Transistorized Pocket Receiver

by **louis garner, jr.**

Both experimenters and builders will agree that a pocket radio receiver would win almost any construction popularity poll. Here is a transistorized pocket superhet with a circuit that uses only three transistors. It features a reflex arrangement and direct coupling.

A small, clear plastic box makes an excellent cabinet for the receiver. You can color the cabinet by spraying the box on the inside with Acrylic plastic of whatever color you prefer.

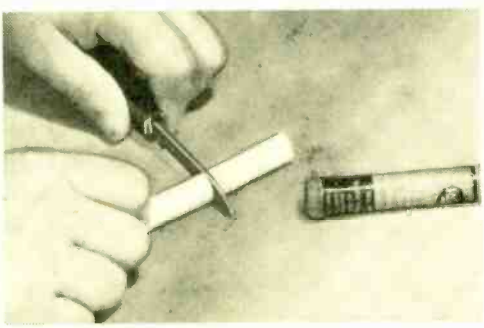
assembly

Cut a piece of thin Bakelite board to fit the plastic box and use this as a chassis, following the general layout shown in the photographs, and wiring according to the schematic and pictorial diagrams. Neither layout nor lead dress is especially critical.

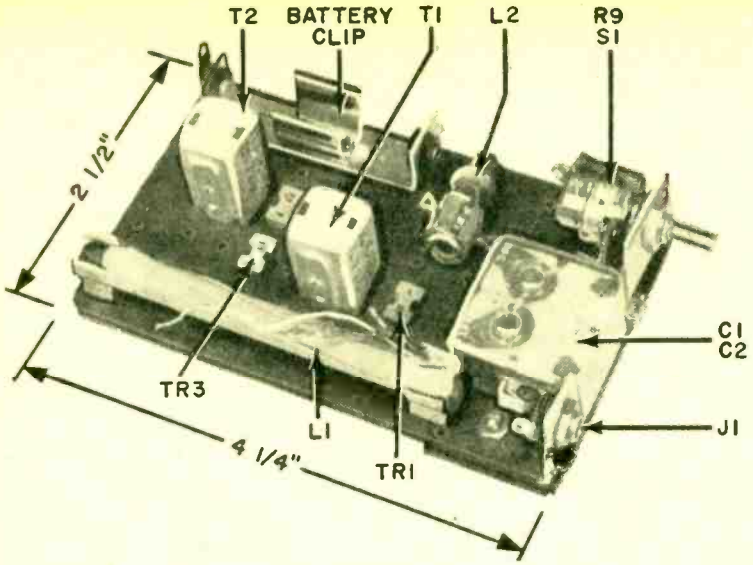
The volume control (*R9*) and output jack (*J1*) are mounted on small brackets. Coils (*L1* and *L2*), i.f. transformers (*T1, T2*), the battery holder, diode (*CR1*), transistors, the tuning capacitor (*C1a/C2b, C2a/C2b*), and ceramic and electrolytic capacitors are mounted above the Bakelite chassis. Resistors are below the chassis.

Use two small fuse clips to mount coil *L1*, placing one clip at each end of the ferrite core. Coil *L2* is simply cemented in position with one terminal inserted through the chassis. Transformer (*T1, T2*) and coil (*L2*) connections are identified on page 55; the coil leads to *L1* are color-coded.

Although the self-contained antenna coil, *L1*, should have adequate pickup for strong local stations, you'll find that the receiver's sensitivity can be increased if you add a short (2' to 3') antenna lead to the "white" terminal of *L1*.



Operating power for the simple receiver is supplied by an 11.2-volt battery, made up by cutting an eight-cell section from an RCA Type VSO87 "separable cell" battery. You can easily cut out the desired section with an ordinary pocket knife.



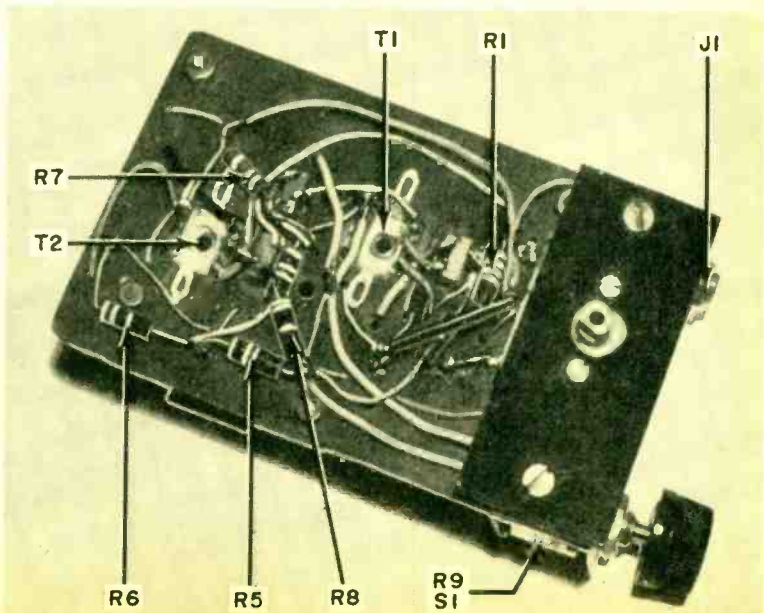
Top view of the receiver chassis shows location of all major components. The transistors are not in their respective sockets. Screw adjustments of C1b and C2b are visible on the top of C1/C2. Antenna coil L1 is held in place with a pair of fuse clips.

alignment

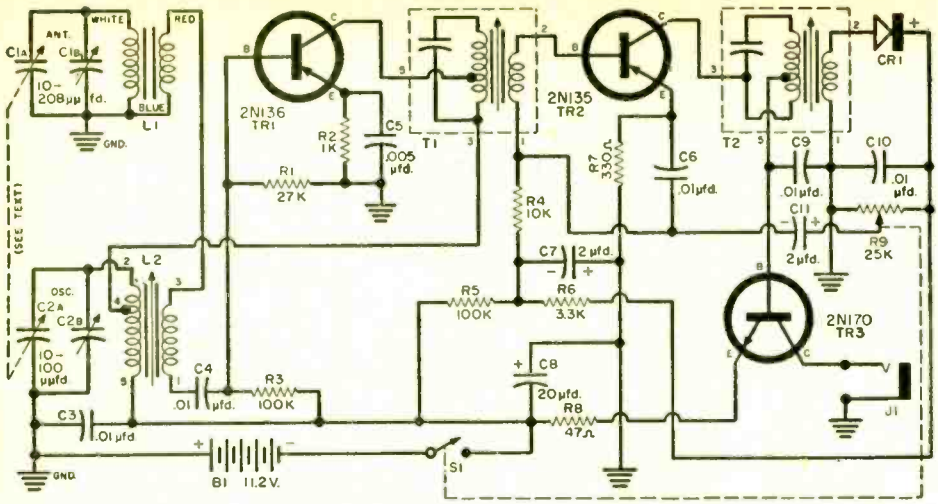
Like all superhet receivers, this set must be aligned before use. It is a fairly simple operation and consists of adjusting all fixed tuned circuits for maximum performance. You'll need a standard r.f. signal generator and an insulated alignment tool.

Connect the signal generator's "ground" lead to circuit "ground" (positive side of *B1*). Connect the "hot" lead through a small (10 to 25 $\mu\mu$fd.) capacitor to the "white" terminal of *L1*. Make sure the tuning capacitor plates are fully meshed. Then adjust the signal generator to deliver a *modulated* r.f. signal at 455 kc.

Advance the volume control to maximum output, listening to the earphone for an audio tone. Adjust the "output" control of the signal generator until the tone can just be heard. Using the insulated alignment tool, adjust the iron core slugs of



Below-chassis view. Printed wiring could be used to simplify the appearance of the unit still further, but the author thought that direct wiring would enable the job to be done in the shortest time. The i.f. transformers are held in place by small tabs that are bent into place.



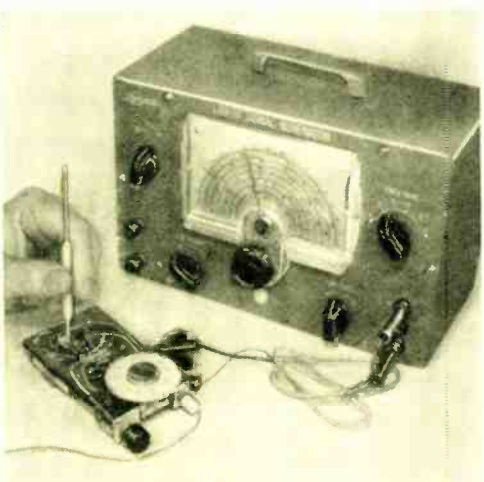
Schematic diagram and parts list for the reflex receiver.

B1—11.2-volt battery (from RCA No. VSO87 separable cell unit)
C1a/C1b (10-208 μμfd.), C2a/C2b (10-100 μμfd.) subminiature superhet tuning capacitor, two sections (Argonne No. AR-93)
C3, C4, C6, C9, C10—0.01-μfd. disc ceramic capacitor
C5—0.005-μfd. disc ceramic capacitor
C7, C11—2-μfd., 15-volt electrolytic capacitor
C8—20-μfd., 15-volt electrolytic capacitor
CR1—1N64 diode
J1—Open-circuit jack
L1—Transistor antenna coil (Lafayete MS-272)
L2—Transistor oscillator coil (Lafayette MS-265)
R1—27-000-ohm, ½-watt carbon resistor
R2—1000-ohm, ½-watt carbon resistor
R3, R5—100,000-ohm, ½-watt carbon resistor
R4—10,000-ohm, ½-watt carbon resistor
R6—3300-ohm, ½-watt carbon resistor
R7—330-ohm, ½-watt carbon resistor
R8—47-ohm, ½-watt carbon resistor
R9—25,000-ohm miniature potentiometer
S1—S.p.s.t. switch, on R9
T1, T2—Transistor i.f. transformer (Argonne No. AR-60)
TR1—2N136 transistor (General Electric)
TR2—2N135 transistor (General Electric)
TR3—2N170 transistor (General Electric)
1—Small plastic case
1—Bakelite mounting board
3—Transistor sockets
2—Small fuse clips
1—Miniature plug
Misc. battery clip, control knobs, machine screws, nuts, wire and solder, etc.
Accessory—High-impedance magnetic earphone

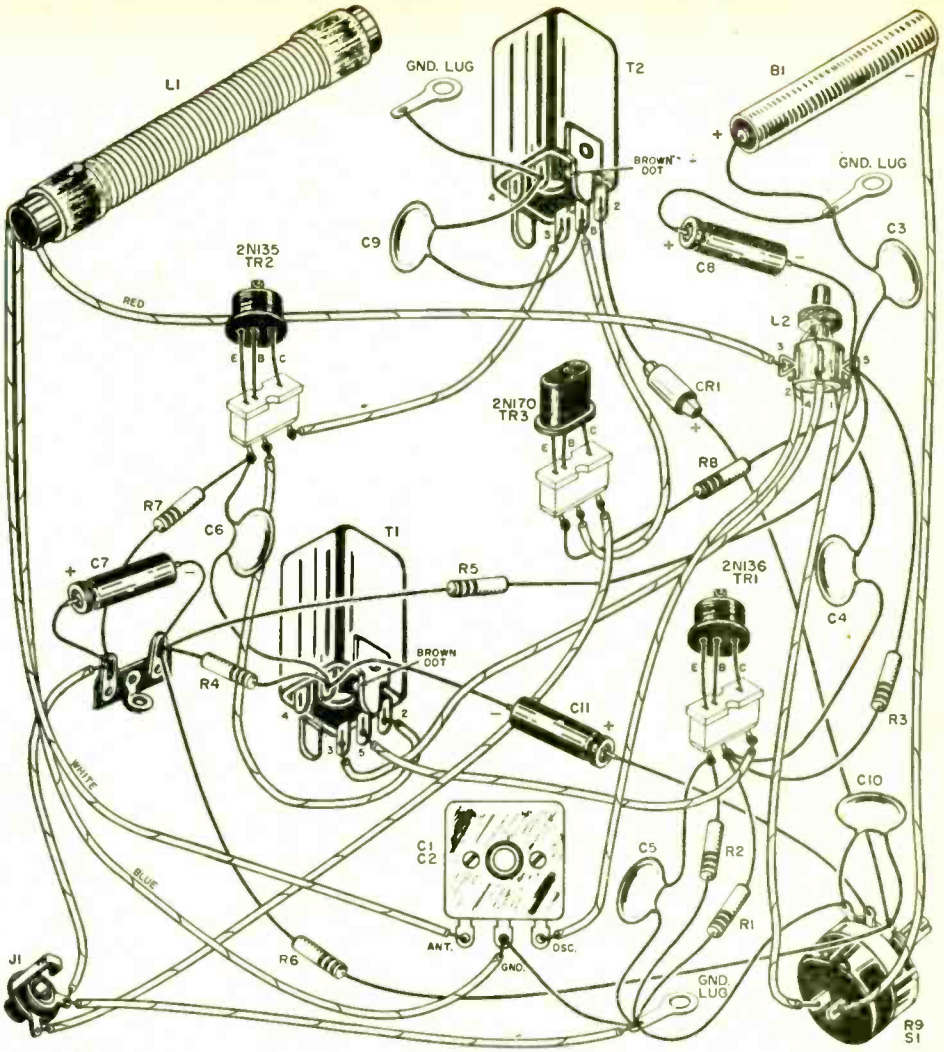
the i.f. transformers for maximum output, as heard in the earphone. These cores are reached through holes in the bottom of the transformers. Always use the *minimum* signal that will give you an easily heard tone.

After peaking the i.f. transformers, remove the coupling capacitor (attached to the "white" terminal), replacing it with a much smaller unit (about 5 μμfd.). Shift the signal generator to 1600 kc. and open the tuning capacitor's plates. Adjust the trimmer, *C2b*, on the back of the oscillator capacitor for a peak in output. Then turn the receiver's tuning dial to 1500 kc. (plates partially meshed), and shift the signal generator to this frequency. Adjust the r.f. trimmer, *C1b*, for a peak in output.

Finally, shift the signal generator to 600 kc. and turn the receiver's dial to the low-frequency end of the band—the tuning capacitor's plates should be almost fully



To align the superhet, you'll need a signal generator and an insulated alignment tool.



This is the way to hook up the transistorized superhet's various components.

meshed. Now, "rocking" the tuning capacitor back and forth slightly, adjust the slug of *L2* for a peak in output. Recheck all three adjustments (*C2b, C1b,* and *L2*).

With the alignment completed, remove the signal generator lead and the small input coupling capacitor. Complete the assembly by installing the receiver in its plastic case.

how it works

In operation, r.f. signals are picked up and selected by tuned circuit *C1a/C1b-L1*. The first transistor, *TR1*, is connected as *oscillator-converter*, with *L2* serving as the oscillator coil. The incoming r.f. signal and the locally generated signal are combined in this stage to produce the 455-kc. i.f. signal which, in turn, is selected by a tuned circuit (*T1*) serving as the collector load for the stage.

The second transistor stage, *TR2*, serves as *both* the i.f. amplifier and the first audio amplifier stage. Capacitors *C6* and *C9* serve as r.f. bypass units. A fixed bias is applied through *R5*, bypassed by *C7*, and isolation resistor *R4*, acting in conjunction with emitter resistor *R7*. In addition to the fixed bias, a variable bias is supplied from the detector's load resistor *R9* through isolation resistor *R6*.

After amplification, the i.f. signal is coupled through transistor *T2* to the second detector, a type 1N64 crystal diode. Detection (demodulation) occurs in this stage, and appears across diode load resistor *R9*, the volume control. The a.f. portion of the detected signal is coupled through *C11* to the base of *TR2*. This signal is then amplified with the base-emitter circuit of *TR3* serving as the collector load for *TR2* as *far as the a.f. signal is concerned*. *TR3* serves as the second a.f. stage and the earphone serves as the collector load for *TR3*.

This general type of circuit arrangement used here is known as a *reflex* circuit.