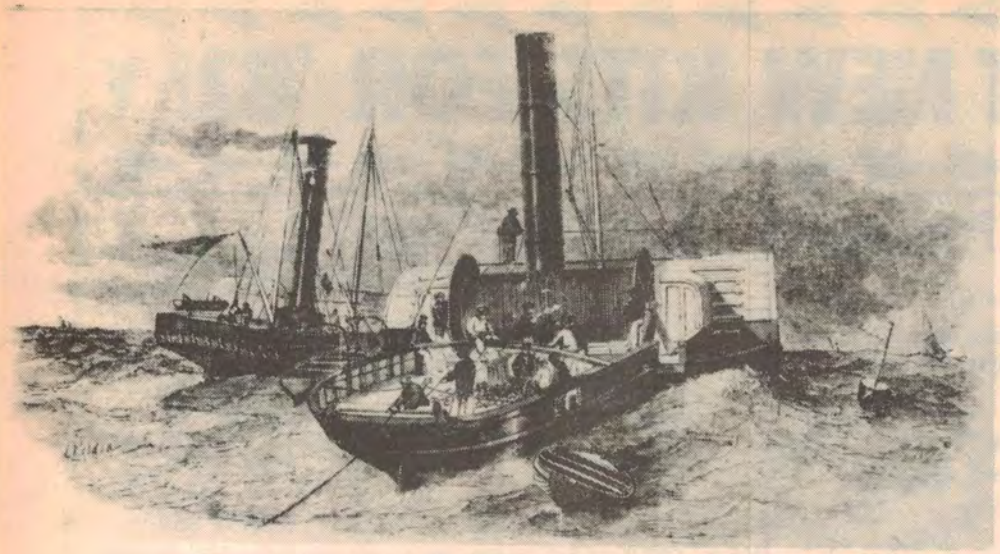

First underwater telegraph cable between England and France, shown here being laid by the tug Goliath, August 28, 1850.

Nowadays we take for granted the ease with which we can pick up a telephone and in moments talk to a friend overseas. Usually the process is simple and trouble-free, and we rarely spare a thought for the thousands of kilometres of cable and the feats of engineering which make our conversation possible. Yet the idea of undersea cables is just a little over a hundred years old, and the first undersea telephone cable was laid only 25 years ago. The history of modern communication is a fascinating story.

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The story of

When Captain Arthur Phillip RN, chose the wooded shores of Sydney Cove as the site for the first British settlement in Australia, he knew that he and his party had no hope of communicating with home for years to come. The voyage out had taken eight months. The first ship to reach the colony after its establishment, the Lady Juliana, arrived two-and-a-half years later, having taken 11 months from Plymouth. The mail it carried was already a year or more old and the recipients had not been in touch with the writers for more than three years.

This fixed relationship between distance and communication had existed since time immemorial. It was one of life's constants, like the daily rising of the sun. The thought could not have occurred to Phillip, or the politicians in Westminster who had sent him, that within 50 years this relationship would have been shattered – or that within a little more than 80 years, people at Sydney Cove would be in daily communication with people in London.

Amid the 18th century courtliness and rustic torpor of the England they had left behind the Industrial Revolution had already begun. Their predictable ordered world of sailing ships and sealing wax was about to be swept away on a great tide of change. The skilled iron workers of Birmingham had already started manufacturing James Watt's steam engine. John Wilkinson had built the first iron boat in 1787. The character of the English countryside was undergoing metamorphosis as villages grew into industrial towns, their skylines dominated by tall factory chimneys, as iron bridges leapt across river gorges, as canals and paved roads cut through the green meadows. And a few far-seeing individuals were already seeking ways of harnessing the magical "fluid" electricity, and utilising it for communication.

The first published suggestion for a system of electric telegraphy had appeared in the Scots Magazine 35 years before, on February, 17, 1753. The author, Charles Marshall, proposed a system using 26 wires "extended horizontally between two given places, parallel to one another and each of them about an inch distant from the next." A ball hanging from the end of each wire at the receiving end would attract a piece of paper placed beneath it when energised with electricity, this being achieved by connecting the other end of the wire to a hand-operated frictional machine. If each piece of paper were inscribed with a particular letter of the alphabet, messages could be sent.

Telegraphic messages were actually sent experimentally in 1787, by means of a system using static electricity, over wires stretched between Madrid and Aranjuez, in Spain. The Spanish showed great interest in this new technology, setting up another line over the same 42km route in 1798 for the private use of the Royal Family.

During the early years of the 19th century the nations of Europe, plagued by the ambitious Napoleon, found themselves continuously preoccupied with the war. Yet a number of scientifically minded gentlemen continued to entertain themselves and their friends by experimenting with home-made systems of electrical telegraphy. One of these, S. T. von Sommering, demonstrated an electro-chemical telegraph to the Munich Academy of Science in 1809. His contribution to the art is worthy of note because his demonstrations inspired a Russian nobleman, Baron Schilling, to take a lifelong interest in the subject. The work of Schilling, in turn, prompted William Cooke 27 years later to stake everything on turning electrical telegraphy into a commercial system.

Schilling had, by then, refined his receiving equipment so as to utilise the ability of an electric current to deflect a compass needle, a property first observed by Professor Oersted, of the University of Copenhagen, in 1820. Schilling had also developed a signalling code based on combinations of black and white, the needle swinging so as to point to either a black or a white card. This technique removed the need to have as many wires as letters in the alphabet, and foreshadowed the more celebrated Morse Code, A being represented by

Far left, the Cooke and Wheatstone telegraph instrument as used on the London railway, 1845. At left, bringing the Australian end of the Trans-Tasman cable ashore, Bondi Beach, 1975.

undersea cables

black-white, B by black-black-black, C by black-white-white, and so on.

William Fothergill Cooke was just 30 years old when, in March 1836, he saw a copy of Schilling's telegraph. Recently invalided out of the East Indian Army, he had gone to Heidelberg to study medicine. He seems to have realised immediately the potential value of Schilling's idea. (The Baron himself died in that same year.) Within a month, the young Englishman had abandoned his medical studies and returned to England to devote himself to the development of electric telegraphy.

The story of Cooke's success is a story of a need and the technology to satisfy that need arriving together. England was ripe for the development. The first railway, between Stockton and Darlington, had opened in 1825. Stephenson's engine, *The Rocket*, had amazed the world by reaching 60km/h when hauling a 13 tonne train. Capitalists were eager to subscribe to new railway ventures. And railway company directors were anxious to have some reliable high-speed system of sending messages between railway stations ahead of the trains.

Cooke, encountering technical difficulties, formed a partnership with Charles Wheatstone, a man of four years his senior, who was Professor of Natural Philosophy at King's College, London. In June 1837 they were granted their first patent. Soon afterwards they demonstrated their 5-needle electromagnetic telegraph system to the directors of the new London-Birmingham Railway. Although this test, conducted between Euston and Camden Town stations, proved the effectiveness of the system, the company chose not to place an order. However, the directors of the Great Western Railway were impressed and invited the partners to install a telegraph between Paddington, their London terminus, and West Drayton, 21km away. This, the world's first commercial electric telegraph, came into operation on July 9, 1839.

The wires of Cooke and Wheatstone's telegraph spread rapidly throughout Britain along with the railways. Improvements in the system reduced the number of needles on each receiving instrument first to two, later to just one. By 1845 the partners were well on the way to becoming wealthy men through royalties received from railway companies.

While the telegraph flourished in England through private enterprise, the American inventor, Samuel Morse, spent several frustrating years striving in vain to obtain financial backing from the US Government for his own proposed system. Morse, a portrait painter, had first sketched his ideas for an electric telegraph whilst on a voyage home from Europe in 1832. The distinctive feature of his concept was that it used the deflections of a magnet to move a pen across a moving strip of paper. After his appointment as Professor of the Literature of Arts and Design at the newly founded University of New York, in 1835, Morse devoted his spare time to perfecting his idea. In 1837, he took on a partner, Alfred Vail. In the following January he gave the first demonstration, in his studio at the University, of the transmis-

Submarine cables — words under the sea

sion and reception of messages in the code of dots and dashes which he and his partner had devised.

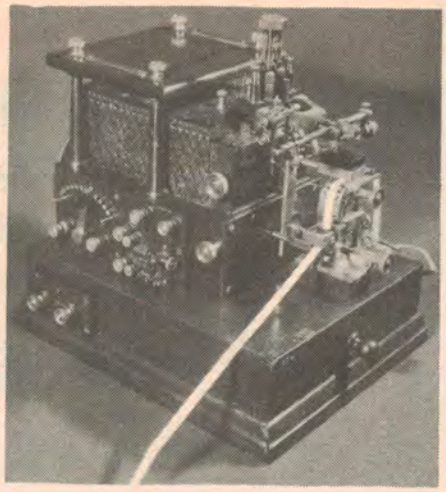
Morse's contribution to the new art was immense. His system needed only one wire, the return circuit being provided by the earth. Transmission of the signals was effected simply by tapping a key so as to make and break the connection. The pen and moving strip of paper were later discarded, for it was found in practice that operators could read the messages at the receiving end by listening to the long and short buzzing sounds made by the instruments. Key transmission and the code of dots and dashes survive to this day, especially in the sphere of ship/shore radio communication – as you could observe if you were to visit any one of OTC'S Coast Radio Stations.

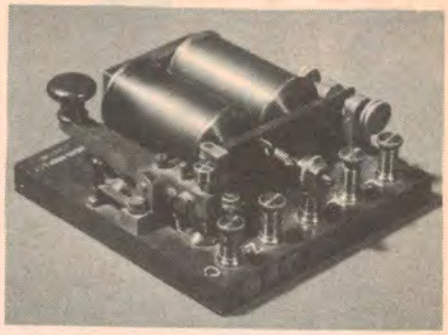
The other great innovation introduced by Morse was the automatic relay, a device which enabled the telegraph to transmit messages over great distances without the need for reception and retransmission by operators at intermediate stations. This device played a vital part in the development of telegraphy, especially in its spread across the American continent. The relay functioned by using the current in one section of line to operate a make-and-break device in another section of the line powered by a separate set of batteries, thus causing the same sequence of long and short pulses of current to be sent down the distant line.

Australia got its first telegraph line, between Melbourne and Williamstown, in 1854, the year of the Eureka Stockade revolt. Victoria, only recently granted independent colonial status, was then experiencing a gold rush. The new colony's population had been expanded by a great influx of fortune seekers from many parts of the world and Melbourne had become Australia's most important city. Within four years the telegraph wires reached all the way to Sydney and westward as far as Adelaide, to enable the three capitals to keep in touch by Morse Code.

International telegrams

The idea of linking the nations of the world by running telegraph wires beneath the sea had excited imaginative minds ever since the first discussions of electric telegraphy. By 1850, there seemed to be no great obstacle to be overcome. All that was needed, surely, was effective insulation of the wire. But the pioneers were to discover – as pioneers usually do – that there were more difficulties in the way of progress than they could have dreamed. Samuel Morse, having experimentally laid a rubber-insulated cable across a section of New York Harbour in 1842, found himself the butt of public derision when the line





At left, a long-distance cable code recorder, used at Australian cable stations last century. Above is a telegraph key as used on the Overland Telegraph, Darwin to Port Augusta, 1872.

went dead even before the official opening ceremony. A fisherman, finding the cable fouling his anchor, had angrily chopped through it, letting the severed ends drop back to the bottom of the harbour.

Despite this experience, Morse remained optimistic about the prospects for submarine telegraph. He expressed the conviction, in 1843, that "telegraph communication may with certainty be established across the Atlantic Ocean."

In England, Professor Wheatstone had put forward a proposal for a cross-Channel telegraph as early as 1840 in a submission to a House of Commons Committee. The first actual attempt to lay a telegraph cable across the Channel came 10 years later. It was a private commercial venture. It failed.

The man behind this scheme to link Britain to Europe by wire was a 45-year-old retired antique dealer, John Watkins Brett. He formed a company with his younger brother Jacob, calling it the General Oceanic and Subterranean Electric Printing Telegraph Company. The cable, manufactured by the Gutta-Percha Company, consisted of a single copper wire surrounded by a 5mm thickness of gutta-percha insulation.

A small steam tug, the *Goliath*, paid out the 25 miles of cable from a huge drum on its after-deck throughout the day of August 28, 1850. The end was safely landed at Cape Gris Nez that evening and connected to the Brett's automatic printer. John Brett, in England, attempted to send a message of greeting to Prince Louis Napoleon Bonaparte, but the receiving equipment recorded only an unintelligible jumble of characters.

Efforts to send messages in both directions continued for some hours but only a few words got through. By the next morning the line was lifeless. A French fisherman had hauled the cable inboard and cut a section from it, believing it to be some strange kind of seaweed with a gold core.

The Bretts tried again, this time with the support and guidance of a railway engineer, Thomas Crampton, who subscribed half the £15,000 capital for the project. Crampton also designed a new cable consisting of four conductors, each insulated with gutta-percha, contained in a protective sheath of tarred hemp and galvanised iron wires. Laid on September 25, 1851, this second Channel cable proved successful. For the first time, two countries separated by sea could correspond by means of the electric telegraph.

A boom in the production and laying of submarine cables now followed. Over the next few years, cables went into operation across the Irish Sea, the North Sea, the Mediterranean and even the Black Sea. In 1857, India and Ceylon were linked. And in 1859 a cable across Bass Strait joined the telegraph systems of Tasmania and the Australian mainland colonies.

Next month: the story of the first Atlantic cable and events in Australia.