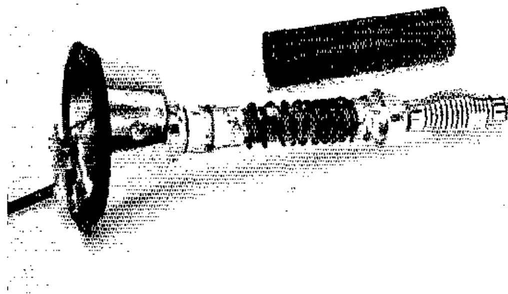
Every ham likes to save a dollar. Here is a modification of a CB whip to provide a 5/8-wavelength vertical for 2-meter operation. Savings over commercial ham equivalent? About $20.



The new coil is tapped two turns from the base end. It may be necessary to file the coil ends so that the assembly will fit in the phenolic covering.

CB Whip + Mod. = 2-Meter 5/8λ Vertical

BY LEW McCOY,* W1ICP

PROBABLY THE most popular mobile antenna used by the 2-meter fm gang is a base-loaded, 5/8-wavelength vertical. Commercial versions of this type antenna are in the thirty- to forty-dollar class. One way to save about half the cost is to modify a CB mobile antenna. We won't go into the philosophy of why CB antennas are so much cheaper than ham antennas, but there must be good reasons!

The whip that was chosen for this modification is an Archer Model 21-908 (Radio Shack), but there are similar types available. The antenna consists of a clamp-on trunk mount, a base loading coil, and a 39-inch spring-mounted, stainless-steel whip.

The modification consists of removing the loading-coil inductance, winding a new coil, and mounting a 3-30 pF trimmer in the bottom housing. The capacitor is used for obtaining a precise match in conjunction with the base coil tap.

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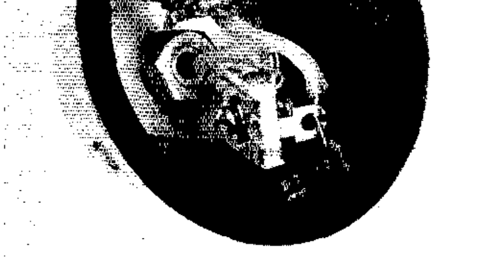
Modification

The first step is to remove the weather-proof phenolic covering from the coil. Remove the base housing and clamp the whip side of antenna in a vise. Insert a knife blade between the edge of the whip base and the phenolic covering. Gently tap the knife edge with a hammer to force the housing away from the whip section. Proceed carefully, working around the edge of the phenolic covering until it starts to loosen. You'll find that the housing comes off quite easily.

Next, remove the coil turns and wind a new coil using No. 12 wire. The new coil should have nine turns, equally wide spaced. The tap point is two turns up from the base (ground) end on the antenna we modified. The trimmer capacitor is mounted on a terminal strip which is installed in the base housing. A hole must be drilled in the housing to allow access to the capacitor adjustment screw.

Adjustments

Initially, the tap on the coil was tried three turns from the bottom. The antenna was mounted on the car, an SWR bridge was inserted in the feed line, and C1 and the whip height were adjusted for a match. A match was obtained, but when the phenolic sleeve was placed over the coil, it was impossible to obtain an adjustment that provided a match with C1 and the whip height. Apparently



The trimmer capacitor is mounted on a tie point. Note the hole (lower left) that provides access to the capacitor. The hole should be plugged with a piece of rubber to keep moisture out of the assembly.

the dielectric material used in the coil cover has an effect on the coil. After some experimenting it was found that with the tap two turns up from the bottom, and with the cover over the coil, it was possible to get a good match with 50-ohm line. It was interesting to note that mounting the antenna at different points on the car required a readjustment of C1 in order to obtain a match.

Several tests were run comparing the 5/8-wave antenna to a quarter-wave whip. Both antennas are omnidirectional, but the 5/8-wave vertical is said to have a 3-dB gain over a quarter-wave whip. The gain results from the lower angle of radiation common to 5/8-wave configuration. We made no actual gain measurements, but it was very apparent the 5/8-wavelength vertical was the better performer. In several instances, when operating near the fringe area of a repeater, it was possible to work into the repeater with the 5/8-wave vertical, but impossible with the quarter-wave whip. Another advantage in using the 5/8-wave antenna is the absence or marked reduction in mobile "flutter," so pronounced using a quarter-wave whip.

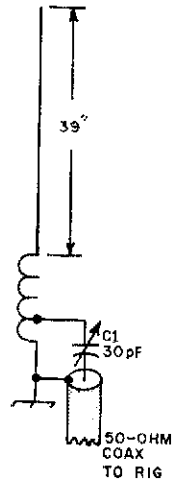


Fig. 1 – Circuit of the whip antenna. C1 is a 3 to 30 pF trimmer.

Fm Front End

(Continued from page 13)

Some of the resistors are installed flat and some are upright, depending on the space available. Power consumption of each stage is low enough that 1/4-watt resistors can be used, resulting in a more neat-appearing board.

Tune-up and Performance

As with most construction projects of this type, a grid-dip oscillator is an almost indispensable tool to aid in getting the tuned circuits on the correct frequency. A good quality crystal should be used for Y1. There is no oven to keep the crystal at a constant temperature, so a good commercial-grade crystal is worth the price. If the oscillator has a low output or shows a reluctance to start, it might need a feedback capacitor connected from emitter to base. Something in the range from 10 to 30 pF should do, but use the smallest value that will assure oscillation. Most of the transistors tried in this circuit did not require extra feedback. The oscillator performance should be checked to be sure that its output is on the 4th harmonic of the crystal, and not the third or fifth.

After the frequency multipliers are tuned for maximum injection to the mixer, the converter can be connected to the input of a receiver. If a transceiver is to be used, the converter must be ahead of the receiver portion only. Accidental keying of a transmitter with the converter connected to it can ruin several hours work! The rf amplifier and mixer stages can be peaked up on a signal while monitoring the limiter current in the receiver. The spacing between L2 and L3 should be adjusted a small amount at a time, and each circuit retuned for maximum limiter current. The ultimate in adjustment requires a calibrated signal generator and an audio-output meter to measure the amount of quieting that a given signal will provide. When this converter was used ahead of a Motorola strip on 52 MHz, sensitivity was such that 0.28-microvolt into the converter produced the sought-after 20 dB of quieting. Under these conditions 0.1 microvolt would open the squelch of the receiver. Performance like this makes the converter equal to many of the two-meter receivers now in use, and better than some. Image rejection was more than 70 dB.

An i-f amplifier was not needed with the strip used to test the converter. If the receiver needs a bit of help in the sensitivity department, it is an easy matter to add a small amplifier. Single-stage preamplifiers for 6 or 2 meters should be adequate. Examples of such amplifiers can be found in the vhf chapter of *The Radio Amateur's Handbook* or in *The Radio Amateur's Vhf Manual.*

Station Counter

(Continued from page 33)

logic circuits is often overlooked by newcomers. When the author first tried his counter, there was a lot of action on the display tubes, but none of it seemed related to the input signal. A few tenets of what digital engineers call "good engineering practice" had been neglected. To get the unit to work properly, shielded cables were used for the 5-V lines to each pc card, a 0.1-µF bypass capacitor was added to the voltage feeder at each circuit card, and the only chassis ground point, other than the input, was made at the power supply. The arrangement used is shown in Fig. 4.

If you count the number of devices needed to make it work, the frequency counter is one of the most complex electronic devices ever to be used in the ham shack. Yet, Heath Co. reports that 40 percent of the sales of their popular IB-101 counter have been to hams. By building counters from scratch or a kit, again amateurs are proving they are interested in any device, no matter how complex, which will improve station efficiency.