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Build These Easy Antenna Projects
Mini-Quad Loop
Dual-Band J-Pole
10 Meter X-Beam
Collapsible Quad
Satellite Dish
73 Reviews
j•Com Low Cost Personal Autopatch
The Ultratorch Soldering Pen
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Mini-Quad Loops

Three-fifths-size loops with full-size performance.

by Dean Frazier NH6XK

Eventually a ham discovers the gain, and especially the quietness on receive, of loop antennas, and plans to construct one. Soon enough it becomes apparent that loops for the bands below 20 meters are impossibly large. A square loop on 40 meters (7.15 MHz), for example, needs sides about 35 feet long, which may be unreasonably large to erect, especially in the vertical plane. However, a loop, or any antenna, can be made physically smaller while maintaining full electrical size. This can be accomplished with loading coils, as is frequently done in mobile applications. Unfortunately, coils do introduce some loss. Another approach is to reduce the size of an antenna, e.g. cause it to be resonant above the desired frequency by mechanical shrinking, and then capacitively "stretch" it, so as to achieve the proper electrical length for resonance. The latter is the approach taken here.

The mini-quad loops described are not quite three-fifths full size, and yet, via capacitive loading, are electrically stretched to a full wave. We don't get something (size reduction) for nothing, however. We do suffer some reduction in bandwidth, and we lose about 1/2 dB compared to the performance of a full-size loop. The former limitation may only be a problem on the higher frequencies, for which bands a mini-quad loop can be tailored for a specific portion of the band. Note that the 2:1 SWR bandwidth on 12 and 17 meters (Table 1) and 30 meters is greater than the entire width of the band. Regarding the second limitation, recall that a very good human ear just might detect a 1 dB difference in received signal . . . clearly a 1/2 dB reduction with a mini-quad loop goes unnoticed. Contrast the "cost" of a loss of 1/2 dB, and some reduction of bandwidth, against the "gain" of a 40% size reduction. Add to this the forward gain (when mounted vertically) of several dB, and side rejection, and the mini-quad loop begins to look pretty good.

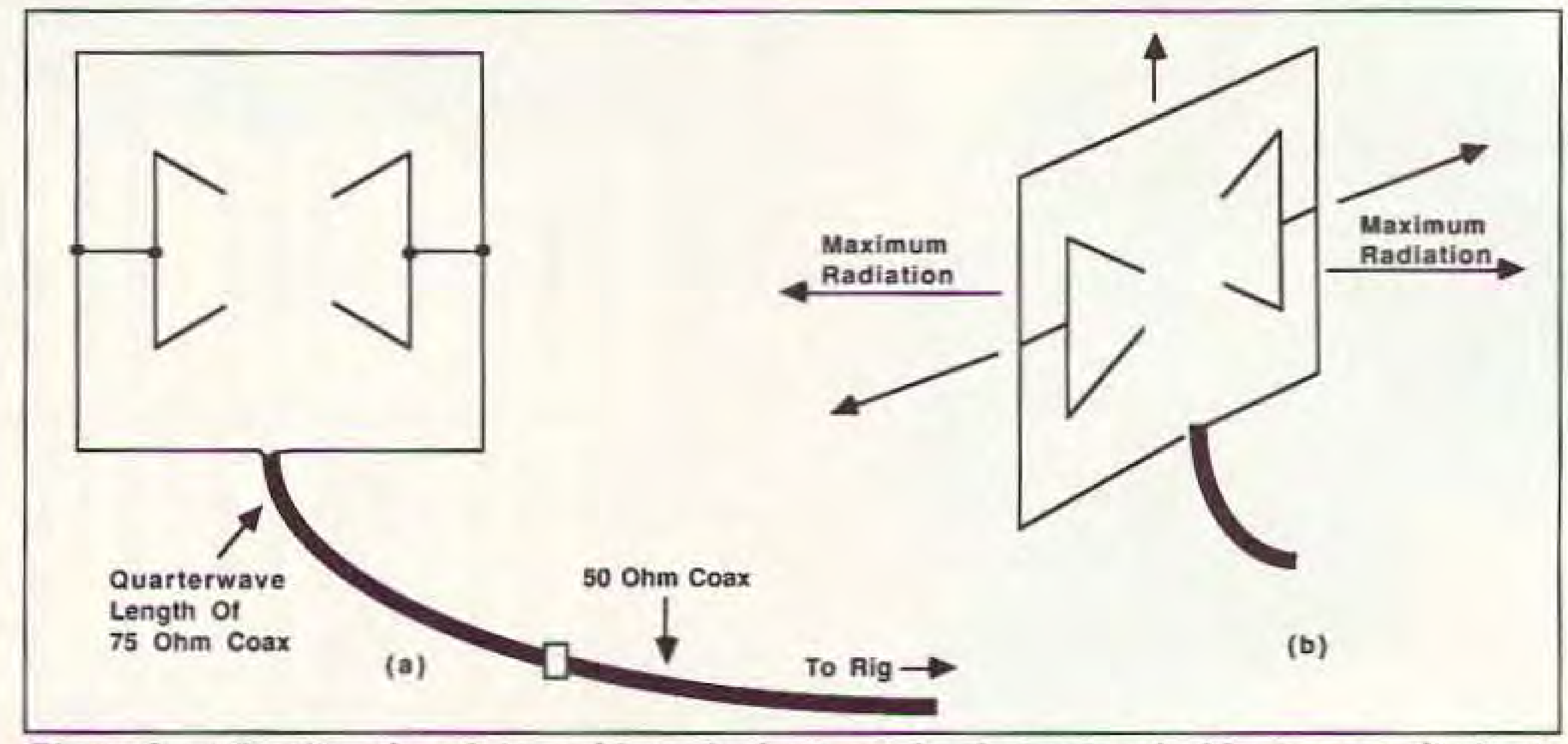

Figure 2. a) Feeding the mini-quad loop for horizontal polarization. b) Maximum radiation is off of the plane of the loop.

For low-angle radiation, the loop works best when mounted vertically and fed at the bottom, but if this is not possible, mount it horizontally and you can still communicate better than with a dipole. (Inspection of radiation patterns shows that while there are low-angle lobes for a mini-quad loop when mounted vertically, there is also considerable radiation in the plane of the loop. Many hams believe full-wave loops only radiate perpendicularly to the loop plane. This is just not so, and my personal experience confirms this.)

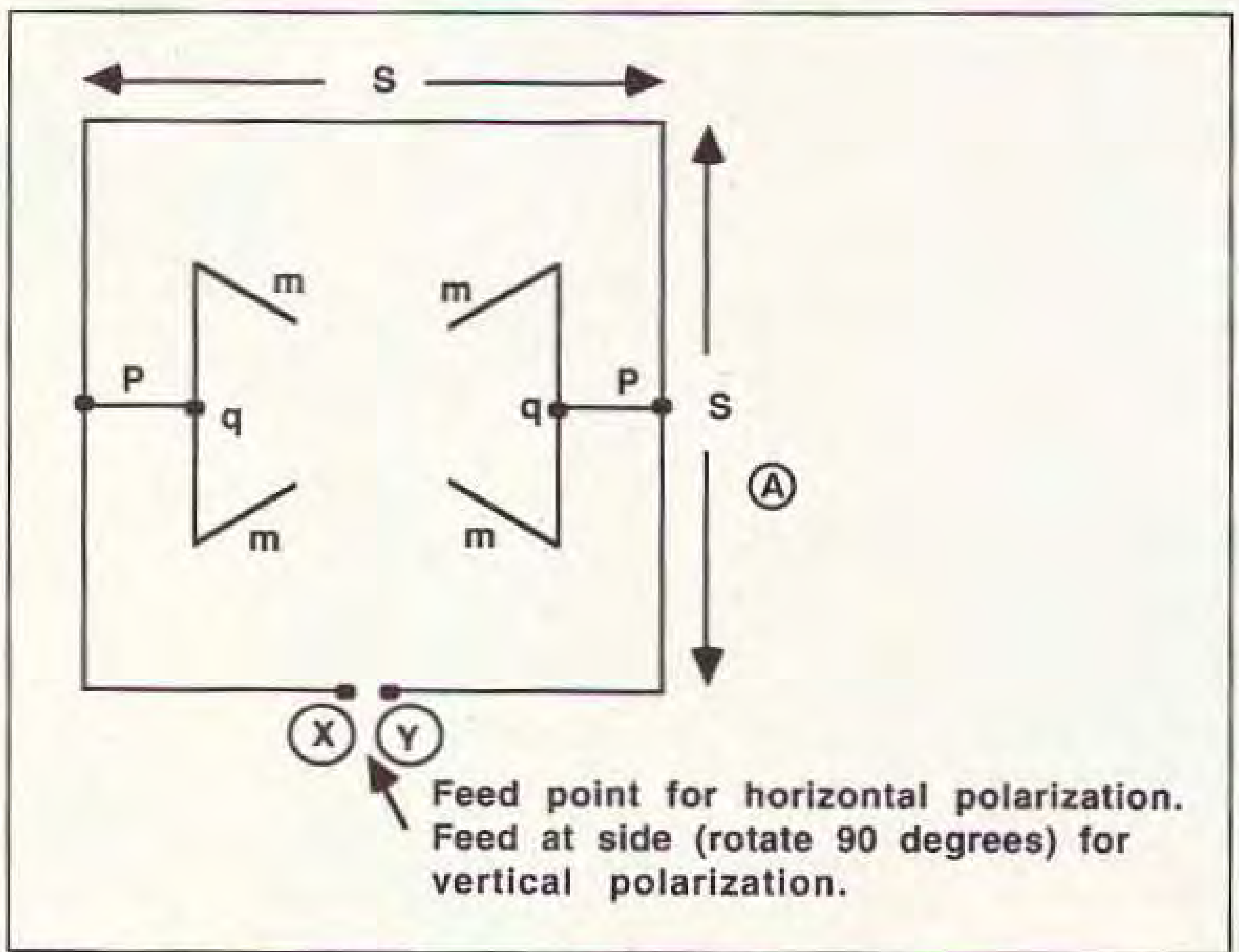

Figure 1. Diagram of mini-quad loop. See Table 1 for measurements.

Mounted in the vertical plane, you'll have to arrange to rotate (point) the broad side of the loop; horizontally mounted, the radiation is omnidirectional. (Height and visual impact restrictions in my planned neighborhood preclude my outdoor loops being vertical . . . but I've had good success with them mounted more or less horizontally on the roof with a few inches of "standoff," and also hung vertically on walls in the house. With a mini-quad loop on my living room wall inside the house, I have communicated as far away as Minnesota from Hawaii, with 5 watts on 12 meters.)

Construction

The dimensions shown in the tables are for wire mini-quad loops, 2-40 meters. Parameters S, p, q, and m are defined below:

S = side length, feet (The loops are square.)
p = capacitance hat inset, feet
q = capacitance hat length, feet
r = capacitance hat fold-in leg, feet
(Or inches if so specified.)
See Figure 1.

For the ambitious (those desiring to build a mini-quad loop for 80 or perhaps 160 meters, or for tailoring for a different portion of a band, such as 10 meters) the following formulae are provided:

$$S = \frac{147.917}{f\,(\text{MHz})} \text{ feet}$$

p = 0.128 x (S) feet
q = 0.774 x (S) feet
m = 0.304 x (S) feet

I feed the mini-quad loop with 50 ohm coax from the rig, terminating in a quarter wave of 75 ohm coax at the antenna feed point. For example, on 40 meters, 7.15 MHz, with 75 ohm coax (Velocity Factor = 0.75), a quarter wave is:

$$\frac{246(0.75)}{7.15\text{ MHz}} = 25.804 = 25'\ 9\ 5/8"$$

See Figures 2a and 2b.

At the feed point, one end of the loop connects to the 75 ohm coax center conductor, the

Continued on page 14

Mini Quad Loops

Continued from page 10

other end to the braid side. Or, you can use an S.O. connector mounted in a convenient manner (I use PVC strips).

Apartment/Condo Dwellers and/or New Hams

See Table 1 for 10 meter dimensions, Table 2 for 2 and 6 meter dimensions.

It is a simple project to mount a mini-quad loop on the wall or ceiling in an apartment, or in the attic of a house. A loop can easily be set up around a picture frame. Small wire, two or three inches of standoff from the wall, some white paint, and/or curtains or a large picture, etc., can be used to make the loop invisible and yet still be effective.

Summary

You'll get 2-3 dB gain over a dipole, and notice much quieter reception. Build the mini-quad loops according to the dimensions supplied. Trim the capacitance legs only as necessary to achieve resonance (lowest SWR at feed point) if metal, wiring, wood, etc., in the near field of the loop cause detuning. The mini-quad loops can form the driven elements of two- or three-element cubical quad beam antennas.

Quad loops don't have to be large to be good performers. And they are "quiet."

NOTE: Mini-Quad-Loops have been constructed, tested and used on 2, 12, 20, and 40 meters, with the data of Tables 1 and 2, with good results. Initial SWRs in all cases, at the feed point, were at worst 1.5:1. Adjustment of the angle between p and m allows improvement in SWR. In each of these cases the relationships for S, p, q, and m given in the text worked—e.g.:

$$S = \frac{147.917}{f\ (MHz)}$$

The table values for 5, 10, 15, and 30 meters are derived, but based on the experiments on 2, 12, 20, and 40 meters, I have no reason to believe that the derived data is not good data.

Acknowledgements: L.A. Moxon G6XN, *HF Antennas For All Locations*, reference to capacity hat loaded mini-quad by G3YDX.

$$S = \frac{147.917}{f\ (MHz)} \text{ feet}$$

p = 0.128 (S) feet x 12 = inches
q = 0.774 (S) feet x 12 = inches
m = 0.304 (S) feet x 12 = inches
T = Wire needed to build mini-quad-loop (includes extra for joint-wraps), feet
B = Approximate bandwidth, kHz

Band (meters)	10	12	15	17	20	30	40
Frequency (MHz)	28.400	24.940	21.225	18.118	14.150	10.125	7.150
S (feet, inches)	5' 2-1/2"	5' 11-3/16"	6' 11-5/8"	8' 2"	10' 5-7/16"	14' 7-5/16"	20' 8-1/4"
p (inches)	8"	9-1/8"	10-11/16"	12-9/16"	16-1/16"	22-7/16"	31-3/4"
q (inches)	48-3/8"	55-1/6"	64-3/4"	75-13/16"	97-1/16"	135-11/16"	192"
m (inches)	19"	21-5/8"	25-7/16"	29-13/16"	38-1/8"	53-5/16"	75-7/16"
T (feet)	37'	42'	50'	58'	74'	103'	146'
B (kHz)	400	350	300	250	200	150	100

Table 1. 10-40 meters

Band (meters)	2	6
Frequency (MHz)	147.00	52.00
S	12-1/16"	34-1/8"
p	1-9/16"	4-3/8"
q	9-5/16"	26-7/16"
m	3-11/16"	10-3/8"
T	8'	20'

Table 2. 2 and 6 meters (S, p, q, m, and T as previously defined).

Copper Dual-Band Super J-Pole Antenna

Build it in less than an hour.

by Marty Gammel KAØNAN

While looking for an antenna project to build I remembered seeing a Marine antenna called the Super J-Pole in the 1988 *ARRL Antenna Handbook*, which claimed a 6 dB gain over a quarter-wave ground plane. I didn't have a machine shop at my disposal to fabricate the parts shown in the Marine antenna article so I set about redesigning the antenna using materials that were easy to find and work with. I have had very good results working with copper J-poles, so I built my refined version of the classic J-pole. I then added a short insulating section, the extra half wave of vertical length, and the needed half-wave matching stub.

Materials

All the materials except the S0239 fitting can be found at any good hardware store, and the whole antenna can be made in less than one hour.

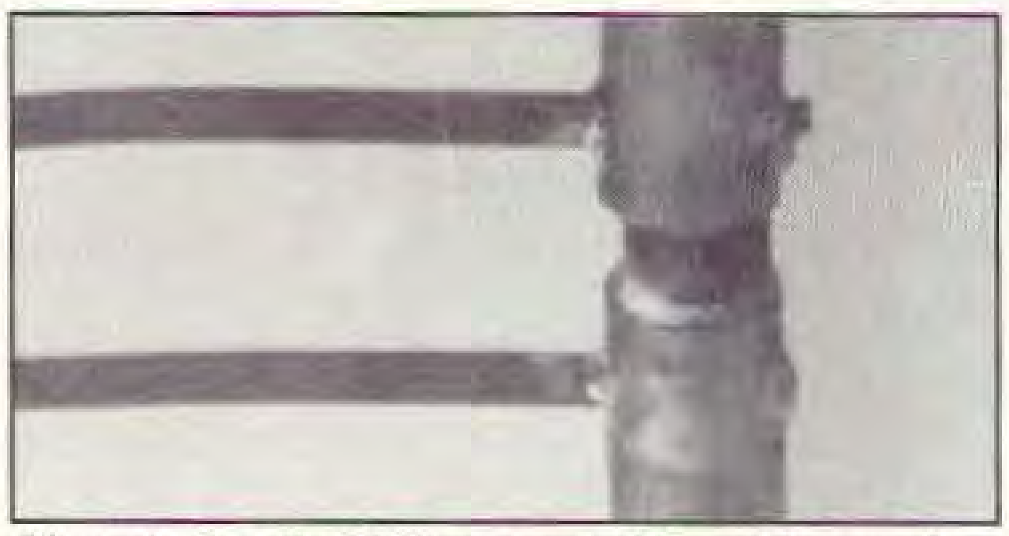

Photo A. Detail of 1/2 wave matching stub mounting.

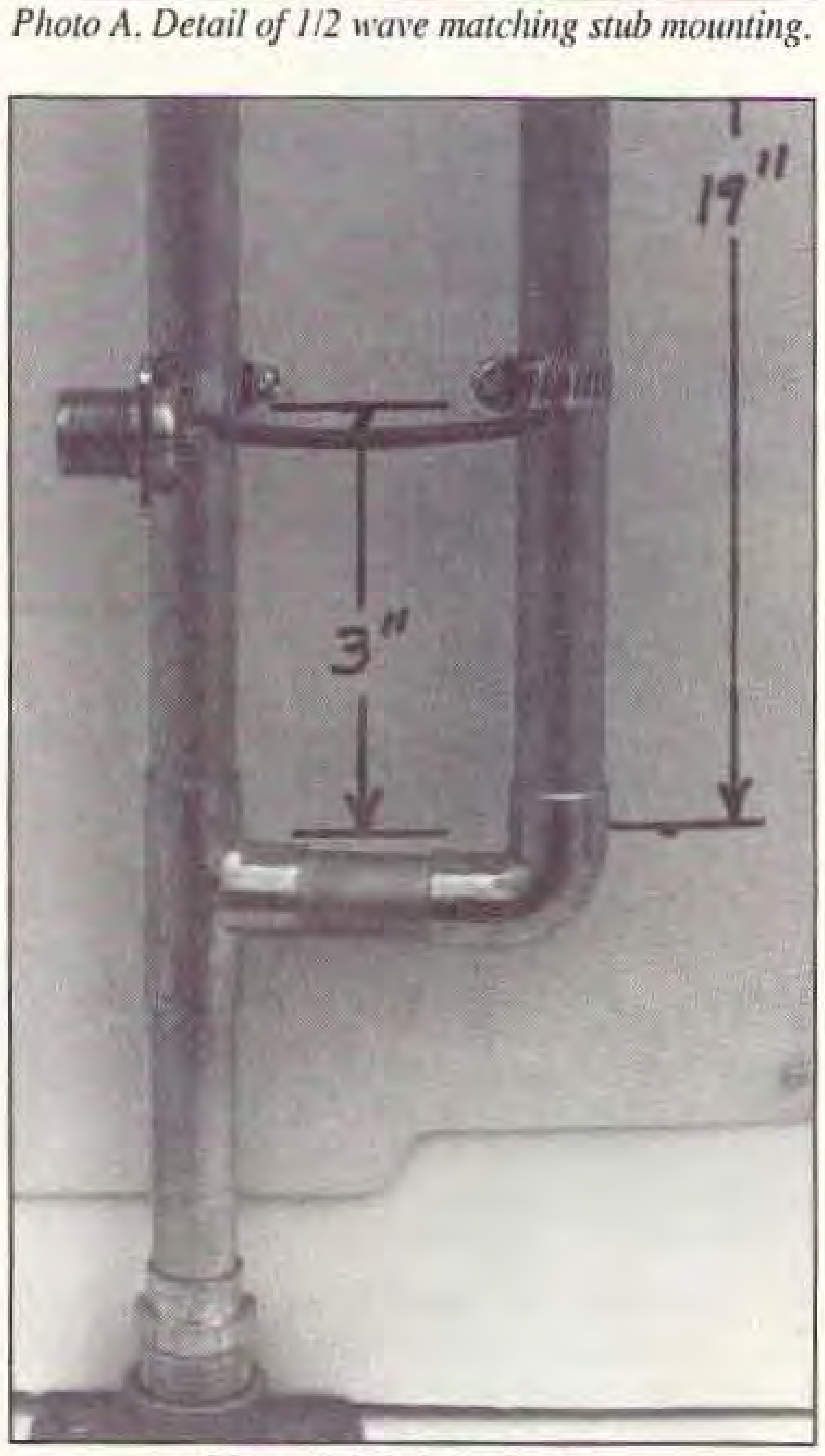

Photo B. J-Pole feed point.

In my design I use 1/2" copper schedule M tubing and 1/4" soft copper tubing. I had experimented with using a Teflon insulator, but have since changed my design to use a 9" length of hardwood dowel with three coats of lacquer as the insulator, for more strength.

Clean all the tubing, and then from the 1/2" tubing cut one piece each of the following lengths: 57-1/2"; 38"; 19"; 2", and a piece about 3" long for a stub to mount the antenna. In addition to the tubing, buy a 1/2" elbow, a 1/2" Tee, two 1/2" end caps, a 1/2" threaded fitting, and a cast iron floor flange for mounting. Get a piece of 3/16" or 1/4" soft copper tubing 42" long. Find the center of the 1/4" tubing and bend it around a 1"-to-1-1/4" diameter water pipe or dowel.

Put the Heat to It

Now fire up the torch and start the assembly process from the bottom up. See Figure 1. Use flux on all joints, solder the 1/2" threaded fitting to the mounting stub, and solder the 1/2" Tee fitting. Then proceed with the 57-1/2" section, 2" cross piece, and 19" section. Pay close attention to getting the 19" piece parallel to the 57-1/2" piece. After these have cooled, drill through both the 57-1/2" section of 1/2" tubing and the hardwood dowel about 1/4" from the top end of the 1/2" tubing, and the bottom of the 38" section of tubing. (See Photo A.) Then insert the 1/4" tubing through the 1/2" tubing and dowel assembly. Sweat solder the 1/4" tubing to the 1/2" tubing and sweat solder the end caps. After these have cooled, clean the entire antenna, bend the half-wave matching section to a half circle of about 4" radius around the antenna to help the balance and match.

Simplify the Feed Point

The feed point also needed to be made simpler, so I elongated one of the mounting holes of a panel mount SO-239 fitting and inserted a stainless steel adjustable band clamp. This goes on the 57-1/2" long section of 1/2" tubing. A short 2-3/4" length of #14 copper stranded wire is soldered to the center terminal to go over to the 19" section. I used another stainless clamp to attach this. (See Photo B.) While experimenting to find the proper feed point, I found that the distance above the crossbar should be about 3".

Building Suggestions

1. You may use a Fiberglas rod as an insulator, but you will have to be very careful with the torch or you may weaken or burn the rod, or make it brittle.

2. When cutting the 1/2" copper tubing, cut the 57-1/2" piece from one end of the 10' length, and the 38" piece from the other end. By doing this you will have factory-cut edges for inserting the 1/2" dowel.

3. Be sure to keep the flame of the torch away from the insulator to avoid burning it.

4. Use paste flux on all joints when fitting the pieces together. Use enough flux, since you will be cleaning the entire antenna with solvent after assembly.

5. Use a weight to hold the 19", 57-1/2", and 2" pieces, and the Tee and the elbow, flat when they are sweat soldered together.

6. Use a ruler or caliper to check the spacing

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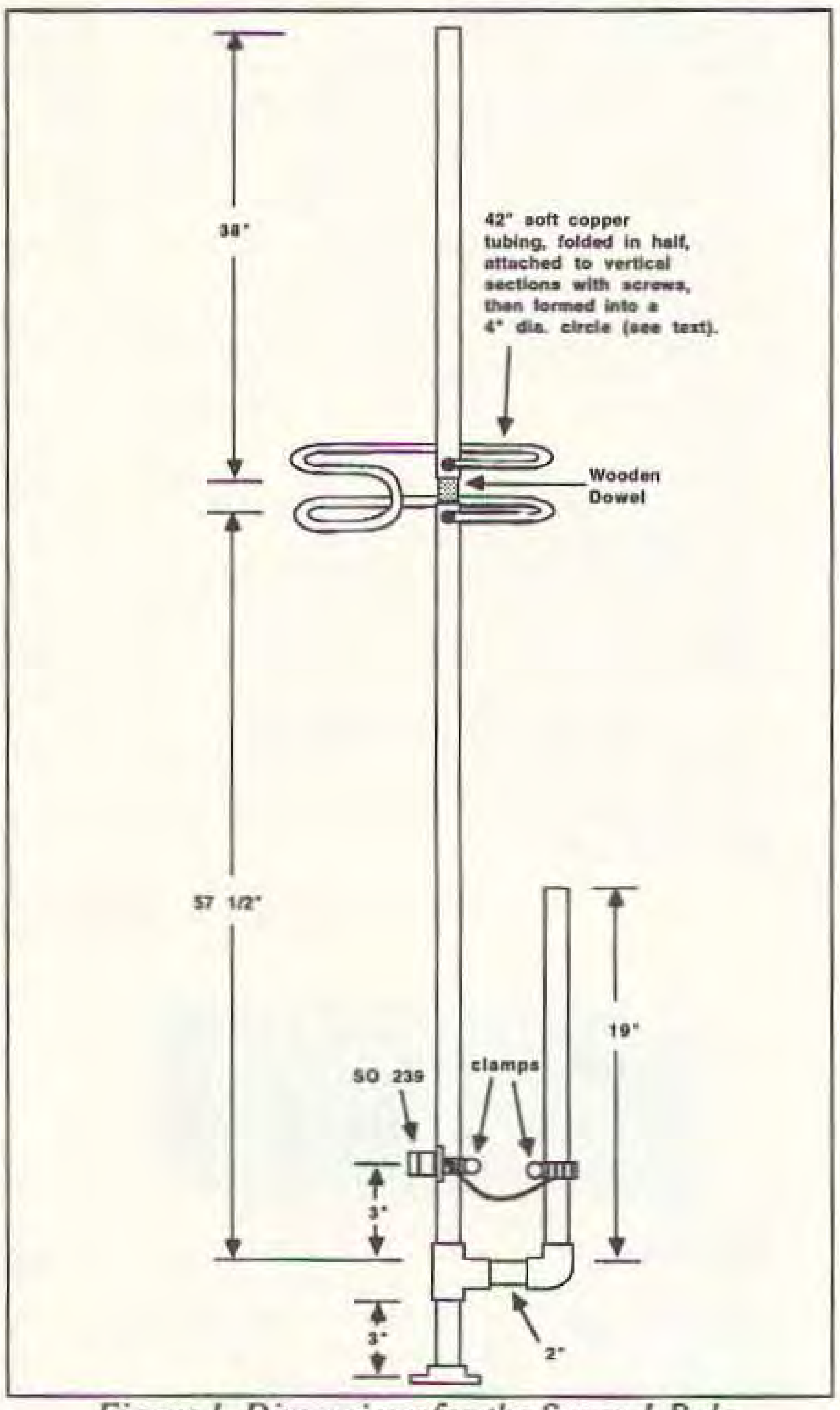

Figure 1. Dimensions for the Super J-Pole.

Copper Dual-Band Super J-Pole Antenna *Continued from page 12*

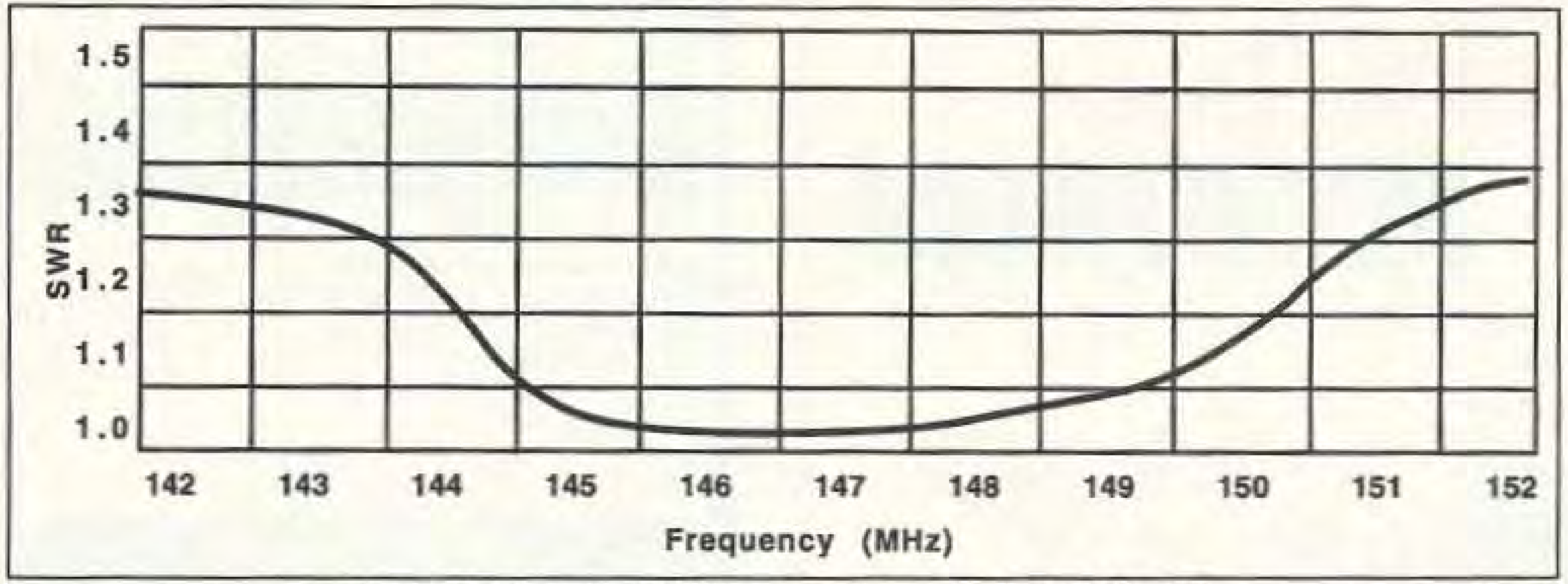

Figure 2. Antenna SWR curve chart for 142-152 MHz.

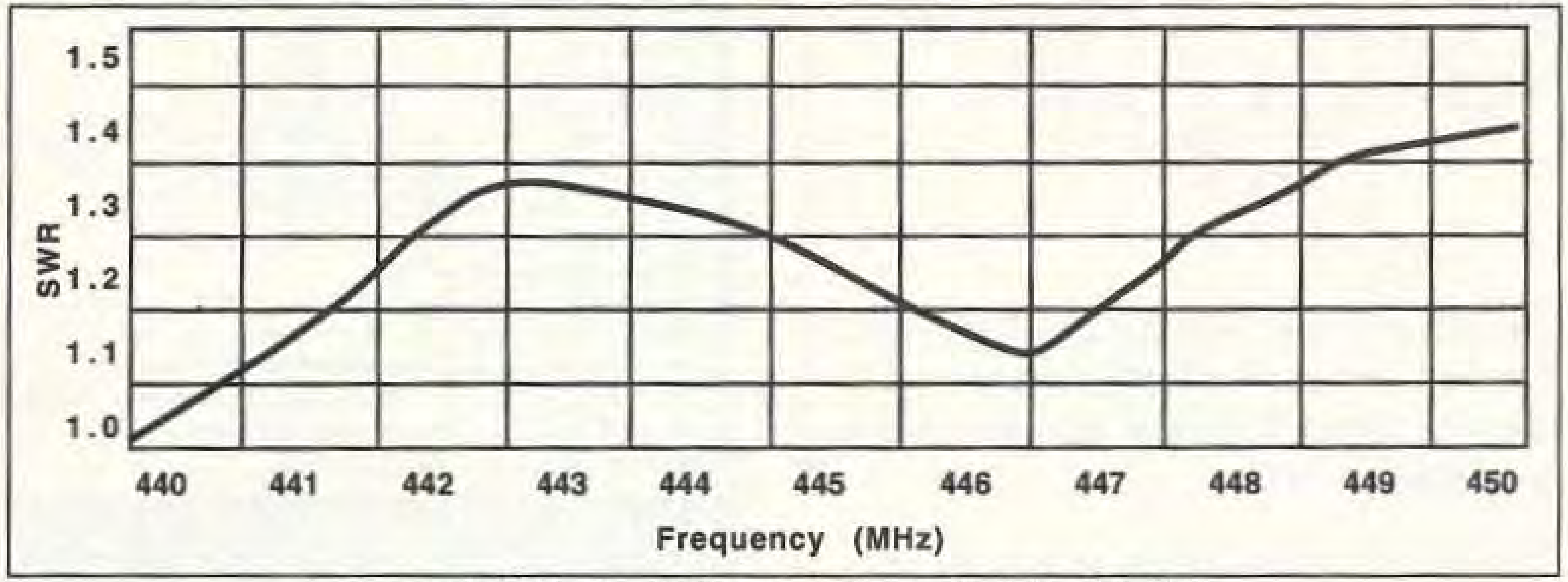

Figure 3. Antenna SWR curve chart for 440-450 MHz.

between the 19" and 57-1/2" pieces, to keep them parallel to each other.

7. When drilling the SO-239 fitting, use a drill press. Be careful not to drill into the threads of the fitting. After the holes are drilled, file the opening flat for a better band clamp fit.

Parts List

1	10-foot section of schedule M 1/2" copper tubing
1	1/2" copper elbow
1	1/2" copper Tee fitting
2	1/2" copper end caps
1	1/2" copper threaded fitting (for mounting)
1	1/2" cast floor flange (for mounting)
1	Piece of 3/16" or 1/4" soft copper tubing 42" long
1	Piece of 1/2" hardwood dowel or Fiberglas rod
1	SO-239 panel mount coaxial fitting
1	Piece of #14 stranded copper wire
2	3/8" by 7/8" stainless band clamps

Tools needed:

- Tape measure
- Tubing cutter
- Propane torch
- Solder and flux
- Electrical tape
- Caulking compound
- Screwdriver
- A weight to keep parts aligned while soldering
- Steel wool or a Scotch Brite pad (for cleaning all copper)
- Spray can of clear exterior lacquer (to finish-coat completed antenna)

8. After the best match has been found, you may want to solder the SO-239 and the stranded wire end to the 1/2" tubing.

9. When the antenna has been cleaned and matched, spray the entire antenna with a coat or two of clear lacquer to keep it looking nice.

10. After everything else has been done, apply silicon or a butyl rubber compound to the insulating section, then cover the joint with electrician's tape for a weathertight seal.

11. A 1/2" pipe coupling and a length of pipe may be used in place of floor flange for mounting in a roof tripod. ■

10 Meter X-Beam

Upgrade your antenna as well as your license.

by John E. Williams N5SJZ

After a year as no-code Techs, my wife Debby N5SKA and I decided it was time to upgrade to Tech-plus and work some DX. With help and encouragement from Joe Nunnamaker KD3VR, passing 5 wpm was much less of a chore than we had imagined. The big day was here and we had our 5 wpm Certificates of Successful Completion in hand; it was time to work the world.

I had previously purchased a small 10 meter rig and had put up a simple 10 meter horizontal dipole in anticipation of this day. Over the next few weeks, even though I made several contacts, I was not happy with the results. I felt it was time to upgrade my antenna. First I considered several commercial antennas. However, I had caught the bug for homebrewing with a 2 meter amplifier kit and had met Joe in the process, but that's another story. Since this was my first antenna project, I wanted it to be simple, high performance, and low cost. At first my criteria seemed mutually exclusive, but then I came upon an article in the *ARRL Handbook* by Brice Anderson W9PNE concerning X-Beam antennas. I spoke with Joe and told him my idea. He enthusiastically agreed to lend his expertise and help with the project.

Materials

I wanted to construct the antenna with materials I could locate at the local hardware store. So, with Joe and Debby, I paid a visit to the hardware store. For the X-beam arms, we considered aluminum and copper. We selected copper tubing for several reasons. First, copper is less than half the price of aluminum. Second, unlike aluminum, copper can be soldered-to directly. And finally, copper has a lower resistance to radiation, perhaps giving a slight performance edge. For the center support we chose a 1/2" thick, 2' x 2' square precut piece of plywood.

After purchasing the necessary materials on a Saturday, we planned to build and put the antenna on the air the next Saturday. All the materials for the antenna cost less than $40.

Construction

The first step is to prepare the copper tubing and plywood. Cut the four 8' pieces of the copper tubing to 6'11" with a pipe cutter, then use extra-fine steel wool to polish the copper tubing to remove oxidation and let the beauty of the copper show. To ensure that the antenna will continue to look good and resist the elements, apply several coats of a spray-on acrylic protectant to the copper tubing. Prepare the plywood with two or three coats of weatherproof paint, allowing two days of drying time between each coat. Next week, the plywood and the tubing will be ready to go.

The first step in actual construction is to draw an X on the center board where the copper tubing arms will go. After drawing the X, measure 2.25" from dead center on each line. This is where the end of each arm is placed on the board. Place the pipe brackets over one arm and use this arm as a guide for marking holes for the bracket bolts on each line. Next, drill the holes for the brackets and a 1.25" hole at dead center for the mast. If you are using a larger or smaller mast you should adjust the center hole size accordingly.

The next step is to drill a small hole on the

Photo A. The construction team with materials. Left to right: John Williams N5SJZ, Debby Williams N5SKA, Joe Nunnamaker KD3VR.

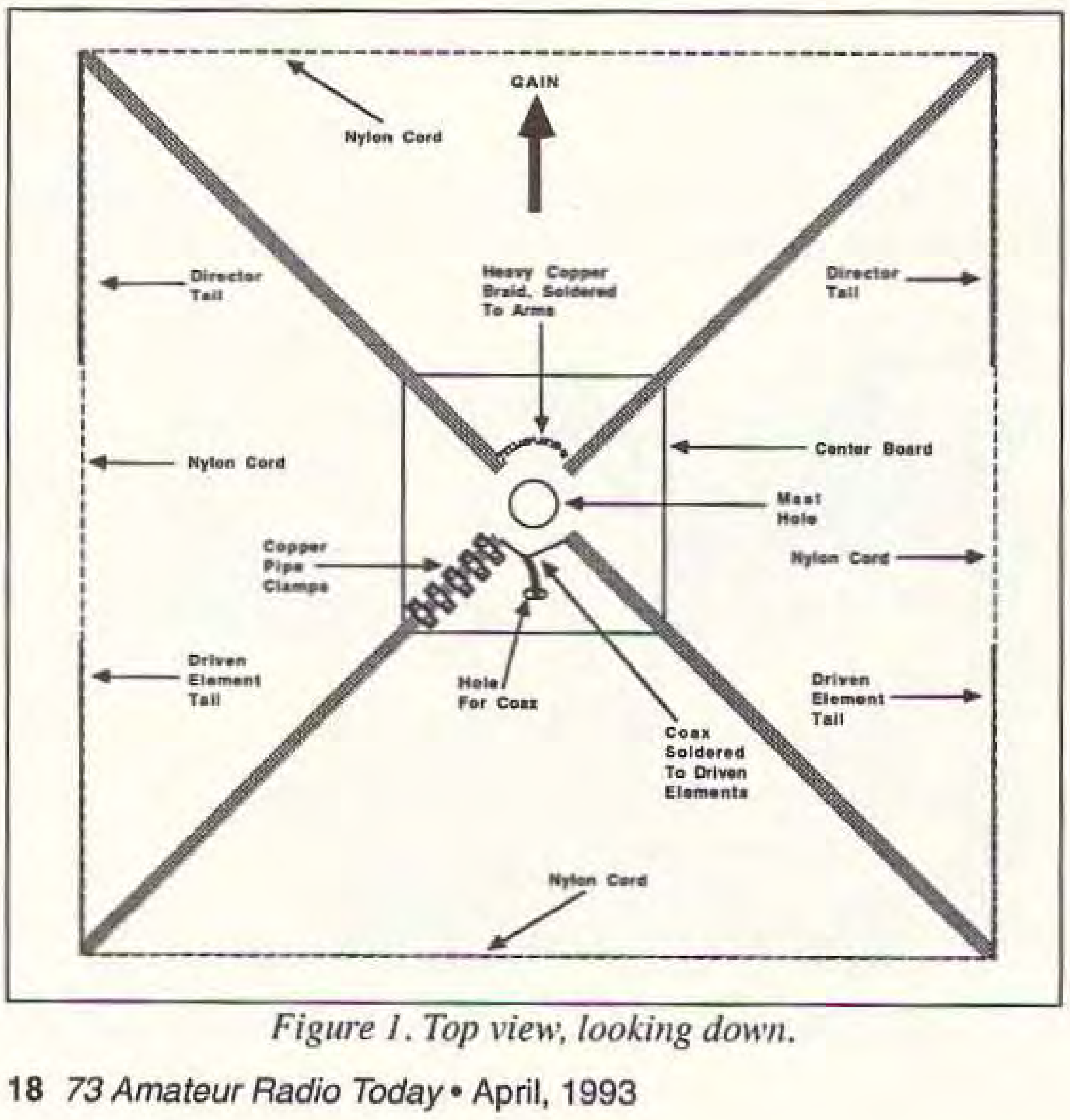

Figure 1. Top view, looking down.

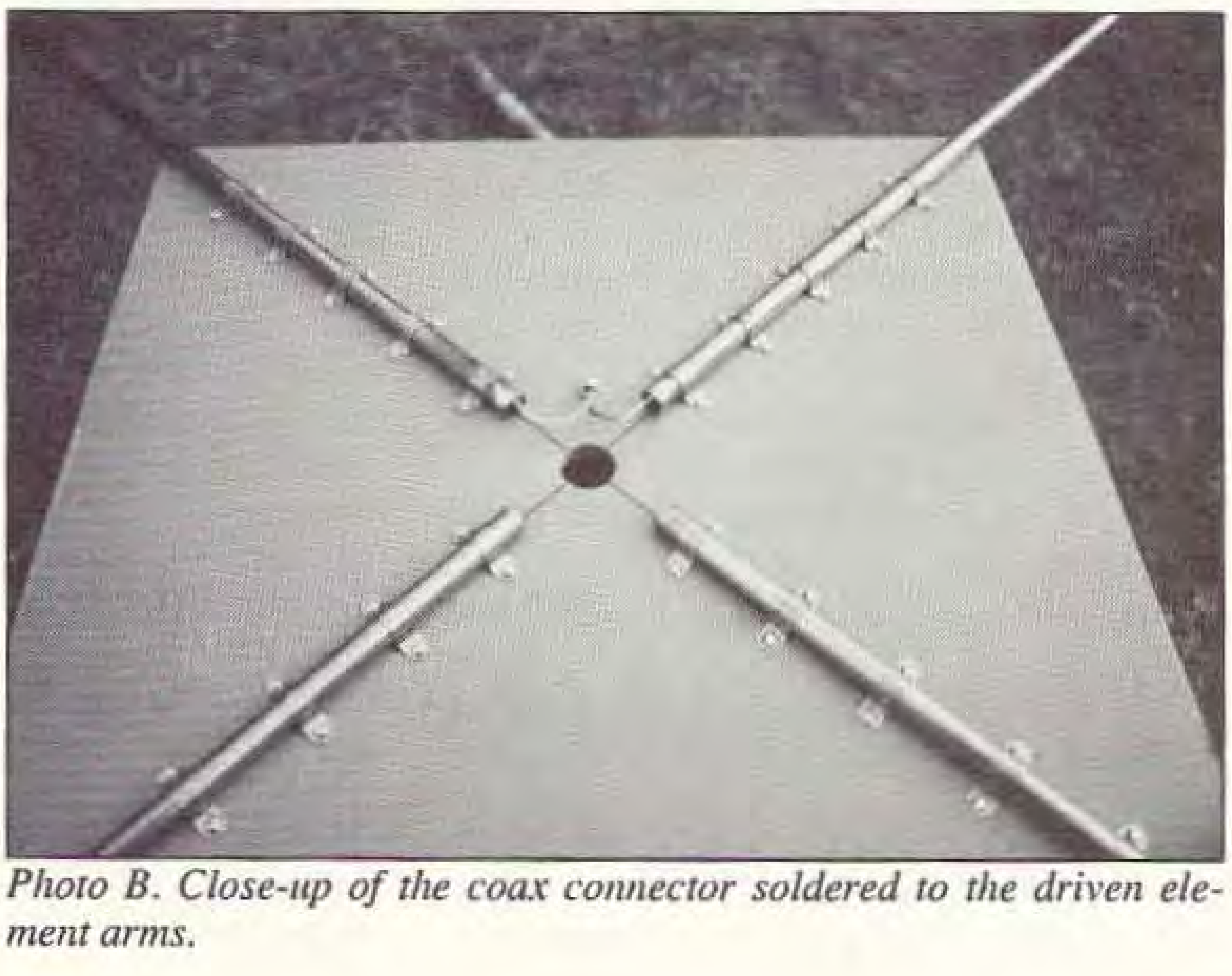

Photo B. Close-up of the coax connector soldered to the driven element arms.

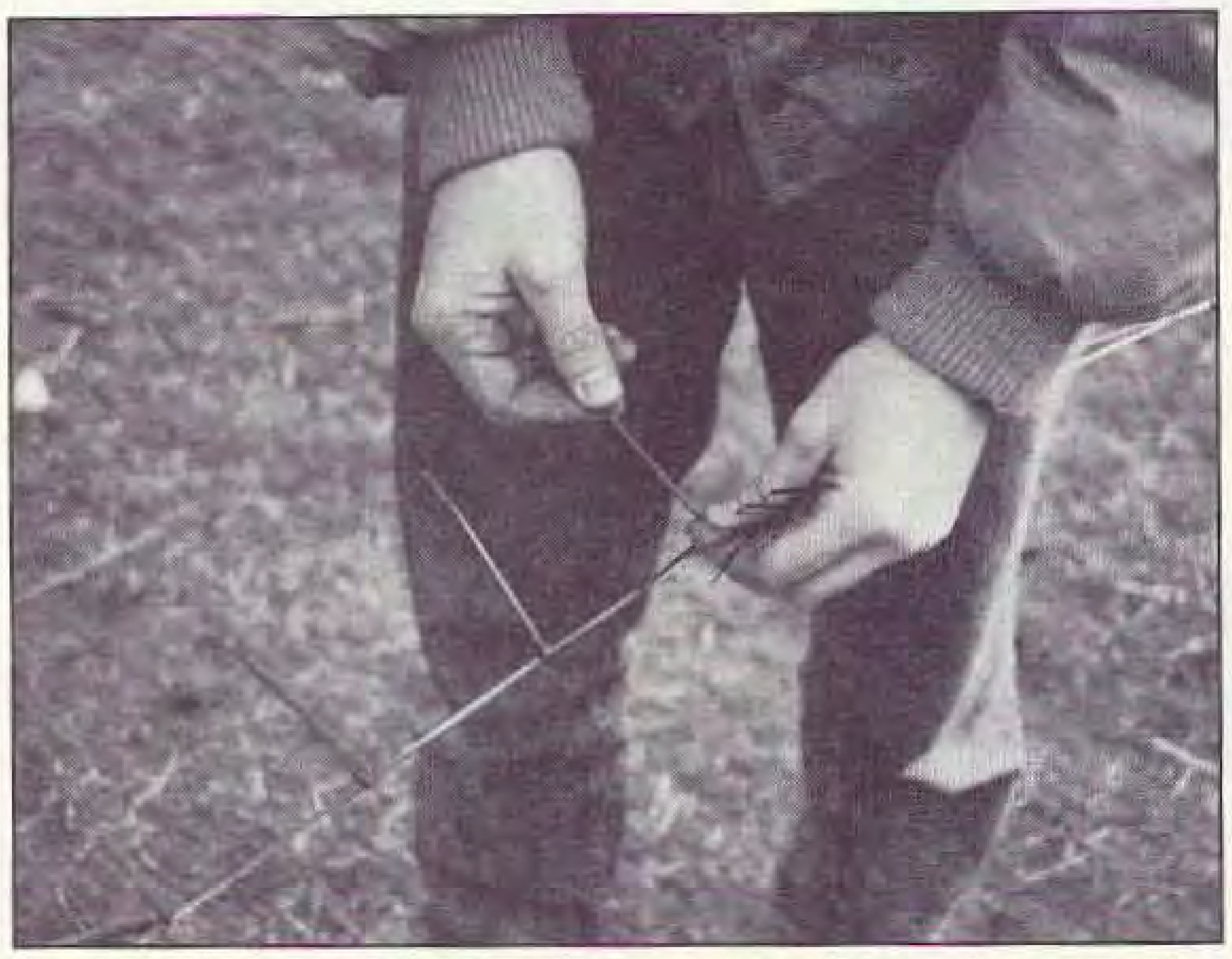

Photo C. Using plastic wire ties to secure tails to nylon supporting cord.

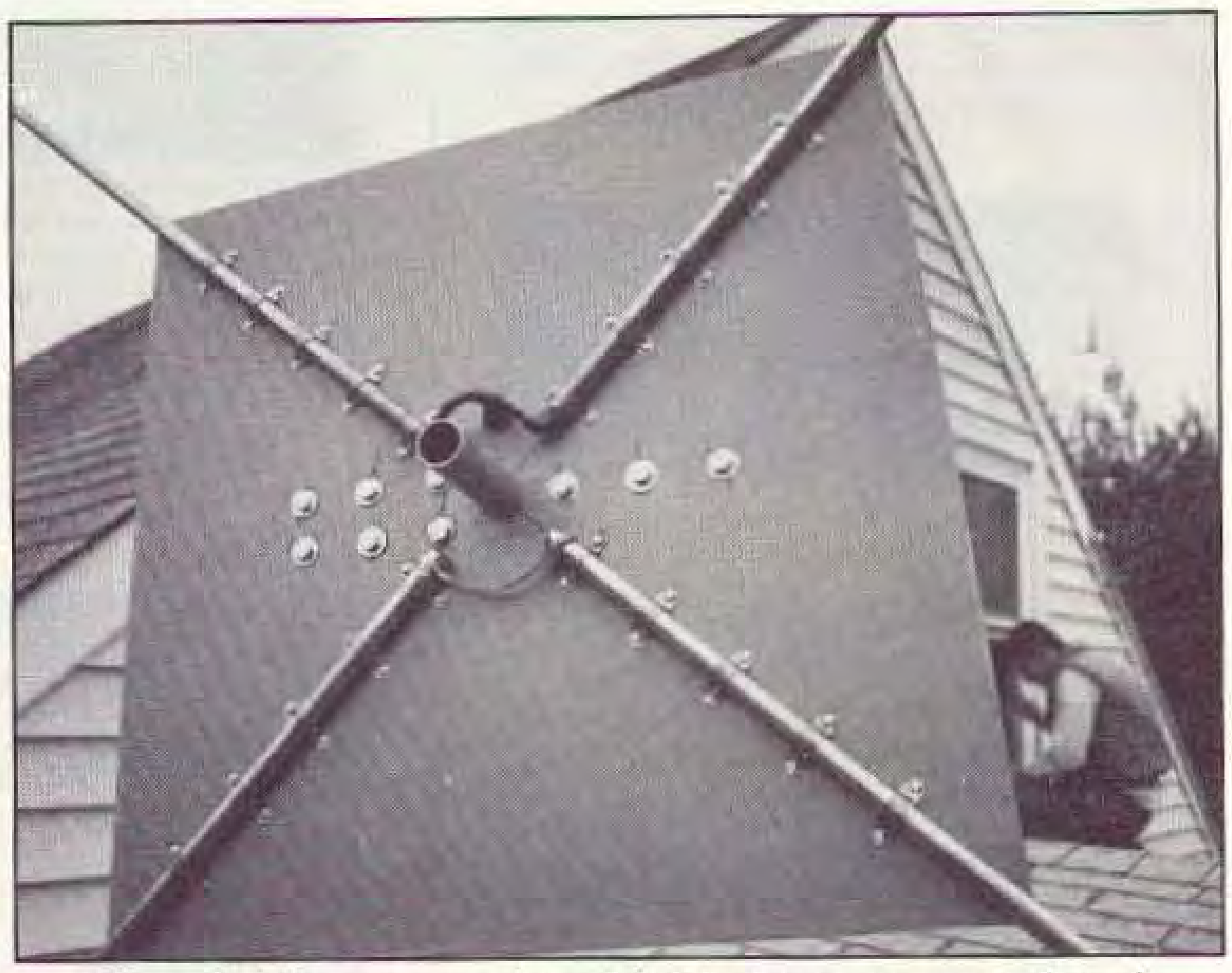

Photo D. Close-up top view of finished antenna center board.

center board between two arms. It makes no difference which two arms you choose at this point since they are all the same length. Route the pigtail coax connector (or plain coax) through the center board and solder the inner conductor to one arm and the outer braid to the other. These now become the driven arm elements. To ensure the best contact, clean the areas on the arms to be soldered with steel wool to remove the acrylic protectant previously applied. Since the weather was somewhat cold, we used a propane torch for soldering instead of a soldering iron. Since we were concerned that the paint would be blistered by the heat, we solved this potential problem by placing a double thickness of aluminum foil under the arms when soldering close to the center board. After soldering the coax connector, solder a heavy piece of copper braid to the other two arms. The arms connected with copper braid become the director arms.

Now that the driven element and director arms have been determined, it's time to solder the element tails to the ends of the arms. Since the element tails will not be under stress, we chose 16-gauge enamel-coated solid copper wire instead of Copperweld wire. Start with each driven element tail 36" long and each director tail 30" long. If you use aluminum tubing or smaller gauge wire you will need to start with each element tail 12" longer to ensure that the antenna can be tuned. If using coated wire, carefully scrape away about 1" of the enamel coating at the ends of the wire to be soldered. To ensure a durable connection, bend the ends of the wires in 1", then solder them parallel to the arms.

To provide support for the element tails, use nylon cord strung through the ends of the arms. To prepare the arms for the cord drill two 1/8" holes, located 1/2" from the ends of each arm, parallel with the center board. Pass one length of nylon cord through the holes, pull it tight and tie it securely. Place the element tails beside the nylon cord and use plastic wire ties to secure them to the cord. The cord not only supports the element tails, it also strengthens the entire antenna structure.

Mounting and Finishing

Now it's time to prepare the antenna for mounting. For good strength use three L-brackets to support the antenna. Place two brackets on one side of the center board and one opposing the other two. Start the L-brackets about 1" away from the edge of the center hole to allow for proper U-bolt placement. After marking and drilling holes, mount the L-brackets securely to the center board. After mounting the L-brackets, place the antenna mast through the center hole and secure the antenna to the mast with three U-bolts.

Now that the antenna is mounted, the next step is to form a current balun (RF choke). Form the balun by winding six turns of coax (directly below the center board) into a 6" i.d. loop. This keeps RF at the antenna and prevents stray RF from coming down the coax cable.

You are now down to the finishing touches to make the antenna last longer and perhaps perform better. Placing plastic wire ties around the coax directly above and below the coax feedhole in the center board will provide strain relief for the coax. Coax seal applied to exposed coax will keep water out and will prevent premature coax failure. Finally, to help ensure a longer life for the center board, apply touch-up paint to any small chips that resulted from drilling.

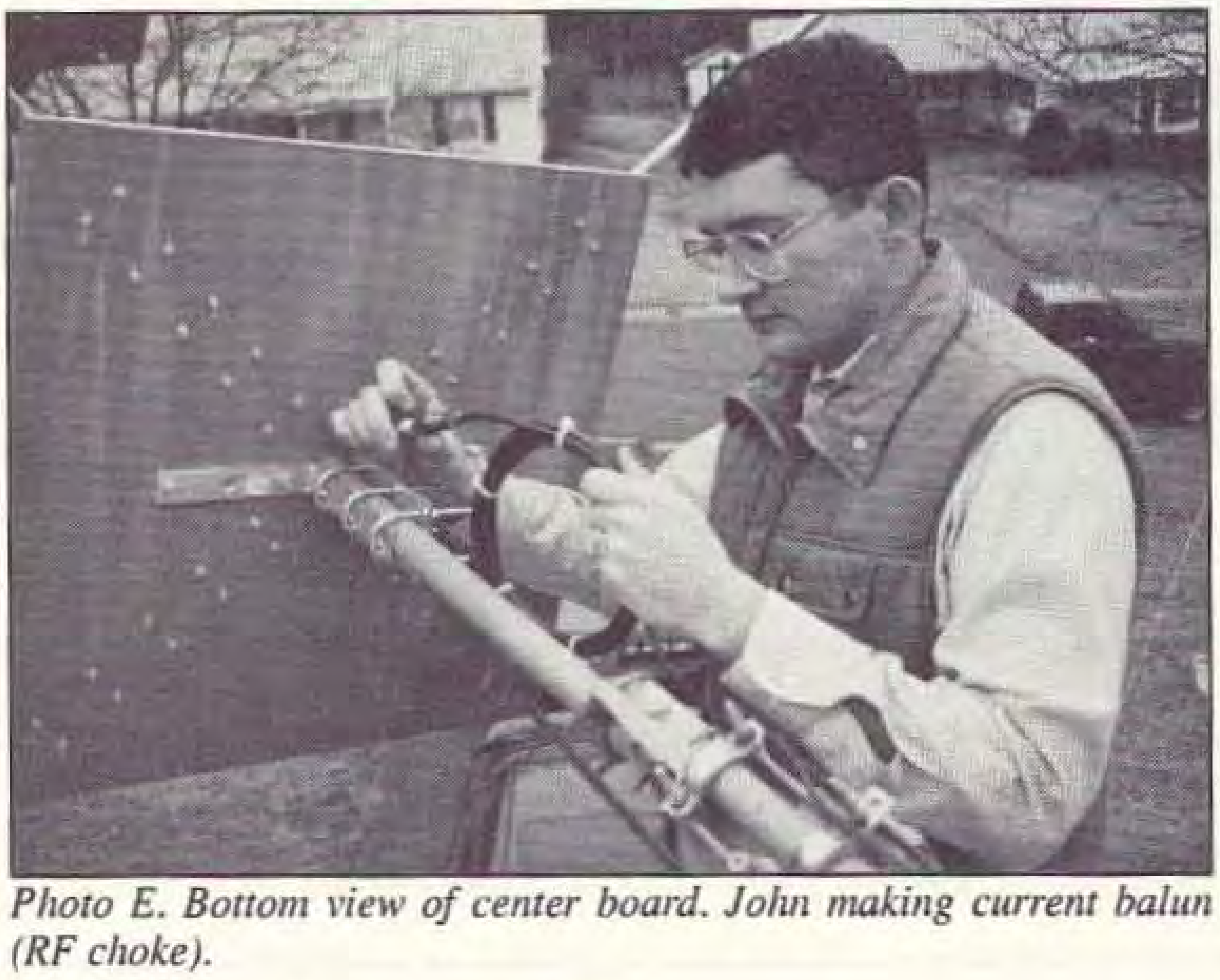

Photo E. Bottom view of center board. John making current balun (RF choke).

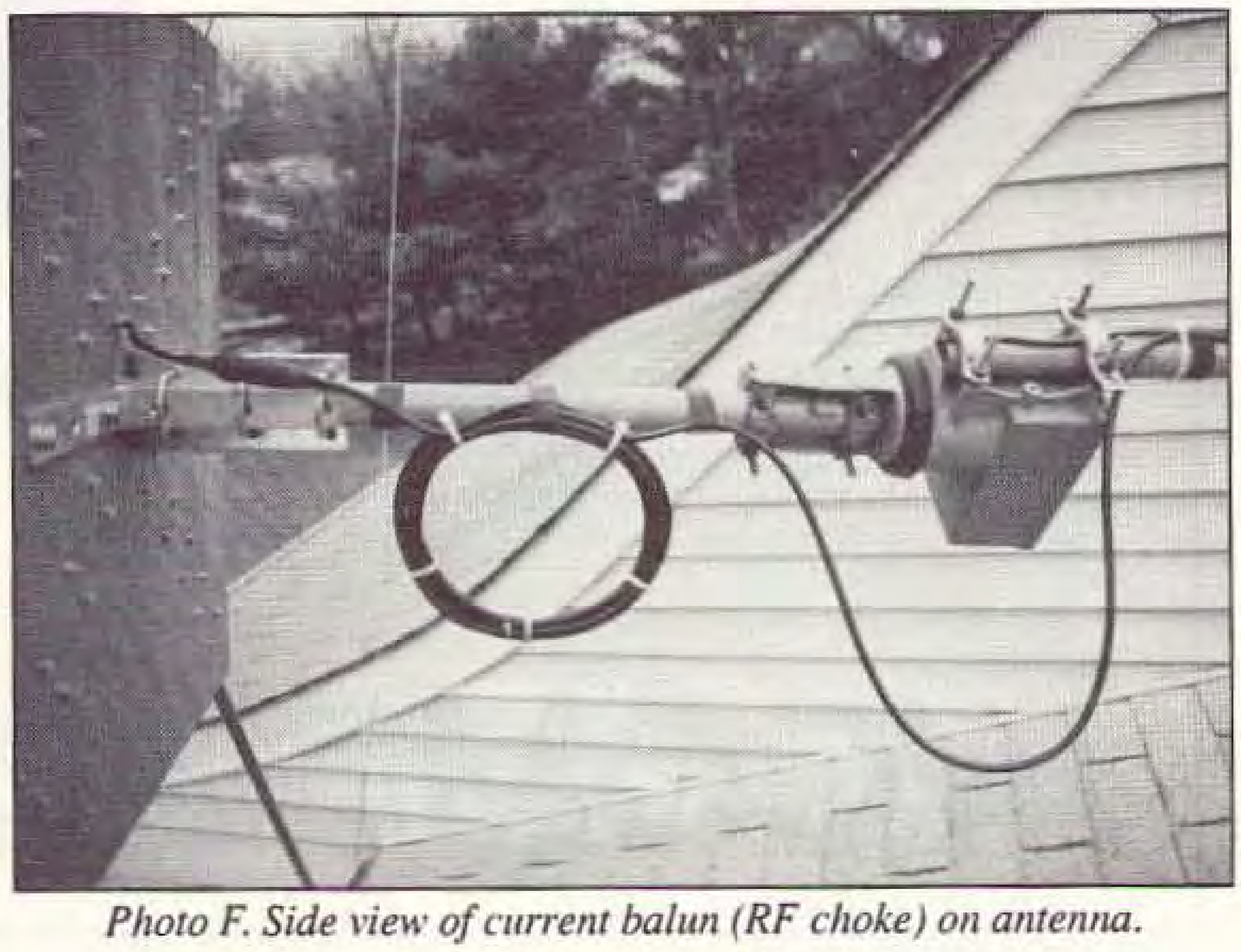

Photo F. Side view of current balun (RF choke) on antenna.

The final step before going on the air is tuning. First, remeasure each element tail. At this point the driven element tails are 36" and the director tails are 30". The driven element tails must be exactly 6" longer than the director element tails. If they are not the same, cut them to length. To tune the antenna, place it in its final position and measure the SWR. The antenna is tuned by taking the antenna down, cutting 1/4" off each tail, putting the antenna up, and remeasuring the SWR. It will most likely take several rounds of checking SWR, cutting the tails, and remeasuring SWR before the antenna is tuned. Our final measurement for each driven element tail was 34", while each director tail was 28". As shown in Table 1, the X-Beam antenna is usable from one end of 10 meters to the other! Since the tail lengths may vary according to the material used in the antenna construction, the antenna height, etc., it is much better to start with tails a bit too long and cut to size.

Performance

The X-Beam more than met my expectations. According to the *ARRL Handbook*, forward gain is about 5 to 6 dBd. Also, the angle of radiation seems very low. The first noticeable difference in performance was that we could hear many more DX stations than with the dipole.

Photo G. The finished antenna.

I have gotten reports of 2 to 3 S-unit differences from both stateside and DX stations, depending on where the beam is pointed. With only 25 watts, I have been able to work pile-ups to DX stations in Senegal, New Zealand, the Balearic Islands, Denmark and Japan, to mention a few. Now I have a fighting chance in pile-ups. Put one up and you will, too. 73

Parts List

4	Pieces 1/2" copper tubing, cut to 6'11" each
1	2-foot-square piece plywood
1 pint	Weatherproof paint for plywood
1 can	Spray acrylic protectant for tubing
15'	16-gauge copper wire
4"	Heavy copper braid
3	Heavy L-brackets
3	U-bolts
20	1/2" pipe clamps
40	Small bolts, 1/4" x 3/8"
9	Large bolts, 3/8" x 1"
	Nylon cord
	Plastic wire ties
	Coax-seal

SWR Measurements

Frequency	SWR
28.0	1.6
28.1	1.5
28.2	1.4
28.3	1.4
28.4	1.3
28.5	1.3
28.6	1.3
28.7	1.3
28.8	1.3
28.9	1.2
29.0	1.2
29.1	1.2
29.2	1.2
29.3	1.3
29.4	1.3
29.5	1.3
29.6	1.4

Lightweight, Collapsible Quad for 2 Meters

Excellent performance in a small package.

by Chester S. Bowles AA1EX

New England is blessed with numerous mountains and hiking trails. While our mountains aren't large by Western standards, they are interlaced with roads and trails that make them very accessible—a perfect opportunity for VHF/UHF mountaintopping trips.

I have been a licensed ham since 1967. However, when I purchased my first HT just a few years ago I discovered the pleasure of combining amateur radio with my occasional hikes through the woods. Of course, the elevation makes long-distance contacts easy. As an example, one of my most pleasant contacts occurred during a hike along the Wapack Trail, which has a trailhead just behind my house in Sharon, New Hampshire. Using the Mt. Greylock repeater in western Massachusetts, I had a long conversation with another hiker who was on the Appalachian Trail in Vermont. As we both huffed and puffed along our respective trails, we marveled at the technology that allowed us to communicate so easily across so many miles.

But using HTs on mountaintops presents some technical difficulties. Even using low power and a rubber duck antenna, keying the mike often opened up multiple repeaters. Hearing all those IDs come back was fun, but having any sort of contact was impossible. In addition, I was disrupting communications in multiple locations. The need for a directional antenna was obvious.

I began to think about various portable antenna options. However, my experience with directional antennas is very limited, so I invested $20 in the latest edition of the *ARRL Antenna Handbook*. It was a wise investment. The book is filled with technical information, along with numerous construction ideas. After reading the appropriate sections of the book and talking with some ham friends, my design began to take shape. Construction and tuning, however, turned out to be more difficult than I expected.

I chose to build a quad because of its inherent light weight and because (I thought) no matching would be required. Also, in theory, a two-element quad has more gain than a three-element yagi, making the boom length shorter and therefore more portable. My basic design was good. Construction was simple, the antenna collapsed as expected, and the weight was acceptably low. I quickly discovered, however, that at VHF frequencies the ratio between wire diameter and element length is crucial. Therefore, the formula for determining the length of a quad's driven element (1005/fMHz) did not work. Countless experiments with various gauge wires and element lengths left me no closer to success. I could not get the SWR below 2.8.

As it turned out, the solution was a simple stub-matching network using a trimmer capacitor. With that addition, the antenna matched perfectly, with SWR readings of less than 1.2 across the entire 2 meter band.

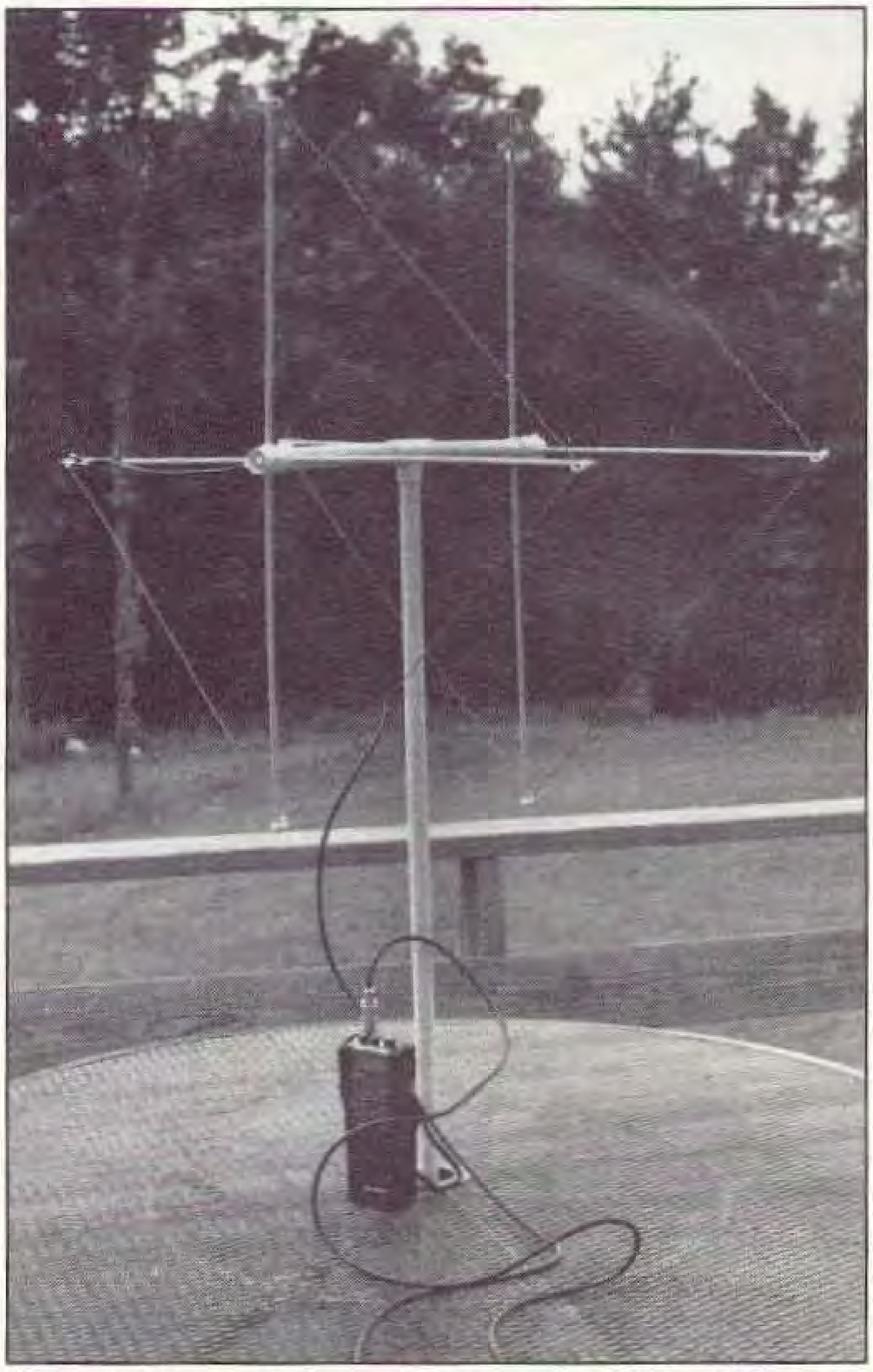

Photo A. The quad shown fully erected. Additional pieces of PVC piping can be added to the mast if more height is needed.

Construction

Construction of the quad is simple and takes very little time. Also, the materials are easy to find and inexpensive.

Start the construction by assembling the boom. The distance between the wire elements is not crucial; any length between 15" and 16" will work just fine. The boom consists of five pieces, as shown in Figure 1. The best approach is to cut two pieces of PVC piping, each about 7" long. Then assemble the boom and measure the distance between the spreader holes. Adjust the length of the boom by cutting off short sections of PVC piping until the total length is correct. Do not glue any of the connections or the antenna will not be collapsible. The parts will stay together by friction.

Next, drill 1/4" holes completely through the boom elements as shown in Figure 1. Note that one set of holes is in the coupling while the other set is in the 3/4" piping itself. This allows the spreaders to be rotated when collapsing the antenna. Drilling holes in PVC is perhaps the most difficult part of the construction. Use a nail or other sharp object to make an appropriate starting point on the PVC. Then, drill carefully, making sure the holes are straight and perpendicular to the PVC. Otherwise, the spreaders will be crooked.

Insert the 1/4" dowels through the holes. I used nylon ties to hold the dowels in place. Do not cut the dowels yet. That will be the last construction detail.

Select one set of wooden spreaders to be used as the reflector element and, using the nylon ties, loosely secure one plastic ring to each of the four spreader ends. Then, loosely secure one plastic ring to three of the spreader ends that will be used as the driven element. The plastic ring is not required on the fourth driven element spreader because

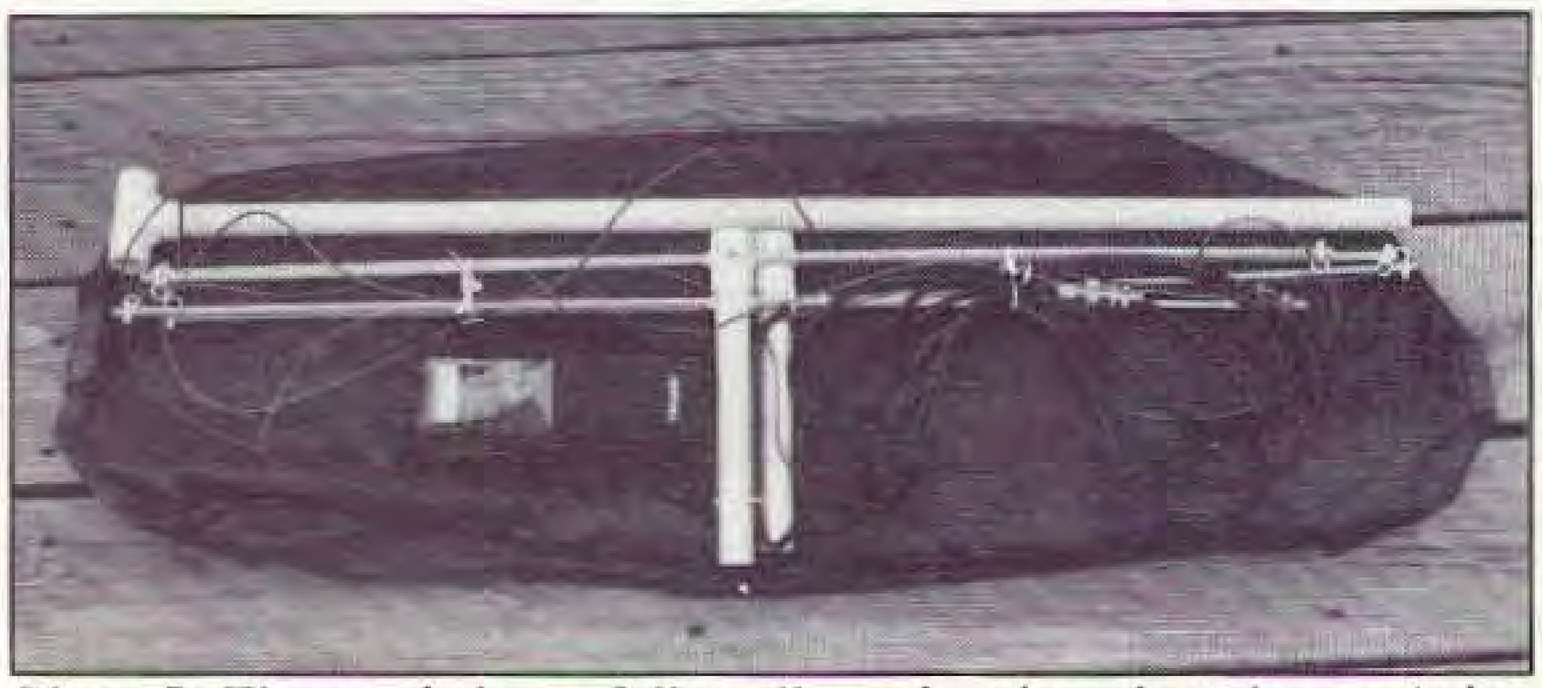

Photo B. The quad shown fully collapsed and ready to be carried to your favorite mountaintop. Note the HT for size comparison.

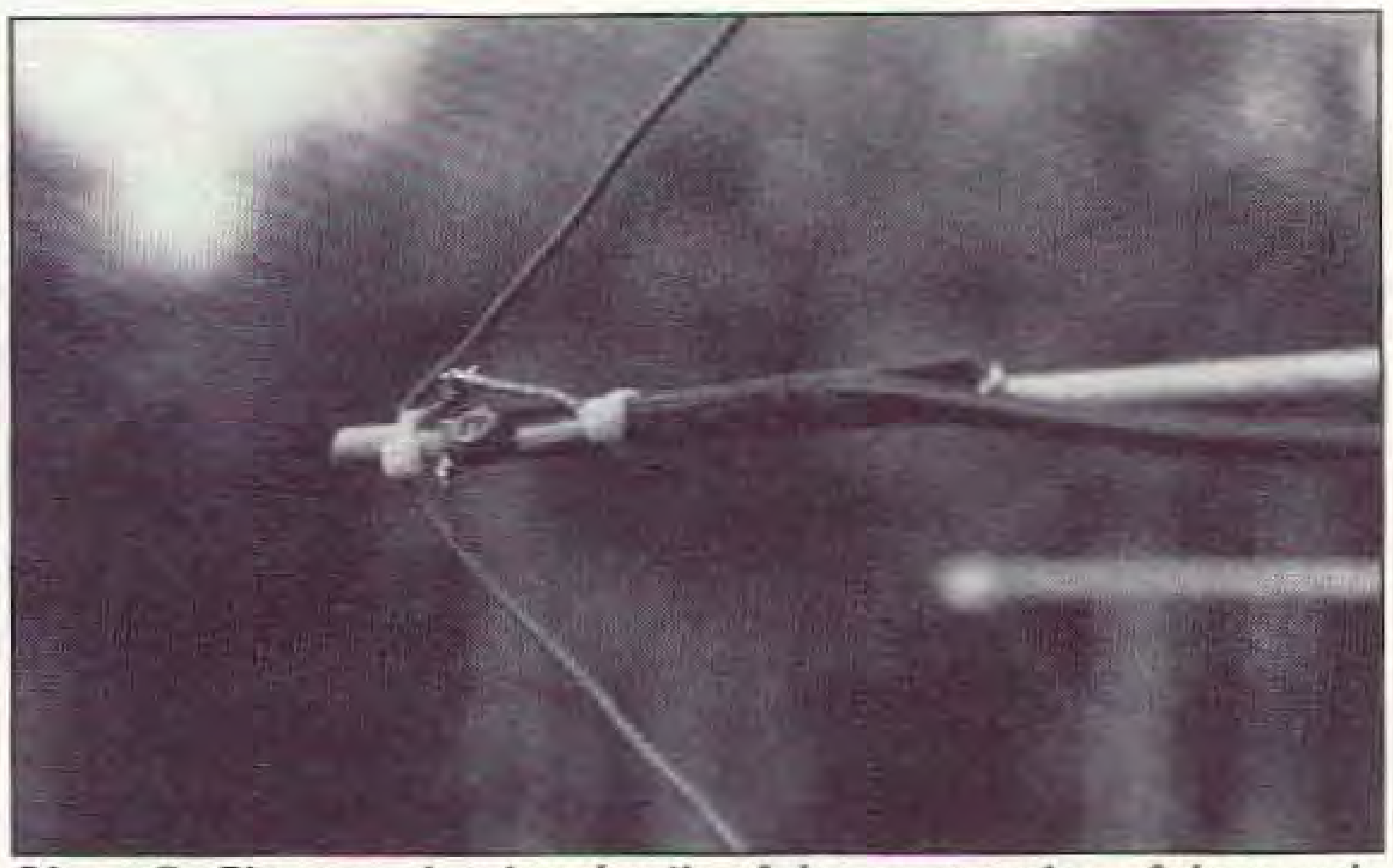

Photo C. Close-up showing details of the construction of the matching network.

the coax feed and the matching network will be installed on that spreader.

Cut the wires for the driven and reflector elements using the 18-gauge hookup wire. The driven element should be 82.5" (209.6 cm). The reflector should be 86.6" (220.0 cm).

Feed the reflector wire through the plastic rings on the reflector spreaders. Then strip about 1/4" of insulation from each end of the wire and solder the two ends together, making a complete loop. Position the plastic loops along the spreaders until you form a tight, perfect square (it helps to measure the distance along each spreader). Finally, tighten the nylon ties securely and cut the tails.

Construction of the driven element is more complex because of the matching network. First, feed the driven element wire through the three plastic rings on the driven element spreaders. Then, using a nylon tie, secure the driven element wires to the fourth spreader, as shown in Figure 2. Assembly and construction details of the matching network are also shown in Figure 2. Use caution when soldering to insure a good connection and to avoid overheating the components. Position the wire into a perfect square and tighten all the nylon ties, cutting the tails. Finally, secure the matching network and coax to the spreader using additional nylon ties.

A 30" piece of PVC piping serves as a short mast. Additional connectors and lengths of piping may be added to extend the mast if desired.

The only remaining construction detail is to trim the wooden spreader elements. Pruning shears work very well, but leave about 1/2" of extra dowel in case future adjustments are necessary.

Adjustments

Signals generated by a quad antenna are polarized. If you want *vertical* polarization, the antenna feed point must be on one of the horizontal spreaders. Conversely, if you want *horizontal* polarization, the antenna feedpoint must be on either the top or bottom spreader. The design of this quad allows the polarization to be changed easily—just twist the spreader elements 90 degrees.

Antenna matching is accomplished using an SWR bridge and tuning the trimmer capacitor to achieve the best reading.

To collapse the antenna, pull the PVC piping out of the "T" connector. Then, while holding the wooden spreader elements, twist the PVC piping and connector 90 degrees. The spreader elements will then line up in a package about 30 inches long. Of course, the wire elements will hang loosely at this point, but they will stretch back into shape when the antenna is reassembled.

I tested the antenna on several recent hikes. One hike took me up Mt. Monadnock in southern New Hampshire, and the second up Mt. Aziscoos in northwest Maine. Performance was as good as expected. The antenna fit easily into a long, narrow bag that I could wear like a backpack. Assembly was easy and quick, taking less than two minutes. And, best of all, the signal reports were outstanding. Using less than 1/2 watt, I was easily able to work repeaters 60-70 miles away with full quieting. Using 3 watts yielded similar signal reports on repeaters more than 100 miles away. Simplex was fun, too. The gain and directivity allowed me to block side signals quite well and to work selected stations with ease.

A note of caution: This antenna was designed to be very lightweight and portable. As a result, it is fragile. The 1/4" dowels can easily be broken, so use care when handling the antenna. Also, the antenna was designed to be used in fair weather. The capacitor and the wooden spreaders should not be exposed to rain or moisture. A light coat of spray lacquer or silicone sealant would afford some protection. Finally, the capacitor can be bumped easily, causing the setting to change. A drop or two of clear fingernail polish will "cement" the capacitor at the proper setting.

Those cautions aside, the antenna performs extremely well and is easily carried on hikes or climbs. I'm sure it will afford much pleasure on your mountaintopping expeditions. 73

PARTS LIST

1	3/4" PVC pipe, 10 ft. long
2	Couplers for 3/4" PVC pipe
1	"T" connector for 3/4" PVC
4	1/4" x 36" wooden dowels (for the spreaders)
1	Package nylon ties
7	1/2" plastic rings (available at craft stores)
20'	18-gauge hookup wire
6"	300 ohm TV twin lead
1	Trimmer capacitor 6-50 pF (Radio Shack # 272-1340)
Coax and connectors	

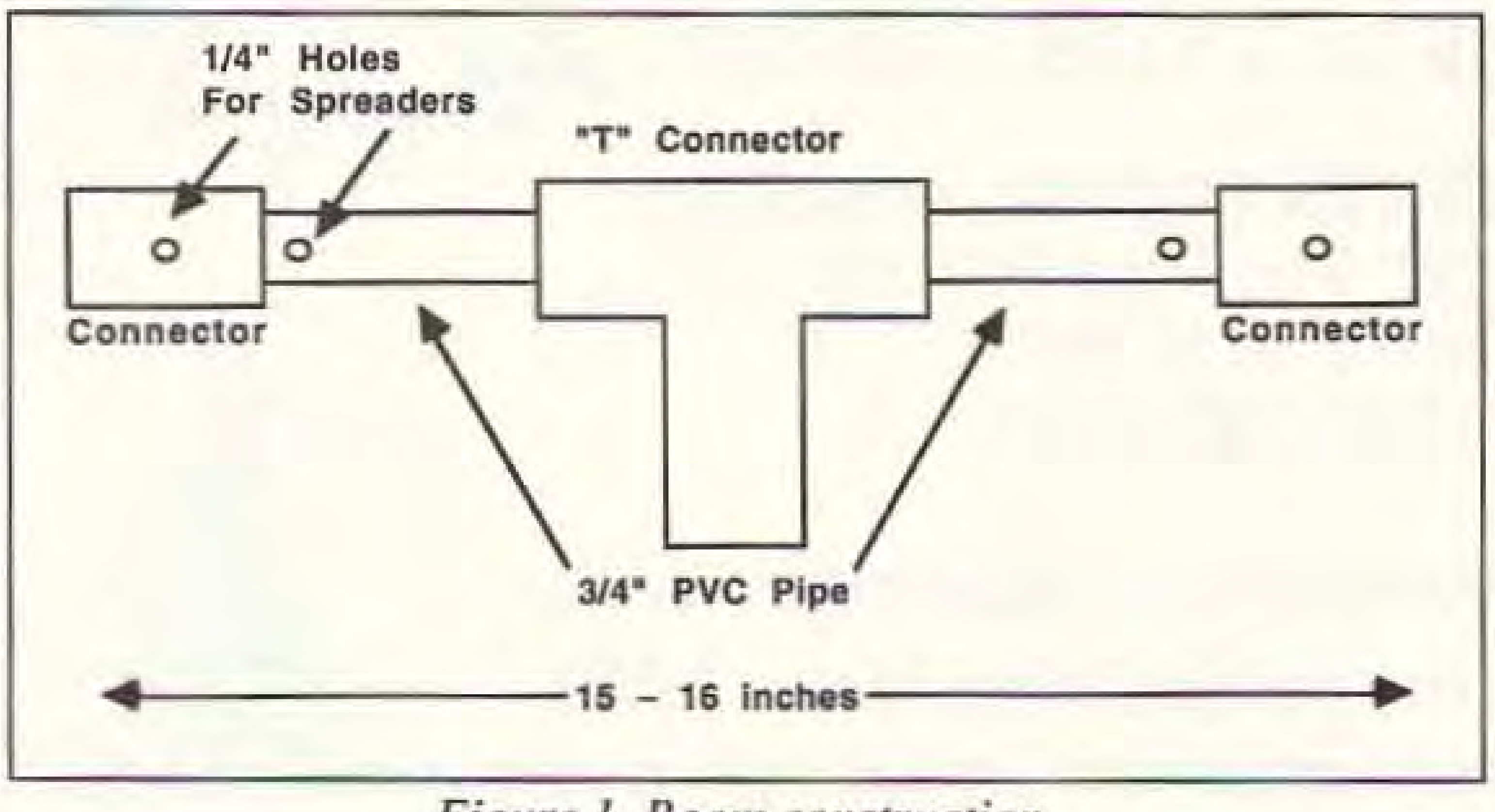

Figure 1. Boom construction.

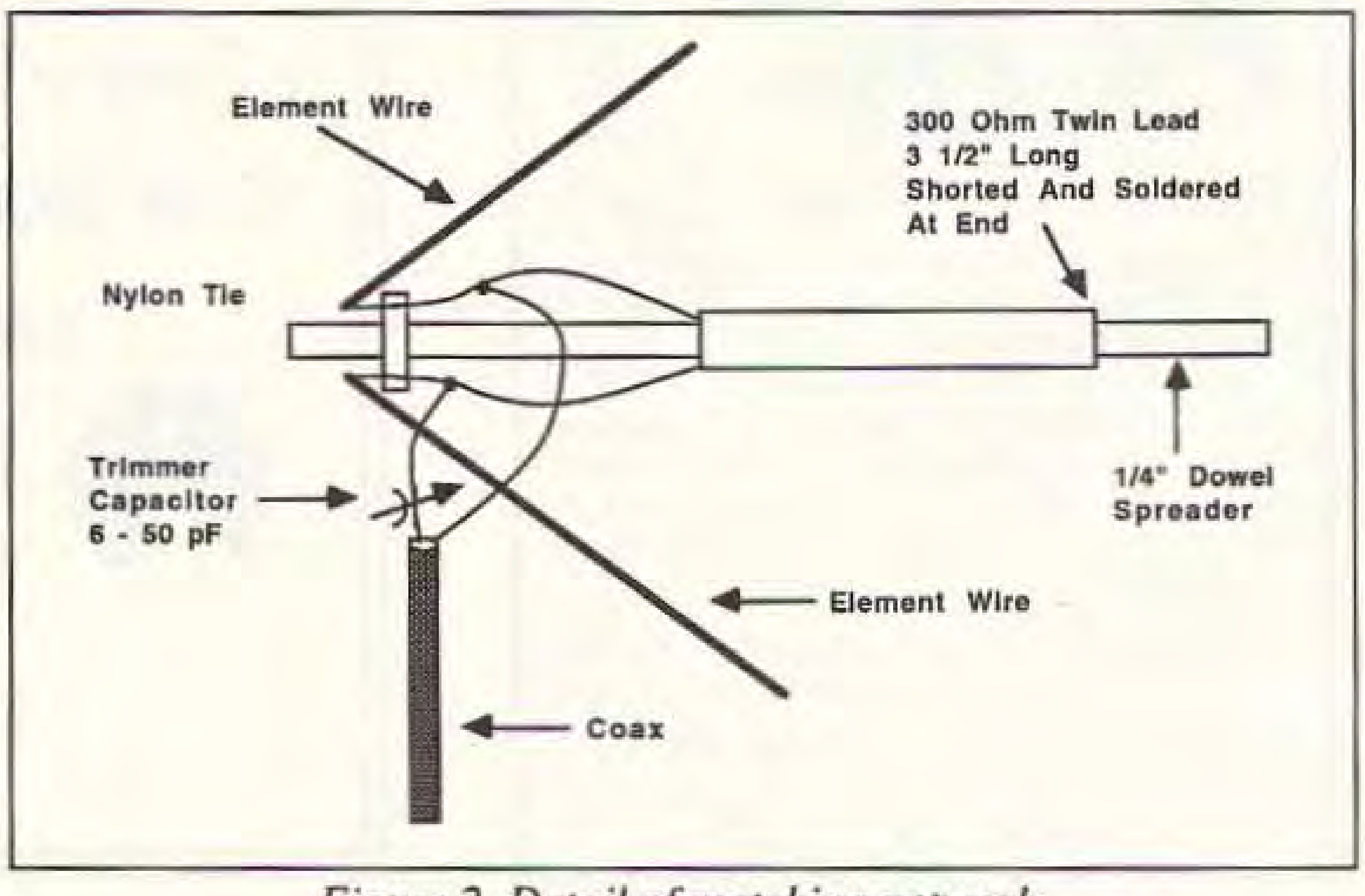

Figure 2. Detail of matching network.