Another Look at an Old Subject: The Bug Catcher

Why aren't more hams going hf mobile? Some say the lack of effective, inexpensive antennas keeps them away. Here is one solution.

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There are many high-frequency (hf) rigs around with 12-volt capabilities, yet hf mobile operation seems to be a novelty to most amateurs. Perhaps part of the reason more amateurs are not on hf mobile is the antenna. Mobile antennas are usually large, expensive, poor performers and a general nuisance with five or six separate coils to keep track of.

The antenna described in this article, while still large, is inexpensive to build (approximately $35) when compared to commercially available models (about $120) and has quite an impressive performance record. The frequency range of the antenna is from 80 to 10 meters. Its overall height can be reduced to slightly above the roof of the car in less than 10 seconds, should a low obstacle be encountered.

Rebirth of the Old Standard

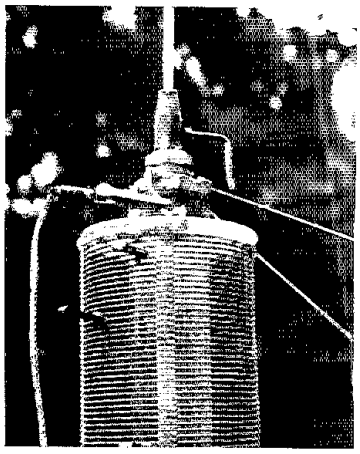
This antenna is quite similar to some of those that were popular in the '50s and the early '60s. These "Bug Catcher" types of antennas (so named because of the open coil, which collects insects) generally performed quite well. This one has some improvements incorporated into it that were not used on its ancestors:

1) It uses locally available parts.

2) It is adjustable to be a full 1/4-wave antenna on either 15 or 10 meters. Most of the parts can be obtained at either a hardware store or the plumbing-supply section of a discount store. The Plexiglas tubing and sheet will have to be purchased at a glass company. It would be a good idea to buy some extra stock and practice on it before attempting to work with the real thing as Plexiglas can be difficult to work with. The coil stock will be the most difficult part to find. It is marketed under the trade name "Miniductor" or "Airdux." We would suggest trying some of the older, more established ham stores which still cater to the do-it-yourself artist.

An electric drill with an assortment of drill bits and grinding devices is an almost essential tool to construct this antenna. A hacksaw is necessary and a saber saw is a big help. Epoxy cement works well to cement the coil assembly together, but seems to become brittle after exposure to the elements. Silicon bathtub caulk has proven to be an excellent substitute for the epoxy.

After procuring the necessary parts and tools, several subassemblies must be completed before the coil is assembled. One of these is the disassembly of the CB whip. The best way we found to accomplish this is to clamp the whip in a vise a short distance above the base fitting (ferrule).[1] Then find a small box-end wrench that will just fit over the threads, contacting the remainder of the base fitting. The base is removed by striking the wrench close to the whip, forcing the base fitting up the whip. Note: slight damage to the threads is not important, as they are going to be forced into a nonstandard fitting later. Continue forcing the base fitting up the whip until it is free and can be completely removed from the whip. The Corona ball



Here is a close-up view of the completed coil assembly. Notice the Allen wrench that has been soldered to the setscrew in the ferrule. Horizontal lines extending from the coil are the noninductive guy lines.

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[1]Notes appear on page 32.

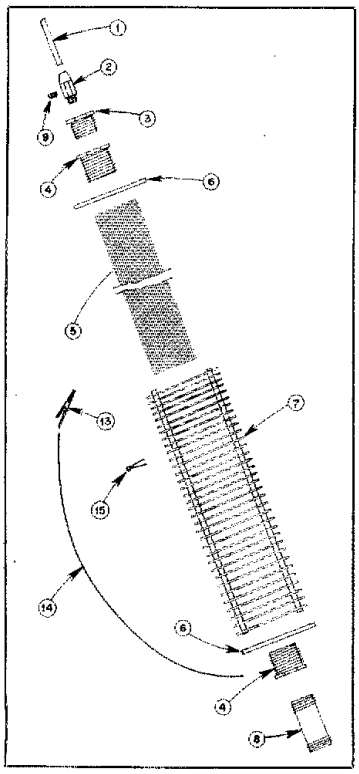


Fig. 1 — This is an exploded view of the coil assembly. Parts numbers refer to the parts list in Table 1.

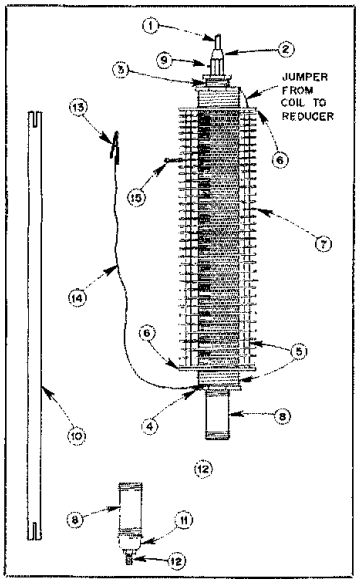


Fig. 2 — The completed coil assembly is shown here along with aluminum tubing mast. The inset shows the reducer which is threaded into the Plexiglas tubing. (Parts list is in Table 1.)

may have to be removed to allow the fitting to slide over the end. Not all whips are manufactured the same way: If, after repeated attempts, the base still won't slide over the top of the whip, then it may have to be taken off at the bottom.

Once this is accomplished, grind down the large end of the whip until the base fitting will slide freely over the whip. Some enlarging of the hole through the base fitting may be necessary. Drill and tap a hole into the side of the base fitting so that a setscrew inserted into the hole will prevent the whip from sliding through the base fitting. If you do not have the facilities to tap the brass base, then any machine shop can do it in a few minutes.

To support the coil, two Plexiglas "doughnuts" must be fabricated from the Plexiglas sheet. Fig. 1 depicts an exploded view of the coil assembly. It is best not to remove the covering from the Plexiglas until final assembly. Begin by drawing two sets of concentric circles on the covering of the Plexiglass. One should be larger in diameter than the outside of the coil, and one slightly smaller than the diameter of the Plexiglas tube. Form two discs by sawing along the larger circles. Next, drill a hole in the exact center of each disc. Enlarge the holes until a snug fit is obtained over the Plexiglas tube. The small circle can be used as a guide.

Another method of making the plastic doughnuts is to find a tin can that is slightly larger in diameter, or the same size, as your coil. Heat the open end of the can over the stove or use a propane torch or other suitable heat source. Be sure to put Plexiglas, to be cut with the can, on top of a piece of wood or other insulator as the can will get hot enough to transfer heat to the bottom side. (Note: Only the open end rim of can need be heated; use a thick glove.) When the can is relatively hot, place it on the plastic sheet and turn with twisting motion until the can starts to cool. Remove it from the plastic and heat it again. Repeat the process about three times on each side; this should render a perfect circle. Then, with a hole saw and some rotary files you can complete your doughnut.

A piece of aluminum tubing of 7/8-inch[2] inside diameter must be modified to go between the bottom of the coil and the mounting assembly. Cut a piece of the aluminum tubing approximately 30 inches long. Then cut two 3-inch-long slots (on perpendicular planes) in each end of the tubing. Slide two hose clamps over the tubing prior to final assembly.

Tackling the Coil

After the above work has been completed, the coil assembly can be tackled. First, screw one of the large reducers into one end of the Plexiglas tube. To do this, heat the reducer over a stove or with a torch until it will melt its way into the

Table 1

Parts List[2]

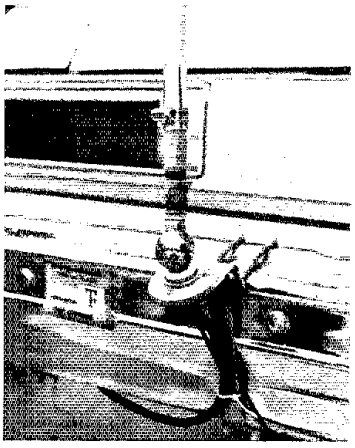
1) Whip (standard 102-inch).
2) Whip base or ferrule (removed from whip).
3) 1/2-inch to 1/4-inch reducer (pipe coupling).
4) 1-inch to 1/2-inch reducer (two required).
5) 1-1/4-inch-OD × 12-inch-long Plexiglas tube.[3]
6) Plexiglas doughnuts (two made from 1/8-inch-thick Plexiglas sheet).
7) Coil (3-inch dia × 10 inch long × 8 turns/inch).
8) 1/2-inch pipe nipple (2 required).
9) Setscrew.
10) Aluminum tubing 30 inches long × 7/8-inch ID.
11) 1/2-inch pipe cap.
12) Mounting bolt 3/8 × 24.
13) Alligator clip.
14) Shorting wire (RG-58 braid, see text).
15) Coil clips (at least five needed).
16) 1-inch dia hose clamps (two required).

Plexiglas as it screws down. It is important that care be taken to ensure that the reducer goes in straight. After the reducer cools, slide one of the Plexiglas doughnuts over the open end of the tube until it will go no farther.

Next, make sure some wire is left sticking out of the top end of the coil stock so that a connection can be soldered to it later. Slide the coil down over the tube followed by the remaining doughnut. Heat and screw the top reducer into the tube. Again take care to ensure that the reducer is in straight. Cement the doughnuts to the tube in such a way that they have the coil tightly sandwiched between them.

The end that has the wire available for soldering will now become the top of the coil. Screw the small reducer into the large reducer at the top of the coil. Screw the whip base into the top of the small reducer (the threads do not match perfectly but the brass base fitting will conform as needed). Solder a wire from the top large reducer to the top of the coil. When cleaning the reducer prior to soldering, don't file through the galvanizing or soldering will become impossible. Solder a piece of large, flexible wire (such as RG-58 shield) to the bottom reducer, leaving it long enough to reach the top of the coil. Solder an alligator clip to the free end of this wire. This completes assembly of the coil.

To assemble the rest of the antenna proceed as follows (Fig. 2): Drill a hole in the exact center of the pipe cap, large enough to just pass the threads of the bolt. Insert the bolt into the hollow portion of the pipe cap and through the hole. Then screw one of the nipples into the pipe cap and down onto the top of the bolt head. An alternative method would be to weld the bolt head to the bottom of the pipe cap. Regardless of which method is used to secure the bolt, screw the exposed bolt threads firmly down into your mount. (Washers may be necessary.) Screw the remaining nipple into the bottom of the coil



"Plumber's Delight" type mast is screwed into a regular CB bumper mount.

assembly. Place the aluminum tubing over the exposed end of the nipple which is attached to your mount. Clamp the tubing in place with one of the hose clamps. Try to get the tubing vertical. Force the pipe nipple at the bottom of the coil into the top of the aluminum stalk. Secure this by the remaining hose clamp. Slide the whip into the top of the coil and make sure that it will slide freely all of the way down through the assembly until it contacts the base mounting assembly. This completes assembly of the antenna.

Tapping the Bands

A tap must be placed on the coil for every band, and for portions of the 80-meter band. Several methods might be used to select the tap locations on each band. Generally it is better to start with the higher-frequency bands and work down. The method we prefer follows, but don't be afraid to try any method you think might work. To locate the tap for the 10-meter band, place the clip as close to the top of the coil as possible. This should be on the top turn next to the solder connection. (The solder connection itself may be used.) Slide the whip all of the way down and the antenna should be resonant on 10 meters. When the whip is extended to the point where the setscrew is close to the bottom of the whip, the antenna should be resonant on 15 meters with the same clip location. Small changes in resonant frequency can be achieved by sliding the whip up or down a small amount. The whip should be fully extended for operation on all lower bands.

To find the tap for 20 meters, it is best to find the point where maximum signal strength is observed in the "receive" mode. To do this, find a signal that is fairly strong and steady. Move the clip down one turn at a time from the top until a peak is observed on the receiver "S" meter. Then with an SWR bridge, move the tap up and down the coil from this point until minimum SWR is observed at the desired frequency. Place the clip here. Taps may be located on any side of the coil, or they all may be kept in a straight line if a slight increase in SWR is tolerable.

The same procedure is followed for 40 meters. The final SWR may not be as good as on 20 meters, however, since the impedance of the antenna is getting lower as more loading is used.

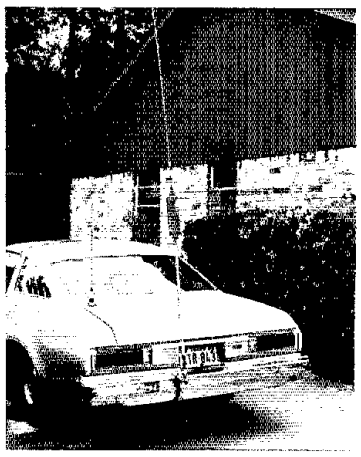
Eighty meters is quite difficult to tune using this method. The impedance of the antenna is down to less than 20 ohms, causing a high SWR on a 50-ohm line even at resonance. This SWR is acceptable with tube-type finals, as long as the rig loads up properly. If operation with solid-state rigs is contemplated, a matching transformer or some other form of impedance matching should be used. Because of the high SWR, the 80-meter taps must be located differently. A field-strength meter is probably the best tool to use. Tune the antenna for maximum observed field strength. If you don't have one and have access to a radio with tube-type finals, however, the following procedure works well. Locate the point on the coil where maximum noise is observed. Then with the clip located at this point, tune the rig up according to the manufacturer's instructions, except do not increase the load control at all, i.e., leave it in the maximum capacitance position. Then move the clip up and down one turn at a time until the observed dip in plate current as the plate-tune control is rotated just dips down to the normal fully tuned level.

Several taps will be necessary to cover very much of the 80-meter band. The resonant frequency of the taps extends upward from each location until the load control can no longer load the rig to normal plate current.

A Bumper Crop

Generally this type of antenna will be located on the back bumper of an automobile. Some people mount it on the fender or the rear deck. The higher it is mounted the better it will work, but the more obstacles it will hit. It is also hard to get a solid mount up high on a vehicle. If the antenna is to be mounted on the bumper, any of the heavy-duty bumper mounts made for CB whips may be used. A nonconductive guy line should be run to the rain gutter or to some other point in front of the antenna on the same side of the vehicle. The guy can be looped around the top of the coil assembly just below the whip. Either RG-8 or RG-58 cable may be used to feed the antenna.

All of the models built by local hams used some kind of "handle" soldered to the setscrew. An Allen wrench works well,



WD5FRN's antenna farm on wheels.

as does a washer. This makes it easier to adjust or remove the whip quickly should the need arise.

Most of the rigs now on the market have very good noise blankers and no noise suppression is needed on the vehicle. The subject of noise suppression is covered in *The Radio Amateur's Handbook* (available from ARRL for $10) should a problem arise, however.

The best test of a mobile antenna is to operate it on the lower frequencies. Several models have been constructed and have been in use for over a year. Mobile-to-mobile contacts on 80 meters always have been possible up to distances of 1000 miles. Several late-night contacts have been made over distances exceeding 3000 miles on 80 meters. Checking into local traffic nets rarely has been a problem, with this antenna performing better than a random wire combined with a tuner at the fixed station. Come on in and try "low-band" mobile. The water is fine!

We would like to acknowledge the help of Mark Kelly; Jimmy Vaello, WD5HBV; Texas Traffic Net; Bruce Love, WB5NOQ; members of the MSC Radio Committee at Texas A & M University and Shelly Gilbert.

Notes

[1]Most CB-style whip antennas have a completely hollow ferrule that is soldered or brazed to the bottom of the whip. Some antennas used by the commercial services have a different style of construction. On those whips, the ferrule is hollow only a portion of the way down and the whip is held in place by setscrews. It will be necessary to drill the hole all the way through the ferrule to be able to use it in this project — probably a most difficult task. We suggest starting with the CB-style ferrule.

[2]Feet × 0.3048 = meters; inches × 25.4 = mm.

[3]PVC pipe can be used instead of Plexiglas tubing if one does not mind not being able to see the base of the whip when it is inside the tubing.