It's time for a quick trip to the hardware store for some PVC, aluminum tubing, and a fresh hacksaw blade. KB6IC shows us how to build a new 2 meter antenna.

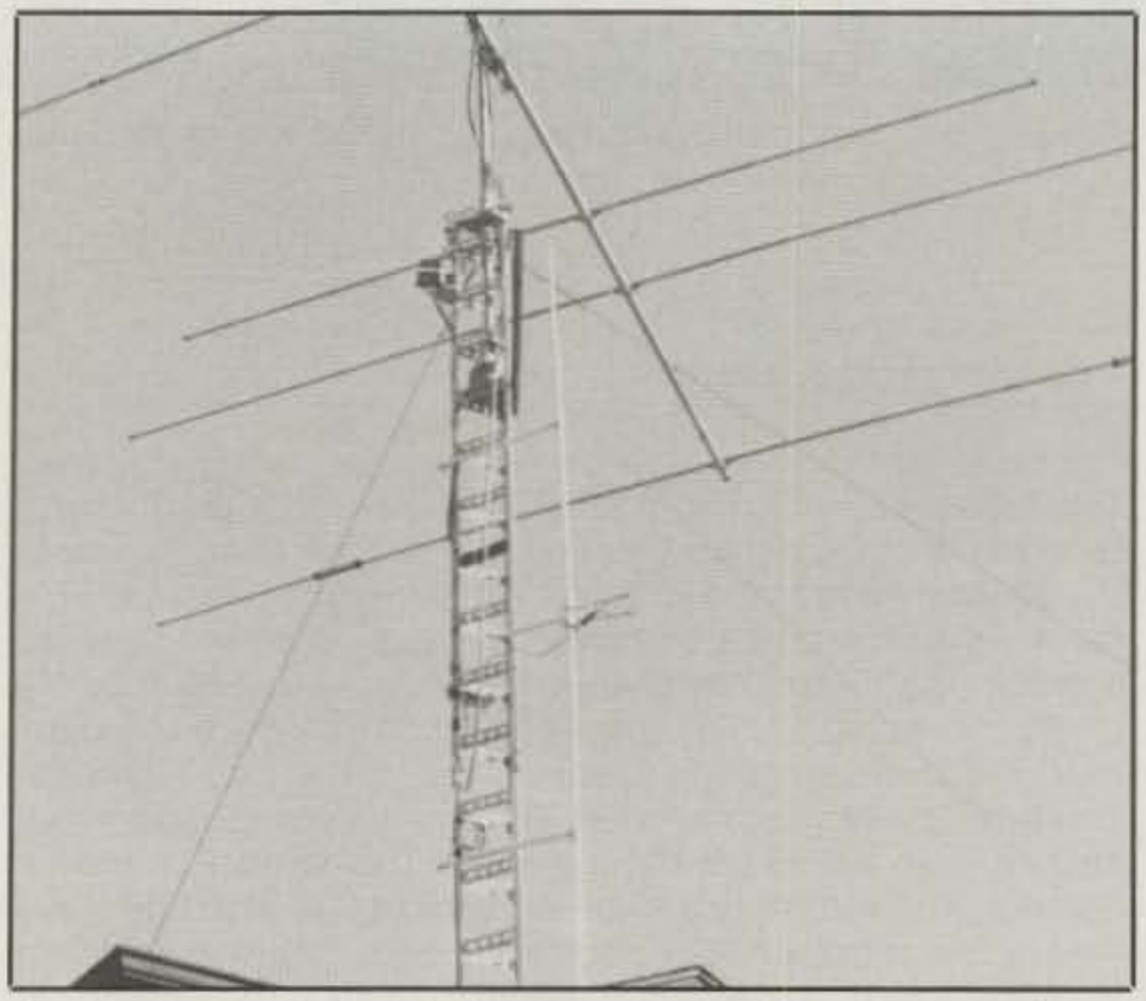
Build Your Own High-Performance Two Meter Collinear Antenna

BY LEWIS F. MCINTYRE*, KB6IC

VHF collinear antennas provide a vertically polarized pattern with good gain. However, they have a high impedance feed and a reputation (perhaps undeserved) for being difficult to build. I've built a two-wavelength unit; I'd like to share the design with you. I must admit, I dislike antenna design immensely, and consider it close to witchcraft; nevertheless, this antenna was relatively easy to assemble and gives good results for under $25.

Collinear dipoles are just two or more dipoles in a line. Figs. 1A, B, and C show two-, three-, and four-element collinear arrays, respectively. Note that a two-element collinear is simply a full-wave dipole. With proper phasing and spacing, the characteristic dipole "doughnut" radiation pattern is compressed to a flatter angle, achieving gain in the broadside direction. If the array is mounted vertically, omnidirectional coverage is preserved. This antenna is well suited for repeaters, home stations, and perhaps Field Day operations.

My antenna is a four-element (two wavelength) array and is shown in fig. 1C. Quarter-wave stubs provide a 180-degree phase reversal at the half-wave points, ensuring that each of the four dipoles are fed in phase.



Completed installation of side-mounted 2 meter collinear antenna on tower.

Mechanical Construction

Fig. 2 shows the mechanical layout and dimensions, cut for a frequency of 146 MHz. I used ⅞ inch aluminum tubing and ¾ inch PVC tubing, tees, and end caps throughout. For some reason PVC is measured in inside diameter (ID) and aluminum in outside diameter (OD), hence the difference in measurements. This means the aluminum tubing fits nicely into the PVC fittings. All are readily available in local hardware stores all over the United States. The quarter-wave stubs are detailed in fig. 3. These 16½ inch lengths of 300 ohm twinlead are housed inside PVC tubing. This tubing is capped at the ends to protect the stubs from the elements and provide convenient mounting brackets for the antennas. The dimensions shown for these tubes aren't critical, but I recommend you use 18 to 24 inches to allow for secure mounting. To prevent them from parting company with the antenna during high winds, use 6 × 1¼ inch hardware through the tees, as shown in fig. 3. Don't rely on PVC cement. The middle tube provides support only and contains no electrical components. Drill drain holes, as indicated, at the bottom of each tube. You should also drill a drain hole through the cap you plan to place at the bottom of the antenna.

Use care when cutting the aluminum elements; at these frequencies ½ inch is equal to 1.88 MHz!

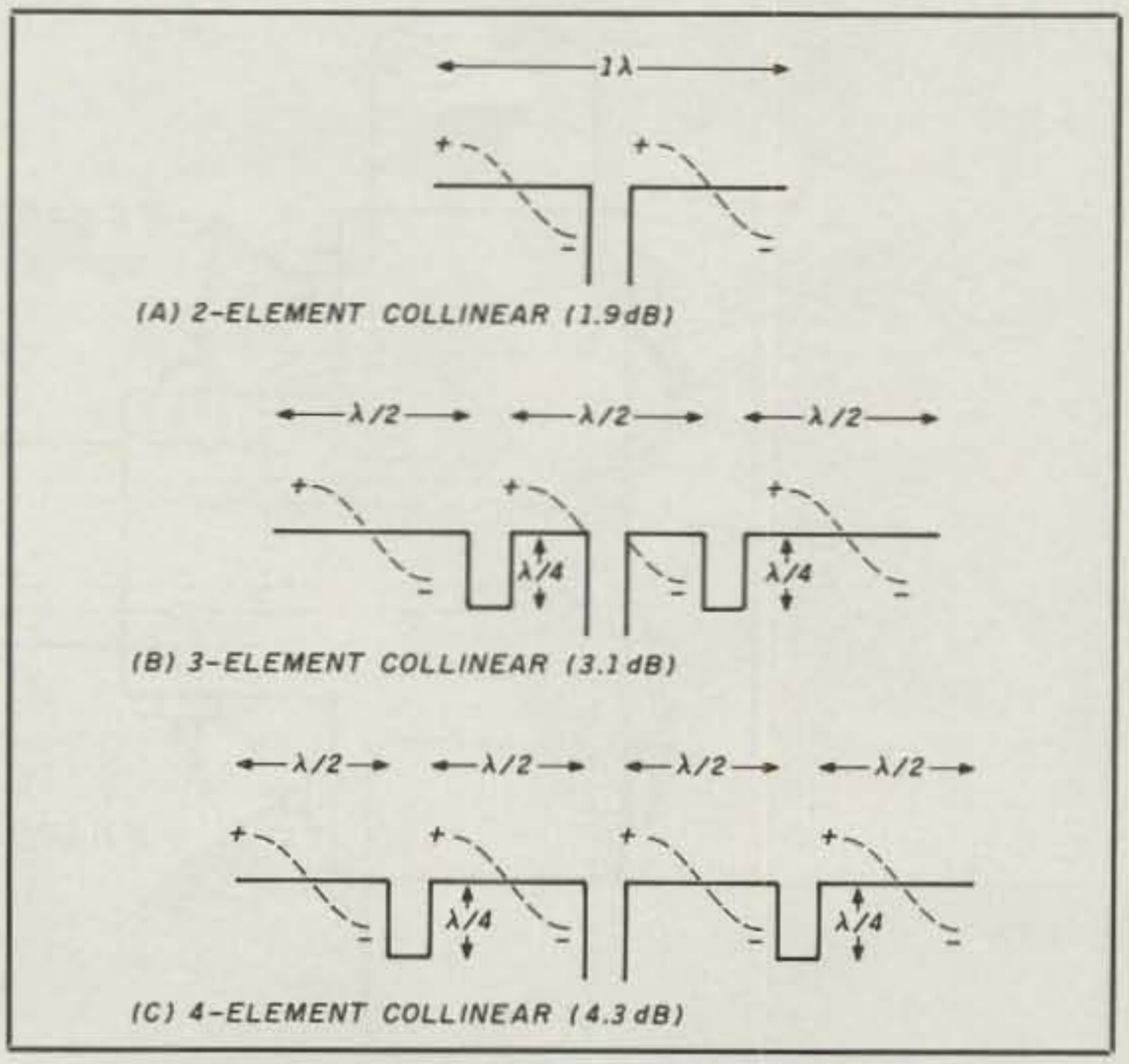


Fig. 1– Two-, three-, and four-element collinear arrays.

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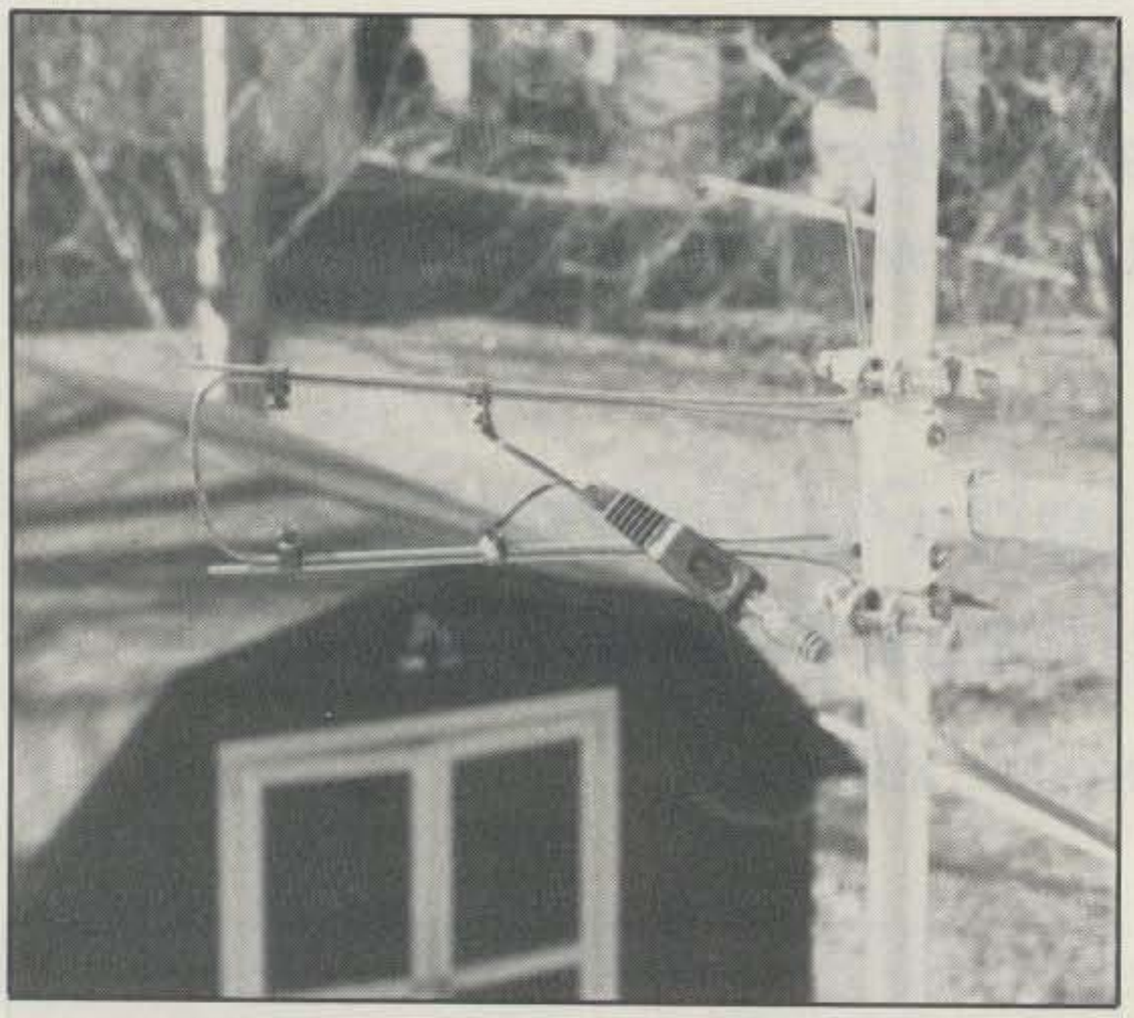

Closeup of the "trombone" matching network and TV balun attachment.

Feeding the Antenna

The collinear dipole requires a balanced high impedance feed. This antenna showed about 3:1 VSWR when fed with 300 ohms. I used a matching network, called a "universal stub," to match the 300 ohm feed to the antenna. The dimensions are shown in fig. 4; a closeup of the completed network is shown in an accompanying photo. The network is made up of three pieces of ⅛ inch copper-clad welding rod. Two 36 inch lengths, available at most hardware stores, will provide you with enough material. The three pieces are clamped with four electrical wire screw splices. This allows the outer piece of the network to slide in and out, like a trombone slide. A TV 75 to 300 ohm balun provides a 300 ohm feed, and is soldered to the innermost electrical splice. This arrangement is mounted to the antenna with two ⅞ inch pipe grounding clamps.

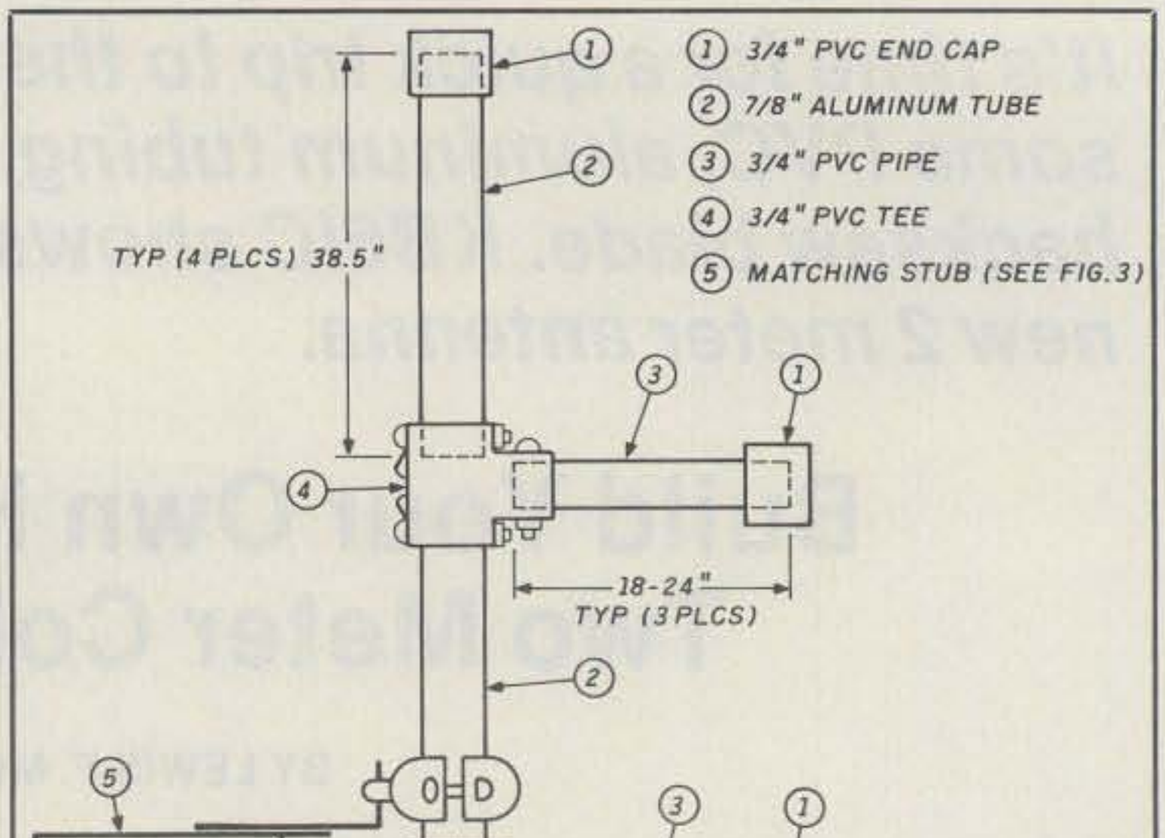

Fig. 2– Physical dimensions of 2 meter collinear antenna. Note: Center extension is for mounting only; it may be omitted. It does NOT contain 300 ohm twin lead, as do the matching stubs (fig. 3).

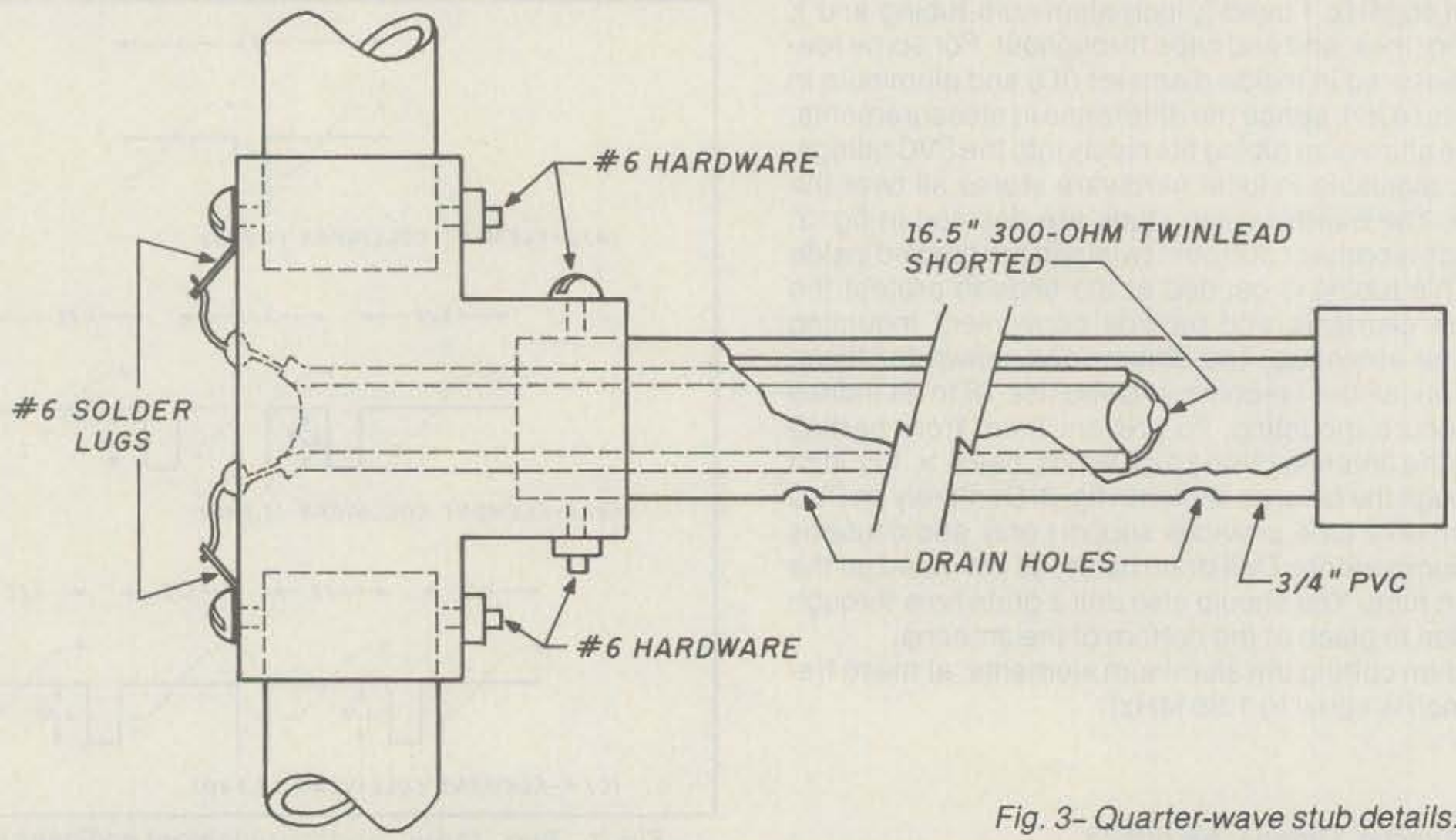

Fig. 3– Quarter-wave stub details.

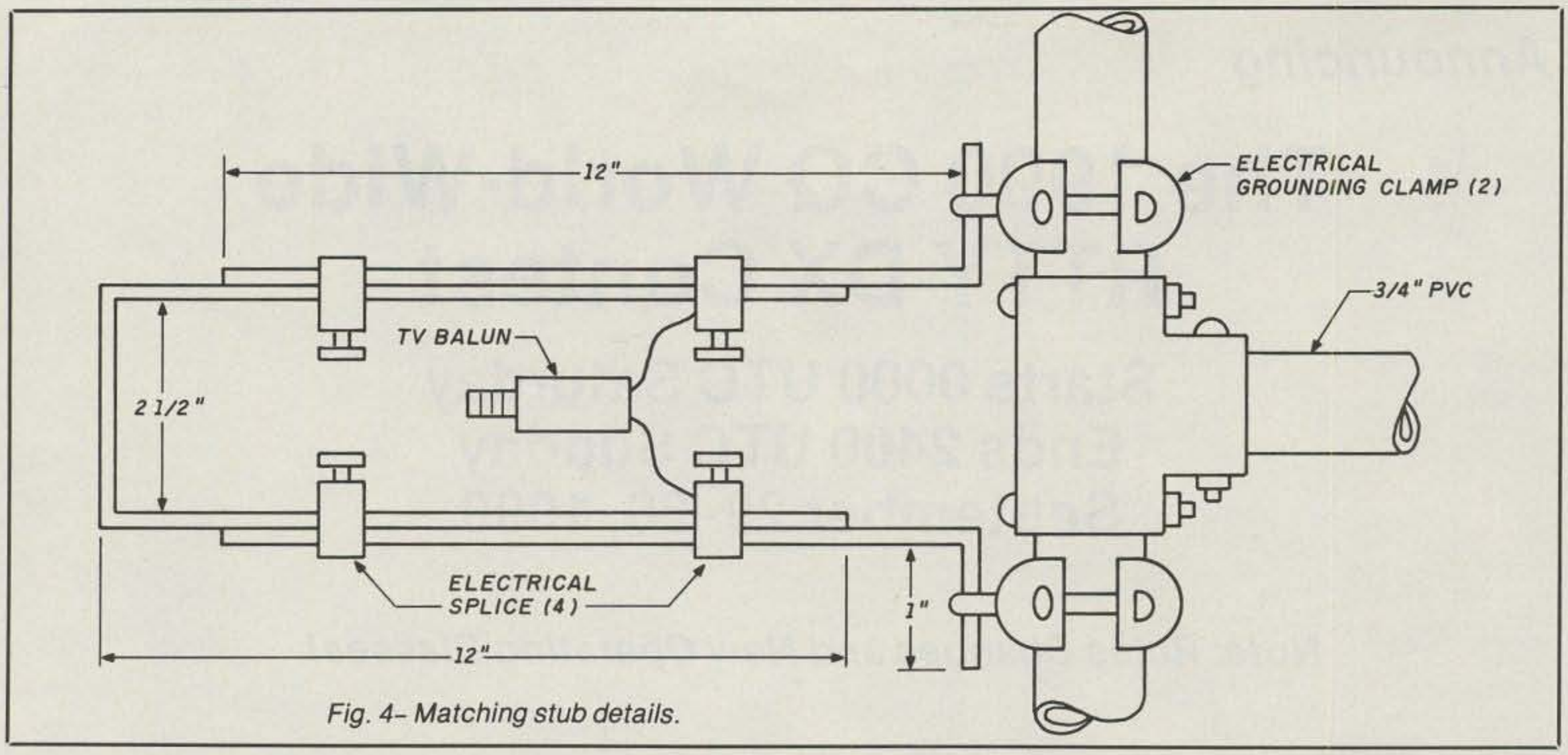

Fig. 4– Matching stub details.

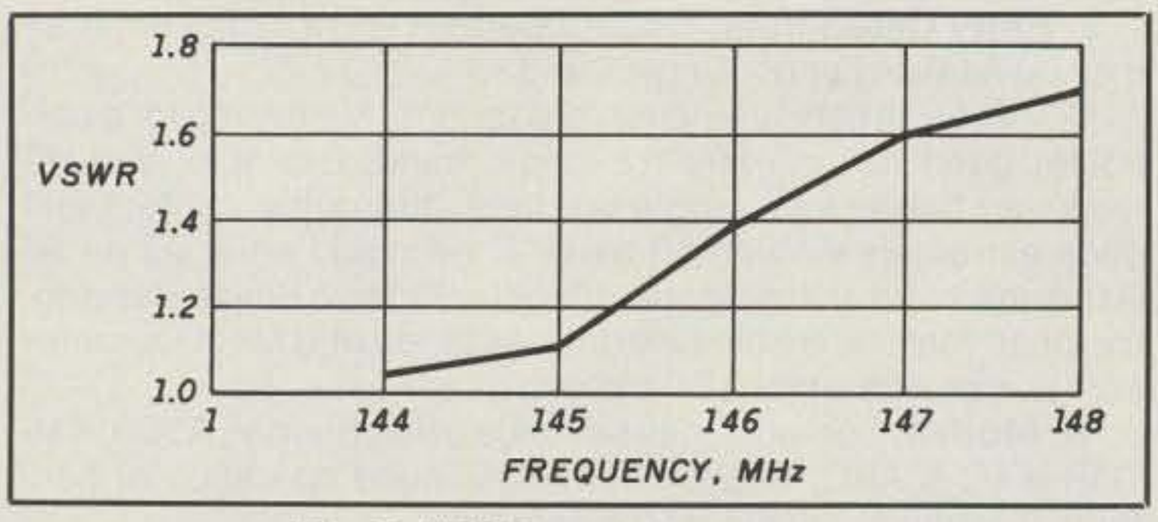

Fig. 5– VSWR versus frequency.

Installation and Tuneup

I mounted the antenna vertically. The three PVC tubes are clamped to my 30 foot tower at about the 20 foot point. Make sure that the drainhole cap and each tube's drainholes face downward. Keep at least 1 foot of clearance between the tower and the antenna.

When the installation is complete, set the trombone slide on the matching stub so the stub is about half extended for a total length of 18 inches with the balun connected about 9 inches from the antenna, or halfway. Make all fittings finger tight. Measure the VSWR as close to the antenna as possible. Using the initial settings described above, tune the antenna at 146 MHz and adjust the balun's position on the stub for lowest VSWR. Then slide the trombone in. Continue these two adjustments until you achieve the lowest VSWR; then tighten all four clamps. If you're a real stickler for accuracy, you can retrim the antenna for optimum resonance. Fig. 5 shows the VSWR as plotted for my antenna across the band. I missed my intended resonance point by about a MHz, which is close enough for me.

If you can't resist the temptation to modify a good design, consider replacing the TV balun with a coaxial balun of about 13½ inches of RG-59—especially if you run over 50 watts. And, if you want to match your antenna to the operating frequency precisely, consider installing telescoping tubing in the center of each of the four half-wavelength sections. Match the inner section first, with the two outer half-wavelength sections removed. Then add the outer two sections, tune them, and rematch.

Results

I'm extremely pleased with this antenna. It hits all repeaters within 50 miles with just 10 watts and a very lossy feedline. It's physically rugged and has withstood winds up to 50 mph. Tune-up was very simple. I think amateurs who want a high-performance vertical for 2 meters will find this is the project for them. And anyone who hates building antennas, as I do, will like it too!