DX CRYSTAL RADIO RECEIVER

By JOSEPH AMAROSE

CRYSTAL radio fans follow a pattern. They search everlastingly for a newer, better circuit that will excel their previous best effort. They want better volume, greater selectivity, higher sensitivity. Everlastingly, too, they must compromise, for no such optimum state can be achieved. Occasionally, an experimenter does find a circuit that is outstanding. Such is the hookup shown. No novelty is claimed, however; basically the circuit is old—only a few embellishments have been added. Nor must the reader expect that this receiver combines all the desired characteristics. What the writer (who has spent some 30 years testing and building the latest crystal “super-dippers”) does promise is an unusual, versatile receiver that has consistently given fine results.

All last winter (in Virginia) this receiver tuned in stations from Canada to Cuba and from the Atlantic to the state of Utah, sometimes as early as 8 pm. Transmitters in Atlanta, Louisville, New York, New Orleans and Cleveland were most frequently logged. Even on the hottest summer nights, dx came in with impressive regularity.

No less impressive is the selectivity of this rig. All six of the Richmond locals are received clearly with no annoying hash or cross-talk. And three of these stations are only 40 kc apart! Worse still, one is a weak sister between two strong ones. Yet this set gets all with ease. With proper co-ordination of controls all locals (from 910 to 1480 kc) can be tuned in with just one main tuning dial. Tested in Baltimore by M. M. Schuman, another old-timer (who built this set), the receiver tuned in all eight locals clearly there, plus the more distant WTOP in Washington, D. C.

Volume on the locals is high. Richmond’s WRNL, 5,000-watt transmitter, five miles away, operates a magnetic speaker loud enough to be heard clearly 15 feet from the reproducer. It doesn’t shake the rafters but every word of speech is intelligible at that distance.
How are these results achieved? First, foremost, for good DX, the antenna system should be the best. A 125-foot mast was used, 31 feet high, with the wire taken from the far end; this proved better than the usual "L" type. Total antenna wire to the set was 290 ft. Shorter aerials are O.K., if high.

The fixed antenna wave trap, L1, L2 and C1, is to be used only when two strong stations interfere. Set C1 so it eliminates the most troublesome station. For DX work, eliminate this trap entirely! Sensitivity is higher.

**PARTS LIST**

C1-150-muf trimmer.
C2-2-gang 100-muf trimmer.
C3-150-muf variable capacitor.
C4-30-muf variable capacitor.
C5-150-muf trimmer.
S1-7-point switch.
S2-9-point switch, or 10 switch points and lever.
S3-3-p.d.t. panel switch.

Other materials needed are coils as given in the table, a crystal, a pair of sensitive phones and the necessary leads, breadboard, hardware, etc.

The main tuning coil, L3, is an XRL (Modern Radio Laboratories, 1151 Valley Drive, Redwood City, Calif.) "low-loss" type. The constructor can make his own by winding 90 turns of No. 22 double-cotton-covered wire on a 2-inch plastic coil form 4 inches long (actual winding is 3 inches). Brush on a layer of very thin coil cement to make it stick to the coil and tap both antenna and secondary sides. Tap the antenna side every three turns from the 3rd to the 51st, and tap the secondary every five turns from the 5th to the 50th. Lift the turns with an ice pick to solder.

A standard 2-gang capacitor is used for C2 and C3, with a 500-muf trimmer across the second section, for band-spreading on high frequency end. Adjust this trimmer, C4, for best volume on a 100-kc station.

Switch 1 selects the proper antenna primary-coil tap. Switch 2 is used to match the impedance of the crystal. Tune in all loci, select the setting that gives best selectivity with good volume, and leave set. From ground end switch 3 provides a choice between peak sensitivity and high selectivity.

In the variable trap, L4, L5 and C5, a Carnon S-645 coil is used. The primary, secondary and variable capacitor are series hooked. An "optional connection" is shown. If used, it makes a conventional wave trap of the section. Not used, another tube, the circuit be provided, acting like a series-tuned loading coil and capacitor. With this arrangement, tuning is better.

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A changing attitude on the part of the radio and television service technician is the thing that is pulling the electronic service profession out of the doldrums. He is learning that he cannot call himself a success, as an individual, until he can look around and see other technicians who have assets he can admire or compare with his own. As long as there are too many in his profession operating without scruples, and trying to get along under a "hand to mouth" economic operation without adequate testing instruments and other technical aids, there is not much to measure one's success by.

His interest and attendance at the local service association meeting shows that the modern Electronic Technician is beginning to look beyond the "tip of his soldering iron." Through these associations, he is rapidly gaining recognition, not only in his own community, but also in the vast electronic industry, as being an essential link between the manufacturer and consumer.

In addition to getting valuable technical "know-how" from non-commercial sponsored lectures and demonstrations, he is finding out how to make his business bring a fair return on this rather large investment in training, experience, and testing instruments. He is also learning how to be fair to both his customers and himself by keeping his "know-how" and test equipment up-to-date and not resorting to price cutting for his service in diagnosing trouble.

As technicians gain that feeling of mutual respect and esteem among themselves by regarding each other as business associates instead of raw competition, their most valuable asset—technical "know-how"—will no longer be obscured. The technician's interest in matters which affect his economic welfare will lead him and the entire service industry to greater economic stability.

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_October, 1952_
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Construction

The ground for this set was the pipe in a well. This makes the best possible ground connection; a signal meter showed almost twice as much signal strength as with other grounds. The urban dweller should use cold water pipes, with the wire attached close to the earth. Additional grounds also boost signal strength and are recommended.

Operating the set

The settings obviously will differ in each locality, depending upon the frequencies employed by the local transmitters. Individual experiment is necessary to determine optimum settings of controls. Generally, for dx work, eliminate the antenna, move to the broad S3 to the broad position, and do not make the "optional connection." For best selectivity, use the antenna wave trap, move S3 to the SELECTIVE position, and hook up the OPTIONAL CONNECTION. With the connection closed, tune the trimmer O to the lowest volume on a 1000-kc station. This completes all adjustments on this set.

In constructing the receiver, it is important to position both wave-trap coils as far as possible from the main tuning coil. The selectivity will be poor if their magnetic fields are allowed to affect each other.

A word about "signal meters." The serious dx fan will do well to consider using a sensitive microammeter across the telephone posts, to determine peak signal strength. All the unusual results obtained by this receiver are due to the use of such a meter. Many months were spent checking circuits until the present circuit arrangement was arrived at; more time was spent in determining the best aerial and ground arrangements. All the optimum conditions were quickly revealed by the meter readings. By the cut-and-try aural method usually used, optimum conditions could not be very readily determined. These meters are still available at prices under $10 in surplus houses. A 200-microammeter instrument is ideal. Especially useful is this device in picking out the most sensitive detector; some crystals give twice as much output as others, and a meter can spot your best one in an instant.

For weak stations and dx work, this is most important. The value of such an instrument in helping to get distance cannot be overemphasized.

Finally, super-efficient as the aforesaid receiver might be, it must be noted that no extravagant claim is made for it. All the writer can say is that a large number of these sets have been tested through the years, and this one stands head and shoulders above the crowd. Made according to specifications, it should provide the enthusiast with no end of pleasure and entertainment.

COIL TABLE

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