Midget Transistor Superhet

Gives Big-Set Performance

LIKE A HOME RADIO, this midget tunes cleanly, without howl, whistle or background hiss, and so sharply that you can get weak stations close to strong ones. In good signal areas, the set will work on a mere wisp of antenna.

By Howard G. McEntee

THIS pocket radio has real power and is as easy to tune and free of noise as the set in your home or car. That's news because, until now, miniature radios have been weak, apt to howl and hard to tune.

A real midget, this one is housed in a 1″-by-2″-by-3″ box, including the battery. Its super-performance comes from three transistors combined in the same kind of superheterodyne circuit that you find in a full-size radio.

The use of this circuit represents a big forward step. Most previous miniature radios were basically primitive crystal sets with an amplifier tacked on. They needed a long antenna, could pick up only powerful nearby stations, and then got two or three at once. Some had tuned radio-frequency amplifiers (TRF) to help separate the stations. These amplify the signal at the same frequency at which it reaches the receiving antenna. But such comparatively high frequencies resist amplification, and thus the set's sensitivity to weak stations is limited.

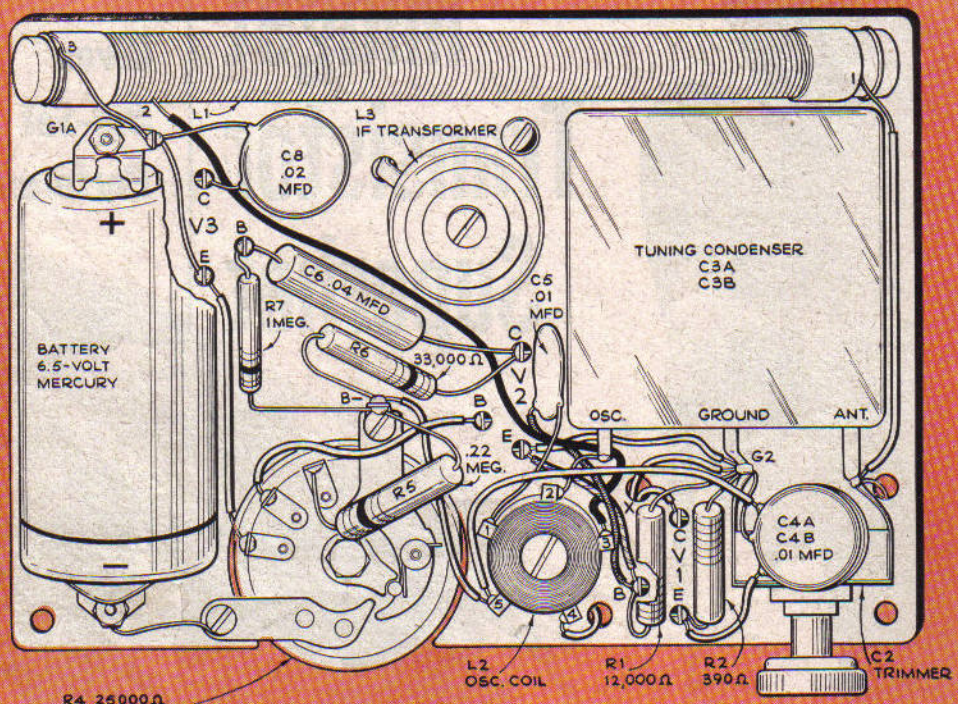
To improve sensitivity, midgets generally used regeneration. This feeds part of the amplified signal back through the amplifier again. But it makes tuning finicky: A slight misadjustment splits your ear with whistles and howls.

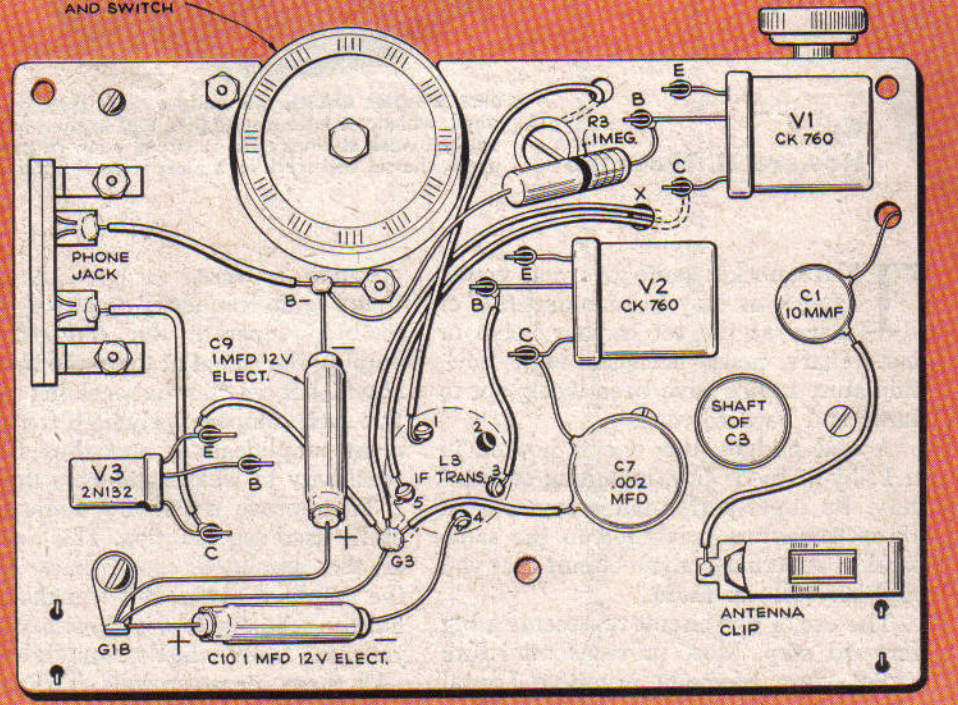
All these ideas—crystals, TRF and regeneration—were long ago discarded by designers of home radios in favor of the

[*Text continued on page 200*]

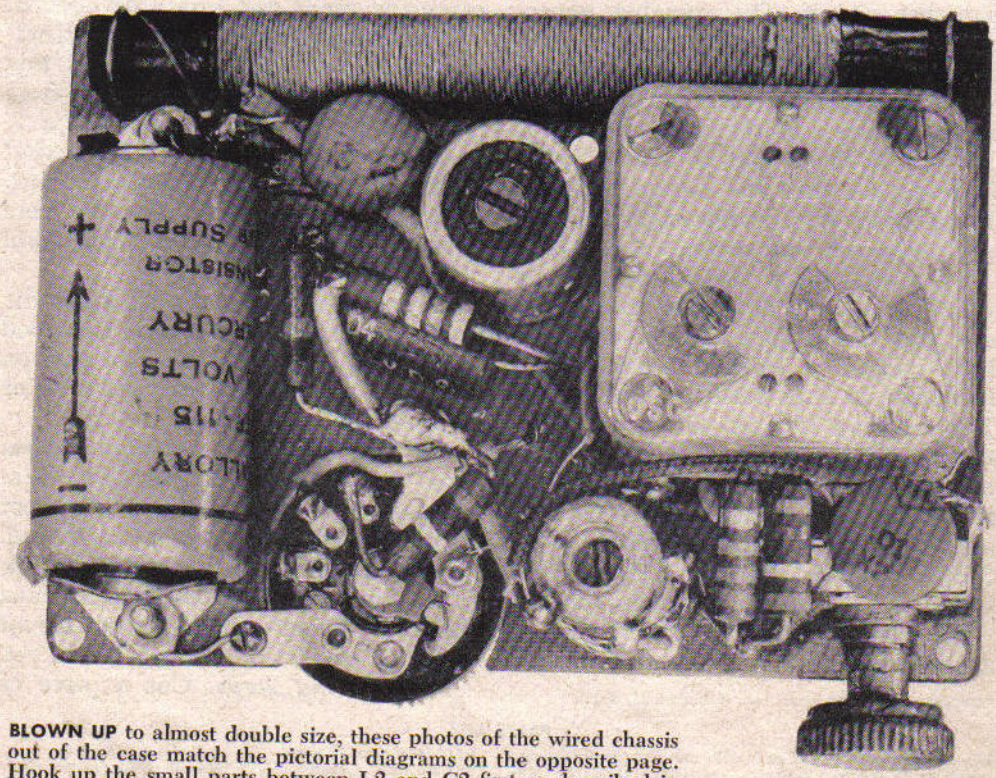
For diagrams and photos of the midget radio, see pages 198-199

BOTTOM OF CHASSIS

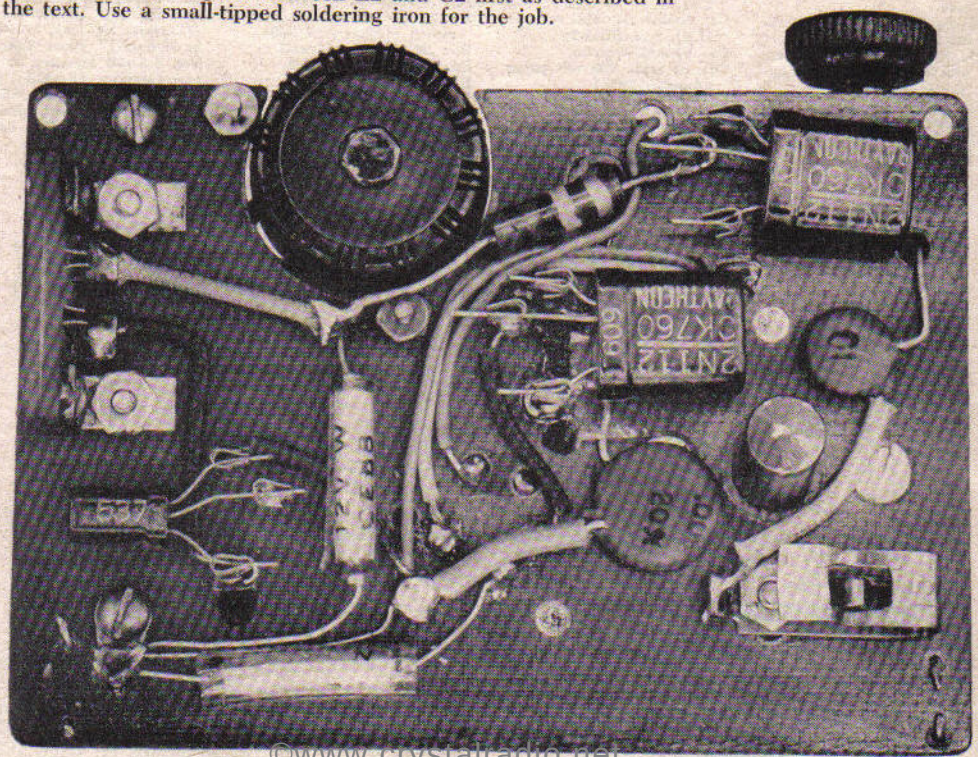




TOP OF CHASSIS



BLOWN UP to almost double size, these photos of the wired chassis out of the case match the pictorial diagrams on the opposite page. Hook up the small parts between L2 and C2 first as described in the text. Use a small-tipped soldering iron for the job.



superhet circuit. The superhet generates a radio frequency of its own in a local oscillator. This is mixed with the incoming signal so that the result is a signal of intermediate frequency (IF). This IF is fixed, and is always lower in frequency than the incoming signal. Being lower, it is readily amplified. You can tune easily and separate stations.

By using three transistors, two of which do double duty, this quality circuit has been squeezed into the new PSM midget. A single transistor (V1) functions as both oscillator and mixer. The resulting IF (445 kilocycles) goes through IF transformer L3 to the detector transistor V2. This detector strips off the sound part of the carrier wave and amplifies it. The third transistor (V3) further amplifies this sound signal, giving more than ample earphone volume.

Miniaturized parts for the midget are available by mail.* Some of them are especially made for transistor circuits.

Winding the coil. L1 must be hand-wound of Litz wire on a special iron core cut 2¾" long. Tape the wire ⅜" from one end, wind six turns, and twist a ¼" loop for the tap at terminal 2. Then wind a total of 115 turns and tape the end fast. Winding is best done with the core chucked and spun in a hand drill clamped in a vise.

Mounting the parts. Fasten L1 on the underside of the panel with U-shaped clips of copper wire, bending the ends on top. Make battery clips from stiff brass or tin plate and bolt them on.

The transistors are mounted in flea clips—tiny beryllium-copper clips. Simply press these into No. 52 holes. Spot those marked C (collector) with red.

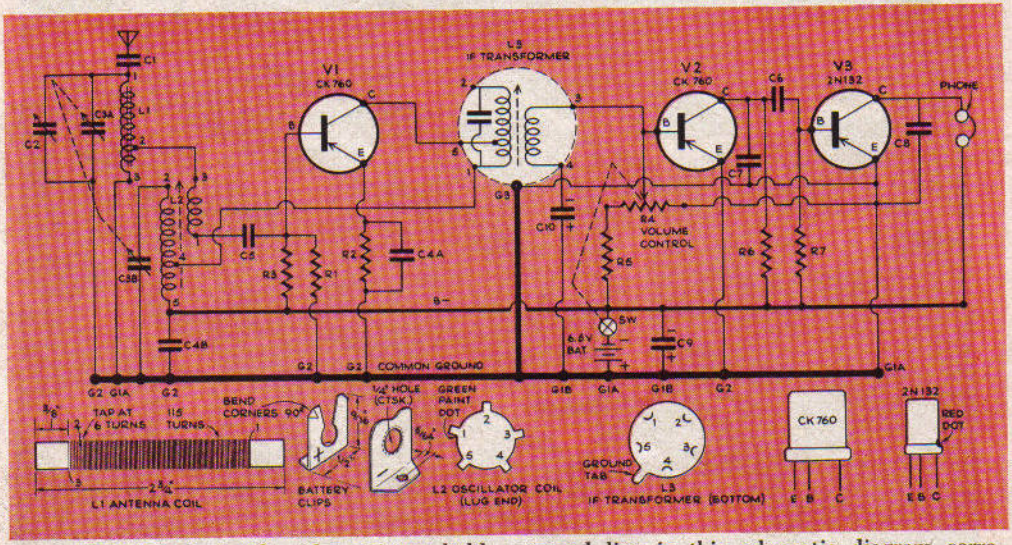
Next, mount the tuning condenser C3, IF transformer L3, phone jack, antenna clip and volume control. Do not mount oscillator coil L2 or trimmer C2 as yet.

First wiring steps. Cut a piece of

*Lafayette Radio, 100 Sixth Ave., New York 13, N.Y.

PARTS LIST

L1: Antenna coil; 81½' Litz wire on ¼"-by-2¾" ferrite core.
L2: Oscillator coil (Lafayette MS-265)
L3: 455 kc. IF transformer, with built-in condenser (Lafayette MS-188)
C1: 10 mmfd. ceramic disk (CRL type DD)
C2: 1.5 to 20 mmfd. trimmer (Arco 402)
C3: two-gang superhet tuning condenser (Lafayette MS-270)
C4: double .01 mfd. ceramic (CRL type DDM-2)
C5: .01 mfd. ceramic
C6: .04 mfd., 200 volt paper (Aerovox P83Z)
C7: .002 mfd. ceramic disk (CRL type DD)
C8: .02 mfd. ceramic disk (CRL type DD)
R1: 12,000 ohm, ¼-watt
R2: 390 ohm, ¼-watt
R3: .1 megohm, ¼-watt
R4: 25,000-ohm variable, with switch (Lafayette VC-45)
R5: .22 megohm, ¼-watt
R6: 33,000-ohm, ¼-watt
R7: 1 megohm, ¼-watt
V1, V2: Raytheon CK760 (or 2N112)
V3: Raytheon 2N132
Phone: 3,000-ohm dynamic (Lafayette MS-278)
Miscellaneous: midget 2-pin phone plug and socket, 1"-by-2"-by-2⅞" plastic case (Lafayette MS-158), 1/16"-by-2"-by-2⅞" linen bakelite, 6.5-volt mercury battery (Mallory TR-115R), 9 flea clips (Lafayette MS-263), antenna clip, dial, metal for battery clips, decals, etc.



TO IDENTIFY LEADS of coils and transistors, hold them in the positions shown directly above and compare with the drawings. Key letters on the ground line in this schematic diagram correspond to the various grounding points similarly marked in the pictorial diagrams on page 198.

hookup wire about 2″ long, pass it through the hole "X" near V1 from the top of the panel (see pictorial diagram on page 198) and solder it to the collector clip of V1 underneath. Solder the other end to lug 5 of the IF transformer L3 on top of the chassis.

Pass another 2″ wire through hole "X" from the top. Solder it to ground lug G2 on the tuning condenser underneath. On top, solder it to lug G3 on L3.

Cut the leads on the 12,000-ohm resistor R1 and 390 ohm resistor R2 about ½″ long. Connect one of each to G2 underneath the panel. Also beneath, run a bit of wire from G2 on the tuning condenser to the emitter clip of V2.

Cut the center (common) lead of the double ceramic condenser C4 ½″ long and connect it to G2. Now install the trimmer condenser C2, soldering its two lugs directly to G2 and the antenna lug of the tuning condenser C3.

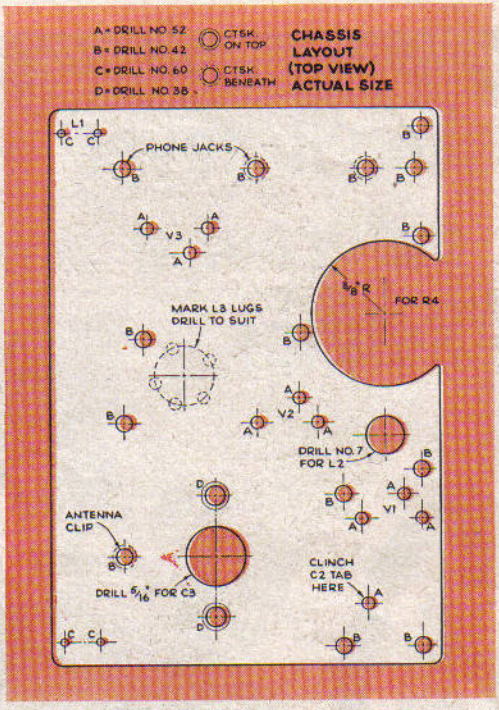
Mount the oscillator coil L2 with cement. Then solder in the remaining condensers and resistors. Note that connections are sometimes made to the same flea clip or lug bolt both on top of and beneath the panel. Don't let solder run into the part of the flea clips that takes the transistor leads. Cut these leads short and bend them to fit.

File the phone jack to 5/16″ in height. Solder the two eyelets set in it to two tiny angle brackets bent from sheet metal and fastened with bolts and nuts.

Fitting in the chassis. The panel is held in the case at two corners and at a point near L3. Cement bits of plastic 5/16″ high into the case, punch-mark through the panel, and tap 2-56 for screws. Cut holes in the case for the tuning shaft, control knob, phone-plug pins and antenna wire, making the latter oversize so that a small screwdriver can be inserted to tighten the knob. Notch the edges of both case halves for the shaft of C2.

File the head of a 6-32 screw flat and solder it to the C2 shaft. Then tighten a tiny knob on the threads.

The dial was made from a clear-plastic cap, the kind that snaps over the



THIS ACTUAL-SIZE PATTERN can be used to spot holes on the 1/16″ linen-bakelite panel. Some holes must be countersunk on the top, some beneath. Mark those for L3 from the unit itself.

center of a phone dial. Knock the bushing out of an old knob, mount it on a ¼″ rod, and chuck in a drill to file a shallow shoulder at one end. Drill the plastic cap to a tight fit on this and cement it.

To protect the transistors, be sure to check every connection, the polarity of electrolytic condensers, and battery position before turning on the switch.

Aligning the circuit. The two sections of C3 must be adjusted to "track," that is, to tune 455 kc. apart at all points on the dial. Since different antennas will cause slight variations, C2 has a knob for peaking weak stations.

You can align the receiver without a signal generator if there are several strong stations nearby. Connect no more than 3′ of wire to the antenna clip. Do not touch L3; it comes set at approximately 455 kc. Set the two tiny built-in trimmers on C3 so that the plates are about two-thirds in, and back C2 half a turn from the tight position.

Tune to a strong station around 1,000

kc.; then adjust the oscillator trimmer on C3 for peak output. Next, tune in a station around 600 kc., but this time peak it by moving the core in oscillator L2 and retuning for loudest reception.

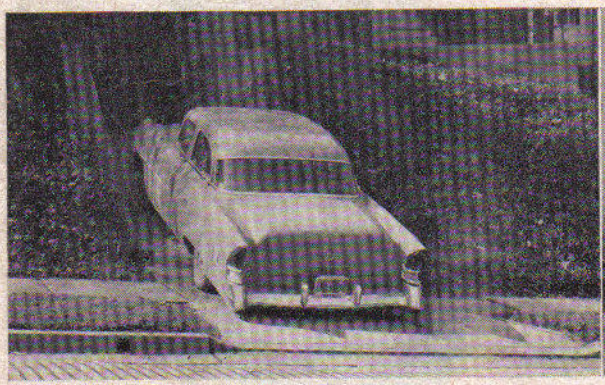
Go back to the 1,000 kc. signal and repeak with the oscillator trimmer. Return to the 600-kc. signal and readjust the oscillator coil. Repeat this sequence until no more than a quarter turn of trimmer C2 will peak any station.

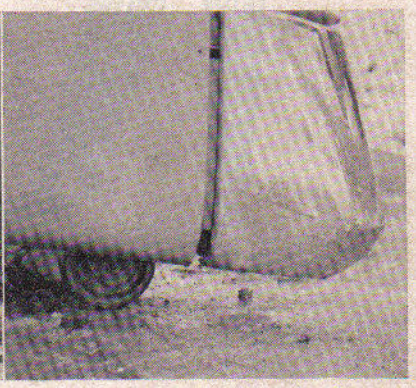
Operating tips. Near metropolitan transmitters, you should get reception with a few inches of antenna by turning the set for best pickup. Three or four feet of antenna will give more sensitivity, and bringing this wire near a phone or radiator should increase signal strength.

If you are far from stations, better pickup may be obtained by boosting C1 to 25 to 50 mmfd. This may require reducing the capacity of C2 and of the antenna trimmer on C3.

Current draw can be checked with a low-range DC milliammeter; V1 alone should take .9 to 1.1 ma.; V2 will take .1 to .3 ma., and V3 (with the phone plugged in) .5 to .7 ma. A *lower* value for R1 will decrease V1 draw, while V3 current can be changed by different values of R7.

Since total current drain is only about 2 ma., the battery specified should last for at least 150 hours. END



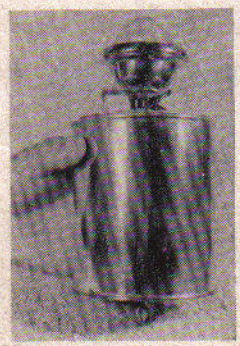


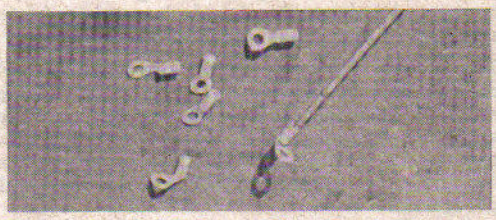
Caster Welded to Rear of Car Keeps Bumper Off the Ground

WHEN we got our "new look" car, we did a double take. The overhung rear end scraped the road when we backed out of our steep driveway. Rather than rebuild the driveway, I had a heavy-duty caster welded to the rear cross member of the frame. A bolting job would have done as well: the caster only has to lift the body an inch or two on the springs.—*A. A. Markson, Pittsburgh.*

Truck Lamp Lights Up Buoy

A TRUCK clearance lamp mounted on a sealed can enclosing a battery will make a mooring buoy that you can see at night. Screw a ring in the bottom for an anchor rope and solder it watertight. The on-off connection is an insulated terminal post.—*L. E. Johnston, Madison, Wis.*





Terminal Makes Fly-Rod Tip

A FEW electric-wire terminals in your tackle box are useful to have on a fishing trip. They make good replacements for fly-rod tips. I bend the eye to a 180° angle before crimping a terminal in place.—*John Krill, North Lima, Ohio.*