You say you want to try something new? Well, W4BIW has just the ticket to get you moving on OSCAR 10.

How To Build a Quick and Easy 432 MHz Helix For OSCAR 10

BY E. BYRON LINDSEY*, W4BIW

If you are an Oscar 10 enthusiast, and if on some rainy weekend you have a hankering to build something on your own, this 435 MHz helix uplink antenna might be just what the doctor ordered.

It can be done in either one or two stages: (1) 6-turn moderate-gain helix; (2) 12-turn high-gain helix. First, the 6-turn "shorty" model will offer only moderate performance, but will fit into some rooms, the attic, or patio, etc., and provide good results when the bird is in a favorable location—especially when using c.w. Then, if you want more gain as I did later on, you can just add 6 more turns on an identical wooden frame which may be bolted to the original frame, and presto! You have tacked on what I call a "gain extension," which will give the needed dB's to equal, and even sometimes surpass, commercial-type crossed dipoles. A big plus is the ability then to say you are using a "homebrew" antenna, even though you may be an appliance operator most of the time these days, as I am.

But back to the original 6-turn job. I wound it in my basement in just two evenings while it was raining. When I finished, it was still raining, so I decided to give it a try right where it was. Sure enough, I could hear my signal coming back down pretty well. You know the next part of the story. I just had to try a couple of QSOs right then and there. I worked a couple of c.w. stations and got RST 5-3-9 and 4-4-9 right up through the basement ceiling, the bed upstairs, and out the roof! A multi-dB pad! This proved to me that some of my friends who live in apartments and condos need not be denied the pleasures of working Oscar 10. They don't know what they are missing.

*1356 Vistaleaf Drive, Decatur, GA 30033

The 6-Turn Helix Construction

After brief research, I started out with about 210 inches of wire or copper tubing in my imagination mounted on a wooden frame to be about 5 feet long and 8¾ inches wide. However, that would be an 8-turn helix, so I scaled down to a starting winding of 175 inches on a frame 4 feet long by 8¾ inches wide for the 6-turn "shorty" model. However, the copper tubing was not too available and would not be insulated, so I decided to use this brand-new type 9913 Belden coax for the spiral. I was already using it to feed my other beams and was familiar with the rigidity of it. It is semi-flex stuff and has a vinyl covering, of course. The inner conductor was soldered to the outer shield at both ends and epoxy was applied.

I used a well-varnished wooden frame and stapled the coax spiral to it. You can see from the photographs that this frame is bolted to a 1 × 4 board via a single large bolt. This permits elevation adjustments to be made via "Armstrong" methods. Likewise, the 1 × 4 board is attached to a pipe driven in the ground by two loosely coupled U bolts. This permits azimuth adjustments to be made, also by the "Armstrong" method. There is nothing wrong with using manual AZ-EL adjustments on Oscar 10 antennas. You only need to change them about once every two hours.

The foundation for the ground plane is

The author "sighting" in via the "Armstrong" method.

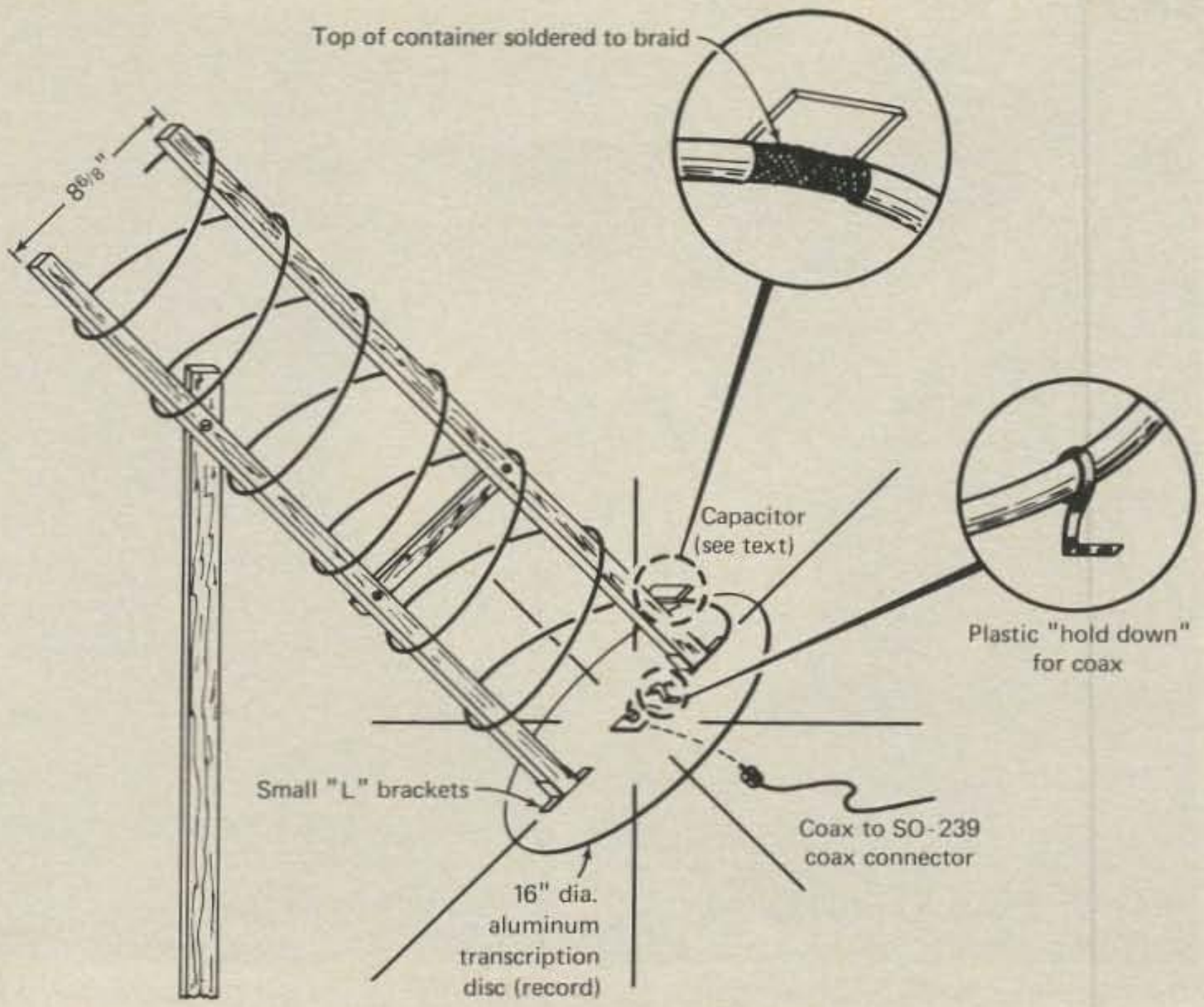
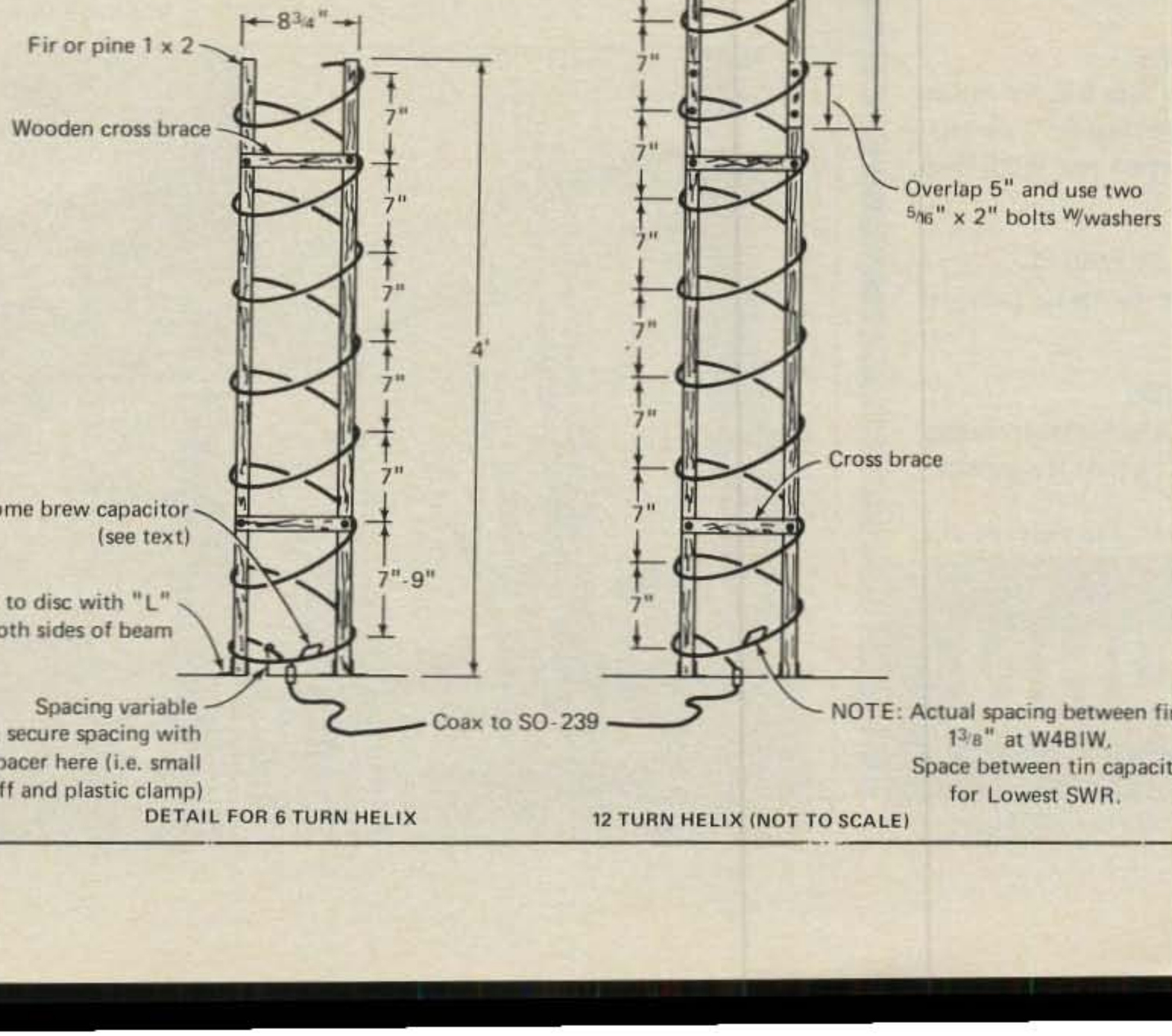


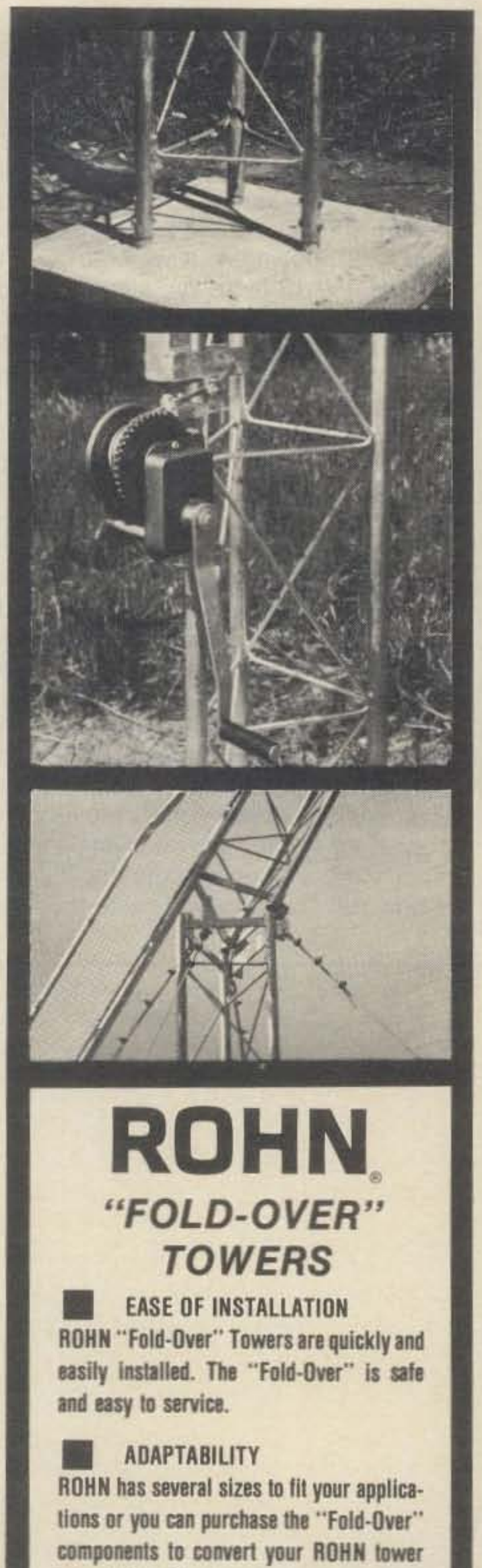
Fig. 1– The 6-turn "shorty" model. The construction is simple and straightforward.

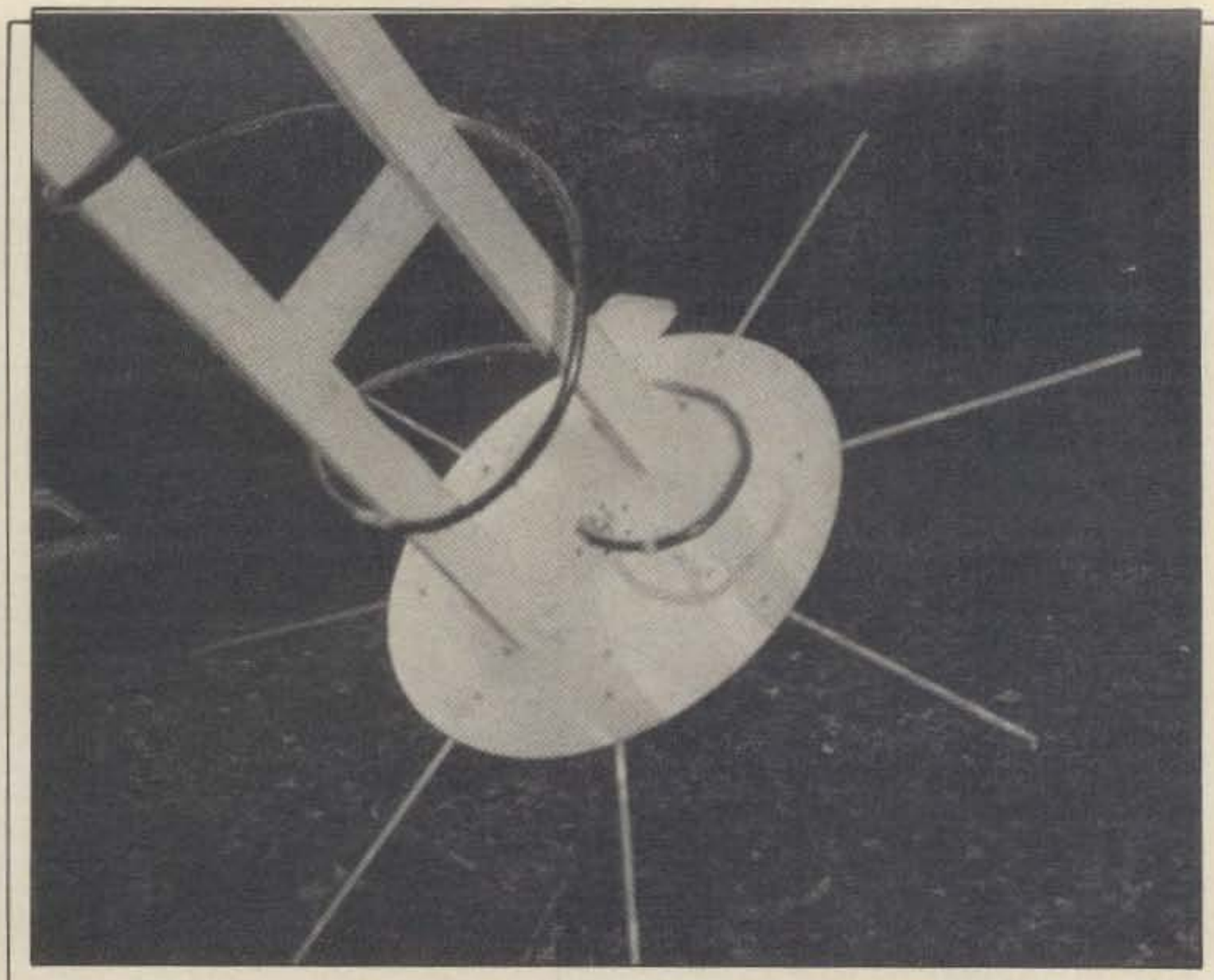
an old 16 inch aluminum disc transcription obtainable from any older radio station. The acetate coating may be removed by soaking it in very hot water. The stuff then peels off readily, and leaves a nice shiny surface with a hole already started in the center for the SO-239 connector. (I might have liked another location for it, but there it was, so . . .) Of course, the 16 inch disc alone is hardly enough surface for the reflector, so I bolted 8 aluminum radials to it. Actually, more radials would be desirable, but this arrangement seems to work okay, so as some people say, "Don't fix it if it ain't broke." I must admit that it looks better and has less wind resistance than the usual copper screen types I have seen.

I would recommend 9913 type coax to feed any rotatable antenna at 435 MHz, but you will find the large center conductor unsuitable for type N connectors. Therefore, the use of so-called u.h.f. connectors is better, I think. Those purists who still may want to use type N may file down the big center conductor and do so, but the result will be rather weak mechanical mating between the coax and the connector. I chose to use the PL-259, since mine is an uplink antenna. If it were a downlink helix, I realize that the impe-

Fig. 2– Details for the 6- and 12-turn helix.







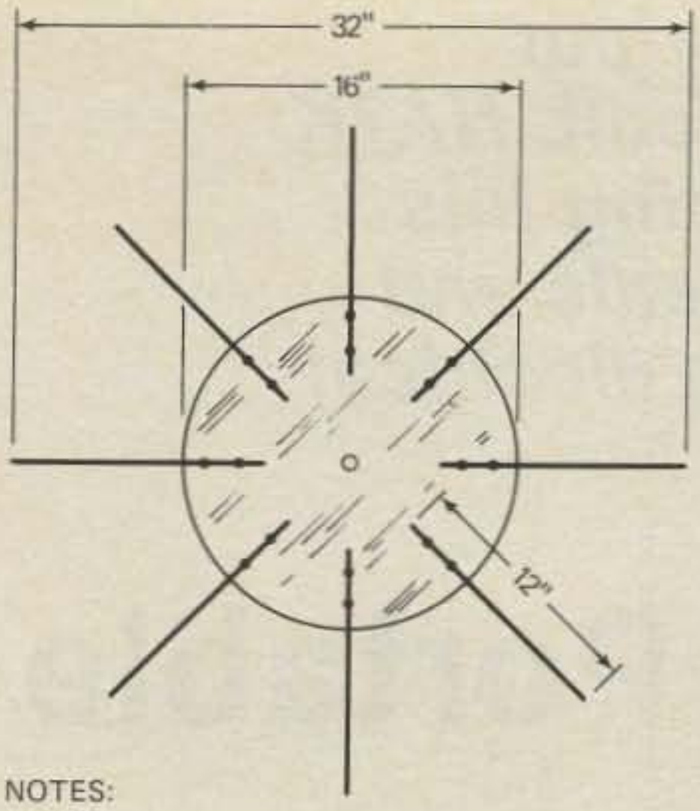
The bottom of the helix showing the radials, capacitor (upper right center of the disc), and the turns.

dance hump caused by the "u.h.f."-type connectors would probably result in maybe a dB of noise added to the system.

The near-perfect 50 ohm match was accomplished by running the first one-third turn of the winding close to the ground plane and adding an adjustable capacitor. In my case this is nothing more than the top of a popular lozenges container which is soldered to the outside braid of the coax spiral at approximately one-third turn from start. If your experience is like mine, you might have something like a 3 to 1 s.w.r. at this point and want to get a better ballpark figure by pruning the far end of the winding a few inches until it at least starts down. Alternately, try adjusting the capacitor, and you will eventually arrive at a good v.s.w.r. My helix has approximately 1.03 v.s.w.r. as measured on a Bird 43 wattmeter.

I realize that some people prefer the classic-type construction of helical antennas over all that has been described here. The classis design is wooden dowels tediously mated into a center piece in a spiral arrangement with a copper screen reflector, etc. All I can say in defense of the "Quick and Easy" is that it

The 12-turn model facing towards the sky.



NOTES:

1. Each of the 12" aluminum spokes are attached with two small machine screws. (Flatten spoke slightly to bore holes at bolt point).
2. Disc is aluminum transcription with coating removed (see text).

Fig. 3– The transcription disc radial system as described in the text.

lives up to its name in assembling and works just as well as any—maybe better. However, don't expect any 6-turn helix to equal the gain of the current commercial high-gain, crossed dipole types. To really compete with these antennas one can add 6 turns and have a 12-turn high-gain signal-shooter that will equal, and at times surpass, the crossed-dipole types. For one thing, I believe you get less QSB and/or "spin modulation" with a helix. I will discuss some of the reasons for this later on.

I will describe now the "gain extension" mentioned earlier, which consists of 6 more turns of 9913 wound on an identical wooden frame as before. It may be bolted to the original frame via four large bolts (see photograph). The result will be a nice 12-turn high-gain helix with right-hand circular polarization, sometimes abbreviated RHCP.

Before proceeding with the 6-turn extension, I decided to slow down a bit, recalling that I had put the original 6-turn together in some haste in order to try it out as soon as possible (normal ham anxiety!). I wondered if I would have any trouble just tacking on 6 more turns. Looking at helical theory some more, I found that everyone agrees that the natural terminal impedance of any helix of over, say, 3 turns is on the order of 130 to 140 ohms, and that this impedance *does not* change appreciably with the addition of more turns. I rationalized, then, that if there was a 50 ohm match obtainable to begin with, it probably would remain stable if the spiral were lengthened also. Sure enough, I later found the v.s.w.r. to be about the same 1.03 with the extra turns. Looking good!

Theorizing a bit more, I wondered just how critical the length of a single turn would be and what winding pitch I should use. It was noted that in a helical beam one complete turn usually equals one wavelength, and at any given instant the positive and negative charges appear at opposite ends of an imaginary line drawn through the diameter. All through one cycle, then, these charges will revolve, and the whole antenna pattern will be one of circular revolving polarization. If the spiral is wound to the right, as viewed from the ground-plane feedpoint out, one w ill get right-hand circular polariztion. This is what Oscar 10 likes 90% or so of the time. The bird also likes good circular polarization, and it is my belief that a helix best provides that. i know I get less QSB and spin modulation with my helix than with other types of antennas most of the time. It is true RHCP.

In view of all of the above, I decided to rewind the whole spiral, paying more attention to the length of each turn and the diameter between turns. I was careful not to stray too far from the usual one wavelength per turn and quarter-wave winding pitch. I did fudge just a little, and made both just slightly longer for what seemed to be convenience and symmetry. No harm done. A helix with these dimensions will have a rather broad bandwidth. It should be mentioned that this antenna could be useful at 432 MHz, of course, and on ATV frequencies. Also, it would be useful for downlink reception on Oscar 10 (Mode L) and other satellites (Mode J).

The final result was just what I wanted. I have named it "Felix the Helix," because 'ole Felix sometimes sneaks in a better signal than the commercial antennas I have when I compare it in an on-the-air test. The commercial antennas are AZ-EL, motor controlled on my chimney, and Felix is on the ground. I get a chuckle and a jolly-good feeling inside when Felix equals or beats the other antennas, and of course, I just ignore it when he loses out to them on rare occasions. Hi!

I did all this for fun and experience anyway, but got "all wound up" doing it, and I hope you do too! CQ