TOP LOADED 160 M VERTICAL

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W8QJH/7

Here's a good antenna you can put together for the CQ 160 M Contest. (January 27 - 28)

Since the birth and growth of single sideband, the use of a.m. equipment on most bands has become virtually impossible, especially in the 100 watt power class. However, there are still quite a few a.m. rigs that can be heard on 160 and 10 meters. Since ten meters poses no problems in antenna construction, this would seem to be a very popular choice for the few a.m. operators left on the air. Of course, who wants to be confined to only one band in which to operate that low-powered a.m. rig? Now, have you ever considered the possibilities of 160 meters? More than likely you have, but after some brief thoughts of how and where you could construct an antenna, you soon gave up any ideas of 160 meters.

Because I live in an apartment, operation on 160 seemed to be an impossible task, until I decided to experiment with top-loaded verticals. My original antenna was nothing more than a quarter-wave vertical for 40 meters; just a piece of TV mast, consisting of three sections joined together and about 33 feet high, which is bolted along the side of the house (thanks to the landlord). My first thoughts were to base-load the vertical, which I did, and it seemed to work quite well. Although it seemed as though every time I made a contact with a California station, and the subject of antennas came up, I was told to get the loading coil up off of the ground and into the air where it could do some good. So I decided to look into the problems of top loading and the advantages of doing so.

Top Loading

Any antenna that makes use of a loading coil poses the problem of getting the coil high enough in the air, away from surrounding objects, to really do some good. Of course, in a mobile installation you are limited as far as the height is concerned, but in a fixed location the problem of height is usually limited by nothing except your own imagination. This being the case, the highest possible installation on 160 will probably only be a small portion of a wavelength.

So now, all that must be done to be top-loaded on 160 is to make up some sort of coil and top-section that will be resonant in the 160 meter band. For this purpose, all you need is some number 18 enamel wire, a 102 inch CB whip and some sort of coil form. I know that the first thought that has come to mind now is, how much of a coil is necessary. Actually, it's not nearly as bad as you may think.

Loading Coil

The coil is wound on a hollow card-board form measuring 2¼ inches by 6 inches and is close-wound with number 18 enamel wire, approximately 140 turns. After the coil is wound it is then ready to be mounted on the 1¼ inch wooden dowel stick. This is accomplished by simply passing the dowel through the center of the coil and fastening the

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coil to mounting bolts. I used a ¼ inch by 20 bolt and large solder lugs to hold the coil in place on the dowel stick. (See fig. 1.)

All that remains is to fasten the C.B. whip on top of the dowel above the coil. In my case, this was accomplished by drilling and tapping a ¾ inch round piece of aluminum in one end, so that I could screw the whip into it. This piece was then inserted into the top end of the wooden dowel. (See fig. 2)

Now we have a completed top-loading section and all that remains is to tune it to the proper frequency. Tuning was accomplished by inserting my top-loading section into a 10 foot piece of TV mast and using a grid-dip meter at the base of the mast to first establish the frequency at which the antenna was resonant. It was around 1800 kc., so in order to raise the resonant frequency, I took off a few turns off the coil and again checked the resonant frequency with a grid-dip meter. This "pruning" process went on until the antenna was resonating around 1950 kc. At this point I put the entire mast together with the top-loading section located on the very top of the vertical and raised the antenna into the air, with the help of Jim Schroeder, an old friend and S.W.L. The purpose of raising the antenna at this point was to determine what effect the height would have on the resonant frequency. The result was a change in frequency of some 30 to 40 kc. Fortunately, at this point, no further adjustments were necessary.

S.W.R. Measurements

Another way in which the antenna could be tuned would be the use of an s.w.r. bridge. Instead of using a grid-dip meter, try tuning the transmitter to the frequency at which you want to operate. If the rig will not load and shows a high s.w.r., increase the frequency and again note the s.w.r. If, with an increase in frequency, the s.w.r. shows an increase this will indicate that the antenna is resonant at some lower frequency than to which you are now tuned. Simply decrease the frequency while noting the s.w.r. until the s.w.r. is as low or as near to zero as possible. Now that you have established the resonant frequency of the antenna, it is a simple matter to raise the resonant frequency by removing one turn at a time from the coil or decreasing the resonant frequency by adding a capacity-hat to the whip antenna above the loading coil. Once you have the top section tuned, keeping in mind that a small change in frequency occurs as the antenna is raised into the air. Note also, that the s.w.r. will be very near zero at resonance and will increase by a noticable amount with an increase in frequency of about 10 kc. This will show that the "Q" of the coil is reasonably high.

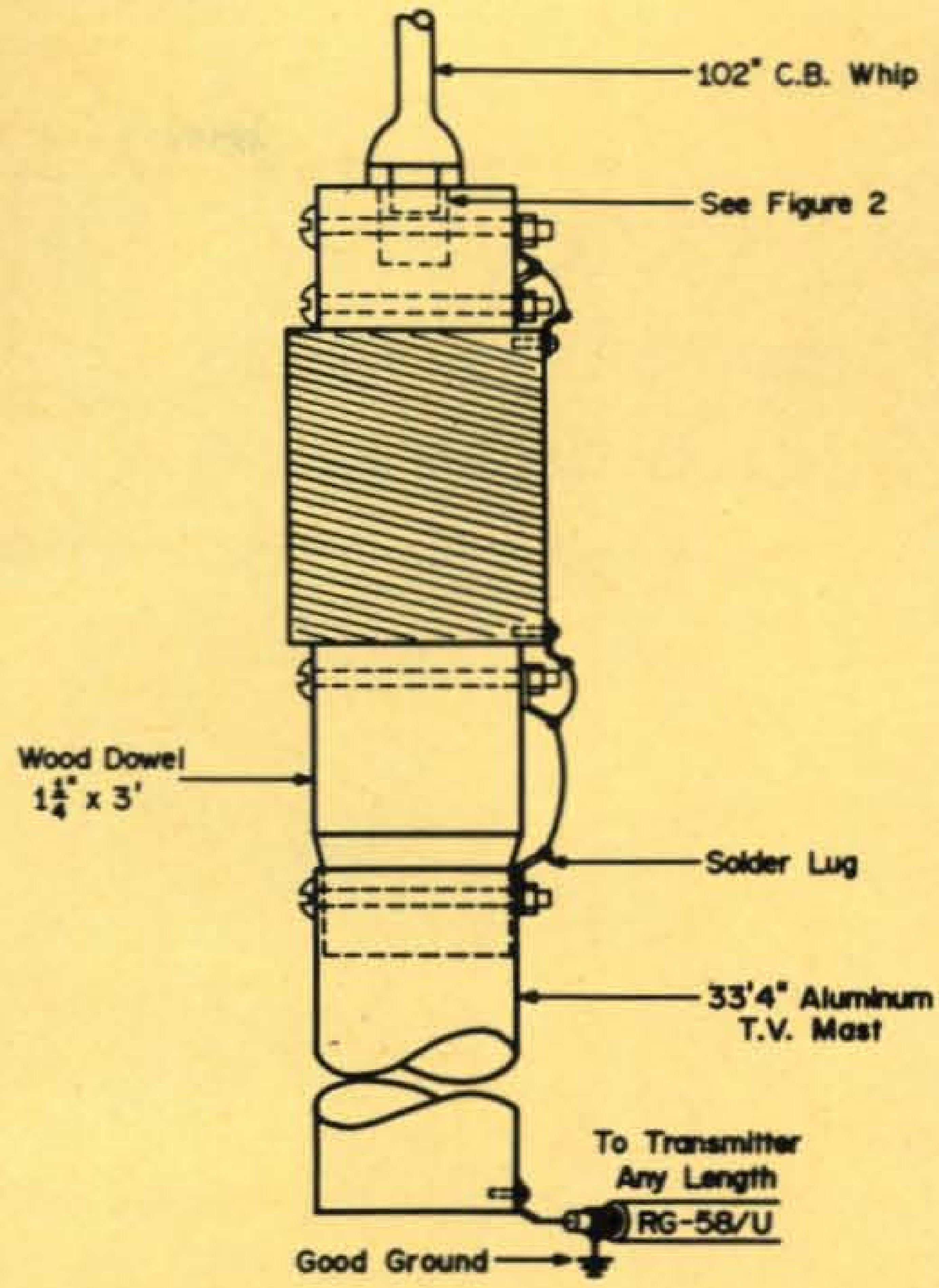


Fig. 1—Construction details for a top loaded 160 meter antenna that also operates on 40 meters. All the bolts used are ¼ × 20. The loading coil, as described in the text, is 6" long by 2¼" diameter. The wood dowel is 1¼" by 3' with at least 1½' to 2' inserted into the TV mast.

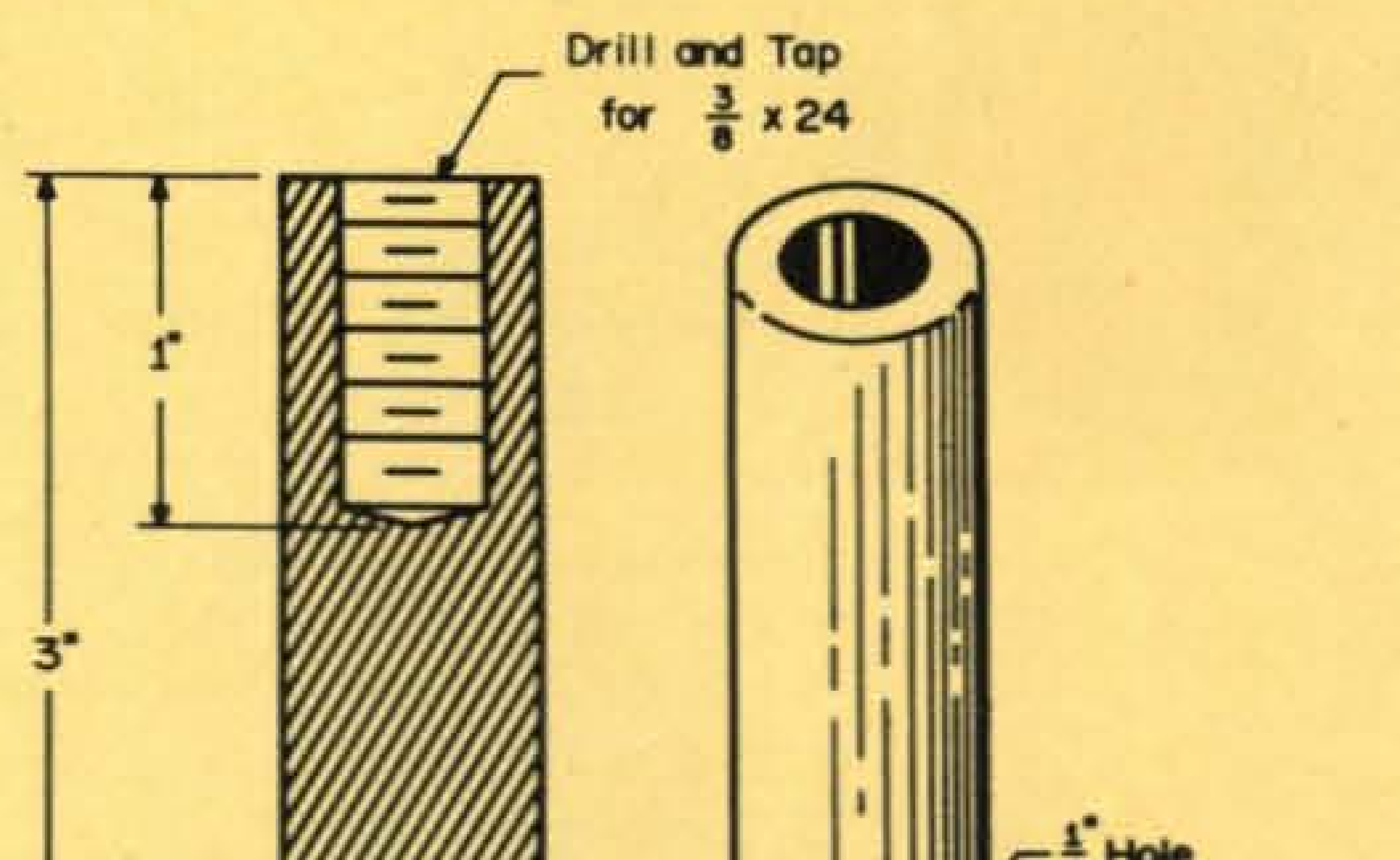
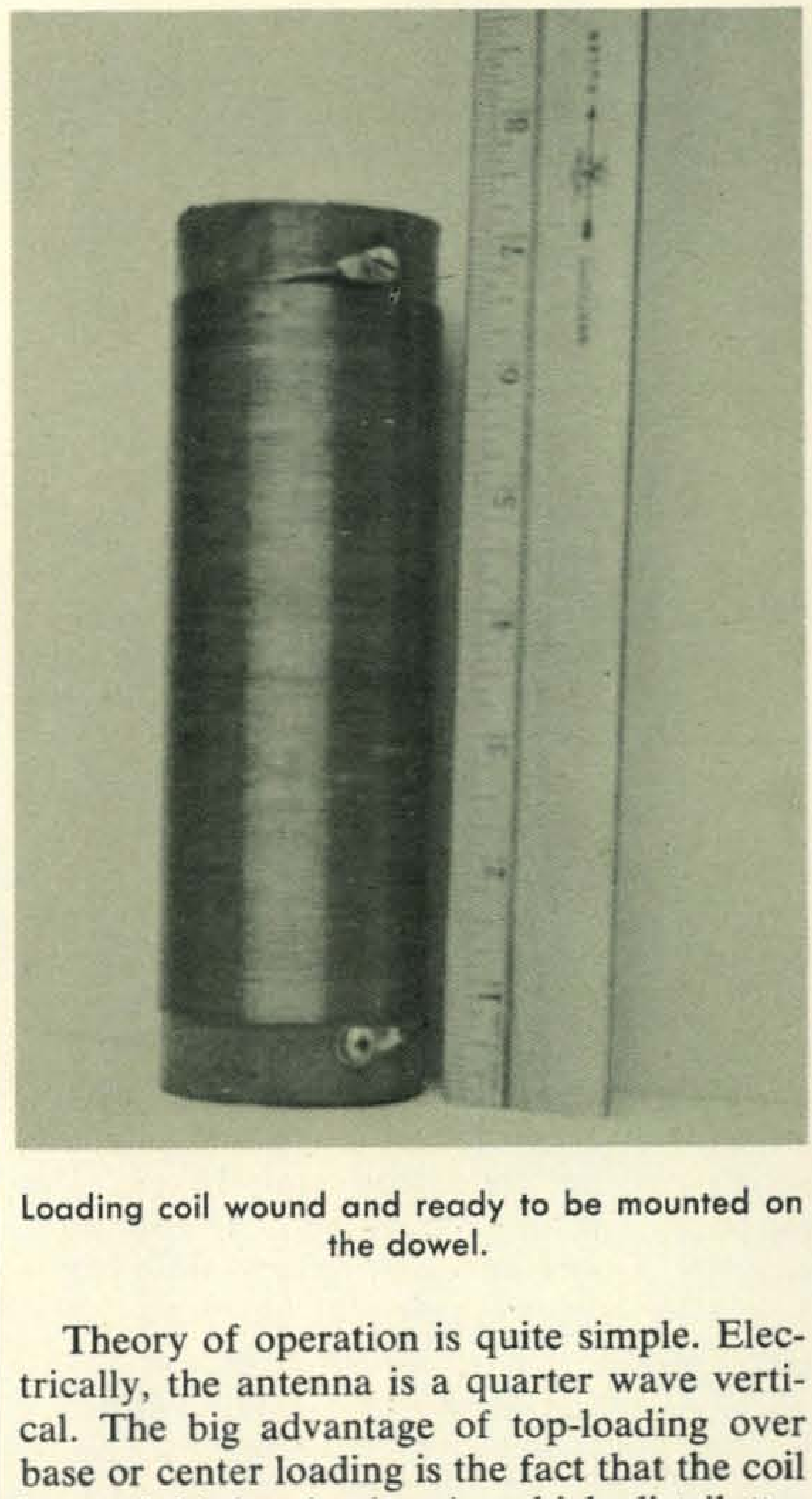


Fig. 2—Aluminum insert used in the top of the dowel to accept the threaded end of the CB whip.



Loading coil wound and ready to be mounted on the dowel.

Theory of operation is quite simple. Electrically, the antenna is a quarter wave vertical. The big advantage of top-loading over base or center loading is the fact that the coil is much higher in the air, which distributes more current along any point of the antenna, compared to base or center loaded antennas. Also, raising the loading coil and top section from the base of the antenna to the top raises the antenna's load impedance which will provide a closer match for standard 50 ohm coax.

Now that the antenna is top-loaded on 160 meters, what effect will this have on the antenna's operation on 40 meters? The answer is none, so without any adjustments at all, you can switch from 160 meter operation directly to 40 meter operation and still maintain a low angle of radiation and a low s.w.r. on the feedline.

I'm very sure that many improvements in the construction of this antenna can and will be made. However, due to the extreme shortage of information on top-loaded antenna's, at least now you will have a place to start experimenting. Good luck, and I'll be listening for you on 160. ■