# A ONE MAN MAST

BY GEORGE P. SCHLEICHER,* W9NLT

*This 33 foot wooden mast made of 2"×2" lumber can be used to support a long dipole or a simple vertical antenna wire. The installation method can easily be handled by one man.*

DO YOU need an inexpensive antenna mast? Maybe one that will hold up the end of a dipole, a long wire or the center of an inverted Vee? How about two of them to be carried out to a field day location and erected quickly? I have used a mast of simple design in such situations and have always been pleased with the results. The mast that is described here is not a big brute and I wouldn't try to put a beam on it. It's great, though, for horizontal wires of any kind and can be used simultaneously with a vertical radiator.

The mast is made of wood and stands 32 or 33 feet above ground, depending on the base arrangement. Its cost is only a few dollars but its main advantage for me is that one person can build it, raise it, lower it or move it without help. In this regard it ought to appeal to the older ham whose family may not be close at hand to help with antenna work.

The upper part of the mast is shown in fig. 1. It consists of two 16′ lengths of 2″×2″ baluster that have been spliced together. Baluster is an especially good grade of lumber that has a fine, straight grain and is free of knots. It is used because the mast parts must be free of imperfections so as to withstand the flexing that takes place when it is raised or lowered. At the present time, 2×2 baluster retails for about 21¢ per lineal foot in the Chicago region. The other parts of the mast—base section and splice—are made of construction grade lumber at a cost of only 7¢ per lineal foot for 2×2s.

The base section is shown in place in fig. 2. It goes a little more than two feet into the ground. The base is made of two 4½′ lengths of 2×2; two 6″ lengths are used as spacers between the two upright pieces at the bottom and at the ground line. Two cadmium plated bolts hold the base section

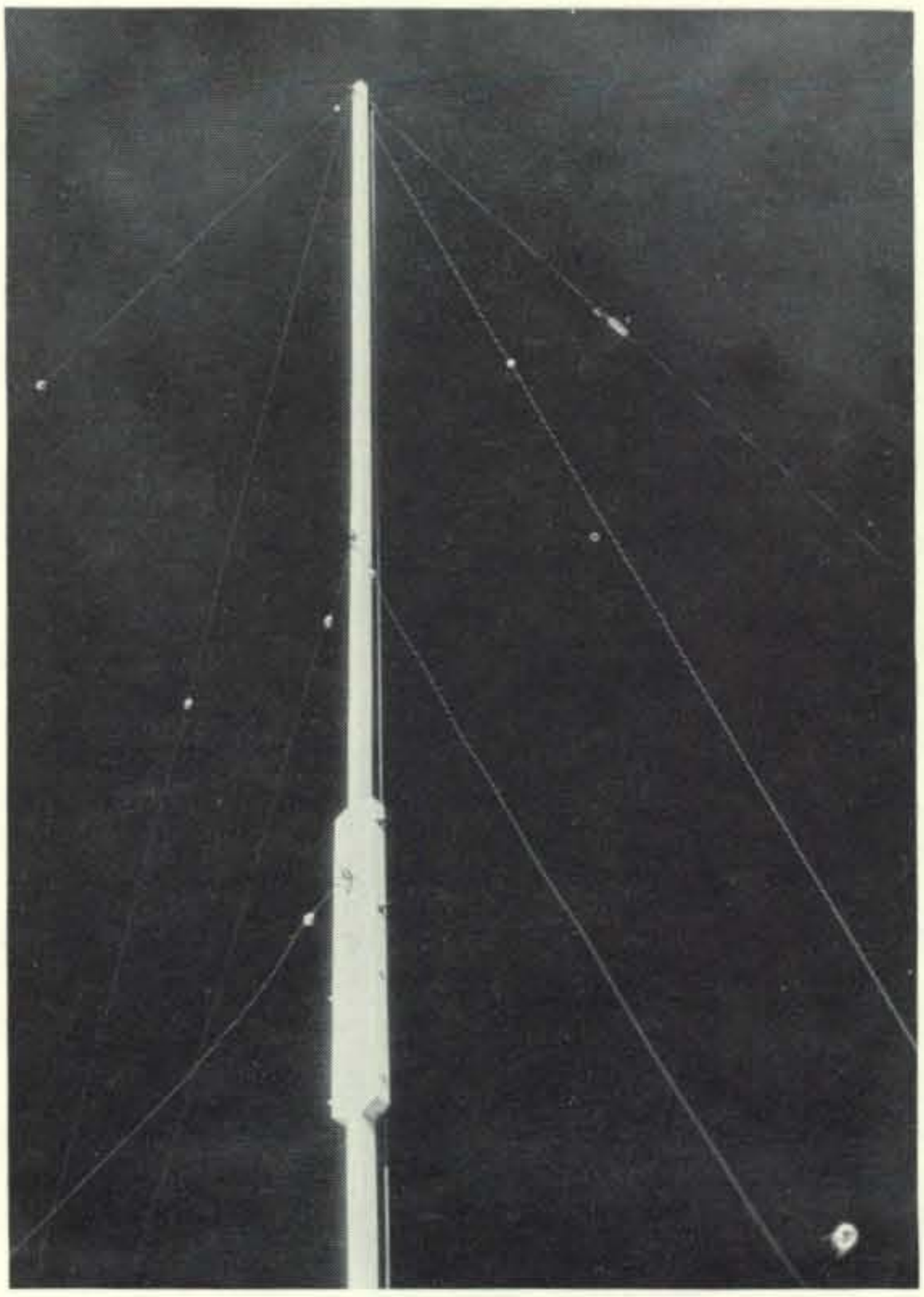

Fig. 1—This view shows the splice between the two 16′ sections. The guy wires have strain insulators at 12 foot intervals.

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together; they are below the ground line in the picture. Two more bolts hold the mast in place; the lower of the two is used as a hinge when the mast is raised or lowered. It is possible to use the mast without a base section for a short period of time such as a Field Day weekend but without the base raising it will be more than a one man job.

## Guying

The mast should be guyed in three directions at the top and at its middle. The guys (or "stays" if you are British) are attached to the mast by means of screw eyes; one eye is sufficient for all of the guys at either level. I made one mistake that you won't need to repeat; I used hard drawn copper wire for the antenna and had enough left over for the guy wires. A storm battered the mast with heavy gusts of wind and some of the guy wires unwound where they were fastened to the egg-shaped strain insulators. I am now convinced that permanent guy wires should be made either of galvanized iron or #14 gauge copper clad steel; I use the latter. For Field Day use, ⅛" nylon line makes an excellent guy and eliminates the need to bother with strain insulators. I also recommend it as the best possible material for use as a halyard, connecting to the antenna end insulator and running through the pulley and down the mast to the awning cleat.

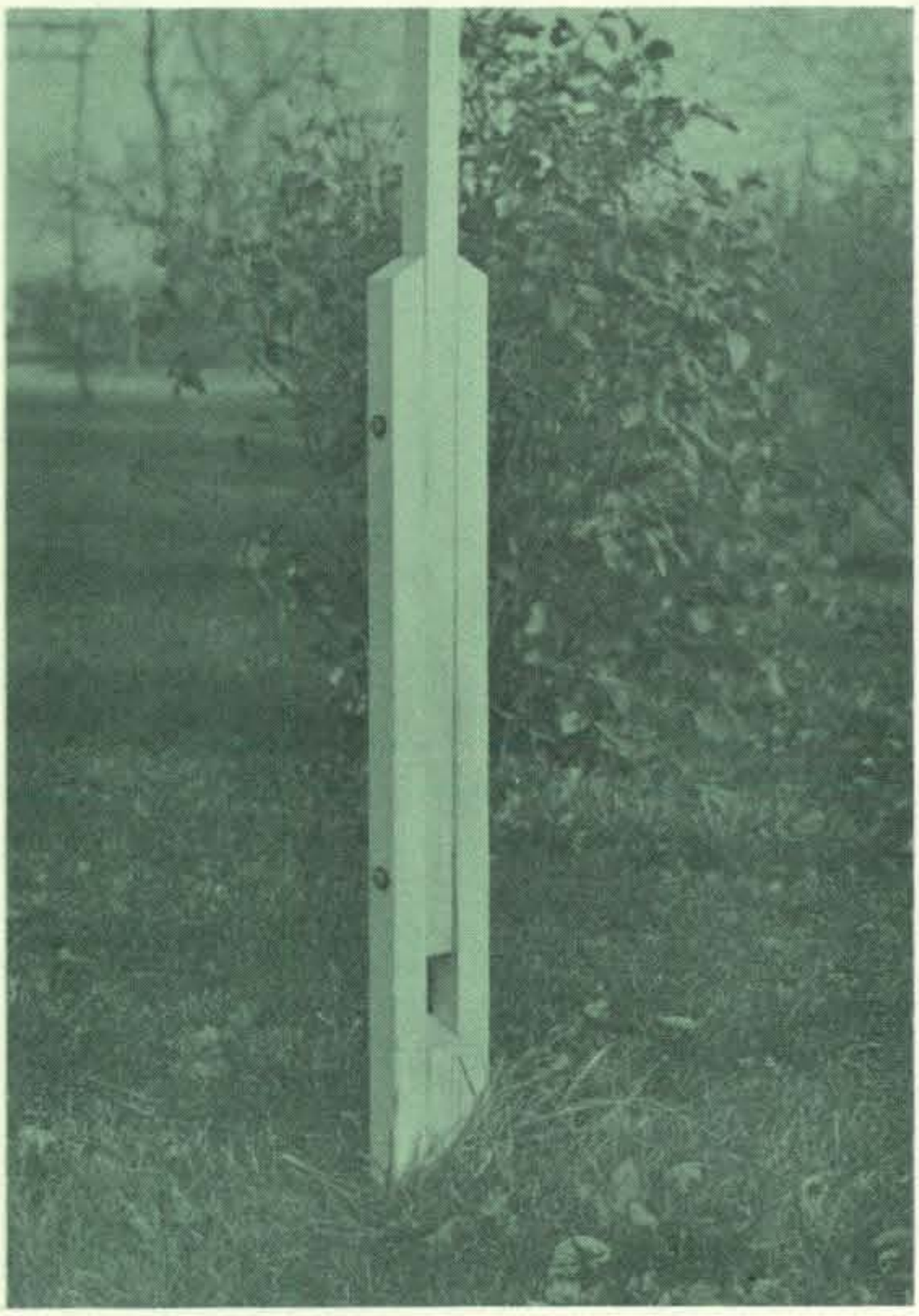

Fig. 2—The base section is shown above with the mast in place.

A number of ways to anchor a guy are shown in the handbooks. I prefer to use metal anchors that can be augered into the ground without any hand digging. For field day a small auger only 18" long is used. These are usually available from stores that sell children's swing sets or outdoor play equipment. For permanent installation I use anchors that are 4' long and have a 4" auger tip. They are rated at 1500 pounds holding strength; one of them is shown in place in fig. 3. These anchors are available from many hardware stores. This and one or two smaller sizes that work well may be found at airports, being offered for sale to flyers who want to buy "tie-down kits" for their aircraft. Only three anchors are required as the middle and top guy are fastened to the same anchor on any one side of the mast.

You may be wondering about the unusual appearance of the photos figs. 1 and 3. Those of you who are also photographers will probably recognize that these two pictures were taken with infra-red film; a deep red filter was also used. As a result, the sky is very dark and foliage (which reflects, rather than absorbs, infra-red) appears light.

Shown below are two lists of the materials that would be required to build a mast of the kind described here. The first list includes the material recommended for a fixed or semi-permanent installation. The second list includes all of the items needed for a field day installation. The main difference is that for field day it is assumed that no base section will be used; the mast will rest on an 8" square piece of lumber. It also assumes that nylon line will be used for the guys as well as the halyard. The cleat is also omitted as the halyard can be tied directly to the mast.

After you have gathered the materials together inspect the wood; if there is a discernible difference, the best piece of the baluster should be used at the bottom of the mast as that is where the greatest strain will occur when it is raised or lowered. From each of the two 8' lengths of 2×2 cut a 4½' piece for the base section and a 3' length for the splice.

There is no magic in these dimensions; they can vary 6" either way without impair-



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Table I—Materials required for one permanent mast.

2 pieces 2″×2″×16′ baluster lumber
2 pieces 2″×2″×8′ construction grade lumber
8 5/16″×6″ cadmium plated bolts with washers and nuts
3 1″ dia. screw eyes
1 ¼″ single sheave aluminum pulley
1 5″ awning cleat with screws
50′ ⅛″ nylon line
3 4′×4″ anchors *
200′ 14 gauge copper clad steel wire
12 small strain insulators
1 at. paint and primer
* Aircraft Components Inc., Benton Harbor, Mich. Item #A-1006, $2.79 each.

ing the performance of the mast. Try to make the cuts in the wood so that any large knots will be left in the waste. From the scrap save two pieces that are 3″ or more in length; they will serve as spacers for the base.

## Hole Locations

Drill $^{11}/_{32}$″ holes for the bolts that will hold everything together. In splicing the baluster I placed the bolt holes 12″ apart and 3″ from one end of each long piece. A foot or so of additional height might be gained by separating the ends of the baluster in the splice but that will require a longer splice, adding weight to the middle of the mast. The uprights that form the base section and a spacer can be drilled 3″ from one end. A bolt can be inserted and made hand tight; this will hold the base together while the other three holes are drilled. The second hole and spacer should be about 2′ from the first one; this will also be about where the ground line will be when the base is in place. The upper hole should be about 6″ from the top of the upright and the next one down should be 18″ from it. These holes are for the bolts that hold the mast in place; they can be seen in fig. 2. Note that a gap of an inch or more is left between the bottom of the mast and the nearest spacer in the base. The gap is necessary to permit the mast to hinge on the lower bolt when it is raised or lowered. After all of the holes have been drilled the parts of the mast and base should be assembled for a trial fit.

## Locating the Mast

Before attaching the screw eyes for the guys or the halyard pulley, decide whether you will want the mast to swing up in line with the antenna wire or at right angles to it. It won't make any difference to the mast; your decision should be based on what fences, flower beds and power or telephone wires are in the vicinity. Remember that you will need a clear path from the base of the antenna mast to a point 32′ away when the mast is down and plan accordingly. The locations for the three anchors can be determined at this time. They should be placed from 10′ to 15′ from the base of the mast and spaced equally around it, conditions permitting. One of the anchors should be directly in line with the antenna wire. Whether it is on the same side of the mast as the antenna wire or opposite to it is not important; I prefer to place it opposite to the wire if I have a choice.

## Assembling

After you have decided which way the mast will swing you can attach the small hardware items. Pilot holes can be drilled for the screw eyes and cleat mounting screws to avoid splitting the wood. Whether you attach the hardware before the mast is painted or afterward is up to you. I do recommend that all of the mast and base parts be painted before they are assembled, however. I usually mount the halyard cleat

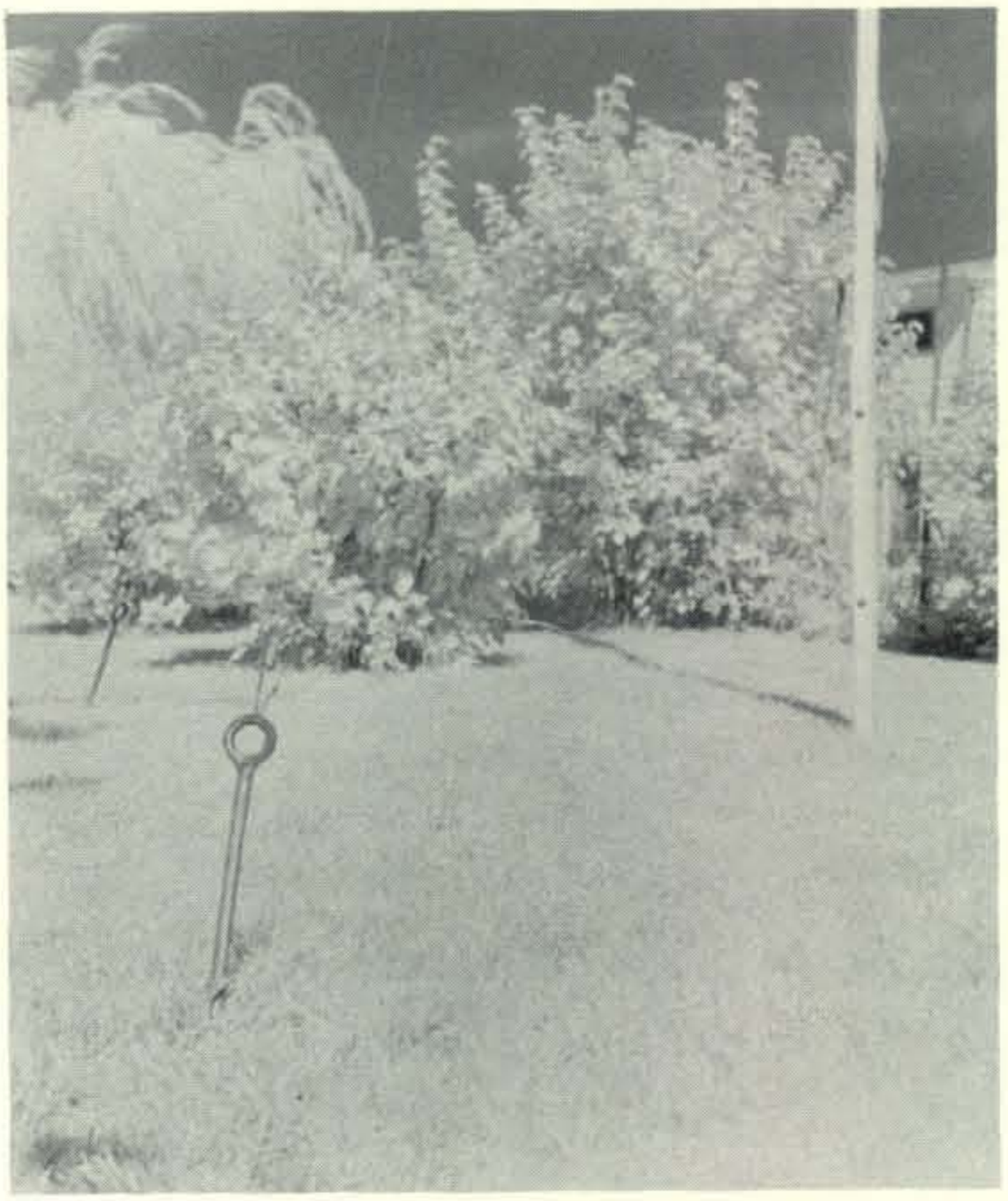

Fig. 3—A close up of one of the anchors used to hold the guys in place. A second anchor may be seen in the left background and the mast is on the right.

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about 8′ from the bottom of the mast. The practice requires that a short stepladder be used to fasten the halyard to the cleat but it leaves the halyard well out of the reach of neighborhood children.

## Tension Weight

I have had very good luck over the years with an arrangement that keeps a constant tension on the antenna. The halyard at one end of the antenna is fastened firmly. To the halyard, at the other end, I attach a sash weight weighing between 12 and 15 pounds. This small weight will be adequate for an antenna over 100′ in length and fed in the center with ¼″ coax. The sash weight is also attached about 8 or 9 feet above ground; a short restraining line fastened between the weight and the house or mast permits about 2 feet of movement in either direction. This degree of freedom is enough to avoid damage to the antenna as the result of storm winds or temperature changes. The sash weight is shown in fig. 4.

## Installation

After the paint is dry put the anchors and base in the ground; try to keep the base plumb. A carpenter's level will help you here. A post hole auger of from 6″ to 8″ diameter will make it easy to put the base in place. The base should be put into the ground a depth of 2′ to 3′, depending on whether the soil is usually firm or soft.

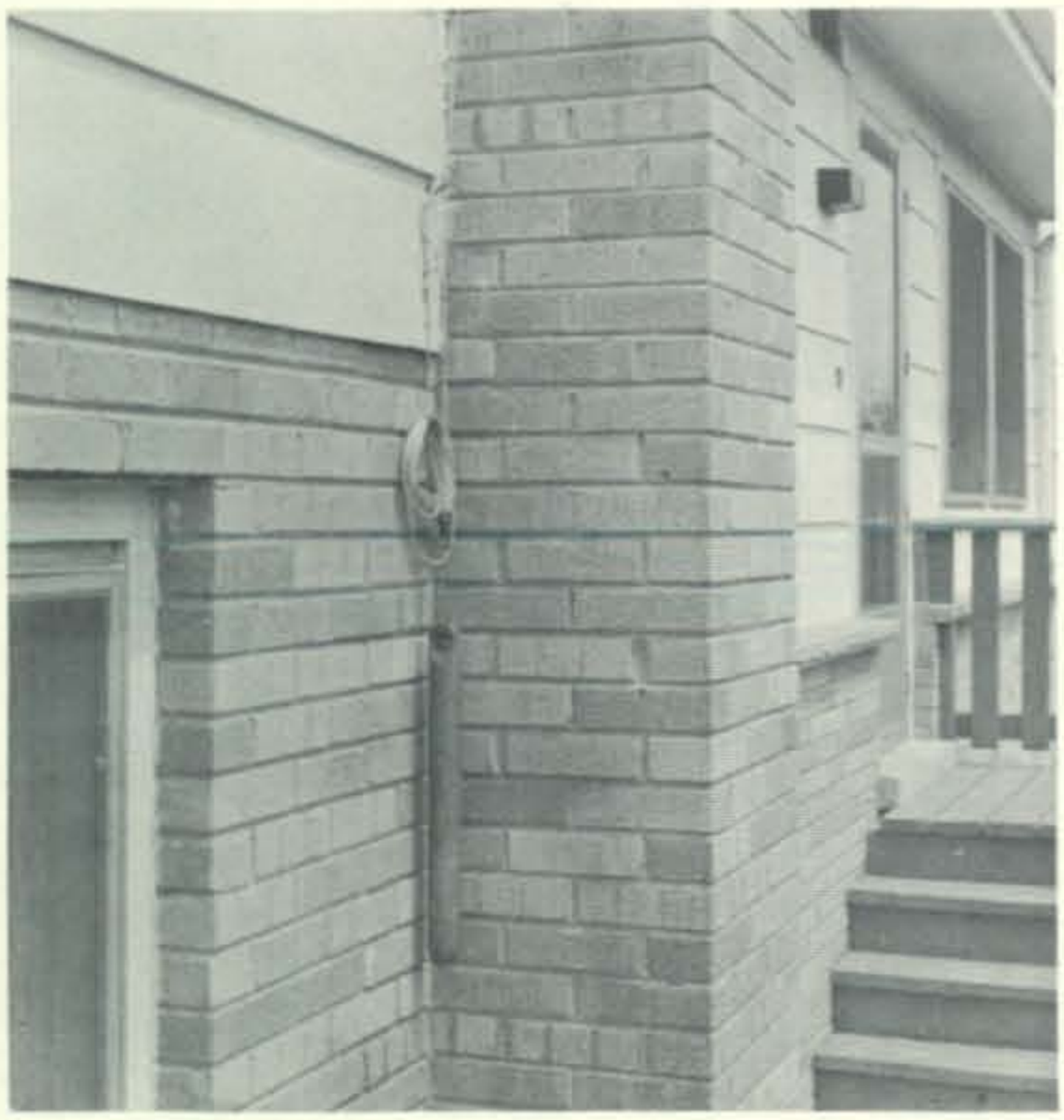

Fig. 4—The antenna is kept under constant tension through the use of a sash weight as shown above.

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| 2 pieces 2″×2″×16′ baluster lumber |
| 1 piece 2″×2″×8′ construction grade lumber |
| 1 piece 8″×8″×¾″ lumber or plywood |
| 8 5/16″×6″ cadmium plated bolts with washers and nuts |
| 3 1″ dia. screw eyes |
| 1 1¼″ single-sheave aluminum pulley |
| 250′ ⅛″ nylon line |
| 3 anchors, Aircraft Components #A-1002, set of 3: $4.50 or Sears Roebuck Catalog #49B7198 @ $1.19 each |

Table II—Materials required for one field day mast.

After the mast has been assembled the guy wires should be made up. Use insulators at 12 foot intervals. Cut the guys at least 3 longer than their computed length to make handling easy. Remember that the top guys will be longer than the mast. For example, if the top of the mast is 33′ above level ground and the anchor is 15′ away from the base the guy will be nearly 35′ long; make them 38′ long to start with. The diagonal length of the guy is computed using the square root of the sum of the squares of the mast height and the distance from the base to the anchor (the Pythagorean theorem).

Fasten the mast to the base by means of the bottom bolt but don't tighten it. Be sure the pulley will end up on the side toward the antenna! Attach the guys to the mast and thread the halyard through the pulley, tying the ends to the mast where they will be within reach after it is raised. Put the top mast mounting bolt through one of the two base uprights so that it will be handy when you want it. Now pick up the mast at its middle, raise it over your head and walk it up into position. Slip the top bolt into place to hold the mast while you attach the top guys loosely to the anchors.

Walk around the mast at a distance of 25′ or so and sight along the mast to the corner of nearby buildings or to a short plumbline held at arm's length. This will help you to see which guys to tighten to bring the mast to true vertical. The guys should be tightened firmly by hand and fastened securely to the anchors when you are finished; the base bolts should then be made snug with a wrench.

The mast can be erected by two people if no base section is used, one holding the bottom in place and the other lifting it up.

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this can make the XYL very unhappy; and hams with unhappy XYL's are *very* unhappy, too.

### Sidetone Modification

By making the addition shown in fig. 2, the sidetone from the keyer is piped into the headphones, or loudspeaker, of the receiver, and the loudspeaker in the keyer is turned off.

The size of the paper capacitor used will depend on how loud the operator wishes the sidetone to sound in the headphones. The higher the capacity, the louder the sidetone. With a Swan 350, a 4 mf paper capacitor proved to be the right size, for with that capacity when the plug is pulled out of the PHONE jack in the rear of the T.O. Keyer, the sound level is also correct for the speaker in the keyer. ■

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It will be helpful, however, if two or three additional people are around to hold the top guys while this is done. The 8" square board can be nailed to the bottom of the mast before it is raised or it can be slid into place before the guys are tightened. Its main purpose is to keep the mast from sinking too far into soft ground.

### Conclusion

This is the end of the story except for one point. Earlier I said that the mast could be used for a vertical; I did that by running a #14 gauge wire up the mast. It was held away from the mast by 1" standoff insulators that were spaced at 3' intervals. The flexing of the mast can tighten the wire enough to break small insulators while the mast is raised if you are not careful. There are several ways to avoid this kind of trouble. I prefer to fasten the wire to the top insulator and let it run through small loops of wire fastened to the other insulators. When the mast is up it can then be fastened to the insulator at the bottom. If the vertical made this way lacks a few feet of height (as when you want a quarter wave at the low end of 40) you can lengthen it easily by mounting a mobile whip near the top of the mast and connecting it to the top of the vertical wire. Choose a whip that comes in sections or one that can otherwise be adjusted in length to make it easy to trim the antenna to your frequency. ■



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