A Discone Just For Fun

Fun to design, build and use.

by L. Scott Hall KAØDAQ

"What's wrong? Couldn't you make the last antenna work?" My wife always says this when I'm working on a new antenna. Putting up and taking down antennas is what I do in amateur radio. Anyway, that was a year ago last fall. It was a discone.

Does a discone sound high-tech? That's not how I made it, but it works.

First thing, when I decided on this project, I looked up what other people had to say about discones. Two references were found: *The ARRL Antenna Book* and *Home-Brew HF/VHF Handbook* by William Hood. I found Mr Hood's book to be particularly useful.

Defining the Project

A discone is a vertically polarized antenna with a disc (a capacitive hat 0.68 x the base width) on top and a cone a quarter wavelength at lowest frequency, from the vertex (the point at the top) to the edge of the base (an equilateral triangle from the side). The base is a quarter wave in diameter (see Figure 1). Mr Hood states that the disc should be spaced 6" from the cone vertex at 14 MHz (no formula was given). A discone should operate over a large frequency range. My plan was to use it on 10 and 15 meters. I took these numbers and plugged them into my pocket computer to run them a few times.

```
10:  Input F
20:  B=492/(2*F) or B=150/(2*F)
     for metric
30:  D=0.68*B
40:  Print B,D
50:  Go to 10
```

Nothing fancy here—just the bare bones. Where F equals the lowest usable frequency, B equals base diameter and D equals the disc diameter.

The final design used 20.5 MHz as the lowest frequency because the SWR is supposed to rise rapidly at the lowest usable frequency. 20.5 MHz is a little below the 15 meter band, but I wanted the SWR to be low all the way to the bottom of the band. And it made the math easy. My final dimensions were 8'2" for the disc, 12' for the cone, and 4" for the spacing (I guessed for the spacing).

Before beginning I had to determine the number of radials to use. My reference book said one radial every 1/50 of a wave. That would be 38 or 40 radials. I didn't believe this number, so I did some experimenting.

Modeling

I decided to build a model. The commercial FM band (88-108 MHz) often uses dual polarization. A discone should work on the vertical portion. A tin can about 4" in diameter was used for the vertex, with a hole in the remaining end for the coax, and 12 small holes punched around the open end to attach the cone radials. The coax is fed through the open end, then through the coax hole, with the braid pulled back 2" and soldered to the can. The 2" of insulated center conductor is fed through a 1" thick, 8" wide wooden disk. Two short screws hold the can to the disk. Any insulation on the coax above the wood is stripped off. I poked a hole in the center of the tin can lid (the one removed to empty the can) and soldered it to the center conductor on top of the disk. The disc radials (six broken TV antenna elements cut to 11") were attached with screws, and the outside ends joined with a copper wire through a slit cut in the radials ends and crimped for a good mechanical connection.

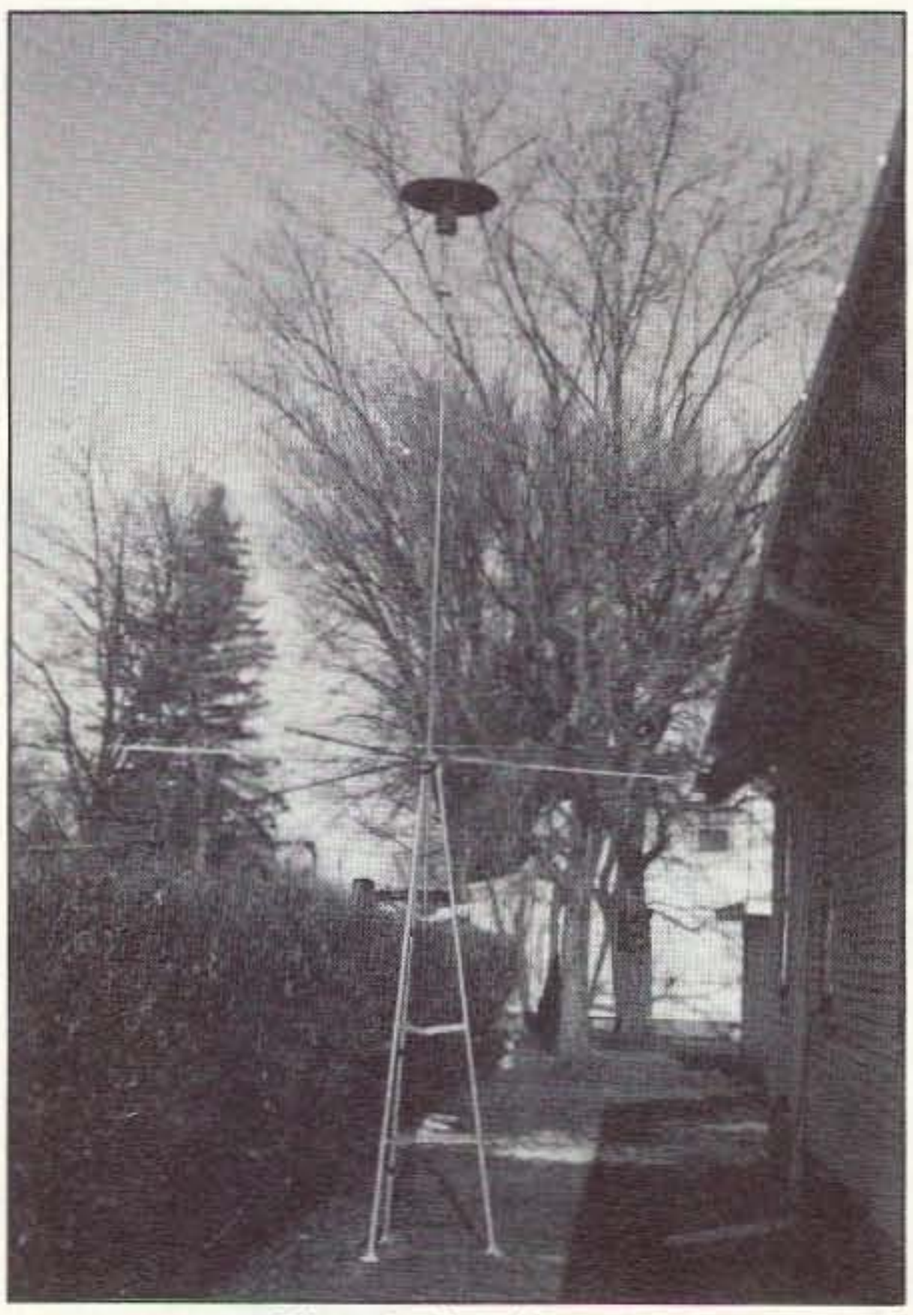

Photo A. The discone.

After the top hat was up, I strung only two cone radials (stranded wire) from the can to start with (a stiff wire base loop was used to hold the radials in place). A small-diameter stick held to the vertex can by one screw was all the support needed. Hooking this up to an FM receiver with a signal strength meter, I was surprised to find it bidirectional. Adding a third was better. After six radials, gain was not noticeable on my equipment. I guess 1/50th of a wave for radial spacing meant without a base wire.

Since I planned on using a base wire to tie all the radials together, I decided on 15 radials per wave, or 12 for this antenna. I chose 12 radials for a better SWR on 10 and for lots of capture area.

Mounting Problems

The cone and disc for the full-size discone are very much like the test model's: a circle of plywood holding six elements, with the far ends shorted together to form the disc and 12 stranded copper wires hanging from a tin can and attached at the bottom to the base loop. The real problem is the supporting hardware. Holding up a tiny model is a lot easier than a disc over 8' across. The parts for this antenna sat around a long time before I finally came up with something I thought would work.

I always knew I'd use a 1-1/2" steel mast for supporting the antenna, but how could I attach it without any possibility of shorting out the cone and disc, yet still holding the disc 4" above the cone?

Mounting Solutions

The mount (spacers) consists of three pieces of 2x4 and a 5" circle of plywood (the 2x4s are 15", 8" and 3-1/2" long). First the 15" and 8" 2x4's were glued together (I used a hot glue gun) with their centers aligned (see Figure 3). A 1/2" hole drilled down the center gave me room to feed the coax through.

I heated up the glue gun again and stuck these two, the large end, to the bottom of the disc. I made sure that the hole in the disc and the spacers were lined up right. The can already had 12 holes punched in it for the radials and the coax hole in the remaining end. After slipping the coax through the hole I stripped off 5" of insulation, then bent

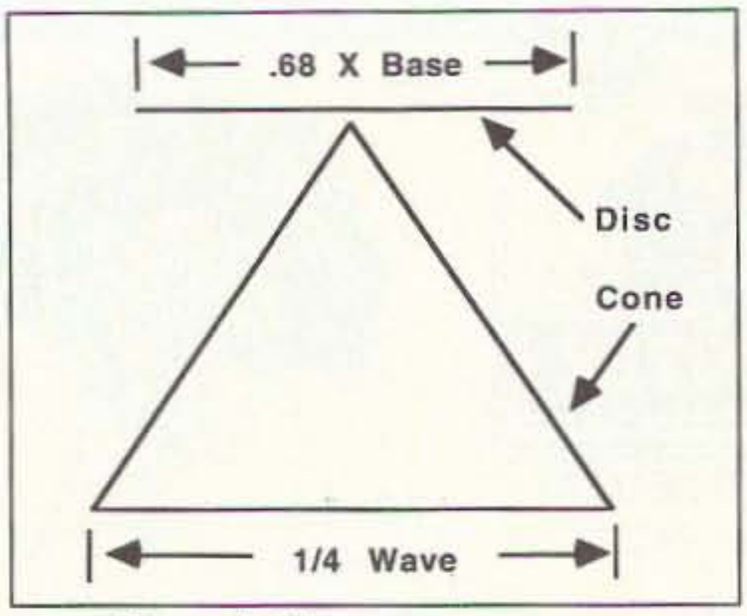

Figure 1. Discone measurements.

back and soldered the shield to the top of the can.

This is when I should have soldered the radials on to the can, but no, I did it the hard way. I slipped the center conductor through the center hole and, using more hot glue, pressed the can into place. I drilled a coax hole in the center of the 5" plywood circle and a mast hole in the 2x4 before gluing them together (see Figure 3). The plywood fit snuggly into the can. And the mast, with the coax slipped through it, fit snuggly into the 2x4 mast hole. This 2x4 collar keeps the mast from shifting. The plywood circle supports the weight of the whole antenna on the top of the mast.

Remember how on Field Day everyone puts up lightweight masts with guy lines? Now turn that picture upside down; that's how I hold the disc level. A guy line ring is mounted 3' down from the disc and four evenly-spaced ropes are tied from the edge of the 2' plywood disc to the guy ring (see Figure 2). This does a great job of holding

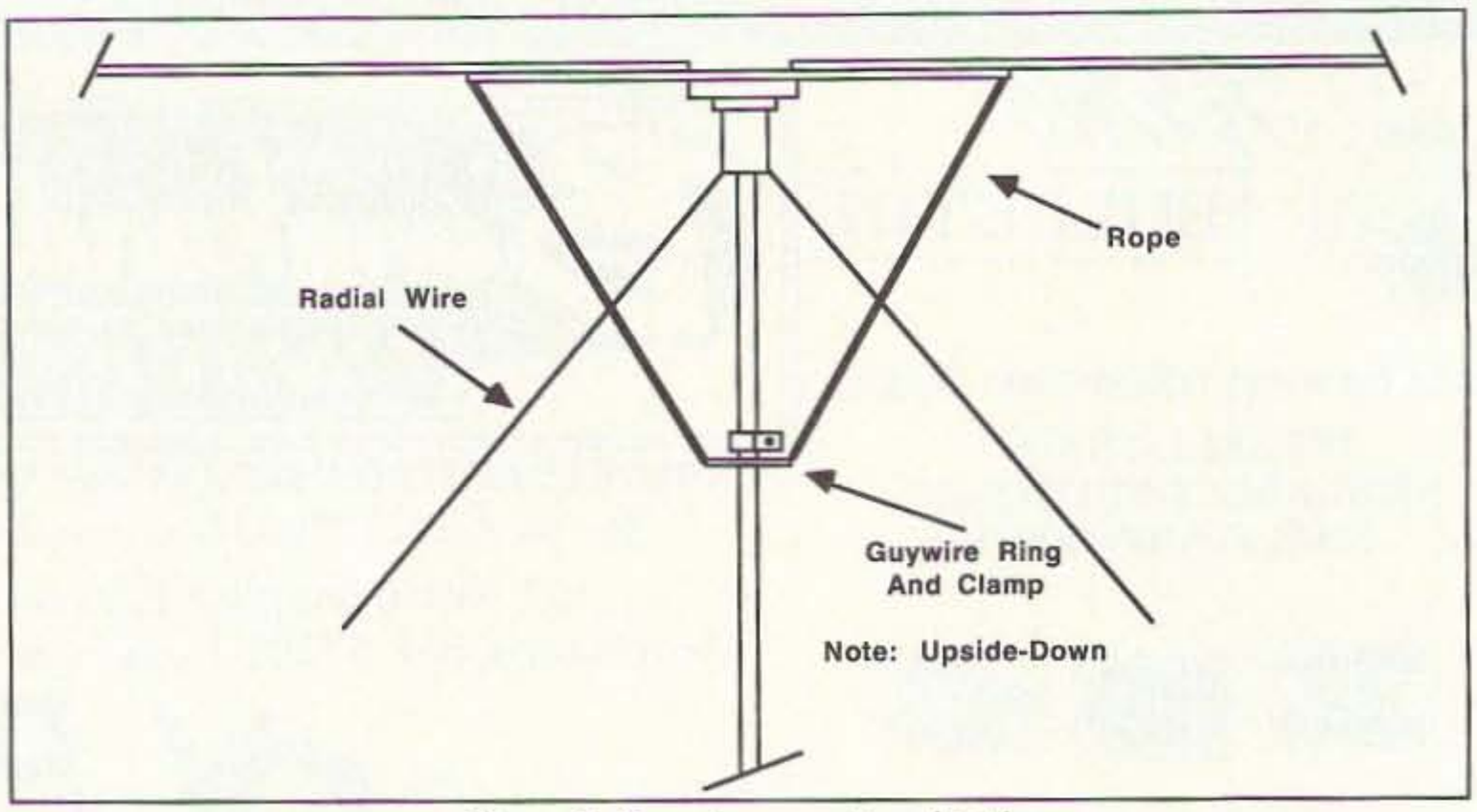

Figure 2. Guy ring mounting detail.

the disc steady.

A stiff wire simply wasn't going to hold 12 radials in place as on the model. I used a stranded wire for the base loop and six 6' sticks (1" x 1"). Two parallel holes were drilled in each stick, one through each end. While soldering the radials to the base loop, I slipped a stick on after every two radials. When all the radials and sticks were in place and the base wire was soldered together, I brought all six ends together around the mast and threaded a rope through the end holes. Then, taking up the slack, I pulled them all tight to the mast, like the spokes of a wheel, and tied them off level with the base loop.

Wrap Up

When I turned on the receiver the first time I knew I had a winner, it worked great. Signals were coming in from everywhere. This antenna worked just like the books said it would: low SWR over a broad bandwidth, and a low angle of radiation for DX. At least this is true for the lowest 10 MHz I played with. Theory states the this discone should have a working bandwidth from 20.5 MHz to 205 MHz, but without VHF equipment I was unable to prove it.

My discone was fun to design, build and use. It had good receive and transmit qualities. I liked it, but it had some problems. Foremost, it pulls in signals from everywhere, not a good quality on crowded bands or in contests. With these qualities it might work well for a net control station, but not a good choice for your only antenna. 73

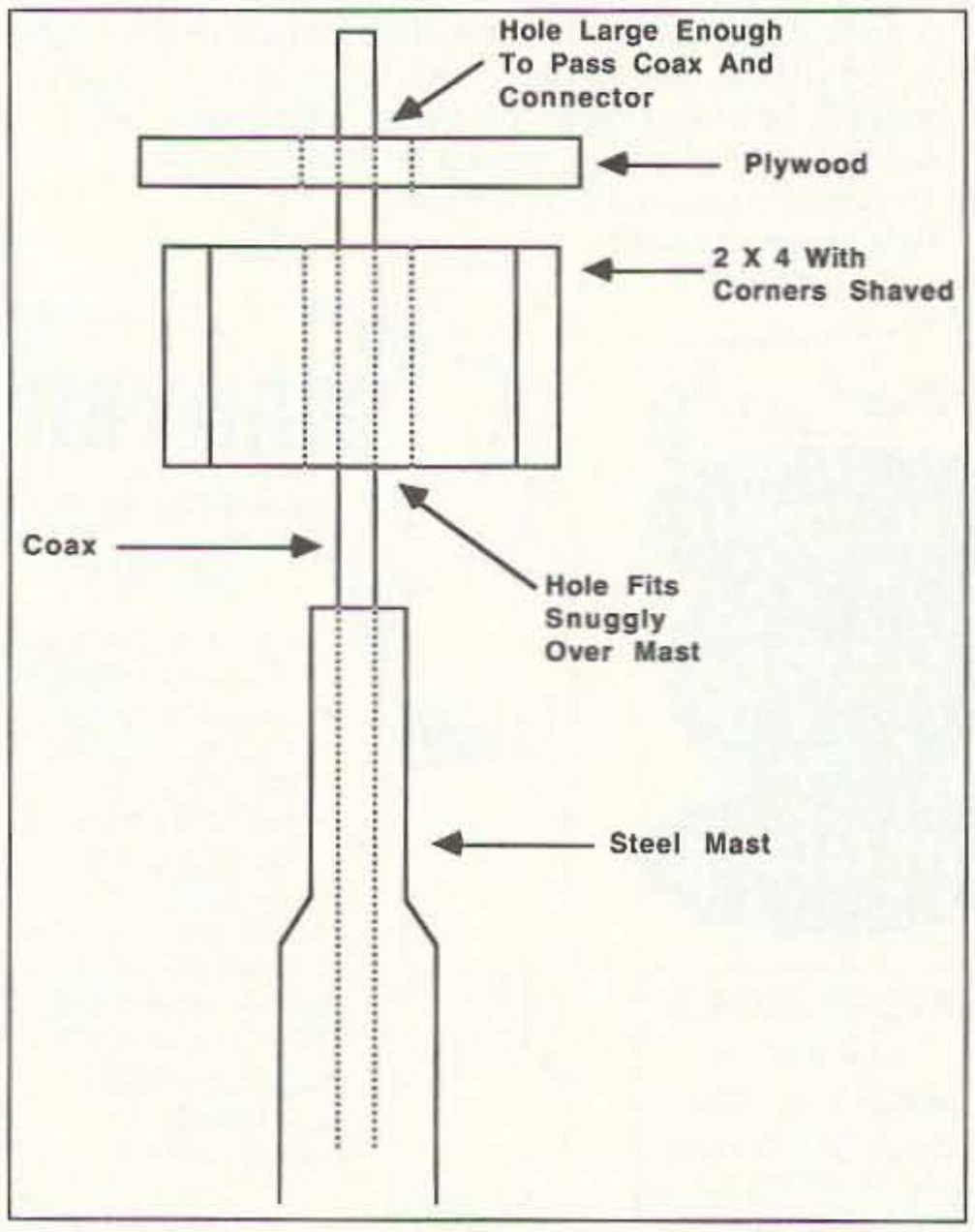

Figure 3. The 2 x 4 wood collar—plywood circle mounting detail.

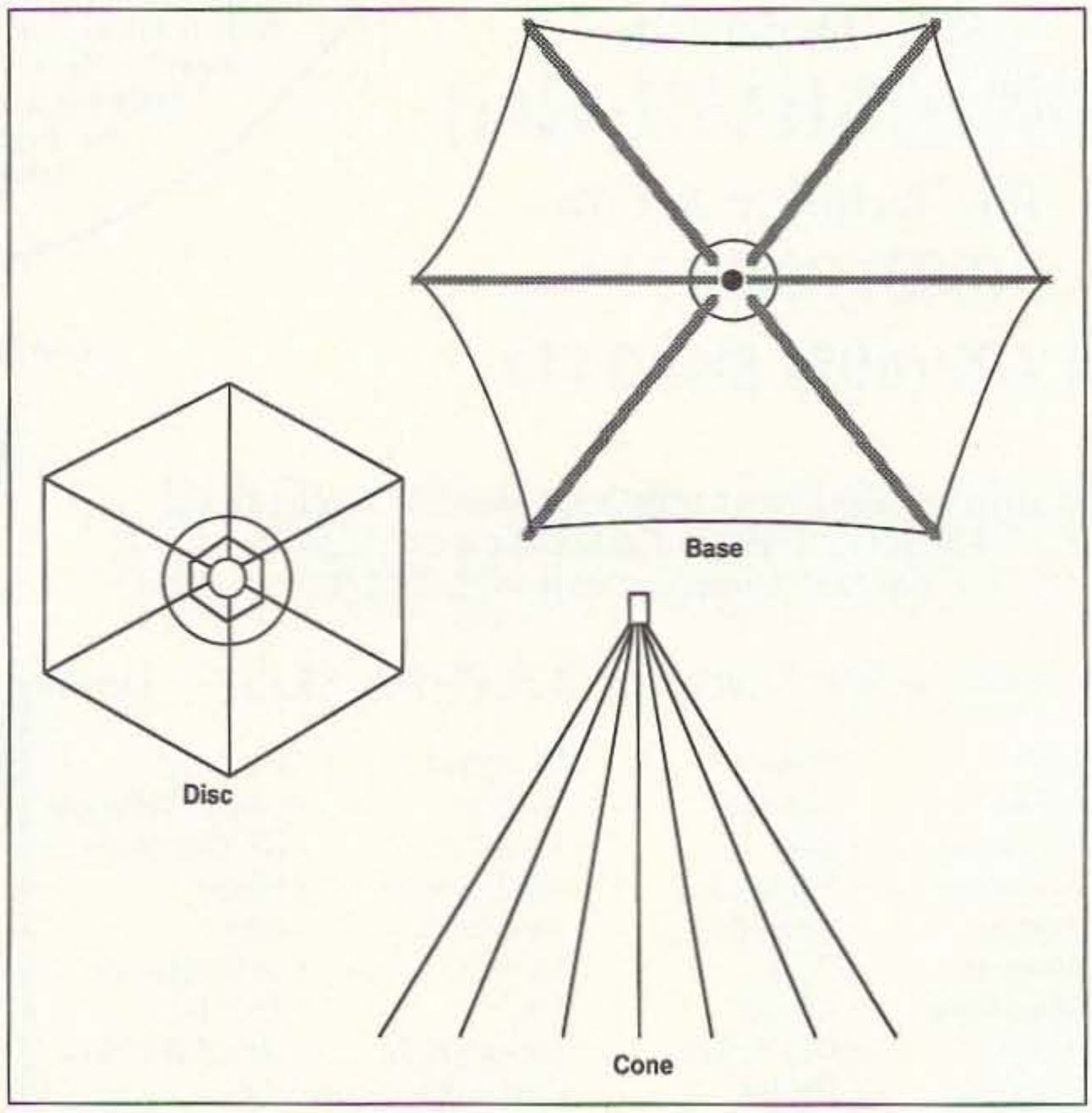

Figure 4. Base, disc, and cone detail.