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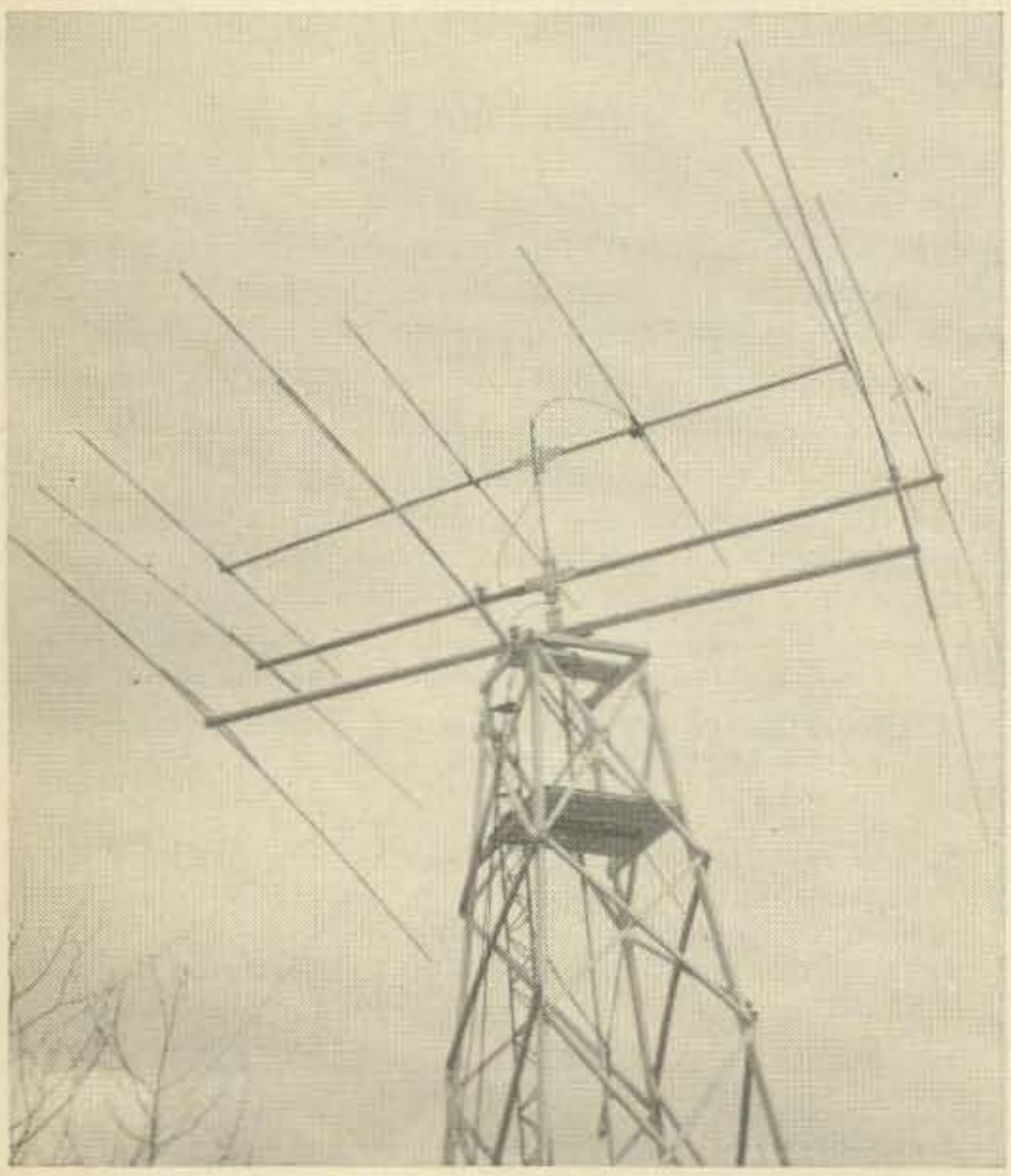
Beginner's Beam for 10 Meters

The ten meter openings are going to be better this winter than they were last—this simple, low-cost four element beam will increase the effectiveness of your signal.

With the steady improvement in 10 meter propagation conditions, it looks like DX prospects will be pretty bright by the winter of 1967/68, and many old-timers will be dusting off their beams and looking forward to a return of the "good old days". However, there are a great many newcomers to the ranks of ham radio who are inexperienced on this band, and this article is really intended for them.

Most people will argue that the power output of the rig is the least important factor in 10 meter DX operation. Naturally a kilowatt will make a big noise, but a 100-200 watt rig will make just as much noise if it's hooked onto a good antenna. The size and weight of 10 meter beams are well within reason for even the most crowded back yard or roof-top.



The antennas at VE1TG—the four-element ten-meter beam is on top with homebrew 15 and 20 meter beams on the bottom. The tower is also home built.

The beam described here is ideal, especially for the newcomer, as it combines light weight, standard components, very simple construction, and of course, low cost. Despite the simplicity, the gain will be 7 to 8 dB for the three-element version, and around 9 or 10 dB for the four element one. For the small extra cost and work involved, the four element version is much to be preferred. The front-to-back ratio will also be better, and the extra gain is worthwhile.

Depending upon your operating preferences, the length of the elements should be decided by reference to the standard formulae:

$$\text{Driven element length} = \frac{473}{\text{Freq MHz}}$$

$$\text{Reflector length} = \frac{501}{\text{Freq. MHz}}$$

$$\text{Director length (both)} = \frac{450}{\text{Freq. MHz}}$$

Since the elements are adjustable, the exact lengths are easy to come by. If the

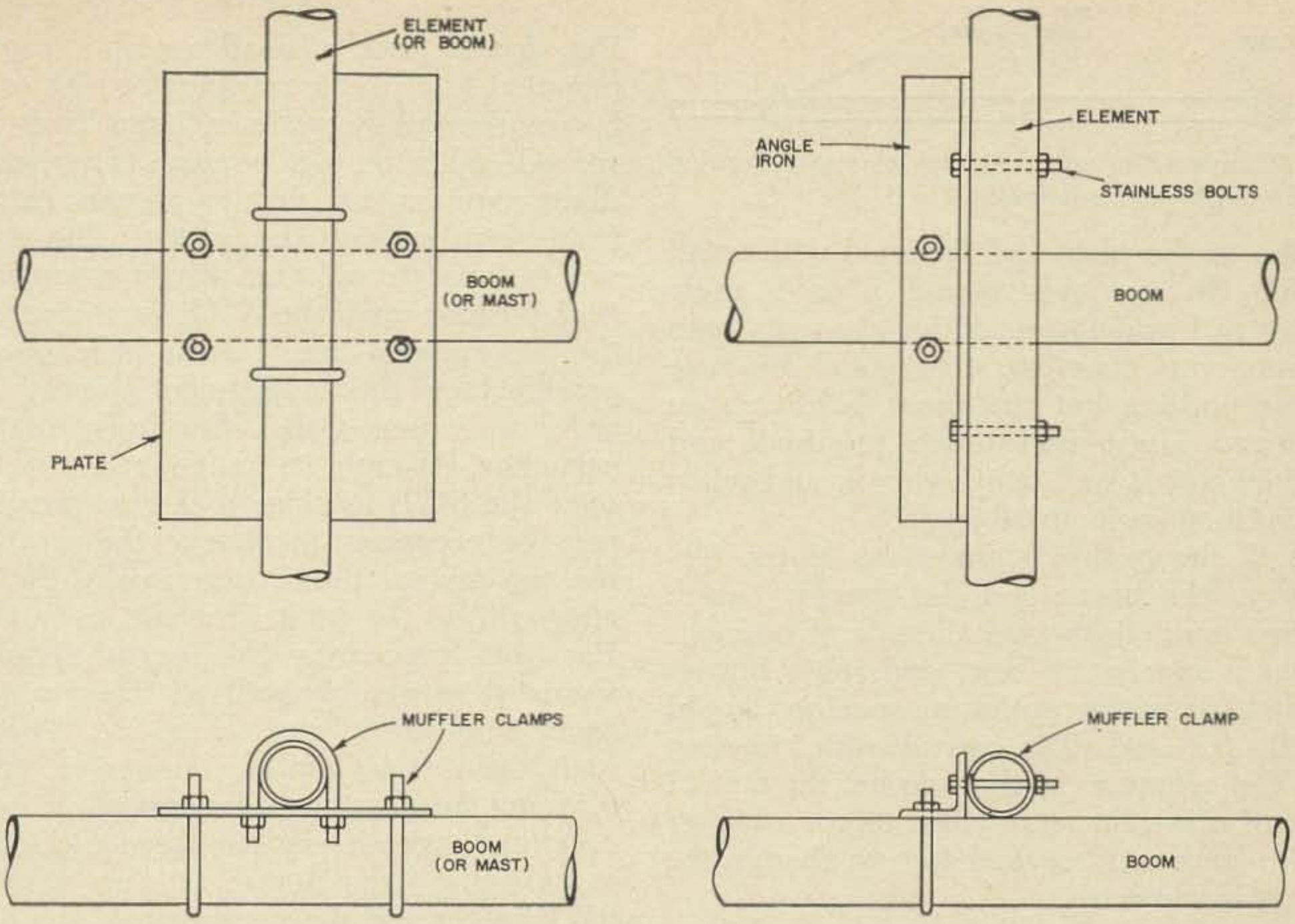


Fig. 1. Alternate methods for mounting the beam elements on the boom.

material is purchased new, choose rigid aluminum tubing 1" and ⅞" in diameter (or similar relationships in size) so that the center sections can be made of the larger tubing with the smaller tubing inserted into the ends to form the adjustable sections. For a 4-element beam, you'll need four lengths of the larger size, and three lengths of the smaller. This is assuming you get 12-13 foot lengths which are pretty well standard. The three lengths of smaller tubing can be cut into four foot pieces for the end sections, with a little left over. If cost is a prime factor, you can use old booms from defunct TV antennae as I did. I scrounged a bunch of these from a local service shop, took off all the elements and assorted junk, and ended up with excellent material for the beam elements.

Without doubt, the best material for the boom is old reliable irrigation tubing. The 2" diameter stuff is fine, in a 20 foot length. This gives reasonably wide element spacing. As a matter of fact, a 5-element beam can be mounted on such a boom if you wish, but I happen to prefer the wider spacing. Steel TV masting is another common material which can be used for the boom, but it is quite a bit heavier and you may have to couple sections together to make up the required length.

Several methods can be used to mount the elements on the boom, as shown in **Fig. 1.** In both cases, standard automobile muffler clamps are used to fasten the element support plates to the boom. Make sure the clamps are given a couple of coats of rust-proofing first. By using the flat plates, the elements can be laid across the long di-

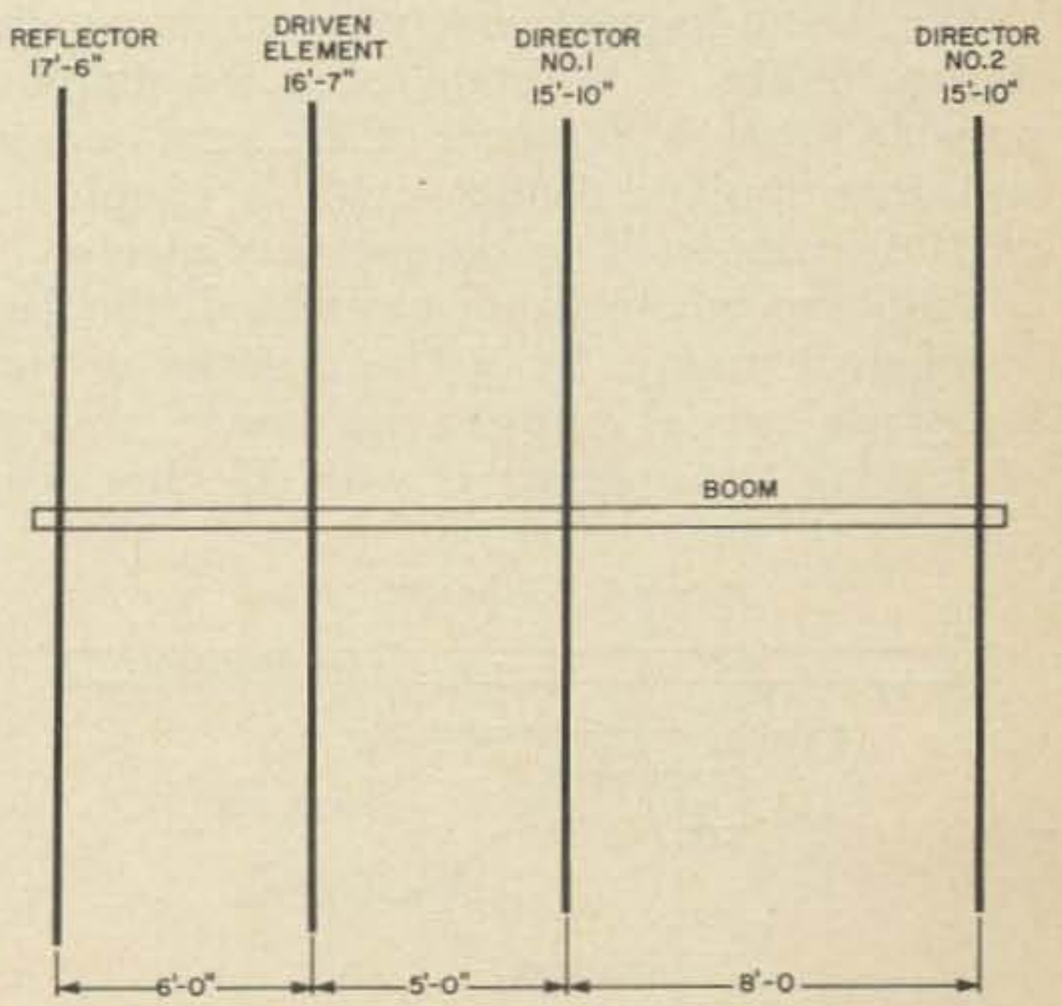


Fig. 2. Physical layout of the four-element ten-meter beam. Dimensions given are for approximately 28.4 MHz.

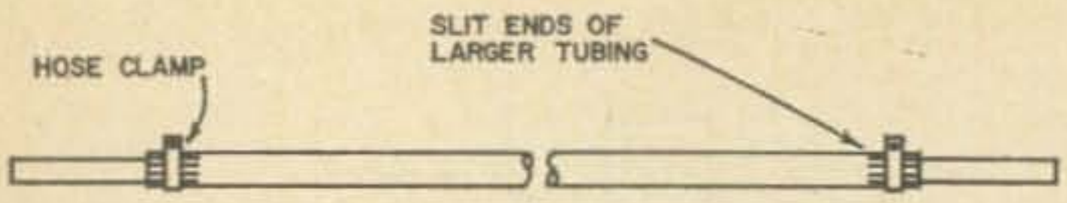


Fig. 3. Construction of a typical element, showing the adjustable end sections.

mension of the plate and fastened with small U-bolts. On my own model I used angle iron instead and fastened the elements onto the iron with *stainless* steel bolts. Be sure you use nothing but rust-proof hardware on the beam. There isn't much required, and the small cost is well worthwhile if and when you try to take it apart again.

Fig. 2 shows the arrangement of the elements on the boom and the spacings used. Antenna handbooks give all sorts of opinions on which spacing is best, and why, but as a general rule the optimum spacing should be 0.2, 0.2 and 0.25 wavelength, reading from the reflector to the second director. I modified this a bit in an effort to get a higher front-to-back ratio, so feel free to change the spacing if you wish.

Fig. 3 shows a typical element and how it is put together. Simple. All you need is a hacksaw, a screwdriver and two hose clamps per element. Depending upon how the tubing fits, you may need small shims to tighten up the joints. Incidentally, if aluminum tubing is not readily available, look up the nearest electrical contractor and his stock of thin-wall conduit, either steel or aluminum. This comes in all diameters, but unfortunately the standard length is only 10 feet, so your total requirements will be a little different.

The boom-to-mast clamping arrangement shown in **Fig. 4** is probably in its simplest possible form. Two pieces of flat steel or iron and four muffler clamps—with a couple of coats of paint—will do the job very nicely.

With the whole beam assembled, the last problem is tuning. Since the majority of rigs today use coaxial outputs, the easiest method of feeding the antenna is with 52 ohm coax and a gamma match. This is diagrammed in **Fig. 5** and uses a small variable capacitor mounted in a plastic refrigerator dish or similar weatherproof container. Use a fairly wide-spaced capacitor, not because of power handling requirements, but to prevent oxidation from shorting out the plates. The gamma rod is tapped onto the driven element at a trial position and the SWR is measured on the transmission line. Use as little power as possible for this adjustment procedure in order to reduce QRM. Carefully rotate the capacitor through its range and try to reduce the SWR as close to 1:1 as possible. It may be necessary to change the position of the tap several times, but usually the capacitor will do the trick after one or two trials. For this procedure the beam should be mounted reasonably well off the ground and away from trees, guy wires, etc. The ideal place for it is on top of your tower, but this may not be possible. The procedure will be infinitely easier if you can persuade someone to turn the capacitor while you watch the SWR meter *and* the resonance of the final in the rig. It changes considerably while all this is going on, so make sure you check it often. Actually, if you get the SWR down under 1.5 you can be pretty happy with it. It is debatable whether or not the extra effort of getting down to 1:1 is worthwhile.

The last problem is tuning the elements for best forward gain-or best F/B ratio. The two factors don't go hand-in-hand. Several methods can be used, all of which involve test dipoles, field strength meters, signals which stay steady enough to make adjustments and of course, the "friendly amateur" "a few miles away" who will dutifully do just what you want him to—baloney! If you figure out your dimensions properly by formulae, measure the lengths exactly, and get the gamma match adjusted, you are very likely going to get just as much out of the antenna as if you spend a month fooling with it. It's your choice—the methods are detailed in the various handbooks. Personally I don't think it's worth the effort.

The tower and rotating system are up to the individual. However, the light weight construction should allow the use of a TV type tower and rotator. This beam will give the low or medium power operator many hours of fine contacts and provides a *kilowatt* type signal at a small fraction of the cost. Welcome to 10 meters.

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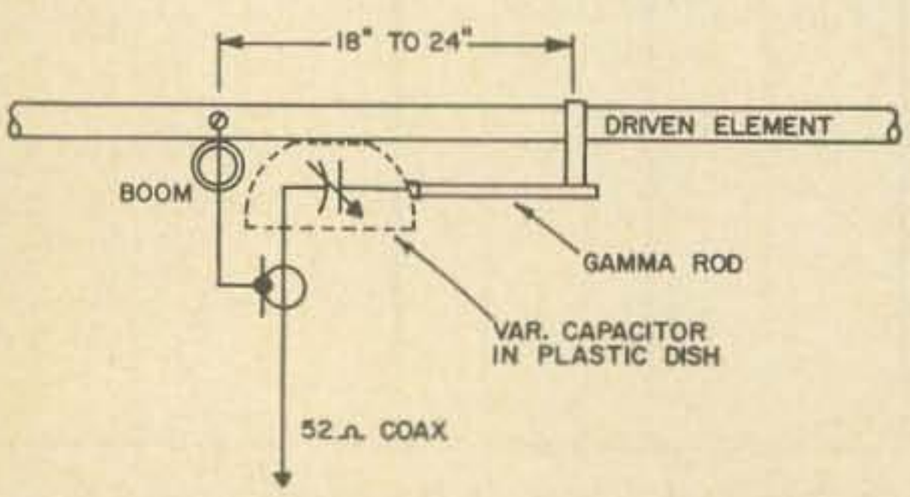

Fig. 4. Gamma match details for the four-element ten-meter beam.