TOWER CONSTRUCTION

BY E. H. MARRINER*, W6BLZ

Erecting antenna masts frequently poses problems both for the beginner and old timer. Here is a detailed account of how a pair of simple and inexpensive wooden masts can be fabricated and installed in a safe manner. Also discussed is the construction of simple dipole antennas.

MANY beginners whether they are young or old, seem to be perplexed by the problems encountered in constructing supports for antennas.

There are many decisions to be made before getting started. Should the antenna support be mounted on the roof or set on the ground? Would a bamboo pole be satisfactory? Should the support be guyed? What materials should be used? Height and anchoring methods must also be decided. These are just a few of the problems for which answers must be found before construction is started.

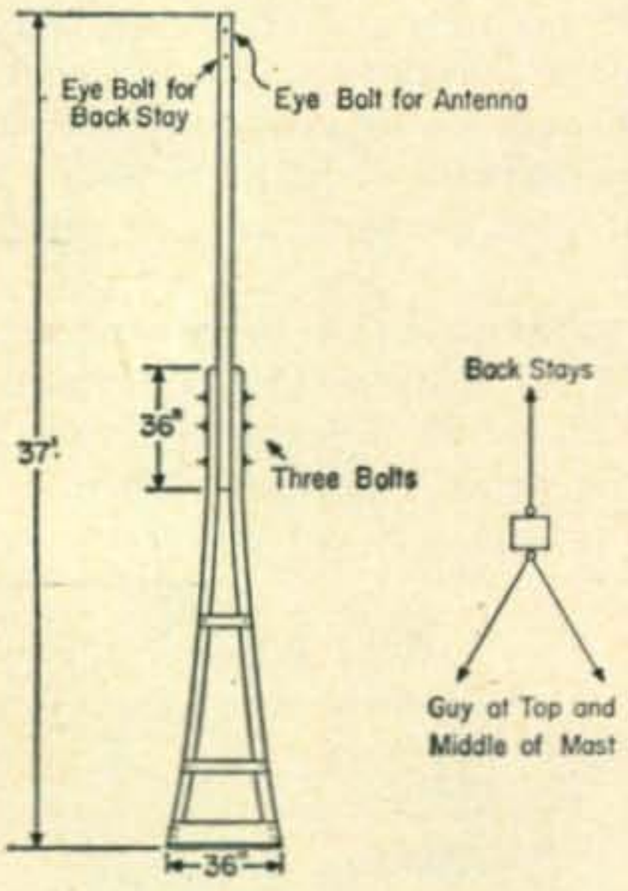

Fig. 1—Mast construction details. Galvanized nails must be used for securing the wood braces.

Decide what the requirements are for your antenna; is it to be for receiving or will it eventually be used as a transmitting antenna? If it will be used for transmitting, a major factor is its height. It should be at least forty feet high since this is the minimum height that would effectively reflect signals off the ionosphere. In this case then, bamboo poles would not do since they are too flexible. A heavier, more substantial guyed pole is needed.

Certainly, expense and durability are factors to be considered. The least expensive material from which to construct the antenna support is wood. However, proper finishing is necessary to prevent rotting. How about hardware? If the antenna is erected in a damp climate area, brass or galvanized hardware should be used. Electroplated hardware is suitable in a dry climate but will rust badly in a damp area. In extreme cases it might rust enough to cause the entire structure to come tumbling down on a neighbor's property.

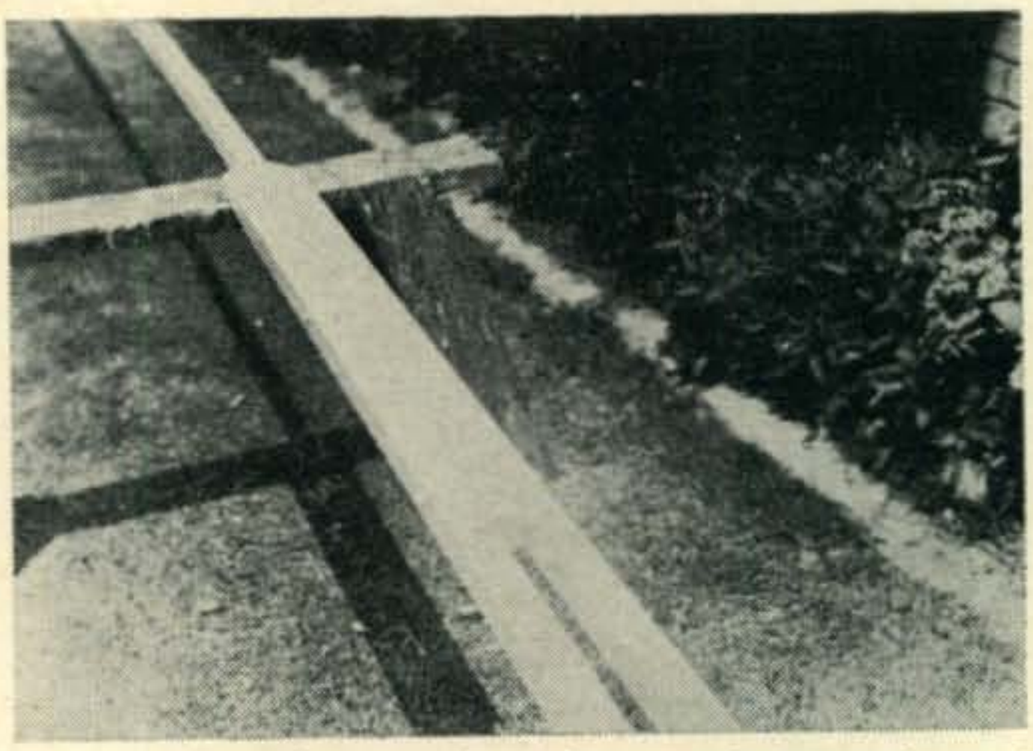

Fig. 2—View showing how the wood is overlapped and bolted.

Getting Started

Once a decision has been made as to the type of hardware necessary, begin accumulating it. Galvanized and brass fittings can be obtained from a marine hardware store sometimes called a Ship's Chandler. It can frequently be ordered through your local hardware dealer.

Construction details for a wooden antenna support are shown in fig. 1. It is made from 3 twenty foot lengths of 2 × 2. The cost of the wood runs about $3.50 at most lumber yards. It is essential that you select straight grained lengths that are knot free.

To begin construction string out the 2×2's on 3 saw horses with the bottom two overlapping the top section by 36 inches as shown in fig. 2. Next drill three ¼ inch holes, about a foot apart, through all three 2×2's. Bolt the

*528 Colima Street, La Jolla, California

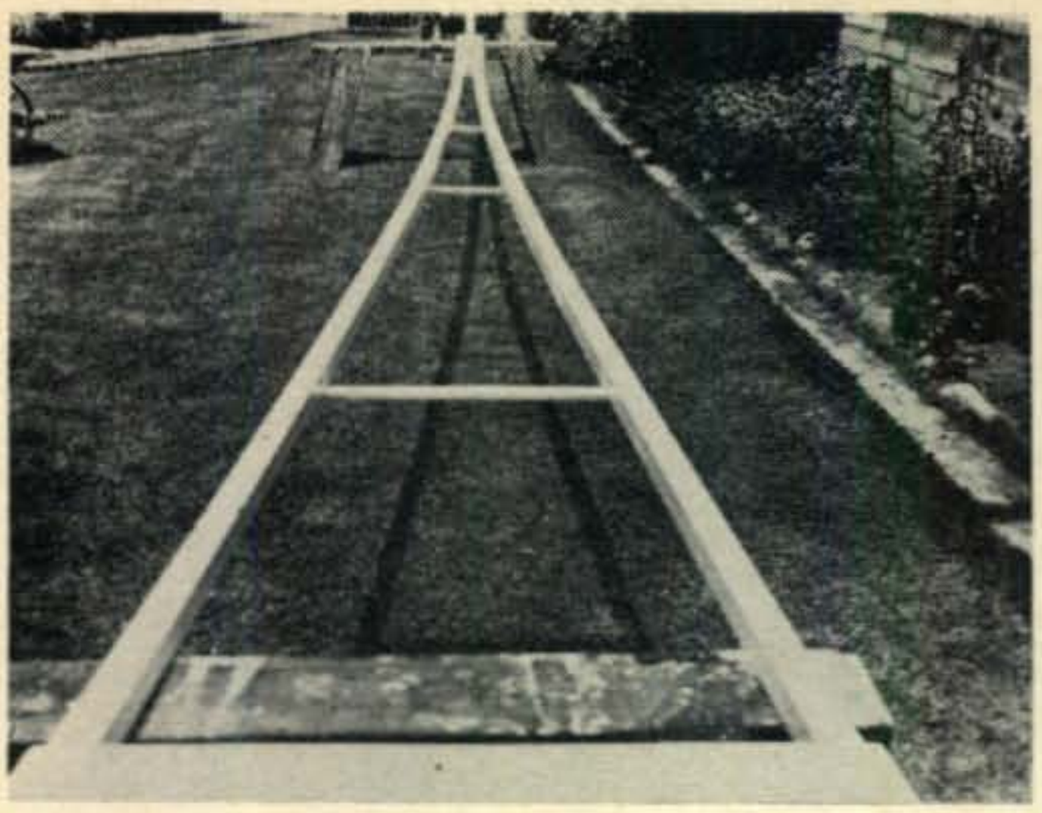

Fig. 3—View showing how the mast legs are spread and braces attached.

three lengths together with ¼-20 threaded brass rod or galvanized carriage bolts 5½" long. Avoid the use of electroplated hardware.

After the wood has been bolted together, spread the bottom ends of the legs apart 36 inches and nail on a 1×4 inch support on each side as shown in figs. 3 and 4. Be sure to use galvanized nails. Trim off the surplus wood edges and nail another 1×4 inch length on the bottom to form a solid base. A few pieces of wood can be tacked across the legs at various heights to give added support and stability.

Drill a hole about 3 inches down from the top for the antenna supporting eye bolt (fig. 5). Six inches below this, drill another hole for the back-stay eye bolt. Each bolt should face in the opposite direction. It is a good idea to use cast bolts, obtainable in any marine supply house, as these will never open under strain.

Now give the mast three coats of a good grade white boat paint which will outlast house paint many years. It will also stay bright and not flake.

Locating and Erecting The Mast

The positions of the masts are determined by several factors. The length of the antenna will determine the separation of the masts and

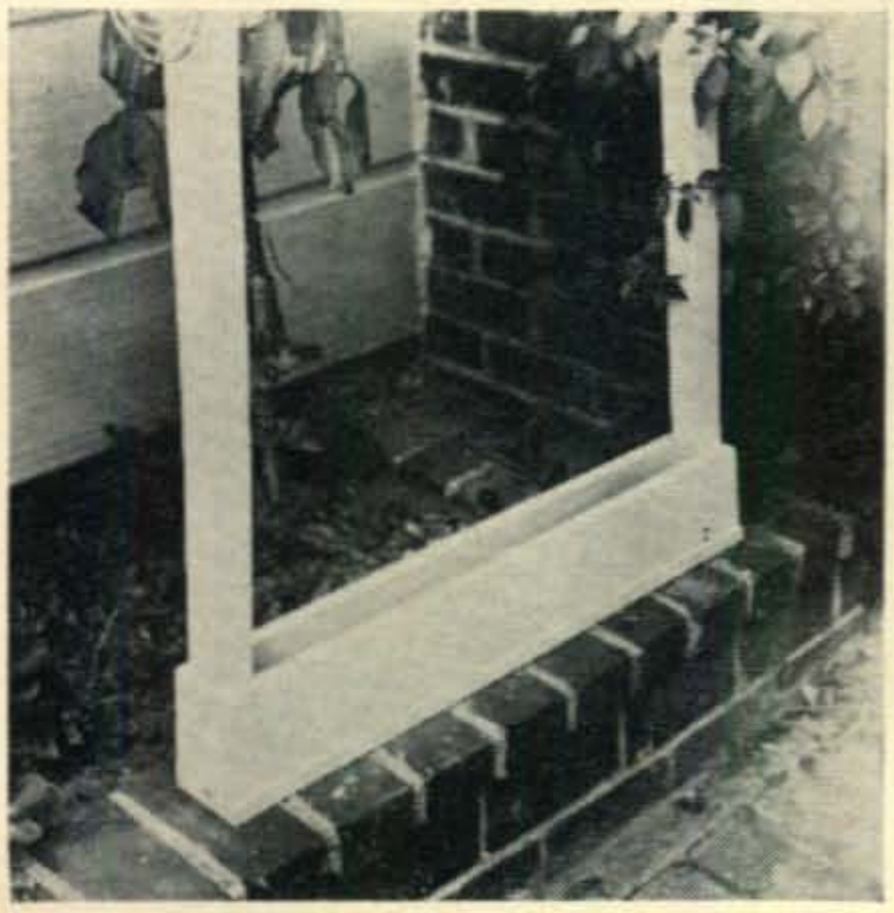

Fig. 4—Completely assembled mast base.

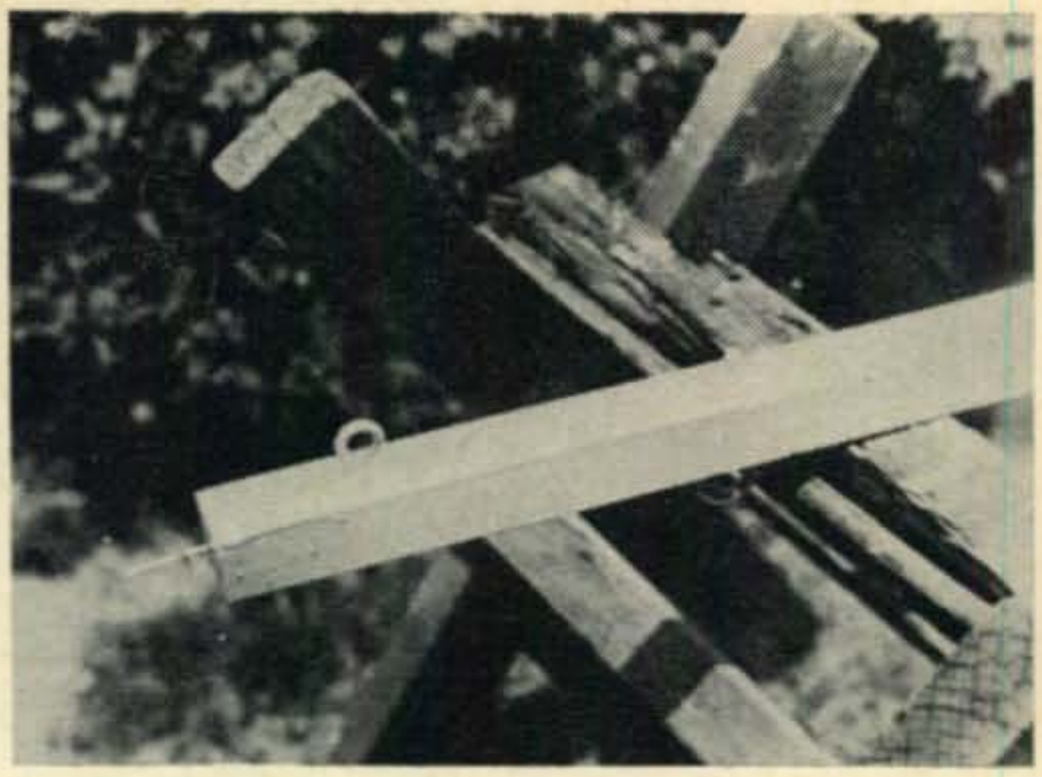

Fig. 5—The antenna eyebolt is secured about three inches down from the top of the mast. Six inches below it, facing the opposite direction, is the back stay eye-bolt. The nail is needed for handling the mast when painting.

this is discussed more fully later. The masts should, if possible, be situated where there are convenient tie points for the guy wires. The selected positions should be such that the wire does not cross a neighbors property as this could be considered a violation of "air rights" and possibly lead to litigation. If the choice is available, select the compass direction that will permit you to operate in the desired direction.

The antenna, guy wires and anchors must be prepared before the masts are "walked" into position. Galvanized wire can be used for the stays if they are broken every 12 feet with egg insulators. If the climate is damp it would be advisable to acquire some stainless steel aircraft control cable. While this is rust proof it is more difficult to handle. The ends of the aircraft cable can be fastened with #6 Burndy electrical clamps. It is also possible to use Stacon lugs, but this requires the use of a spe-

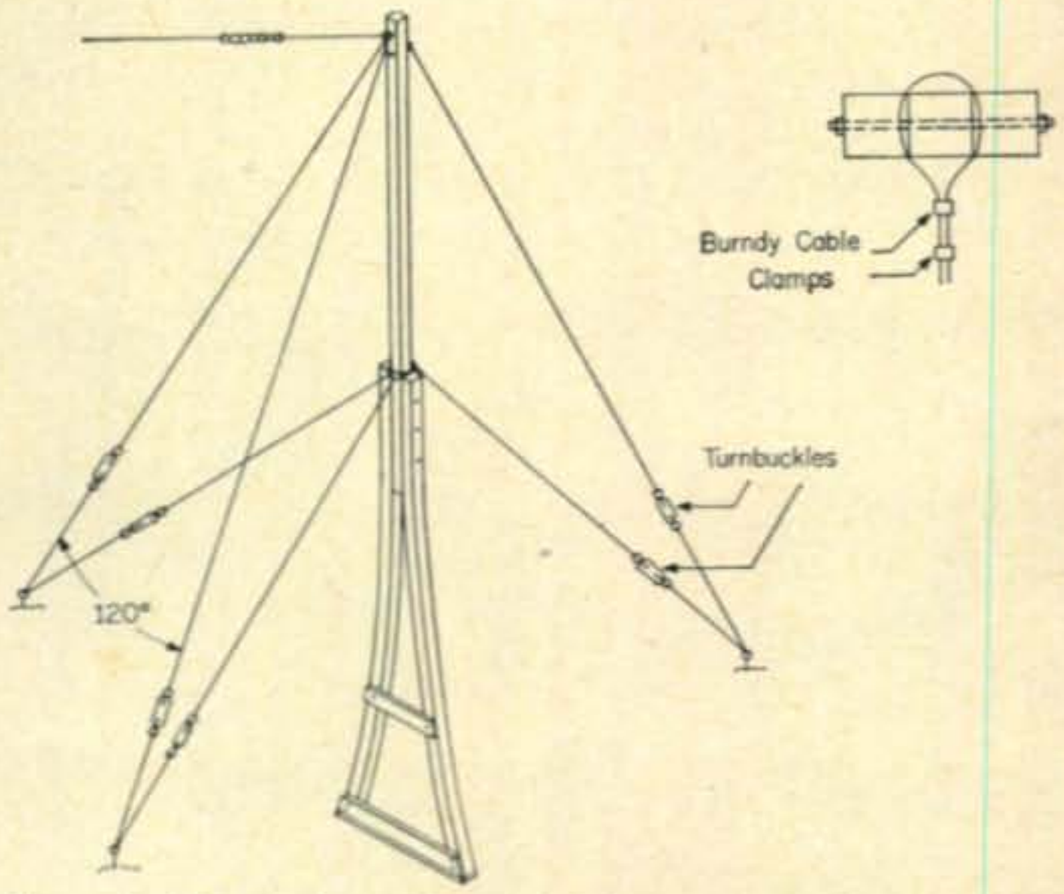

Fig. 6—Illustration of a satisfactory guying system. The top backstay is secured to its eye-bolt while the two forward stays are tied to the antenna eye-bolt. The lower stays are secured by loops over the top mast section as snown in the insert. Each set of forward stays should maintain an angle of 120° for maximum strength.

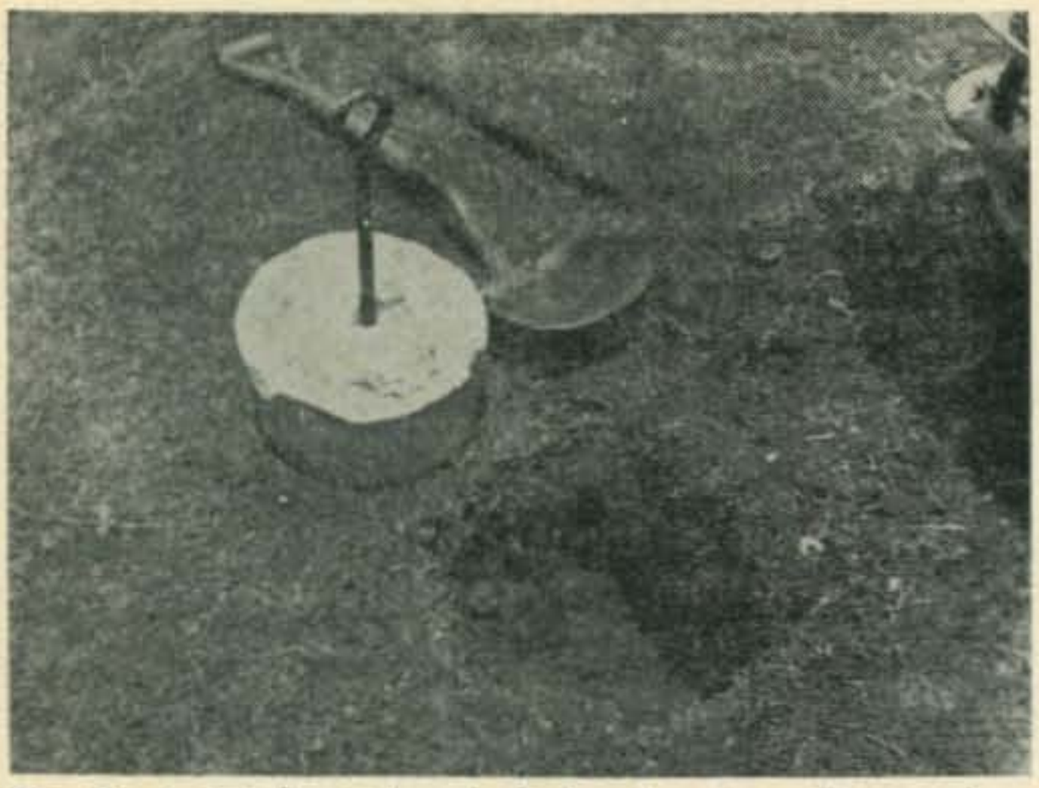

Fig. 7—A simple anchor bolt for the stays. The anchor, laced with wire mesh, can be formed in a bucket or the hole in the ground can be used, as explained in the text.

cial crimping tool. The number and location of guys to be used are shown in fig. 6.

Turnbuckles placed in the guy lines will enable you to adjust the mast to a perfect vertical position. If care is taken in adjusting the side stays then the turnbuckles can be confined to the back stays only.

The stays can be secured to the house or a large tree if they are conveniently located. If not, a concrete anchor, such as shown in fig. 7, must be poured. This is done by placing a 20 inch long eye bolt (half inch diameter) in the concrete form (an old waste basket or bucket). Secure a foundation washer to the bolt so that it won't pull out of the concrete later. Position the bolt in the form and add some chicken wire for reinforcement. Stir up a batch of Redi-Mix concrete and pour it into the form. Poke at the mixture with a trowel or a scrap of wood to work out all the air bubbles. When hardened, remove the anchor and pour the rest of them. If you form the anchor in the hole on the site, be sure the sides of the hole are vertical and damp. Wet the concrete down occasionally to prevent it from setting too fast. A complete anchor is shown in fig. 8. Secure the antenna to the masts as

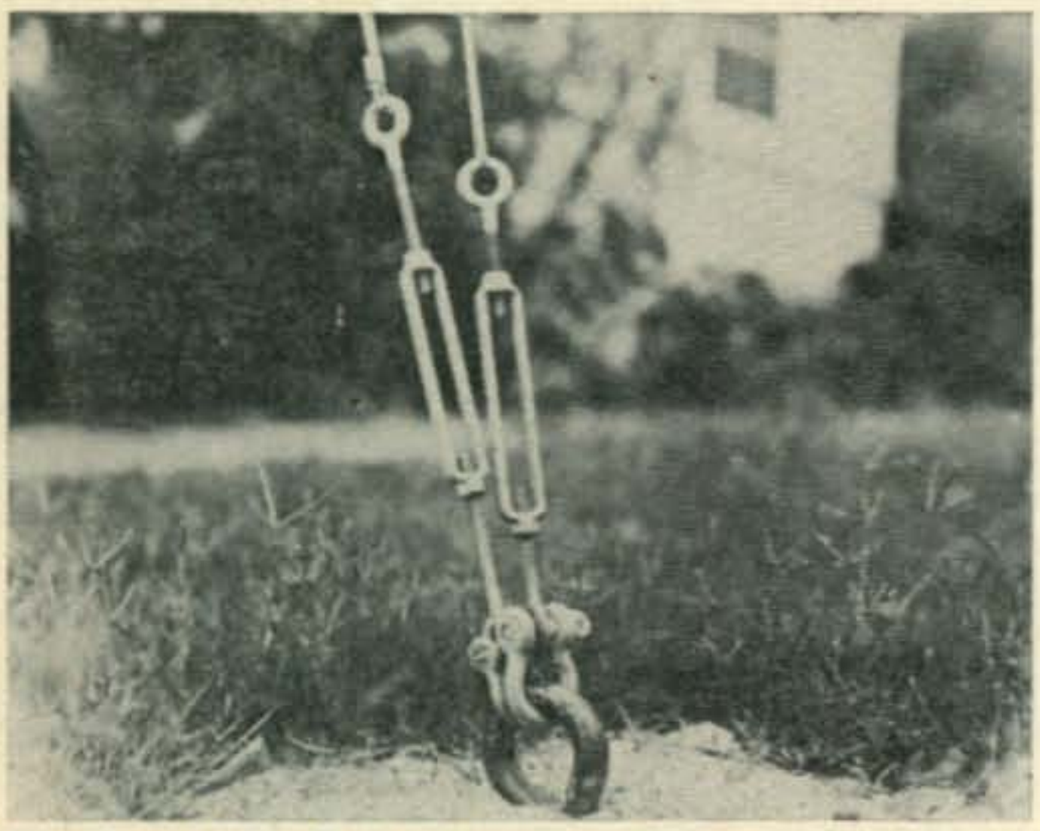

Fig. 8—View of the upper and lower back stays secured to the anchor bolt with shackles. Number 6 Burndy electrical clamps are used to secure the wire.

explained in the section on antennas and proceed to erect the mast.

Walk the mast into position, hold it in place, and secure the stays. Using a carpenters level to insure a true vertical position, align the base. Then adjust the turnbuckles until the mast is straight.

Preparing The Antenna

As previously indicated, the distance between the masts will be determined primarily by the length of the antenna. The following table indicates the antenna lengths for the various amateur frequencies. For transmitting purposes the antenna will be effective for about 100 kc on each side of the cut frequency. It is most practical to cut the antenna for the center of the desired band. The table is based on the formula:

$$L(\text{in feet}) = \frac{468}{f(\text{mc})}$$

Freq kc	Feet	Inches	Freq kc	Feet	Inches
3500	133	8	14,000	33	5
3600	130	—	14,100	33	3
3700	126	6	14,200	32	11
3800	122	—	14,250	32	10
3900	120	—	14,300	32	9
4000	117	—	14,350	32	7
7000	66	10	21,000	22	—
7100	65	4	21,100	22	3
7200	65	—	21,200	22	1
7300	64	5	21,450	21	9

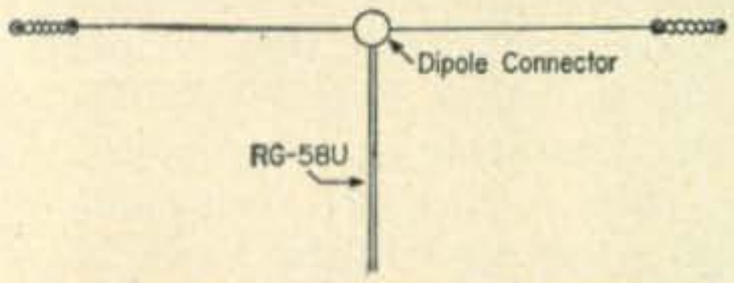

Fig. 9—Simple dipole antenna that may be strung between the masts. The lengths versus frequencies are listed in the text. The center dipole connectors to be used are shown in fig. 10. If one is not used, a center insulator should be substituted and the coax feedline properly waterproofed.

The most practical method of erecting the antenna is by pulley since it would be quite a feat to climb this type of mast. A galvanized pulley whose diameter is determined by the size of the hoisting line used, is hooked into the top eyebolt. The hoisting line may be sisal rope or Glass Line. Glass Line is preferable since its length does not vary with moisture as does sisal rope.

The antenna itself should be made from steel core copper wire, gauge #12 or 14. This type of wire will not stretch and the operating frequency of the antenna will be maintained. The end insulators should be large enough to handle the required power if the antenna is used for transmitting.

The simple antenna configuration, a dipole, is shown in fig. 9. A special connector manufactured by Cesco, Hy-Gain and other firms, is recommended as shown in the illustration. Use of one of these provides a proper impedance

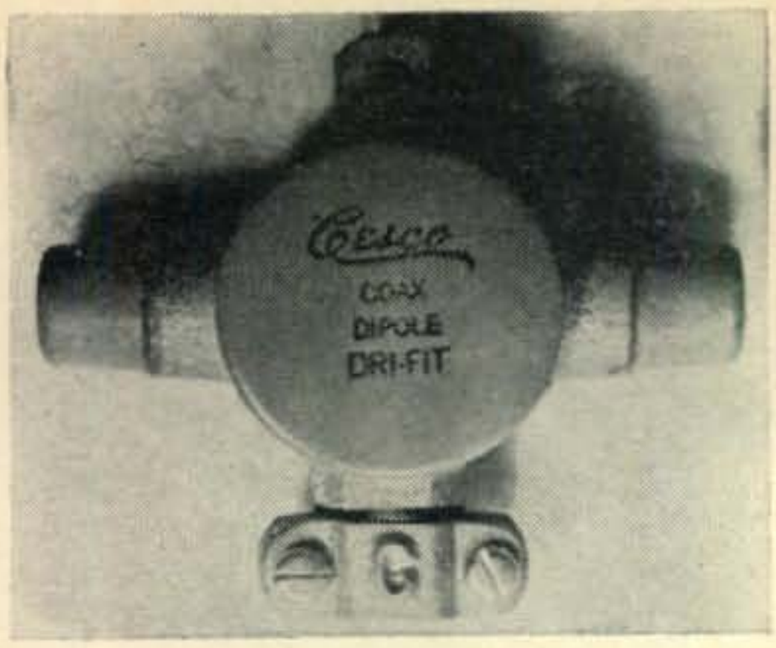

Fig. 10—Two types of dipole connectors are shown above. The top unit is manufactured by Continental Electronics and Sound Co. and the lower by Hy Gain Antenna Products.

match, a water tight connection and support for the RG-58/U coaxial line. The center of this dipole has an impedance ranging from 75 to 52 ohms depending upon the height above ground. In most installations it is nearer to 52 ohms and RG-58/U cable would be best. A good length for the feedline is about 60 feet and it should come away from the antenna at a right angle for as long a distance as possible but a minimum of one third the antenna length.

Before using the antenna with a transmitter, check the standing wave ratio and prune the antenna length (or increase it if necessary) so that the lowest v.s.w.r. exists at the desired operating frequency.

A good straight antenna mast, painted white, is a magnificent sight to behold, even for the neighbors! Why not give it a try? ■

Parts List (For Two Masts)

1—Galvanized hot dip pulley. Size according to type rope or line used.

12—Stub and forged steel turn-buckles. Stub length 5½ inches, eye-inside diameter ½ inch, stub diameter ½ inch. Total length with eyes unscrewed, 9 inches. (It is possible to only use four turn-buckles if front guy wires are fastened correctly.)

4—Nut type eye bolts, galvanized weldless drop forged steel with closed eye, ¼" shank and large eye shoulder.

40"—Brass threaded rod, ¼"-20 threads per inch with twelve each brass nuts and washers.

12—Screw Pin Anchor Shackles. Width between eyes ⅝" with ⅜ inch diameter pin. Inside length 1½ inches.

6—Nut Lock Malleable Iron Washers or Cast Iron Washers. 2⅜ diameter.

6—Anchor Eye Bolts, ½ inch diameter bolts with 1½ inch diameter eye, drop forged construction bolt. Place malleable washer between two nuts and tighten before pushing in cement.

24—Egg Insulators.

200'—Guy wires, #16 galvanized or stainless steel wire.

1 Qt.—Z-Spar boat paint, white.

200'—Glas-Line rope, 500 pound test.

1—Dipole center connector.

A TVI Filter for the 6 Meter Man

BY FREDERICK W. BROWN*, W6HPH

Although most six meter TVI is caused by 50 mc r.f., this easily constructed filter will insure that no other frequencies are getting into the antenna.

THE first step in eliminating TVI is to clean up your own rig. It's usually a pretty convincing demonstration to show your own TV set to be free from interference. Of course, nothing can be done at the transmitter to cure TVI that is the fault of the TV set, but it's hard to know just where to point the finger of blame if the transmitter is not well shielded and filtered.

Described here is a filter for 50 mc transmitters designed to suppress frequencies other than 50 mc that may be getting to the antenna. It will do absolutely nothing for harmonics being radiated by the transmitter power leads, key lead, mike lead, etc. Before you worry about a transmission line filter, make sure the tranmitter is completely shielded and all entering wires are adequately filtered. This can be checked by disconnecting the six meter antenna and firing up the rig. If you still have TVI, it's a pretty good indication you need to do some more shielding and bypassing.

If disconnecting the transmitting antenna eliminates the interference, it means the TVI is either the fault of the TV set or your transmitter is putting something into the antenna it should not. This filter is designed to eliminate

*Star Route, Idyllwild, Calif.