Constructing An Inexpensive 15 Meter Beam

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Beams are very much desired when operating the high frequencies. One of the most popular bands in the last few years has been the 15 meter band. Desiring to operate some 15 we decided to try our hand at constructing a beam. After reading beam theory we decided that it should not be too hard and would offer some construction fun in the building.

Materials

Our choice was a three element beam. Checking the dimensions, we figured we would use light material to save weight, and we could then purchase all material locally. Thin wall conduit was chosen for our elements and was readily available locally. About the cheapest boom material suitable was TV mast extension sections. These came in 10 foot lengths and 1¼ inch in diameter. Since we had chosen three elements, our boom would have to be at least 14 feet. This necessitated buying two 10 foot lengths. Using this for a boom allowed us to use TV hardware, "U" bolts, etc., which also solved the problem of mounting the elements.

Thin wall conduit also came in 10 foot sections. Our elements were to run in the vicinity of 21 feet. We finally decided to purchase 3 sections of ¾" tubing. Placing these in the center of the boom would give us five feet either side of the boom and provide strength. This meant we needed approximately 6 feet either side to make up the necessary length. Since ½ inch tubing was the next useable size and would telescope nicely into the ¾" center sections, we purchased these in 10 foot lengths also. Now this meant we could purchase 3 sections and by cutting them in two it would give us the approximate length needed. However, we would have to add small sections to prune the elements to necessary length. This may be kept in mind and could result in a saving if economy is the problem, however, the extra mechanical difficulty may offset this gain. By purchasing six sections there is no mechanical problem and the correct length is easily reached.

Fig. 1—Details of the ¾" to ½" junction. Pipe clamps plus self tapping screws provide strength.

Construction

With the tools and materials we adjoined to the back yard. Here the material was placed in what appeared to be a beam, and some thought was given to the means of clamping the beam together. One of the problems was getting the ½" and ¾" sections together with a good joint. This was solved by splitting the ends of the ¾" pieces two ways and back about 3 inches (fig. 1). By cutting the slots wide enough and applying an adjustable pipe clamp we could form a tight joint that was satisfactory. I might say now, that after the beam has been checked, these joints should be soldered or several self-tapping screws applied to make a good electrical joint. Using regular TV mast clamps and "U" bolts the ¾" sections are mounted to the 1¼" section used for a boom. Since the boom was to be fifteen feet long, two sections of mast extension

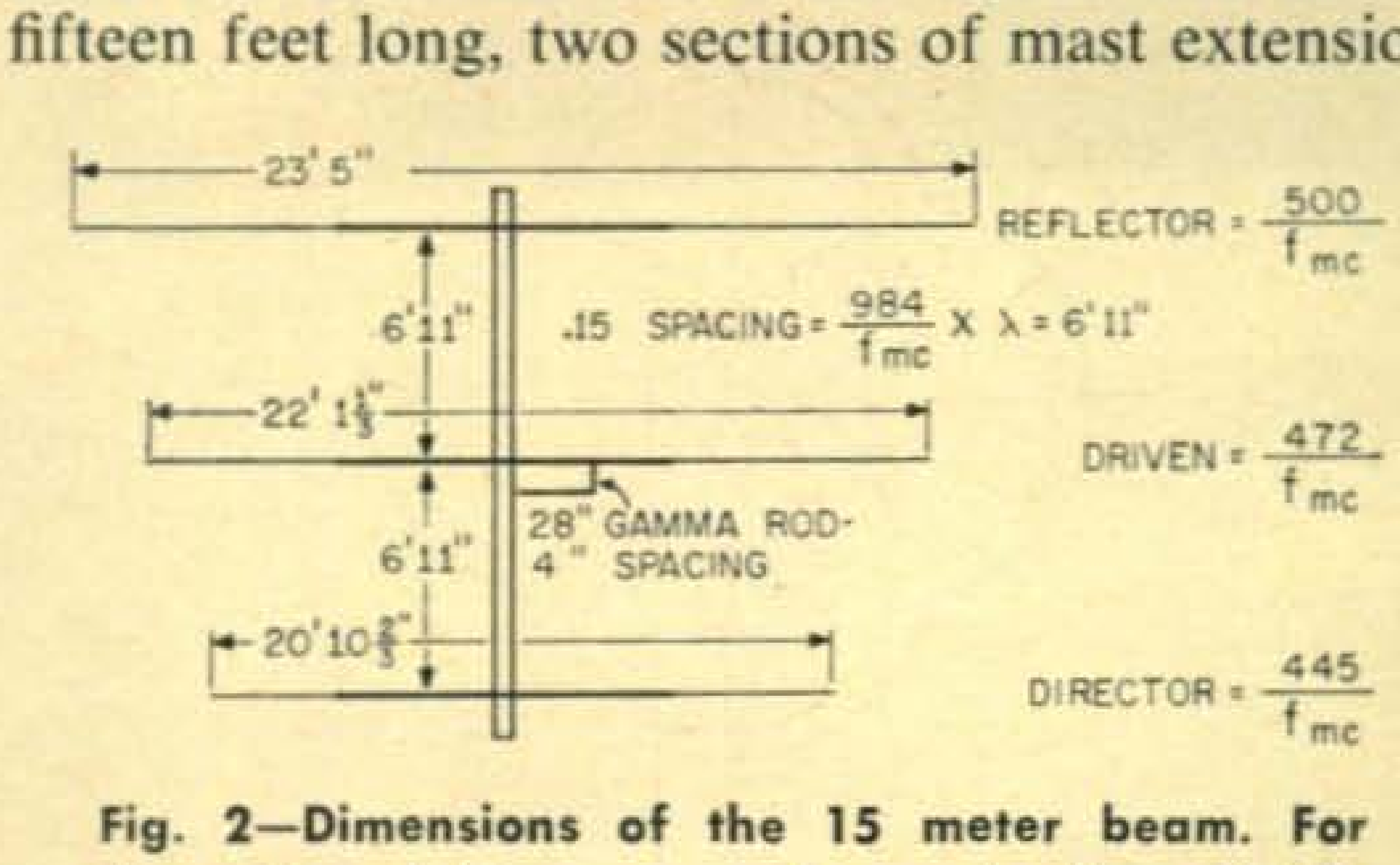

Fig. 2—Dimensions of the 15 meter beam. For element and Gamma match construction details see text.

were used; and the unnecessary five feet was removed with a hacksaw and saved for later use. The joint in the boom was secured with several self-tapping screws. Some care should be used in finding the center of each ¾" section, and on either side of this mark a hole should be drilled to accommodate the "U" bolts. The elements are adjusted to the necssary length and the pipe clamps tightened. The element spacing is adjusted to 6′ 11″ and the "U" bolts tightened. A careful check of the overall dimensions is now performed to be assured that everything is ok.

Matching Systems

While there are many good matching systems, we felt that the gamma would be best suited to our beam. A small length of ½" tubing makes a good gamma rod. This is applied to the driven element. A lot of different lengths and spacings can be used, but by following ours some time should be saved in final adjustment. Basically the gamma is a means of transforming the low Z (15 to 20) up to 52 or 75 ohm coax, whichever is preferred.

Using insulation, in our case two strips of polystyrene, we insulated one end of a 33″ section of ½" section, and at 28 inches we made a right angle bend and then turned up a lip to secure this end to the bam with a self-tapping screw. This gave us a gamma rod 28″ with a spacing of 4 inches. We connected a variable condenser between the center of the croax and gamma rod, one lead to the rod and the other to the center of the coax. The purpose of this condenser is to cancel out the reactance. The shield of the coax is then connected to the center point of the driven element. The variable is a small spacing, 12 to 200 mmf capacitor.

Adjustments

While there are several different ways to work out the matching system, we found, after trying several suggested methods, that by connecting the beam to the transmitter and using low power or a tune-up position, the transmitter was loaded as best could be. A standing wave bridge is a necessity, and one can usually be borrowed from a willing friend. This is connected at transmitter end and a reading taken. For this we needed the beam placed in its final resting place, or as many hams do, on a step ladder. We choose the step-ladder and placed the whole shebang on the house. This would let us make our adjustment and also allow us to make some "on the air" checks before placing the beam on the tower.

Our first reading was high, as yours probably will be too. These readings should be made at the frequency for which the beam is cut, 21.3 in our case. Adjust the variable condenser to obtain the lowest reading. The safest way to do this is: turn the rig off, move the condenser one way slightly, then reload the rig, and take a new *swr* reading. While this method is slow, it does give you constant check on many variables and keeps out some possible operator mistake that might slip in otherwise. After the minimum reading is obtained with the variable condenser, (which in all probability will not be a satisfactory *swr*), the next step will be to move the tap where the gamma rod is connected to the driven element. Only a slight movement will be needed, and the *swr* reading should be noted, taking into consideration that the rig and bridge will have to be readjusted. If the *swr* goes up, you have moved in the wrong direction and the tap will have to be moved back past the original point and slightly beyond. A new reading should disclose a lower *swr*. By touching up the variable condenser this can be improved. Following this procedure of tap adjustment, then variable condenser, the *swr* can be brought to a perfect match 1:1. The variable condenser is now sealed in a small plastic box which may be taped to the boom. One will find that the *swr* will change only slightly in the process of mounting permanently.

Mounting

Each tower will offer its own mounting problems, and possibly other means will have to be worked out to suit the individual location. In our case we used a section of 1¼" TV mast as a mounting stub. By using the surplus 5 foot section and a TV mast clamp and "U" bolt, we mounted this section perpendicular to the boom and just off-center with the major portion stick-

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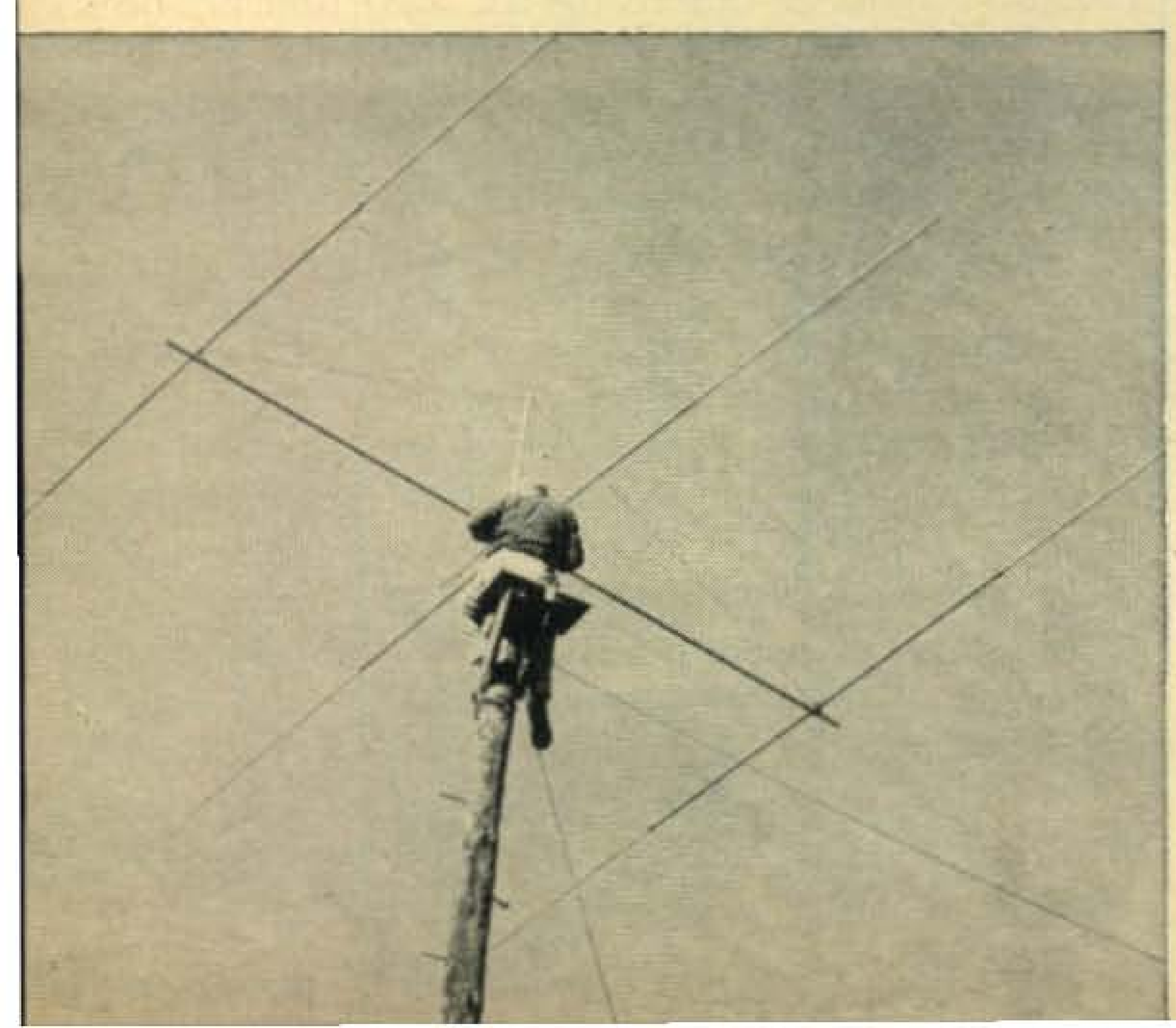
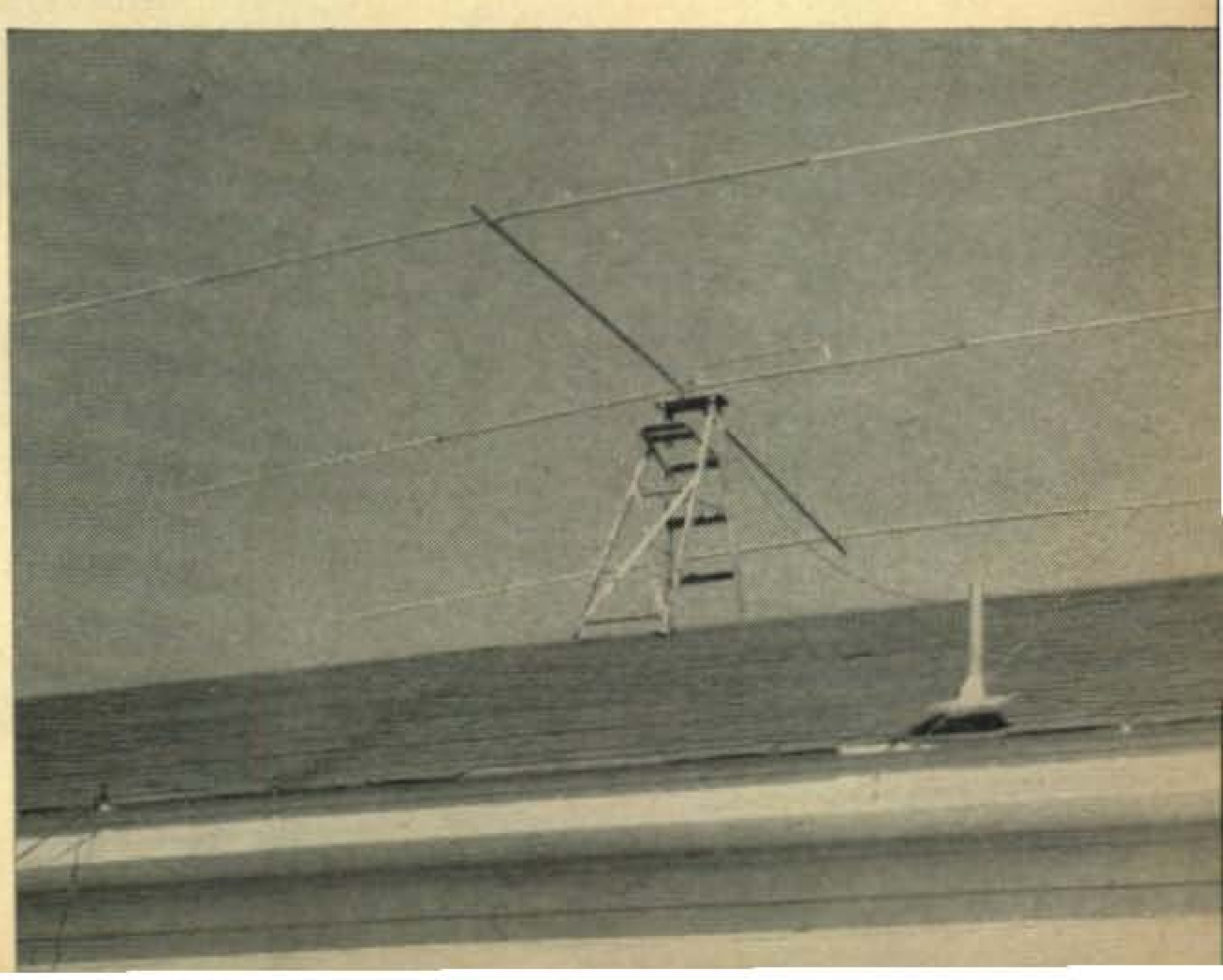
Two locations for beam adjusting. Take your pick.





HALO [*from page 43*]

make a good solder joint so that coil "B" is an extension of "A" and the two coils are now in fact one coil. Solder the outer braided shield of your coax feed line to the center of coil "A". Connect the coax center wire to the coil about in the position shown in the diagram.

Now connect an *swr* bridge in your feed line. Adjust the capacity adjustment in your halo plates for minimum *swr*. This adjustment is quite critical and very important. Be sure to stand away from car when taking readings and be sure the halo is mounted on your car exactly as it will be when you are in motion. Changing position of halo on the car so much as an inch will throw it off considerably.

After getting the *swr* down as much as possible with the halo adjustment, try connecting the inner wire of the coax to different points along the coil and solder it permanently to the point where you find minimum standing waves. Your match will now be very good but if you want every ounce try adjusting the coax shield each way from the point it was first soldered. Although you connected the shield to what is the physical center of the "A" coil the electrical center may be a bit one way or the other. Solder shield to where you get minimum *swr*. If you don't have an *swr* bridge you can use a field strength meter and make all of these adjustments for maximum field strength.

In conclusion I hasten to point out that I claim this 9 *db* increased signal over the whip while working halo to beam. Perhaps if the receiving antenna were vertical the situation would be reversed, however since 99% of the contacts I have made have been to home stations using beams or to other mobile units using halos, I feel now the halo is worth keeping on the car. ■

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ing straight up. To this top end we attached short pieces of guy wire while the other end of the guy wire was attached to the ends of the boom. This served to keep the boom from drooping under element weight and gave additional strength to our beam. The bottom end of our vertical section has an expandable coupler which allows it to slide down over our mounting stub. A pin is placed through the coupler to keep it from turning.

Performance

As far as results go: we were well pleased to work KC4-land while the beam was on the house. Running 100 watts on AM we managed to get a 59 report. Since that time the beam has been used over a year, and we have received favorable reports on phone and CW in all parts of the world. ■