A NO COMPROMISE FIVE BAND TWO ELEMENT QUAD

BY RICHARD E. JAMES,* W4DQU

THE quad described here is designed to give maximum gain with minimum feed line losses, to be of minimum weight with maximum strength obtainable, and, being a quad, it will give a low angle of radiation with low antenna elevation. At 35 feet of elevation it will compare, on 20 meters, with a beam at 65 feet.

Maximum gain (5.7 db) on a two element quad, using a driven element and a reflector, occurs at about 1/8 wave length spacing (0.125λ). This is the spacing selected and the feed point impedance is approximately 72 ohms (balanced). I made the decision to feed the driven elements with a single 72 ohm (Belden No. 8210) transmitting type twin lead because:

1–There would be an almost perfect match with the feed line to the driven elements.

2–The 72 ohm twin lead is not heavy or bulky. It compares favorably, in this respect, with RG-58/U or RG-59/U.

3–The line loss on this 72 ohm twin lead is somewhere between RG-58/U and RG-8/U.

4–No baluns are required at the antenna. If coax had been used, baluns would have been needed for optimum performance, and they are bulky and heavy.

5–It is easy to connect twin lead to the feed points on five antennas. Try this with coax.

6–A matching device will be needed to match a transmitter with an output of 52 ohms to 72 ohms unbalanced, but you can use a balun at the transmitter, a Transmatch or a Matchbox. I personally am using a Transmatch built from June 1964 *QST*[1] and the results are excellent. If you do not have a Transmatch or a Matchbox any 1 to 1 ratio unbalanced to balanced balun can be used at the transmitter. These can be built from the handbooks or can be purchased for from $9.00 to $12.95 each.

7–Line losses with this antenna at about 35 feet can be about half as much as a beam at about 65 feet because the feed line can be made about half as long.

Construction

The hub of this antenna is constructed of ordinary pine or fir lumber which can be obtained in any lumber yard. The wood is glued together with U.S. Plywood Weldwood Plastic Resin Glue.

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[1]McCoy, L., "A Completely Flexible Transmatch for One Watt to 1000", *QST*, June 1964, p. 39.

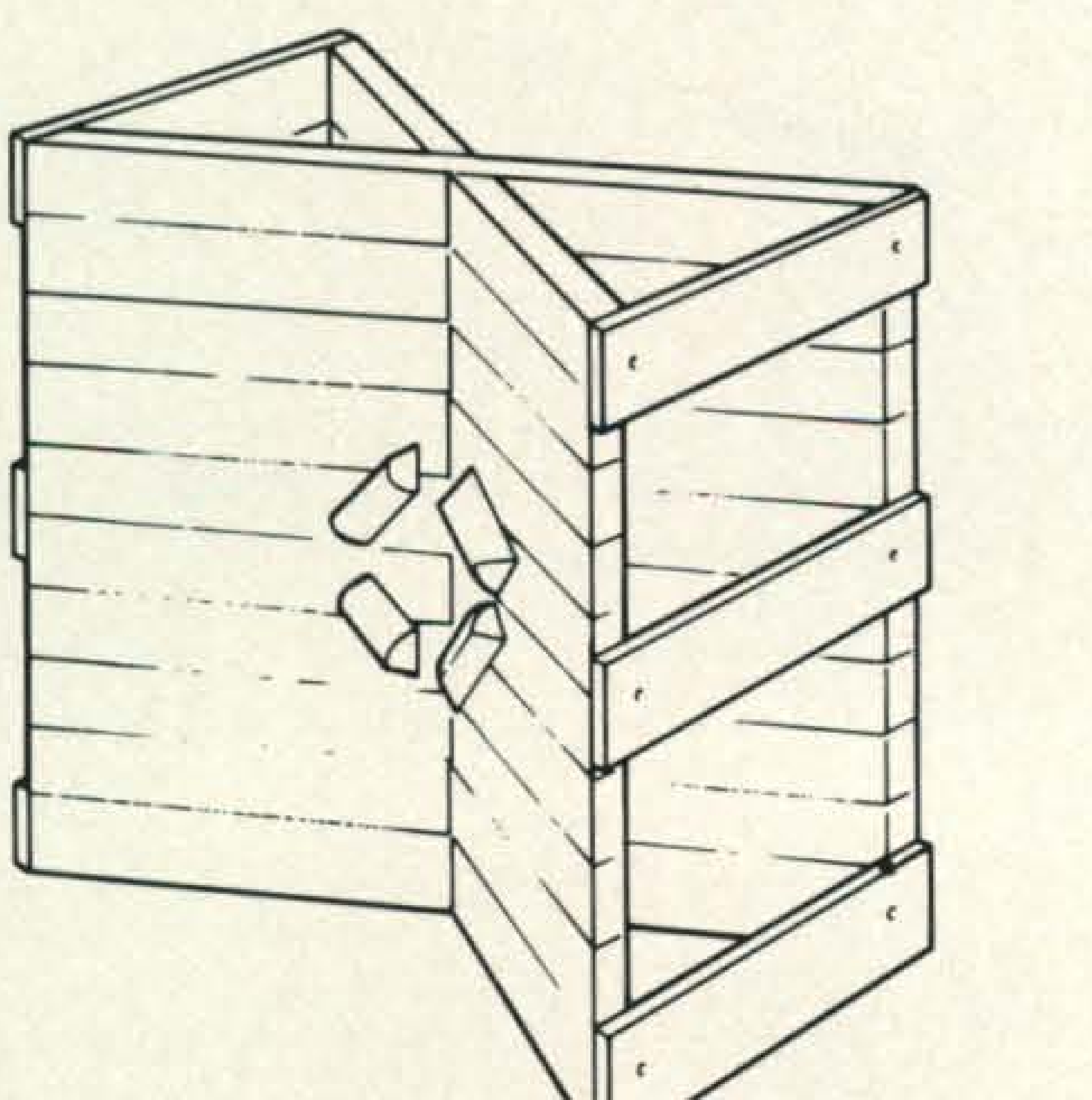

Fig. 1—Isometric view of the laminated quad hub. Three quarter inch pine or fir is secured with Weldwood Plastic Resin glue.

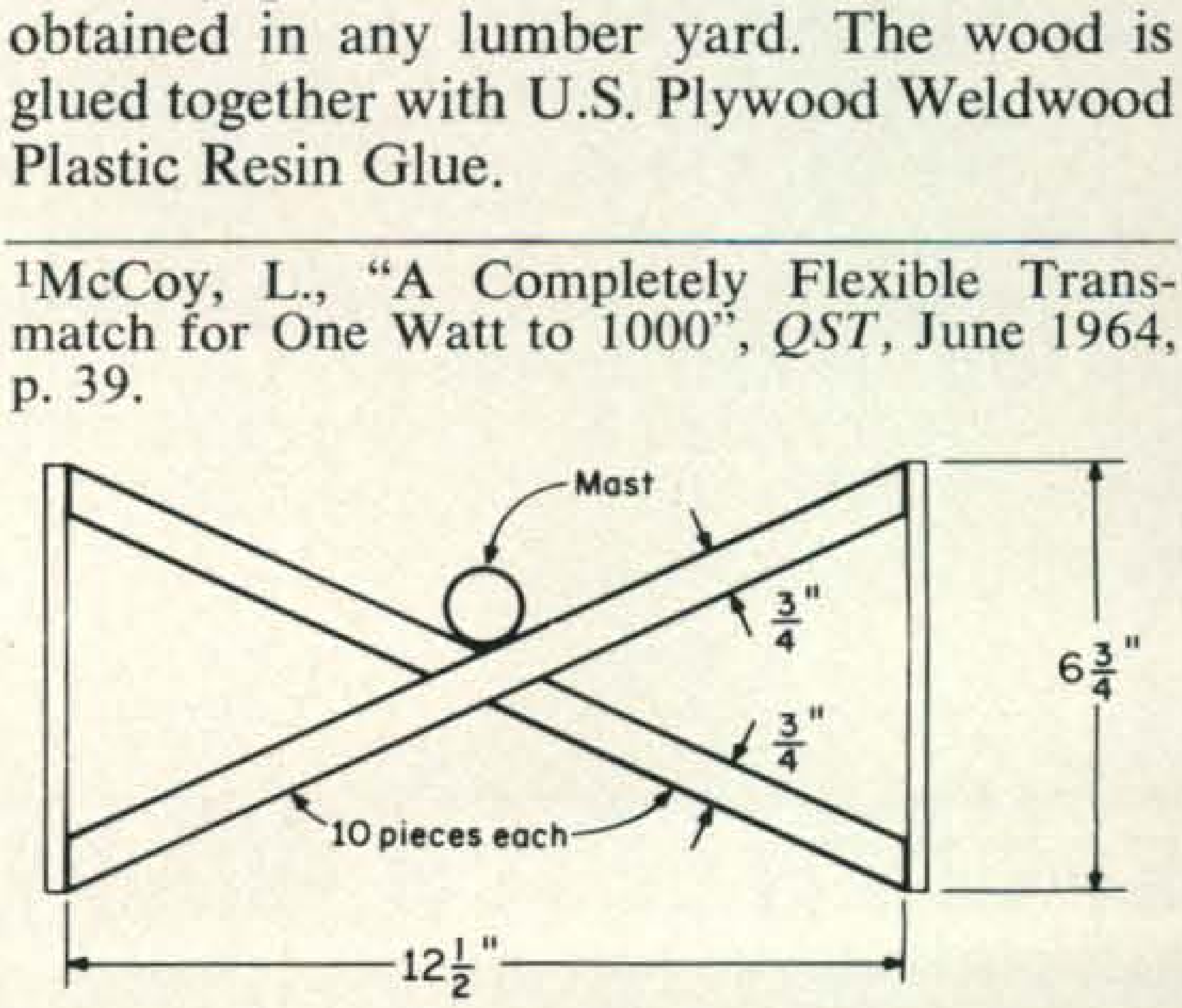

Fig. 2—Top view of the hub showing the dimensions and angles that must be cut.

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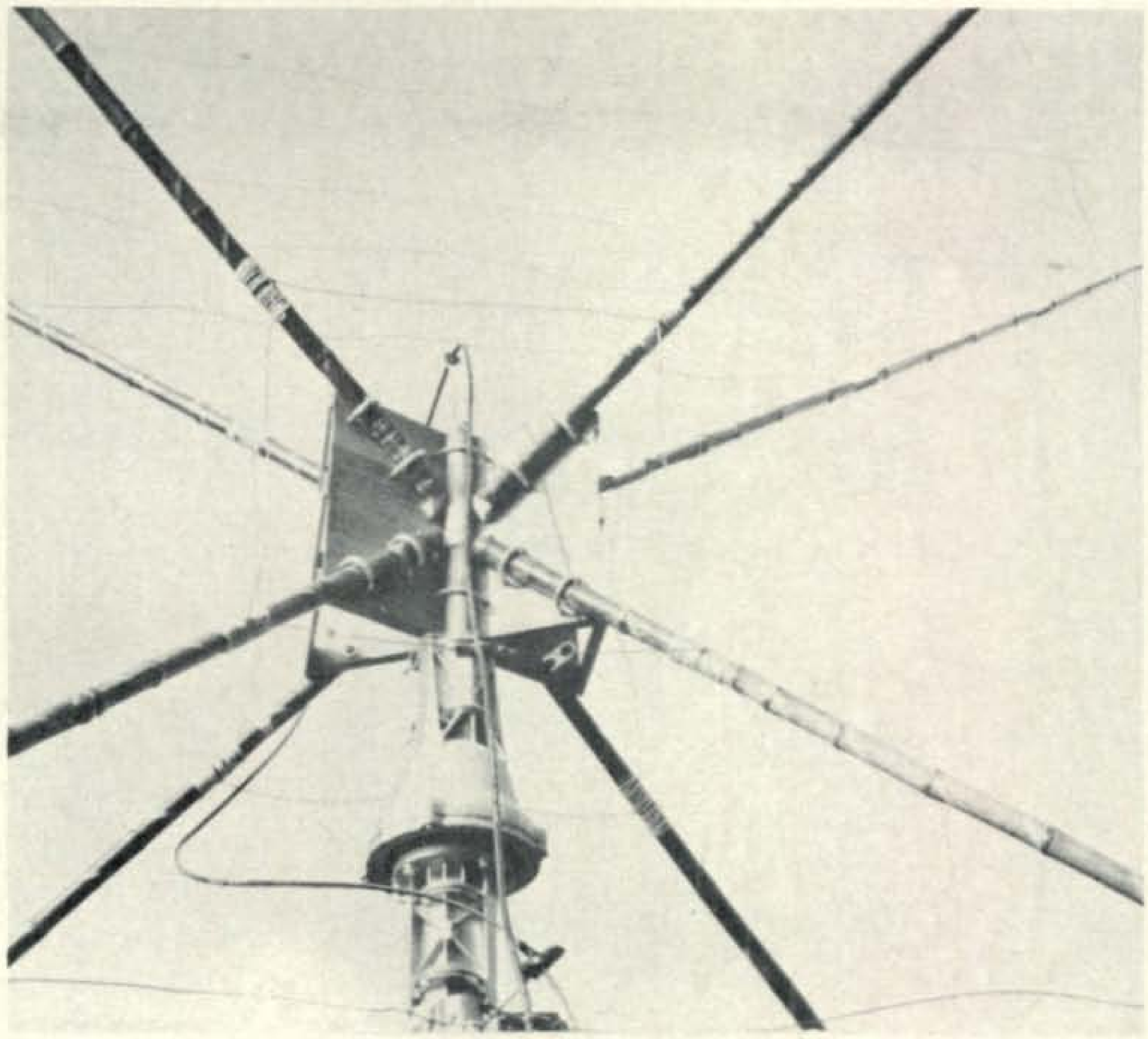

View of the hub and rotor of the five band two element quad.

Figure 1 shows the completed hub. Figure 2 shows the top view and the assembly of the component parts. First, make a scale drawing of fig. 2. Saw ten of the long pieces out of 3/4" × 1¼" pieces of wood. Saw 20 of the short pieces out of the same size wood. Using the full scale drawing, place one of the long pieces and two of the short pieces (with glue on the inner ends) on top of the drawing. Next, spread glue over the top of the three pieces and place a long piece on top of the two short pieces. Next, place two of the short pieces (with glue on inner ends) on top of the long piece. Press all pieces down firmly and wipe off excess glue. Continue this process until all the pieces are used up, remembering to always put a long piece on top of two short pieces and two short pieces on top of a long piece. Leave the assembly in a warm place (70° *F* or more) for 24 hours for the glue to set.

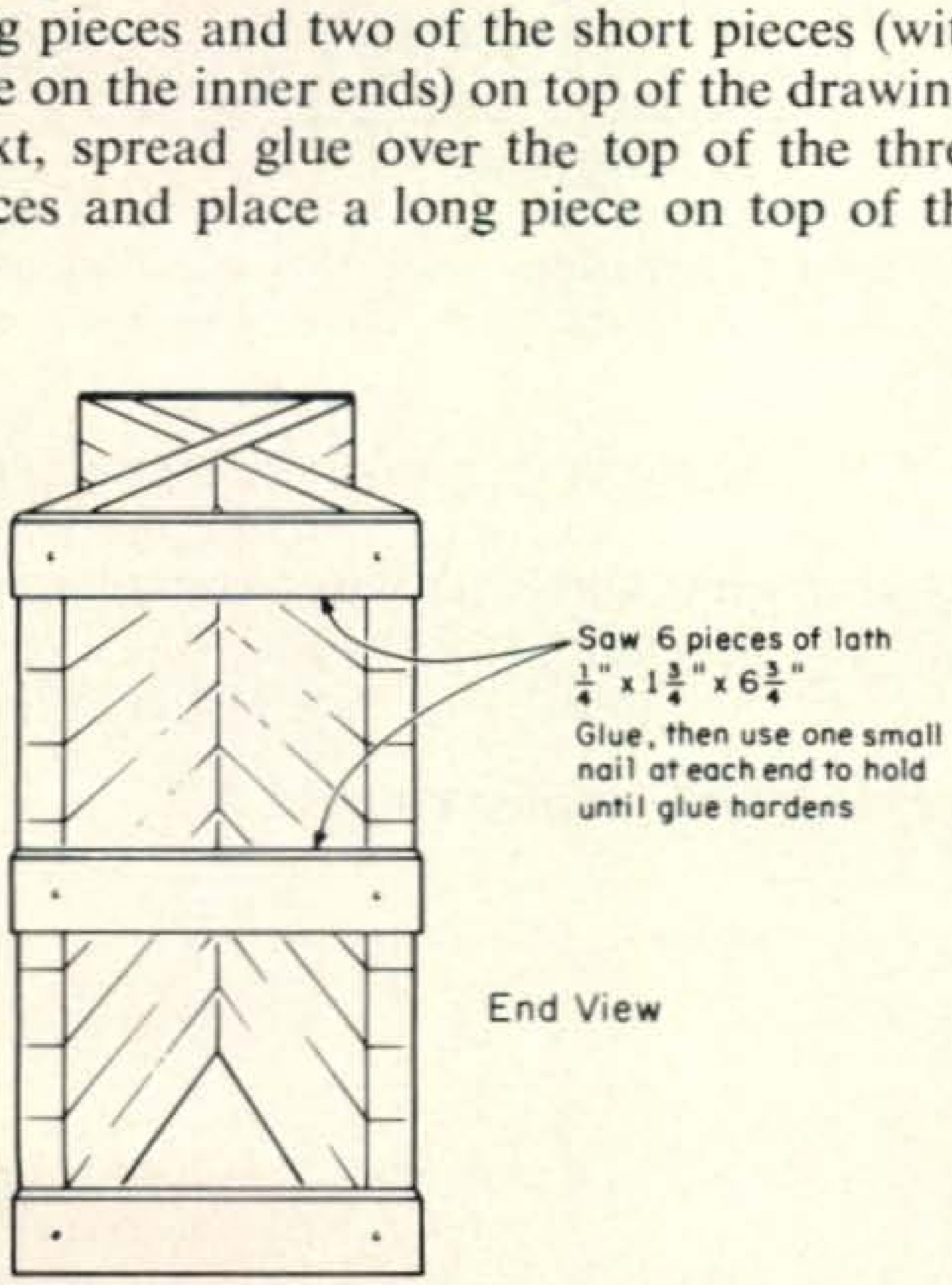

Fig. 3—End view of the quad hub shows the location of the braces desirable for reinforcement. They each measure 1/4" × 1¾" × 6¾". They are glued and secured with small brads.

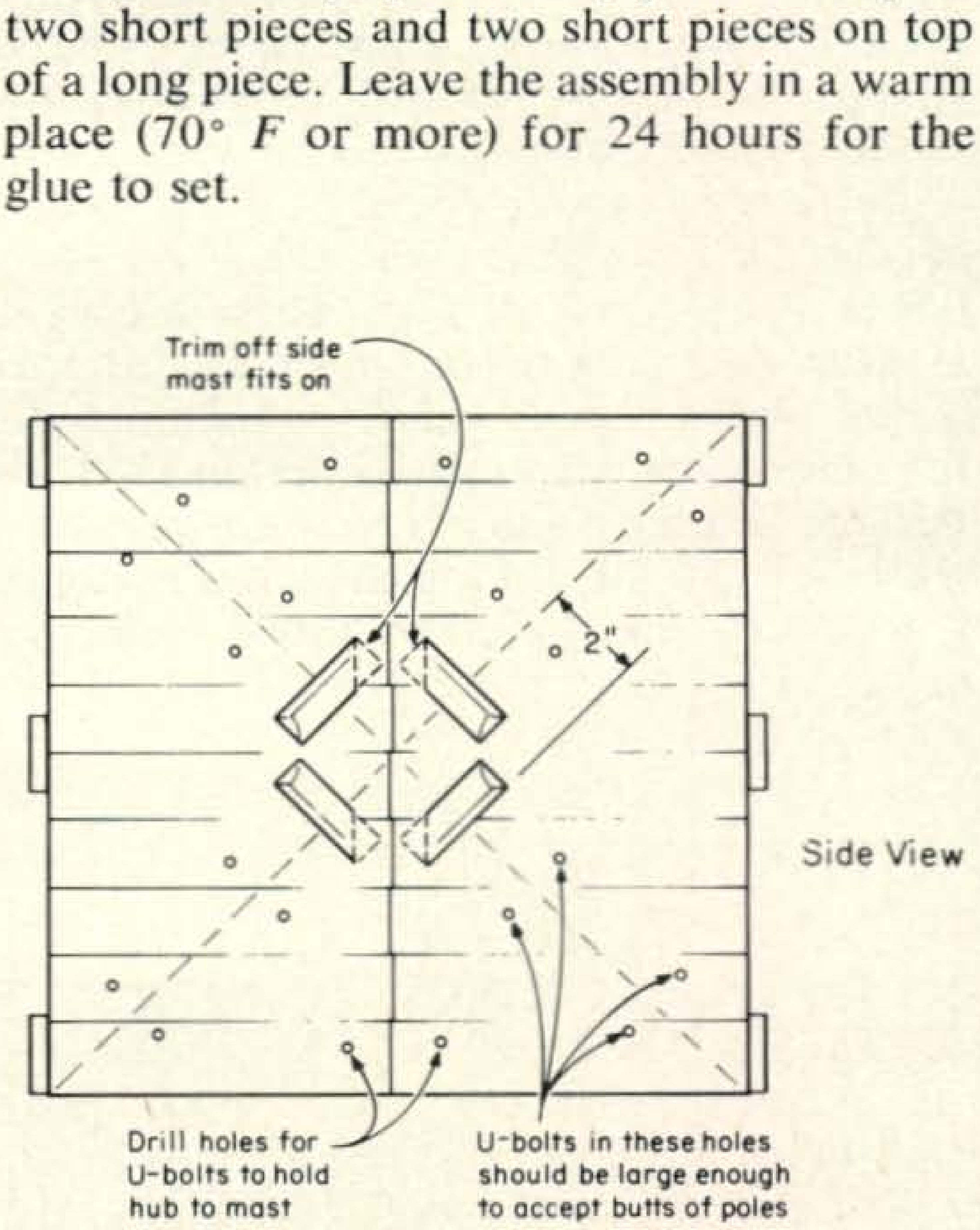

Fig. 4—Side view of the quad hub showing the positions of the wooden blocks used to keep the butts of the poles 2" from the hub center. Be sure the insides of the blocks are cut to clear the mast.

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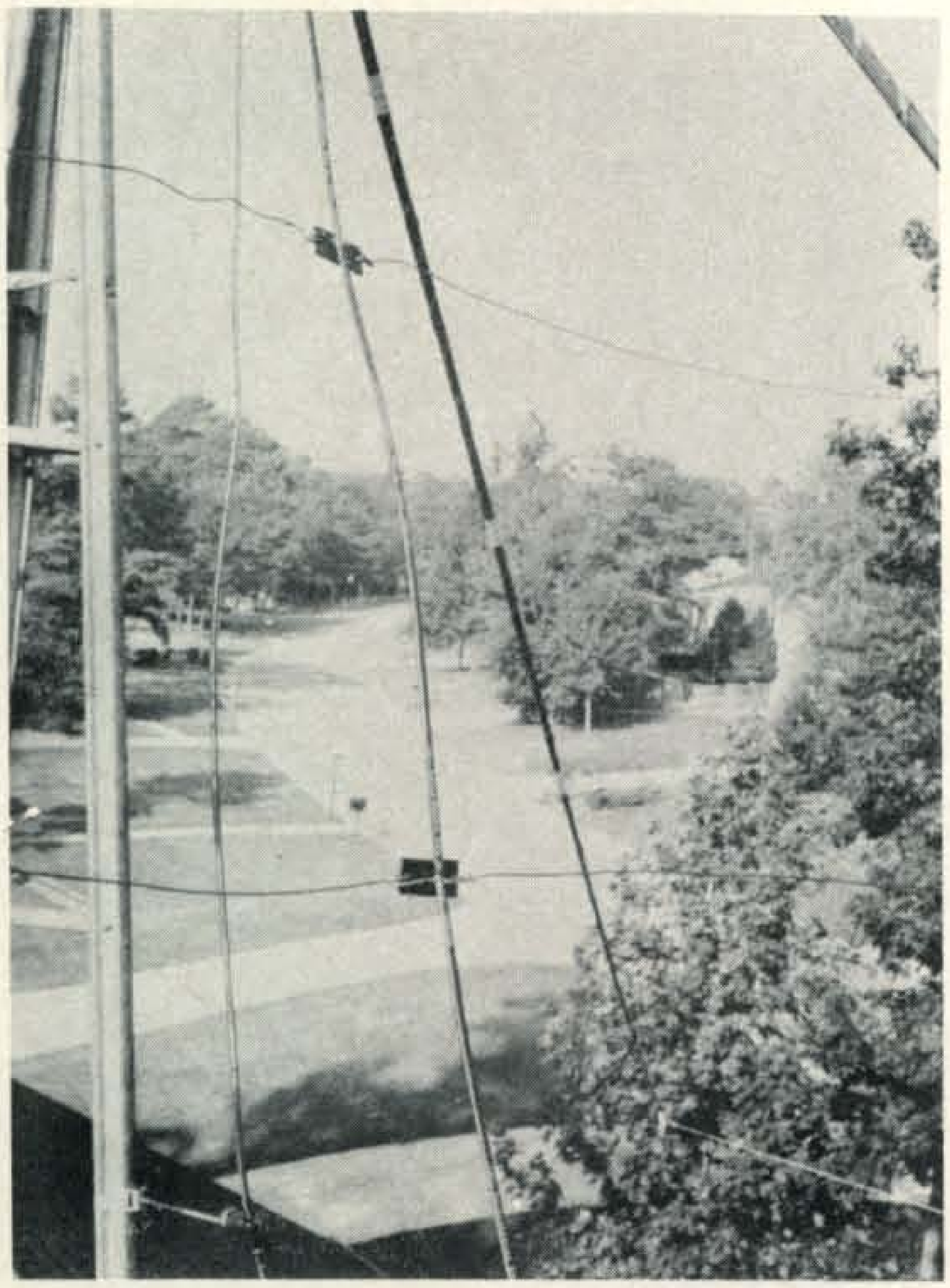

View of the 72 ohm ribbon feedline at the connection points to two of the driven elements.

Next install the braces as shown in fig. 3. While probably not absolutely necessary, (the cross laminated, glued construction is very strong) the braces probably do add greatly to the strength and only weigh a few ounces.

Refer to fig. 4 and glue eight wood blocks of 3/4″ × 3/4″ × 2″ with their faces two inches from center of hub. These are used to keep the butts of the poles spaced two inches from the dead center of the hub. All the dimensions out to the eyelets have taken this into account. If all the poles converged at the center, all the dimensions given in Table I, would have to have two inches added to them.

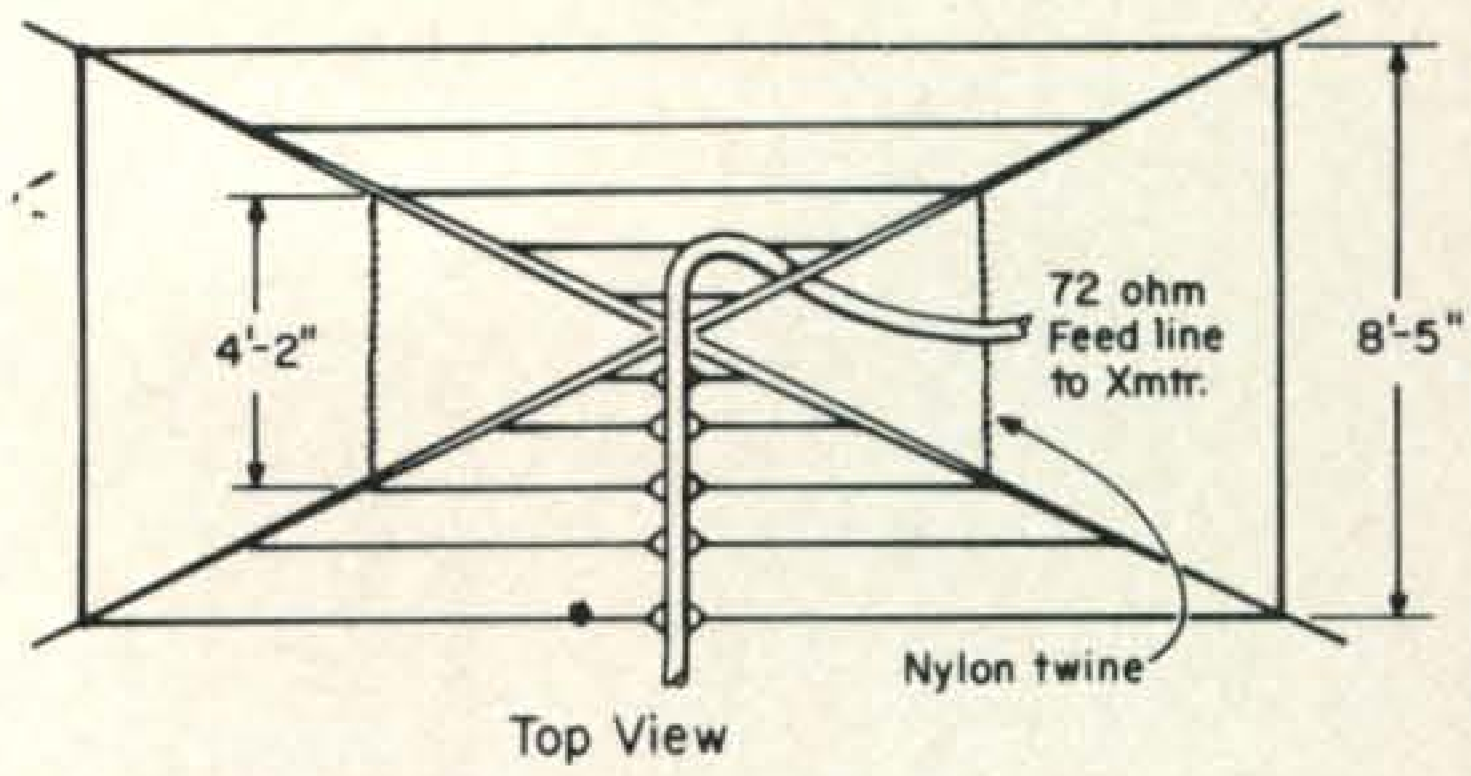

Fig. 5—Top view of the 5 band quad. Note the use of nylon twine at two points along each of spreaders to avoid bowing and sagging. The insulators and feedline connections are on the bottom of the driven element.

The location of the wires for each band is shown in fig. 5. The measurements used to locate these points are given in Table I.

Locate the listed points and secure eyelets of the type shown in fig. 6. You will need forty of these eyelets and they can be made from #16 copper wire. The eyelets are secured to the poles by wrapping the legs with string and securing the string with model airplane glue. The string should then be doped with clear airplane dope.

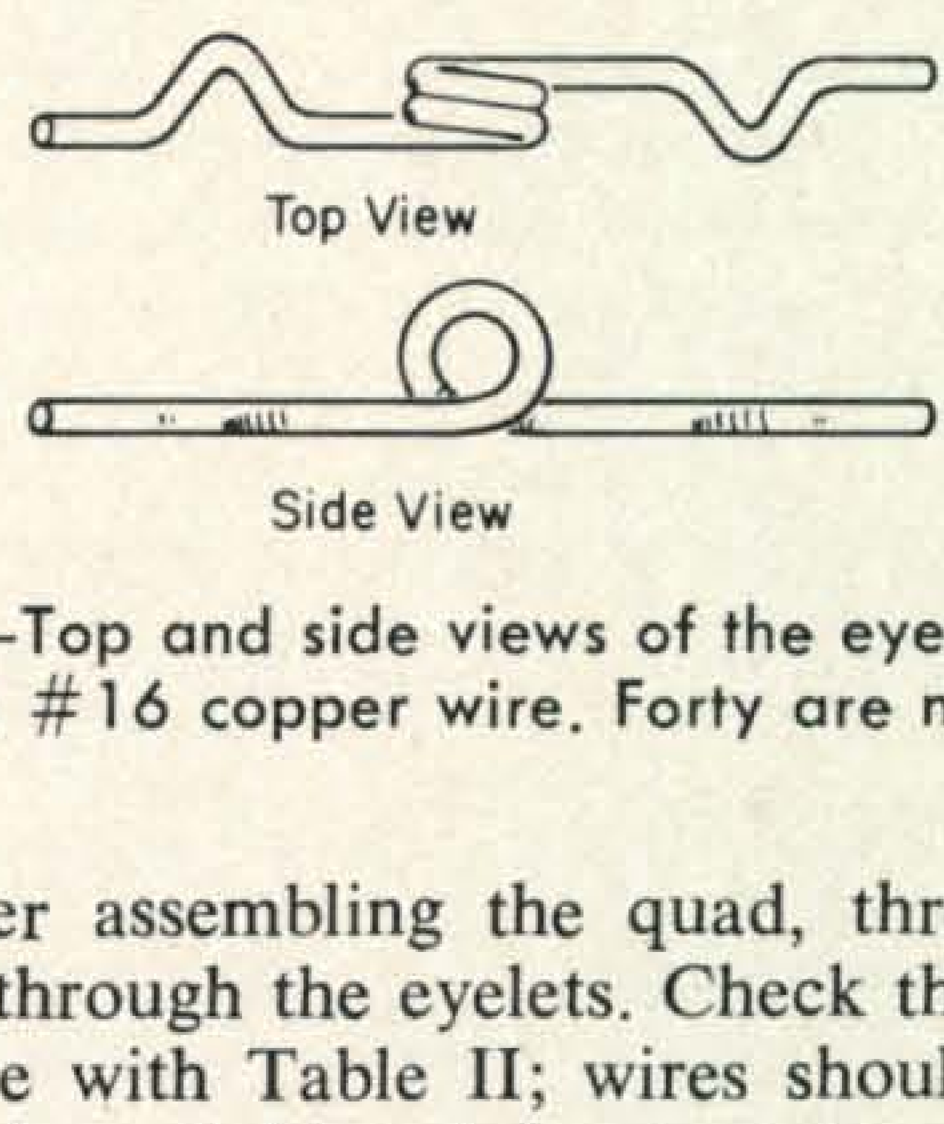

Fig. 6—Top and side views of the eyelets made from #16 copper wire. Forty are needed.

After assembling the quad, thread #14 wires through the eyelets. Check the lengths of wire with Table II; wires should not be tight. As matching stubs are not used on the reflector, just solder the ends of the reflector

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Band	Driven Element Poles	Reflector Poles
2 M	1′ 1″	1′ 1⅝″
6 M	3′ 5¼″	3′ 6⅝″
10 M	6′ 3″	6′ 5″
15 M	8′ 6½″	8′ 9¼″
20 M	12′ 11½″	13′ 3½″

Table I—Measurements from pole butts to eyelet centers.

Band	Driven Element	Reflector
2 M	1′ 8½″	1′ 9″
6 M	4′ 10″	5′ 0″
10 M	8′ 7″	8′ 10″
15 M	11′ 8″	12′ 0″
20 M	17′ 7″	18′ 1″

Table II—Lengths for one side of each element ($\lambda/4$).

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Calibrate Your Own D.C. Meters [*from page 52*]

ratios you establish must take this limitation into consideration. Again, the input resistance of the Volt Box must be considered from the standpoint of each point because there will be "circuit loading" effects on the voltage being measured. You cannot design this out of the Volt Box, but you can design and build a good Volt Box using the principles outlined above. But, you must know how to use it properly.

A second installment will cover the Standard Resistor, construction and application of all three of the units.

(To be continued)

A No Compromise 5 Band 2 Element Quad [*from page 18*]

wires together. Use a small insulator on each driven element. Run the wires through the ends, wrap them around, solder and bend the wires toward each other and trim them to where the ends are about 1/4" from each other. Refer to 5 and the photo for the method of attaching the 72 ohm twin lead o the driven elements.

I painted the finished hub with zinc napthenate, a clear liquid which prevents rot.

Results

This quad has given me excellent results, working such places as Australia, Chile and the Antarctic on 10, 15 and 20 meters. It seems to have a front to back ratio of about 25 db. I have built other quads but I have seen no other two element quad that would out perform it.

If you have an antenna tuner such as a "matchbox" or a "transmatch" you can use open wire line to feed all five antennas. I tried this with 300 ohm television open wire line and it was surprising how much this improved reception and transmission on even as low a frequency as 10 meters. Checking theoretical feed line losses per 100 feed of feed line on 10 meters, the 72 ohm twin load loses about 1.5 db while the 300 ohm line loses only about 0.15 db plus the 4 to 1 s.w.r. loss of about 0.15 db additional making a total of only 0.3 db per 100 feet compared with 1.5 db when using 72 ohm line ■
