High-Power Crystal Set

Voltage-doubler circuit drives miniature speaker.

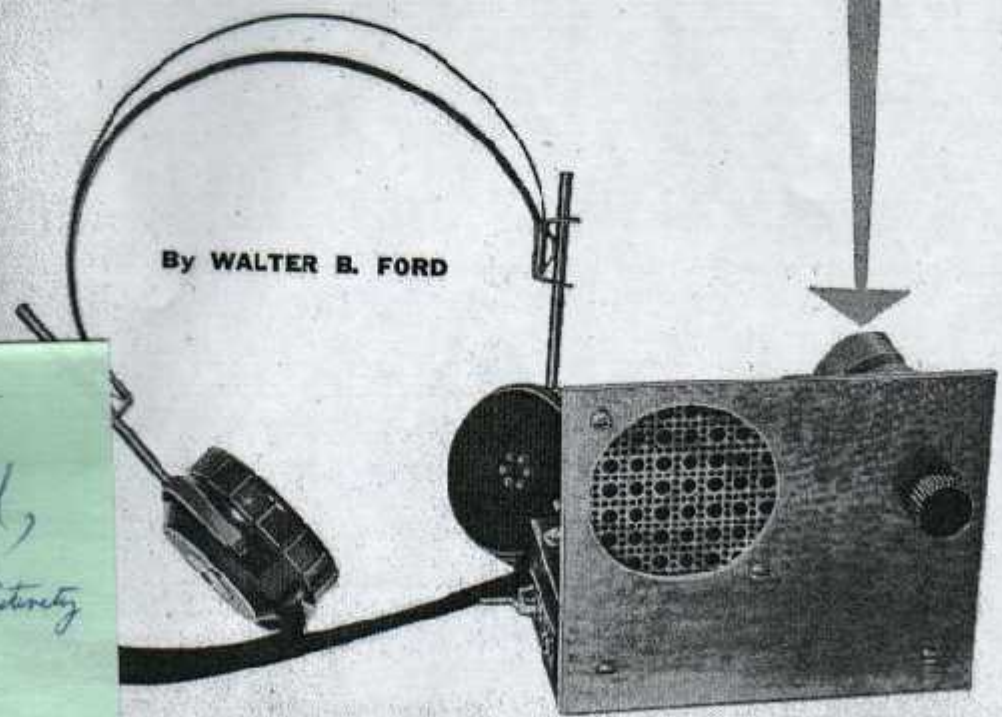
By WALTER B. FORD

HERE'S a pint-sized crystal radio with enough comph to drive a 2½" speaker. This little unit's selectivity is far better than you'd expect to find in a crystal receiver and volume is equal to that obtained with sets using a transistor. No external power source is required.

The unusual selectivity of this radio is due to its special double-tuned circuit. A pair of diodes connected as a voltage-doubler provides the extra kick to operate the small speaker. An output jack is provided for headphone listening and for connecting the set to an amplifier.

Construction. The model was built on a 2½" x 4½" wooden chassis with a 3½" x 4½" metal front panel. However, size is not critical, and other materials can be substituted if desired.

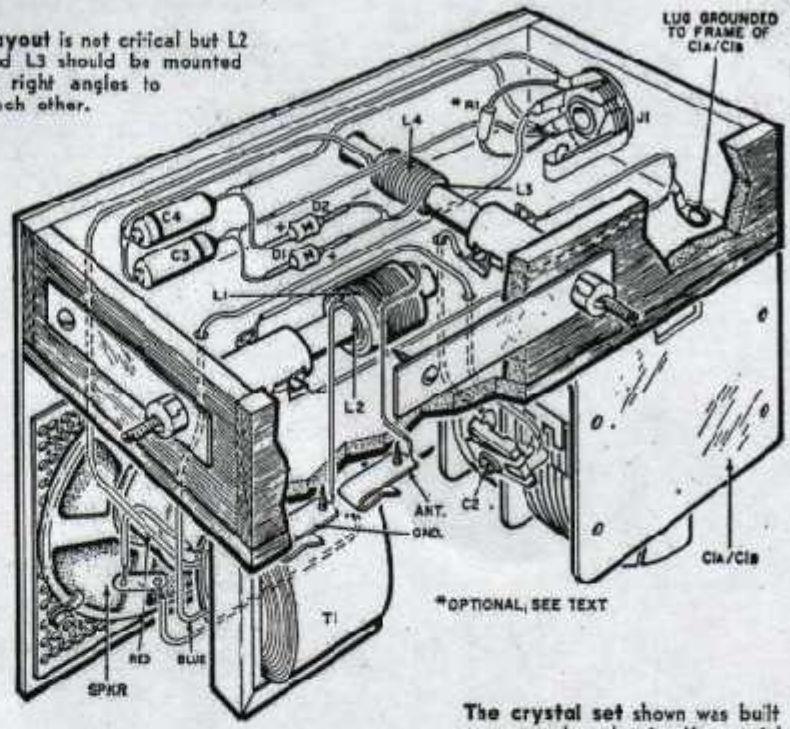
Two standard ferrite loopsticks, *L2* and *L3*, are used. Both must be modified by the addition of a second winding, *L1* and *L4*, respectively. Each of the added windings consists of 22 turns of No. 24 cotton-covered wire wound on a small cardboard tube as shown on the pictorial. (Actually, any wire size from No. 22 to No. 28 with cotton or enamel insulation will do the job.) The



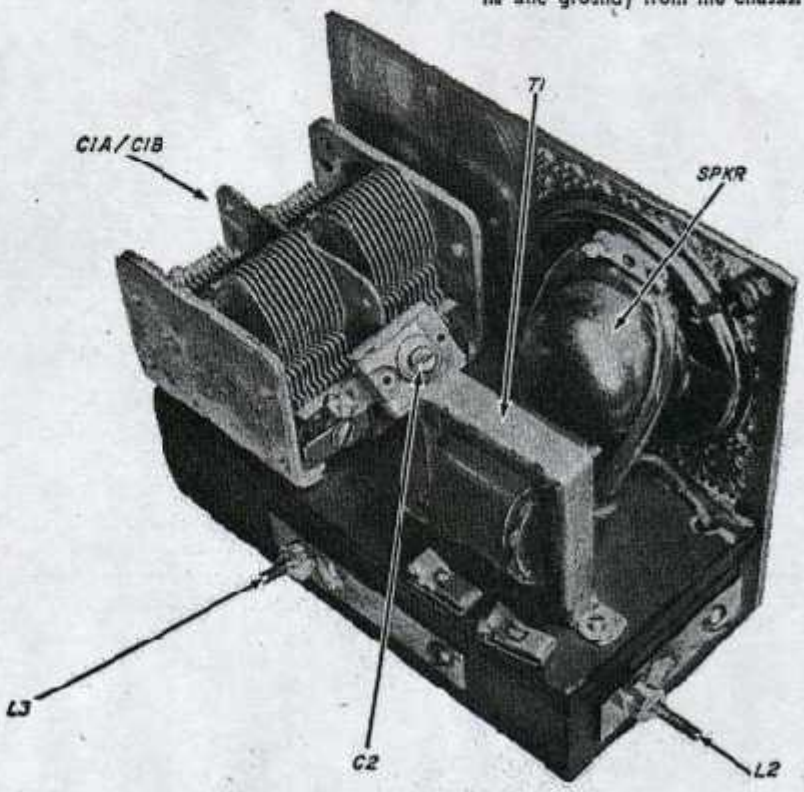
ELECTRONIC EXPERIMENTER'S HANDBOOK

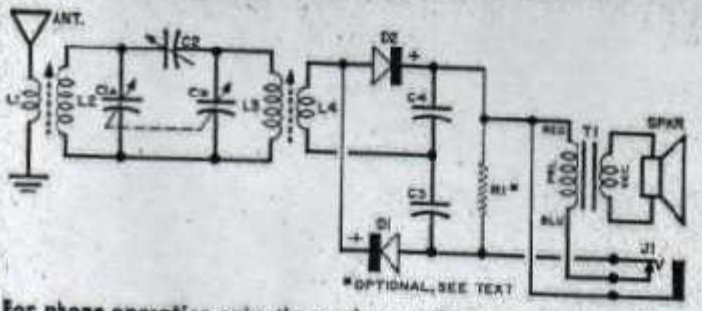
one of the best designs around, full wave, good selectivity good sensitivity

Layout is not critical but L2 and L3 should be mounted at right angles to each other.



The crystal set shown was built on a wooden chassis. If a metal chassis is used, be sure to insulate the Fahnestock clips (antenna and ground) from the chassis.





For phone operation only, the speaker, transformer, and resistor R1 can be omitted. In this case, connect high-impedance phones in place of R1.

diameter of the cardboard tube should be slightly larger than *L2* and *L3* so that *L1* and *L4* will slip over *L2* and *L3* easily.

Resistor *R1* is used only for feeding the set into an amplifier; it should be omitted for both earphone and loudspeaker operation. Trimmer capacitor *C2* should be soldered across the stator terminals of two-gang variable capacitor *C1a/C1b*, as shown. The speaker and output transformer can be mounted wherever convenient.

After all of the parts have been mounted on the chassis, wire them together following the schematic and pictorial diagrams. Be sure that diodes *D1* and *D2* and capacitors *C3* and *C4* are correctly polarized.

Alignment and Operation. To align the receiver, first connect it to an anteana and ground. (The optimum length of the antenna varies with location, but 50 feet will usually be suitable in areas serviced by several broadcast stations.) Next, plug in a high-impedance earphone at jack *J1*. Tune in a station near the high-frequency end of the broadcast band—say 1500 kc.—and adjust the trimmer capacitors on variable capacitor *C1a/C1b* for the loudest signal.

Trimmer capacitor *C2* should then be adjusted for the best selectivity and volume over the entire broadcast band. Finally, coils *L1* and *L4* can be optimumly positioned by sliding them back and forth over coils *L2* and *L3*. If a nearby station interferes with reception of a weaker one, tune the slug on *L2* for minimum interference.

For loudspeaker operation, simply unplug the earphone from *J1*—strong local stations should come in with fair volume. To operate the set as an AM tuner, wire *R1* in place and connect *J1* to the crystal-phono input of a preamplifier or integrated amplifier. The set should give excellent results with a quality hi-fi system. —30—

PARTS LIST

C1a/C1b—3-gang, 365-μμf. variable capacitor (*Lafayette ME-142 or equivalent*)
C2—100-μμf. compression-type trimmer capacitor
C3, C4—.005-μf. fixed capacitor
D1, D2—*1N34A* diode
J1—Closed-circuit phone jack
L1, L4—22 turns of No. 24 cotton-covered wire (*see text*)
L2, L3—Ferrite antenna coil (*Miller 6300 or equivalent*)
R1—47,000-ohm, ½-watt resistor (*see text*)
T1—Replacement-type output transformer; 3000- to 10,000-ohm primary; 4-ohm secondary
Spkr.—2½" speaker, 4-ohm voice coil
Misc.—Hardware, wood, aluminum sheet, Fahnestock clips, etc.

HOW IT WORKS

The receiver employs a double-tuned circuit feeding a crystal-diode voltage-doubler/detector which drives a small speaker. In operation, r.f. signals picked up by the antenna system are induced into coil *L3* from coil *L1*. The desired signal is selected by tuned circuit *C1a-L2* and coupled through capacitor *C2* to a second tuned circuit, *C1b-L3*, which improves the selectivity by narrowing the r.f. bandpass. The twice-tuned r.f. signal is then induced into coil *L4* from coil *L3*.

The positive half of the r.f. signal appearing across *L4* passes through diode *D2* to charge capacitor *C4*; the negative half of the signal passes through diode *D1* to charge capacitor *C3*. Polarities of the charges on *C3* and *C4* are such that the effective voltage is doubled. This voltage appears across the primary of output transformer *T1*, which changes the high impedance at the output of diodes *D1* and *D2* to the low impedance required by the speaker.

When high-impedance earphones are plugged into closed-circuit jack *J1*, the speaker is disconnected and the output from the diodes feeds directly into the earphones. Optional load resistor *R1* is placed across the output of the diodes when the receiver is used with an amplifier.