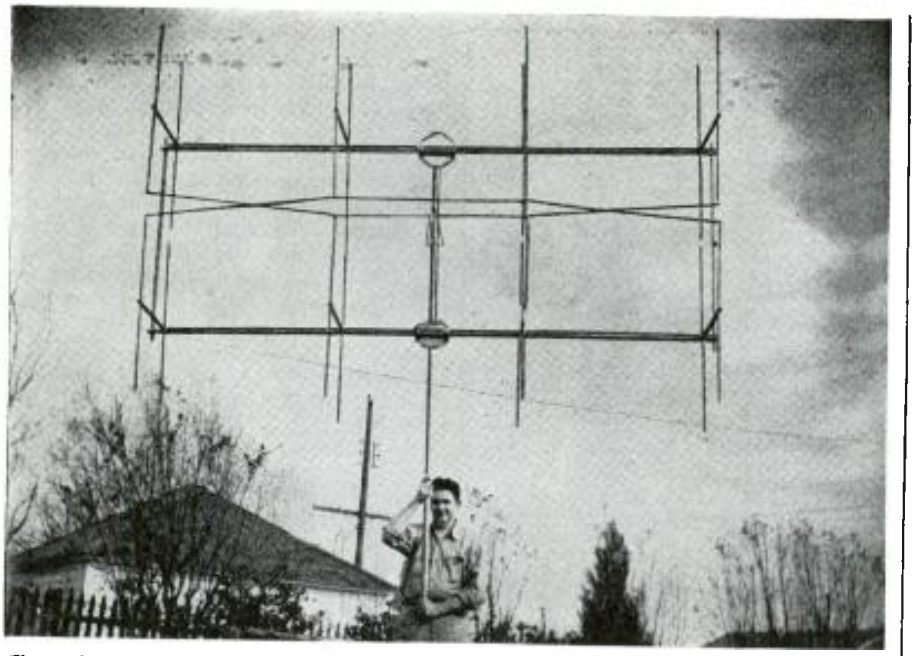

The author holds the 16-element array in his hands to show how aluminum cuts down weight.

# Aluminum 144-mc Beam Is Light and Strong

**By L. W. MAY, Jr., W5AJG**

ONE of the more popular antennas now in vogue among the 144-mc v.h.f. gang is the so-called standard 16-element array. It consists of four pairs of stacked collinear, in-phase, half-wave elements, spaced one half-wave apart, backed up with eight reflector elements spaced approximately a quarter-wave to the rear.

Transmission-gain claims for this array vary somewhat, but tests conducted with a fellow v.h.f. amateur W5ABN, 10 miles distant, indicate a decibel gain of between 12 and 14. Converted to power figures, that would be approximately 15 to 25 times the power radiated by a half-wave dipole mounted at the same height above ground. This is very well worth the effort. For example. one of the popular SCR-522 transmitters producing about 10 watts output could be effectively transformed into a 250-watt-output rig. Power gains of this order do not come easily at these frequencies by merely increasing power in the final amplifier.

At W5AJG we decided to construct one of these beams. Since it was to go atop a steel tower nearly 80 feet high. rigid construction was imperative and lightning danger required a well grounded system. Some trouble had been experienced in past years with various beams of wooden material (average life

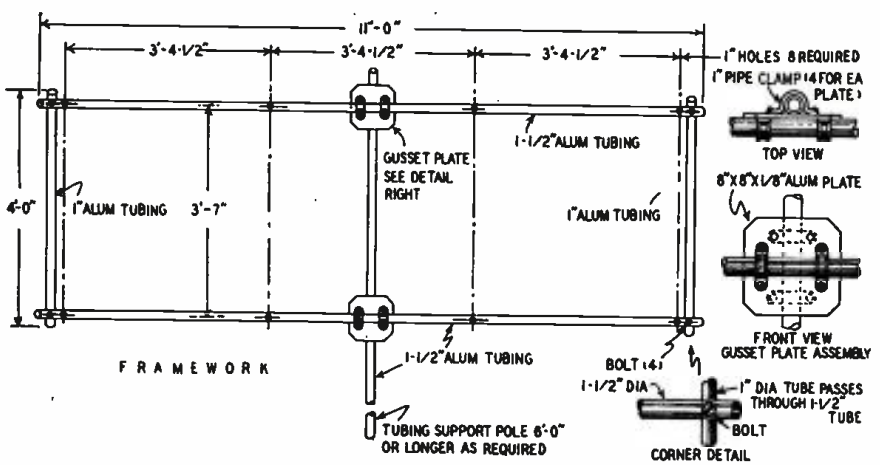


Fig. 1—The supporting framework for the beam. Note how support pole is clamped to frame.

without warping about two years), so we thought that all-aluminum fabrication would be a good idea. The aluminum antenna has worked out very well and was not at all difficult to build.

Since vertical polarization seems to be standard around our area, the beam is vertical. It can be used for horizontal polarization by simply bolting it to the supporting pole the right way.

The completed beam, including the 10-foot supporting pole, weighs only 15 pounds. On the surplus market aluminum tubing sells for very little. Various bolts and self tapping screws and a few pipe clamps are the only other materials needed.

Aluminum tubing of different diameter than that used in the original could be employed with a possible reduction in total weight to somewhere around ten pounds. Our list of materials included the following hard-drawn aluminum tubing:

| No. of pieces | O. D. (inches) | Length |
|---|---|---|
| 2 | 1½ | 11 feet |
| 1 | 1½ | 6 to 11 feet |
| 2 | 1 | 4 feet |
| 8 | 1 | 21½ inches |
| 8 | ½ | 38½ inches |
| 8 | ½ | 41 inches |
| 6 | ⅜ | 40½ inches |
| 2 | ⅜ | 22 inches |

In addition, we used two pieces of hard-drawn aluminum sheet, ⅛ inch thick and 7 to 8 inches square. Eight 1-inch, standard, galvanized pipe clamps and an assortment of self-tapping and machine screws complete the list.

## Construction

As Fig. 1 indicates, the two 11-foot pieces of 1½-inch-diameter tubing, along with the two 1-inch-diameter, 4-foot pieces, form a rectangular supporting structure for the beam. This drawing also shows how the supporting pole, which is the 6-foot or longer piece of 1½-inch material, is bolted on with the aid of the 8-inch-square aluminum gusset plates and the 1-inch galvanized pipe clamps. One-inch holes should be drilled in the two 11-foot pieces as shown.

A drawing of the antenna and reflector elements mounted on their horizontal 1-inch-diameter, 21½-inch-long supporting tubes is given in Fig. 2. Here

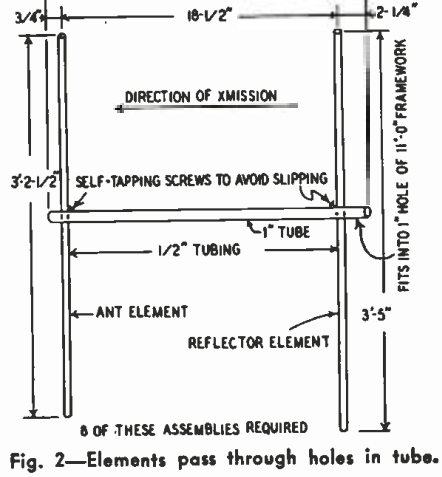


Fig. 2—Elements pass through holes in tube.

it is necessary merely to drill out ½-inch holes to accept the two elements. After they are in place, small self-tapping screws can be added to keep the antenna and reflector elements from slipping. No insulators whatever are used in the antenna or reflector elements since they are mechanically supported in their respective centers, which is, of course, a point of zero r.f. voltage.

When eight of the antenna and reflector assemblies are completed, one end of each support is passed through a 1-inch hole in the main 11-foot-long framework and bolted by using long brass machine screws through both tubes. Incidentally, in cutting these 1-inch holes in the 1½-inch material, use a 1-inch hole-cutting saw and take your time in lining up the holes.

The phasing lines are next on the list (Fig. 3). These are the six pieces of ⅜-inch-diameter tubing 40½ inches long. When these pieces are bolted to the ends of the antenna elements the entire structure will be quite rigid. At the cross-overs, the ⅜-inch tubing is bent slightly so as not to touch. A small ceramic insulator may be used here to keep the tubing in place. We found some small, square, post-type ceramic insulators threaded for 8-32 machine screws. They are about 1 inch long and came from some surplus BC-375-E tuning units. The ends of the antenna elements and phasing lines may be mashed flat and drilled. Small aluminum aircraft-type clamps could also be employed.

The point of feed of the beam is the exact center of the phasing section. The two pieces of ⅜-inch tubing 22 inches

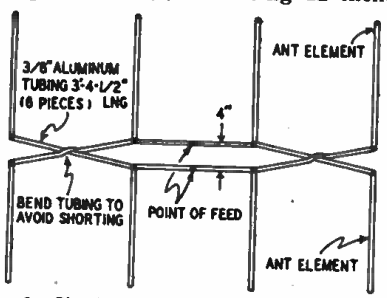


Fig. 3—Phasing lines fastened to radiators.

long are fastened to the phasing lines and brought straight back to the upright supporting pole. A piece of polystyrene ¼ inch thick is secured to the support pole with a 1-inch pipe clamp. Two brass 8-32 machine screws and nuts are used to clamp the ends of the tubing to it. The antenna or matching stub (if used) can be tied on at this termination and pulled straight down or back at an angle, without being in the field of the array. The photograph (Fig. 4) shows the feeder termination.

The bottom of the support pole may be made to fit an existing rotator, or it may be clamped to a wooden pole with pipe clamps or by some other method.

## Feeding the array

The exact impedance of the feed point in this 16-element array is not definitely known. As with transmission gain, many different opinions exist. It is undoubtedly best to employ some sort of matching transformer or stub and

adjust for minimum standing-wave ratio. However, dispensing with the matching arrangement will probably still be quite satisfactory. In that case, a standard 300-ohm ribbon line might be used, or even a two-wire open line, spaced about two inches. At W5AJG we tried the two types, a 450-ohm, two-wire, open line and 300-ohm twin-lead. Both types were entirely satisfactory. From rough measurements, however, it seems that the impedance of the array is lower than the 300-ohm value, probably around 150 to 200 ohms. 150-ohm twin-lead was not available during the tests but no doubt it would be as good as or better than the 300-ohm line as far as matching goes. It must be borne in mind that at 2 meters losses in the transmission line can be appreciable, especially if the run is long.

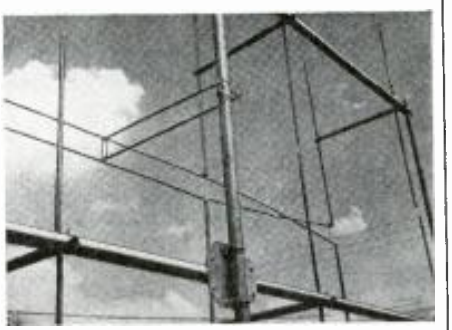

Fig. 4—Feeders connect to the phasing lines.

One last point in connection with this beam. The voltage and current distribution is such that very little "fire" is noticed when a pencil or neon bulb is touched to the elements.

A few amateurs using the 16-element array report obtaining even better results by phasing out the reflector elements, that is, using the phasing and cross-over tubing on the reflector elements just as with the driven elements.

The dimensions shown in the drawings are designed to favor the lower one megacycle of the 144-148-mc amateur assignment. Should operation be desired higher up in the band, the antenna elements should be shortened by about ¼-inch for each megacycle range. The reflectors may be shortened likewise, but it is not necessary.

## U. S. HAMS NUMBER 77,000

The number of amateur radio operators in the United States appears to be decreasing, according to a report released by the Federal Communications Commission on January 28th. There were an estimated 81,000 operators on December 31, 1947; the roster as of the end of 1948 carried only 76,666 names. Though the difference between the two figures is something over 4,000, the 1947 figure was estimated, not exact, and may have been a slight over-estimate. Station licenses in the hands of amateurs at the end of 1948 numbered 77,338; radio clubs, schools, and similar organizations (notably the UN) are often issued station licenses only.

The total number of radio authorizations held in this country was 677,060 as 1948 began.