A Tuned Loop for 80- and 160-Meter Reception

Compact Directivity for Improving Portable and Emergency Operation

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THE interesting developments of the day—new circuits, new equipment and new ideas, come so fast that we are all hard pressed to keep up with the procession. In the rush we sometimes forget, or perhaps merely overlook, some of our old friends. This is somewhat the case with loop antennas, such as were used quite extensively on broadcast receivers a few years back.

When the word "loop" is used we generally think of direction-finding equipment. Loops are still used to a great extent on the longer wave bands for this purpose, but for direction finding or beam operation on the higher frequencies, they have been replaced almost entirely by the larger multi-element antenna systems used by many of the airways stations.

An important use for the loop lies in the field of noise elimination—"noise" being any background disturbance that tends to obscure the wanted signal. It may be caused by a station operating on the same frequency, but not in the same line of direction as the station you are trying to receive, or it may result from a leaky insulator on a power pole a block or so away. The loop has advantages in combating these noises that are not present in any of the more popular noise suppressors, such as the crystal filter and the Lamb noise silencer, because it can help prevent them from getting into the receiver at all. It is not claimed that the loop is a cure for all the ham's troubles, but we do believe that its addition to the receiver will make the operating job more pleasant under some conditions.

The loops described have been used very successfully by the SARO (a Pacific Coast emergency network) for a number of months. Most of these stations are low-powered and designed to work with gasoline-driven a.c. supplies. The small amount of power in the carriers makes for very difficult operation during bad QRM and QRN conditions. The use of loops on the receivers when working these stations has caused a vast improvement in the operation of the network. It has made possible contacts that previously were out of the question.

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The loop has another very practical advantage for use with emergency equipment, in that it eliminates the necessity for erecting a receiving antenna, which is a requirement in duplex operation.

PRELIMINARY EXPERIMENTS

The design of a loop antenna for use on the 160- and 80-meter bands was something new to all of us. In fact most of us had never operated a loop before, and others were not even familiar with the theory of its operation. A little time was spent in reading the available literature on the subject, especially the information given in

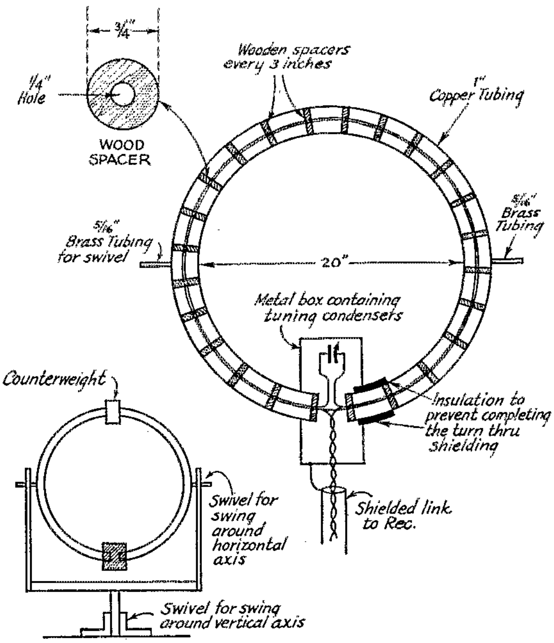

FIG. 1—DETAILS OF LOOP CONSTRUCTION

The spacers, cut from ¾-inch round stock and drilled in the center, are spaced every three inches along the wires, and taped in place. Five separate wires, of length sufficient to run through the tubing with a little to spare, are used. The wire and spacer assembly is pulled through the tubing and four of the wires spliced at the opening to form the loop proper. The fifth wire is the link for coupling to the receiver. The insulation at one end of the tubing is essential, since a continuous circuit would prevent signal pickup.

Terman's "Radio Engineering" and also Morecroft's work on the same subject.

The first trial loop constructed was a cumbersome affair made out of two-inch copper stove pipe, welded into a two-foot square open at one corner. Wooden discs were cut on the drill press with a panel cutter and these discs were fitted into the pipe so as to support the wires of the loop. These wires were threaded into the discs before the welding job was done. The open corner of the square provided a separation so that the tubing would not form a shorted turn, and at the same time provided a place to splice the wires of the loop.

Six turns of wire were used in this loop, and they were tuned by a regular broadcast variable condenser. Connections were made from each side

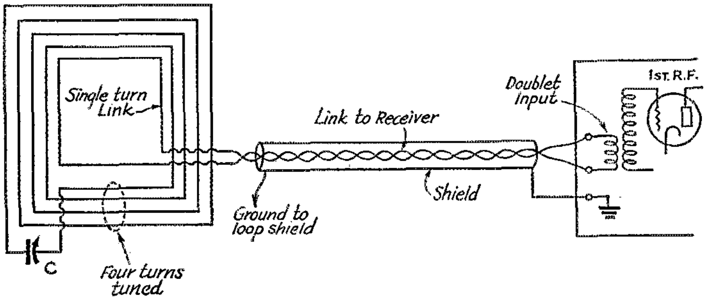

FIG. 2—THE LOOP CIRCUIT

The four-turn loop is tuned by condenser C, a broadcast-type variable, having a maximum capacity of about 370 µµfd. The loop resonates to the 160-meter band with C near maximum capacity, and to 80 meters with C near minimum.

of this condenser to the grid and ground of the first r.f. or input stage of the receiver. This worked very well, but the coupling method was inconvenient since it required going into the receiver and lifting the grid cap. It was not so good from a shielding standpoint, either, so other methods of coupling were sought. The system which seems to work best is to place an additional turn of wire in the loop and connect it to the doublet input of the receiver by means of a twisted pair of wires. The wires of this link can be shielded, with the shielding tied to the receiver at one end and to the copper shield of the loop at the other end.[1]

Six turns proved to be too many to resonate on both the 160- and 80-meter bands, so the number was cut to four. The fifth turn was used for the link, and the sixth turn was left open and unused.

A second loop was constructed in an effort to cut down the size and make it more convenient for use in portable work. This new loop was made out of half-inch soft copper tubing, bent into a fifteen-inch circular shape. No spacers were used in this loop, with the result that the capacity of the wires to the grounded copper shield greatly reduced its effectiveness. Another lesson learned—keep the capacity of the loop to ground as small as possible.

[1] Shielding of both loop and receiver is essential if the directive properties of the loop are to be realized. The loop and receiver input circuit also should be balanced to ground; the doublet connection recommended by the author provides a means for doing this.—Editor.

FINAL CONSTRUCTION

The third loop was started with the idea of including as many as possible of the good points of the first two loops and at the same time eliminating the bad features. This third loop was made out of one-inch copper tubing bent into a circle about twenty inches in diameter, with the wires supported in the center of the tubing by small wooden spacers. Four turns were used in the loop proper, tuned with a condenser as in the first loop. The fifth turn was used for link-coupling the loop to the receiver. This loop worked exceptionally well and was of satisfactory size.

At this point in the construction, it was decided to mount the loop so that it could be rotated in either the vertical plane or the horizontal plane. This last change really brought home to use the nicest feature of loop operation. By swinging the loop in both planes and taking into account the polarization of the received wave, it was possible to reduce any signal to the inaudible, or nearly so, and still hear the desired signal. The constructional and electrical features are shown fully in the two figures.

Loop antennas have very broad tuning characteristics when turned to the maximum signal position, but are very sharp when turned to the minimum signal position. This means that the sharp minimum can be placed on an interfering signal or noise, and the broad maximum will allow the desired signal to come through. The signal received from the wanted station will not be as loud as when tuned in on a regular antenna, but the signal-to-noise ratio will have been improved to the point where the signal can be copied solid.

Other loops have been constructed, of the non-shielded type, using wooden strips for the framework. These loops have all proved their worth, but they are harder to build into compact form, and perhaps not quite as rugged for portable use.

There is a fertile field for further work with loops and it is hoped that others will take it up. We have had very gratifying results with these loops on the 160- and 80-meter bands, but we have only tried them on these two bands. Whether they can be made to work as well on the higher frequencies remains to be seen.