey its suggestions to the Committee of the Radio Society of Great Britain. If the General Committee is not the supreme power, our Society consider its purpose cannot be very important, but if it will have the power to carry out the ideas on which it has opinions then I can see that this General Committee will be able to do very useful work. My Committee has requested me to ask this question before any decision is made so that we may know the purpose of this new Committee.

Mr. H. Taylor (Derby Wireless Club).

We are in favour of holding the meeting in London as heretofore.

Mr. A. J. Dixon (North Middlesex Wireless Society).

My Committee thinks that the idea of the Committee being formed as suggested is quite a good one, but I, personally, more or less agree with the first speaker that it would be well to know what is the precise position of that Committee. As regards the meeting in the provinces, this is nearly the same as our suggestion two years ago, but we do not think we need to have four conferences. Probably one in the North or one in the Midlands would do. As regards the capitation fee, we suggest a subscription which is a percentage of the subscription income of the club. Some clubs have a very nominal subscription, of say 5s., and obviously it is unfair for those clubs with 5s. subscriptions to have to pay out of their funds the same as the club which has a half-a-guinea subscription or more. We suggest that you have say a five per cent. subscription on the income of the club. That is to say on the club's net subscription for the year.

Mr. Y. P. Evans (Manchester Wireless Society).

My Committee have asked me to propose, with regard to this item on the Agenda, first paragraph, with reference to the General Committee, that one delegate per society including the Radio Society of Great Britain, should form that Committee. That two meetings be held annually, in addition to the Annual Conference, and at the Annual Conference as many delegates may attend as possible, say one for the first fifty and one for each fifty afterwards.

My Committee agree that the meetings should take place at different towns, to be decided upon by the Committee at its first meeting. They agree with the suggestion that the meeting should elect its own chairman.

Regarding the affiliation fees I am to say that our suggestion is £1 for the first fifty, and £1 for every fifty afterwards. The last item to the effect that Secretarial expenses should be met by the Radio Society of Great Britain was quite agreeable to them.

Mr. Platt (Wanstead Wireless Society).

We have a Society comprising adults and juveniles; the Society is only six months old. Our subscription fees are only 10s. entrance and 5s. annually, and we are on this account prevented from accepting any higher expenses as regards our affiliation to the Society. The information we have received from time to time has been very satisfactory, and we hope to continue to get such information in the future.

With regard to the question of a General Committee. I asked our Secretary if he had any information which suggested why the Radio Society of Great Britain had caused such a minute to be put on the agenda for debate. I really think that your own Committee would do well to give some reasons why these subjects were coming up for discussion to-day, because it is only your present Committee that has had that experience which enables them to say whether it is necessary to extend or increase the activities in this direction. We delegates do not know whether it is necessary or not.

On the question of finance, I really think, if more money is required, an appeal might bear good results. There are men in my own Society who may be able to afford a further amount, but some cannot afford even a shilling.

Mr. Watkins (Maidenhead District Wireless Society).

Is there not some confusion arising out of the term "General Committee." The General Committee is in regard to the Conference of Affiliated Societies, and is quite distinct from the Committee which acts in an advisory capacity to the Radio Society of Great Britain. As far as we in Maidenhead are concerned we are quite anxious that everybody in the Societies in the country should be represented at this Conference, and I take it that the motive of the Radio Society is that there should be better facilities in getting the members together. The delegates here, on that account, do not fully represent the Societies of Great Britain. Some arrangements should be made for meetings in different parts of the country so that the Conference should be fully representative. I should like to ask the Committee to give us some particulars of the financial requirements which necessitate the suggestion of a shilling per head.

Mr. R. H. Parker (Smethwick Wireless Society).

My Society agrees with this proposal in principle, but why is it suggested that they should hold two meetings in London? Why not in the provinces, Cardiff, or Sunderland, so that it would be more convenient for the amateurs extending over the country? We agree with (*c*), but not with (*d*).

Mr. S. Sugden (Birkbeck College Wireless Society).

I just want to put one point in connection with (*d*). In our college, as in many other colleges, the whole of the monies for students' societies are raised from a central fee which is paid with the ordinary tuition fees. It is impossible for us, therefore, and perhaps for a number of other Societies associated with schools and colleges, to define our particular number of members. Every student can belong to all the societies, or he may not do so, but the funds of each individual society of the college or school is not affected by its membership total.

Mr. Watt (Dartford and District Wireless Society).

My Committee are agreed upon the general proposals for the Conference. As regards representation, this might be one for 50, and two for 100.

With reference to (*d*), my Society also wish me to state that an increase in our case would be equal to fifty per cent. of our total, and they think that half that amount should be ample.

Mr. C. T. Atkinson (Leicestershire Radio and Scientific Society).

With regard to this question our Society is generally in favour in principle, but we are not quite sure exactly on the various details which have been raised. We feel that the affiliated societies should have as much power as is possible, and if a number of conferences are necessary, then they must of course be held. We do, however, feel that if the number of conferences can be limited it will be the better for all concerned, providing the work can be expeditiously carried out, and therefore if we can cut the number down by two conferences a year, one to be held in London and one in a place farther north so as to be better as regards attendance for the Societies in the North of England, it would be perhaps the best way.

With regard to (*c*), this is satisfactory.

As regards (*d*), like most of the other Societies, we object to the amount suggested, not knowing exactly what money would be required. We have not fixed any amount to bring before you, but we do feel that it is very essential that the amount should be the absolute minimum necessary, and below the amount figuring in the agenda. We have endeavoured to keep our funds as low as possible because of the large number of people we have in our Society who have not too much of this world's goods. A payment of (in our case) twenty per cent. of the annual subscription to the Radio Society of Great Britain would be excessive. On this account item (*e*) has been well received.

Mr. J. H. Reeves (Kensington Wireless Society).

On the subject of the number and powers of the Conference General Committee. We have certainly thought that the Committee members of the Radio Society of Great Britain as we know them, are very much overworked. They have a tremendous amount to do, and the general idea seems to be that while the Radio Society of Great Britain is going to take care of the amateurs in bulk, this Conference of all the Societies has for its primary object the direct personal concerns of the Societies and of the individual. If one may argue from an analogy some years ago, in the motoring world, the Royal Automobile Club found there was a very large group of provincial bodies, and it became very necessary to arrange some local conferences so that they could act in closer touch all over the country.

Now this organisation will probably develop very largely on the same lines. I think there is a good deal to be done which is particularly suitable for a general conference of all the societies of the Kingdom. For that reason I fall in with the suggestion, and so does my Society of Kensington—that this Conference be held rather more frequently. The meetings should be, say alternately in London and the provinces. If four are too many, I think we could have three at any rate. The success of the Radio Show in the autumn of last year is going to be repeated. It is going to be bigger in the future, and I think it will attract people all over the country. It would be no hardship for every Radio Society in England to find a member who would be very glad to have the excuse to come to London and attend the Conference, and also the exhibition. I think as a start there might be three conferences, one during the Exhibition in London, the Annual Conference in January, and one meeting in the provinces during the summer months.

There could never be what one might call a clash of powers. If a point is not voted unanimously it is hardly ever voted at all. These conferences meet together to discuss and to advise the Radio Society of Great Britain on important matters, on the same lines as the various motoring societies meet together monthly in order to advise the Royal Automobile Club, and between them they come to unanimous decisions.

Mr. H. A. Epton (Hackney and District Radio Society).

I had expected that my earlier question would have been answered so that the matter might be clear to us. No answer was given to it then, and there was a suggestion of closing the discussion.

Mr. Reeves seems to speak with an air of authority. I think he has had experience of meetings which we are not all in the position of having had. In a businesslike body like ours, we should know exactly what we are going to do. The question of power must come up. At present, as far as I understand it, the affiliated societies have no definite standing. Now, if this General Committee has no power beyond that of an advisory Committee, I cannot see how we are going to have any control over the running of this Society. If we have to pay an annual fee, surely we ought to have some representation either on the original Committee or else our new Committee must have full power.

As regards the representation by delegates, my Society maintains this figure is too high (the figure of fifty); it should be reduced to twenty-five. I do not think there are many societies in this country who have one hundred members or more. Fifty to seventy-five is the average. The great majority of societies would only have one delegate and a very few indeed two delegates.

(Here the Chairman interrupted, as Mr. Reeves had not completed his remarks.)

Mr. J. H. Reeves, after emphasising that he was not speaking with authority, continued:

I happen to know the members very well, and I am sure they do an enormous amount of work, and put in an enormous amount of time, and if there is much more to be done, that Committee must, it seems, be enlarged or else we, the Societies who want these things done, have got to do more to assist in the work ourselves. I think the Radio Society of Great Britain have done a very wise thing in bringing this matter forward. As regards the power which the conferences will have, let us think what is going to happen if the one hundred and twenty-five Radio Societies are unanimous on something which the Radio Society of Great Britain does not agree with? Surely either the Radio Society goes out, or the result of such a strong expression of opinion will convince the Committee of the Radio Society of Great Britain. Personally I am only suggesting that. I feel there is no possibility of a clash of voting. It would certainly be well to define the powers of the proposed Committee.

(To be concluded.)

The British Wireless Relay League.

THE announcements which have appeared in this Journal in connection with the British Wireless Relay League have stimulated a very considerable interest in the matter. A large number of applications for membership have been received, and there is every indication that it fills a gap which should do much to bring into closer association the amateurs, and particularly those holding experimental licences, of this country. The work of the League should go farther, for it is intended that it shall co-operate as far as possible with similar organisations abroad.

In a recent letter received from Mr. Léon Deloy, so well known as one of the leading amateurs in France, mention is made of the fact that at the last meeting of the Comité de la Société des Amis de la T.S.F. Mr. Deloy brought up the subject of the handling of such traffic by amateurs in France, and states that Général Ferrié expressed approval of the proposals outlined. Dr. Pierre Corret, President of the Comité Français des Essais Transatlantiques was asked to request his committee to get in touch with the postal authorities on the matter. Let us hope that the near future will bring good news of the result of their negotiations.

There is little need here to refer to the work of the American Radio Relay League since their activities are already so well known to British amateurs, and already the British Wireless Relay League is assured of their hearty support and co-operation in any experimental transmissions or other work to be undertaken.

The British League cannot, of course, ever aspire to the same membership as the American League, but nevertheless, if all those who have an interest in the work will come in, a very efficient organisation should result. Below are published the provisional rules of the British Wireless Relay League for the information of readers of this Journal :

BRITISH WIRELESS RELAY LEAGUE.

NAME.

The League shall be named the "British Wireless Relay League."

OBJECTS.

Intercommunication between members with a view to improving existing transmitting circuits.

Relaying of messages through stations owned by members, at times to be regulated by headquarters, the object of which will be the efficient organisation of all amateur transmitting stations, whereby a service of excellent utility will be maintained. All messages shall be confined to the business of the League.

Strict observance of all laws and regulations applicable to wireless telegraphy and telephony.

Co-operation with wireless leagues of other countries.

The advancement of wireless science generally.

RULES.

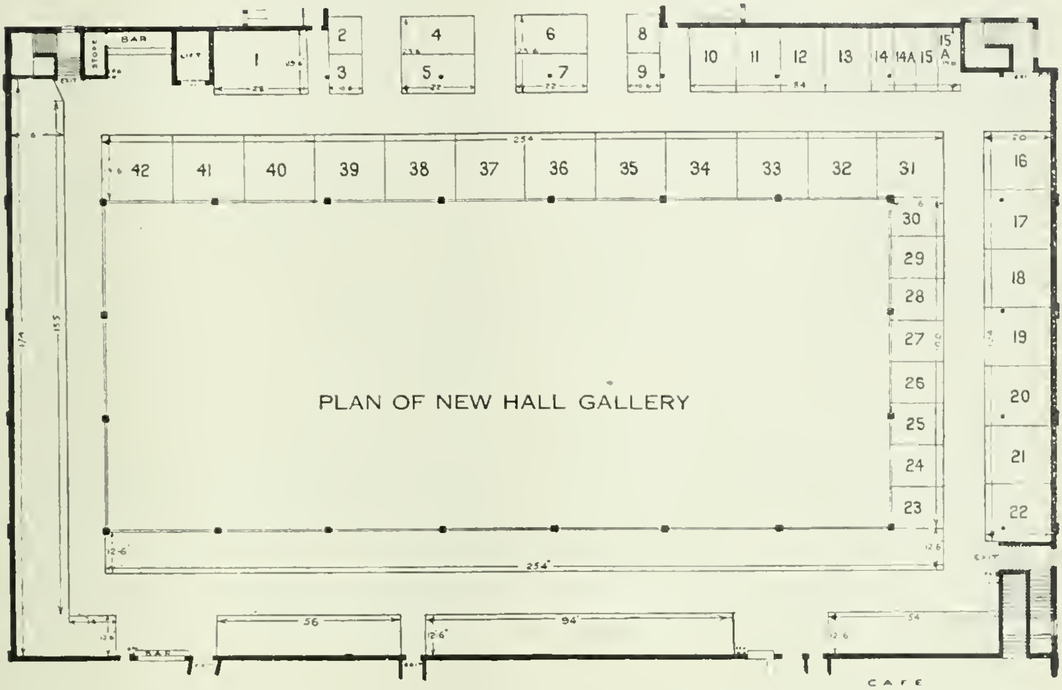
1. The League shall consist of members and associate members, and shall be governed by a central committee consisting of the officers and four committee members, assisted by a local committee elected by members.
2. Members shall possess an Experimental Transmitting Licence.
3. Associate members shall possess an Experimental Receiving Licence, and may transfer to full membership on compliance with rule 2.
4. Members and associate members shall be eligible for any office of the League and shall receive all circulars and printed matter concerning the League.
5. Prospective members shall apply to the Hon. Secretary for the necessary application form, and after completing and returning same, with remittance, shall receive a certificate of Membership.

SUBSCRIPTIONS.

6. An entrance fee of five shillings shall be paid by each member on election, and the annual subscription shall be ten shillings, payable in advance, and due on the 1st January each year.
7. Associate members shall pay an entrance fee of five shillings on election, and the annual subscription shall be five shillings payable as in rule 6.
8. Any member whose subscription is one month in arrears shall be notified by the Hon. Treasurer. Should his subscription not be paid at the expiration of one month from the date of such notice, the committee shall have power to erase his name from the list of members.
9. The committee shall have power to reprimand any member who, in the opinion of one or more members, has wilfully acted in contravention of the rules of the League, or the laws and regulations governing wireless telegraphy, after such an act has been investigated.
10. Should any member wilfully break these rules or regulations a second time the committee shall have power to expel him from the League.
11. Until other rules are drawn up for the management of the League, the above provisional rules shall be considered binding.
12. In these rules the word member includes associate members unless otherwise stated or where the context does not so admit.

Applications for membership or associate membership should be made to the Hon. Secretary, The British Wireless Relay League, care of this Journal, 12-13, Henrietta Street, London, W.C.2.

Ideal Home Exhibition.



The *Daily Mail* Ideal Home Exhibition, which will be open at Olympia on March 1st to 24th, will include as an important feature a Wireless Section situated in the New Hall Gallery. The following are the firms exhibiting in this section with the numbers of their Stands :—

1. Burndept, Ltd.
2. H. Stanley Prince & Co.
3. Electric Appliances Co., Ltd.
4. Amalgamated Press, Ltd.
5. Radio Press, Ltd.
6. Cassell & Co., Ltd.
7. Wireless Press, Ltd.
8. Tingey Wireless, Ltd.
9. Igranic Electric Co., Ltd.
10. Wates Brothers.
11. Gambrell Brothers, Ltd.
12. Perophone, Ltd.
13. Rogers Foster & Howell, Ltd.
14. ———

14A A. H. Hunt, Ltd.

15. ———

15A Abbey Industries, Ltd.

16. General Radio Company.
17. L. McMichael, Ltd.
18. Telephone Mfg. Co., Ltd.
19. A. W. Gamage, Ltd.
20. Radio Society of Great Britain.
21. ———
22. Peto & Radford.
23. Beaver Electric Company.
24. Alfred Graham & Co.
25. J. A. Coomes & Co., Ltd.
26. Siemens Brothers & Co., Ltd.
27. Tomlinson, London, Ltd.
28. Fellows Magneto Co., Ltd.
29. Dubilier Condenser Co. (1921), Ltd.
30. Radiophones, Ltd.
31. Sterling Telephone & Electric Co., Ltd.
32. Automatic Telephone Mfg. Co., Ltd.
33. British Thomson-Houston Co., Ltd.
34. Western Electric Co., Ltd.
35. General Electric Co., Ltd.
36. Marconi Scientific Instrument Co., Ltd.
37. Marconi's Wireless Telegraph Co., Ltd.
38. Metropolitan-Vickers Electrical Co., Ltd.
39. C. F. Elwell, Ltd.
40. Radio Communication Co., Ltd.
41. Radio Instruments, Ltd.
42. S. G. Brown, Ltd.

Calendar of Current Events

Thursday, February 22nd.

Institution of Electrical Engineers.
At 6 p.m. At Savoy Place, Victoria Embankment, W.C.2 Lecture on Transoceanic Wireless Telephony, by Dr. H. W. Nichols.

Friday, February 23rd.

Manchester Wireless Society.
At 7.30 p.m. In Council Chamber, Houldsworth Hall. Discussion.

Leeds and District Amateur Wireless Society.
Lecture on "Receivers and Loud Speakers." By Mr. A. M. Bage (President).

Birmingham Experimental Wireless Club.
At 7.45 p.m. Lecture by Mr. Abbott.

Hull and District Wireless Society.
At 8 p.m. At the Memorial Institute Schoolroom, Dewsbury Street. Smoking Concert.

Saturday, February 24th.

Mount Pleasant Radio Society.
At 7 p.m. At Lecture Hall, 21a, John Street, Theobald's Road, W.C.1. Lecture on "A Beginner's Difficulties in Receiving anything but Broadcasting." By Mr. A. Hinderlich, M.A.

Sunday, February 25th.

At 3.5 p.m. Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, February 26th.

9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Tuesday, February 27th.

Lowestoft and District Wireless Society.
At St. Margaret's Institute, Alexandra Road, Lowestoft. Lecture by Mr. L. Burcham.

The East London Radio Society.
Lecture on "Charging Accumulators on the House Lighting Mains." By Mr. J. Keens.

Wednesday, February 28th.

Royal Society of Arts.
At 8 p.m. At John Street, Adelphi, W.C. Lecture on "Heat Resisting Glasses." By Professor W. E. S. Turner.

Halifax Wireless Club and Radio Scientific Society.
Lecture by Lieut. H. E. H. Burbury.

Edinburgh and District Radio Society.
At 8 p.m. At R.S.S.A. Hall. Lecture on "Detection and Measurement of Minute Electric Currents." By Dr. H. Dryerre, M.R.C.S., L.R.C.P.

Thursday, March 1st.

Daily Mail Ideal Home Exhibition, with Radio Section. Opening Day (March 1st-24th inclusive).

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School. Practical Work and Demonstration.

Stoke-on-Trent Wireless and Experimental Society.
Lecture: "Half-an-hour with a Technical Dictionary." By F. Bew.

Thames Valley Radio and Physical Association.
At 8 p.m. Film on Radio Transmission and Reception.

Friday, March 2nd.

Sheffield and District Wireless Society.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture on "The Progress of Telephony and its Bearing on Modern Life." By Mr. W. Davies.

Leeds and District Amateur Wireless Society.
Lecture on "The Evolution of Receiving Valve Amplifiers." By Mr. H. H. T. Burbury.

Saturday, March 3rd.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. A. Southgate, A.M.I.E.E.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	2LO	369	metres.
Birmingham	5IT	420	,,
Manchester	2ZY	385	,,
Newcastle	5NO	400	,,
Cardiff	5WA	395	,,

Glasgow Broadcasting Station (**5 SC**) is expected to be in operation on March 19th.

Correspondence.

To the Editor of The Wireless World and Radio Review.

Sir,—As I have been experimenting with chemical rectifiers for some considerable time I read with interest Mr. Rushton's investigations on the well-known Tungar Rectifier.

Although the article sets forth with considerable aptitude the scientific side of the subject, there are several points which need consideration from the practical or commercial point of view. These are:—

1. The cost of valve replacements.
2. Only one wave of the supply current is "rectified," the other wave being repressed.
3. The low overall efficiency.

I understand that the cost of replacing the valve or bulb is over £4, and that such bulbs are guaranteed only for a maximum of 600 hours.

Taking this at the 5 ampere rate for a 6-volt cell of 50 ampere hours capacity, the cost per charge is 1s. 6d. for the bulb alone, to which must be added a certain amount towards the first cost of the apparatus, and then the cost of the current consumed from the mains at 29 per cent. efficiency, that is, rather over 100 watts input.

In comparison with chemical and other rectifiers this does not appear to me to be sufficiently good, but doubtless improvements will be effected in course of time.

Mortimer A. Codd.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12 13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6)* **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** *(7) Four questions is the maximum which may be sent in at one time.*

"G.T." (Leeds) *asks for a diagram of a telephony and C.W. transmitter for short wave work. It is proposed to use about 5 watts of H.T.*

The diagram is given in Fig. 1. The aerial inductance will be determined from the constants of your aerial, but will generally be 6″ in diameter and 6″ long, of No. 16 D.C.C. The closed circuit coil may be 8″ in diameter and 6″ long, of No. 18 D.C.C., the wire in each case being spaced. The grid circuit coil should be a winding 5″ in diameter and 3″ long, of No. 20 D.C.C. The air choke coil in the anode circuit of the first valve may be a winding 2″ in diameter and 3″ long of No. 28 S.S.C. The key is connected to join the grid leak across the grid condenser. When it is required to use the transmitter for telephony, the key is screwed down, and the switch is thrown over to the right-hand side. 200 volts anode potential would be suitable. Some experimental work will be necessary before the best values for the components are obtained.

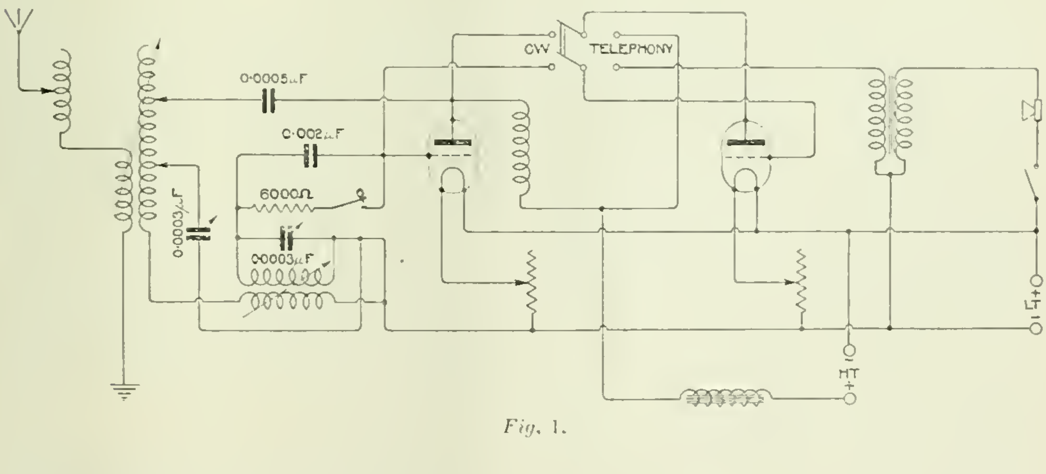


Fig. 1.

"SIGIL" (Cheshire) *asks (1) For diagram of a three valve circuit capable of later extension. (2) Where detailed instructions for making such components as are desired may be obtained.*

(1) We would refer you to Fig. 5, page 356, December 9th, issue. The diagram is a very good one, and may be thoroughly recommended. (2) We do not know of any text-book which deals with the construction of such components as you would require, in a suitable manner. We suggest you obtain the last volume of *The Wireless World and Radio Review*, where you will find a number of constructional articles, and in particular articles dealing with "Experimental Station Design," which appeared in every other issue.

"PUZZLED" (Pendleton) *asks (1) What type of Dewar switch would perform the same functions as a double pole throw-over switch. (2) Could the three-valve receiver illustrated in the issue of October 28th, 1922, be converted into a cabinet set.*

(1) A Dewar switch, which has six contacts,

comprising two moving contacts and four fixed, may be used in place of the double pole throw-over switch. The Dewar switch would be such that with the springs in one position contact is made in a similar manner to when the double pole throw-over switch is thrown over into one of its contact positions. (2) The three-valve receiver referred to may of course be assembled to form a cabinet receiver, provided the components are suitably mounted. Any receiver may of course be mounted in a cabinet in this manner.

"**W.B.**" **(Bristol)** *is interested in telephony transmission, and asks* (1) *Where he can find information.* (2) *Where to obtain microphones.* (3) *For criticism of diagram submitted.* (4) *What power is required to transmit ten miles, the receiver to be a one-valve receiver.*

(1) We suggest you look through back numbers of *The Wireless World and Radio Review*, where you will find a considerable amount of useful information. In particular we would refer you to the issue of December 23rd, where you will find, under the heading of "Experimental Station Design," a constructional article dealing with a small telephone and C.W. transmitter. (2) We suggest you communicate with the Automatic Telephone Manufacturing Company of Liverpool. (3) The diagram submitted is quite suitable for a beginner, although the arrangement is very inefficient, and it cannot be expected that one would be able to transmit for any great distances with such a transmitter. In addition, the tuning adjustments are shown. (4) If you use 10 watts of high tension, your transmissions should be heard over a ten miles radius.

"**RESISTA**" **(Mont)** *asks* (1) *Whether the licence purchased from the General Post Office, London, is an experimental or a broadcast licence.* (2) *Is he allowed to use a receiver purchased some time ago, and may he add to it; and will he be called upon to pay the British Broadcasting Company's fees.* (3) *Is he allowed to give demonstrations, say in the local village.* (4) *May a power valve be used in the last note magnifier panel.*

(1) We think the licence which was sent to you is an experimental licence. (2) If you hold an experimenter's licence, you are of course able to experiment with apparatus just as you desire, provided the conditions under which the licence is granted are borne in mind. You will not be called upon to pay any fees to the British Broadcasting Company. (3) You will probably have to gain the permission of the Post Office before you are able to give wireless concerts. We suggest you write to the Secretary of the Post Office, London. (4) The power valve is connected in the circuit in the same manner as an ordinary receiving valve, but the anode is supplied with a higher potential, which is tapped off the H.T. battery. This is the only alteration required. The aerial may, as you suggest, be either 60′ long and 40′ high, or it could be 60′ long, two wires, and 40′ high.

"**ULTRA FIXED**" **(Rugby)** *asks* (1) *For suitable values of components to use in the circuit wired according to the diagram submitted.* (2) *Whether a certain book has been published.* (3) *How can a reactance coil be made so that it is reasonably efficient, and tuned by taps only.*

(1) and (3) The A.T.I. may be a winding 4″ in diameter and 3″ long, of No. 22 D.C.C., with six tappings. The A.T.C. should have a maximum value of 0·001 mfds. The tuned anode winding may be 4″ in diameter and 5″ long, of No. 26 D.C.C., and the tuning condenser should have a maximum value of 0·0002 mfds. The reaction coil may be a winding 3″ in diameter and 3″ long of No. 26 D.C.C. with three tappings. The grid leak and condenser have values of 0·0003 mfds. and 2 megohms. (2) The volume referred to has not yet been published.

"**B.H.H.**" **(E. Yorks.)** *proposes to use a frame aerial, and asks* (1) *For a diagram showing how to connect two high frequency, one detector, and one L.F.* (2) *Is there any serious objection to the use of a frame aerial.*

(1) A suitable diagram is given in Fig. 2, page 72, in the issue of October 14th, 1922. (2) As your open aerial is rather poor, you will probably find no very great decrease in signal strength with the use of a frame aerial, it being borne in mind that one can take advantage of the directional properties of the frame.

"**G.R.B.**" **(Essex)** *refers to the diagram given on page 418 of December 23rd issue and asks* (1) *What would be suitable dimensions for the anode and reaction coil.* (2) *Which valves give best results in a circuit of this description.*

(1) The anode and reaction coils may be plug-in coils if desired, in which case a two-coil holder is very useful. For the reception of broadcast transmissions two small single layer coils may be used, but the anode coil should be 3″ in diameter and 3″ long of No. 28 D.C.C., and the reaction coil could be 2″ in diameter and 3″ long of No. 28 D.C.C. Ten and three tappings should be taken from the coils. (2) "R" valves are quite suitable for use in a circuit of this description.

"**MARRIED QUARTERS**" **(Halesowen)** *submits particulars of his proposed aerial arrangement and asks* (1) *Are the results from the arrangement likely to be as good as from an outdoor aerial, 30 yds. long and 25′ high.* (2) *With condenser plates of the size given, and the distance between the plates 1/16″, what is the capacity.* (3) *Is the proposed layout satisfactory.* (4) *What capacity is considered desirable, if at any time the set is used on a 250-volt D.C. main.*

(1) We think stronger signals will be obtained with the outdoor aerial. (2) The capacity of the condenser would be of the order of 0·00005 mfds. (3) The lay-out is not very satisfactory, and it is not safe to use air dielectric condensers for work of this description. (4) We suggest you use mica dielectric condensers with a capacity of the order of 0·0005 mfds.

"**W.J.T.**" **(Surrey)** *asks* (1) *Can we say why when listening-in to French and Dutch amateur transmissions, the signals appear to fade occasionally.* (2) *What power is put into the aerial at Ongar,* **GLO.**

(1) When listening in to short wave transmissions it is often noticed that the signals appear to fade away at times. This is due to absorption, which is very pronounced at short wavelengths. (2) This station is operated by a private company, and we have no definite information of the power employed.

"**P.L.B.**" **(Bucks)** *submits a sketch of his receiver and asks* (1) *Whether the circuit is suitable* *for general purposes.* (2) *How to add two L.F. connected valves.*

(1) The circuit submitted is quite suitable for short wave telephony, although it would be better to couple the reaction coil with the secondary of the intervalve transformer instead of the aerial tuning inductance. (2) The method of connecting L.F. valves is given in all issues. In particular we would refer you to Fig. 4, page 386, December 16th issue.

"E.W.C." (Birmingham) *asks* (1) *For an explanation of the tuned anode method of H.F. amplification.* (2) *For particulars of the construction of an anode coil suitable for a wide range of wavelengths.*

(1) The tuned anode method of H.F. amplification works on very similar principles to the resistance method, but in the former case the high impedance is brought about by tuning the anode winding to the frequency of the signal it is desired to amplify. When the frequency of the winding and the frequency of the signal coincide the tuned circuit offers very high impedance to the signal, and consequently there are large voltage variations across it. These are transferred to the grid of the next valve through a small condenser. (2) We suggest that you wind a cylindrical coil 3″ in diameter and 6″ long full of No. 36 S.S.C. wire and take twelve tappings. The winding should be tuned with a variable condenser having a maximum value of 0·0003 mfds.

"A.H." (Purley) (1) *Wishes to construct a two-valve high frequency panel to add to a single valve unit which he has by him, and* (2) *Asks for a diagram of connections, using certain components.*

(1) and (2) See Fig. 2. Suitable values are indicated in the sketch.

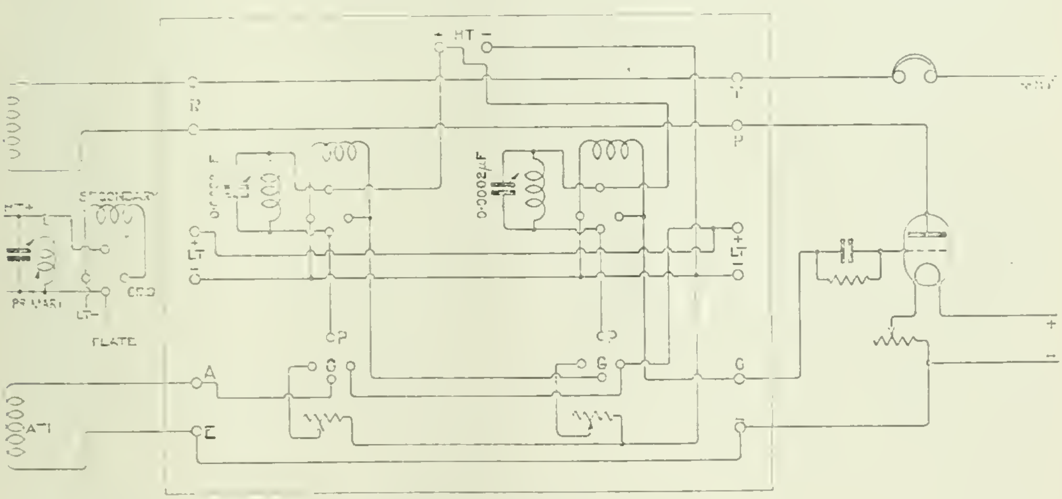


Fig. 2.

"F.G." (Scarborough) *asks* (1) *Whether a crystal may be used in place of a detecting valve.* (2) *Whether any alteration of the wiring will be necessary if the reaction coil is made to swing over the plug-in transformers.* (3) *What would be a suitable basket coil winding for the reaction coil suitable for use over a wavelength range of 400 to 5,000 metres.*

(1) A crystal may be used in place of the detecting valve, but we do not recommend it. The advantage of having a detector valve is the stable adjustment. This cannot be claimed for a crystal. (2) No wiring changes will be necessary. The reaction coil will simply be moved and the reaction leads will be taken to the foot of the stand on which the sliding reaction coil is mounted. (3) A suitable reaction coil would be one consisting of 60 turns of No. 32 S.S.C. wire with a mean diameter of 3″. For the higher wavelengths we suggest a coil having 120 turns of No. 36 S.S.C. wire with a mean diameter of 3½″.

"TYLER" (Huddersfield) *asks* (1) *For diagram of a three-valve receiver, comprising one high frequency, one detector, and one L.F. valve* (2) *For criticism of the receiver, particulars of which are submitted.* (3) *May honeycomb coils be used in place of a loose coupler.* (4) *What honeycomb coil should be used to receive* **WJZ.**

(1) We would refer you to Fig. 5, page 147, of the issue of October 28th. Suitable values are indicated in the diagram. (2) and (3) We suggest you secure the single-wire aerial from the house chimney to the post. Honeycomb coils may, of course, be used in place of the loose coupler. Basket coils work equally as well as honeycomb, but are a little more difficult to mount. (4) The wavelength of **WJZ** is 360 metres, and you will use the first set of honeycomb coils mentioned. We would point out that the reception of the transmissions from this station is in the nature of a freak; that is, the transmissions cannot be received except under the most favourable conditions.

"W.A." (Windermere) *asks* (1) *Why, when anyone touches the headphones, the tuning is altered.* (2) *Is it possible to put a milliammeter in series with the telephones and + H.T. to indicate when the receiver is on the point of oscillation.* (3) *What is the maximum number of telephones which may be connected in series in the anode circuit of the last valve.*

(1) The reason why tuning is altered when the telephones are touched may be because the telephones have low insulation, and because they are connected directly in the anode circuit. A telephone transformer should be used if possible, and the receivers should be tested for low insulation. The loud-speaker circuit is correct because a telephone transformer is used. (2) We do not think much would be gained by inserting a milliammeter in series with the telephones as suggested. (3) Three or four pairs of telephones may be connected in the anode circuit of the last valve without any great loss of signal strength.

"E.C.H." (Doncaster) *asks* (1) *The capacity of a 33 plate condenser built up from plates of the dimensions of the samples submitted.* (2) *The capacity of an 11 plate condenser.* (3) *The dimensions of a suitable anode coil.*

(1) The 33 plate condenser will have a maximum value of 0·0005 mfds. (2) The 11 plate condenser has a maximum value of 0·00016 mfds. (3) The anode coil may consist of a winding 4″ in diameter and 6″ long of No. 30 S.S.C. wire, 18 tappings being taken.

"N.G.C." (S.E.) *asks* (1) *Whether the diagram submitted is correct.* (2) *Whether good results will be obtainable, it being desired to receive signals other than the broadcast transmissions.* (3) *Is a reaction coil tuning condenser and a high frequency transformer tuning condenser necessary.*

(1) The diagram submitted is quite correct, and it is a standard circuit. (2) Good results will be possible over all wavelengths, provided suitable tuning coils are used. (3) The reaction condenser may have a value of 0·0002 mfds., and the high frequency transformer primary should also be tuned with a small condenser, one having a maximum value of 0·0002 mfds. being suitable.

"PIPACAC" (Harpenden) *submits a diagram of connections and asks* (1) *Would it be useful to include a switch so that the tuned anode or the high frequency transformer may be used as desired.* (2) *What connections are necessary so that a Dewar switch may be connected for throwing the high frequency valve out of circuit when not required.*

(1) If desired, a switching arrangement may be included for the purpose of using the high frequency transformer or the tuned anode method of amplification as desired. A suitable diagram is given in Fig. 1, page 129 of October 28th issue. (2) The method of switching valves with a circuit of the description submitted is given in most issues of this journal.

"SPARKS" (Yorks) *asks* (1) *For criticism of the circuit submitted.* (2) *What is the reason for the distortion of speech which is received from a broadcasting station.* (3) *With reference to the diagram of aerial submitted, is it to be expected that interference will result, due to telephone and tram wires.* (4) *Are any additional tuning arrangements suggested.*

(1) and (4) The diagram of connections is correct, except that a wire is connected across the reaction coil, which is presumably an error. The tuning arrangements are quite correct, and with the high frequency transformer in use, it is not desirable to connect a small tuning condenser across the primary winding. It would probably be better if the secondary coil were connected between the grid and filament negative instead of filament +. (2) The distortion may be caused by a number of reasons, and you should find for yourself the best values of anode voltage and filament current. One or two small cells may be connected in the grid circuit of the last valve, for the purpose of giving the grid a small negative potential. Distortion may be caused through allowing grid current to flow through the grid becoming too positive. The normal grid potential may not be correct, resulting in the operating point on the characteristic not being central. The filament temperature may be too low. (3) It is very likely that some interference will be caused by the telephone wires running close to the aerial, and if possible we suggest the aerial be removed round a little, so as to form an angle with the telephone wires, which at the present time are running practically parallel.

"H.F.W." (Leeds) *submits a diagram of his receiver with particulars of the components used, and asks for criticism.*

The diagram of connections submitted is quite correct, although it is sometimes an advantage to tune the primary of the high frequency transformer with a two-plate condenser. The high frequency transformer has suitable dimensions, but the L.F. transformer has rather a high ratio to be efficient. The tuning coils are of suitable dimensions, but it is difficult to see why such peculiar results are obtained when the aerial tuning condenser is in series with the A.T.I. If care is taken that the right tuning coil is used, the results may be accounted for by your aerial lead being rather long, and perhaps the aerial has a large capacity.

"D.G.B." (S.W.15) *asks* (1) *What is the meaning of the expressions "R4," "R5," etc.* (2) *With reference to the diagram submitted, how many turns of wire, using No. 20 enamelled, would be required on the aerial coil to tune between 200 and 300 metres, the former to be 6″ in diameter.*

(1) The terms "R4," "R5," etc., mean that signals of a certain strength are being received. In the military service only the odd numbers were used, and the following meanings are attached: R9, Signals clear and strong; R7, signals strong; R5, signals readable; R3, Signals weak; R1, signals heard but not readable. (2) We suggest you wind 40 turns of No. 20 enamelled wire upon the 6″ diameter former. The wire should be spaced slightly, a suitable spacing being the thickness of the wire itself. With the arrangement suggested, it is only possible to modulate a small amount of power without the microphone being heated.

"G.F.H." (Epsom) *submits a diagram of connections and asks* (1) *Are the connections correct and suitable for the reception of telephony.* (2) *Is it necessary to have a filament rheostat connected with each valve.* (3) *Is it better to connect the grid leak across the grid condenser or across the grid and L.T.*

(1) The proposed arrangement is quite suitable, although instead of coupling part of the high frequency transformer with the aerial coil, it would be better if a reaction coil were used. The reaction coil should be connected in series with the low frequency transformer connected in the anode circuit of the detector valve. (2) It is better to have a filament resistance to control the temperature of each filament, because each valve will have slightly different characteristics, and it is desirable to be able to adjust the filament temperature of each valve separately. (3) It is generally better to connect the grid leak between the grid and plus or minus L.T. The correct connection depends upon the valve in use, and one should try whether best results are obtained with the leak connected to + or − L.T.

"WELSHMAN" (Woking) *asks* (1) *Whether he may expect to receive the London broadcast transmissions, using a frame aerial and the single valve receiver.* (2) *What are suitable dimensions for a frame aerial.* (3) *Which type of frame aerial is the better.* (4) *Is it necessary to obtain an experimental licence before one may use a receiver built up from parts.*

(1) We do not think you could expect to receive the London broadcast transmissions using a frame aerial and a one-valve receiver. We suggest you use an outdoor aerial, or if you cannot fix an outdoor aerial, use a three-valve receiver in conjunction with the frame aerial. (2) The frame aerial may be 4′ square, wound with eight turns of No. 20 D.C.C., the turns being spaced a ¼″ apart. (3) The form suggested in your sketch B is preferred. (4) An experimental licence is necessary.

"TELEPHONY" (Scotland) *asks* (1) *Are the two diagrams submitted suitable for the reception of wireless telephony.* (2) *Would "R" type valves be suitable for use with the receivers referred to.* (3) *Would a C Mark II or A Mark IV low frequency amplifier be suitable as a note magnifier with this combination.* (4) *What size of wire and how many turns are required for the construction of the A.T.I. and closed circuits.*

(1) As the receivers give excellent reception of spark signals, we think you should certainly hear telephony transmissions. (2) "R" type valves may be used with a receiver wired according to the diagram submitted. (3) As suggested, a low frequency amplifier may be added to the receiver, but it should be borne in mind that the purpose of a high frequency connected valve is to amplify very weak signals before applying them to the detector. The low frequency amplifier is to magnify the rectified currents. The high frequency amplifier enables one to obtain a greater range, while the low frequency gives stronger signals. We suggest you use the first valve as a high frequency connected valve, the crystal detector, and a two or three-valve low frequency amplifier. (4) The aerial circuit may be a winding 4″ in diameter and 4″ long of No. 20 D.C.C. The anode winding may be 3″ in diameter and 4″ long of No. 30 S.S.C. with 12 tappings in each winding.

"O.W.M." (Brighton) *asks who are the stations with call signs* **GGB, GGC,** *and* **FNB.**

The first two calls have probably been allotted for special experimental or test purposes. We have no record of them being in permanent or regular use. **FNB** is the call sign of the ship station "Aviateur Roland Garros."

"ZULU" (Catford) *submits a lay-out of a three-valve receiver and asks* (1) *Whether the wiring is correct.* (2) *Whether double-pole throwover switches will do what is required.* (3) *Could a diagram of connections showing the correct values of the components, which would be suitable for the arrangement proposed in* (1), *be given.* (4) *Which method is recommended to safeguard the H.T. and L.T. batteries from short circuits.*

(1) The lay-out is quite suitable from the point of view of ease of wiring and arrangement of apparatus. We do not recommend the wiring of a Dewar type switch for the purpose of connecting or disconnecting coils in the aerial and closed circuits. When it is desired to receive short wave telephony, we suggest you use a three-coil holder, but use coils having a small inductance. The complication and the loss of signal strength occasioned by the inclusion of switches in the aerial and closed circuits is not accompanied by any great gain. (2) Suitable diagrams are given in many recent issues, together with suitable values for the condensers. (3) If desired, a small flash lamp may be used in series with the H.T. battery. The dry cells should be well insulated at all times, and they should not be kept in a damp place. It is as well to disconnect the various units when they are not in use. In the event of a short circuit the flash lamp will burn out, and this will to some extent protect the battery. If you wish to protect the accumulators from short circuits, we suggest you use a small fuse. Suitable fuses may be purchased from several of the manufacturers who advertise in this journal.

"RADIO" (Stourbridge) *refers to the diagram Fig. 2, page 780, September 16th issue, and asks* (1) *Is the high frequency intervalve transformer properly connected when it is desired to use a plug-in type transformer.* (2) *May a variable* 0·005 *mfd. condenser be used in place of the* 0·001 *mfd. fixed condenser shown in the diagram.* (3) *May the reaction coil have the same number of turns as the aerial coil, or will the results be poor if the number of turns is a little different.* (4) *Is a Vernier condenser suitable for use across the primary of the high frequency transformer.*

(1) As the high frequency transformer is of the plug-in type, the L.T. should be connected with the plate; I.P. with + H.T.; I.S. with grid; and O.S. to − L.T. (2) A 0·0005 mfd. variable condenser may be used in place of the fixed condenser if desired. (3) The reaction coil need not have the same number of turns as the aerial coil. In some cases it will require more turns, and in others less. The coil could be provided with two or three tappings for this purpose. (4) A Vernier condenser may be used in place of the 0·0001 mfd. condenser shown in the diagram if desired.

"ZODIACAL" (London) *asks* (1) *How to add a high frequency connected valve before the crystal detector.* (2) *How to prevent the noises which are heard in the receivers.*

(1) We suggest you connect the high frequency valve as shown in Fig. 3. Suitable valves are indicated in the diagram. The anode coil may be a winding 4″ in diameter and 6″ long of No. 30 S.S.C. wire with 18 tappings. The reaction coil

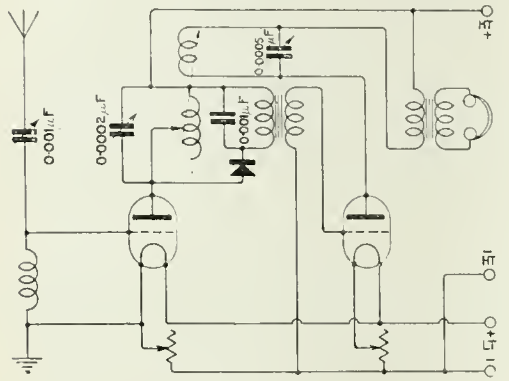


Fig. 3.

may be 3″ in diameter and 4″ long of No. 30 S.S.C. wire with six tappings. The remainder of the apparatus is connected up as shown in the diagram submitted. (2) We suggest you connect the 3 mfd. condenser across the H.T. battery, and a 0·001 mfd. condenser across the telephone transformer, and another 0·001 mfd. condenser across the low frequency transformer which is in circuit with the crystal detector.

"L.B.B." (Weston-super-Mare) *asks whether we can tell him which transmitting station he heard transmitting music and speech in French, while listening-in a short time ago. The wavelength was 440 metres.*

Without a knowledge of the call sign, we cannot identify this station. We would point out that several British experimenters appear to have been transmitting music and speech in French recently, and of course there are a number of French amateurs who are engaged in telephone transmissions.

"T.C.P." (Treorchy) *submits a diagram of connections and asks* (1) *Is the diagram correct: if not, kindly point out the fault.* (2) *Is the aerial quite suitable.*

(1) The diagram of connections is quite correct, but you are not making use of reaction. We suggest you use a 6-volt L.T. battery, and put the aerial tuning condenser marked B in your diagram in series with the A.T.I. The grid condenser and leak should have values of 0·0003 mfds. and 2 megohms. If the tuning arrangement, which is the condenser and plug-in coil, will tune to the wavelength of the signals you wish to receive, you should certainly hear signals. (2) The aerial is quite large enough, but we suggest you take the lead-in from the end nearest the house instead of from the mast end. The lead-in will then drop straight down from the aerial to the lead-in insulator fastened to the house. Great care should be taken with the earth connection, which should be as short as possible and go directly to an earth. A waterpipe may be used if there is one convenient, and the connection with the waterpipe should preferably be soldered. If an earth clip is used, the waterpipe must be thoroughly cleaned and the earth clip securely fastened, otherwise a high resistance earth will result. If the waterpipe is not conveniently situated, we suggest you construct an earth by burying a sheet of galvanised iron of as large an area as possible, two or three feet in the earth. A heavy wire such as 7/22 should be soldered with the earth plate and brought to the instrument.

"H.W." (Birmingham) *refers to the diagram on page* 128, *October 28th issue, and asks whether the wiring is correct.*

The diagram referred to has a small error. The leads to the negative terminals of tho high frequency and the detector valves should be interchanged, when it will be found that the wiring is correct. The operation of the circuit is best seen from the previous figure, which is a theoretical diagram.

"W.R.C." (St. Margarets) *asks whether we have any particulars of multiple microphones.*

We would refer you to the article by Mr. Deloraine, page 156, in November 4th issue. We regret we are unable to give you much information concerning the construction of this type of microphone.

"ROBIN HOOD" (Staffs) *submits a diagram of his receiver and asks* (1) *Whether the anode coil may be used as a reaction coil, or should a second coil be used for reaction.* (2) *Are the tuning arrangements correct.* (3) *How many tappings should be taken off the coils.*

(1) The proposed arrangement is quite suitable, and the anode coil may be used as the reaction coil as desired. It would be better to connect a fixed condenser with a capacity of 0·001 mfds. across the telephone terminals. The tuning arrangements are correct, and you should be able to tune to just beyond 4,000 metres. It would be better, of course, if the aerial circuit were wound with No. 22 D.C.C., the closed circuit with No. 26, and the anode coil with No. 32, but no great loss in signal strength will be noticed, due to the use of a little finer wires. (3) We suggest you take 16 equally spaced tappings from the aerial coil, 8 tappings from the closed circuit coil, and 16 from the anode coil.

SHARE MARKET REPORT

Prices as we go to press on February 16th, are:—

Marconi Ordinary	.. ..	£2 12 6
,, Preference	.. ..	2 5 6
,, Debentures	.. ..	108 0 0
,, Inter. Marine	.. ..	1 8 3
,, Canadian	.. ..	11 0

Radio Corporation of America:—

Ordinary	.. .. ..	15 4
Preference	.. .. ..	13 3

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 185 [No. 22. Vol. XI.] MARCH 3rd, 1923. Weekly

"5 MS."

THE TRANSMITTING STATION OF THE MANCHESTER WIRELESS SOCIETY.

One has heard a good deal recently of the reception in this country, often with inferior or indifferent apparatus, of the transmissions of American amateurs. It is now reported that 5 MS (the C.W. transmitter built and operated by members of the Manchester Wireless Society) has been received in Pittsburg, U.S.A. Below is a copy of a letter from Pittsburg reporting the reception of signals.

(*Copy of letter addressed to Mr. F.H. Schnell, Traffic Manager, American Radio Relay League, from J. B. Westervelt and J.H. Leighmer.*)

Radio 8 ZD.
5306, Westminster Place,
Pittsburg, Pa.
December 12, 1922.

Mr. F. H. Schnell,
Hartford, Ct.

My Dear Mr. Schnell,

I have just learned from Mr. John Leighmer, operator JL of this station and operator of station 8 ALF, that he received signals from a British station signing 5 MS. He gives the time as 0511 G.M.T., December 10th, and says signals were heard until about 0514 G.M.T.

The station sounded like D.C., but was broken up, giving the effect of rectified 25 cycle A.C. QSS was medium, he says.

Wavelength of about 270 metres.

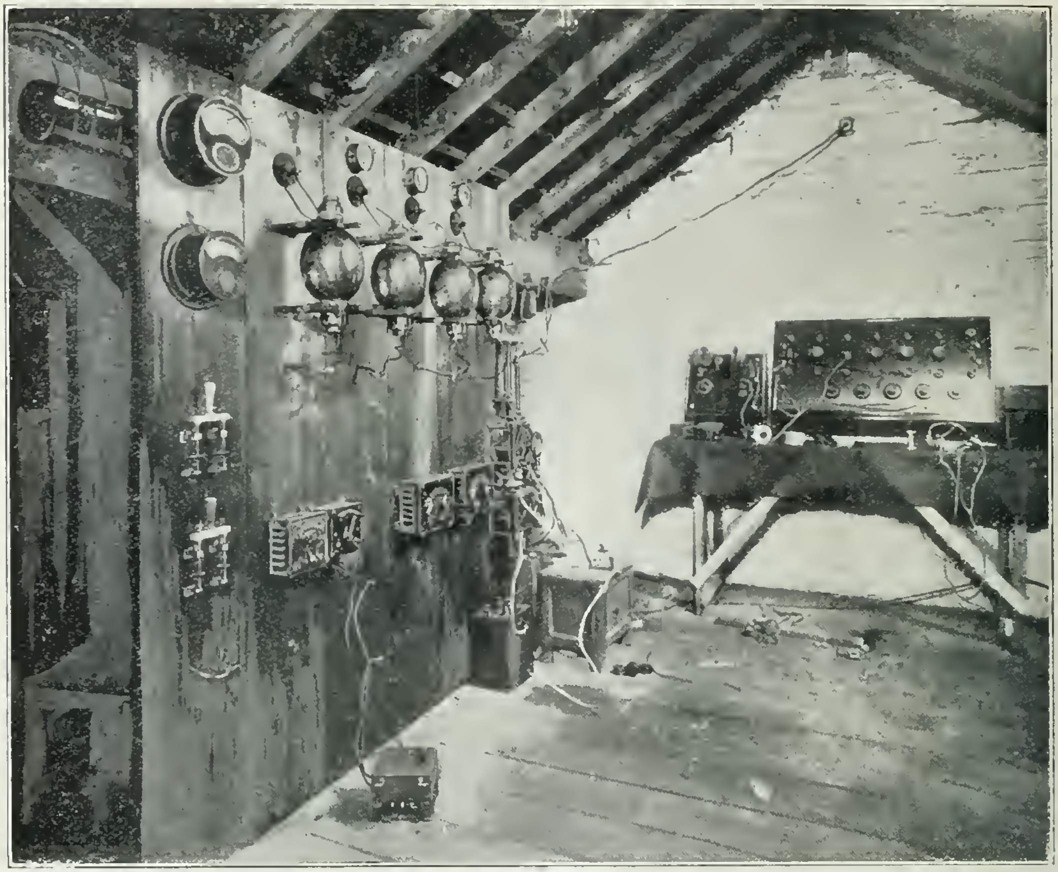
I regret the delay in forwarding this information, and trust that it will be of interest to those concerned.

Very truly yours,
J. B. Westervelt (WX).
John Leighmer (JL).

The aerial. It is 80 *ft. high and the masts are* 120 *ft. apart.*

One Manchester amateur has reported having heard American amateurs discussing by wireless telephony the reception of the signals transmitted from 5MS.

When these reports are confirmed Manchester Wireless Society may stand credited



The Transmitting and Receiving Apparatus.

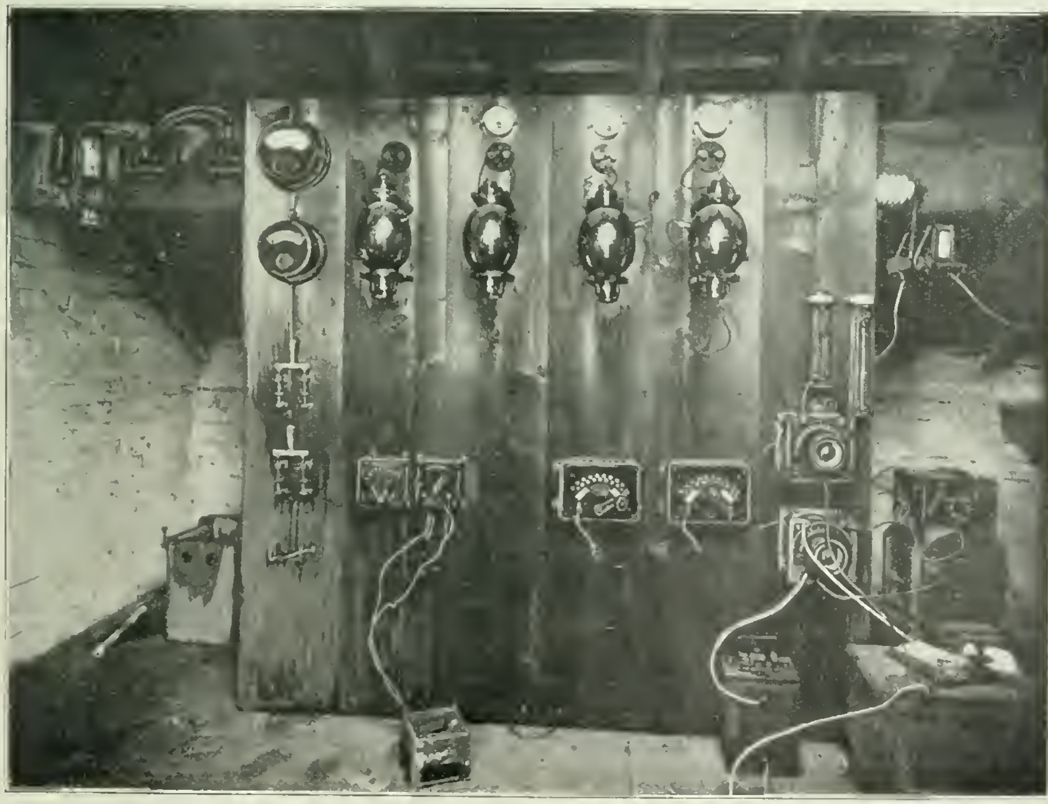
with being the first to have their transmissions received in America, and so it is thought a short discussion of the transmitting apparatus will be of interest.

It is pointed out here that credit should not be given so much for the actual transmission and reception of the signals as for the obstacles and difficulties which have been overcome before the station could be built at all, the chief difficulty being the electric supply, which is 100 volts 80 cycles, single phase. Lack of funds made it impossible to purchase suitable transformers for this periodicity, so recourse had to be made to the nearest available apparatus. The 100 volt 80 cycle mains, supply energy to the high tension transformer, rectifier filament transformer, and power valve filament transformer. Each transformer is provided with a centre tap. The high tension transformer is rated at 200 watts, 100 volts to 10,000 volts, 50 cycles. The primary energy dealt with is something less than 1 kW., so that the transformer is seriously overloaded. The approximate voltage between the centre tap and the anodes of the rectifying valves is 5,000. "U3" type rectifying valves are used, a voltmeter being connected across each filament.

It is obvious that, given an ample supply of current, an efficient filter system should be employed, but this has to be sacrificed so as to eliminate loss in chokes, the result being, probably, not pure C.W., which point was reported upon by the American amateurs who received the transmissions. The oscillating circuit comprises two "T 450" valves, a tuned grid circuit, and a direct coupled aerial. The direct current high tension is connected across a condenser, which is joined in the foot of the aerial system and passes to the anode of the two valves in parallel from the A.T.I. and anode tap. The anode tap is variable to secure the best efficiency. The earth is connected with the centre points of the filament transformers, and to the grid circuit. The grid circuit comprises a coil coupled with the A.T.I., and is tuned with a small variable condenser, the vanes of which are widely spaced to withstand the voltage. The grid condenser and leak are both variable and the key is arranged to connect or disconnect the grid leak with the grid condenser. Additional cells up to about 70 volts are connected to provide more negative on the grids of the valves.

Contrary to usual ideas about a direct coupled aerial not being conducive to sharp tuning, it was found in this instance that the reverse result was obtained owing to every part of the circuit being variable, enabling very critical adjustments to be made. This point was particularly and favourably reported upon by a good many members of the wireless fraternity. The aerial is of the sausage type, connected "T" fashion. The horizontal cage comprises six wires arranged round suitable hoops, and is supported between masts 80 feet high and 120 feet apart. The lead-in is also in the form of the six wires spaced round the small loops, and is taken from the electrical centre of the aerial.

The earth consists of a number of wires buried in the ground at water level, and run the whole length of the aerial. When the set is properly adjusted, the aerial ammeter connected in the aerial circuits reads 9 amperes, which is considered very good, observing that the actual input is less than 1 kW. This particular circuit when being experimented with previous to the actual tests, and using the same apparatus, but with a D.C. supply of 2,500 volts, registered an aerial current of 12 amps., with an input of 1 kW. It has been decided to continue tests each Sunday, using alternate stations 5 MS and 5 MT, until further notice. Any reports will be appreciated, and should be forwarded to the Hon. Secretary, Manchester Wireless Society, 2,



Another view of the Transmitter. The mounting of the components permits of ample spacing and easy access to the high tension equipment which is assembled behind.

Parkside Road, Princess Road, Manchester, stating particulars of receiver, strength and characteristics of signals. The wavelength will be as near 200 metres as possible.

The thanks of the Society are due to the Marconi-Osram Valve Company, and the Mullard Radio Valve Company, for the loan of the transmitting valves. Also to Messrs. Burndept, Ltd., for the advice given on various technical points. Mr. J. H. Brown, Vice-President of the Society, made success possible by providing the best facilities as regards accommodation for the complete station.

Notes on Rectified A.C. for Plate Circuits.

By MORTIMER A. CODD.

WHILE carrying out investigations on electrolytic rectifiers during the past twelve months, certain experiments were tried with the view to employing rectified A.C. to feed the plate circuit of one or more valves.

In the first place it was necessary to ascertain the order of the current flowing in the circuit using the normal type of reception valves.

The current from a 50-volt dry battery in good condition was passed through a standard laboratory Weston milliammeter.

Using up to seven valves, the current varied from 1 to 2 millamperes per valve, thus with three H.F., one rectifier and two L.F. valves the current used was from 8 to 12 milliamperes.

This experiment is most instructive, the variation in current with the different conditions of tuning, etc., being most illuminating.

As the current required is so minute, quite a small rectifying cell will suffice. Fig 1 gives a diagram from which it will be seen that the "middle point" method of connection is employed.

Fig. 2 is an oscillograph of the voltage curve taken directly over the rectifier. It will be noticed that the lowest point of the rectified wave is considerably above the zero line. This is due, possibly, to the capacity of the aluminium electrodes which even when small have a very considerable capacity.

The writer suggests this property may adventitiously aid in smoothing the resultant current when passed through the series choke coil.

In measuring the current at this point it should be borne in mind that the usual moving coil instrument cannot be used since the current is pulsating and the instrument therefore itself acts as a very efficient choke.

In this case a Paul vacuo-junction thermal milliammeter was used.

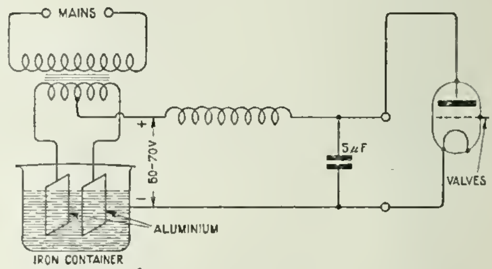


Fig. 1. The Electrolytic Rectifier and smoothing circuit.

In order to smooth out the rectified current a choke was inserted in series as shown in the diagram, the value of the self induction being of the order of 25 henries. Probably two smaller chokes, one inserted in each leg, would give better results, besides presenting a more symmetrical arrangement.

The condenser, as shown, was very necessary, the value being varied on trial from 0·1 to 10 microfarads.

Quite good results were obtained with 0·5 microfarads, but 5 microfarads gave perfect results. Fig. 3 is an oscillograph of the voltage curve of the filtered wave, so near to

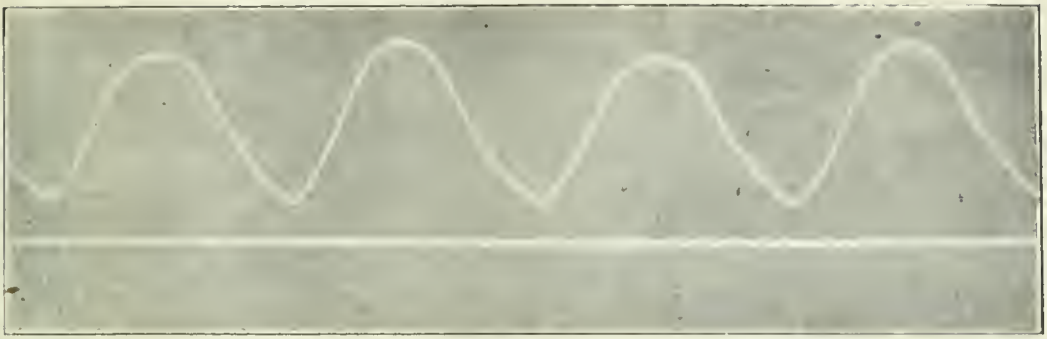


Fig. 2. Voltage as derived from the Rectifier with a 50 cycle supply.

continuity as barely to be distinguishable from a straight line.

Both Figs. 2 and 3 are voltage curves, and are so similar to the corresponding current curves which were also taken that their reproduction is unnecessary.

This system seems to present certain advantages not only for reception, but for transmission. Further, by employing a coarse winding on the transformer it would be possible to charge the filament batteries also or even to dispense with them altogether.

Fig. 3. Voltage after passing Rectifier and smoothing choke and condenser. Frequency 50 cycles.

Illegal Use of Wireless Apparatus

The announcement which has recently appeared in the daily press of the first prosecution by the Post Office of a person using a wireless receiving set without a licence will not come as a surprise to readers of this journal. In these pages, the necessity of keeping within the law has been persistently pointed out, and even at a time when it was becoming very difficult for those desiring to conduct experiments to obtain the necessary experimental licence, an endeavour to meet the difficulties was made in an article which appeared on page 394 in the issue dated December 23, 1922. In this article, the issue of an additional type of licence for those who desired to make up their own sets was advocated for the first time. It was of interest to note that very shortly after this article had appeared, the Post Office did actually start to authorise the making up of receivers from components, thereby introducing just such an additional type of licence as had been suggested.

The importance of obtaining a licence before using wireless apparatus, and making quite certain that the licence obtained is one applicable to the type of apparatus, is a matter which the wireless societies in particular are in a special position to impress upon those who, being new to the subject, may be unacquainted with the existing conditions.

Semi-Aperiodic H.F. Transformers

By J. H. REEVES, M.B.E.

(*Continued from page 684 of previous issue.*)

IN a footnote in the first part of this article attention was drawn to the changes in optimum wavelength produced by various types of panel and valves, hence the three panels will be described on which these transformers have been tested.

Panel A.—A photograph of this appears in Fig. 8, and the scheme of its wiring in Fig. 9. It will be noted that low capacity has been the aim throughout.

Panel B.—This is identical in layout and wiring except that ordinary R type, four-pin valves are used.

Panel C.—This belonged to a friend, and was arranged for valve socket transformers, disc type, with variable condenser tuning across each primary.

As illustrating the great differences it may here be said that suitable transformers for the broadcasting band were found to have 350, 250, 110, turns in the primary respectively on A, B, and C.

The size of wire finally selected, as well as the $4\frac{1}{4}$ ins. standardised length, were chosen as results of measurements made on the experimental panel, and are therefore most suitable for panel B. Modifications have been necessary to suit panel A. The choice of gauge is determined by two considerations (1) if too fine it is hard to wind evenly; (2) if too large transformers for longer wavelengths become unwieldy. Tests have been made with wires running from 40 to 47 S.W.G., double and single silk covered, the final choice being 45 S.W.G., D.S.C., constantan wire supplied by the Concordia Electric Wire Company, and sometimes for the secondaries 42 S.W.G., S.S.C. copper. The H.R. wire winds 185-190 turns to 1 in., and on panel B 600 turns, primary and secondary, gave excellent results

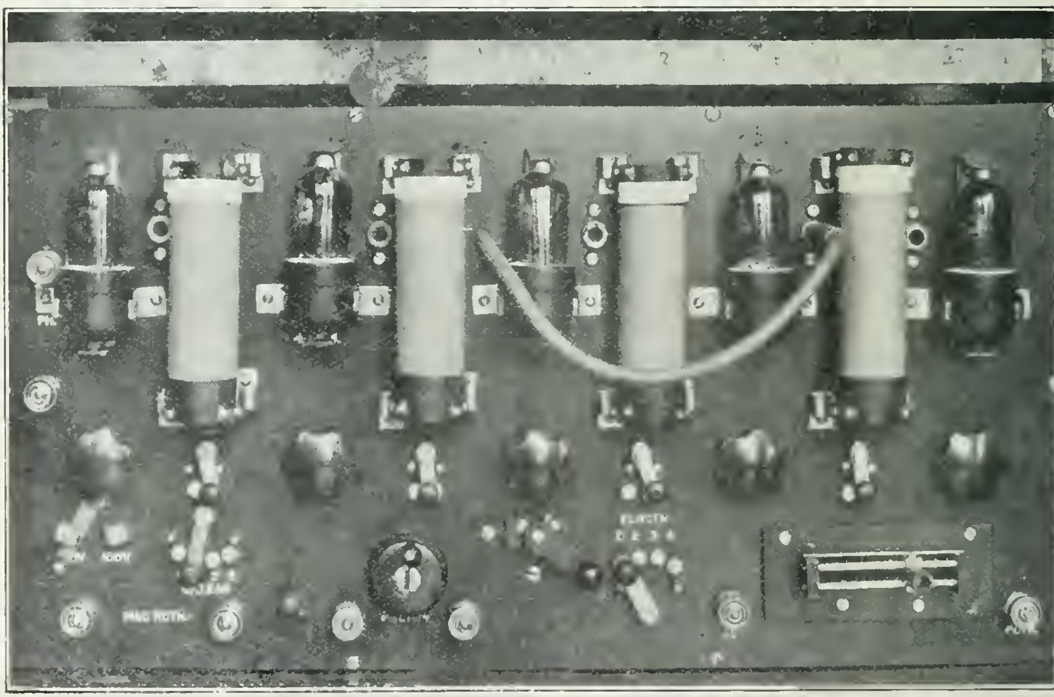


Fig. 8. High Frequency Amplifier employing the Transformer described and designed to give a minimum of capacity in wiring and arrangement. Break jacks permit of the use of the required degree of amplification.

on 900 metres with a band of approximately 600-1,500 for fairly efficient amplification. This number winds nicely into the standard $4\frac{1}{4}$ ins. body.

The primaries were originally wound directly on to the ebonite body; a few have recently been wound with the body first surrounded by paper. These have not yet been fully tested as regards efficiency of reception, but so far as this has been done the improvement is most marked.

Between the layers were tried oiled silk and empire cloth; these were found to give difficulty in winding the secondaries quite evenly, and for them was substituted celluloid from disused photograph negatives cleared of gelatine, of the order 0·003 in. thick.

Mechanically this proved perfect, but in deference to the expressed opinion that electrically celluloid is bad, paper has been substituted. If this latter is damped, pasted on, and then well dried, it gives a winding surface equal to celluloid, but the coils so wound have not yet been tested properly.

Experiments were made to see if any step-up effect could be obtained by winding more turns on the secondaries; for instance, on panel B, four were tried, all with primaries 280 turns, and secondaries 280, 300, 350, 400 turns. Of these the 350 was best, but not much better than the 280 and 300. The 400 was decidedly inferior. On others about the same proportion seemed to hold, and a useful guide may be put down as follows: secondary = primary + 20 per cent.

It will be tedious to give further details as to the number of turns, as with the exception of those suitable for the 200 metre band a convenient rule seems to have shown itself as follows :—

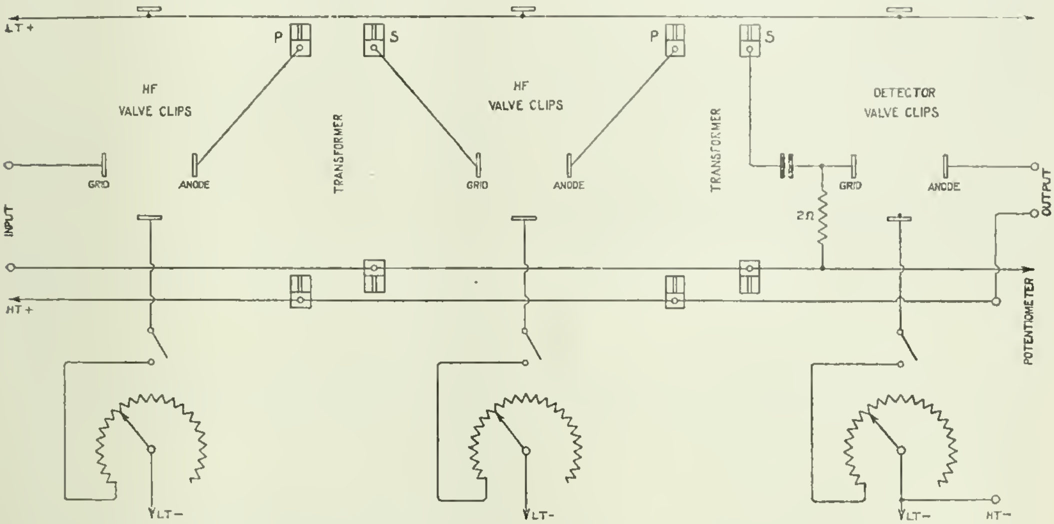


Fig. 9. Wiring lay-out of the H.F. Amplifier showing the special arrangement of the leads.

For Panels of Type B.

Primary, 45 *S.W.G., H.R. D.S.C.*

Secondary, 45 *S.W.G., H.R. D.S.C., or copper* 42 *S.W.G. S.S.C.*

Number of turns on primary = $\frac{2}{3}$ *wavelength in metres.*

Number of turns on secondary = primary + 20 *per cent.*

N.B.—For 200 *metres* 100 *and* 130, *to* 110 *and* 150 *seems about right.*

For Panels of Type A.

In the above rule for $\frac{2}{3}$ *substitute* $\frac{6}{7}$.

For Panels of Type C.

So very much depends on the wiring and switch gear that no hard and fast rule can be given, but on the friend's panel one of 110-150, both 40 S.W.G. copper, with an 0·0003 condenser tuning proved very good at 400 metres.

One will be given for panel type A.

Primary 350 H.R., secondary 400 copper, optimum wavelength about 390 metres. Primary wound over paper, paper between layers. Three of these could be worked without much trouble from self oscillation, and a fourth, all H.R., could be added. These have given quite respectable amplification at 190 and 600 metres.

Experiments have been made to substitute for the transformers a resistance capacity coupling to fit the same clips. These are illustrated in Fig. 10. They have only been in use a short while, but the first tests show great promise for longer wavelengths. The problem of a suitable transformer on the A type panel for 900-1,500 has not yet been solved.

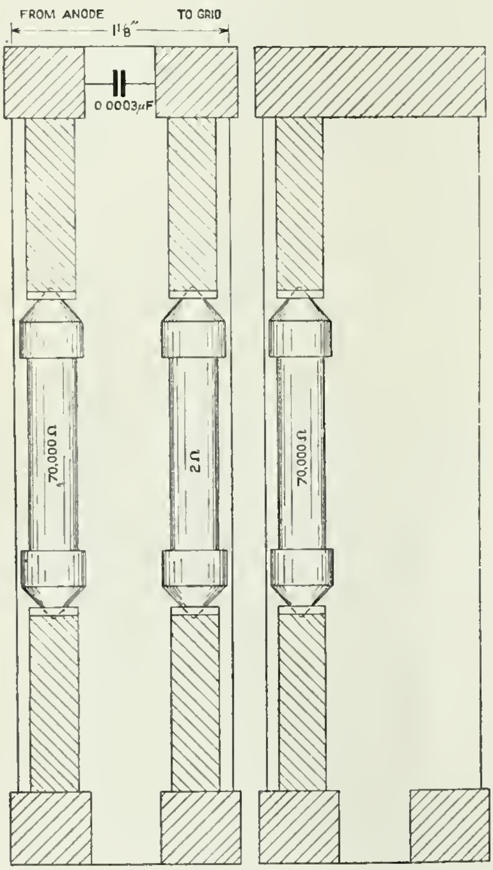


Fig. 10. Resistance-capacity units to replace transformers on longer wavelengths.

One consideration has not been tried, *viz.*, seeing that sometimes only part of the body is used, would it not be better to wind with rather larger wire? Several transformers have thus been wound, and the only point which seems definitely settled is that rather more turns are required as the size of wire increases.

One more point has been considered and tested. In laying out a multi-valve H.F. panel provision has to be made for using less than the full number of valves. Two such methods are illustrated in Fig. (*a*) and (*b*).

The first was founded on the practice in the 7-valve amplifier previously mentioned; the second is by means of an ordinary telephone jack and plug. This latter will be noted in the photo of the panel (Fig. 8), and this type found preference, but it will be noticed that the insertion of the aerial plug introduces a small capacity leak to earth through the secondary. If consequent loss of efficiency is of importance the removal of the transformer immediately preceding the first valve in use ought to increase signal strength. On the B type panel such loss was not definitely established, but there is no doubt about it being present in the A type. A simple remedy lies in pulling forward the top ends of the transformers not in use, the friction of the lower clips proving quite sufficient to hold the transformers in a slightly inclined position.

In connection with the use of a variable number of H.F. valves it should be noted

(1) That each additional valve brought into action alters the sign of the reaction, hence, if this be used a reversing switch should be in the reaction circuit. In any case this switch is a useful addition.

(2) That as the impulses increase from the first to last H.F. valve, varying degrees of filament brightness may be necessary. Hence the provision of separate filament

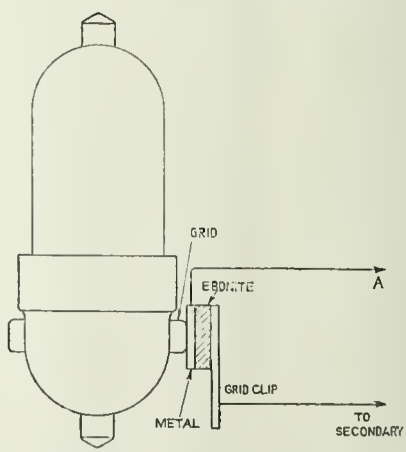


Fig. 11(a). A method of tapping-in on to the grid circuits to vary the number of valves used.

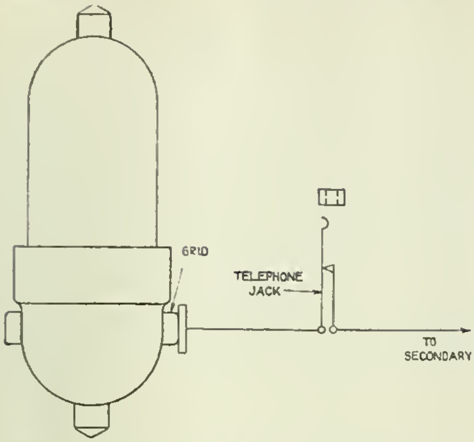


Fig. 11(*b*). *Another method of breaking-in on the grid circuits.*

control to each valve. It was found that the valves were distinctly sensitive to this control, hence the fitting of a separate on and off switch to each so that on putting a valve out of action its rheostat adjustment may remain in what has been found to be its best.

In conclusion, these tests and numbers can only form a small portion of data collected years ago in the research departments of the manufacturing companies, obtained, as they are, at the expenditure of time and money and past experience. The writer hopes that in bringing these details to the knowledge of amateur workers he will induce others to come forward and give their own results for mutual benefit.

Looking after the Filament Battery.

ADVICE ON KEEPING ACCUMULATORS IN GOOD CONDITION.

MANY broadcast listeners-in are being introduced to the use of accumulators for the first time, and it is well to point out a few of the difficulties met with in maintaining accumulators in good condition so that they may give reliable service and have long life.

One of the greatest contributory causes of deterioration in an accumulator battery is through overworking it—that is, employing a battery which has insufficient capacity for the amount of the current which it is required to give. Accumulators are rated in ampere hours, and the user must satisfy himself that the ampere hour capacity as stated on the label is *actual*, and not the rating with regard to intermittent discharge such as would be the case were it used for motor car ignition purposes. The actual capacity of an accumulator is exactly half the stated " ignition " rating. An accumulator having an actual capacity of say, 60 ampere hours, should be capable of, delivering a current of 2 amperes for 30 hours, or 3 amperes for 20 hours and so on. Each receiving valve requires a current of about 0·8 amperes, and thus the total number of hours which an accumulator should run a receiver before recharging can be arrived at by multiplying the number of valves with which the set is fitted by 0·8, and dividing the actual ampere hour capacity by the product.

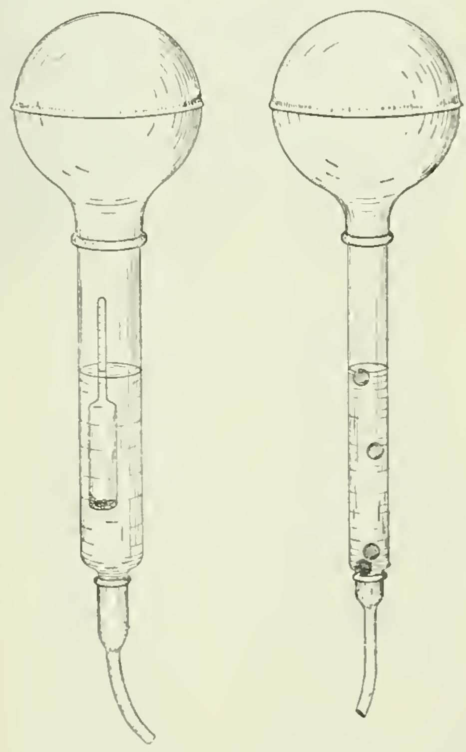
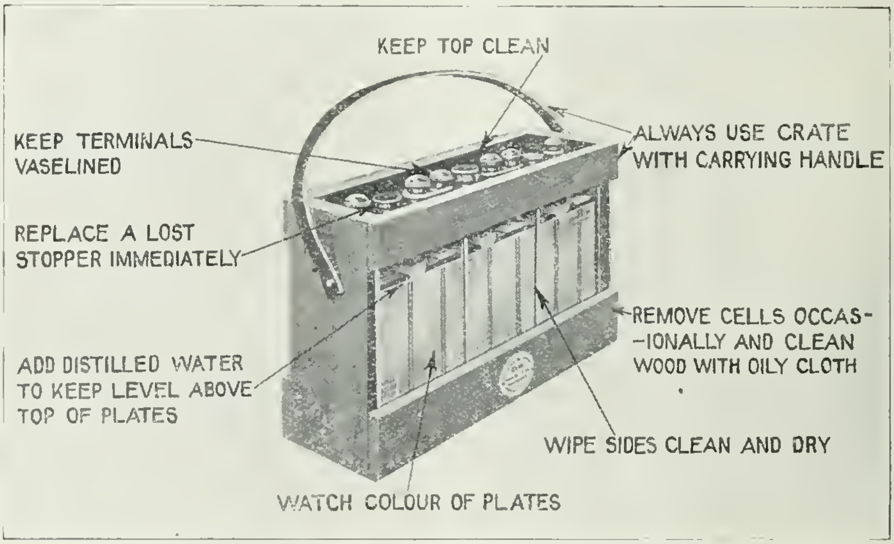


Fig. 1. *Fig.* 2.

Types of Hydrometers.

When purchasing an accumulator, it is worth while asking the retailer to give it the first charge, as this needs to be carried out with care. For the purchaser who charges his own accumulators, instructions are usually provided on the battery, and a point of great importance is that the first charge should be carried out slowly, and charging should be continued until the battery gasses freely.

One very good method of charging a new accumulator by which it is possible to ensure that the acid in the charged cell is of the right specific gravity, is to fill the accumulator with acid having a gravity of 1·200, charge for the required time as stated on the accumulator, and then discard the original acid and refill with fresh acid having a gravity of 1·250. It is the gravity of the acid which is the best guide as to the condition of an accumulator, and in order that it may vary through the required range, the method by which the accumulator is filled with acid of the correct gravity when fully charged is recommended.



A Portable 6-volt. accumulator, suitable for use with a receiver having several valve amplifiers. Accumulators must be carefully looked after to maintain them in good condition.

It is best to procure acid specially made up for accumulator work and of the required gravity. This diluted acid is made up from pure sulphuric acid and distilled water, and can consequently be relied upon to be free from impurity. If this cannot be obtained, pure sulphuric acid must be purchased having a gravity of 1·835 and diluted to the required strength with distilled water. The operation must be carried out with caution as considerable heat is involved when acid and water are brought together, and on no account must the water be poured into the acid, as the great evolution of heat will set up spontaneous boiling, and the liquid will froth vigorously. The acid should be carefully measured out, and slowly poured whilst stirring into the distilled water, allowing the mixture to cool should the temperature rise too rapidly. Only glass and china receptacles must be used for sulphuric acid, and care must be taken to see that no foreign matter is present. Four parts of distilled water and one part of acid produce a diluted solution having approximately the correct specific gravity with 1·200.

In order to easily determine the specific gravity of the acid in an accumulator, a hydrometer of the type shown in Fig. 1 is recommended as it permits of the drawing off of acid from the accumulator. Another type (Fig. 2), in which coloured glass beads are employed instead of a floating hydrometer, is equally useful, beads of certain colours being arranged to float, while others sink, according to the gravity of the acid in which they are suspended.

An article on the home charging of accumulators from D.C. mains appeared in a recent issue.* whilst numerous devices to permit of charging from A.C. mains have been described from time to time.†

When circumstances necessitate the taking of the accumulator to a local electrician or garage for charging, the user should make the same observations with regard to the density of the acid as if he were charging the accumulator himself. The condition of the accumulator can then be watched and any indication of deterioration observed.

The gravity of the electrolyte in the cells should be taken when fully charged and when discharged, and the two figures should differ from one another by about 0·025.

The colour of the plates, too, is an indication as to the condition of the battery. When discharged, the positive plates will have a reddish-brown colour and the negatives a dark grey, whilst when fully charged, the positive plates should be a dark chocolate colour and the negatives whitish-grey.

It is important that the electrolyte should be kept above the top of the plates, and this level is usually kept up by adding distilled water, though, if there is any indication that the gravity is too low, a little dilute acid may be put into the cell. The quantity of electrolyte in the cell becomes less, partly because of the evaporation, and also because of the electrolysis of the water during charging. It must be remembered that the water only is disposed of, and not the acid, hence the reason for adding water, and not sulphuric acid, to a cell which requires filling up.

An accumulator must not be left in a discharged condition, but, as soon as it is observed that the voltage is falling off (as would be indicated, of course, by a dimming of the filaments) it should be put on charge as early as possible. There is no detrimental action in more or less completely discharging an accumulator, provided it is put on charge immediately, and charging continued until the gravity indicates between 1·225 and 1·250. Immediately after being taken off charge, the voltage of the accumulator should be about 2·5 volts per cell, as may be easily determined with a small pocket-type voltmeter.

Expanding of the plates, particularly of the positives, is a frequent trouble and is indicated by a bulging of the case. The only remedy is to remove the plates, clean them, and file the edges. If this is not done the case may develop a leak, or the positive plates buckle so much that small pieces of paste will bridge them in contact with the negatives.

Frothing during charging is frequently a serious trouble with an accumulator, and should this occur with a more or less new cell, the user should refer the matter to the manufacturers, as it is usually due to unsuitable celluloid being employed for making the case.

Accumulator batteries must be kept clean. The top of the cases should be wiped down free from acid and dust from time to time, and the screw terminals removed, cleaned if necessary, and thoroughly smeared over with vaseline.

Sediment in the bottom of the celluloid container must be looked for, and should it become so deep that it makes contact with the plates, the cell should be thoroughly washed out and refilled with new electrolyte. It is usual, however, to leave a liberal space between the plates and the bottom of the container so that quite a lot of paste may fall from the plates before contact with them is likely. One of the chief causes for paste falling from the plates is charging and discharging at excessive rates. As far as charging is concerned, the instructions on the cell may, of course, be adhered to, but, when discharging, one should estimate the current which it is required to deliver by multiplying the number of valves which it operates by 0·8.

* P. 559, Jan. 27th, 1923, and p. 692, Feb. 24th, 1923.

† P. 318, June 10th, 1922, p. 397, June 24th, 1922, and p. 535, Jan. 20th, 1923.

The Condenser across the H.T.

Although the experienced amateur always adopts the practice of bridging the terminals of his H.T. battery with a condenser, doubt seems to exist as to the most suitable capacity. The internal resistance of the battery may be as high as 100 or 200 ohms. Such a resistance is undesirable in high or low frequency circuits, particularly if it is common to a number of valves.

The condenser used should have a value of about 2 microfarads in order that it may bypass currents at the frequency usual to telephony.

The Elementary Principles of Radio Telephony*

By G. G. BLAKE, M.I.E.E., A.Inst.P.

SINCE the inauguration of the London Wireless Society in 1913, many changes have taken place in the world of "Wireless." The Society has recently been renamed "The Radio Society of Great Britain," this change of name being made for two reasons; firstly, because ever since our inception we have been the body which has acted as the mouthpiece of the amateur on all occasions when it has been felt necessary to approach the Post Office, and it was felt that, as our work was of a national character, we could represent the amateur with even greater strength under this new title. The name "Radio" was chosen owing to the fact that it is rapidly replacing the old term "Wireless," and has now been adopted in all countries as an international word.

As far back as 1903 or 1904, and even prior to that date, many of those present to-night, including myself, commenced experimenting in radiotelegraphy, and we have had the pleasure of seeing the science grow with astonishing rapidity.

There are now some hundreds of societies all over the country, the most important of which are affiliated to the Radio Society of Great Britain, and I think it is fair to say that it is mainly owing to the work and growth of the "wireless" amateurs that Broadcasting has been established. As you know, a company has been organised which undertakes to transmit items of news, weather reports, lectures and concerts. Already they have commenced working their stations in London, Birmingham, Manchester and Newcastle.

There are two distinct types of listener. First there is the old amateur, holding an experimental licence, who is engaged in experimenting with a view to acquiring all the knowledge he can about the circuits which he employs, and in making improvements, and the more advanced workers occupying themselves in carrying out serious research work. Then there is the "broadcast listener," who has a "broadcast" licence, which only permits him to use apparatus having the stamp of the Broadcasting Company, and he uses his instruments for the sake of the information and entertainment which he receives.

There are a great number of receiving sets at various prices which he can buy, and if he gets a selective one, it is possible for him to sit in his own room at home and listen to either of the broadcast concerts he likes, and to reject the others by merely turning a couple of handles.

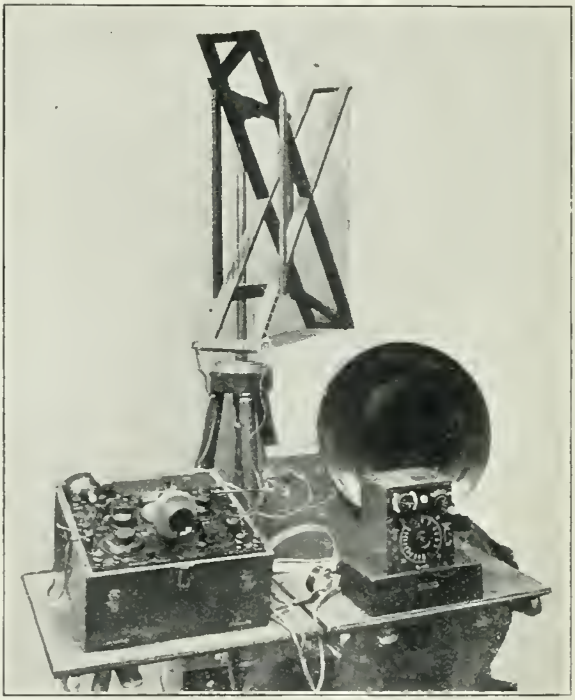


Fig. 1. Receiving Apparatus used during the Lecture.

At this point there is a very important matter to which I would like to call your attention. I have heard of a good many complaints from broadcast listeners, to the effect that they cannot hear the broadcast concerts as they are being jammed by other stations and amateur transmissions.

In these days the Post Office is rightly very particular in the granting of a transmitting licence, to ensure that the applicant shall have sufficient technical knowledge to prevent him from making use of an improper wavelength and so interfering with other stations. Amateur transmitters are using a band of wavelengths ranging from 150 to 200 metres, and a fixed wave of 440 metres. The London Broadcasting Station transmits on a wave of 369 metres, Manchester on 385, Birmingham on 425 and Newcastle on 400.

The tuning of C.W. and radiotelephone stations is sharp, and while we all experience a certain amount of jamming, particularly from spark stations, I would point out that if the broadcast listener is getting undue interference it is probably owing to his receiving set not being sufficiently selective in its tuning arrangements. Of course if he buys the cheapest possible set he cannot expect the Broadcasting Company (or a firm connected therewith) to supply him with anything

* An Experimental Lecture delivered before the Radio Society of Great Britain on January 12th, 1923.

else; but I would point out that he must not throw all the blame on the amateur transmitter. He has the remedy in his own hands, for he can buy a selective set by paying a little more for it, and he should then be able to cut out the interference.

For at least a couple of years music has been transmitted from the Hague in Holland. Recently the arrangements have been taken over by the *Daily Mail*, and concerts are still being transmitted from that station every Sunday afternoon from 3 till 5, on a wavelength of 1,050 metres. Then we have concerts transmitted from the Eiffel Tower in Paris, on a wavelength of 2,600 metres, also concerts transmitted by "La Société Française" (also from Paris), every evening at 8.45 till 10 on a wavelength of 1,565 metres, and in fact if we get many more stations transmitting we shall soon be able to hear more than we want.

The Committee of our Society feels that with the influx of the new class of wireless (perhaps I had better say Radio) listener, it now becomes our work to gather them together as a new class of amateur, and it devolves upon us to do all we can to look after and protect their interests. With this in view we recently formed a new section which anyone holding a broadcast listener's licence may join, and we propose to give lectures to them, and to hold special meetings for them from time to time.

We are also asking our affiliated Societies to do the same wherever possible. We expect that there will be many "broadcast listeners" who will get interested in the technical part of the subject and who will welcome our lectures and our help, so that the "broadcast listener" of to-day may become the experimenter of tomorrow. With this object we shall specially endeavour to make the lectures given to this section of our Society popular and instructive in character. All those who are admitted to this Section will be known as Associates of the Radio Society of Great Britain. As this is the inaugural lecture, I propose to make it an introduction to the study of radiotelegraphy, so as to leave the field quite open for subsequent lecturers.

The scientist, as you know, in order to account for certain phenomena, is in the habit of making postulates or theories These he is equally ready to discard or replace by others as soon as he finds some fact which does not fit in with his scheme of things or discovers some more plausible theory.

In order to explain light, X-rays, radiotelegraphy, etc., we believe there must be some medium present which, though we have never seen it, is there, and is capable of conveying wave motion. To this intangible and omnipresent medium we give the name "Ether."

At the present time, owing to the work of Einstein, the ether theory, which we radio men feel it is almost impossible to do without, is in the melting pot; but if it is dying it is making a hard fight, for many of our leading scientists still believe in the necessity for its existence. We cannot hope tonight to decide which school of thought is right: but as thoughts of the existence of the ether assist us in our study of radiotelephony, and account for all the facts we so far know concerning this branch of science, we will be of those who take its existence for granted.

Radiotelephony is a subject which possesses great fascination both to the engineer and to the man in the street; it is little short of a modern miracle. How, one asks, is it possible for the audience in this hall to hear music and speech taking place miles away, while the people next door are not conscious that any sounds are passing them? Can it be possible that these sounds are being transmitted for so many miles and arrive at their right destination without any telegraph or telephone wires connecting the two places? How is it that when several people are telephoning wirelessly at the same moment they do not create an unintelligible babble of voices? I hope this evening to make these points more understandable, and by actual demonstration to prove to you the truth of these seeming miracles.

I first want to give you just a fleeting glimpse of this part of the universe as scientists see it. We will try for a few minutes to forget that we are in this lecture hall, and let us imagine ourselves looking down upon our earth as it travels round the sun. It progresses at the rate of seventeen miles per second, and even at this enormous pace it takes a whole year to complete one journey round it. This speed so far exceeds our conception that it gave very just occasion for a remark of Lichtenberg, that while a man salutes another in the street he goes many miles bareheaded without catching cold. The earth takes, as I said, a whole year to complete its circuit around the sun; this gives us some conception of the relative smallness of our earth compared to the infinity of space wherein it moves. Now it is to this apparently empty space in which the far off stars and the solar system with all its planets exist, that I particularly wish to direct your attention.

Is it as empty as it at first sight seems? If it is empty, how can the light from the sun reach us across nothingness?

Science has analysed the rays of light and found that they are waves. Waves of what? That is the question. We know that they are not waves of air, as our atmosphere only exists a comparatively few miles around our earth, also light will pass across a vessel from which all air has been removed.

Again, as wind makes no difference to the strength of light or of radio signals, it cannot be the air which conveys them.

We therefore believe that all space is filled with something which we call the ether, which is capable of transmitting wave motion.

As we are able to see light through air, it is obvious that the ether permeates it. We know that X-rays will penetrate through all solid bodies; these rays are really vibrations of the ether of very short wavelength. It is obvious that this infinite ocean of ether permeates all things, including ourselves. We are in some respects like little fishes in an infinite ocean; the ocean in which we live is imperceptible to any of our senses. When we move in it, it passes through between the atoms of which we are made. We cannot feel it as it offers no resistance to our motion, we cannot smell it, see it, or hear any sound of it. The fact that it penetrates through what our senses tell us is solid matter proves to us how crude are our senses, and that in reality matter is by no means as solid as we have supposed.

Sir Oliver Lodge (who is an honorary member of this Society) once showed a very pretty experiment illustrating this. He filled a length of india-rubber tube with water, this he attached to a small motor, which caused it to rotate with great velocity. The motor was then suddenly stopped, and he showed that as long as the water in the tube continued in motion the tube exhibited the properties of a solid rod.

Imagine this spectrum drawn out at each end so that it covers a length at least 53 times that of the strip you see before you on the screen; it would then reach approximately from here (Savoy Street, Embankment) to the Strand (Fig. 3).

Down below the last visible violet rays you would come to what we call the ultra violet rays. Although these rays are so short that our eyes cannot see them, their presence can readily be

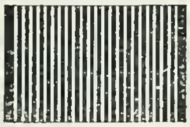


Fig. 2. The two components of a mechanical lantern slide for demonstrating wave motion. The white lines represent the transparent portions. The grid and wave line stand face to face in the lantern, giving a number of dots on the screen, and as the wave line travels past the grid, the effect of wave motion is produced. (Reproduced by the courtesy of Dr. J. A. Fleming.)

This slide (shown in Fig. 2), which Professor Fleming, one of our Vice-Presidents, has kindly allowed me to copy from a slide which he showed at the Royal Institution Christmas Lectures last year, will serve to illustrate wave motion. I want you to keep your eyes on the red dot which you see in the centre of the dotted line on the screen. You will notice that while the wave actually travels across the screen, the little dot, and in fact all the dots of which the line is composed, only move up and down in a straight line vertically.

When we see a ray of say, red light, it represents a series of such waves in the ether, all of one wavelength, reaching our eyes from the source of light. White light is made up of a number of rays of different wavelengths all travelling at the same speed, namely 186,000 miles per second, and all impinging on our eyes at the same moment of time.

(*The lecturer here showed a band of white light.*)

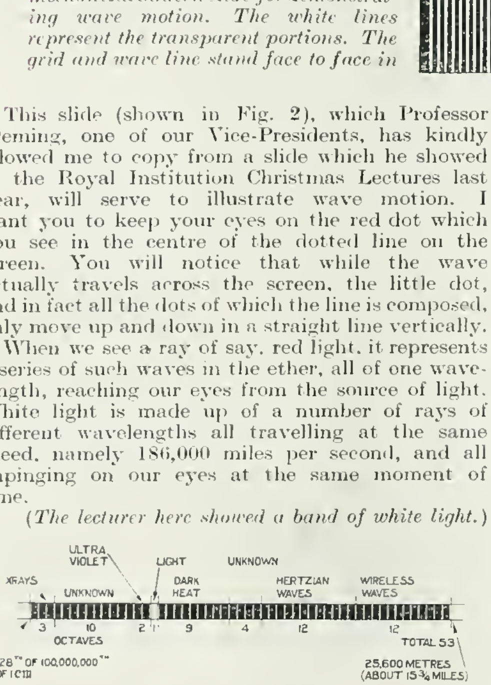


Fig. 3. The comparative frequencies of the known ether waves. The white portion represents those frequencies to which the eyes are sensitive.

By means of a prism we can separate out the rays composing this strip of white light so that each wavelength is allowed to reach our eyes independently of the others. *A colour slide of the spectrum was shown on the screen.*

Thus we see that the light was composed of violet, indigo, blue, green, yellow, orange, and red. (One octave.)

But these visible waves are by no means all the waves that are there. Far shorter waves are to be found below the violet, and much longer waves beyond the red.

detected, as I will presently show. Below these again we come to still other vibrations of such minute wavelength that they can freely pass through the spaces between the atoms in solid matter. These are known as X-rays.

Fig. 4 is an ordinary photograph of a small wireless set, and Fig. 5 is an X-ray picture of the same object, which shows how transparent it is to the X-rays.

(*By means of an X-ray apparatus and a large screen, transparency of the human body was demonstrated, and the heart of a member of the audience was shown beating*.)

Referring again to the spectrum, beyond the red end we come to infra-red radiations; beyond these again we have waves of much greater length, known as Hertzian waves, and it is these waves that we employ for radiotelegraphy and telephony.

It may help you to get a better grasp of what is involved by the presence of all these varying wavelengths in the ether, if I give you an illustration.

Suppose one of our greatest artists, say Turner, had seen all the beauty in a landscape it was possible for a man to see, he was only able to see less than one fifty-third of the colours which were there, for the visible spectrum is made up of only one fifty-third of the ether waves which are at present known to science; our eyes are blind to all the rest.

It has produced in me a feeling of awe and wonder, when I have stood with a number of other people in a garden of flowers of varied hue, to think how the light of the sun, made up as it is of all the colours, shines down upon them, and how each flower absorbs the energy of certain waves, reflecting others in all directions; yet however great the crowd, each person is conscious of the colour waves reflected from each flower. When one considers the immense number of waves, crossing and recrossing in every direction, without causing any interference with one another, it is hard to conceive it possible.

Yet, there it is, and not only the waves we see are there, but a far greater number which to us are invisible.

We cannot contemplate such wonders as these without a feeling of awe. Surely here is evidence of a master mind which conceived it all. One cannot believe that such laws as govern these wonders came into being by blind chance.

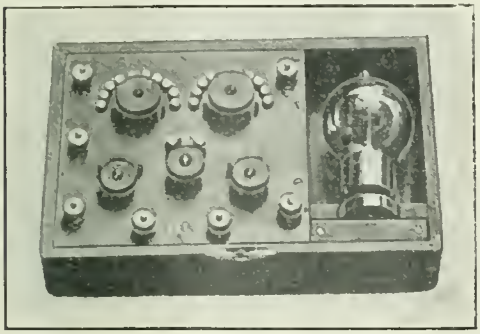


Fig. 4. A small wireless instrument as the eye discerns it with the aid of ether oscillations of a limited range of frequencies.

I will now endeavour to demonstrate to you the presence of some of the invisible waves of which we have been speaking, at each end of the spectrum.

(Here the lecturer obliterated the visible light emitted by an optical lantern by means of suitable coloured screens, and in the darkness in front of the lantern caused certain materials to glow, including slices of bread and butter and margarine, under the effects of the invisible rays. He also showed that the waves emitted by a small wireless transmitting apparatus were capable of freely passing through a wooden blackboard. He also showed a small electric spark apparatus, Fig. 4, and demonstrated that it not only emitted visible light radiations but simultaneously it produced ultra-violet at one end of the spectrum and Hertzian waves at the other. He showed the presence of these otherwise invisible radiations respectively by causing Willomite to fluoresce, and by causing a small electric lamp to glow when attached to a single loop of copper wire which he held in his hand at some distance from the origin of the rays.

The sensation of colour which we see depends upon the number of ether waves which strike the eye in a second. Thus the sensation of red is produced by imparting to the optic nerve 474 millions of millions of impulses per second, while violet, the visible light which you saw in the experiment just now, is produced by imparting to the nerve some 699 millions of millions of impulses per second. Sir John Herschell once said, "There is no mode of conceiving the subject which does not call upon us to admit the exertion of mechanical forces which may well be termed infinite."

I have endeavoured to convey to you some faint idea of the existence of an all-pervading medium, the highly complex properties of which are so subtle that we can only perceive its existence in our imagination, and that not without a great effort.

Let us now turn our attention to what we ordinarily consider to be solid matter. The work of Dalton, Crookes, Röentgen, J. J. Thompson, Rutherford, Soddy, Bragg, and many others, has shown us that it is made up of groups of atoms known as molecules, each atom, according to present theory, consisting of a positive nucleus around which are grouped a number of electrons (negatively charged). We can visualise each atom as a tiny solar system; between its positive nucleus, and its electrons, there are relatively vast spaces, which, like the inter-planetary spaces of our universe are permeated by the ocean of ether. In a fragment of any elementary substance it is believed that there are millions of atoms of that particular element, each made up of a definite number of electrons grouped round a positive nucleus, like planets around a sun.

The forces of the whole system being in a state of equilibrium, it is the definite number and grouping of the electrons which give to the substance the properties by which we distinguish it from other elements. There are, of course, several variations of this theory to account for certain phenomena, but I think what I have said will suffice for the purpose of this lecture. In addition to the electrons in each atom, there are vast numbers of free (or unattached) electrons, in the inter-atomic spaces, which can be caused to move like a swarm of gnats in a summer breeze. This movement of electrons constitutes an electric current.

Sir Oliver Lodge once said that there are as many atoms in a glass of water as there are glasses of water in the Atlantic Ocean, and modern science has proved to us that the electrons belonging to each atom are as far distant from their positive

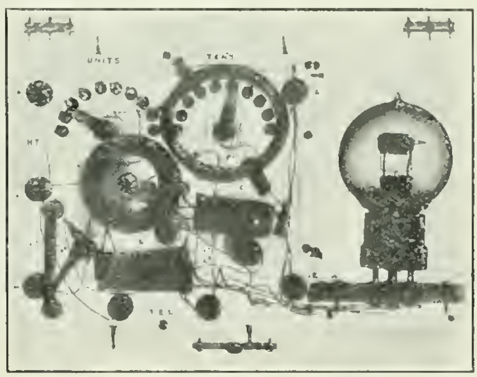


Fig. 5. The same instrument X-rayed, or when illuminated with ether waves of a frequency to which certain portions are transparent.

nuclei as are two specks of dust one in each corner of this lecture hall.

The number of electrons present in matter is unthinkable. If Adam had possessed a two ounce bottle full of air, at ordinary atmospheric pressure, and if he had commenced to remove the electrons from it at the rate of two per second, working night and day (Sundays included), and if he had lived on through the ages he would still be hard at work at it, and would not nearly have completed his task.

(To be concluded.)

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

The Leeds and District Amateur Wireless Society.*

Hon. Secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

A dinner and smoking concert was held at the Peel Restaurant, Leeds, on January 22nd. Thirty members were present, the excellent fare and most entertaining musical items being thoroughly enjoyed by all. Members of the Society and members of the Leeds Amateur Dramatic Society kindly contributed to the programme.

An instructional meeting was held at the Grammar School on January 26th, Mr. S. Kniveton, F.R. Met. Soc., lecturing upon the "Construction of Intervalve Transformers." Theory and practice of H.F. and L.F. transformations were thoroughly examined.

A general meeting was held at the Grammar School on February 2nd, under the chairmanship of Mr. F. H. Pickard. Business having been dealt with, the Chairman called upon Mr. E. M. Washington to give a paper and demonstration entitled "Vacuum Tubes, Their History and Phenomena." The lecturer briefly considered the electronic theory of matter and examined the progress of the study of vacuum tube work. By the kindness of Messrs. Reynolds and Branson, Ltd., the lecturer was enabled to exhibit a unique collection of apparatus, which he most successfully demonstrated as the lecture proceeded. The X-ray tube and allied apparatus were also demonstrated. The discussion was eagerly supported by the meeting and a vote of thanks was accorded to Mr. Washington. Mr. T. Brown Thomson was elected Chairman for the next general meeting.

The interior of the Captain's cabin of H.M.S. "Impregnable," which is now being used by a West End wireless firm as a demonstration room.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

An interesting demonstration of the "Burndept Ultra IV. Receiver" was given at the Huddersfield Radio Society's club-room, on Tuesday, January 30th, by Mr. Townsend of Messrs. Burndept, Ltd., Leeds. Mr. T. Brooke was Chairman and about 30 members were present. A very clear explanation of the receiver was given, as well as many useful "tips" for amateur "listeners-in." Music was heard from London, Manchester and Birmingham on a loud speaker and a Brown's amplifier. The set was taken to pieces and passed round for examination by the members. A vote of thanks was passed to Mr. Townsend, for his kindness on the proposal of the president, Mr. T. F. Brook, and seconded by Mr. H. W. Sellers. The lecture was followed by an open discussion of transmitting licences and the merits of various transmitters.

Barnsley and District Wireless Association.*

Hon. Secretary, Mr. G. W. Wigglesworth.

On Wednesday, January 24th, a special demonstration was given by Messrs. Jepson, Morgan and Coates, of the General Electric Company, the chair being taken by Major E. A. Barker, M.C., the President of the Association. The meeting was attended by about 100 people.

The Association's receiving set is being designed and hopes are entertained that it will be built and put into use very shortly. Plans are also being discussed for a summer programme of field days.

Stoke-on-Trent Wireless and Experimental Society.*

Hon. Secretary, Mr. F. T. Jones, 360, Cobridge Road, Hanley.

At a meeting of the Stoke-on-Trent Wireless and Experimental Society on February 1st, Mr. T. R. Clarke (Member), gave a lecture on "A Broadcasting Crystal Receiver."

He fully described the construction of a crystal receiver, on which he regularly receives the Manchester programmes over a distance of about 35 miles.

Mr. Clarke exhibited his crystal receiver, the good workmanship and neat appearance of which was much admired.

Mr. Clarke also gave a report of the Annual Conference of Wireless Societies, recently held in London, at which he represented the Stoke-on-Trent Society.

The Thames Valley Radio and Physical Association.*

Hon. Secretary, Mr. E. A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

On Wednesday, January 31st, a concert was given by the Thames Valley Radio and Physical Association to the Mortlake Girl Guides and their friends, about 150 being present at headquarters. An excellent concert was received with the assistance of Messrs. Driver and Harris, and Mr. Rogers explained in simple language how they were able to give such concerts with the receiving apparatus. He also amused them for a few minutes by showing how simple it was to make many useful articles from a piece of paper. Miss Tennant, on behalf of the Commandant and Officers proposed a hearty vote of thanks to the Association.

On Thursday, February 1st, at a meeting of the Association, which was well attended, Mr. Kenneth Davy gave an interesting lecture on "Accumulators," explaining how they were made, how to take care of them, and how to charge them. It was evident from the way the lecture was given that much trouble had been spent in preparing it and that the lecturer was a master of the subject. Exhibits were kindly lent by Messrs. The Ediswan Company.

The next lecture was given on Thursday, February 15th, when Mr. Wade (of the M.O. Valve Company), lectured on "Valves and their Manufacture."

Hackney and District Radio Society.*

Hon. Secretary, Mr. C. H. Phillips, 247, Evering Road, E.5.

The weekly meeting of the above Society took place on Thursday, February 1st, at the Y.M.C.A., Mare Street, Hackney, E.8, with an attendance of over forty, the chair being taken by Mr. H. A. Epton.

After a general discussion on the recent Radio Conference, concerning which the Chairman and the Secretary made reports, and on broadcasting and experimental licences, a lecture was delivered by a new member of the Society, F. G. Francis, Esq., B.Sc., on "Electrical Units and Ohm's Law." Mr. Francis dealt with a most difficult subject, requiring mathematical calculations, in a simple and lucid style, and was heartily applauded.

At the conclusion of his lecture, Mr. Francis suggested that an evening be set aside for "waistcoat pocket" talks on radio experiences, and this was arranged for a future meeting.

The Secretary would like to hear from prospective members living in the district of Hackney. It is hoped to arrange shortly a public meeting and demonstration, with a lecture by a well-known radio expert.

The Cowes District Radio and Research Society.*

Hon. Secretary, Mr. J. W. L. Ingram, 1, Mill Hill Road, Cowes, I.W.

At the headquarters on Wednesday, January 17th, the Secretary gave a practical demonstration of coil-winding. Various types of coils were made, and their particular advantages in use explained and data for winding coils to specific wavelengths given. Following this, several members expressed their opinions and recounted their experiences in the use of different types of coil.

"High Frequency Intervalve Coupling" was the title of a very interesting and instructive lecture given by Mr. C. Mugliston at the meeting on January 24th.

The lecturer dealt with the various methods of coupling in turn, explaining the characteristics of each, particularly on short wave reception. The great interest taken in high frequency amplification by the members, resulted in a lively discussion at the conclusion of the lecture.

Derby Wireless Club.

Hon. Secretary, Mr. R. Osborne, The Limes, Chellaston, Derby.

A meeting of the above club was held on Thursday, February 1st, at the Shaftesbury Restaurant. When the minutes of the last formal meeting had been read and confirmed, Messrs. Taylor and Jolley submitted their report of the Wireless Conference held in London, on January 24th. A vote of thanks was then given to the two delegates for so kindly giving their services. It was agreed that the affiliation with the Radio Society of Great Britain be continued.

Mr. Allwood then opened a discussion on "Broadcasting," and sets for the reception of broadcasting. Several members related their experiences and described how they had met troubles which had arisen. A few words in regard to loud speakers proved very interesting, and much useful knowledge was gained.

The membership of the Club is increasing every week, and it is hoped that this state of affairs will continue. The Committee have arranged a programme of papers for the spring session, which, it is expected, will prove an attraction.

Isle of Man Radio Society.

Hon. Secretaries, Mr. J. S. Craine, 6, Belmont Terrace, and Mr. J. P. Johnson, 16, Hildesley Road, Douglas.

A meeting was held on Monday, January 22nd, in the Physics Laboratory of Park Road Secondary School, Douglas, which is the Society's headquarters, Mr. H. Colebourne occupying the chair. There was a good attendance, and thirteen new members were elected.

Mr. S. Hinton spoke on "The Construction of a Simple Wireless Receiving Station, with considerations of detecting and tuning." His treatment of the subject was very acceptable. He dealt almost exclusively with the principles underlying the action of the various component parts of a crystal receiver. His remarks were liberally illustrated by diagram and experiment. Crystal rectification was discussed, and the characteristic of a crystal explained. Many other kindred matters were gone into, and the whole demonstration and address was an intelligent and enlightening presentation.

The Pudsey and District Radio Society.

Hon. Secretary, Mr. W. G. A. Daniels, 21, The Wharrels, Lowtown, Pudsey.

A meeting was held at the Mechanics' Institute, on Monday, January 22nd, Mr. F. Wild being in the chair.

There was a fair attendance, and a number of new members were elected. Reference was made to ladies being accepted as members, and the Society extends a hearty welcome to any ladies interested in radio work.

The Chairman subsequently called upon Mr. W. C. Ramshaw, Vice-President of the Bradford Radio Society, to give his lecture on "The Fundamental Principles of Radio Telegraphy and Telephony." The lecturer ably dealt with his subject, which was greatly appreciated.

Bexhill and District Radio Society.

Hon. Secretary, 15a, Sea Road, Bexhill-on-Sea.

A general meeting of the Society was held at the Committee Room, 15a, Sea Road, on Thursday, February 1st. Mr. C. S. Parker (Chairman), presiding.

Mr. S. L. Taylor was appointed Vice-Chairman. It was proposed and carried that the London Joint City & Midland Bank should act as Bankers, the office of Treasurer thereby being dispensed with. Cheques would be signed by the Chairman and the Secretary.

Mr. P. Webber and Mr. Holes were appointed as Auditors.

A "Bench" Committee (consisting of Mr. Hill, Mr. Brickett and Mr. Taylor) was formed to deal with the mechanical side of the Society. A bench was to be fitted in the Committee Room for the use of junior members.

Provision was made for junior members to join the Society at half fee, who could go to the Committee Room at any time to take advantage of various magazines, etc. which were being given to the Society by several members.

The Secretary reported that a profit of £5 13s. 10d. was realised from the whist drive, recently held at the Kahveh Café.

Southend and District Radio Society.

Hon. Secretary, Mr. A. L. Whur, 4, Wimborne, Southend-on-Sea.

At the meeting held on Friday, February 2nd, the Chairman, Mr. D. L. Plaistowe discussed the various transmitting circuits submitted in response to an application by him on a previous occasion, for a suitable transmitting circuit for the Society's portable experimental station **5 QK.** It was decided to make a start at once on the building of a single valve portable transmitter, closed circuit with grid control.

Mr. F. Mayer gave a most interesting lecture on his station **2 LZ,** giving circuits of both transmitter and receiver, and particulars of some experiments carried out on very short wavelengths by that station, which proved to be of great interest.

Tottenham Wireless Society.

Hon. Secretary, Mr. R. A. Barker, 22, Broadwater Road, Bruce Grove, Tottenham, N.17.

At the meeting of the above Society held at 10, Bruce Grove, Tottenham, on January 31st, Mr. Kaine-Fish delivered his second lecture on "Valves." As the actual theory of valves and their intricate working is not so fully understood as it might be by many people, the lecture proved very instructive. The lecturer dealt with the theory and practise of valves as detectors, and low frequency and high frequency amplifiers, and showed exactly how they should be used in a wireless receiving set to obtain the maximum efficiency. The diagrams used during the lecture made the whole subject perfectly clear. A good discussion on the subject followed and Mr. Kaine-Fish went over all doubtful points.

Business was then discussed and a report of the last committee meeting was read. This included a good programme of lectures for February. Mr. Kaine-Fish also gave a report of the Annual Conference of the Radio Society of Great Britain held recently, at which meeting he represented the Tottenham Wireless Society.

The Wireless and Experimental Society.

Hon. Secretary, Mr. Geo Sutton.

At the meeting of the Wireless and Experimental Association at the Central Hall, Peckham, on Wednesday, January 24th, the Assistant Secretary reported that, acting on the instructions of the last meeting, he had written to the founders of the Prescot and District Wireless and Experimental Association wishing them success in their venture, and expressing the hope that the temporary stay of their Secretary in Prescot would be to their benefit. Mr. A. W. Knight then reported his experiences at the Conference of Wireless Amateurs convened at the instance of the Radio Society of Great Britain. The matter of the present position of the Broadcasting Company was fully discussed, but it seemed that the representative of the B.B.C. who was present at the Conference had nothing concrete to suggest as to how the present difficult position might be relieved.

Later in the evening Mr. Hersey exhibited a wavemeter which he had constructed, and Mr. Joughin presented to the notice of the members the new club wavemeter. Mr. Knight read a suggested set of rules governing the loan of the wavemeter to Association members. Mr. Voigt followed with the construction of a straight line graph for the wavemeter, and the meeting then proceeded to the consideration of the calibration of received signal strength. A short discussion on electron flow brought the meeting to a close at 10 p.m.

Bath Radio Club.

Hon. Secretary, Mr. Geo. J. B. Curtis, 6. Pierrepont Street, Bath.

An interesting meeting of the Bath Radio Club was held at the Old Red House, Bath, on January 26th. The Chairman being unavoidably absent, Mr. J. G. Young (founder of the Club), presided.

Following the usual half-hour's Morse code practice, with Mr. H. L. Bowen at the buzzer, the second of a series of six elementary lectures by Mr. L. E. R. Boxwell was delivered. This lecture comprised a study of oscillatory circuits with particular reference to the crystal set. Mr. Boxwell's able and lucid delivery won him the warm appreciation of all present. Members were unanimous in their opinion that they had seldom heard a lecture delivered with such clarity.

Brighton and Hove Radio Society.*

Hon. Secretary, Mr. D. F. Underwood, 68, Southdown Avenue, Brighton.

The usual fortnightly meeting of this Society was held at the residence of Mr. Magnus Volk on January 18th.

In the absence of the President, the chair was taken at 8 p.m. by Mr. W. E. Dingle.

The members were exceptionally fortunate in listening to a valuable address given by Mr. Volk upon the correct method of using tools and workshop practice generally. Mr. Volk lucidly explained several points, aided by diagrams, and specimens of various types of tools, etc. The orthodox method of using cutting tools in conjunction with a lathe was dealt with, the right and the wrong way being clearly defined. A discussion ensued during the course of which the following items received consideration: jointing, drilling, tapping, turning brass and ebonite, soldering, slide rest, and care of tools.

At the conclusion of the lecture Mr. James Cowie, A.M.I.E.E., moved a hearty vote of thanks to Mr. Volk, expressing appreciation on behalf of the members present for the very free way in which the knowledge had been imparted. This was carried unanimously.

The Brighton and Hove Radio Society is engaged upon experimental work of a valuable nature in the interests of the science generally, and more particularly at the present time in connection with the elimination of interference during the reception of broadcast transmissions caused by inexperienced persons. Too strict attention cannot be paid to this matter, and it is hoped that all local radio enthusiasts will cooperate to avoid annoyance in this direction by keeping their valves from oscillating.

Wanstead Wireless Society.

Hon. Secretary, Mr. A. B. Firman, 18, Clavering Road, Wanstead Park, E.12.

On Thursday, January 25th, 1923, the Society had what proved to be the most successful meeting of the season. The chair was taken by the President, William Platt, Esq., who was supported by Brig.-General R. B. Colvin, C.B., M.P., a Vice-President of the Society.

Major Parker, M.B.E., A.M.I.E.E., then gave a delightfully interesting and instructive lantern lecture dealing with the ether theory and the early discoveries and inventions of wireless telegraphy and telephony, passing on to a discussion on circuits and other items of practical interest to the amateur experimenter, and finally concluding the lecture by again showing slides depicting the commercial and other applications of the wireless of to-day.

Later, Major Parker thanked the Marconi Company for the lantern slides, and Mr. Lambert and others who so generously gave their services.

The Senior Lintonian Radio Society.

Hon. Secretary, Mr. J. D. Meeke, 14, Avonmore Road, West Kensington, W.14.

The above Society has been formed at Linton House School.

A meeting was held on Wednesday, January, 19th, and the following officers elected:—President, Mr. A. E. Hardie, M.A.: Vice-Presidents, Rev. H. Martin Thorpe, M.A., Mr. J. D. Steel, M.A., and Mr. W. H. Littleton; Chairman, Mr. D. G. Bower: Hon. Secretary, Mr. J. D. Meeke: Committee, Messrs. R. Croxton, J. Hardy and C. L. Bradley.

The first general meeting was held on Thursday, January 25th, with Mr. D. G. Bower in the chair, at which Mr. C. L. Bradley spoke on the "Elementary Principles of Wireless Telegraphy and Telephony." The Vice-President, Mr. J. D. Steel, was also present.

On Wednesday, January 31st, Mr. C. L. Bradley gave his paper on "Aerial Construction and Erection." The different types of aerials were shown in diagram, the earthing system and the insulation of the aerial being also explained.

Gorton and District Wireless Society.

Hon. Secretary, Mr. T. E. Rowe, 8, Fairhaven Street, West Gorton, Manchester.

At a meeting of wireless enthusiasts held at Gorton, Manchester, on Thursday evening, February 1st, the above Society was formed and the following members were appointed officers:—President, Mr. E. Jones; Hon. Secretary, Mr. T. E. Rowe: Asst. Hon. Secretary, Mr. O. A. Potter; Chairman, Mr. G. Sykes; Deputy Chairman, Mr. C. W. Potter.

The above officers, together with Messrs. W. Kirkham, Junr. and A. Oliver, also comprise the Committee.

Meetings are to be held every Thursday evening at 7 p.m. at the Headquarters, Gorton Villa Inn, Hyde Road, West Gorton, Manchester. A hearty welcome is extended to all enthusiasts living in the above district, and full particulars will be forwarded on application to the Secretary.

The North London Wireless Association.

Hon. Secretary, Mr. V. J. Hinkley, Northern Polytechnic Institute, Holloway, London, N.7.

The 115th meeting of the Association was held at 8 p.m. on Monday, January 29th, this being the second annual general meeting.

After the business of the meeting the President called upon the Hon. Auditor to make a report upon the financial affairs of the club. The report showed that, after expenses for rent, construction of three-valve experimental set, and secretarial expenses had been settled, there was a cash balance of £6 10s. 4½d.

The Hon. Secretary then read a report on the work of the Association during the past year. The next business to be put before the meeting was the election of Officers and Committee for the year 1923. The following is a list of the names of those now in office:—President, R. S. Clay, Esq., B.A., D.Sc.; Vice-President, B. Binyon, Esq., O.B.E.; Chairman, H. N. Wilson, Esq.; Vice-Chairman, J. Nicol, Esq., B.A., B.Sc.: Hon. Treasurer, F. S. Angel, Esq.; Committee, Messrs. G. D. Meyer, F. W. Horton, R. J. James, J. A. Reading, H. W. Nunn, A. G. Hill; Hon. Secretary, Mr. V. J. Hinkley.

The President at the conclusion of the above business gave an address on "Electrons, and the part they play in the Thermionic Valve," the object of which was to give a clearer conception, to both beginners and more advanced workers in wireless, of the nature of the electron. The lecturer touched upon the work of Crookes and of J. J. Thomson, and performed a number of experiments to illustrate his remarks.

Making a Simple Valve and Crystal Receiver.

THE BEGINNER'S CONSTRUCTIONAL ARTICLE.

IN the issue of February 24th, the construction of a simple crystal receiver was dealt with in detail. The receiver described is suitable for the reception of broadcasting up to a distance of approximately 30 miles. When it is desired to receive at greater distances, the addition of a high frequency amplifying valve circuit is necessary, and a receiver embodying such an arrangement is given below.

High frequency amplification is specially suitable when the distance from the transmitting station is likely to be in excess of that just mentioned, and it permits also, when required, of arranging the reaction coupling on to the windings of the inductances in the H.F. amplifying circuit instead of directly back to the aerial tuning circuits, thus limiting the extent of radiation. Such an arrangement was first advocated in this journal in a series of articles under the title of " Experimental Station Design," commencing from September 16th, 1922, and has since been approved by the Postmaster General for use in apparatus intended for reception on broadcast wavelengths.

Reaction is not made use of in the receiver about to be described, though it is quite an easy matter to add it when desired.

The article in the previous issue of this journal is intended for the man who is about to start in wireless. The design in this case has also been arranged to suit the beginner, but who is perhaps a little more ambitious than to be contented with merely a simple crystal set.

The materials required are as follows :—

Polished sheet ebonite, 10 ins. by 4 ins. by ¼ in.
No. 26 D.C.C. wire (get about 4 ozs.).
4 ozs. of No. 18 or 20 bare copper or tinned copper wire.
8 terminals.
4 valve legs with washers and back nuts.
Filament resistance with fixing screws (which will probably be 4BA by ½ in.).
A simple crystal detector (Silicon or " Perikon ").
1 condenser 0·0003 mfds.
1 condenser 0·001 mfds.
Shellac varnish.
4 cards for inductances.
2 1-in. brass screws (4BA, round or cheese heads).
2 4BA nuts.
4 lengths (each nearly 1 yard) of " Sistoflex " insulating tubing.
A piece of wood for base, ½ in. to ¾ in. in thickness.
Miscellaneous brass wood screws.

The construction of the inductances should be the first step, and the method by which they

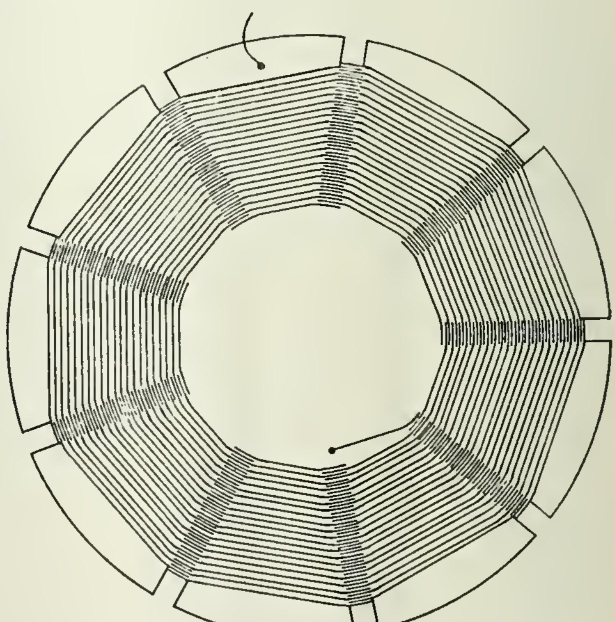


Fig. 1. A wound card inductance, drawn exact size.

have been made was fully dealt with in the previous issue. The shape and dimensions to which the cards must be cut are shown in Fig. 1. Starting at the centre, the card is wound full with the No. 26 D.C.C. wire. Four inductances will be required. Next, the panel should be made up which carries the filament resistance, crystal detector, valve holder, condensers, and terminals. The dimensions of this panel are shown in Fig. 2 and also the setting out for the positions of the holes.

The ebonite must be sawn to size and the edges finished by careful filing and rubbing down with emery cloth. Care should be taken to ensure that the edges are at right angles to one another and also with the face, and, moreover, that they are quite straight. The reader should purchase a small steel square for this purpose.

The position of the holes should be measured out with the utmost care and accuracy, particularly with regard to the position of those which are to carry the valve legs.

Fine scratching lines may be made on the under-side indicating the positions for the holes, and before drilling, points must be made with a sharp centre-punch in order to act as a guide for the point of the drill and to prevent it wandering over the smooth ebonite surface.

If the terminals and valve legs have 4BA threads, then the sizes of the holes will be 5/32 in. Care must be taken in drilling the holes not to fracture the back of the ebonite, and to avoid this, it is advisable to drill down on to a piece of hard wood or scrap ebonite.

The mounting of the filament resistance and the crystal detector will depend upon the types purchased, and it is quite a simple matter to devise a method for securing these two components, according to their design.

Before finally assembling the components on the panel the polished surface should be removed by rubbing with emery cloth attached to a small block of wood. By rubbing in small circles and using a fairly rough emery cloth, it is possible to remove the polish and produce a good matt finish free from scratches. A trace of oil may be used while rubbing down. The surface must be wiped quite clean and free from oil before finishing.

Fig. 3 gives the complete lay-out of the finished instrument and little explanation is required with regard to assembling. It is quite apparent from the diagram how the inductance coils are to be mounted, and the method in which they should swing one over the other.

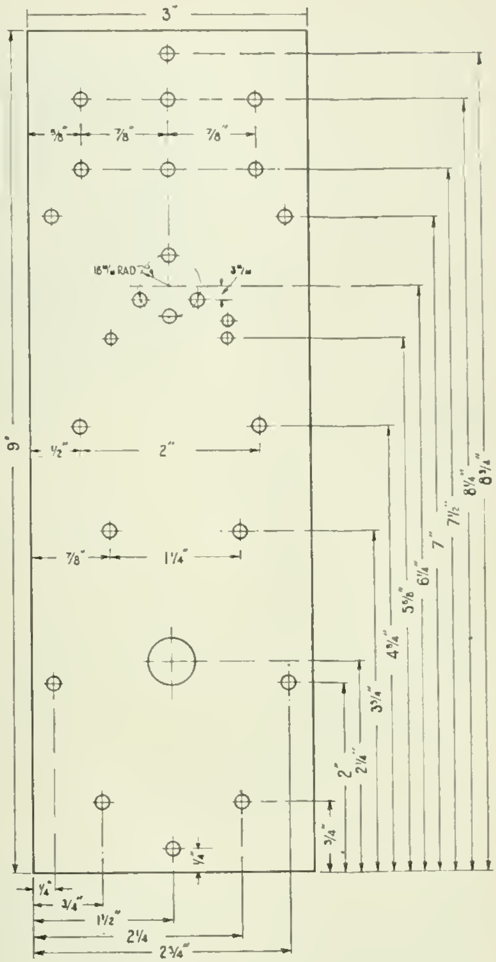


Fig. 2. The setting out of the holes in the ebonite panel.

The wiring is shown in Fig. 4 and is quite easy to follow. It is shown also in Fig. 5, in the form in which wireless circuits are usually represented.

It may be necessary, before finally soldering off the ends of the moving coils, to try the effects of reversing the connections to the ends, or unscrewing them from the moving arms and turning them over.

The moving inductances are secured to the wooden adjusting arms by means of No 4. by $\frac{1}{2}$ in. brass screws with countersunk heads,

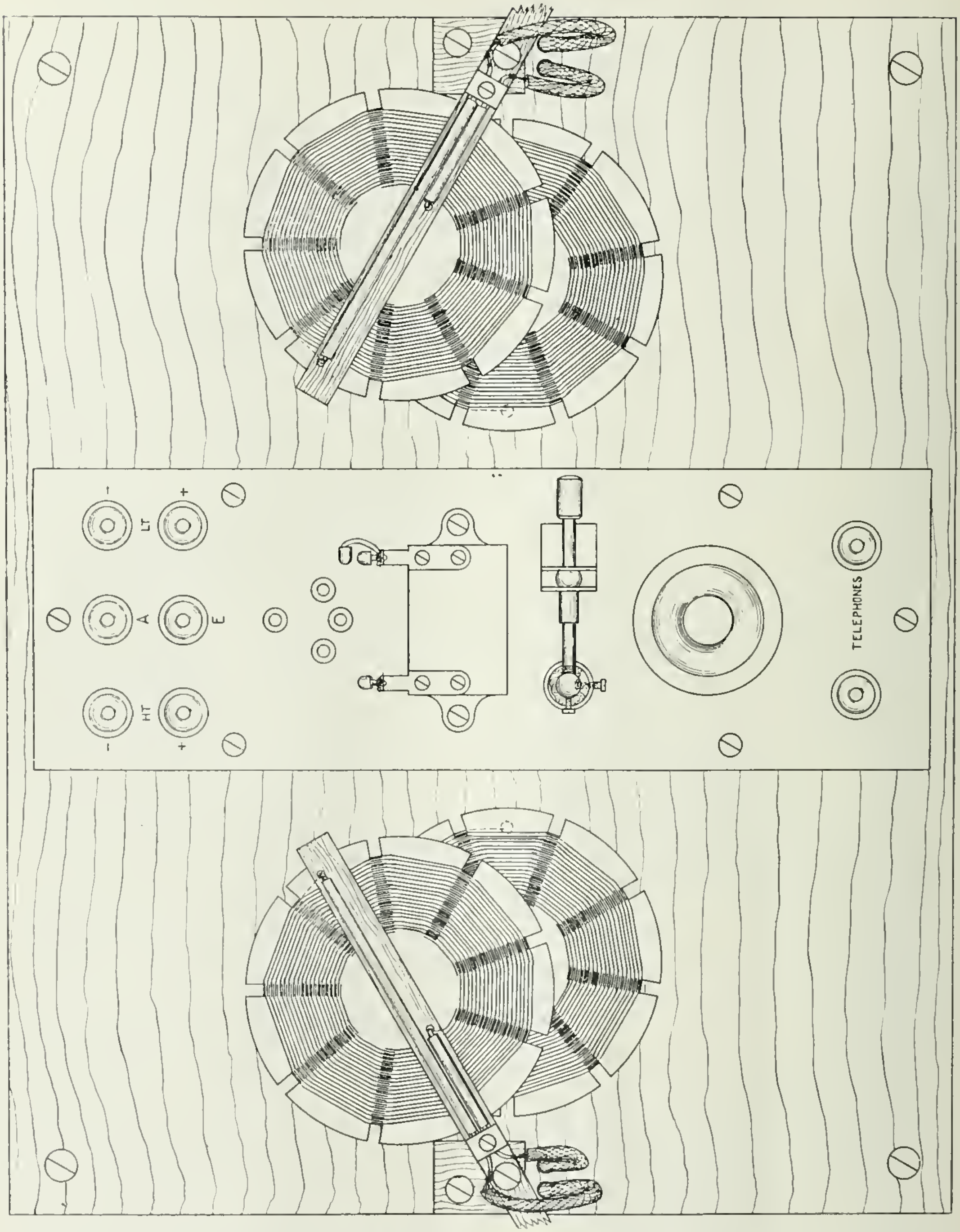


Fig. 3. The complete receiver, with H.F. amplifier and valve detector. It is drawn to scale, and the overall dimensions are 12″ × 9½″.

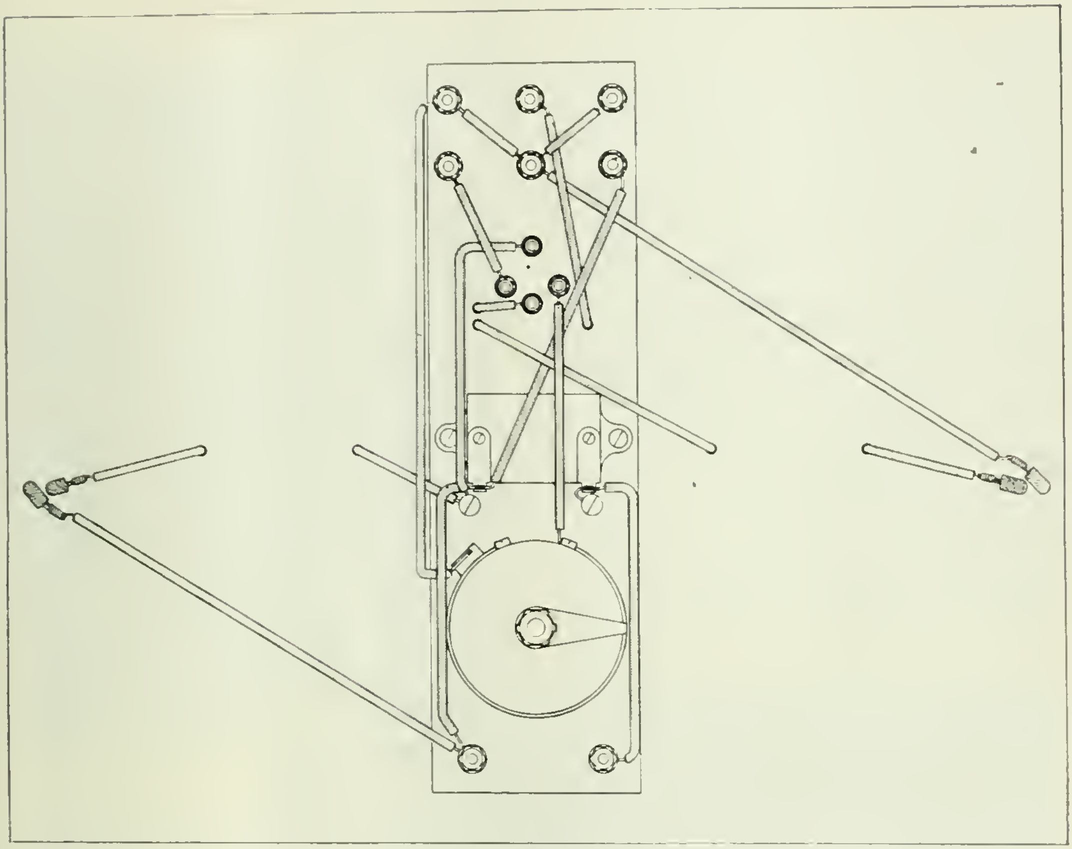


Fig. 4. The connections on the underside.

and to prevent the screws from tearing the card, an additional piece of stiff card should be put on in the centre.

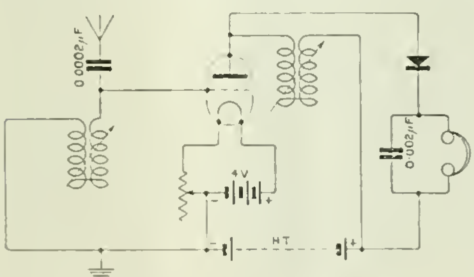


Fig. 5. Circuit diagram.

The tuning-in of signals is effected by moving the two inductances more or less together, though the actual setting of one with regard to the position of the other moving coil depends essentially upon the dimensions of the aerial to which the set is connected.

It must not be overlooked that the crystal must be adjusted to its most sensitive setting before tuning is attempted. The type of valve used is of importance, and should be one which has a characteristic which is specially suitable for H.F. amplifying, such as the " R."

The method of adding reaction to this tuner will be dealt with in a subsequent issue.

Accumulator Charging Station.

THE accompanying photographs show an accumulator charging equipment which has been designed essentially for providing various charging rates, such as are required when handling the many types and sizes of batteries used in wireless work. Power is taken from D.C. mains at 220 volts for driving a motor generator, the windings of which are arranged to give practically constant voltage when the load fluctuates through a wide range. Current is fed on to two distributing switchboards, each of which provides three charging rates. Overload and no-load release switches are arranged to prevent damage to batteries on charge should the supply vary within certain narrow limits from the normal charging rates of the distributing circuits. An auxiliary prime mover is available for use in the event of breakdown.

Provision is made for charging and discharging new cells so as to bring them into good condition. Charged batteries which are not required for immediate use are kept on the circuit, with a very changing current, such as is passed by a lamp.

The station is well set out, and the distributing circuits and leads being permanently wired, the chance of damage to cells is practically eliminated.

Above. — The motor generator and main switch-board at the charging station of The Park Motor Co., Ltd., in Wells Street, S.W.

Left.— The accumulator room and auxiliary distributing board.

Notes

A Norwegian Station's Transatlantic Success.

The wireless station at Bergen, Norway, it is stated, has recently been in communication with American stations and reports from America show that transmissions from Bergen have been clearly received there.

British Broadcasting Received in Denmark.

A Danish reader reports that with his single-valve set at Copenhagen he is able to hear British broadcasting from **2 LO**, **5 IT** and **5 NO**. **2 LO** (London) is 920 km., **5 IT** (Birmingham) is 1,000 km. and Newcastle 800 km. from Copenhagen. The reader's aerial consists of two wires, each 40 metres in length and 20 metres in height.

Continental Stations Received by a Staffordshire Reader.

While listening-in round about 200 metres during February, Mr. A. C. H. Bassano of Old Hill, Staffordshire, heard **8 AP** (France), **OMX** (Holland), **OBS** (Holland), and **OYS** (Holland)—all on C.W. The receiver was a 3-valve set—one high frequency, one detector, one low frequency; the H.F. being tuned anode. The signal strength was about R 5-R 7 in each case.

Broadcasting in India.

The Indian Government has decided to permit private enterprise to undertake broadcasting by wireless in India and Burma upon lines similar to those followed in the United Kingdom. A Conference has accordingly been arranged to take place in March, under the Presidency of the Director General of Posts and Telegraphs to discuss the project of forming a company open to both British and Indian manufacturers of receiving apparatus.

The Award of the Faraday Medal.

The Council of the Institution of Electrical Engineers have made the second award of the Faraday Medal to the Honourable Sir Charles Algernon Parsons, K.C.B., F.R.S., Honorary Member of the Institution. The Faraday Medal is awarded for notable scientific or industrial achievement in Electrical Engineering or for conspicuous service rendered to the advancement of electrical science.

Broadcasting Licences.

Up to the end of January, it is reported 58,000 licences for the reception of broadcasting had been issued by the Post Office.

Senatore Marconi Planning Investigation of Atmospherics.

Senatore Marconi will shortly undertake a cruise in his steam yacht *Electra*, which is now being refitted in the Solent. As in the case of the cruise last year, the object is deeper research into wireless matters, and in particular the influence of atmospheric disturbances.

Wireless Sets for Liner Passengers.

The United States liner *Leviathan* which will start on the New York-Southampton service in June, will have wireless headphones in every cabin.

The New British Broadcasting Stations.

Reports from various parts of the country served by the new Cardiff broadcasting station indicate that the first transmissions were a great success, and notably there was a total absence of interference. The Glasgow station which it was expected to have in operation by March 19th, may actually be ready to begin transmissions well before that date, as the British Broadcasting Company are naturally anxious to have this station working at the time the National Opera Company is due to visit Glasgow. It is probable therefore, that the new station may be opened at the beginning of March. The opening ceremony will be performed by the Lord Provost of Glasgow (Sir Thomas Paxton) and Lord Gainford (Chairman of the British Broadcasting Company), Sir William Noble and other directors of the Company will also be present.

Do you hear Brussels Aerodrome ?

The Brussels Aerodrome radiotelephone station broadcasts weather reports on 1,100 metres at 12·00 and 16·50 G.M.T. every day excepting Sundays and Belgian bank holidays. The 16·50 report includes a short summary of the day's aerial traffic at Brussels Aerodrome. The report issued from Uccle **(OPO)** on C.W. at 12·00 G.M.T. on 1,500 metres is only transmitted on Sundays and Belgian bank holidays, and when the R/T station is out of action.

The Director of the Belgian Royal Meteorological Institute kindly requests amateurs who receive Brussels 'phone messages at a distance greater than 300 miles, to let him know, through the medium of *The Wireless World and Radio Review*, the amount of amplification necessary to receive the message.

The Bamberger Tests.

In the early morning of February 24th, signals were received in England from the Bamberger Station, New York. The occasion was a special test transmission, details of which were given in a recent issue. Mr. Inman of Hampstead, using one H.F., detector and one L.F., heard every word from 6 o'clock until the station closed down at 6.15. Mr. Brice, also of Hampstead, heard portions of the transmissions, using a detector valve and one L.F. Mr. Baldry, of Wembley, Middlesex, also received a portion of the programme with receiver employing a detector valve and two note magnifiers. Each of these gentlemen in reporting particulars, pointed out that reception would have been much better had there been less interference from local oscillating receivers.

Newspapers and the Broadcasting Programmes.

The continuance of the Broadcasting Programmes in the daily newspapers has now been agreed upon in view of the widespread desire that this feature should be available to the large number of persons possessing receiving sets throughout the country.

International Meteorological Reports.

The Director of the Office National Météorologique of Paris, announces the procedure adopted regarding weather reports received from ships. It is explained that observations made by French ships are transmitted in the first weather report sent out from the Eiffel Tower, following their reception. These Eiffel Tower transmissions are carried out under high power at intervals of about three hours throughout the day, viz., 0220, 0400, 0820, 1005, 1420, 1600, 1920, 2100. In addition to this, reports from French ships may appear in the Le Bourget transmissions at 1050, 1128, 1250 and 1528. In this case they are repeated either in their complete form in the Eiffel Tower report of 1420, or in abbreviated form in the Eiffel Tower report of 1600.

All reports received in France from ships of other nationalities are repeated in an abbreviated form in the high power transmissions from the Eiffel Tower at 0400, 1005, 1600 and 2100. These reports are only transmitted if they are not more than 24 hours old. Where several reports relating to the same locality are received from different ships, only one is transmitted. It is of the greatest importance, therefore, the Director points out, that observations made by ships should be communicated without delay to the Office Météorologique de France in order that the information may be utilised to the greatest possible advantage.

Radio Society of Great Britain : Elementary Lecture for Associates.

The third of the series of elementary lectures, primarily intended for Associates of the Society, will be given by Mr. L. F. Fogarty, A.M.I.E.E., at the Institution of Electrical Engineers, Victoria Embankment, on Friday, March 16th, at 6.30 p.m. The title of the lecture will be :—" Accumulators, Dry Cells, and the Currents used in the Reception of Radio Telephony." The lecture will be illustrated by experiments. Non-members may obtain an admission card by forwarding a stamped addressed envelope to the Hon. Secretary, 32, Quex Road, West Hampstead, N.W.6. Readers are reminded that Associateship of the Society is open to anyone interested in wireless, and no qualifications are required. The annual subscription is 5s.

Correspondence.

To the Editor of The Wireless World and Radio Review.

Sir,—The fact that the Writtle concert has now been definitely closed down has recently been publicly announced. This concert was brought into being specially for the benefit of amateur experimenters, and directly by reason of a petition to the P.M.G., presented by the Radio Society of Great Britain, and signed by about 60 affiliated societies, the Halifax Wireless Society making the original suggestion. Directly permission was granted for this concert, the Marconi Scientific Instrument Co. very kindly made arrangements to carry out the weekly programmes from a special station at Writtle. Thousands of your readers will know how successful these concerts have been, and I wish to express the sincere thanks of the Radio Society of Great Britain, and I am sure also the thanks of all the affiliated societies, for the public-spirited manner in which Messrs. Marconi Scientific Instrument Co. have carried out these concerts week after week with unfailing regularity over so long a period.

Leslie McMichael,
Hon. Sec. of the Radio Society of Great Britain.
32, Quex Road,
West Hampstead, London, N.W.6.
February 17th, 1923.

To the Editor of The Wireless World and Radio Review.

Sir,—I was much interested in the article on the vernier time beats as given by Mr. Mitchell in the current issue of *The Wireless World and Radio Review*.

There are, however, some points which I think require a little further explanation.

For example the times of the first and 300 beat are now given in sidereal time by **FL**, as to-day, January 15th, for instance the series are 17352632 and 17401948 equal to 453·16 time occupied in sending the 300 beats. If a clock is to be adjusted by these beats to G.M.T. is not some further correction necessary.

The series as mentioned by your correspondent and examples given appear to be based on the old system when Paris gave out the times of the first and 300 dots in G.M.T. I should be glad if some further information could be given through your contributor, with examples on the present system, showing how a clock may be adjusted or checked on G.M.T.

P. M. Plumtree.

Sir,—The examples given in my article are not based on the old system, and they are given in sidereal time units as now sent out by Paris **FL**.

Taking the series you quote—

17401948 = 17h. 40m. 19·48s.
17352632 = 17h. 35m. 26·32s.
Difference = 4m. 53·16s.
= 293·16 sec (sidereal).

$\therefore$ Interval between any two dots

$$= \frac{293{\cdot}16}{299} \text{ sidereal sec.}$$

$$= 0{\cdot}9805 \text{ sidereal sec. (approx.)}$$

The tables required for converting intervals of sidereal time to intervals of mean Solar Time are given in the "Meteorological and Time Signal Section" of the *Year Book of Wireless Telegraphy*, 1923, in the section on Time Signals, together with an example of the use of the tables.

In order to be able to set a clock to G.M.T. from the "rhythmic beats," it is necessary to know the mean time at the preceding sidereal noon, and these values are given for everyday in the year in the "Nautical Almanack" (published by H.M. Stationery Office, Kingsway, W.C.2, price 5s.), page 3, *et seq.* It was not possible to give these values in the pages of *The Wireless World and Radio Review*, owing to the amount of space they would have taken up.

These rhythmic beats are intended chiefly for accurate longitude measurements at astronomical observatories, where the standard clock is set to sidereal time for reasons given in my article. For setting a clock to G.M.T. adopt either the above method or make use of the New International System of T.S. at 0923 G.M.T., daily from **FL.** as explained in previous articles.

W. G. W. Mitchell.

Calendar of Current Events

Thursday, March 1st.

Daily Mail Ideal Home Exhibition (with Wireless Section). Opening day. (March 1st-24th inclusive.)
At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

LUTON WIRELESS SOCIETY.
At 8 p.m. At Hitchin Road Boys' School. Practical Work and Demonstration.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.
Lecture: "Half-an-hour with a Technical Dictionary." By Mr. F. Bew.

THAMES VALLEY RADIO AND PHYSICAL ASSOCIATION.
At 8 p.m. Film on Radio Transmission and Reception.

Friday, March 2nd.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture on "The Progress of Telephony and its Bearing on Modern Life." By Mr. W. Davies.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture on "The Evolution of Receiving Valve Amplifiers." By Mr. H. H. T. Burbury.

RADIO SOCIETY OF HIGHGATE.
At 7.45 p.m. At the 1919 Club, South Grove. Lecture: "Modulation" by Mr. H. Andrewes, B.Sc.

Saturday, March 3rd.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. A. Southgate, A.M.I.E.E.

Sunday, March 4th.

From 3 to 5 p.m. Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, March 5th.

9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

CAMBRIDGE UNIVERSITY WIRELESS SOCIETY.
At 8.30 p.m. Lecture on "Some Anti-Atmospheric Devices." By Major A. G. Lee, M.C.

Tuesday, March 6th.

LOWESTOFT AND DISTRICT WIRELESS SOCIETY.
At St. Margaret's Institute, Alexandra Road, Lowestoft. Third Annual Meeting.

EAST LONDON RADIO SOCIETY.
Meeting.

WEST LONDON WIRELESS AND EXPERIMENTAL ASSOCIATION.
Lecture on "Wireless and Flying." By Lieut. D. Sinclair.

Wednesday, March 7th.

THE INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION).
At 6 p.m. At Savoy Place, Victoria Embankment, W.C.2. Lecture on "The Development of High Power Valves." By Mr. H. Morris-Airey, C.B.E.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.
Elementary Mutual Instruction.

MANCHESTER WIRELESS SOCIETY.
At 7.30 p.m. In Council Chamber, Houldsworth Hall. Lecture: "My Experiences in the Reception of Wireless Messages." By Mr. J. W. Goodman.

EDINBURGH AND DISTRICT RADIO SOCIETY.
At 8 p.m. At 117, George Street. Business meeting. Lecture by Mr. G. D. Crichton.

NORTH MIDDLESEX WIRELESS CLUB.
At the Shaftesbury Hall, Bowes Park, N.11. Annual Meeting.

LEEDS Y.M.C.A. WIRELESS SOCIETY.
At 7.30 p.m. Lecture: "Wireless as applied to Aircraft" (with lantern illustrations). By Mr. M. Eskdale (Bradford Wireless Society).

Thursday, March 8th.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

ILFORD AND DISTRICT RADIO SOCIETY.
Lecture: "Magnetic Detector and Multiple Tuner." By Mr. A. J. Thompson.

LUTON WIRELESS SOCIETY.
At 8 p.m. At Hitchin Road Boys' School. Lecture on "Measurement of Valve Characteristics." By Messrs. G. W. Chandler and W. F. Neal.

Friday, March 9th.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At Dept. of Applied Science, St. George's Square. Elementary Class conducted by Mr. J. G. Jackson, B.Sc.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture: "Experiences with an Experimental Receiving Installation." By Mr. J. Croysdale.

RADIO SOCIETY OF HIGHGATE.
At 7.45 p.m. At the 1919 Club, South Grove. Lecture: "Measuring Instruments used in Wireless" by Mr. G. A. V. Sowter, B.Sc.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,
Cardiff	5WA	395 ,,

Glasgow Broadcasting Station **(5 SC)** is expected to be in operation on March 19th.

FRENCH BROADCASTING TIMES.

Eiffel Tower. 2,600 metres. 11.15 a.m. weather reports (duration 10 mins.) 6.20 p.m., weather reports and concert (duration about 30 mins.) 10.10 p.m., weather reports (duration 10 mins.).

Radiola Concerts. 1565 metres., 5.5 p.m. news; 5.15 p.m. concert till 6 p.m.; 8.45 p.m. news; 9 p.m. concert till 10 p.m.

L'Ecole Supérieure des Postes Télégraphes et Telephones de Paris. 450 metres. Tuesdays and Thursdays, 7.45 p.m. to 10 p.m. Saturdays, 4.30 p.m. to 7.30 p.m.

Radio Society of Great Britain.

REPORT OF ANNUAL CONFERENCE HELD ON JAN. 24th, 1923.

(*Continued from page 705 of the previous issue*)

Mr. L. F. Fogarty (Hon. Treasurer, The Radio Society of Great Britain).

I very rarely address a meeting either of the Radio Society of Great Britain or of this Conference without speaking about finance, and I do not propose to disappoint you on this particular occasion. We appreciate that the majority of the affiliated societies object to an increased subscription. That is perhaps fairly natural, particularly as they do not know why the increased subscription is necessary. The point is this, that the general expenses of the Radio Society of Great Britain last year exceeded its income by £38, and obviously, therefore, we cannot do more, either for ourselves or for the affiliated societies without an increased subscription. A subscription of 1s. per head in place of the present fee seemed to us at the time a fair proposal, but of course it is open to discussion, but to refuse any increase means that we shall perhaps have to do less than we have done so far. Several members have pointed out that the subscription which their members pay to their societies is too small to allow them to contribute more than they are at present doing. We appreciate that there are a great many societies in that condition. Now, speaking personally, and not as a member of the Committee of the Radio Society of Great Britain, I want to emphasise the fact that in my opinion any attempt to run a Radio Society with too small a subscription is a mistake, and usually dooms the enterprise to failure. I think most secretaries of societies, managers of businesses, and every engineer will agree that there is a certain state of efficiency below which it does not pay to do anything. If you try to run a society on anything but a satisfactory subscription you cannot give your members the convenience of reasonable apparatus, and decent accommodation for meetings, with the result that your members stay away. The whole thing goes in a vicious circle, and finally the scheme falls to pieces. Essentially you should charge a fair admission fee and a fair subscription. You will either have success or you will find it is not worth doing. There was one suggestion made that this Society should accept say, in lieu of the present fee, 5 per cent. of the subscriptions of the provincial societies. I think I am correct in saying that the minimum number of members which a society must have before it can become affiliated to the Radio Society of Great Britain is twenty members. We have been told that some of these societies have a subscription as low as 2s. 6d. If they have twenty members, each paying 2s. 6d., and we agreed to accept five per cent. of that, the total amount would be 2s. 6d. from that society. What could we do for you in the way of sending journals, writing you letters and advice, for 2s. 6d. a year ? That, I think you will agree, is absolutely impossible.

The whole question as to whether the increased subscription should or should not be paid seems to me to depend on whether you ultimately adopt the idea of bringing into being this General Committee, and if this General Committee is going to meet in various parts of the country. We are undertaking to meet the expense of hiring halls, etc., but visits to various parts of the country, and the secretarial work in arranging these things, obviously means an increased subscription of some kind. We are quite willing to pay our own share, and our subscription, as everyone knows, is set at a reasonable figure. The whole matter depends upon whether you adopt this General Committee.

If, some time or other, this Committee comes into being—I am very keen that it should, for I feel good will result from it—I should like to see the funds (a separate fund if you like) representing this 1s. per head amounting to such proportions as to enable us to offer not only accommodation (the hire of the hall), but to pay the delegates their reasonable expenses such as fares, etc. The 120 affiliated societies in the kingdom might want to send two members each, that would make 240. Assume 240 persons, with an average expense in attending the meeting of about £2 each, and you will readily see that a very considerable sum of money would have to be found annually to carry out that idea. On the other hand, without such scheme, I can foresee that these conferences will not always be attended by quite so many people from the far parts of the country as may be desirable, and in that case the Committee will find it difficult to arrive at a definite decision upon every point, simply because there will not be a representative there to speak for every society in the kingdom.

Mr. F. Hope-Jones (Chairman).

It may be asked what was the motive of the Committee of the Radio Society of Great Britain in putting on the Agenda an apparently ill-digested scheme ? Let me remind you of what I said in introducing the subject. We have our ears to the ground, always listening for what the provinces want. We welcome these conferences and look forward to them for guidance in all matters of important policy. We want to make the most of them, and to anticipate your wishes if you are not satisfied. Are you content with this annual meeting ? We want to give you such an opportunity as we have tried to do to-day to suggest what concerns you more than us—some method that you may care to propose among yourselves of forming a sort of Association of Societies in order to bring your points of view clearly before us, and even to take upon yourselves the executive authority should you wish it. That is our motive in promoting this discussion.

Personally, I think you can rest contented as to your interests being guarded by my colleagues and myself on the Committee. We think we have been fairly successful in finding out what you want and in giving effect to your wishes. That is our constant aim throughout each year and we have no desire that you should form yourselves into an Association of Societies and create an organisation of your own to take the executive authority yourselves. Personally, I do not think the circumstances warrant it. I do not think the political forecasts at the present time in wireless affairs demand it. I think your interests are sufficiently well looked after as they are. Though no concrete proposal has been put forward, later in the afternoon I will try and give you a further opportunity of bringing one up.

I propose now to pass to a subject akin to it, inasmuch as it refers to the formation of another Society, namely the Relay League.

"The British Wireless Relay League; co-operation of all Societies in the organisation and management of the League."

We have been asked to put that on our Agenda and I am quite sure there are gentlemen in the room who will tell us in the first place, as briefly as possible, but no doubt forcibly and effectively, the aims and objects of the proposed Relay League.

It originated in Manchester. Mr. Evans is here, so I will call upon him to open the subject.

Mr. Y. W. P. Evans (Manchester Wireless Society).

Sometime last year I attempted to form a British Wireless Relay League on something like the lines on which a league is run in America, simply because I thought it was necessary and that we ought to form a kind of brotherhood throughout the country of people possessing transmitting licences. The object of the Relay League in America was to form a body to assist in a collective effort of carrying out various experiments. A number of suggestions put forward may be ahead of the commercial world in wireless, and with the opportunity of publishing these ideas and encouraging collective experimental work on particular subjects, much useful information will result.

My object is to forward our work in general, and see if we cannot get together some organisation which will prevent many evils—individual jealousy in wireless transmitting, and so on. At the same time it is up to those holding a transmitting licence to make suggestions and put forward views as to how transmitting can be carried out efficiently. At the present time there is the band of wavelengths —from 150 to 200 or a fixed wave of 440—and, especially for the London area, this is ridiculous. You cannot all be working on 440 at once unless you have an organisation to carry out experiments at certain times, and each man in his turn. I have sent out 350 communications to various holders of licences, and societies are in communication with a view to an improvement of the existing transmitting conditions. An efficient organisation of all amateur transmitters would maintain a service of excellent utility. A Relay organisation among the whole band of transmitters throughout the country could be carried out under the auspices of the League, and reports of the results would appear in *The Wireless World and Radio Review.*

I have been in communication with practically every amateur organisation, and the Americans and French particularly show a desire to see a League established here, and an International League for carrying out definite experiments between countries. I daresay a good many of you will know that Manchester has been trying for some time to get across to America with a view to establishing direct communication between the two countries. We have done it with France, and we shall not be satisfied until we have done it with America. I should like to see that spirit shown throughout the country.

I may say I asked for this matter to be put on the agenda so that the societies could be approached with a view to obtaining from them their co-operation. I do not mean that the societies shall collectively become members of the League, but every Society can assist the League by inducing transmitting licensees to join.

As regards the rules, they have been amended somewhat from the first that we sent out. We do not intend to be dictators, and we do not profess to dictate to anyone. I am simply trying to help forward the cause in general. I ask the opinion of the meeting as to whether they think it worth while going on. The support of *The Wireless World and Radio Review*, of the Radio Society of Great Britain, of several societies in France, Holland, Belgium, and American Radio Relay League, may, I think, be depended upon. The present officers have been elected provisionally, and of course, they can always be changed in course of time by the members of the League themselves.

The Chairman.

The American Relay League was very successful. It organised the first communications on short wavelength across the Atlantic. On this side there is one man who has done here what the whole of the American Relay League did in the U.S.A., and that is Mr. Philip Coursey, whom I will now call upon to express his views.

Mr. Philip Coursey.

There are several things to be said for and against the formation of such a Relay League as has been suggested. You are all aware, no doubt, of the existence of the American Radio Relay League and of the sort of work it does. To a certain extent I join issue with Mr. Evans as to the need of that work, but all the correspondence I have had with them strengthens my opinion that their chief aim and object in relay work is communication rather than experiments. They mainly want to handle messages, and the greater the distance the better they like it. There are some extraordinary examples of such handling of messages.

As regards this country the chief objects of such a League would be for experimental work mainly in conjunction with other countries. In our own country, there is really very little use for relay messages, as with short wavelength and amateur power any part of the country could be reached on C.W. transmission. I am not referring so much to telephony, of course, and that is a field in which further experimental work may be done.

The three main French societies formed a committee in connection with the Transatlantic Tests, and that committee is extremely anxious to work in conjunction with us, and, as Mr. Evans says, the American Relay League is also very anxious to work with us. The Americans themselves are astonished at what we have done during the last month, and they frankly admit that our receiving sets are vastly ahead of theirs in efficiency. They, however, have had much more experience than we have in transmitting.

Mr. Evans referred to communication from this country to the United States

It will be remembered that the Radio Society put up a special station in London, for which the Post Office gave us a temporary licence, and we transmitted messages to the States in conjunction with other tests. We sent a special code message, together with Christmas greetings (which we added on to the end of it), about Christmas time. These tests, which were entirely successful, demonstrated what could be done with short wave on C.W. transmission.

The main use for any such League appears to be that it will carry on for experimental purposes the organisation which was started by the meetings of transmitting licensees held a short time ago. If there is any possible way of bringing all new licensees together, under any such league or similar association, in order that they can be informed of what other amateurs are doing, the difficulties they have encountered, and what rules have been found necessary among ourselves to facilitate such experimental work, and its existence can be brought to the notice of all new licensees, then it would be extremely useful.

Regarding offenders against the ordinary rules governing the operation of sets, there is only one way of punishing a member who persistently continues in his offence, and that is by reporting him to the Post Office as being guilty of a breach of the licence regulations. I am convinced that if its members are thoroughly agreed a league such as is suggested could have very useful results.

If, for example, there were introduced some simple organisation to ensure that several stations were always listening in at certain times for American signals, we could in that way obtain most valuable information on the short wave transmission possibilities over the Atlantic. In connection with our tests which we have carried out, we found that although the signal strength varied during the period of the tests, and although the number of signals fluctuated enormously, there was no complete break. Such an organisation would doubtless work in with many of the officially recognised international societies which are investigating such matters at the present time.

In connection with such work I am in support of this formation. But if it is merely for relaying messages for ourselves I do not think it has anything like the scope that the American League has. Its use for relay in that way would be, of course, simply to collect information together as to the result of the particular tests made, and to enable it to be collected quickly. As a final suggestion, as you all know, the term wireless is being dropped generally in favour of radio, and in view of this fact I suggest the British Radio Relay League would be a better title than the British Wireless Relay League.

Mr. H. S. Pocock.

I do not think I have anything to add to what Mr. Evans and Mr. Coursey have said in regard to the League. I would merely like to state that *The Wireless World and Radio Review* would be very pleased to assist in every way possible in furthering the work of the League. I think the fuller organisation and the objects of the League would be a matter for discussion amongst those particularly concerned.

Mr. Y. W. P. Evans.

It was not so much the intention to relay messages for their sake alone, but to further experiments, especially in telephony. Messages, however, that refer to any special test, can be relayed by Morse, as Mr. Coursey suggests.

Mr. H. S. Walker (Hounslow and District Wireless Society).

The question of the Radio Relay League is a rather important matter. I may say that during some recent tests we transmitted mostly during the hours of the stilly night, sitting up for ten days. There are many points cropping up which I think the Radio Relay League could settle. We have discussed it in our society and our society would be prepared to support it with all the assistance in its power.

We would like to know, however, what would be the attitude of the Postmaster-General towards relaying messages ?

Mr. Y. W. P. Evans.

The Postmaster-General has given permission for messages to be relayed provided they are confined to the work of the League.

Mr. A. J. Dixon (North Middlesex Wireless Society) supported the League, and other delegates also indicated useful work which might be undertaken.

Mr. Maurice Child.

Speaking as a member of the Radio Society of Great Britain, I foresee some objections to the formation of this League.

I think we ought to bear in mind that there is a vast difference between the American Relay League and anything which we could do in this country. The Americans have got a territory equal to practically the territory of the whole of Europe to work over. There is some utility perhaps in their experiments under such conditions, since scattered populations ought to be able to communicate one with another over such a vast area. If we are going to do anything of the same kind in Europe, we must first of all start, in my opinion, by not calling it a British Wireless Relay League, or even the British Radio Relay League, but The International Radio Relay League of Europe, or something of that kind. Now, the Americans have settled their internal political questions very satisfactorily for many years. But I ask you gentlemen, are the conditions in Europe to-day favourable for such a League to be formed ? You can arrange communication between England and France, but can you work from England to Turkey, or can you work from England to Moscow ? I think the time is not yet ripe for the formation of a League which is going to do experimental work between all these countries. We have got to get behind a great deal of red tape in Whitehall before we shall get favourable conditions.

Mr. W. Winkler (Edinburgh and District Radio Society).

We have heard that a great number of people are in favour of the institution of such a League, and at the same time there are others against the idea. Nobody is forced to join, and the organisation is there for those who wish to do so.

The Chairman.

I think that there is very useful work in front of this League. It would naturally handle transatlantic transmissions. Perhaps it is to be regretted, as Mr. Child pointed out, that it cannot very well tackle continental traffic at present, but it might expand into an international organisation afterwards, after experience in handling the work here. A certain banding together of transmitters is very advantageous. There are matters frequently arising which require the transmitters to confer together rather urgently. It seems to me essential that the Relay League would consist primarily of transmitters, although I understand from Mr. Evans that it is at present open to holders of "receiver" licences also. I just want to say this. If the British Radio Relay League undertook such important work as is indicated, it might have to act as a watch committee, reporting and trying to suppress bad manners in wireless. In these circumstances the League should strengthen its organisation and personnel. I would like to ask Mr. Evans when the British Wireless Relay League was formed.

Mr. Evans.

The original idea was embodied in a letter which I sent out in the autumn of last year, and up to the present time we have about 24 members, and I understand there are about 15 applications which are in abeyance until after this Conference.

The Chairman.

That sufficiently answers my question. Would Mr. Evans welcome my suggestion that the League's personnel should be considerably strengthened and more influence and ability added to that which you already have in large measure? It occurs to me that if you were able to persuade Mr. Coursey to become your President you would secure the greatest authority on that class of work on this side of the Atlantic, and all the other transmitters should be specially invited to join.

Mr. Evans, replying, said:

I would like to say that I did write to Mr. Coursey about this Relay League, but just at that time he was busy with the organisation of the Trans-atlantic Tests. I do assure Mr. Coursey that the valuable work he has done will not be overlooked in this League.

The Chairman then asked for a show of hands to indicate whether the desire of the meeting was to support the League or not. Very strong support was indicated.

The Chairman.

I promised to bring up again the first item on the Agenda, which relates to the organisation of the Conferences, and the meeting is now open to hear any proposals or alternatives to our present annual conference held in January.

Mr. H. Epton (Hackney and District) put forward a resolution relating to the constitution of the Radio Society of Great Britain, and it was explained by the Chairman that the Conference was not concerned with and had no powers to deal with such a matter.

Mr. L. F. Fogarty (Hon. Treasurer).

When a society becomes affiliated to the Radio Society of Great Britain there is included with the receipt for their subscription a membership card with a note asking the Secretary of the Society to fill in the name of their accredited member, and to notify me accordingly. A member so credited can attend and vote at every meeting of the Radio Society of Great Britain.

The Chairman.

The next item on the Agenda is:—

Broadcasting: How it affects members of Affiliated Societies:—

(a) From the point of view of those holding Transmitting Licences.

(b) Those holding Receiving Licences.

This afternoon we have with us, as a member of the Radio Society of Great Britain, a broadcasting authority. I refer to Mr. Reith, the General Manager of the British Broadcasting Company. I hope that we shall later have the pleasure of hearing something from Mr. Reith.

Major Basil Binyon.

I am sure all of us who are interested in amateur experimental work appreciate the fact that to the amateur, and particularly to the transmitting amateur, broadcasting may at times be very troublesome, particularly as regards the 440 metre wave. But surely, with the suggestion we have before us for the formation of a Radio Relay League, organised for all those holding transmitting licences, in conjunction with the Radio Society of Great Britain, I am sure we could obtain some other transmitting wave which would enable us to carry out those experiments throughout the whole broadcasting periods.

But just consider for a moment what it is that broadcasting can do for the amateur. One has heard of the disadvantages of broadcasting to the amateur. One ought not to lose sight, however, of some of the advantages, because at any rate I am convinced there are some advantages which arise. Speaking from my own experience, personally I certainly have found regular telephony programmes exceedingly useful in carrying out a whole variety of experiments in connection with improvements in receivers, testing of all other kinds of loud speakers, and research for improvements in articulation in receiving apparatus, and a number of things of that kind, where regular transmitting programmes are very beneficial.

Broadcasting is unquestionably creating a great deal of interest throughout the country. What does that mean to our amateur societies? People who knew nothing about it before have become interested purely from the point of view of hearing a concert. A little later on they come to want to know how the instruments work, and later they will join a wireless society, and it is therefore a great help in bringing in new recruits.

I would emphasise the point that societies are formed to look after the interests of the experimenter and that listeners-in will soon be the vast majority of wireless users, and though we may be organised we have to remember that if we are going to be a nuisance to the listener-in in any way he will perhaps organise himself against us, and therefore what we want to do is to regulate our transmissions or work in co-operation so that we secure the best results, and at the same time allow people who only want to listen in to broadcasting to enjoy broadcasting.

The discussion was opened by comments by a number of delegates, most of whom pointed out the difficulties under which experimental work, and especially transmitting, was conducted as a result of the monopolising of the ether over the period of broadcasting, and on a wide band of wavelengths.

Mr. J. W. C. Reith.

There was once a fellow called Daniel who, on entering a room, was introduced to society in which he found he was not welcome. Daniel was much wiser than I, because I came here willingly. In the little while I have been here I have been very much inclined to study the most expedient means of exit!

There is no doubt that the formation of the British Broadcasting Company has aroused criticism to a very large degree in two quarters. First from the amateur (or the experimenter), secondly from certain commercial undertakings who may consider that they have been excluded, or are about to be excluded, from fulfilling their lawful functions. The difficulties that we have been faced with have been, are still, and will continue to be, enormous. Criticisms which were made are, shall I say, of three orders. Before I indicate what those are, I may mention that I have had to decide three weeks ago, when I joined the British Broadcasting Company, whether I was going to set out to reply to those criticisms and endeavour to eliminate the misconceptions which had arisen, or whether I was going to get on with broadcasting. We decided to get on with broadcasting, and I think most of those who listened to our programme last week when we were transmitting opera would agree that we have attained a certain degree of success. Criticisms are of these three categories. First, the perfectly reasonable; second, the not wholly unintelligible, and thirdly the altogether ridiculous and inaccurate. I am not, of course, referring to the criticisms which we have heard to-day. I am just going to point out some of the difficulties. Our programmes are exceedingly expensive. A very gross misconception exists that we are a most prosperous firm, coining money. Our revenue is derived from two sources—Post Office licences and royalties. I could give you figures of the number of broadcasting licences and experimental licences, and the preponderance of the experimental licence over the other would, I think, surprise you. Now we know there are thousands of people in possession of apparatus with no licences at all. I personally know several and endeavour to deal with them. The Post Office are undoubtedly going to get at them some time. I know that there are firms selling to holders of broadasting licences apparatus which does not carry the Broadcasting Company's stamp. If a man with a broadcast licence goes and buys a set which is not marked "B.B.C." we get no tariff on it, and he gets the whole of our programme for 5s. a year. If he has an experimental licence and buys so-called experimental apparatus he may be doing it with the sole purpose of listening-in to broadcast programmes. We are up against the operations and opposition of "experimenters," falsely so called. One speaker indicated what broadcasting owed to the experiments of the amateur. Don't you think we realise it? Don't you think we realise that perfectly well, and that if it had not been for the many years of arduous efforts on the part of the amateur, broadcasting would not be an accomplished fact? We are not really the hard pig-headed commercial concern we are sometimes represented to be. Nor are we, on the other hand, an iniquitous monopoly, as some commercial concerns consider us to be. We acknowledge our debt to the amateur, and if we did not acknowledge it—well, more fools we!

I would point out that it is quite likely that the amateur may do a good deal for broadcasting in the future. If he is experimenting and succeeds, where is his market if the Broadcasting Company had not succeeded in preserving that market for him? The experimenter can help *us* in two points. Where you know a man is ungenerous and dishonourable, help us in that. Where you know a man is not using B.B.C. material—by unscrupulous means—help us in that! I think you will agree with me that it is not in accordance with British ideas that a man should get something for nothing.

We are in every way out not only to co-operate with you, but to assist you in recognised experiments where possible.

As regards broadcasting hours, we are under obligations to the public to put some kind of programme over, and everybody in the country holding copyright or any other rights are on to us. People say is it necessary to have broadcasting programmes from 5 to 11 o'clock regularly, and though it may surprise you, some people seem to enjoy them. What are the public going to say if we suddenly shut down to give the amateur a chance? We must regard, above all things, the terms of the licence under which we exist, and under those terms we are under an obligation to broadcast to the public through the stipulated hours.

We invite your co-operation, and, speaking on behalf of the Company, I say that we will and can have no other attitude towards you than that of anticipating your co-operation.

The Chairman then said:

We have had a very interesting discussion on broadcasting. I do not think anybody will accuse me of being a champion of broadcasting to the detriment of the amateur, and perhaps on that account I am all the more free to confess how greatly I enjoyed the programme of **2 LO**, particularly during the Christmas festivities, which, from the point of view of anyone with children at home, introduced a very novel and welcome element, to say nothing of Covent Garden opera, culminating in that wonderful Melba performance the other night. It was just two years ago, almost to the day, and in this very room, that the Second Annual Conference asked that permission should be granted to the Marconi Company to broadcast from Chelmsford.

We boldly asked for music, and, greatly daring, defended the request by claiming that the amateur experimenter was such an asset that he should be encouraged by popularising the science. After losing nine months in patient negotiations we presented a petition which produced the desired result within a fortnight. There is a saying that we English muddle through, that we go slowly, and always follow after other people, but that ultimately we usually do it very well. I think the Broadcasting Company are doing it very well, and that their organisation is not of the kind which is here to-day and gone to-morrow, but is substantially founded. Our duty is clear. It is perfectly true we were there first. It is true we were not consulted on the vexed question of wavelength. But don't let us forget that the object is the greatest good to the greatest number, and just as we have set up a standard of good manners in things wireless, so we must maintain it. We are going to see to it that the law is obeyed, and I think Mr. Reith will find that we are competent to do a great deal of work in the way of removing difficulties without detriment to our own interests. Certainly such evils as reaction, illegal practices, the taking out of no licences at all, and the purchase of goods which are not intended to be bought with broadcasting licences and things of that kind, will not be countenanced by the Radio Society of Great Britain. It and its 152 affiliated societies are on the side of law and order.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each questions should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, The Wireless World and Radio Review, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* **(6) Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"E.B." (S.E.15).—(1) The samples of materials submitted are quite suitable for use in the construction of condensers. The tinfoil is about 0·001″ thick and the paper less than 0·001″. It will be difficult to calculate with any accuracy the capacity of a condenser built with these materials. However, you should try. The specific inductive capacity of paper may be taken as 2·4. (2) We suggest you take tappings at 200, 350, 550 and 800 turns. The remainder of the wire should be used in a larger coil with a diameter of 2″. You will not require a variable condenser. (3) There is no best value for the coupling, and we suggest you find by experiment which is better for the wavelength range over which you wish to receive. (4) The correct sizes of pins and the spacing between the centres of the sockets is given on page 328, December 9th issue.

"R.K." (Flint) *asks* (1) *How to wire up a receiver so that different potentials may be applied to the high frequency detector and low frequency valves.*

(1) The connection is quite easily made. Instead of a common lead supplying the H.T. to the anode of the valve, one lead is taken to the high frequency valves, another to the detector valve, and the third to the low frequency valves. Three plugs are provided for tapping into the battery. The method is given in Fig. 1, page 601, February 3rd issue.

"H.R." (London, N.6) *refers to the Armstrong super-regenerative receiver and asks* (1) *Could a circuit be given in which only two valves are used.* (2) *May a cardboard tube wound with No. 26 D.C.C. coupled to the tuning coil be used instead of the variometer.* (3) *May 80 or 100 volts be used as the high tension supply for the anodes.* (4) *Is an "Ora" type valve suitable for this receiver.*

(1) See the reply to **"H.R." (Highgate)** in the issue of January 6, 1922, page 488. (2) and (4) It is always better, when one is constructing a receiver of this description, to follow out the writer's instructions precisely, and when one has gained working experience with this type of circuit, it is then an easy matter to make changes and experiment, but until considerable experience is obtained, great difficulty will be met with in securing satisfactory operation. (3) 80 or 100 volts is quite a suitable potential for the anodes of the valves.

"F.F." (Manchester) *asks* (1) *Whether the combined length of the aerial and lead-in may be 100′ irrespective of the number of wires used in parallel.* (2) *Would it be necessary, if one wishes to change the aerial, to get the permission of the Post Office.* (3) *Would the substitution of a four or six-wire cage aerial be an improvement. It is desired to conduct experiments with long wave reception.* (4) *Is 7/22 stranded wire better than No. 16 hard drawn copper wire for aerial purposes.*

(1) We believe the Post Office will allow you to erect an aerial, the length of which from the free end to the earth connection is 100′. Any number of wires may be used in parallel. (2) We do not think you will have to obtain permission before you may add more wires in parallel to the aerial. (3) We do not think any great advantage will be obtained by the use of a cage aerial, as you are only interested in reception. (4) We suggest you use the No. 7/22 stranded wire instead of No. 16 hard drawn copper wire.

"F.G." (Birmingham) *refers to Fig. 3, page 549, January 20th issue, and asks whether it will meet his requirements.*

With reference to the diagram, Fig. 3, page 549, January 20th issue, the circuit is quite correct, and is a good circuit if the switching arrangements meet your requirements. It is necessary to couple the high frequency valves by means of the condensers and resistance shown in the diagram, and we would point out that the resistance is not joined across the condenser, but is connected between the grid and filament. The method of connecting the potentiometer is indicated in the sketch. The potentiometer is joined across — and — L.T., and the two leaks from the grid leaks, instead of going directly to the filament battery, are taken to the sliding contact on the potentiometer. Because the reaction coil is coupled to the close circuit coil, energy may be radiated from the aerial circuit if care is not taken, and we suggest when listening to broadcast transmissions you keep this reaction coil short-circuited. The reaction coil could be removed from the circuit, and when it is required to listen to other transmissions, the short circuit could be removed and the reaction coil brought into use again. Apart from this, we think the Post Office would grant you permission to use this circuit.

"A.McD." (Edinburgh) *asks whether interference is likely to be caused from the use of a small motor generator which is used to supply plant-heating current.*

We suggest you try whether interference is caused through the receiver when the induction motor is running with the ordinary accumulator filament heating. If there is a hum present in the receivers, we suggest you screen the motor by placing it in an iron box, and take care with the earth lead. If the leads to the motor are earthed in any way, a separate earth should be made for the wireless receiver. It may consist of a galvanised iron sheet about 2′ wide and 3′ long, to which are soldered the earth wires. The earth lead should run directly to earth, and not run parallel with the power leads. When the generator is connected with the valve filaments, it may be noticed that there is a hum due to the commutator ripple. This is easily smoothed out by means of a large capacity condenser connected across the filaments. 4 to 6 mfds. would be suitable. Attention should be paid to the brushes of the generator, because any sparking here will be heard in the receivers.

"A.H." (Cambridge) *submits a diagram of connections and asks for criticism and advice.*

We have examined the diagram submitted, and the circuit is quite correct, but we suggest you use a closed circuit as well as the aerial circuit, and the connection from the grid leak resistance should also come to the potentiometer. The loose coupler may be used as the anode winding and a reaction coil, but it is rather large if it is desired to receive short wavelength signals. We suggest you rewind each winding with No. 22 D.C.C. and take off 15 tappings from the anode coil, and 6 from the reaction coil. The alternative to this arrangement is to use dead-end switches. The tuner coil is suitable. When the reaction coil is coupled with the anode coil, energy will not be generated in the aerial circuit, but when the reaction and aerial coils are coupled together, it is quite possible to set up oscillating energy in the aerial circuit, which will cause interference.

"J.S." (Bolton) *asks whether an inverted L type aerial is directional, and if so, whether it is worth while attempting to make use of the property.*

The ordinary inverted L type aerial is slightly directional, and to obtain the benefit of this property, the free end of the aerial should point away from the station it is wished to receive. However, the gain through making use of this property is very slight, and will, generally speaking, be hardly worth while. Therefore the lead-in should be taken at the most convenient end of the aerial. It should, of course, be direct, and be held away from the walls of buildings, trees, and so on.

"M.C." (Wicklow) *asks* (1) *For the dimensions of a grid leak to have a resistance of about 10,000 ω.* (2) *Whether a grid condenser and leak connected with each H.F. transformer will cause a reduction in the signal strength.*

(1) A suitable grid leak would be constructed as follows: A piece of ebonite rod 1½″ in diameter should have eight grooves 0·5″ deep and 0·3″ wide. Each should contain 1,000 turns of No. 38 Eureka wire, preferably D.S.C. It is not necessary to take any pains to ensure that the grid leak winding shall be non-inductive, as no great advantage is brought about through the use of a non-inductive grid leak. It is very convenient to provide tappings on the grid leak, and in between the slots the wire may be brought to a brass tab which is secured with a small screw. Although the grid condensers and leaks are permanently connected in the receiver, it will be found that no serious loss in signal strength will result when high frequency transformers are used in place of the tuned anode or anode resistance method. It is, however, better to remove the grid condensers and leaks, except from the detector valve.

"H.F." (Orpington) *asks* (1) *How connections are arranged so that the anodes of the valves may be supplied with independent voltage taps.* (2) *How may the last valve in the L.F. amplifier be converted to a power valve.*

(1) The arrangement is very simple, and is indicated in Fig. 1, page 601, in the issue of February 3rd. Instead of the ends of the transformers being coupled together and taken to one H.T. terminal, independent leads are taken from the transformers, and are tapped off the battery as required. There will be no voltage drop due to the anode current passing through the filament resistance, because the anode current has such a small value. (2) We suggest you connect a few negative cells in the grid circuit of the last valve, and increase the anode potential to about 200 volts. We would refer you to the article on page 601, February 3rd issue of this journal.

"G.F.K." (Sidmouth) *asks* (1) *Whether we can identify stations from the particulars submitted.* (2) *Why the signal strength was increased when a tapping was taken from the centre of the grid leak, which consisted of pencil lines upon a piece of cardboard.* (3) *Would the H.T battery send sufficient current through the grid leak to cause it to run down rapidly.* (4) *Are the results obtained satisfactory for a single valve receiver.*

(1) We have no definite information concerning the stations referred to, and we believe the call-signs have only recently been allotted for experimental work. (2) We cannot say why you should obtain such a great increase of signal strength when the H.T. is connected with the grid leak, but we think if a proper grid leak were used, you would not notice changes in the signal strength through making connections of this kind. (3) The amount of current passed by the grid leak when connected with the H.T. battery would be so small that it could be neglected. (4) We consider you are obtaining good results with your receiver.

"A.C." (Woodford) *asks* (1) *Whether a telephone transformer is necessary.* (2) *What resistance telephones should be used.* (3) *If the telephone transformer is unnecessary, what would be the resistance of the telephones to be used, and how would they be connected in the same circuit.*

(1) and (2) We suggest you use the telephone transformer. 60 ohm telephones should be used. The transformer described on page 553 of the

January 20th issue is, as you suggest, quite suitable for your purpose. (3) If you do not care to go to the trouble of making a telephone transformer, high resistance telephones may be used. Telephones with a resistance of 4,000 ohms will be quite suitable, and should be connected in the circuit as shown on page 552 of the January 20th issue.

"READER" (Birmingham) *asks* (1) *Whether the circuit submitted is suitable.* (2) *What are suitable values for the condensers.* (3) *What would be a suitable frame aerial.* (4) *What is the value of the resistance marked R in the diagram submitted.*

(1) The receiver wired according to the diagram submitted will certainly give signals, but we suggest you use a standard arrangement. A number of circuits appear in these columns from time to time. (2) The condensers have the following values:— C_1, maximum value, 0·0005 mfds.; C_3, maximum value, 0·0003 mfds.; C_2, maximum capacity, 0·002 mfds. (3) We suggest a frame aerial with 6′ sides and ten turns, the turns being spaced ¼″ apart. No. 18 D.C.C. wire is suitable. Four or five tappings should be taken. The resistance R may be 2 megohms.

"A.C.S." (N.10) *submits a diagram of connections of his receiver and asks* (1) *Is the circuit correct.* (2) *What is the value of the inductance marked X in the diagram.* (3) *What H.T. battery is needed for use in connection with "Ora" type valves.*

(1) The diagram is quite correct, except that a connection across the series parallel switch is missing. This connection is given in all diagrams which appear in these columns. (2) The value of the inductance X is such that, together with the tuning condenser, it tunes to the wavelength of the closed circuit. A plug-in coil may be used, and would therefore have about twice as many turns as the closed circuit coil. (3) We suggest you use a 60-volt H.T. battery. A lower voltage often gives quite good results, but it is convenient to be able to provide 60 volts for the anodes of the low frequency valves, even if this voltage is not required for the high frequency valves.

"THREE VALVE" (Wallington) *asks* (1) *Whether better results should be expected if different types of valves are used for H.F. and L.F. amplification.* (2) *Why, with the aerial tuning condenser in parellel with the A.T.I., the signals are much weaker, and in addition, the receiver oscillates directly the anode winding is tuned to the wavelength of the aerial circuit.*

(1) We do not think there will be any great gain in signal strength through connecting different valves in the high frequency and L.F. portions of your receiver. It is generally advisable to use one type of valve throughout the receiver, and we suggest "Ora" type or "R" type valves. (2) When receiving short wavelength signals, it is often noticeable that the signal strength is louder when the A.T.C. and A.T.I. are connected in series. When the anode winding is in tune with the closed circuit, there is a tendency for the receiver to oscillate, and for this reason the grid leak is connected with the grid and + L.T. If there is still a tendency for the receiver to generate oscillations, we suggest you reverse the connection to the reaction coil, so that the tighter the reaction coil coupling, the greater is the reduction of signal strength.

"G.V.F." (Beckenham) *asks* (1) *What would be a suitable winding for an anode coil and reaction coil.* (2) *If an experimental licence is taken out between now and June, is it necessary to renew the licence again in June.* (3) *Is a variable grid leak likely to be satisfactory when made of a piece of ebonite, containing pencil lines along it.*

(1) We suggest you wind the anode coil 8″ long and 3¼″ in diameter as suggested, with No. 34 S.S.C. wire. There should be 12 tappings. The reaction coil can be 2¾″ in diameter and 6″ long, of No. 34 S.S.C wire. (2) We have no definite information on this point, but the Post Office will ask you for the renewal of the fee when it is due. We believe it will be due upon the anniversary of the date of granting the licence. (3) We do not think a variable grid leak constructed as suggested is of much value, because it is so difficult for one to know the actual resistance of the leak, and it is not always possible to obtain consistent results. The usual value of grid condenser and leak is 0·0003 mfds. and 2 megohms.

"SPARKS" (Stone) *asks* (1) *Is the proposed arrangement correct.* (2) *What improvements could be made.* (3) *Would the Post Office give him permission to use the receiver.*

(1) and (2) The diagram is correct, but it is not necessary to connect a variable condenser across the L.F. transformer connected in the anode circuit of the first valve. The grid condenser should have a value of 0·0003 mfds., and you would find it helpful to connect a 2 mfd. condenser across the H.T. battery. (3) As the reaction coil is coupled with the aerial coil, it will be possible to easily transfer oscillating energy to the aerial circuit, and we do not think the Post Office will give you permission to use a circuit of this description, especially if the receiver is intended for the reception of broadcast transmissions. The reaction coil should be short-circuited, or one stage of high frequency amplification be used.

"RAWLINGS" (Hull) *submits particulars of a valve which he has purchased, and asks whether we can give him any information.*

We regret we have no information concerning a valve of the type in your possession. It is obviously an American valve—probably a small power valve. You will be able by experiment to find out the approximate filament voltage and current, when we should probably be able to identify the valve.

"W.L.B." (Bristol) *asks* (1) *What is the wavelength range of a loose coupler, particulars of which are submitted.* (2) *What would be suitable windings for an anode coil.* (3) *What would be a suitable reaction coil.* (4) *What is the address of the manufacturers of the Fuller Block Accumulators.*

(1) The wavelength range of the loose coupler will depend very largely upon the dimensions of your aerial, but with a normal aerial the range covered is approximately 150 to 900 metres. (2) A suitable tuning coil would be 3″ in diameter and 6″ long, of No. 32 S.S.C. The coil should be tuned with a condenser having a maximum value of 0·0002 mfds. (3) A suitable reaction coil would be 2⅜″ in diameter and 4″ long, wound with No. 34 S.S.C. wire. Five tappings should be taken. (4) The address of the manufacturers of the Fuller's Block Accumulator is Iddesleigh House, Caxton Street, Westminster.

"STUCK" (N.W.8) *has a receiver and uses a crystal for rectification, and asks why the addition of one valve does not give much magnification.*

The fault probably lies in the transformer which is used. We suggest you try different combinations of crystals, and use the combination which gives the loudest signals. As you probably know, the different crystal combinations have different resistances, and with a little experimental work you will find the best combination which, used in conjunction with the transformer, gives the loudest signals.

"J.O." (Manchester) *asks what size variable inductance to use in conjunction with a crystal for the reception of broadcast transmissions.*

We suggest you use an aerial coil 4″ in diameter and 3″ long, of No. 20 D.C.C. The secondary may be 3″ in diameter and 4″ long, of No. 26 D.C.C.

"E.J.M." (Surrey) *asks whether the proposed method of coupled L.F. valves would give as good results as the usual low frequency transformer method.*

The proposed method is often used with success. The grid condenser should have a value of about 0·002 mfds., and the grid leak about 1 megohm. Good results should be obtained, and when proper adjustments are made, the results should compare favourably with the more usual transformer method of coupling.

"H.H.D." (Essex) *asks* (1) *Whether it is possible to charge accumulators from A.C. mains using a chemical rectifier of the type described recently in this journal.* (2) *If the method referred to is practicable, please give specifications of suitable transformer for use in connection with the charging of a four-valve accumulator.* (3) *What would be suitable dimensions for the cells used in the rectifier.*

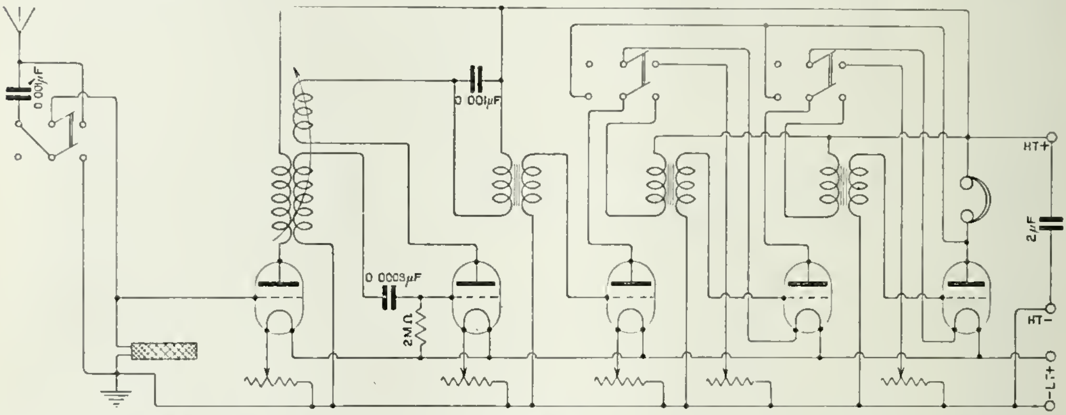


Fig. 1. A 5-valve receiver with 1 H.F., 1 Detector, and 3 L.F. valves. The H.F. valve is transformer coupled and the reaction coil is coupled with this transformer. Switches are provided for cutting out L.F. valves.

"R.T." (Kent) *asks for a diagram of a five-valve receiver.*

A suitable diagram is given in Fig. 1, and shows how one H.F., one detector, and three L.F. valves are connected. Suitable values for the condensers are given in the diagram. Switches are connected for the purpose of connecting the telephones to any of the last three valves.

"WIRELESS" (Staffs.) *asks* (1) *Whether the proposed method of constructing a low frequency transformer is suitable.* (2) *What resistance telephones should be used in conjunction with the telephone transformer.* (3) *What type of valve is recommended for use in the high frequency portion of the circuit.* (4) *Should he expect to get better results if the No. 12 copper wire which is at present used in his aerial were removed and No. 7/22 copper wire is used in its place.*

(1) The telephone transformer primary winding may consist of 2½ ozs. of No. 42 S.S.C. wire, the secondary being 5½ ozs. (2) The telephone transformer should work quite well if 60 ohms telephones are used. (3) We suggest you use "R" type or "Ora" type valves. There is nothing much to choose between them. (4) We do not think you should expect to obtain a great increase in signal strength through using 7/22 copper aerial wire in place of No. 12.

It is not possible to charge accumulators with the aid of the chemical rectifier referred to. This rectifier will only pass a current of a few milliammeters, and it is therefore only suitable for supplying the anode circuits of the receiver. To charge your accumulator satisfactorily, a current of 3 amperes would be required, and we suggest you use either a mechanical rectifier or a special valve rectifier.

SHARE MARKET REPORT.

Prices as we go to press on February 23rd are :—

Marconi Ordinary	£2	14	6
,, Preference	2	6	10
,, Debentures	108	0	0
,, Inter Marine ..	1	8	9
,, Canadian	0	11	6
Radio Corporation of America :—			
Ordinary		15	0
Preference		13	3

The Directors of W. T. Henley's Telegraph Works Company, Ltd., recommend a final dividend on the ordinary shares of 2s. per share less tax, making a total of 3s. per share.

THE
WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

No. 186 [No 23 Vol. XI.] MARCH 10TH, 1923. WEEKLY

Some Practical Applications of Time Signals

By W. G. W. MITCHELL, B.Sc., F.R.A.S., F.R.Met.S.

1.—Method of Obtaining G.M.T. from Rhythmic Beats.

IN my article which appeared on January 13th on Time Signals, all times were given in *sidereal time*, this being the standard unit of time adopted at astronomical observatories for the reasons set out in the article. There may be some uncertainty as to the method of arriving at G.M.T. from these results. Tables for converting intervals of sidereal time into the corresponding intervals of mean solar time will be found in the "Meteorological and Time Signal Section" of the *Year Book of Wireless Telegraphy*, 1923 edition, together with an example showing the working. Further, in order to be able to "set" a clock to mean solar time (*i.e.* G.M.T.) from the data furnished by the rhythmic beats, it is necessary to be provided with tables giving the mean solar time at the preceding sidereal noon. These tables are printed in the Nautical Almanack for the current year (published by H.M. Stationery Office, Kingsway, 5s.) under "Transit of First Point Aries," page iii of each month. Then the mean solar time required = mean time at preceding sidereal noon + the equivalent to the given sidereal time.

Therefore, unless the highest accuracy is aimed at, it is better to make use of the ordinary time signals sent three times daily from FL in order to determine G.M.T.

One further point about which there seems to be some misunderstanding cannot be passed over. It is very often assumed that the rhythmic beats commence *precisely* at 1,000 G.M.T. This is not the case, as will be seen from further reading below.

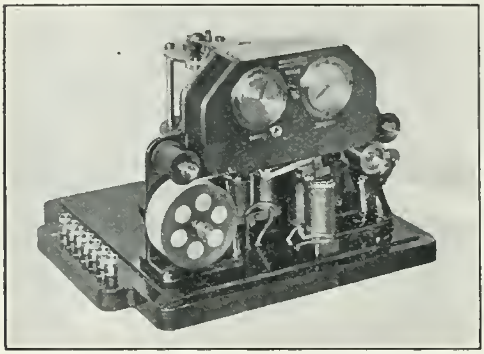
2.—Method of Determination of Longitude.

The difference in longitude between two places on the earth may be expressed as their difference in time, which again is simply a measure of the amount of rotation of the earth in that time interval. Whether this is expressed in mean solar time or sidereal time matters not; in practice the sidereal unit is adopted.

Previous to the facilities now afforded by long distance W/T, longitude determinations were only possible by using a celestial time signal common to all the world. One method consisted of the repeated transmission of chronometers (deck watches) between the ends of the arc it was desired to measure. Otherwise the two posts were required to be telegraphically connected by land line. A pre-arranged signal emitted from one station was automatically recorded at the other by some form of printing chronograph, due allowance being made for the "lag" of the interposed instruments. The actual recording of a certain instant of time enters so fundamentally into all longitude determinations that a brief description of one form of printing chronograph is given. The front and back view of the chronograph are shown in the photographs on the next page. This instrument prints on a paper strip the time of any signal in minutes, seconds and thousandths of seconds as in the actual record.

For this purpose three discs, with engraved printing figures on the periphery rotate over the paper strip, which is pressed against the disc during an extremely short time by an electromagnet, when a current excites the magnet.

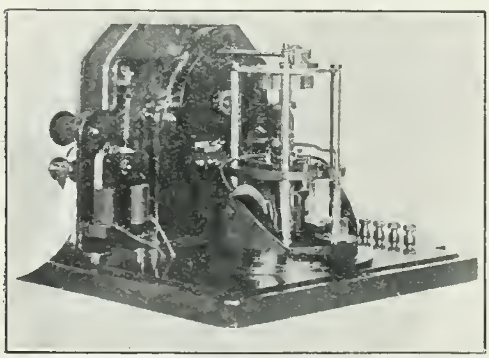
The chronograph is driven by an electric motor, direct current 12 volts, provided with a very sensitive speed regulator. The error in the speed can be adjusted to be less than



Front view of a Printing Chronograph.
By Courtesy of Société Genevoise d'Instruments de Physique.

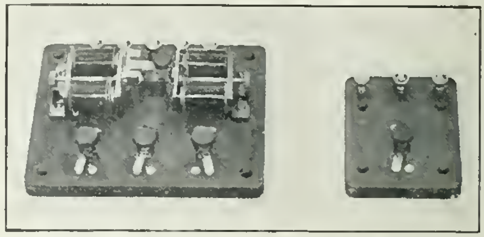
a few seconds per hour and a slight positive advance is given to the motor. A synchronisation device acted by a very accurate electric clock eliminates automatically every second the very small advance of the instrument. At the beginning of each second, the time recorded on the paper strip is the absolute time given by the clock; at the end of each second, the time as printed cannot be affected by an error exceeding 0·005 second. The chronograph can be placed at a great distance from the observer, and in longitude determinations it is set up at one of the stations and operated from the other station by means of the relay.

Let us consider the determination of longitude say between Washington and Greenwich by making use of the rhythmic beats sent by



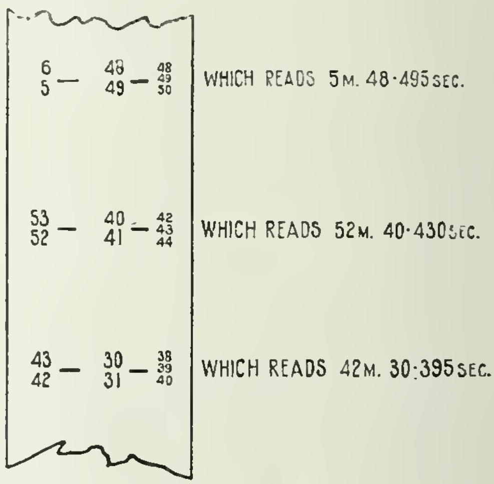
A back view of the same Printing Chronograph.
By Courtesy of Société Genevoise d'Instruments de Physique.

FL. The observatories at both places are provided with accurate clocks whose error and rate may be determined regularly. The times of receipt of the rhythmic beats are



Relay for Printing Chronograph.
By Courtesy of Société Genevoise d'Instruments de Physique.

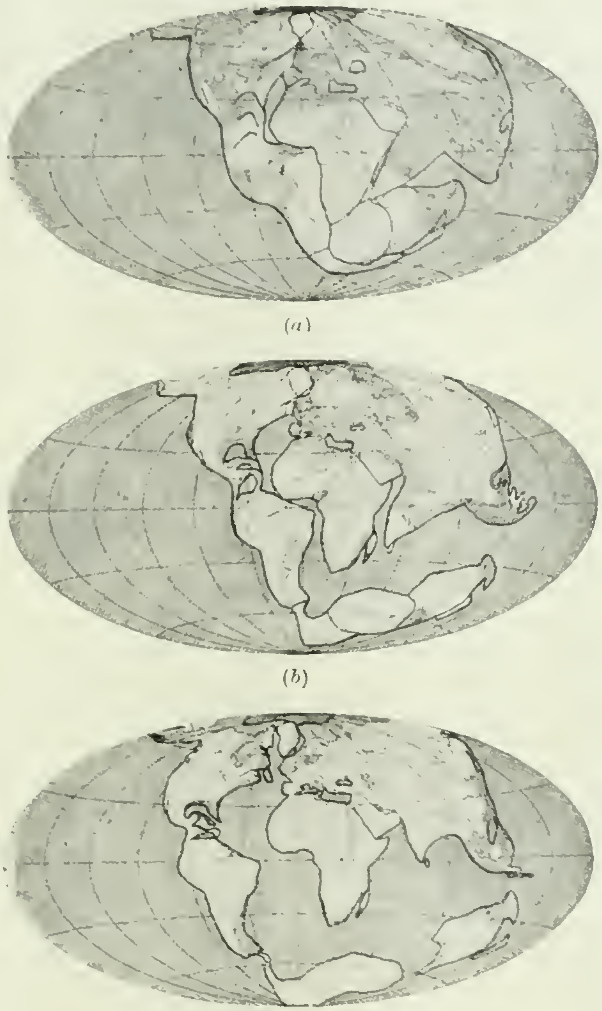
recorded simultaneously by both observatories, the records extending over an interval of months and each of sufficient duration to determine "lag" constants of the recording apparatus, and



An example of time recording on paper strip by the Printing Chronograph.

to make accidental errors negligible. By bringing together the two sets of results for comparison the times of receipt of the signals at Washington and the corresponding times at Greenwich, the differences in the two sets should be a *constant* interval of time which is, in effect, the difference in longitude. Provided, therefore, that means exist of determining a time standard at each end of the arc which it is required to measure, the time signal itself may be entirely eliminated, and further, for the purpose of the experiment, it is immaterial at what instant of time the signal is sent from Paris. This last statement shows the error of assuming that the rhythmic beats are regulated to commence at 1,000 G.M.T. precisely.

Such determinations have already been carried out and a comparison of the results so far obtained shows that a small fluctuation persists, after all known connections have been made. The error appears to be seasonal, and at present is not fully explained. The result of the Washington-Paris longitude determination made in 1913, using a crystal detector and a wavelength of 2,200 metres, with an emission from Paris of 18 kw. gave the longitude of Washington as 5 hrs. 17 mins. 36·549 secs. ± 0·0051 secs. By interchanging the observers at each end, a second result agreeing very closely with the first was obtained, namely, longitude = 5 hrs. 17 mins. 36·758 secs. ± 0·0027 sec. The *Longitude of Adelaide*, from an experiment conducted between June 21st and July 5th, 1920, using the rhythmic beats from Lyons, was 9 hrs. 14 mins. 19·95 secs., and from two series of Annapolis signals between July 6th and 28th, and August 8th and 19th, 1920, 9 hrs. 14 mins. 19·79 secs., and 9 hrs. 14 mins. 19·78 secs. respectively, the previously adopted value being 9 hrs. 14 mins. 20·07 secs.



(a) (b) (c) *By Courtesy of "Discovery."*

Maps to illustrate Professor Wegener's displacement theory. White portions denote land. (a) In the carboniferous period about fifty million years ago, (b) Eocene period when mammals became common about ten million years ago. (c) Old Quaternary period when man and present-day animals appeared about one million years ago.

Discussing the signals received from Paris, Nauen and Annapolis, and taking weekly and monthly "means" of determined values from 1912 - 1919, the Astronomer Royal, Sir Frank Dyson, says "If the positive value is regarded as due to error in longitude and not as arising from instrumental errors, either in time determination, sending or reception of signals, these figures imply that Greenwich is about 0·03 sec. to westward of its assumed position relatively to Berlin, Paris and Washington."

The work has gone far enough to show that (*a*) longitude determinations made before the advent of W/T are subject to larger errors than were hitherto suspected, and (*b*) that the fluctuations appear to depend on the time determinations at the different observatories, and are not due to errors in transmission or reception of the signals.

(3) The Wegener Hypothesis.

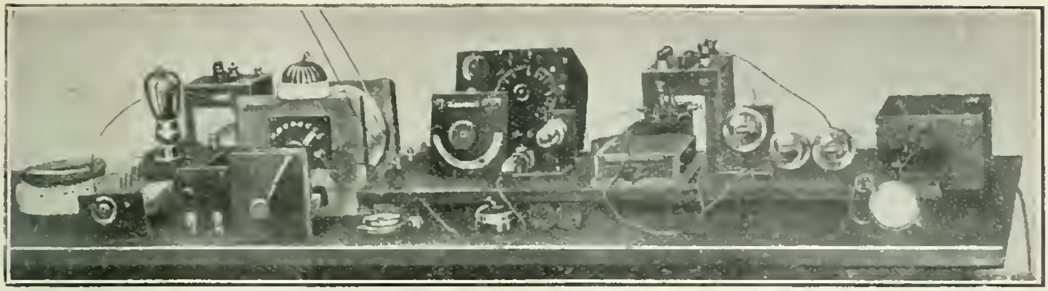
In view of the results previously cited, the question has arisen as to whether the discrepancies might be explained by a systematic movement of the parts of the earth's crust. Special interest attaches at the moment to the fascinating theory of Professor Wegener, and known as "The Wegener Hypothesis of Continental Drift." Briefly the theory assumes that the continents are "cakes" of light siliceous material floating on a heavier substratum. The continents, which are thus movable, are supposed, in early times, to have been joined together and to have formed one single land mass. Thus, according to Wegener, the continents are slowly drifting from the poles and from east to west. America appears to be going west faster than Europe, and in its westward drift has crumpled up on its forward side to form the continuous mountain chain known as the Andes. It is also suggested that Southern India has shrunk up northward as expressed by the great foldings of the Himalayas. Wegener also mentions a supposed motion of Greenland (the longitude of which has been determined three times in 1823, 1870 and 1907), indicating a continued westward drift during the past hundred years amounting to about thirty feet per annum. The theory was in the first place devised with a view of explaining the occurrence of allied forms of life on continents separated by great oceans, but it is now receiving much opposition from geologists.

Wireless thus opens up new ground for the determination of longitude and it may also provide some evidence in the future discussions of this new theory. Using modern long-distance working plant, it should not be impossible to establish a net of five or six points roughly equidistant round the globe. The longitude of these points would be found with high accuracy at frequent regular intervals of time, the closing of the arc thus establishing a check on the measures.

A Note on the Action of a Receiving Valve.

WHEN the filament in a valve is heated and the grid and plate are disconnected, negative electrons are given off from the filament, but on account of their small velocity they do not move far from the surface of the filament, and in fact they return to the positive end of the filament. When the plate of the valve is connected with the positive end of the filament, the plate, of course, has a slightly positive potential with respect to the negative end of the filament, and the electrons, which after all are negative electricity, are attracted to the positive plate, and they flow in the external circuit between the plate and the positive end of the filament. The number of electrons which reach the plate is small. When a positive potential is supplied to the plate, a far larger number of electrons are passed to the plate, until a point is reached at which no more electrons are drawn to the plate by the addition of positive volts.

If now a small potential is supplied to the grid, the grid will influence the number of electrons which go to the plate. The grid, of course, is much closer to the filament than the plate, and is made of fine wire with large spaces in between the wires. If a small positive potential is supplied to the grid, a large number of electrons will be attracted to the grid, and some will actually flow in the grid circuit, but on account of the spaces, a large number will pass through the grid openings and will reach the plate, so that we have two currents, a small grid current and a much larger plate current. If now a negative potential is applied to the grid, the grid returns the electrons back to the filament, and but few are able to escape through the openings and reach the plate. When a varying potential is applied to the grid, a varying number of electrons pass through the openings of the grid to the anode. Actually the shape of the current curve in the plate circuit is identical with the voltage curve applied on the grid.



Apparatus used by the Author in his experiments.

Notes on the Armstrong Super.

By FREDERIC L. HOGG.

A GREAT deal of interest has been aroused, especially in America, by the new super-regenerator circuit recently invented. On the publication of the circuits, many amateurs attempted to make the circuit work, and so obtain enormous amplification at little expense. In most cases, however, little success was obtained. In these notes I hope to be able to help some of those who have been unsuccessful so far, as once the circuit has been made to work, astonishing results can be obtained.

Immediately on the publication of the first article in the *Wireless World and Radio Review*, I attempted the circuits, each in turn, with more or less negative results. However, on seeing the article by Mr. Cockaday, mentioned by Mr. Percy W. Harris in his article, I had another try, and immediately, on getting constants correct, excellent results were obtained.

The whole secret lies in the proper proportioning of the various parts and plenty of patience. It is a simple matter to convert an ordinary single valve or two-valve (L.F.) set into an Armstrong by the addition of a small panel. This panel contains the oscillator coils and valve, etc.

The actual constants used on my set are as follows :—

Valves	Rectifier	"Ora"
	L.F. Amplifier	"R"
	Oscillator	Mullard "O.20" Transmitter
H.T.	Rectifier and L.F.	60 volts
	Oscillator	120 volts
L.T.	Rectifier and L.F.	4 volts
	Oscillator	5.5 volts

From Fig. 1 it will be seen that the necessary additions are as follows :—

1. Valve.
2. Large honeycomb or slab coil.
3. 1 0.001μF. fixed condenser.
4. 1 0.001 μF. variable condenser.
5. 60 volts H.T., valve holder, etc.

A panel containing these suitably arranged can easily be made up. A switch can be placed in the lead from the oscillator grid to the detector grid, and then the set can be quickly changed from one circuit to the other.

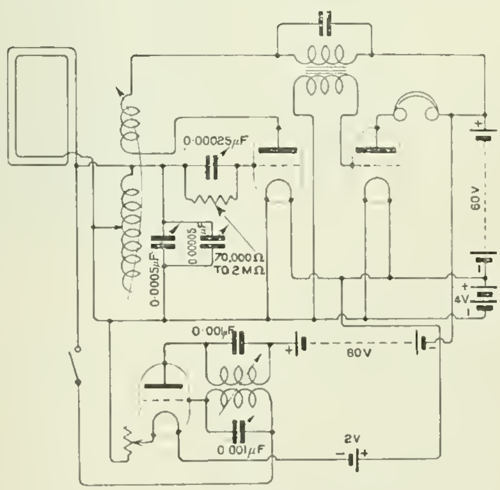


Fig. 1. Two-valve Receiving Circuit adapted for super-regenerative action.

No specific constructional details are given, as each experimenter wishes to make his set in a different way.

In erecting the set care must be taken to keep leads well spaced to avoid capacity effects.

As regards operation, the first point is to use a frame aerial invariably. An outside aerial makes the set very difficult to work, and the radiation is serious. I use a square frame, with 4 ft. sides and having 20 turns spaced $\frac{1}{4}$ in. This frame has a natural wavelength of about 600 metres which, when placed in parallel with the usual 440 metres inductances, just gives the correct inductance for 440 metres, making up for the loss of the aerial. This sounds peculiar but is what happens in practice owing to the large value of the reaction used.

Having erected the panel, etc., the procedure is as follows :—The oscillator is cut off from the grid circuit of the detector, and a loud telephony station tuned in on the frame. The oscillator filament current is then switched on, and with coupling and condensers at maximum, the connection is made by means of the cut-out switch. The detector will be far removed from the oscillation point, and the station will be inaudible. Then on slight adjustments of tuning, and increasing reaction very considerably, the station comes in with enormous strength. Of course it is assumed that the oscillator, reaction, etc., are of correct coupling for oscillation.

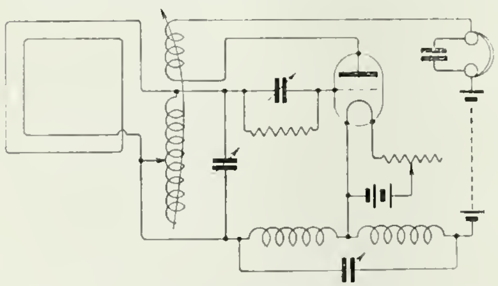


Fig. 2. A single valve circuit embodying the super-regenerative principle.

Various extraordinary squeals and howls are heard, and after a little experimenting it will be found possible to avoid these and to receive speech and music without distortion. It will be found that H.T. and L.T. voltages are fairly critical for best results.

It is fairly easy to operate the set after a few hours' practice, but certain things require to be done before the circuit is suitable for general use.

An amateur of my acquaintance evolved the arrangement shown in Fig. 2, and says that he will never go back to the usual circuit for long-distance work. Once this set is suitably arranged, there are no extra adjustments needed over the usual number.

On the three-valve circuit, Fig. 1, I have received telephony from the following London amateurs, on a loud speaker :— 2 OD, 2 ZT, 2 ZM, 2 NM, 2 WQ, 2 WJ, 5 BT, 5 CV, 5 BW, 2 WD and 2 DF. Many others, within about thirty-five miles radius, have been heard, either speech or morse, on the loud speaker (small Brown).

Of course, 2 LO, 2 OM, 2 ON, 2 KT and 2 FQ are absolutely impossible owing to their great strength, the loud speaker or telephones being nearly torn up ! The longest distance received is 2 IF, speech and music, also on the loud speaker. This station is 60 miles away from Highgate.

In conclusion, I hope many amateurs will soon have " supers " going, as, after a little while, extraordinary results should be obtained with simplified circuits and easier control, which means greater ranges for our 10 watts of telephony.

The Ideal Home Exhibition.

At the *Daily Mail* Ideal Home Exhibition now being held at Olympia, the section devoted to wireless exhibits attracts enormous public interest.

The public demonstrations of wireless Broadcasting too, adds to the general attractiveness of this section.

A splendid array of wireless apparatus by all the leading manufacturers is on view and many novelties and new designs are shown for the first time. In our next number we shall describe and illustrate these exhibits.

A preliminary study of the apparatus on view indicates the progress which is being made by British manufacturers in the development of radio apparatus, particularly for Broadcast reception. The Exhibition affords a unique opportunity for prospective purchasers to examine every type of set before deciding on a purchase. Such an opportunity does not occur except through an Exhibition conducted on these lines, and it is one which should not be missed by anyone who is in any way interested in the subject, whether from a technical point of view or from the point of view which the name of the Exhibition suggests—that the home is not " ideal " unless wireless finds its place there amongst the many things which invention and industry have added to the home equipment.

The Elementary Principles of Radiotelephony.

By G. G. Blake, M.I.E.E., A.Inst.P.

(Continued from p. 729 of previous issue)

I have here an experiment which was shown last year before the Physical Society by Mr. F. Harrison Glew.

This experiment should, I think, make the existence of electrons more real to you. It has for some years been known that radium, in the process of disintegration, creates such violent disturbance in the air round about it that it breaks up the atoms of oxygen, nitrogen, etc., by causing them to smash into each other, and in the process some of the atoms loose a number of their electrons, so that not having their proper number, they exhibit a positive electrification, while other atoms gain several electrons more than they ought to have, and therefore exhibit negative electrification.

I have here two tiny radium coated spirals, and as long as I keep the radium covered, the atmosphere in this room remains in its normal condition, and when I turn the handle of this little machine and electrify this spiral nothing happens.

On removing the covers you will notice that the leaves of the electroscope spring apart, due to the rapid ionisation of the air by the electrical machine.

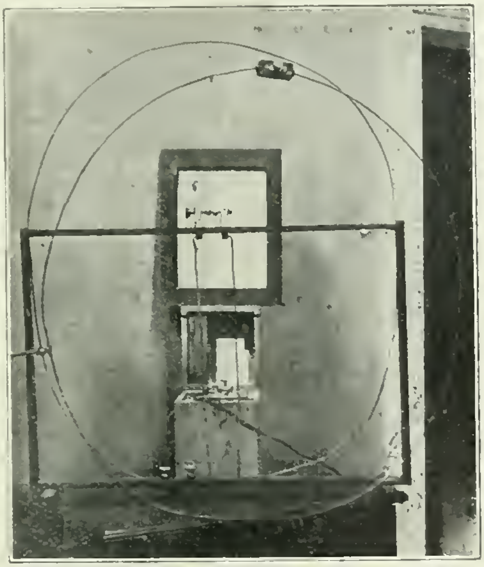
(The lecturer demonstrated this action by arranging the detecting electroscope in the optical lantern and casting an image of it on the screen. The electroscope and electrical machine were about 20 feet apart and on removing the caps from the radium tubes an immediate effect was indicated when the electrical machine was worked.)

I have already stated that in all conductors there are innumerable free or unattached electrons floating about in the inter-atomic spaces (*i.e.*, the spaces between the atoms), and that the movement of these electrons is what we know as an electric current.

If I rub this ebonite rod against my coat sleeve I rob the wool of my coat of a large number of its free electrons and increase the number on the ebonite rod, so that having an excess over its normal number, it exhibits negative electrification, and it creates a strain in the ether in its neighbourhood; this zone of disturbance reaches out and affects the electrons in other bodies in its vicinity.

For example, here is a little instrument which we call an electroscope; this consists of a metal rod or cylinder from the bottom of which are suspended two long metallic leaves.

The accompanying slide (see Fig. 6) is a diagram from which you will see that the little cylinder and the leaves can be considered as being part of a continuous system. The dots represent the free electrons in the interatomic spaces. Now when we bring our electroscope near the charged rod or vice versa it comes into the zone of strain in the ether created by the rod, and the free electrons are driven down into the leaves of the electroscope, and cause them to repel one another. We have not added to the number of electrons in the metal of which the electroscope is made, but we have driven most of them down into the leaves, the rod retaining less electrons than it does normally. Conditions will remain unchanged as long as we keep the charged ebonite rod stationary: but if we move it up and down (*i.e.*, if we cause a number of electrons in the vicinity of the electroscope to oscillate up and down we can cause the electrons in the electroscope to follow their movements, and move up and down in the metal of the electroscope.



With this apparatus the lecturer demonstrated how a wooden blackboard was transparent to ether strains of certain frequencies.

What happens in the metal of the electroscope happens in any metallic conductor.

In a transmitting aerial electrons travel at a speed approximating to that of light, so that even the very fastest movement which I can make by hand is extremely slow compared to their rate of travel.

I can, I think, give you a clearer conception of this phenomenon by the following experiment.

You see before you on the lecture table a block of jelly; this represents a portion of the ether, and you will see three discs, two of which are connected to movable pointers and are fastened to the front edge of the jelly (Fig. 7). A third disc rests on the top near to one of them. These discs represent groups of electrons. If I press down the top disc, the jelly becomes strained or stretched, and the one nearest to it is pulled out of position (*i.e.*, moved), if the movement is made slowly the third disc and pointer at the other end of the jelly (representing a distant receiving station) remains stationary.

So far we have only produced a condition analogous to electrostatic strains (similar to those which caused the electrons to move down into the leaves of the electroscope when I moved a charged rod in its vicinity).

If I press down the top disc and quickly release it so that it moves at above a certain critical speed, wave motion is produced throughout the entire mass of the jelly (which is seen to quake), and the third disc and pointer are seen to respond.

(The lecturer apologised for the somewhat crude state of his model, the idea of which, he explained, only occurred to him shortly before the lecture.)

In the case of radiotelegraphic and telephonic transmission and reception the electrons in the transmitting aerial are caused to oscillate up and down at so great a speed that their movement creates wave motion in the surrounding ether; when these waves reach the receiving aerial they cause the free electrons in it to oscillate, and it is the movement of these electrons which operates our receiving instruments.

In order to picture the process yet more easily, let us consider for a moment what happens in the case of just one electron, as it oscillates with all its brothers (and in these days probably sisters as well) up and down the aerial. Suppose we were dealing with an ocean of water which was invisible, instead of our ocean of ether, you could imagine

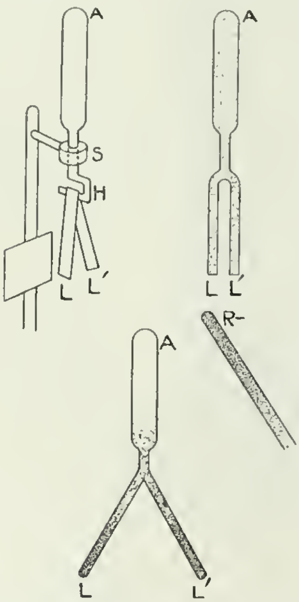


Fig. 6. Experiments with an electroscope. The uneven distribution of the electrons constitutes an electric charge.

a rope floating upon its surface, connected at one end to a floating buoy, and you could observe the wave motion produced by the buoy in the surrounding water by bobbing it up and down and watching the movements of the rope. Of course you would only see the wave motion along this one line; but you could show that the waves travelled out in every direction from the buoy, by arranging ropes radiating from it in every direction. We will now apply this simile to our ocean of ether, and one electron in our aerial.

The buoy represents the electron, and the rope one line of force radiating from it. Needless to say there are innumerable lines of force radiating in every direction; but we will observe this one. You must imagine that when the electron oscillates waves travel along the line of force, their wavelength (that is the distance between the crests of any two

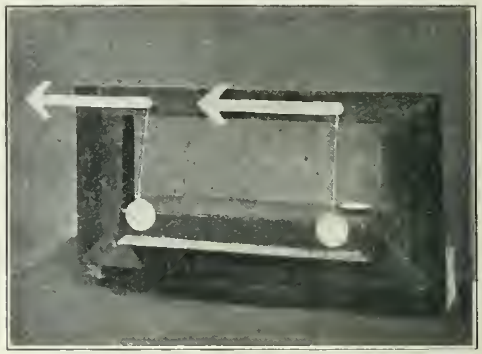


Fig. 7. A slab of jelly arranged to show the transmission of wave motion along it.

waves) depends upon the distance the electron has to travel; if the aerial is short, and it only has to move a short distance, it will do a greater number of journeys in a given time, and produce therefore a greater number of smaller waves.

A slide was here shown, and the movement of a single electron up and down the transmitting aerial was represented, and one electron was also represented in the receiving aerial. When the latter was out of tune, it remained stationary; but when the two stations were tuned to the same period of oscillation, the electron in receiving the aerial followed the movements of that in transmitting the aerial. The question was then asked how is the electron in the receiving aerial caused to oscillate, and a hitherto invisible line was revealed joining the two stations. When the electron in the transmitting aerial oscillated, it was seen that this line took on wave motion, and as this reached the receiving aerial it caused the electrons there also to oscillate. The lecturer pointed out that the slide only represented one electron; but its movements were typical of those of many billions of billions of free electrons in each aerial.

I spoke just now, when showing the mechanical slide, of tuning the two stations. Electrical tuning is analogous to musical tuning. You all probably know how tuning forks are tuned to one another, and that in order to transmit vibration from one fork to another, the two forks must both have the same period of vibration.

If you have a certain length of wire it obviously takes a certain period of time for the electrons in it to travel to one end of it and back again. Another wire in its vicinity is said to be in tune if it takes its electrons exactly the same time to do the same journey.

There are two main factors in the tuning of a wireless station, inductance and capacity. Roughly speaking, we can say that the length of its aerial represents its capacity, and the number of turns which we make it take in our instruments represent its inductance (this statement is not exactly correct, but will suffice just now), and you will see from this slide that it is the product of capacity by inductance which counts in tuning. All these stations are in tune. Some have long aerials and a small number of turns of wire and *vice versa*. (Fig. 8).

Here are two pendulums joined by a fine elastic thread, both are the same size and length (capacity), and both have weights at their extreme end (inductance). These two pendulums are in tune, and if we swing one of them it will rapidly transmit all the energy we apply to it to the other which will be seen to swing. If, however, we alter the position of the weight on one pendulum, *i.e.*, alter its inductance, they will no longer be in tune, and the second pendulum will remain stationary while the other swings.

Electrons, like water, can be caused to evaporate. Let us visualise for a moment a large dish of water, heated from below by a flame. If this water is at zero temperature, its molecules and atoms will be comparatively still; but as the temperature rises, they will get into a violent state of agitation, and soon they will move up to the surface with such velocity that many of them will be projected (as water vapour) right out of the dish into the surrounding atmosphere, where they will be absorbed.

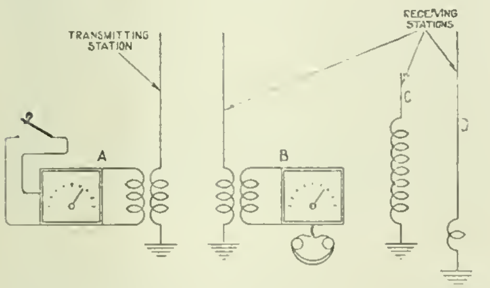


Fig. 8. The transmitting station A is producing signals at B. Aerials C and D are equally capable of being in tune with the transmitter.

After a time so many of them will have been absorbed in the air that it will not hold any more, *i.e.*, it will have reached saturation point, and after this stage has been reached they will fall back into the water, each time after they have been shot out of it. Now suppose we think of the warm water evaporating at a stage before saturation point has been reached, if anything at a lower temperature than the air, say a sheet of metal is held over the evaporating water, the temperature of the air is lowered and the water vapour is condensed back into the water.

A state of affairs very analogous to this exists in the interior of a thermionic valve used in radio, as I will endeavour to explain in a minute or two.

Having seen the two foregoing slides (Figs. 9 and 10), you will, I think, be easily able to understand this one (Fig. 11). On the left-hand side I have represented a simple receiving set complete with its aerial, condenser, inductance, high and low tension batteries, telephone and valve. On the right you see how the same circuit should be diagrammatically represented, this may help you in understanding electrical diagrams.

When the filament battery L is connected up to the filament of the valve, it acts as a pump, and pumps electrons rapidly through the wires leading from it and through the filament, this being made of exceedingly fine wire has difficulty in coping

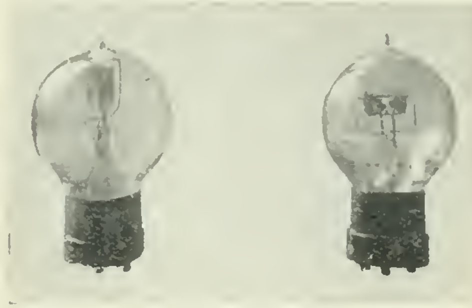


Fig. 9. Typical receiving valves.

with the rush of electrons and becomes hot, like a single policeman trying to restrain a crowd.

It is here that we can begin to make use of our analogy of the heated water, as the filament gets hot, electrons begin to evaporate from its surface, and in an inconceivably short space of time the space in the valve becomes saturated with them, after this they fall back on to the filament.

The valve is now said to have reached saturation point. If at this stage the high tension battery is connected up, it begins to pump away the electrons out of the valve, making room for others to come away from the filament, and the electrons it draws away pass through the telephone earpiece and then back again, to replace those being ejected by the hot filament.

In spite of this the filament may still evaporate electrons faster than the high tension battery can draw them off, and saturation point (though a higher one) be again reached.

We will now connect up the negative pole of a small battery E to the grid of the valve; this will pump a number of electrons into the grid.

As I explained earlier in my lecture, two like charges repel one another, so that the electrons

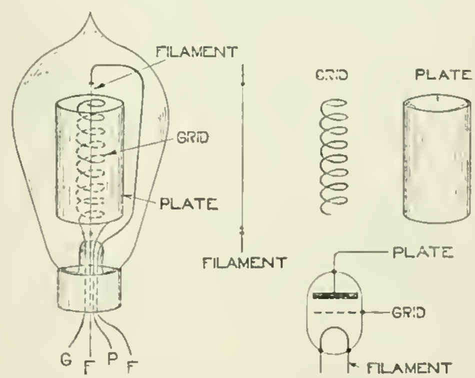


Fig. 10. Component parts of the valve and the method of representing them in wireless circuits.

on the grid push back the electrons coming across from the filament, and condense them back on to the filament (much as the cold metal plate condensed the water vapour back into our dish). They cannot any longer get across to the plate, and their flow through the telephone receiver ceases. (We have put our plate current pump or battery out of action.)

If at this stage a radio wave arrives at our receiving aerial, it causes the free electrons in it

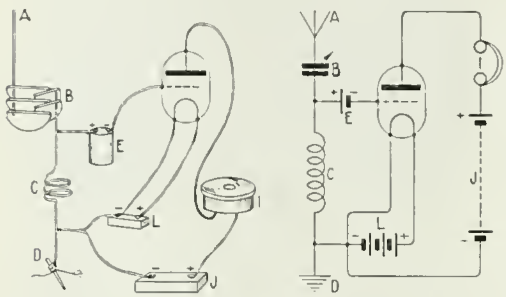


Fig. 11. Pictorial and diagrammatic representation of a valve circuit.

to rush down to its bottom end with terrific force and then up again as each wave passes. As they descend they suck all the electrons back from the grid, and for a moment paralyse our grid battery pump E. This liberates the electrons being evaporated off the filament, and a flow of them takes place through the telephone, making a sound. When the electrons again rush up the aerial, the grid battery E or grid pump again comes into play, and electrons rush into the grid, and repel those coming from the filament, and so the plate current is again stopped.

I have only mentioned the case of a single oscillation produced by one wave. In radiotelephony a continuous succession of such waves are radiated from the transmitting station, following one another at such a speed that the electrons in the receiving aerial oscillate at an extremely high frequency, and the corresponding vibrations which they cause in the diaphragm of the telephone are therefore above audition. These inaudiable waves act as the carrier of human voice, and when a person speaks into the telephone at the transmitting station, he causes audible ripples to take place on the carrier wave, and these ripples cause corresponding variations in intensity in the movement of the electrons through the telephone at the receiving station, these being at audible frequency are translated by the telephone into sound, and so an exact reproduction of the speaker's voice is attained.

At this point two slides were shown reproduced from an article by R. Ranger, from the "Radio Broadcast," an American journal, by kind permission of the publishers, which caused some amusement, as the electrons were represented as little imps and the atoms as worlds (Figs. 12 and 13).

A speech was then received on a small frame aerial, transmitted specially to the audience at the Institution of Electrical Engineers from the London Broadcasting station.

In July, 1920, in a lecture to the London Wireless Society in the Lecture Hall of the Society of Arts, I ventured on some predictions as to the future possibilities and developments of wireless, and as some of these have already come to pass I thought that in conclusion I could not do better than repeat what I then said, which was as follows :—

"May we not confidently look forward in the near future to a much wider use of wireless telephony ? I forsee a time when it may be the general custom for us to receive our daily news in the morning while breakfasting, by wireless telephone.

"With a small frame aerial, an amplifier, and a loud speaking telephone we may hear our news from powerful telephone stations. I see no reason why photographophonic records could not be taken of public speeches, important lectures, etc., by making use of Ruhmer's photographophone" (See Fig. 14).

This was invented in 1900, and described in Dr. Erskine Murray's book. All public platforms could be fitted with microphones (much as they are now for the electrophone), these microphones would be used to control a speaking arc A or manometric flame, the light from which is photographed upon a photographic film F. When developed this film would be of uneven density, corresponding

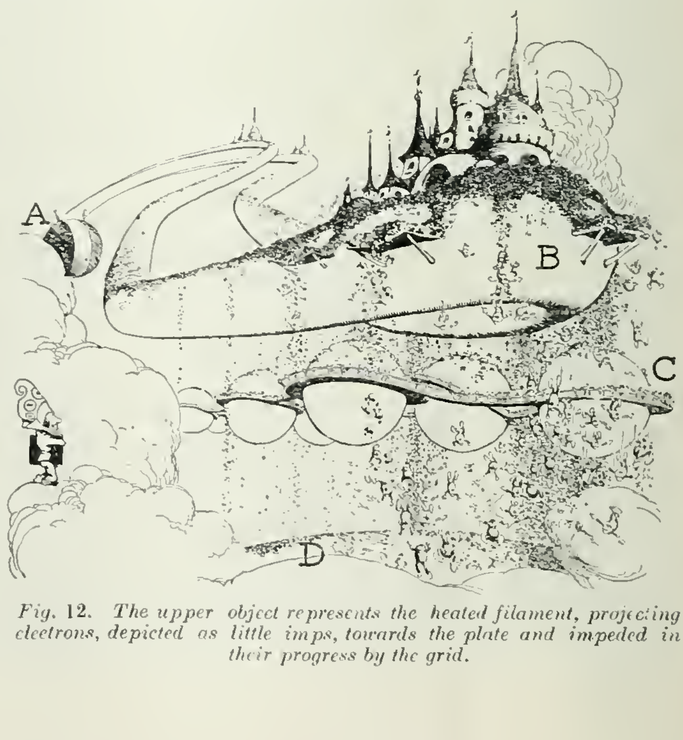


Fig. 12. The upper object represents the heated filament, projecting electrons, depicted as little imps, towards the plate and impeded in their progress by the grid.

accurately to the variations in the intensity of the light as controlled by the voice. The film could then be sent to the wireless transmitting station, where it would be passed in front of a steady source of light (as shown in diagram for Ruhmer's reproducer), the variations of light thus produced would be focussed upon a selenium cell. The corresponding current variations passing through this cell could then be amplified by a series of thermionic valves and employed to modulate the radiations from the aerial of the transmitting station.

So that not only would people hear the news, but they would hear the actual speeches delivered

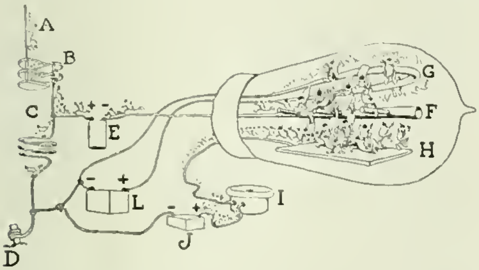


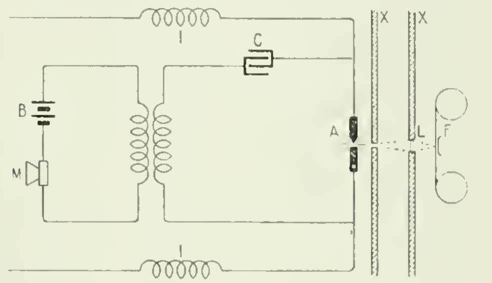
Fig. 13. The electron stream, indicated by the rapidly moving imps, in a valve receiving circuit.

word for word in the voices of the original speakers. Such photographophonic records should be far more reliable than shorthand notes.

To carry this dream one step further we could imagine all the speeches from, say, the Houses of Parliament, transmitted on one fixed wavelength, and other fixed wavelengths allotted to other important Institutions, so that as one sits at breakfast one could turn a switch on to a stud marked "Houses of Parliament," Albert Hall," etc., and select that portion of yesterday's news one wished to hear.

Should such a system become universal I forsee a time when a room is set apart in such an institution as this, where photographophonic records of important lectures that have been delivered during the week in all parts of the world are redelivered either by wireless from transmitting stations or by reproduction directly from the film by using a selenium, cell, etc., in the lecture room, this together with a cinematographic reproduction of experiments given at the lecture synchronised with the speech film should give a most life-like representation. The synchronisation of the photographophonic film with cinematographic film opens up great possibilities to the film producer; it would enable plays to be reproduced, not only in dumb show as at present, but with words also. The nearest approach to this at present is, I believe, the synchronisation of the cinematographic film with the gramophone. One objection to this arrangement is the small size of the record; a photographophonic film could, of course, be of any desired length.

Before I resume my seat I would like to thank my assistant, Mr. Pickering, Mr. Hope-Jones, who



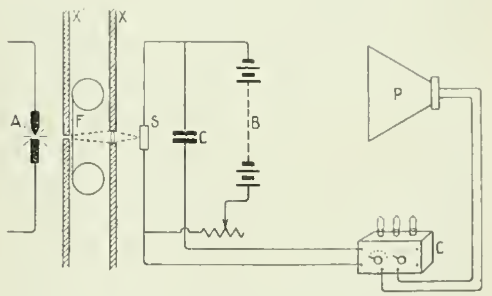


Fig. 14. Circuit arrangement of Ruhmer's photographophone.

kindly helped me to make some of the movable slides and who showed them in the lantern for us, and also the lanternist who kindly obliged us this evening.

The third of the series of lectures, especially arranged for Associates of the Radio Society of Great Britain, will take place at the Institute of Electrical Engineers, Savoy Street, Victoria Embankment, W.C., at 6.30 p.m. on Friday, March 16th, when Mr. L. F. Fogarty, A.M.I.E.E., will give an elementary instructional lecture dealing with Accumulators, Dry Cells and the Currents used in the Reception of Radiotelephony. The lecture will be accompanied by a number of experiments.

Much benefit can be derived from these attractive lectures by those new to wireless. Associateship is open to all interested in the subject and the annual subscription is five shillings.

Tickets for admission to the lectures can be obtained by sending a stamped addressed envelope to the Hon. Secretary, Mr. L. McMichael, 32 Quex Road, Hampstead, N.W.

All who are desirous of obtaining a working knowledge of wireless, which will be most useful to them in the manipulation of their apparatus, are cordially invited.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Liverpool Wireless Society*.

Hon. Secretary, Mr. G. H. Miller, 138, Belmont Road, Anfield, Liverpool.

The usual bi-monthly meeting of the above Society was held on Thursday, February 8th, at the Royal Institution, Colquitt Street, Liverpool.

Mr. E. B. Grindrod occupied the chair, and there was an attendance of more than 50 members and friends. Six new members were elected.

The Chairman asked for suggestions from members regarding subjects for lectures for the summer session, and in this connection members who were not able to be present at the meeting are also invited to submit suggestions.

Mr. S. W. Philpott (broadcasting member of Committee) suggested that reports from members relating to the merits of the broadcasting sets used by them, should be sent to the Hon. Secretary for consideration by the Society, and a separate evening in next session was promised by the Chairman to be devoted to discussion on broadcasting sets in use by members.

A demonstration was successfully given by Mr. A. W. Robinson, representative of Messrs. Pulford Bros., Ltd., Liverpool, of a set comprising six stages of H.F., one-valve detector, and one L.F., worked in conjunction with Magnavox loud speaker. The results were surprisingly loud. With reduced amplification, improved tone of reception was apparent.

Experiments were also conducted with the assistance of Mr. S. Lowey in reception with the aerial on the floor, and moved to different angles. The movement round the room showed that the position at different points of the compass materially affected signal strength, and was useful for direction finding.

A hearty vote of thanks was accorded to Mr. Robinson and Messrs. Pulford Bros., Ltd., who suitably replied.

The Portsmouth and District Wireless Association.*

Hon. Secretary, Mr. S. G. Hogg, 9, Pelham Road, Southsea.

The usual fortnightly business meeting of the Club was held on January 31st, the President, Mr. J. H. C. Harrold, A.M.I.R.E., being in the chair. The Secretary, Mr. S. G. Hogg, reported that the Association's application for affiliation to the Radio Society of Great Britain had been passed. Amongst other matters discussed it was proposed to start a Club journal, which was duly christened the "Portsmouth Aether." A number of members promised to write articles for the first number, which is now being looked forward to.

After the meeting, the President gave an interesting talk, in place of Mr. Mant, who was booked to address the Club on "Auto Telephony," but who, unfortunately, could not fulfil his engagement. The President, however, ably filled the breach by recounting his experiences in the war. Mr. Harrold explained the system of co-operation that existed between aeroplanes and the artillery, and the method adopted in directing the fire of the latter on enemy points.

The Secretary would welcome enquiries as regards the Club activities, and would be pleased also to welcome new members.

Bromley Radio and Experimental Society.*

Headquarters: Ex-Service Men's Club, Bromley.

Hon. Secretary, Mr. J. F. Croome, 26, Wendover Road, Bromley, Kent.

A particularly interesting meeting was held at the Society's headquarters on Monday, February 5th, when various types of receiving sets were entered for the first competition organised by the Society. The entries were divided into two classes: (*a*) Valve Sets, (*b*) Crystal Sets, with a further class for "Gadgets." Following a practical test of each instrument exhibited the undermentioned were adjudged the winners in the respective classes:—Valve Sets, Mr. E. F. Janes; Crystal Sets, Mr. W. E. Bridgman; Gadgets, Mr. W. E. Bridgman. The prizes were respectively a valve, a voltmeter and a wheel brace.

The Society, which meets every Monday at the Ex-Services Club, includes 66 members, and is completing its own three-valve receiving set. All interested in broadcasting and experimental wireless are cordially invited to become members.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

The Society met on Monday evening, February 5th, at St. Mary's Schools, Church End, Finchley, N.3., when a number of pieces of apparatus were exhibited by the members. Amongst these were a B.B.C. crystal set lent by Mr. Brown, a home-made tuner by Mr. Howard, and a high frequency amplifying unit made by Mr. Campion. The Club set made its first appearance and gave good results on 2 LO. Later the Society discussed a number of improvements which it was hoped would take place shortly.

On Monday evening, February 12th, the Society met at 8.15 at St. Mary's Schools, when a number of arrangements were agreed upon. Competitions are to be held about every eight weeks. An exchange and mart of wireless apparatus will run continuously, and further advertisement of the club to amateurs in the district will be undertaken.

Mr. Brown was elected Vice-Chairman owing to Mr. Trussler's illness. Re-election of the committee members who have resigned was postponed owing to insufficient attendance. The Society also agreed to hold future meetings on Thursday evenings at the St. Mary's Schools, Church End, at 8.15.

Ipswich and District Wireless Club.*

Hon. Secretary, Mr. H. E. Barbrook, 46, Foundation Street, Ipswich.

Owing to the unavoidable absence of Mr. Waters the meeting on February 5th was an open night, and it was decided to discuss the question of local disturbances.

Mr. Stanley Lewis took the chair and opened with a very interesting chat on a new method of learning Morse.

The Club's technical adviser was called upon to give instructions to the members on the best method for the tuning in of telephony. Mr. Bird seemed to be quite at home in this subject, and gave a most interesting and instructive discourse, after which the Secretary announced that the Society's affiliation to the Radio Society of Great Britain had been accepted.

The Secretary also mentioned that the total membership had risen to ninety.

Members are reminded that subscriptions for 1923 are now due, and should be sent to the Hon. Treasurer, Mr. F. Page, of 58, Pearce Road, Ipswich, in order that new membership cards may be issued for the year ending November, 1923.

The Streatham Radio Society.*

Hon. Secretary, Mr. S. C. Newton, "Compton," Pendennis Road, Streatham, S.W.16.

The February meeting of the above Society was held at the headquarters, Streatham Hill College, on Feb. 7th, when a joint paper was contributed by Messrs. A. G. Wood, A. Nielson, and H. J. Swift, describing their work in connection with the reception of the transatlantic tests. This comprised a full description of the apparatus used, the methods of working, and the reading of a log giving details of the various stations received, some 48 in all. The paper, ably read by Mr. A. G. Wood, raised a keen discussion, and was highly appreciated.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

On January 25th, 26th and 27th, the Society held its Second Annual Exhibition at the Drill Hall, Belle Vue Barracks. The proceedings were opened at 6 p.m. on January 25th, by Professor Richardson, of the Technical College, in the presence of a large number of people. Apparatus by all the principal makers was exhibited by the various local agents, who gave demonstrations at intervals in addition to the demonstrations by the Society.

One welcome result of the exhibition is a considerable influx of new members to the Society.

A meeting was held in the club-room at 7.45 p.m. on February 9th, with the President, A. Leardet, Esq., in the chair. After the business of the meeting several new members were elected.

The chairman then called upon Mr. Denison (of Denison Bros., Halifax) to give his lecture on "General Wireless Matters." In a very lucid manner the lecturer imparted a great deal of valuable information in a short time, using a series of excellent lantern slides, including views of **2 KD**, the lecturer's station.

The West London Wireless and Experimental Association.*

Hon. Secretary, Mr. H. W. Cotton, 19, Bushey Road, Harlington, Middlesex.

Club Room: Belmont Road, Chiswick, W.4.

At a meeting held on February 5th, Mr. J. H. Bruce gave a paper on a specially-constructed three-valve set of his own design. Diagrams were afterwards passed round. The lecturer gave full data of the panel and its wiring, also reports on its achievements. After the lecture the set was opened up and passed round for inspection.

Forthcoming events:—February 20th, lecture by Mr. A. O. Gibbon. March 6th, lecture by Lieut. D. Sinclair, "Wireless and Flying."

The Wireless Society of Hull and District.*

Hon. Secretary, Mr. A. Nightscales, 79, Balfour Street, Hull.

A private exhibition of members' home-made apparatus was held at the club-room on January 26th. The quality of those shown was very good, and reflected great credit on the exhibitors. From the apparatus on view it could be clearly seen that most experimenters built up their sets upon the unit system, which would appear to be the best plan.

Mr. H. Strong (Vice-President) was in the chair, and previous to the exhibition, the members present were asked to consider the report of a sub-committee with regard to the holding of an invitation smoking concert. The report was adopted, and this important event will take place on Friday, February 23rd, in the Memorial Institute School Room, Dewsbury Street, at 8 p.m. A large attendance is expected on this occasion. Each member will receive an invitation card for himself and a lady.

Meetings of the Society are held on the second Monday and fourth Friday at the Signal Corps. Headquarters, Park Street, at 7.30.

New members will be welcomed, and full particulars re membership can be obtained by communicating with the Hon. Secretary, who will also be pleased to hear from any members willing to read papers or give lectures before the Society.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

The fifth general meeting of the Radio Society of Birkenhead took place on the evening of February 1st. Buzzer practice as usual was held at 7.30 p.m. The attendance not being as good as it ought to be, the Committee expressed the hope that more advantage would be taken of Mr. McKinlay's buzzer class.

At 8 p.m., the Chairman, Mr. Austin, called upon Mr. Bailey to deliver his lecture on "Ohms Law," whereupon the lecturer, in a very clear manner, explained the various units of electricity. After the lecture, many questions were handed in to the technical advisers, Messrs. Hughes and Austin, who dealt with them in a very clear and lucid manner, drawing many diagrams on the board. The meeting terminated at 9.45 p.m.

Weston-super-Mare and District Radio Society.

Hon. Secretary, Mr. J. P. Gorton.

The first meeting of this Society at their new club-room at "Torwood," kindly loaned by Mr. H. Tidman, of that address, was held on January

26th, there being present the President, Chairman, and a fair number of members. Application has been made for an experimental wireless licence, and it was decided to build some receiving apparatus at the club-room.

Mr. P. Warrilow has presented the Society with a large accumulator, and another member has promised the loan of a foot lathe.

An aerial is about to be erected by Mr. J. Powell, and as soon as permission is obtained members have arranged to bring their gear to the club-room for demonstration purposes.

The attendance on the part of some of the Committeemen having been poor, Messrs. R. E. Morris, A. H. Giles, H. Tidman, W. Tucker and J. Powell were elected to the Committee in order to strengthen it.

It was decided to hold meetings on Wednesday evenings, when a "buzzer" class will be run for the benefit of those wishing to learn Morse reading.

The Isle of Man Radio Society.

Joint Secretaries, Messrs. J. S. Craine, 6, Belmont Terrace, and J. P. Johnson, 16, Hildesley Road, Douglas.

A meeting was held on Monday, February 5th, at the Secondary School, Douglas. Mr. H. Colebourn presided over an attendance of twenty-six. Five new members were elected. Preliminary business having been disposed of, Mr. J. S. Craine addressed the meeting. He confined himself entirely to the principles underlying the tuning of a receiving circuit, and his capable handling showed a thorough grasp of the subject. Blackboard diagrams were freely used, and it may be certainly said that the speaker conveyed a good deal of valuable theoretical information which will result in the more intelligent operation of receivers by all who heard him. Mr. Craine received the best thanks of the meeting for his able lecture.

Next week Mr. G. Gillmore will speak on "The Theory and Construction of Primary and Secondary Cells."

The Hornsey and District Wireless Society.

Hon. Secretary, Mr. H. Hyams, 188, Nelson Road, Hornsey, N.8.

The Society recently transferred its headquarters to The Queen's Hotel, Broadway, Crouch End, and is now making rapid progress.

A meeting was held on Monday, January 29th, and after the general business was dealt with the Chairman called upon one of the members, Mr. Pugh, to give a demonstration of wireless reception by indoor aerial. The apparatus used consisted of a valve detector, one L.F. amplifying panel with an additional valve connected through an old German transformer. Although the aerial consisted of only a few feet of bell wire carelessly slung across the room, the concert from **2 LO** was received excellently on an ordinary loud speaker. The result was so satisfactory that most of the members remained until the finish of the musical programme.

The Hon. Secretary will be pleased to send full particulars regarding membership on application.

Mansfield and District Wireless Society.

Hon. Secretary, Mr. W. A. Blackwell, 65, Nottingham Road, Mansfield.

The first annual meeting of the Mansfield and District Wireless Society was held at the Y.M.C.A. Hall, Mansfield, on January 30th, the chair being occupied by the President of the Society, J. Malcolm Whitehouse, Esq., F.G.S.

The minutes of the last two meetings disclosed continued interest in the work of the Society by its members, though, as the Secretary pointed out in the annual report, not the interest that should manifest itself in a town like Mansfield.

A move in the right direction has been made in the resolution to affiliate the Society with the Radio Society of Great Britain, a step which will doubtless tend to make its meetings of increasing value because of the advantages gained by unity with an Association possessing first-hand knowledge of any measures tending towards efficiency in wireless experimental work. It was reported that during the past year a very interesting lecture was given by Mr. J. T. Thornton, late principal of the City School of Wireless Telegraphy, Nottingham, dealing with the history of Wireless Telegraphy and its value in warfare and commercial enterprise. Another lecturer had been Mr. E. V. R. Martin, of the Derby Wireless Society, on the Principles and Practice of Wireless Telegraphy, including the workings of the Thermionic Valve. So instructive and interesting were these lectures that another invitation is to be extended to both these gentlemen to address the Society again in the near future.

The matter of erecting a new aerial and building up a wireless set is at present under consideration and is to be dealt with at an early date.

The Cheshunt Experimental Radio Club.

Hon. Secretary, Mr. J. Bonnett, 9, Gew's Corner, Cheshunt, Herts.

The fourth meeting of the above club, which now has a membership of twenty-two, was held on Monday, February 5th.

The Secretary is giving a course of lectures on the elementary theory of radio and the construction of receiving apparatus, with a view to enabling each member to obtain his own experimental licence.

Meetings are held every Monday at 7.30 p.m. at "The House," Churchfields Path, Cheshunt. All radio enthusiasts in and around the district are cordially invited to join.

Beckenham and District Radio Society.

Hon. Secretary, Mr. J. T. Butterfield, 10, The Close, Elmers End.

An interesting lecture was given by the Secretary on "Dual Control Circuits," on February 8th, at the Society's new headquarters.

During the evening it was stated that Lt. Walker, of **2 OM**, had kindly consented to give a lecture on Thursday, March 1st. It is hoped that the members of the Society will turn up in full force.

Scarborough and District Wireless Club.

The name of this Club has been changed to "The Scarborough Radio Society," and the new headquarters are at the Belle Vue Hotel, Scarborough.

Panel for a Single Valve Receiver.

EASY CONSTRUCTION OF A USEFUL INSTRUMENT.

THE crystal receiver described in a recent issue serves as a good introduction to the reception of wireless signals. It affords a simple exercise in home instrument making, and the operation of it brings out the principles of tuning, whilst successful reception with a crystal set indicates that there cannot be much wrong with the aerial, tuning coils, earth connections and telephones. Another recent article described the construction of a receiver which made use of a valve for increasing the magnitude of the currents induced in the aerial after which a crystal functioned in the usual way by causing the picked up currents to produce signals in the telephones.

The valve panel about to be described, carries the apparatus necessary for controlling and manipulating the valve, and is the first real step on the high road to the construction of perhaps, an elaborate experimental station. However that may be, every user of wireless apparatus finds that sooner or later he must possess a detector valve panel whether he intends to purchase one or build it himself.

The panel consists of a piece of ebonite which carries a valve holder, filament resistance with " off " position, grid condenser having a value of 0.0002 or 0.0003 microfarads, a grid leak of value between 1.5 and 2 megohms, telephone condenser of 0.001 or 0.002 microfarads and ten terminals. All of these, together with about two yards of " Sistoflex " insulating sleeving and some No. 18 or 20 bare or tinned copper wire for connecting up, can be found in the lists of retailers of wireless parts or at any of the numerous stores which now specialise in this class of business.

The piece of ebonite, which when purchased should be highly polished on both sides, must be large enough, so that when the edges are filed and rubbed smooth in the manner described in the two articles referred to above, a panel $4\frac{1}{2}$in. $\times$ $6\frac{1}{4}$ in. is obtained. The thickness of the panel is $\frac{1}{4}$ in. The marking out of the exact points for drilling holes should be carried out most carefully and an error of $\frac{1}{64}$ in. will not only be apparent to the eye when the parts are assembled, and thus spoil the appearance of the work, but in some instances will make the fitting up of the parts very difficult and necessitate the enlarging of any incorrectly located holes with a small rat-tail file. This advice is offered in order to impress upon the reader that he must appreciate right from the start the necessity for the utmost precision and accuracy, as it has such a marked effect on the appearance and value of his apparatus. It is quite common in wireless journals to see reproduced photographs of amateur apparatus to which the builder may have given a great deal of time and thought, yet which present a somewhat crude appearance for no other reason than that accuracy in setting out has been lacking.

Having procured the components, place them on a sheet of paper on which the outline of the panel is marked and measuring from two edges which are at right angles, fix the location and size of the holes to be made. With the great variety of types of components at present available it is not possible to give a working drawing making use of purchased parts, but it is quite a simple matter to go over them with a rule and thus arrive at the spacing for the holes.

Drawings of the front and underside of the panel are given in Figs. 1 and 2, and photographs of one constructed on the same lines but embodying another style of components are given in Figs. 3 and 4.

Before assembling, it is necessary to remove the polished surface of the ebonite and a good finish to the faces can be obtained by rubbing down with a piece of emery cloth wrapped round a block of wood. By employing a circular motion an even surface can be obtained, free from scratches. The reader is reminded that is is quite a simple matter to have the panel engraved by carefully marking it and placing it in the hands of one of the several firms who undertake this work and whose addresses can be found in the advertisement pages of this journal.

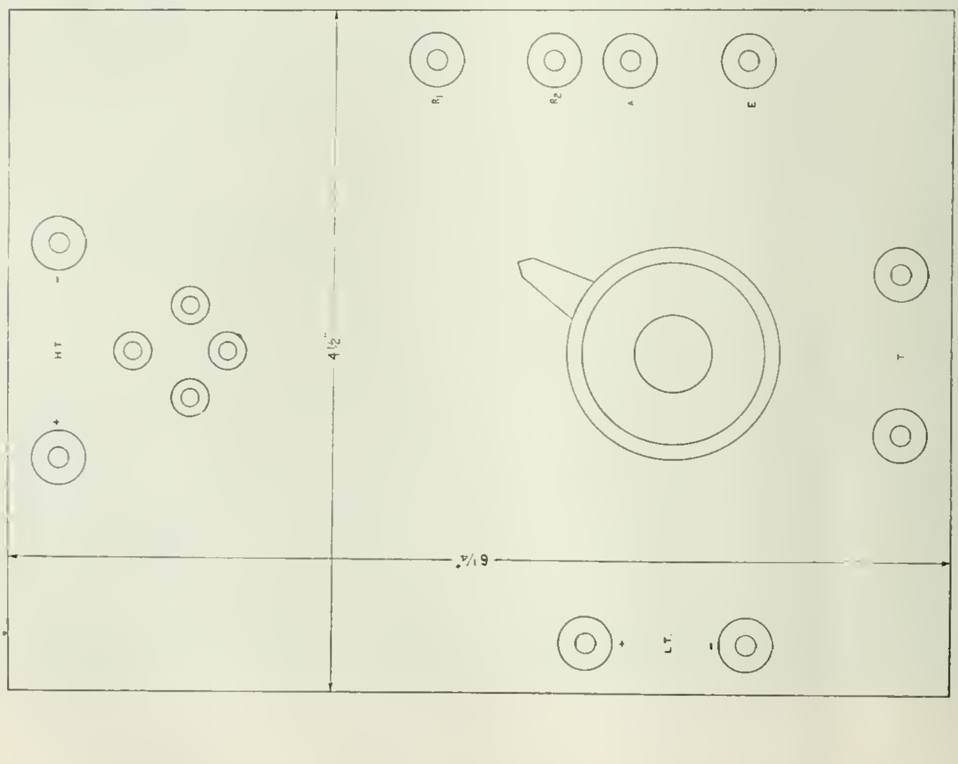


Fig. 1. Scale drawing of the top of the panel, showing lay-out of terminals and valve holder. The actual size is 6¼" × 4½".

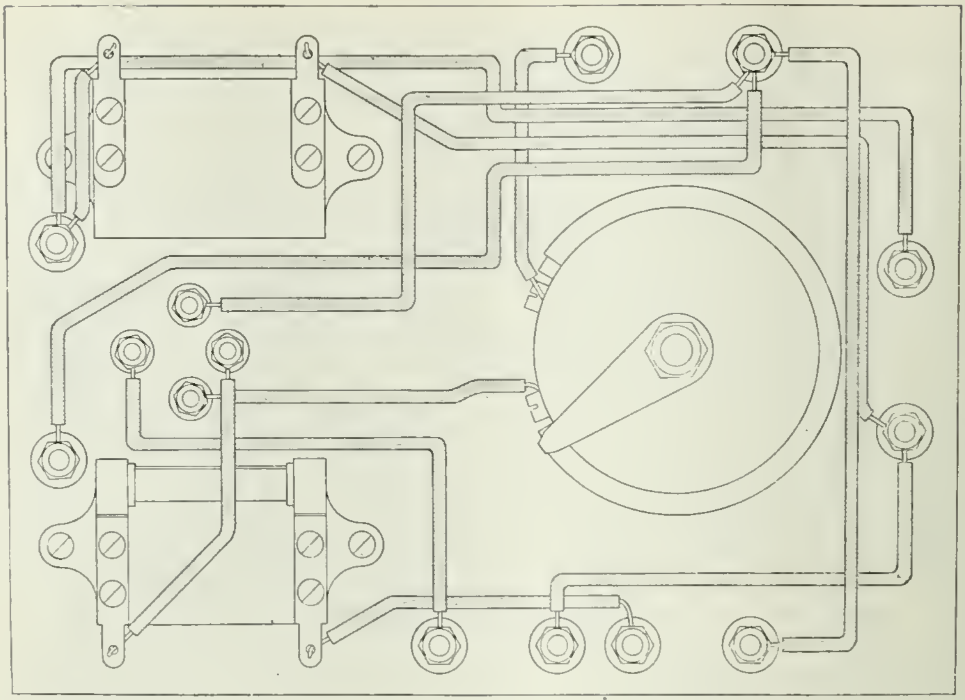


Fig. 2. The arrangement of the components on the underside. The practical wiring can be followed from this drawing.

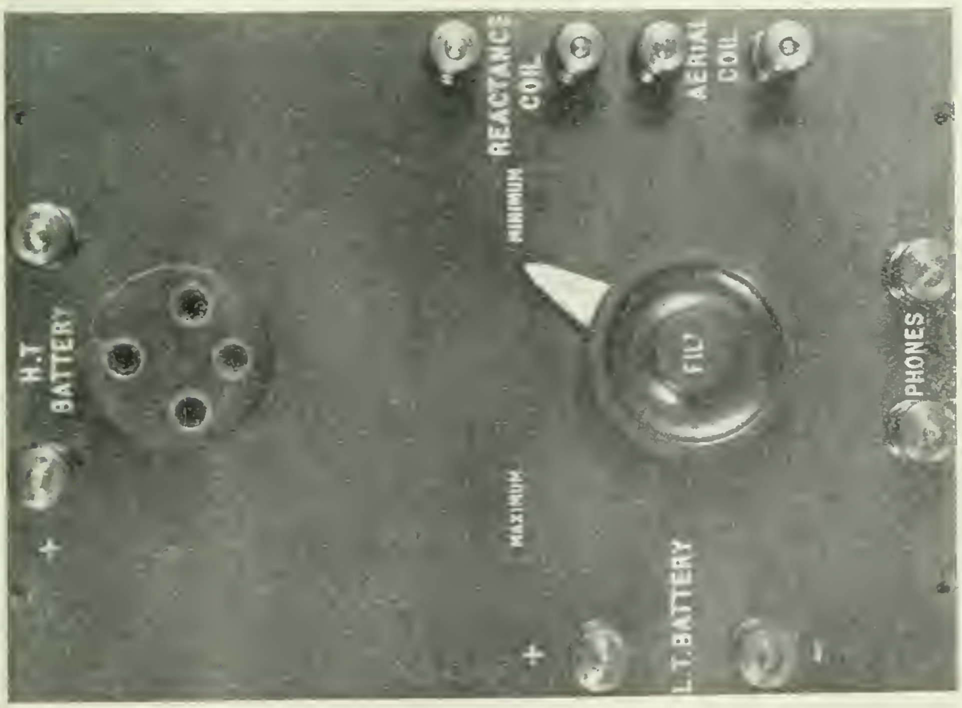


Fig. 3. *A detector valve panel made to the description given in this article.*

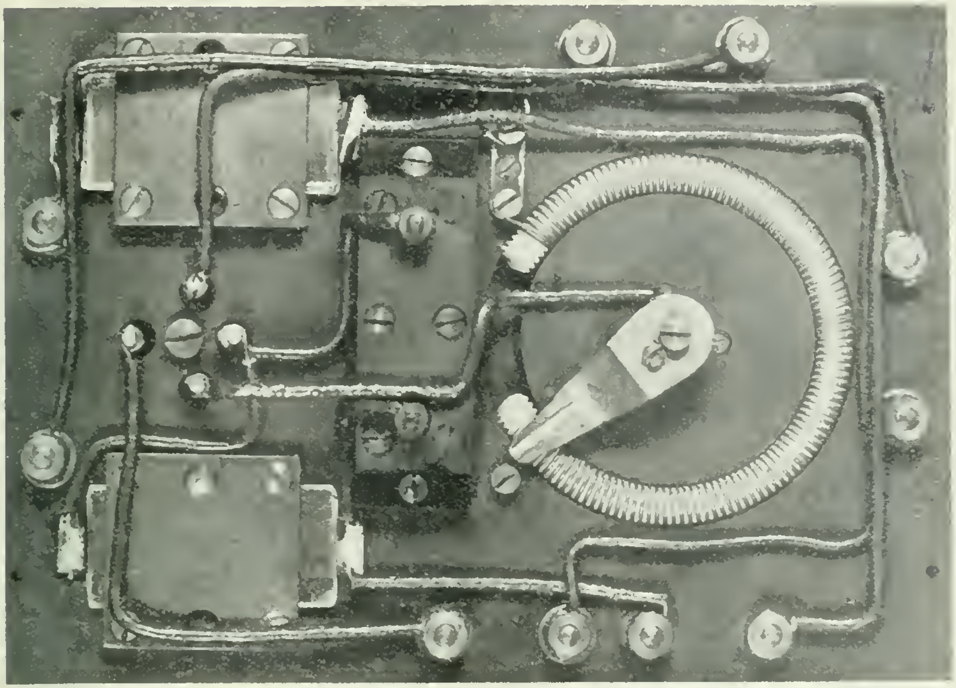


Fig. 4. *Other types of component parts are made use of here. It is a simple matter to adapt the lay-out to suit the parts available.*

The wiring up can be clearly seen in the drawing of the under-side and it should be observed that the leads do not take the shortest route between the points which they connect but are arranged parallel to the sides. This is a good practice for simplicity in tracing connections though in multivalve sets it is liable to set up noises owing to induction between certain of the leads. For this reason grid and tuning circuit leads should be well spaced from all others and kept as short as possible.

Fig. 5 is a circuit diagram of the panel wired up for experimental reception, while it shows also the arrangement worked out practically The method shown for obtaining reaction should not be used by the experimenter on broadcasting wavelengths, and many articles in this journal have advocated methods of limiting the extent of interference by receiving apparatus. This matter will be dealt with again in an early issue as applicable to the detector panel here described.

F.H.H.

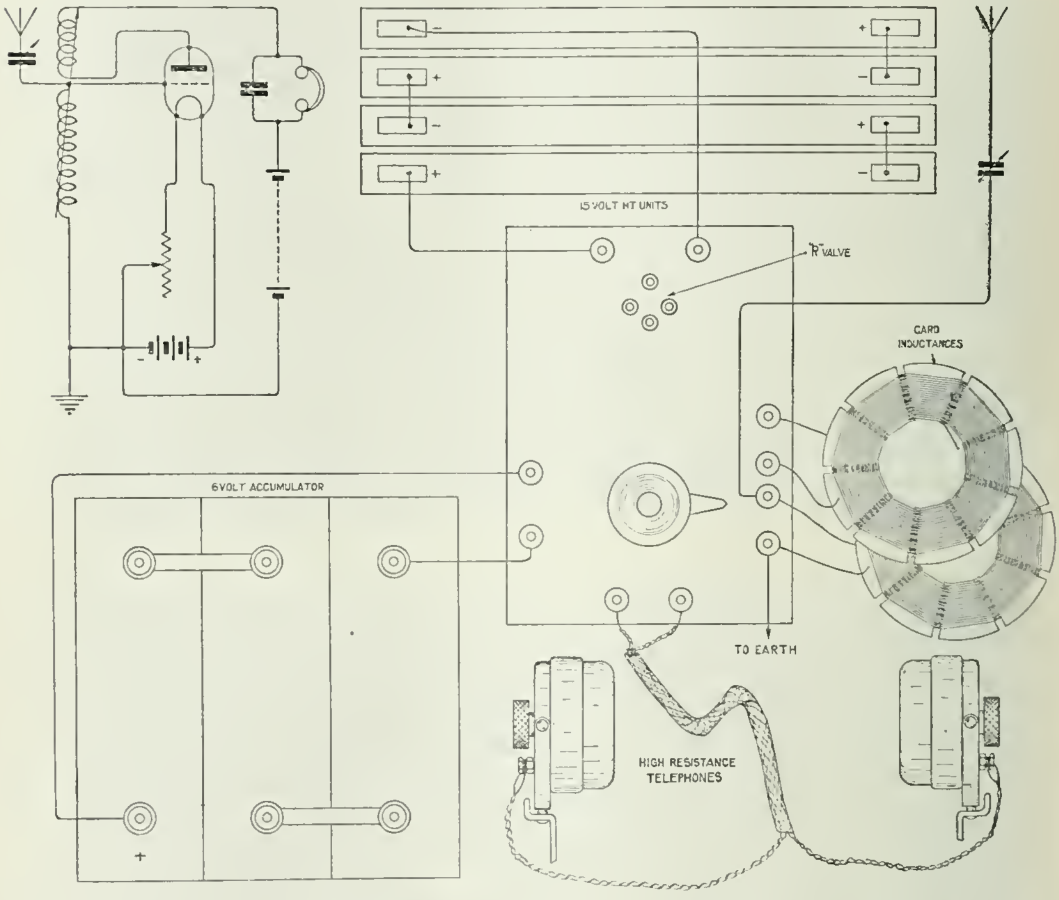


Fig. 5. The method of connecting up the panel in an experimental receiving circuit. The tuning coils are of the type described in recent issues, though any arrangement of coupling coils may be employed. A circuit of the entire outfit is shown diagrammatically on the left.

The Transatlantic Amateur Tests.

SUMMARISED REPORT OF BRITISH RECEPTIONS.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

BRIEF notes have already appeared in these columns indicating some slight measure of the success of the series of Transatlantic Tests recently completed. Not only have they been successful, but the results achieved have astonished both the Americans and ourselves, even although we had some indication in advance of what was likely to come from the almost daily reports of American short-wave signals—amateur and broadcasting—being heard here.

The difference between the reports from a few listeners prior to the Tests, and the multitude of receptions made during the Test periods, arises almost entirely from the larger number of listeners taking part. Although we know quite well, and have also been repeatedly reminded of it by the U.S. League, that the bulk of U.S. radio amateurs are sending every night and should therefore be able to be heard here, there is no question that the publication of definite test arrangements acts as an enormous stimulus to encourage people to stay up all night and listen for signals.

The time difference between the two countries is a great deterrent to such listening-in without some additional encouragement, since we all have our daily duties; we have broadcasting till 10.30 p.m., we then have our own work to attend to, and if after that, from midnight to 6 a.m., we listen in for the U.S. signals, we have a rather small proportion of the twenty-four hours left for sleep. However, a number of listeners sacrificed their sleep during the tests, and sent in many reports of receptions made.

It may be useful here to recall briefly the main outline of the Tests. The first part lasted from December 12th to 21st inclusive, between midnight and 0600 G.M.T., during which times the U.S. and Canadian amateurs transmitted special test signals to Europe. From midnight to 2.30 a.m. each night there were ten "free-for-all" periods, each of fifteen minutes duration, and during these periods the transmitters in any one district could transmit for one fifteen-minute period. The transmission time for each district was changed from night to night so as to give everyone as far as possible an equal chance.

Between 2.30 a.m. and 6 a.m. successive fifteen-minute periods were allocated to groups of stations for "individual" transmissions, such transmissions including a special code word to enable the receptions to be verified on this side. In addition to these special transmissions, there were the ordinary communications between various U.S. amateurs, which were continuing throughout the whole time of the Tests.

Reports of receptions were asked for day by day so that the results obtained could be sent back to the American Radio Relay League by a radio message from Carnarvon each morning. These messages were repeated by New Brunswick station so that all U.S. and Canadian amateurs could get some idea of how the Tests were progressing. Many listeners were good enough to forward their results daily by telegram, telephone, or by express letter, and so materially helped in the preparation of these daily reports. Other reports were received by post, and were incorporated in the daily radio messages as early as possible. As the end of the Test periods approached Christmas, however, there were greater delays in the post reports, so that the daily radio messages towards the end of the tests, while reporting many receptions, were by no means complete. Some reports—in some cases posted from only a few miles away—were delayed in the post for over a week before delivery, and this fact, together with the large number of reports to be analysed, has accounted for the delay in presenting any proper report of the results achieved.

Before proceeding to a detailed discussion of the results it may be of interest to mention the radio messages which were prepared for transmission each day from Carnarvon. These messages, as has been explained in an earlier article in these columns, were sent in a code so as to avoid errors arising from accidental telegraphic mistakes, a word being used for each letter of the call sign being reported, the initial letter of the word giving the particular letter it is desired to indicate. Thus, **1 BCG** was reported as "One Boy Cast George," and so on.

Messages were transmitted daily from Carnarvon at 0700 G.M.T. from December 13th to December 23rd.

Unfortunately a few errors crept into these messages as transmitted, arising from the difficulties under which they were prepared—some in intervals between other office and experimental work, some in odd moments snatched during the erection of the transmitting station **5 WS**, some in the small hours of the morning. One or two errors have apparently arisen due to verbal mistakes occasioned by the necessity of shouting the calls from one person checking them off to another preparing the list for transmission, over the noise of motors, etc. (at **5 WS**), while others apparently arose from their having to be passed over the telephone. The summary set out below, of calls received each night, gives however a truer idea of the test results than the above telegrams, since some results were received too late for transmission by the radioed reports.

On some occasions certain U.S. stations were heard using their special code words at other times than during the "individual" transmission periods set out in the schedules, and when these were reported correctly, with the proper call letters, etc., they were reported in the radiograms as calls heard with code words verified. In the tabulated results set out below, these interceptions, if not during the "individual" periods, have been separated from the others, and included under Sections B or C as more appropriate.

During the ten days of the reception tests reports were received from 47 different amateur listening stations in Great Britain, and from two Dutch stations, making 49 in all. The total number of interceptions of U.S. and Canadian amateur signals reported in this way during these ten days was 2,297. This figure includes all interceptions—"Individual" transmissions, "Test" signals during the free-for-all periods, and calls and messages from stations simply carrying on their ordinary communications and "DX" transmissions.

A better idea of the distribution of these "calls heard" amongst these three classes of trans-

"GREAT CIRCLE" MAP WITH LONDON AS CENTRE.

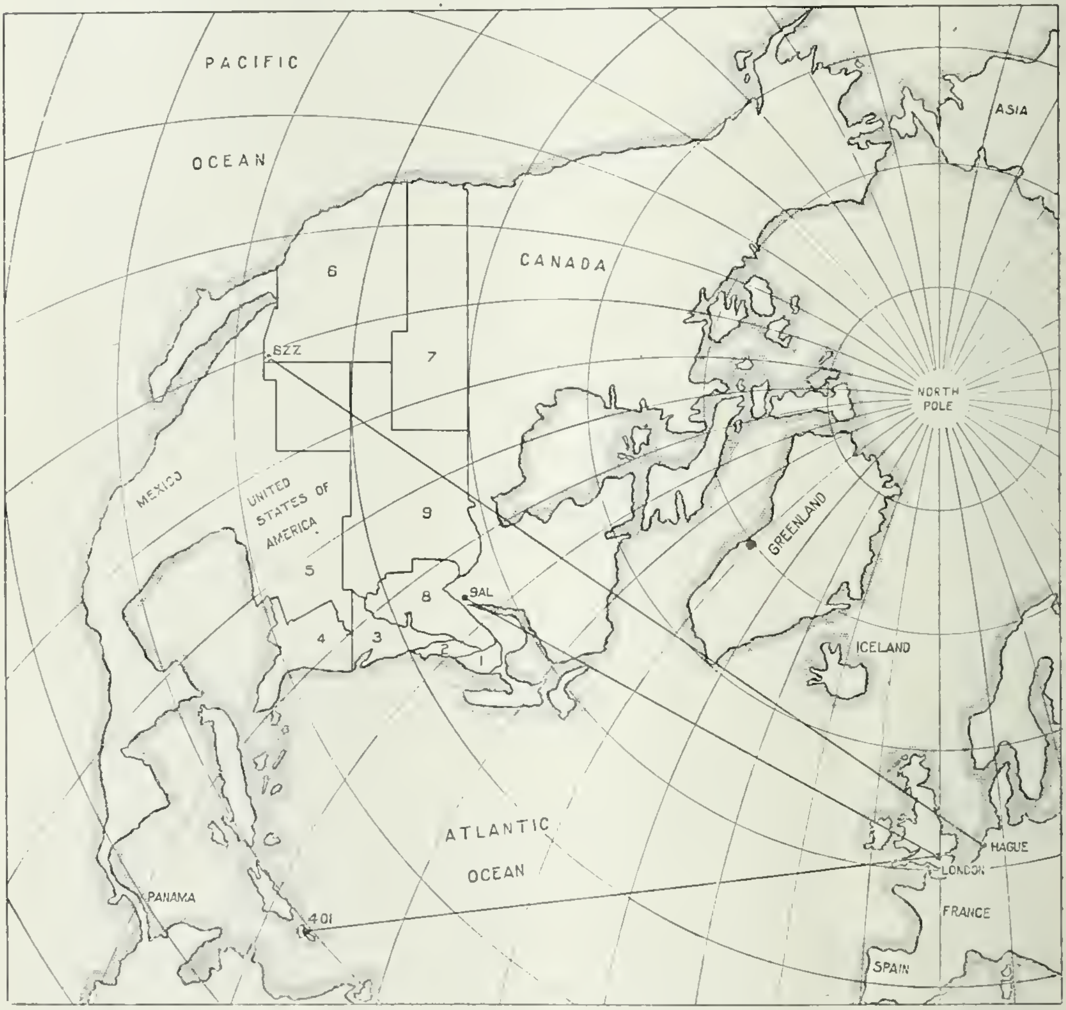


Fig. 1. This map is drawn on the "great circle" projection with London as centre so that it indicates the correct distance and direction from London to any other point on the map. The distances and directions from points in England will also be approximately accurate. The numbers indicated in different areas of the United States are the numbers of the different districts.

TABLE I.

Summary of Numbers of Stations heard.

District (U.S. Inspection District, or Canada).	Number of stations heard with verified Individual Transmissions at correct times, with code words, etc.	Number of stations heard during "free for all" period at correct schedule times.	Number of stations heard working DX, sending messages, etc.	Total number of different stations heard.
1st	20	44	97	134
2nd	24	44	126	154
3rd	15	26	45	59
4th	5	6	9	14
5th	2	3	20	24
6th	1	0	1	2
7th	0	0	5	5
8th	21	13	63	82
9th	5	1	28	31
Canada	1	1	2	2
Totals	94	138	393	507

In the above table the U.S. Inspection districts are identical with the numbers on the map, Figure 1.

missions may be obtained from the following summary, giving the numbers of different stations heard, under each of these classes for each of the U.S. inspection districts and for Canada.

It will be observed that the figures in the last column of the above table are not simply the sums of those in the preceding columns, as several of the stations heard making individual transmissions with code words, or transmitting at the schedule times during the free-for-all periods were also heard at other times sending messages, etc. The figures given in the last column are the numbers of *different* stations in each district that were heard during the tests.

The most successful districts were obviously the first and second, the third and eighth being next best. This, of course, was to be expected, both from last year's tests and also because these districts are nearer to the Atlantic seaboard. The sixth and seventh districts, on the Pacific coast, are naturally less well represented. A sixth district station was, however, heard with code word, thus verifying the reception, which reception is really a remarkable performance considering that the station is located in Arizona, on the Pacific side of the Rocky Mountains. Signals from all districts have been reported, but as several of these from the sixth and seventh districts were only ordinary DX calls, it was not possible definitely to verify them, as in the case of the individual transmissions.

It should also be pointed out that some signals (with code words) were reported on *every* night of the tests. The number reported varied largely from night to night, there being in particular two bad nights and one especially good one, and bearing this in mind, an *average* of over 200 interceptions from 50 different stations per night seems to the writer to be a great tribute both to the design of the receiving apparatus used, and to the skill of the operators who were listening in.

The wide area from which signals were heard is perhaps emphasised by the map in Fig. 1, which is a "great-circle" map plotted out from London as centre. Such a map gives an accurate idea of the apparent directions of the various places from London, as well as their true distances, since the waves will presumably follow the shortest path over the earth's surface, which is the "great circle" between those places. The "great circle" distances of these U.S. stations from any point in Great Britain will not differ very much from their distance from London, from which centre this map has been plotted.

This map has marked on it the approximate boundaries of the various U.S. Inspection Districts, so that the average distance of these districts can also be estimated.

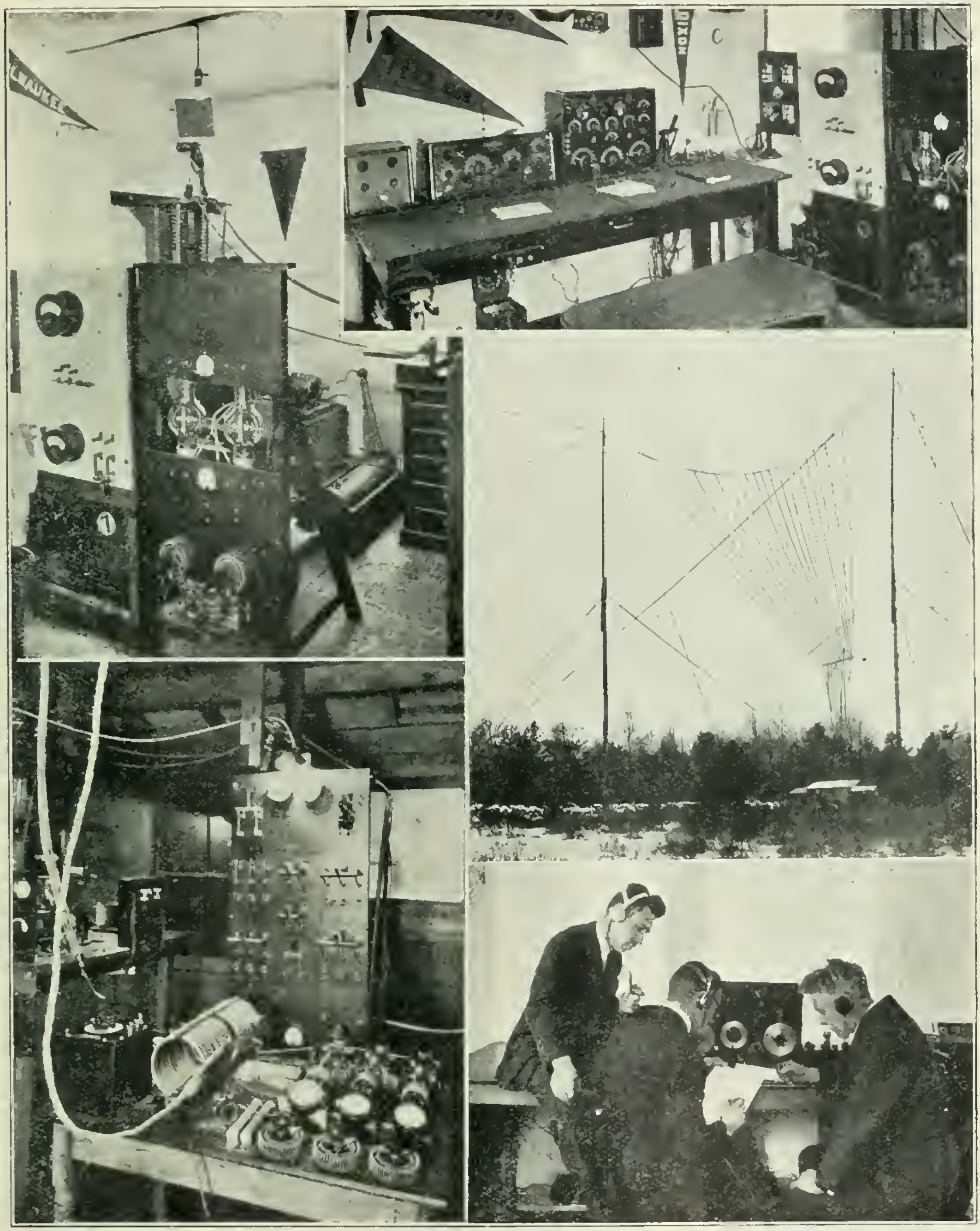
In the following table (II) is given a list of the U.S. and Canadian stations heard, together with the names of the station owners, and the address and location of each station. This table gives only those stations that have been heard making individual transmissions at the correct times, and whose code words have been verified, as only these stations were included with their owners and addresses in the schedule sent over from the American Radio Relay League.

TABLE II.

List of U.S. and Canadian Stations reported in Great Britain and Holland during "Individual" periods, the Codes being verified.

Call Letters.	Name of Owner of Station.	Address.	Town.	State.
1 AGK	S. K. Hefferman	28½, Grove Street	Salem	Massachusetts.
1 AHZ	H. N. Dole	27, Columbus Avenue ..	Haverhill ..	Massachusetts.
1 AJP	N. Bishop	Box 336, Yale Station ..	New Haven ..	Connecticut.
1 ASF	L. F. Sise	31, Power House Road ..	Medford ..	Massachusetts.
1 AZW	H. Toumajanian	70, Broadway	Newport ..	Rhode Island.
1 BCF	L. G. Cushing	—	S. Duxbury ..	Massachusetts.
1 BCG	M. Cronkhite	—	Greenwich ..	Connecticut.
1 BDI	F. E. Handy	412, Hannibal Hamlin Hall.	Orono	Maine.
1 BEP	F. L. Vanderpoel	—	Litchfield ..	Connecticut.
1 BET	College of the Holy Cross..	(Dept. of Physics).. ..	Worcester	Massachusetts.
1 BGF	P. O. Briggs	52, Girard Avenue ..	Hartford ..	Connecticut.
1 BKQ	Worcester Co. Radio Association.	776, Main Street	Worsester ..	Massachusetts.
1 CJA	G. E. Nothnagle	176, Waldemare Avenue ..	Bridgeport ..	Connecticut.
1 CMK	P. H. Bloom	682, East Street	Holyoke ..	Massachusetts.
1 CNF	St. Mark's Radio Club ..	—	Southboro ..	Massachusetts.
1 FB	L. G. Cumming	83, Marlboro Street ..	Boston ..	Massachusetts.
1 GV	H. H. Tilley	119, Pratt Street	Providence ..	Rhode Island.
1 XM	Massachusetts Institute of Technology.	—	Cambridge ..	Massachusetts.
1 YK	Worcester Polytechnic Institute.	—	Worcester ..	Massachusetts.
1 ZE	I. Vermilya	24, Allen Street	Marion ..	Massachusetts.
2 AFP	G. Milne	142, Totowa Road ..	Paterson ..	New Jersey.
2 AHO	Eastern C. W. Association	150, Coit Street	Irvington ..	New Jersey.
2 APD	C. F. Muchenhoupt ..	317, Church Street ..	Poughkeepsie	New York.
2 AWF	E. Wirsing	33, Quail Street	Albany ..	New York.
2 AWL	R. S. Johnson	—	Red Bank ..	New Jersey.
2 AYV	N. van Heuvel	413, Magnolia Street ..	New Brunswick	New Jersey.
2 BML	A. B. Tyrell	—	Riverhead ..	Long Island.
2 BNZ	E. A. Dickinson	10, Hawthorne Place ..	East Orange ..	New Jersey.
2 BQU	H. Kuch	Bertha Place, Grymes Hill	Saten Island ..	New York.
2 BRB	E. M. Glaser	845, East 13th Street ..	Brooklyn ..	New York.
2 CKN	B. M. Francisco	12, North Jay Street ..	Schenectady ..	New York.
2 CQZ	R. M. Morris, ...	827, Cross Avenue ..	Elizabeth ..	New Jersey.
2 EL	H. H. Carman	— ..	Freeport ..	Long Island.
2 GK	A. G. Kastenmeyer ..	417, Paige Street ..	Schenectady ..	New York.
2 GR	J. M. High, Jr.	Riverdale-on-Hudson ..	New York City	New York.
2 HJ	H. J. Hasbrouck, Jr. ..	—	Port Chester ..	New York.
2 HW	A. M. Hanna	1211, Hatters Street ..	Troy	New York.
2 KF	H. D. Selvage	45, Durand Place ..	Irvington ..	New Jersey.
2 LO	N. D. Dunham	103, South 1st Avenue ..	New Brunswick	New Jersey.
2 NZ	E. R. Raguse	151, Main Street	Tottenville ..	Long Island.
2 UD	W. B. Ross..	1957, 61st Street	Brooklyn ..	New York.
2 XAP	H. R. Mimms	Box 592	Troy	New York.
2 ZK	G. C. Cannon	183, Drake Avenue ..	New Rochelle..	New York.
2 ZL	J. O. Smith	3, Corona Avenue ..	Valley Stream	Long Island.
3 ABF	R. T. Shaw..	1914, Park Avenue ..	Wimington ..	Delaware.
3 AUU	W. M. Lamb	—	Petersburg ..	Virginia.
3 BG	P. C. Peterson	Ashland Avenue and Hood Road.	Falcroft ..	Pennsylvania.
3 BGT	C. S. Risley	Rumson and Ventnor Avenue.	Atlantic City ..	New Jersey.

1 3 4 2 5



By Courtesy of the American Radio Relay League.

1. *Transmitting equipment at* **9QN**, *Chicago. This station has been heard in Holland.* 2. **8AQO,** *at* **Cazenovia,** *New York.* 3. *Receiving apparatus at* **9QN**. 4. *Fan aerial of* **1ZE,** *Marion, Mass.* 5. *Taking the reports from* **MUU** *and* **UFT**. *Left to right, K. B. Warner (Secretary, A.R.R.L.), F. H. Schnell (Traffic Manager, A.R.R.L.), Hiram Maxim (President, A.R.R.L.).*

TABLE II.—*Continued.*

Call Letters.	Name of Owner of Station.	Address.	Town.	State.
3 BIJ	W. R. Selden	201, Franklin Street	Richmond	Virginia.
3 BLF	R. Hofman	202, N. Addison Street	Richmond	Virginia.
3 BNU	O. A. Hiskey	22, W. Fairview Street	Bethlehem	Pennsylvania.
3 CC	C. W. Weber	Huntingdon Road	Abingdon	Pennsylvania.
3 CG	V. M. Wintermute	47, Spring Street	Newton	New Jersey.
3 FS	C. G. Benzing	2425, S. 12th Street	Philadelphia	Pennsylvania.
3 NH	W. G. Butterfield	—	Plainfield	New Jersey.
3 XM	H. J. Hemphill	233. Pyne Hall	Princetown	New Jersey.
3 YO	Lafayette College	Radio Club	Easton	Pennsylvania.
3 ZW	W. A. Parks	1220, Jackson Street	Washington.	—
3 ZZ	A. A. Kubiac	54, Burtis Street	Craddock	Virginia.
4 BY	J. E. Hodge	143, Hull Street	Savannah	Georgia.
4 EA	A. W. Parker	—	New Bern	N. Carolina.
4 EB	B. W. Cochran	—	Palmetto	Georgia.
4 ID	J. H. Robertson	600, W. Council Street	Salisbury	N. Carolina.
4 KM	T. K. Rush	22, Cherry Street	Atlanta	Georgia.
5 FV	J. De Witt	1812, 15th Avenue S.	Nashville	Tennessee.
5 XK	P. Stout	1621, Riverside Drive	Knoxville	Tennessee.
6 ZZ	H. L. Gooding	—	Douglas	Arizona.
8 AQO	C. B. Meredith	Fernwood Farm	Cazenovia	New York.
8 ATU	J. K. Marcus	87, Kelly Street	Rochester	New York.
8 AWP	S. W. Woodworth	425, Brownell Street	Syracuse	New York.
8 AWZ	C. L. White	—	Stockdale	Ohio.
8 AXC	E. Manley	214, 5th Street	Marietta	Ohio.
8 BFM	C. J. Sonneberger	919, Beardsley Street	Akron	Ohio.
8 BK	H. G. Squires	14001, Ardenall Avenue	E. Cleveland	Ohio.
8 BNJ	W. Black	6256, Rohns Avenue	Detroit	Michigan.
8 BPL	S. J. Hutchinson, Jr.	1914, Delaware Avenue	Swissvale	Pennsylvania.
8 BXH	H. C. Hedges	35, 12th Avenue	Columbus	Ohio.
8 IB	R. C. Higgy	73, E. Frambes Avenue	Columbus	Ohio.
8 KG	J. W. Kidd	404, Lafayette Street	Niles	Ohio.
8 ML	F. M. Murphy	Grand Division and Warner Road.	Cleveland	Ohio.
8 OW	A. Mag	4212, Penn Avenue	Pittsburgh	Pennsylvania.
8 SP	A. G. Kisner	Box 428	Fairmont	W. Virginia.
8 UE	N. Schafer	32, Broadway	Lancaster	New York.
8 XE	Penn State College	—	State College	Pennsylvania.
8 YD	Shaw Technical School	—	East Cleveland	Ohio.
8 ZAF	R. C. Bohannan	1188, Willard Avenue	Columbus	Ohio.
8 ZW	E. W. Weimer	1033, Main Street	Wheeling	W. Virginia.
8 ZZ	C. E. Darr	137, Hill Avenue, Highland Park.	Detroit	Michigan.
9 AUL	L. C. Smeby	1504, W. Broadway	Minneapolis	Minnesota.
9 DYN	D and M. Koerner	—	Kempton	Illinois.
9 FM	S. J. Blum	702, Shukert Buildings	Kansas City	Missouri.
9 XAC	R. Karlowa	5000, Brady Street Road	Davenport	Iowa.
9 ZN	R. H. G. Matthews	332, S. Michigan Avenue	Chicago	Illinois
9 AL	A. H. K. Russell	11, Pinewood Avenue	Toronto	Ontario, Canada.

A further instalment of this summarised report of the Transatlantic Tests will be included in our next issue.

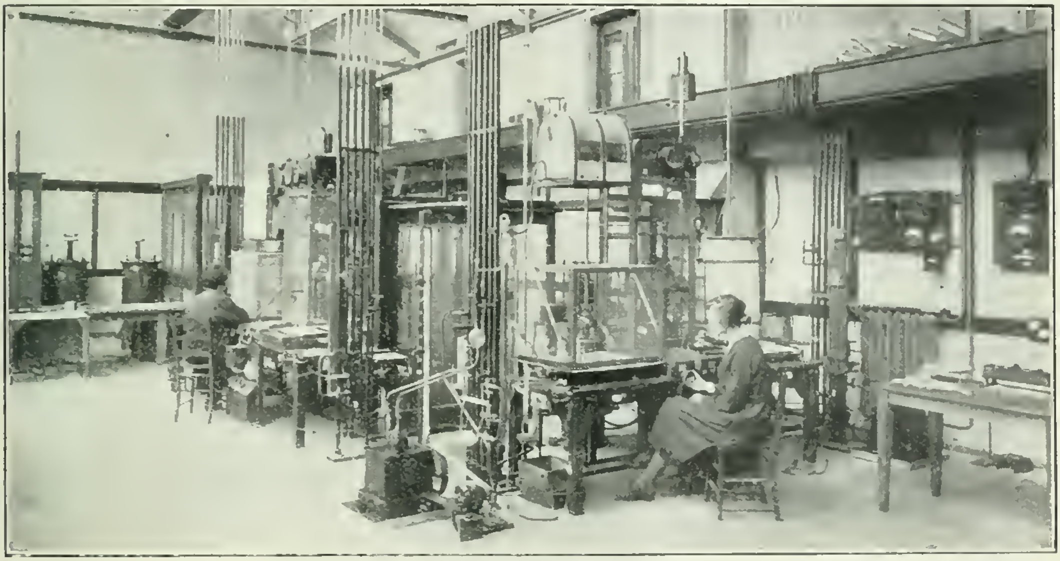
The Research Laboratories of the General Electric Company at Wembley.

THE new research laboratories of the General Electric Company, Ltd., situated in Wembley, Middlesex, were formally opened on February 27th by the Rt. Hon. Lord Robert Cecil, K.C., M.P. A description of the arrangement of the laboratories is considered to be of special interest, as they probably represent the largest electrical research department in this country, and approach in magnitude those controlled by the large electrical manufacturing establishments in the United States.

The laboratories are divided into a number of departments according to the class of investigation carried on, and a brief description of the many sections is given below.

Each laboratory, apart from the interesting equipment installed for a number of routine tests, was arranged with demonstration equipment for indicating the progress made by the company in the design of all classes of electrical gear.

In the vacuum physics laboratory were demonstrated a number of attractive experiments relating in particular to gas filled lamps, and an instrument was exhibited which is used for determining the most suitable arrangement of filament both as to length and formation.



The Valve Research Department.

Adjoining this laboratory is a lamp development section. Here is established complete manufacturing plant for producing all types of lamps, adjoining which is the Valve Department, and, as regards general manufacturing processes, may be regarded as a development of the Lamp Department. A complete description of the manufacture of thermionic valves by the M.O. Valve Company was given in a recent issue,* and the accompanying photograph shows a large transmitting valve in the process of being exhausted. This depa.tment is equipped with elaborate test tables for examining the valves manufactured in the laboratory. Special attention is being given to the design and manufacture of the dull emitter type of valve, having thorium treated filaments. The dull emitter filament requires a voltage of 1.6 and a current of 0.36 amperes, whilst the ordinary receiving valve of similar dimensions requires a voltage of 4 and a current of 0.7 amperes, or more than four times that of the dull emitter. Owing to the marked oxidising properties of the thorium treated filaments, special precautions have to be taken in manufacture in order to obtain a very high degree of vacuum. A method of obtaining a suitable vacuum has been developed and valves are being produced which have

*P. 641. August 19th, 1922.

very long working lives, frequently as high as 5,000 hours.

The electrical laboratory contained a number of interesting exhibits and, to the wireless experimenter, the thermionic repeater apparatus was especially attractive. By means of this apparatus it is possible to carefully investigate distortion as may be produced in valve amplifiers, and great attention can consequently be given to the design of equipment intended for distortionless amplifying at voice frequencies.

Passing from the electrical room, the generating sub-station was visited in which were to be seen a number of machines used for producing electrical power for use throughout the laboratories. Installed in this room also are a number of pumps which are coupled up to pipe lines extending throughout the building, and enabling apparatus to be roughly exhausted before being connected to more elaborate pumps for producing high vacuum.

Metal and wood-working workshops adjoin the main building and are liberally equipped with machines for instrument manufacture.

A microscopy laboratory is also to be found and is engaged chiefly in the examination of thorium and other filaments.

A laboratory is provided for the study of metallurgy as applied to lamp filament manufacture, and experiments were in progress in this laboratory demonstrating how fine wire filaments were manufactured.

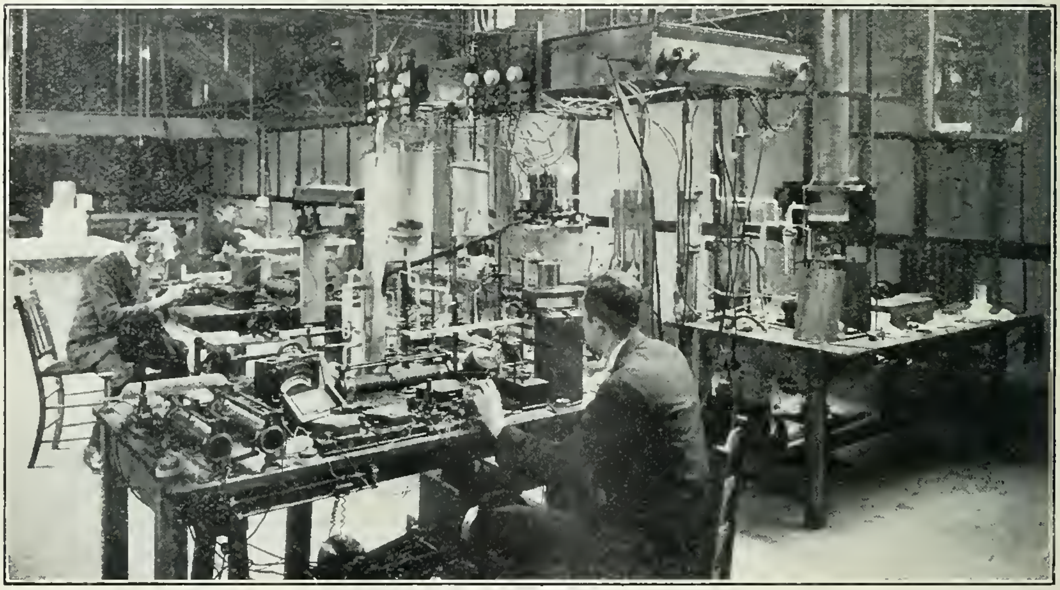
Glass making and glass examining laboratories are to be found in which investigations are carried out concerning all the physical properties of glass,

Two other laboratories are devoted to the investigation and manufacture of various types of primary batteries, and test racks are arranged for investigating the properties of the various types under working conditions.

Other laboratories are arranged for testing the life of lamps and for carrying out colour determinations.

Adjoining the latter department is a laboratory devoted to research in the design and application of neon gas filled lamps, and it is interesting to learn that the manufacture of neon tubes for the rectification of high potential currents, such as are used in wireless transmission, is contemplated. A novel type of oscillograph is exhibited here consisting of a rotating tube, the electrodes of which were slightly separated in order to distribute the glow. The simplicity of this apparatus should bring it within the sphere of the amateur worker when more details relating to its construction become available.

The General Electric Company, Ltd., are to be congratulated on the setting up of such a well-equipped research department, which is in the hands of the able research engineer, Mr. Clifford C. Patterson, while conversations with his staff indicated that they were possessed of the fullest expert knowledge of the work in which they are engaged.



A corner of the Electrical Laboratory.

Notes

The Bamberger Tests.

Reports continue to reach us of the reception of the test broadcast transmission on February 24th from WOR, the Bamberger station, New York.

One of the notably successful attempts was that of Mr. D. W. Pugh, of Ealing, who heard the whole transmission distinctly with the use of a single valve employing reaction.

Other amateurs whose nocturnal vigil was rewarded by the reception of WOR were as follows :—

Mr. Brian A. Butt, Kingston-on-Thames. 1 H.F., detector.
Mr. W. R. Stainton, Leigh, Lancs. Detector, 1 L.F.
Mr. A. S. Gosling, Nottingham. 1 H.F., detector.
Mr. T. E. Hamblett, St. Helens, Lancs. 1 H.F., detector.
Mr. Henley, London. 3 valves (Burndept Ultra III).
Mr. Pool, Newton Abbott. 3 valves (do. do.)
Mr. A. G. Yates, Lincoln. 1 H.F., detector, 1 L.F.
Mr. F. Wiseman, Jun., Buxton. Detector, 2 L.F
Mr. A. G. Saunders, Runcorn, Cheshire. Detector 2 L.F.
Mr. C. J. Flint, Stafford. Detector, 2 L.F.
Mr. R. D. S. Hodgins, Egerton, Kent. 2 H.F., detector.
Mr. R. Hardy, Nelson, Lancs. 1 H.F., detector, 1 L.F.
Mr. H. D. Pope, Swindon, 1 H.F., detector, 1 L.F.
Mr. H. A. Brooke, Maldon, Essex. 1 H.F., detector, 1 L.F.
Mr. Graham Hunt, Torquay. 2 H.F., detector.
Mr. John R. Jones, Victoria Park, E.2. 1 H.F., detector, 1 L.F.
Mr. G. Trice, Godalming. 2 H.F., detector.
Mr. R. T. Wright, Chiswick. Detector, 2 L.F.
Mr. Tucker, Loughborough. 4 valves (Burndept Ultra IV).
Mr. R. J. Wood, Halifax. 2 H.F., detector, 1 L.F.
Mr. I. W. Woodrow, Lowestoft. 1 H.F., detector, 2 L.F.
Mr. W. Douglas Clague, Gateshead-on-Tyne. 2 H.F., detector, 2 L.F.
Mr. Jas. Hawley, Musselburgh, N.B. 3 H.F., detector, 1 L.F.
Mr. H. J. Galliers, Brighton. 4 valves (Burndept Ethophone V Broadcast Receiver).
Mr. Thos. Ball, Cannock.
Mr. W. Pratt, London, W.1.

2 LO Programme in U.S. Newspapers.

A New York telegram announces that, as a matter of course, the newspapers now publish the programme of **2 LO**, the London Broadcasting station, in common with the principal American stations. London has been included in consequence of the broadcasting by a Newark, New Jersey, store on February 23rd, of a radio concert in which items from London, Paris and even Berlin, were heard.

Birmingham Heard in Canada.

On February 18th, says the *Times*, a message sent out by the Birmingham Broadcasting station was picked up by Mr. Humphrey Marshall, of London (Ontario).

Parliamentary Proceedings not to be Broadcast.

That he did not think that the Hon. Member's proposal was desirable was Mr. Bonar Law's reply on February 26th to Mr. Tillett (*Lab.*, Salford, N.), who asked whether the Prime Minister would consider the practicability of arranging for the proceedings of the House to be broadcast.

The Experimental Licence.

In the House of Commons on February 20th, Mr. Neville Chamberlain stated that the issue of experimental licences, for which applications were being received in very large numbers from persons who did not appear to be *bona fide* experimenters, was at present subject to some delay, but he hoped to make arrangements which would obviate it.

British Broadcasting Heard in Sweden.

At Lund, in the South of Sweden, approximately 700 miles from this country, Dr. G. Alb. Nilsson states that he is able to receive all the British Broadcasting stations with only one valve, with reaction, and an antenna of moderate size. Every word can be understood. With the addition of a two-valve note magnifier, speech and music can be heard in a large room. On the same set, he adds, using one detector and two L.F., but with a single wire of 25 feet stretched across the floor, the British Broadcasting stations can be heard one or two feet from the telephones.

Broadcast Concerts from Italy.

The possibility that listeners-in will soon have an opportunity of hearing wireless concerts direct from "the land of song" is indicated by the announcement that the Italian Government has been authorised to allow the building of wireless telegraph and telephone stations by private companies.

The Conscience of the Listener-in.

That owners of unlicensed home-made sets are not such unmitigated "pirates" as is suggested in some quarters is reflected by the report that the British Broadcasting Company is receiving, almost daily, remittances of "conscience money" from anonymous sources. The company refuses, however, to collaborate in the alleviation of stricken consciences, for the money so received is regularly handed to a number of deserving charities.

Comprehensive.

Advertisement in local paper: "House to let, furniture effects, wireless (one valve), etc., £250 all in."

Cardiff Tries Lower Wavelength.

In consequence of complaints by listeners-in to **5 WA** of interference by Newcastle and Manchester, the new Welsh Broadcast Station, on February 21st, reduced its wavelength to 353 metres. Although this is rather low (the lowest in the broadcast band), it is believed that the change will give satisfaction. Further tests will be made, however, if trouble is still experienced, so that the complete elimination of other stations may be attained.

Broadcasting Difficulties in Shanghai.

That any wireless sets imported would be seized as contraband of war, was the information received from the Shanghai Customs Commissioner by an American Company which had announced the intention of inaugurating a wireless broadcasting service.

Imperial Wireless Chain.

An announcement is made from Ottawa from which it would appear that the Canadian Government has decided not to participate in the Imperial Wireless Chain Scheme.

According to the *Central News*, the Department of Marine has issued a licence to the Canadian Marconi Company for the operation of a station on Vancouver Island, with a nominal range of 7,000 miles. This will enable communication to be made with Australia, Japan, Montreal and Great Britain.

Manchester Wireless Convention.

A Convention will be held on Wednesday, March 21st, at the Albion Hotel, Piccadilly, Manchester, under the auspices of the Manchester Wireless Society in connection with the forthcoming wireless exhibition organised by Messrs. Bertram Day & Co., Ltd., to be held in the Burlington Hall, Burlington Street, Manchester, from March 17th to 24th inclusive.

All members of wireless societies are invited. Visitors are requested to meet at the exhibition before 4.30 p.m. on that day, or at the Albion Hotel not later than 5 p.m. Tea will be served between 5 p.m. and 5.45 p.m., and the meeting will commence at 6 p.m. prompt.

Dr. Hodgson, M.D., F.R.C.S., L.R.C.P. (President) will occupy the chair, and a discussion will be invited on various subjects appertaining to amateur wireless.

Suggestions for the agenda should reach the Hon. Secretary, 2, Parkside Road, Princess Road, Manchester, not later than March 12th.

It is requested that as many as possible will attend.

Any further particulars may be obtained from the Hon. Secretary.

THREE NEW BOOKS.

A NEW publication which will be readily welcomed by all whose interests turn to wireless constructional or experimental work, has this week made its appearance, and is entitled "The Amateur Book of Wireless Circuits."* The author, Mr. F. H. Haynes, is known to readers of this journal by his contributions under the heading of "Experimental Station Design," and on a number of other practical subjects. On the 107 pages are to be found 111 reliable circuits, each accompanied with such working advice as may be needed in the practical application of the arrangement shown. The book is progressively arranged so that the beginner will at once find circuits to meet his needs, and he may look ahead and frame the lines on which his set may develop. The inclusion of such circuits as accumulator charging by a variety of methods from A.C. and D.C. mains, wavemeters, and ex-Government apparatus, renders the book most helpful. Many pages are devoted to useful switching systems making use of Dewar and other switches, and types of break jacks available on the British market. By turning over the pages of this valuable book it is possible rapidly to gain a knowledge of the best modern radio practice, from all types of crystal sets to telephony transmitters of moderate power.

Although booklets and cards of instruction are issued with every broadcast receiver, possessors of these instruments are often desirous of knowing more about the apparatus, feeling that with a little more instruction they could get far better results. With the object of satisfying this desire, the Wireless Press, Ltd., has just issued a useful sixpenny book entitled "Your Broadcast Receiver and How to Work It."† The author, Mr. Percy W. Harris, is known to readers of this journal and has endeavoured throughout the book to give practical hints and tips that can be applied at once by every reader. The text of the book is accompanied by a number of interesting photographs of English and American broadcasting stations, and should prove helpful to the large number of broadcast listeners who do not desire to trouble themselves with the study of theory.

The recent highly instructive and interesting articles by Dr. J. A. Fleming, the eminent scientist, which have been appearing during the last few months in this journal, have been reprinted in book form, and readers ought certainly to possess themselves of one of these interesting volumes.* Dr. Fleming, the inventor of the valve, is well known to our readers for his clear exponential powers and lucid descriptions and the interesting way in which he describes his pet theme—the valve and its application to Wireless—is well known to all. His articles, it will be remembered, dealt in a most complete and concise manner with Wireless Telephony, and were entitled "Electrons, Electric Waves and Wireless Telephony."* In the first chapter Waves and Wave Production are extensively dealt with, followed by a chapter on Waves in Air, showing many novel and yet simple methods of measuring and recording them. Descriptions of atomic structure, electrons and molecules have a chapter to themselves under the title of "The Structure of Atoms," leading up to a chapter on Electromagnetic Wave Forces and Radiation. The Production and Detection of Long Electric Waves introduces a chapter on Telephony and Speech Transmission, and the last chapter (there are seven in all) deals with the principles of Wireless Telephony, with its problems and special features, concluding with the present activities in the science as exemplified by radio broadcasting in England. The edition, clearly printed and handsomely bound, will, we understand, be ready for sale during the coming week.

* "The Amateur's Book of Wireless Circuits." By F. H. Haynes. Post free, 2s. 10d. The Wireless Press, Ltd.

† "Your Broadcast Receiver and How to Work It." By Percy W. Harris. Post free, 8d. The Wireless Press, Ltd.

* "Electrons, Electric Waves and Wireless Telephony." By Dr. J. A. Fleming, M.A., F.R.S. Post free, 8s. 3d. The Wireless Press, Ltd.

Correspondence

To the Editor of The Wireless World and Radio Review.

Sir,—I read with interest a recent letter in your Correspondence column dealing with a frame aerial.

As I am also getting very good results from one, I should like to state my experiences, in the hope that they will be of interest to some of your readers. The frame is approximately four feet six inches square, or some six feet across the diagonals, with the diagonals vertical and horizontal.

It is wound with No. 16 gauge copper wire in two sections, the wires are spaced approximately ½ in. apart on ebonite combs,as described in Mr. Coursey's book, "The Experimenter's Handbook."

Each section consists of eight turns and will tune, with a 0·001 condenser, from about 325 to 750 metres. The two sections in series with the same condenser gives me somewhere between 900 to 1,500 metres.

Results when using five valves (two H.F. tuned transformer coupled, detector, and two low frequency amplifiers) are as follows : —

British Broadcasting. Very loud and clear telephony from London, Birmingham and Manchester, under favourable conditions, and using two pairs of phones in series, it is quite possible to make reception too loud for comfort and *this without distortion.* There is no noticeable difference in the strength of any of these stations now, though they have varied considerably in the past. London and Birmingham are some 200 miles from here, and Manchester nearly 300.

Hague Telephony. This is received at quite readable strength, but owing to jamming from a C.W. station, there is a fair amount of distortion. There is no difficulty in tuning in.

I am almost afraid to put the next heading down, but it is really true. Anyway, I have received American telephony of quite readable strength on the frame with five valves arranged as above. On the mornings of the 24th and 25th December respectively, I heard **WZY** and **WJZ** and was able to follow the programmes fairly well. **WZY**, the station of the General Electrical Co., Schenectady, is by far the best that I get on my outside aerial. I have frequently followed his speech with the telephones on my knees.

Croydon and Le Bourget telephony is easy, Lympne rather more difficult. I have a good outside aerial, and so am able to make a comparison. The frame I should say is about a valve-strength weaker than the outside aerial, or perhaps it would be more correct to say between one and two-valve strength.

No reaction coil is employed in either case, the set oscillating very easily to any wavelength by tuning the transformers ; in fact on short wavelengths I have to use the potentiometer freely.

I have yet to hear my first atmospheric with the frame and its directional properties give some selectivity. The chief trouble is stray capacity effects, long handles for tuning being absolutely necessary ; in fact, for American telephony I prefer to sit well away from the instrument table and operate the controls with a walking stick. When tuned critically, shifting the 'phones (H.R.) on one's head is often sufficient to lose the signal or induce howling.

But for English Broadcasting such fine tuning is not at all necessary.

I trust these facts may induce some of your readers to experiment on these lines, for I believe there is a big field here yet only partly explored.

I can assure your readers that I do not consider either the above results or my instruments exceptional, but that I feel sure that anyone else working on these lines will get similar results.

Edgar R. Kelman.

Guernsey, Channel Islands,
January 1st, 1923.

To the Editor of The Wireless World and Radio Review.

Sir,—The points raised by Mr. L. F. Fogarty in his letter to *The Wireless World and Radio Review* in connection with the subject of H.T. electrolytic rectifiers, are interesting ones. In particular, I hardly expected that my use of four banks of rectifier cells and an ordinary transformer instead of two banks of cells and a split-winding transformer would pass unchallenged. Although only half the number of cells is required for a given voltage where the centre-tapped transformer is used, I maintain that this method is not very convenient for general experimental purposes. The centre-tapping must be exactly half-way on the secondary, both as regards resistance and inductance ; this practically prohibits tapping various voltages off the secondary as the balance would be upset thereby. On the other hand, the cells are so cheaply and easily made that the use of twice the number with an ordinary transformer does not present much objection.

Mr. Fogarty's experience with ammonium phosphate seems to be less fortunate than my own. The pure salt only should be used if the best results are desired, the difference between pure and commercial ammonium phosphate being quite as great as that existing between chalk and the proverbial cheese. With regard to the electrolyte creeping and corroding the brass connectors, I find that the paraffin oil stops this entirely. I totally disagree that any decomposition of the paraffin takes place, even at heavy loads ; paraffin being chemically inert to anything but the most powerful oxidizing agents, such as chlorine or fuming sulphuric acid. I have a rectifier of 40 cells with strip electrodes 1 cm. wide immersed in a solution of pure ammonium phosphate, covered with a layer of paraffin which has been performing heavy duty since it was made up over a month ago. Amongst other things it has been supplying an experimental Chaffee gap, which takes nearly 0.2 amp. at over 500 volts. The electrolyte is still quite clear, practically no sediment has formed and no appreciable creeping has taken place. The only noticeable thing is a slight decrease of the paraffin in each cell due to slow natural evaporation.

Scrupulous cleanliness of the surfaces of the aluminium electrodes is essential, and for satisfactory working the area of the aluminium electrode in each cell should be so proportioned that the current density is of the order of 10 milliamps. per square centimetre.

I have had no opportunity of making oscillographs of the rectifier output.

E. H. Robinson.

The recent letter from Mr. Robert Tingey and reply from Dr. J. A. Fleming on the matter of Transatlantic transmission has aroused many readers to express opinion on the subject, and cast their vote for or against the theory put forward. In short, Mr. Tingey put forward the suggestion that the many high-power Transatlantic stations set up strains in the ether which act as "carriers" for the low power amateur and broadcast transmissions, and facilitate the bridging of the great distance by the small stations. Dr. Fleming, in his reply, set aside the theory, explaining that it was contrary to the properties of ether strains to react upon one another in their progress. To facilitate the formation of a correct idea on wave motion in the ether he gave the analogy of ripples on an ocean surface tossed by storms. To this comparison very many readers take exception, and perhaps with some justification, as waves in the ocean are not in all respects analogous to those in the ether, excepting, of course, that it is a fact that interaction by the waves of large amplitude acting as carriers for those more feeble and of other frequencies does not occur. Owing to the limitations in space, it is not possible to give publication to many letters which have come to hand, and to publish some without others would hardly be fair to the writers or help the reader in forming a true conception of the subject.

Calendar of Current Events

Friday, March 9th.

Sheffield and District Wireless Society.
At 7.30 p.m. At Dept. of Applied Science, St. George's Square, Elementary Class conducted by Mr. J. G. Jackson, B.Sc.

Leeds and District Amateur Wireless Society.
Lecture: "Experiences with an Experimental Receiving Installation." By Mr. J. Croysdale.

Radio Society of Highgate.
At 7.45 p.m. At the 1919 Club, South Grove. Lecture: "Measuring Instruments used in Wireless." By Mr. G. A. V. Sowter, B.Sc.

Sunday, March 11th.

From 3 to 5 p.m. Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, March 12th.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. R. Crombie.

Wireless Society of Hull and District.
At 7.30 p.m. At the Signal Headquarters. Lecture by Mr. Lax.

Tuesday, March 13th.

Plymouth Wireless and Scientific Society.
At 7.30 p.m. General discussion and questions on wireless.

Wednesday, March 14th.

Halifax Wireless Club and Radio Scientific Society.
Lecture by Mr. A. F. Carter, A.M.I.E.E.

Edinburgh and District Radio Society.
At 8 p.m. At R.S.S.A. Hall. Lecture: "Some Legal Observations on Wireless Telegraphy." By Mr. A. B. Noble, W.S

Thursday, March 15th.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Stoke-on-Trent Wireless and Experimental Society.
Lecture: "Simple Radio Receivers." By Mr. F. J. Goodson, B.Sc.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School. Practical Work and Demonstration.

Thames Valley Radio and Physical Association
At 8 p.m. Lecture: "The Problems of Short Wave Reception." By Mr. Maurice Child.

Derby Wireless Club.
At 7.30 p.m. At the Shaftesbury Restaurant. Lecture: "Accumulators." By Mr. E. F. Clarke, B.A., B.Sc., A.M.I.E.E.

Friday, March 16th.

Sheffield and District Wireless Society.
At 7.30 p.m. At Dept. of Applied Science, St. George's Square. Lecture: "Design and Construction of Receivers." By Mr. W. Burnet.

Leeds and District Amateur Wireless Society.
Lecture: "The Construction of a Tuner." By Mr. G. P. Kendall, B.Sc. (Vice-President).

Radio Society of Highgate.
At 7.45 p.m. At the Highgate 1919 Club, South Grove. Lecture: "Elementary Theory of Wireless Reception, Part I." By Mr. H. Andrews.

Saturday, March 17th.

Manchester All-British Wireless Exhibition. At Burlington Hall, Burlington Street. Opening Day (March 17th to 24th.)

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,
Cardiff	5WA	395 ,,
Glasgow	5SC	415 ,,

FRENCH BROADCASTING TIMES.

Eiffel Tower. 2,600 metres. 11.15 a.m. weather reports (duration 10 mins.) 6.20 p.m., weather reports and concert (duration about 30 mins.) 10.10 p.m., weather reports (duration 10 mins.).

Radiola Concerts. 1,565 metres., 5.5 p.m. news; 5.15 p.m. concert till 6 p.m.; 8.45 p.m. news; 9 p.m., concert till 10 p.m.

L'Ecole Supérieure des Postes, Télégraphes et Téléphones de Paris. 450 metres. Tuesdays and Thursdays, 7.45 p.m. to 10 p.m. Saturdays, 4.30 p.m. to 7.30 p.m.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each questions should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12 13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6)* **Where a reply through the post is required, every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** *(7) Four questions is the maximum which may be sent in at one time.*

"X" (Kent) *asks* (1) *Whether the circuit submitted is correct.* (2) *How many coils would be required to cover the complete range of wavelengths.* (3) *Should it be expected that a cage type aerial would give an increase in the signal strength.* (4) *What is meant by a power valve, and how is it connected to a receiver.*

(1) The diagram of connections is correct. We would point out, however, that the reaction coil, being coupled with the secondary circuit, may cause oscillating energy to be generated in the aerial circuit, and care should therefore be taken. (2) 14 coils of the type referred to will be required if you wish to receive signals over the whole wavelength range. (3) We do not think you should expect to receive a great increase in signal strength by substituting for your present aerial a cage type aerial. (4) A power valve is a valve which operates according to the same principles as an ordinary receiving valve, but the emission is greater, and a higher anode potential may be used. It is connected in the circuit in the same manner as the ordinary receiving valve, and provision is made for supplying its anode circuit with a potential of 200 or 300 volts, according to the particular valve used.

"C.J.C." (York) *submits particulars of his receiver and asks why no signals are received.*

The diagram submitted is quite correct, and good results should be obtained. We suggest you commence looking for the fault by examining the aerial and earth. The aerial should of course be insulated at each end, and should be well away from the walls of the house. The aerial should preferably be about 30 to 40 ft. high. The earth connection should be as short as possible, and should make contact with a good ground connection; it may be either a water-pipe or an earth plate. The latter may be a sheet of galvanised iron 5′ or 6′ long and 2′ wide, to which the wires are soldered. If this is buried at a depth of 2′ or 3′ you will have a good earth. The L.T. battery should be increased to 6 volts. If you have a friend who has a wireless receiver, perhaps you could try your receiver when connected with his aerial and earth. When purchasing H.F. transformers great care is necessary, otherwise very poor results are obtained, especially if, as is often the case, the transformer is poorly made and the primary and secondary wires are in contact. We assume, of course, that the tuning coils are the right size and enable you to tune to the required wavelength, and that the telephone transformer is connected in the right direction.

"VARIO" (Cambridge) *asks* (1) *Referring to the circuit Fig. 2, page 548, January 20th issue, would it be more efficient to use variometers in the anode circuit in place of the tuned coils.* (2) *Would capacity reaction, used as indicated in the diagram submitted, be suitable.* (3) *With reference to a jamming eliminator (particulars of which are submitted) should it be expected that signals would be reduced if it is used.* (4) *Is one permitted to use the Armstrong super-regenerative receiver in connection with a small frame aerial to receive broadcast transmissions.*

(1) If desired, variometers may be used in place of the tuned circuits, but it is not altogether recommended because tuning adjustments become very difficult. (2) Capacity reaction may be used as suggested. A small condenser having a maximum value of 0·00005 mfds. may be connected between A and B as indicated in your diagram. (3) Provided the eliminator mentioned is properly constructed fair results will be obtained, but it should not be expected that any wonderful improvement will take place, because it will not. The tendency, as suggested, is to shunt away useful energy, and one is generally better without such an arrangement. (4) We believe the P.O. will grant permission for an experimenter to use the Armstrong super-regenerative receiver in conjunction with a frame aerial but not for the reception of broadcasting.

"L.B.C." (Bedford) *asks* (1) *For particulars of windings of L.F. transformers.* (2) *May wire similar to the sample submitted be used.* (3) *May 8,000 ohm telephones be used in conjunction with a telephone transformer, the latter being wound for 180 ohm telephones.* (4) *Is an experimenter who holds an experimental licence permitted by the P.O. to use reaction coupled with the closed circuit coil for the reception of broadcast transmissions.*

(1) The proposed design for L.F. transformers is quite suitable. We suggest you make the bobbin 3″ long. The primary winding should be wound

with 15,000 turns of wire as sample submitted, and the secondary with 40,000 turns of No. 44 S.S.C. (2) The sample of wire submitted is No. 39. (3) The purpose of a transformer is to match the impedance between the ode circuit and the telephones. 8,000 ohm telephones should therefore be connected directly in the anode circuit, and the 180 ohm telephones should be connected to the secondary winding of the transformer. (4) The holder of an experimental licence is not permitted to use reaction when listening to the broadcast transmissions unless the reaction wire is coupled in such a manner that oscillating energy may not be set up in the aerial circuit.

"A.T.N." (Surrey) *refers to the three-valve experimental diagram given in the issue of October 28th, and asks for a diagram showing how to add one note magnifier.*

The diagram is given in Fig. 1.

"H.G." (Sheffield) *submits a diagram of his receiver and asks* (1) *For a diagram of a suitable L.F. amplifier.* (2) *The gauge of sample of wire enclosed.*

(1) A suitable diagram is given in Fig. 2. (2) The larger sample of wire submitted is No. 34 S.S.C., and the finer wire is No. 42 enamelled.

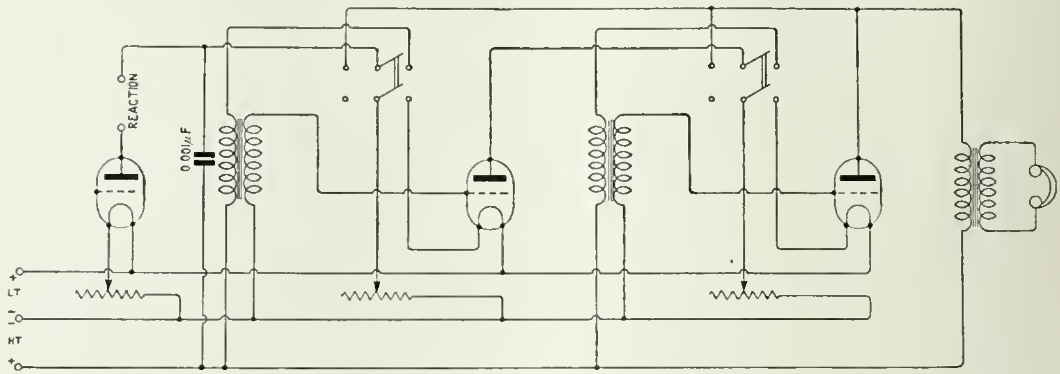


Fig. 1. The circuit shows the switching of two note magnifying valves.

"J.McK" (London, W.) *asks* (1) *Whether under the circumstances he should adopt a different method of tuning because it is difficult to tune out local broadcast transmissions.* (2) *What kind of tuner is recommended.*

(1) and (2) We suggest you use a three-coil holder, one coil being for the aerial circuit, one for the closed circuit, and the other for the reaction coil. When listening to the broadcast transmissions the reaction coil may be short circuited. The method of connecting a three-coil holder is given in most issues of this journal. With this combination you will find it possible to tune out the transmissions of the local broadcasting stations.

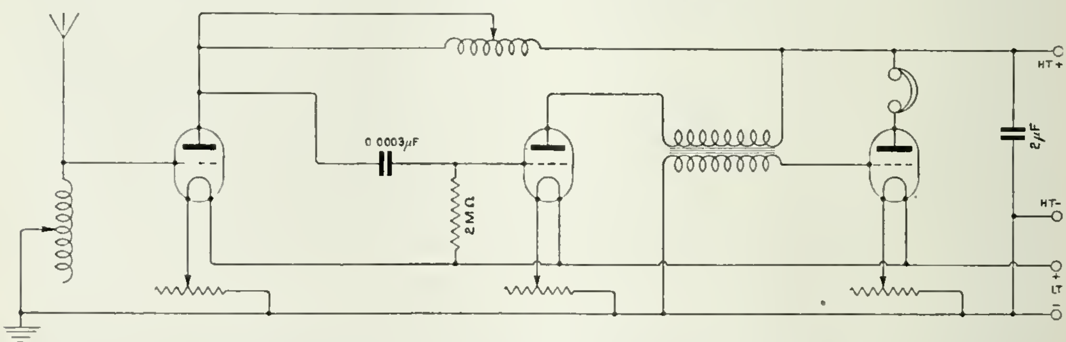


Fig. 2. A three-valve receiver with 1 H.F., 1 Detector and 1 L.F. valves. The H.F. valve is coupled with a self-tuned anode coil and a grid condenser and leak.

"J.G.P." (Oldham) *submits a diagram of his receiver and asks whether it is suitable.*

The diagram submitted is quite suitable, and very good results should be obtained. The aerial tuning condenser should have a maximum value of 0·001 mfds. and the anode condenser 0·0002. The remaining condensers have the usual values.

"P.P." (Yorks) *asks* (1) *For the dimensions of a small transformer which will give 30 volts 2 amps.* (2) *Can we recommend a suitable book.* (3) *What would be the suitable dimensions for a transformer to give 200 volts 50 milliamps.*

(1) A suitable transformer would have a primary winding of 230 turns of No. 24 D.C.C. wire. The secondary would have 32 turns of No. 18 D.C.C. The core should be 2″ × 2″ and the former should be 3″ long. (2) We do not know of a suitable book. (3) As the primary voltage is 230 and you require a secondary voltage of 200, the most economical method would be to use resistances to reduce the voltage of the mains by 30. If, however, you wish to use a transformer, the primary would have 460 turns of No. 36 D.C.C., and the secondary 410 turns of No. 24 D.C.C. The core should be 2″ × 1″, and the bobbin may be 2½″ long.

"J.W." (Ilford) *asks* (1) *For criticism of his receiver.* (2) *Whether it would be an improvement to connect a variable tuning condenser across the anode coil.*

(1) The diagram submitted is quite correct except that the small coil shown connected in series with the telephones is not required. The *coil holder is used, is there any particular ratio of coils which gives best results.*

(1) If a moving coil ammeter were connected in series with the H.T. battery, it would be found that the plus terminal of the instrument should be connected with + H.T. The filament of the valve should certainly be considered as the source of electricity, and when the anode is made negative by the electrons from the filament, it would appear that positive electricity flows from the battery to neutralise the charge on the plate. (2) We think the local authorities would not object to your erecting an aerial across the street provided it lies 20′ above the road. We suggest you communicate with the local authorities and ask for their permission. (3) When using a three-coil holder, it will be found that when the aerial tuning condenser is in series with the A.T.I. the largest coil is the aerial coil and the smallest the reaction coil. The closed circuit coil will be an intermediate size. The size of the reaction coil, however,

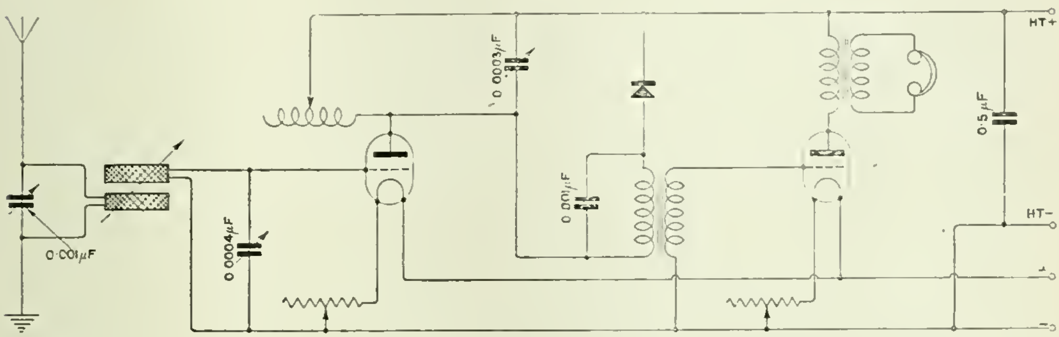


Fig. 3. The diagram shows the connections of a receiver which has one H.F. amplifying valve, crystal rectifier, and one note magnifier. The anode circuit of the first valve contains a coil which is tuned with a condenser to the wavelength of the signal. Good amplification is obtainable with a receiver wired to this diagram, and its simplicity should appeal to those who have but recently taken an interest in reception. The circuit is ideal for the reception of broadcast transmissions and its range would be of the order of 80 miles.

receiver is very simple and straightforward, and may be recommended if you are a beginner. (2) A tuning condenser is not required to tune the anode coil, but if you have a small condenser by you, you should certainly try whether adjustments are made easier with the aid of the condenser.

"NEW READER" (Smethwick) *asks* (1) *For a diagram of a two-valve receiver with crystal rectification.* (2) *For suitable values.* (3) *What results should be obtained.*

(1) and (2) A suitable diagram is given in Fig. 3. Suitable values are indicated. (3) You should certainly hear broadcast transmissions and any other stations which are transmitting with sufficient power.

"SANDY" (Ramsgate) *asks* (1) *With reference to the H.T. battery, does the current actually travel from the filament to the plate, i.e., from the negative of the H.T. to the positive of the H.T.* (2) *May he erect an aerial wire across the street without permission of the local authority.* (3) *When a three-*

depends very largely upon the wiring of your receiver.

"LEAD-IN" (Halifax) *submits a diagram of a receiver and asks* (1) *For criticism.* (2) *How could Dewar type switches be connected for the purpose of cutting out the first and last valves when required.* (3) *What is the difference between a power valve and a note magnifier valve.*

(1) The diagram submitted is quite suitable, although it might be better to connect the aerial tuning condenser and A.T.I. in series when receiving short wave signals. A 0·001 mfd. fixed condenser should be connected across the primary winding of the transformer connected in the detector valve circuit. It would be better if you used a telephone transformer with a 0·001 condenser connected across the primary. We suggest you test the telephones for continuity as it would appear that they are faulty. It should not be necessary to connect the fingers across the telephone terminals in order to hear signals. (2) The method of connecting switches for cutting out valves is given in most issues of this journal, and we would refer

you to them. (3) The power valve is one which is capable of dealing with more power than the ordinary receiving valve, *i.e.*, the H.T. potential connected to its anode, and the filament emission are both greater than in the case of the "R" valve. The connections of a power valve are the same as those for a receiving valve. If you propose to use a power valve as the last valve of your note magnifier, a separate H.T. tap should be provided, and you will find it necessary to include a few cells in the grid circuit.

"NOVICE" (Notts.) *asks* (1) *For diagram of a three-valve receiver.* (2) *If the components used in the construction of the receiver were stamped "B.B.C.," would it be necessary to obtain an experimenter's licence.* (3) *If the receiver were constructed according to the diagram given in reply to* (1), *would any patents be infringed.*

(1) See reply to **"H.G." (Sheffield)**, p. 782. (2) If you construct the receiver yourself, it will be necessary to obtain an experimenter's licence before it is used. (3) The method of connecting valves given in the diagram is covered by patents. You are, however, permitted to wire up a receiver according to the diagram given, if the receiver is for your own experimental use.

"H.F.G." (Huddersfield) *asks* (1) *Whether a certain combination of crystal and valves is recommended.* (2) *Is the diagram submitted suitable.* (3) *What is the highest voltage which should be connected to the filament of a new "R" type valve.*

(1) We do not recommend the combination suggested. (2) The diagram submitted is quite correct and is very suitable for a beginner. It would be better, of course, if the anode winding were tuned with a variable condenser instead of with the aid of the slider, but you should try this for yourself, and notice whether the signal strength is increased or not. You may find it an advantage to connect a variable condenser having a maximum capacity of 0·001 mfds. in series with the aerial coil. (3) 4 volts may generally be safely applied to the filament of an "R" valve when it is new, and sometimes a little over 4 volts may be used.

"D.W.M." (Burton-on-Trent) *asks whether we can suggest a receiver which has been described and which would meet his requirements.*

We would refer you to the articles by Mr. Bull which appeared on page 667 in August 26th issue, and page 720, September 2nd issue of this journal. This receiver has one H.F., one detector and one L.F. valve. Switches are provided for the purpose of regulating the number of valves in circuit.

"E.C." (Sheffield) *asks* (1) *With reference to Fig. 4, page 550, January 20th issue of this journal, is the reaction effect increased when the anode coil is brought closer to the aerial coil.* (2) *Is energy likely to be transferred to the aerial circuit if proper care is not taken.* (3) *May the grid leak be connected across the grid condenser, or must it be connected between the grid and L.T.+.*

(1) The reaction effect is increased when the reaction coil is coupled tighter with the aerial coil provided the reaction coil is correctly connected. If the connections are reversed, the signals will be reduced in strength when the coupling is increased. (2) If care is not taken oscillating energy will be transferred to the aerial circuit. (3) The grid leak should be connected as shown in the diagram, *i.e.*, between the grid and + L.T.

"J.S.A." (Wavertree) *asks for the dimensions of suitable reaction coils for use between various wavelengths.*

The dimensions depend largly upon the wiring of your receiver. One coil will probably be sufficient and would be more convenient than a number of coils. A suitable coil would be 3″ in diameter and 4″ long. No. 30 D.C.C. with 8 tappings.

"F.W.G." (Finchley) *submits a diagram of his receiver and asks* (1) *Whether the connections are suitable.* (2) *Whether he may expect good results if the receiver is used in conjunction with a frame aerial.* (3) *Would the signals be loud enough to operate a loud speaker.* (4) *Could the D.C. mains be used to supply the anode circuits of the valves.*

(1) The diagram of connections submitted is quite correct, and is a standard circuit. Results, however, will not be satisfactory when a frame aerial is used, because all the valves are L.F. connected. When a frame aerial is used it is generally necessary to employ two H.F. connected valves. The method of connecting is given in all issues. (2) The reaction coil is shown coupled to the aerial coil, and unless care is taken, oscillating energy may be transferred to the aerial circuit. (3) It should not be expected that a receiver of this kind will successfully operate a loud speaker when connected with a frame aerial unless H.F. connected valves are used. (4) In connection with this question, we would point out that, as the supply of energy is direct current, you cannot use transformers as suggested for the purpose of stepping down the voltage. We suggest you use a high resistance across the mains, and tap off the voltage required. A large condenser should be connected across the mains, and an iron core choke put in circuit in the positive lead of the valves. We would refer you to the article entitled "Methods of Deriving Valve Currents from Public Supply Mains," by F. H. Haynes, in the issue of June 17th, 1922.

SHARE MARKET REPORT.

Prices as we go to press, Friday, March 2nd :—

Marconi Ordinary	£2 14 0
„ Preference	2 6 10½
„ Debenture	108 5 0
„ Inter. Marine ..	1 9 3
„ Canadian	11 6
Radio Corporation of America	
Ordinary	14 10½
Preference	13 1½

THE
WIRELESS WORLD
AND RADIO REVIEW
THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN

No. 187 [No. 24 Vol. XI.] MARCH 17TH, 1923. WEEKLY

"5 WS."

THE SUCCESSFUL TRANSATLANTIC TRANSMITTING STATION OF THE RADIO SOCIETY OF GREAT BRITAIN.

By PHILIP R. COURSEY, B.Sc. (Eng.), F.Inst.P., A.M.I.E.E.

THE subject of this evening's lecture bears mainly on the Transatlantic Tests, which, as you are probably aware, were held at the end of December last. These tests followed previous tests which had been arranged between the radio amateurs of America and Great Britain in previous years, although the recent tests were on a much larger scale than those which had been held before. They were organised more in advance, rendering possible the making of more complete arrangements, so as to include France, Switzerland, Belgium and Holland, as well as Great Britain. In previous years it had been America, Canada and Great Britain only.

The tests were marked, as compared with previous years, by a very great measure of success. Success had been obtained before, but on by no means such a big scale. Better results were anticipated on this occasion because the amateurs in this country had for some time been experimenting to a great extent with reception on 200 metres, 180 metres and short waves generally. Reports had also come in from time to time to the effect that signals from United States amateurs were being heard in this country, but up to the first day of the Tests I certainly had not, and I think no one else had, any idea of the magnitude of the results that would be obtained.

[A short summary was then given of the results obtained. The report of these results is now being published elsewhere in these columns.]

The main object of this meeting to-night is to deal with the second part of the Tests. The first ten nights were devoted to transmission from the other side, the second part were devoted to transmissions from Europe to America. The French transmitted and we transmitted for the six-hour period of each night from midnight to 6 a.m., this total period being divided up into two three-hour periods, which were taken in turn by France and Great Britain. On the first night we took the first three hours and the French took the second. The second night the French took the first and we took the second three-hour period, and so on alternately. In that way it was hoped to give the two countries as fair a chance as possible for the transmissions, as undoubtedly the transmission over the Atlantic varies at different times of the night, being best about 3 to 4 a.m., while also the transmission qualities vary from night to night so that by transmitting alternately in this way we hoped to give a reasonably fair distribution of the available time.

By the results achieved during the first part of the Tests we showed the Americans that we knew how to receive their signals, while in the second part of the Tests we tried to show them that we could transmit as well. Last year they sent a representative over to us to show us how to work on 200 metres (at least that is what they said). This year we have been trying to show them that we know.

The ordinary amateur licence, as you know, is for about 10 watts, and with that power it was not thought that we should stand much chance in transatlantic transmissions. However, the

Paper read before the Radio Society of Great Britain, 21st February, 1923.

Post Office were kind enough to grant a number of special permits to several of the more prominent experimenters in this country to use increased power for the purposes of the Tests, and I think we owe to the Post Office our thanks for the generous way they treated us in this respect. This Society was granted a special permit to use up to 1 kW for the purpose of these transmissions, and a few of us set to work to put up a special station for the purpose.

Fig. 1. The site of 5 WS, *showing the aerial suspended from the chimney.*

The question of a site was a difficult one. We naturally did not want to purchase ground or rent ground for the purpose of a test lasting less than a fortnight, and many tentative feelers were put out to find a suitable spot where someone would be good enough to lend us some space, and also if possible to lend us some power. After a number of attempts at finding a suitable location, we eventually obtained permission from the County of London Electric Supply Company to use their generating station at Wandsworth, and also to use the chimney of that generating station for supporting our aerial. We were also fortunate in finding close at hand a disused hut belonging to the Metropolitan Water Board, and were able to obtain permission from the Board to utilise this for the purpose of housing our apparatus. The hut was quite near the base of the chimney, so that we were able to erect an almost vertical aerial.

The Society had not the necessary equipment for the Tests, so that we approached several of the radio manufacturers to see if we could borrow suitable parts, and a number of manufacturers generously responded and loaned us apparatus for the purpose. The valves being the most important item, they had to be considered first of all. Four valves were required, two rectifiers and two oscillators, and these were lent to us by the M.O. Valve Company, Ltd.; filament rheostats and transformers loaned by the Zenith Manufacturing Company; and aerial wire and insulators by Messrs. Leslie McMichael, Ltd. The generator and transformers for obtaining our high voltage to feed the oscillator valves were loaned by Messrs. R.M. Radio, Ltd.; the driving motor for the set, some condensers and sundry other things were lent by the Dubilier Condenser Co., Ltd.; grid leaks were supplied by the Zenith Manufacturing Co., and Messrs. Gambrell Bros. Inductances were lent by Messrs. McMichael, Ltd., the Radio Communication Co., Ltd., and the Dubilier Condenser Co., Ltd. Accumulators and H.T. batteries were lent by Messrs. McMichael, Ltd., and a receiving set by Mr. Maurice Child.

These, I think, cover the main parts of the set and the main parts of the apparatus which we collected together. The time available for putting up the station was very limited, and it eventually came down to the last two or three days, when the set had to be thrown together and got into operation.

The second part of the tests, in which these transmissions took place was due to commence in the early hours of Friday morning, December 22nd, 1922. On the previous Saturday we started to put the apparatus together. The parts had all been collected in the experimental laboratory of the Dubilier Condenser Co., Ltd., and they let us use their premises and workshop facilities for putting the apparatus together, assembling the parts and generally fitting things up before taking them down to Wandsworth. We thought it best to assemble the parts as much as we could, to avoid the difficulty of doing it in a rather confined space, with few tools or other equipment available. We therefore, on the Saturday previous to the tests, started to put the parts together. The frame for the valves was fixed up and the transformers fixed. (See illustrations which follow), and eventually on the Tuesday afternoon (December 19th) the apparatus was moved down to Wandsworth. On the Tuesday evening we arranged the apparatus there and joined up the circuits. On the Wednesday evening there was a meeting of this Society and nothing further was done until late on Thursday night, when we got the set tuned up ready to start transmitting at 2.15 a.m. on the Friday morning, December 22nd.

We were a little bit worried at first because we thought we were not getting enough aerial current, but when we came to work things out we concluded that we were getting the energy into the aerial all right, and the fact that we were able to transmit across the Atlantic was evidence of the fact that we had the energy there.

Fig. 1 is a photograph taken on the location where we put the apparatus up. The chimney of the Power Company's station can be seen very prominently, the 200 ft. chimney stack of brick forming a very convenient support for the aerial. The station was situated in the Causeway, Wandsworth, being the Wandsworth station of the County of London Electric Supply Company. The upper part of the aerial was made up of a six-wire cage, the length of the cage being approximately 94 feet, the spreaders were of bamboo, and were about 6 ft. 6 ins. long each. The upper ends of the six wires were all brought together and attached to three porcelain insulators connected in series. These were attached to a rope which you can see in the photograph coming down from the top of he chimney. We employed a firm of steeplejacks to fix a pulley block to the top of the chimney before the aerial was constructed. At the junction point on the left of the picture we used three more insulators, and the same six aerial wires were carried right through to the down leads which were arranged on small hoops about 12 inches in diameter. The down leads came straight down to the hut in which the apparatus was located. The roof of the hut can just be seen in the lower left-hand corner of the photograph. The left-hand end of the aerial cage was pulled away by a rope running from the insulators to the end of the coal conveyor which can be seen crossing the photograph.

In many ways the site was not ideal, and there were only two, or perhaps three, features to recommend it; these were the high point of support for the aerial, the availability of supply current for the set, and the proximity of the river for a good earth connection. In other respects it possesses many disadvantages. The proximity of the power station was not good for reception, and the proximity of all this metal work was by no means good for transmission.

In the photograph the coal conveyor can be seen. It extends from the base of the stack and runs over the roadway to the river on the other side. There were also many other metal obstructions in the neighbourhood which we expected would screen the station, and probably did so to a considerable extent. These included some gasometers, which can be seen in the background of the picture.

This metalwork and a number of telephone and power wires which were strung about overhead in several directions probably screened the transmission quite a lot, but we were able to utilise some of them by making our earth connection to the coal conveyor. We found it an extraordinarily good earth. I do not know what the actual resistance to earth was but it was apparently quite low. For this connection we strung four wires from the conveyor, which was about 40 feet above the ground, and spread them out in a fan over the roadway so that they formed in that way to a certain extent something in the nature of a screen or counterpoise (although not an insulated one), as well as an earth connection.

We were able to get very much more current into the " coal conveyor " earth than when we used an ordinary earth connection. Six wires were also taken down to a water main which passed underneath the station, and a copper strip was also run out down to the river and connected to some brass plates buried in the mud of the river bed. Altogether then we had three earth connections, and we tried various combinations in order to get the best earth system. We found that each time we put one on we got more current, so that evidently each was doing some work, but the " coal conveyor " earth, I think, did the most.

Fig. 2. The generator unit with driving motor.

We used them all in parallel for the actual transmissions.

The lead-in to the station was made through an insulator fixed into one of the windows of the small hut. We used a Dubilier mica insulator for that purpose. It was one which had been tested up to about 15,000 volts on C.W., and it was mounted in the middle of a sheet of ebonite which we fitted into a wooden frame in the window. That gave us a good lead-in with very little losses.

Having arranged the aerial and the earth connections, the next consideration was the source of the power supply. The Power Company connected us on a pair of leads to their " station auxiliaries " switchboard at about 230 volts, 50 cycles alternating, and we used a 3 H.P. induction motor run off that supply to drive the generator used for feeding the set. The generator was primarily a rotary converter, one of Newton's make, designed for a ship's wireless set to carry a rotary spark gap at one end of its shaft, and arranged for 100 volts D.C. input and 100 volts A.C. output at 350 cycles. We fixed a pulley in place of the rotary spark and drove the machine by a belt from the 3 H.P. induction motor. The output of the generator was used to feed the step-up transformers. By driving the machine in this way we obtained also 100 volts D.C. from the dynamo and used it to excite the alternator field as well as for battery charging. We fitted up a change-over switch to enable us to throw the machine over quickly from the running to the charging position because between transmissions we needed to charge up our batteries very quickly, and therefore a quick throwover was very necessary. Fig. 2 shows the arrangement of the generator with the driving motor, and Fig. 3 the connections. When the D.P. throw-over switch is in the lower position we had the normal running conditions in which the D.C. dynamo field is connected directly across the D.C. armature making a shunt wound dynamo to give 100 volts D.C., and the field regulator is joined into the circuit of the alternator field. That gave us the normal running position and we obtained our 350 cycle supply from the slip rings of the machine, getting voltage control by means of the main field regulator.

For battery charging we put in a double pole throw-over knife switch straight off the D.C. machine armature and put the throw-over switch in the upper position which interrupted the alternator field and put both field regulators into the field circuit of the D.C. generator, enabling us to get a better control of the voltage which was necessary for charging the batteries. This was a very simple arrangement, but it served our purpose and gave us all the current we wanted. By means of the field regulator on the machine we could control the input to the valves, and so control the aerial current of the set. The 350 cycle current was used to feed two step-up transformers which were supplied with the set, being part of a ship's wireless installation. They were two transformers manufactured by Messrs. Hamilton Wilson for 350 cycles for 100 volts input and 6,600 volts output, the 6,600 volts being controllable of course by means of the field regulator of the generator. The two transformers were connected with their primaries joined in parallel and the secondaries in series, so as to use two-wave rectification.

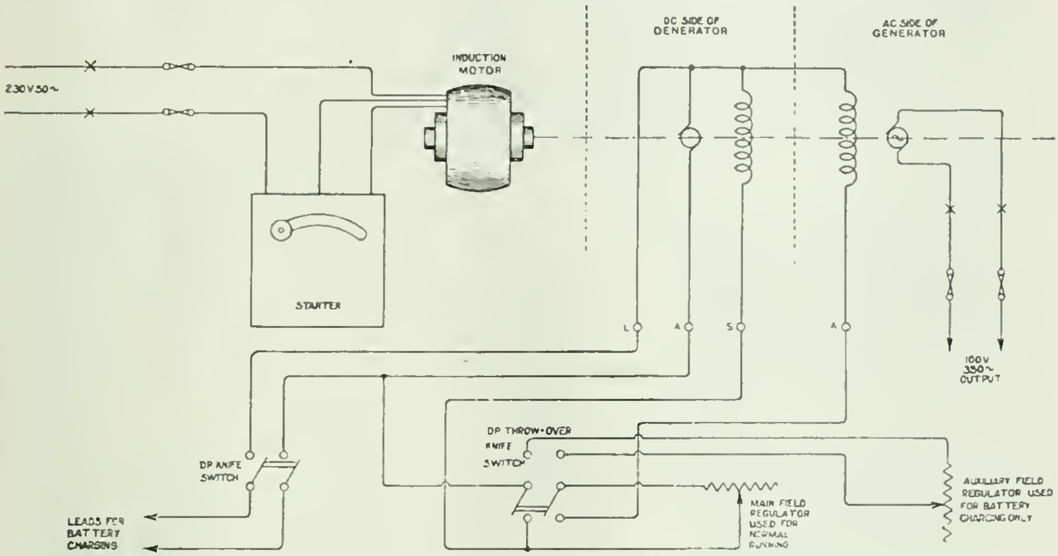


Fig. 3. Connections of generator unit.

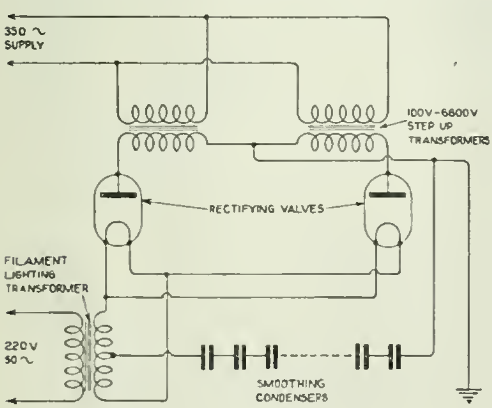


Fig. 4. The Rectifying circuit.

The rectification circuit was of quite an ordinary type, one valve being used for each half wave (Fig. 4). The filaments of the valves were joined in parallel and were eventually fed from a step-down transformer fed off the 220 volts 50 cycle supply. We had no available transformers to run off the 350 cycle supply, but we lighted the filaments from the 50 cycle supply and used a centre tap on the 20 volt filament winding so as to get rid of the effects of the 50 cycle supply on the output.

The smoothing condenser consisted of a number of 1 microfarad condensers connected in series, and joined the junction point of the H.T. transformer windings and mid-point of the filament transformer winding as shown. Ten 1 microfarad condensers were used in series, each condenser having been tested at 1,500 volts D.C. Since, however, surges always occur in smoothing circuits, we thought we were on the safe side to allow for a 100 per cent. factor of safety over the test voltages—safety being most desirable when carrying on experimental work. Hence the actual capacity of our smoothing condenser was 0·1 microfarad. That does not seem very much, but with the 350 cycle supply, the frequency being fairly high, the smoothing was quite reasonably effective. Actually there was some ripple left which was audible for some distance on a simple detector valve without any heterodyne circuit, but this ripple was not large enough to be serious.

(To be concluded)

The Olympia Exhibition

SOME NOTES ON THE WIRELESS SECTION.

At the time of writing, the *Daily Mail* Ideal Home Exhibition at Olympia is in full swing, and the special section devoted to Wireless exhibits, to which brief reference has already been made in previous issues, is attracting a large amount of interest.

In addition to the Wireless Section, with stands of all the principal manufacturers' apparatus, there is a hall devoted to the reception of broadcast transmissions from the London Broadcasting station, where accommodation is provided for an audience of about 1 000. This affords an opportunity for those unacquainted with broadcast reception, to appreciate its possibilities and attractions as an adjunct to the home.

The Wireless Exhibition is, of course, primarily arranged in the interest of those who are new to wireless, and are taking it up solely for the reception of the broadcast programmes, but the Exhibition is, nevertheless, a feature of attraction to everyone interested in wireless, whether amateur and experimenter of long standing, or one only new to the subject. Such an Exhibition affords a splendid opportunity for those who contemplate purchasing wireless apparatus, to make a selection from amongst a choice of all the best that is produced in this country, and there is no more effective guide to the choice of apparatus than that which is the result of comparison. It is, however, difficult to indicate where comparisons between the apparatus of various makers can be drawn, since all the sets and components exhibited are for the most part of a uniformly high standard both in design, and workmanship. Very valuable information, particularly to the experimenter, can be obtained from a visit to the Wireless Section, and a careful survey of the apparatus exhibited. A number of new ideas are introduced into sets on view, some of which will undoubtedly be new to the experimenter, whilst the enormous variety of designs for receivers will provide much food for thought.

We illustrate here some of the sets and apparatus on view, but this represents only a very small proportion of what there is to be seen. The Radio Society of Great Britain is represented at one of the stands, where comfortable chairs are available, and literature relating to the Society. Members are cordially invited to bring their friends here where they will have the opportunity of resting during their visit to the Exhibition, and those who are in a position to do so, may bring prospective members to complete forms of application for membership which are at hand for their use.

For those who desire to know something of the past activities of the Society, there has been reprinted from a past issue of this Journal a History of the Society, illustrated with photographs of those who have been actively engaged in its development.

Space does not permit of dealing in detail with the exhibits of the various firms, but points of special interest which may be noted are the extended use by certain firms of the low temperature valves, where, of course, the principal advantage lies in the fact that accumulators are not required, substantial size dry batteries sufficing for the filament current.

On many of the broadcast receivers it is noticeable that an adjustable reaction is introduced, though of course so arranged that it does not pass the point of oscillation. Unit sets, some of new design, are to be seen on one or two stands, whilst elaborate sets embodying new principles are being shown for the first time by one or two firms. On one stand there is exhibited a crystal and single-valve broadcast receiver where the valve functions both as high frequency and low frequency amplifier. There are to be seen a large number of component parts, some of which embody new ideas, though for the most part the Exhibition specialises in complete receivers for broadcast reception.

Various publishers of wireless literature are represented, and on the stand where this Journal is displayed, an invitation is extended to readers to avail themselves of the services of one of the editorial staff for advice and help relating to their apparatus.

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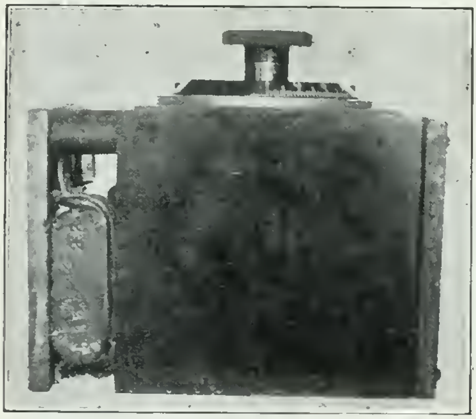
1. *The Marconi Scientific Instrument Co., Ltd.* 2. *Dubilier Condenser Co., Ltd.* 3. *Graham & Co., Manufacturers of the "Amplion."* 4. *The Marconiphone Co., Ltd.* 5. *Loud Speaker by the Automatic Telephone Manufacturing Co., Ltd., and Receiving Apparatus by Ashley Radio, Ltd.* 6. *Burndept Ltd.* 7. *General Radio Co., Ltd.* 8. *Metropolitan-Vickers Co., Ltd.*

The Construction of a Short Wave Wavemeter.

A USEFUL INSTRUMENT FOR ADJUSTING THE RECEIVING APPARATUS.

BETTER than adjusting the crystal detector by means of the signals it is desired to receive, is to employ a small buzzer actuated near to the receiving apparatus. Thus if a buzzer is connected to a dry battery, it is possible to vary the contacts of the detector until the buzzing noise is heard in the telephones, and when this is done, it is only necessary to wait for the transmission to commence, while varying the tuning adjustments, if the setting for the particular station from which reception is desired is not known. Such an arrangement is very useful for testing if everything is in order in a valve receiving set, should the location or design of receiver not permit of the tuning in of ship stations for proving that the apparatus is in working order.



The Buzzer Wavemeter.

The combination of a battery and buzzer with a tuning circuit, such as a coil of wire and variable condenser, is capable of serving a dual purpose, firstly of testing the sensitiveness of the crystal or valve and secondly of adjusting the tuning devices to the wavelength on which it is desired to receive. The instrument is called a "buzzer wavemeter" and its construction is quite simple.

It is necessary to procure a variable condenser of good construction and preferably contained in a wooden box and having a value of 0·0007 microfarads, a small buzzer, usually to be obtained in a nickel-plated case, and measuring about 1½in. × 1in., a dry battery of the type employed in pocket lamps, a few miscellaneous brass screws and pieces of wood, a card inductance of the type described on page 734 of the issue of March 3rd, and some wire for connecting up. The essential tools are a small saw and a screwdriver and other tools likely to be very helpful are a hand brace with small twist drills, a vice and a file.

It is not proposed to deal with the construction of the variable condenser in the present article, as the subject has already been exhaustively dealt with in this journal * and moreover the actual design of this component will depend so much on the dimensions and the number of the available parts. If the thickness of the spacing washers is ⅛ in. and the plates No. 22 S.W.G. in thickness, then about 20 fixed and 19 moving plates will be required. Get bushes if possible to support the spindle where it passes through the ebonite end plates, and what is most important in this instance, is to make sure that there is not the slightest play on the spindle. If the condenser is made up by the reader or is one purchased unmounted, it will require mounting in a wooden box as indicated in Fig. 1. Two holes are to be made in each of two opposite sides of the box to permit of two wires from the two sets of plates passing through.

The battery and buzzer may be secured to a piece of wood which is equal in size to one of the sides of the box. The buzzer is of course attached with screws, whilst the battery is held in position by means of strips of tin cut with a pair of scissors from a scrap tin box or perhaps better still, by means of strips of soft leather. A small wooden arm pivoting about a screw will serve as a switch by pressing the long spring connector of the battery up against a piece of bent brass, or more simply, a screw.

The short spring of the battery is joined to one terminal of the buzzer, whilst the brass

* "Wireless World and Radio Review," p. 581, August 5th, 1922.

stop or screw, and the other terminal of the buzzer are connected to the two leads coming from the condenser on the side to which the battery and buzzer are attached. The method of joining up is indicated in Fig. 2.

The inductance card is cut from a post- the box, or better still, short pieces of ebonite tube and No. 2 B.A. screws and nuts as shown in Fig. 1 may be used. The adjusting screw of the buzzer must be accessible and may necessitate the discarding of the cover.

As to operation, it will be found that the

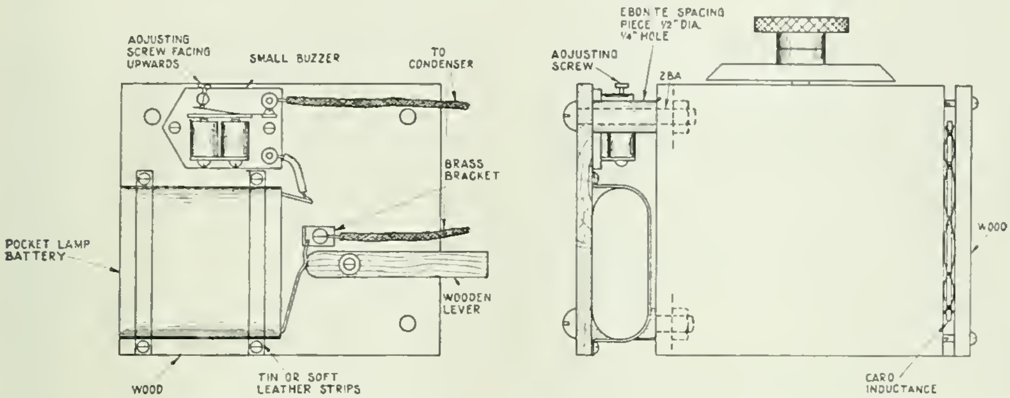


Fig. 1.

Method of assembling buzzer and battery.

Buzzer, battery and inductance attached to box of variable condenser.

card by pricking through, and is wound full with No. 28 double cotton covered wire. It is connected to the two free condenser leads and clamped to one of the sides of the condenser box.

Spacing pieces of wood will be required for attaching the battery and buzzer board to

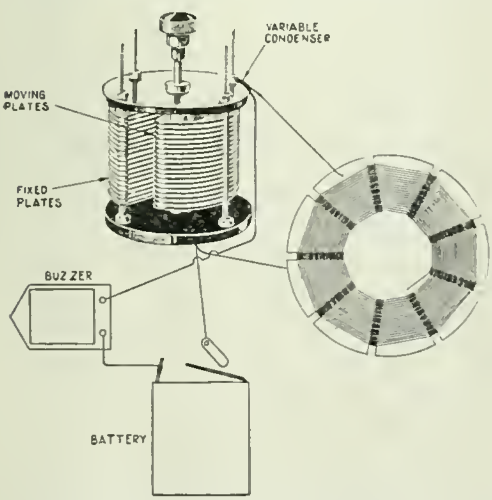


Fig. 2. *The Connections. The inductance is here shown exactly ½ full size.*

buzzer operates when the lever presses the spring against the screw. Switch the buzzer off and adjust the crystal on a strong signal or the nearest broadcasting station. Now, without making any change in the setting of the tuning handles of the receiver, set the buzzer in operation and turn the condenser until the buzz can be heard in the telephones at its loudest.

Mark the setting of the condenser and the position indicates the wavelength of the transmitting station on which the test was made. On future occasions when it is desired to tune in the station it is only necessary to set the condenser to the mark, adjust the crystal and vary the tuning, until the buzz is heard at its strongest. Similarly a number of marks can be made on a paper scale, attached to the dial of the condenser, for tuning to a number of stations. The instrument is equally useful with a valve set for the purpose of tuning as just described.

If the reader is a member of one of the many wireless societies existent throughout the country, he can very probably take his instrument along on an evening devoted to practical work and calibrate against a reliable wavemeter.

WIRE TABLES: Some Valuable Data for the Experimenter.

S.W.G.	Diameter Bare.		Diameter S.S.C.		Diameter D.C.C.		Ohms per 1,000 yards.			Comparison between diameters of—		
No.	Inches.	Mm.	Inches.	Mm.	Inches.	Mm.	Copper Wire	Manganin	Eureka.	S.W.G.	B.W.G.	B. & S.G.
14	·080	*2·032*	·086	*2·20*	·091	*2·30*	4·784	120	133·9	·080	*·083*	·0641
16	·064	*1·626*	·070	*1·80*	·075	*1·90*	7·478	186	209·4	·064	*·065*	·0508
18	·048	*1·219*	·053	*1·346*	·056	*1·42*	13·28	332	371·8	·048	*·049*	·0403
20	**·036**	***·9144***	**·040**	***1·017***	**·044**	***1·118***	**23·62**	**591**	**661·3**	**·036**	***·035***	**·0320**
22	·028	*·7112*	·032	*·812*	·036	*·915*	39·05	976	1,093	·028	*·028*	·0253
24	·022	*·5588*	·026	*·660*	·030	*·762*	63·24	1,581	1,770	·022	*·022*	·0201
26	·018	*·4572*	·022	*·559*	·026	*·660*	94·48	2,362	2,645	·018	*·018*	·0159
28	·0148	*·3759*	·019	*·483*	·023	*·585*	139·8	3,495	3,914	·0148	*·014*	·0126
30	**·0124**	***·3149***	**·017**	***·432***	**·021**	***·533***	**199·1**	**4,977**	**5,575**	**·0124**	***·012***	**·010**
32	·0108	*·2743*	·015	*·381*	·019	*·432*	262·5	6,562	7,350	·0108	*·009*	·0079
34	·0092	*·2337*	·013	*·330*			361·7	9,042	10,128	·0092	*·007*	·0063
36	·0076	*·1930*	·011	*·280*			530·0	13,250	14,840	·0076	*·004*	·005
38	·006	*·1524*	·0095	*·241*			850·3	21,257	23,808	·0060	—	·004
40	**·0048**	***·1219***	**·008**	***·203***			**1328·0**	**33,200**	**37,184**	**·0048**	—	**·0031**
42	·004	*·1016*	·007	*·177*			1913·0	48,825	53,564			
44	·0032	*·0813*					2988·0	74,700	83,664			
46	·0024	*·0610*					5313·0	132,825				
48	·0016	*·0406*						303,000				
50	**·0010**	***·0254***										

In the table particulars are given of the diameter of bare wire, and wire with single silk and double cotton covering. From the latter data, the number of turns per inch or centimetre which may be wound is readily determined. To take an example, No. 22 D.C.C. is 0·040 inches in diameter and it should be expected that $\frac{1}{0{\cdot}044} = 22$ turns of this wire will be wound in one inch. Of course a slight deduction in the number of turns should be made in the case of those who are not expert at winding coils. If the winding is to be with No. 22 S.S.C., $\frac{1}{0{\cdot}04} = 25$ turns should be wound in one inch. Wire as ordinarily purchased slightly varies in diameter measured over the insulation, but apart from this slight irregularity, with the aid of the tables it is possible for those who are not familiar with wire gauges, or who have no measuring instrument such as a micrometer to determine the gauge of wire they may have. The wire should be wound upon a small diameter rod, and the number of turns in a one-inch length counted. The covering of the wire is easily determined by inspection. If the wire has been tightly wound, and there are say 45 turns, and the wire has a single silk covering, the diameter of the covered wire is $\frac{1}{45} = {\cdot}022$ in. From the tables it is evident the wire is No. 26 S.S.C.

The resistance per 1,000 yards of copper and resistance wires given in the 8th, 9th and 10th columns are useful in that one is able to closely estimate the length of wire in a coil, and hence its resistance. As an example suppose a potentiometer is required. A potentiometer has a resistance generally of the order of 450 ohms, and No. 36 manganin or Eureka resistance wire will be used. In the case of the Eureka wire, from the tables No. 36 has a resistance of 14,840 ohms per 1,000 yards or 14·8 ohms per yard. The length required for the potentiometer is then $\frac{450}{14{\cdot}8}$ or 30·4 yards. If the rod upon which the wire is to be wound has a diameter of one inch, its circumference is 3·14 inches. The total number of turns is the total length of wire in inches divided by the circumference. Hence 30·4 yards = 1,094 inches, and the number of turns $\frac{1094}{3{\cdot}14}$ or 348 turns. The wire will wind 90 turns to the inch, and the length of the potentiometer will be nearly 4 inches.

The last columns give a comparison between the diameter of American and British wire gauges.

The Antennæ.

THE TRANSMITTING STATIONS RADIATING SYSTEM.

(*Continued from page* 652, *February* 17*th issue.*)

TURNING now to practical details, it is proposed to indicate how the constants of the antennæ may be arrived at. The simplest methods only will be described, as it is not worth while to take great pains with elaborate methods when the instruments available to most experimenters are only accurate to within several per cent.

THE MEASUREMENT OF ANTENNA RESISTANCE.

The method to be described makes use of the experimenter's transmitter. The arrangement is given in Fig. 1. Here we have the aerial circuit, which includes a calibrated hot-wire ammeter or thermo-couple, the aerial tuning be about 20 ohms. The coil L should be connected to take the place of the aerial coil normally used when transmitting. The small coil L_1 is for the purpose of providing coupling with the aerial coil, and should be only just large enough to provide a small aerial current—50 or 60 milliamperes will be a suitable value. The condenser C is used to tune the closed circuit and should be of the oil dielectric type to safely withstand the voltage. It may be necessary to include a little resistance in this circuit. To take measurements the transmitter is switched on, and the wavelength of the closed circuit adjusted to the wavelength upon which it is desired to take the measurements. The

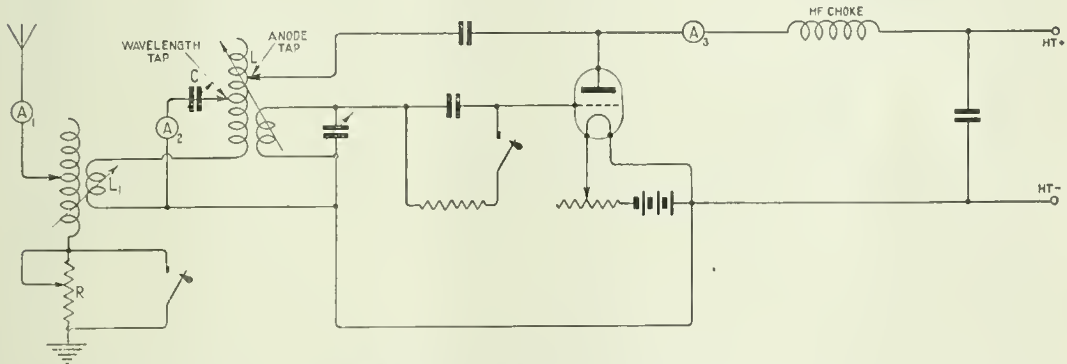


Fig. 1. The diagram gives the connections of a transmitter loosely coupled to the aerial circuit. The grid circuit comprises a coil tuned with a condenser, and is connected through a grid condenser to the grid. When the key is pressed the grid leak circuit is closed and the valve is capable of generating oscillations. The H.F. choke is to prevent the oscillating energy passing through the condenser connected across the H.T. supply.

inductance of the transmitter proper and a key or switch arranged to short circuit the variable resistance R when required. The resistance R may be a number of short lengths of Eureka resistance wire connected in series. The wire should be fairly fine, in order that its high-frequency resistance shall not greatly exceed ts direct cu rrent resistance. No. 34 "Eureka" wire is suggested, which has a resistance of 10·13 ohms per yard, and will carry 100 milliamperes without reaching a temperature of 100° F. The total resistance available should coupling between L_1 and the aerial tuning coil is loosened until ammeter A_1 shows a small reading, and the coupling is then fixed; it is not changed while resistance measurements are being taken. The current A_2 and A_3 should remain fairly constant throughout the tests. The reading A_1 is taken and recorded. The key shunting the resistance is opened, and the resistance varied until the ammeter A_1 records about half its previous value. Calling the latter reading A_R and the value of the resistance R ohms, the antennæ resistance is given by

$$R_{antenna} = \frac{A_R \times R}{A_1 - A_R}.$$

As an example suppose

$$A_R = 20MA,\ A_1 = 40MA.$$

$R = 150$ ohms, then

$$R_{antenna} = \frac{20 \times 15}{20} = 150 \text{ ohms.}$$

It will be noticed the resistance of the antenna is equal to that of the added resistance in the above case because the current with the resistance in circuit was exactly half that with the resistance short-circuited. If, therefore, the resistance R is made continuously variable, and we use a hot-wire milliammeter, it is not necessary that the ammeter be calibrated. The reading with the resistance in circuit should be made equal to half the reading when the resistance is out of circuit. The antenna resistance is then equal to the value of R. A number of readings should be taken at different wavelengths and a curve plotted, showing the resistance at the wavelengths at which the antenna is likely to be used.

The Measurement of Antenna Resistance and Capacity.

Another method which may find favour with some experimenters uses the arrangement of Fig. 2. Here we have an ordinary transmitter, which is coupled to the aerial in the usual manner. The only alteration required in order to take measurements is the inclusion of a switch S, condenser C and resistance R. The condenser and resistance may be identical with those used in the previous tests. The ammeter A_1 is of the hot-wire type and does not need to be accurate. The milliammeter A_3 is a direct current instrument and a moving coil instrument is suggested. With switch S to the right, the transmitter is tuned up in the usual way to the wavelength desired. The milliammeter A_3 will give a steady deflection which should be noted. Reading A_1 should be taken. The switch S is now thrown to the left and adjustments of C and R made until the currents indicated by A_1 and A_3 are exactly as before. The resistance R is then equal to the antenna resistance, and the capacity of C is the capacity of the antenna at the wavelength of measurement. The essential point to remember is that the transmitter once adjusted should be left alone, and only the switch and dummy circuit adjusted. A number of readings should be taken as before and a resistance wavelength curve plotted. It will be noticed the resistance of the condenser should really be known and added to that of R to give the correct result, but generally this additional resistance may be neglected if the resistance is well designed. Its resistance should not exceed an ohm or thereabouts.

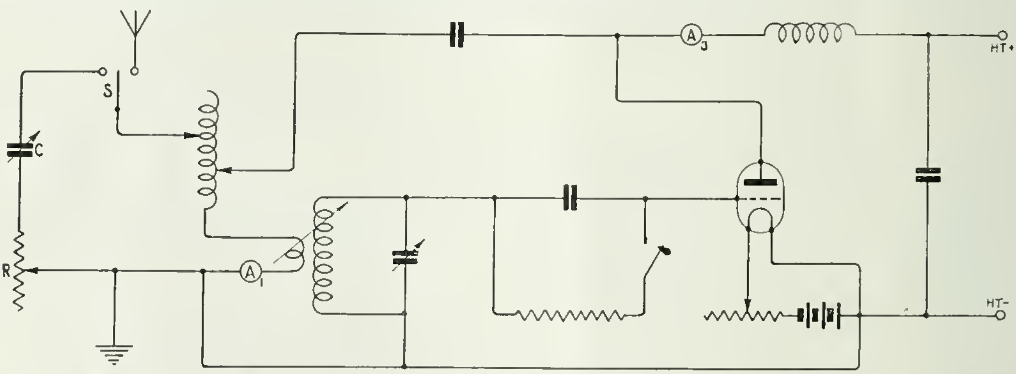


Fig. 2. Here the aerial circuit is directly coupled with the valve generator. The transmitter is the same in principle as that given in Fig. 1.

Measurement of Natural Wavelength.

The transmitter is loosely coupled with the aerial circuit which has a single turn of wire included in it as well as the ammeter. The arrangement given in Fig. 1, modified to Fig. 3, may be used. The transmitter is adjusted to the frequency of the aerial circuit as indicated by the maximum aerial current. The coupling between the single turn and L_1 is made as loose as possible, consistent with reliable readings. The aerial circuit is then removed and the wavelength of the oscillations generated measured with a wavemeter.

The antenna inductance may be calculated from the values of capacity and wavelength obtained by using the well-known wavelength formula.

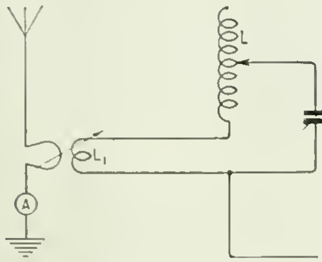


Fig. 3. The coil L and variable condenser C form part of the oscillating circuit LC of Fig. 1. The remainder of the circuit not shown is the same as Fig. 1, but here the aerial circuit includes a hot-wire ammeter and a single turn.

MEASUREMENTS WITH A WAVEMETER.

A coil of one turn of the antenna wire is coupled with a few turns of the circuit *A*, Fig. 4, which in turn is coupled with the aperiodic detector circuit comprising a larger coil, crystal detector and telephones. The wavemeter, which is set to generate oscillations, is coupled to a single turn of the antenna

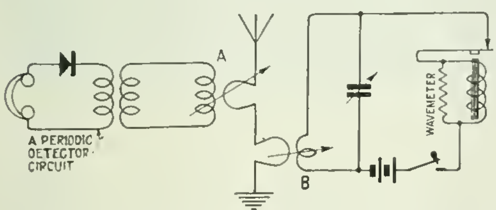


Fig. 4. The figure shows the arrangement of apparatus when a wavemeter and a detector and telephone circuit are employed to determine the natural wavelength of an antenna. The method may also be used to determine the natural wavelength and the capacity of the antennæ, whether used for transmitting or receiving purposes.

wire, as indicated at *B*. When the wavemeter is generating oscillations a sound will be heard in the telephones. The wavelength of the oscillations generated are varied until a maximum sound is heard. The reading of the wavemeter at this setting gives the natural wavelength of the antenna. If now an inductance coil of known value is inserted in the antenna circuit and the measurement taken again, we can calculate the approximate capacity of the aerial. If the wavelength with the coil is, say, 600 metres, and the inductance of the coil is 300 microhenries, the capacity, calculated from the formula

$$\lambda \text{ metres} = 1885 \sqrt{LC} = \cdot 00034 \text{ mfds.}$$

A number of measurements of amateur antennæ show the resistance at 400 metres to average 20 to 30 ohms. The average capacity is ·0003 mfds.

From these figures it is evident great improvement is possible, and it is intended in the following sections to describe antenna suitable for small power transmitters.

TYPES OF ANTENNA.

The antenna used by experimenters fall under one of the following headings as a rule, inverted *L*, *T*, vertical, or fan. Each is

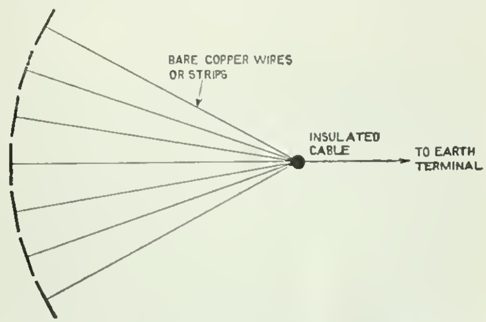


Fig. 5. A suggested earthing arrangement very suitable for those who have a licence permitting the use of up to 1 kW. of power input to the transmitter.

suitable and the correct choice depends largely upon the conditions which confront the experimenter.

If there is plenty of open space available, no doubt the T type of antennæ will give best results. The vertical and fan types should only be chosen when the area available is small.

A suitable height would be between 60 and 70 feet. The flat top should preferably be in the form of cages, and it is suggested a double cage antenna, with the two cages, spaced 14 feet apart, will be most suited to the needs of experimenters. The cages may be constructed of 6 or 8 wires, secured to wooden hoops 4 feet in diameter. Three hoops in each section would be suitable. The down leads should be in the form of a rat-tail, and be run so that it is several feet away from buildings except where it is secured to the lead-in insulator. Lead-in insulators of the type illustrated are recommended; the same figure shows suitable aerial insulators. Suitable conductors were mentioned in the first portion of the article.

The figure gives an outline of a cage, inverted L type aerial. Those who expect to generate up to about 100 *watts in the aerial circuit would find a single cage satisfactory.*

The lower capacity, which may be an earth connection, counterpoise, or a combination of each, is worthy of serious consideration, as it is here that one should look for the cause of most high-resistance antennæ. A water-

The photograph illustrates a number of aerial and lead-in insulators. Those insulators which have a long leakage surface are generally the best.

pipe is often used as the earth. The connection between the earth terminal of the receiver and the earth should be large and well soldered.

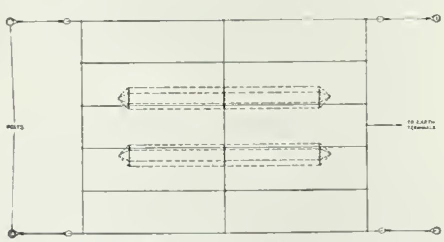


Fig. 6. The counterpoise consists of a copper wire network insulated from the earth and raised several feet above it. The dotted outline of the top flat portion of the aerial will give an idea of the relative dimensions.

In cases where the use of a water-main carries with it the use of a long earth lead, it is advisable to construct an earth. An earthing scheme is shown in Fig. 5. Copper wires are laid out

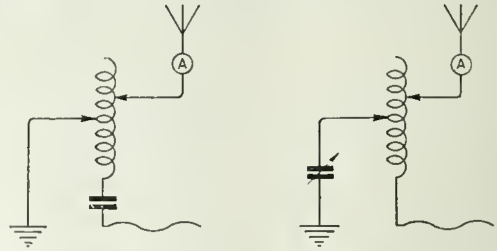


Fig. 7. An earth connection may be combined with the counterpoise in the manner indicated in the figure. The correct connection to be employed depends essentially upon the transmitter connections, and the experimenter will have no difficulty in adapting the arrangement to meet his own needs.

symmetrically with the aerial wires and are soldered to zinc, or even galvanised iron plates, at the distant end of the aerial. A total of 6 or 7 wires buried about 3 feet should, if possible, be used. In this way the resistance is reducible to something of the order of 10 ohms.

When space is available, the use of a counterpoise is to be strongly recommended. With a good counterpoise, the antenna total resistance may be reduced to the order of 4 or 5 ohms. A counterpoise is constructed by suspending 6 or 7 feet above the earth a network of wires with an area 100 per cent. greater than that of the antenna top. To prevent losses through the counterpoise, the wooden supports which are generally used should be fixed several feet away from the nearest wires, as shown in Fig. 6, and the wires well insulated.

Multiple Earths.

It will often be found the antenna resistance is increased when several different earth connections are connected together at the transmitter. This appears to be due to lack of balance, resulting in the antenna currents being unequally divided. The fault should be guarded against.

Combined Earth and Counterpoise.

It is possible by tuning to combine the earth and counterpoise connections and so take full advantage of each. The arrangement is shown in Fig. 7, the difference between the two connections shown being to suit the connections of the transmitter. The circuit is tuned to the required wavelength, using the counterpoise connection alone. Then the earth is connected, and its point of connection is varied until connecting or disconnecting the earth with the tuning inductance does not change the wavelength. The capacity of the counterpoise and the inductance between the counterpoise and earth connection are then in tune. The arrangement is very effective in reducing antenna resistance.

Radio for the Deaf

By P. J. Risdon.

This short article is of special interest in view of the recent attention drawn to the possibility of deaf persons listening to broadcasting.

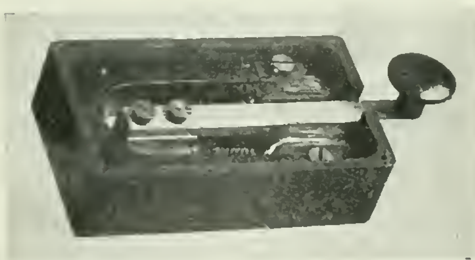
A YEAR or two ago an instrument was invented that is now arousing world-wide interest. The inventor is Mr. S. G. Brown, of London, and the invention is known as the Ossiphone—derived from the Latin word "os" or "ossis," a bone, and the Greek word "phone," meaning sound. It is no less, as its name implies, than an instrument *that enables one to hear through one's bones.*

The writer has tested the ossiphone in a variety of ways, both in connection with the ordinary telephone, and with another instrument known as an aural box.

The ossiphone is quite small and can be carried in the waistcoat pocket. It comprises a little ebonite case containing an electro magnet of the horseshoe pattern, between the poles of which an iron bar is fitted that can be made to vibrate. It contains no accumulator or dry cells, the electro magnets being energised by current from the telephone batteries when used as a telephone receiver, or from dry cells in the aural box when employed for carrying on a *viva voce* conversation.

The aural box and ossiphone together take the place of the old-fashioned ear-trumpet and other appliances commonly used by deaf persons. In the former there is an opening, developing into a curved horn shape, and diminishing in size to where it joins up with a microphone. Connections between the ossiphone and aural box or telephone are made by means of small plugs and sockets to which ordinary flex may be attached. Dry cells in the aural box provide electric current for the microphone.

In order to carry on a conversation over the telephone, a small socket is wired up in parallel with the ordinary receiver and, for the sake of convenience, is secured to the outside of the telephone box. There is a similar socket on the ossiphone, a length of flex with a twin plug at each end connecting the two. The vibrator bar projects outside the ossiphone case, and a small ebonite button is screwed to the end of the bar. The case is held in one hand and the button is then pressed gently but firmly against the skull or finger knuckle, and by this means the vibrations of a person's voice at the other end of the line



Copyright.] [P. J. Risdon.

A device for listening by vibrations transmitted through the bones.

are conveyed through the body to the aural nerves and so to the brain, where the sensation of sound is produced independently of the outer ear. This may be proved by stopping the ears effectually, or by putting the ordinary telephone receiver temporarily out of commission. In this way it is possible actually to hear more clearly than with the ordinary receiver, although incidentally the ossiphone constitutes an excellent duplicate receiver. It is not quite certain whether the vibrations follow the bony structure all the way, or whether the nerves compressed between the ossiphone knob and the bone, take up and transmit them. In the former case it would certainly appear that, where the bones are separated by cartilage, the vibrations must be transmitted by nerves from bone to bone. In either case, however, it is only by means of the bones that the vibrations can be communicated.

When it is desired to converse in the usual manner, one end of the flex is secured to the ossiphone, and the other to the aural box, which is placed in any convenient position near one of the speakers, who merely has to face it and to speak in an ordinary tone of voice within about eighteen inches of the opening. The other person may be seated comfortably in an armchair anywhere in the room, holding and applying the ossiphone as already described. An alternative to the ordinary vibrator is a vibrating stem, very much like the curved mouthpiece of a pipe, that may be held between the teeth; that gives equally good results, but is a less convenient method, since the ordinary vibrator can be changed from one hand to the other.

In order to appreciate the action of the ossiphone, it is necessary to bear in mind the fact that sound is an effect on the brain produced by power waves or vibrations. When a person speaks to another, the vibrations of his voice cause the ear drum of the other person to vibrate, and so to communicate the vibrations through the mechanism of the ear to the brain. If the middle or outer ear be damaged or stopped up by an excess of wax or a growth, or if the ear drum be damaged, the vibrations cannot reach the aural nerves leading to the brain and the person is unable to experience the sensation that we call sound. Ordinary appliances for the deaf are for magnifying sound waves. This, in certain cases, whilst of temporary service, may in the long run aggravate the original trouble and increase the degree of deafness. With the delicate vibrations of the ossiphone, such a result could not occur.

The value of these instruments to deaf persons depends to a great extent upon the nature and cause of their deafness. When deafness is due to what one may call mechanical affections of the outer and middle ear, in many cases the ossiphone has proved successful where all other appliances have failed. If, however, there be disease of the aural nerves leading to the brain, there is little hope of any instrument proving successful, since the aural nerves are an essential means of communication with the brain. It should therefore be quite clearly understood that it is not claimed for the ossiphone that it constitutes a certain remedy in every case of deafness.

From the foregoing description of this interesting invention, it is clear that, in all cases where it assists the deaf to hear, it will equally well enable them to enjoy broadcast wireless concerts and speech. For there is no difficulty in coupling up the ossiphone to an ordinary wireless receiving set, or in its use, in conjunction with an aural box and a "loud speaker," for the reception of music and the delights of wireless generally by many deaf persons to whom, hitherto, sound has been an almost meaningless expression

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The Radio Society of Gt. Britain.

The next meeting of the Society will be held at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C. 2, on Wednesday, March 28th, at 6 p.m., when Messrs. A. D. Cowper, B.Sc., and G. P. Mair will demonstrate super-regenerative receivers entered for the competition recently arranged by the Society.

At the meeting of the Society on Wednesday, February 28th, the following were elected as to full membership:—

JOHN ARMSTRONG LAKIN, JOHN HERBERT LAVENDER, GEORGE HERBERT LESLIE, B.Sc., ARTHUR C. BUSHNELL, SIDNEY A. L. GAUBERT, ALEXANDER V. SIMPSON, JAMES J. NEASMITH, MAJOR CHARLES H. MALDEN, WILFRED K. HARRIS, KENNETH H. MULHOLLAND, GEORGE D. ADAMSON, HARDMAN A. EARLE, VICTOR H. T. INMAN, A. FREDERICK COLLINS, A. HOWARD READ, HERBERT R. SMITH, ALFRED G. S. BARNARD, LIEUT. TORAHIKO INADA, K. HARTRIDGE, JAMES P. MORTER, CHARLES R. HONIBALL, M.I.E.E., ARTHUR F. BULGIN, LORD CLIVE, R. VERNON HIBBERT, LAWSON A. DARBY, WALTER J. G. POWILL, GEORGE LEE, R.I.M.S., RAYMOND BERYL, PAUL L. BENSON, STANLEY E. BLAND, FRANCIS S. DE BARRO, A. E. TREHEARN.

The following were elected as Associate Members: STANLEY M. HILLS, ARTHUR REMINGTON HOLLINS, EDMUND GILBERT DROWER, HENRY FIELD.

The Societies affiliated since the previous meeting were the following:—

The Evesham and District Radio Club, Merthyr Tydfil Radio and Scientific Society, The Worthing Radio Club, The Pudsey and District Wireless Society, Kingston and District Radio Society, Bath Radio Club, Trafalgar Wireless Society, Redditch and District Radio Society, Humber Radio Club, South Woodford Radio Society, Midland Railway (Derby) Institute Radio Society, Berkhamsted Wireless Society, Swansea and District Radio Experimental Society, Morecambe and District Radio Club, Denton and District Radio Society.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

North Middlesex Wireless Club.*

Hon. Secretary, Mr. E. M. Savage, "Nithsdale," Eversley Park Road, Winchmore Hill, N.21.

The 108th meeting of the North Middlesex Wireless Club was held on Wednesday, February 7th, at Shaftesbury Hall, Bowes Park, Mr. Symons being in the chair. Mr. Dixon gave his lecture on "Various Instruments used in Wireless Work."

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

On Friday, February 2nd, a lecture was given by Mr. H. Andrewes, B.Sc., on "Secondary Cells."

The Hon. Secretary will be pleased to give full particulars of the Society to any lady or gentleman in the district who is at all interested in wireless, either from an experimental or broadcasting point of view.

Smethwick Wireless Society*

Hon. Secretary, Mr. R. H. Parker, F.C.S., Radio House, Wilson Rd., Smethwick, Staffs. At a large gathering of members on Jan. 26, the Secretary, who was the delegate at the last Conference of affiliated societies, gave a report of the proceedings.

At a meeting held on February 2nd, Mr. Leslie Carter, M.Inst.Mech., F.C.S., F.Inst.P. (a committee member), gave a most interesting lecture on "Non-ferrous Metals and Wireless, with Special Reference to Wireless Aerials." Judging by the discussion which followed, the lecture was greatly appreciated.

A meeting was held in the Society's headquarters, the Technical Institute, on Friday, February 9th. Mr. L. Carter in the chair. After the usual business the chairman called upon Mr. Lee to give his report on the visit to the Birmingham Broadcasting Station, **5 ZT**, kindly arranged by the Secretary.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

At the twenty-first meeting of the Belvedere and District Radio Society, held on Friday, February 19th, at the Erith Technical Institute, the evening was devoted to a discussion on "The Proposed Transmitting Apparatus." The whole of the apparatus is being made by the equipment engineer.

The Cowes District Radio and Research Society.*

Hon Secretary, Mr. J. W. L. Ingram, 1, Mill Hill Road, Cowes, I.W.

The formal opening of the Society's new Headquarters, at the Gloster Restaurant, took place on Wednesday, January 31st. The meeting, being open to the public, resulted in a crowded attendance. Sir Godfrey Baring, the newly-elected President, made his first appearance at a club meeting.

A demonstration of broadcast reception followed, to the great enjoyment of the company. A five-valve set, constructed by Mr. Mugliston, was used for this purpose, and **2 LO** was successfully received.

Ipswich and District Radio Society.*

Hon. Secretary, Mr. H. E. Barbrook, 46, Foundation Street, Ispwich.

At a recent meeting of the Ipswich and District Wireless Society it was unanimously resolved to change the title of the Society to the above.

A general meeting of the Society was held on Monday, February 19th, at 55, Fonnereau Road. It was opened by Mr. Akester, Chairman of the sub-committee, who had been elected to enquire into the Society's rules.

Owing to the steady growth of the Society, the rules which had sufficed for the preceding year were found to be totally inadequate, and several amendments were made.

A meeting of the Society was held on February 12th, a lecture being delivered by the President, S. A. Notcutt, Esq., B.A., B.Sc., LL.D., whose subject was "Electricity and Magnetism and its Allied Phenomena."

The West London Wireless and Experimental Association.*

Hon. Secretary, Mr. Horace W. Cotton, 19, Bushey Road, Harlington, Middlesex. Club Rooms: Acton and Chiswick Polytechnic, Bath Road, Chiswick.

At a meeting held on February 13th, Mr. F. E. Studt gave a paper on "Elementary Principles of Wireless" (Part 1), which was very acceptable to recently enrolled members.

A concert is to be arranged shortly so that members may have a musical evening with their friends. Particulars will be announced later. The Secretary will have much pleasure in replying to all applications for particulars of membership, and objects of the Association.

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

A lecture was given on February 9th by Mr. F. L. Hogg on "How to get the Best Out of Your Set."

The Society has had the misfortune to lose its Vice-Chairman, Mr. L. Grinstead, who has removed from the district, and at a general meeting held on February 16th, Mr. P. H. Youngman was elected in his place.

An attractive programme for the next three months has been drawn up, and includes a special series of elementary lectures on theory of wireless reception and the construction of apparatus suitable for the reception of broadcasting. This series will start on Friday, March 16th, at the 1919 Club, Highgate, at 7.45. Meetings are held at the same time and place every Friday.

Particulars of the Society and a full programme of lectures may be obtained from the Hon. Secretary.

Exeter and District Wireless Society.*

Hon. Secretary, Mr. F. S. Valentine, 10, College Avenue, Exeter.

A lecture was given before the above Society on February 8th, by Mr. Smitham, on "The Uses of Reaction," with special reference to the requirements of the Postmaster-General.

Meetings are held on Mondays at 7.15 p.m., and intending members are cordially invited to communicate with the Secretary.

The Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 557, Lordship Lane, S.E.22. Assistant Hon. Secretary, Mr. G. H. Horwood, 557, Lordship Lane, S.E.22.

At the meeting of the Wireless and Experimental Association, held at the Central Hall, Peckham, on January 31st, Mr. Voigt described some experiments which he had carried out.

The meeting held at the Central Hall, Peckham, on February 14th, was so crowded that several members had to stand round the room.

More ample accommodation has at last been secured at the Camberwell Library, and the Association will "move in" as soon as possible.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. A. Leslie Lancaster, c/o Messrs. Lancaster Bros. & Co., Shadwell Street, Birmingham.

On February 9th, at the Digbeth Institute, a very interesting meeting was held, discussions taking place on many wireless topics and difficulties.

Sheffield and District Wireless Society.*

Hon. Secretary, Mr. L. H. Crowther, A.M.I.E.E., 18, Linden Avenue, Woodseats, Sheffield.

At the weekly meeting of the Society held on February 16th, a paper was read by Mr. A. F. Carter, of Leeds, dealing with some of the comparisons between power engineering practices and wireless work.

The Wireless Society of Hull and District.*

Hon. Secretary, 79, Balfour Street, Hull.

There was a satisfactory attendance of members at the meeting on February 12th, when Mr. J. Brazendale delivered a lecture entitled "The Construction of a Single Valve Set and Note Magnifier."

All wireless enthusiasts in Hull and District are strongly recommended to join the Society. Full particulars of membership can be obtained from the Hon. Secretary.

Hackney and District Radio Society.*

Hon. Secretary, Mr. Charles Phillips, 247, Evering Road, Upper Clapton, E.5. (Letters only.)

The Society held its usual weekly meeting on Thursday, February 15th, at its premises at the Y.M.C.A., Mare Street, Hackney, the Chairman, Mr. H. A. Epton, presiding.

After the formal business had been dealt with, when several new members were elected, three "waistcoat pocket" talks were given by Messrs. Kierman, Francis and Bell, on their experiences with radio.

The Clapham Park Wireless Society.

Hon. Secretary, Mr. J. C. Elvy, A.M.I.E.E., 12, Tavistock Street, Strand.

The seventeenth general meeting of the Society was held on January 3rd.

Mr. A. E. Radburn, the Chairman, introduced Mr. Hope-Jones and Mr. Leslie McMichael, Chairman and Hon. Secretary respectively of the Radio Society of Great Britain, who had been persuaded by Mr. Elvy to attend with a view to clearing up any questions at issue with regard to affiliation.

To allow of fullest possible attendance, Mr. McMichael graciously consented to Mr. Hope-Jones' suggestion to occupy the intervening minutes by giving an account of their activities in the Atlantic transmissions.

The Chairman of the Clapham Society then called upon the two visitors to give an exposition of the working and organisation of the Radio Society of Great Britain, and facilities that would accrue by affiliation. Both Mr. Hope-Jones and Mr. L. McMichael were subjected to a keen fire of questions, which they welcomed, all questions being answered to the full satisfaction of those present.

The visitors having taken their leave, the question of affiliation was proceeded with. The result was a unanimous decision in favour of affiliation by the members present.

The eighteenth general meeting took place on January 10th at headquarters, Mr. A. L. Beedles occupying the chair, when Mr. Gallard led a discussion for amateurs only, with the aid of blackboard diagrams, on fundamental points of wireless,

The next meeting was held on January 24th, Mr. A. E. Radburn being the Chairman.

Mr. Hurst opened discussion on affiliation preparatory to voting, and the subject was again discussed.

The Society's aerial then came under review, Mr. Daniels promising a second demonstration in the near future by his friend, Mr. Ayres, of **2 QD** transmitting station, when the aerial was perfected.

At the twentieth general meeting, held on January 31st, under the chairmanship of Mr. J. G. Hurst, Mr. Richardson reported on the question of aerial improvement.

Fulham and Chelsea Amateur Radio and Social Society.

Hon. Secretary, Mr. W. Roberts, 5, Normand Gardens, S.W.6.

Mr. Roberts having applied for assistance in his secretarial duties, Mr. R. G. Smith has been elected assistant secretary.

On January 23rd, the Chairman (Mr. Witts) called upon Mr. Hayden to give a short report on the progress of the construction of the Society's aerial.

On January 20th a lecture and demonstration was delivered by the Assistant Secretary on the Armstrong Super-Regenerative receiver, single valve, with one low frequency amplifying stage.

On February 6th a demonstration of a three-valve set, one detector, two low frequency amplifiers, was given by Mr. Caola.

The Society's aerial is now ready for use, and the apparatus is in the course of construction. A programme of lectures and demonstrations is in preparation, and members wishing to participate in these should communicate with the Hon. Secretary.

Beckenham and District Radio Society.

Hon. Secretary, Mr. J. F. Butterfield, 10, The Close, Elmers End.

On February 1st the Society held its first meeting at their new headquarters, the United Services Hut, High Street, Beckenham. A demonstration was given as a suitable start off on a four-valve low-frequency amplifying set.

Mount Pleasant Radio Society.

Hon. Secretary, Mr. W. R. Fleming, 156, Upton Park Road, Forest Gate, E.7.

The above Society held a meeting at the Lecture Hall, 21a, John Street, Theobalds Road, London, W.C.1., on Saturday, February 3rd, when Mr. W. D. Keiller gave a very interesting lecture on "Induction." He commenced with the phenomena of the lines of force around a conductor, leading up to the inductive effect of the loose coupler.

The meeting terminated with a few items from **2 LO** on the Society's apparatus.

The Rhondda Wireless Enthusiasts' Society.

Hon. Secretary, Mr. R. Evans, 69, William Street, Ystrad-Rhondda, Glam.

A highly successful and well-attended whist drive and dance, promoted by the Rhondda Wireless Enthusiasts' Society, was held at St. David's Hall, Ton Pentre, on Monday evening, February 5th. This Society, which has been in existence since June, 1922, is the pioneer wireless society of the Rhondda, and has continued to hold priority both as regards the apparatus possessed, and the enthusiasm of its members. The Society meets on Wednesday evenings at headquarters, the Brodringallt Girls' School, Ystrad-Rhondda. Intending members should write for particulars to the Secretary.

Hoylake, West Kirby and District Wireless Association.

Hon. Secretary, Mr. J. D. Wood, 7, Grosvenor Road, Hoylake, Cheshire.

There was a large gathering of members of the local wireless association and their lady friends at the Green Lodge Hotel on Monday evening, February 5th, when a special ladies' night was held.

An excellent musical entertainment, consisting of humorous monologues and pianoforte and violoncello selections was provided by Mr. J. E. Corlett and his talented young daughters, every item of which was heartily applauded.

Through the courtesy of Mr. G. V. Wall, of West Kirby, who had kindly brought his large six-valve wireless receiving set with loud speaker, all present were enabled to listen-in to selections at intervals from the programme being broadcasted by wireless from **2 ZY**, the Manchester station of the British Broadcasting Company.

The Pudsey and District Radio Society.

Hon. Secretary, Mr. W. G. A. Daniels, 21, The Wharrels, Lowtown, Pudsey.

A meeting was held on Monday, February 5th, at the club room.

After the usual business had been transacted, the Chairman, Mr. F. Wild, tendered an invitation to any gentleman to give a "ten-minute" talk on some interesting subject, such as the description of their sets at home. Several gentlemen responded, and a very enjoyable evening ensued.

The question of an aerial for the use of the Society was then brought forward, and a discussion followed. At length it was decided that an aerial of the single wire type was, from the experience of those present, most suitable for the Society's requirements.

Ladies or gentlemen wishing to become members should communicate with the Secretary. The meetings are held on the first and third Mondays in the month, at 8 p.m.

Felixstowe and District Radio Society.

Hon. Secretary, Mr. E. Cork, 3, Highfield Road.

The Society is still progressing, and the receipt of the experimental licence has added interest to the busy weekly meetings.

On Friday, March 2nd, 7.30 to 10 p.m., at the Society's headquarters, a public exhibition and demonstration of wireless apparatus was given.

The North London Wireless Association.

Hon. Secretary, Mr. V. J. Hinkley, Northern Polytechnic Institute, Holloway Road, N.7.

At a meeting of the Association, held on Monday, February 5th, a lecture on "The Neon Lamp and its Use in the Production of Oscillations," was given by Mr. E. H. Robinson.

The lecturer gave a description of the construction of the lamp and its ordinary uses. He then went on to show how it could be included in a circuit to enable currents of an oscillatory nature to be produced.

On this occasion seven new members were elected.

The Ilford and District Radio Society.

Hon. Secretary, Mr. A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

On February 8th Mr. C. G. Rope lectured on "Accumulators." In view of the trouble that is often experienced with accumulators, Mr. Rope's remarks with reference to "frothing," sulphating, etc., were greatly appreciated.

Isle of Man Radio Society.

Joint Hon. Secretaries: Mr. J. S. Craine, 6, Belmont Terrace, and Mr. J. P. Johnson, 16, Hildesley Road, Douglas.

A well-attended meeting was held on February 19th, at the Secondary School, Douglas, Mr. H. Colebourne presiding. After the opening business, the chairman called upon Mr. P. J. Johnson to address the meeting on "The Valve as a Detector." Mr. Johnson illustrated his very capable address by a large number of clear diagrams.

Wireless in the Territorial Army

The following notice has been sent to The Wireless World and Radio Review *through the Divisional Chief Signal Officer, Eastern and London Commands, T.A., Lt.-Col. J. Waley Cohen, in order that it may receive publication and so be brought to the notice of our readers.*

UNDER a recent decision of the military authorities, wireless has assumed a position of great importance in the signal organisation of the Territorial Army. This development should be of considerable interest to members of the Amateur Wireless Societies. Most of these gentlemen have Post Office licences themselves or are working with friends who have them, but the great majority of these licences only allow for reception and the interception of broadcasting. Younger members of the Amateur Societies who join the Royal Corps of Signals (Territorial Army) will find there opportunities for a great deal of wireless work which should be of use to them in maintaining their own sets; and in other directions they will gain technical experience which is beyond the reach of the ordinary amateur.

Regular courses of lectures by experts, both officers and non-commissioned officers, are included in the training programmes of all Territorial Signal Units; these lectures should be of great use to the amateur.

In addition many pamphlets with information and reference to new developments circulate to T.A. Signal Units as and when they are published.

Signal Units of the Territorial Army are equipped with modern valve wireless sets of various types, and have special wavelengths reserved for them for sending and receiving. At annual training in camp, and at Headquarters throughout the year, the wireless operator gains practical experience in sending, and in tuning transmitting sets, as well as in reception and operating procedure. The practical experience of learning wireless procedure should be of considerable advantage to the amateur in helping him to unravel and distinguish the various signals which he intercepts apart from the broadcast telephony. In addition, the amateur will get opportunity to learn and practice the Morse alphabet.

The camp training, including as it does transmission and reception and the rapid erection and dismantling of stations connected with operations, should give the wireless operator great scope and interest. He learns, in addition, to charge and maintain accumulators.

A glance at the Army List will show that there are 14 Divisions and a Cavalry Division in the Territorial Army, each with its Signal Unit. When it is realised that each Division has an establishment of 25 wireless sets and 80 operators, it will be seen that there is considerable scope in the Territorial Army for the wireless amateur who is ready to help his country and is not averse at the same time to benefiting himself.

Most units still have vacancies for wireless operators, and now is a very good time for recruits to join, as the training season is just starting, and there is comfortable time to get through the preliminary training and recruit drills before annual training.

The liability for a man joining the Territorial Army is:—

4 years' service.
40 Drills in the first year.
20 Drills in each subsequent year.
Annual training in camp of 15 days.

Detailed information about the annual bounty, rates of pay during camp, scale of free uniform and equipment, etc., can be obtained at any of the Divisional Signal Headquarters given below. Any amateurs interested in the question, who care to call at any of these Headquarters, can see the types of wireless sending and receiving sets in use. It is advisable to make an appointment beforehand, by writing to the Adjutant of the Division Signals concerned.

Headquarters of Divisional Signals, Territorial Army.

London District.

2nd Cavalry Division, Duke of York's Headquarters, Chelsea, S.W.3.
56th (The London) Division, 51, Calthorpe Street, Grays Inn Road, E.C.1.
47th (The London) Division, Fulham House, Putney Bridge, S.W.16.

Eastern Command.

44th (Home Counties) Division, Drill Hall, Stamford Brook Lodge, Ravenscourt Park, W.6.
54th (East Anglian) Division, Bay Lodge, The Green, Stratford, E.15.

Western Command.

53rd (The Welsh) Division, Drill Hall, Park Street, Cardiff.
55th (West Lancashire) Division, Drill Hall, Aspinal Street, Prescot.
42nd (East Lancashire) Division, Drill Hall, Burlington Street, Manchester.

Northern Command.

50th (The Northumbrian) Division, Drill Hall, Elmgrove Terrace, Gateshead.
49th (The West Riding) Division, Gibraltar Barracks, Leeds.
46th (The North Midland) Division, Drill Hall, Phœnix Street, Derby.

Southern Command.

48th (The South Midland) Division, The Barracks, Great Brook Street, Birmingham.
43rd (The Wessex Division), The Priory, The Friars, Exeter.

Scottish Command.

51st (The Highland) Division, Fonthill Barracks, Aberdeen.
52nd (The Lowland) Division, 21, Jardine Street, Glasgow.

I cannot help feeling that a close liaison between the Amateur Wireless Societies and the Divisional Signal Unit of the District would result in much mutual benefit.

Notes

2 LO Reduces its Power.

The London Broadcasting Station states that at the request of the Air Ministry a slight reduction in power has been made for the special transmissions during the afternoon in connection with the *Daily Mail* Ideal Home Exhibition.

Important Empire Wireless Decision.

Mr. Bonar Law made a timely announcement in the House of Commons on March 6th regarding the Government's plans in connection with the projected Empire wireless chain. In replying to Mr. Hurd (Frome, U.), the Prime Minister intimated that it was not considered necessary any longer to exclude private enterprise from participation in wireless telegraphy within the Empire. Licences are therefore to be issued for the erection of wireless stations in this country for communication with the Dominions, Colonies and foreign countries. In the interests of national security, however, a similar station will be erected which will be owned and operated by the State.

The new decision of the Government will lead to considerable extensions in the activities of the Marconi Company. In a statement to a representative of the *Times*, Mr. Godfrey Isaacs said that, provided it was not held up by delay in the actual granting of the licences, the Company was ready to go ahead within 24 hours with the erection in this country of five high-power stations at a cost of approximately £2,000,000, to conduct telegraph services with all the other capitals of Europe, similar to that being carried on to-day between London and Paris.

The total sum which the Marconi Company, together with its associated companies, will now spend in erecting stations at home and abroad, will probably approach £6,000,000. The bulk of the material must come from the home country, and the company contemplates being able to give a considerable amount of employment, both directly and indirectly.

Broadcasting and Experimental Work.

The effect of broadcasting on experimental work was discussed at the usual monthly meeting of the Kensington Radio Society on Thursday, March 9th, when the members were invited by the President to express any views that they had on the subject, together with suggestions for the improvement of their conditions.

Certain proposals of a practical character were put forward, and a resolution passed that they should be submitted to the Radio Society of Great Britain, with a request that they should be considered by that Society with a view to incorporating them, together with any others that may be received from affiliated societies throughout the country, to both the General Post Office and the British Broadcasting Company.

New Army Call Letters.

The call letters **GGB** and **GGC**, we are informed, have been allotted to the army stations at Aldershot and Cologne respectively.

Radio and the Deaf.

Much interest and speculation have been aroused by the "miracles" wrought on deaf persons who have attempted to listen-in. To enable sufferers to test the results for themselves, the British Thomson-Houston Company last week placed special facilities at their disposal, and all deaf persons were invited to listen in at Crown House, Aldwych. By means of a crystal receiver and eight pairs of head phones a number of guests each day are able to hear the wireless concerts broadcast from **2 LO** between 3 and 4 p.m. It is understood that the results were gratifying in nearly every case.

London Broadcasting Heard in Massachusetts.

The British Broadcasting Company have received a letter from a correspondent in Massachusetts who claims to have picked up London **(2 LO)** on February 20th, and listened to the last musical item and the closing down.

New Zealand hears New York.

A cable has been received at Troy, New York, announcing that a concert broadcast from that place had been received in New Zealand, 9,577 miles distant.

A New Filament Resistance.

Messrs. Fuller's United Electric Co., Ltd., Chadwell Heath, in a communication addressed to *The Wireless World and Radio Review*, announce that they are patentees of a filament resistance wound on the tapering principle described in the issue of *The Wireless World and Radio Review* for February 3rd, p. 602, and that this instrument will shortly be marketed.

The Democratic Pastime.

Wireless parts are offered for sale on a number of new stalls which have taken their place among the fruit, meat, and second-hand books in Farringdon Road, London, E.C.

Ealing's Wireless Troubles.

Mystification still reigns in Ealing, it would appear, as to the origin of recent interference to broadcast reception by a local transmitter. An appropriate advertisement in the *Chiswick Times* at once evoked a strong protest from an Ealing resident who owns a transmitting set. His remarks, in which he quotes Mr. G. G. Blake's comments in *The Wireless World and Radio Review*, of February 24th, on the importance of selective tuning arrangements, were reprinted in the *Star*. "There are," he says, "only two persons in Ealing, I believe, with transmission licences, of whom I am one. I never work before 10.30 p.m., and not then if broadcasting is still going on, and I know the same remark applies to the other gentleman." Hence the mystification.

Broadcasting Regulations.

A White Paper was issued on March 7th, containing the text of the licence issued by the Postmaster General to the British Broadcasting Company for the establishing of eight radiotelephonic stations and the transmission therefrom of broadcast matter. The Paper also sets forth the terms of the agreement regarding the broadcasting of news and the agreement made with the Company by the makers of wireless apparatus. The licence to the Broadcasting Company covers the period from November 1st last to January 1st, 1925.

Broadcast Reception on Aeroplanes.

Tests were made by Mr. N. D. Bryce and Mr. G. C. Shore in conjunction with Captain Greer and Captain Game of the Instone Air Line, who kindly lent the machine, on the reception of broadcasting on aeroplanes. Using the Burndept "Ethophone V," which makes use of reaction in a manner approved by the Post Office, good reception was obtained from **2LO** at a height of 1,200 feet over Croydon.

Book Received

Rapport Annuel sur les Travaux Effectués par le Bureau Internationale de l'Heure (B.I.H.) en 1922 (3e année). Par M. G. Bigourdain, Directeur. (Paris: Gauthier-Villars et Cie, Quai des Grands Augustins, 55. Price 1 franc).

La Radiophone, Vol 1, No. 1. (Brussels: 9, Rue Maximilien. Price 50 centimes).

Correspondence.

To the Editor of The Wireless World and Radio Review.

Sir,—Further to my letter of yesterday's date re the reception of **WGY** on my single valve home-made set.

I again received **WGY** between the hours of 1.50 and 3.10 a.m. this morning.

This station transmitted the Gilbert and Sullivan Opera "The Pirates of Penzance" complete.

After this transmission, which ended at 3.10 a.m., the announcer asked for criticism on the transmission and directed critics to address their communications to **WGY**, The General Electric Broadcasting Station, Connecticut, U.S.A.

Before closing down the announcer said that the outstanding feature of this week's programme, to come, will be the broadcasting of a drama by the **WGY** players.

The whole of the Opera was received perfectly word for word. During the last half hour of the transmission it was possible to hear same with 'phones four inches away from the head. My set is open to examination or demonstration to any of your representatives at any time, and I can guarantee to receive **WGY** *any night* in the week.

J. H. Brittain.

SHORT WAVE TRANSMISSION.

To the Editor of The Wireless World and Radio Review.

Sir,—It may interest some of your readers to have the result of a trial I made the other day of a wavelength of 100 metres. The signals were strongly and clearly heard by a friend of mine at Geneva. The input power was 50 watts, the aerial current 1 ampere. The gear was very hurriedly rigged up, the aerial being a single wire 15 ft. long, with a rather doubtful lead-in tube: there was a bad snowstorm going on at the time of transmission. I think that if insulation had been better, and the transmitter more carefully adjusted considerably more than 1 ampere could have been put into aerial on 50 watts.

The distance to Geneva from here is about 750 miles, and the receiver used was a two-valve one.

H. H. T. Burbury.

Crigglestone,
Near Wakefield.
February 26th, 1923.

Calendar of Current Events

Saturday, March 17th.

Manchester All-British Wireless Exhibition. At Burlington Hall, Burlington Street. Opening Day (March 17th to 24th).

Sunday, March 18th.

From 3 to 5 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, March 19th.

At 9.20 to 10.20 p.m. Dutch concert from **PCGG**, The Hague, on 1,050 metres.

Ipswich and District Wireless Society.
At 8 p.m. At 55, Fonnereau Road. Meeting.

Tuesday, March 20th.

Plymouth Wireless and Scientific Society.
At 7.30 p.m. Lecture: "The Electron Theory." By Mr. Lock.

Wednesday, March 21st.

Manchester Wireless Society.
At 7.30 p.m. In the Council Chamber, Houldsworth Hall. Lecture: "The Story of Communications." By Dr. Hodgson, F.R.C.S., L.R.C.P.

Edinburgh and District Radio Society.
At 8 p.m. At R.S.S.A. Hall. Lecture: "X-Rays." By Mr. A. M. Martin.

Halifax Wireless Club and Radio Scientific Society.
Lecture by Mr. P. Denison.

Thursday, March 22nd.

At 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Luton Wireless Society.
At 8 p.m. At Hitchin Road Boys' School. Exhibit and Demonstration. By Mr. H. S. Barber.

Ilford and District Radio Society.
Lecture: "Light-wave messages from the Stars." By Mr. Adams, F.R.A.S.

Friday, March 23rd.

Sheffield and District Wireless Society.
At 7.30 p.m. At Dept. of Applied Science, St. George's Square. Elementary Class conducted by Mr. J. C. Jackson, B.Sc.

Leeds and District Amateur Wireless Society.
Lecture: "Construction of Intervalve Impedance Coils." By Mr. S. Kniveton, F.R.Met.Soc.

Radio Society of Highgtae.
Lecture: "Construction of Tuners." By Mr. J. F. Stanley.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	**2LO**	369 metres.
Birmingham	**5IT**	420 ,,
Manchester	**2ZY**	385 ,,
Newcastle	**5NO**	400 ,,
Cardiff	**5WA**	395 ,,
Glasgow	**5SC**	415 ,,

The Transatlantic Tests.

SUMMARISED REPORT OF BRITISH RECEPTIONS.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

(*Continued from page 774 of previous issue.*)

The number of stations heard (with code words during the individual transmissions) from each district may be compared with the total number of entrants from that district by the figures in Table III. The number of entrants was determined by the ability of those stations to signal over at least 1,200 miles during the preliminary tests which were held in October and November last. It will be particularly noted that 29 per cent., or nearly one-third of the total number were received, the falling off in the number from the more distant stations accounting for the drop as compared with those near the Atlantic coast. The 66·6 per cent. from the first district is particularly noteworthy.

TABLE III.

Comparison of number of stations heard (verified individual transmissions), with total number of entrants.

No. of District.	No. of Stations heard (individual transmissions only).	No. of entrants.	Percentage of entrants heard.
			per cent.
1	20	30	66·6
2	24	42	57·1
3	15	26	57·7
4	5	15	33 3
5	2	37	5 4
6	1	22	4 5
7	0	4	0·0
8	21	70	30·0
9	5	70	7.1
Canada	1	8	12.5
Total ..	94	324	29

Some of the stations heard signalled to the effect that they would try radiotelephone transmission. In most of these tests it was reported that their carrier wave could be heard quite strongly, but that the percentage modulation was too small to enable the voice to be heard when the local heterodyne was switched off. In a few instances, however, reports were sent in to the effect that the 'phone transmissions were heard. The stations thus reported were :—**2 EL 2 XAP 2 ZK**

The positions of these stations, and as many as possible of those set out in Table II, are marked on the map given in Fig. 2, which is plotted to a larger scale than Fig. 1, and on a more usual projection.

In connection with these stations heard making the individual transmissions with code words, it should be noted that several discrepancies have been observed. In fact, many listeners complained of the very careless sending of some stations. For instance, **1 AGK** often sent his call as **1 AKG**, and was, in fact, accidentally reported in this manner on one occasion. **2 UD** sometimes sent his call as **D2U**, the spacing being bad, while **8 AQO**, who produced extremely powerful signals here, practically always sent his code word as **PQPPG** instead of **FQPPG**. The regularity with which these and similar errors were reported show that they did not arise from careless reception. Apparently **1 BET** only sent his proper call sign once or twice during the whole duration of the tests, since he was always reported as sending "Test Test de UWXXI UWXXI, etc.," UWXXI being his code word. Many stations also continued repeating their code words over and over again for prolonged periods before giving their call signs, and omitting all spaces between the successive repetitions of the code word. Thus listeners on this side had no idea where the code word began and ended, and several were reported with the letters in the wrong sequence from this reason.

This style of transmission caused unnecessary delays in receiving the stations, since everyone was naturally loth to tune on to another station before completing the reception of call and code word from the one, and, in the opinion of many amateurs here, more stations would have been logged if only *every* transmitter had kept rigidly to the transmission scheme :—

"Test Test Test de (call letters, 3 times) (code words, 3 times), (break sign)," repeated as often as necessary.

On the best nights of the tests the aether was so full of signals that it was not possible to log more than a small proportion of the total for the above reasons.

In addition to the above-mentioned difficulty most listeners in this country were hampered to a greater or lesser extent, depending upon their locality, by harmonics from various high-power stations. Of these, of course, the most complained of from all parts were Leafield and Northolt, with their multitudes of harmonics and "hash" bands in the short wave regions. Stonehaven was also troublesome to some, as were also the very bad spark harmonics from **FFU** (Ouessant, France) and from the short wave spark transmissions. On one occasion "SOS" calls from Niton and **FFU** on spark jammed out American signals for some time. Many listeners in the neighbourhood of London, in particular, found it quite impossible to receive anything on wavelengths near 200 metres until after Northolt had finished its press transmissions, usually about 3 a.m. Thus, to them, half the test period each night was completely spoilt.

During the "free-for-all" periods each night—*i.e.*, between midnight and 0230 G.M.T.—the successive 15-minute periods were allocated in turn to the various districts and to Canada. During these periods some of the stations made use of the code words which had been allocated to them for the individual transmissions, and these, when reported, made an additional check on the receptions. Many stations, however, were heard

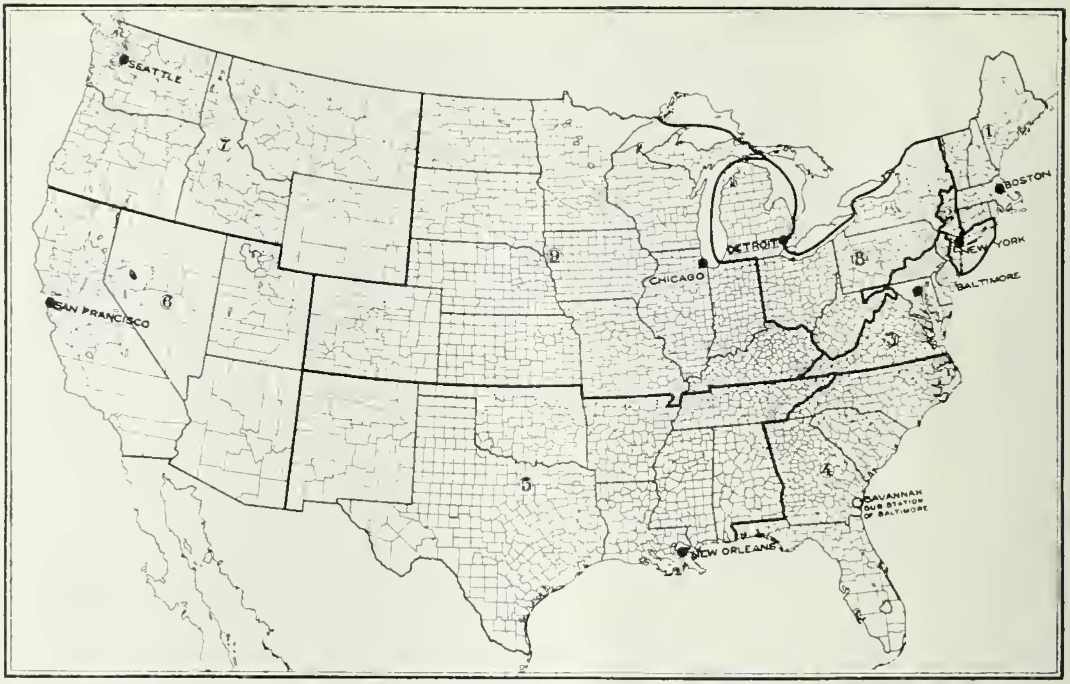
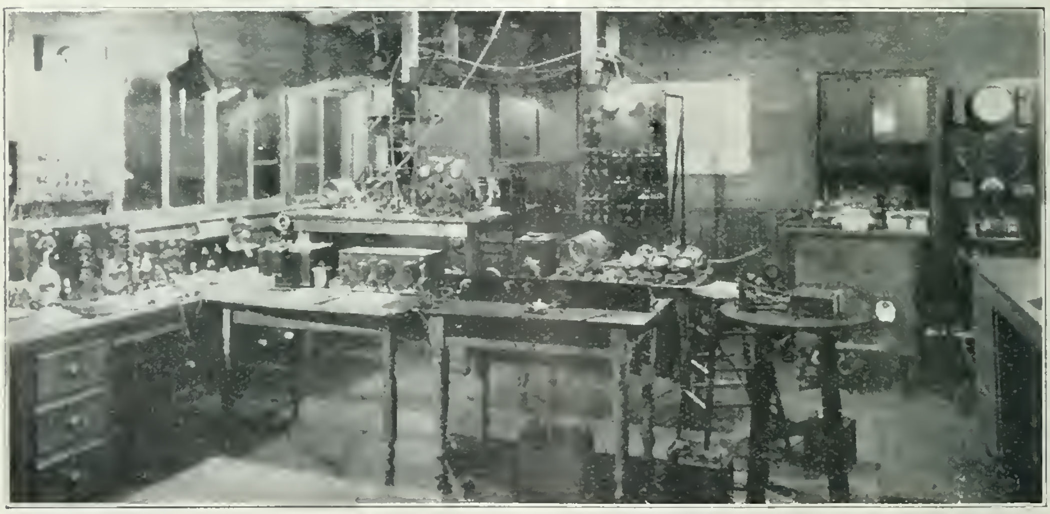


Fig. 2. A map of the United States of America showing the division into Radio Inspection Districts. The numbers prefixing the call signs of American Amateur Transmitting Stations relate to the district in which they are located.



Photo; Courtesy The American Radio Relay League.

The apparatus in the centre background is that of **8 AQO**, *on the left is* **8 BSS**, *and on the right by the window,* **8XH**. *The equipment is operated by Mr. C. B. Meredith.*

TABLE IV.

Stations heard making "Test" transmissions at schedule times during the "free-for-all" periods.

In this Table the column headed "No." gives the Total No. of times that the station was reported during total Free-for-all periods during Tests, this being the sum of the number of reports from *different* observing stations on each night.

First District.

Call Letters.	No.	Call Letters.	No.
1 ADL	3	1 BW	1
1 AGK	1	1 BX	1
1 AJP	3	1 CBR	1
1 AK	1	1 CDK	1
1 AN	1	1 CKG	2
1 ARQ	1	1 CKP	4
1 ARY	1	1 CMK	9
1 ASF	1	1 CNF	2
1 AZW	2	1 CUF	1
1 BAS	1	1 GV	1
1 BCF	2	1 GX	1
1 BCG	2	1 II	9
1 BDI	6	1 KW	1
1 BDT	17	1 MV	1
1 BEP	2	1 OR	3
1 BES	5	1 TOK	1
1 BET	8	1 XK	1
1 BFQ	1	1 XM	6
1 BKA	1	1 XNT	1
1 BN	1	1 XU	1
1 BNT	1	1 YK	1
1 BRQ	5	1 ZE	2

Second District.

Call Letters.	No.	Call Letters.	No.
2 AFP	1	2 CQZ	4
2 AWF	3	2 CRB	1
2 AWL	3	2 EL	5
2 AYV	2	2 FP	15
2 BBB	1	2 GJ	1
2 BMC	1	2 GK	5
2 BML	5	2 HJ	1
2 BLP	3	2 HW	1
2 BQN	1	2 IG	1
2 BQT	1	2 KW	2
2 BQU	2	2 LO	3
2 BRB	1	2 LY	1
2 BYS	1	2 NN	1
2 CBX	3	2 NX	6
2 CHH	2	2 PR	1
2 CJN	2	2 UD	2
2 CJW	1	2 XAD	1
2 CKM	1	2 XAO	4
2 CKR	9	2 XAP	3
2 CMZ	1	2 YK	1
2 CP	1	2 ZK	3
2 CPD	3	2 ZS	2

Third District.

Call Letters.	No.	Call Letters.	No.
3 AFB	2	3 DM	1
3 AQR	2	3 HG	10
3 AUU	1	3 HQ	1
3 BF	1	3 JJ	1
3 BFU	2	3 MX	1
3 BG	1	3 OE	1
3 BGJ	1	3 SG	1
3 BGT	5	3 XM	2
3 BLF	3	3 YO	1
3 BNU	3	3 ZW	7
3 BVC	2	3 ZY	1
3 CC	2	3 ZZ	1
3 CG	1		

Fourth District.

4 EA	4	4 OI	1
4 EB	1	4 ZS	1
4 FN	1	4 ZW	1

Fifth District.

5 NK	1	5 XR	1
5 XK	1		

Eighth District.

8 AQO	16	8 BUM	7
8 ATF	1	8 BXF	1
8 AW	1	8 CJH	2
8 AWP	1	8 DKX	1
8 AXC	3	8 UE	1
8 BBT	1	8 XAE	1
8 BK	1		

Ninth District.

9 CM	1

Canadian.

3 CO	1

who did not take part in the individual transmissions and therefore had no code words. These simply sent signals in the form, "Test Test Test de (call letters 3 times)," and the only check on these receptions was that they were heard at the correct times that belonged to the particular district in which the station was situated.

In Table IV is set out a list of those stations which were heard making the above type of transmissions at the proper schedule times. Other calls—DX work, etc.—reported during these and the individual periods are not included in this table.

Many of the stations listed in the above Table (IV) were also heard making other transmissions and calling up various U.S. stations. These extra transmissions are not included in this Table.

A very good indication of the variation in the transmission quality from one night to another may be gathered by tabulating the number of observers who heard the various stations reported during the "individual" transmissions on each night of the test. This information is set out in Table V, the first column of which gives the call letters of the stations, alphabetically arranged in

TABLE V.

Summarised results of receptions of "Individual" Transmissions with Code Words.

Note.—In a few cases parts of the code words were jammed or incorrectly sent, or the calls were omitted, as described in the text, but these results have been included here when sufficient evidence was furnished in the report to reasonably verify the reception ; D indicates reception in Holland.

Call Letters	Number of Times Reported by Different Observing Stations.										
	Dec. 12th	Dec. 13th	Dec. 14th	Dec. 15th	Dec. 16th	Dec. 17th	Dec. 18th	Dec. 19th	Dec. 20th	Dec. 21st	Total.
First District :—											
1 AGK ..	0	0	0	0	0	0	2	3	0	0	5
1 AHZ ..	0	0	0	0	0	0	0	0	1	0	1
1 AJP ..	0	2	2+D	0	0	0	0	4	1	0	10
1 ASF ..	0	0	0	0	0	0	4+D	7	2	1	15
1 AZW ..	0	0	0	0	0	1	6	0	0	0	7
1 BCF ..	0	0	0	0	0	0	6	0	4	0	10
1 BCG ..	1	2	0	2	0	0	0	0	0	0	5
1 BDI ..	0	4	11	2	0	0	0	0	0	1	18
1 BEP ..	0	2	0	0	0	0	0	2	5	0	9
1 BET ..	0	0	1+D	0	0	0	9	7	0	0	18
1 BGF ..	1	0	0	0	0	1	0	0	1	1	4
1 BKQ ..	0	0	0	0	0	0	1	0	4	0	5
1 CJA ..	0	0	0	0	0	0	1	0	0	0	1
1 CMK ..	0	0	0	0	0	0	1	0	5	1	6
1 CNF ..	0	0	0	0	0	0	4	4+D	7	0	16
1 FB ..	0	0	0	0	0	0	0	2	2+D	2	7
1 GV ..	0	0	0	0	0	0	2	4	5	3	14
1 XM ..	0	2	1	0	0	0	5+D	9	3+D	1+D	24
1 YK ..	1	0	1	0	0	0	3+D	2	1	3	12
1 ZE ..	0	1	5	2	1	2	0	1	0	0	12
Second District :—											
2 AFP ..	0	0	0	0	0	0	0	0	4	0	4
2 AHO ..	0	2	0	1	0	0	0	1	0	0	4
2 APD ..	0	0	0	0	0	0	0	0	1	0	1
2 AWF ..	1	1	5	0	0	0	7+D	3	4+D	2+D	26
2 AWL ..	0	1	7	2	0	1	6+D	7	7	8	40
2 AYV ..	0	0	0	1	0	0	0	0	0	0	1
2 BML ..	1	2	0	0	D	0	0	5	0	0	9
2 BNZ ..	0	0	0	0	0	0	1	0	0	0	1
2 BQU ..	1	0	2	0	0	0	1	1	2	1	8
2 BRB ..	0	0	0	0	0	0	0	0	1	0	1
2 CKN ..	0	0	0	0	0	0	0	0	4+D	0	5
2 CQZ ..	0	0	0	0	0	0	6	0	9	3	18
2 EL ..	2	1	2	1	0	1	3	6	8	5	29
2 GK ..	1	1	0	0	0	0	9+D	5	7+D	4	29
2 GR ..	1	3	1	0	0	0	0	0	2	0	7
2 HJ ..	0	0	0	0	0	0	0	0	0	D	1
2 HW ..	0	0	1	0	0	0	0	0	0	0	1
2 KF ..	0	0	0	0	0	0	0	0	1	0	1
2 LO ..	0	0	3	0	0	0	9	6	9+D	4	32
2 NZ ..	0	3	5	0	0	0	0	4	0	3	15
2 UD ..	1	0	0	0	0	0	2	0	1	0	4
2 XAP ..	1	0	0	0	0	0	0	3	2	1	7
2 ZK ..	4+D	2	1+D	2	1	2	2	9	0	3	28
2 ZL ..	2	0	0	0	0	0	0	2	2	0	6

TABLE V.—(*continued*).

Call Letters	Number of Times Reported by Different Observing Stations.										
	Dec. 12th	Dec. 13th	Dec. 14th	Dec. 15th	Dec. 16th	Dec. 17th	Dec. 18th	Dec. 19th	Dec. 20th	Dec. 21st	Total
Third District.											
3 AFB ..	0	0	0	0	0	0	2	3	2	0	7
3 AUU ..	0	0	1	0	0	0	4	1	3	1	10
3 BG ..	0	1	2	0	0	0	3	2	3+D	0	12
3 BGT ..	2	0	0	0	0	0	1	0	7	2	12
3 BIJ ..	0	1	0	0	0	0	0	0	0	0	1
3 BLF ..	0	1	1	0	0	0	1	0	0	0	3
3 BNU ..	0	0	0	0	0	0	0	0	6	0	6
3 CC ..	0	0	0	0	0	0	5	0	3	0	8
3 CG ..	0	0	0	0	0	0	0	0	8+D	1	10
3 FS ..	0	0	0	0	0	0	0	0	2	0	2
3 NH ..	0	0	0	0	0	0	1+D	0	1	0	3
3 XM ..	0	1	1	2	0	0	1	1	5	0	11
3 YO ..	0	0	0	0	0	0	0	1	1	0	2
3 ZW ..	1	2	1	0	0	0	3	3	6	1	17
3 ZZ ..	0	0	1	3	0	0	1	1	2+D	0	9
Fourth District.											
4 BY ..	0	1	D	0	0	0	1	0	7+D	0	11
4 EA ..	0	0	0	0	0	0	0	0	2	0	2
4 EB ..	0	0	0	0	0	0	1	0	1	0	2
4 ID ..	0	0	0	0	0	0	0	0	D	0	1
4 KM ..	0	0	0	0	0	0	0	0	4+D	0	5
Fifth District.											
5 FV ..	0	0	0	0	0	0	0	0	1	0	1
5 XK ..	0	0	0	0	0	0	1	0	4+D	0	6
Sixth District.											
6 ZZ ..	0	0	0	0	0	0	D	0	0	0	1
Seventh District.											
— ..	—	—	—	—	—	—	—	—	—	—	0
Eighth District.											
8 AQO ..	3	6	5+D	0	0	0	9	8	11	8	51
8 ATU ..	0	3	1	0	0	1	0	0	3	1	9
8 AWP ..	1	1	0	0	0	0	3	2	6	0	13
8 AWZ ..	0	0	0	0	0	0	0	0	1	0	1
8 AXC ..	0	0	0	0	0	0	0	0	6	0	6
8 BFM ..	0	0	0	0	0	0	0	0	0	1	1
8 BK ..	0	0	0	0	0	0	0	0	4	3	7
8 BNJ ..	0	0	0	0	0	0	0	0	1	0	1
8 BPL ..	0	0	0	0	0	0	0	0	1	0	1
8 BXH ..	0	0	0	0	0	0	0	1	9	1	11
8 IB ..	0	0	0	0	0	0	0	0	9	1	10
8 KG ..	0	0	0	0	0	0	0	0	1	0	1
8 ML ..	0	0	0	0	0	0	0	0	1	0	1

TABLE V.—(*continued*).

Call Letters	Number of Times Reported by Different Observing Stations.										
	Dec. 12th	Dec. 13th	Dec. 14th	Dec. 15th	Dec. 16th	Dec. 17th	Dec. 18th	Dec. 19th	Dec. 20th	Dec. 21st	Total.
Eighth District—(continued).											
8 OW ..	0	0	0	0	0	0	0	0	1	0	1
8 SP ..	0	0	0	0	0	0	3	0	4	1	8
8 UE ..	0	0	0	0	0	0	2	1	7	3	13
8 XE ..	0	1	1	0	0	0	0	0	0	0	2
8 YD ..	0	0	0	0	0	0	0	1	3	1	5
8 ZAF ..	0	0	0	0	0	0	0	0	0	1	1
8 ZW ..	0	0	0	0	0	0	0	0	3	0	3
8 ZZ ..	0	0	0	0	0	0	0	0	1	0	1
Ninth District.											
9 AUL ..	0	0	0	0	0	0	3	0	0	0	3
9 DYN ..	0	0	0	0	0	0	1	0	0	0	1
9 FM ..	0	0	0	0	0	0	0	1	0	0	1
9 XAC ..	0	0	0	0	0	0	2	0	0	0	2
9 ZN ..	0	0	0	0	0	0	D	0	D	0	2
Canada.											
9 AL ..	0	0	0	0	0	0	1	0	2	1	4

districts (this being the same list as already given in Table II), while the figures in the ten remaining columns give the number of British observers who reported the station in question. In these columns also D indicates an additional report from Holland, these reports being indicated in this manner in order to distinguish the different receiving locality. Only one of the two Dutch stations referred to at the opening of this article reported any individual transmissions with code words—the other heard only a few "DX" transmissions.

The indications of the figures in this Table (V) are, however, masked by the fact that the time of transmission from each station varied from night to night, since some parts of the night seem more favourable to transmission, and in many cases, too, to reception, in view of local disturbances from certain transmitting stations. For instance, it may be seen from Table V that several stations were heard during the early part of the tests and were not heard during the best nights—19th-21st. Reference to the transmission schedule shows that in these cases these stations were sending towards the later parts of the periods (4.30 to 5.30 a.m.) for the first days, but that on the last days of the tests they were sending much earlier, such as 1 a.m. These differences would seem to indicate a better transmission for times in the neighbourhood of 4 a.m.; but against this must be set the fact that fewer observers were listening in the early hours of the night due to excessive harmonic jamming from high power stations before about 3 a.m.

It is also interesting to note the marked difference between the number of nights on which some stations were heard as compared with others. This difference would seem to indicate that while good transmission nights, and also the best transmission times on a good night markedly affect the weaker signals, these differences in transmission quality have much less effect upon the better stations. This therefore means that the signals from the best stations were capable of being heard under almost any of the conditions met with during the period of the tests, and that improvements in the transmission quality merely affect the strength of the signals received from these stations. On the best nights and times the signals from the best stations were of extraordinary strength, **8 AQO** in particular being reported by most listeners as being of exceptional strength and readable many feet from the telephone receivers. The nights on which his individual transmissions were not heard his transmission times were earlier than 3 a.m., and therefore came in a very bad period, since during the worst nights of the tests signals were only reported during the last two hours or so before 6 a.m.

(To be concluded)

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules:—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, *12/13, Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"E.L.F." (Southport) *asks whether the electric lighting system of a house may be used as an aerial.*

The electric light system of a house may be used as an aerial provided proper precautions are taken. A fitment is sold by manufacturers for the purpose of plugging into an electric light socket, and we think you may rely upon this being satisfactory. The results will depend largely upon local circumstances, but if it is difficult to erect an outdoor aerial, you should certainly give this method is trial.

"R.I.R.D." (Derby) *submits a diagram of connections, and asks* (1) *For criticism of circuit.* (2) *For a diagram of a note magnifier which can be connected to his present receiver without the necessity of rewiring.* (3) *Is the method of connecting plug-in H.F. transformers submitted standard with manufacturers.*

(1) The diagram submitted is correct. (2) A suitable diagram is given in Fig. 1. (3) We believe most manufacturers connect plug-in transformers as indicated in the diagram submitted, but we would not like to say that the method is a standard one.

"T. H. L." (Salop) *asks* (1) *Why three valves, which have been used as detector valves, have burnt out during a few weeks.* (2) *Why great difficulty is experienced in tuning in the broadcast transmissions from London.* (3) *Is the addition of a few more valves suggested.* (4) *The tuner is provided with a three-coil holder, but only two are connected. Is it expected that, with the third coil connected, the results would be improved.*

(1) Without more information we are afraid we cannot say why you should experience trouble with the valves. We believe the method of manufacture has been changed recently, and this may account for your difficulty. (2) The receiver referred to should give very good results, and we think probably your aerial or earth connection is not quite what it might be. (3) We do not think there is any necessity for the addition of valves to your receiver. (4) Probably the addition of the third coil to your three-coil holder would be of assistance. We suggest you examine the coil holder and remove the connections so that, when the coil is inserted in the holder, it will be in series with the circuit. At present the coil holder is short circuited.

"J.W." (S.E.13) *asks for a diagram of a three-valve receiver with a three-coil holder.*

We would refer you to the diagram given on page 583, January 27th issue. It will be noticed there are three coils coupled together in this diagram, and the method of coupling three coils in a three-coil holder is the same. The closed circuit coil will be the centre coil, and the outer coils the reaction and aerial coils. The diagram is very suitable for your purpose, and switches are

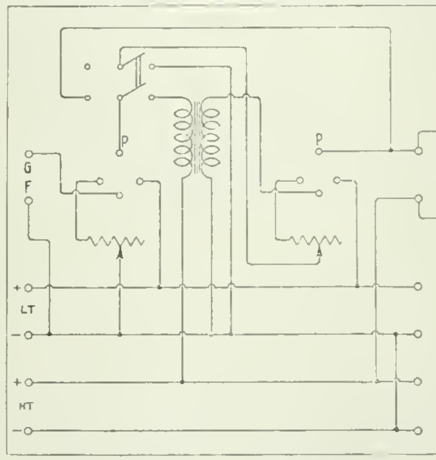


Fig. 1. Two-valve note magnifier panel. A switch is provided to cut out the last valve when required.

provided for the purpose of (1) connecting the A.T.C. or A.T.I. in series or parallel; (2) connecting the aerial and closed circuits with the grid and filament of the first valve; (3) connecting the high frequency valves; (4) cutting in or out the last valve; and (5) for reversing the reaction coil connections.

"T.W." (W.12) *asks* (1) *for a design of a telephone transformer to operate a 120-ohm loud speaker.* (2) *What gauge of wire should be used for the winding of the loud speaker.*

(1) A suitable design is given in reply to **"H.D.K." (Clapham), page 553, January 20th**

issue of this journal. (2) We suggest you wind the loud speaker with No. 34 S.S.C. wire.

"**WILK**" **(S.E.12)** *asks* (1) *Whether we could state the tuning range of the coil in his possession.* (2) *With reference to the diagram submitted, what would be suitable values for the coils A, B and C.* (3) *Is a telephone transformer necessary when it is desired to use 4,000 ohm telephones.*

(1) The coil will tune from about 200 metres up to 2,500 metres, assuming you have a full-size post office aerial. (2) The diagram submitted is quite correct, and, as you suggest, the coils A, B and C, are intended to slide one within the other. Coil C is the outer coil, and A the inner coil. Coil B slides between coils A and C. (3) If it is desired to use 4,000 ohm telephones, a telephone transformer is not required, and the telephones are connected directly in the anode circuit of the last valve.

"**H.F.**" **(Greenock)** *submits a diagram of his receiver, and asks* (1) *Whether the values are suitable.* (2) *Should dead end switches be fitted to the coils.* (3) *Should it be possible to receive the London broadcast transmissions when a frame aerial is used.* (4) *Will the circuit meet the Post Office requirements.*

(1) The diagram of connections is correct except that the closed circuit condenser is shown connected in series with the closed circuit inductance instead of in parallel. (2) We do not think any great improvement would result from the use of dead end switches, although, if you care to try, we would suggest the switches be connected to break the 75th and 120th turns in the aerial circuit. You might try the effect of short-circuiting some of the disused turns. (3) We think you will probably hear the London transmissions, although the signal strength will hardly be loud enough unless the conditions are very favourable. We suggest you use the standard outdoor aerial. You should hear the **PCGG** transmissions. (4) We think the circuit complies with the Post Office requirements.

"**F.J.**" **(London, N.16)** *asks for a diagram of a three-valve receiver with provision for using crystal or valve detector.*

A diagram is given in Fig. 2. To use the valve detector and note magnifier, put switch 1 to the left, and 2, 3 and 4 to the right. To use the valve detector only, put switch 1 to the left, 4 to the left, and 2 and 3 up. To use crystal detector and valve note magnifier, put switch 1 to the right, 2 to the left, 3 to the right, and 4 up. To use the crystal detector alone, put switch 1 to the right, 2 and 3 to the left, and 4 up.

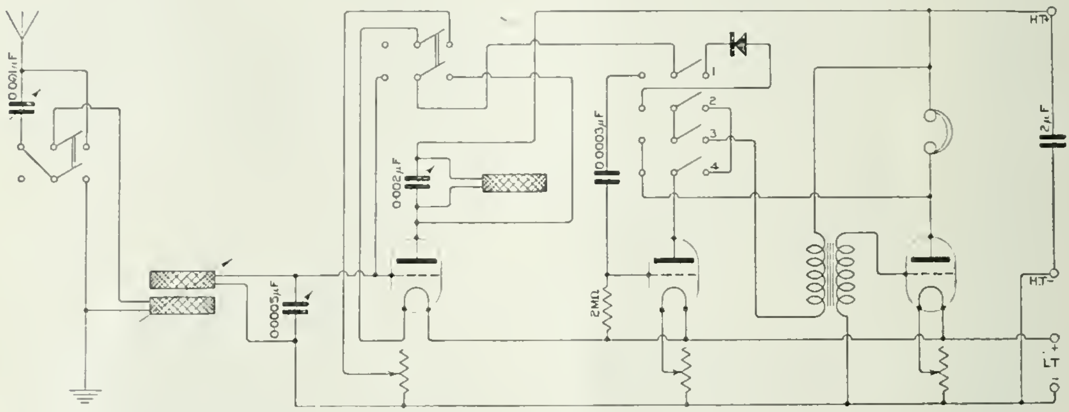


Fig. 2. A 3-valve receiver. A crystal detector may be used instead of the detector valve when required.

"**S.C.F.**" **(Watford)** *submits a diagram of his receiver and asks* (1) *Why he has difficulty in hearing the broadcast transmissions.* (2) *How may the reaction coil be connected so that it will increase the signal strength result from the reaction coil being coupled with the anode coil.* (4) *For criticism.*

(1) and (4) The diagram of connections submitted is not quite correct. The secondary circuit should be tuned with a small variable condenser with a maximum value of 0·0005 mfds. The grid leak and condenser are not shown connected correctly in your diagram. When a tuned anode winding is used in the high frequency valve anode circuit, the grid leak should not be connected across the grid condenser, but between the grid and filament. The connection should be with + L.T. The remainder of the connections are correct. The reason why larger coils are necessary in the tuning circuit is because (1) the aerial tuning condenser is in series with the A.T.I., and (2) because no secondary tuning condenser has been used. We suggest you continue using the A.T.C. in series with the A.T.I., and use a small condenser—one having a maximum value of 0·0002 mfds—to tune the reaction coil. (2) If bringing the reaction coil closer to the closed circuit coil reduces the signal strength, the connections to the coil holder should be simply reversed. It will then be found that bringing the reaction coil closer to the closed circuit coil increases the strength of the signals. (3) If the reaction coil is coupled with the anode coil, reaction effects

may be obtained, although with the type of anode coil in use, you would find it difficult to secure the proper coupling.

"ENGINEER" (Birmingham) *asks* (1) *Are the values shown on the diagram submitted correct.* (2) *What standard book dealing with wireless reception, do we recommend.* (3) *Is it best to obtain a licence to use a receiver which has the reaction coil coupled with the aerial circuit.*

(1) The values of the condensers given in the diagram are too large. The aerial condenser should have a maximum value of 0·001 mfds., and the closed circuit condenser 0·0005 mfds. The grid leak may be 2 megohms. A 2 mfd. condenser may be connected across the H.T. battery. (2) It is a difficult matter to know which book to recommend without information concerning your present wireless knowledge. We suggest you read Bangay's "Elementary Principles of Wireless Telegraphy," Parts I and II, and then choose a standard work, such as Morecroft's "Principles of Wireless Telegraphy and Telephony." These books may be obtained from the Mail Order Department at this address. (3) We suggest you apply to the Secretary of the Post Office, London, for an experimenter's licence. We cannot say whether he will grant you a licence.

"H.H.D." (Essex) *asks whether, by using a suitable transformer and chemical rectifiers, as described in the issue of December 30th, it would be possible to charge his accumulators.*

The method of obtaining direct current from alternating current referred to is only suitable when a few milliamperes is required, and the method is not suitable for supplying heavier currents to charge accumulators. We suggest you abandon the idea, and use a special valve or mechanical rectifier. Reliable electrolytic apparatus, however, for accumulators from A.C. mains is on the market.

"J.J.H." (Waterford) *asks* (1) *For a diagram of a low power telephone transmitter.* (2) *What voltage will a Mansbridge 2 mfd. paper dielectric condenser withstand.* (3) *How to find the output of a small valve transmitter.* (4) *What would be the approximate range of a C.W. transmitter using 100 volts H.T., and a telephone transmitter using 100 volts H.T.*

(1) A suitable diagram is given in Fig. 3. The aerial coil may be a winding 6″ in diameter, of No. 16 D.C.C. About 20 turns will give you a sufficient inductance to enable you to make the correct wavelength adjustments. The wire should be spaced slightly. The reaction coil may be a winding 4″ in diameter and 2″ long, of No. 22 D.C.C. The transformer connected in the grid circuit is a microphone transformer, with the secondary shunted by a small variable condenser. The condensers used should be able to withstand the high voltages which may be generated. (2) A 2 mfd. Mansbridge condenser will probably safely withstand 100 volts D.C. They will not, however, stand up to a pressure of 100 volts when connected in an oscillating circuit. When purchasing these condensers care should be taken to see that the insulation is good, otherwise the H.T. battery will soon discharge. (3) If a 5-watt transmitting valve is used with the best adjustments you may expect to put about 5 watts high frequency energy into the aerial circuit. The amount of power required would then be about 10 watts. The efficiency of the valve is about 50 per cent. (4) This question is not clear, but with a good outdoor aerial and proper adjustments with a suitable valve, and 100 volts on the plate you should be able to transmit C.W. and telephony for a mile or two. The range as a telephone transmitter is necessarily much less than the C.W. range.

"VAMBERG" (W.C.2) *asks* (1) *What type of coil is recommended for tuning coils.* (2) *Would any advantage be gained through coupling the reaction coil with the aerial coil and anode circuit coil.* (3) *What would be suitable dimensions for a set of honeycomb coils to tune up to 1,500 metres.* (4) *Will the use of telephone jacks reduce the signal strength.* (5) *Will connections, which are 3′ long between the tuning coil and the remainder of the receiver, cause a reduction in the signal strength.* (6) *How many different anode potentials can be applied to the valves.*

(1) We suggest you use plug-in coils for the anode coils. We suggest you construct coils having the following numbers of turns: 25, 35, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600 and 750. The coils should be about 1″ wide, and the smaller coils could be wound with No. 22 and the larger with No. 28 D.C.C. The former should be 2½″ in diameter. (2) We suggest you couple the reaction coil with the anode coil. There is no need to couple the aerial coils with either of the two latter coils. (3) The coils should have the dimensions

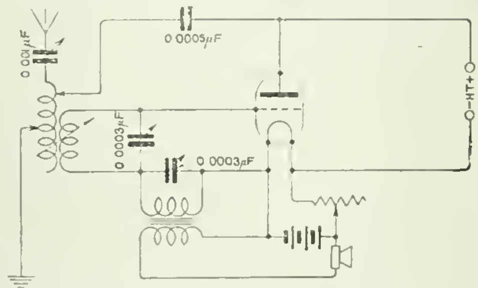


Fig. 3. Simple telephony transmitter. The minus terminal of the H.T. is connected to earth.

given in No. (1). (4) We do not recommend the use of plugs and jacks in high frequency circuits. (5) All connections, especially grid connections, should be as short as possible, and we suggest you reduce the distance between the tuner and amplifier. (6) The method of applying different H.T. potentials to the anode of the valves in the amplifier is given on page 601, Fig. 3, February 3rd issue. We would point out that only four questions are permitted.

"H.A." (Weston-super-Mare) *asks* (1) *With reference to the article described by Mr. A. J. Bull in the August issue of this journal, is the coil which is shown on the top of the instrument a reaction coil.* (2) *Will the Post Office permit the use of this receiver.*

(1) The coil which is seen on the top of the instrument is not a reaction coil. It is the anode coil, and is used for high frequency amplification. (2) We think you will have no difficulty in obtaining a licence to use this receiver.

"H.E." (S.E.23) *submits a diagram of a receiver he proposes to construct, and asks for advice.*

The condenser C.2 should have a value of 0·001 mfds., and C.1 should be variable up to 0·004 mfds. We suggest the use of one or two fixed condensers, which may be connected in parallel, combined with a 0·0005 variable condenser so that the best capacity may be obtained. The inductance coil L.1 may be a winding 4″ in diameter and 6″ long, of No. 22 D.C.C. Ten tappings should be taken. If it is desired to use a plug-in type of coil the coil may be tuned either with a condenser in series in the aerial circuit, or with the condenser connected across the coil in the usual manner. Two coils, L.2 and L.3, may be in the form of a loose coupler, or a two-coil holder holding two plug-in coils may be used. Coil L.2 may have a winding 4″ in diameter and 6″ long; No. 26 D.C.C. Coil L.3 may be 3″ in diameter and 6″ long, No. 30 D.C.C. Ten tappings should be taken from each coil. We do not recommend that coils L.1, L.2 and L.3, be in the form of a three-coil holder. With a circuit of this description a good deal of experimental work is required before satisfactory results are obtained. We would refer you to the issue of May 27th of this journal, where several circuits with constructional particulars are given, and which shows how one, two or three valves may be used for the purpose of dual amplification.

"B.D." (Cambridge) *asks* (1) *How to obtain reaction effects with the anode coil.* (2) *For criticism of aerial arrangement.*

(1) It is a rather difficult matter to secure sufficient coupling between a reaction coil and a tapped anode reactance coil of the type mentioned. However, if you wind 200 turns of No. 36 S.S.C. wire in a former 2½″ in diameter with a 1″ screw ⅛″ wide, you will obtain sufficient coupling. The reaction coil should be tuned with a small condenser having a maximum value of 0.0002 mfds. The reaction coil may have three taps equally spaced. Much louder signals should be received if the instrument is located downstairs. (2) It will be remembered that the actual height of the aerial is its height above the instrument, and not its height above the ground. If the lead-in were brought in on the bottom floor, the earth connection could be taken to the water main, and the result would be a much lower resistance earth. If possible, the free end of the aerial should be raised to a height of 40′.

"R.B." (Cheshire) *submits a diagram of his receiver and asks for advice.*

As it is required to receive over a wavelength of 200—500 metres, we suggest you use small cylindrical coils, as they are the simplest to make and are the most efficient. The aerial coil may be 4″ in diameter and 2″ long of No. 20 D.C.C., and four tappings should be taken. It is not possible to give the exact position for the tappings because we have no particulars of the capacity of your aerial, which is the factor that determines the position of the taps. The anode coil marked L.2 will be 4″ in diameter wound with No. 28 D.S.C. Tappings should be taken at the 20th, 30th, 45th and 70th turns. The reaction coil should be filled with No. 28 D.S.C. wire. The idea of the arrangement is quite suitable, although considerable experimental work will be necessary before the arrangement suggested will give satisfactory results. The condenser values given are quite suitable. You may find it necessary to use a 6-volt accumulator in place of the 4-volt shown. The anode coil of the A.T.I. should be well spaced so that they do not inter-act.

"MANTOLA SUBSCRIBER" *asks* (1) *Whether the diagram submitted is correct.* (2) *For particulars of suitable tuning coils.* (3) *Whether the receiver should operate a loud speaker.*

(1) We have examined the diagram of connections and the connections are correct, apart from the switch in the aerial circuit, which disconnects the condenser in one position, and in the other position the condenser is in parallel with the coil. We do not recommend the use of so many switches, because the signal strength is seriously reduced, and there is no practical advantage in using switches having so many contacts. We suggest you use switching arrangements as shown in many issues of this journal. The switches should be of the anti-capacity type, or double-pole throwover switches may very conveniently be used. The reduction in signal strength is particularly noticeable when grid circuits are switched. (2) We suggest you use basket coils connected in series. Suitable coils would have 35 turns of No. 26 D.C.C., wound upon a former 2″ in diameter. Six of these should be connected in series and mounted together, with about ⅛″ between each coil to reduce self-capacity. The connections between the coils may be taken to a switch. The closed circuit will require eight of these coils, and the anode circuit may have ten coils, each having 50 turns of No. 30 D.C.C. wound upon a 2″ former. The anode tuning condensers have a rather large value, and we suggest you use condensers with a maximum of 0·0002 mfds. The smaller the value of these condensers the better the results in general. A receiver wired according to the diagram submitted should amplify signals sufficiently to operate a loud speaker. We would point out that a loud speaker is a power operated instrument, and low frequency connected valves are required. High frequency valves are for the purpose of increasing the signal strength before rectification. A rectifier works best when signals having considerable amplitude are impressed across its input circuit.

SHARE MARKET REPORT.

Prices as we go to press on March 9th, are :—

Marconi Ordinary	.. ..	£2 14 0
,, Preference	.. ..	2 7 3
,, Debentures	.. ..	108 4 0
,, Inter Marine	.. ..	1 8 10½
,, Canadian	.. ..	11 6
Radio Corporation of America :—		
Ordinary	.. .. ..	17 0
Preference	.. .. ..	15 0

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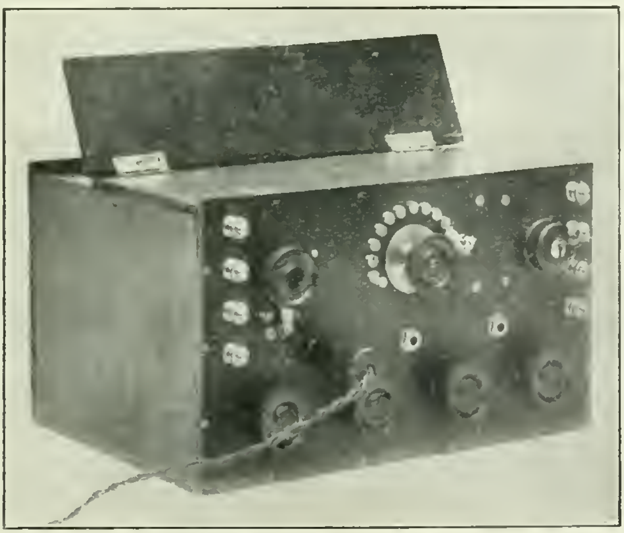
American Ideas in British Design.

THE CONSTRUCTION OF A FOUR-VALVE DETECTOR AMPLIFIER.

By Percy W. Harris.

THE instrument I am about to describe was designed and built in the endeavour to produce an efficient four-valve set which would combine simplicity of operation with compactness. In addition it incorporates two features not frequently found in British amateur - built apparatus—plug-and-jack control and concealed valves. It is not a complete receiver, as the means of tuning are absent, but it can be attached to any existing tuner and will be found a very interesting instrument to build and operate.

The first valve is used as a high frequency amplifier, the second as a detector and the third and fourth as note magnifiers. The coupling of the high frequency valve is of the reactance-capacity type, the anode coil being provided with twelve tappings to cover all wavelengths. While this form of coil is not quite so efficient, save on its "peaks" or optimum points, as one which is combined with a variable condenser, it is nevertheless very simple to handle and gives good results, even in the hands of the beginner.



A Four-Valve Detector Amplifier, the construction of which is fully described in this article.

A particular advantage of this instrument is the simplicity with which it is possible to change from one combination of valves to another. If the photographs and diagrams are examined, it will be seen that there are three plug sockets and three switches on the front of the instrument. The switch on the right is a miniature tumbler switch made of ebonite, serving to switch all of the valves on and off as required. This is an advantage when it is desired to leave the set accurately tuned to a station with the valve rheostats set at the best position for each valve. Once these positions have been found the whole instrument can be switched off, left for the night, and switched on again the next evening without the necessity of making new adjustments. This is much appreciated by unskilled members of the family who may want to hear the bedtime stories in daddy's absence.

The central switch controls the high-frequency coupling coil tappings. The wavelength ranges for each tapping are supplied with the coil and can be marked on the panel or noted in any convenient place, such as on the inside of the lid of the box. There are actually 13 studs, the first being an "off" position, which is sometimes useful for experimental work.

The left-hand two-way switch serves to switch the high frequency valve in or out. The three jacks are so wired that when the plug belonging to the telephones or loud speaker is placed in the left-hand hole we work with the detector valve (with or without the high frequency valve preceding it, according to the position of the switch), while plugging in to the central or right-hand holes brings in one or two note magnifying valves as required. There is a separate filament resistance for each valve so that those not required can be cut off, saving current.

A further advantage lies in the fact that the filament resistances can be set to suit each particular valve, a matter of some importance if one desires to use or try different kinds for different purposes. Some valves, for instance, work very well for note-magnifiers, but poorly for detectors or high frequency amplifiers, and it is well to try each valve in each circuit before forming an opinion as to its relative merits.

The terminals are marked in the diagram on this page, and explain themselves The large diagram on page 820 shows the internal connections and arrangements of components on the back of the panel and on the base of the instrument. To understand this diagram it must be remembered that it is drawn as if the panel were laid flat on the table in the same plane as the baseboard. The relative position of parts can be better understood by bending the drawing so as to bring the back of the panel vertical, leaving the baseboard flat.

Before we start the constructional work, here are the components required :—

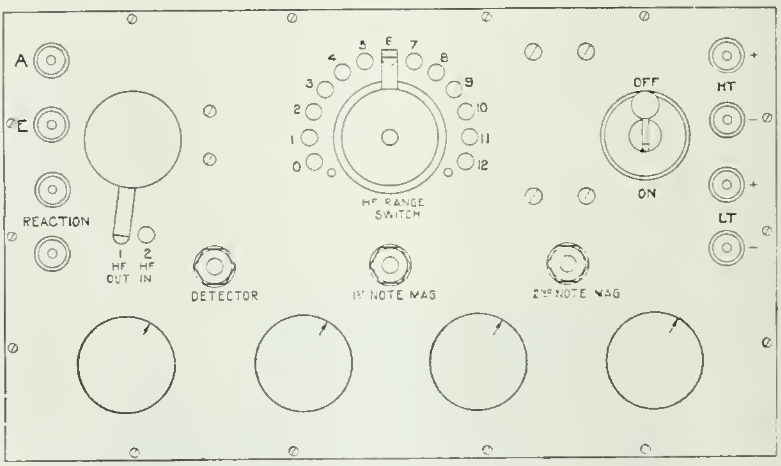


Diagram showing the layout of the panel (top).

Ebonite panel, $\frac{1}{4}''$ or $\frac{3}{8}''$ thick, measuring $12''$ by $7''$. (This is the smallest possible size for the components used, and if desired it can be larger).

Ebonite strip, $10\frac{1}{2}''$ by $1\frac{1}{2}''$ by $\frac{1}{4}''$.

Suitable tapped anode coil.

Ten terminals.

Four filament resistances for panel mounting.

Two double-circuit jacks.

One single-circuit jack.

Two switch-knobs with arms.

Fifteen contact studs.

One miniature tumbler switch (this can be obtained from any dealer in motor accessories).

One grid leak (2 megohms).

Fixed condensers as follows (one each):
0·0003 mfds.
0·001 mfd.
0·01 mfd.

Two intervalve transformers of any good make.

Four valve sockets.

One plug for jacks.

Suitable hinged-lid box, constructed in a manner to be described.

Quantity of connecting wire (tinned) and insulating tubing.

About three dozen 6BA metal screws with nuts. (These may be about $\frac{3}{4}''$ long).

The first step is to remove the shiny surface of the ebonite with fine emery paper, working with a circular motion so as to give a smooth even finish without scratches. The edges of the ebonite should also be finished off smoothly. This can be done by glueing a strip of emery paper to a board and rubbing the edges of the panel along the abrasive surface so formed.

Now mark out the *back* of the panel with the positions of the various terminals and components. Use for this purpose a sharp "scriber," which can be purchased from any tool shop for about a shilling. With the aid of a ruler or other straight edge scratch a fine line parallel with the left and right edges at a distance of three quarters of an inch in. On these lines mark off (by means of a transverse scratch) points at $\frac{3}{4}$ in. from the top, at $1\frac{3}{4}$ ins., $2\frac{3}{4}$ ins., and $3\frac{3}{4}$ ins. These points will give the positions for the sets of four terminals on each side.

You will also need three horizontal lines, the uppermost being two inches, the second four, and the lowest five and a half inches from the top. These three lines will give you the horizontal positions for the switches, jacks and filament resistances. The thirteen point switch is placed centrally on the upper line, while the centre points of the right and left-hand switches are two inches from each side. On the middle line mark off points at the exact centre and at $2\frac{3}{4}$ ins. on each side of this, so as to give the positions for the jacks.

Other points will need to be marked off to take the fixing screws for the box, the various components and the switch points. These cannot be indicated by measurements, as they will differ for different components. Their positions are best found by laying out the components in their correct positions on the back of the panel.

As this set can be made to look very pleasing when finished, the reader is strongly advised to take pains with this initial marking out. When all the positions have been indicated, take a centre-punch (this can be bought for a shilling, or a substitute can be made from a large French nail), and with a hammer make a small depression on the exact point where a hole is to be drilled. Do not trust the drill to make a hole in the place you want, with merely a scratch to guide it—drills have a nasty habit of slipping about a sixteenth of an inch without being noticed, if there is no central depression as a guide. The use of a centre-punch is strongly advocated and will make drilling much neater and simpler than is otherwise possible.

Here is a hint which will be found helpful when it is necessary to drill holes to take fixing screws for such items as the fixed condenser, grid leak and tumbler switch. These articles will probably have holes already drilled in them, and it is then merely necessary to drill clearance holes in the panels through which suitable screws can be passed, nuts holding the screws in place. Many beginners find difficulty in drilling the holes in the exact places necessitated by the holes in the components. The simplest way is to lay the article on the panel in the position it is to occupy, and drill *through* one of the holes in the article. The drill is then withdrawn and a suitable metal screw (probably 6 BA) dropped through the clearance hole so formed, holding that end of the component in place. The second hole can now be drilled in the same way. If this is done the beginner is often saved the annoyance of finding that the holes in the panel and those in the components do not exactly coincide.

The holes to take the jacks will probably be larger than the largest drill available to the average experimenter. In this case it is well to mark out on the panel small circles of the size required, and then drill out the centres with the biggest drill available. The holes can then be enlarged with the help of a fret-saw or a round file.

The radius of the semicircle on which the studs will fall will of course depend upon the radius of the switch arm used. The separation of the studs should be just less than the width of the switch arm, or the latter will fall between the studs when the switch is rotated. To determine the points for drilling the holes for the studs, first scratch with dividers a semi-

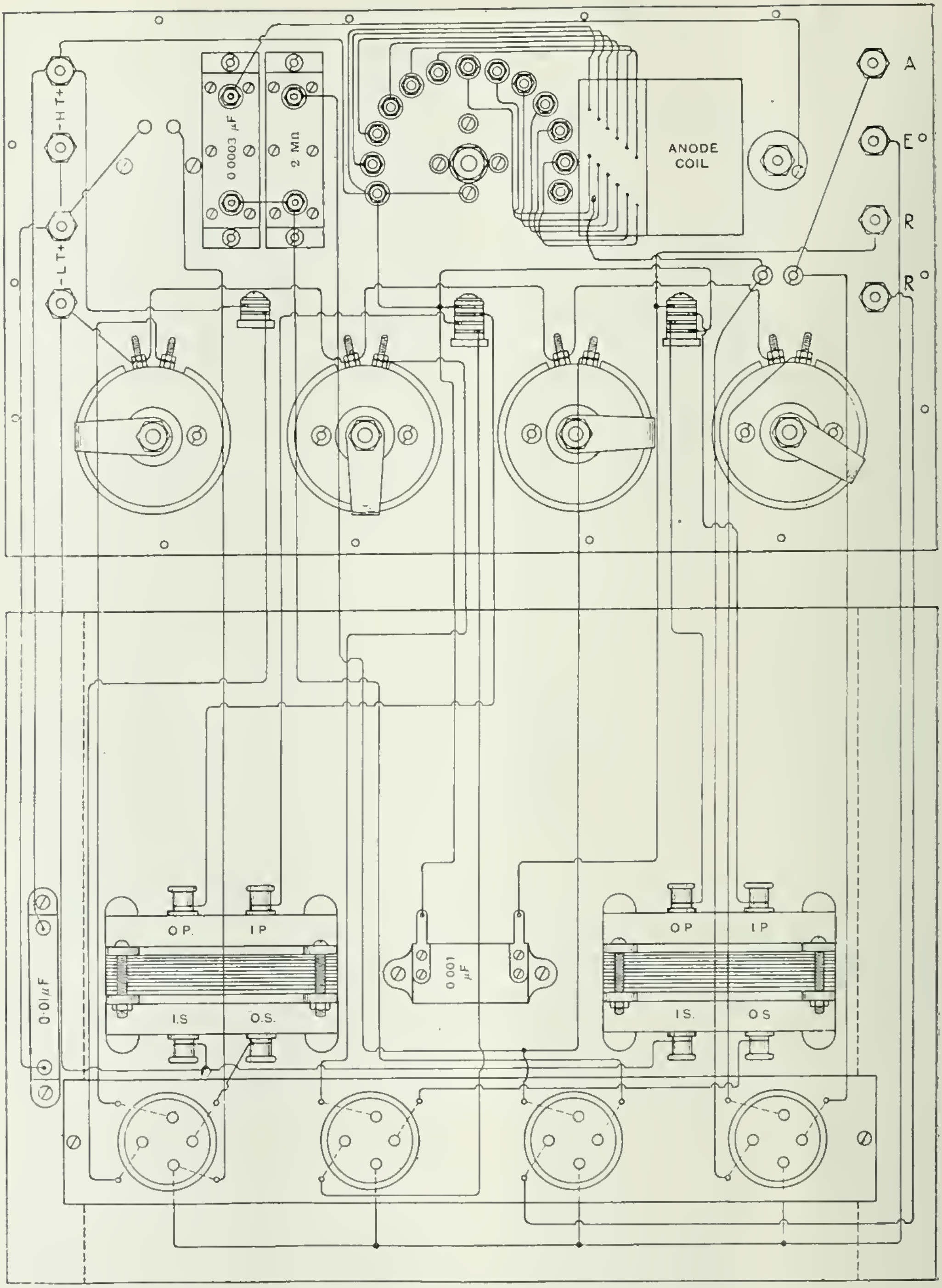


Diagram of connections for the underside of the panel.

circle of the radius of the switch arm, next mark off the point for the stud numbered 6 (this is exactly on the centre line of the panel), and then with the same dividers mark off six points on each side. This will give a symmetrical layout. As before, use a centre punch before drilling. The drilling of the holes for the two-point switch on the left of the panel will present no difficulties, nor will the drillings for the filament resistance spindles and their securing screws. For these latter adopt the procedure advocated in a previous paragraph, drilling *through* the holes in the resistance formers.

After the panel has been drilled, lay it aside and drill the strip of ebonite which is to take the valve holders. For convenience in wiring, it is advisable to drill holes around each of the valve sockets as shown in the illustration. You will see why later. The strip must have a hole at each end to take the wood screws for securing it to the base strips.

The remaining holes are for the grid leak, grid condenser and the tapped anode coil. The grid leak is wired between the grid condenser and the filament, and not across the grid condenser, so that the pattern of grid condenser which carries the grid leak in clips across it will not do. In the illustration of the back of the panel the grid leak and condenser are both made up between strips of ebonite. There is no special reason for this other than that the author happened to have these two components handy. The reader will probably use small ready-made grid condensers and a leak between clips. The holes for these are easily made as previously explained, as are the holes for the tapped anode coil bracket.

Before we can wire up the instrument it is necessary to make a suitable cabinet. This should measure (if exact dimensions of the panel described are followed) 12″ by 7″ by $8\frac{3}{4}$″ externally. The baseboard, measuring $8\frac{3}{4}$″ wide, should have fixed at each end strips of wood measuring $8\frac{3}{4}$″ by 1″ by about $\frac{3}{4}$″ thick. The length of this base should be 12″, less twice the thickness of the wood used for the side pieces, as these will be screwed to the ends and will be partly supported by the thickness of the strips which also serve to raise the valve-holders to allow room for the wiring and the projecting legs.

The back and the top are fixed in place after the panel has been fitted and the instrument wired. The top should have a hinged lid to allow access to the valves. The back is simply a suitable piece of wood which can be screwed on when required.

If the reader gets his cabinet work done for him, he should arrange for the box to be made so that the top and back can be screwed on separately, or he will have difficulty in assembling.

Assembling the Set.

Wiring up should be carried out with tinned copper wire of suitable thickness (such as No. 18 or No. 20 S.W.G.), insulating tubing being used everywhere. Owing to difficulty in handling it may be necessary to use finer wire for wiring up the tappings of the anode coil and the studs of the multi-stud switch. These leads should be kept as short as possible, if the efficiency of the tapped anode coil is not to be lost.

To begin wiring lay the big panel face downwards on the table and connect up all leads which begin and finish on the panel itself. Solder all connections, as it is not easy to tighten up nuts at a later stage if they should become loose. Be careful to keep all leads as short as possible. When these connections have been made, solder long wires to all the terminals and connections which have to be joined to the components mounted on the baseboard, generous lengths being used, as the surplus will be cut off later.

Now mount the various components which are placed on the baseboard, leaving for the moment the ebonite strip which carries the valve holders. There are two fixed condensers here, one (0·001 microfarad) in the middle and another (0·01 microfarad) secured either to the side strip as shown or, if not a vertical pattern, to the left upright piece. Be careful to place the intervalve transformers with their terminals in the positions shown.

It will now be necessary to solder lengths of wire to the terminals on the underside of the ebonite strip. These wires can be threaded through the holes around each socket and left for the moment projecting upwards, the strip then being secured by two wood screws to the end wooden strips previously mentioned.

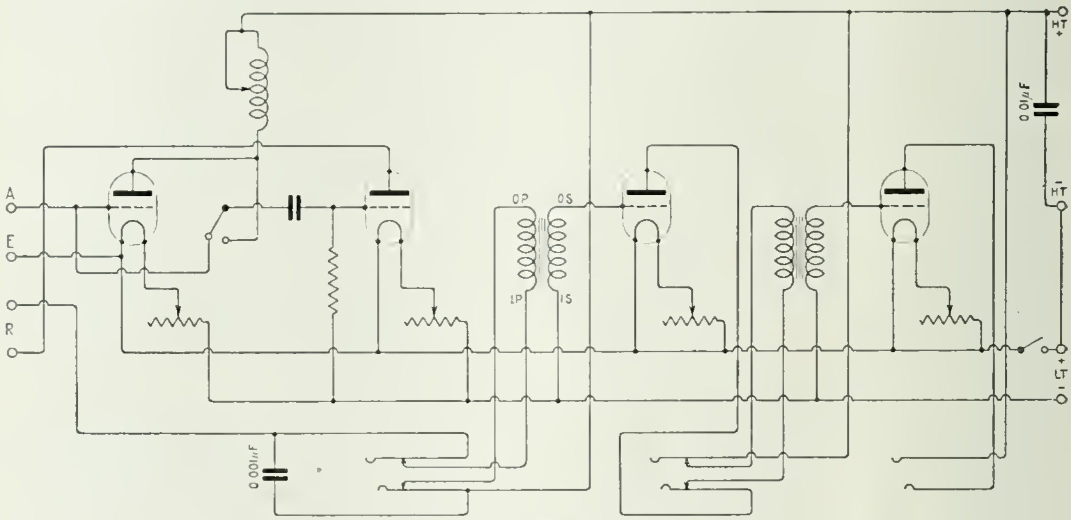
The final stages of assembly consist of securing the upright panel to the front of the cabinet, and pulling the long wires from the panel across to the terminals or points to which they are to be soldered. When the correct length of these leads has been measured, they are cut off to size and soldered in place (tubing being slipped on as usual). In some cases, such as when joining the panel to the valve sockets, one wire will be soldered to another. When this is done it will be found convenient to twist the two wires together before soldering.

The set should now be tested. This will be found quite an easy matter, as one, two, three or four valves can be used at will. If all is well the back and top can be secured in place.

Notes on Operating.

This set will need some form of tuner, which preferably should be a three-coil holder with two variable condensers (0·001 for aerial tuning and 0·0005 for closed circuit) with a series-parallel switch for the aerial condenser and a reversing switch for the reaction coil. This latter is necessary, as when the H.F. valve is cut out it will be found necessary to reverse the leads to the reaction coil. If less selectivity is required and the reader is not accustomed to the rather tricky ways of three-coil tuning, two coils can be used, but of course direct reaction on the aerial must not be used on broadcast wavelengths during broadcast hours. The reader is begged not to use it on short wavelengths *even after* broadcast hours, unless he is perfectly certain that the set is not radiating, or the poor amateur burning his midnight oil will be seriously inconvenienced by the howl set up. With the tapped anode coil is supplied a table showing the wavelength range for each tapping. This can either be marked on the panel against the particular studs (you can get the panel professionally engraved for a reasonable sum at any dealers), or the table can be gummed to the lid of the box.

No provision is made in the design for a telephone transformer, but the reader is strongly advised to purchase one and to take the leads from the telephone plug to the transformer, which can be mounted in a suitable box with terminals for telephones or loud speaker.



The circuit diagram.

The finished instrument will be found extremely simple and convenient to operate, as it is a great advantage to be able to change from one to two, three or four valves in a moment, and there is no critical high-frequency tuning. It is also economical to work, as the valves not in use can be switched off. If good quality components are used, the efficiency of the set will compare very favourably with the most expensive four-valve sets, while in size it is much more compact than most of the commercial four-valve instruments now on the market. It is not necessary to drill inspection holes or ventilating windows for the valves if the lid is left slightly raised during operation. This can easily be effected with the aid of a catch.

Wavelength Abacs.

SIMPLIFYING INDUCTANCE AND CAPACITY CALCULATIONS.

By J. A. Tomkins, A.R.C.S., F.Inst.P.

THERE have been published from time to time in the *Wireless World and Radio Review* and elsewhere, abacs relating to the various formulæ employed in wireless telegraphy and telephony.

One of these, based on a little-known property of the conic, is due to Dr. W. H. Eccles and is described in his "Wireless Telegraphy and Telephony." It expresses the relation between the wavelength λ, the inductance L and the capacity C of an oscillatory circuit, these quantities being read off in the usual way from the alignment obtained by means of a piece of thread.

It consists of an ellipse on the major axis of which a scale of wavelengths is marked off from one vertex, while along the two arcs scales of inductance and capacity respectively are similarly described. By stretching a thread through the divisions corresponding to the values of any two of the three quantities λ, L and C, the third may be determined by observing the reading in alignment with the other two.

The relation between wavelength, inductance and capacity is given by the equation

$$\lambda = K\sqrt{LC} \quad . \quad . \quad . \quad (1)$$

where K is a constant which depends on the units employed.

If λ be expressed in metres, L in microhenrys (μH) and C in microfarads (μF) the equation is

$$\lambda = 1885\sqrt{LC} \quad . \quad . \quad . \quad (2)$$

This may be written in the form

$$LC = \left(\frac{\lambda}{1885}\right)^2 = W^2, \text{ where } W = \frac{\lambda}{1885} \quad . \quad (3)$$

whence

$$\frac{L}{W} = \frac{W}{C} \quad . \quad . \quad . \quad . \quad (4)$$

The last equation suggests the following simple abac for determining L or C :—

On a sheet of ordinary squared paper take two of the ruled lines at distances W from the top and left-hand sides. These, numbered from the top and left respectively, are the L and C scales for the given wavelength. If, then, a thread be pinned at the left-hand top corner and stretched so as to cut the two scales, the readings at these points will give corresponding values of L and C for this wavelength. Hence, if the thread be set to a given reading in one scale the required value can be read off from the other. Values of λ for the various lines can be marked at the top and side of the diagram.

For values outside those indicated it is necessary to multiply or divide by the appropriate power of ten, as described below.

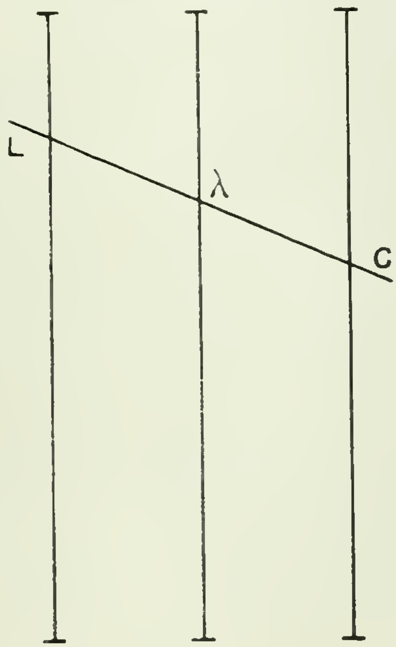


Fig. 1.

As it is not very convenient to determine λ by this method, another, which gives L, C or λ with equal facility, may be employed.

The chart shown on the accompanying page is based on the following simple principle :— Take three parallel equidistant uniform scales with their zeros in alignment and along which the values of the three quantities L, λ and C respectively are marked (Fig. 1). If then we take any two divisions L and C on the first and third scales, their join LC will meet

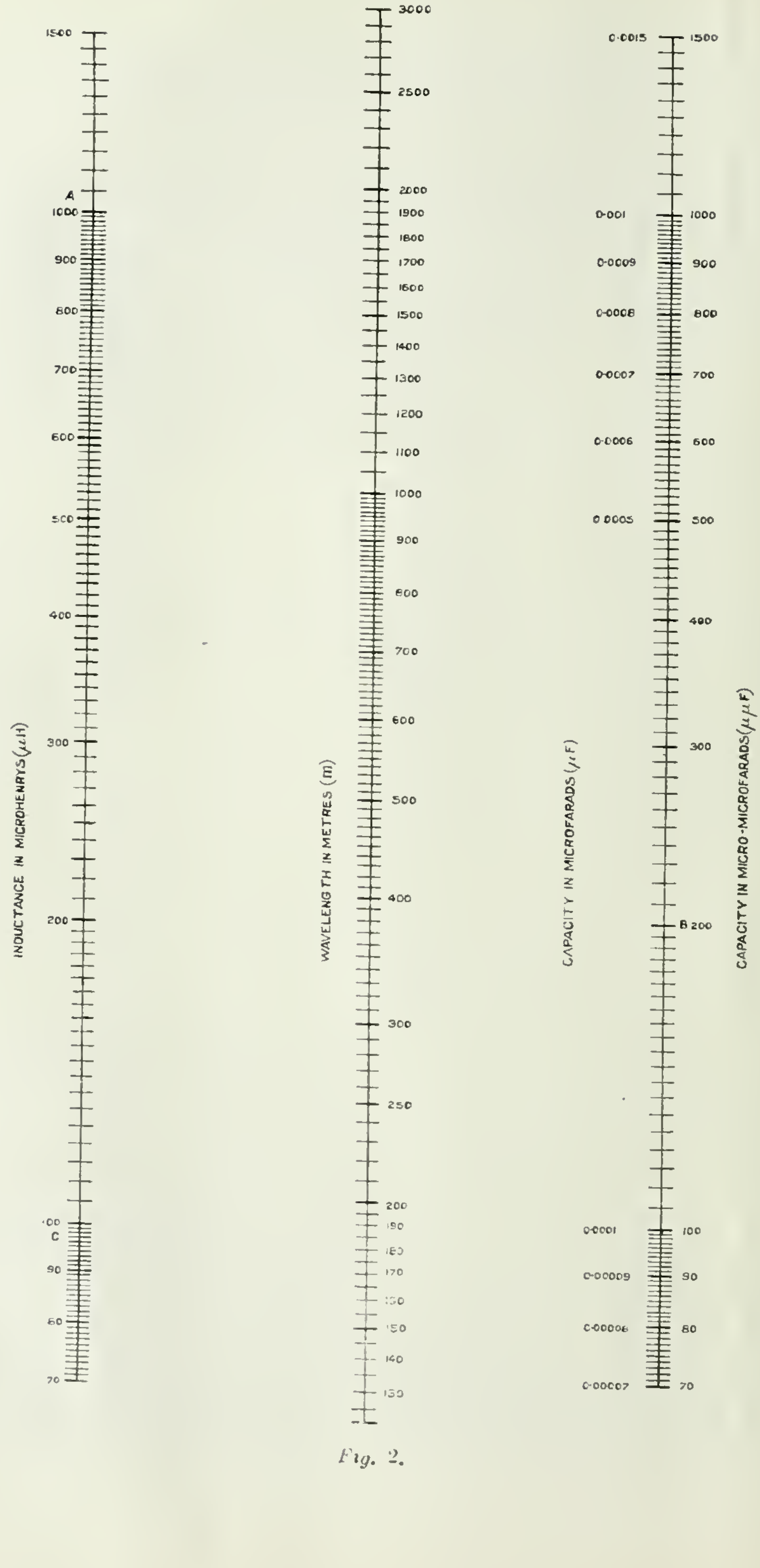

INDUCTANCE IN MICROHENRYS (μH)
1500
A
1000
900
800
700
600
500
400
300
200
100
C
90
80
70
WAVELENGTH IN METRES (m)
3000
2500
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
250
200
190
180
170
150
140
130
CAPACITY IN MICROFARADS (μF)
0·0015
0·001
0·0009
0·0008
0·0007
0·0006
0·0005
0·0001
0·00009
0·00008
0·00007
CAPACITY IN MICRO-MICROFARADS ($\mu\mu$F)
1500
1000
900
800
700
600
500
400
300
B 200
100
90
80
70

Fig. 2.

the middle scale at the division λ given by the equation

$$\lambda = \tfrac{1}{2}(L + C) \quad . \quad . \quad (5)$$

We are thus able to read off half the sum, *i.e.*, the arithmetic mean, of the two quantities L and C.

Next suppose that we wish to find in a similar manner the geometric mean of the two quantities, *i.e.*, to solve the equation

$$\lambda = \sqrt{LC} \quad . \quad . \quad . \quad (6)$$

Taking logs we get

$$\log\lambda = \tfrac{1}{2}\log L + \tfrac{1}{2}\log C \quad . \quad (7)$$

This equation can be dealt with if, instead of uniform scales, we take logarithmic scales, the divisions being marked, not with the logarithms, but with the numbers themselves, as in the ordinary slide rule.

Then the join of any two divisions L and C will meet the middle scale at the point λ, which satisfies equations (3) and (2) and therefore gives the geometric mean of L and C.

Finally, taking the usual wavelength equation

$$\lambda = 1885\sqrt{LC} \quad . \quad . \quad (8)$$

we get

$$\log\lambda = \log 1885 + \tfrac{1}{2}\log L + \tfrac{1}{2}\log C \quad . \quad (9)$$

Here the reading required will be higher up the middle scale than that obtained in the previous case by a distance log 1885. Hence, to obtain the reading directly the whole scale may be supposed shifted down by this amount so that division 1885 of the middle scale will come into alignment with divisions 1 of the other two. Since, however, the logarithms of successive multiples of 10 differ only by unity, the decimal part being the same, so that the scales are repeated at these intervals, this operation is equivalent to bringing division 1·885 into alignment and multiplying all the readings of the middle scale by 1,000.

Convenient scales can be obtained by multiplying the readings of the L scale by 100, dividing those of the C scale by 10,000 and therefore dividing the readings of the λ scale by 10. The final result is shown in Fig. 2, in which the C scale is also marked in micro-microfarads ($\mu\,\mu F$), for which unit the numbers are the same as those on the L scale.

If one or both of the values lie outside the scales, the readings may be suitably altered by noting that if the numbers on the L scale be multiplied by 10^m and those on the C scale by 10^n, then the numbers on the λ scale must be multiplied by $10^{\frac{1}{2}(m+n)}$, as may be seen by equation (2).

Thus if $m = 2$ and $n = -4$, then $\frac{1}{2}(m+n) = -1$, so that the λ readings must be multiplied by 10^{-1}, *i.e.*, divided by 10, as was done to obtain Fig. 2.

Obviously $m + n$ must, for convenience, be an *even* number, to avoid the awkward multiplier $\sqrt{10}$. As examples take :—

(1) $L = 1{,}000\ \mu H$, $C = 0{\cdot}0002\ \mu F$ (or $200\ \mu\,\mu F$).
The join AB of these readings meets the middle scale at $\lambda = 845\ m$.

(2) $L = 100\ \mu H$, $C = 0{\cdot}0002\ \mu F$.
The join $B\,C$ gives $\lambda = 267\ m$.

(3) $L = 1{,}000\ \mu H$, $C = 0{\cdot}002\ \mu F$.
These values being 10 times those in (2), the reading of the middle scale must be multiplied by 10, giving $\lambda = 2{,}670\ m$.

In a similar manner, if any two of the three quantities L, C and λ are given, the third may be found.

This abac was made by cutting strips from a sheet of logarithm paper and pasting them on a piece of cardboard. A disadvantage of this method is that the paper stretches somewhat, and, if the stretch is not uniform throughout, this would lead to slight inaccuracy.

The obvious, though longer, method, is to mark off the scales on ordinary squared paper from a table of logarithms or to transfer to a piece of plain paper, the divisions of a slide rule. But, to save all trouble, a sheet of logarithm paper could be used by merely numbering the divisions on three equidistant parallel lines if all readings on the λ scale are increased or decreased, as the case may be, by an amount corresponding to the constant distance log 1·885. This could be effected by the use of a piece of thin card or celluloid cut to length or having on it two marks at the required distance apart.

Journal of The Radio Society of Great Britain.

Some enquiries from members of the Society have indicated that they are unaware that, at the last Annual General Meeting it was announced that in future the Journal of the Society would be published in half-yearly volumes instead of more frequently as in the past. This explains why it is that copies of the Journal have not been circulated recently.

The volume for the past session, however, is now in preparation and will be circulated shortly.

"5 WS."

THE SUCCESSFUL TRANSATLANTIC TRANSMITTING STATION OF THE RADIO SOCIETY OF GREAT BRITAIN.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

(Continued from p. 789 of previous issue.)

The filament lighting current was obtained from a transformer fed from the 50 cycle supply. It was, however, desirable to earth the junction point of the secondaries of the two H.T. transformers, otherwise we might subject the windings to a greater voltage than that for which they were insulated. Hence the secondary of the filament transformer must be insulated from earth for the full rectifying voltage, and we had some trouble at first in getting adequate insulation at that point. As we were somewhat pressed for time, the difficulty was overcome at first by supplying the rectifying valve filaments from accumulator batteries. We had a 20-volt accumulator battery which we fitted up on a wooden platform and some insulators to insulate it from earth, and in that way fed the filaments of the rectifying valves without any fear of breakdown to earth. It was for this reason that we had to arrange for the charge to be put back into the batteries between each transmission. The two valves each took about $5\frac{1}{2}$ amperes filament current, and this needed to be put back again fairly quickly. We actually charged the batteries at 10 amperes, but difficulty arose owing to the short time of preparation beforehand, during which we pretty well exhausted the batteries, so that it was necessary to put in some charge each time before we took some out to light the valves, since we had no time to get a full charge into the battery. Mr. Fogarty, of the Zenith Manufacturing Co., Ltd., eventually made up a special transformer for us with heavy insulation between the windings, and we then got the circuit to stand up to the rectified voltage, so that half way through the tests we changed over from the battery lighting of the rectifier filaments to A.C. lighting. This made no difference to the running of the set to any appreciable extent, but eliminated the battery charging troubles.

I am explaining these things as we did them because it thus gives a better idea of how the arrangements were made, and also because I wish to show you that the set was in no way fitted in an elaborate manner. It was really a rush job put together with the idea of getting something to work rather than something nice to look at.

The oscillation circuit used was of a more or less conventional type. In the main three types of circuit were tested, and eventually transmission was effected with the third one since it was the simplest and as effective as the others. The first type of circuit was of the "anode tap" variety, with anode and grid tappings on to the aerial tuning inductance. Two T4A valves of the M.O. Valve Company were connected in parallel for the oscillators.

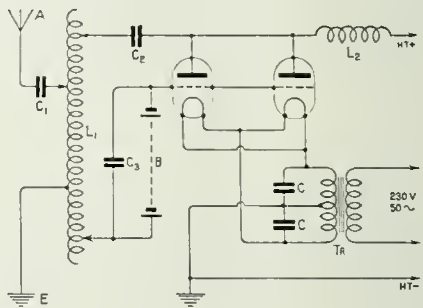


Fig. 5. First type of oscillation circuit.

Each of these valves was capable of dissipating about 450 watts on its anode, so that by limiting our input to a kilowatt nothing serious happened to the valves if they stopped oscillating, the valves being thus capable of dissipating the whole of the energy on their anodes without being damaged. The anodes just began to show red under these conditions, so that under normal working conditions when the energy was passing out into the aerial the valves were quite cold.

In the first place we used the arrangement sketched in Fig. 5, the H.T. supply being drawn from the terminals of the smoothing condensers shown in Fig. 4, through a radio frequency choke L_2 on to the anode of the oscillator valve. An adjustable potential was at first applied to the grids of the valves by means of the battery B. That was the first type of circuit employed, but as I said, at the time we were not satisfied with the aerial current, though, as we afterwards found, it was nearly as large as was obtainable from the set, so we tried other arrangements.

A series condenser was used in the aerial circuit, since the aerial is quite a large one for operating on 200 metres, its fundamental being fully 200 metres. This series condenser was 0·0005 microfarad capacity, and was designed to carry up to 10 amperes at any voltage not exceeding about 10,000 volts. At these frequencies and by using that condenser we were able to get more inductance into the aerial circuit, since by its use we considerably reduced the effective aerial capacity. It is frequently thought that the use of a shortening condenser is undesirable on 200 metres, but I do not think this is really so to any serious extent providing one does not introduce any losses in the condenser. The fact that one can get more current into an aerial by that means, means that more energy must be radiated from the aerial, since the ordinary transmission formula shows that the signal strength depends upon the product of the current at the base of the aerial and the effective height of the aerial.

For the oscillation circuit we had a choice of three inductances, one being in the form of a solenoid of copper strip about 15 ins. diameter, the strip being about $\frac{3}{8}$ in. × $\frac{1}{16}$ in. with about $\frac{3}{8}$ in. spacing. We had also one wound in strip 1 in. × $\frac{1}{16}$ in. and one similar to the one I first mentioned, but with a smaller diameter. The effect of changing from the inductance wound with $\frac{3}{8}$ in. × $\frac{1}{16}$ in. copper to the one in 1 in. × $\frac{1}{16}$ in. strip was quite marked, the heavier copper strip giving a lower resistance and appreciably more aerial current.

With this first circuit it was found difficult to prevent loss of the 200 metre energy back on to the condensers of the H.T. supply as the frequency being so high (a million and a half per second) very small capacities will draw off considerable current. Hence eventually we used the circuit shown in Fig. 6, in which the H.T. supply was connected between the valve filaments and the mid point tapping of the tuning inductance, thus keeping it entirely at a point of low radio-frequency potential. We then used a coupled circuit for the aerial through the shortening condenser, and made a separate oscillation circuit through a separate condenser C_2 (Fig. 6), which formed the oscillation circuit with the coil L_2. We could then get the valves to oscillate at the desired wavelength independently of the aerial, and then couple up the aerial circuit afterwards. As this was done the current in the oscillation circuit fell from about 25 or 26 amperes to about 5 or 6 amperes as the aerial drew the energy out of the circuit.

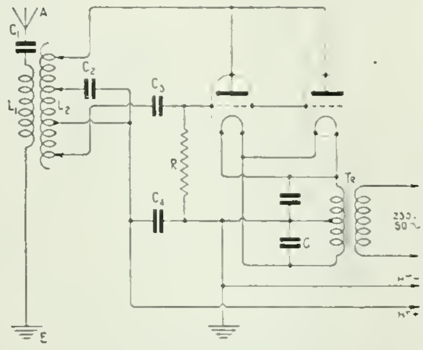


Fig. 6. Final type of oscillation circuit.

With this arrangement we eventually obtained $4\frac{1}{2}$ amperes in the aerial. This did not seem much at the time, but we took some approximate measurements of the effective resistance of the aerial and found it about 30 ohms, so that with 4·5 amperes we had something of the order of 700 watts of high frequency energy in the aerial or were therefore getting an efficiency from the valves to the high frequency energy in the aerial of something of the order of 60 per cent. These are only rough figures, as we did not take any exact quantitative measurements. Thirty ohms sounds rather high for a transmitting aerial, but as it was almost a vertical aerial, its radiation resistance might be expected to be of the order of 25 ohms. The grid condenser shown in Fig. 6 was eventually made about 0·0025 microfarad with a grid leak of 30,000 ohms.

So far I have not mentioned how we keyed the circuit. Transmission was only by means of Morse transmission, and therefore some method of keying was necessary. The commonly adopted methods are keying either in the grid circuit or in the H.T. supply to the oscillation valves. We had not the time available or the apparatus to fit up special keying arrangements with extra keying valves, etc., nor did we fancy a hand key operating on 6,600 volts, so we eventually adopted the rather crude method, but still an effective one, of keying in our main 100 volt supply circuit from the 350 cycle generator. The key rather tended to stick a little, and one or two operators had difficulty in transmitting for that reason, but on the whole the signals appeared to be quite clear cut. The charge in the smoothing condensers was sucked out very quickly by the valves, and as these smoothing condensers were fed at 350 cycles, even if two or three cycles of the 350 cycle supply were necessary to charge them up, this is quite a small period and not noticeable at ordinary hand speed Morse. The method, of course, would not be suitable with a low frequency supply, but at 350 cycles it worked quite well.

The general arrangement of the parts of the set can be gathered from the remaining photographs. Fig. 7 is a general view of the inside of the cabin. The hut we used, as can be seen, is not a very large one, and the photographer had some difficulty in taking photographs at all, but eventually obtained quite good ones. The supply from the Power Company came in at the right-hand side, and beneath it is the generator unit to which I have already referred (Fig. 2). The driving motor and the generator of this unit can be seen on the right in the background. The valves are on the framework on the left, and the lead-in can be seen behind them. The key, mounted on a convenient packing case, can be seen in the centre.

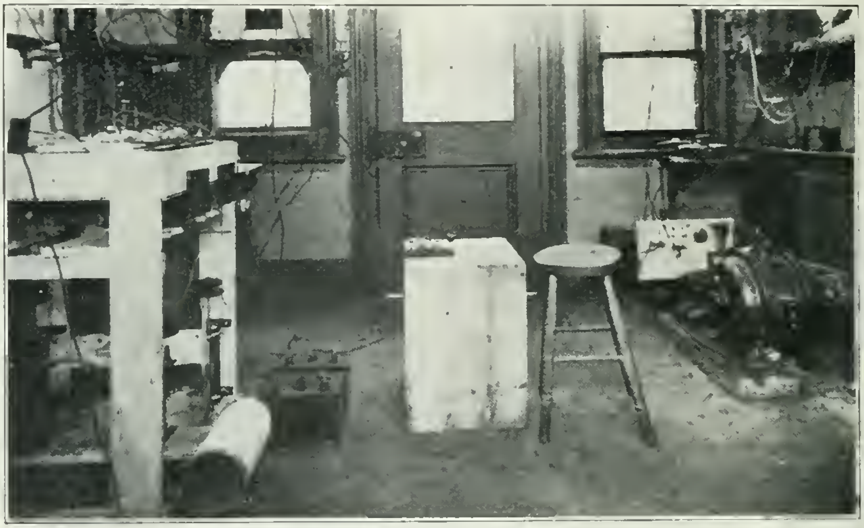


Fig. 7. General view of the interior of the station.

Fig. 8 shows the framework on which the valves were mounted. It is quite a rough one, knocked up from wooden strips, the frame being some 3 ft. 6 ins. high, and somewhere about 2 ft. 6 ins. square. Four valves were mounted in it, between the framework at the top and a second framework fixed about 1 ft. down. The filament lighting transformers can be seen at the base of the stand, and the rheostats were attached to the uprights. Where insulation was required it was provided by means of small strips of ebonite screwed on to the wood, and carrying screws and nuts or terminal connections. The switch mounted on the right of the framework supplied the 200 volts A.C. current to the primaries of the two filament lighting transformers. In the lower right-hand corner can be seen one corner of one of the two H.T. transformers which supplied the rectifiers. The H.T. smoothing condenser bank was on the floor, and can be seen in the background. One had to look where one trod with these things, and space being limited, it was necessary to walk warily. The milliammeter in the plate circuit of the oscillator valve was also on the floor, and can just be seen on the right of the photograph.

Fig. 9 shows the corner of the hut in which we actually produced the oscillations. The inductances I have already referred to can be seen, the lower one forming the main oscillation circuit inductance, while the upper one was in the aerial circuit. The grid leak can be seen hanging from the earth wire which is joined to the midpoint of the filament lighting transformer, and is connected at its lower end to the grid condenser. The condensers in the grid circuit, oscillation circuit and aerial circuit can be seen arranged around the inductances; the condenser standing on a porcelain insulator to keep it well away from earth is the aerial shortening condenser. An aerial ammeter was put in the circuit when required for tuning up.

These photographs may give, perhaps, just a little idea of how the set was arranged, and serve to emphasise the fact that the installation was by no means a finished one, but was just put together from whatever materials were most readily available in the time at our disposal.

Before concluding it may perhaps be worth while mentioning where the set was heard. We transmitted for ten nights at a different time period each night, and our signals were heard on four nights out of the ten by ten different American amateur stations.

They heard our code word transmiss'ons, and practically the whole of the transmissions made on these four occasions, the signals being apparently quite good on a single detector valve.

They blame themselves for not hearing more of our signals, because their own transmitters would not stop work. So many of them were busy on 200 me res carrying on their ordinary League traffic, so that apparently reception of our signals was rendered extremely difficult through the jamming. We were heard by ten stations located in various parts —Rhode Island, Connecticut, Massachusetts, Schenectady, Pennsylvania, New York, New Jersey, and so on, mostly by stations in the neighbourhood of the Atlantic seaboard. The

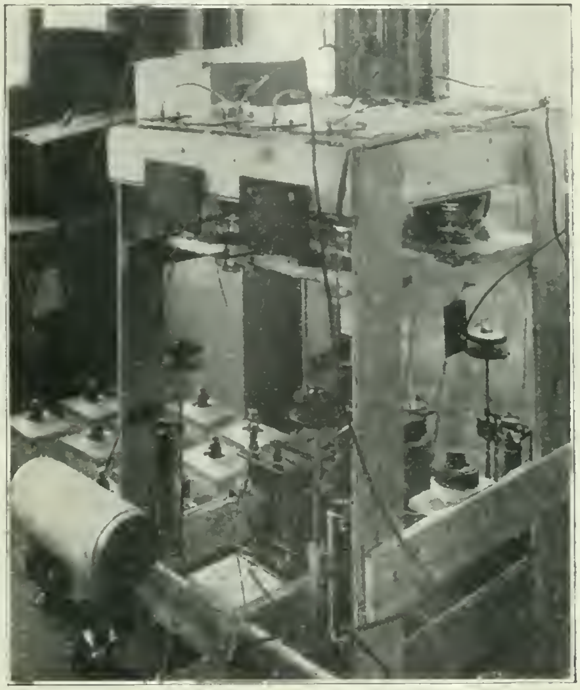


Fig. 8. The valve mounting.

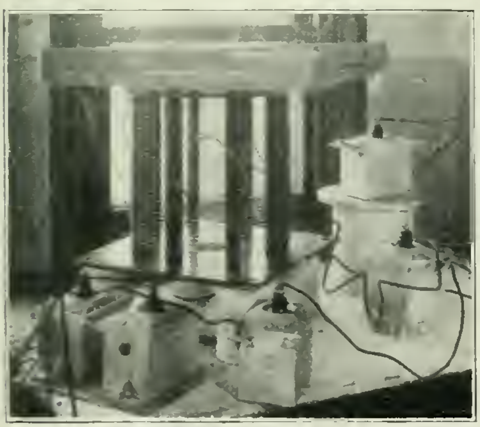


Fig. 9. The transmitting inductances and condensers.

Americans also reported hearing 8 AB, the French station owned by M. Léon Deloy, who was reported on three nights. His code words and one hour's transmission on one night were copied. On the other two nights he was reported on a wavelength different to that on which he was transmitting, and apparently sending with a marking and spacing wave, which he was not doing. The Americans think that one of their own friends was having a joke with them on these two occasions. They also reported signals from a station 2 FZ. Now 2 FZ is a call sign which is allotted to the Manchester Wireless Society for a portable station, and we have been informed that that call sign was not used at all by the Manchester Society during the tests, and the times at which they were reported were times when they were not supposed to be working. Hence one is for the present led to the conclusion that these signals too were probably also the work of American amateurs.

This leaves us then with the verified receptions of 5 WS and 8 AB. 5 WS being Wandsworth station, so that we were apparently the only British station which got across with the complete code word and other transmissions.

Our signals were also reported from an operator in Iceland who listened in for a couple of nights and heard us with a single valve. We have also been reported by ship's operators from a little way outside New York.

That I think summarises the main parts of our little effort at transmitting across the Atlantic. The main object in doing so was to show the Americans that we could transmit as well as we could receive, and the fact that we did produce good signals in America, signals which were apparently readable quite strongly on a single valve circuit, shows that apparently we got the energy into the æther and that it got across. Whether it could be repeated every night over a prolonged period is another question, since these tests are by no means of a commercial nature.

Signals from American broadcasting stations are heard by amateurs in this country pretty well every night. There are, of course, bad nights when nothing comes through, but they seem to be somewhat rare at the present time. The transmission quality fluctuates a good deal, and the American Radio Relay League is quite keen on further co-operation with us as much as possible, in order to investigate the question of transmission on short waves over long distances, and to see how such transmissions vary, and when they vary; while it would also be nice to know why they vary. One puts it down to the Heaviside Layer, but that does not tell us a great deal.

The transmission of amateur signals has now been effected over many thousands of miles (one of the American stations that was heard on this side was at least 4,000 miles away). The Americans have also spanned the Pacific with their signals, having been heard off the Japanese coast, and also in the neighbourhood of Australia, so that it seems as if the various amateur organisations, if proper facilities are granted to them, can, at least under favourable conditions, transmit their short-wave signals a good proportion of the whole way round the earth if the organisations in the various countries are allowed to co-operate with one another.

(The Discussion which followed the reading of this Paper will appear in the next issue.)

Who Invented Super-Regeneration?

Readers will remember that in the issue of *The Wireless World and Radio Review* for January 20th, page 546, a letter from Mr. P. W. Harris, a contributor to this journal, was published, in which mention was made of the fact that the solicitors to Captain Bolitho had communicated with him, and referred to Captain Bolitho's patent, No. 156330, which they stated covered the principles of the super-regenerative circuit described by Mr. Harris in this journal.

In this connection, therefore, it is thought that the following letter, published in the *New York Daily Mail* recently, may be of interest to readers, since it sets forth the views of Mr. E. H. Armstrong on the matter. The letter is dated January 19th, 1923, and is addressed to the Editor, the Radio section of the *Evening Mail*. The text is as follows:—

SIR,—In your issue of January 13th last, under title of "Who Discovered Super-Regeneration?" I note you make the following statement:

> "Major Edwin H. Armstrong, contrary to the announcement made public last summer, was apparently not the first to discover the principle of super-regeneration.
>
> "That honour, judging from facts unearthed by *The Evening Mail*, belongs to John Bruce Bolitho, an Englishman."

If the editor will read my paper published in the "Proceedings" of the Institute of Radio Engineers of August, 1922*, a copy of which I am sending you herewith, he will find that his investigation was quite unnecessary as Bolitho's work is described, his British patent number referred to, and due credit given to his contribution.

If the editor will read still further he may be spared the trouble of still further investigation, as he will find that the work of another Englishman, Laurence B. Turner, who preceded Bolitho in the "trigged valve art," and upon whose work Bolitho built, is also fully discussed, and reference made to his patent.

Then, without investigation, the editor will have thrust upon him the claims of other inventors, who now, when the "farthest north" is reached and the complete theory formulated, are preparing to contest priority.

As Charles V. Logwood, through his attorneys, Darby & Darby, has now made such formal claim, we are preparing to try out the question before the proper tribunals, and the question will be definitely settled. Upon the completion of these proceedings, I will be very glad to advise you of the result.

Meanwhile, permit me to state that your account of the manner in which I made the discovery of super-regeneration is not correct, and as I have never made public the story I am at a loss to understand on what your account is based.

In all fairness may I ask that the same prominence be accorded this letter as was given to your article.

Very truly yours,

(Signed) EDWIN H. ARMSTRONG.

* For abstract, see *The Wireless World and Radio Review*, page 234, November 18th, 1922.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letter and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

A meeting of the Society was held on Tuesday, February 13th, when Mr. George Newby delivered a lecture on "Frame Aerials and Loud Speakers." The various forms of frame aerials and their directional properties were discussed.

On Wednesday, February 21st, in the Society's clubroom, an interesting lecture on "Direction Finding as Applied to Aircraft" was given by Mr. Eskdale, of Bradford. Mr. T. Brook was in the chair. Mr. Eskdale explained the various methods used, illustrating his remarks with circuit diagrams on the blackboard.

Sutton and District Wireless Society.*

Hon. Secretary, Mr. E. A. Pywell, "Stanley Lodge," Rosebery Road, Cheam, Surrey.

Meetings are held on the second and fourth Wednesdays in the month, at 8 p.m., at the Adult School, Benhill Avenue, Sutton (near tram terminus), and all those interested in radio work in the district are invited to join.

At the meeting held on Wednesday, February 14th, a lecture was given by Mr. Bentley of Messrs. Dickie & Co., Streatham, on "The Care of Accumulators." Some of the latest types of accumulators were exhibited, together with sections of plates, and a very interesting discussion followed.

Ilkley and District Wireless Society.*

Hon. Secretary, Mr. E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

On Monday, January 1st, Mr. E. Shackleton gave a lecture before the Society on "Inductances," the various types being treated in historical sequence and their relative advantages explained.

A general meeting of the Society was held on Monday, January 14th, at which Dr. J. B. Whitfield presided. Following the meeting, Mr. J. C. Croysdale, of the Leeds and District Amateur Wireless Society delivered his lecture on the "Armstrong Super-Regenerative Circuit."

On Monday, February 5th, an enjoyable evening was spent listening to the broadcasting programmes on a Gecophone receiver and loud speaker lent by Messrs. Francis Law, Ltd.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

On Tuesday evening, February 13th, the fortnightly lecture was given by E. Blakemore, Esq., A.M.I.E.E., A.Amer.I.E.E., the subject being "The Theory of the Condenser."

Demonstrations with electrical apparatus served to illustrate the lecture, and marked appreciation of Mr. Blakemore's discourse was shown by the large audience present.

The Portsmouth and District Wireless Association.*

Hon. Secretary, Mr. S. G. Hogg, 9, Pelham Road, Southsea.

A meeting of the Association was held at the Clubrooms on February 7th with Mr. J. H. C. Harrold, A.M.I.R.E., in the chair. Mr. A. Gall, the Treasurer of the Association, gave a most interesting talk on "Hints to Amateurs."

After the lecture, an auction sale of component parts was held.

The Secretary would welcome enquiries regarding membership of the Club.

Woolwich Radio Society.*

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.

On Wednesday, February 7th, through the courtesy of one of the staff of the Western Electric Company, who kindly lent a new Western Electric loud speaker and two-valve power amplifier, the members enjoyed a demonstration of the powers of the new instrument, and comparison was made with the Amplion loud speaker, kindly lent by Mr. Everitt.

The Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

The bi-monthly meeting of the Leicestershire Radio and Scientific Society was held on Monday, February 5th, at Headquarters, the *Mercury* Office, Mr. C. T. Atkinson, President, taking the chair at 7.30 p.m.

Mr. Dyson, Vice-President, delivered his lecture entitled "How to Make an Efficient Receiver out of Scrap," explaining how the average amateur can become the possessor of an efficient receiver at a minimum cost. An appreciative discussion followed, the proceedings terminating at about 10-30 p.m.

The Society still has plenty of room for new radio enthusiasts, and full particulars can be obtained from the Hon. Secretary.

Southport Wireless Society.*

Hon. Secretary, Mr. E. R. W. Field, 26, Hartwood Road, Southport.

Great interest has been manifested in the recent American amateur tests, and two members of the Society, Messrs. Briggs and Hough, logged over 200 separate stations and 395 separate messages. Another member, Mr. Fielding, on a single valve set, has received over 50 stations. Quite a dozen members report frequent reception of American broadcasting stations, in several cases so strong that loud speakers have been used.

Over 60 persons were present at a social and whist drive held on January 9th.

On January 15th a lecture was given by Mr. J. Briggs on the "Development of a Circuit," the lecturer explaining the uses of each separate part of a set. An appreciative discussion followed.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

On February 7th, a meeting of the Society was held under the chairmanship of Mr. G. G. Boullen, when Mr. J. Morris, Jr., gave his paper on "Home Constructed Apparatus and Data for Honeycomb Coil Winding."

The next meeting was held on February 14th, when Mr. Southern, of the D.P. Battery Co., Ltd., gave a paper on "Accumulators." As may be imagined, this subject proved of great interest to all present, and Mr. Southern concluded his paper with a number of useful hints for experimenters on the care of accumulators.

In the near future an interesting paper will be given by Mr. Vernon, of the G.P.O., Manchester, on "Multiplex Telegraphy as Applied to Land Line Working."

Streatham Radio Society.*

Hon. Secretary, Mr. S. C. Newton "Compton," Pendennis Road, Streatham, S.W.16.

The first annual dinner of the above Society was held upon February 14th, when 52 members and friends, including ladies, sat down to an excellent repast at the Telegraph Hotel, Brixton Hill. The Chairman of the Society, Mr. H. Bevan Swift, presided. After the toasts, the evening concluded with a concert contributed by various members and guests.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

On Friday, February 16th, Mr. A. H. Norman read his paper on "The Armstrong Super-Regenerative Receiver."

Owing to the non-completion of the set forming the title of the paper, a practical demonstration was not possible, but the paper proved of great interest, diagrams of the various circuits being projected on a screen.

After the discussion, a short address given by Dr. J. A. Fleming on the "Thermionic Valve," transmitted by the London Broadcasting Station, was received on the Society's set.

The Fulham and Putney Radio Society.*

Hon. Secretary, Mr. J. Wright Dewhurst, 52, North End Road, West Kensington, London, W.14.

The above Society has been reorganised, and a new Committee formed with the intention of running the Society on up-to-date lines. At a meeting held at headquarters on Friday, February 16th, Messrs. R. H. Redmond, T. Hart Smith and E. M. Wolfe, M.B.E., were elected Vice-Presidents. A demonstration was given by Mr. Pincott with his four-valve set and loud-speaker, made by himself, and at 9.30 p.m. Mr. Hubbard, **2 XO**, a member, transmitted speech and music from his station.

The Thames Valley Radio and Physical Association.*

Hon. Secretary, Mr. Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

On Thursday, February 15th, the Association met in their Headquarters at the Hut, Wigan Institute, at 8 o'clock, Mr. C. Appleton-Smith taking the chair. The Chairman called upon Mr. J. Wade (of the M.O. Valve Co.) to give his lecture on "Valves, and their Manufacture," and this proved to be both interesting and instructive.

The Association covers the districts of Barnes, Mortlake, East Sheen, Richmond, Twickenham, St. Margarets, Teddington and Kew.

Guildford and District Wireless Society.*

On Monday, February 19th, the Club assembled for the first regular meeting at their new premises (148, High Street) to hear a paper read by Mr. P. K. Turner on "Aerials and Aerial Circuits." Mr. Turner dealt very fully with his subject, devoting the greater part of his time to a consideration of the outside aerial.

The Willesden Wireless Society.*

Hon. Secretary, Mr. G. D. Wyatt, 70, Craven Park, Harlesden, N.W.10.

A very interesting meeting was held on January 30th last, when Mr. Wyatt gave an instructive lecture regarding the club's three-valve set. It was decided at this gathering that the meetings should in future be held fortnightly instead of weekly as hitherto.

On February 13th, Mr. Picker proved himself a most able exponent of the various methods of high frequency amplification, and in order to demonstrate the efficiency of those methods, kindly brought along his own set.

It is confidently anticipated that in the very near future a "bumper" lecture and demonstration will be given at the Society's headquarters at the Harlesden Public Library. Further particulars regarding this demonstration will be sent upon application being made to the Hon. Secretary at the above address.

Paddington Wireless and Scientific Society.*

Hon. Secretary, Mr. L. Bland Flagg, 61, Burlington Road, Bayswater, W.2.

A well-attended meeting of the Society was held in the Physics Theatre of the Paddington Technical Institute on the evening of February 1st, Dr. J. H. Vincent, M.A., D.Sc., M.I.E.E., being in the chair. The meeting received with interest the report of Mr. G. Turton, the Society's delegate to the Radio Society of Great Britain's Annual Conference. Designs for the Society's apparatus were submitted by Messrs. Beak and Turton, and volunteers were forthcoming to commence building.

Fine signals are reported from those of the members who have used the new aerial, and the amount of time that was devoted to its erection has been voted well spent.

A few words by the Hon. Secretary on what he had seen on his recent visit to Northolt Wireless Station brought to a close a very enjoyable evening.

The Finchley and District Wireless Society.*

Hon. Secretary, Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3.

Several new schemes were discussed at the Society's meeting on Thursday, February 22nd, at St. Mary's Schools, when Mr. Brown took the chair, and two new committee members were elected to fill vacancies. The club set was operated and gave the usual good results.

Exeter and District Wireless Society.*

Hon. Secretary, Mr. F. S. Valentine, 10, College Avenue, Exeter.

At the meeting of the Society held at 31, Longbrook Street, Exeter, on February 12th, a lecture was given by Mr. W. Smitham on "The Principles of Wireless," in which he outlined the principles of radio transmission and reception.

"Bridge and Megger Testing" was the subject of a very instructive lecture and demonstration by Mr. Parkhouse at a meeting on February 19th. Various questions were asked during the interesting discussion that followed.

Prospective members are invited to communicate with the Secretary.

The Wireless and Experimental Association.*

Hon. Secretary, Mr. Geo. Sutton, 557, Lordship Lane, S.E.22.

The Association met at the Central Hall, Peckham, on February 7th, when a general discussion took place on such topics as appeals for wireless help, the library and subscriptions, the best resistance for a potentiometer across an accumulator, the best proportion primary to secondary for a tuner, the practical efficiencies of single, double and triple wire aerials, and multiple magnification with one valve.

Stratford-on-Avon and District Radio Society.

Hon. Secretary, Mr. E. W. Knight, 17, Park Road, Stratford-on-Avon.

The fourteenth general meeting of the above Society was held on Monday, February 12th, at headquarters, with Mr. F. A. Sleath in the chair.

A lecture on "The Single Valve Rectifying Panel" was delivered by Mr. Sleath, who dealt in a simple and concise manner with the parts required and their function. A very successful evening was concluded by switching on the club set and listening to the close of **5 IT**'s concert.

"The Construction of a Variometer and Its Use" was the subject of an address by the Secretary at the fifteenth general meeting held on Monday evening, February 19th, at the Rother Street headquarters, various parts of the instrument being passed round for inspection. The winding of "honeycomb" inductances, both by hand and machine, was also dealt with. A receiving set made by a member was inspected, tested, and coupled to the aerial, good results being obtained.

Bath Radio Club.

Hon. Secretary, Old Red House, New Bond Street, Bath.

On February 6th, a special social evening was held at the Old Red House, New Bond Street, Bath, the headquarters of the Bath Radio Club. Although membership of the club is confined to men, ladies were made specially welcome to this function, and dancing was predominant among the features of the evening.

At the club meeting on February 14th, Mr. L. E. R. Boxwell, of Bradford-on-Avon, Wilts., continued his series of lectures to the members. Mr. Boxwell, whose instruction is proving so popular, dealt with the thermionic valve.

Prescot and District Wireless and Experimental Association.

Hon. Secretary, Mr. C. E. Macaulay, 55, Central Avenue, Prescot, Lancs.

The Association had a well attended meeting at the Drill Hall, Prescot, on Wednesday, February 14th, when Mr. Geo. Sutton, A.M.I.E.E., gave a lecture entitled "Electricity in Relation to Wireless."

Councillor Cross took the chair, and a considerable amount of useful business supervened on the lecture.

Radio Society of Birkenhead.

Hon. Secretary, Mr. R. Watson, 35, Fairview Road, Oxton, Birkenhead.

A meeting of the Society was held on February 15th, Mr. Hughes occupying the chair.

A lecture on the "Electronic Theory" was delivered by Mr. McKinlay, who very lucidly dealt in turn with the atom and electron, and what is really meant by an electric current.

Now that the Society has forty members, the Secretary has been asked to apply for affiliation to the Radio Society of Great Britain.

Stourbridge and District Wireless Society.

Hon. Secretary, Mr. P. Harper, 33, High Street, Lye, Stourbridge.

At a meeting held on Tuesday last it was resolved to form a Wireless Society for Stourbridge and District, some thirty persons signifying their willingness to become members.

Colonel C. W. Thomas was unanimously elected President, Major Thompson, Harboro Hall, Blakedown, and Mr. F. Smith, late senior wireless operator, Admiral's flagship, R.N., becoming Vice-Presidents. It is proposed to affiliate with the Radio Society of Great Britain.

Trafalgar Wireless Society.

Hon. Secretary, Mr. F. A. L. Roberts, 43, Adelaide Road, Brockley, S.E.4.

Meetings are held every Tuesday at 8 p.m. at Trafalgar Hotel, Park Row, Greenwich, S.E.10.

The annual general meeting of the above Society was held at their headquarters on February 13th, 1923, Mr. R. J. Stanley (President and Director of Instruction) occupying the chair, when the election of officers for the ensuing year was proceeded with.

The President introduced the question of affiliation to the Radio Society of Great Britain, several members speaking in favour of the suggestion. Ultimately the meeting decided that the Secretary be instructed to make the necessary arrangements.

Before a well attended meeting on February 20th, Mr. R. J. Stanley gave an interesting lecture on various types of tuners used in wireless reception, giving many useful hints to members constructing their own sets, following his remarks with a demonstration on the Society's crystal set, and a L.F. amplifier unit of his own make.

The Secretary would be pleased to hear from any gentlemen who would be willing to give a lecture or demonstration before the Society.

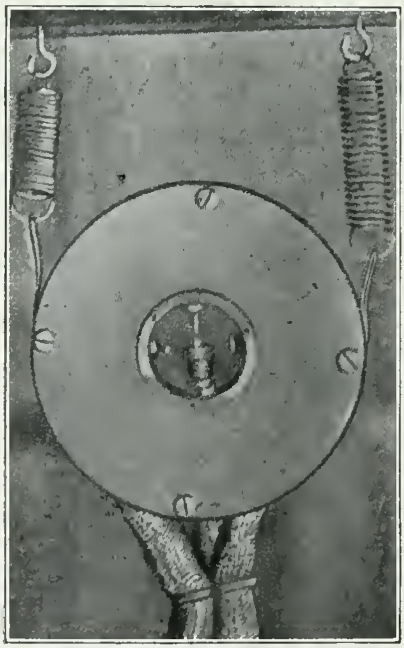
Applications for membership, which are cordially invited, should be addressed to the Secretary.

The Glow Discharge Microphone

A MICROPHONE OPERATING ON AN ENTIRELY NEW PRINCIPLE.

THE new transmitter invented by Dr. Phillips Thomas, research engineer of the Westinghouse Electric and Manufacturing Company of America, and designed essentially for broadcast purposes, is stated to practically eliminate microphone distortion, and has been used at the Westinghouse Broadcasting Station KDKA within the past few months with marked success.

The basis of the invention is the elimination of the diaphragm now used in all transmitters in practical service, which, because of its inherent inertia, is not capable of vibrating in perfect sympathy with the entire range of audible sounds. If it can transmit low notes



Photo—Courtesy, Westinghouse Electric Co.

A suspended glow discharge microphone.

successfully, it will fail on high notes ; and *vice versa*. The ordinary diaphragm is designed with reference to the middle register, and it therefore does not transmit extremely high and extremely low notes satisfactorily. The piano is a case in point. The highest notes become a series of clicks, whilst the very bass notes are reproduced as a roar.

In the Thomas transmitter, a minute electrical discharge takes the place of the

Photo—Courtesy, Westinghouse Electric Co.

Dr. Phillips Thomas, the inventor.

mechanical disc. This discharge flows between two points, separated by a fraction of an inch. It is affected by sound waves, just like the diaphragm, but being non-material and having no perceptible inertia, it responds equally well to all vibrations. Hence music broadcasted by means of it is transmitted with practically its original purity.

Dr. Thomas has recently been experimenting with his transmitter at the Westinghouse Pittsburgh Station, and within the near future all Westinghouse Broadcasting Stations will be regularly equipped with this device.

In appearance the Thomas transmitter resembles a large watch, with the front and back covered by wire gauze. On looking into it, a point of light can be seen, caused by the flow of the electric energy against one of the terminals.

The Manchester All-British Wireless Exhibition.

The Black Bess Orchestra at the Manchester Broadcasting Station.

THE Manchester All-British Wireless Exhibition and Convention, organised by Messrs. Bertram Day and Co., Ltd., 9-10, Charing Cross, London, S.W.1, was held in the Burlington Hall, Burlington Street, from the 17th to the 24th, and included in its programme a convention held under the auspices of the Manchester Wireless Society.

Exhibits were exclusively confined to wireless goods, apart from such items as bear directly on this industry, such as trade publications, etc. The needs of the public were very thoroughly catered for and every possible step taken to appeal to the interests of the purchasing public by means of practical demonstrations, displays and lectures. On the other hand, the educative side of the subject was not overlooked, and it may be stated that anyone with any wireless interests whatever, whether concerned solely with the trade or with wireless as a hobby or profession, found this exhibition a very excellent opportunity of obtaining first-hand information and up-to-date advice.

Among the principal exhibits were the following :—

Messrs. W. C. Barraclough, 61, Bridge Street, Manchester ; Messrs. J. L. Cartwright & Co., 24, London Road, Manchester ; Messrs. Hemm & Lambert, Ltd., Camp Street, Deansgate, Manchester ; Messrs. H. Clarke & Co., (Manchester) Ltd., Eastnor Street, Old Trafford, Manchester ; Messrs. Chloride Electrical & Storage Co., Ltd., Clifton Junction, Manchester ; Messrs. E. M. Evans & Sons, Ltd., 1, Lever Street, Manchester ; Messrs. Peto Scott Co., Ltd., Featherstone House, 64, High Holborn, W.C.1; Messrs. Victoria Electrical, Ltd., 1-5, Chapel Street, Salford, Manchester ; Messrs. Telephone Manufacturing Co., Ltd., 2a, Mount Street, Albert Square, Manchester ; Messrs. Mottershead & Co., 7, Exchange Street, Manchester ; Messrs. John Roberts, 261, Deansgate, Manchester ; Messrs. British Radio Sales Co., Ltd., Stevens Buildings, Gresse Street, Rathbone Place, W.1 ; Messrs. Meager & Ratcliffe, 221, Deansgate, Manchester ; Messrs. Finnigans, Ltd., Deansgate, Manchester ; Messrs. E. O. Walker & Co., Cannon Street, Manchester ; Messrs. Stephens Brothers, 83, Stretford Street, Manchester ; Messrs. Manchester Radio Co., Ltd., 155, Oxford Street, Manchester ; Messrs. Arc Electrical Co., Trevelyan Buildings, Corporation Street, Manchester ; Messrs. Chase Motors Co., Ltd., Sandyford Square, Newcastle-on-Tyne ; Messrs. Concordia Electric Wire Co., Ltd., Trent Mills, New Sawley, Derbyshire ; Messrs. Richard Whaley, Ltd., New Islington, Manchester ; Messrs. W. T. Rawcliffe, Ltd., Salford, Manchester ; Messrs. The Wireless Press, Ltd., 12-13, Henrietta Street, W.C.2 ; Messrs. The Trader Publishing Co., Ltd., 139-140, Fleet Street, E.C.4 ; Messrs. Fullers United Electric Co., Ltd., Woodland Works, Chadwell Heath, E. ; Messrs. Northern Radio Co., 96, Arcade Chambers, St. Mary's Gate, Manchester ; Messrs. Barrett & Elers, Ltd., Wallis Road, E.9 ; O.C. 42nd (East Lancs) Divl. Signals, Captain Monks, Burlington Street Drill Hall, Manchester ; Messrs. Bertram Day & Co., Ltd., 9 and 10, Charing Cross, S.W.1 ; Messrs. Odhams' Press, Ltd., 84-95, Long Acre, W.C.2 ; Messrs. A. Franks, Ltd., 95, Deansgate, Manchester.

Notes

Midday Broadcasting.

The British Broadcasting Company has received permission from the Postmaster General for the permanent transmission of concerts between 11.30 a.m. and 12.30 p.m. from all the Company's stations.

Broadcasting in Norway.

It is proposed to erect broadcasting stations at Christiania, Bergen and Trondhjem and application for the necessary licences has already been made by the Norwegian Marconi Company and the Morse Telegram Bureau.

Madagascar Wireless.

Work is proceeding rapidly on the construction of a high power wireless station at Antananarivo, on the central plain of Madagascar. The antenna system consists of eight pylons, 795 feet high, and when the surrounding buildings are completed they will house the fifty white members of the staff and 500 natives. The station will not be ready for several months.

A rival to the barrel organ. The latest product of Burndept, Ltd. It contains an Ethophone V, with power amplifier and two loud speakers.

The Glasgow Broadcasting Station.

A few details of **5 SC**, the new Scottish station opened on March 6th, will be of interest. The studio, which is modelled on lines similar to the other stations of the British Broadcasting Company, is situated at 202, Bath Street. The

The opening of the Glasgow Broadcasting Station by Lord Provost Paxton. Many well-known gentlemen associated with the broadcasting enterprise can be readily recognised.

microphones are connected to a three-stage amplifier, which communicates by underground cable with the transmitting station at the Port Dundas Electricity Works. The transmitting installation is on the second floor of the electricity works tower, between which and one of the tall chimney stacks the aerial is suspended.

The newly appointed Director of the Glasgow station is Mr. Herbert A. Carruthers, a musician of high repute in the city. After seeing a great deal of active service in France, Mr. Carruthers came to Glasgow, when he was appointed organist in the Park Parish Church, a position he still holds. He has recently been in London studying broadcasting organisation and the compilation of programmes.

Eiffel Tower Time Signals Re-transmitted from Manchester.

The Manchester Broadcasting Station is re-transmitting nightly the time signals sent out from Paris. The Eiffel Tower wavelength being 2,600 metres, a reduction has to be effected for transmission on 385 metres. This is done automatically, and the consequent lag is only 1/300th of a second. The aerial used at Manchester for this purpose is a small one running almost underneath the main transmitting aerial at Trafford Park.

No Broadcast Concerts for the Navy Yet.

The fitting of warships with broadcast sets has not as yet been found possible by the Admiralty, says the "Navy," the organ of the Navy League. One reason, that the public expense would not be justified, is supplemented by the possibility of undesirable effects on the service apparatus, and the question is undetermined. On the other hand, the U.S. Navy Department are broadcasting monthly concerts for the benefit of the American Navy.

An International Language for Radio.

Venice will be the scene, during Easter, of an International Commercial Conference, which will discuss the need for an international language for commercial purposes. Chambers of Commerce, Rotary Clubs, and other public commercial bodies, will be sending delegates to take part in the discussions. One of the subjects to be considered will be the utilisation of Esperanto for Wireless

Telegraphy and Telephony. The need for an international language for radio will become more and more acute as the means of intercommunication between amateurs in Europe become easier, and we trust that as a result of this conference the subject will be considered seriously by all interested in radio.

Appointment of Cardiff Station Director.

Major Arthur Corbett-Smith has been appointed Director of the Cardiff Station of the British Broadcasting Company, Limited. Amongst other things Major Corbett-Smith is M.A. (Oxon.), F.R.G.S., Barrister-at-Law, Major, R.F.A., Officer de l'Instruction Publique, Hon. Secretary-General, The Naval and Military Musical Union, Editor, "The Journal of State Medicine," etc. Major Corbett-Smith is an accomplished musician, and has several operas and other compositions to his credit. He held a commission in the Army for many years, and much of his time was devoted to furthering musical and educational schemes amongst the troops.

A Correction.

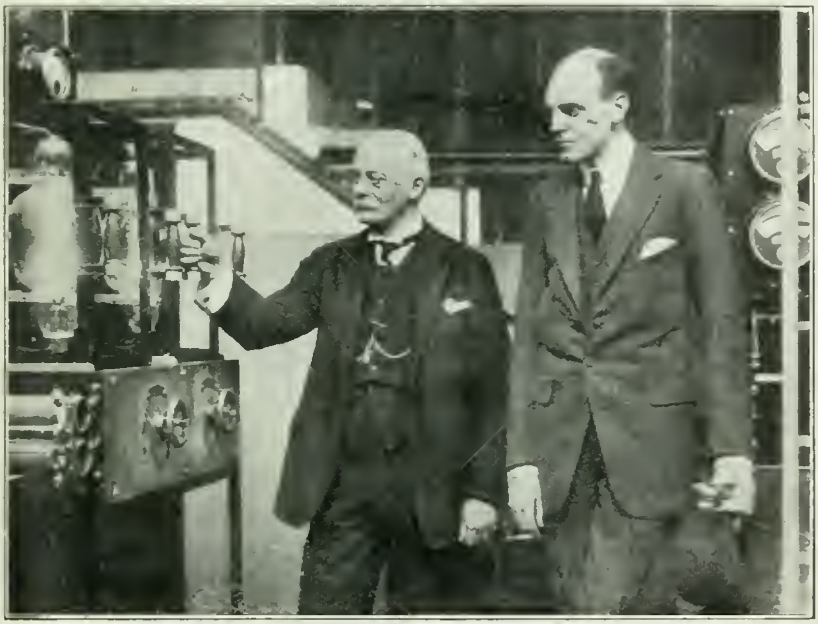
We ave been asked to state that, in the advertisement of the British Wireless Supply Company, appearing on page xxii of the March 10th issue of this journal, it should have been made clear that the words "Indoor Aerial" apply only to Newcastle and Manchester.

Marconi Wireless at Motor Club's Rally.

For some considerable time the Marconi Company have been perfecting their wireless receiving set for large cars. A Daimler car was present for demonstration purposes at the opening rally of the Junior Car Club held last Saturday at Burford Bridge Hotel, when many members of the Club listened in while travelling at speed. The results were excellent in every way, the broadcasting from 2 LO being received quite well. By arrangement with Wireless Equipment, Ltd., 2 OM very kindly gave two special transmissions.

New Sterling Instruments.

Loud speakers and power amplifiers of new design are described in an interesting catalogue (No. 347) we have received from Messrs. The Sterling Telephone and Electric Co., Ltd. The firm has also issued an attractive catalogue (No. 348) dealing with its extensive range of receiving units.



Lord Gainsford, Chairman, and Mr. J. C. W. Reith, Managing Director of the British Broadcasting Co., Ltd., at the new Glasgow station.

Interference in the Twickenham District.

The Thames Valley Radio and Physical Association is conducting a campaign in the Twickenham district in an endeavour to get in touch with some stations which are causing interference. They ask for the co-operation of all interested in wireless in this district, and hope to obviate the trouble by inducing those new to wireless to join the association and thereby acquire a better acquaintance with the proper manipulation of apparatus.

Book Received

"Sterkstroom" (Holland : s'-Gravenhage ; Amalia van Solmstraat 2-4). Price, 80 centimes. A twice-monthly periodical devoted to electricity in all its applications.

Correspondence.

To the Editor of The Wireless World and Radio Review.

Sir,—The enclosed is a photograph of my home-made receiving set, which contains two panels—a four and a five-valve—built entirely on the lines of your article "Refinements in Receiving Circuits," of February 3rd, 1923. The only part not constructed by myself is the Burndept Ethophone III, which stands on the top of the switchboard. The complete set contains: one three-valve panel, one D. and two L.F.; one four-valve, one H.F., one D., two L.F.; and the five-valve, two H.F., one D. and two L.F. The three tuners are two loose couplers and one double circuit with reaction. The condensers are of 0.001, 0.0003, 0.0002 and vernier, which are brought to plug sockets and can be used in any combination over the whole set. In the same manner any tuner can be connected in circuit with any valve panel. The sockets are at the back of the condenser block and do not show in this photograph. The switchboard naturally controls the H.T. and L.T. and local grid cells to the various panels, and all accumulators and batteries are kept in the back of the switchboard, out of sight. The "Brown" speaker can be used either with or without the Brown relay which can be seen to the right of switchboard. Telephone transformer is on left of the board and either high or low resistance telephones can be used.

R. F. Lamport.

The five receiving installation belonging to Mr. R. F. Lamport of 21, Church Street, Croydon.

To the Editor of The Wireless World and Radio Review.

Sir,—I note with interest letters by Messrs. Deloy and Tingey in to-day's issue, and should like to make a few comments.

With reference to the suggestion of prefixing the initial letter of the name of the country in front of the call letters, it will be realised that this method greatly increases the necessary call length. Take American **5 ZADA** (an actual station) and **8 RRX**. We get **A 5 ZADA** de **F 8 RRX**! Apart from the wrist exercise, the chances of getting a complete call sign from a very long distance U.S. amateur such as the above **5 ZADA**, are greatly diminished, as any who have listened to U.S.A. stations know, for the longer the call sign the harder it is to read, especially when Northolt is on. In the *Q.S.T* mentioned it was proposed to alter the "de" interval into the initial letters of the countries of the respective stations, first the called and then the calling station, *i.e.*, **5 ZADA** af **8 RRX**, They point out, however, that this is a breach of the law, which says that "de" should be used. Why not, then, call as follows: **5 ZADA** de af **8 RRX**?

This sounds rather lengthy, but is not so bad as it looks. When the "de" is omitted we are again likely to be put off into thinking that we are hearing a high power station harmonic, sending code.

I expect someone else has a better suggestion, and I hope we will hear about it.

With reference to Mr. Tingey's remarks, the following may be of interest. My station is just far enough from the Northolt nuisance for me to be able to work while he is on. Immediately he stops transmitting faint signals are doubled in strength, whether they are actually on a harmonic or not. On the last night but one of the reception tests, when so many U.S. stations were heard, everyone noticed how few harmonies were present. Also, for the short period during which Northolt worked, almost nothing was heard. It would be interesting to hear from someone near a high-power pure C.W. station, as matters are complicated by the arc and its "mush."

You may possibly be interested in the following test results recently obtained. About a fortnight ago, at 0100, while listening for U.S. amateurs and broadcasters, I heard **OMX** Amsterdam working, and, merely to show a friend how my transmitter worked, I called him. I was greatly surprised to get a reply, and we were able to work for some time though fading was bad. He was receiving me on one valve. Transmitter here was putting 0·195 into a 38-ohm aerial on 200 metres (earth lead 70 ft. long), or 1·52 watts output. Since then the aerial resistance has been reduced to 12 ohms by means of a counterpoise, so that about two-thirds of this power was wasted in ohmic losses, so that the effective power was just about 0·5 of a watt, the distance being 290 miles. The input was about 5 watts, owing to the use of an unsuitable valve without a grid leak, the set having been rigged up to work with a friend, who was also staying up, about 300 yards away. I think this is a record, so hats off to Holland !

With reference to the reception of U.S. broadcasting, I picked up a station, evidently in the U.S.A., on about 365 metres on February 3rd, 1922, at 2140 p.m., during a five-minute interval at **2 LO** The song, by a soprano, "Coming Thro' the Rye," was heard, after which the announcer said that the singer would speak, which she did. Then **2 LO** started again. My "score" so far is as follows: First telephony heard for half-an-hour. October 15th, 1922, 0015 a.m., for half-an-hour; complete programme but no call. From December 10th, 1922, to date, telephony heard on 32 occasions, **WJ 2** 30 times, **WGY** 25 times, with call letters (reports of some of this made to Mr. Coursey with trans-atlantic report). Receiver: two valves in first two cases (one rectifier, one L.F.,) and all subsequent occasions, one H.F. tuned anode and one rectifier (reaction to anode coil). Aerial crossed by phone wires. Earth lead 70 ft. long.

I hope these particulars will interest you, and I hope to see more discussion on the first two questions.

Yours faithfully,

FREDERIC L. HOGG. **(2 SH)**

Calendar of Current Events

Friday, March 23rd.

MANCHESTER WIRELESS SOCIETY.
At 3.30 p.m. At the Albion Hotel, Piccadilly, Manchester (Wireless Convention). Lecture: "Methods of Reducing Interference in Wireless Sets." By Prof. Marchant, D.Sc.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.
At 7.30 p.m. At Dept. of Applied Science, St. George's Square. Elementary Class conducted by Mr. J. G. Jackson, B.Sc.

LEEDS AND DISTRICT AMATEUR WIRELESS SOCIETY.
Lecture: "Construction of Intervalve Impedance Coils." By Mr. S. Kniveton, F.R.Met.Soc.

RADIO SOCIETY OF HIGHGATE.
Lecture: "Construction of Tuners." By Mr. J. F. Stanley.

BELVEDERE AND DISTRICT RADIO AND SCIENTIFIC SOCIETY.
Lecture: "Aerials and Earths." By Mr. H. H. Smith.

Sunday, March 25th.

From 3 to 5 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

Monday, March 26th.

From 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

IPSWICH AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At 55, Fonnereau Road. Lecture by Mr. C. A. Jamblin.

ASHTON-UNDER-LYNE AND DISTRICT RADIO SOCIETY.
At 8.15 p.m. (Particulars of venue available from Secretary). Lecture: "X-Rays." By Dr. Brice (of Dukinfield).

Tuesday, March 27th.

WEST LONDON WIRELESS AND EXPERIMENTAL ASSOCIATION.
At Acton and Chiswick Polytechnic, Bath Road, Chiswick. Lecture by Mr. O. S. Puckle.

GRAYS AND DISTRICT RADIO SOCIETY.
At 7.30 p.m. At the Victoria Hall, High Street. Ordinary Meeting.

PLYMOUTH WIRELESS AND SCIENTIFIC SOCIETY.
At 7.30 p.m. Lecture by Mr. K. S. G. Monk.

Wednesday, March 28th.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.
Elementary Mutual Instruction evening.

EDINBURGH AND DISTRICT RADIO SOCIETY.
At 8 p.m. At R.S.S.A. Hall. Lecture on "Electrical Power Meters." By Mr. J. A. Beveridge.

WOOLWICH RADIO SOCIETY.
At 8 p.m. At the Y.M.C.A., Woolwich. Demonstration of X-Rays. By Mr. A. G. Beeson.

Thursday, March 29th.

From 9.20 to 10.20 p.m. Dutch Concert from **PCGG**, The Hague, on 1,050 metres.

STOKE-ON-TRENT WIRELESS AND EXPERIMENTAL SOCIETY.
Annual General Meeting. Election of officers. Reading of winning student's paper.

LUTON WIRELESS SOCIETY.
At 8 p.m. At the Hitchin Road Boys' School. Practical Work and Experiments.

THAMES VALLEY RADIO AND PHYSICAL ASSOCIATION.
At 8 p.m. Lecture by Mr. Shaughnessy, O.B.E., M.I.E.E. (Chief Engineer, G.P.O.).

DEWSBURY AND DISTRICT WIRELESS SOCIETY.
At 8 p.m. At South Street, off Church Street. Lecture by Mr. Pettigrew (Leeds).

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	2LO	369 metres.
Birmingham	5IT	420 ,,
Manchester	2ZY	385 ,,
Newcastle	5NO	400 ,,
Cardiff	5WA	353 ,,
Glasgow	5SC	415 ,,

FRENCH BROADCASTING TIMES.

Eiffel Tower. 2,600 metres. 11.15 a.m. weather reports (duration 10 mins.) 6.20 p.m., weather reports and concert (duration about 30 mins.) 10.10 p.m., weather reports (duration 10 mins.).

Radiola Concerts. 1,565 metres., 5.5 p.m. news; 5.15 p.m. concert till 6 p.m.; 8.45 p.m. news; 9 p.m., concert till 10 p.m.

L'Ecole Supérieure des Postes, Télégraphes et Téléphones de Paris. 450 metres. Tuesdays and Thursdays, 7.45 p.m. to 10 p.m. Saturdays, 4.30 p.m. to 7.30 p.m.

The Transatlantic Amateur Tests.

SUMMARISED REPORT OF BRITISH RECEPTIONS.

By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E.

(*Concluded from page 812 of previous issue.*)

These differences may be brought out by Table VI., which gives the number of nights on which the best of the stations listed in Tables II and V were heard, the figures in this Table being extracted from Table V.

The remaining stations listed in Tables II and V were only heard on one night during the tests. Hence 60 stations were heard making their "individual" transmissions for two or more nights during the tests, *i.e.*, 63·8 per cent. of the total number reported during these individual periods.

TABLE VI.

Variation in number of nights on which individual transmissions were heard from the best stations listed in Tables II and V.

2 EL	9
2 ZK	9
2 AWL	8
2 AWF	7
3 ZW	7
8 AQO	7
1 XM	6
1 YK	6
1 ZE	6
2 BQU	6
2 GK	6
3 XM	6
2 LO	5
3 AUU	5
3 BG	5
3 ZZ	5
8 ATU	5
8 AWP	5
1 AJP 1 ASF 1 BDI 1 BGF 1 GV 2 BML 2 NZ 2 XAP 3 BGT 4 BY 8 UE	4
1 BCG 1 BEP 1 BET 1 CMK 1 CNF 1 FB 2 AHO 2 CQZ 2 GR 2 UD 2 ZL 3 AFB 3 BLF 8 BXH 8 SP 8 YD 9AL (Canada)	3
1 AGK 1 AZW 1 BCF 1 BKQ 3 CC 3 CG 3 NH 3 YO 4 EB 5 XK 8 BK 8 IB 8 XE 9 ZN	2

The names and addresses of the British amateurs (and the Dutch amateur) who reported the "individual" transmissions tabulated above, are set out below in Table VII, which also gives the number of such individual transmissions heard by each throughout the Tests.

TABLE VII

British and Dutch amateurs who reported the "Individual" Transmissions in Table II.

Total Number of Different Stations heard making Individual Transmissions (Codes, &c.).

J. Briggs	Brank House, Ainsdale, Southport	65
Manchester Wireless Society (Receptions by W. R. Burne & A. Cash)	Manchester, Lancs.	43
B. H. C. Matthews	Hillcroft, Nore Road, Portishead, near Bristol, Somerset	38
W. E. F. Corsham	104, Harlesden Gardens, Willesden, London, N.W.10	34
D. W. Walters	4, Mansel Street, Gowerton, Swansea	31
G. J. Eschauzier	19, Parkweg, The Hague, Holland	29
E. W. Penney	34, Coldrenick Street, St. Budeaux, Plymouth, Devon	27
E. J. Simmonds	"Meadowlea," Gerrard's Cross, Bucks	24
J. A. Partridge	22, Park Road, Collier's Wood, Merton, London, S.W.19	17
H. C. Chadwick	9, Raymond Street, Bolton, Lancs.	15
G. R. Lewis and D. F. Owen	10, Lansdowne Road, Ashton-on-Mersey, Cheshire	14
R. E. Williams	29, Holborn Road, Holyhead, North Wales	13
J. Ridley	"Studley," Woodside Green, South Norwood, London, S.E.25	12
F. L. Hogg	37, Bishop's Road, Highgate, N.6	11
L. J. Leslie	Fairwater, Evesham, Worcestershire	11

TABLE VII—*continued.*

F. J. Dinsdale	14, Highfield View, Stoneycroft, Liverpool, Lancs.	10
E. C. Dorling	161, Earlsfield Road, Wandsworth Common, London, S.W.18	10
A. Higson	161, Cotton Tree Lane, Colne, Lancs.	10
F. Walker	Holly Farm House, Feltham, Middlesex	9
R. S. Elven	Hurst Lodge, Waverley Grove, Hendon	8
A. G. Gregory & W. Vernon	17, Lincoln Street, Hulme, Manchester	8
A. G. Wood, A. Neilson and H. J. Swift	112, Tulse Hill, London, S.W.2	6
C. Shearston	135, Landguard Road, East Southsea, Portsmouth, Hants.	5
J. Croysdale	5, Elm Grove, Burley-in-Wharfedale, Leeds	4
M. V. Williams	3. Holmesgrove Road, Herleage, Bristol	4
—Andrews	London	2
H. Collin	Ramsden Heath, Billericay, Essex	2
A. H. Fielding	32, Stanley Avenue, Birkdale, Lancs.	2
H. B. Grylls	Trenay Fauton, Crewe Road, Eastbourne	2
F. W. Higgs and J. S. Hobbs	45, Howard Road, Westbury Road, Bristol, Somerset	2
C. E. Morris	Southernhay, Heron Hill, Belvedere, Kent	2
A. Richardson	29, Josephine Avenue, Brixton Hill, London, S.W.2	2
C. G. Williams	22, Scholar Street, Sefton Park, Liverpool	2
D. A. Brown	24, Booth Street, Handsworth, Birmingham	1
F. Foulger	118, Pepys Road, New Cross, London, S.E.14	1
A. E. Greenslade	9, Jelf Road, Brixton, London, S.W.2	1
L. Lott	Lenshop, High Street, Burnham-on-Sea	1
C. S. Naylor	43, Hill Crescent, Longden Road, Shrewsbury	1
P. G. A. H. Voigt	Bowdon Mount, 121, Honor Oak Park, London, S.E.23	1

Further particulars of the apparatus used during these receptions will be published later, together with other particulars of the receptions.

Before closing this preliminary report, it may be of interest to give a complete list of the call signs of all the stations (U.S. and Canada) reported during the tests. This list, set out in Table VIII on the next page, includes the individual transmissions, those heard during the "free-for-all" periods at the correct times, and all other stations from which calls have been intercepted—many calling CQ, others calling other U.S. amateur stations, and carrying on DX communications, and other traffic. These have been arranged alphabetically under each district for convenience in reference.

A large proportion of these stations, apart from those heard with code words, were reported on several nights and by several different observers, but some were reported on one occasion only, and if heard through jamming there was in a few cases some slight doubt as to the accuracy of the call letters. Doubtless the American Radio Relay League will at a later date be able to advise us with regard to these when they have had time to check through the reports.

In addition to the above, signals were reported by several listening stations from **WUBA**, calling "Test" and working with U.S. amateur stations. This station is a U.S. Signal Corps station located at Camp Alfred Vail, New Jersey.

Several of the U.S. stations taking part in these Tests attempted to transmit messages to Europe in addition to making the scheduled calls of "Test, Test, Test," etc. Several of these messages were intercepted correctly, both in this country and in France, but as a general rule listeners concentrated on hearing as many stations as possible rather than on copying messages. The tests have, however, established the possibility of transmitting such amateur messages from America to Europe should occasion arise. No attempt was, of course, made during the tests to reply to such messages, but a few messages of greetings, and of similar nature were sent back to America from the British station **5 WS** during the second half of the tests. Several of these messages were correctly received by U.S. amateur stations, so that to a limited extent it may be said that two-way communication has been established across the Atlantic by radio amateurs. The setting up of a definite two-way communication between the two countries—in which a message sent in one direction can be replied to at once in the other—yet remains to be done.

The most remarkable features of the tests have doubtless been, besides the large number of signals heard during the ten nights, the reception of amateur

TABLE VIII.

List of Total U.S. and Canadian Stations reported during the Tests by British and Dutch Amateurs.

First District.

1 AC	1 AT	1 BET	1 BRY	1 CJA	1 FB	1 MY	1 XK
1 ACN	1 ATV	1 BFR	1 BSZ	1 CJF	1 FD	1 ON	1 XM
1 AD	1 AWL	1 BFT	1 BW	1 CJH	1 GER	1 OR	1 XN
1 ADL	1 AWP	1 BGF	1 BWJ	1 CKD	1 GV	1 OW	1 XNT
1 AHZ	1 AXE	1 BGY	1 BX	1 CKG	1 HT	1 PC	1 XR
1 AJ	1 AZW	1 BH	1 BY	1 CKP	1 II	1 PM	1 XU
1 AJI	1 BAS	1 BHR	1 CBR	1 CKR	1 IL	1 RA	1 XW
1 AJP	1 BB	1 BI	1 CCA	1 CLA	1 IT	1 RD	1 XY
1 AJU	1 BCF	1 BK	1 CDA	1 CMK	1 JR	1 SD	1 XZ
1 AJW	1 BCG	1 BKA	1 CDI	1 CN	1 KDI	1 SPW	1 YK
1 AK	1 BCS	1 BKQ	1 CDJ	1 CNF	1 KW	1 TM	1 ZA
1 AL	1 BDG	1 BN	1 CDK	1 CNI	1 LAU	1 TMS	1 ZE
1 AN	1 BDI	1 BNA	1 CDO	1 CNJ	1 LL	1 TOK	1 ZN
1 ANA	1 BDS	1 BNT	1 CDR	1 CQX	1 MIE	1 TT	1 ZT
1 ARQ	1 BDT	1 BPG	1 CES	1 CW	1 MK	1 UN	1 ZUK
1 ARY	1 BEP	1 BPH	1 CF	1 CYM	1 MO	1 VI	
1 ASF	1 BES	1 BRQ	1 CIV	1 DD	1 MV	1 WN	

Second District.

2 AB	2 AWF	2 BNZ	2 CJH	2 EI	2 KL	2 PR	2 VX
2 ACK	2 AWL	2 BQH	2 CJN	2 EL	2 KP	2 PY	2 XAD
2 ACT	2 AWP	2 BQM	2 CJW	2 FP	2 KQ	2 QU	2 XAM
2 AF	2 AWZ	2 BQN	2 CK	2 FU	2 KRQ	2 QV	2 XAO
2 AFB	2 AYV	2 BQT	2 CKD	2 FW	2 KS	2 QYX	2 XAP
2 AFP	2 BAO	2 BQU	2 CKK	2 GI	2 KW	2 QZ	2 XL
2 AFX	2 BAS	2 BRB	2 CKN	2 GJ	2 KZ	2 RC	2 XM
2 AG	2 BBB	2 BRP	2 CKR	2 GK	2 LO	2 RO	2 XMO
2 AHO	2 BDA	2 BT	2 CKS	2 GM	2 LY	2 RP	2 XRB
2 AJ	2 BDT	2 BYS	2 CMK	2 GR	2 MF	2 RW	2 XRO
2 AMD	2 BG	2 BYW	2 CMZ	2 GS	2 MN	2 RY	2 YK
2 AON	2 BGA	2 CAR	2 CP	2 GU	2 MU	2 SG	2 ZA
2 APD	2 BGO	2 CBW	2 CPD	2 HJ	2 MV	2 SH	2 ZK
2 ARF	2 BL	2 CBX	2 CQ	2 HW	2 NM	2 SP	2 ZL
2 ARS	2 BLF	2 CDO	2 CQZ	2 IG	2 NN	2 TK	2 ZM
2 ATS	2 BLP	2 CF	2 CRB	2 IS	2 NZ	2 TSU	2 ZS
2 AU	2 BM	2 CGT	2 CSL	2 KB	2 OAO	2 UD	2 ZW
2 AUM	2 BMC	2 CHH	2 DMA	2 KF	2 OYM	2 UE	2 ZY
2 AW	2 BML	2 CIM	2 DZ	2 KG	2 PQ	2 US	
2 AWA	2 BNN	2 CIN					

Third District.

3 ADT	3 BF	3 BLZ	3 CYN	3 HQ	3 MY	3 RP	3 XM
3 AFB	3 BFU	3 BMT	3 DM	3 JJ	3 NH	3 SG	3 XR
3 AP	3 BG	3 BNU	3 EU	3 KD	3 OD	3 TJ	3 YG
3 AQP	3 BGJ	3 BOB	3 FS	3 KFU	3 OE	3 UFD	3 YO
3 AQR	3 BGT	3 BS	3 GE	3 LK	3 OL	3 XA	3 ZW
3 AUU	3 BHM	3 BVC	3 GG	3 MO	3 OT	3 XBK	3 ZY
3 AYY	3 BIJ	3 CC	3 HG	3 MX	3 QO	3 XL	3 ZZ
3 BES	3 BLF	3 CG					

Fourth District.

4 AA	4 BX	4 EA	4 FB	4 ID	4 KS	4 ZS	4 ZW
4 BF	4 BY	4 EB	4 FN	4 KM	4 OI		

Fifth District.

5 AAM	5 DH	5 EK	5 HS	5 MA	5 US	5 XA	5 XR
5 AGI	5 DQ	5 FV	5 JL	5 MX	5 WD	5 XB	5 ZA
5 BV	5 DWP	5 GBZ	5 KK	5 MK	5 WW	5 XK	5 ZB

Sixth District.

6 CBI	6 ZZ

TABLE VIII—*continued.*

			Seventh District.				
7 BXV	7 OE	7 BO	7 WZR	7 ZV			
			Eighth District.				
8 AA	8 ATU	8 AZQ	8 BPL	8 BZY	8 FU	8 QT	8 XAE
8 ADG	8 AV	8 BBT	8 BSS	8 CDD	8 GM	8 SB	8 XAN
8 AIW	8 AW	8 BCS	8 BTI	8 CJH	8 GQ	8 SP	8 XC
8 AJM	8 AWP	8 BDE	8 BTV	8 CMK	8 HJ	8 SPM	8 XE
8 ANP	8 AWZ	8 BFM	8 BUM	8 CNE	8 IB	8 TT	8 YB
8 AP	8 AXC	8 BJC	8 BVL	8 CPK	8 JCZ	8 UE	8 YD
8 AQO	8 AXE	8 BK	8 BX	8 DB	8 KG	8 UF	8 ZAF
8 AR	8 AXK	8 BKF	8 BXF	8 DET	8 KM	8 UY	8 ZV
8 ASC	8 AYO	8 BLC	8 BXH	8 DKX	8 ML	8 VK	8 ZW
8 ASV	8 AZD	8 BNJ	8 BYH	8 FQ	8 OW	8 XA	8 ZY
8 ATF							8 ZZ
			Ninth District.				
9 AGT	9 AUL	9 BET	9 CBX	9 CR	9 EP	9 IM	9 XB
9 AN	9 AX	9 BP	9 CD	9 CX	9 FM	9 KM	9 XE
9 AMT	9 BDF	9 BRY	9 CG	9 CXP	9 GM	9 UU	9 ZN
9 ASW	9 BDS	9 BZ	9 CM	9 DYN	9 II	9 XAC	
			Canadian.				
3 CO	9 AL						

telephone transmissions across the Atlantic. The almost nightly reception of American radiophone broadcast transmissions by British amateurs shows that there is no inherent difficulty in picking up these relatively feeble telephonic transmissions over such great distances, but the reception of amateur radiophone transmissions is a tribute to the amateur transmitters as well. The remarkable strength and steadiness of signals received from the best stations is also particularly noteworthy.

The latest information received from America after the main part of this report had been compiled indicates that signals from a number of U.S. amateur stations signalling during the tests were heard on U.S. vessels in the English Channel—several of the code transmissions during the individual periods having been picked up on single valve receivers, and the codes subsequently verified.

The French amateurs, who were also listening in, heard a large number of stations. Particulars of their receptions will be given in a later issue.

PHILIP R. COURSEY,

February 3rd, 1923.

Amateur Progress in South Africa

Recent wireless developments in other countries have greatly stimulated amateur interest in South Africa. Whereas, prior to the war, there were only a few amateurs in each province, their number had so increased by 1920 that a Society was formed, now flourishing under the name of the Radio Society of South Africa.

Modelled on similar lines to the Radio Society of Great Britain, to which it is affiliated, the Society has for its principal objects the furtherance of radio research and the promotion of intercourse between experimenters, securing members the advantages of collective representation and facilitating the obtaining of supplies.

The Society intends to maintain branches at Cape Town, Durban and Johannesburg, and the two first-named are already in existence, with a membership of 37 and 87 respectively. General meetings, at which lectures and demonstrations are given, are held monthly. The Society has been granted the Postmaster-General's licence to install a wireless station for scientific and instructional purposes.

The Cape Provincial Branch of the Society has now three affiliated branches, their aggregate membership totalling 143.

South Africa being noted for its abundance of atmospherics, amateur reception is somewhat restricted to the local stations at Slangkop, Port Elizabeth, Durban and Lourenço Marques. Many amateurs have, however, succeeded in obtaining signals from European and American stations, the French station at Saint Assize being most frequently heard.

The development of broadcasting in England is being keenly watched, and it is hoped that the time will not be very far distant when the South African amateur will be able to enjoy a regular broadcasting service. According to the latest information Johannesburg has been offered the loan of a broadcaster, and prospects are considerably brightened.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents. (6)* **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** *(7) Four questions is the maximum which may be sent in at one time.*

"HOPEFUL" (Surrey) *asks* (1) *Whether we can give details of a tapped wire frequency transformer to tune from about 300 to 1,200 metres.* (2) *For a diagram showing how a single valve H.F. panel may be connected.*

(1) A variable high frequency transformer was described in the issue of September 23rd, and full constructional details are given. The ebonite former is 2″ in diameter, and the slots are ½″ deep and $\frac{1}{16}$″ wide. There are eight slots and four tappings for the primary and secondary winding. Each slot in the former should be wound with 90 turns of No. 40 S.S.C. copper wire. The slots are all wound in the proper direction, and the connection between each slot is taken to one stud of the four-stud switch. The primary should be tuned with a small condenser having a maximum value of about 0·00001 mfd. (2) A single valve high frequency panel is given in Fig. 2 on the next page.

"STICKER" (Bristol) *is having trouble with his receiver, and asks* (1) *Whether we can suggest anything which will help him.* (2) *Have we any suggestions with regard to the earth or counterpoise.*

(1) and (2) The diagram of connections is correct, but we would point out that a condenser should be used in series with the aerial when it is desired to receive the broadcast transmissions. This will give you a slightly larger potential across the detector valve. As your aerial is rather badly screened and the earth lead long, we suggest you use one high frequency valve before the detector valve. The method is given in most of the issues of this journal. The earth connection should be as short as possible, and should make contact with an earth plate much larger than the one you are using, if it is at all possible. We suggest you use a sheet of galvanised iron or something equivalent, with dimensions about 2′ by 3′. The counterpoise should be built, if possible, a few feet above the earth. We do not recommend constructing the counterpoise immediately below the aerial, as sketched in the diagram submitted, because the effective height of the aerial is so greatly reduced. The lower end of the counterpoise should be dropped as low as it is convenient for you to make it.

"VICEROY" (Eastbourne) *asks* (1) *Whether the diagram submitted is correct.* (2) *What wavelength would a 4″ coil tune to when connected with a 0·0005 mfd. condenser and an ordinary Post Office aerial.* (3) *What would be a suitable coil to use in the anode circuit of the high frequency valve.*

(1) The diagram is correct. (2) and (3) You have unfortunately omitted to state the length of the coil and the gauge of wire with which it is wound, but we suggest the short wave coil be a coil 4″ in diameter and 4″ long, wound with No. 20 D.C.C., with six tappings. The long wave coil may be 4″ in diameter and 8″ long, wound with No. 26 D.C.C. with 18 tappings. The anode coil may be 4″ in diameter and 4″ long, wound with No. 28 D.C.C. for the short wavelengths, and for the longer wavelengths 4″ in diameter and 8″ long, wound with No. 34 D.C.C. The smaller coil should have 10 tappings and the larger coil 18. You will be able to tune up to a wavelength of about 10,000 metres.

"E.H." (Sweden) *asks* (1) *For criticism of circuit submitted.* (2) *Whether an A.E.G. type E.V. 173 valve will work well as a high frequency valve, and if so, what voltages should be applied.*

(1) The circuit proposed is quite suitable, and the connections are correct. For short wave work we suggest you build cylindrical coils, one for the aerial circuit 4″ in diameter and 4″ long, of No. 20 D.C.C., with eight tappings, and one for the anode circuit 4″ in diameter and 6″ long, of No. 30 D.C.C., with 12 tappings. For the H.T. bypass condenser we suggest you use 21 foils, each foil having an overlap of 4″ by 3″. The mica should be 0·002″ thick, and only good mica should be used. Waxed paper is not very suitable unless you are prepared to make up two or three condensers and connect them is series. (2) We believe that this type of valve gives satisfactory results in H.F. circuits. We would refer you to the diagram Fig. 2, page 614, February 3rd issue, and Fig. 1, page 613, February 3rd issue.

"C.W.P." (S.E.1) *asks whether his earth connection is suitable.*

We suggest you earth your receiver with a wire having the same dimensions as the aerial wire. A good earth connection is essential. The waterpipe earth is probably suitable if the distance between the point where the wire is soldered to the waterpipe and the point where the waterpipe enters the ground is not great. It may be better to bury an earth plate, which may be a sheet of galvanised iron about 2" by 3", to which the earth wires are soldered. The suggested earth in the window box is not at all suitable.

"ADANA" (Battersea) *asks* (1) *With reference to the reply to* **"A.G.L." (Sutton Coldfield)** *in the January 27th issue, could another diagram be given showing the connections when a high frequency transformer is used.* (2) *Are the other component values the same when the transformer is substituted for the tuned anode coil.*

(1) and (2) The diagram is given in Fig. 1, and suitable values are indicated.

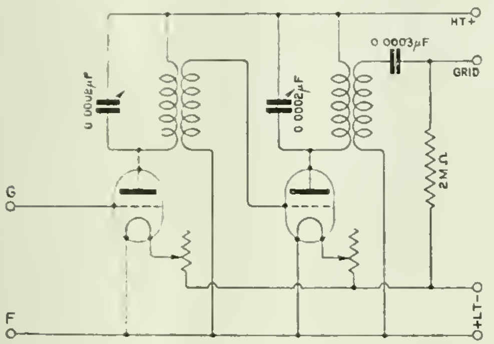


Fig. 1. A 2-valve H.F. amplifier. The valves are transformer coupled.

"E.R.S." (Hammersmith) *asks for a diagram of a H F. and L.F. panel to use in conjunction with the detector panel, diagram of which is submitted.*

The diagram is given in Fig. 2.

(1) We understand the Post Office regulations apply to the use of reaction only. They are not concerned with the number of valves used. The reaction must be so used that oscillating energy cannot be set up in the aerial circuit. (2) We cannot recommend a set which will receive the American concerts, but it should be borne in mind that the reception of American concerts is in the nature of a freak—that is, something which cannot be repeated with the slightest unfavourable conditions, and no signals would be received in daylight. However, if you wish to try, we suggest you use the receiver given on page 453, Fig. 3, December 30th issue of this journal. The diagram shows the connections of a five-valve receiver—four H.F. and one detector. We suggest you use an outdoor aerial.

"E.McD." (Manchester) *refers to a diagram in the issue of November 18th, and asks* (1) *Whether basket coils may be used for the primary and secondary inductance.* (2) *What would be suitable coils.* (3) *What would be a suitable coil for use in the anode circuit, as marked with an arrow in the diagram submitted.*

(1) We suggest you connect three small basket coils, each having thirty turns, wound upon a former 2" in diameter, for the aerial circuit. The coils should be wound with No. 22 D.C.C. The closed circuit inductance may consist of three coils, each having 45 turns of No. 26 D.C.C., wound upon a former 3" in diameter. The anode coil may be a winding of No. 30 D.C.C., wound upon a 3" former. We suggest you use a cylindrical coil 4" in diameter and 3" long, with six tappings.

"E.R." (Tottenham, N.17) *refers to the Reinartz tuner described on page 89, May 13th issue, and asks the gauge of wire used in the coils.*

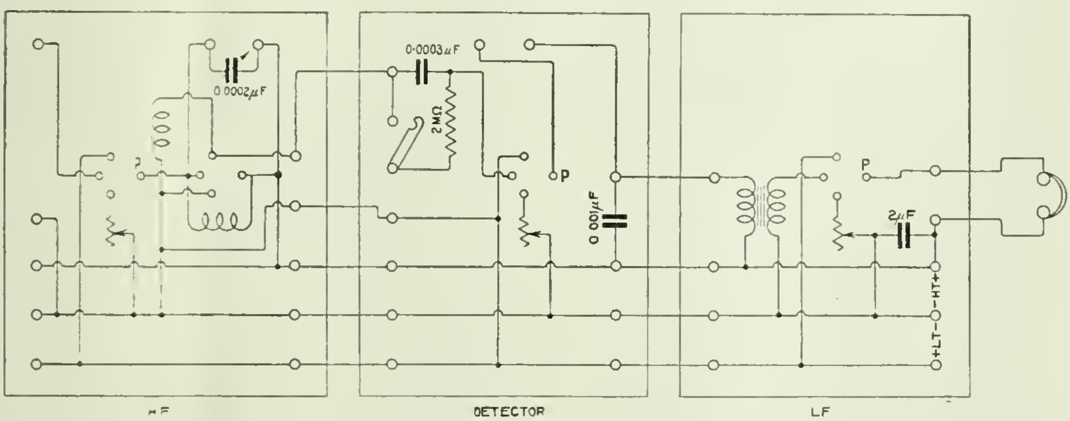


Fig. 2. The diagram shows a H.F. panel coupled to a detector panel and followed by a note magnifier. The windings shown in the first panel are those of a H.F. transformer.

"A.J." (Manchester) *asks* (1) *What are the restrictions laid down by the P.M.G. concerning the use of valves in valve receivers.* (2) *What sort of receiver would be suitable for the reception of American concerts, using a frame aerial.*

No. 26 D.C.C. is used in the coils of the Reinartz tuner described on page 89 of May 13th issue. We would refer you to the description of a Reinartz receiver given on page 604 in the issue of February 3rd.

"J.S.M." (Norfolk) *asks* (1) *For windings of an anode coil which, together with his tuning condenser, will tune up to* 1,200 *metres.* (2) *What would be the best value of a small variable condenser to be used to provide capacity reaction.* (3) *How may two potentiometers be connected for the purpose of controlling the first three valves and the detector valve. It is desired to use a large negative potential.* (4) *What would be suitable windings for an iron core transformer to step down from* 110 *volts to* 6 *volts.*

(1) The anode coil may be a winding 4″ in diameter and 6″ long, of No. 32 D.C.C., with 12 tappings. (2) The condenser which is to be used to provide capacity reaction may have a maximum value of 0·0005 mfds. It would probably consist of one moving and two fixed plates. (3) The method of connecting potentiometers is given in several recent issues. In particular we would refer you to the connection given in Fig. 1, page 601, February 3rd issue. When it is required to apply voltages of the order of 30 volts to the grid, a potentiometer is not essential. It is better to take tappings from the cells. (4) The primary winding of the transformer may consist of 350 turns of No. 22, and the secondary should consist of 21 turns of No. 16 D.C.C. The core of the transformer should have a cross section of three square inches. A resistance on the primary side as suggessed would control the output. As it may be required to use more than six volts on the secondary side, we suggest you wind an extra 10 turns, making a total of 31 turns, with a tapping at the 21st.

"M.A.H." (Stoke Newington) *asks* (1) *How many turns of No.* 40 *S.S.C. wire, wound on a former containing eight slots,* ⅛″ *wide and* ⅝″ *deep, will be suitable for a high frequency transformer to tune between* 100 *and* 30,000 *metres.*

We suggest you wind 200 turns for the primary and secondary winding in each slot. You will not, however, find that the results are very satisfactory, and we suggest you use a special high frequency transformer for short wavelengths. A transformer with eight slots, four for the primary and four for the secondary, will be suitable. The bobbin may be 2″ in diameter, and the slots ½″ deep and $\frac{1}{16}$″ wide. Ninety turns should be wound in each slot, and four tappings should be provided for the primary and secondary.

"A.F.C.B." (S.W.) *submits particulars of a transmitter, and asks whether the values are correct.*

The dimensions suggested are quite suitable, and with a normal Post Office aerial would tune over the wavelength range desired. The proposed tuner is quite suitable.

"J.S." (N.10) *asks* (1) *How many basket coils will be required to tune from* 180 *to* 12,000 *metres.* (2) *May the coil above or below the A.T.I. be used for the reaction coil.*

(1) We suggest you wind eight basket coils and connect them in series. The coils should be spaced ⅛″ apart to reduce the self-capacity. We suggest you wind three coils having 60 turns of No. 26 D.C.C. upon a former 2″ in diameter, and the remainder, having 90 turns of No. 26 D.C.C., upon a former 2½″ in diameter. The 0·001 mfd. variable condenser should be used in series on short wavelengths, and in parallel when receiving longer wavelength signals. The connections between the coils should be brought to the studs of a switch. (2) We suggest you wind basket coils for the reaction, and mount them so that the coupling is variable.

"E.H." (Nottingham) *refers to the diagram given on page* 129, *October 28th issue, and asks* (1) *Whether the five coils shown should all have the same dimensions.* (2) *If the coils should have different sizes, what relationship should they bear one with the other approximately.* (3) *What size duolateral coils should be used for the broadcast wavelengths.* (4) *What stations of interest should be received with a receiver of this description.*

(1) (2) and (3) The coils shown should not have the same dimensions. When receiving the broadcast transmissions the aerial tuning condenser will be in series with the A.T.I. The A.T.I. should be approximately a No. 75 coil, and the closed circuit coil No. 50. The anode or high frequency transformer coils should be No. 75 coils. The reaction coil will probably be a No. 25 coil. It should be borne in mind that the anode or high frequency transformer coils should tune to the same wavelength as the closed circuit. (4) You should receive the transmissions from the British broadcasting stations, and also the transmissions of amateurs in your neighbourhood. You would, of course, hear the French transmissions if you cared to tune up to that wavelength.

"L.G.C." (Newark) *asks for a diagram of a receiver suitable for receiving the broadcast transmissions and also the connections, so that the low frequency valves may be connected to operate a loud speaker.*

We would refer you to the diagram Fig. 4, page 615, February 3rd issue. Switches are provided so that the number of valves in circuit may be cut out when not required. Another suitable diagram is given in Fig. 4, page 418, December 23rd issue.

"A.T." (Rotherham) *asks* (1) *What wavelength range will be covered by the high frequency transformer which he has constructed.* (2) *What would be a suitable coil for use in the anode circuit of a high frequency amplifier to tune between* 150 *and* 3,000 *metres.* (3) *Will the self-capacity of Dewar type switches be of sufficient magnitude to prohibit their use in the high frequency portions of circuits.* (4) *Could particulars be given so that condensers having the following values may be constructed—* 0·05, 0·025 *and* 0·021 *mfds.*

(1) The wavelength range over which you will be able to tune will depend largely upon the self-capacity of your receiver, but we suggest from 100 to 4,500 metres. (2) A suitable tuned anode coil would be 4″ in diameter and 6″ long, wound full of No. 32 D.C.C., with 15 tappings. The reaction coil may be constructed to revolve inside the 4″ tube, and should contain 100 turns of No. 32 D.C.C. (3) It is not a very good practice to connect Dewar type switches in the high frequency portions of wireless receivers, but there is no objection to using special anti-capacity type switches, which may be purchased. The ordinary Dewar type switch is quite useful for switching the low frequency portions of wireless receivers. (4) The condensers could be made up as follows (mica 0·002″ thick) :—

0·5	mfd.	51	foils with an overlap ..	12×8·5 cms.
0·25	,,	51	,, ,, ,, ..	8·5×6 ,,
0·05	,,	26	,, ,, ,, ..	5×4 ,,
0·025	,,	13	,, ,, ,, ..	5×4 ,,
0·01	,,	7	,, ,, ,, ..	5×4 ,,

"O.H.M," (Bloemfontein) *submits a diagram of his receiver, and asks* (1) *Why results are unsatisfactory.* (2) *How many plates should be used in construction of* 0·01 *mfd. fixed condenser.* (3) *For a circuit diagram showing how to cut out H.F. and L.F. amplifiers.*

(1) The diagram of the tuning panel is correct: also the connections of the amplifier. The probable reason why you do not hear signals is due to the tuning arrangements not being properly proportioned. We cannot help you much without a knowledge of the wavelength of the signals you wish to receive. If "R" type valves are used the L.T. should be 6 volts and the H.T. 90 volts. (2) A 0·01 mfd. fixed condenser may consist of 17 plates, each plate having an overlap of 2″ × 1″. The mica should be 0·002″ thick. (3) Diagrams showing how high and low frequency valves may be cut in or out are given in most issues of this journal. Why not choose a circuit and rewire your receiver according to the connections given. A large number of suitable circuits have appeared in the last few issues.

"G.R.E.C." (Coulsdon) *asks* (1) *With reference to the circuit given on page* 883, *September* 30*th issue what would be a suitable reaction coil to be coupled to the secondary of the first H.F. transformer.* (2) *How would three potentiometers be connected, one for the H.F. valve, one for the detector, and the other for the L.F. valve.* (3) *What is a suitable size for the variable condenser which tunes the primary winding of the H.F. transformers.* (4) *Which valves are recommended.*

(1) We suggest you wind 150 turns of No. 38 S.S.C. on a former 2½″ in diameter containing a slot ¾″ deep and ⅛″ wide. The reaction coil should be fitted so that it will slide close to the surface of the plug-in transformers. (2) Potentiometers are quite easily connected. They should be joined across the L.T. battery, and the grid connections of the H.F. valves should go to the sliding contact of one potentiometer. The grid leak of the detector valve, instead of going to the plus or minus L.T. should go to the sliding contact of the second potentiometer. The sliding contact of the third potentiometer should be connected with the filament connection of the L.F. transformers. The method of connecting potentiometers is given in most issues. In particular we would refer you to page 601 January 3rd issue. (3) The primary of the H.F. transformer may be tuned with a variable condenser having a maximum value of 0·002 mfds. (4) We suggest you use "R" type valves.

"E." (Northumberland).—With reference to the diagram submitted we would point out that this is a theoretical diagram, and many practical features are absent. If you have not had previous experience with this type of super-regenerative receiver, we think it would be better if you constructed a receiver from particulars given in this journal from time to time. In particular we would refer you to the article which appeared in the issue of September 2nd, page 711, and the articles by Mr. Harris in the issues of October 21st and 28th. In the diagram referred to, the coils L_1 and L_2 may be an ordinary tapped loose coupler. The coil L_3 is a reaction coil. The circuits A and B are coupled with the valve, so that a frequency of the order of 30,000 cycles per second is produced. The circuit A should therefore contain a large variable condenser and a large coil. It would be found difficult to remove a continuous hum from the receivers because of the absence of choke coils and filter circuits. In addition, a receiver of this kind must not be connected with an open aerial, but with a frame aerial, which must not exceed a certain size.

"R.B." (Falkirk) *asks* (1) *For particulars of a* 10,000 ω *grid leak to be wound with No.* 30 *Eureka wire.* (2) *For dimensions of basket coils.*

(1) No. 30 Eureka wire has a resistance of 5,575 ohms per thousand yards; 70 yards wound on a cylindrical former will therefore be suitable as a potentiometer. It is not essential to use two potentiometers, although there is a certain advantage in using two potentiometers, as shown in the sketch on the attached sheet. (2) We suggest you wind the basket coil former with 35, 50 and 60 turns of No. 24 D.C.C., and for higher wavelengths use more turns with the finer wires. The exact number of turns is a matter for experiment. The three given should be suitable for use as the aerial coil, closed circuit coil, and reaction coil. The anode coils could each have 80 turns of No. 30 D.C.C. The voltage of the grid cells shown in the diagram on page 601 depends entirely upon the anode potential used, but two or three cells will be satisfactory. Only a coarse adjustment need be provided, and no potentiometer is required.

"J.R.M." (Durham) *submits a diagram of connections of his receiver and asks for advice.*

We have examined the diagram submitted, and the connections are correct. As you live so close to the Newcastle Broadcasting Station, you will find it a difficult matter to successfully tune in the transmissions from far distant broadcast stations while the Newcastle station is operating. We suggest you use a closed circuit which will give you fine tuning. To reduce noise, we suggest you connect the 2 mfd. condenser across the H.T. battery, which will reduce noises due to the internal resistance. If you are situated near the tram lines or a power plant, you may hear a noise due to induction and earth currents. The earth appears to be quite satisfactory. All connections in the receiver should be soldered and not merely held down with screws or terminals. It is quite safe to use a 6 volt accumulator with Marconi "V 24" type valves, but of course a filament resistance should be used, and a little should always remain in circuit. The capacity values are suitable, and best results are generally obtained when plug-in coils are used. The reaction coil should be coupled with the high frequency transformer. If the high frequency transformer is of the plug-in type, a reaction coil having 100 turns should be wound in a former similar in shape to the plug-in transformer, and it should be mounted so that it will move close to the face of the plug-in transformers.

"D.G." (Selby) *wishes to receive the broadcast transmissions and asks whether the diagram referred to is suitable.*

The diagram referred to (Fig. 4, page 615, February 3rd issue) is very suitable for your purpose, and you should be able to operate a loud speaker comfortably. The reaction coil, which is tuned with a 0·0005 mfd. condenser, should be coupled with the high frequency transformer. The high frequency transformer is of the plug-in type, and the reaction coil may consist of 100 turns, wound in a former similar to that of the high frequency transformer, and it should be constructed so that it will move close to the transformer, so that the coupling is variable. If it is desired, a three-coil holder may be used, in which case the reaction coil will be one outer coil of a three-coil holder. The switching arrangement shown in the figure referred to will enable you to switch out any valve except the detector valve, which of course must always remain in circuit. The switch indicated is a double-pole throw-over switch. With the switch in the left-hand position, the valve is cut out, and the filament is disconnected at the same time. Small switches may be purchased mounted on porcelain, and these should be dismantled and the switch parts mounted upon the ebonite panel. This type of switch is very serviceable, and furthermore, no losses are brought about through its use. Suitable values are given in the diagram. The grid condenser and leak should have values of 0·0003 mfds. and 2 megohms. The closed circuit condenser has a value of 0·0005 mfds. The L.T. and H.T. voltages should be 6, and variable up to 60 volts respectively.

"F." **(N.22)** *submits a diagram of his receiver and asks for suggestions.*

(1) The diagram submitted, in which a crystal detector is used as the rectifier is correct, and the values of the components are suitable. If the tuning condenser which was connected across the anode coil had a maximum value of 0·0005 mfds., signals should be expected to be rather weak. The tuning condenser used in this position should be as small as possible to secure good amplification, and it would be found tuning is very much sharper. The anode coil should be larger than the aerial coil. Difficulty is sometimes experienced in getting the crystal to rectify properly, and its position should be changed from one side of the transformer to the other.

"G.P." (Surrey) *submits a diagram of his receiver and asks whether the wiring and components are correct.*

We have examined the diagram submitted, and we suggest that when receiving the broadcast transmissions you short circuit the reaction coil which is coupled with the closed circuit coil. The circuit, apart from this, is correct. We suggest you wind basket coils on a former 2″ in diameter, with 13 spokes, having 40, 50, 60 and 80 turns of No. 22 D.C.C. The correct number of turns to be used will depend upon the size of the aerial. The low frequency intervalve transformer may have a primary winding of 1,000 turns of No. 42 S.S.C. wire and the secondary may be 25,000 turns of No. 44 S.S.C. wire. The primary winding should be wound on first.

"W.B.G." (Shrewsbury) *submits a diagram of a speed amplifier and asks for advice.*

We have examined the arrangement submitted, and the principle of the circuit is correct. The correct ratio of the transformer winding should be determined by experiment. If an "R" valve is used and an ordinary post office microphone, we suggest a ratio of about 40 to 1, the primary winding consisting of 150 turns of No. 22 S.C.C. However, when winding a transformer, we suggest you make taps on the secondary winding, so that the step-up ratio may be varied, and the tap which gives the best results found. The core may consist of a bundle of iron wires 4″ long, built up to a diameter of ½″. The secondary winding could be of No. 40 S.S.C. copper wire. Only one battery need be employed for the valve and the microphone circuit.

"H." (Nuneaton) *has a C Mk. III type amplifier, and asks whether it may be used in conjunction with his receiving set.*

The C Mark III type amplifier may be used as a note amplifier if desired. The input circuit of the amplifier, which includes a transformer, is connected to the anode circuit of the last valve of your receiver. We do not, however, recommend the use of so many low frequency connected valves. It would be better if you rearranged the circuit, using two high frequency, one detector, and two L.F. valves. A number of arrangements are given in the journal from time to time. When using the amplifier, common L.T. and H.T. batteries may be used, provided H.T. is connected with the same side of the L.T. battery in each case. We suggest you examine the Mark III amplifier and notice whether the H.T. minus is connected with + or −L.T., and make an alteration if necessary; but the receiver is quite simple to operate, as it is an ordinary note magnifier.

"J.M." (Southport) *wishes to receive the broadcast transmissions and asks for advice.*

We suggest you employ a five-valve receiver, comprising two high frequency, one detector and two L.F. valves. The aerial attachment referred to is often very suitable, but whether or not it would be successful in your case depends largely upon local conditions. To secure satisfactory operation, we suggest you use an aerial and a closed circuit, and use the tuned anode method of high frequency amplification. The method is explained in a number of issues of this journal, and diagrams are given from time to time. You will have no difficulty in making a suitable choice if you wish to construct the receiver also.

"W.G.M." (Bristol) *asks why he finds difficulty in receiving the London broadcast transmissions.*

We believe it is often difficult to receive the broadcast transmissions from certain parts of the country, but as you hear the transmissions from other broadcast stations we do not think you are so situated that the London transmissions should not be heard. We consider the difficulty is simply one of tuning. From the table submitted, it appears that the aerial circuit will tune down to the required wavelength, but the high frequency transformer will not. We suggest you use another transformer which will enable you to reduce the wavelength sufficiently. At present we do not think you are tuning down to 300 metres, although the ship stations are heard working. We suggest you build another transformer with a few less turns than the 180 to 300 metres transformer which you are using at present. We shall be glad to know whether the addition of the smaller wavelength high frequency transformer enables you to hear the London station, because we believe difficulty is often experienced while other broadcasting stations are in operation.

"E.J.R." (Beds.) *submits a sketch of a relay, and asks how it should be connected to operate a Morse inker.*

Terminals D and C should be connected in series with a battery, and the Morse inker, and terminals E and B should be connected with the last valve of your valve receiver.

"P.Q." (Dingwall) *asks* (1) *Whether the proposed method would be suitable for making comparison tests between tapped inductance coils and plug-in coils.* (2) *Would the arrangement require a second condenser for the secondary circuit.* (3) *Could we supply the name of a firm which supplies Gambrell plug-in coils.* (4) *What capacity condensers would be suitable for the above arrangement.*

(1), (2) and (4) The idea is quite sound, and it should be remembered that the plug-in coils should be connected to replace the cylindrical coils. If this arrangement were carried out, no extra tuning condenser would be required. (3) The address of Gambrells Brothers, Ltd., is Merton Road, Southfields, London, S.W.18.

"A.B.D." (Cambridge) *asks* (1) *Whether the house lighting supply may be used for the high tension. The house is supplied with electricity from the accumulators.* (2) *What is the difference between a power amplifier and a low frequency amplifier.*

(1) The house lighting may be used as the H.T., although care must be taken not to earth any portion of the wireless receiver which is connected with the H.T. A large capacity condenser should be connected across the supply. (2) The difference between a power amplifier and a low frequency amplifier is principally due to the valves used. A power valve is able to control more power than an ordinary receiving valve. A higher anode voltage is used, and the energy supplied to the filament is greater. Negative volts are connected with the grid circuit.

"N.E.K.E." (London, E.5) *asks* (1) *Whether the proposed arrangement submitted is suitable.* (2) *For a diagram of a five-valve receiver—two high frequency, one detector and two L.F. valves—with switches to cut out the valves. Three panels are required—one for the tuning arrangements, one for the high frequency valves, and the other to contain the detector and two L.F. valves.*

(1) The diagram submitted is correct, although no secondary circuit is used, and the reaction coil is coupled with the aerial coil. We suggest you use a secondary circuit and connect the A.T.I. and A.T.C. in series when receiving short wavelength transmissions. (2) A suitable diagram was given in Fig. 7 on page 646 of Feb. 10th issue.

"AMATEUR" (E.8) *asks* (1) *What wire should be wound on a former which he has by him to make it suitable for use as the closed circuit coil.* (2) *What capacity condenser would be required for the secondary circuit.* (3) *What is the wavelength range of the combination.* (4) *Would we refer him to a diagram showing the connections of one high frequency valve, crystal detector, and one L.F. valve.*

(1) We suggest you wind the secondary former with No. 28 D.C.C. and take eight tappings. The primary former should be rewound with No. 24 D.C.C. and 20 tappings should be taken. (2) The secondary circuit should be tuned with a condenser having a maximum value of 0·0005 mfds. (3) The wavelength range of the tuner is approximately from 100 to 8,000 metres. (4) A suitable diagram is given on page 614, Fig. 2.

"E.E.G." (Hants) *submits a diagram of connections and asks* (1) *Whether the circuit is correct.* (2) *How may the circuit be modified to prevent the liability of energy being radiated.* (3) *Can the balanced crystal method of detection be employed to reduce the risk of jamming.* (4) *What type of valve would be suitable for use with a receiver wired according to the diagram.*

(1) and (2) The diagram is quite correct, but it is not necessary to couple the aerial coil with the tuned anode coil. The two coils should be well separated. In this way you need not fear that energy will be radiated. If reaction effects are desired, we suggest you connect a reaction coil in the anode circuit of the L.F. valve. (3) With a circuit of this description, it will not be found necessary to use balanced crystals. (4) "R" type valves may be used throughout.

"C.E.P.W." (Ealing) *submits particulars of a number of tuning coils and asks* (1) *To what wavelength they will tune.* (2) *How many turns are to be wound on a 2″ former for a* 300/500 *H.F. transformer.* (3) *Is the secondary coil and three-coil tuner larger than the A.T.I.*

(1) The coils will tune to the following wavelengths:—600, 1,800, 3,500 and 5,000 metres. (2) We suggest you wind the primary and secondary with 180 turns of No. 36 S.S.C. wire. (3) When the aerial tuning condenser is connected in series with the A.T.I., it is found that the A.T.I. is larger than the secondary tuning inductance. When the aerial tuning condenser is in parallel with the A.T.I. the closed circuit inductance may be a little larger.

"F.M.W." (West Hartlepool) *asks* (1) *How many hours it is safe to discharge the accumulator.* (2) *What method may be employed to determine whether the accumulator is discharged.* (3) *Using four 16 candle power carbon filament lamps in parallel connected with 230 volt D.C. mains, approximately how many hours should the accumulator be left in charge.*

(1) The accumulator should not be discharged for longer than about 30 hours. (2) The accumulator is discharged when the voltage per cell drops to 1·8, and should immediately be taken from the circuit and placed on charge. (3) The accumulator would have to be connected for 50-60 hours. We suggest you employ larger candle power lamps; for example, four 50 candle power would allow a much larger charging current to flow through the accumulator and the charging rate would be reduced to about 25 hours. The instructions given by the makers of the cells should be carried out.

"N.B." (Broughty Ferry) *asks* (1) *What is the usual ratio between the turns of the primary, secondary, and reaction coils as usually connected in a three-coil holder.* (2) *Is there a formula for calculating the wavelength of a coil.* (3) *Is there a suitable formula for calculating the inductance of frame aerials.*

(1) If the aerial tuning condenser is in series with the A.T.I., the latter will be the largest coil; the secondary coil a little smaller, and the reaction coil will have a size depending upon the ease with which oscillation will be generated. Generally the reaction coil is the smallest coil of the three. (2) The inductance of a frame aerial should be calculated

with the aid of any of the inductance formulæ. The inductance of a frame aerial is largely affected by the spacing of the wires. We would refer you to a book entitled "The Calculation and Measurement of Inductance and Capacity," by Nottage. (3) We would refer you to an article on frame aerials which will shortly appear.

"NO GOOD" (West Kensington) *asks* (1) *Whether the diagram submitted is correct.*

We have examined the diagram of connections submitted, and provided the tuning arrangements are satisfactory, the circuit should work well. You may find it an advantage to use a grid condenser having a value of 0·0003 mfds. with a grid leak of 2 megohms. The grid windings of the L.F. transformers should be connected between L.T. minus and the grid.

"F.E.B." (Brixton Hill) *asks* (1) *If the aerial is well insulated at each end, is it necessary to insulate the aerial mast which is made of metal.* (2) *Should metal aerial masts be provided with lightning arresters.* (3) *Which is the most economical method of adding a lightning conductor to a metallic mast.* (4) *Is a wooden mast considered more efficient.*

(1) It is not necessary to insulate the aerial mast from the ground, but it is generally advisable to insert insulators in the stays which are fastened with the aerial. One or two insulators will be sufficient in each stay wire. (2) and (3) It is not necessary to provide a lightning conductor to a metal aerial mast. (4) From a wireless point of view there is not much to choose between a metal and a wooden mast. If a transmitter is used with an aerial which is supported by a metal mast a small loss may occur, but the loss is not serious

"W.H.D." (Felixstowe) *submits a diagram of his receiver and asks* (1) *How to stop a severe cracking noise which is heard in the telephones.* (2) *Whether improvements can be made to the wiring.*

(1) and (2) We have examined the diagram of connections and the circuit is correct. The cracking noise is probably due to the H.T. battery being run down. A large condenser with a value of the order of 2 to 4 mfds. should be connected across it. If this does not cure the trouble, we suggest you try a new H.T. battery. Noises are often due to faulty ebonite, and we suggest you roughen the ebonite surface.

"I.C.S." (The Hague) *asks* (1) *Why the tuned anode method of coupling H.F. valves with reaction coupled with the aerial circuit is stated, in a book on circuit diagrams, to give poor results when used for reception on C.W. signals.* (2) **2 LO** *transmissions are received with one-valve and a small aerial. Is it probable that the addition of one H.F. connected valve with the tuned anode coupling, and one L.F. valve, will amplify the signals sufficiently to operate a loud speaker.* (3) *Is it correct that* **PCGG** *is heard in London when only a single valve receiver is used.*

(1) We disagree with the statement contained in the book of circuit diagrams referred to. It will be found that the receiver is very suitable for the reception of C.W. signals. (2) If the signals received by your single valve receiver are heard loudly in a pair of head receivers, in general two-note magnifying valves will be required to produce the same strength of signal from a loud speaker. The addition of the H.F. connected valve will increase the signal strength for rectification, and the note magnifier will magnify the L.F. signals. You will probably find that the increase in signal strength will enable you to satisfactorily operate a small loud speaker such as would be sufficient to provide music throughout a small room. (3) The **PCGG** transmissions have been received in London with the use of a single valve receiver, but you may be sure the signals are rather weak and reception is not at all of a practical nature, *i.e.*, the adjustments have to be very critically made, and the least disturbance is sufficient to wipe out the signals entirely.

"H.K." (Gorleston-on-Sea) *is having trouble with his receiver and asks* (1) *Can we suggest a remedy.* (2) *How may the earth wire be shortened.* (3) *For a diagram of connections showing how one H.F., one detector and two L.F. valves are connected.* (4) *How may interfering spark signals be removed.*

(1) and (2) We think your trouble is due to such a long earth wire. We suggest you construct an earth yourself, or, if this is not possible, try and arrange for a counterpoise which may be two or three wires running the full length of the aerial and insulated from the earth. They could be arranged about eight feet above the ground. With the earth connection you have at present the signals are sure to be very weak, and you would probably find that signals of the same strength could be obtained if a well designed frame aerial were used. (3) A suitable diagram is given in Fig. 6 on page 645 of Feb. 10th issue. The H.F. cut-out switch and the provision for plug-in telephones into either of the L.F. valves can be dispensed with. (4) With the proper use of the three-coil holder, and with the H.F. valve anode circuit tuned sharply, you should not experience interference due to spark station.

"THEBES" (East Grinstead) *submits a diagram of a receiver, and asks if the circuit is correct.*

The diagram of connections is not correct. The H.F. valves should be added between the A.T.I. and the detector valve as shown in the diagrams which appear in most issues of this journal.

"G.O.B." (London, E.C.2) *submits a diagram of connections, and asks* (1) *Whether the circuit is suitable.* (2) *Should switches be fitted for cutting out valves when listening to near-by transmitting stations.*

(1) The circuit is quite correct and is a standard one. It is advisable to use switches for the purpose of cutting out valves when listening to strong signals. The arrangement is given in most issues of this journal. We would point out that the closed circuit tuning condenser should have a maximum value of 0·0005 mfds., not 0·001 mfds.

SHARE MARKET REPORT.

Prices as we go to press on March 15th, are :—

	£	s.	d.
Marconi Ordinary	£2	13	0
,, Preference	2	6	0
,, Debentures	108	0	0
,, Inter. Marine ..	1	8	6
,, Canadian		11	4
Radio Corporation of America :—			
Ordinary		17	6
Preference		14	9

Our Readers Finding ALL They Want at GAMAGES

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Variable Condensers

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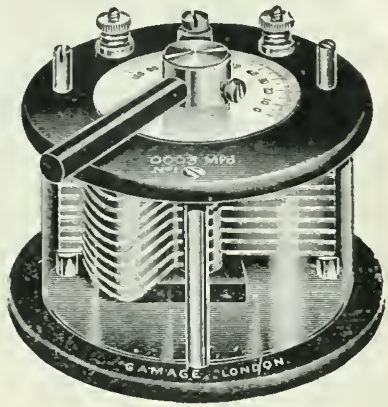

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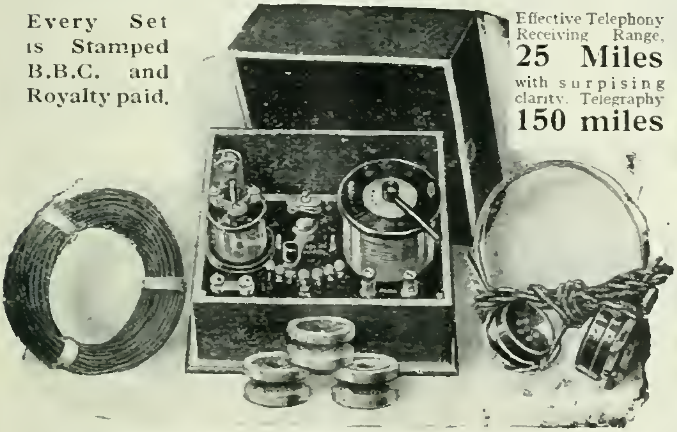

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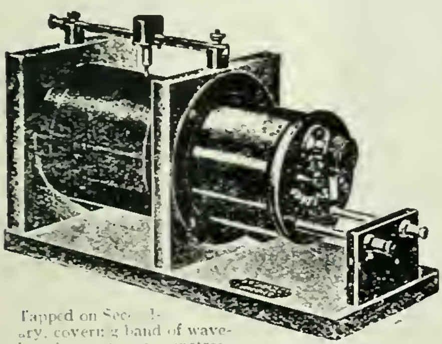

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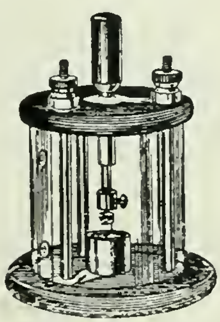

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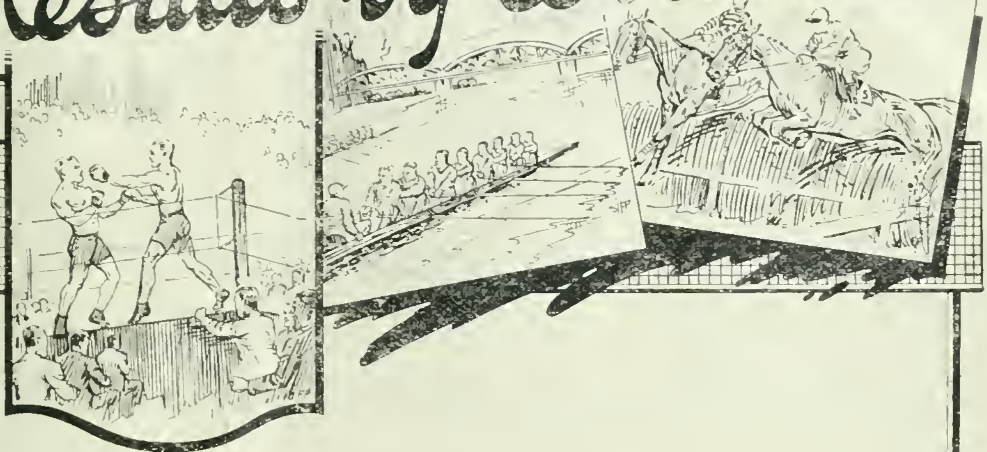


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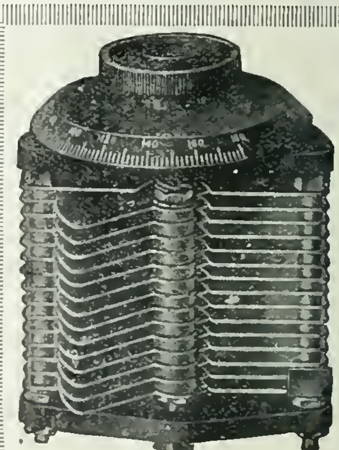

Type A.II. Cap. ·0005.

THE WIRELESS WORLD
AND RADIO REVIEW

THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GREAT BRITAIN
A MAGAZINE DEVOTED TO WIRELESS TELEGRAPHY AND TELEPHONY

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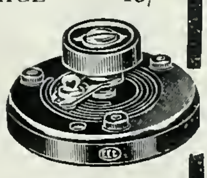

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THE
WIRELESS WORLD
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THE OFFICIAL ORGAN OF THE RADIO SOCIETY OF GT. BRITAIN

No. 189 [No. 26. VOL. XI.] MARCH 31st, 1923. WEEKLY

The Spark Transmitter System of the Eiffel Tower.

IMPROVEMENTS IN THE COMMON SPARK GAP AND OF THE SIGNALLING SYSTEM.

By E. M. DELORAINE, Ing., E.C.P.I.

A SHORT description of the spark transmitter of the Eiffel Tower was given in *The Wireless World and Radio Review* for December 9th. Lately the operation of the spark gap has been improved by the addition of an auxiliary synchronous rotating gap.

OPEN GAP.

The open gap discharger is operated as follows :—

A high voltage is impressed across the gap, and across a capacity-inductance circuit in parallel, by the secondary winding of a step-up transformer. As the primary circuit is in resonance, the voltage across the spark gap rapidly increases until the gap breaks down, and a high frequency oscillatory discharge of the condenser takes place. This is due to the fact that after breakdown, the gap offers only a small resistance to the passage of currents, because of ionisation phenomenon and of the presence of metallic vapours from the electrodes.

As the gap must be conducting only during the passage of a high frequency discharge, it is necessary to have some means of restoring the previous state of high resistance. Generally an air blower is used which causes deionisation, carries away the metallic vapours and cools the sparking surfaces. The ideal spark gap is, in effect, simply a switch, " making " for a very short time to allow the oscillatory discharge of the condenser, afterwards " breaking " to permit the charge of the condenser.

A high power spark gap does not permit of this ideal. The state of the electrodes is essentially variable, the wear is not uniform, so arcing and irregular discharges take place. The result is that the spark note instead of being clear and musical, is irregular and scratchy.

SYNCHRONOUS ROTATING GAP.

The operation of such a gap is very different from the plain spark discharge. A toothed wheel is clamped on the alternator shaft, the teeth offering the minimum gap space when the voltage is maximum. The gap breaks down regularly at a frequency determined by the spacing between teeth. The gap space increases rapidly immediately after the discharge, thus preventing arcing.

In addition to these points, the rotary motion of the wheel helps considerably to cool the electrodes.

With this type of gap, the tone of the spark is pure, musical, and of constant pitch, if the alternator speed is constant. However, for very large power the wheel would be of such a size that it is not practicable to use a rotary gap. Furthermore, it is necessary to have the alternator very close to the high-frequency, high-voltage circuit and this is often inconvenient.

M. P. Laut, engineer of the station, thought that it would be convenient to continue the desirable properties of the rotary gap system with the open gap, and to this end the author collaborated with him in the experiment.

PRINCIPLE.

A small synchronous rotary gap is rigidly fastened to the alternator shaft working with an output power of 1 kW. The high frequency output is indirectly coupled to a tuned circuit which is reacting on the main open gap at the other end, in such a way as to give a secondary spark across the open gap for every spark on the synchronous rotary gap

AUXILIARY CIRCUIT.

The circuit comprises (see Fig. 1): (*a*) A primary circuit with a self inductance and a condenser C1, and the synchronous spark gap. The condenser C1 is fed by the transformer immediately below it, the primary winding being connected in series with a resistance and a tuning inductance across the output terminals of the main alternator.

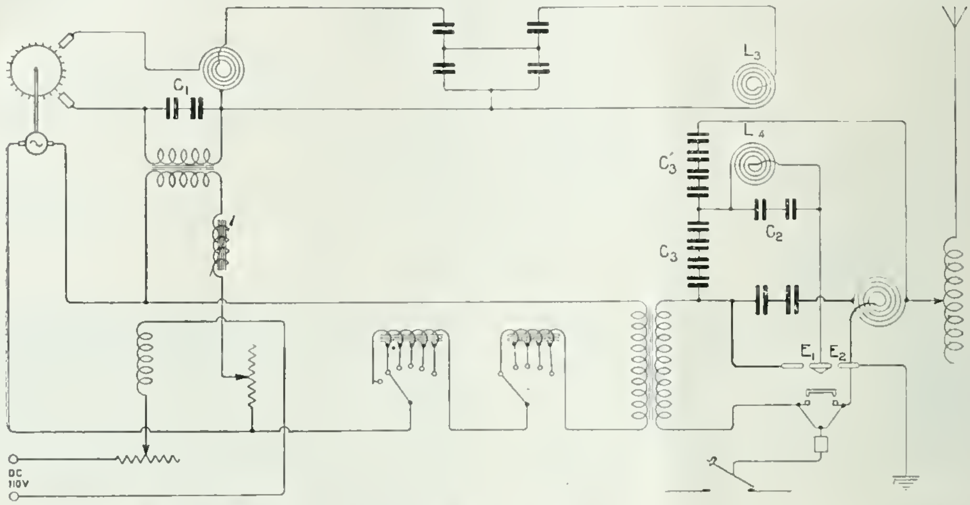


Fig. 1. The transmitting circuit at the Eiffel Tower, showing the main oscillatory circuit and the spark actuating oscillatory circuit.

The distance between electrodes of the open gap is increased so that the main discharge cannot normally take place. But when the resistance of the gap is considerably decreased by the secondary spark induced by the synchronous spark gap, the open gap breaks down and the main discharge takes place. The obvious result is that the main spark is working regularly like a rotary gap.

MAIN OSCILLATORY CIRCUIT.

The only modification in the ordinary circuit, as previously described, is that the spark discharger has two gaps instead of one, the two sparks being in series (see Fig. 1). The spark gap is shown in Figs. 2 and 3. It is essentially a system of three rotating electrodes. The centre one always rotates in the same direction and is insulated by its support. The two external electrodes have an alternating movement as they are connected by flexible copper tapes to the two plates of the condenser. A strong current of air supplied by a Roots blower is directed on each spark thereby cooling the electrodes and preventing the formation of arcs.

(*b*) An intermediate circuit consists of a condenser bank and inductance, L3, which is coupled to L4 of the primary and secondary circuits. The intermediate circuit is tuned to an oscillatory frequency, which has no relation at all to the frequency of the oscillatory circuit, the wavelength being about 500 metres.

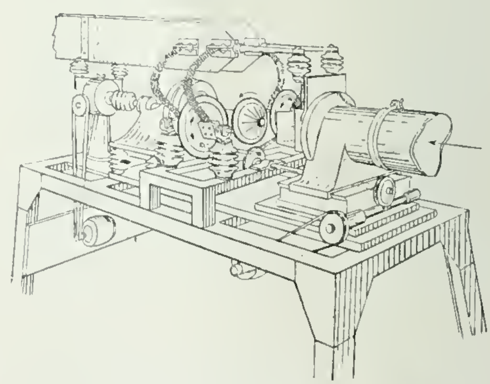


Fig. 2. The spark discharger, showing the two gaps.

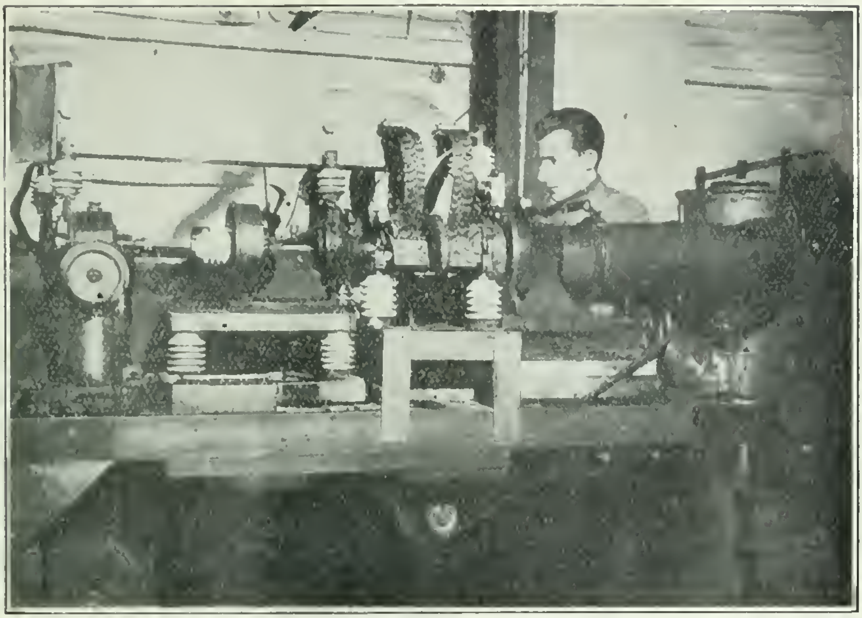


Fig. 3. The spark gap, with ventilated revolving electrodes, and arranged so that the total sparking distance is synchronously broken down by the discharge a condenser bank separate from the main oscillator.

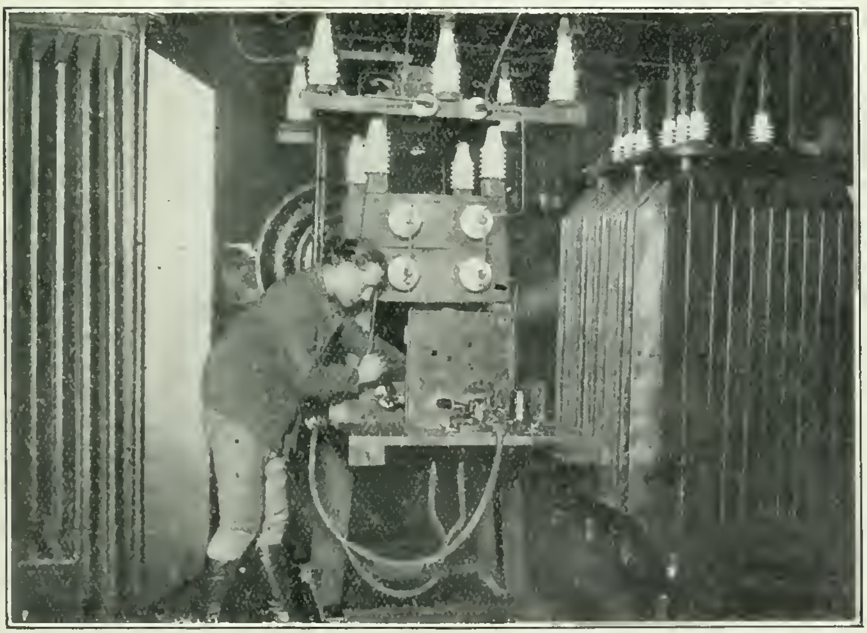


Fig. 4. The pneumatic relay, used for signalling in the high tension circuit. The arc caused by breaking the circuit is extinguished by compressed air.

The secondary circuit comprises a self induction L4, and condensers, C2 having a capacity of 0.001 mfd. and C3 and C'3 having a capacity of 0.01 mfd. and connected in a bridge arrangement to the main circuit as shown in the figure.

OPERATION.

The system of condensers is symmetrical, the pressures across the two gaps E1, E2 are equal. When C1 discharges we get a sudden peak of high frequency voltage across E1 and E2. The gap having the lower resistance breaks down and a group of condensers is discharged, say C2, C3. The total resistance of the double spark gap is sufficiently decreased to allow the total discharge of the condenser C1 to take place.

ADVANTAGES.

The spark is regular and of a musical tone, although the spark gap is a device of comparatively small dimensions. The field of the alternator may be increased or decreased, and the energy in the antenna varied accordingly, without affecting the frequency and the quality of the spark.

SIGNALLING.

The signalling system in the field current of the alternator does not allow of the use of very short signals, because of the self inductance of the circuit. Furthermore, it is necessary to include a second relay on the synchronous spark gap, otherwise the main spark would still be passing.

It has been found preferable to make use of a contactor working in the high tension side of the step-up transformer. This is a pneumatic Creed relay (Fig. 4). The morse key acts on a polar relay which opens or shuts a compensated control valve working the main valve and the piston.

The field current of the alternator is constant, the contactor being inserted in series with the high tension supply, the arc being blown by a strong jet of compressed air. This system of signalling gives very much better signals and enables the speed of working to be increased.

Audio-Frequency Reaction.

A PRINCIPLE WORTH INVESTIGATING.

By H. M. THEAKER, A.M.I.E.E.

WE are very familiar with the reaction principle as used in our high frequency circuits, but applying the principle to the low frequency circuits has not received much attention. Before describing the method adopted mention might be made of the double magnification system which has been treated fully in previous numbers of *The Wireless World and Radio Review.*

A simple diagram of connections is shown in Fig. 1. This requires a second low frequency transformer in the anode circuit which passes the low frequency impulses through the valve after being rectified. The condenser " C " is required to pass the high frequency current from the secondary tuned circuit to the valve which is acting as a rectifier, and also a low frequency amplifier.

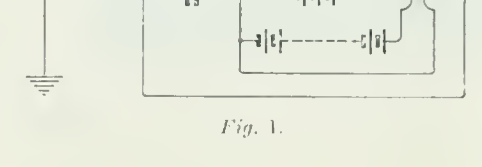


Fig. 1.

Consider now Fig. 2 in which the first valve acts as a rectifier, and the second one as a low frequency amplifier with the reaction principle applied to it. TR_1 is the usual intervalve transformer, and in the anode circuit the telephone transformer, also a transformer of about half the size of TR_1 is arranged in series. The secondary of this transformer is connected in series with the secondary of TR_1 to produce the low frequency reaction effect. If the transformer in the plate circuit of the second valve is too large, continuous low frequency oscillations will be set up, but by adjustment of the windings or arrangement it is possible to get maximum effect without distortion of signals. This can be done by regulating the value of the H.T., adjusting the grid potential or filament current,

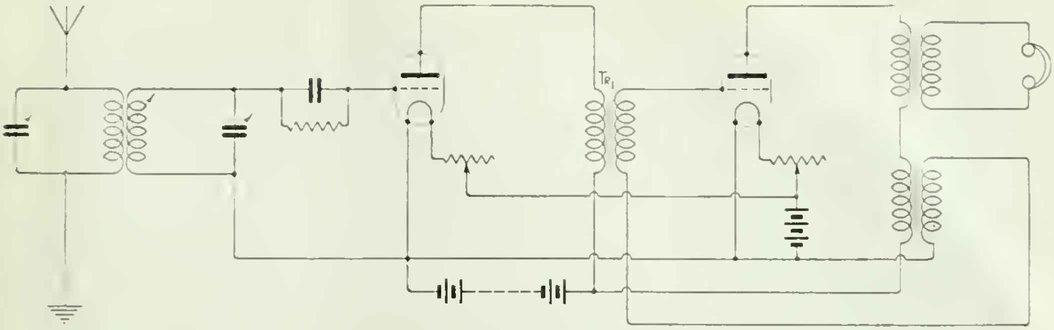


Fig. 2.

or by connecting across the primary of the second transformer a condenser of about 0·01 mfds. capacity, an iron cored choke coil, or a high non-inductive resistance.

Fig. 3 shows a similar circuit using a special intervalve transformer consisting of three windings, the third, or reaction winding being wound over the secondary. The primary and secondary are similar to the ordinary type of intervalve transformer, but with a ratio 1 to 1, whilst the reaction winding has about half the number of turns.

This circuit, in use, can be regulated to give very good results.

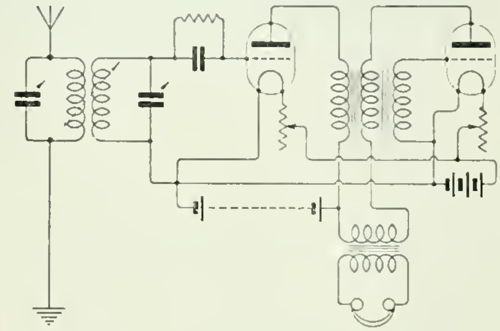


Fig. 3.

Simultaneous Amplification.

A FURTHER DEVELOPMENT IN DUAL AMPLIFICATION CIRCUITS.

By A. D. COWPER, M.Sc., A.I.C.

THOSE readers who have been intrigued by the method of simultaneous (or dual) amplification, associated with the name of Mr. P. G. A. H. Voigt,* may be interterested to learn that it has proved, with a similar circuit, perfectly feasible to hear Transatlantic telephony, under favourable circumstances, on the loud speaker with *two valves* only, though of course it is not exactly noisy.

The very successful transmission of the voice of Miss Edith Bennett from the Newark (New Jersey) Broadcast Station, about 5.30 a.m. G.M.T., on Saturday, February 24th, came through in the midst of a fearful welter of jamming and heterodyne, clearly audible to more than one hearer a short distance from the loud speaker in a quiet room; very distinct and the words of the announcer all but readable amidst the din, on the head-phones.

On the same circuit, in a N.W. suburb of London, all the British broadcasting stations, also Hague and Paris Radiola concerts, come in well, jamming permitting, on the loud speaker, on two valves; though, of course, another valve as note magnifier is more comfortable sometimes for several listeners. (Twin 40 ft. P.M.G. aerial, moderately well situated).

With an absurdly small frame aerial, 2 LO at 13 miles, and nearer amateurs are up to loud speaking strength, and Birmingham pleasant on the telephones.

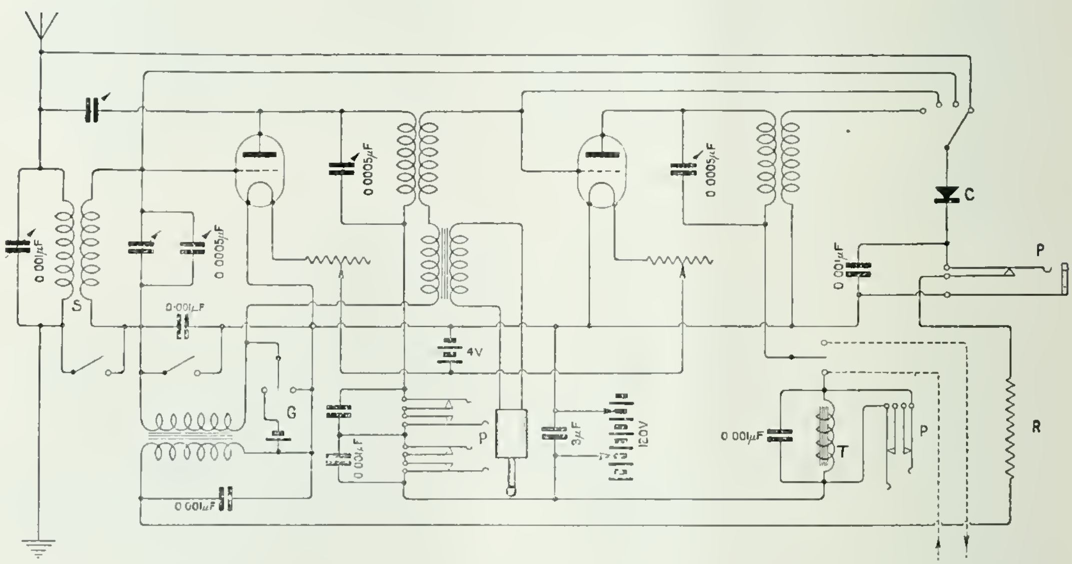
The circuit was developed by the writer from a suggestion given by French T.S.F. army experiments, and an inspiration from one of the single-valve circuits given by Mr. Voigt, and differs in some details from that recently described by him in this Journal.

* *Wireless World and Radio Review*, p. 250, May 27th, 1922.

A spider-coil loose coupler is used (fixed 2-in. centres); tuned low resistance spider coil H.F. plug-in transformers, giving good selectivity; two low frequency transformers (following French practice); and in particular a special radio-choke filter-circuit between the crystal rectifier and the first L.F. transformer, to shunt off any H.F. current that escapes an imperfect crystal. The last is, in the writer's opinion, quite essential to avoid that distressing persistent howling to which a simultaneous amplification circuit is notoriously addicted, and which makes "searching" at times a painful ordeal. With this filter, and the merest trace of electrostatic reaction from the plate of the first valve to the top of the A.T.I., the receiver can be made to oscillate quietly and manageably over a considerable range. The provision of variable H.T. supply is also found essential.

However, with four tuned circuits and six condensers to tune, it is not an easy circuit to operate unless a calibrated buzzer wavemeter is available.

The actual amplification, measured by Prof. Fleming's method, is roughly 100 times normal good crystal reception (2 LO speech), with two good "R" valves. By actual comparison, the writer has shown that on broadcast transmissions, with a tiny frame aerial, the efficiency of this circuit just surpasses that of the single valve Armstrong Super-regenerative Circuit, if the latter is limited to an ordinary "R" valve. With a power valve the Armstrong circuit has it; and is infinitely simpler to operate.



The simultaneous amplification circuit providing two stages high-frequency amplification; crystal rectification; two stages of low-frequency amplification.

S. Spider-coil loose coupler; fixed at 2 ins. centres. C. Synthetic galena crystal detector. R. Radio-frequency choke (¾ oz. No. 32 enamel wire, low-capacity pile-wound on small bobbin). G. Grid-bias cell of 1·4 volts. P. Plugs and jacks. T. Auto Transformer, for 4,000 ohm telephones or L.S. (2 ozs. No. 40).

Switches allow: "stand-by" straight crystal reception.

Loose-coupled crystal reception.

Ditto, with one or two stages L.F. amplification.

One stage H.F. amplification, followed by crystal rectification; with or without reaction.

Two stages H.F., do.

Two stages H.F., followed by crystal rectification, and one or two stages L.F. amplification.

Reactance to point of steady oscillation when required.

Switch in front of last telephone jack allows extra note magnifier to be interposed at will.

Rectification on valve alone by grid bias cell and filament temperature adjustment, followed at will by note magnifiers.

Ditto, preceded by H.F. amplification.

The bandstand and one of the sound projectors in the main hall.

The Latest Application of the Loud Speaker.

PUBLIC ADDRESS SYSTEM AT THE IDEAL HOME EXHIBITION.

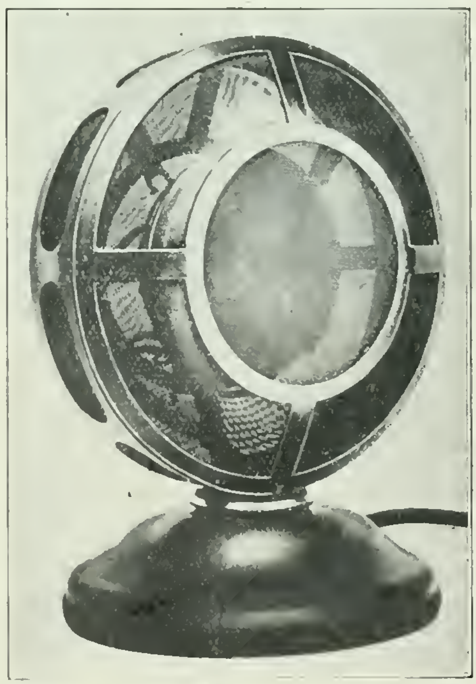
VISITORS to the previous *Daily Mail* Exhibitons will doubtless go to the Ideal Home Exhibition this year prepared for something novel, but they will perhaps hardly expect to find novelty actually on the doorstep. Such is the case, however, for even before entering Olympia the observant visitor begins to marvel, for orchestral music is heard, and yet no performers are visible.

This feature is provided by the Western Electric Public Address System, which is one of the recent applications of the thermionic valve, and by its aid the music from the bandstand in the gallery of the Main Hall is reproduced throughout the main hall, the New Hall, the Gardens, the Pillar Hall, and the Vestibules.

The complete equipment is under the control of an operator, and the degree of loudness from any one particular projector can be adjusted according to circumstances. To enable this to be accomplished to the best advantage a system of telephones is arranged whereby a person listening in a remote corner can communicate with the operator and arrange for the apparatus to be adjusted as desired. Only in this way is it possible to secure the natural effect, and any attempt to amplify the sound to an unnatural degree, as so often attempted, results in more noise rather than music.

The Public Address System, as its name implies, has been primarily designed to aid public speakers.

The system consists essentially of three distinct portions—the microphone, the amplifier, and the loud speaking projectors which



The Microphone.

throw the required volume of sound over the area to be covered. The microphone is designed so that the natural period of vibration of the diaphragm is well above speech and music frequencies, so that resonance of the diaphragm at these frequencies is avoided. resulting in pure reproduction. It is sensitive to speech at distances from three to eight feet.

The amplifier, together with the associated batteries and power board, are situated on the

One of the sound projectors.

balcony just to the rear of the orchestra. The amplifier consists of four stages of amplification, the first two stages being voltage amplification, the third stage current amplification, and the final stage power amplification. The power valves in the final stage are connected in a special differential circuit to minimise distortion. It is constructed in panels, the cabling from the microphones being brought on to one panel which is provided with means of switching to any desired microphone. It also contains telephone apparatus to enable the operator of the amplifier to get into touch with his observers.

Another panel contains the apparatus associated with the first three stages of amplification, that is, two stages of voltage amplification and a stage of current amplification as explained above. It is on this panel that the total output from the system is regulated by means of a potentiometer situated between the first and second stages.

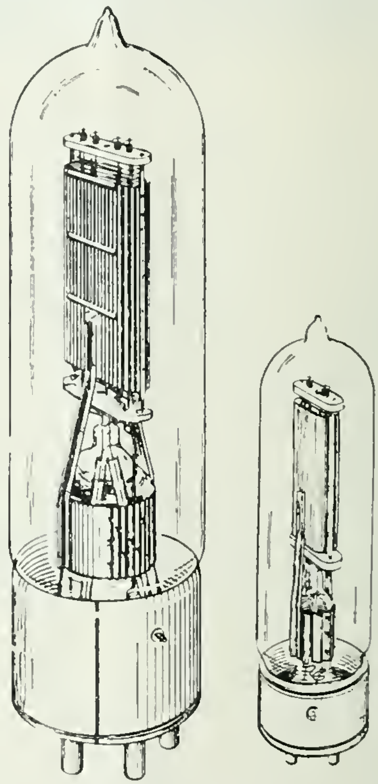
An additional panel contains the necessary measuring instruments, and is provided with plugs and cords so that the current in any part of the system may be measured by plugging into jacks provided on the amplifier panel for this purpose.

The volume indicator is a valve detector device which measures the alternating current power in the system by means of a deflection on a galvanometer, and enables the proper transmission level of the system to be maintained.

The power amplifier receives the output from the first amplifier and increases the power available to such a value as to operate the projectors at the required volume to cover the area served by the projectors.

Finally there is a control panel provided for adjusting the volume in the individual projectors to the desired value.

The arrangement of the projectors for serving the entire exhibition is as follows :—Four projectors serve the Main Hall, these being suspended above and slightly forward of the orchestra A single fibre horn serves the Gardens, and is mounted in the corner nearest the orchestra. The New Hall is covered by two fibre horns mounted in the centre



The Western Electric Co.'s amplifying valves. Types 212A and 211A.

at one end. A single projector with fibre horn serves the Pillar Hall. At the Hammersmith Road entrance, and also at the Addison Road entrance, a projector with a small curved horn is fitted, the total volume required in these cases being much less than in the main buildings.

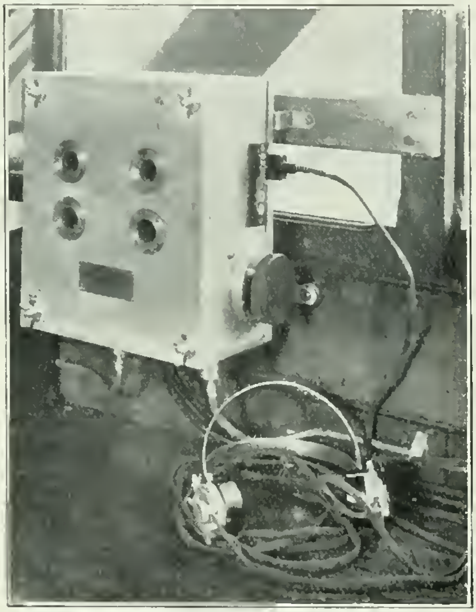
The loud speaking projectors are of the balanced armature type, combining sensitiveness with the ability to handle comparatively large currents.

Directional Wireless as an Aid to Navigation

THE first vessel to benefit by the "wireless lighthouse" established by Marconi's Wireless Telegraph Co., Ltd., on Inchkeith Island, in the Firth of Forth, is the s.s. "Royal Scot," owned by the London and Edinburgh Shipping Co., Ltd. This boat, which is employed on the London and Leith service, has been fitted with a special type of wireless receiver which will detect the signals sent out by the "wireless lighthouse" and enable the navigating officer to pick his way through the dangerous channels of the Firth of Forth in the thickest fog.

The "Royal Scot" has just returned to Leith after her first round trip to London with this apparatus on board, and reports that the "lighthouse" signals were received perfectly during the whole time the vessel was within range, and that the ship's officers were easily able to use the apparatus.

Wireless Beam Receiving Antennæ on s.s. Royal Scot.

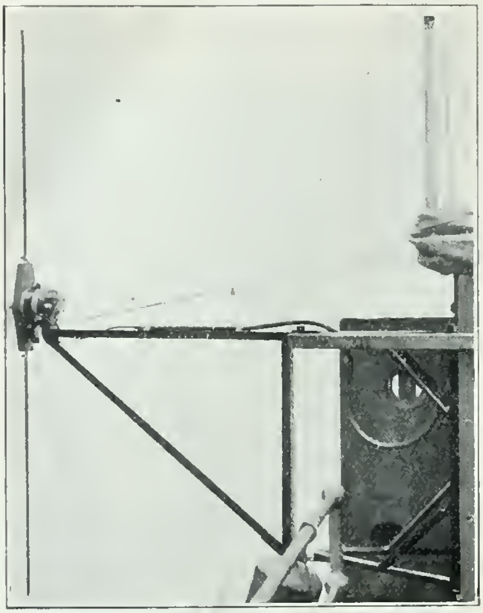


Wireless Beam Receiving Apparatus in Chart House.

The "wireless lighthouse" on Inchkeith Island is the first of its kind ; but it is possible that similar stations will be established in other dangerous channels. For instance, the Farne Islands are situated in a particularly dangerous spot, and vessels which shape their course from these islands find great difficulty in localising the fog-horn.

Of importance to ship owners is the fact that this device will frequently enable their vessels to save a tide.

The receiving apparatus is extremely simple. Only one handle has to be operated. This switches the gear into use and is also calibrated so as to give a very fair indication of the distance from the shore in addition to the actual bearing. Thus the navigating officer can determine whether he is inside or outside his course.



Marconi Wireless Beam Receiving Antennæ on Ship's Bridge.

The transmitter sends out a directional wireless beam which gives a distinctive signal as it passes through each point of the compass.*

A conspicuous feature of the transmitting station is a metal framework tower, some 30 feet high, supporting four metal arms. These in turn support a series of vertical wires. The whole revolves on a circular base, driven by an electric motor. The frame is, in effect, an electric reflector and the ether strains are projected so as to sweep round the surrounding sea in just such a way as a light would from a lighthouse. Thus, instead of fixing a point by visual means, the result is obtained aurally, and is in no way interfered with, whatever the weather conditions may be.

A point of very great interest in connection with the apparatus is the fact that its development may be regarded as a reversion in ideas to the earliest known form of transmission of wireless waves. In effect the apparatus is more akin to the original system devised by Hertz than any subsequent wireless system introduced. Marconi in his early work made use of long waves on account of the increase in range which was thereby obtained, and as a result of later developments along these lines the importance of a system employing very short wavelengths became obscured. There are, however, many advantages in short wave working, and the comparatively short range of the transmitter is now largely compensated for by the enormously increased sensitiveness of modern valve receiving apparatus, apparatus such as was not dreamed of at the time that the development of the present long wave systems for commercial purposes was commenced.

The London and Edinburgh Shipping Company is to be congratulated upon its enterprise in installing the first commercial Beam Receiver.

* A technical description of the apparatus appeared in the issue of May 20th, 1922.

AN AMATEUR DEVICE FOR AUTOMATIC TRANSMITTING.

Photo—Courtesy, American Radio Relay League.

Those who took part in transmissions in the Transatlantic Tests found that to keep on sending out the same test message was rather a tiring performance. Our illustration shows one method adopted by the owner of the successful American amateur station **1 BGF**. The arrangement consists of a continuous band of paper tape punched with the required message in morse characters. The band is passed between contacts by means of rollers, motor driven, and the keying circuit is thereby opened and closed to order.

Wireless Club Reports.

NOTE.—Under this heading the Editor will be pleased to give publication to reports of the meetings of Wireless Clubs and Societies. Such reports should be submitted without covering letters and worded as concisely as possible, the Editor reserving the right to edit and curtail the reports if necessary. **The Editor will be pleased to consider for publication papers read before Societies. An Asterisk denotes affiliation with the Radio Society of Great Britain.**

Correspondence with Clubs should be addressed to the Secretaries direct in every case unless otherwise stated.

The Belvedere and District Radio and Scientific Society.*

Hon. Secretary, Mr. S. G. Meadows, 1, Kentish Road, Belvedere, Kent.

The twenty-third general meeting was held at the Erith Technical Institute, on Friday, February 23rd, at 8 p.m., and was chiefly devoted to a discussion on a suggestion put forward by Mr. E. Walker regarding wireless applied to railways.

On Saturday, February 24th, the first trial transmission was made from the Society's headquarters. Messages were sent out in Morse code, and were received very satisfactorily.

Liverpool Wireless Society.*

Hon. Secretary, Mr. Geo. H. Miller, 138, Belmont Road, Anfield, Liverpool.

The usual bi-monthly meeting of the above Society was held on Thursday, February 22nd, 1923, at the Royal Institution, Colquitt Street, Liverpool. Mr. E. B. Grindrod occupied the chair.

The theory and principles of amplification were exhaustively dealt with in a lecture by Mr. A. J. Haining to a record attendance, his explanations being given in language that was understandable to all.

Applications for membership should be addressed to the Hon. Secretary.

Wireless and Experimental Association.*

Asst. Hon. Secretary, Mr. G. H. Horwood, 557, Lordship Lane, S.E. 22.

The future meetings of the Association at Peckham will be graced and brightened by the presence of ladies.

The "return thanks" of our Vice-President, Sir Frederick Hall, Bart., M.P., was read. The wireless beginner is to have a special half hour of his own every week in future.

Bradford Wireless Society.*

Hon. Secretary, Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

A meeting was held at headquarters at 7.45 p.m. on February 23rd, the Vice-President, W. C. Ramshaw, Esq., being in the chair.

A short and interesting description of a method of charging accumulators from A.C. mains by means of a chemical rectifier was given by Mr. Mitchell. This was followed by a short address on "Spark Transmitters" by Mr. Whiteley, which was much appreciated.

Birmingham Experimental Wireless Club.*

Hon. Secretary, Mr. A. Leslie Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

An unusually entertaining and instructive lecture was given before the above Club on February 23rd by Mr. Abbott on the subject of "Wireless Procedure."

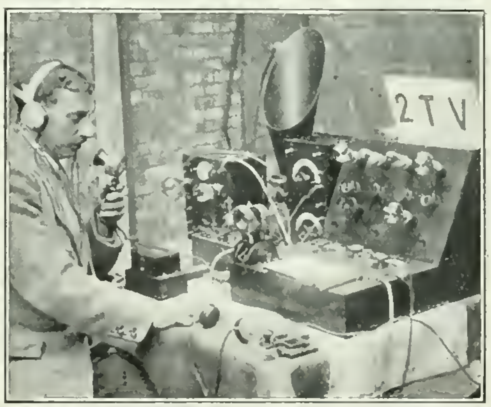
The lecturer traced the origin of many of the ship and shore station call signs in regular use, and devoted a considerable part of the lecture to wireless "slang" signals in regular use by operators in the mercantile marine.

The Wembley Wireless Society.*

Hon. Secretary, Mr. W. R. Mickelwright, 10, Westbury Avenue, Alperton, Wembley, Middlesex.

On February 1st the President, Mr. C. R. W. Chapman, lectured on "Symbols," and on February 8th Mr. H. E. Comben, B.Sc., gave a very detailed paper on "A Crystal Set." At each of the lectures a précis of the paper is handed to members present, and this is found to be very useful for reference at the discussions which are held the week following each lecture.

Mr. A. F. H. Baldry, A.M.I.R.E., the Hon. Asst. Secretary, has recently been successful in receiving American stations.



The Experimental Transmitting and Receiving Station of Mr. E. W. Wood of Northampton.

The Ilford and District Radio Society.*

Hon. Secretary, Mr. A. L. Gregory, 77, Khedive Road, Forest Gate, E.7.

On February 22nd Mr. A. J. Thompson delivered a lecture on the "Magnetic Detector and Multiple

Tuner," dealing very thoroughly first with the working of both instruments.

Bishop's Stortford and District Amateur Wireless Association.*

A public demonstration of wireless telephony was given by members of the Society at the Junior Club, Bishop's Stortford, on Tuesday, February 27th, when a large audience listened with interest to the broadcast programme from the London station. Mr. W. A. Field, President, gave a short description of the indoor aerials, valves, and other apparatus.

The Kensington Radio Society.*

Hon. Secretary, Mr. John Murchie, 2, Sterndale Road, W.14.

On Thursday, February 15th, at 8.30 p.m., the postponed monthly meeting of the Society was held at headquarters, 2, Penywern Road, Earl's Court.

Dr. Gordon Wilson gave an address on the management of a Mark III two-valve receiver, and demonstrated this set with a Brown relay and Amplion "loud speaker." Excellent signals were received on outdoor, indoor, and Ducon aerials.

The Hon. Secretary will be pleased to furnish particulars of the Society to anyone desirous of joining.

Eastbourne and District Radio Society.*

Hon. Secretary, Mr. W. F. G. West, Bridle Gate, Willingdon, Sussex.

The Society is now flourishing, and lectures are being held every fortnight in the Technical Institute, Eastbourne. Full particulars of membership can be obtained from the Hon. Secretary.

The Manchester Radio Scientific Society.*

Hon. Secretary, Mr. H. D. Whitehouse, 16, Todd Street, Manchester.

On Wednesday, February 21st, the members and friends present were favoured by another visit of Mr. Bell, of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, this time accompanied by Mr. Wright, whose voice is familiar to listeners-in round Manchester. These gentlemen gave a very interesting talk, illustrated with lantern slides, on "Studies and Programmes,"

The Leicestershire Radio and Scientific Society.*

Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

At a meeting of the Society, held on Monday, February 19th, Mr. Atkinson gave his promised description of a three-valve receiver of his own design and construction.

Further members are required for this Society, and also students, who must be under the age of 18 years. The Hon. Secretary will be pleased to give full particulars to those interested. The meetings are held fortnightly on Monday evenings, at headquarters, Vaughan College, 8, Chatham Street, Leicester.

Wolverhampton and District Wireless Society.*

Hon. Secretary, Mr. J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

The Society held its usual fortnightly meeting at the A.J.S. Assembly Rooms (kindly lent by Mr. Harry Stevens) on Tuesday, February 27th, when a lecture on "Valves, and the use of High and Low Tension Batteries" was given by Mr. Harold Taylor (**2 KQ**).

Huddersfield Radio Society.*

Hon. Secretary, Mr. C. Dyson, 14, John William Street, Huddersfield.

On February 23rd and 24th the Society held a very successful wireless exhibition in the Lecture Hall of the Y.M.C.A., 14, John William Street, Huddersfield.

On both days a number of items, including broadcast concerts and short lectures on wireless subjects were introduced during the proceedings, and contributed greatly towards the enjoyment of the visitors, who numbered over 400.

The Radio Society of Highgate.*

Hon. Secretary, Mr. J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

Of the three or four British amateur transmitting stations received in America during the recent Transatlantic Tests, it is with pleasure that we have to report that one of these stations is owned and worked by a member of this Society. The station referred to is **2 SH**, owned by Mr. F. L. Hogg.

A special series of elementary lectures is now being given, full particulars of which may be obtained from the Hon. Secretary.

Leeds Y.M.C.A. Wireless Society.

Hon. Secretary, Mr. N. Whiteley, Central Y.M.C.A., Albion Place, Leeds.

A meeting was held at headquarters on February 12th, Mr. R. Toynbee presiding, when Mr. Whiteley gave his paper on "Radio Transmission," which was much appreciated.

The Society's four-valve set is now almost completed, and it is hoped that the licence will be to hand by the time the set is ready for operation.

Whitby and District Radio Club.

Hon. Secretary, Mr. R. Barry, 14, Abbey Terrace, Whitby.

A whist drive and dance was held on February 12th at Messrs. E. Botham & Sons' Café. A novel feature was a dance to music transmitted from **5 NO**.

Sunbeam (Moorfield) Wireless Society.

Hon. Secretary, Mr. C. E. Beresford, Moorfield Works, Wolverhampton.

The membership of the Society, which now totals 66, is confined to employees of the Sunbeam Motor Car Company. An experimental licence has been applied for, and the club set ordered, and when these come to hand work will begin in real earnest. The Company is heartily in sympathy with the movement, and has provided club, class, and demonstration rooms on a generous scale.

It is intended to install a workshop for the use of members for experimental work, and classes of instruction in wireless, electrics and Morse are in course of preparation.

Morayshire Radio Society.

Hon. Secretary, Mr. D. G. Leslie, C.R.A., 2, Culbard Street, Elgin.

On Thursday, February 8th, Mr. J. S. Souter, A.I.E.E., President of the Morayshire Radio

Society (which was inaugurated on January 23rd). gave a lecture on "Wireless Telegraphy and Telephony" to an audience of between five and six hundred in the Parish Church Hall, Elgin.

At the close of Mr. Souter's interesting lecture the audience were able to listen to speech and music from Birmingham, Newcastle, Manchester and London.

Croydon Wireless and Physical Society.

Hon. Secretary, Mr. B. Clapp, A.M.I.R.E., Meadmoor, Brighton Road, Purley.

At a meeting of the Croydon Wireless and Physical Society held at the Central Polytechnic, Croydon, on Saturday, February 3rd, Mr. J. H. Reeves, President of the Kensington Radio Society, gave an interesting lecture on "Some Experiments with Semi-Aperiodic H.F. Transformers."

A keen discussion followed the lecture.

The Secretary, will be pleased to furnish intending members with particulars.

Oldham Lyceum Wireless Society.

Hon. Secretary, Mr. G. Halbert, 16, South Hill Street, Oldham.

On Thursday, February 8th, a lecture was given on "Condensers," by Mr. H. H. Wareing, Principal of the Oldham Municipal Technical School.

The Society entered its new headquarters, St. Thomas's Schools, Coppice, Oldham, on Thursday, February 15th.

A campaign has been started for the enrolment of new members, and those interested are invited to write to the Hon. Secretary for particulars of membership.

The Overland Radio Association.

Hon. Secretary, Mr. N. D. Cumming, 30, Overport Drive, Berea, Durban.

The attention of amateurs in South Africa is drawn to the above Association, which was founded a year and a half ago. The Society is recognised by the Postmaster-General, and has been granted authority to recommend its members for experimental licences. At present there are thirty members, some of whom reside in remote parts of Zululand.

Meetings are held on Friday nights, and papers of practical and theoretical interest are periodically read. Buzzer practice takes place on Monday nights, proficiency in Morse being very desirable in South Africa, there being as yet no broadcasting.

Applications for membership should be made to the Hon. Secretary.

The Wireless and Scientific Society of Bridlington.

Hon. Secretary, Mr. A. R. Horspool, "Darley," Marton Road, Bridlington.

This Society, which held its first meeting in August of last year with a membership of sixteen, now has a membership of over thirty.

On Tuesday evening, February 6th, Capt. W. E. Dennis, of Hull, lectured on "Wireless for the Amateur and Broadcasting." At 8.30, by special arrangement of Captain Metz, the Eiffel Tower commenced to transmit an excellent twenty minutes' concert for the special benefit of the Society.

All prospective members should communicate with the Hon. Secretary.

A Society for Rye.

A Society has been formed at Rye, under the name of "The Rye and District Radio Society."

A meeting was held on February 12th, when Mr. W. E. Philpott gave a lecture on "The Elementary Principles of Wireless Telegraphy and Telephony."

Prospective members are invited to write to the Hon. Secretary, Mr. W. E. Philpott, 18, Eagle Road, Rye.

Watford and District Radio Society.

Hon. Secretary, Mr. F. A. Moore, 175, Leavesden Road, Watford.

The first annual general meeting of the above Society was held at headquarters (The National Schools) on Friday, February 9th, and officers were appointed for the ensuing year.

On Friday, February 16th, Mr. Christie gave a lecture on the Morse code and some very useful hints on how to attain a high speed.

The Beckenham and District Radio Society.

Hon. Secretary, Mr. J. F. Butterfield, 10, The Close, Elmers End, Beckenham.

The exhibition of members' and trade sets, organised by the Society, was a great success, and many good ideas were revealed in the construction of the amateur exhibits. During the evening broadcast selections were received on a four-valve set constructed by a member.

The new headquarters of the Society are at The Hut, High Street, Beckenham.

Dewsbury and District Wireless Society.

Hon. Secretary, Mr. Fred Gomershall, A.S.A.A., 1, Ashworth Terrace, Dewsbury.

The Society gave a very successful demonstration at the Highfield Chapel, Earlsheaton, on Tuesday, February 13th.

The Secretary complains of the unsatisfactory attendances at recent meetings, and urges the members to take advantage of the valuable discussions which are a feature of the Society's activities.

St. Bride Radio and Experimental Society.

Institute Manager, Mr. R. J. Berwick, Bride Lane, Fleet Street, E.C.4.

A very interesting and instructive evening was spent by members of the Society on Wednesday, February 21st, when the President, Capt. H. Riall Sankey, C.B., C.B.E., R.E. (Ret.), M.Inst.C.E., occupied the chair. The proceedings opened with an admirable lecture by the President, in which he explained in non-technical language the rudiments of Wireless Telephony.

This was followed by a short demonstration and general meeting, when the Formation Committee gave an account of their stewardship: draft rules of the Society were submitted to the meeting and approved: permanent Committee and officials elected; and meeting nights arranged, alternate Mondays at 7.30 p.m., commencing March 5th.

Visitors and prospective members will be cordially welcomed at any of the meetings of the Society.

Sale and District Radio Society.

Hon. Secretary, Mr. H. Fowler, "Alston," Old Hall Road, Sale.

The above recently formed Society, having now secured very central and convenient premises in School Road, Sale, intends to hold an exhibition of amateur made wireless apparatus, on the first Saturday in April, at which the formal opening will take place. The lecture and reading rooms are now ready for use, and the workshop and experimental room are being thoroughly equipped with benches, tools, stores, etc.

Should the Society be successful in obtaining an experimental license, it is intended to equip the premises with an efficient aerial and receiving set.

In the meantime applications for membership will be welcomed by the Hon. Secretary.

Walton-on-Thames and District Amateur Radio Society.

Hon. Secretary, Mr. N. V. Webber, Walton House, Walton-on-Thames.

The second general meeting was held at headquarters on February 19th, at 8 p.m., with R. V. Somers-Smith, Esq., J.P., in the chair.

At the conclusion of business regarding the election of officers, the Technical Adviser demonstrated and explained a non-radiating receiver (H.F. rectifier and L.F.), and impressed on all present who held experimental licenses, the importance of using such a circuit while experimenting during broadcast hours.

South Shields and District Radio Club.

Hon. Secretary, Mr. J. A. Smith, 66, Salmon Street, South Shields.

The first general meeting was held on February 23rd, at the Club's headquarters, Edinburgh Buildings, 34, King Street, South Shields.

In his address, the Chairman recalled the commencement of the Club, when the inaugural meeting was attended by nine of the Club's present members. Since that time, barely six months ago, rapid and sound progress had been made. Foremost of all being the obtaining of a transmission licence (the call sign allotted being **5 QI.)**

The election of officers next took place, resulting, among others, in the appointments of Sir Jas. Readhead, Bart., as Patron, and H. R. Cullen, Esq., M.A., A.R.C.S., as President.

Meetings are to be held at headquarters every Friday at 7.30 p.m., and the premises are open during the day and evening, to members who hold keys.

Merthyr Tydfil Radio and Scientific Society.

Hon. Secretary, Mr. Davies, 5, Pantysellog Terrace, Pant, Dowlais.

At the meeting of the Society held on Wednesday, February 21st, it was decided to make application for affiliation to the Radio Society of Great Britain. It was also agreed that the Society should construct a new receiver (five valve) in place of the existing three-valve, the receiver to be designed on the unit system, employing a two H.F. detector, and two L.F. valves.

Intending members are invited to any of the weekly meetings (Wednesday evenings at 7 p.m., at the Cafarthfa Castle School).

NEW SOCIETIES.

Chorlton-cum-Hardy.

A wireless society is being formed at Chorlton-cum-Hardy, Manchester, and applications for membership from all wireless enthusiasts in the district will be warmly welcomed. All communications should be addressed to Mr. Maurice C. Booth, 4, Chatsworth Road, Chorlton-cum-Hardy, Manchester.

Farnborough, Hants.

Mr. J. E. Catt, A.M.I.E.E., A.I.R.E., "Melrose," Alexandra Road, South Farnborough, Hants, would be pleased to hear from any amateurs who would give support to the formation of an amateur wireless society for the district.

Harpenden.

It has been decided to form a Society under the title of the Harpenden Radio Society, to be affiliated in due course with the Radio Society of Great Britain. Particulars of membership can be obtained on application to the Hon. Secretary, Mr. Percival A. Anscombe, Wellington House, Harpenden, Herts.

Worthing.

At a meeting held at the recreation room of the Central Fire Station recently, under the chairmanship of Dr. H. Leeds Harrison, it was decided to form a wireless society to be known as the Worthing Radio Society. Mr. R. N. Oates was elected Hon. Secretary, and Mr. E. A. Jemmett, Hon. Treasurer.

St. Albans.

The St. Albans and District Radio Society was formed on February 27th. All who are interested and who reside in the district are invited to communicate with the Hon. Secretary, Mr. J. H. Holderness, 8, Westview Road, St. Albans.

Seaforth.

A society has been formed under the title of the Seaforth and District Radio Society. Applications for membership should be addressed to the Hon. Secretary, 237-9, Crosby Road, Seaforth, Liverpool.

Leyton.

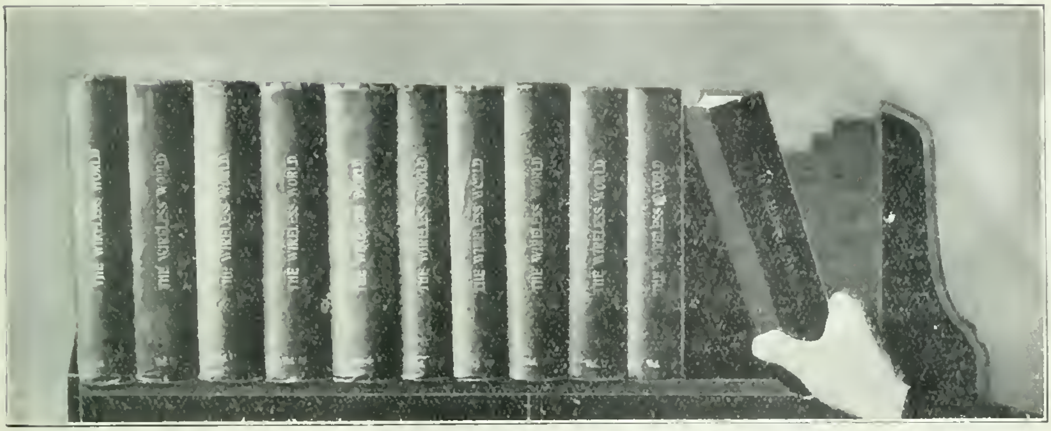
The Leyton and District Wireless Club was formed on March 14th. The President and Chairman are E. R. Alexander, Esq., M.P., and W. Bassett, Esq., respectively. The Society begins with a membership of over 50. Prospective members are invited to communicate with the Hon. Secretary, Mr. W. G. Peacocke, 73, Frith Road, Leytonstone, E.11.

Sydenham and Forest Hill.

A radio society bearing the name Sydenham and Forest Hill Radio Society, with the chess room of the Greyhound Hotel, Sydenham, as headquarters. Particulars of membership can be obtained from the Hon. Secretary, Mr. Chas. F. Field, 20, Knighton Park Road, Sydenham, S.E.26.

Loughborough.

At a meeting held on February 27th it was decided to form a radio society. Particulars of membership can be obtained from Mr. W. J. Tucker, 1, Charnwood Road, Loughborough.



1913—1923

Another Volume Added to Our Bookshelf

THE present issue marks the close of the XIth volume of *The Wireless World and Radio Review*, and the completion of a year's record of weekly numbers.

During the currency of each volume it is our endeavour to gauge the requirements and wishes of our readers, and with each new volume we have endeavoured to introduce those features which our observations and the kindly criticisms of our readers have indicated to be desirable.

With our next issue, to bear the date of April 7th, therefore, will be included some special features which we feel sure will be appreciated.

Whilst it is not intended here to give details of the contents of forthcoming issues, it may be mentioned that the outstanding attraction will be practical articles for the amateur and experimenter, with all necessary information to help and guide both the new and the advanced readers in the practical application of wireless principles.

A point which we desire to emphasise in this connection is the value which is to be attached to descriptions of the work of individual readers which we look forward to having the opportunity of publishing for the benefit of others. Those who have ideas to pass on are cordially invited to forward them for publication so that *The Wireless World and Radio Review* may become more than ever the wireless journal of the amateur and experimenter through the medium of which he can describe new ideas and new circuits embodied in his experimental work.

The policy of the Journal to keep up to date in recording new developments in all fields of wireless telegraphy and telephony will be fully maintained in order that readers may rest assured that progress both in commercial and amateur work will be promptly and accurately brought to their notice.

Due in large measure to the enormous increase in the popularity of the subject dealt with in our pages our circulation continues to build up with astonishing rapidity. One of the direct results as affecting readers is that the Publishers are able to make a reduction in price of the Journal approaching the pre-war figure. The price will accordingly be 4d. per copy, commencing from our next issue, instead of the present price of 6d. The subscription rates will also fall from 28s. per annum to 20s. post free.

Photographing Wireless Apparatus

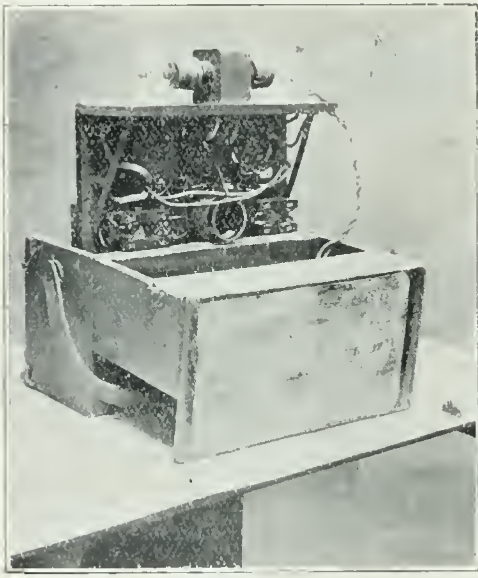
By D. Charles.

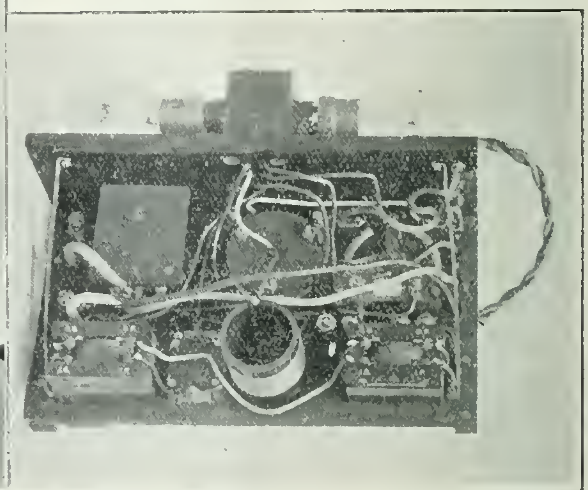
THAT babies should not be easy to photograph everyone realises, because obviously the little beggars won't keep still, but when you have a thing that will stay where it is put till further orders, there seems nothing more to do than to point the camera at it and expose the plate or film for the length of time decided to be correct. The supposition is so very general that whatever may be in front of the camera must necessarily be faithfully recorded.

Unfortunately such is not the case, and if I may be permitted to describe first certain peculiarities and limitations of photographic technique, and afterwards to show how these matters are brought into play when dealing with wireless apparatus, the reader will be able to adapt the information thus imparted to any particular case.

If the photograph is to illustrate a technical article or lantern lecture, or for some kindred purpose to describe the apparatus in all its varied detail, not only is it necessary to adopt the most careful procedure, but it comes as a surprise to many what a lot of extra thought and care is entailed in producing a picture that will tell all the story over one that will just pass muster. It is really a matter of critical observation, and if the reader knows what he wants to show, the following notes should enable him to obtain it.

A photograph consists of a number of steps of light and shade, ranging from almost white to almost black. A plate of the "special rapid" class can render a very long range of such tints; it has been said as many as two-hundred-and-fifty odd steps, each one distinguishable from the one before it. Now very few printing processes, unfortunately, will do anything like a tenth of this. You may have noticed in some holiday "snap" that although it has a most attractive appearance generally, and although the cloud forms and the muslin frocks of the ladies are perfectly rendered, yet the hair under their large hats and the shadows of the near-by rocks and trees are seen when examined closely to consist of mere patches of detailless black. If the negative be printed so as to preserve this lost detail, the lighter areas referred to will be blank paper. If, on the other hand, the negative had been developed less far, so that the "high-lights" could be printed before the "shadows" are clogged





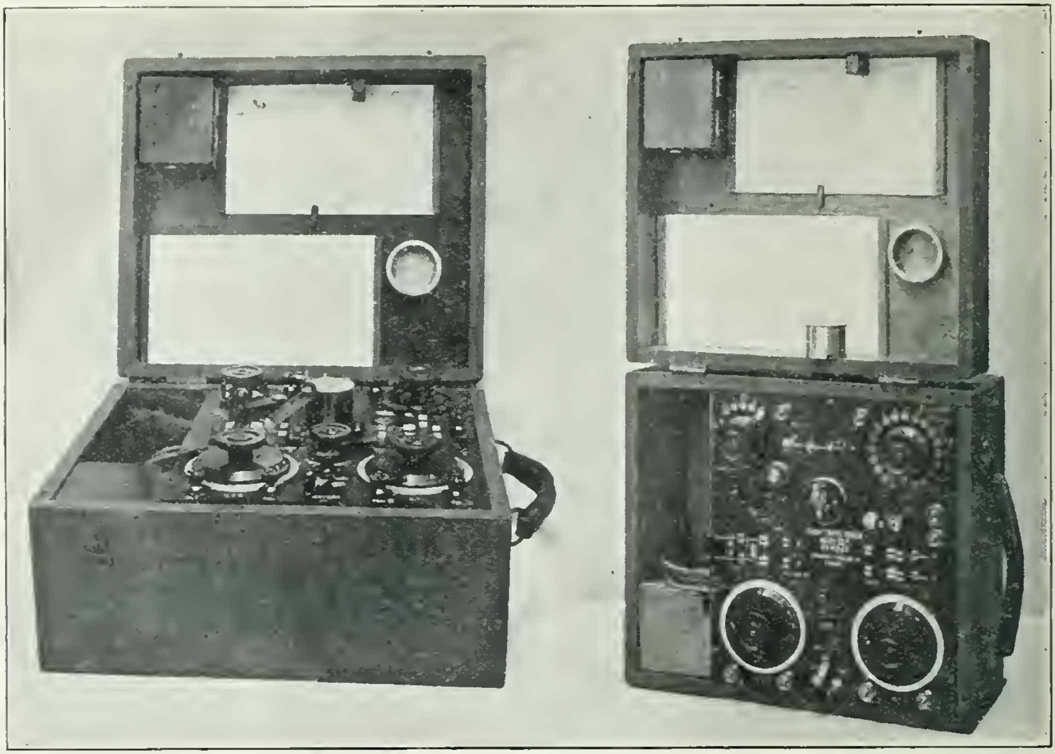
Apparatus kindly loaned by Messrs. Leslie McMichael, Ltd.

up, the "high-lights," *i.e.*, the clouds and the frocks, will not exhibit the brilliance that the actual subjects do in nature; that is to say, they will appear somewhat flat or "dirty," and the shadows, although showing more detail, are far less rich than one could wish. It sometimes, but rarely, happens that a print is obtained that shows every detail and gradation of the original subject and still looks bright and in every way technically satisfying to the most critical eye. In such a case it is always obvious that the negative was correctly exposed and developed, and was made of the correct strength for the particular printing paper used.

If the reader will take the trouble to acquaint himself with a sound method of ensuring correct exposure and development, so as to get a good negative every time, he will be a very long way on the road. The best systems are explained in "Watkins' Manual," price 2s. 6d., at any photographic dealers. We still have the difficulty left that our subjects do present a most unusual range of light and shade, from the nickel-plated telephones and the finely engraved ivorine scales, down to details of black ebonite, these being situated often in the most dim recesses of the apparatus.

Fortunately it is possible to even up the apparent excessive contrast inherent in such subjects as we are considering by choosing suitable conditions of light. It is fairly obvious that if sufficient exposure is to be obtained to render the blackest details in printable shades of grey, it is essential to have plenty of light shining on to them. Sometimes it is argued that if the light is dim one can always give a longer exposure, but the result will never be the same. Probably the reader will think I have already given him enough "theory," so I will ask him to accept that statement as a fact. To give technical reasons for every statement obviously would occupy several issues of the *Wireless World and Radio Review*, but I am always prepared to prove, if required, any statement made, even if it appears prima facie to be contrary to common sense.

Even more important than plenty of light, however, is its distribution. To give an example which will for the moment take the mind from wireless, so as not to confuse the issue, it must be obvious that to photograph a negro in black clothing requires either more light or more exposure than for a fair bride in traditional array. If we complicate matters by standing the nigger in a doorway, while placing the bride in the full light of day outside we have obtained a subject that "takes all our time" to photograph successfully. This is, if a moment's thought be given, exactly what is done in many wireless instruments, with their valves and dials on top, and their interesting details of coils and wiring in their black interiors. While one could ask the bride and the negro to change places, so as to even up the light falling upon them, and so to reduce our difficulty, we cannot do the same with our apparatus, but what we can do is to place the latter so that the light may fall more strongly on the dark parts. This has been done in the case of the Mark II instrument shown in Figs. 1 and 2, as well as other things which have helped in producing the more satisfactory photograph. In No. 1 the instrument has been lifted up with the intention of showing the "works" and connections. The valves catch the top light and the shelf on which they are held casts the already dark wiring, etc., into still deeper shadow. By lifting the instrument entirely clear of its case, and standing it *on one end* with the valves on the side further from the light, we have done as much as possible to reduce the inherent contrast of the subject instead of exaggerating it as in the previous example. Still it must be noted that the range is longer than will be rendered by ordinary photographic methods, and although the details of the valves are discernible in the print, they do not show so strongly as if these were photographed separately, and probably much of this very delicate gradation will be lost in reproduction. Even with the careful method explained, the valves would still have been too strong in the negative to print satisfactorily while retaining the other portions of the picture, but this trouble was rectified by means of tissue paper, of which a piece was stretched over the printing-frame, a little distance from the negative, over the thin portions. The effect of this was to make the dark parts print more slowly, while the full strength of the light reached the valve image and got them to full strength before the remainder printed too dark. In some cases it is found advantageous to make quite a complicated "mask," in similar manner to the letterpress printer who makes an "underlay" or "overlay" for his blocks and display matter. In enlarging from negatives the same principle may be carried out by stopping the light from the weaker portions



Apparatus kindly loaned by Messrs. Leslie McMichael, Ltd.

of the negative during part of the exposure. Sometimes the fingers are used, and sometimes a bit of paper or cotton-wool on the end of a wire. Needless to say, the shield should be held at such distances from the easel that it is not in sharp focus, and should also be kept gently but continuously moving during exposure.

These dodges are regular matter-of-fact items of procedure in every professional photographic workroom, and another point that needs only mentioning to become equally obvious is that although we placed our subject on its side in order to get a more satisfactory photograph, that is no reason why the resultant print should be exhibited in such an unnatural attitude. Fig. 1 not only illustrates the pseudo-brilliance obtained by over-lighting of the "lights" and under-lighting the "shadows" (lights and shadows in photographic technical parlance referring merely to light and dark portions of the subject, irrespective of their position) but to a less extent shows how faulty exposure and development can accentuate this false, because detail-less, brilliance.

At the same time it must be pointed out that this easily obtained accentuation of brightness often is a very convenient means of emphasising forms of details when photographed singly. When the point to be illustrated is the method of winding a coil, or the shape of an insulator, for instance, a little harshness of lighting, increased by a little more prolonged development of the plate, will produce the desired relief. A choice of background very often helps to give an appearance of brightness to an otherwise flatly lit subject, but let me say at once that to employ an absolutely white background (which usually is demanded of the professional) introduces a surprising amount of technical difficulty in many cases, especially where the subjects comprise polished surfaces.

In the photograph of the Mark II receiver (Fig. 1) it may be noticed that some portions are not so sharply defined as others. It must be left entirely out of consideration, in making photographs of such subjects as this, that a lens may have been purchased on account of its "rapidity." In order to obtain sharpness of detail in every plane only the smallest stops are of any use, so that no one lens is any more rapid than another in this class of work. Not only is it necessary to use a very small stop, but it is desirable to employ a lens of rather longer focal length than usual. This is because the more distant view-point that such a lens permits reduces to a minimum such apparent exaggeration of perspective as is shown in the photograph under consideration. The trouble is that the longer the focus of the lens, the smaller is the stop that will be found necessary to obtain the same "depth of focus." It may be found often that the smallest stop in the lens is not fine enough to get the required sharpness all over. In such a case one must be content with a smaller image which can naturally be enlarged afterwards in the usual way.

There are other ways in which one can make things easier for oneself, photographically speaking, and at the same time obtain a more satisfying result. Some of these ideas can be appreciated by examination of the photographs of the Mark III crystal receiver. If this be opened for use and photographed in the usual way, even with a rather long focus lens, the result is as Fig. 3. While this may be a true representation of the subject as seen, the first impression obtained is that a Mark III receiver consists mainly of a rather ugly box and two large white cards, while the stuff that really interests the wireless man is an inconspicuous jumble in the centre.

Compare this with the next illustration. Not only is every detail distinct, but as there is so very little depth of detail from front to back we can get our result with no distortion as well as with the use of a much larger aperture, and with a consequent decrease in the length of exposure. Another slight improvement has been attained in the matter of the background. A friend was asked to hold this some little distance from the table upon which the instrument was placed, and during the exposure he kept it gently moving about so that no definite image was obtained of the many creases and stains which actually it contained. There is another difference of rather greater importance. It will be noticed that in Fig. 3 the cap of the relay is practically black, as are also the terminals, except where the light strikes certain spots, so that for all anyone might know they were made of ebonite. In the next picture, however, they can be seen in their true relation. This result is obtained simply by using a colour-sensitive plate, which is not "blind," as is the "special rapid" variety, to details of red, yellow and orange tints, as every photographer knows. As a matter of fact both these plates were treated together, being developed in the same dish of solution together, and fixed together, both processes taking place in absolute darkness. Anyone who takes the trouble to master and follow out the very simple methods of standard exposure and development recommended earlier in this article need have no fear that the use of colour-sensitive plates will involve him in any extra trouble beyond the attainment of some facility in loading and unloading them in darkness. Probably he is already so used to his existing plates and slides that if the ruby light were suddenly switched off it would cause him not the slightest inconvenience. Anyone who has ever used a changing-bag has nothing to learn in this respect.

Hitherto I have dealt with the problems involved in photographing units. This is because they present the greatest difficulties as a rule. Complete installations often present their own difficulties. Frequently they are placed with their backs to the window, and in such a case the use of flashlight is practically the only way of getting a really satisfactory photograph. Where the lighting conditions are favourable, a perfect result is always obtainable by the use of a small stop in the lens and by then giving twice the exposure that would be required for that stop in photographing a normal interior subject. It occurs sometimes that some important detail of a set is rather in the shadow of some more bulky units (I am dealing here, of course, with fixed installations) or it may be there is something under the table, or in a recess, that one desires to "bring out." Apart from the good old rule of "exposing for the shadows, and letting the rest take care of itself," much may be done in such cases by using a mirror, as large as possible, to reflect light from the window into the dark corner during the exposure. The mirror must be kept moving, either continuously or intermittently, during the exposure. An acetylene cycle or motor lamp may be employed for local lighting in much the same way. In fact it is perfectly possible to make the complete photograph by artificial light if panchromatic plates are employed. Where half-watt lamps are installed the exposures should not be long, but even with incandescent gas it is quite practicable. Obviously the more and the better distributed the lamps are, and the lighter the walls of the room, the softer the lighting of the resulting photograph will be, but with electric lamps the same desirable result can be got by moving the lamps to different positions during the exposure, or even just by swinging them, so as to get some light into the dark corners. The actual length of exposure differs so much in varying conditions, and the tint of an exposure meter is not easy to judge in such artificial light, but it is not easy to over expose. I have obtained quite good results at a stop of F 11 with about five minutes' exposure in favourable conditions, but have also exposed for many hours in dark, poorly lit rooms. However, an average subject lit under ordinary home or workshop conditions should not require more than about twenty minutes if a stop of F 16 be used in the lens, and a panchromatic plate be employed. The contrasts are apt to be harsher in this evening work, but either a weaker developer or less developing time will assist towards correcting this.

The most pleasing prints of wireless gear usually are found to be those on daylight printing papers such as "self-toning," and a carefully made lantern-slide also shows a great deal more of the delicate gradations of each detail that are lost in the black and white developing processes, but prints of the latter class are those demanded by photo-engravers for reproduction as process blocks for printing in publications.

There is one factor in the success or otherwise of the illustration that is really not photographic at all, and that is merely a matter of critical observation. It is a point, however, that is frequently overlooked in practice. Just before making the exposure it is very advisable to look at the subject from just behind the camera. Then carefully to note first of all whether any detail that it is desired to show is hidden by a pair of telephones or other object of less importance. Then it is desirable to see that there is no omission of essential connections. For instance, if a person is introduced as using the set with the object of showing its proportionate size, it will be rather noticeable if the necessary accumulators are merely stood in position without actually connecting them up. That may seem a rather stupidly obvious example, but it is a mistake the writer has seen made, and there are plenty of such sins of commission or omission which may be committed under the impression that "they won't show in the photograph," but which are subsequently discovered to jump into the eye of the experienced technical man. For the sake of effect, too, it is desirable to smooth out some of the crudenesses of wiring that are apt to obtrude themselves on the eye in photographs of experimental sets, and furthermore, just to give one final glance for any cigarette ends and for that screwdriver. It is so much less trying to remove them before one makes the exposure than when one has already wasted a plate.

Experimental Station at Bath.

THE following description of the transmitting and receiving apparatus of 5 CC at the Bath Electro-Plating Works is of interest.

The aerial system is of the twin wire, inverted "L" type, having an average height of forty feet, and Post Office regulation length, whilst the earth consists of a large copper plate buried underneath the aerial.

The aerial and earth are brought to a large double-pole double-throw switch seen in the centre of the photograph, by which changing over from the transmitting to receiving apparatus, and *vice versa*, can be quickly effected. An earthing switch for protection against lightning, when the set is not in use, is also fitted.

The receiving apparatus is of the six-valve type, two valves being high frequency amplifiers, one a detector, and the remaining three note magnifiers. Three separate rheostats are used to control the filaments of the valves. High frequency transformer coupling is used, the transformers being tapped in both primary and secondary windings to give maximum amplification on all wavelengths. A potentiometer is used to control the potential on the grids of the H.F. valves. The low frequency transformers are of a well-known make, and are specially placed to reduce howling, etc., which is so common where low frequency amplification is used. Reception can be carried out using headphones or Brown's loud speaker and microphone amplifier.

The three-circuit tuner seen to the left of the change-over switch is of rather novel design, basket coils wound on a special former being used as inductances. Below the tuner are the three tuning condensers fitted with extension handles to reduce capacity effects. It may be mentioned here that no reaction whatsoever is used for the reception of broadcast telephony.

The transmitting apparatus is situated on the lower bench on the right. The power valve, pancake inductances and variable condensers can be clearly seen. Grid modulation is employed, and has proved generally successful under all conditions, a Western Electric microphone being used. The H.T. generator seen under the bench is of the aircraft type, and is a combined motor generator, but has

5 CC. *An Experimental Station at Bath.*

A series-parallel switch for the A.T.C. is to be seen between the tuner and change-over switch.

On the extreme left is a charging board for the filament batteries.

Excellent reception is carried out on all wavelengths. All the broadcasting stations working in England and also on the Continent are received, whilst Birmingham and Paris can be heard very strongly over the whole of the works. The American broadcasting stations have been received on several occasions, and have been audible over the whole room on the loud speaker.

recently been replaced by a heavier machine capable of giving 600 v 250 m.a. driven by a separate motor. A large capacity condenser is shunted across the commutator to cut out the ripple and a choke coil inserrted in each lead. Telephony has been transmitted over a distance of 100 miles with this set, on a wavelength of 440 metres, and recently some successful tests have been made by linking up the land telephone to the transmitter. A small spark set has been installed as a stand-by in case of breakdown of the C.W. transmitter, and also for local work. This set works on a wavelength of 180 metres.

Notes

Broadcast and Experimental Licences.

Up to February 28th, states Sir William Joynson-Hicks, 56,000 broadcast and 30,000 experimental receiving licences had been issued.

International Rules for War Wireless.

Importance is attached to an announcement from Washington that President Harding will soon propose new rules to govern the use of wireless and aircraft in war. Great Britain, France, Italy, Japan and the Netherlands are to be asked to sign an agreement putting these rules into effect. Information is not available as to the probable nature of these recommendations. Steps are to be taken to arrange for a conference between the Powers concerned.

2 LO to Move.

On Monday, March 19th, at the request of the Air Ministry, the British Broadcasting Company cancelled the mid-day concert from the London Station. It has been found that the broadcast transmissions from **2 LO** interfere with reception at the Air Ministry Station in Kingsway, the distance between the two stations being little more than one hundred yards. To obviate this difficulty, the British Broadcasting Company is searching for a more convenient site, probably in the City, to which **2 LO** can be moved.

Wireless Talks to Girl Guides.

Official information regarding the Girl Guides will be transmitted from all stations of the British Broadcasting Company every Thursday evening at 6.45.

Parliament and Empire Wireless Licences.

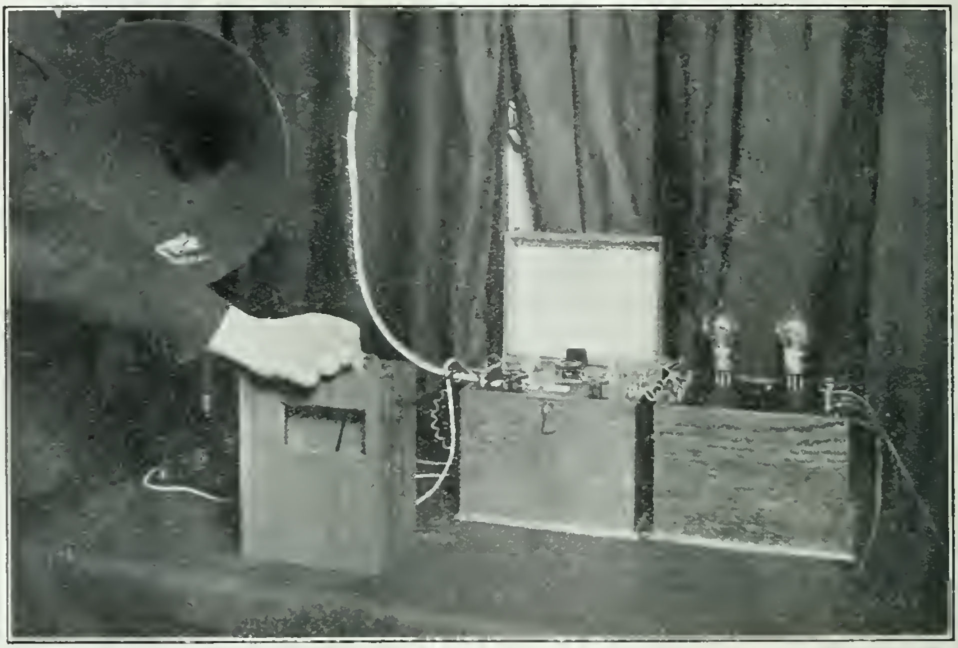
In the House of Commons on March 14th, in answer to a question by Mr. Ramsay Macdonald, Major Barnston stated that the provisions of the licences had not been settled, but that when completed they would be laid on the table of the House. The Government was not prepared to provide a special opportunity for discussion, but the question could be raised on the Estimates.

New Austrian Wireless Service.

An Austrian Marconi Company, with a capital of £130,000, will be formed very shortly, the company having obtained permission to erect and operate a station in Vienna. This station will communicate with all foreign countries, and the service is expected to commence in a few weeks. The Marconi Company is also taking over all the Austrian stations built during the war, in return for which the State will be granted shares to the extent of £40,000, payable in pounds sterling.

The Wireless Institute of Australia.

Whole-hearted support on the part of members has led to the indubitable success of a movement to improve the Institute's status in the community. It is now claimed that the prestige of the Institute is sufficient to place it among the principal scientific societies of the Commonwealth. The Patron of the Society is Senatore Marconi, who has held the position since the termination of the war.



Five minutes for a penny. A new "penny-in-the-slot" machine which can be affixed to any valve set. It is understood that its use in public houses renders a music license unnecessary. The device is a product of Messrs. The Tower Carriers, Ltd.

Of late, as in this country, radio has seized the popular imagination in Australia, and, due in no small degree to the efforts of the Wireless Institute, the authorities have wisely taken steps to cope with the amateur position. Extremely liberal facilities have been accorded all genuine experimenters, and prospects are bright.

The Hague Concerts.

Some doubt having arisen as to the exact times of transmission of the concerts from Holland, we give below particulars of the transmissions as kindly supplied by the organisers, Messrs. Nederlandsche Radio-Industrie.

Wavelength, 1,050 metres.

Sunday.—3 to 5.40 p.m. Concert with orchestra.

Monday.—8.40 to 9.40 p.m. Concert and announcements.

Thursday.—8.40 to 9.40 p.m. Concert by different vocalists under the auspices of the Dutch Wireless Society.

Special announcements concerning future arrangements are made every Sunday after 5 p.m., in English, Dutch and French.

The Monday concerts are sometimes transmitted on 1,300 metres, notice of this being given on the previous Sunday.

Exit the Gold Watch.

To commemorate the completion of 25 years' service, Mr. Gilbert Campbell, M.B.E., was presented, by the officials and workmen of the Wallsend Slipway and Engineering Company, with a wireless receiving set. This marks a new and significant departure from the conventional gold watch presentation.

Photo, Barratt's

Wireless Set in an Easter Egg. A novelty constructed by a young North London enthusiast.

A New Book on Valve Set Construction.

To build an efficient valve station is the ambition of every enthusiastic beginner. Before this can be accomplished, however, it is necessary that the incipient experimenter should have a working knowledge of the principles of valve operation and the components which go to make up a set. Such information, in tabloid form, is now available in a compact little book by Mr. Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E., entitled, "How to Build Amateur Valve Stations," just issued by the Wireless Press, Limited. (1s. 6d. Post free, 1s. 8d.).

Wireless at Sandhurst.

The authorities at Sandhurst Military College have installed a wireless transmitting and receiving station.

By courtesy of the A.R.R.L.

Miss M. Adare Gamhausen, an active American wireless enthusiast. Her station is **3 BCK.** *She is the author of several constructional articles published in America.*

Wireless Instruction for Electrical Engineering Students.

A scheme of technical instruction in wireless is to be incorporated in the electrical engineering courses at Cardiff Technical College. The view taken by the Technical Instruction Committee is that wireless apparatus now comes essentially within the purview of any electrical engineer and consequently instruction calculated to enable students to handle any set of apparatus, and in some cases to carry out investigations, will be automatically included in the ordinary courses.

Portuguese Colonial Wireless.

Work on the establishment of wireless communication between Portugal and the Portuguese Colonies will be begun next month, when the erection of high power wireless stations will be proceeded with. The operations, under a contract with the Marconi Company, are to be completed within three years.

Official Radiotelephony in Denmark.

The little island of Bornholm, in the Baltic, which, says the *Times*, has hitherto had no telephonic connection with the rest of Denmark, will shortly be in regular official communication by wireless telephone with Copenhagen. The distance is about ninety miles.

An Omission.

Owing to an oversight the initials of Mr. W. James were omitted from his recent contribution entitled "The Antennae."

The New P.M.G.

Sir W. Joynson-Hicks began his duties at the General Post Office, on Monday, March 19th, when he received a deputation of wireless manufacturers, on the subject of the broadcasting agreement.

Compulsory Ship Wireless at Malta.

In future every British sea-going passenger ship, registered in Malta, of 1,600 gross tonnage and upwards, will be required to carry wireless while within a port of the Islands of Malta. The rule will also apply to foreign ships of the same categories. The Governor has power to enforce these regulations under a new Ordinance entitled: "The Merchant Shipping Wireless Telegraphy Ordinance, 1923."

S.O.S. Stops Broadcasting.

An incident in broadcasting of a kind which has not occurred in this country, took place in New York City on February 6th. A peremptory QRT order was issued by the U.S. Navy and all broadcasting abruptly stopped. The cause was an S.O.S. signal received from a vessel in distress 800 miles off the coast of France.

Tuition by Radio.

Correspondence Schools will have to look to their laurels if the latest experiment in wireless proves successful. On Wednesday, March 21st, for the special benefit of three Sheffield schools, General Ferrié, whose name is well-known to readers of this Journal, gave a wireless reading in French of a fable and a poem. The latest method of teaching languages will be watched with interest.

South Africa's Wireless.

The capital of the South African Wireless Company has been fixed at £500,000, says a Reuter telegram from Capetown. The Marconi Company will own four-fifths of the capital and South Africa the remainder. The obtaining of a site has presented some difficulty and the receiving station may be within range of gunfire from the coast, but the transmitting station must be free from such risk. Provision is made for a new agreement permitting the South African Company to use Marconi patents free of payment.

Home Charging of Accumulators.

Messrs. Ward and Goldstone, the well-known Manchester firm of electrical engineers, have issued a useful four-page pamphlet dealing expressly with their apparatus for the charging of accumulators under varying conditions, including charging at home from electric light mains.

The pamphlet, which will be of great interest to all those amateurs who contemplate dispensing with the garage and "doing the job themselves," can be obtained from the branch offices of the firm at 8a and 9, Great Chapel Street, Oxford Street, London, W.C.1., and Mercantile Chambers, 65, Bothwell Street, Glasgow, or direct from the head office, Frederick Road, Pendleton, Manchester.

Radio Research in Great Britain.

Proof is not wanting of the patient and methodical work in the field of radio research which has been carried on in this country by the British National Committee for Scientific Radiotelegraphy. The proposals of this committee, prepared for consideration at last summer's conference of the Union Radio Scientifique, at Brussels, afford interesting reading.

Many phases of the science which have been investigated are enumerated, and in each case the proposals of the Committee are appended. The first item is the measurement of the strength of an electromagnetic field at receiving stations. The measurement at different stations of the strength of the U.R.S.I. signals is principally to ascertain the law of the propagation of energy on a completely scientific basis. In this connection it is suggested that simultaneous observations using accurately calibrated apparatus would be of much more value than observations at a single station, and it is proposed that an organised system of simultaneous observations should be arranged by all countries ready to co-operate in this scheme.

Another subject dealt with is the maintenance of radio standards and improvements in the method of radio frequency measurements. This work is carried out at the National Physical Laboratory in collaboration with the Radio Research Board. The standards, which include those of capacity, inductance and wavelength, are in constant use, and have been brought to a very high point of accuracy. The value of inter-comparing national standards of frequency is emphasised, and it is proposed that the question be discussed with the object of coming to some practical arrangement for the purpose.

A summary is given of the results obtained from observations on the direction and intensity of atmospheric disturbances and their daily and seasonal variations. Observations were made by an aural method at the same time each day, the average number of atmospherics heard being 80 per minute. The mean direction of arrival of the greatest disturbance was 153° (measured from north as zero), with a diurnal variation of 60° range and a seasonal variation of 100°. The aural method of observing has now been replaced by a continuously recording method, and the fitting of other stations in the British Isles and abroad with similar apparatus is contemplated.

Investigations have been made as to the causes of error of bearings of transmitting stations on land and sea at different receiving stations, with special reference to those errors which may be due to the local conditions existing at or near the receiving station. The errors have been classified as follows:—

(1) Instrumental.

(2) Those produced by local site variations.

(3) Those caused by variations of the Heaviside and other ionised layers, by the waves crossing rough country, or by refraction at coast lines, etc., and

(4) Those influenced by the system of transmission, or by the configuration or orientations

of the aerial or earth systems of the transmitting station.

Direction finding observations, it is proposed, should be made at continental stations with radiogoniometers comparable in accuracy to those now in use in Great Britain. It is also suggested that, if the northern countries agree, special observations be taken at stations within or near the arctic circle, where effects of the aurora, especially with reference to its height, could be noted.

The Heaviside layer has been the subject of study. The height of the layer is not known in temperate regions, nor is it known if the layer is as constant in form as it appears to be in the tropics. It is proposed, therefore, that experiments should be made by night to determine the power received at a number of stations along a great circle extending to 4,000 or 5,000 km. at least.

Correspondence.

To the Editor of THE WIRELESS WORLD AND RADIO REVIEW.

Re CHEMICAL RECTIFIERS.

SIR,—With your permission I would like to make one or two observations on Mr. Isenthal's letter appearing in your issue of February 17th, otherwise a mistaken impression may be produced in the minds of your readers.

In a catalogue of these devices compiled by Mr. Isenthal about 1913, at a time when, by his own computation, his experience was of twenty-eight years duration, he says :—

> "Some fourteen years ago we handled the 'Nodon' Valve, and in consequence of certain inherent defects we afterwards discontinued its use and brought out the 'Grisson' Valve, which in itself was mechanically and electrically an improvement on the previous type. We very soon recognised that this could be greatly improved, and we then introduced our own 'Grid' type, which gave us a vast deal of experience in the construction of such apparatus. The defects which still attached to the Electrolytic Rectifier were, the gradual heating up of the electrolyte, the consequent deterioration and failure of the valve, and the necessity of using four cells for the purpose of utilising both half waves of the current.
>
> "Comparatively recent work on the part of several experimenters have resulted in much improvement on these points.
>
> "We are fully aware that when bringing the new construction to the notice of our clients, many misgivings will undoubtedly have to be removed before the confidence of early users of similar but faulty constructions can be regained."

The foregoing should suffice to show that at no far distant date Mr. Isenthal was still hopeful, both on the scientific and financial side.

Having admitted the existence of experimenters and improvements in 1913, it is impossible to deny a continuance of this work on Rectifiers, for the pages of the *The Wireless World and Radio Review*, and other scientific publications show on the contrary that a vast amount of investigation has been done.

During the last four years in particular, M. A. Codd has brought the resources of his knowledge and an up-to-date laboratory to bear on this particular subject with remarkable success, but this result has only been obtained by patient and laborious work, consisting, in brief, of oscillographic tests with various chemical combinations, various sizes of electrodes, etc. I am sure Mr. Codd does not claim to have worked through every known salt which will produce a rectifying action, neither could this be done in one lifetime.

On the occasion of my lectures to Radio Societies in various parts of the country, I have shown amongst others, chemical rectifiers of considerable efficiency and of extremely convenient design, and at my recent lecture to the Associates of the Radio Society of Great Britain on March 16th last, I demonstrated one of these Rectifiers, not only charging accumulators, but also serving to supply energy direct to the anode circuits of valves used for the reception of telephony. In both types the polarisation difficulty regarded by Mr. Isenthal as important has been entirely overcome.

In conclusion I submit it to be rather presumptious to condemn the chemical rectifier in its most modern form without full investigation or, at least, careful enquiry.

L. F. FOGARTY.

Books Received

"**The Practical Electrician's Pocket Book, 1923.**" (S. Rentell & Co., Ltd. 3s. net).

"**Wireless Component Parts and How to Make Them.**" Edited by Bernard E. Jones. ("*Amateur Wireless" Handbooks.* Cassell & Co., Ltd., La Belle Sauvage, E.C.4. 1s. 6d. net.)

"**A Beginner in Wireless.**" By E. Alexander. (Drane's, Danegeld House, Farringdon Street, E.C. 3s. 6d. net.)

Catalogues Received.

Messrs. Maritime Stores, Ltd., 18, Billiter Street, London, E.C.3. 301 pages + lxviii. Embracing a wide range of marine goods, and of special interest to those requiring aerial tackle.

Messrs. Richard Melhuish, Ltd., 50, 51, 84, Fetter Lane, London, E.C.4. Metalworkers' Catalogue (No. 20), 562 pages, and Catalogue of Wood Workers' Tools, etc. (No. 21), 338 pages. Both catalogues are of great interest to all wireless amateurs who construct their own apparatus, and an extensive choice of all classes of hand and machine tools is offered.

FOURPENCE.

In consequence of the enlarged circulation now enjoyed by "The Wireless World and Radio Review," the Publishers have pleasure in announcing that they are now able to reduce the price of the Journal to 4d., as from the April 7th issue, which is the first number of the new volume.

Calendar of Current Events

Tuesday, April 3rd.

MANCHESTER WIRELESS SOCIETY.

At 7.30 p.m. In the Council Chamber. Houldsworth Hall. Discussion.

Wednesday, April 4th.

HALIFAX WIRELESS CLUB AND RADIO SCIENTIFIC SOCIETY.

Lecture: "Induction Coils and Transformers." By Mr. M. F. Farrar.

Thursday, April 5th.

ILFORD AND DISTRICT RADIO SOCIETY.

Lecture: "H.F. Currents." By Mr. A. Landsler, L.D.S., R.C.S. (Eng.).

DERBY WIRELESS CLUB.

At 7.30 p.m. At the Shaftesbury Restaurant. Lecture: "Modern Inventions." By Mr. E. J. Allen.

Friday, April 6th.

SHEFFIELD AND DISTRICT WIRELESS SOCIETY.

At 7.30 p.m. At the Dept. of Applied Science, St. George's Square. Lecture: "The Effect of Capacity in W/T Circuits." By Mr. J. R. Halliwell.

DEWSBURY AND DISTRICT WIRELESS SOCIETY.

At 8 p.m. At South Street, off Church Street. Lecture by Mr. W. R. Gibbings.

RADIO SOCIETY OF HIGHGATE.

At 7.45 p.m. At the 1919 Club, South Grove Lecture: "Elementary Theory, Part II." By Mr. H. Andrewes.

BROADCASTING STATIONS.

Regular evening programmes, details of which appear in the daily press, are now conducted from the following stations of the British Broadcasting Company:—

London	2LO	369	metres.
Birmingham	5IT	420	,,
Manchester	2ZY	385	,,
Newcastle	5NO	400	,,
Cardiff	5WA	353	,,
Glasgow	5SC	415	,,

DUTCH BROADCASTING.

PCGG. The Hague, 1,050 metres, Sunday: 3 to 5.40 pm., Concert. Monday and Thursday: 8.40 to 9.40 p.m., Concert. (Monday concerts are sometimes given on 1,300 metres, notice of this being given on the previous Sunday.)

FRENCH BROADCASTING TIMES.

Eiffel Tower. 2,600 metres. 11.15 a.m. weather reports (duration 10 mins.) 6.20 p.m., weather reports and concert (duration about 30 mins.) 10.10 p.m., weather reports (duration 10 mins.).

Radiola Concerts. 1,565 metres., 5.5 p.m. news; 5.15 p.m. concert till 6 p.m.; 8.45 p.m. news; 9 p.m., concert till 10 p.m.

L'Ecole Supérieure des Postes, Télégraphes et Téléphones de Paris. 450 metres. Tuesdays and Thursdays, 7.45 p.m. to 10 p.m. Saturdays, 4.30 p.m. to 7.30 p.m.

"5 WS."

THE SUCCESSFUL TRANSATLANTIC TRANSMITTING STATION OF THE RADIO SOCIETY OF GREAT BRITAIN.

By PHILIP R. COURSEY, B.Sc. (Eng.), F.Inst.P., A.M.I.E.E.

(Continued from previous issue.)

DISCUSSION.

The President.

Mr. Coursey and his collaborators in the Society have to be congratulated on these wonderfully successful results of their efforts. I can see that Mr. Coursey set his heart on sending as well as receiving, acting, I suppose, on the principle that it is more blessed to give than to receive. I feel sure that questions will arise for discussion. I will ask Admiral Jackson to open the discussion and later to propose a vote of thanks.

Admiral of the Fleet Sir Henry B. Jackson.

I do not propose to enter into the discussion at present, but I shall be pleased later to propose a vote of thanks to Mr. Coursey.

Capt. P. P. Eckersley.

I am most interested and appreciative of the wonderful achievements that amateurs have made. At the same time I want to put before you a certain point of view, which is the point of view of the professional towards these things. The result of these tests emphasises the extraordinarily small power used to cover enormous distances with success and many of you may wonder why the professionals build an aerial three miles long, putting in kilowatt after kilowatt and then consider they are allowing only a safe margin to bridge the distance. If the professional is asked to communicate across the Atlantic on telephony he probably employs say 200 kilowatts and a fifteen-valve receiving set, and you are doubtless wondering why he should go to these elaborate precautions to span the Atlantic when it has already been done on such small powers. The difference is in getting intelligible speech for a moment and getting good and lasting speech for twenty-four hours of the day. Mr. Coursey spoke of the Heaviside layer, and I think that the Heaviside layer is enormously helpful, but in broadcasting work the extraordinary phenomena of fading which is taking place every day is, I think, also due to the Heaviside layer. I put this point of view forward, Mr. Coursey, but not in the spirit of criticising. The attitude I emphasise is that the professional and the amateur are working from an entirely different point of view, and it is rather unfortunate that there should be this criticism of the profession.

I would ask Mr. Coursey one technical point. Mr. Coursey said his radiation resistance was 24 ohms. I do not think that is right. With 24 ohms the radiation efficiency would be something like 80 per cent., which is enormous, and has never been known. I think that the vertical aerial or its effective height might be equal to this height. As a matter of fact I think it is only about half its height. I am taking the effective height of about 30 metres ; the radiation resistance is about 4 ohms, which would give you 60 watts radiation efficiency.

Mr. L. McMichael.

I do not think there is anything I want to discuss, but I desire to say that I hope everyone will realise how very hard Mr. Coursey has worked on these tests. Many of us put in a certain amount of time which was great pleasure. The whole inception of the thing, and the real hard work has been done by Mr. Coursey, and we ought to include Mrs. Coursey, who also has devoted much time to the work.

Mr. Maurice Child.

There are one or two remarks that Mr. Coursey made at the beginning of his discourse which I think I might emphasise. The first was the reference to the improvements in the reception of the signals from the American amateurs in this country this year, and he put it down to the fact that it was customary for us to carry on our work on the low power of 10 watts, that is to say, the average power allotted to amateurs by the Post Office of 10 watts, and the result of that has undoubtedly been that our receiving sets have been enormously efficient. To that extent we are indebted, of course, to the Post Office for their kindness in limiting our power for experimental work. On the other hand, however, I was rather disappointed that Mr. Coursey took the attitude that we should all feel indebted to the Post Office for allowing us to use for a short test—about a quarter of an hour or so every night—about ½ to 1 kilowatt of energy. I think that as a scientific body, working on a scientific subject, we ought to feel that we have a right to demand to use the power which is required to carry out a definite scientific experiment, and not to be expected to go down, as it were, on our knees and pray to the Post Office to allow us to use a few more watts than customary. After all, these services are important, and they belong to us as a community, and they should feel that they have to give these facilities freely when required, and not out of kindness. It is only a little point, but I wish to let my views be recorded.

There is a little technical point which Mr. Coursey touched upon which is interesting. I, with others, had a certain amount to do with the actual operating work in this station, and I amused myself periodically, when I was not actually transmitting, by carrying out a few little experiments on my own account, and I quite agree with Mr. Coursey that I had to be extremely cautious in working on that station. It was the most uncomfortable station I ever worked, with an 8,000 volt to earth accumulator on the floor. Mr. Coursey mentioned that between aerial circuit and the closed circuit inductance we used a glass plate, and that reminds me of a little point which happened there which struck me very much at the time. The glass plate was put there in the first place for insulation purposes, and was a convenient method for preventing the coils getting close to each other. One day the glass plate got punctured, and I substituted a sheet of ebonite. In the course of about a minute and a half it began to smell most horribly, and I thought I had better take it away, and in doing so got a very nasty burn, not from the current, but from the heat of the ebonite.

Subsequently we took away the glass sheet, and managed to support the coil in the air, with enormously increased efficiency in the aerial circuit. A point which is of interest to us working on transmitting circuits is this, that using a 200 metre wavelength, you want to be very cautious not to use any other material than air for winding the coils on.

Mr. G. G. Blake.

I do not know that I have anything really that I can add to this. I would rather like to amplify the remarks made by Mr. McMichael as to the amount of work which I noticed Mrs. Coursey did in collecting all these results.

The President.

One or two things occur to me in connection with this discussion. The professional referred to by Mr. Eckersley is of course very stiff and conservative. He takes a formula like the Austin formula, which has been demonstrated in a rough way and only on long wavelengths, and he tries putting various values for wavelengths in that formula. He may arrive at a result such as that if 3,300 metre waves travel across the ocean with a certain amount of loss in the daylight, then the 300 metre waves will travel across with about 2,000 times that loss, and therefore it seems hopeless to attempt transmission with short waves. That formula has only been confirmed in connection with wavelengths considerably greater than 300. But it may be that for say 600 metres and less the formula encounters a different set of conditions, and it looks rather as if that might be the case. I daresay some of you were here in this room a week ago when Dr. Nicholls described the experiments made by the Western Electric Company between Long Island and London in transoceanic telephony. He showed two curves, one of them the daylight curve, the other the night curve, and the formula of Austin was correct for the daylight results on long waves of 5,000 metres, but the formula did not correspond well with the night results until you left out part of it. The curious physical result was that these waves appeared to travel across the Atlantic in the night as if they were moving on a flat earth and there was no absorption, that is, as if there was no curvature.

Well, that is very remarkable, but the short wave results which Mr. Coursey and his collaborators have got seem to show that more than that happens when the waves are short, that is to say that the upper atmosphere does really come in, and that reflection assists the transmission, because the waves seem to travel much better than they would on a flat earth. It looks as if the sky did do something in the way of helping these short waves across, and I think the subject is well worth following up, because conservative professionals will have to be converted before anything powerful and extensive can be done.

A vote of thanks was then proposed by Admiral of the Fleet Sir Henry B. Jackson and seconded by Mr. Maurice Child.

Questions and Answers

NOTE.—This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless work. Readers should comply with the following rules :—(1) Each question should be numbered and written on a separate sheet on one side of the paper, and addressed "Questions and Answers," Editor, THE WIRELESS WORLD AND RADIO REVIEW, 12/13, *Henrietta Street, London, W.C.2. Queries should be clear and concise. (2) Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (3) Each communication sent in to be accompanied by the "Questions and Answers" coupon to be found in the advertisement columns of the issue current at the time of forwarding the questions. (4) The name and address of the querist, which is for reference and not for publication, to appear at the top of every sheet or sheets, and unless typewritten, this should be in block capitals. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a "nom de plume." (5) In view of the fact that a large proportion of the circuits and apparatus described in these answers are covered by patents, readers are advised before making use of them, to satisfy themselves that they would not be infringing patents.* (6) **Where a reply through the post is required every question sent in must be accompanied by a postal order for the amount of 1s., or 3s. 6d. for a maximum of four questions.** (7) *Four questions is the maximum which may be sent in at one time.*

"E.W.H." (Edinburgh) *asks questions relating to the receiver diagram given on page 601, February 3rd issue.*

The diagram referred to on page 601 in the issue of February 3rd is, of course, covered by patents, but one is allowed to build a receiver wired according to this diagram for one's own experimental use. The set may not be sold, however. The transformers shown in the diagram are low frequency—that is, from the right hand side of the diagram the three transformers shown are low frequency. Connected in the anode circuit of the first valve is a plug-in coil and, coupled with this coil is the reaction coil. A telephone transformer may be purchased from any of the advertisers in this journal. Low resistance, that is, 60 ohm telephones, should be used.

"A.D." (Leven) *wishes to build a receiver, and asks for suggestions.*

We suggest you use a five-valve receiver comprising two H.F., one detector and two L.F. valves, with an additional power valve connected to operate the loud speaker. The aerial should be as high as possible, and the length must not exceed 100′ from the free end to the earth terminal, by the Post Office regulations. A number of suitable diagrams are given in this journal from time to time. If you are thinking of building the instrument yourself we shall be glad to refer you to a suitable diagram if you have any difficulty in making a choice yourself.

"I.R." (Watford) *submits sample stampings which he proposes to use in the construction of intervalve transformers, and asks for particulars.*

We are afraid we cannot give you the number of turns for the windings of the L.F. transformer, because the number of turns depends very greatly upon the method of winding, the amount of insulation used, and so on. The No. 40 S.S.C. wire is very suitable for windings of the transformer. The stampings are of suitable size, and we suggest you wind the bobbin one-third full of wire for the primary winding, and then fill the bobbin with the secondary winding. This winding will give a ratio of approximately 2 to 1, and a very satisfactory transformer should result.

"J.G." (Edinburgh) *refers to the diagram given on page 867 in the issue of September 30th, and asks for advice.*

If the diagram given on page 867 of the issue of September 30th has been carefully followed the receiver should give good results. If the receiver works well with the high frequency valve disconnected we suggest the reaction coil connections are not correct. If you have made the reaction coil so that it rotates through 360 degrees, of course this fault cannot exist. The probable cause of the trouble is that the anode circuit does not tune to the same wavelength as the aerial circuit, and we suggest you reduce the capacity of the anode tuning condenser. In addition, one or two tappings should be taken off the anode coil, with the object of changing the constants of the circuit so that the wavelength range may be adjusted. While experimenting, it would perhaps be better if you short-circuited the reaction coil. The method of tuning is rather difficult to explain. We suggest you adjust the aerial circuit with only a valve detector in circuit. Then connect the high frequency valve and make alterations to the anode circuit until the signals are heard. The H.T. voltage should be about 60 volts, and the L.T. 6. The high frequency valve will not work properly unless the filament is sufficiently bright.

"V.L.N." (Cheshire) *asks what is a T.V.T. unit.*

The T.V.T. unit referred to on page 830 of No. 26, Volume X, of *The Wireless World and Radio Review,* may be purchased from dealers in ex-Government wireless stores. The T.V.T. unit is simply an induction coil with a make and break. The primary circuit contains an accumulator, the make and break, and the primary of the induction coil. The secondary circuit contains the secondary winding of the induction coil. The secondary winding should be connected with the rectifier valves and smoothing apparatus. A spark coil such as is suggested could no doubt be made to operate satisfactorily, provided care is taken not to allow the secondary voltage to become excessive. The circuit of this instrument is given on p. 96 of the Amateurs' Book of Wireless Circuits by F. H. Haynes.

"F.F." (S.E.18) *submits a diagram of his receiver, and asks (1) Is the diagram correct. (2) Which coils should be used for A.T.I., reaction and C.C.I. (3) Are the B.T.H. type valves useful. (4) May a common L.T. and H.T. battery be used when an L.F. amplifier is connected.*

(1) We have examined the diagram submitted, which is correct except that the anode tuning condenser has rather too large a value. A

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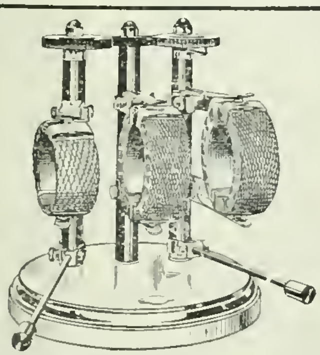

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0·0001 mfd. condenser would be quite suitable if it is desired to receive broadcast transmissions. (2) If a set of Burndept concert coils is purchased the largest coil, No. S 4, should be used in the anode circuit, S 3 in the aerial circuit, and S 2 in the closed circuit. The same ratio holds whichever type of coil it is desired to use. (3) The B.T.H. type of valve as a rule gives very good results when used in any portion of a valve receiver. In general, however, " R " type valves give better results as low frequency amplifiers. (4) When connecting up the receiver to the low frequency amplifiers, a common H.T. and L.T. may be used. It is advisable to examine the amplifier and make sure that the —H.T. is connected with +H.T. in the manner shown in the diagram submitted, otherwise the L.T. battery will be short-circuited.

" A.C." (South Wigston) *asks* (1) *Whether the diagram submitted is correct.* (2) *For particulars of a coil marked A in the diagram, which is the anode coil.* (3) *Would honeycomb type coils having the dimensions given be suitable for use in this receiver for the reception of broadcast transmissions.* (4) *Is the proposed aerial suitable.*

(1) We have examined the diagram of connections submitted and they are correct. The coil marked A in your diagram may be a cylindrical coil 4″ in diameter and 4″ long, wound with No. 30 double silk-covered wire. There should be 16 tappings. (3) The proposed honeycomb type coils are quite suitable for use with the receiver. (4) The aerial will be satisfactory, provided the lead-in wire is kept well away from the sides of the wall. It should not be held against the wall for a distance of 24′ as suggested.

Ltd., in which all values are indicated. The principle of switching is given, and you will have no difficulty in making connections to a five-valve receiver. (2) The suggested former is too small. To cover the wavelength range desired we suggest you use a coil 4″ in diameter and 6″ long, wound with No. 33 S.S.C. wire; 18 tappings should be taken. (3) It is better to use a separate rheostat for each valve instead of using one rheostat to control the filament temperature of two or more valves.

" VARIOMETER " (Chesterfield) *asks* (1) *Whether the diagram submitted is correct.* (2) *What is the wavelength range of the circuit given when the coils have the values submitted.* (3) *What should be heard when one uses this receiver.* (4) *Could a diagram be given which will cover all wavelength ranges.*

(1) We have examined the diagram submitted, which is correct, and is quite a standard circuit. It has appeared a number of times in these columns. (2) The wavelength range of the receiver will be from approximately 200 to 800 metres. (3) We cannot say what signals you will receive on this receiver. This will depend upon your skill in tuning, and upon the power of the transmitting stations. You will probably hear the British broadcast transmissions and ship stations. (4) Most of the diagrams given in these columns, in which plug-in coils are used, are quite suitable for receiving signals having any wavelength. It is not possible to construct a variometer which alone would enable you to cover a wide wavelength range such as suggested. We suggest you use plug-in coils in the manner shown in the diagrams given in these columns.

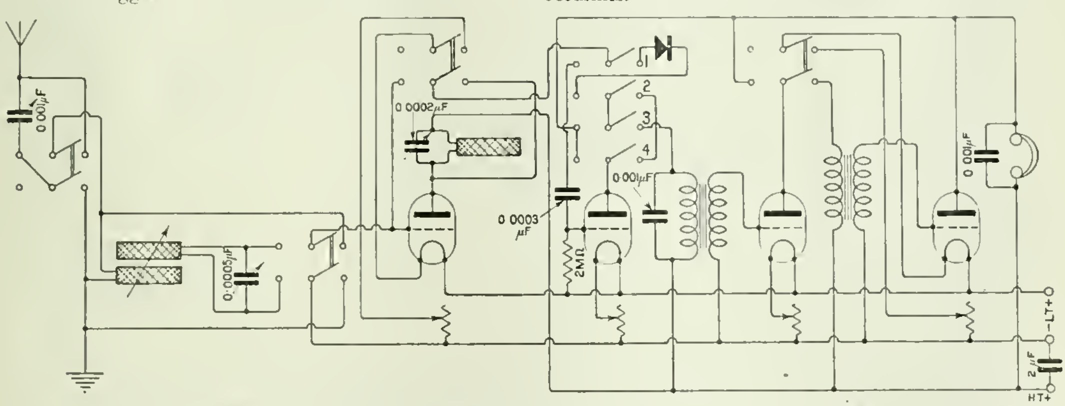

Fig. 1. This diagram gives the connections of a four-valve receiver with switch for connecting or disconnecting the H.F. and L.F. valves. Other switches are connected so that a crystal may be used instead of the valve detector.

" T.H.J." (Derby) *asks* (1) *For diagram of a five-valve receiver comprising two H.F., one detector and two L.F. valves, using a three-coil holder, and with the tuned anode method of high frequency amplification. Switches are to be provided for cutting out the H.F. valves, and telephone jacks for the L.F. valves.* (2) *Will the former, particulars of which are submitted, when wound with wire, be suitable for use as the anode coil.* (3) *Is it necessary to use a separate rheostat for each valve.*

(1) We would refer you to the many diagrams arranged for this purpose in " The Amateurs' Book of Wireless Circuits," price 2s. 6d., Wireless Press,

" C.J.S." (London, N.22) *asks* (1) *For a diagram of a receiver comprising one high frequency, one crystal detector, and one L.F. valve, with switches so that the receiver may be used as a crystal receiver, crystal and H.F. valve, crystal and L.F. valve, H.F., crystal and L.F. combination, or two-valve receiver—that is, with a valve detector and high frequency amplifier.* (2) *What would be the turn ratio of three honeycomb coils suitable for use in the primary and secondary and tuned anode circuits of the receiver.* (3) *The aerial is a double wire inverted L type; it is used indoors. Would it be an advantage to connect another two wires to the flat top of the aerial.*

(4) *Does a tuned anode coil couple with the secondary coil when a three-coil holder is used. If not, where is it connected.*

(1) The diagram given in Fig. 1 will allow you to use the following combinations :—1. With switch 1 to the left and switches 2, 3 and 4 to the right, the valve detector with note magnifier is used. 2. With switch 1 to the left, switches 2 and 3 up, and switch 4 to the left, the valve is used as a detector alone. 3. With switch 1 to the right, and switches 2 and 3 to the left, and 4 up, the crystal is used with the note magnifier. 4. With switch 1 to the right, switches 2 and 3 to the left, switch 3 to right and 4 up, the crystal is connected to the telephones. The high frequency valve is controlled by a separate switch. (2) We cannot give the turn ratios of the honeycomb coils exactly. If a No. 75 coil is used in the anode circuit, No. 50 coils should be used in the closed circuit. The coil which is used in the aerial circuit will depend upon whether the aerial tuning condenser is used in series or parallel with the A.T.I., which may be a No. 75 coil or a No. 35. (3) We do not think much would be gained by the addition of two more wires to your aerial. (4) The anode coil should not be coupled to the three-coil holder. It should stand quite apart from the aerial and closed circuit coils.

"G.E.B." (Manchester) *asks* (1) *With reference to the three-valve receiver given in the article entitled "Experimental Station Design," in the issue of October 28th,* 1922, *could the connections be given showing how a set may be connected for changing over from the valve detector to a crystal detector.* (2) *Could a diagram be given showing how a frame aerial may be connected in place of the outdoor aerial.*

(1) and (2) The diagram is given in Fig. 2. See reply to **"C.J.S." (London, N.22.).**

"E.A.P." (Leeds) *asks* (1) *For a diagram of a three-valve receiver comprising one detector, and two L.F. valves, with switching arrangements so that one of the L.F. valves may be thrown over to the high frequency portion of the circuit and become a H.F. amplifier.* (2) *At what frequency does an air core transformer become inefficient and an iron core transformer become necessary.* (3) *The receiver has suddenly developed the habit of generating oscillations without adjustments being changed. What is the likely cause.* (4) *Would a small condenser connected across the reaction coil improve matters.*

(1) The diagram is given in Fig. 3. We do not recommend the connection of Dewar type switches for the purpose of transferring the connections from the L.F. portion of the circuit to the high frequency circuit. The switches in the diagram show how to cut out L.F. valves. (2) Iron core transformers may be designed for use in radio circuits, but generally it may be said that iron should be kept out of a coil when the currents flowing in the coil have a frequency of about 50,000 cycles. (3) We cannot say exactly why your receiver should generate oscillations suddenly without adjustments being made. We suggest you examine the earth connection, and also connect a 2 mfd. condenser across the H.T. battery. Try a new grid leak. The addition of the small tuning condenser mentioned in (4) will probably enable you to obtain finer reaction control.

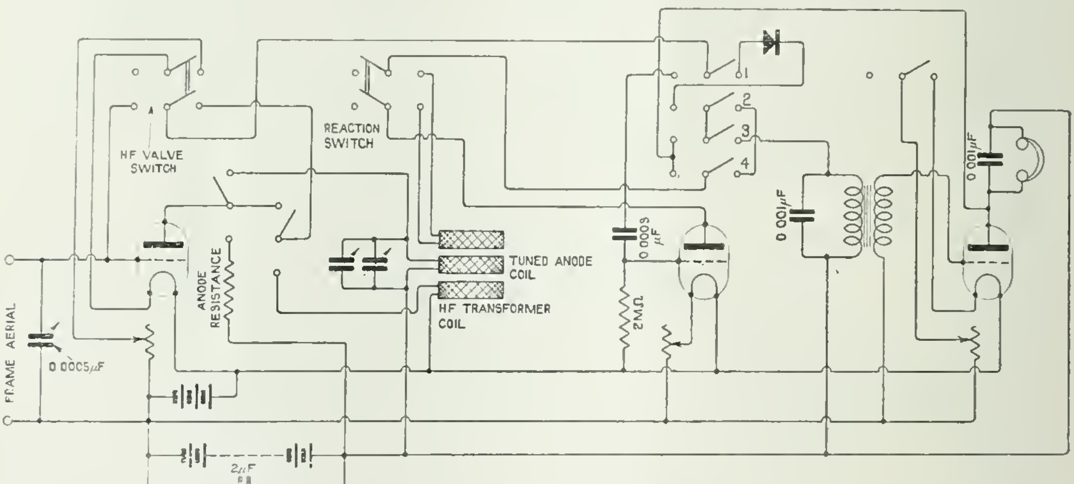

Fig. 2. A three-valve experimental receiver.

"C.B." (Hampstead) *asks* (1) *Which is the best type of indoor aerial.* (2) *What is the best total length for a ceiling type aerial, and should the frame aerial be in series or parallel.* (3) *What is the best arrangement for a frame aerial, with size and number of turns.* (4) *Is the length of the aerial wire material.*

(1) We suggest you use a frame aerial. (2) When a frame aerial is used no other aerial need be used in conjunction with it. (3) We would refer you to the article entitled "Frame Aerials in Radio Reception," which appeared in the issue of January 27th. (4) An earth wire is not needed when a frame aerial is used, but if an outdoor aerial is employed an earth wire is needed, and it should be as short as possible and should make connection with a good earth.


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"J.D.S.G." (Derbyshire) *asks* (1) *Whether the Post Office would permit him to use a circuit of the type submitted.* (2) *How may permission to transmit be obtained.*

(1) The diagram submitted is correct, and we think the Post Office would give you permission to use it for the reception of broadcast transmissions. (2) We suggest you communicate with the Secretary of the Post Office London.

give him permission to use a receiver wired according to the diagram. (2) *Is the circuit thoroughly practicable for the reception of C.W., spark and telephony signals.* (3) *Is it possible to add a high and low frequency amplifier to this receiver; if so, could the connections be given.* (4) *Could a fixed coupling between the closed aerial circuits be used, and the remainder of the A.T.I. and closed circuit inductance be apart from the coupling coils.*

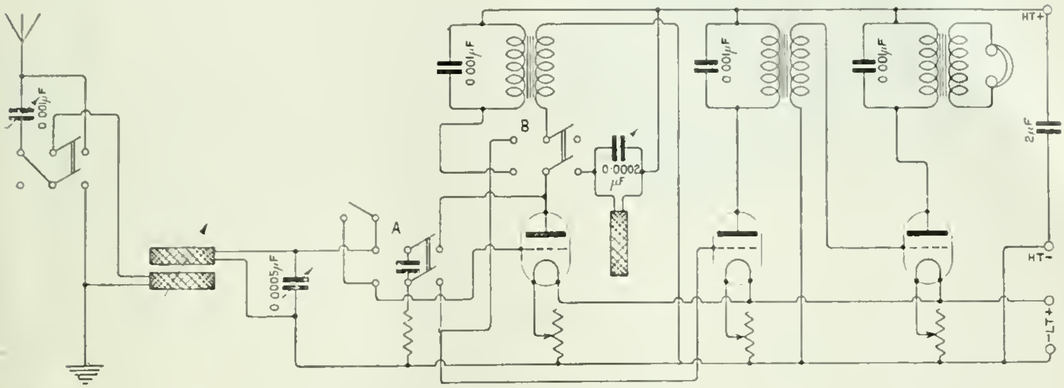

Fig. 3. This is a three-valve receiver the first valve of which may be used as a H.F. amplifying valve or as a detector valve.

"NOSEY" (Cardiff) *asks* (1) *Why does the use of resistance wire in a high frequency transformer slightly extend the tuning range.* (2) *Would the same effects be obtained in the case of the tuned anode method of high frequency amplification.* (3) *Why should the use of resistance wire have any effect at all, in view of the fact that the resistance of the valve is of the order of 20,000 ohms.* (4) *It is found that the signal strength is the same whether the anode coil is wound with No. 40 or No. 24 copper wire. Is this correct.*

(1) If the high frequency transformer is wound with resistance wire, tuning is flattened considerably, therefore the range is slightly increased. The strength of the signals would not be so great when the windings are wound with resistance wire. (2) The effectiveness of a tuned anode circuit depends very greatly upon the resistance of the coil and the condenser circuit. If the resistance is high, there could be no rejector effect. If the resistance is low, the tuned anode circuit will only allow signals of the wavelength to which it is tuned to be effective. (3) The resistance of the valve has nothing to do with the resistance of the tuned anode circuit, which is a separate oscillatory circuit tuned to the wavelength of the signal. (4) When receiving short wavelength signals we can quite understand that a very little difference in the volume of the signal received would be noticeable, even when the coil is wound with No. 40 copper wire instead of No. 24. You would probably notice a great increase in signal strength if the reaction coil were coupled with the tuned anode coil, so that the resistance in the circuit is almost neutralised.

"W.B." (Norfolk) *submits a diagram of connections and asks* (1) *Whether the Post Office will*

(1) The diagram submitted is not quite correct. The grid condenser should not be variable. The coils and condensers shown in the anode circuit do not serve any useful purpose. We suggest you rewire the receiver according to the diagram Fig. 4, page 678, February 17th issue, which shows the connections of one high frequency, one detector and one L.F. valves. We think the Post Office will permit you to use a circuit of this description. (2) The circuit will be quite useful for the reception of signals desired. (3) The method for adding H.F. or L.F. connected valves is given in practically all issues of this journal. (4) The proposed arrangement is quite suitable. A portion of the aerial coil may be coupled with a portion of the closed circuit coil.

"J.E.R." (Evesham) *asks* (1) *For a diagram showing how to connect a power amplifier suitable for a loud speaker.* (2) *May the* 120 *Brown microphone relay be used in conjunction with a "Magnavox" loud speaker.*

(1) A power valve amplifier is connected in exactly the same way as a low frequency magnifier, but a few cells should be connected in the grid circuit to make the grid a little more negative. The H.T. volts should be higher than normally used. Care should be taken when using a power amplifier that the loud speaker is not burnt out. It is not always necessary to use power valves just to operate a loud speaker for ordinary use. (2) The Brown relay may be used to operate the loud speaker, provided a transformer is connected with the loud speaker. We suggest you purchase a suitable transformer from the manufacturers of the amplifier.

"H.J.H." (Paddington) *asks* (1) *Is the circuit submitted correct.* (2) *Could reaction effects be* *obtained by coupling the coils marked C and D in the diagram.* (3) *Does a person who applies for an experimental licence and who states that he intends to listen to the broadcast transmissions pay an additional fee.* (4) *Are the types of coils referred to suitable for use as tuned anode coils.*

(1) The diagram submitted is quite correct, and is a standard circuit. A number of similar circuits have appeared recently in these columns. (2) Reaction effects cannot be obtained in the manner suggested. It would be necessary to couple coil D and coil B, and then there is the danger that oscillating energy may be transferred to the aerial circuit. (3) The cost of an experimental licence is 10s., and one does not have to pay more if it is intended to listen to broadcast transmissions. (4) The type of coil suggested is satisfactory.

"KEMS-WAT" (Watford) *submits a plan of his three-valve panel and asks us to complete the connections.*

The diagram is given in Fig. 4.

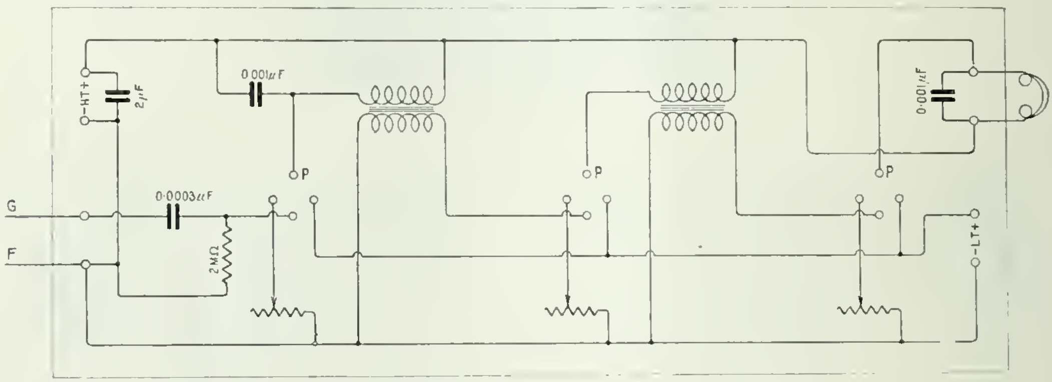

Fig. 4.

"C.R.L." (Windsor) *wishes to make basket coils and asks for particulars of the former and wire to be used.*

We suggest you use a former 2″ in diameter, containing 13 spokes. Six coils should be used, each coil having 90 turns of No. 28 D.C.C. The coils should be connected in series and a spacing washer fastened between each coil, so that the total self-capacity is not appreciably raised.

"S.F.P." (Birmingham) *wishes to construct a telephone and low frequency transformer and asks for particulars.*

The iron suggested is satisfactory, although it is better to use soft iron wire. We suggest you wind a bobbin to 1½″ long and 2¼″ in diameter. The figures are applied to the winding space. The bobbin should be wound for one-third of its space with No. 40 double silk covered wire for the primary, and the remainder of the winding space should be filled with No. 44 single silk covered wire for the secondary. The iron should be cut out so that it fits round the bobbin. The telephone transformer may have a primary winding of the same dimensions as the intervalve transformer, but the telephone winding should be 1,000 turns of No. 34 S.S.C. wire.

"G.A.S." (Erith) *asks* (1) *Whether the diagram submitted is correct.* (2) *What would be the numbers of suitable honeycomb coils for use in the receiver.* (3) *Is there any disadvantage in mounting the whole of the variable condensers required in the receiver in one cabinet.*

(1) The diagram submitted is correct. The connections shown between −H.T. and +L.T. may stand, as there is not a great deal to choose between this connection and the alternative, namely −H.T. to −L.T. (2) For the A.T.I. we suggest you use a No. 75 coil, a No. 50 coil for the closed circuit, and a No. 35 coil for the reaction coil. It will be better, however, to purchase, in addition to the above coils, Nos. 100 and 150. The size of the reaction coil depends very greatly upon the winding of your receiver, and cannot always be accurately estimated. (3) Provided the connecting wires are kept reasonably short, no ill effects will result from mounting the condensers in one cabinet. If the connecting wires are long losses will occur.

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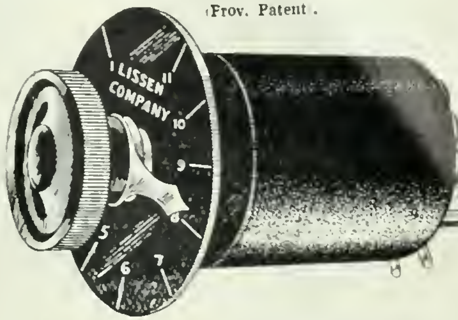

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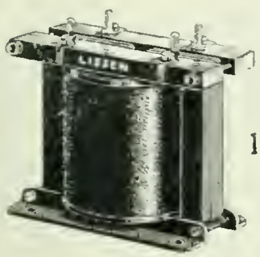

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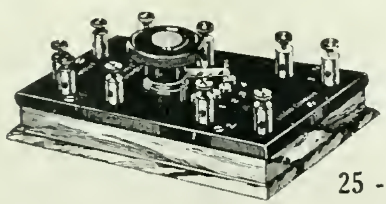

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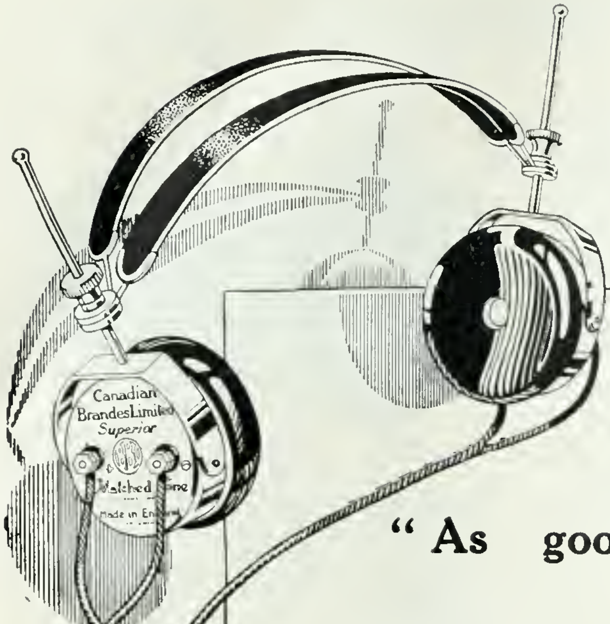

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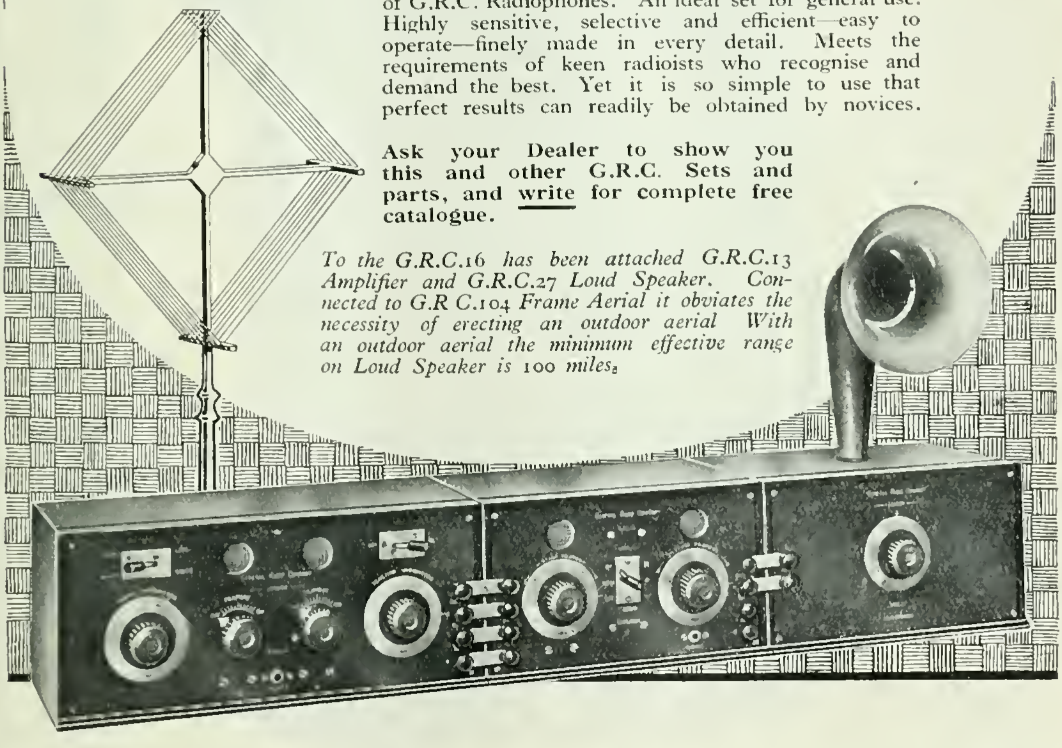

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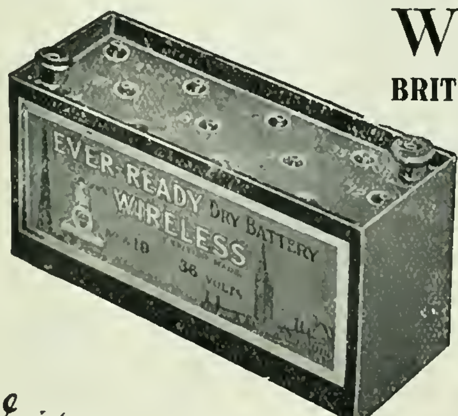

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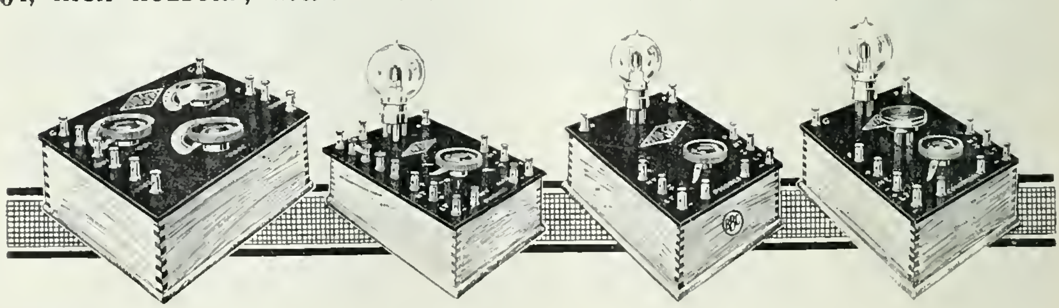

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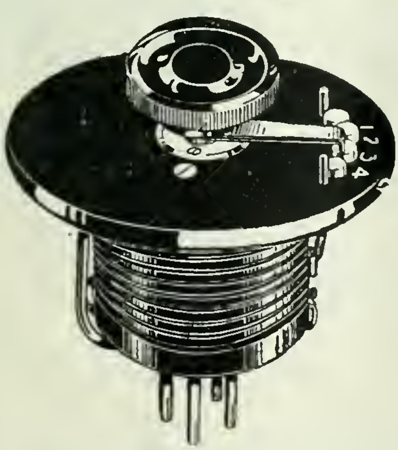

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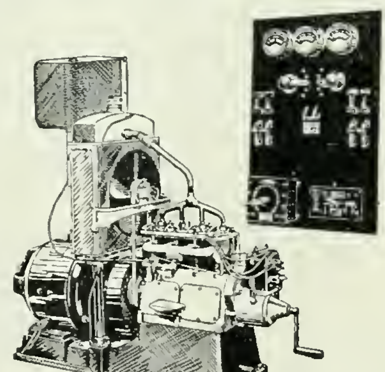

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VOL. XI, NO. 26.

See Conditions on Page 878.

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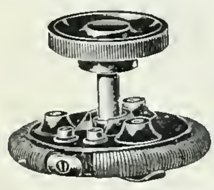

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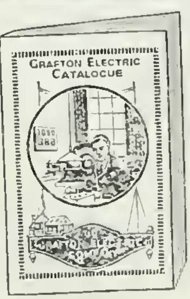

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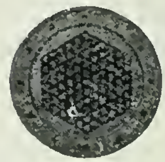

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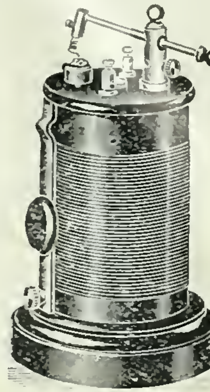

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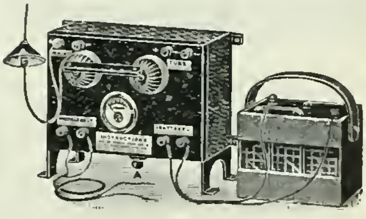

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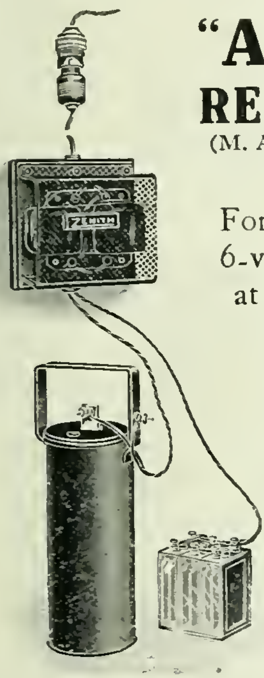

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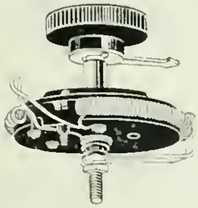

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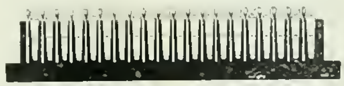

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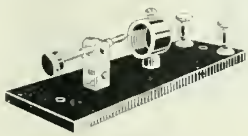

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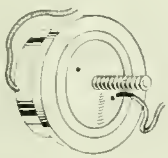

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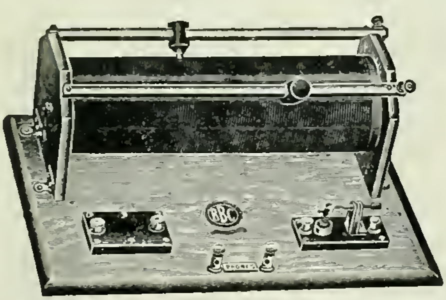

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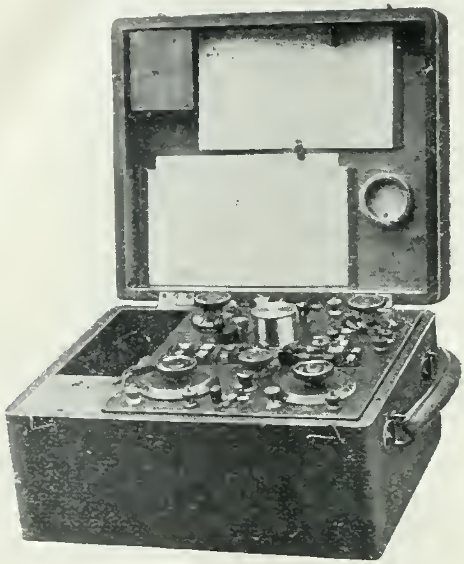

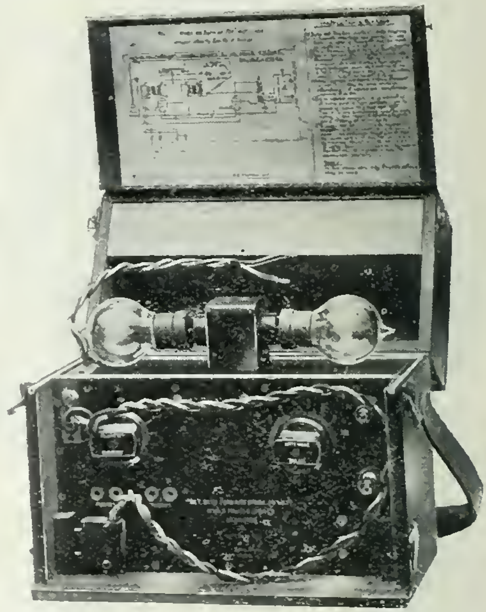

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Ditto, with variable air condenser
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15′ Steel Masts in sections, each 2′ 8½″, complete with halyard, pulley and stays. Per mast complete

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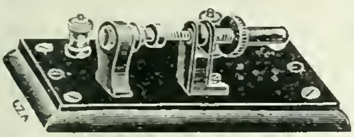

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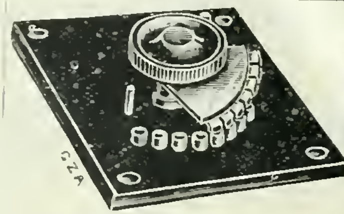

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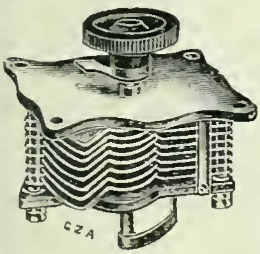

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Specify and SEE YOU GET THEM.

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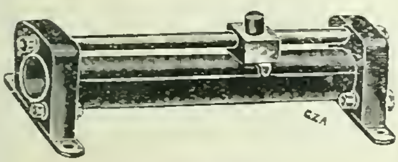

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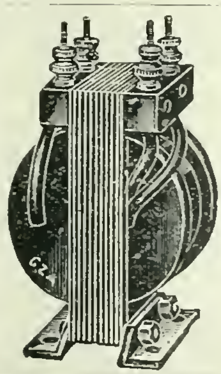

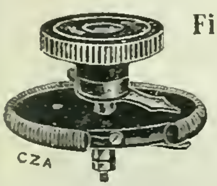

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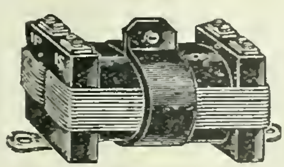

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