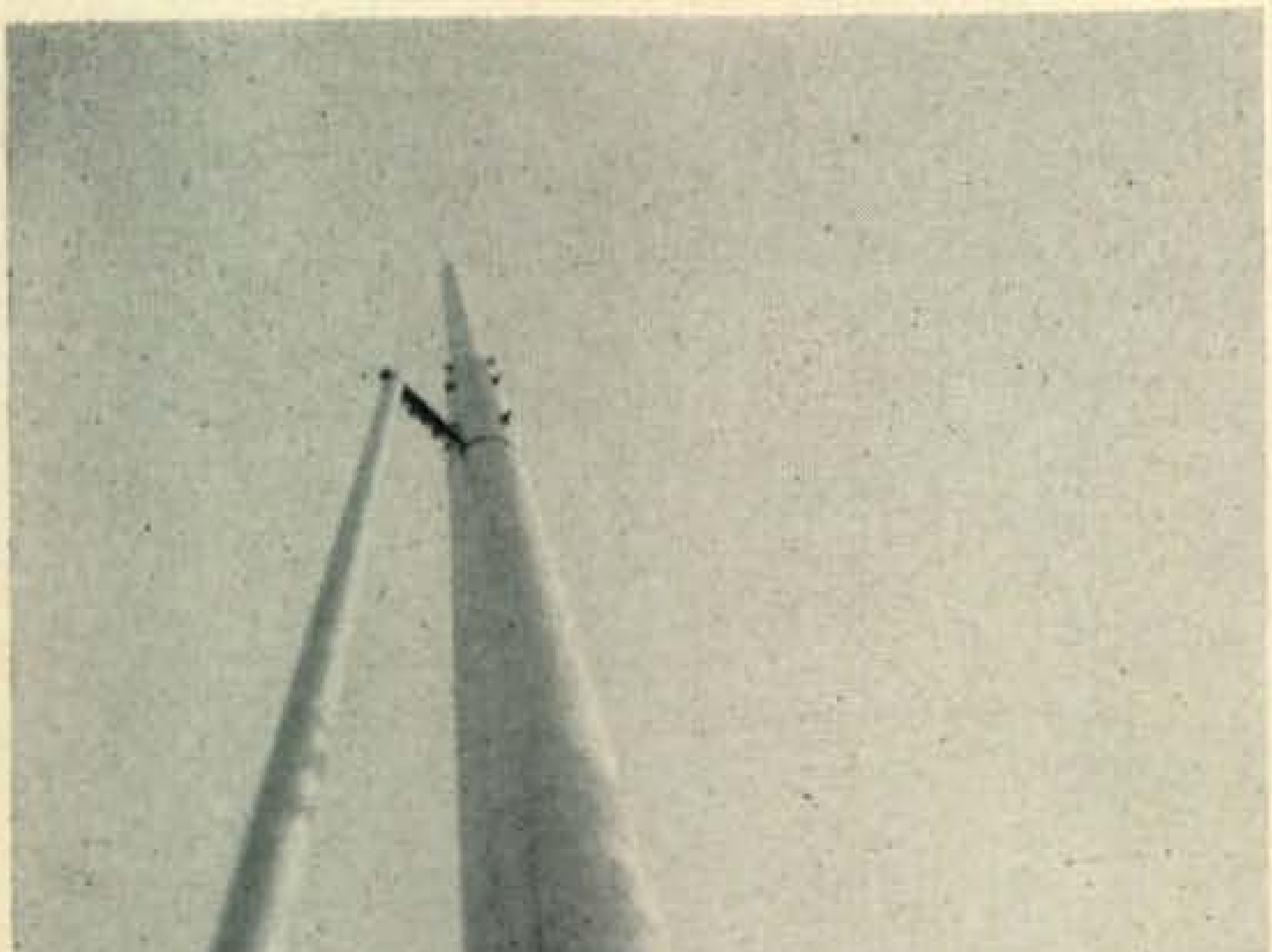
# The Mail Order Antenna

## A 40-Meter Vertical for the Space Starved Amateur

R. W. JOHNSON, W6MUR

1202 Avoca Avenue, Pasadena 2, California

Getting a 7-Mc ground-plane antenna on a small city lot can be quite a problem. After all, a 32 to 36 foot antenna does not stand up by itself, unless it is made of some special (and usually expensive) material. The little matter of erecting a guyed "whip," without breaking it in half in the process is also something to consider. Then, there is the base insulator, as well as the location of the radials, to worry about. The radials are around thirty-five feet long too, you know.



Looking up from the base of W6MUR's vertical. The small diameter tube on the left is the matching section. It is ten feet long, one inch in diameter and four inches from the radiator.

The "Sears-Roebuck Special" eliminates or avoids most of these problems. Its evolution began upon noticing in a *Sears* catalog that aluminum irrigation tubing, with 0.050-inch walls, was listed in twenty-foot lengths and in diameters of two, three, and four inches, at a cost of \$4.85, \$6.75, and \$8.95, respectively.[1] I ordered a length of each of the larger sizes.

The tubing proved to be very rigid, therefore, I joined the two lengths together in the manner shown in *Fig. 2.* First, I cut four pieces of plywood, 48 x ¾ x ½ inches, to use as spacers between the two pieces of tubing. After dressing them down to fit, I wrapped them with thin flashing material (*Sears* "Valley Roll," 0.19 x 14 inches—\$2.38 for a ten-foot roll), so that they would become conductors.

Next, I telescoped the two lengths of tubing together for four feet, with the aluminum-sheathed wooden strips evenly spaced between them. The assembly is held together by six ⅜-inch threaded rods (Cut from *Sears* "Redi-Bolt Rod"—sixty-five cents for a three-foot length) completely through tubing and spacers, three in one direction and three more at right angles to them. Nuts and washers on the rods and some strong-arm work with a pair of wrenches finished this part of the job.

The complete 36-foot length weighs twenty-eight pounds, and when held horizontally from one end, the sag is just discernible.

#### Installation

I dug a hole four feet deep in which to set the antenna with a standard post-hole auger. It

1. Not all Sears catalogs list this tubing, which is described on page 842 of the spring-summer, 1953 edition (No. 206) of the catalog distributed in the Los Angeles area. If not listed locally, it can be ordered from: Sears, 925 South Homan St., Chicago 7, Ill. It is also available from other sources.

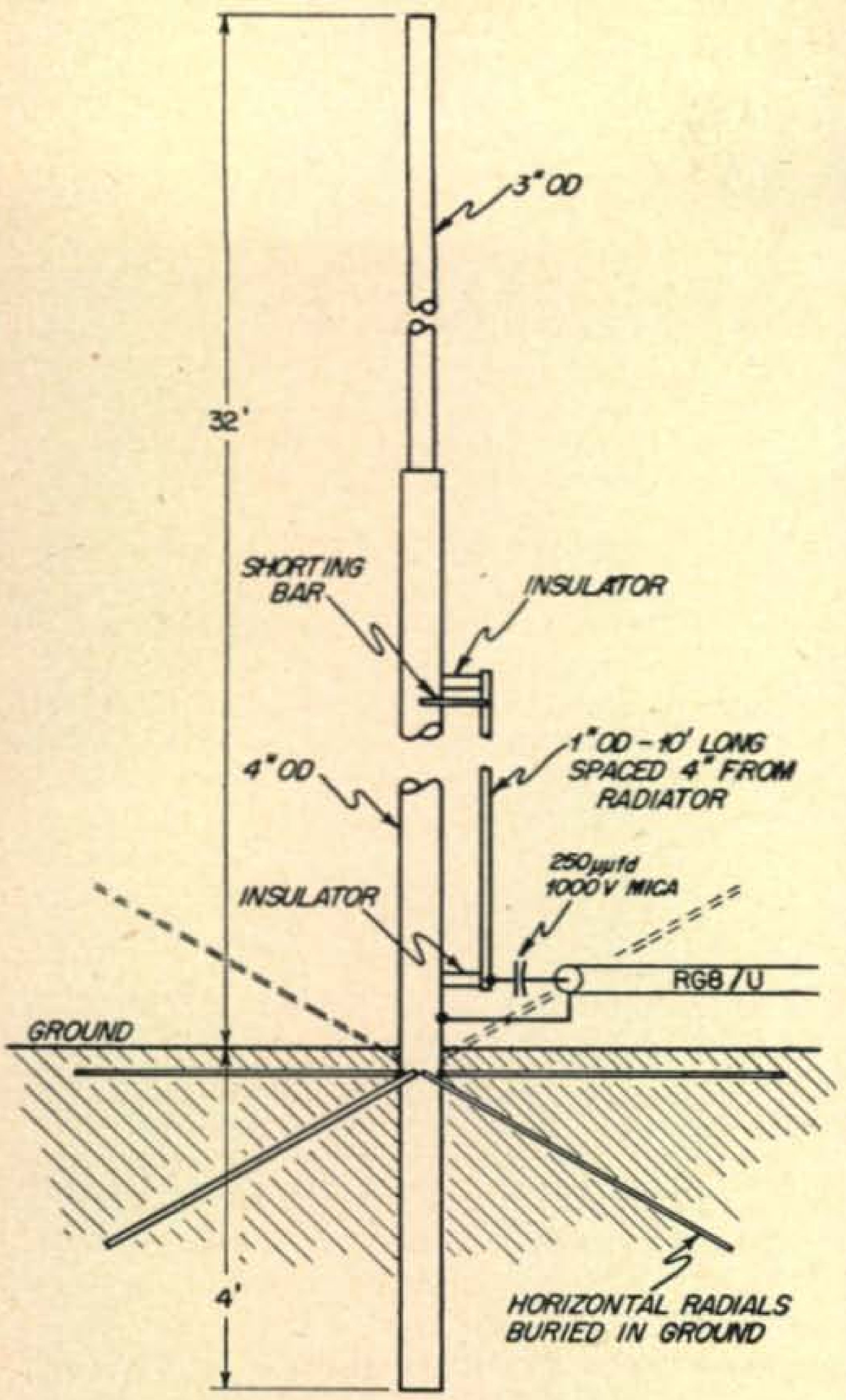



Fig. 1. Working sketch of the 7-Mc. vertical described in this article. The details are thoroughly explained in the text.

happened that the only suitable place in the yard for the antenna was beside a neighbor's garage. After the hole was dug, I leaned the antenna against the garage and worked it down into the hole.

Holding the antenna vertical with one hand, I pushed dirt into the hole around it and tamped it down firmly with a "two by four." This operation took five minutes! And I am under-powered. I now had a self-supporting vertical antenna, thirty-two feet high.[2]

Next, I fastened a ten-foot length of one-inch diameter aluminum tubing left over from an old beam, parallel to the bottom section of the antenna and four inches from it, as indicated in *Fig. 1.* Insulators are *National GS-3* or equivalent. (These I could not find in the *Sears* catalog.) Double-thick bands of the flashing aluminum fasten the insulators to both pieces of tubing and are also used for the shorting bar at the top of the matching section. The bottom of the one-inch tubing extends to about an inch and a half from the ground.

2. In locations where the temperature drops below freezing, rain and moisture trapped inside the tubing might freeze and split it; therefore the four feet that are below the ground should be plugged and a few small holes drilled in the tubing near the ground level to prevent water from accumulating—Editor.

To reduce ground losses, I next installed a set of four, buried, No. 9, aluminum fence-wire radials. (*Sears*—$6.10 for 500 feet.) I used a lawn edger to cut slots in the ground a few inches deep in which to bury them. One radial angles across the lawn and is connected to a water pipe. The others run off in different directions, as permitted by buildings and other obstructions.[3] The incisions in the lawn healed in two days to where they were no longer noticeable. Copious watering helped heal the scars.

The feed line is RG-8/U, 52-ohm, coaxial cable, which may be buried. Its shield connects to the base of the antenna at the same point at which the radials are connected, and the inner conductor is connected to the one-inch diameter tubing through a 250 μμfd, 1,000-volt, mica condenser (good for up to a kilowatt input). The SWR is less than 2:1. It could be made to approach unity by careful adjustment, but the difference in results would be negligible.

The condenser is important in obtaining a low SWR on the feed line. Only at the ends and at points a whole multiple of a ¼-wave from them does a resonant antenna represent a pure resistance. At other points along its length, there is also a reactive component present. With this feed system, the reactive component is reflected to the feed point as inductive reactance, which is tuned out by the capacitive reactance of the condenser.

### Adjustment

Although duplicating the antenna shown will result in an efficient antenna, the following information is included for the benefit of those who are experimentally inclined or who wish to vary the dimensions in the matching section.

Adjustment procedure is this: substitute a variable condenser of about 300 μμfd. capacity for the fixed condenser. Connect an s-w-r meter

*(Continued on page 68)*

3. The radials are not absolutely necessary. The antenna will work without them at reduced efficiency, because of higher ground losses. Their exact length is not critical, but should be at least ¼-wave long (thirty-five feet at 7 Mc.), if possible. A minimum of four gives best results. Ground losses will continue to decrease slowly as additional ones are added. Broadcast stations use 120, equally spaced around the base of the antenna —Editor.

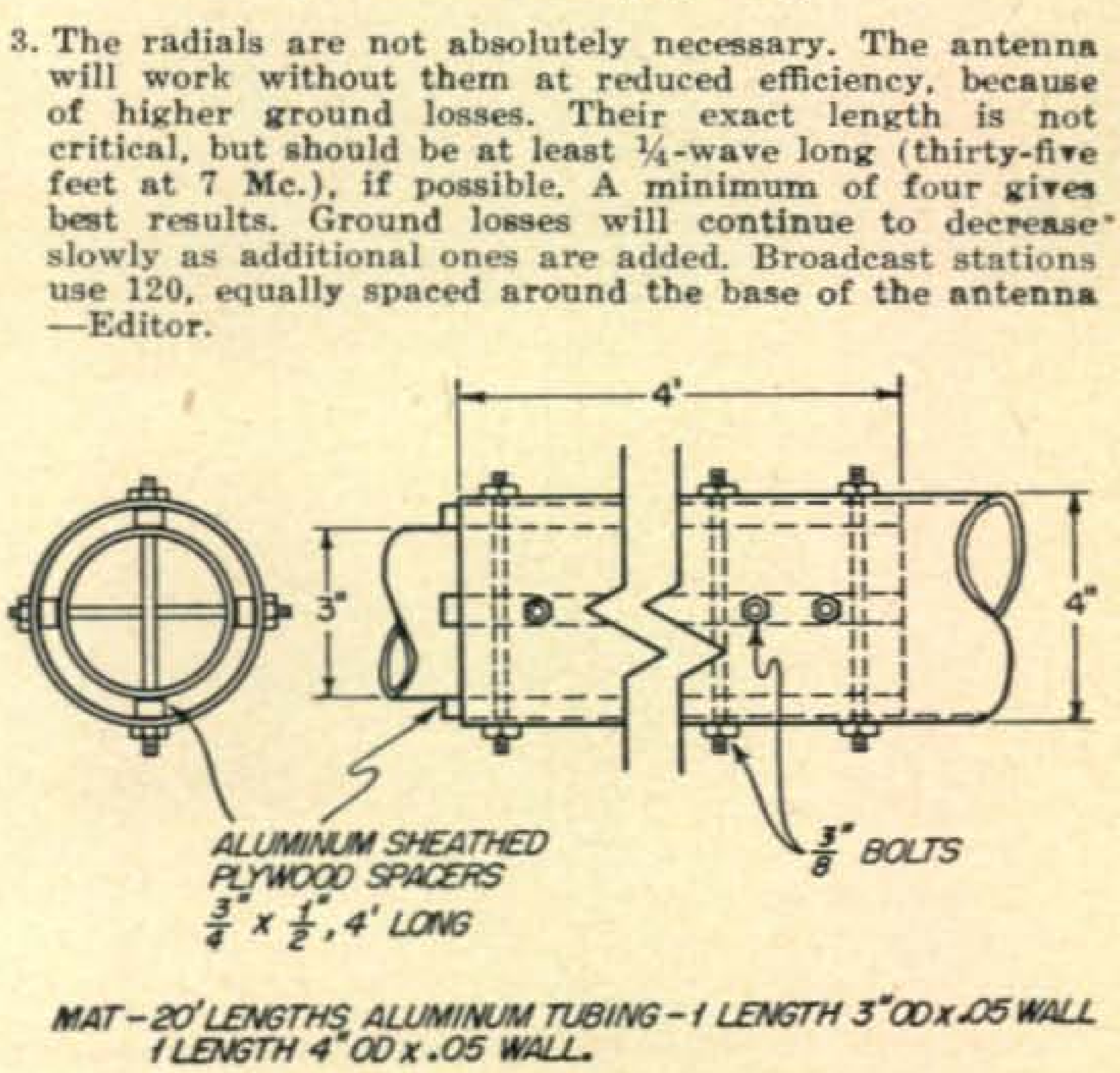



Fig. 2. Method of joining lengths of three-inch and four-inch aluminum tubing.

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*(from page 37)*

in the coaxial feed line. Set the shorting bar at an arbitrary position and feed a small amount of r-f energy at the desired frequency into the feed line. Adjust the variable condenser for minimum SWR. If the SWR is higher than desired, change the position of the shorting bar slightly and re-adjust the variable condenser. Repeat as often as necessary to reduce the SWR to a satisfactory value.

This procedure assumes that the radiator itself is fairly close to resonance, so that it will efficiently radiate the power fed into it. This is a valid assumption, especially as the large diameter of the radiator reduces its *Q*, making its length non-critical. The relatively-small length/diameter ratio is also the reason the recommended radiator length is somewhat less than that of a conventional ¼-wave antenna constructed of wire or small-diameter tubing.

For a given set of conditions, the position of the shorting bar and the capacity of the series condenser can be calculated with fair accuracy by making certain asumptions. However, best results still require a cut-and-try procedure, therefore the mathematics are omitted. Antenna design is an art, not a science! However, thanks are due to W6DSZ of the Antenna Laboratory, University of California, for his original assistance in calculating constants for the feed system.

### Life Expectancy Of Antenna

All metal is subject to corrosion, especially when in contact with the earth. Aluminum is no exception; therefore a check was made with a metallurgist on the life that can*be expected from this antenna. The following is based upon his report:

If the antenna is installed in dry, sandy soil, its life will be indefinite. In normally-moist soil, which is essentially chemically neutral, a *minimum* life of five years can be expected. In wet, heavily-alkaline or acid soil, corrosion is more intense and the useful life will decrease. If in doubt of the type of soil in your yard, an easy-to-use kit for testing its acidity or alkalinity may be obtained from any garden-supply store.

The critical point is at the ground level of the vertical member. Corrosive pitting of the tubing will decrease its strength, and heavy winds might snap off the antenna. This possibility can be greatly decreased by driving a five-foot wooden "round" inside the tubing; so that the point of maximum stress will be raised about a foot above the ground, where it will be isolated from corrosive effects of the earth.

Do not saturate the base of the antenna in a
It or sea water will corrode aluminum practical-
salt solution to decrease the ground resistance.
ly while you watch.