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A Low-Life Antenna

— tune in on the life below 500 kHz

There has been a resurgence of interest in the low-frequency bands (0-500 kHz) of late among many radio amateurs. Twenty-four hour weather broadcasts, navigational beacons, standard time broadcasts, the license-free 160-190 kHz communications band, as well as many other services residing in this lowest end of the spectrum, make it a very special challenge to the active amateur.

Unfortunately, many experimenters shy away from LF due to the misconception that antennas for this band must be gigantic to work well. I have spent several years experimenting in this band, using all shapes and forms of antennas, but I have found the antenna described here to be an excellent performer, as well as being practical and of low construction cost.

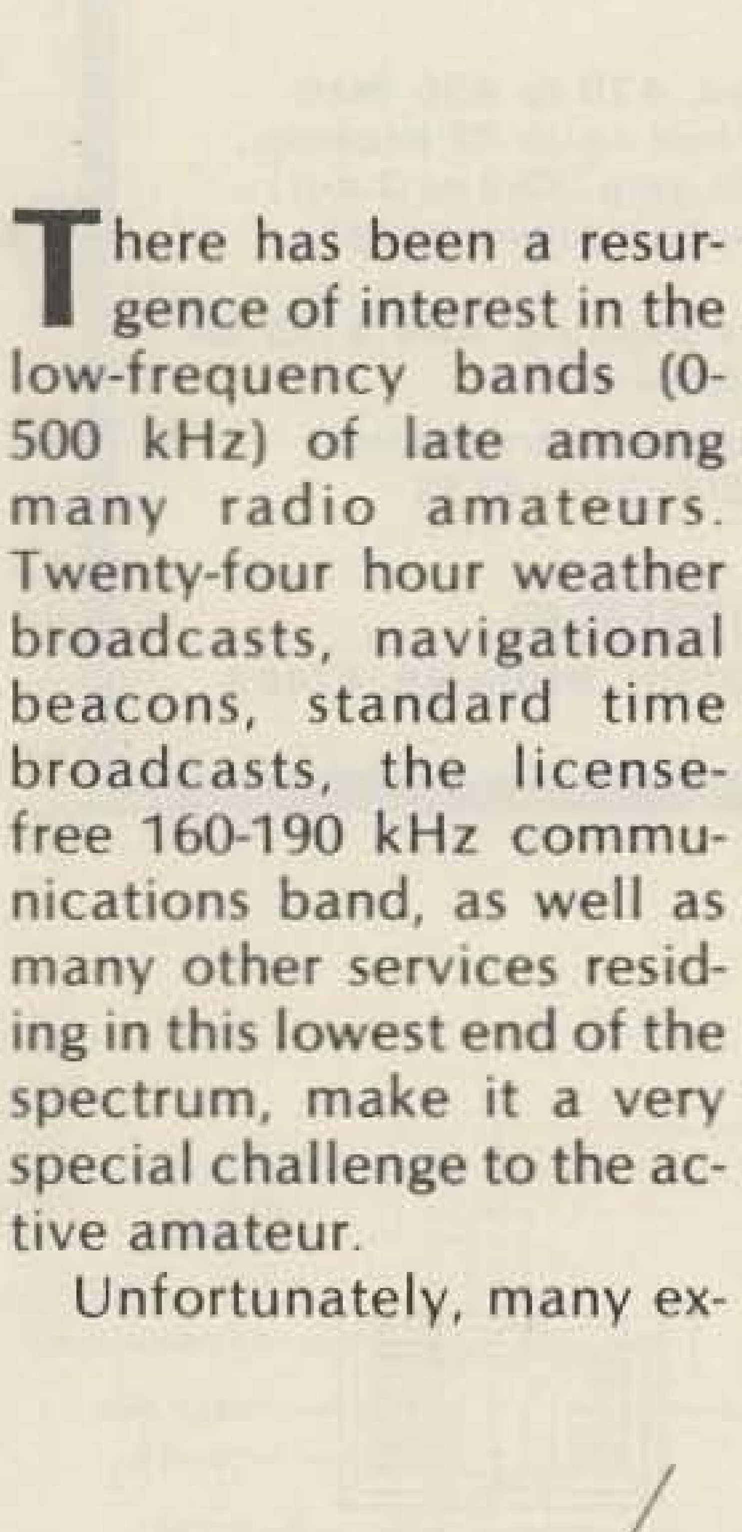

Fig. 1. Antenna.

Description

There are three basic rules to follow in designing a low-frequency antenna.

1. It must be vertical. A horizontal antenna of any practical size on this band is a real exercise in frustration and will perform about as well as a dummy load.

2. It should use a tuning network of some kind. Antennas on this band are very high Q devices, and some kind of tuning arrangement will be of great help.

3. It should have a good ground system. Although I have gotten good results with nothing more than a 6-foot ground rod, results are directly proportional to your ground system's efficiency.

The antenna is basically a center- and base-loaded vertical with a capacitance "top hat." The major components are the tuning box, loading coil, and top hat, shown in Fig. 1.

Tuning Box

A suggested tuning network is shown in Fig. 2. In this configuration, the tuning is all done by the variable capacitor, C1. C2-C5 are switched into the circuit to give the capacitor an effective range of 0-2365 pF. If you happen to have a switch with more than five contacts on it, you can extend this range, but I do not recommend going overboard. L1 is wound on a 2.5-inch-diameter, 5-inch-long form (I used a large pill bottle), using about #28 wire. Several layers may be required, but be sure to secure each layer as it is finished. There is little more maddening than to finish 299 turns and then have your winding go flying off the end of the form.

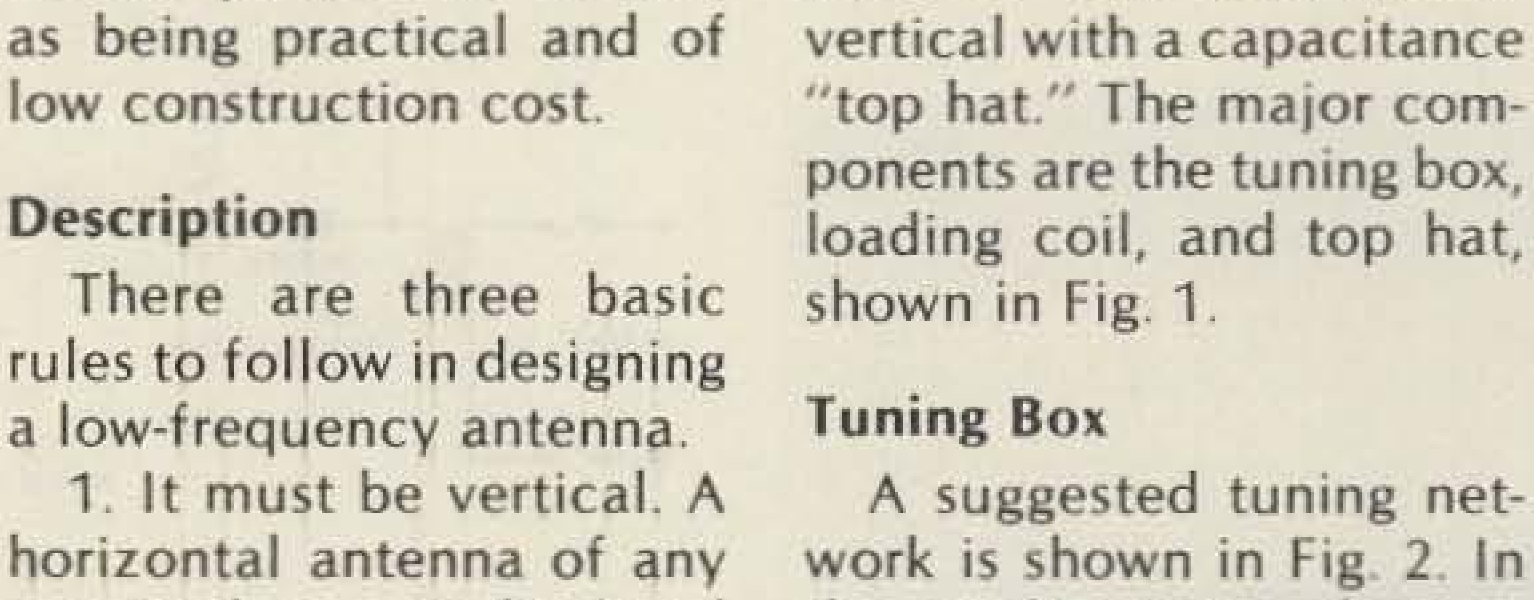

Fig. 2. Tuning box.

The coil is tapped at 50 turns in order to tie in the feedline. The best method of doing this is to bring out some slack at the 50th winding, twist together, and solder. Be sure to secure the tap to a terminal strip when you mount it so that you won't have to strangle your kids when they trip over the coax and pull the tap out of the coil. If you have another rotary switch on hand, you can tap the coil at several other places to give even more tuning range.

The manner of mounting components in the tuning box is a matter of personal preference as, at this frequency, long leads do not show an appreciable inductance (within reason, of course).

The network can be mounted in the shack, but in most cases this would require a long horizontal run to the first standoff supporting the end of the vertical element. As much of the antenna as possible must be kept vertical.

Loading Coil

The loading coil is constructed from a 4-foot length of 1.5-inch PVC pipe available from any hardware store. Start the winding six inches in from the end and wind to within six inches of the other end. This leaves enough space at either end to secure the vertical wire elements. Alternate every six inches with close- and wide-spaced winding. I don't know why, but this seems to work better than using consistently close- or wide-spaced winding. Have patience!

I was able to secure the enameled wire I needed by going to a TV repair shop and getting some old television yokes. These contain a lot of #24-28 wire that can be gotten out with little effort. The owner of the TV shop gave me the bad yokes just to get them out of his way.

Always keep a piece of electrical tape close at hand to secure the winding should you have to get up from the table. When the winding is finished (if you haven't gone crazy by now), cover the entire length with electrical tape and plug the ends to keep the bugs and other undesirables out.

Top Hat

The top hat's function is to increase the antenna's capacitance to its ground plane, thus increasing its efficiency. My top hat was constructed from two 2-foot-diameter loops of coat-hanger wire joined at right angles, with a brace down the center to support the weight of the rest of the antenna. (See Fig. 1.)

Installation

Fig. 3 shows my method of installation. This system was chosen simply because the tree was in the right place and tall enough, and I have a friend who is good at climbing 75-foot tall sweet gum trees. (Not recommended!) You can erect your LF antenna by likewise sloping it up any kind of support, of course. Use the bow-and-arrow trick or just throw a rock up there with a string tied to it. (A case of cool 807s to the first one to do that!) Use your own ingenuity; just keep the antenna as vertical as possible.

Ground System

I recommend an 8-foot ground rod with a minimum of four radials, each about 20 feet long. The more ground, the better. However, you can get surprisingly good results with no radials at all. The tuning network does not have to be mounted directly on the ground. Remember, we are talking about low frequency.

Some Results

The antenna is at its best between 50 and 500 kHz, the most active part of the band. Fourteen states have been logged on TWEB stations (24-hour aviation weather stations). Some of the best DX has been CUT in upper Michigan—227 kHz, MF in southern Florida—365 kHz, LE in North Carolina—350 kHz, and CMH in Ohio—391 kHz. None of these was even faintly detectable with a standard loop antenna.

On occasion, I have copied beacon TUK in New England on 194 kHz with a solid signal. However, it is my understanding that this is a high-power beacon. (Most TWEB stations run about 100-1000 Watts.)

Performance on the 160-190 kHz band is really super. By the way, if you mount the transmitter right at the base, this is a legal and effective antenna for use on this band. WWVB on 60 kHz is much more readable with this system than with the loop.

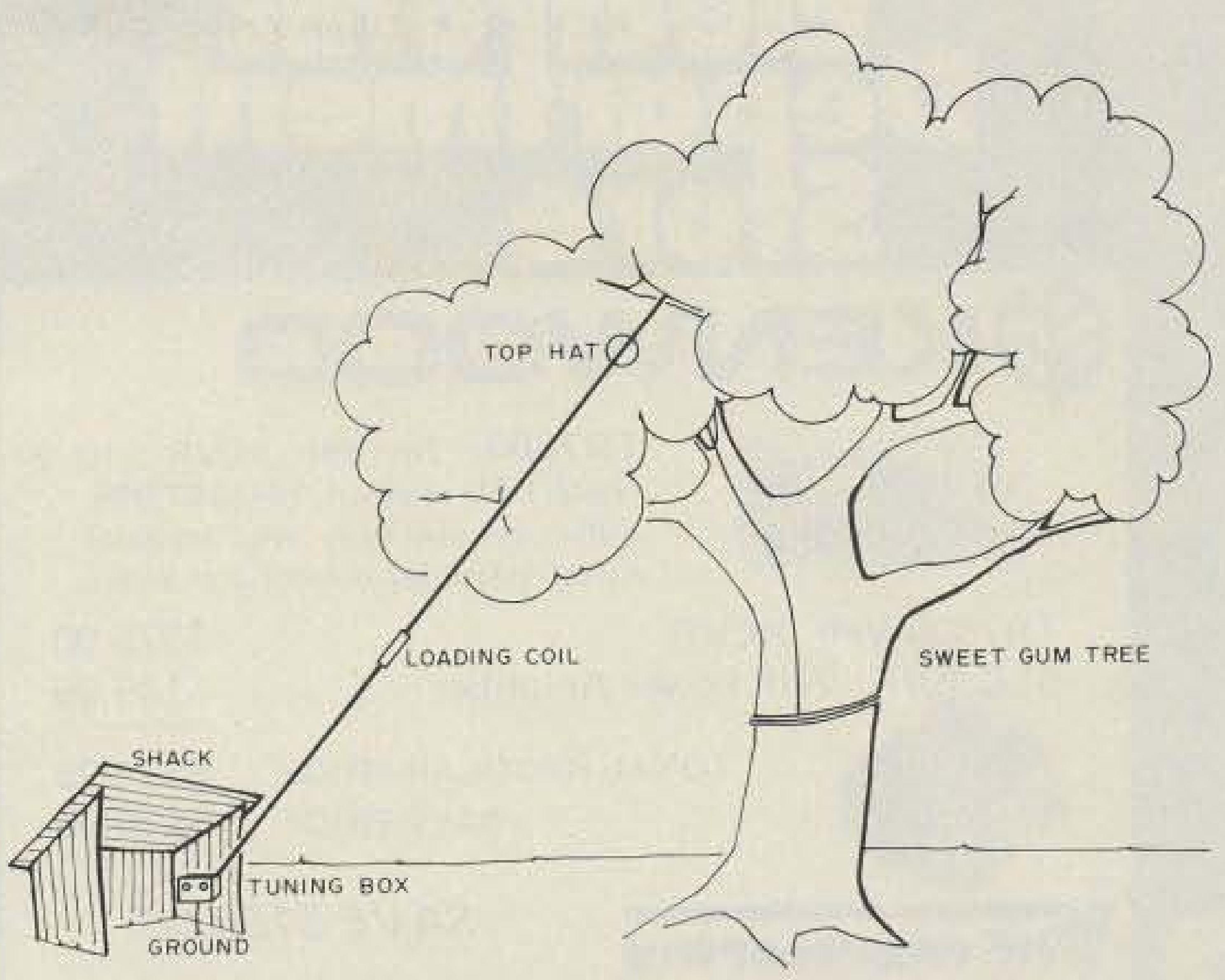

Fig. 3. The AB5S installation.

Conclusions

I have found this antenna to be a real winner for anyone interested in long-wave work who will put forth the effort to construct it. Many refinements can yet be made, I am sure, and I hope those of you who construct this system will try your own ideas. By the time you read this, my beacon, AB5S, should be back on 188 kHz, using this antenna. I will gladly answer any questions with an SASE. Good luck, and see you on long-wave! ■