AERIAL VIEW

Antenna Update

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BROADBAND 80m ANTENNAS

Eighty meters is one of our most popular HF bands. It's also our widest in percentage terms. This latter point can cause difficulties if you enjoy operating at both ends of the band but are using a coax-fed single-wire dipole and a typical solid-state transceiver. The problem that arises is that the ordinary 80-meter dipole is too narrowbanded to present an swr of 2:1 or less over a bandwidth of 500 kHz. Therefore, your transceiver output begins of fold back as you stray very far (typically more than ±125 kHz) from the resonant frequency of the antenna.

One solution is to use a transmatch to couple the transceiver to the antenna system, but doing so compromises your ability to make rapid frequency excursions with your no-tune transceiver. Another possibility is to replace that single-wire dipole with a broadbanded antenna. What follows are some examples of relatively simple broadbanded antennas that will allow you to operate over most, if not all, of the 80-meter band while using a coaxial transmission line and no tuner.

Two dipoles mounted at right angles to one another and cut for opposite ends of the band (Figure 1) can produce a broadbanded response. Logan claimed an swr of 2:1 or less from 3.5 to 4 MHz for such an antenna, with dipole 1 resonant at 3.56 MHz and dipole 2 resonant at 3.94 MHz.[1] If you have the room to mount two 80-meter halfwave dipoles at right angles to one another, this is an easy way to improve the swr bandwidth of your 80-meter antenna system.

A somewhat similar wideband antenna credited to ZS6ZO uses two dipoles cut to the center of the band and fed 90 degrees out of phase from one another via a quarter-wavelength phasing line (Figure 2).[2] Once again, the two dipoles are mounted 90 degrees apart. The reported bandwidth with this antenna was approximately twice that of a single dipole alone, thereby covering most of the 80/75-meter band.

What is probably my favorite in this class of antennas is one that's been around for a long time: the cage dipole (Figure 3). This uses several wires to simulate a conductor of large diameter. Increasing the conductor diameter produces an antenna whose reactance (and swr) varies less with changes in frequency than it does with a "skinny" antenna.[3] The increased diameter also means that these antennas are shorter than a single-wire dipole tuned to the same frequency. For instance, a cage dipole that I used for a number of years had 4 conductors spaced 2 feet apart and was 117' long. Mounted 80 feet above ground, it was resonant at 3800 kHz and provided a 2:1 or better match across the band. Harbach, using a 115' antenna with 4 conductors spaced approximately 4 feet apart, reported similar results.

When assembling a cage dipole you must make allowance for the increased wind area relative to an ordinary dipole—you now have 3 or more wires plus spreaders—so plan accordingly when choosing wire and insulators. I used #14 wire for my antenna, and experienced no mechanical failures. The spreaders were fashioned from some Plexiglas™ that I had on hand at the time. However, they could be made of wood or PVC. Conductors such as angle aluminum have also been used for spreaders, although some claim that doing so increases the antenna Q and hence markedly decreases bandwidth.[5]

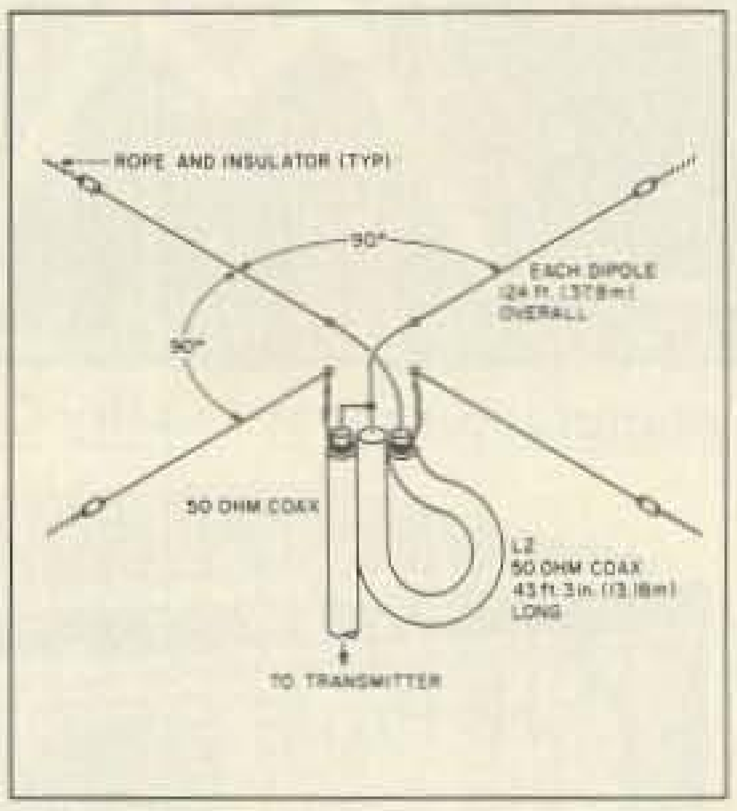

Fig. 2. The 80m wideband antenna at ZS6ZO. Two dipoles spaced 90 degrees apart are fed 90 degrees out-of-phase with an electrical quarter-wavelength interconnecting line. Shields of lines are all soldered together at dipole feedpoint and connected to adjacent antenna sections.

Attempting to erect a cage dipole in an area cluttered with underbrush and overhanging limbs can be a nightmare (trust me, I've tried it), but if you can suspend one wire near ground, build the remainder of the antenna around that wire, and then pull the complete assembly into position, the task is not especially difficult.

Another dipole cousin is the fan dipole.[6] As can be seen in Figure 4, each side of a fan dipole consists of two arms 55 feet long, spaced 12 feet from one another at the ends, and joined at the center. The antenna is 110 feet long, causing it to have a capacitive reactance on 80-meters. To compensate for that reactance, a reactance of opposite sign (i.e., an inductor) is connected across the antenna terminals (see Figure 4 for details). This procedure also transforms the resistive component seen at the antenna to approximately 50 Ohms.

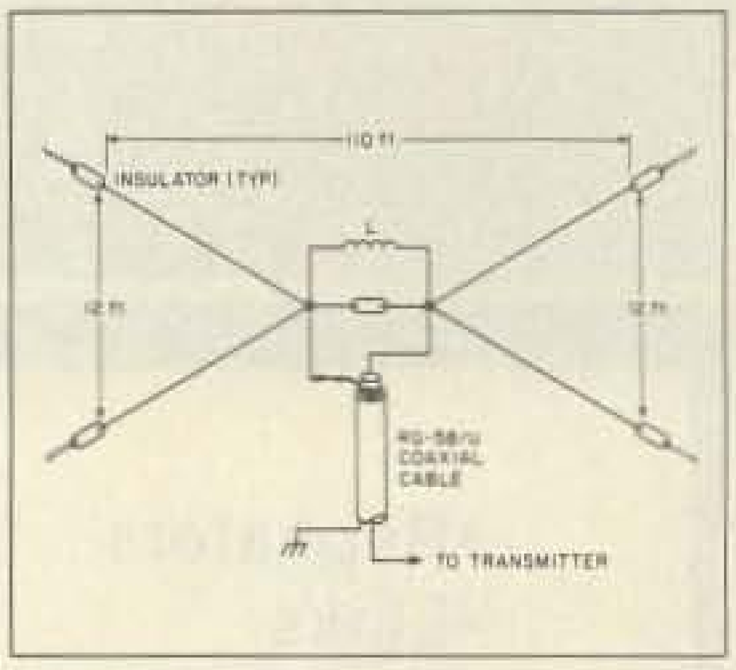

Fig. 4. Broadband fan dipole for 80m. Wires may be either in the horizontal or vertical plane. The inductive reactance (X_L) is 64 Ohms. At 80m, L = 2.7 uH; this is achieved by winding 8-1/2 turns of #12 wire around a 2"-long, 2"-diameter tube.

W7IS, has his own version of a wideband dipole for 80-meters (Figure 5).[7] As you can see in the illustration, he uses five equal length wires connected in parallel for each leg of the dipole. The wires are spaced approximately 2 feet apart, with no spreaders being used. W7IS claims an swr of less than 2:1 over the 80-meter band with this antenna. Although he used a 1:1 balun at the feedpoint of this antenna, I suspect that it would work equally well with direct coax feed.

The discone and conical monopole (Figures 6 and 7) are two wideband vertically-oriented antennas that not only covers all of the 80/75-meter band with a low swr, but works well over several adjacent amateur bands. Their shortcoming is that they take up considerable real estate when designed for the lower HF bands. Due to their limited application, interested readers are referred to the ARRL Antenna Book (edition 13) and an article by Stan Gibilisco W1GV/4 in the May 1985 issue of *73* for further details.

The antennas discussed above certainly do not constitute an exhaustive list of the wideband antennas that can be used on 80-meters. However, they do provide some examples of how you can erect an antenna that yields a relatively low swr over the

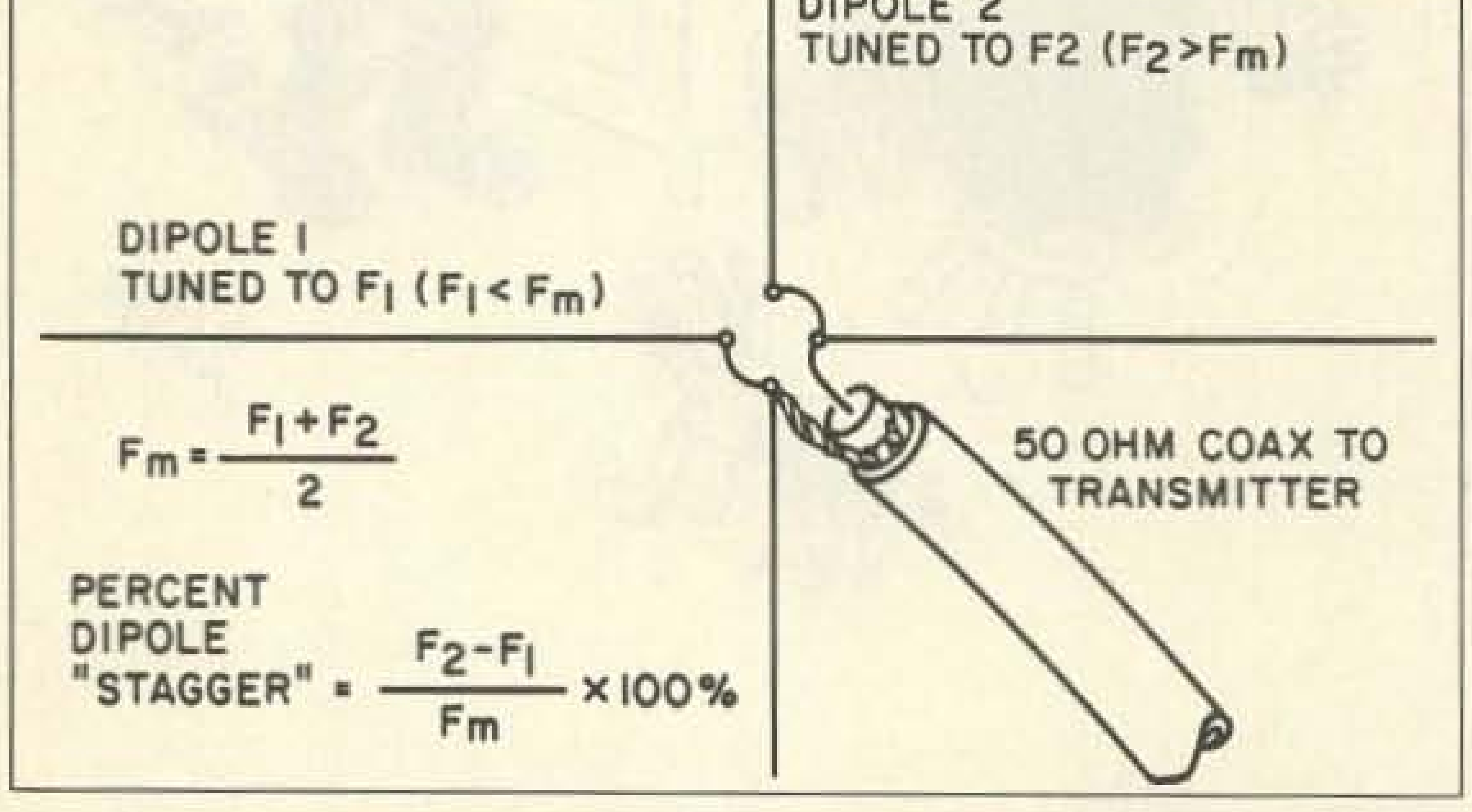

Fig. 1. Top view of the broadband stagger-tuned, crossed dipole antenna.

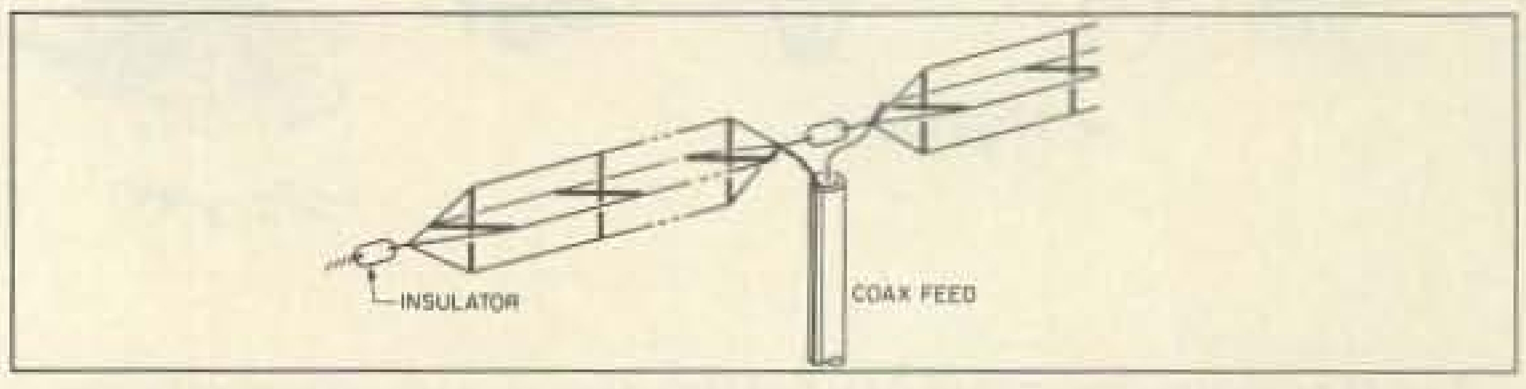

Fig. 3. Cage dipole. The spreaders are spaced at 10-15' intervals.

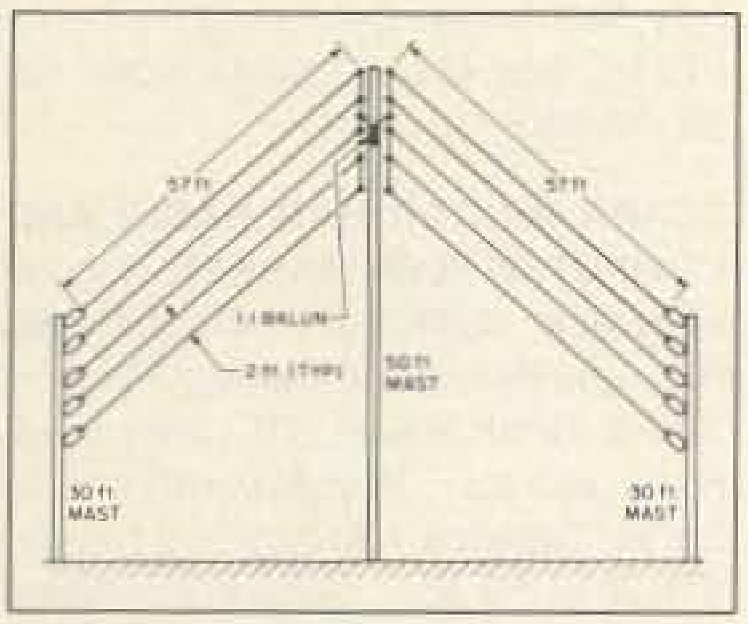

Fig. 5. W7IS's 80m wideband dipole.

3.5 to 4-MHz range. And don't forget that these antennas can also be scaled for use on the other amateur bands that have relatively large bandwidths, such as 160 and 40 meters. So, give one of these antennas a try and free yourself from antenna-tuner slavery. I'm interested in hearing how they work for you and what new ideas readers have for these (and other) antennas.

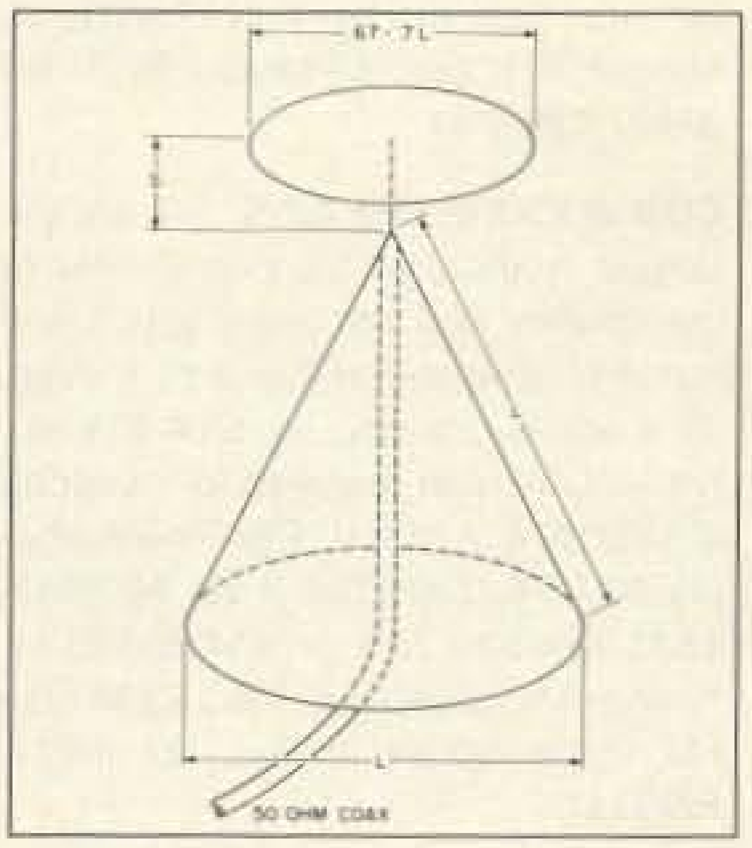

Fig. 6. Discone antenna. L = wavelength/4 (free space) at lowest operating frequency. S = 1-6 inches.

References

1. Logan, Mason A., "Stagger-tuned dipoles increase bandwidth," *Ham Radio*, May 1983, p.22-24

2. Orr, Bill, "Ham radio techniques—the ZS6ZO wideband 80-meter antenna," *Ham Radio*, June 1984, p.60

3. The *ARRL Antenna Book*, ed.13, p.30

4. Harbach, Allen B., "Broadband 80-meter antenna," *QST*, December 1980, p.36-37

5. Johnson, David C., "Technical Correspondence—Cage antennas," *QST* November 1983, p.61

6. Orr, Bill, "Ham radio techniques—broadband dipoles," *Ham Radio*, October 1983, p.66

7. Orr, Bill, "Ham radio techniques—a wideband 80-meter antenna," *Ham Radio*, July 1987, p.57.

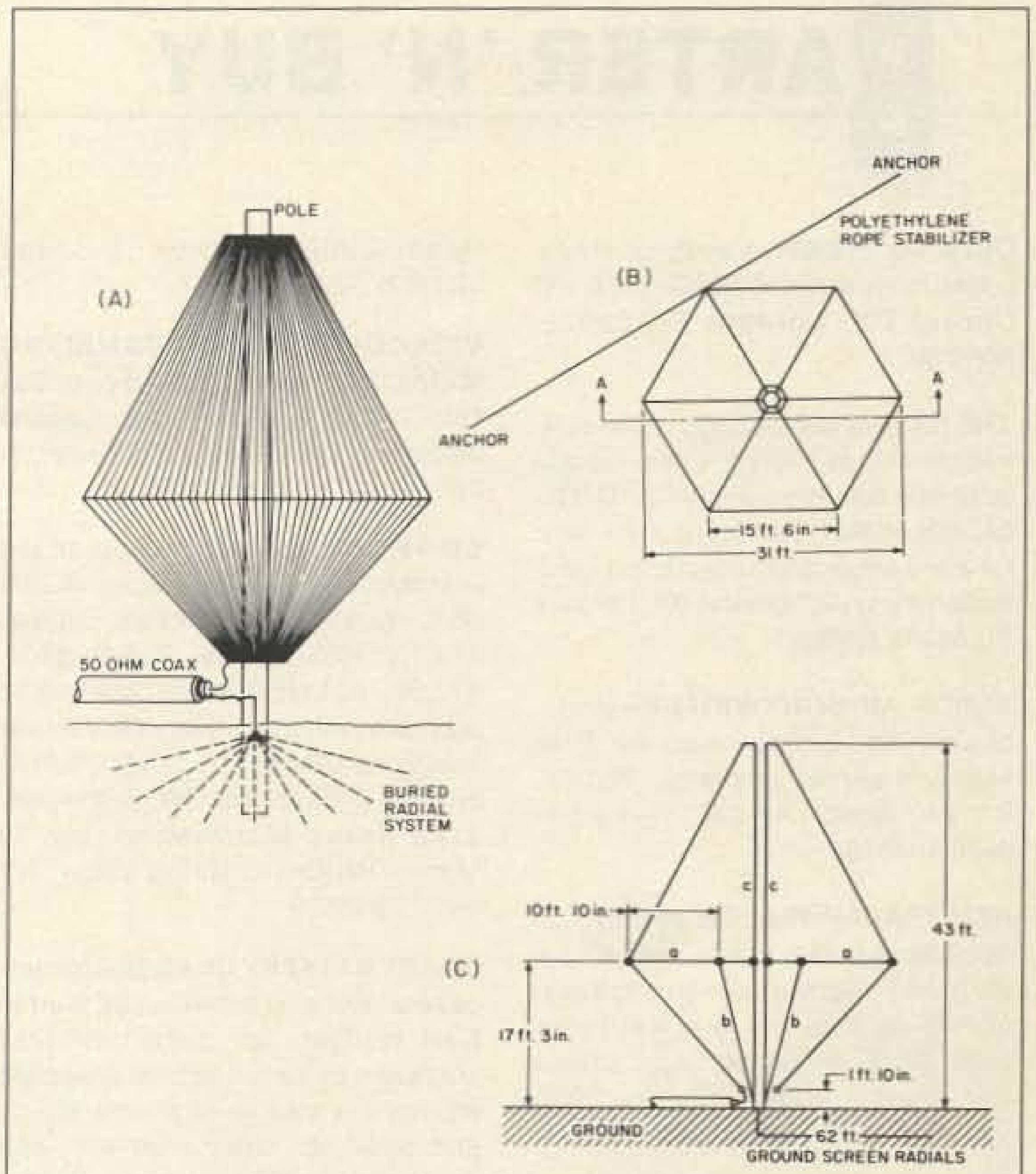

Fig. 7. The conical monopole antenna. At B, top view shows the dimensions for 3.5-14 MHz. At C is shown the side view of the conical monopole at section A-A. Note that the grounding stubs, b, *connect to the short radial wires,* a. *Wires* c *run up the sides of the supporting pole, which is unguyed.*