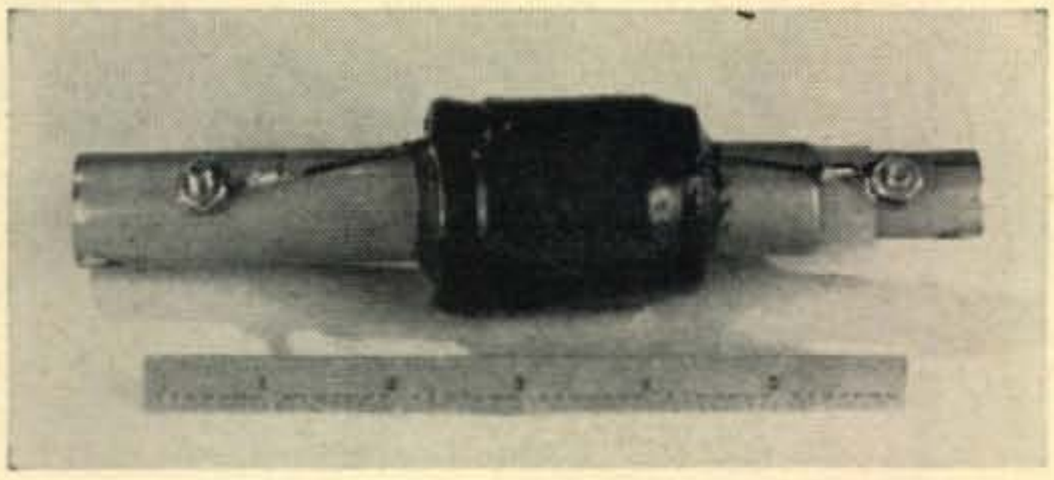
A Four Band Trap Tuned Antenna

BY A. D. SINNING*, WØUYS

This article describes a trap antenna which can easily be constructed by the average ham. The antenna is designed for 75 and 40 meters and operates quite well on 15 and 10 with a low s.w.r. Best of all, it is inexpensive since it requires only several short lengths of thin wall electrical conduit, some #14 enameled wire and a few pieces of plastic tubing.

THE average amateur is usually hampered in his operation on the lower bands by the lack of adequate space for antennas. Usually there is room, lengthwise on the lot, for an antenna approximately 100 feet long. Now, unless you are interested in transmitting on approximately 4500 kc this is of very little use to the amateur who wants to get efficient output on 75.

This trap antenna is made with a few lengths of thin wall electrical conduit, some #14 enameled wire and a few pieces of plastic tubing.

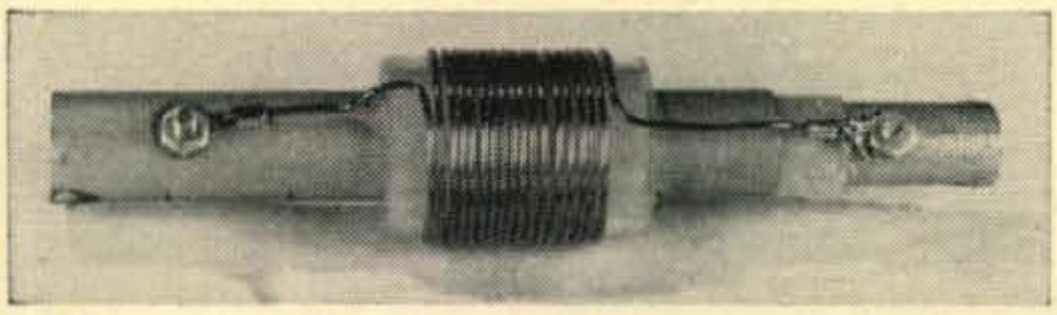


Above is the finished trap after an application of epoxy for weather proofing. The epoxy used and the application method is explained in the text.

Principles of Operation

The antenna works on the principle that a capacitor and inductor in parallel when tuned to a particular frequency and placed in a line present an almost infinite impedance to radio frequency current at that particular frequency. This is the same principle used in noise suppression on mobile receivers to eliminate generator noise. In other words, a parallel inductor and capacitor "trap" the particular frequency and act electrically as though the line were terminated for this signal. All other frequencies pass through the trap almost as though it were not there. Besides this the inductor acts to effectively shorten the overall length necessary to get efficient operation on the lower bands. This fact can be taken advantage of to build an antenna with an overall length of only 108 feet which will give almost as good performance on 75 as a full ½ wave doublet, as well as being very good on the higher bands. Twenty meters gives a higher s.w.r. but for 10 and 15 the s.w.r. is very low, usually between 1.1:1 and 1.5:1, depending on the placement of the antenna and the proximity of nearby objects.

*6944 11th Avenue South, Minneapolis 23, Minnesota.



One of the two traps used for the antenna is shown above. The two 6" lengths of conduit are mounted on a core of paraffin impregnated dowel. The coil is mounted on a plastic tube that is centered on the conduit by strips of plastic. The coil ends are secured to the ends of each conduit by screws. These screws also keep the length of the interlocked conduit sections fixed by securing them to the dowel centerpiece.

Trap Construction Details

Now for the construction details. First get about one foot of ½" thin wall conduit and the same length of ¾" conduit. Cut each into two six inch lengths and remove burrs from all edges. Next get a section of ⅝" wood dowel stock. Cut into two eight inch lengths and boil in paraffin to waterproof it. You will find that this will just slip inside the ½" thin wall. Now cut a strip of polyethylene, such as is used to cover clothes when returned from the cleaners, about 5½" wide and wrap tightly around the ½" thin wall, so as to slip snugly inside the ¾" length. Leave about ¾" sticking over the end of the thin wall. You now have a tubular capacity which can be varied in capacitance by sliding the tubing in or out.

Insert the wooden dowel, which you have prepared by boiling in paraffin, inside the smaller tube and adjust the capacitance to exactly 100 mmf. This can be done by the use of a resistance

[*Continued on page 84*]

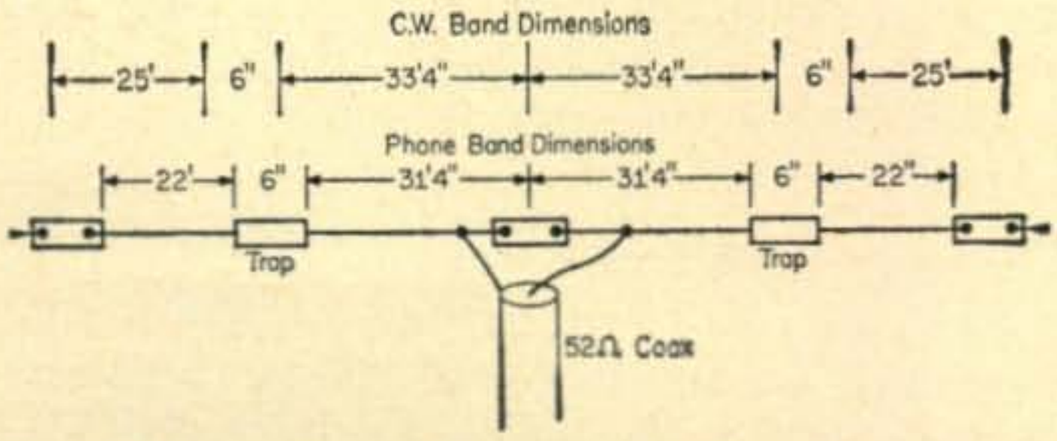


Fig. 1—Trap antenna dimensions for the phone or c.w. portions of the 75, 40, 15 and 10 meter bands are shown above.

Trap Antenna [*from page 39*]

capacitance bridge; or, if this is not available, a grid dip meter can be used.

If you use a grid dip meter, a 100 mmf mica capacitor can be connected across the ends of any convenient coil and the resonant point found on the grid dipper. The capacitor is then disconnected and the tubular thinwall capacitor is inserted in its place. By carefully adjusting the capacitance the same setting on the grid dipper can be made to dip. During this operation be sure that you do not have stray hand capacitance or metal in the immediate vicinity. Otherwise the setting will be inaccurate and the trap will be tuned to a wrong frequency.

After the tubular capacitor has been adjusted mark the position and drill a hole for a 10-32 screw exactly one inch from each end. These screws will serve to fix the capacitor to the dowel and also will be used as terminals for each end of the inductor.

To make the inductor get a piece of #14 enameled wire about 12 to 15 feet long. One end should be clamped in a vise and the wire stretched to remove all kinks. Now, using a cylinder of about 1¼" in diameter close wind the entire length of the wire on the cylinder.

When the tension is released the wire will spring out so that it is just under 1½" diameter. A coil form of clear plastic, laminated bakelite, or other insulating material 2" long can be used and 17 turns of the wire are carefully worked over the form, allowing enough on each end to make connection with the 10-32 screws. These are uniformly spaced over exactly 1½" for an inductance of 5 μh. This, in parallel with the 100 mmf capacitor will tune to 7200 kc. For construction details of the trap refer to the accompanying photographs. On each end a small hole is drilled through both the wood and thin wall for the #14 copperweld wire. Both ends of the trap are tinned for a good electrical connection.

Weatherproofing

In order to provide all weather operation the coil should be waterproofed. This can be done in several ways. The coil is spaced equally from the thin wall using strips from a polyethylene squeeze bottle and various materials can be used for waterproofing. Tar from an old transformer worked well, provided that it was not too hot. A mixture of paraffin and beeswax worked well but showed a slight tendency to crack in cold Minnesota winters. Our best results were with an epoxy cement which comes in two tubes and can be purchased in most hardware stores. The Borden Company makes a two component Epoxy Elmers glue as does the Welwood Company. This can be loaded with whiting (calcium carbonate) to increase the amount, lower the cost, and eliminate the running or sagging properties of the glue. For those amateurs employed in electrical manufacturing firms the possibility exists of procuring the raw epoxy resins and hardeners. Shell's Epon 828 and General Mills Versamid 140 in equal proportions worked well.

Antenna Construction

Dimensions of the antenna are as follows: A center insulator is fed on each side with the center and braid, respectively, of a 50 ohm coax cable. Exactly 31 feet 4 inches on each side of the center of the insulator, install the traps with the larger thin wall toward the center to prevent water from collecting around the wooden dowel. The outer sections of the antenna extend beyond each trap 22 feet for a total antenna length of 108 feet. This is shown in fig. 1.

Theoretically the center of a dipole should have an impedance of 72 ohms. However, most hams do not place their antennas high enough to be ¼ wave length above ground, and as a result the impedance is usually lower and 52 ohms gives a better match.

Feeding with RG-8/U coax the best feeder length was found to vary with location but around 70 feet seemed to give the lowest s.w.r. on all bands.

As in all antennas, maximum efficiency is available only at one frequency in each band, and the s.w.r. will increase as the transmitter is tuned farther from the resonant point. It does not change much for about 100 kc on each side of the resonant frequency.

If you are interested in operation in the c.w. portion of the bands the center sections should each be made two feet longer and the end sections should be made three feet longer for a total length of 118 feet. The trap should also be tuned to 105 mmf before winding the inductances. This will give a much lower s.w.r. in the area of the bands you are most interested in.

This antenna offers an interesting and inexpensive building project and will allow the average ham with limited space and budget a chance to improve his transmitting efficiency and operating enjoyment. ■

Solution: Dec. Polargram Puzzle

Arrows denote hidden words