The Copper Cactus J-Pole

For 2m and 70cm.

by John Post KE7AX

Remember those Novice days when you ran your 40 meter dipole on 15 meters? Have you had your eye on one of the fancy new dual-band radios? Does the idea of putting up two separate antennas and running two feedlines pour cold water on your enthusiasm? Well, if you enjoy home-brewing, this may be your cup of tea!

This probably makes you think of using one antenna, cut for a particular frequency, on a multiple of that frequency. Fifteen meter frequencies consist of roughly the third multiple of frequencies in the 40 meter band, just as amateur frequencies in the 70cm band (440 MHz) are roughly the third multiple of frequencies on the 2 meter band, our most popular amateur band.

Since I was making a J-pole antenna for the 2 meter band, I decided to try the antenna on 440. I was pleasantly surprised to find that it worked reasonably well. However, I was concerned because the SWR curves didn't bottom out. After making several changes, I plotted new SWR curves, and decided on the dimensions shown in this article. You can change the dimensions slightly, but be careful! Changing the dimensions will change both bands.

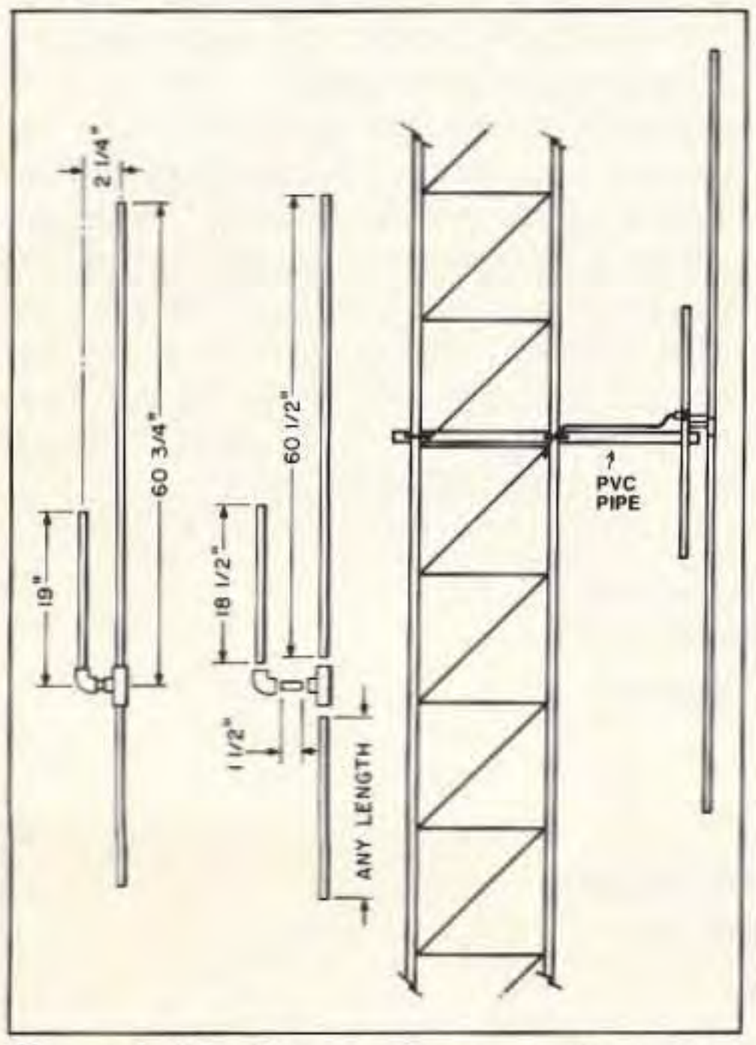

Figure 1. The Copper Cactus, and a typical Double Cactus installation.

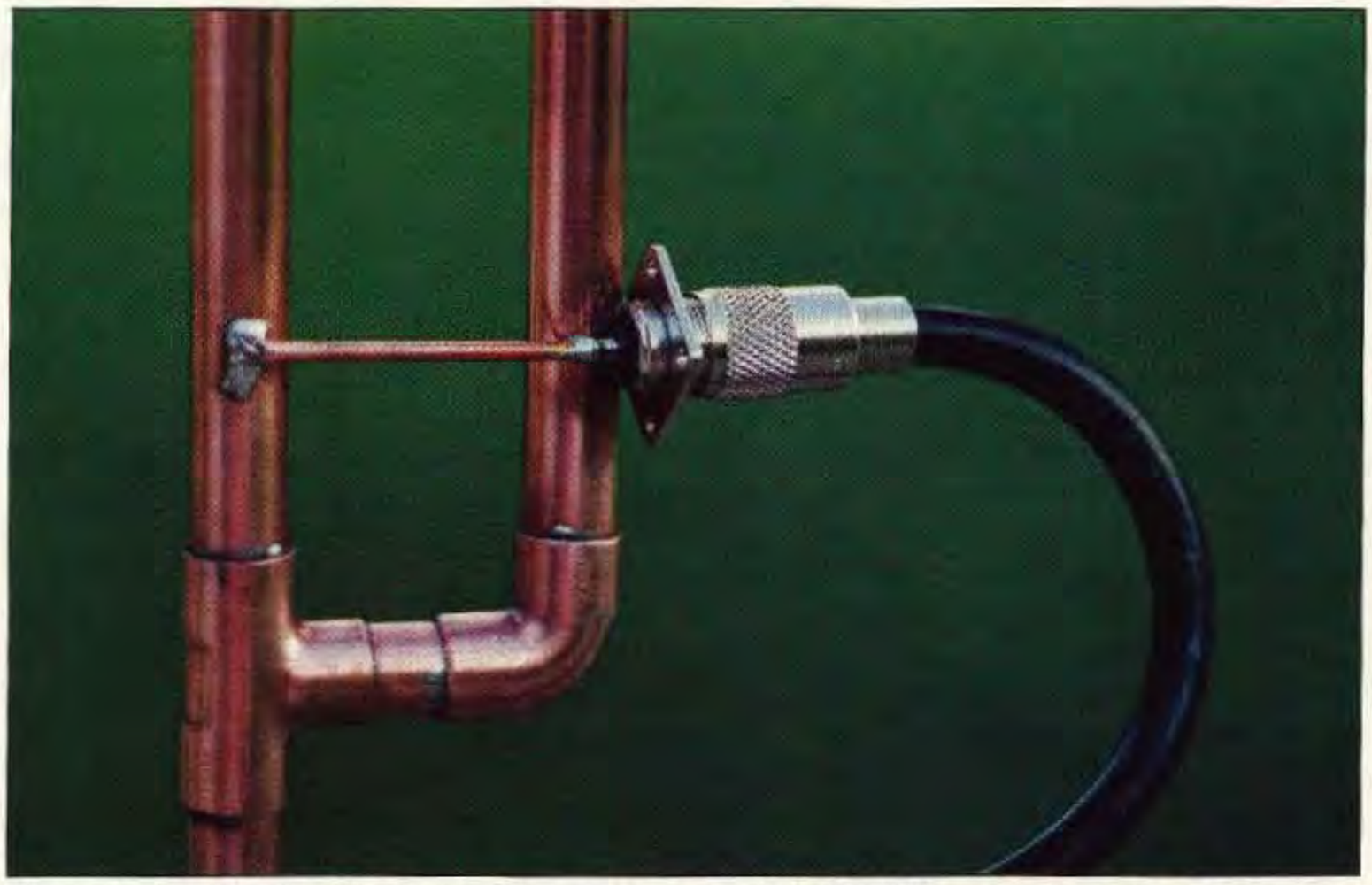

Photo A. Details of the feedpoint. Rivet one corner of the SO-239 connector to the short section of the Copper Cactus. Run a #12 wire from the center pin of the connector and solder it to the long section of the antenna. Make sure the center conductor doesn't touch the short section.

Before you construct this antenna, I want to emphasize that I designed it primarily for use on 2 meters, and it will radiate most efficiently on that band. But you can get on the 440 band quickly and enjoy your dual-bander right away. It does LISTEN very well on 440. It is employed locally as a single antenna for a crossband repeater system. In this system, it listens on 440 and transmits on 2 meters.

One thing is certain: It's hard to beat the cost and fun you will have building the Copper Cactus!

Construction

1. Cut a 10-foot piece of 1/2″ copper water pipe into the following sizes: 60-1/2″, 18-3/4″, and 1-1/2″. The mounting tube may be any length. (You will have a section about 3 1/2 feet long to cut the mounting piece from.) See Figures 1 and 2. Special thanks go to Gary Rogers WR7L for assistance with the technical drawing.

2. Clean all the pieces where they will be inserted into the T and elbow fittings. Assemble the antenna and check your dimensions.

3. Disassemble the sections, flux the ends

Photo B. Run the long section of the Double Cactus through the PVC pipe to secure it to the tower side mount.

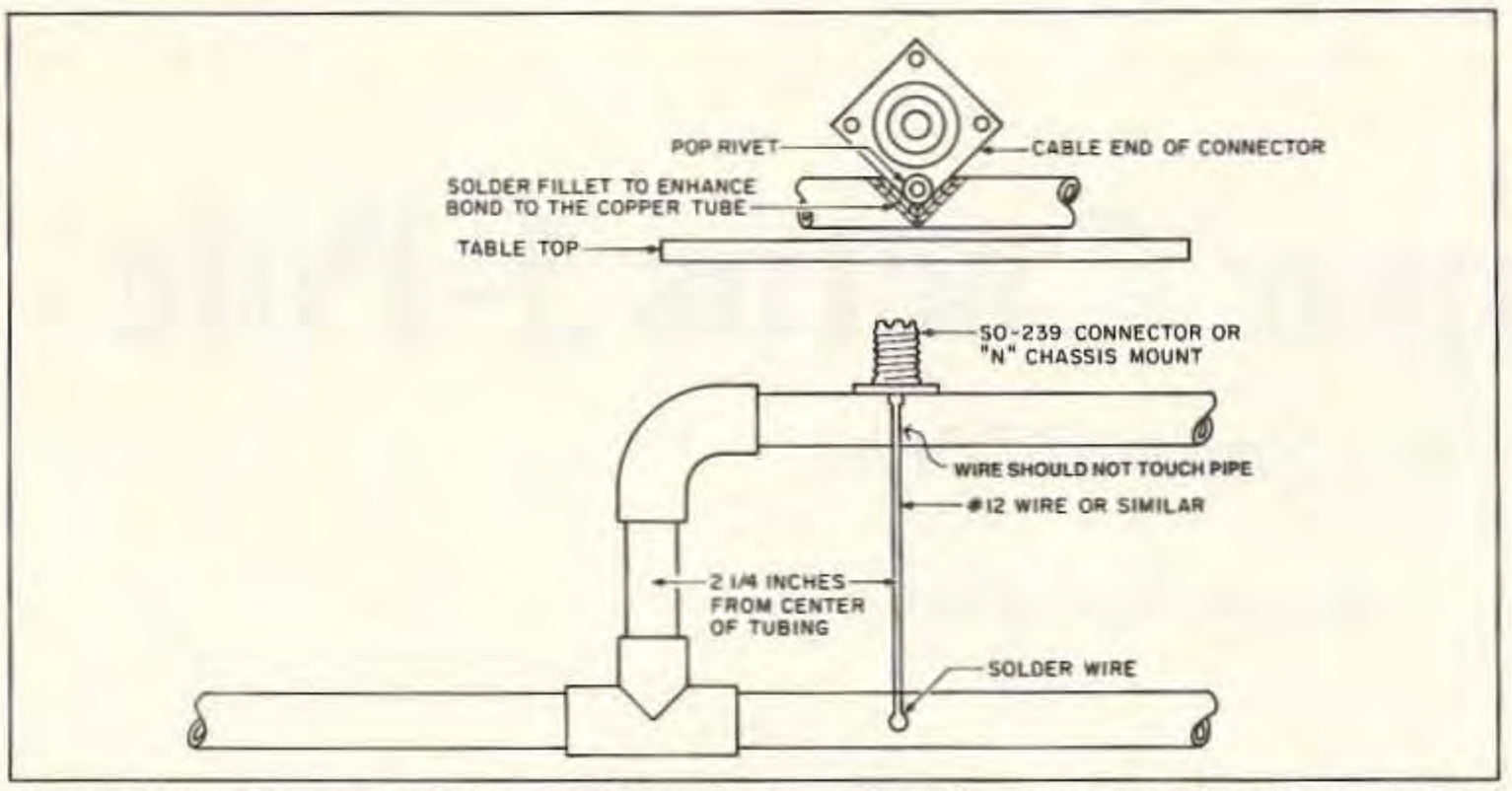

Figure 2. See the materials list. Before soldering, clean the joints and place the assembled antenna on a flat, noninflammable surface. Practice on some scraps of tubing and extra pipe joints if you're new to this. All dimensions are center-to-center.

that will be reinserted into the fittings, and reassemble the antenna, taking care to recheck the dimensions before soldering.

4. Carefully solder your antenna together. Make sure the matching stub and radiator element are parallel. You will need to turn the antenna over to solder the fittings on the other side. Use the minimum amount of solder, but make sure the antenna is stout!

5. After the initial soldering is done and the antenna is cool, measure the spot where the feedpoint will be located. Also, clean and mark the spot on the long radiating element where you will solder the wire from the center of the chassis mount.

6. Now you get to make a decision! You will need to drill a hole in the short section for either a pop rivet or machine screw. This will help secure the chassis mount to the antenna. If you use a machine screw, choose one that is long enough to allow a nut to be placed on the other side of the short section. Approximately one inch should do it. Also, you will need to drill out the hole in the chassis mount that will accommodate the screw/rivet. Make sure it isn't too fat, or you'll find yourself with too large a hole in the chassis mount. I use 1/8″ aircraft-grade pop rivets, but I have made several antennas with machine screws. They all work fine. If you have any qualms about the quality of your rivets, go with the machine screw.

7. Place the chassis mount where it will be located, and mark the spot. Carefully drill the hole in the short matching section. If you are using a rivet, just drill in the outside wall. If you chose the machine screw, drill it all the way through.

8. After drilling the hole to match in the chassis mount, secure it to the matching stub with either the rivet or machine screw. Make sure the threads face away from the radiating element! Your chassis mount should be very secure to the matching stub.

9. Now, go find an old connector to use as a heat sink while you place a bit of solder on the spot where the chassis connector meets the matching stub. Solder this area carefully. Apply the heat to the copper pipe, and the chassis connector will be warm enough for the solder to adhere to. This will make a good electrical connection and enhance the mechanical one as well. Remove the old connector from the chassis mount and check the insulation for distortion/melting. It should be fine. (Unless you applied the flame directly to the chassis mount.) I also use an extra T-connector for a head sink; you can do whatever you want.

10. With the torch, heat the spot where the feed wire will attach on the radiating element. Place a small bead of solder on the spot. It should be directly across from the center of the chassis mount.

11. Cut and strip the ends of the wire that will go from the center of the chassis mount to the feedpoint. Solder one end to the chassis mount, using a soldering iron, NOT the torch! Tin the opposite end where it will attach to the radiator, and try to attach it with your iron. If you can't get the feedpoint hot enough with the iron, use the torch carefully and secure the wire that way.

12. Let the antenna cool, then check all fittings for security. They should be very strong. Clean up the antenna with some steel wool, taking care not to leave any small "hairs" behind. Check the SWR on both bands and paint the antenna as desired. Enjoy your new dual-band Copper Cactus!

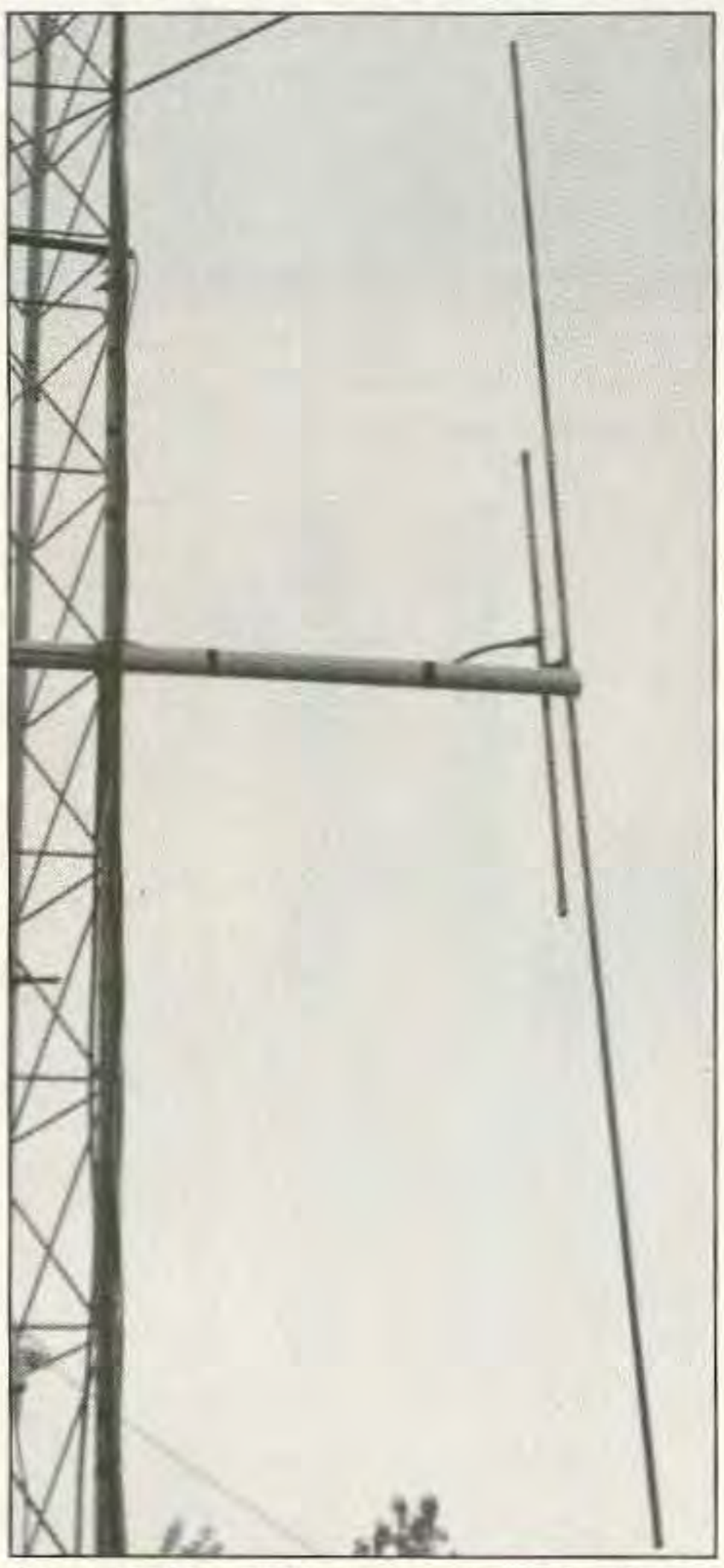

Photo C. Use PVC pipe to mount the Cactus to the side of your tower. The Double Cactus is shown here.

Now—the Double Cactus

This one is for those of you who love BIG antennas. It is built using the same basic procedure as above. However, instead of a 90-degree connector, buy two T-fittings. Also, cut the matching sections 1/2″ longer. Buy two 10-foot sections of copper pipe and build a mirror image of the standard Cactus below itself.

I use a 5-foot section of 1-1/2″ PVC pipe to suspend the Double Cactus from the side of my tower. This seems like the best way to do it. Just drill a 5/8″ hole about one inch in from the end of the PVC pipe, and slide the long leg of the antenna down through it. The feedpoint will be above the PVC, allowing you to secure the feedline to it. When comparing this antenna to the standard J design, we found a stronger signal report on both bands. The reports weren't much stronger—maybe one or two S-units—but you may find that this antenna meets the need better. I have a standard J on the top of my mast, and the extended version off the side of the tower.

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The Copper Cactus
Materials List

1	10-foot section of 1/2″ copper water pipe
1	T-section
1	90-degree elbow
1	SO-239 or N-type chassis mount
1	2-1/2″ piece of no. 12 or similar copper wire
1	machine screw, about 1″ long, with nut; or pop rivet 1/8″ dia. x 1/2″ long

Other: Propane torch, solder for copper pipe, and flux.

The Copper Cactus

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With the help of Bob Post N7KUC, preliminary tests were run in the field. Tom Ring WA2PHW, my friend, just had to try his new MININEC program (written by Brian Beezley K6STI) on the Cactus. Tom is a real pro at building antennas, and the eternal skeptic when it comes to antenna gain claims. He found the patterns pretty close to those described in other tests of similar antennas. That is, a large lobe near the horizon and several radiating at higher angles, on 2 meters. Unfortunately, Tom couldn't get the specs on 440, so we had to rely on field tests. I'm sure the radiation angle is fairly high with the "standard" Cactus, and the gain over a quarter-wave is nil on 440 MHz.

The Double Cactus seems to have a flatter angle of radiation when compared to the standard J design. The SWR curves are fairly flat, usually less than 1.5 to 1 across the band from 145 to 148 and 440 to 450. I have been running both versions of the Cactus J-pole for over two years, and I haven't seen a change in the SWR curves. You should enjoy many years of happy dual-banding with the Copper Cactus. 73

You may write John Post KE7AX at 13263 Europa Ct., Apple Valley MN 55124. Please enclose an SASE if you request information.