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El Cheapo Superbeam

This article describes a rotary beam antenna for 10, 15 and 20 meters, with two elements on each band. It works well and is very inexpensive to build.

Design

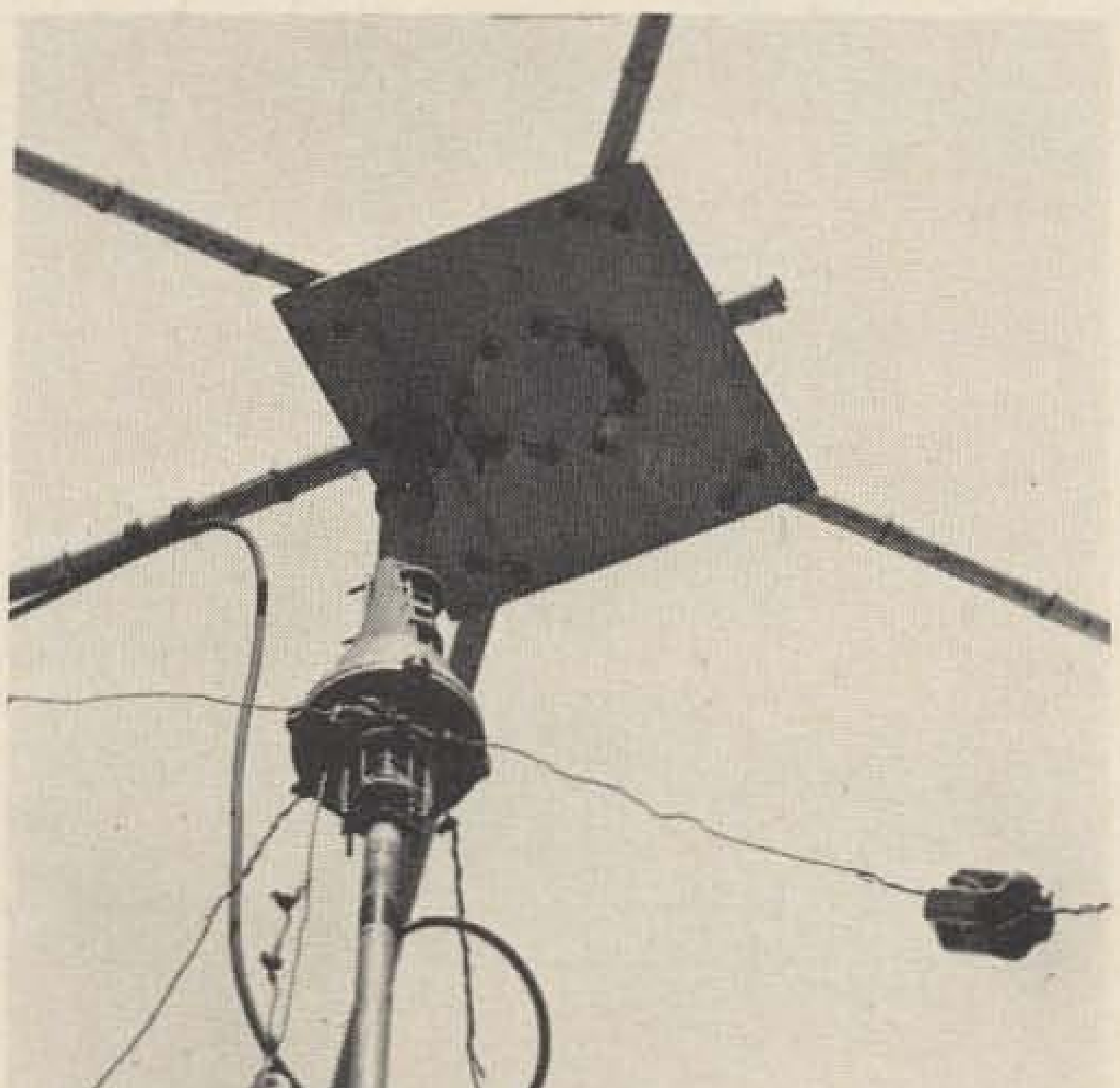
The antenna uses the idea of multiple dipoles connected to one feedline to achieve triband operation. The driven element consists of separate 10, 15 and 20 meter dipoles joined at their centers and fed with one RG-8/U line. Three separate parasitic reflectors are each spaced approximately .22 wavelength behind the driven element. The reflectors are tuned lower in frequency than the driven elements and are about 5% longer physically.

A spacing of .22 wavelength is somewhat greater than the .15 spacing which, according to the charts, yields maximum forward gain. The sacrifice in gain is only on the order of .75 dB, hardly detectable, and is justified by a higher front-to-back ratio and an increase in radiation resistance. The choice of using a reflector as opposed to a director was made to obtain yet another increase in radiation resistance, and for greater bandwidth. To keep cost to a minimum the antenna uses wire elements instead of the more common aluminum tubing found in similar antenna designs, and so it was deemed desirable to keep the radiation resistance high in order to reduce loss due to the ohmic resistance of the thin elements.

Construction

Constructing antennas out of wire elements always poses the problem of how to support them. Ropes and trees and chimneys would severely limit the usefulness of a unidirectional beam such as this tribander. In order to make the antenna rotatable, a framework was built on which the wires could be "hung." The frame is made of bamboo poles and standard hardware – very inexpensive items. If bamboo is not available, plastic water pipe might be tried as a substitute. The photographs and diagrams show how the frame is constructed.

The exact position of the pipe flange under the mounting plate is best determined by holding the water pipe and flange vertical



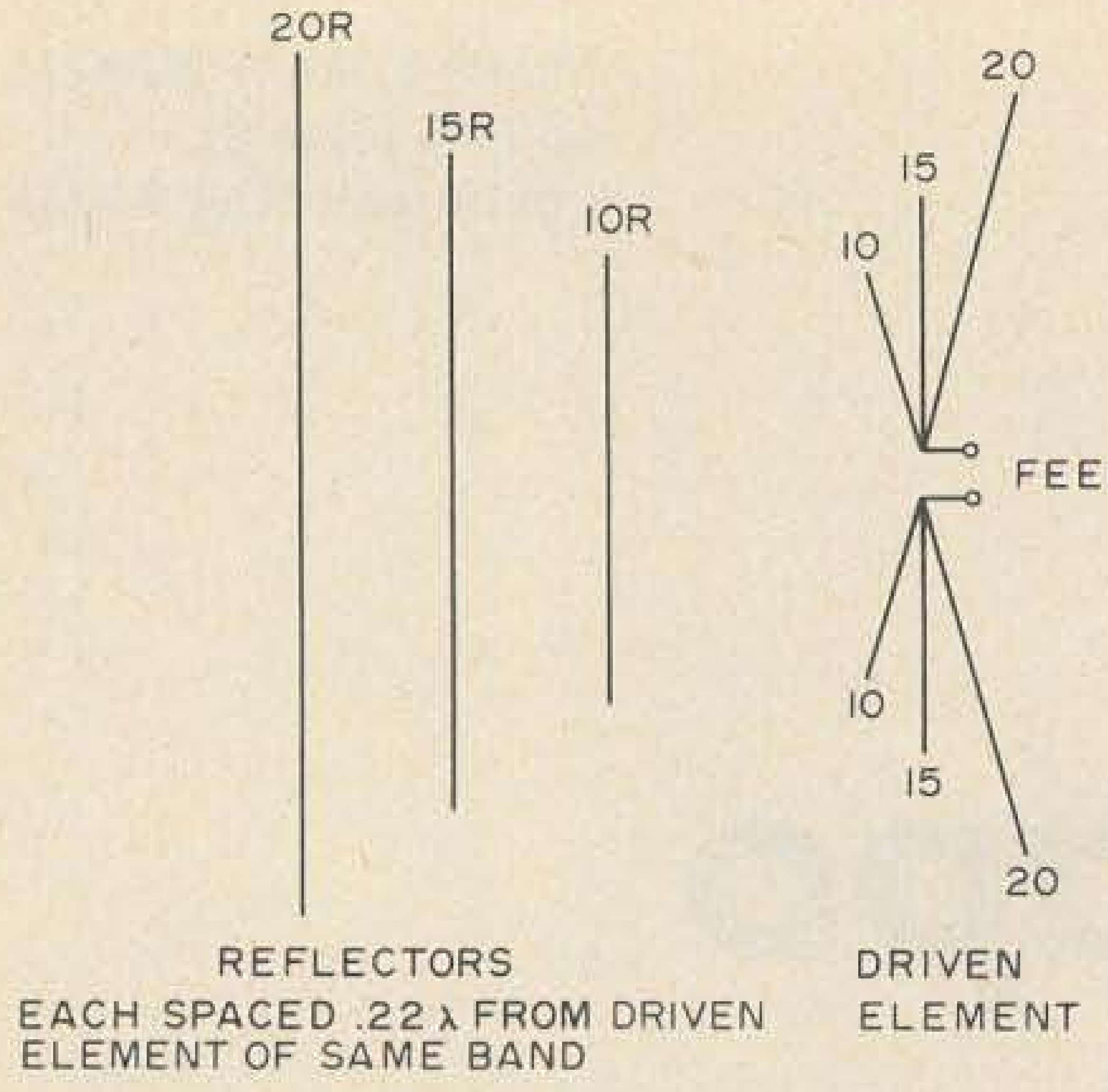


Fig. 1. Antenna theory.

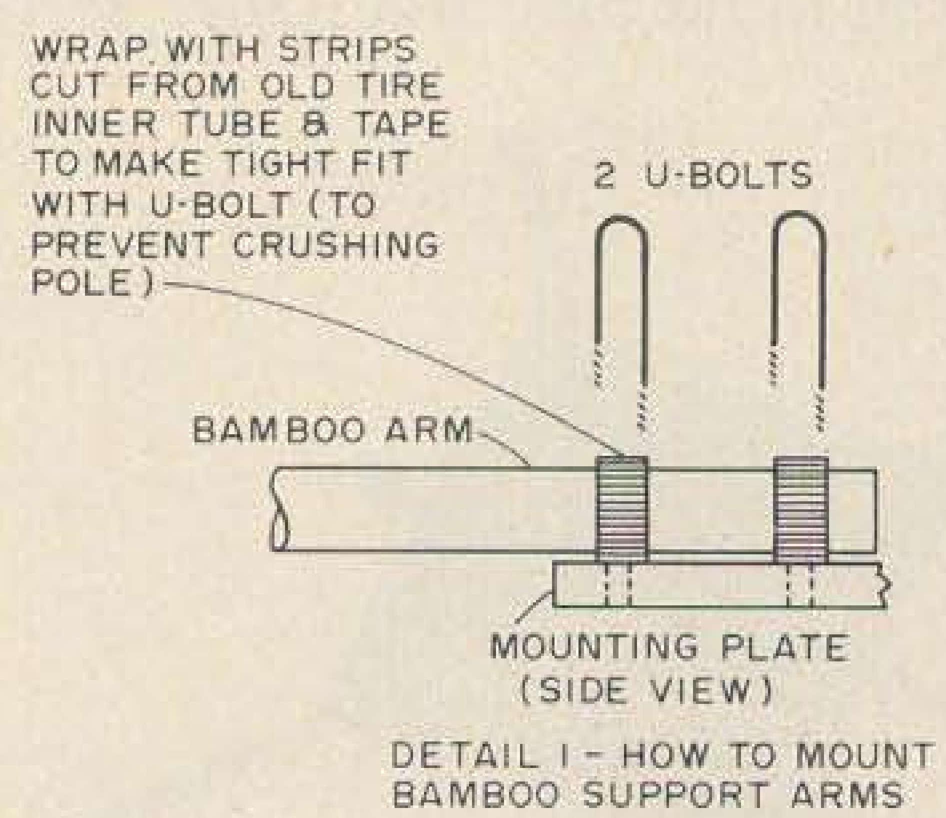
while balancing the assembled frame on top of them, and marking the location. This will not be in the center of the plate since the fifth support arm unbalances the weight distribution. Mounting the flange at the point of balance will reduce the strain on the rotator bearings.

The wire elements can be fastened to the support arms by means of tape or fish line or whatever you have handy. The excess length of the wire is allowed to hang down from the supports. Allowing the ends of the elements to droop does not seem to hamper operation of the antenna. After all, this beam is really just the top half of a quad.

Although no tests were run to compare performance with and without the 1:1 balun in the feedline, there is no reason why the antenna should not work without it. The beam shown in the photographs uses a Hy-Gain BN-86. Less expensive baluns such as the kit from Amidon Associates or the Greene Insulator might be tried. Even if the balun is eliminated, it is wise to include the fifth support arm to carry the weight of the coax feedline and prevent sagging of the driven element supports. The feedline is taped to this arm, and the center insulator in the driven element is also supported from this pole by a short piece of wire or fish line.

Installation and Tuning

The performance of this antenna will be determined by the height at which it is mounted. Towers are expensive; however, telescoping type TV masts are reasonably priced, with 50 footers going for around $35. If you must ground mount the mast, a 50 footer should allow you to get the antenna up to around 37 feet. This allows for some overlap of sections and assumes you will not extend the thin top section more than a couple of inches. Mounting the rotator between the mast and beam will give you another foot or so, and if you can set the whole thing up on a rooftop, so much the better. A very successful – slow but safe – method of raising the antenna is to temporarily fasten the guy wires, leaving some slack, and then extend the mast until the wires are taut. Loosen the guys, again let out a little slack, refasten them, and raise the mast a couple more feet. Repeating this operation several times takes longer, but is much safer, than getting three or four men



BAND	SPACING	START WITH DRIVEN	START WITH REFL
10M	7'7"	16'10"	17'9"
15M	10'3"	22'6"	23'9"
20M	15'7"	33'10"	35'6"

DIMENSIONS CHART

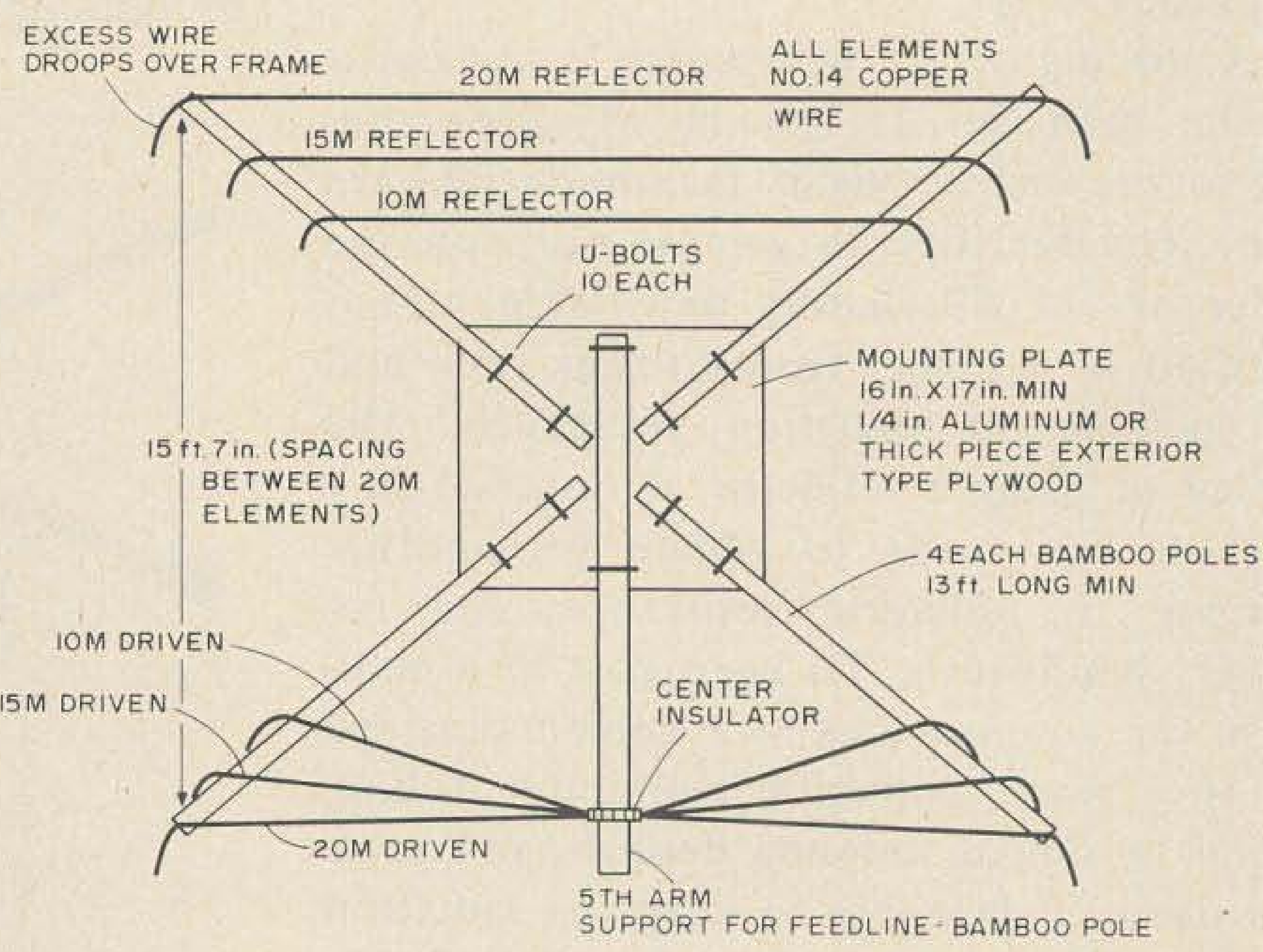
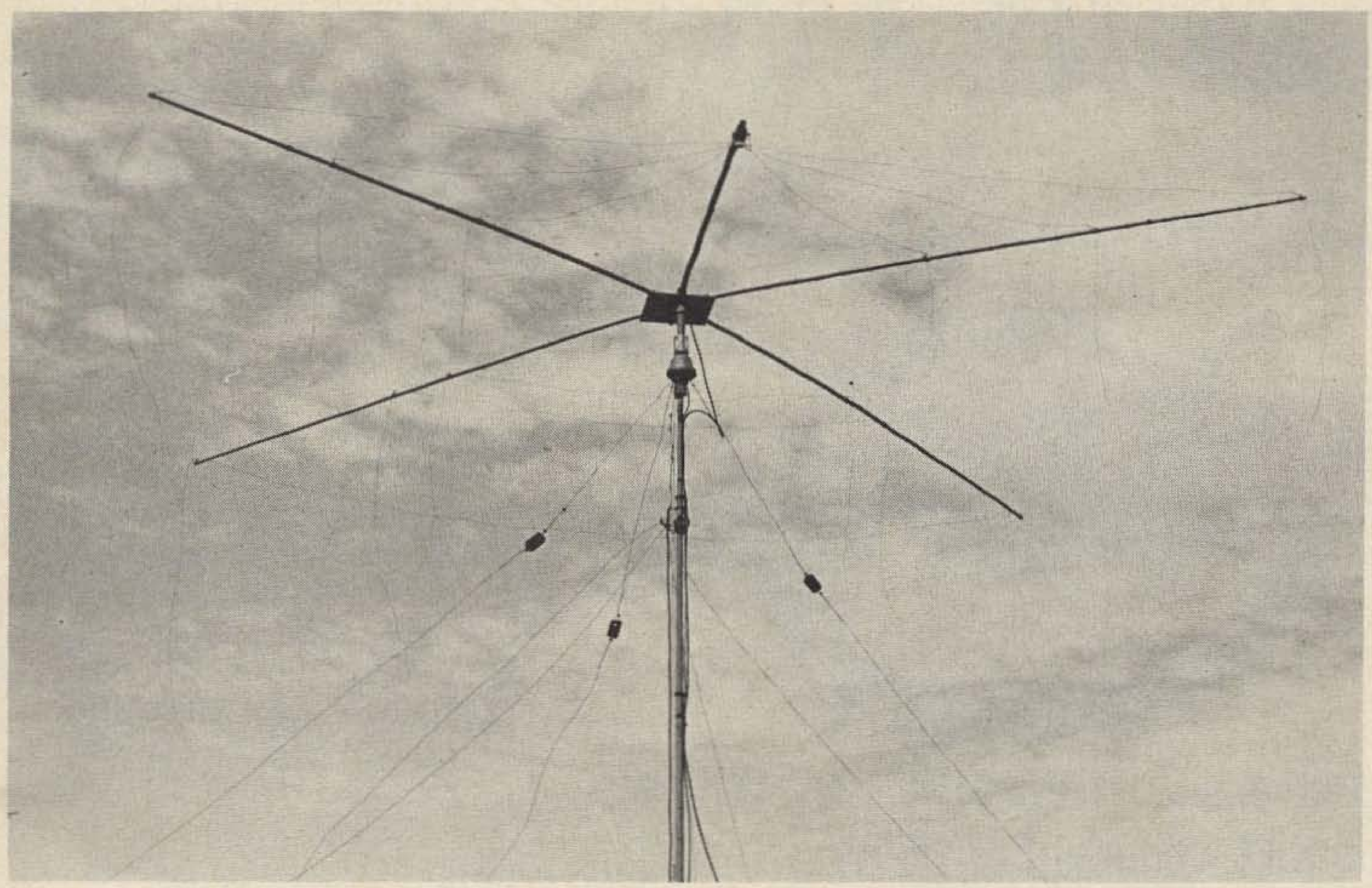


Fig. 2. Frame – top view – this frame mounts parallel with the ground.



to hold the ends of the guys and juggle their tensions and positions, trying to keep the antenna, rotator, and mast from all crashing to the earth. The heartbeat increases rapidly as a slight bow in the mast becomes a full-fledged bend just as the crunching of bamboo fills the air. Ask one who has been there!

Before you raise the antenna out of reach, it should be tuned. (It might also be wise to attach a rope and pulley somewhere near the top of the mast for use as the apex of a 40/80 meter inverted V, thus completing a 5 band antenna system.) Tuning this antenna is rather easy, as there is nothing to tighten or loosen, or slide in or out. Merely snip at the drooping ends of the elements with wire cutters. Trim as you watch your grid dip meter, or swr bridge, or noise bridge. Adjust the reflector and driven elements together, one band at a time, remembering that the reflector should be maintained about 5% longer than the driven element. The dimensions given are starting points only and are purposely long to allow for tuning. It would be best to start with 20 meters and work your way up in case there is any interaction between bands. Keep in mind that the resonant frequency of the antenna will go up when it is at its full height, and also that a 2 element beam with a reflector will drop off in performance faster as you move down in frequency than as you swing upward. So tune for a lower

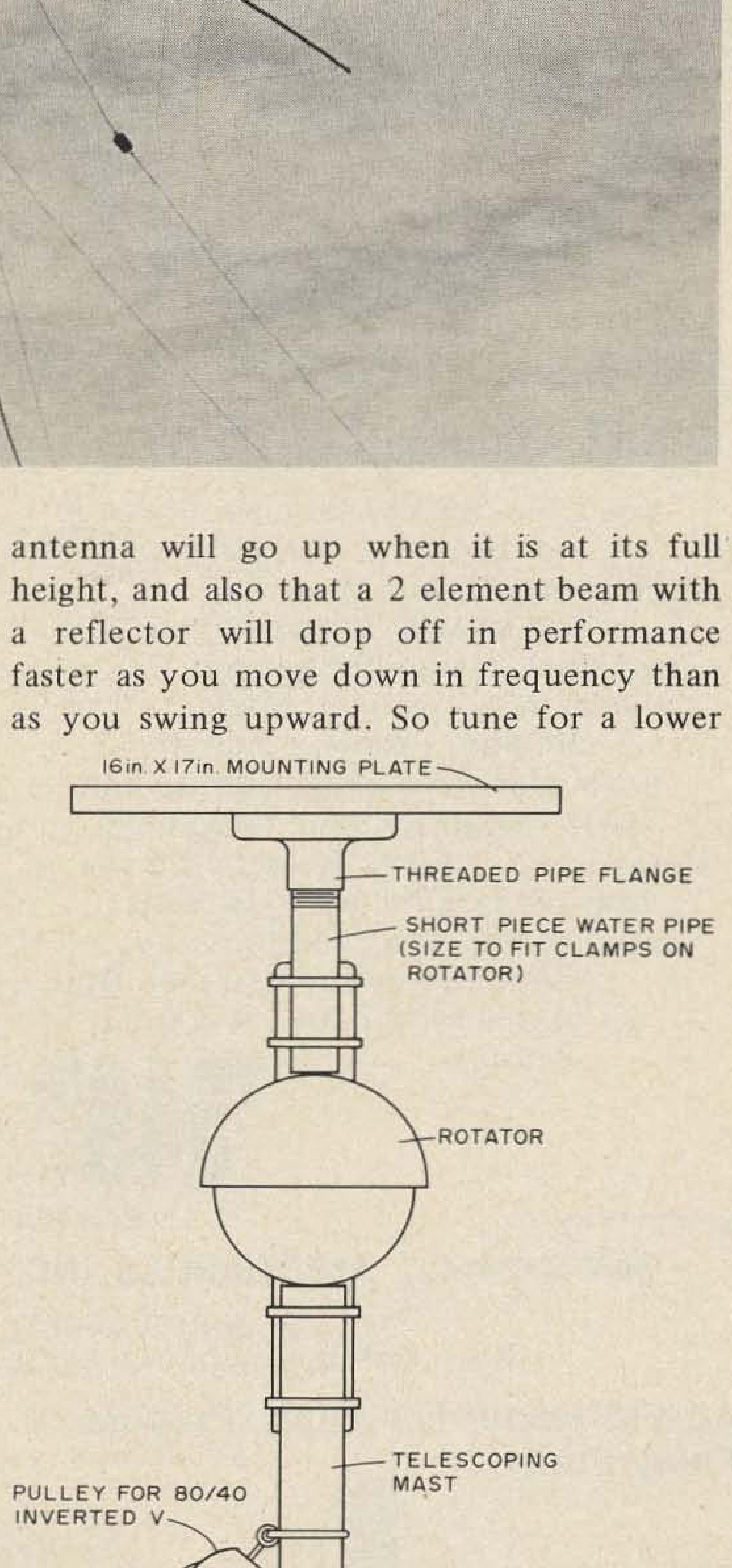


Fig. 3. Antenna-to-mast mounting.

frequency in the band, and if you err on the length of the reflectors, it is better to be on the long side. At 35 feet this antenna has given a good match to RG-8 coax with no extra matching devices. This is due, at least in part, to its higher than usual radiation resistance as compared with the close spacing of some commercial 2 element tribanders.

Performance

If you have tuned the elements correctly, the antenna will exhibit a definite front-to-back ratio. You can check this by listening to a signal on the station receiver while rotating the beam. On some signals the effect will be more dramatic than on others, due to the angle at which the signal is arriving and the fact that some DX signals may be coming through over both long and short paths simultaneously. In general, though, there should be a difference of two or three S units when making this test. The front-to-side discrimination will be even greater.

With this antenna at a height of only 35 feet it has been possible to hear and work plenty of DX, although no one should expect to be able to crunch the Big Guns using large arrays up at 80 feet. Running 100 W input I worked about 80 countries in 9 months time. Adding a pair of 813s and 5 months brought the total up to over 130 worked. This was during 1970 and early '71. I am a college student, so my operating hours are somewhat limited, and I did not spend all day every day tuning for DX. I do feel this project can provide the ham operating on a limited budget (pun) with an effective rotary beam antenna and a chance to work some new ones.

In closing I wish to thank my non-ham dad, Mr. Abraham Smolar, for his helpful suggestions and great patience.

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References

Antennas and Radio Propagation, TM 11-666, Department of the Army, February 1953.

The Radio Amateur's Handbook, 44th Edition, ARRL, 1967.

Radio Handbook, 16th Edition, Editors and Engineers, Ltd., 1962

73 Magazine, July 1963, p. 62.