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SIX ELEMENTS ON TWENTY METERS

Literally hundreds of articles have been written over the past few years describing antenna arrays ranging from dipole simplicity to full-size 40m quads. Still, it seems that most hams do not have as good an antenna system as they would like to have. There are two major reasons for this: They don't have the room or they don't have the money. Well, here is a high-gain antenna which was built in a 55 x 35 ft back yard at a total expense of about $5 for antenna wire plus some leftover hardware from a 75m dipole.

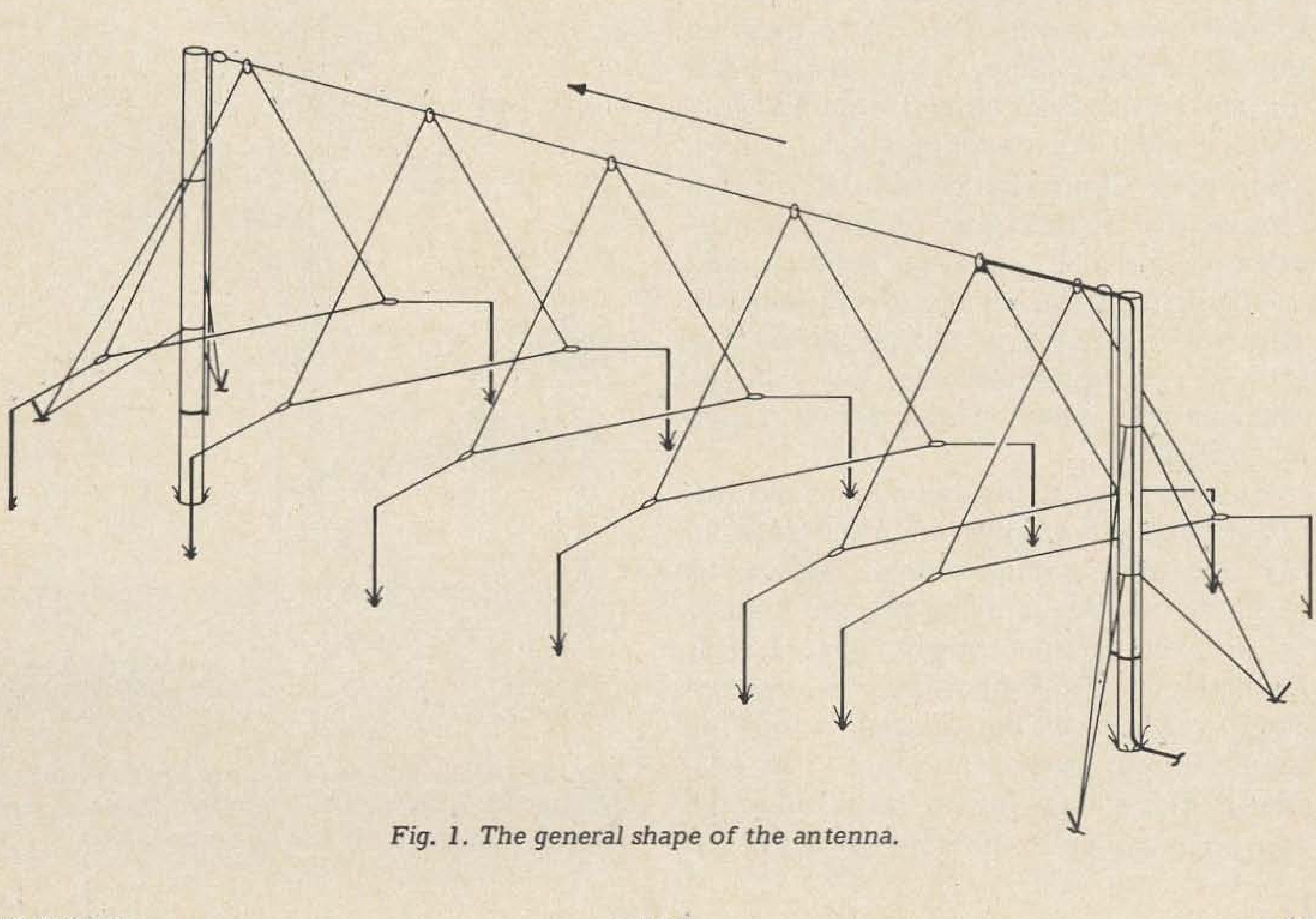

Fig. 1. The general shape of the antenna.

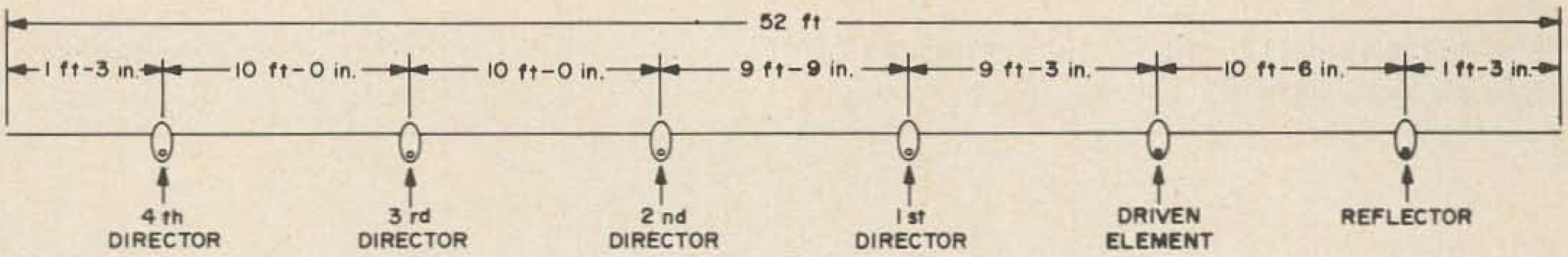

Fig. 2. Spacing of the elements on the support wire.

Checking back over the past two years of 20m operation I discovered that 62% of all contacts were with stations in Europe. The remainder were mostly contacts in Canada, South America, and a small country to the south known as the U.S. Although I was working a fair number of stations, the reports were usually, "You have a good signal here, but there is plenty of QRM on the frequency, 73 and hope to see you when the band is quieter." Of course, the band has not yet quietened down. Since I enjoy ragchewing much more than the quick "report exchange" contact, I decided to take stock of what I had in my junkbox and build the best unidirectional antenna I could devise in the space available.

My search complete, I came up with two 33 ft TV masts, a few hundred feet of guy wire, and a box of egg type strain insulators. After purchasing 450 ft of antenna wire, a roll of nylon clothesline, and two small pulleys, I had all the parts for my superbeam. Several months ago I had the idea of suspending a quad from a wire boom. Closer examination of this idea showed that if the square element configuration was to be used, two booms would be required, if the diamond configuration were to be used it would be difficult to form the square shape necessary and the elements themselves would almost touch the ground.

Suddenly while playing about with different element configurations, I realized that the most compact shape with a 1λ perimeter would be a triangle. So I came up with the antenna shown in Fig. 1. This requires only one supporting wire, and the element shape can be adjusted so that the height above ground is about 7 ft. Although this sounds low, it turns out to be just high enough to mow the lawn, yet low enough to reach easily for pruning. With the guys which hold the elements in shape attached to a fence at the edge of the yard, the forces are directed to the side instead of downwards, thus putting less stress on the supporting wire.

Although I will explain the method of construction in considerable detail here, the mechanical structure is not very critical and is only presented for the use of those who wish to duplicate my antenna exactly.

First, measure off a 52 ft length of guy wire, which will be the supporting cable. Slide six of the strain insulators onto the wire and space them according to the

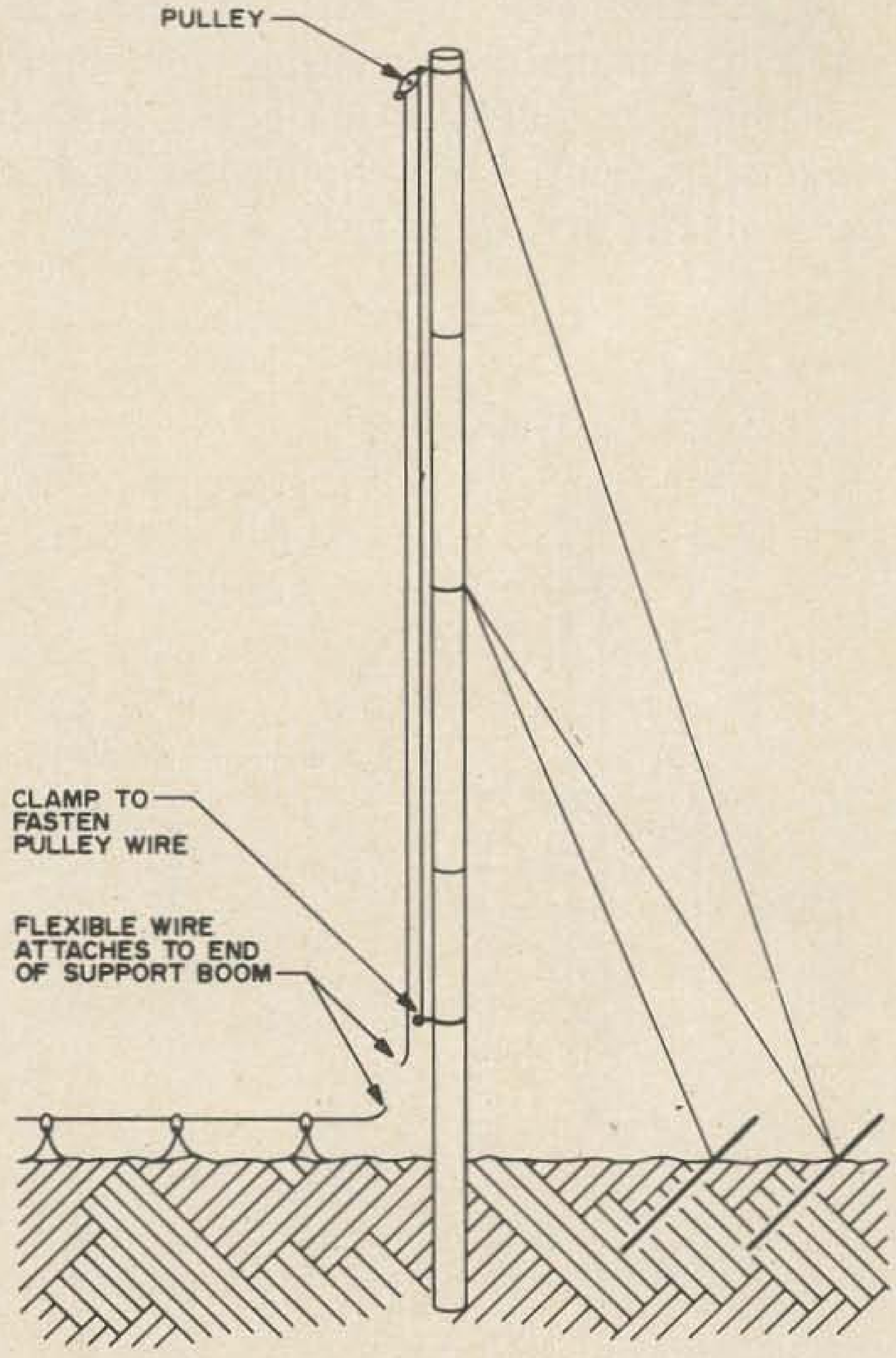

Fig. 3. Details of masts. Do not anchor guys to ground until the mast is vertical. Then tighten guys as tension on the antenna is increased.

spacing shown in Fig. 2. The insulators I used have the two holes drilled perpendicular to each other, which makes them excellent for supporting the elements of this antenna. Electrical tape was used to hold them in position.

Second, set up the masts according to the details of Fig. 3. The poles I used are TV masts made to a length of about 33 ft each by adding three 10 ft sections with swaged ends and a 4 ft scrap of tubing to be buried in the ground. A pulley is attached to the top of the mast and 50 ft of flexible guy wire is pulled through it. This will be used to lift the antenna into position after the masts have been erected and lower it for changes or servicing. Two guys attached adjacent to the pulley are used to balance the tension on the supporting wire. In addition, two more guys are attached halfway up the masts to hold them straight. The entire assembly is light enough to be walked up into the vertical position and dropped into a 3–5 ft hole. The earth can then be filled in around the mast and the guys temporarily anchored.

Next, measure the wire for the elements according to the table in Fig. 4 and insert the wire in the insulators as shown in Fig. 5. Make sure you do not mix up the elements at this point. Add two more insulators to each element and spread the wire out on each side of the boom so that it will not tangle when the antenna is being lifted into place. The feedline should be attached to the driven element and taped along the support wire to the end nearest the shack. Any 50Ω coax will work well (depending on the power you are running). Incidentally, the loss in RG-8 is 0.7 dB/100 ft. The loss in RG-58 is 1.7 dB/100 ft. In watts that means that 100W output from the transmitter at the end of 100 ft of RG-58 is only 68W at the antenna. But with RG-8, 100W at the transmitter means 83W at the antenna.

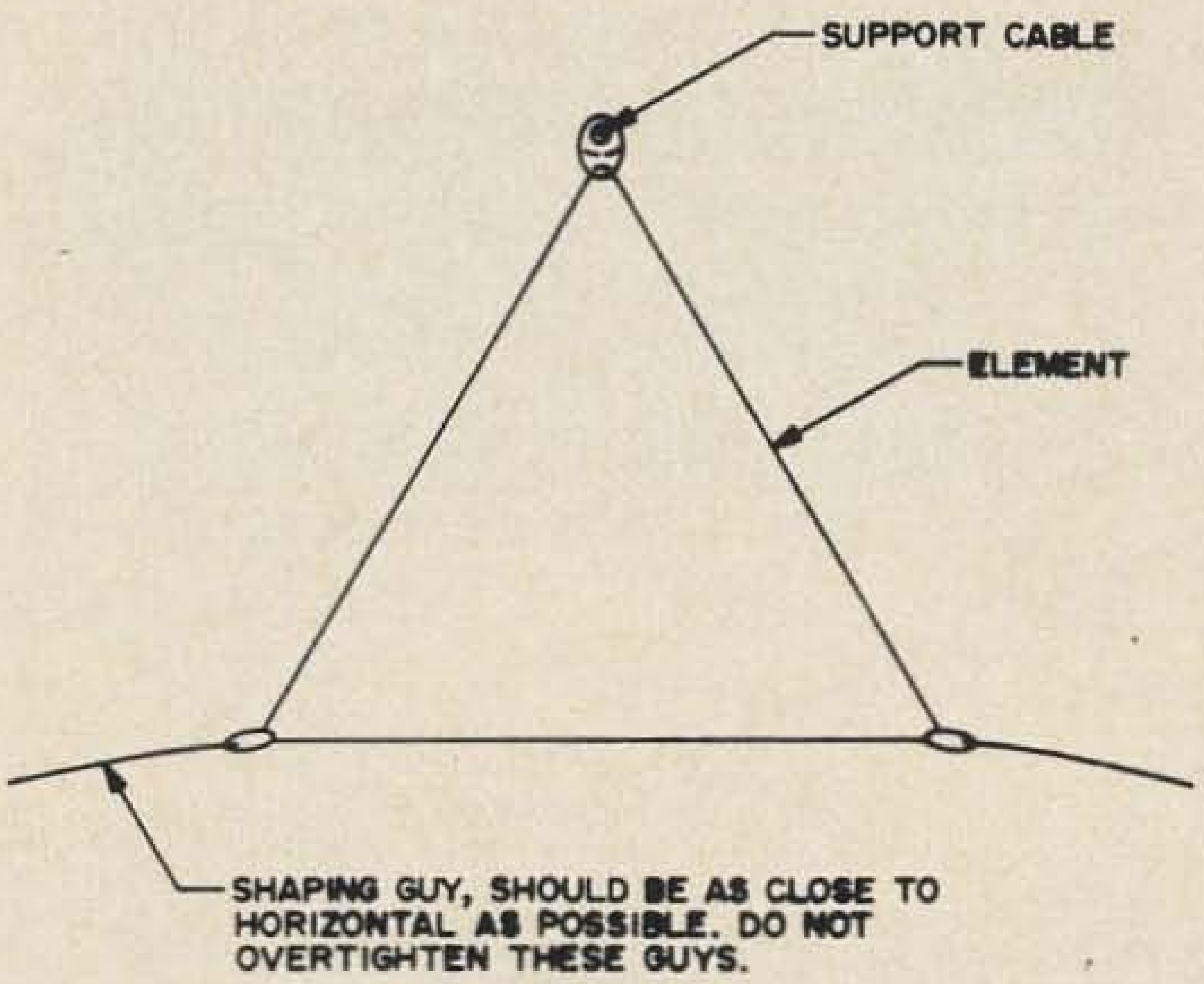

Fig. 5. Details of the element mounting.

Next, attach the support wire ends to the wire on pulleys of the masts and hoist the antenna into the air. Attach nylon clothesline or heavy string to the insulators and pull the elements into a triangular shape. These guys should be attached as far from the antenna as possible or even better as high from the ground as possible. This is to prevent the strain of the guys from pulling the support wire out of shape.

Now you are ready to prune the elements. This can be done by setting a field strength meter in front of the antenna and trimming the elements for a maximum reading. If this is not possible, a reasonably good approximation can be made by resonating the elements to the frequencies shown in Fig. 4 with a grid dip meter. To be sure that the calibration of the grid

Element	Length of Wire Needed	Resonant Frequency
Reflector	71'9"	13.8 MHz
Driven Element	70'0"	14.17 MHz
First Director	68'3"	14.60 MHz
Second Director	66'6"	14.90 MHz
Third Director	64'9"	15.40 MHz
Fourth Director	63'0"	15.90 MHz

Lengths are given for a resonant frequency of 14.170 MHz. If the frequency is higher, they should be shortened accordingly. IMPORTANT: These lengths are rough estimates and should not be used without pruning with the antenna in the air.

Fig. 4.

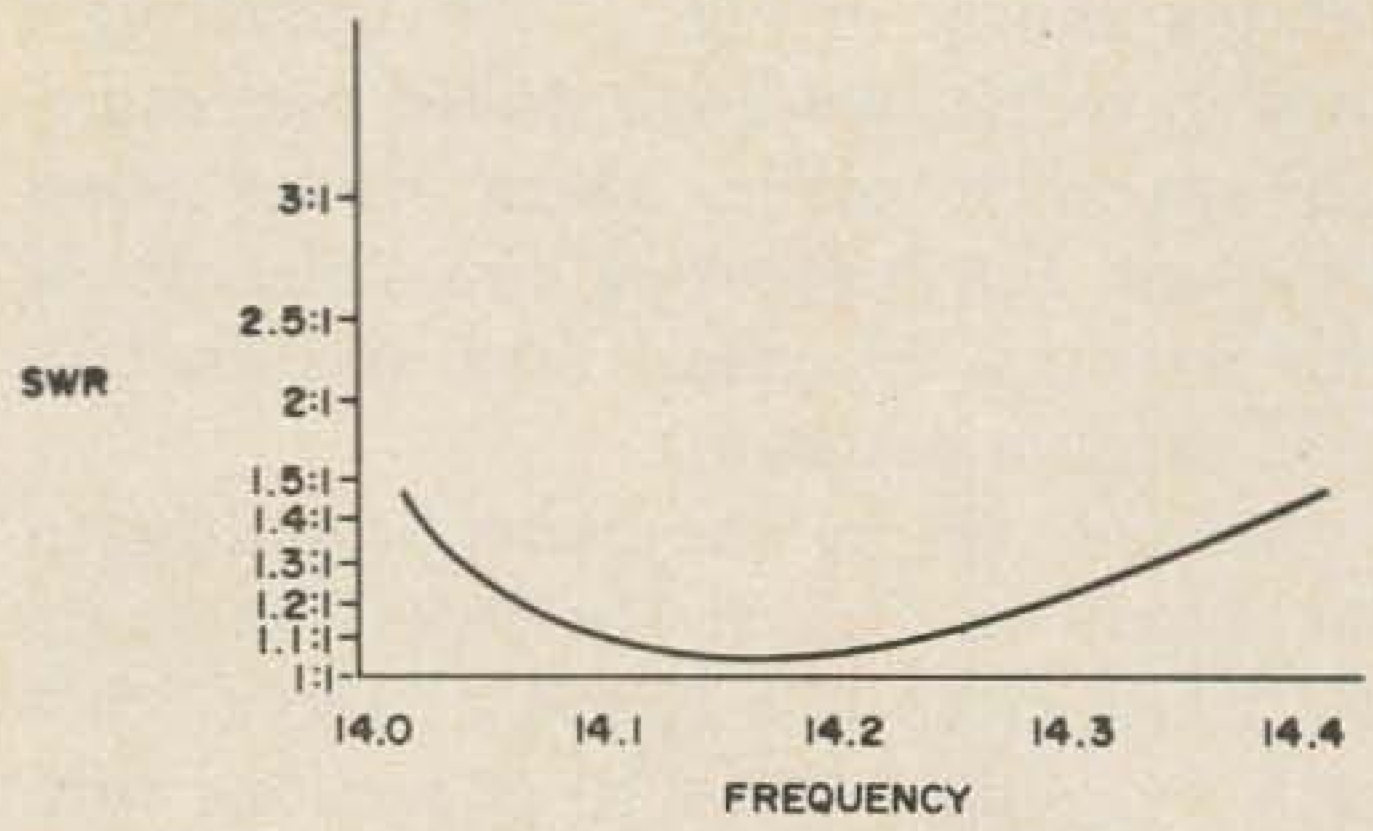

Fig. 6. A plot of swr vs frequency shows that the antenna is quite flat across the entire band. In fact the swr does not exceed 1.5:1 on any frequency.

dipper is not being pulled by the antenna element, a communications receiver can be connected to the antenna which will pick up the signal and assure accurate calibration. Last, trim the driven element for a minimum swr.

The first time I plugged the antenna into the transmitter I thought something had gone wrong with my swr meter. No matter how far I advanced the sensitivity I could not get a reading in the reflected position. The swr was a flat 1:1. The final resonance swr is shown in the graph of Fig. 6.

The first station I worked was OZ7KB, who reported my signals to be S9, and one of the few VEs coming through at that time. Receiving, his signals were also S9. A few more contacts with more S9 reports using 150W PEP confirmed that the antenna was working well.

Comparison reports with a vertical show a consistent 10 to 15 dB gain on both receive and transmit. The antenna has the added bonus of cutting out the QRM I used to get from the South American kilowatts.

Since I am no antenna engineer, I cannot give any rigid theories as to how or why this antenna works. I do not even know what the polarization is. All I can say with certainty is that it works for me and I am quite pleased with its performance. Incidentally, I do not see why the antenna can't be extended to more elements if the room is available. Like, how about a cheap 12-element 20m beam?

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