POPULAR SCIENCE

SECOND Radio Annual

35¢

PLANS FOR 35 RADIOS AND PHONOGRAPHS ANY ONE CAN BUILD —

POPULAR SCIENCE

SECOND

RADIO ANNUAL

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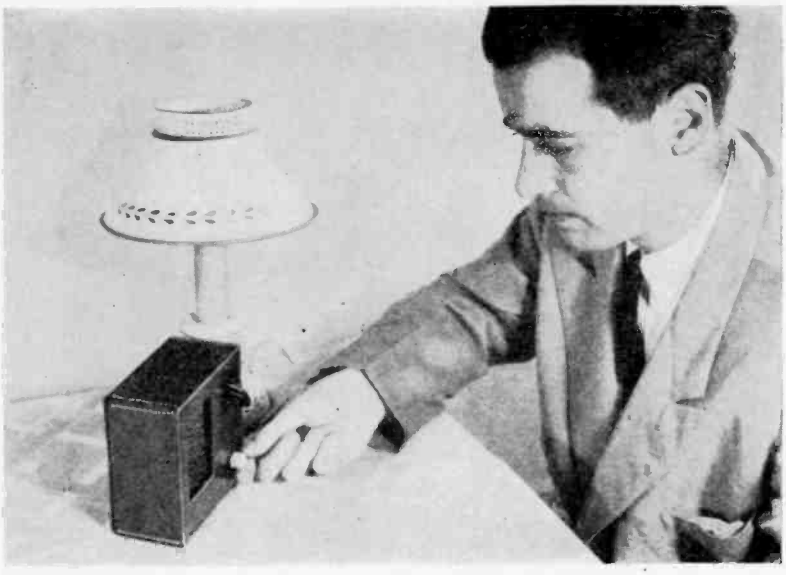
NOTE—The first page of this book is numbered 101 for the convenience of those who file their Annuals from year to year.

SERVICING YOUR RADIO



Measuring just over 5" square and less than 3" thick, this receiver and its 2" speaker cone equal the performance of much larger sets. The tiny cabinet is made of wood bound in genuine cowhide

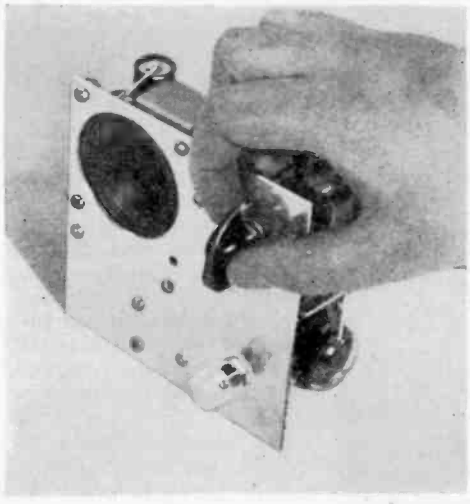
Midget AC-DC Receiver

PULLS IN LOCAL STATIONS AT FULL STRENGTH

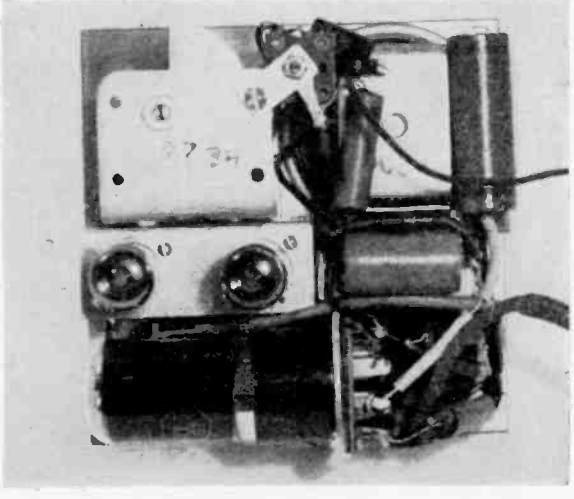
Set Has A 50-Mile Radius

ALTHOUGH small enough to slip easily into a woman's handbag, this midget three-tube radio receiver is nevertheless capable of tuning in all local stations within a 50-mile radius at full loudspeaker strength on its tiny 2" speaker, which handles up to ½-watt power without distortion.

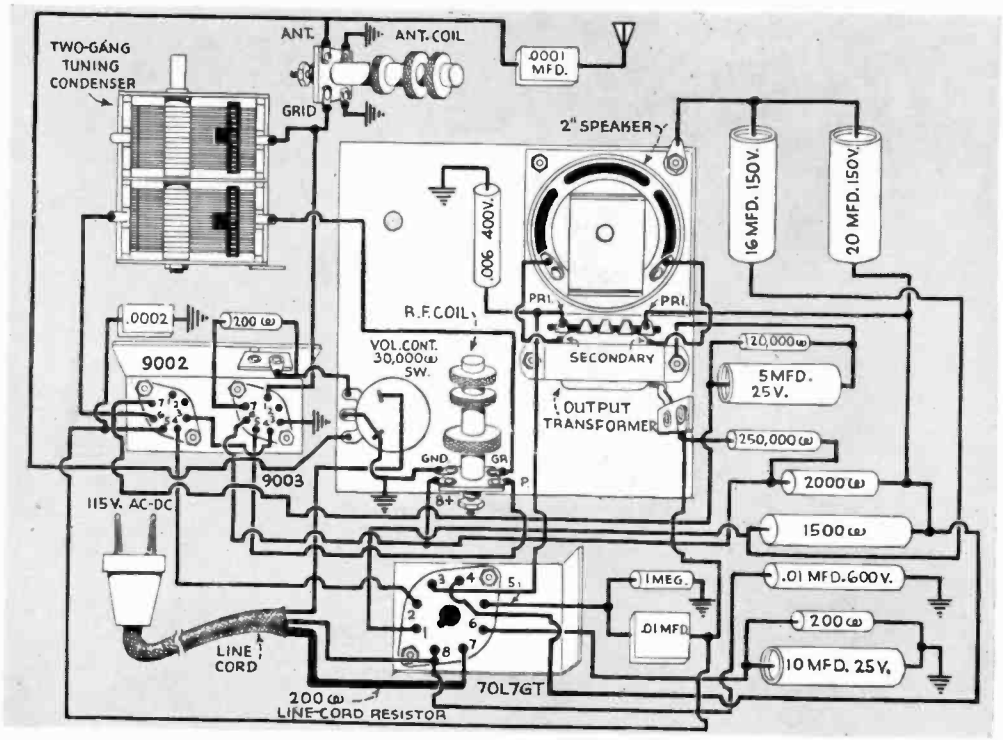
Making use of the new tiny electric tubes and iron-core coils, the set pictured on these pages was mounted on a front panel (no chassis was used) of unusual design and measuring only 4¾" square. In the upper left-hand corner a circle 2½" in diameter was punched out for the speaker. Beside it, on the upper right-hand side, and mounted directly on the front panel, is a .00036-mfd,



Front view of panel on which receiver is mounted



Close-up of the wiring. All parts are accessible

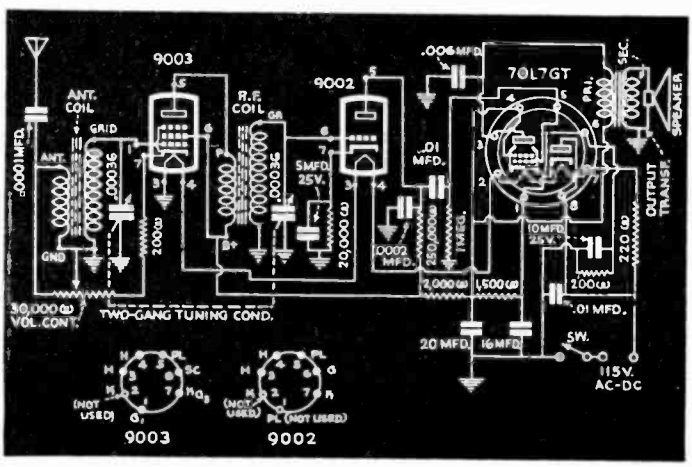


In this pictorial diagram, the compact placing of the parts of the midget receiver is shown in detail

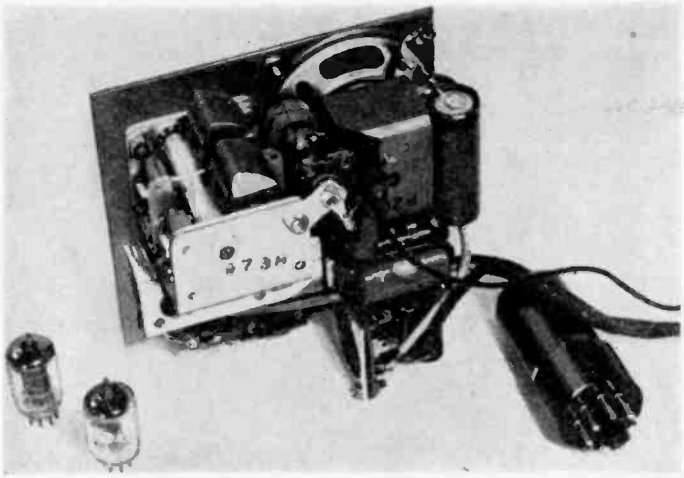
two-gang tuning condenser. Clamped to the framework of the tuning condenser by means of two 6-32 machine screws, ¼" long, is a small bracket on which were mounted the midget seven-prong wafer sockets for the tiny RF pentode amplifier (9003) and the high-mu detector triode (9002). Another bracket was used for mounting the standard-size eight-prong socket of the 70L7GT tube, which is a combination power pentode and half-wave rectifier. The midget output transformer, coupling the pentode portion of the 70L7GT tube to the 2" speaker, was mounted directly under the speaker.

The iron-core antenna coil was mounted on the two-gang tuning condenser just next to the speaker. The RF coil was mounted next to the bracket holding the 70L7GT tube. A 50,000-ohm variable resistor acts as a volume control and was put in place on the front panel directly under the two-gang condenser.

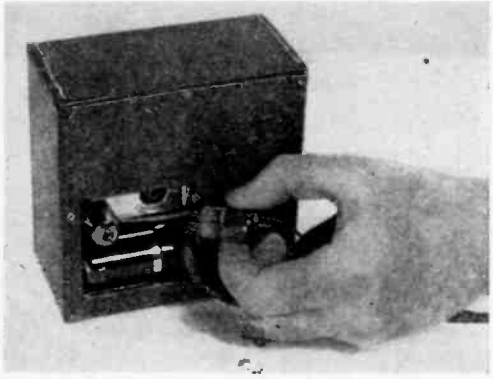
The four-stage TRF circuit which is used in this midget receiver consists of a tuned RF stage coupled to a biased detector stage, which in turn is resistance coupled to the beam power pentode. A half-wave rectifier furnishes plate voltage to the tubes, and this plate supply is amply filtered by the 2,000- and 1,500-ohm, 2-watt resist-



Complete wiring diagram, including base layouts (at bottom) for tubes



Back view of receiver, wired but with the tubes removed. The RF coil, mounted on the metal panel by means of a ¾" angle bracket, is shown just next to the 50,000-ohm variable resistor. The 9002 midget high-mu triode tube and 9003 pentode are at left



Leather-covered cabinet from the rear. The opening at the lower left corner ventilates the three tubes and is 2¼" square. The back cover is a piece of heavy cardboard and leather held by four screws

ors, the 20-mfd. and 16-mfd., 150-volt electrolytic condensers, and the .01-mfd. paper tubular condenser (400 volts) in the plate circuit of the rectifier.

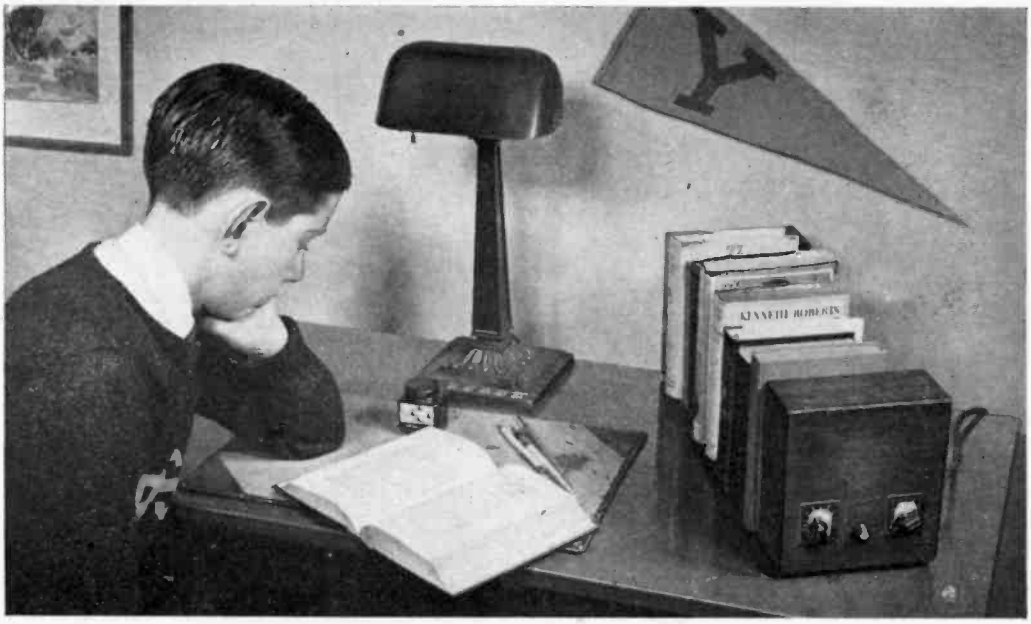
The new midget tubes used employ mount structures similar to those of the older Acorn tubes, but the new ones have glass button bases which provide short leads and low-lead induction. Each tube employs two cathode leads which cause a reduction in input loading and provide an increased gain. The single-ended design of the new tubes has the added advantage of requiring a minimum mounting space. Although these tubes were designed primarily for use by engineers, experimenters, and amateurs working in the ultra-high frequencies, they can also be used for operation in a receiver designed for service in the regular broadcast band.

When completed, the receiver and its front-panel mounting were placed in a small wooden cabinet covered with cowhide leather stitched at the corners. The outside dimensions of the cabinet used were 5 3/16" by 5 3/16" by 2¾". A heavy piece of cardboard, also covered with leather, was used for the back cover. This cover was held in place by four small brass wood screws. An opening 2¼" square was cut in the back cover to make allowance for the necessary ventilation of the tubes.

As this is an AC-DC receiver and therefore already grounded through the electric outlet, no further ground connection was needed. If a ground should be used it must be connected to the receiver through a .1 mfd., 400-volt tubular paper condenser, otherwise a short will occur, blowing out the tubes. Only a short antenna (about 15') is employed and may consist of stranded S.C.C. wire strung along the floor.

LIST OF PARTS

Cabinet, 5 3/16" by 5 3/16" by 2¾".
Two-gang tuning condenser, .00036 mfd.
Iron-core antenna and RF coils.
Midget permanent-magnet 2" speaker.
Midget output transformer.
Midget tubes (two): Super-control pentode, 9003; high-mu triode, 9002.
Pentode-rectifier tube, 70L7GT.
Line cord resistor, 220 ohms.
Variable resistor, 50,000 ohms.
Plate cover switch, S. P. S. T.
Electrolytic condensers (four): 20 mfd., 150 volts; 16 mfd., 150 volts; 5 mfd., 50 volts; 10 mfd., 25 volts.
Mica condensers (three): .0001 mfd.; .0002 mfd.; .01 mfd.
Tubular condensers (two): .006 mfd., 400 volts; .01 mfd., 600 volts.
Carbon resistors (seven): ½ watt, 20,000 ohms; ½ watt, 250,000 ohms; ½ watt, 200 ohms; ½ watt, 1 megohm; 1 watt, 200 ohms; 2 watts, 2,000 ohms; 2 watts, 1,500 ohms.
Midget wafer sockets: Seven prong (two), eight prong (one).



Decorative and doubly useful, the efficient radio shown above is a worth-while addition to one's desk top

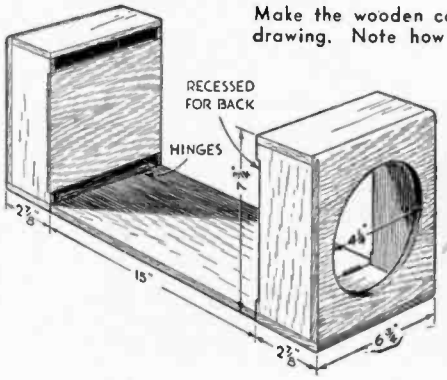
BUILD THIS

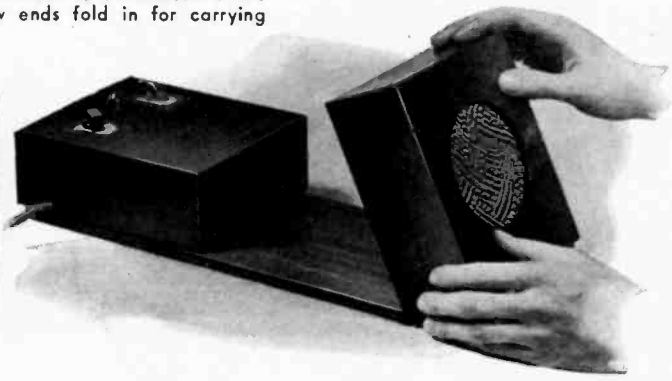
Book-End Radio for Your Den

COMBINING usefulness with novelty, this folding book-end radio provides something new and novel in the design of radio cabinets. It is a set that should appeal to every one who builds radio receivers as a hobby.

The circuit chosen uses four of the latest all-metal electric tubes and will operate equally well on either alternating or direct current. Although not a tuned-radio-frequency receiver, this set is just as sensitive and selective, and is cheaper to build because only one coil and one tuning condenser are needed. A regenerative detector built around one of the new radio-frequency pentodes is used in the first stage, and is resistance-coupled to one of the new triodes, which is in turn resistance-coupled to a 25A6 output pentode. The fourth tube, the 25Z6, rectifies the current for the receiver, changing the al-

Make the wooden cabinet to dimensions in the drawing. Note how ends fold in for carrying





An A.C.-D.C. Four-Tube Set

ternating house current to direct. However, when plugged into a D.C. outlet, this tube merely acts as a resistance.

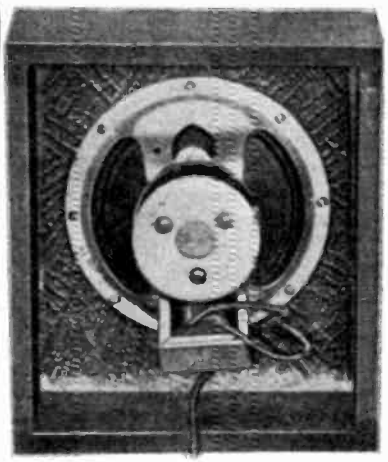
Regeneration is controlled by a 20,000-ohm variable resistor, which is connected across the tickler coil. The slider, or arm, of this variable resistor is grounded to the chassis through a .0005-mfd. mica condenser. A 6-mh. choke is inserted in the plate lead of the detector tube in order to keep radio-frequency currents out of the audio stages, and also to add to the smoothness of the regeneration control. The grid-lead detection, chosen because of its greater sensitivity over the usual bias method, consists of a one-meg. fixed resistor in parallel with a .00025-mfd. mica condenser.

A plug-in coil must be used with this circuit since a standard A.C.-D.C. antenna coil has no tickler winding. This coil is tuned by a .00036-mfd. single-gang variable condenser. Inserted in the ground lead of the primary winding on the coil is a new type of tuning control, which may be best described as a selectivity control. It consists of one of the new ultra-flat tuning condensers using molded-plastic insulation, and is mounted on the front panel behind the plug-in coil, between the tuning condenser and the 20,000-ohm variable resistor.

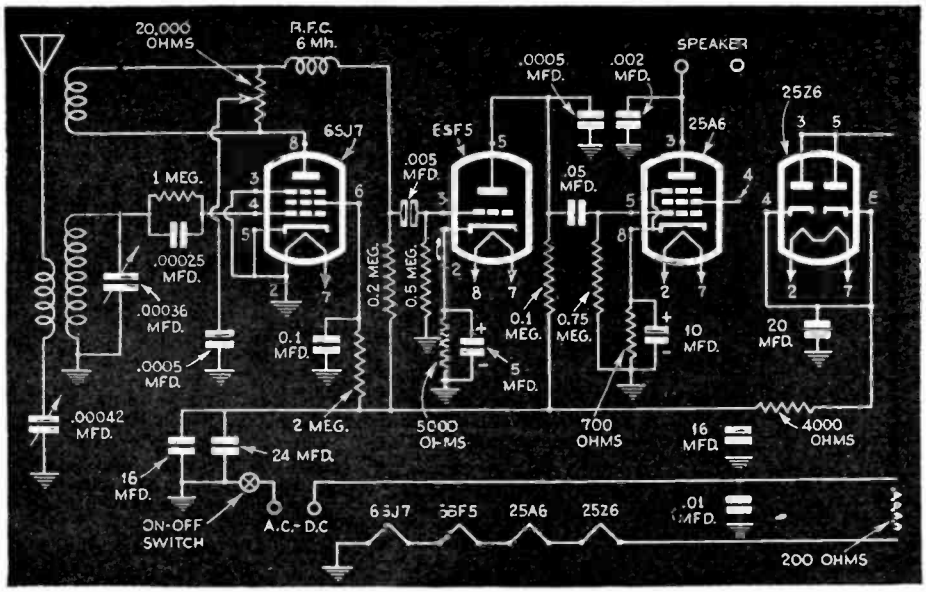
Decreasing the capacity of this condenser increases the selectivity of the receiver. At its minimum setting, it will cut down the volume by decreasing the coupling of the primary and secondary coils. This is especially useful when tuning to a strong signal.

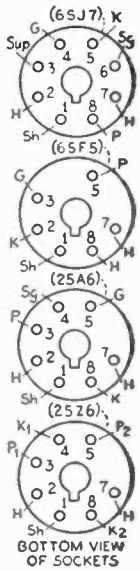
A .0005-mfd. and a .002-mfd. mica condenser are used in the plate leads of the first and second audio stages, and help to cut down feed-back and unwanted oscillation, which would cause distortion in the loudspeaker.

To avoid any excessive hum that might be caused by the compactness of the circuit, a



The chassis end of the unit and, at right, the loudspeaker end. Diagram below shows the wiring





total of 76 mfd. should be used for filtering the rectified direct current. The filter circuit is made up of four electrolytic condensers, one 20 mfd., two 16 mfd., and one 24 mfd.

The cabinet is easy to build, and may be made at home from any kind of wood, such as pine, walnut, or mahogany. After careful sandpapering — with the grain, not against it—the finished cabinet can be given one or two coats of stain, depending upon how dark a finish is desired. Once these coats have thoroughly dried, a thin layer of shellac can be applied and rubbed down to kill some of the gloss. Rubber feet will raise the book ends and provide room for the speaker cord that runs from the compartment box at one end which houses the chassis to the compartment at the other end which houses the 5" permanent-magnet speaker. A built-in aerial is used so that no antenna or ground connections are needed for good reception.

LIST OF PARTS FOR BOOK-END RADIO

One 6SJ7 tube.
One 6SF5 tube.
One 25A6 tube.
One 25Z6 tube.
Antenna condenser, .00042 mfd.
Tuning condenser, .00036 mfd.
Electrolytic condenser, 24 mfd., 150 v.
Electrolytic condenser, 20 mfd., 150 v.
Two electrolytic condensers, 16 mfd., 150 v.
Electrolytic condenser, 10 mfd., 25 v.
Electrolytic condenser, 5 mfd., 25 v.
Mica condenser, .0005 mfd. (two)
Mica condenser, .00025 mfd.
Tubular condenser, .1 mfd.
Tubular condenser, .01 mfd.
Tubular condenser, .005 mfd.
Tubular condenser, .05 mfd.
Tubular condenser, .002 mfd.
Line-cord resistor, 200 ohm.
Resistor, 1 meg., ½ watt.
Resistor, 2 meg., ½ watt.
Resistor, ½ meg., ½ watt.
Resistor, 750,000 ohm, ½ watt.
Resistor, 200,000 ohm, ½ watt.
Resistor, 100,000 ohm, ½ watt.
Resistor, 5,000 ohm, ½ watt.
Resistor, 4,000 ohm, 1 watt.
Resistor, 700 ohm, 1 watt.
Switch and volume control, 20,000 ohm.
Radio-frequency choke, 6 mh.
Six-prong, plug-in coil.
Miscellaneous:—Speaker, four midget octal sockets, aluminum chassis, cabinet, wire, etc.

Beginner's

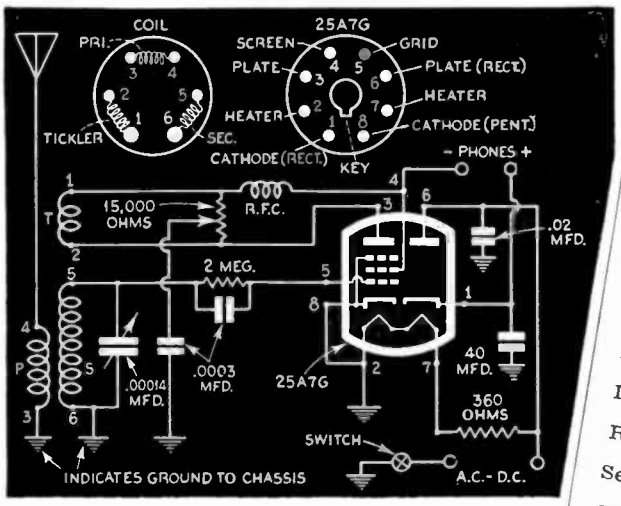
This sturdy set is compact and has a range up to 1,000 miles

WITH a broadcast-band range up to 1,000 miles, the one-tube, all-electric, A.C.-D.C. receiver illustrated is designed especially for beginners. It requires a minimum of parts, costs little to build, and is easy to assemble and wire.

The set is built around one of the new bantam-type, midget, octal-base tubes. This particular tube, the 25A7GT, is really a pentode tube and a half-wave rectifier in one. The pentode section is used as a regenerative detector.

In spite of the compactness of the steel cabinet (5" by 4" by 3"), it is an easy matter to mount and wire the parts, as the top and bottom panels can be unscrewed and taken off. The six-prong plug-in coil, the insulated earphone terminals, and the tube are all mounted on the top panel. The .00014-mfd. tuning condenser and the 15,000-ohm wire-wound combined regenerative control and switch are mounted on the front panel.

One-Tuber IS ALL-ELECTRIC



All connections are clearly shown in the diagram. Note particularly the negative phone connection to pentode-tube screen, and absence of a ground

LIST OF PARTS

One 25A7GT tube.

Tuning condenser .00014 mfd.

Electrolytic condenser, 40 mfd.

Tubular condenser, .02 mfd.

Two mica condensers, .0003 mfd.

Switch and variable resistor, 15,000 ohm.

Resistor, 2 meg., ½ watt.

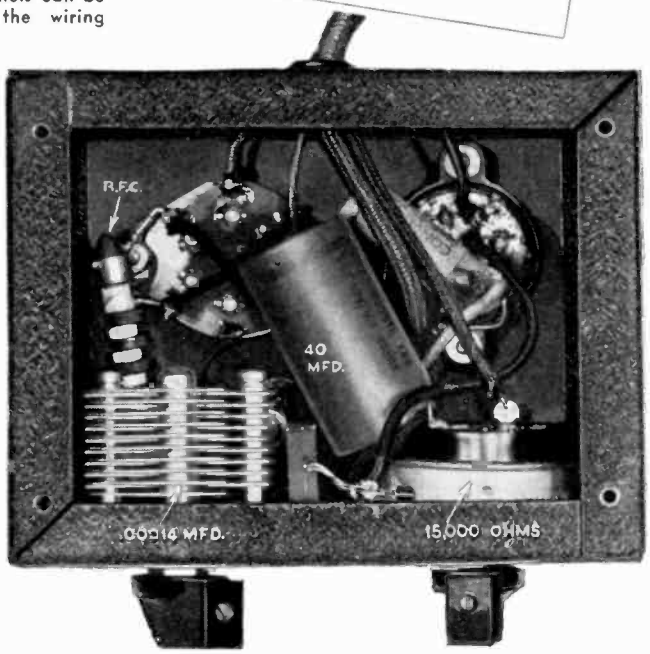
Line cord, 360 ohm.

Radio-frequency choke, 2.5 mh.

Set of six-prong coils.

Miscellaneous.—Cabinet (steel), octal-tube socket, six-prong-coil socket, two insulated banana jacks and plugs, earphones, wire, solder, etc.

Bottom view of the chassis, below, indicates how parts are arranged. Both top and bottom panels can be removed to facilitate the wiring



A very simple filtering system, consisting of only one high-capacity electrolytic condenser, is used. The earphones are connected in series with the cathode of the rectifier, and the reader should note that the screen of the pentode tube is connected to the negative terminal of the phones instead of the positive. No ground should be used with this receiver, as circuits of this type are grounded through the house wiring. A rubber grommet should be used to protect the line cord where it passes through the steel cabinet, otherwise the sharp metal sides of the hole may cut the insulation and cause a short circuit. Should the set hum, reverse the phone leads.

Superhet for Beginners

USES ONLY TWO TUBES

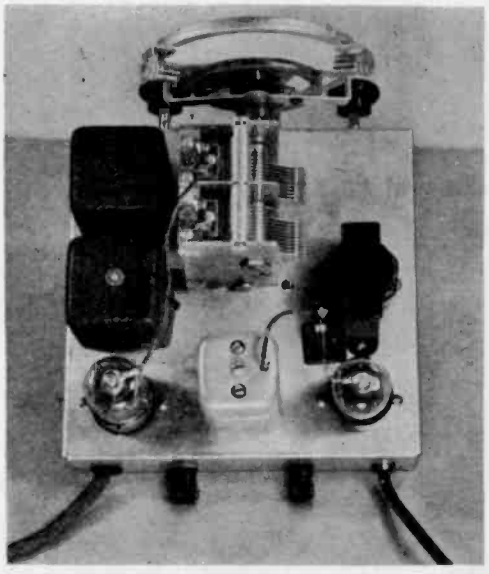
This two-tube superhet gives loudspeaker reception of local stations with a 20-foot antenna laid on the floor

SEVERAL years ago, a superheterodyne receiver had to consist of at least seven tubes—sometimes nine, for in those days the multiple tubes we use so frequently in our present sets had not been perfected. A two-tube super is possible these days, and one of them is shown on these pages.

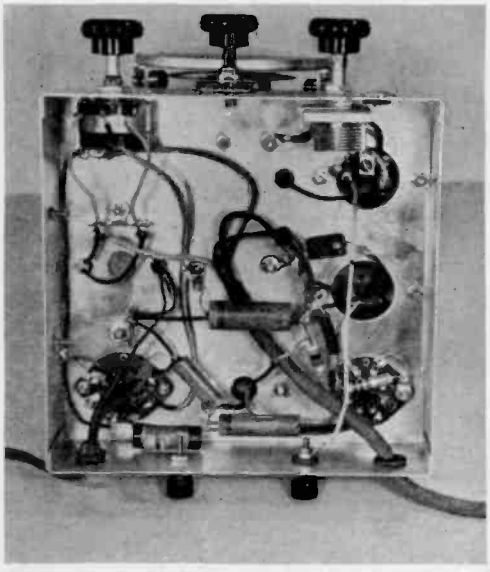
A 1A7GT pentagrid tube is used as the first detector and oscillator. A two-gang .00036 condenser tunes these two stages. To insure proper tracking of the oscillator tuning condenser a fixed mica condenser with a capacity of .0004 mfd. is wired in series with the oscillator coil. This condenser must be accurate within +3 percent.

Across the other tuning condenser (in parallel with it) is a low-capacity (.00005 mfd.) midget variable trimmer condenser. This is adjusted to compensate for any irregularities between the two tuning condensers. It is not necessary to adjust it for each station.

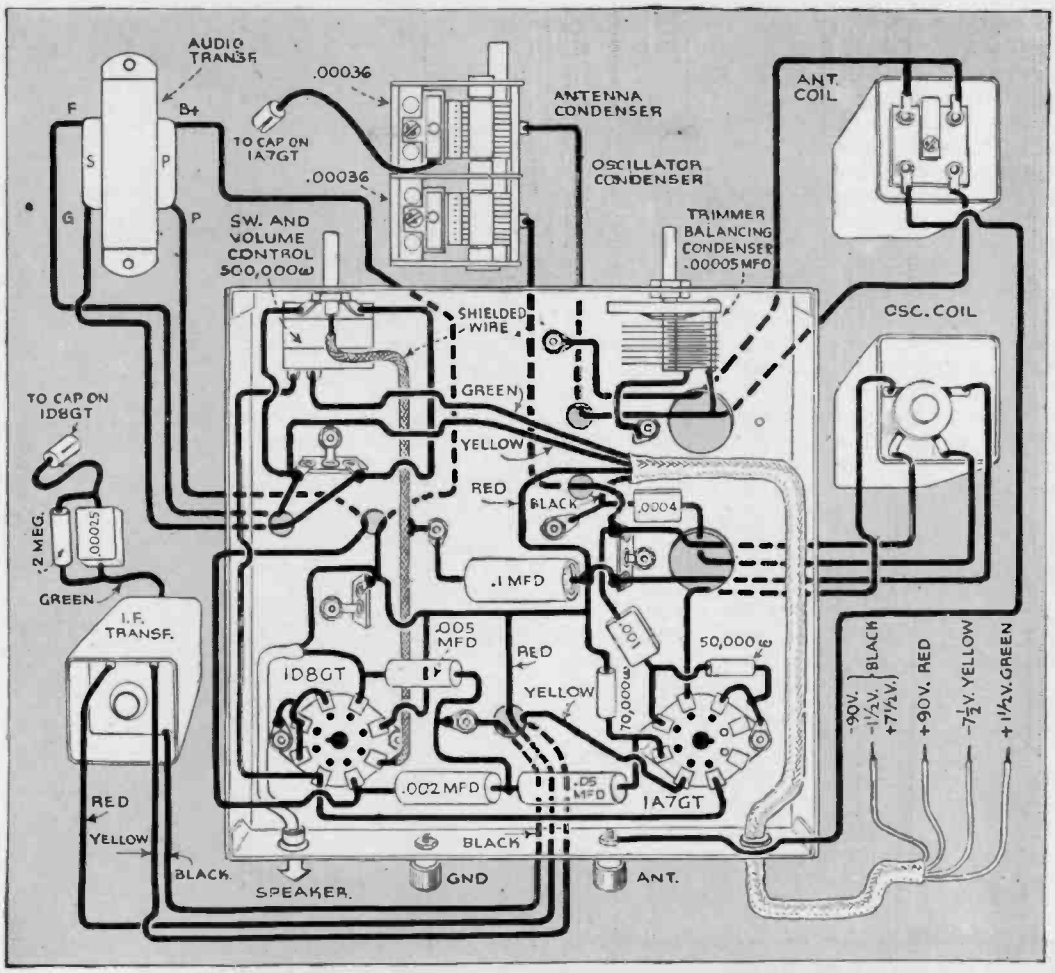
The output of the 1A7GT is coupled to the detector stage through a 456-kc. I. F. transformer (this may be either an iron-core or air-core type). Both primary and secondary windings of the I. F. transformer are tuned by tiny built-in trimmer condensers which have to be adjusted before the receiver will operate. This may easily be done by tuning in the strongest local signal and turning the two screws on top of the



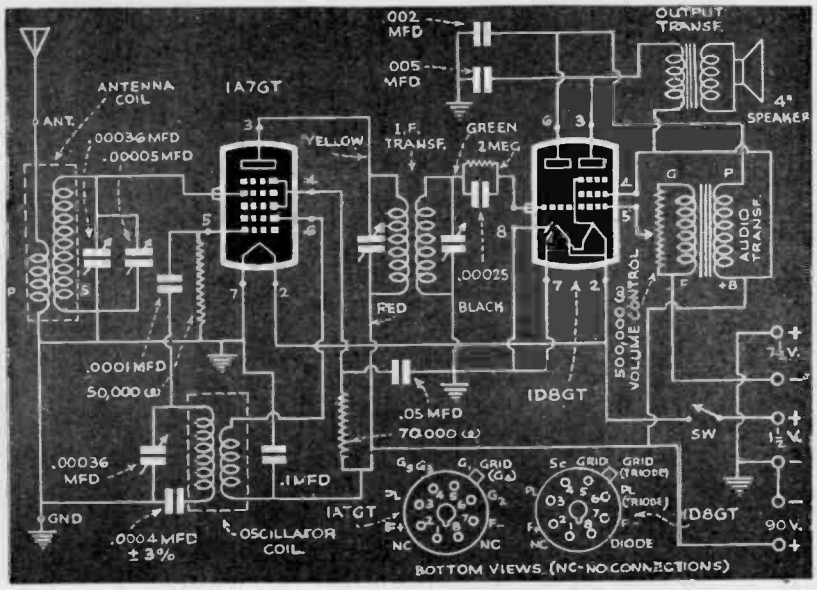
Topside of chassis, showing the two multiple tubes that do the work once performed by seven or more



This is the underside of the chassis. The on-and-off switch is operated by the volume-control knob



As shown in this pictoriol diagrom, the 1A7GT pentagrid tube is used as the first detector and oscillator, with the two-gang tuning condenser



The detector (triode portion of the 1D8GT) is transformer-coupled to the power-amplifier pentode of the same tube, as shown at the right

I. F. transformer can with a screw driver, until the signal is at its loudest. Then tune to a weaker station (near 1,500 kc.) and give it a final adjustment.

The detector (triode portion of the 1D8GT) is transformer-coupled to the power-amplifier pentode of the 1D8GT. Unrectified RF currents in the plate circuit of the detector stage are by-passed to the chassis through a .002-mfd., 400-volt tubular condenser. Volume is controlled by means of the 500,000-ohm variable resistor across the secondary of the audio transformer. The S. P. S. T. on-and-off switch is also controlled by the shaft of the resistor.

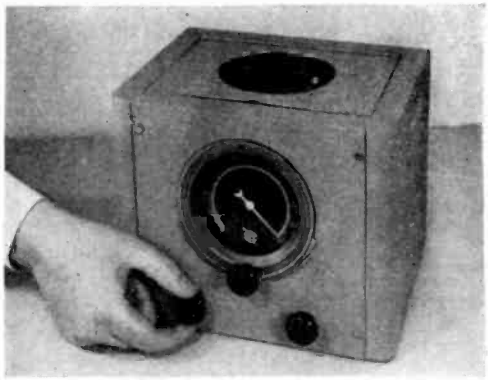
Output of the two-tube super is fed into a 4" or 5" permanent-magnet speaker installed in the lid of the gray-wrinkle steel cabinet. A 3¾" diameter opening must be drilled for the 4" speaker, and another opening about 4" in diameter in the front panel for the dial.

Loudspeaker reception of all local stations is possible, using an antenna of only about 20 feet, stretched across the room on the rug. No ground is necessary, although it may improve the volume on weak signals. A small trimmer condenser should be inserted in series with the antenna whenever a long antenna is used with the set.

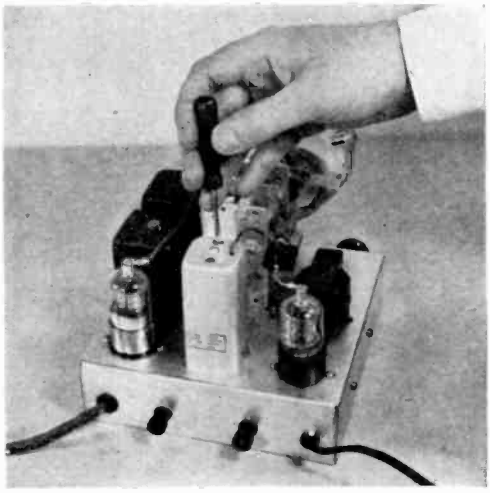
Although 90 volts is shown in the wiring diagram as the plate or "B" battery voltage this value may be safely increased to 110 or 120 volts with a correspondingly greater signal strength. In this case the "C" battery voltage should be advanced to 9 volts.

LIST OF PARTS

Steel chassis, 7" by 7" by 2".
Shielded iron-core antenna coil.
Shielded air-core oscillator coil.
Two-gang tuning condenser, .00036 mfd.
Four-inch round dial.
I. F. transformer, 456 kc.
Audio transformer, 3:1 ratio, unshielded.
Output transformer, universal type.
PM speaker, 4" or 5".
Steel cabinet, 8" by 12" by 8".
Volume control, 500,000 ohms.
Switch cover plate, S. P. S. T.
Variable trimmer condenser, .00005 mfd.
Pentagrid converter tube, 1A7GT.
Triode-pentode amplifier tube, 1D8GT.
Octal (eight-prong) wafer sockets (two).
Mica condensers: .0001 mfd., .00025 mfd., .004 mfd. (padder).
Tubular condensers: 1 mfd., 400 volts; .05 mfd., 400 volts; .005 mfd., 400 volts; .002 mfd., 400 volts.
Carbon resistors: ½ watt, 50,000 ohms; ½ watt, 70,000 ohms; ½ watt, 2 megohms.
Knobs, cable, binding posts, etc.

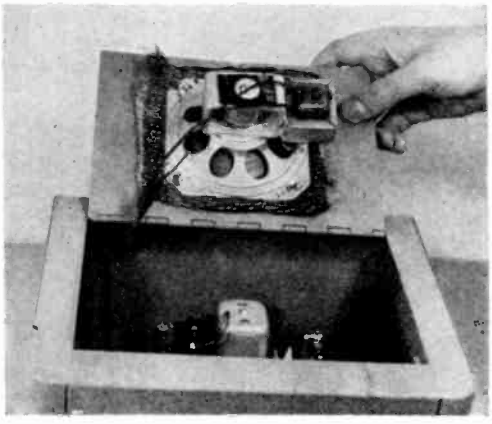


Front of the gray-wrinkle steel cabinet, showing the three control knobs and four-inch round dial



Both primary and secondary windings of the I.F. are tuned by turning the two screws on top of the transformer can until selected signals are loudest

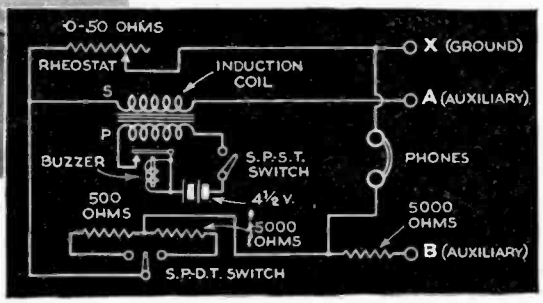
Output is fed into a permanent-magnet loudspeaker (either four or five-inch) set in the cabinet lid



Pocket-Size Radio Tester

IS EASY TO BUILD FROM ODDS AND ENDS

The author using the test circuit shown at the left to measure a small resistor



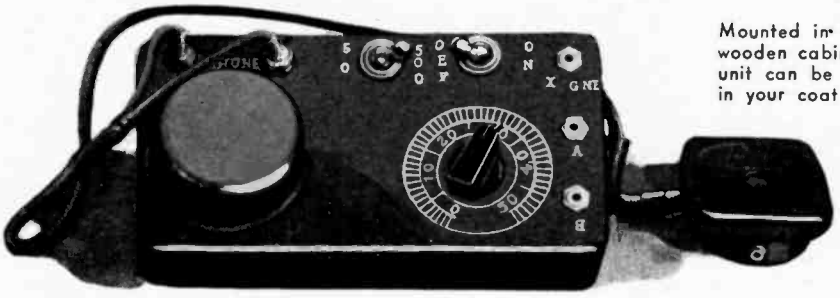
PROVIDING a quick and easy means for measuring small resistances and testing grounds, the unit illustrated forms a handy piece of equipment for the radio experimenter and service man.

The circuit consists of a buzzer and battery, three fixed resistors, a rheostat, an induction coil, two switches, and an earphone. As shown in the diagram, three binding-post terminals (A, B, and X) are provided. To test a resistance up to 50 ohms, terminals A and B are connected together with a short piece of wire, the toggle switch is flipped to the "50" position, and the unknown resistor is connected across terminals X and A. The buzzer is then turned on and the rheostat adjusted until the buzz *cannot* be heard in the earphone. The position of the pointer on the rheostat scale indicates the value of the resistor. For resistors from 50 to 500 ohms, the toggle switch is moved to the "500" position and the same procedure followed, but the scale reading must be multiplied by ten.

In testing grounds, simply connect the ground in question to terminal X, attach terminal A to some other ground, and terminal B to a third ground, which can be nothing more than a screw driver pushed into the earth. When the rheostat has been adjusted to eliminate the buzz, the resistance of the ground can be read directly from the rheostat scale.

LIST OF PARTS

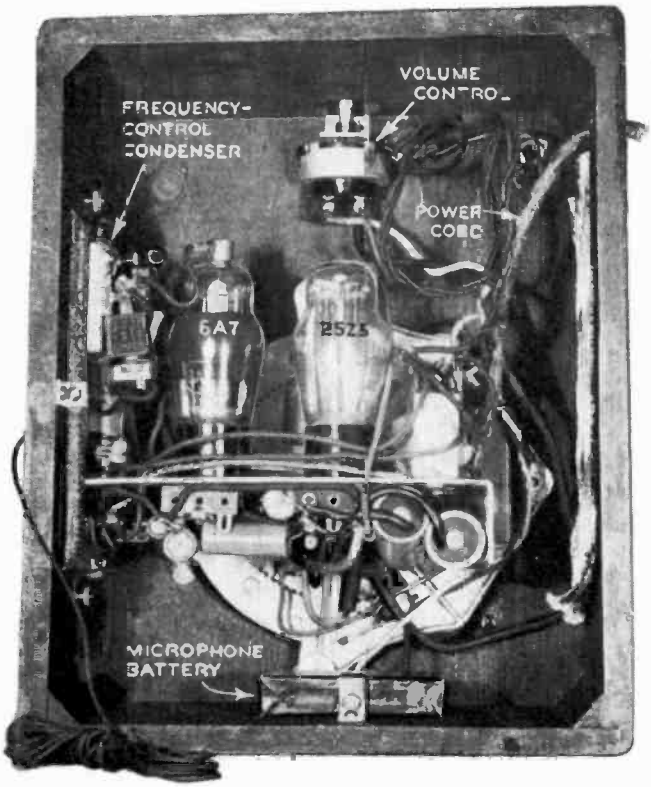
Fixed resistor, 500 ohms.
Fixed resistors, two 5,000 ohms.
Rheostat, 0-50 ohms.
Single-pole, single-throw switch.
Single-pole, double-throw switch.
High-frequency buzzer.
Induction coil, 1-100 ratio.
Battery, 4½ volts.
Binding-post terminals, three.

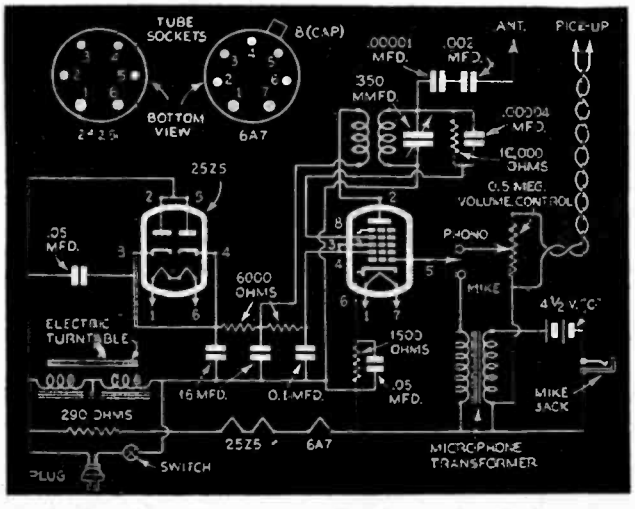


Mounted in a small wooden cabinet, the unit can be carried in your coat pocket

"Wireless" Radio Phonograph

REQUIRES NO CONNECTION TO SET





Study the wiring diagram carefully. The set is actually a two-tube transmitter. Parts are best arranged as in the photo above

INEXPENSIVE and easy to build, this "wireless" record player may be used with any alternating-current radio receiver without making any actual connections to the receiver circuit. In addition, when you plug in a microphone and flip a switch, the record player becomes a public-address system that will allow you to do your own program announcing through the radio's loudspeaker. In use, the device is simply plugged into a convenient electric outlet.

Essentially, the "wireless" feature of the pick-up consists of a tiny radio transmitter (oscillator) tuned to a frequency around 550 kilocycles, or to any unused band at the upper end of your radio's tuning dial. The power of the little transmitter is, of course, very low, and the distance it may be placed from your receiver depends upon the radio's sensitivity. With a good superheterodyne, the phonograph can be used in an adjacent room. With less powerful receivers, it may be necessary to wrap the insulated antenna of the phonograph-transmitter loosely around the receiver's antenna lead-in, without making an electrical contact.

If the reader already has a synchronous electric turntable, and either a magnetic or crystal pick-up, he may use these with the wireless oscillator and avoid the expense of buying new ones.

The oscillator circuit is built on a compact aluminum chassis measuring 1¼" by 2½" by 6½". A black crackle panel serves as the mounting for the trimmer condenser that adjusts the tiny 550 - kilocycle radio - frequency transformer, the microphone jack, and the switch for changing from pick-up to microphone.

The two tubes used are a 25Z5, as a rectifier, and a 6A7, as a combined modulator and oscillator. Two 6,000-ohm, one-watt

Plugged into an outlet anywhere in the room with your radio, the unit "broadcasts" records through the loudspeaker

Volume is controlled by a knob mounted near the pick-up arm. The antenna, seen leading out of the cabinet, is stretched on the floor during operation

By flipping a switch and plugging in the micraphone, yau've got yaur own public-address system for entertaining friends. How the synchronous motor for the turntable is installed may be seen at the left

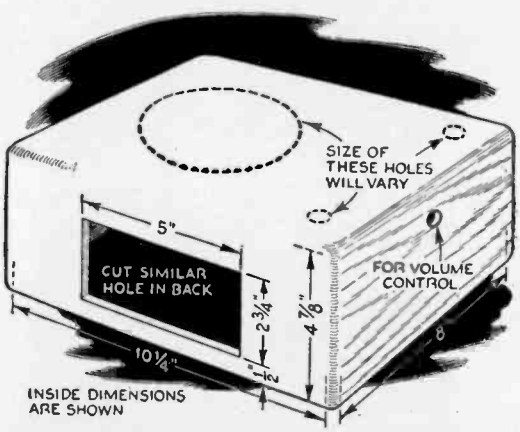
resistors, and two 16-mfd. electrolytic condensers are used for filtering the rectified current from the 25Z5.

To obtain the best results with the carbon-type microphone recommended, a suitable transformer with a 200-ohm primary is used in conjunction with a 4½-volt "C" battery. As shown, the battery fits snugly inside the cabinet.

Care must be taken to follow the exact values of the fixed condensers and resistors specified in the wiring diagram, and under no circumstances ground any of the wiring to the chassis or panel. This is to prevent any possibility of shock should the user accidentally touch the chassis of the receiver while holding the pickup. Standard A.C.-D.C. antenna wire can be used for the aerial of the transmitter, which may be approximately twenty-five feet long. When making the wooden cabinet shown below, be sure and cut a ventilator opening in the back.

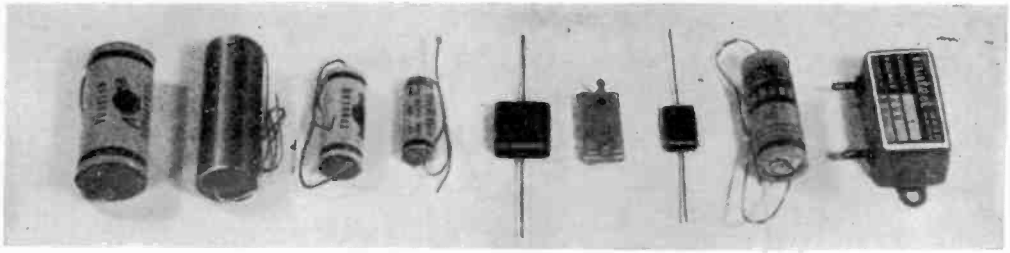
LIST OF PARTS NEEDED

Rectifier tube, 25Z5.
Oscillator-modulator tube, 6A7.
Synchronous motor (2" deep).
Magnetic or crystal pick-up.
Radio-frequency transformer, 560 Kc. (special).
Microphone transformer (midget).
Hand microphone (carbon-type).
Toggle switch.
Midget wafer socket, six-prong.
Midget wafer socket, seven-prong.
Two electrolytic condensers, 16 mfd., 175 volt.
Two tubular condensers, .05 mfd.
Tubular condenser, .1 mfd.
Trimmer condenser, 350 mmfd.
Mica condenser, .00001 mfd.
Mica condenser, .00004 mfd.
Mica condenser, .002 mfd.
Two resistors, 6,000 ohm, 1 watt.
Resistor, 1,500 ohm, 1 watt.
Resistor, 10,000 ohm, ½ watt.
Line-cord resistor, 290 ohm.
Volume control and switch, 500,000 ohm.
Miscellaneous: — Aluminum chassis, crackle panel, microphone jack and plug, A.C.-D.C. antenna, cabinet, etc.

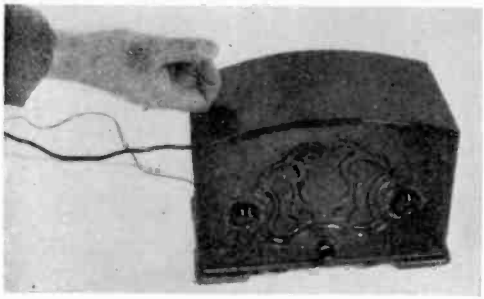


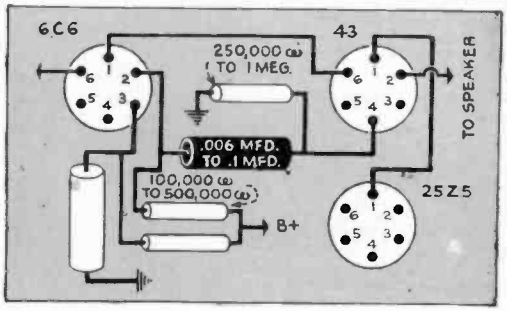
Details of the inexpensive wooden cabinet. No bottom is needed, but rubber feet should be used

Servicing Your Radio

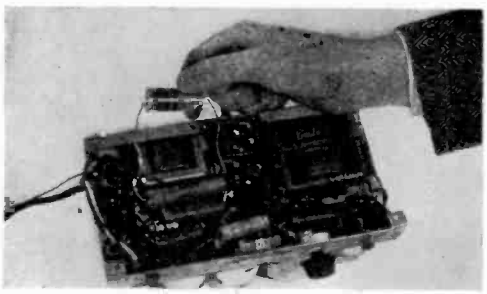


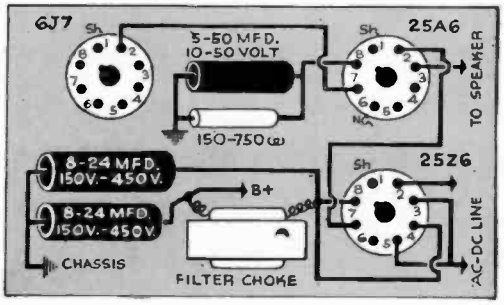
FIXED CONDENSERS. Nine types commonly used, left to right: .5-mfd. paper condenser; 8-mfd. midget electrolytic condenser; two (.05 and .02-mfd.) small paper condensers; three mica condensers (.002, .00075 and .0001-mfd.); a 50-volt, 25-mfd. electrolytic condenser; and a 1-mfd. paper condenser in a steel shell



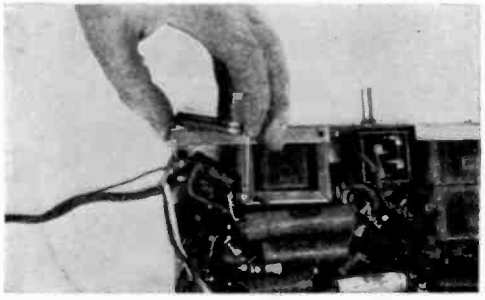


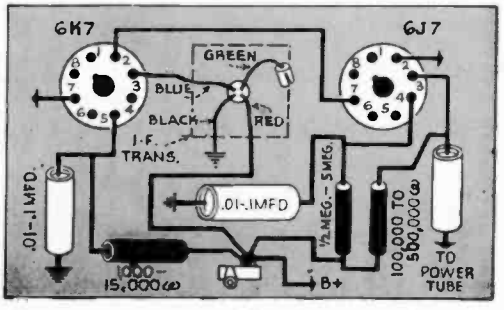
IF RECEPTION STOPS suddenly and resumes when the cabinet is knocked, the cause may be a loose connection or a bum tube. Or it may be a bad audio coupling condenser. This looks like the .05 or .02 paper tubular shown above. Diagram shows location. Before replacing, connect an .05 across it for a test





HUMMING is usually due to a faulty electrolytic condenser like the 50-volt, 25-mfd. shown above, across the power-tube bias resistor, or one like the 8-mfd., in the filter circuit. Connect an 8-mfd., 450-volt condenser across each electrolytic condenser in the set until the faulty one is found, and replace it





FADE-OUT experienced on many old sets is due to a fixed carbon resistor that has become crystallized. It usually can be recognized by a coating on its surface. If not, try connecting a 50,000-ohm, 2-watt resistor across each carbon resistor in the B+ circuit. If playing resumes, replace with one of correct value

Low-Cost Home Recorder

Making a record with the home recorder. It is just as easy to record radio programs, amplify weak stations, or play regular phonograph records by the simple flick of one of its switches

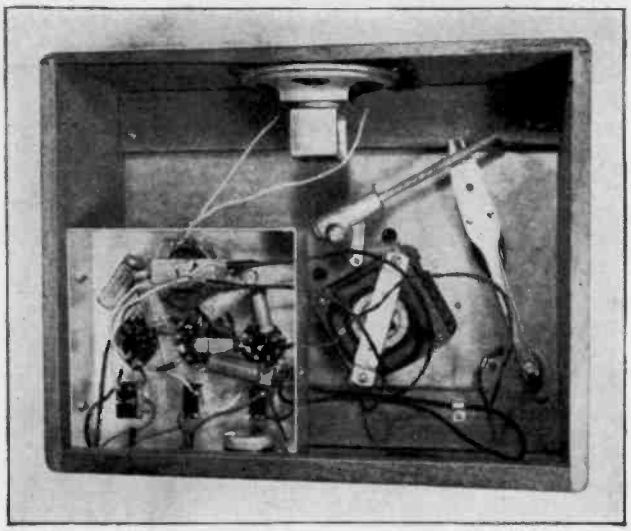
EXTREMELY versatile, this home recorder will enable anyone to record radio programs, to record home programs, to boost the volume on weak stations, and to play regular phonograph records.

The recording unit on top of the cabinet is very reasonably priced. It consists of a record-cutting mechanism with a concealed feed screw situated underneath the base plate, a high-impedance crystal play-back pick-up, a powerful induction-type self-starting motor, a weighted ten-inch turntable, a cutter-arm rest, a pick-up rest, and a base plate. The unit will cut records up to 10" in diameter and will play records up to 12" in diameter.

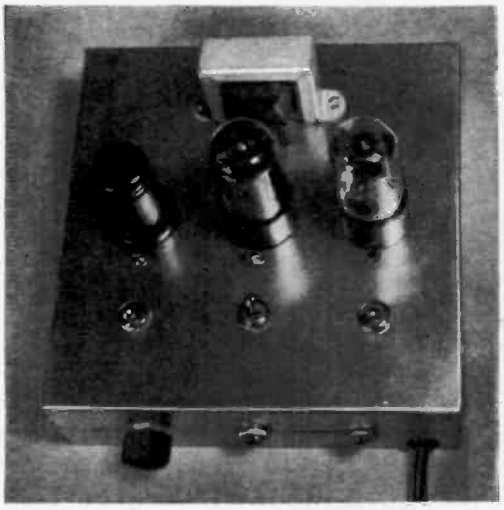
A compact three-tube amplifier is used with the home recording unit, and is installed just inside the back of the cabinet on a steel, cadmium-plated chassis measuring 2" by 7" by 7". Output from the amplifier is fed into a good-quality 5" permanent-magnet speaker mounted in the front of the cabinet. The rear of the cabinet is left open to ventilate the tubes and motor.

The amplifier proper consists of a high-mu triode, resistance-coupled to a beam power pentode. These two tubes provide all the power needed for either recording or playing records. A 250,000-ohm variable resistor controls the volume for pick-up or microphone. The voice current for recording is tapped off the plate circuit of the audio output tube through a .1-mfd. tubular paper condenser.

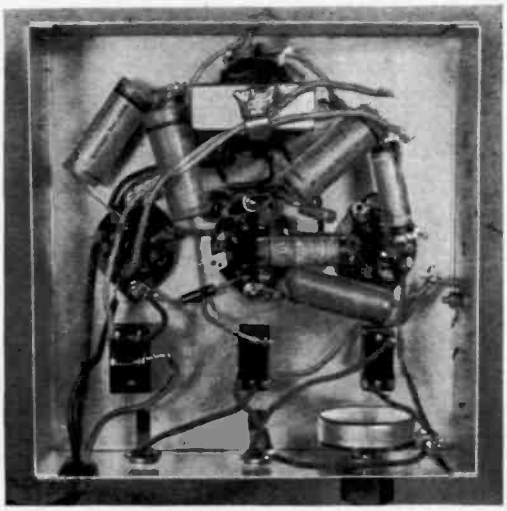
Three toggle switches mounted on top of the chassis regulate the various operations of the instrument. Although an A.C.-D.C. amplifier is used, the motor will operate only on alternating current, so that the unit must not be used on direct current. For



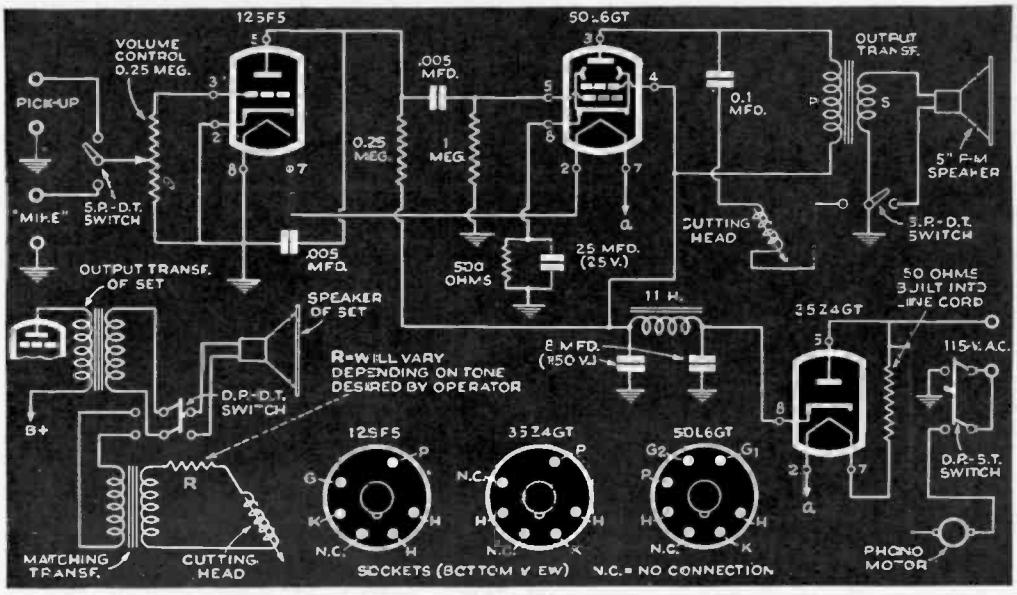
Bottom view of the finished unit, showing arrangement of parts



The three tubes, transformer, and control switches as they are mounted conveniently on the top of the chassis before mounting in a corner of the cabinet



All wire leads are kept as short as possible underneath the chassis. Be sure all connections are tight and arrange the parts approximately as shown here



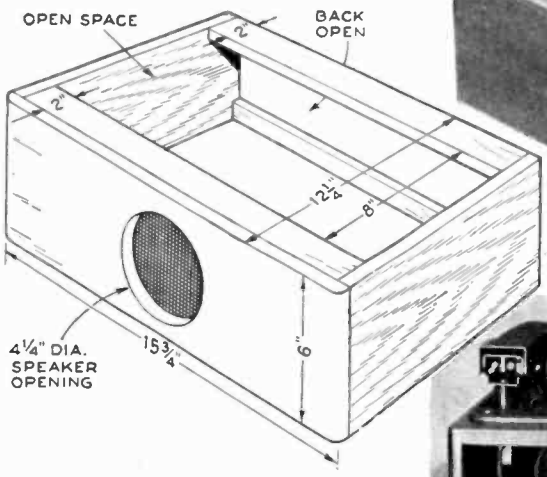
This circuit diagram will give you all the needed information for hooking up the home recording unit

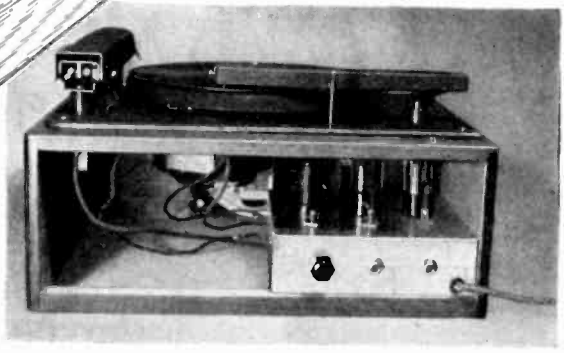
LIST OF PARTS

Home recorder unit.
Cadmium-plated steel chassis.
Triode amplifier tube 12SF5.
Beam power tube 50L6GT.
Half-wave rectifier tube 35Z4GT.
Octal wafer sockets (3).
Volume control, 250,000 ohm.
D.P.S.T. toggle switch.
S.P.D.T. toggle switches (2).
Filter choke, 11 henrys.
Line cord with 150-ohm resistor.
Single-circuit jacks (2).
Permanent-magnet speaker (5").
Universal output transformer.
Electrolytic condensers (2), 8 mfd., 150 v.
Electrolytic condenser, 25 mfd., 25 v.
Tubular paper condensers (2) .005 mfd., 600 v.
Tubular paper condenser, .1 mfd., 400 v.
Carbon resistors: 500 ohm, 1 watt; 250,000 ohm, ½ watt; 1 meg., ½ watt.
Crystal microphone.
Miscellaneous: Cutting and play-back needles, wire, solder, etc.
Blank records.

CABINET-CONSTRUCTION DETAILS

Note that the back of the cabinet is left open to supply ventilation for the tubes and the phonograph-turntable motor. The recorder unit comes with its own base plate ready to be set on the top of the cabinet





use in recording radio programs, the microphone is switched on and placed before the speaker of the radio receiver. In this manner, a permanent recording, right in one's own home, of a favorite dance tune or a historic speech can be made for preservation.

If better quality is desired in recording off the air one should connect the cutting heard directly to the output of the radio receiver through a special matching transformer.

For best results the radio must not be played too loud, as distortion will occur on the record. The correct volume can best be found by trial and error. When this has been obtained it is a good idea to "monitor" future recordings in order to keep the volume constant. To monitor a recording, headphones are plugged in across the cutting-head circuit so that the quality and volume may be checked.

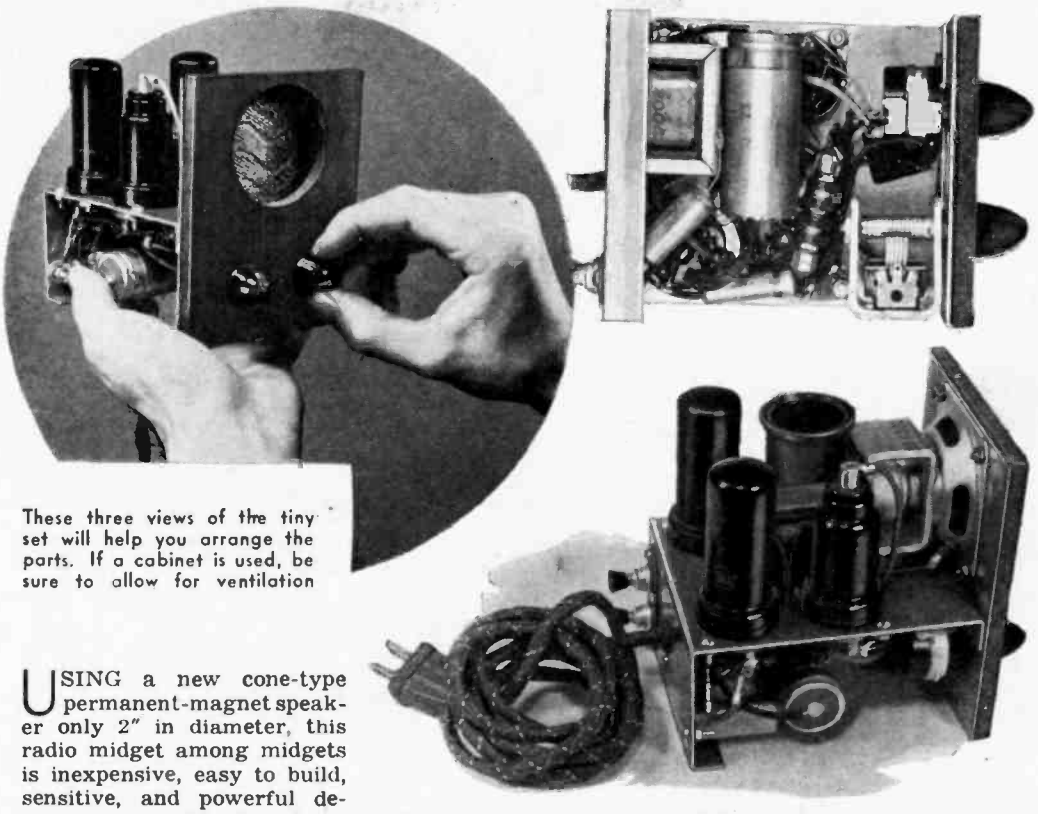
In recording a voice or home programs directly the microphone should be placed close to the source of the sound. It is advisable first to make a test through the speaker. When the results are satisfactory, switch in the cutting head and record on the blank disk.

A good crystal microphone may be obtained for about six dollars, complete with a desk stand, a 7′ cable, and a spring protector for the cable at the mike.

The unit may also be used, as already stated, to boost the volume on weak stations by placing the microphone as close to the receiver's speaker as possible and using the amplifier in the home recorder to increase the volume further.

How the mike is used for recording or boosting progroms

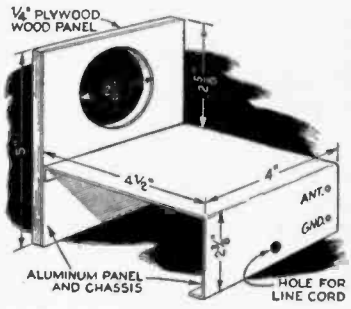
Tom Thumb Radio FOR A MIDGET SPEAKER

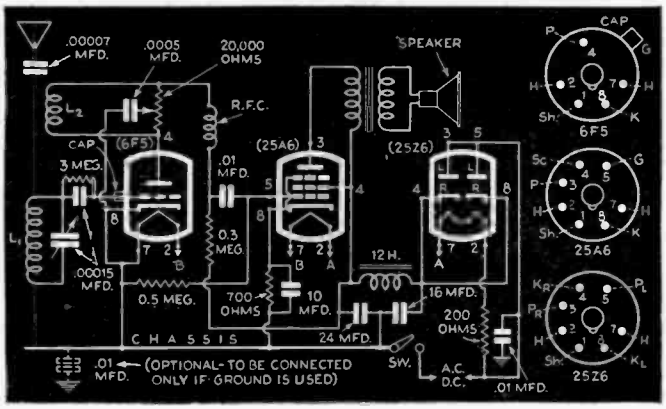


These three views of the tiny set will help you arrange the parts. If a cabinet is used, be sure to allow for ventilation

USING a new cone-type permanent-magnet speaker only 2" in diameter, this radio midget among midgets is inexpensive, easy to build, sensitive, and powerful despite its size. The broadcast-band set uses a four-prong coil consisting of a grid winding and a tickler winding (L_1 and L_2). Regeneration is obtained by a variable resistor across the tickler winding and grounded to the chassis through the .0005-mfd. fixed mica condenser. The 25-mh. choke in the plate lead of the detector (6F5) smooths regeneration and keeps stray radio-frequency currents from the resistance-coupled audio stage. Another new item in the set is the compact 24-16-10 mfd. tubular electrolytic condenser. A 200-ohm line-cord resistor reduces the house current for the three metal tubes. A ¼" wooden panel in front of the aluminum panel acts as a speaker baffle.

Note dimensions below for the aluminum chassis and panel. The wiring diagram gives all resistance and other values





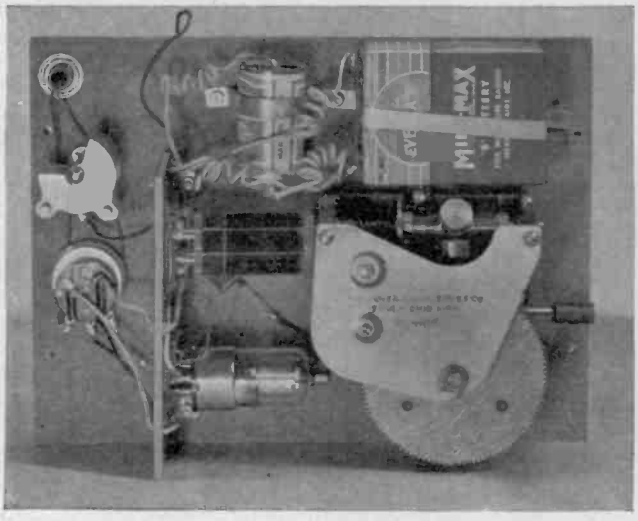
You can "broadcast" a record directly from the suitcase phonograph to any portable radio

Suitcase Phonograph FOR PORTABLE RECEIVERS

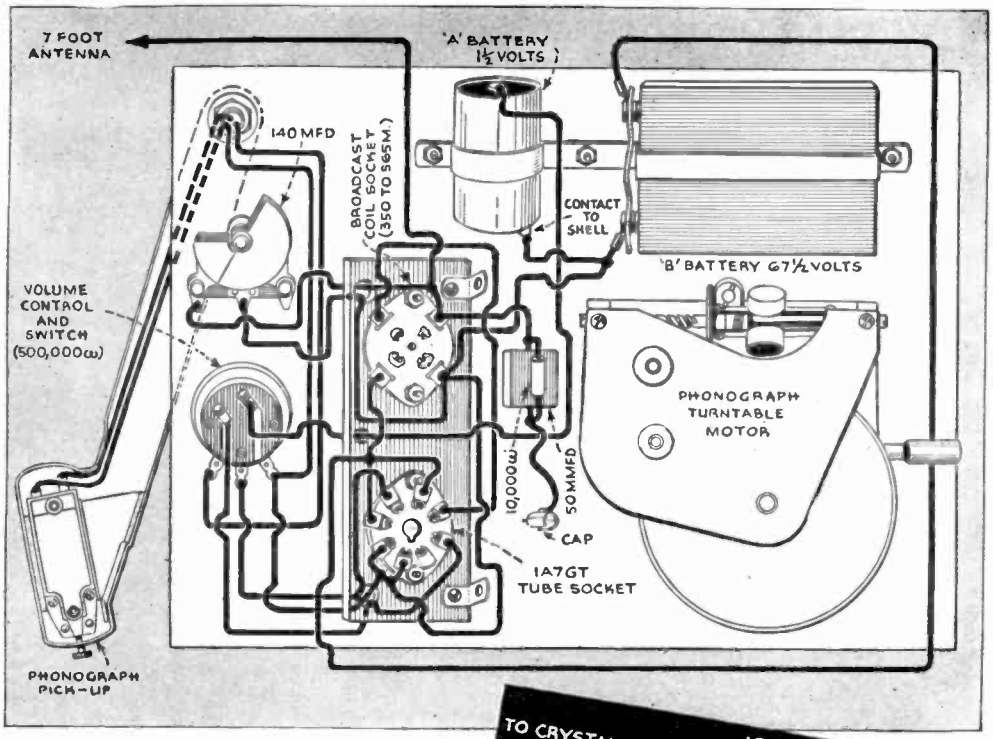
THIS SUMMER there will be thousands of battery-operated portable radios in use on beaches, in parks, and on picnics and excursions everywhere. They will range from the camera-style midget or "personal" radios to the "twenty-pounders," capable of bringing in Europe on the short-wave band.

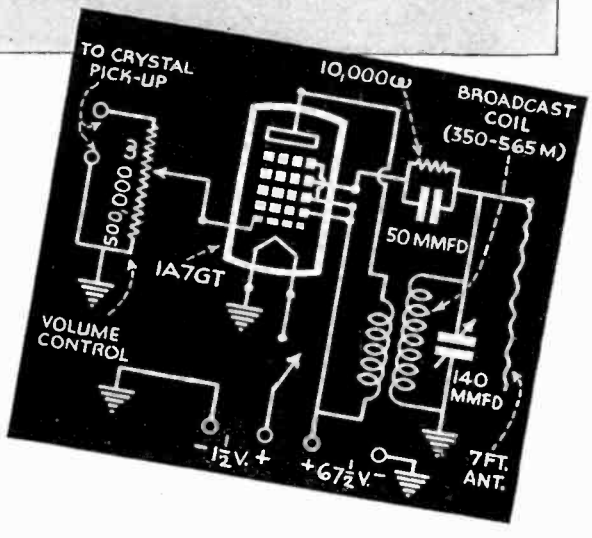
This battery-operated "wireless" phonograph was designed for use with these portable sets. As the name implies, the unit will transmit recorded sounds to the portable, through the medium of radio waves. The radio in turn reproduces them through the loud-speaker. No connections between the phonograph and the portable are necessary.

This combination of radio and phonograph will enable you to fill the interludes between radio programs that appeal to you with recorded dance music, symphonies, or whatever you wish. The volume control will



Underside of the phonograph's Masonite baseboard, showing transmitter, batteries, and turntable motor





Above, sketch of the set-up of the suitcose "wireless" phonograph, as shown in photo on previous page. At right is wiring diagram

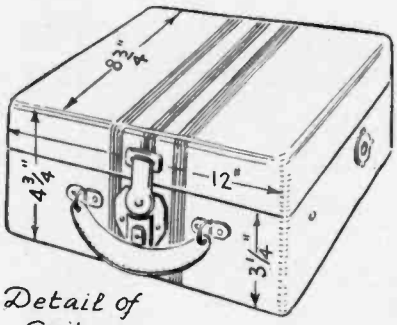
make it possible to lower the sound of your music so that it will not disturb your neighbors, or turn it up to fill a room with music for dancing.

Being light and compact (12 by 8¾ by 4¾ inches) the phonograph can be carried along as easily as a small suitcase. It is entirely self-contained and self-powered. Two small batteries (similar to those used in the personal-type radios—a 1½-volt flash-light cell and a 67½-volt "B" battery) supply all the current necessary to operate the transmitter. The power of this transmitter is so small that it will not radiate signals beyond a few feet. It is the only type of transmitter that can be operated without a license under Federal Communications Commission regulations.

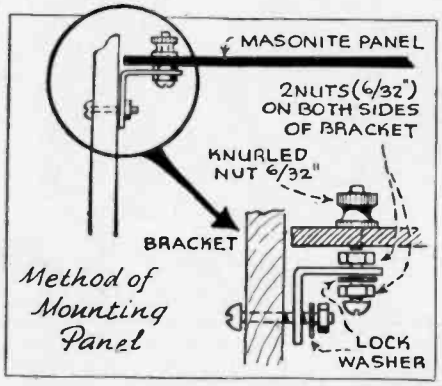
The transmitter uses a 1A7GT converter tube which acts as a combined modulation and radio-frequency amplifier. The electric impulses from the phonograph pick-up are modulated by the first and second grids of the tube. In a 1A7GT, or similar tube, the second grid acts as a plate. The modulated signal is then superimposed on the carrier wave, generated by the second portion of the tube, and transmitted to the receiver, where it is amplified and transformed back into sound.

The transmitter is tuned by a .00014-mfd. (or 140-mmfd.) tuning condenser and a standard four-prong broadcast coil. To cut down costs, the four-prong socket for the coil and the eight-prong (or octal) socket for the tube are both wafer types, inverted so that they can be mounted on the Masonite baseboard and used instead of the more expensive molded socket.

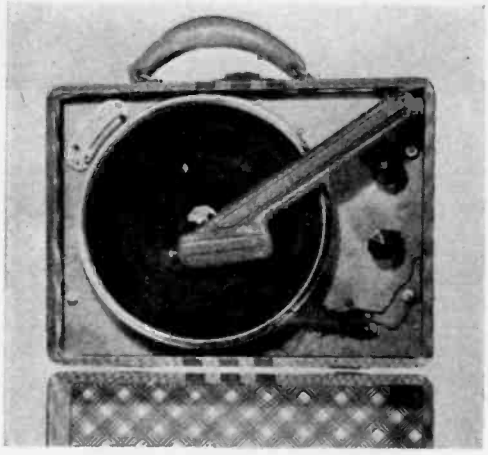
The suitcase into which the phonograph is fitted can be purchased almost anywhere for



Detail of Suitcase

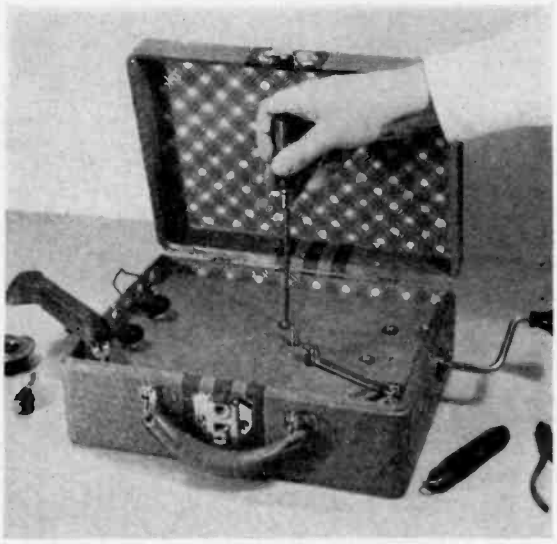


Method of Mounting Panel



Completed phonograph seen from above, with eight-inch turntable. The seven-foot antenna is coiled

less than $1. A spring motor can be picked up secondhand for about $2.50, or it may be ordered direct from a manufacturer. An eight-inch or smaller turntable must be used, otherwise a larger suitcase than is shown in the accompanying illustrations will have to be purchased. A Masonite panel 11¼" by 8¼" is used for mounting the motor, pick-up, and transmitter parts. In the set shown here, the panel was left in its natural brown finish, since this blended with the brown-



Left, detail of the suitcase, and above, a stage of mounting, before installation of the turntable

striped covering of the suitcase. The two batteries are strapped to the undersides of the panel with a flexible brass band ⅜-inch wide. This will keep them from knocking about in the bottom of the case, and they may easily be replaced whenever necessary.

To operate the phonograph, place the seven-foot antenna near the back of the portable receiver (where manufacturers usually place the loop antenna). Then turn the transmitter on by means of the switch on the 500,000-ohm volume control, and tune the unit to some free spot on the receiver's dial by rotating the 140 mmfd tuning condenser. Records can then be played on the phonograph, and will be heard over the set's loudspeaker.

LIST OF PARTS

Converter tube, 1A7GT.
Volume control and S.P.S.T. switch, ½ megohm.
Crystal pick-up.
Four-prong broadcast coil, 350 to 565 meters.
Tuning condenser, 140 mmfd.
Octal and four-prong wafer sockets.
Carbon resistor, 10,000 ohms, ½ watt.
Mica condenser, 50 mmfd.
Seven-foot antenna.
Small, brown-striped suitcase.
Masonite panel, 11¼" by 8¼".
Midget "B" battery, 67½ volts.
Standard flashlight cell, 1½ volts.
Spring-wound motor with 8" turntable.

TWO-TUBE PORTABLE

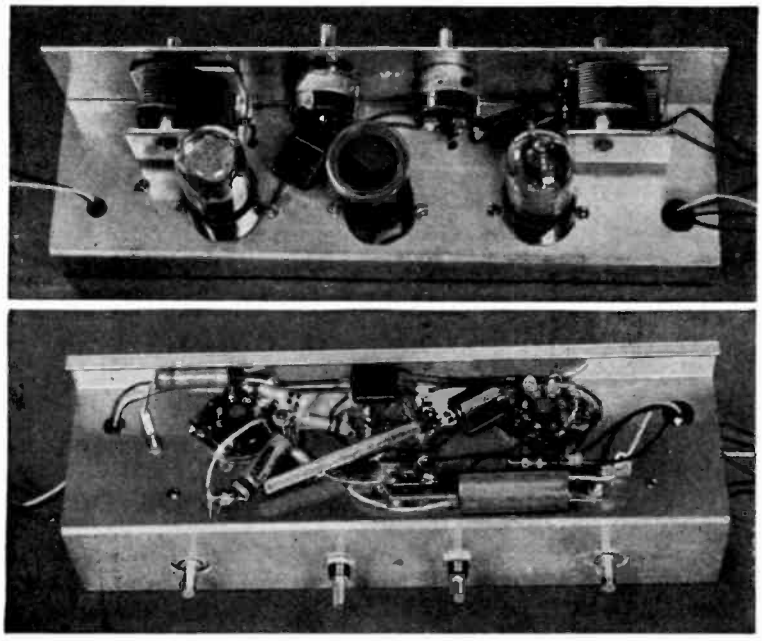
A COMPANION FOR A SUITCASE PHONOGRAPH

As a receiver, the set brings in local stations with good volume

DESIGNED as a companion piece to the suitcase phonograph shown on page 120, this battery-operated portable will provide many hours of radio entertainment in your home, at parties, or on summer trips and picnics. Though it has only two tubes, it has sufficient power to bring in all local stations. When used with the phonograph, which it matches in size and appearance, it will give you your choice of recorded music or broadcast programs anywhere and at any time.

The suitcase in which the set is built can be purchased at almost any five-and-ten-cent store for 50 or 60 cents, and should measure 12" by 9" by 4½". If you made the suitcase phonograph, you will probably wish to get a second suitcase with a similar exterior finish.

The two-tube chassis of the set, the four-inch speaker, and the batteries are fitted in the lower half of the suitcase, while the 9½" loop antenna is placed inside the lid and fastened with two ½"-long 6/32" machine screws.



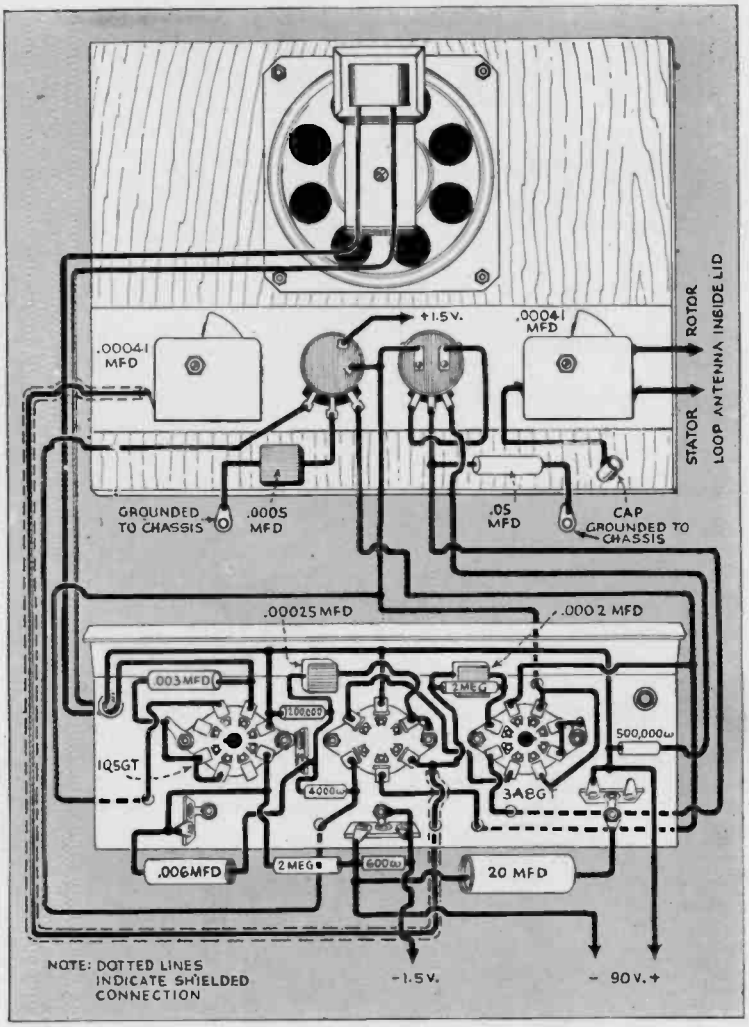
The upper picture at the left shows top view of the chassis with tubes and controls in place. Separate tuning condensers were found to be better than a ganged condenser. Lower photo shows the arrangement of parts underneath the chassis

Connections to the loop are made with two Fahnestock clips mounted on the lower inside edge of the lid. To hide the loop antenna, the author covered it with a 10" by 8" sheet of stiff paper.

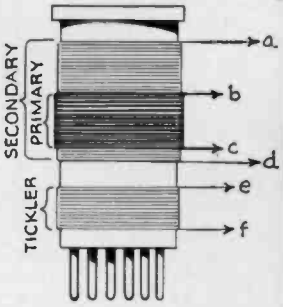
The metal chassis and speaker are mounted on a wooden panel measuring ¼" by 8½" by 11¼". The panel has a 3¾" diameter hole drilled near the top for the speaker, which is decorated with a bronze escutcheon plate.

The set uses a three-tube tuned-radio-frequency circuit, built around the two tubes —a 3A8GT (diode-triode - pentode) and a 1Q5GT (beam-power output tube). The 3A8GT is used for the tuned radio-frequency stage and the regenerative detector. The diode portion of the tube is not used and is wired directly to the chassis.

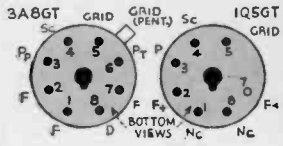
Separate tuning condensers were found to be better than a ganged condenser, as



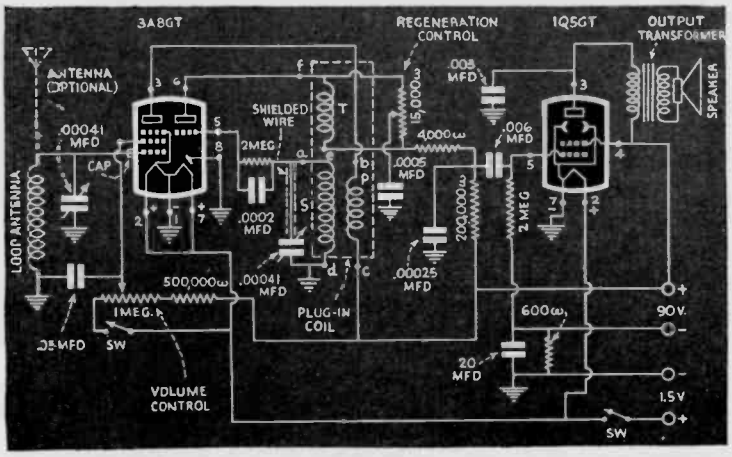
Complete wiring details for the circuit are given in this picture diagram

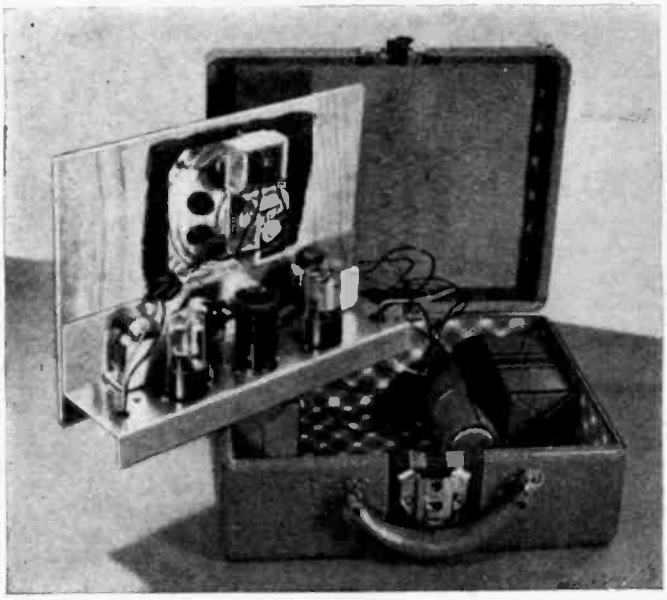


How the six-prong plug-in coil is wound. Below are tube-socket connections

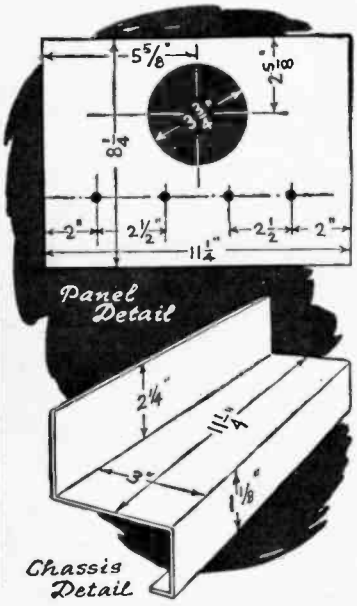


. . . and the schematic drawing below. Bias for the receiver is automatic





Metal chassis and speaker, mounted on a wooden panel, fit into the lower half of the suitcase along with the set's batteries



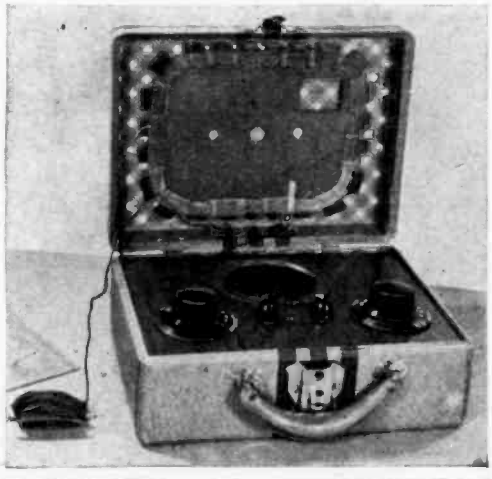
Panel and chassis details. Panel has a 3¾" hole for the speaker

they enable the receiver to operate at its best.

Single-pole, single-throw switches are mounted on the back of both the volume and regeneration controls. The one on the regeneration control turns the receiver on and off, while that on the 1-megohm volume control disconnects the grounded side.

Bias for the receiver is automatic and is supplied through the 600-ohm, ½-watt resistor and the 20-mfd. electrolytic by-pass condenser in the "B-" and "A-" circuits.

If more volume is desired from the set, the "B" power supply can be increased from 90 to 135 volts. Or a short length of antenna wire (about 10 feet can be connected to the grid side of the loop antenna.

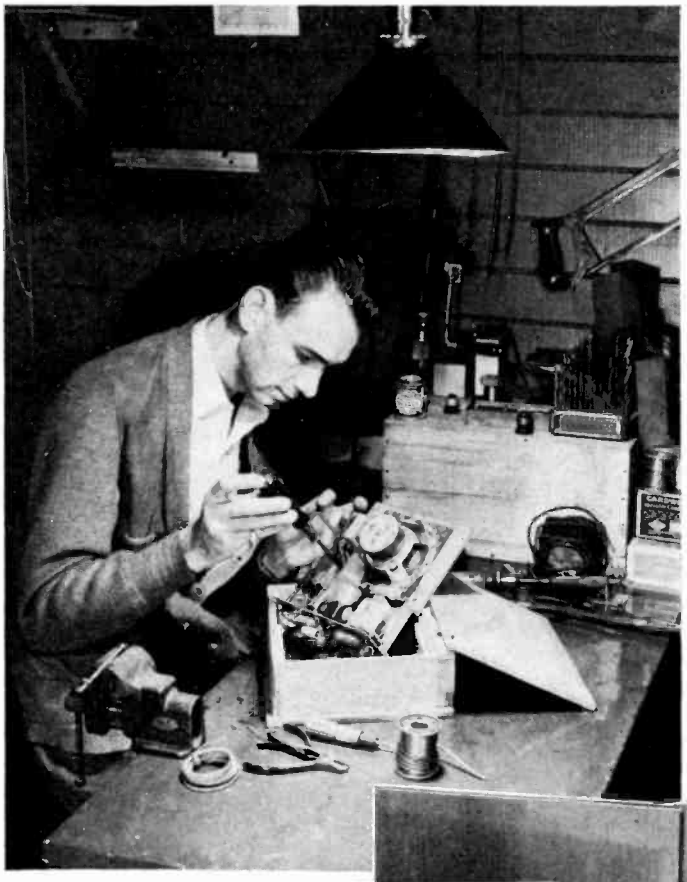


The 9½" by 7½" loop antenna goes inside the lid of the case and can be concealed by poper if desired

LIST OF PARTS

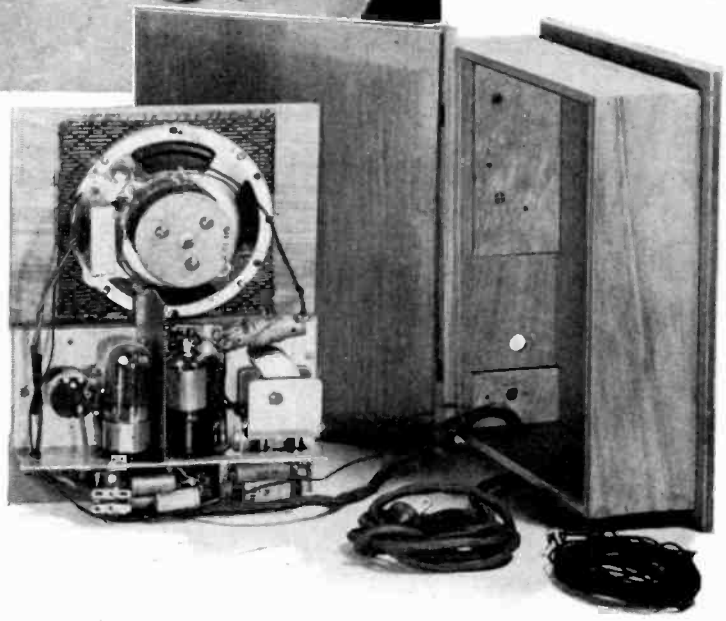
Loop antenna, 9½" by 7½". Suitcase.
Tuning condensers, .00041 mfd.
Three-inch tuning dials (two).
Four-inch PM speaker.
Universal output transformer.
Six-prong plug-in coil.
Six-prong wafer socket.
Volume control, 1 megohm.
Regeneration control, 15,000 ohms.
S. P. S. T. attachable switches (two).
Diode-triode-pentode tube, 3A8GT.
Beam-power output tube, 1Q5GT.
Octal wafer sockets (two).
Carbon resistors (two), 2 megohm, ½ watt.
Carbon resistor, ½ megohm, ½ watt.
Carbon resistor, 200,000 ohms, ½ watt.
Carbon resistor, 4,000 ohms, ½ watt.
Carbon resistor, 600 ohms, ½ watt.
Electrolytic condenser, 20 mfd., 150 volts.
Paper tubular condenser, .05 mfd., 400 volts.
Paper tubular condenser, .006 mfd., 400 volts.
Paper tubular condenser, .003 mfd., 400 volts.
Mica condenser, .0005 mfd.
Mica condensers, .00025 mfd., .0002 mfd.
Midget 1.5 volt "A" battery.
Midget 45-volt "B" batteries (two).

Library-Table Radio



MAKING an attractive decoration for the library table, this book radio will appeal to all builders who prefer housing their receivers in some unusual type of cabinet. It can be easily assembled and built at home by any beginner, and the entire set, including the cabinet, should cost less than ten dollars.

The cabinet for the receiver was made from the wooden covers removed from a large scrapbook which cost less than a dollar at a local department store. The covers serve as the bottom and hinged top of the cabinet, while the sides were built up, as shown in the drawings, from matching wood. A jigsawed decoration on the cover, left intact, adds to the attractiveness of the cabinet.

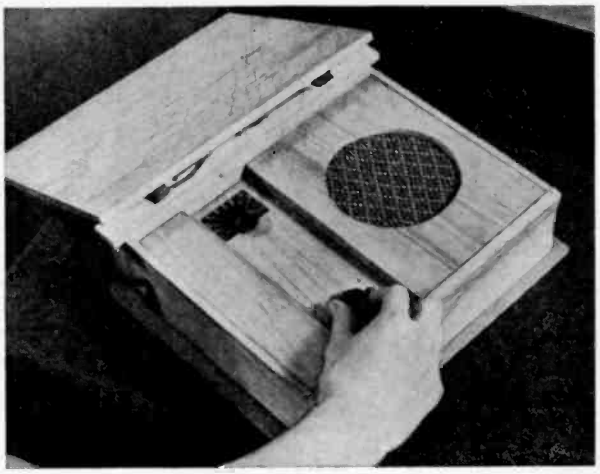


Putting the finishing touches on the chassis of the extremely compact "scrapbook" radio

Notice the shield separating the two tubes, with its soldered connection to the metal frame of the permonent-magnet speaker

Resembles a Book

The circuit, which appears to use only two tubes, has in reality plenty of punch behind it, since the two tubes do the work of four. The first tube (12B8GT) contains a high-frequency pentode and a high-mu triode. The high-frequency pentode is used as a regenerative detector which is resistance-coupled to the triode. The triode is in turn resistance-coupled to a pentode element in the second tube. This second tube (25A7GT) contains, besides the output pentode, a half-wave rectifier. A 260-ohm line cord reduces the house current to the voltage required by the heaters of the two tubes.



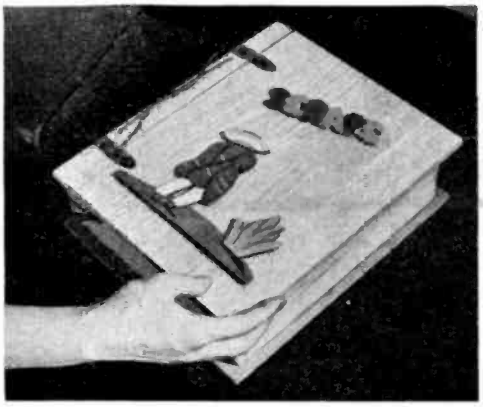
The booklike radio in use, showing its recessed control knobs

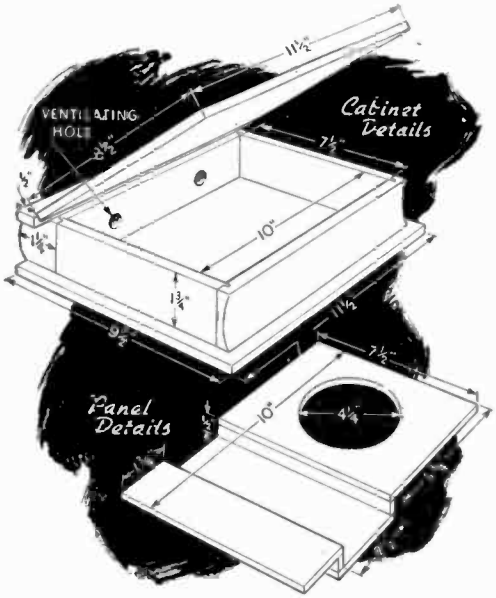
For the sake of compactness, a small A.C.-D.C. antenna coil is used. As the coil has no tickler winding, the reader will have to add one himself. This can be done easily by winding approximately thirty-five turns of double-silk-covered wire around the bottom portion of the grid coil. If tests show too little volume, reverse the connections to this tickler winding.

A five-inch permanent-magnet speaker is used, with its cone facing upwards. Choose a speaker whose depth does not exceed 2⅜", otherwise the cabinet will have to be made deeper.

The reader will notice that a shield is used between the two tubes. This is necessary as the feed-back coupling between these tubes would cause a terrific hum. Arrange the shield so that its top portion almost touches the frame of the speaker and make a soldered

When the cover is shut, the set makes an ornamental piece to put on the library-table top



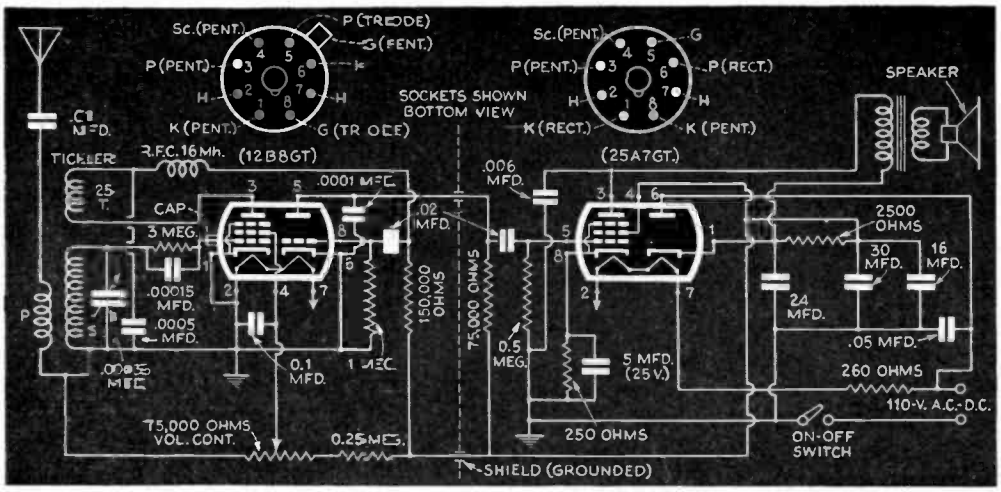


LIST OF PARTS

Midget antenna coil.
Radio-frequency choke, 16 mh.
Potentiometer (75,000 ohm) and switch.
Line cord, 260 ohm.
Triode-pentode tube (12B8GT).
Rectifier-pentode tube (25A7GT).
Permanent-magnet speaker (5" diameter).
Tubular paper condenser, .1 mfd.
Tubular paper condenser, .05 mfd.
Tubular paper condensers (two) .02 mfd.
Tubular paper condenser, .01 mfd.
Tubular paper condenser, .006 mfd.
Mica condenser, .0005 mfd.
Mica condenser, .00015 mfd.
Mica condenser, .0001 mfd.
Midget tuning condenser.
Electrolytic condenser, 5 mfd., 25 volt.
Electrolytic condenser, 16 mfd., 150 volt.
Electrolytic condenser, 24 mfd., 150 volt.
Electrolytic condenser, 30 mfd., 150 volt.
Resistor, 500,000 ohm, ½ watt.
Resistor, 250,000 ohm, ½ watt.
Resistor, 150,000 ohm, ½ watt.
Resistor, 75,000 ohm, ½ watt.
Resistor, 1 meg., ½ watt.
Resistor, 3 meg., ½ watt.
Resistor, 2,500 ohm, 1 watt.
Resistor, 250 ohm, 1 watt.
Miscellaneous: Two octal sockets; aluminum chassis, 1¾" by 3" by 7⅜"; special cabinet; knobs; dials, etc.

connection between the shield and the frame.

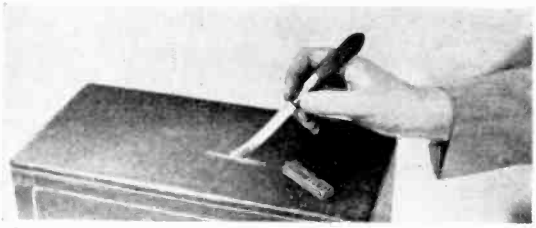
Regeneration is controlled by varying the screen voltage on the detector with the 75,000-ohm potentiometer, one side of which is connected to the plus "B" voltage through a 250,000-ohm, half-watt resistor, the other side grounded to the chassis.



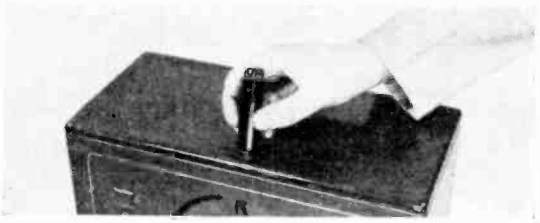
Top, the cut-out cover decoration. Diagrams—cabinet, panel, and wiring—give all construction details

Servicing Your Radio

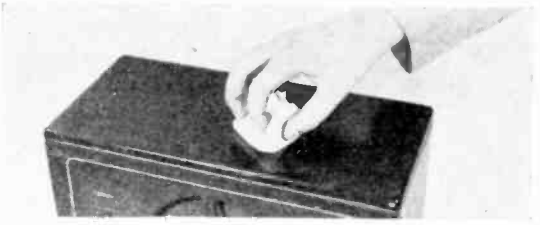
You can get a repair kit for fixing up your old cabinet



Deep scratches and dents are filled with stick shellac

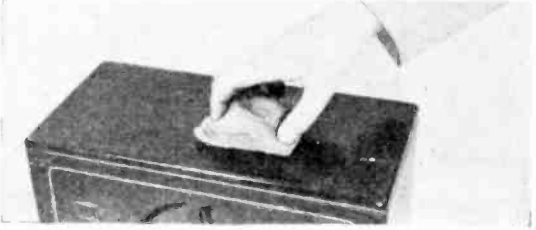


. . . while slight ones are removed by a special polish



French polishing can be done with new synthetic materials

. . . and rubbing with fine steel wool gives a satiny finish

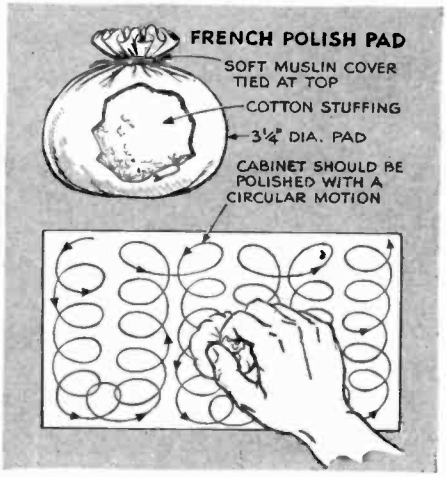


MANY radio cabinets today are in sad need of repair. The old finish has peeled off in places, nicks have been made in the wood, and maybe a few scratches have appeared.

Various kits are now on the market which will enable even an inexperienced person to patch up anything from a small scratch to a bad dent. First take the spatula which comes with the kit and heat it over the alcohol lamp. With the heated spatula melt a shellac stick cement of the proper shade and color into the hole, scratch, or dent. Once the imperfection is filled, it is smoothed off as well as possible with the spatula. The high spots are scraped off with a razor blade or sandpaper, and then rubbed down with fine steel wool and polished. Care should be taken not to injure the surrounding finish. Always make sure the spatula is clean and *never* use matches or a candle to melt the shellac stick.

For slight faults and scratches on the cabinet, you can use a special scratch remover and polishing liquid. This usually is made up into a convenient applicator with a felt brush at one end. Touch the injured spot with the brush and the mark disappears.

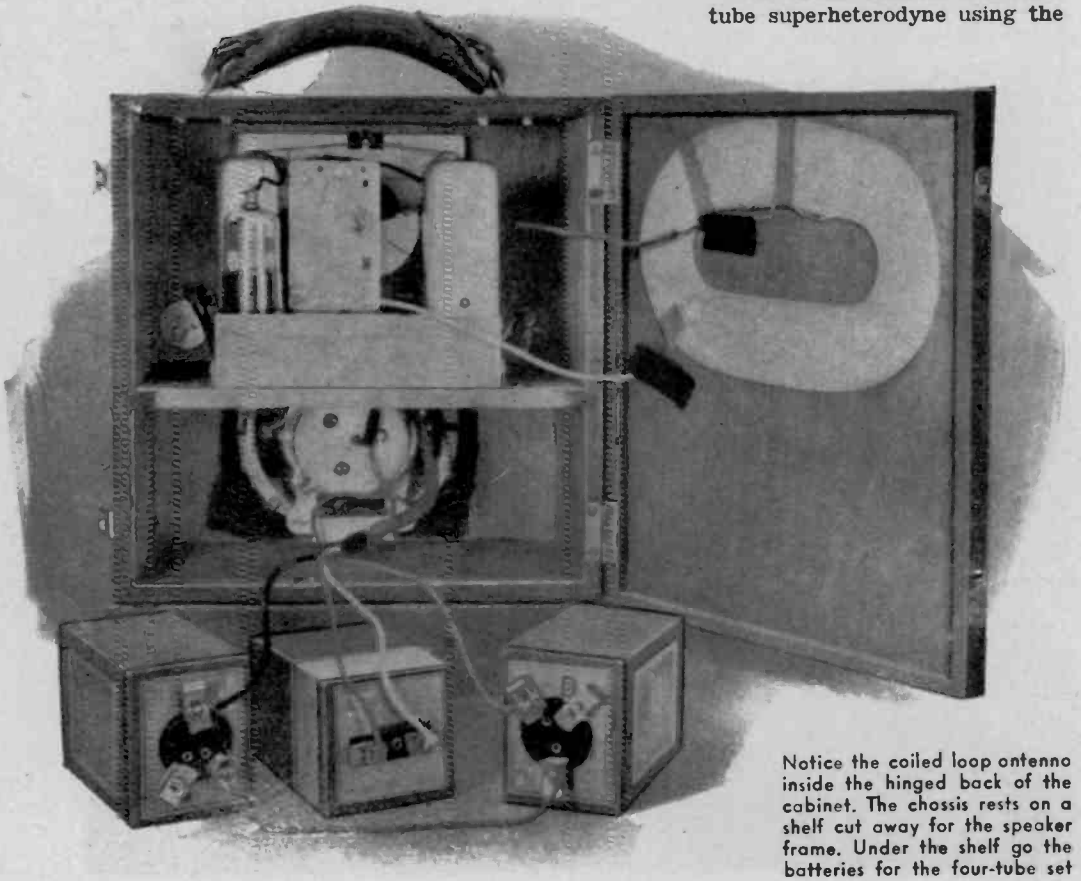
Synthetic materials now on the market make French polishing a simple matter. A small additional amount of the liquid is placed on a pad already saturated with the French polish and rubbed over the surface of the cabinet with a circular motion until a high gloss is obtained. Fine steel wool, lightly used, will tone down the gloss.



All-Purpose

EXTREMELY compact and light, this battery portable will work anywhere—on trains, in the home, on a boat, in the city or country. Having a loop inside the case, the set needs neither antenna nor ground connections. It has a nighttime range of 500 miles and a daytime range of more than 100 miles. If greater distances are required, an antenna may be attached to the loop by an extra connection provided for this purpose. It consists of two extra turns which are loosely coupled to the other turns on the loop. One side of this extra "coil" is grounded to the chassis—the antenna being attached to the other side.

The circuit consists of a four-tube superheterodyne using the



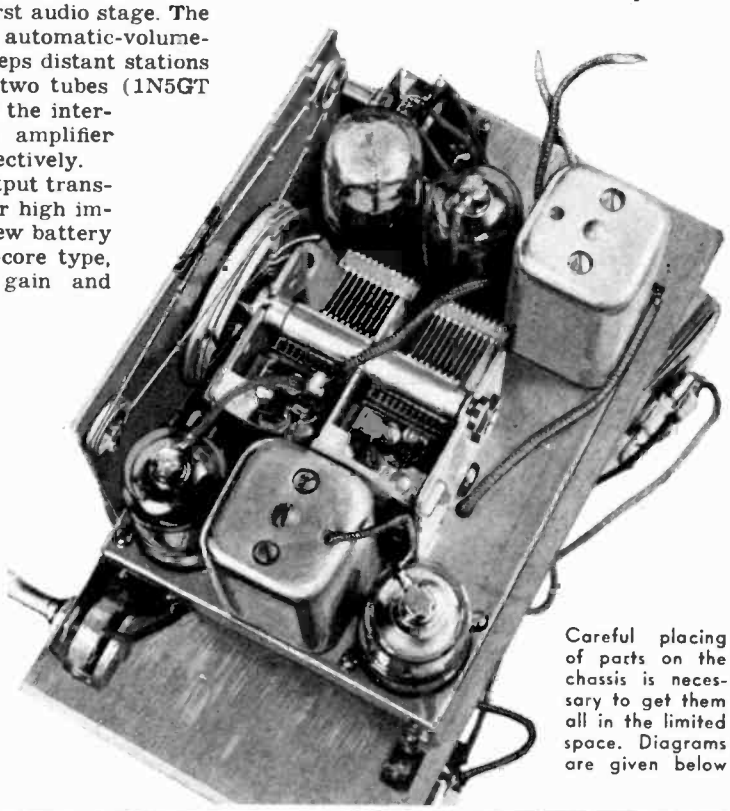
Notice the coiled loop antenna inside the hinged back of the cabinet. The chassis rests on a shelf cut away for the speaker frame. Under the shelf go the batteries for the four-tube set

Portable EASILY BUILT RECEIVER FOR USE AT HOME OR ON YOUR VACATION

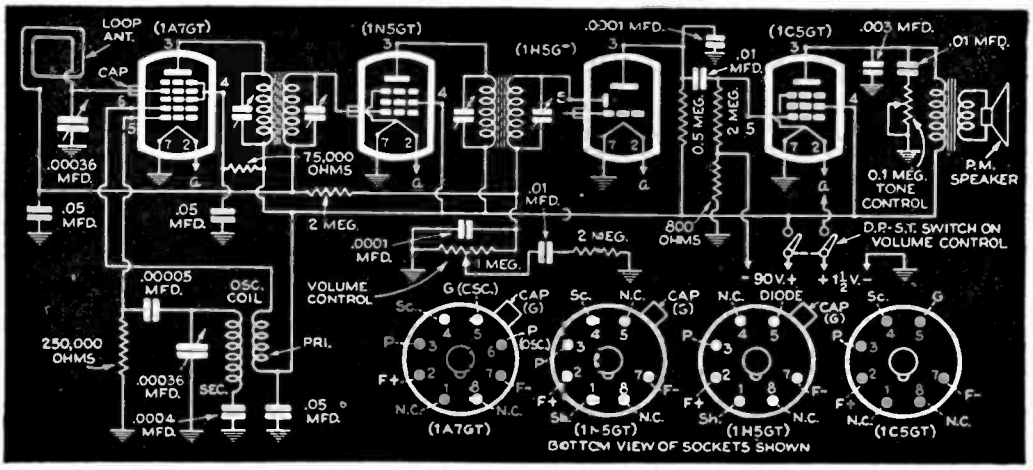
new small-size 1.4-volt tubes. The first tube, the 1A7GT, acts as a combined first detector and oscillator, while the third tube, the 1H5GT, fills the rôle of second detector (a diode in this case) and first audio stage. The 1H5GT also controls the automatic-volume-control current which keeps distant stations from fading. The other two tubes (1N5GT and 1C5GT) are used as the intermediate-frequency (I.F.) amplifier and power pentode, respectively.

Iron-core input and output transformers are used, as their high impedance matches these new battery tubes better than th air-core type, resulting in a higher gain and greater selectivity. On top of each of the I.F. transformer cans are two screws which are connected to the rotors of the primary and secondary trimmer condensers. These must be adjusted carefully with a small insulated screw driver while the set is in operation in order to tune the I.F. transformers to their resonance peak of 455 kilocycles.

Care must be taken in punching out the 1½" by 4⅜" by 5¾" chassis. If desired, of course, it may be purchased already punched, ready for the parts to be mounted on it. The volume control, with its on-off switch, and the tone control are mounted on L-shape metal



Careful placing of parts on the chassis is necessary to get them all in the limited space. Diagrams are given below



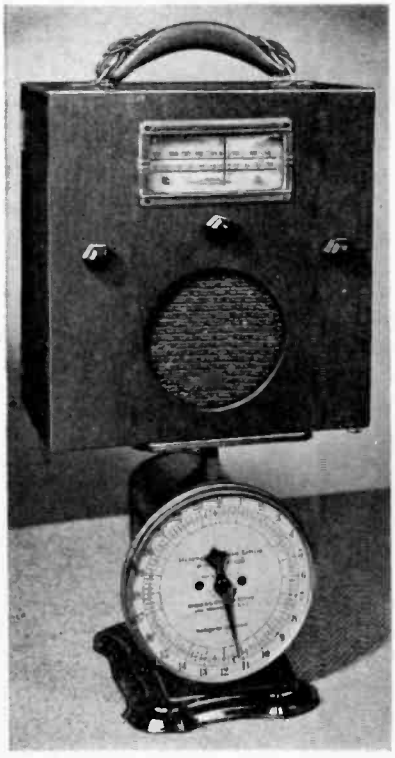
brackets attached to either side of the chassis in front. A piece should also be cut out in front of the chassis to clear the speaker frame, which otherwise is too large to fit in the bottom compartment. The speaker frame must be grounded to the chassis.

Mahogany, ⅜" thick, was used to make the cabinet. A shelf is placed inside the case to support the small steel chassis, which is held in place by two ½" right-angle brackets.

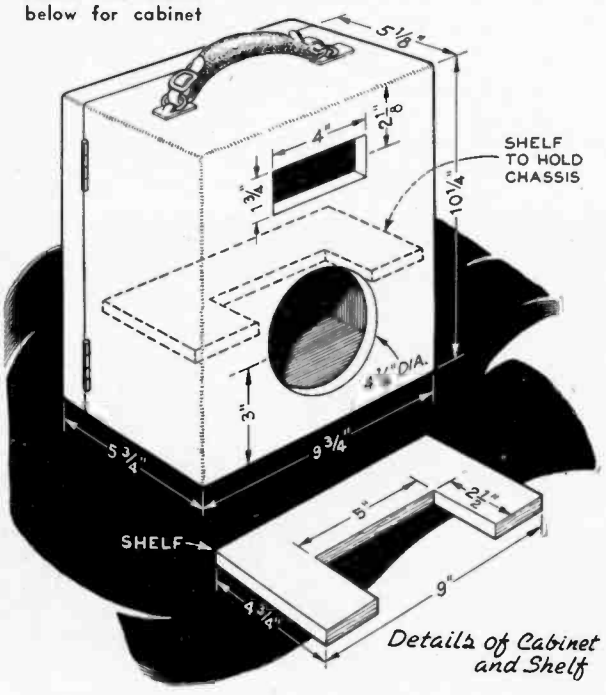
The tiny loop antenna (1/16" by 5" by 8"), which can be purchased ready-made, comes with a paper backing so that it may be easily glued in place on any surface. The best place for it is on the inside of the back cover. Any ordinary glue may be used, but not paste. The back cover which is only ⅝" thick is hinged to the front portion by two 1¼" brass hinges and is fastened by two small brass latches.

LIST OF PARTS

P-M speaker, 5".
Tuning condenser, 2 gang, .00036 mfd.
Oscillator coil.
Iron-core I.F. transformers, 455 kc.
Volume control with D.P.S.T. switch, 1 meg.
Tone control, 100,000 ohm.
Tubes: 1A7GT, 1N5GT, 1H5GT, 1C5GT.
Portable 45-volt "B" batteries (two).
Portable 1.5-volt "A" battery
Carbon resistors:
½ watt, 2 meg. (three).
½ watt, 500,000 ohm.
½ watt, 250,000 ohm.
½ watt, 75,000 ohm.
½ watt, 800 ohm.
Tubular condensers:
.05 mfd. (three).
.01 mfd. (three).
.003 mfd.
Mica condensers:
.0001 mfd. (two).
.0004 mfd. (padding).
.00005 mfd.
Miscellaneous: Chassis, cabinet, 4 octal wafer sockets, dial, wire, battery cable, loop antenna, etc.



This good-looking portable is light. Follow the sketch below for cabinet



Details of Cabinet and Shelf

One-Tube Receiver

USES RECTIFIER AS DETECTOR

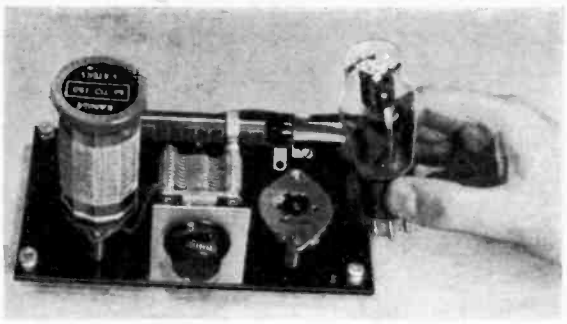
BASED on a novel and simple one-tube circuit, operating on the house current, this new type of radio receiver brings in stations as clearly as a crystal set, with absolutely no hum, and with fine selectivity and sensitivity.

Using a rectifier as a detector tube, no filtering system is needed because no plate voltage is used! The A.C. voltage is needed only to heat the filaments of the 25Z5, with no connections between the A.C. line and the receiver proper. The 25Z5 acts as a diode and has its two plates and cathodes tied together. The plates are connected to the fixed plates of the .00015-mfd. tuning condenser, to the four-prong coil, and to the antenna. The cathodes are connected to the moving plates of the condenser and to the other end of the grid winding on the coil. The phones are placed in the cathode circuit of the tube.

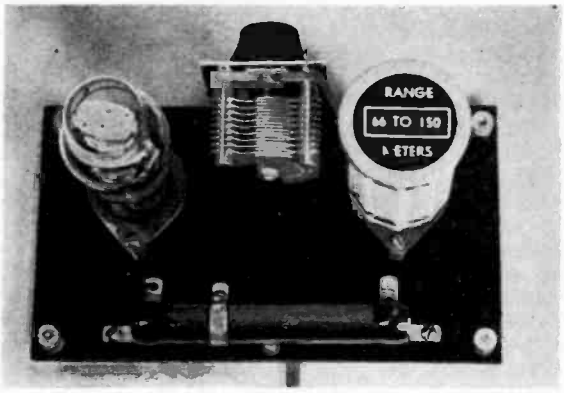
The rectifier heater voltage must be adjusted critically to from five to six volts, instead of the rated 25, for satisfactory operation. As there is no line cord on the market rated at 600 ohms, use an 80-watt fixed resistor with an adjustable tap. Otherwise connect two 300-ohm line cords in series.

LIST OF PARTS

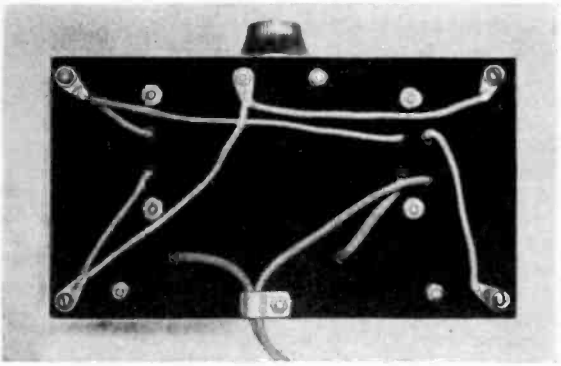
Tuning condenser, .00015 mfd.
Set of two 4-prong broadcast coils.
Rectifier tube, 25Z5.
Six-prong wafer socket.
Four-prong wafer socket.
Wire-wound resistor (tapped), 80 watt, 750 ohm.
Headphones, 2,000 ohm.
Line cord.
Black Bakelite panel for baseboard, 4" by 7".
Miscellaneous: Wire, solder, 20' indoor antenna, etc.



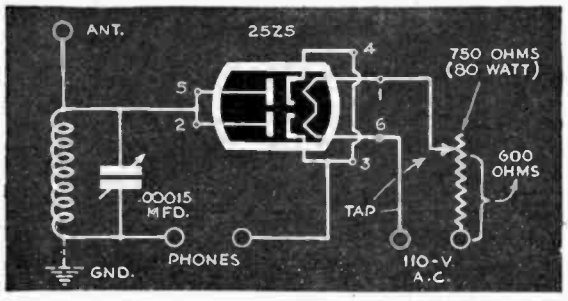
The complete receiver with its tube removed from its socket



This close-up view shows how the four main parts are placed



Bottom view, revealing the extremely simple wiring of the set



Only the heater uses power, so a ground may be safely used

High-Fidelity Amplifier

FOR YOUR P A SYSTEM, PHONOGRAPH, OR F M RECEIVER

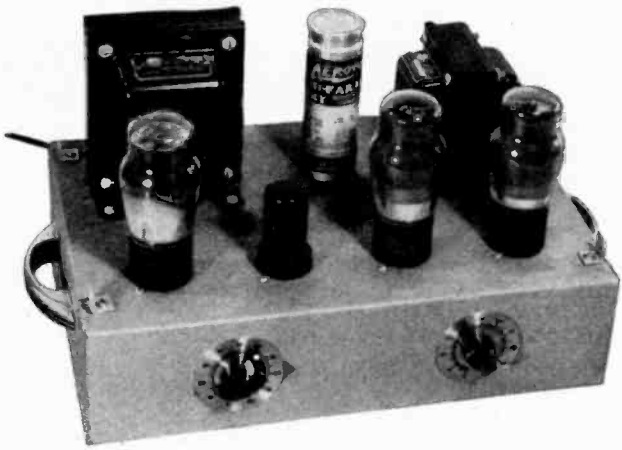
EXTREMELY versatile, this 10-watt audio amplifier may be used with either a crystal or magnetic pick-up for playing recorded music, with a crystal microphone for public-address work, as an amplifier for a high-fidelity tuned radio frequency or superhet tuner, or as an amplifier for use with an FM receiver, such as the one described in book one (page 44) of this two-book series.

The amplifier employs a unique output, two different types of tubes being used in a push-pull circuit. A 6AD7G is used on one side of the circuit while a 6F6G is used on the other. The pentode section of the 6AD7G, however, has the same characteristics as the 6F6G, and the triode portion of the 6AD7G is used as a phase-inverter tube. No push-pull audio transformers are used. Instead the first audio stage (6SJ7) is resistance-coupled to the push-pull output stage.

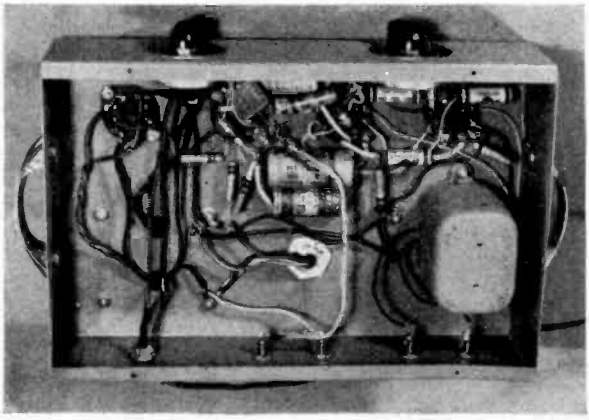
The input is fed through a .005-mfd. mica condenser and 500,000-ohm volume control to the grid of the 6SJ7. This tube is one of the newest types, using the single-end construction where the grid cap has been eliminated from the top of the tube—the grid being connected to one of the prongs on the base of the tube. This, of course, helps to enhance the general appearance of the amplifier, since no wires are visible above the chassis.

In the plate circuit of the 6SJ7 there is a tone control consisting of a .006-mfd., paper tubular condenser in series with a 250,000-ohm variable resistor—one side of the variable resistor being grounded to the chassis. This tone control really acts as a treble control. In other words it cuts out only the high notes without affecting the low notes. No control for the low notes was considered necessary, as these are reproduced by the amplifier to their full value.

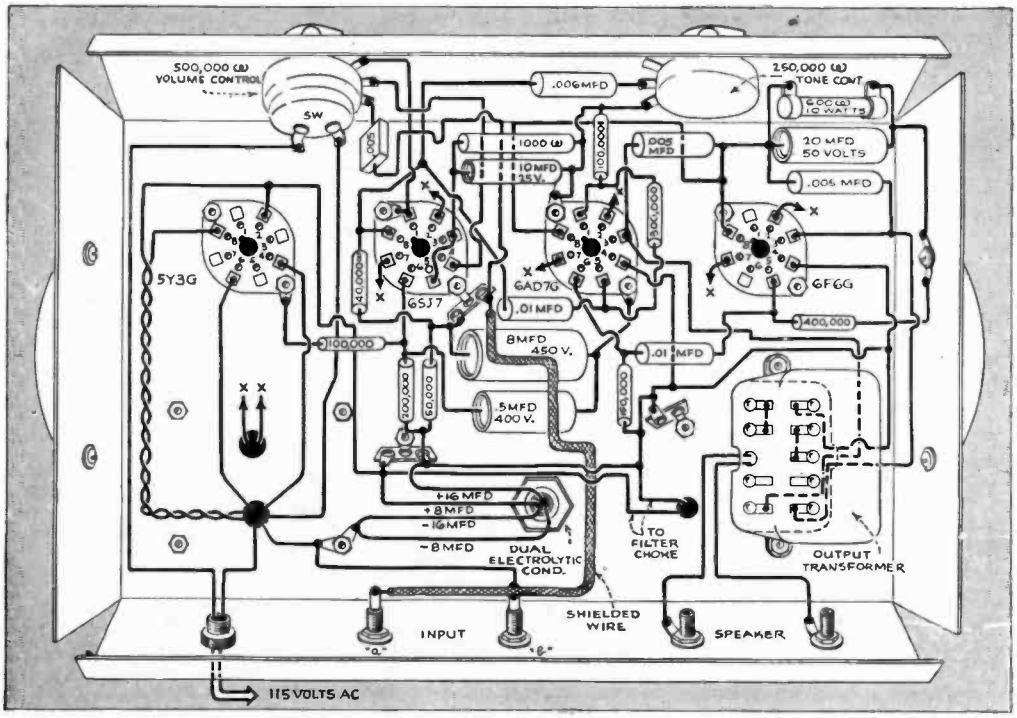
The new amplifier (right, above) in use with a FM receiver



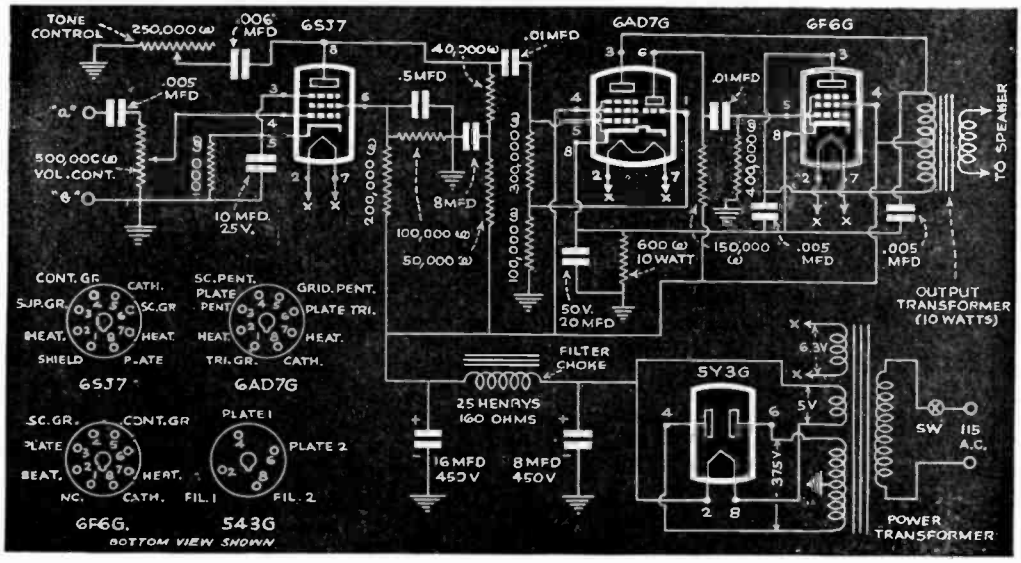
Close-up top view of amplifier with cover removed. This and the bottom view of chassis below will help you locate parts

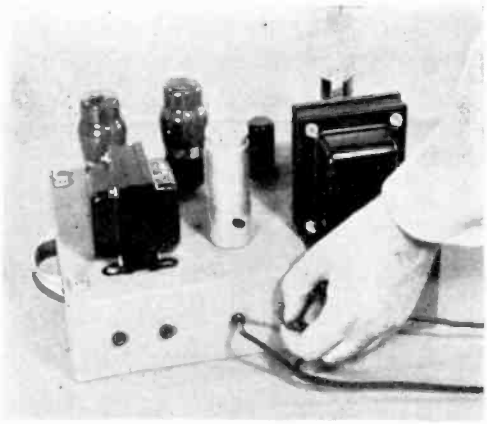


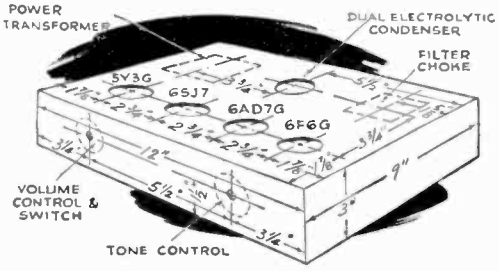
The plate and screen-grid circuits of the 6SJ7 are elaborately decoupled to avoid feedback. This helps to reduce hum and instability in the amplifier. An adequate filtering system is also used in the rectifier circuit—the 350-volt output from the 5Y3G full-wave rectifier being filtered by the 8-mfd. and 16-mfd., 450-volt electrolytic condensers and the heavy-duty, 25-henry filter choke. This choke is rated to pass 140 milliamperes. The power transformer, operating on 110 to 115-volt A.C. only, has three secondary windings: a 6.3-volt winding rated at 3½ amperes for the tube heaters, a 5-volt



The plan diagram above (compare with underchassis view at bottom of opposite page) shows not only where each part is placed but the general path of the connecting wires. Below is shown the schematic wiring diagram. Bottom view of the tubes (below, left) identifies terminals (prongs) of tube elements

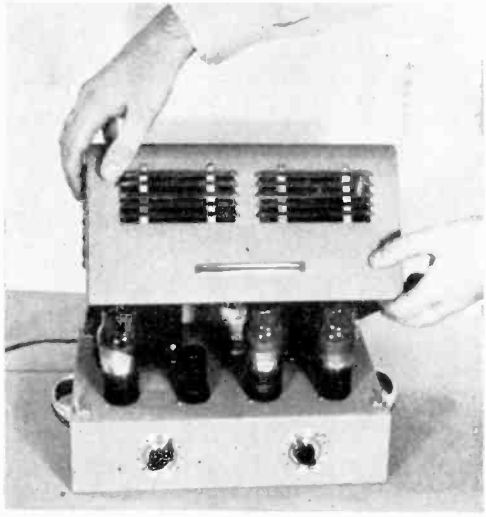






Dimensions of the chassis and additional data on positioning of parts are given in the drawing above

Back of amplifier with the cover removed is shown at the left. Note the jacks for the microphone, phono, or radio connections in the center. At far left are two banana-plug jacks for speaker connections. In the front view below, the cover is being removed. Note the attractive ventilators, handles, and moldings. Chassis finish, marine gray ripple enamel



winding rated at 3 amperes for the rectifier's filament, and a high-voltage winding rated at 375 volts, 90 milliamperes. The power transformer is fully shielded to protect the windings and to reduce hum pick-up to a minimum.

In connecting the high-fidelity audio amplifier with the FM receiver described in a recent issue of POPULAR SCIENCE, the power tube (6F6) in the receiver will have to be removed from its socket and a short piece of shielded hook-up wire connected to the control-grid pin (No. 5) on that socket. The other end of the wire is connected to terminal "a" on the amplifier, while the braided shielding on the wire is connected to terminal "b." The shielding on the wire will also have to be grounded to some point on the chassis of the FM receiver.

The speaker should be at least an eight-inch model—preferably 10 or even 12 inches. It should be a permanent-magnet type with a voice coil of 6-8 ohms. It should be mounted on a good-size baffle (40" square) or a properly designed cabinet. There are several special console-type speaker cabinets available which are especially useful with high-fidelity speakers. In selecting one of these for use with the amplifier, the set builder may be governed by his individual taste and requirements.–

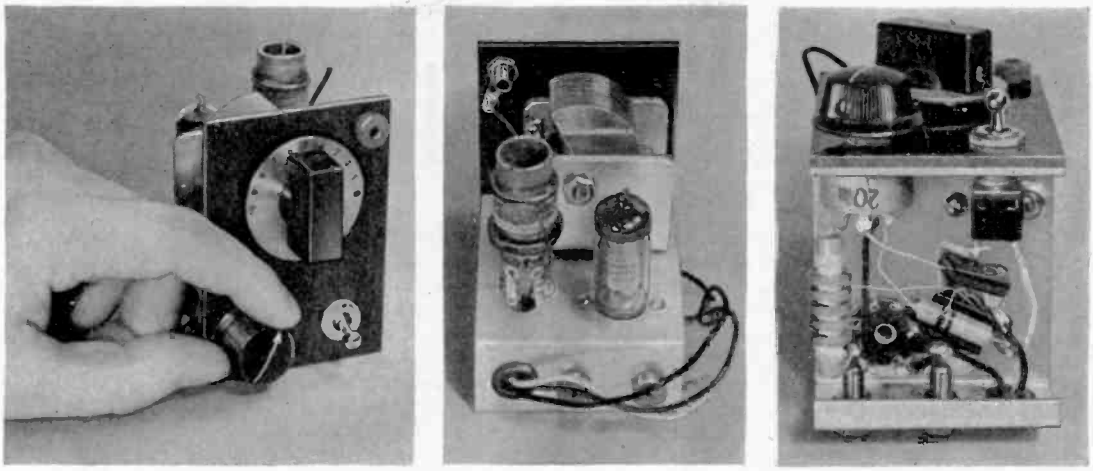
LIST OF PARTS

Shielded power transformer, 115 volt, A. C. Universal output transformer.
Filter choke, 25-Henry, 160 ohm.
Amplifier cabinet, 8" by 9" by 12".
Control knobs, red (two).
Dial plates, chrome, (two).
Volume control and switch, 500,000 ohm.
Tone control, 250,000 ohm.
Octal wafer sockets (four).
Tubes: 6SJ7, 6AD7G, 6F6G, and 5Y3G.
Electrolytic condensers:
- Dual, 8—16 mfd., 450 volt.
- Tubular, 8 mfd., 450 volt.
- Tubular, 10 mfd., 25 volt.
- Tubular, 25 mfd., 50 volt.

Mica condenser, .005 mfd., 600 volt.
Paper tubular condensers:
- .01 mfd., 400 volt (two).
- .005 mfd., 400 volt (two).
- .006 mfd., 400 volt.
- .5 mfd., 400 volt.

Carbon resistors:
- 400,000 ohm, 1 watt.
- 300,000 ohm, 1 watt.
- 200,000 ohm, 1 watt.
- 150,000 ohm, 1 watt.
- 100,000 ohm, 1 watt (two).
- 50,000 ohm, 1 watt.
- 40,000 ohm, 1 watt.
- 1,000 ohm, 2 watt.

Wire-wound resistor, 600 ohm, 10 watt.
Insulated phone jacks, red (two).
Insulated banana jacks, red (two).
Line cord and rubber plug.



Front, rear, and bottom views of a compact one-tube receiver that you can take along almost anywhere. Power to operate the tiny set is supplied by a 1.5-volt flash-light cell and a midget 45-volt battery

MIDGET RADIO HAS 400-MILE RANGE

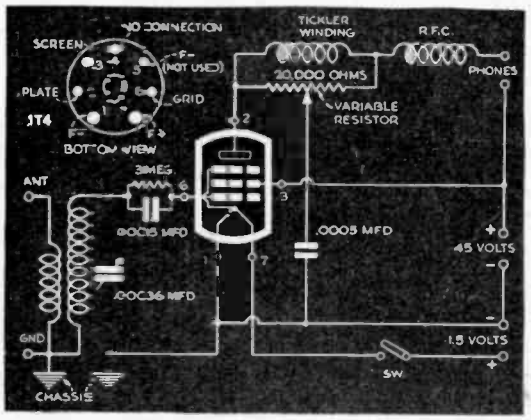
SMALL enough to be carried in a knapsack on hiking trips, this midget one-tube broadcast set will receive radio signals over distances up to 400 miles at night. It uses one of the new small-size RF pentode tubes as a regenerative detector, and all parts are standard.

To conserve space, an unshielded antenna coil is used instead of plug-in coils. Twenty-five turns of No. 34 d.s.c. wire are wound around the lower portion of the grid winding of the coil. This serves as the tickler.

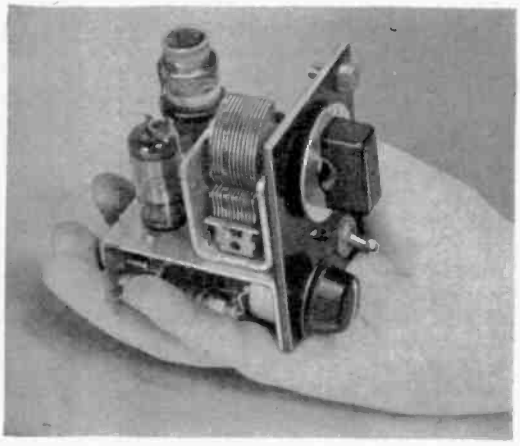
A midget seven-prong wafer socket for the tube is mounted on the 2¾" by 2½" by 1⅛" chassis in the conventional manner. A S.P.S.T. switch placed in the "A"-plus lead turns the set off and on and is mounted on the panel beside the variable resistor.

The antenna plug is mounted at the upper right-hand corner of the panel. The ground plug is mounted on the chassis beside the tuning condenser, while the insulated phone-tip jacks are mounted at the back of the chassis.

A 1.5-volt flash-light cell and a midget 45-volt battery supply power for the set. Outdoors, a long nail driven into the earth can be used as the ground, while a 40-foot wire strung to the branch of a tree serves as an antenna.



A small-size RF pentode tube, mounted in a seven-prong wafer socket, serves as a regenerative detector



This gives an idea of the size of the set. To save space, an unshielded antenna coil replaces plug-ins

MARIE ANTOINETTE DOLL CONCEALS

Dressing-Table Radio

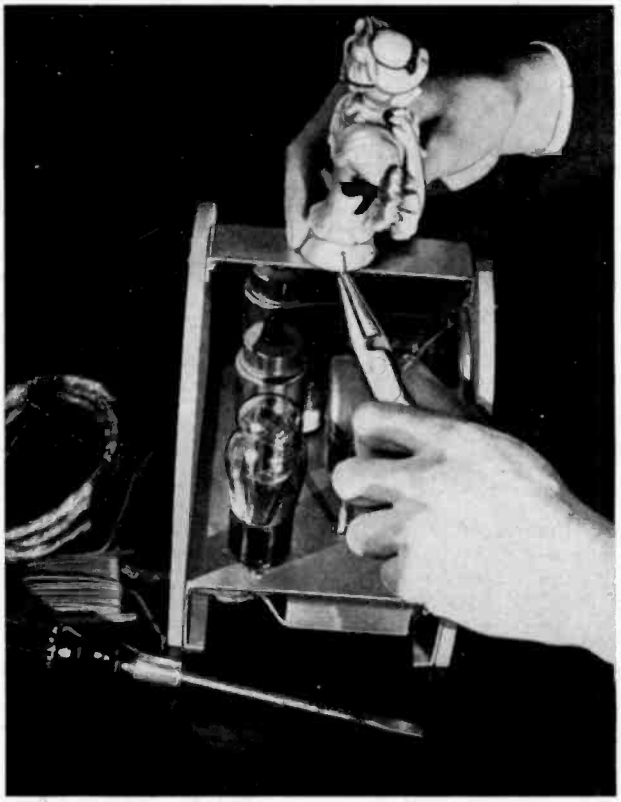
WHEN a friend asked me to design an all-electric dressing-table receiver that would provide good broadcast reception, yet would not look like a radio, I hit on the idea of housing the circuit in one of the old-fashioned dolls popular some years back for concealing bedroom telephones. The result is the Marie Antoinette radio shown in the photographs. It provides good loudspeaker volume on all major stations, yet it matches the frilly femininity of the average dressing table.

Compactness being an important factor, the A.C.-D.C. circuit was designed around two brand-new dual-purpose tubes, making it possible to obtain five-tube power and sensitivity with little more than half the number. The two new tubes are designated as the 6C8G and the 25A7G. The 6C8G, which consists of two triodes, is used in the set as the combined detector and first audio-amplifier stage. The detector, using the bias method of detection, is resistance-coupled to the first audio stage. Bias for the detector tube is obtained by means of a 100,000-ohm, ½-watt resistor bypassed by a 5-mfd. electrolytic condenser.

The second new tube used, the 25A7G, serves as a combined high-power pentode output tube and a half-wave rectifier. The 25A7G, although similar to the older 12A7, has a much higher output rating. Consequently, extreme care must be exercised to obtain adequate filtering to eliminate any possibility of trouble due to excessive hum. In the circuit shown, additional filtering was incorporated in the design in the form of a 1,000-ohm fixed resistor and a 24-mfd. electrolytic condenser. These parts are indicated in the wiring diagram of the circuit. Resistance coupling was used to couple the first and second audio stages, and a 5-inch permanent-magnet dynamic speaker was chosen to handle the output.

All parts, with the exception of the speaker, can be mounted directly on the 2 by 5½ by 8-in. aluminum chassis. For convenience in wiring, the antenna coil can be mounted directly on the ganged tuning condenser, while the radio-frequency coil, the filter choke, and the electrolytic condensers can be mounted under the chassis. The grid lead to the 6C8G should be shielded to insure stability of operation and to avoid any possibility of troublesome coupling with other parts of the set. Both the 6K7G (radio-frequency tube) and the 6C8G can be shielded by means of the conventional ventilated aluminum cans.

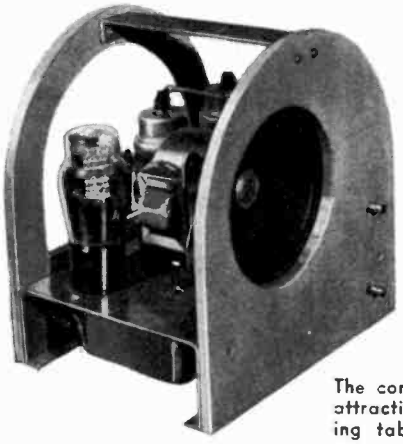
When connecting up the rectifier and power



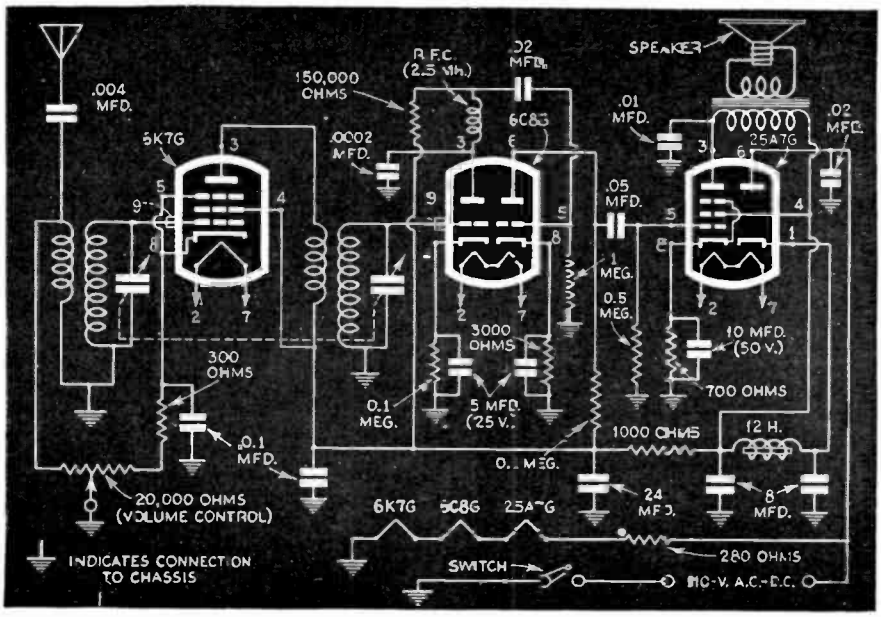
Wire and glue can be used to mount the porcelain figurine on the aluminum brace at the top of the cabinet. Suitable dolls, once popular as telephone covers, can be obtained for a dollar or less

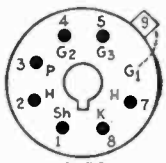
circuit, care should be taken in wiring the power cord and its built-in filament resistor. The resistance wire, generally distinguishable by its asbestos covering, *must* be connected to the filaments.

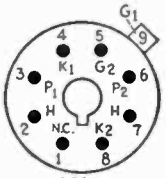
To form the cabinet and provide a mounting for the doll figure, two rounded wooden panels, 8½ in. high, 8 in. wide at the base, and 5/16 in. thick are attached to the chassis. The panels should be reënforced at the top with an aluminum strip 5½ in. long and 1½ in. wide. This also serves as the support for the doll. Strong glue and wire can be used to hold the porcelain body of the

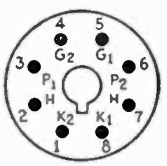


The completed Marie Antoinette doll forms an attractive and useful decoration for a dressing table. The cabinet is shown at the left





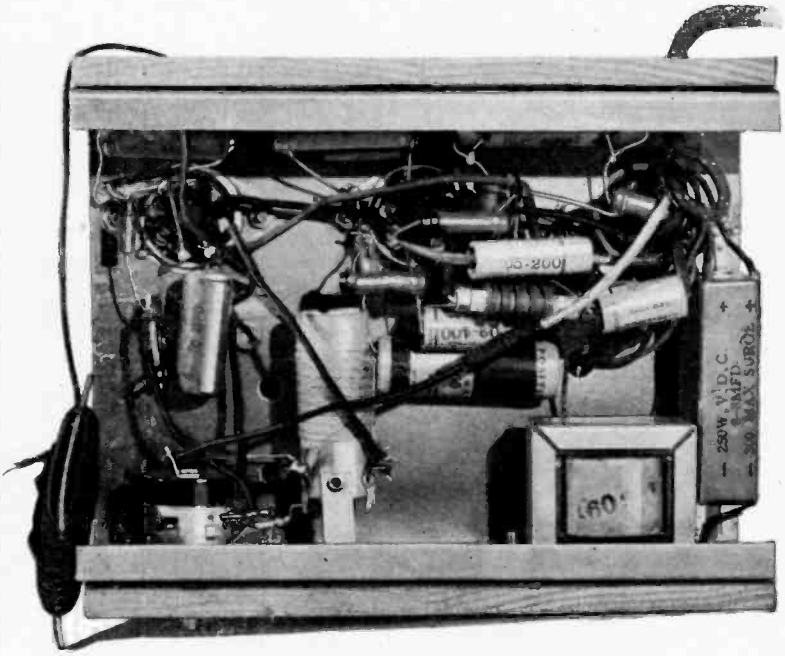




When wiring the tubes follow these socket diagrams carefully

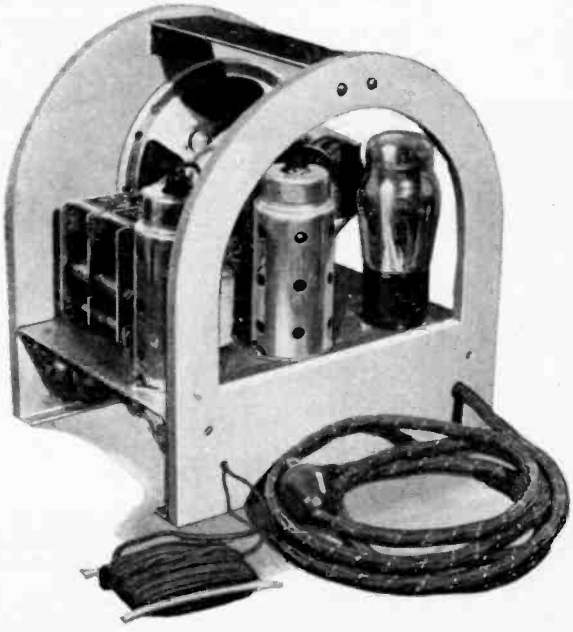
doll securely in place. In the original, the doll's dress with its full skirt was made of taffeta and bordered around the bottom with a lace frill 2 in. wide. Any materials available, however, can be used. This completely hides the receiver. The doll was purchased at a small antique shop for a dollar. With a little shopping, however, less-expensive figures can be obtained.

To provide adequate ventilation for the tubes, a large hole should be cut in the rear panel of the cabinet. A sheet of cardboard; or better still, asbestos board; should be placed at the top of the cabinet to protect the skirt material from the heat of the tubes. The two tuning controls, one for the ganged tuning condenser and the other for the combination volume control and switch, can either be hidden under the doll's skirt or mounted on the outside.



Condensers and other small parts are mounted under the compact chassis

In use, the receiver requires only an antenna, twenty or thirty feet long, strung around the baseboard or ceiling molding. No ground should be used, as the A.C.-D.C. hookup is grounded through the house wiring and additional grounding would blow the tubes.



No outside ground connection is needed with the receiver. Only the short flexible antenna wire, at the left, is necessary to get excellent reception

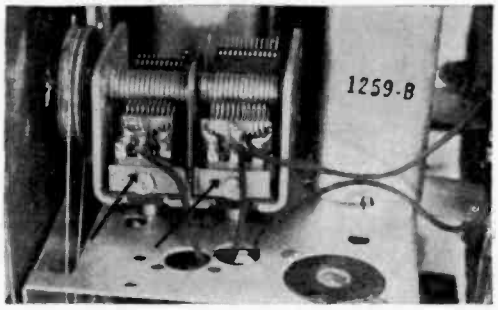
LIST OF PARTS

Two-gang tuning condenser, .00036 mfd.
Fixed condensers, two, .1 mfd.
Fixed condensers, two, .02 mfd.
Fixed condenser, .05 mfd.
Fixed condenser, .01 mfd.
Fixed condenser, mica, .004 mfd.
Fixed condenser, mica, .0002 mfd.
Electrolytic condenser, dual, 8-8 mfd., 250 volts.
Electrolytic condenser, dual, 5-5 mfd., 25 volts.
Electrolytic condenser, 10 mfd., 50 volts.
Electrolytic condenser, 24 mfd., 150 volts.
Fixed resistor, 100,000 ohms, ½ watt.
Fixed resistor, 150,000 ohms, ½ watt.
Fixed resistor, ½ meg., ½ watt.
Fixed resistor, 1 meg., ½ watt.
Fixed resistor, 300 ohms, ½ watt.
Fixed resistor, 700 ohms, 1 watt.
Fixed resistor, 3,000 ohms, 1 watt.
Fixed resistor, 1,000 ohms, 1 watt.
Plate choke, 2.5 mh.
Filter choke, 12 h.
Midget volume control with switch, 20,000 ohms.
Miscellaneous.—Power cord with 280-ohm resistor, matched antenna coil and radio-frequency coil, speaker, chassis, tubes, sockets, shields, doll, dress materials, wire, solder, etc.

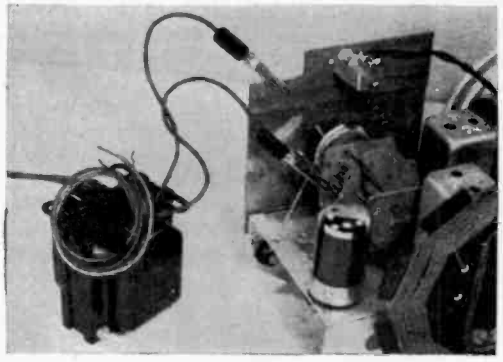
Servicing Your Radio

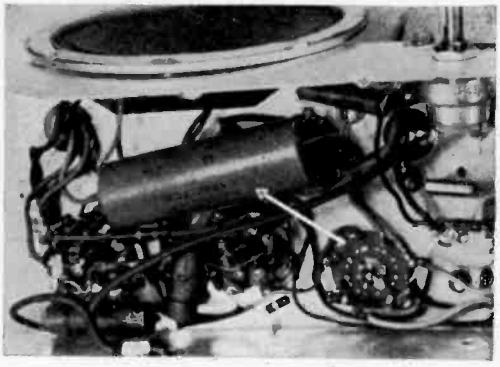
OFTEN minor adjustments that can be made at home will correct radio-receiver difficulties or give additional reception to an old set. Below are methods for detecting a faulty heater in the power pentode tube, extending reception at the upper end of the dial, eliminating noise in a new condenser, altering a midget filter circuit.

REPLACE THE POWER PENTODE TUBE if the pilot light goes on and then immediately goes off again each time the receiver is turned on. The trouble is a faulty heater in the 50L6GT tube. It makes proper connection inside the tube when cold, but when it warms up the contact is broken.



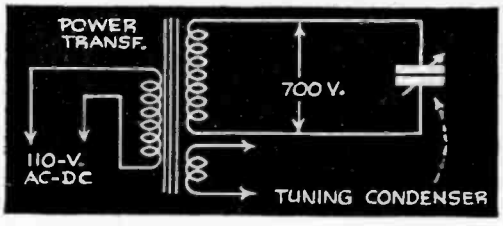
1,600-KC. STATIONS CAN BE BROUGHT IN on an old AC-DC midget set by readjusting the trimmer on the oscillator tuning condenser. The capacity is reduced a sixteenth of a turn at a time by loosening the nut shown at left above. Then loosen the nut on the other condenser to increase volume.

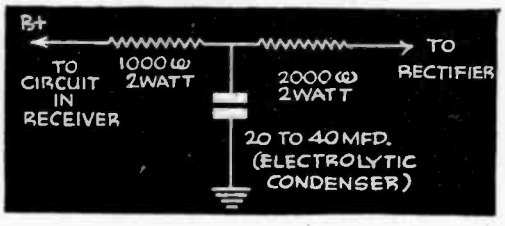




NOISY TUNING IN THE LATEST RADIOS may be caused by filings between plates of the oscillator tuning condenser. These may be burned out by connecting the secondary of a 700-volt power transformer across the condenser, as shown above and in the diagram. Be sure to disconnect the house current and the grid connection to the oscillator unit.

THIS SIMPLIFIED FILTER CIRCUIT for a midget AC-DC receiver uses only one electrolytic condenser, and may prove worth substituting when servicing a filter circuit that contains two or more electrolytic condensers if replacements for these condensers are hard to obtain. The diagram below shows how the substitute wiring is done.





Easily Assembled Unit

WITH the easily assembled unit illustrated, you can convert your regular superheterodyne set into a "diversity receiver" that will provide signals of constant strength free from the bothersome fading so common to short-wave reception and often experienced on the broadcast band. Called a "diversity coupler," the unit operates on the same principle as the "diversity receivers" with this one main difference—what the receivers do electrically, the coupler does mechanically.

The secret of diversity reception is based on the fact that the degree of fading of a given signal varies with different antennas. The coupler, acting as a link between two antennas—one vertical and the other horizontal—and the receiver, automatically couples the receiver by means of a motor-driven variable condenser to the antenna providing the stronger signal.

The coupling condenser, sold complete with its motor, consists of three plates, two stationary and one movable. One stationary plate is connected to the vertical antenna, the other to the horizontal antenna, while the movable plate is wired to the receiver's antenna terminal. As the signal in one antenna or the other fades, the movable plate is turned automatically to a new position. Thus, the antenna receiving the stronger signal becomes "capacity coupled" to the receiver in direct proportion to the signal strength.

Three tubes are used in the coupler circuit, a 6B8G amplifier, a 2A4G control tube, and a 25Z6 rectifier. The 2A4G, the heart of the circuit, acts as a sensitive relay to control the tiny magnetic motor that operates the dual coupling condenser. When the signal fades, this tube allows current to flow to the motor until the condenser has been adjusted to the new

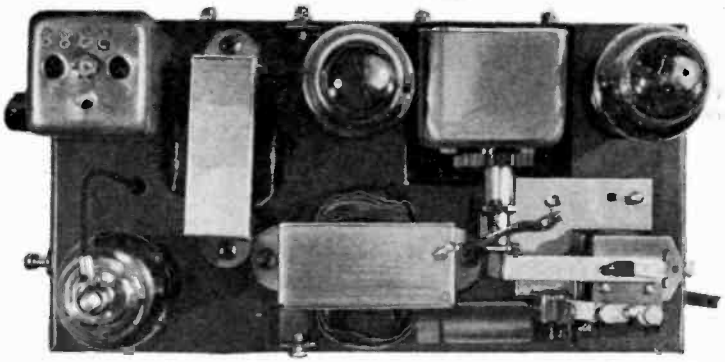
All connections must be soldered carefully, and a metal shield, as at the right, must be used to eliminate radio interference

Kills Radio Fading

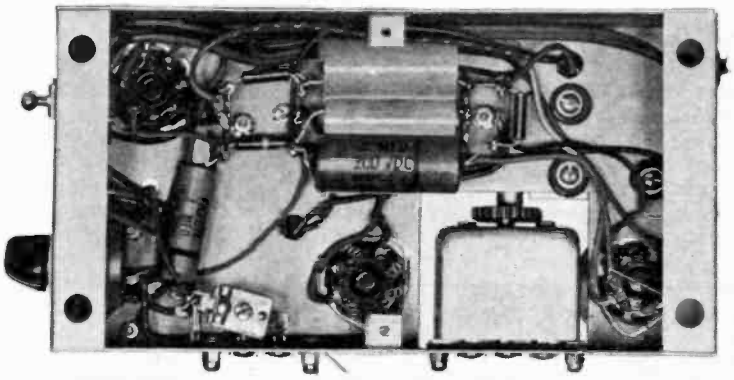
setting for maximum signal strength. The action is entirely automatic, and so swift that audible signal strength is constant.

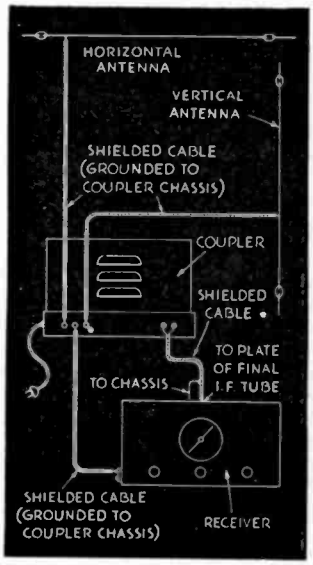
In wiring the circuit, follow the diagram carefully. Make sure that all connections are well soldered, since any poor joints will cause losses that will completely upset the balance of the hook-up. When connecting the coupler to your receiver, use shielded cable and ground the outer sheathing as indicated. Shielded cable also should be used for the antenna lead-ins. A wafer adapter can be used to make the necessary connection to the plate prong of the receiver's last intermediate-frequency tube, as shown in the diagram.

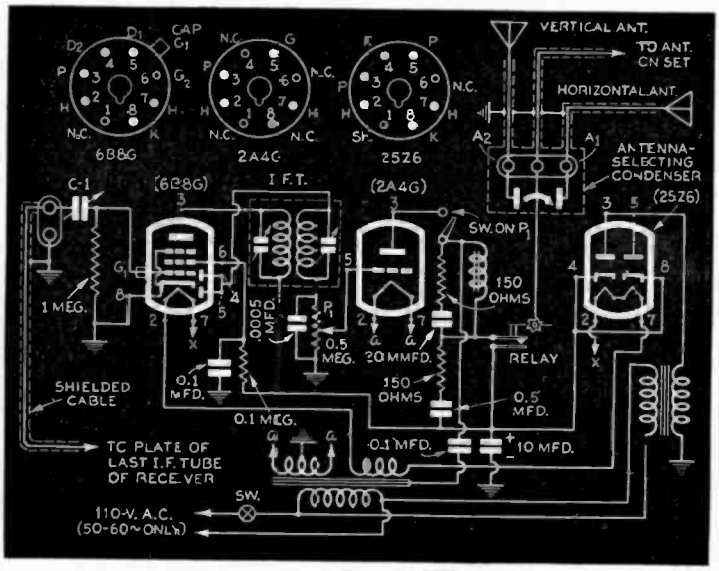
To adjust the coupler, tune in a short-wave signal which is fading, as indicated by the rise and fall in volume, or by the fluctua-



How the various parts are arranged above and below the metal chassis. The tiny motor, which turns the dual condenser to tune in the antenna giving the strong signal, is on the top face of the chassis







These drawings show how the coupler is connected to receiver and antennas, and the complete wiring diagram

A close-up of the motor that turns the dual condenser

tions of the visible tuning meter if the set is equipped with one. Then advance the sensitivity control or 500,000-ohm potentiometer until the signal remains constant. Do not turn the control too far or the motor will tend to operate continuously. It is best to adjust it to a point just below that of maximum response. The best point can be permanently marked on the dial with a pencil.

Some experimenting may be necessary in placing the two antennas for best results.

LIST OF PARTS

FOR RADIO-FADING ELIMINATOR

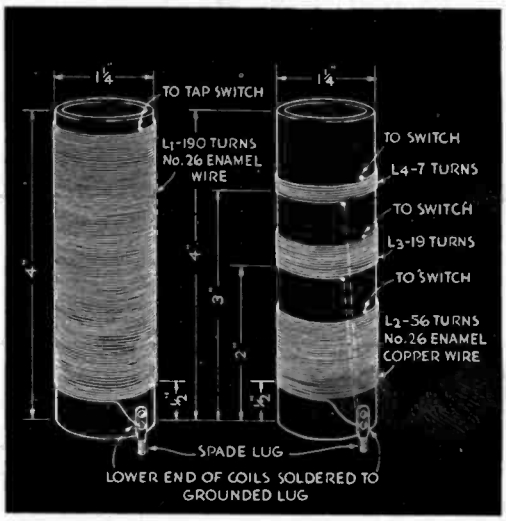
Antenna - selecting condenser, and motor.
Plate transformer.
Filament transformer.
Intermediate - frequency transformer, 455 Kc.
Trimmer condenser (C-1).
Condenser, 10 mfd., 300 volt.
Fixed condenser, 20 mmfd.
Tubular condenser, .5 mfd., 200 volt.
Tubular condenser, .1 mfd., 200 volt.
Tubular condenser, .1 mfd., 400 volt.
Mica condenser, .0005 mfd.
Two resistors, 150 ohm, ½ watt.
Resistor, 1 meg., ½ watt.
Resistor, 100,000 ohm, ½ watt.
Volume control (500,000 ohm) with switch.
6B8G tube.
2A4G tube.
25Z6 tube.
Three octal sockets.
Toggle on-off switch.
Special chassis with cover and bottom plate.
Miscellaneous:—Nuts, clips, washers, lugs, wire, etc.

ALL-WAVE

HERE is an inexpensive alternating or direct-current receiver that covers all the wave bands from 430 to 10,000 kilocycles. It is of the regenerative type, but the functions of regeneration and detection are separate. Regeneration is furnished by a 6C5 tube and is controlled independently of the 6J7 detector tube, while the output tube, a 25L6, provides ample power for a 6-inch dynamic speaker, as well as earphones.

Contributing to the low cost of the set are the four tuning coils (L_1, L_2, L_3, and L_4), which you can wind yourself with No. 26, enameled-copper wire, on tubing 1¼ inches in diameter. Three of these coils (L_2, L_3, and L_4) are wound on one form as shown in the diagram below. The only coil you need buy is a universal-wound inductance coil (L_5) used to tune the circuit to the very long wave bands. It may have any inductance value from 2.5 to 60 millihenries. A tap switch instantly selects the coil for the wave length desired. It should be noted that the lower end of the coil (L_5) goes to the cathode of the 6C5 tube instead of being grounded to the chassis. Plate voltage, and consequently the regeneration, of the 6C5 tube, is controlled by a .25-megohm potentiometer.

As a safeguard, a "polarized" plug is used on the power cord. One blade of the plug is slightly wider than the other for easy identification. When first plugging it into the outlet to be used with the set, take a 10-watt lamp and test to see if there is current flowing between the set chassis and a grounded

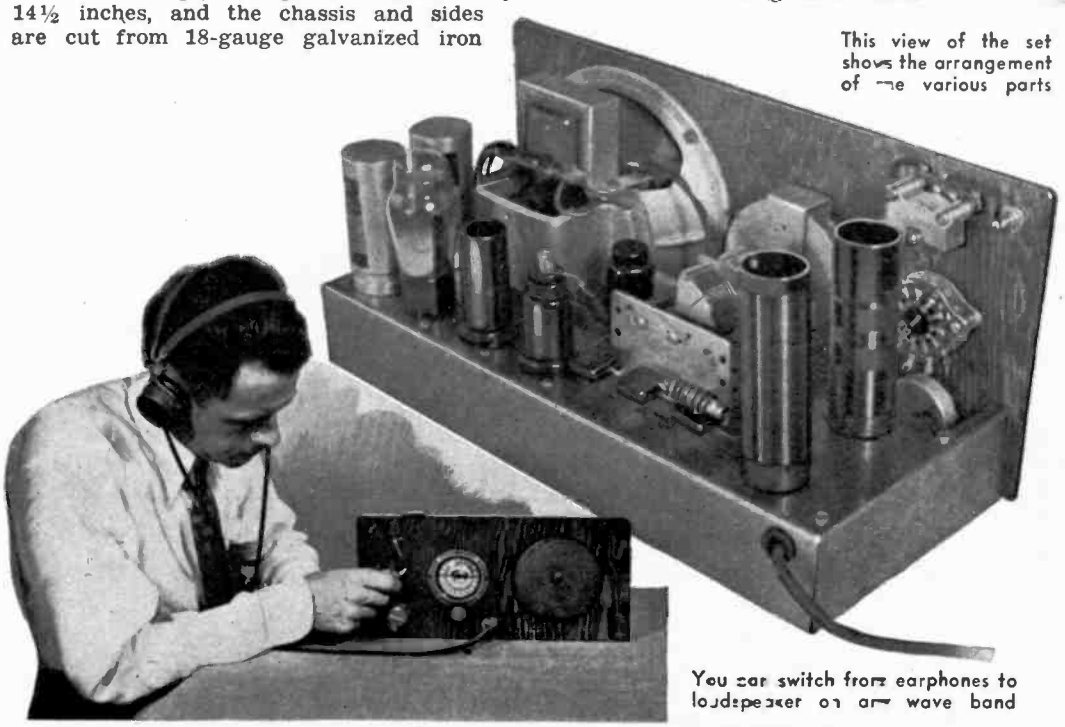


Follow these specifications in winding the coils

RECEIVER for Radio Amateurs

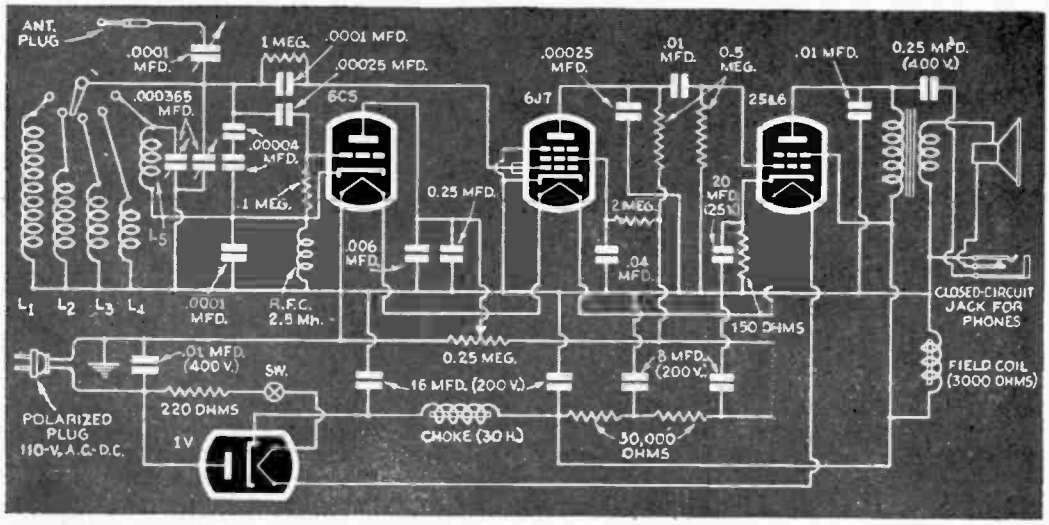
wire. If there is, reverse the leads of the polarized plug. Thereafter, when the plug is inserted in the outlet in the same position, a solid ground connection to the chassis will entail no danger of a shock or a short.

The ¼-inch plywood panel measures 7 by 14½ inches, and the chassis and sides are cut from 18-gauge galvanized iron or cold-rolled sheet steel, and bolted together. A 50 to 150-foot antenna, with the antenna coupling condenser set near maximum capacity, will work best for the longer wave bands. On the short waves, an aerial wire from 5 to 25 feet long can be used.



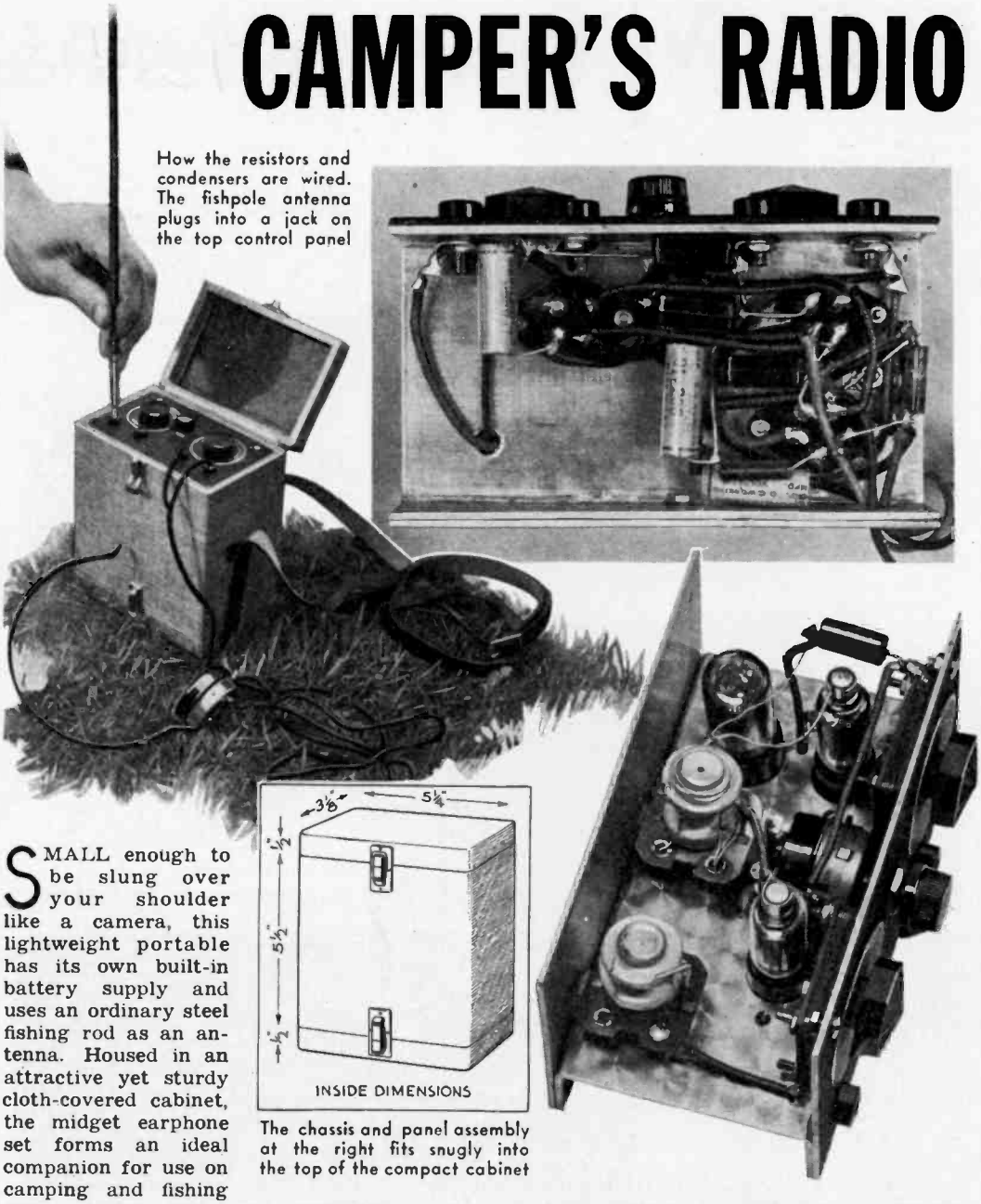
This view of the set shows the arrangement of the various parts

You can switch from earphones to loudspeaker on any wave band



Two novel features of the hook-up are the polarized power plug, and the use of a separate tube for regeneration

CAMPER'S RADIO



How the resistors and condensers are wired. The fishpole antenna plugs into a jack on the top control panel

The chassis and panel assembly at the right fits snugly into the top of the compact cabinet

SMALL enough to be slung over your shoulder like a camera, this lightweight portable has its own built-in battery supply and uses an ordinary steel fishing rod as an antenna. Housed in an attractive yet sturdy cloth-covered cabinet, the midget earphone set forms an ideal companion for use on camping and fishing trips, picnics, and long automobile tours.

Three of the latest-type midget tubes form the basis for the compact circuit. Operating on a filament voltage of 1½ volts and a plate supply of 45 volts, the tiny tubes not only make it possible to pack a three-tube hook-up into a small amount of space, but they cut down the number of necessary batteries to a minimum—a 45-volt "B" battery and a small 1½-volt dry cell. These tubes, of English manufacture, can be obtained from almost any large radio-parts supply house and must be used with the special midget sockets designed for them. In wiring the tubes, bear in mind that the metal connection at the top of each XSG tube is not the grid, as on most American tubes, but the plate.

To obtain the highest possible volume, iron-core coils are used. However, to save space they should be removed from their aluminum shielding cans. To obtain the necessary feedback in the detector or second coil, fifteen

Uses Fishpole Antenna

Camera-Size Set

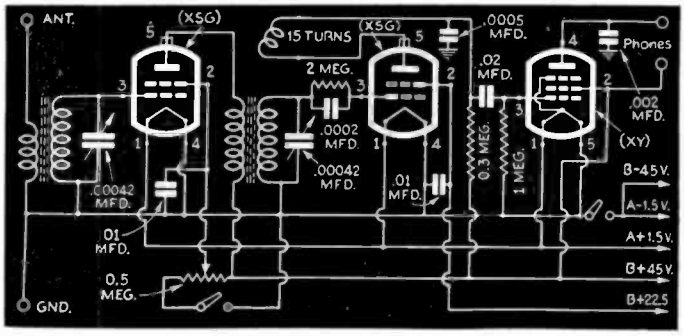
If you wire the receiver carefully according to the diagram below you will be able to get good radio reception miles from home

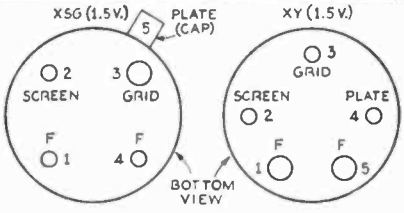
turns of No. 28 double-cotton-covered wire should be mounted close to the grid winding. This is indicated in the wiring diagram.

Composition-insulated tuning condensers are used instead of the usual air-spaced variety. They cost no more, and do conserve space. However, since these condensers cannot be ganged or mounted on a single shaft, each stage must be tuned separately.

A 500,000-ohm variable resistor connected across the "B" battery serves to control the volume. To avoid any unnecessary drain on the batteries while the set is not in use, a switch should be placed in the ground lead of the volume control. This switch can be ganged with a second switch placed in the minus lead to the "A" battery, so that both then can be controlled by a single knob on the panel.

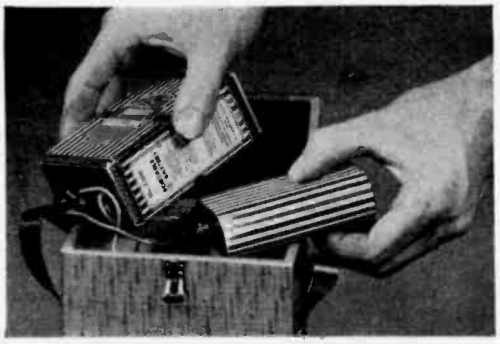
The cabinet used for the original set illustrated was made of wood and covered with airplane cloth. If you desire, it can be covered with imitation leather. To simplify the problem of changing the battery supply, two hinged covers are used—one at the top to cover the control panel and the other at the bottom to close the battery compartment. A leather strap run through leather loops mounted on the sides of the cabinet makes it easy to carry the receiver.





Follow these socket diagrams when making the various connections to the three tubes

No ground is needed in operating the set, only an antenna, which need be nothing more than the business end of an inexpensive telescoping steel fishing rod. For the original, the author sawed about ⅜" from the bottom end of the main ferrule that fits into the socket in the fishing-rod handle and soldered a short banana-type plug in place. This plug fits in a small jack mounted in the lower left-hand corner of the control panel as shown



Two small batteries housed in the bottom of the cabinet form the tiny receiver's complete battery supply

in one of the photographs. If desired, a wire from the antenna plug can simply be clipped to the end of the fishing-pole handle. As a matter of fact, the receiver can be used while fishing—the steel rod serving not only to catch fish, but to snare the radio waves. In this case, however, the fishing rod must be one fitted with a cork or other nonconducting handle to insulate the antenna and eliminate body capacity.

In laying out the parts and wiring, follow the photographs and diagram closely. The tubes and coils have been arranged with an eye to compactness and ease in wiring. Be particularly careful in making the connections to the three tube sockets, and follow the socket diagrams to the letter.

LIST OF PARTS

FOR CAMPER'S RADIO

Volume control, 500,000 ohms.
Iron-core antenna coil.
Iron-core radio-frequency coil.
Variable condensers, two, .00042 mfd.
Fixed resistor, 2 megohm, ½ watt.
Fixed resistor, 1 megohm, ½ watt.
Fixed resistor, 300,000 ohms, ½ watt.
Tubular condensers, two, .01 mfd.
Tubular condenser, .02 mfd.
Mica condenser, .002 mfd.
Mica condenser, .0002 mfd.
Mica condenser, .0005 mfd.

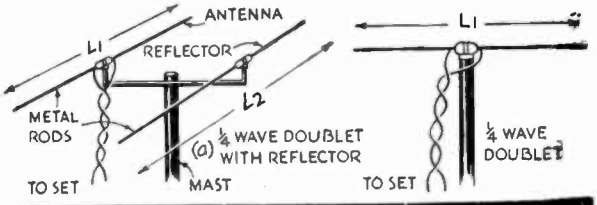
Miscellaneous: Tubes (two XSG, one XY), one 45-volt "B" battery, one 1½-volt midget dry cell, chassis, cabinet, special tube sockets, switches, four insulated plugs and jacks, cabinet, fish-pole, knobs, dials, wire, solder, etc.

HOW TO *Install*

THE problem of setting up an efficient television antenna for yourself or one of your friends will be greatly simplified if you will follow a few simple rules. First of all, although television antennas may vary in appearance and size, they are basically all alike, consisting of a quarter-wave doublet antenna of predetermined length. A "reflector" antenna, similar in design but from eight to ten inches longer, is mounted beside the doublet when necessary to eliminate "ghosts," or unwanted, out-of-register duplications of the television image on the fluorescent screen. Such ghosts usually are caused by a reflection of the signals from near-by buildings, just as visible light waves—which television waves resemble in many characteristics—reflect from a wall or other surface.

It is advisable to have a helper when setting up the antenna, so that one person can adjust its position while the other tests the operation of the receiver. Locate the antenna in a clear space on the high-

a Television Antenna

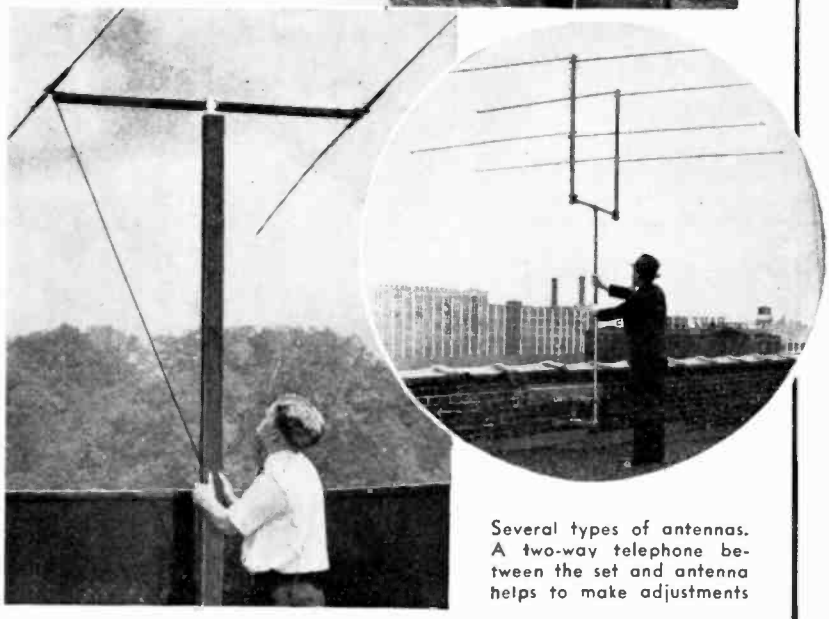


FREQUENCY	L1	L2
(a) 44-56 MC	122 INCHES	134 INCHES
(b) 66-72 MC	83 INCHES	93 INCHES
(c) 78-90 MC	70 INCHES	80 INCHES
(d) 96-109 MC	58 INCHES	66 INCHES

NOTE: REFLECTOR IS ALWAYS 8 TO 12 INCHES LONGER THAN RECEIVING ANTENNA

est possible part of a building, and on the side toward the transmitter. If the antenna and receiving set are not within easy shouting distance much time can be saved with a two-way, portable telephone system strung up temporarily between the two points.

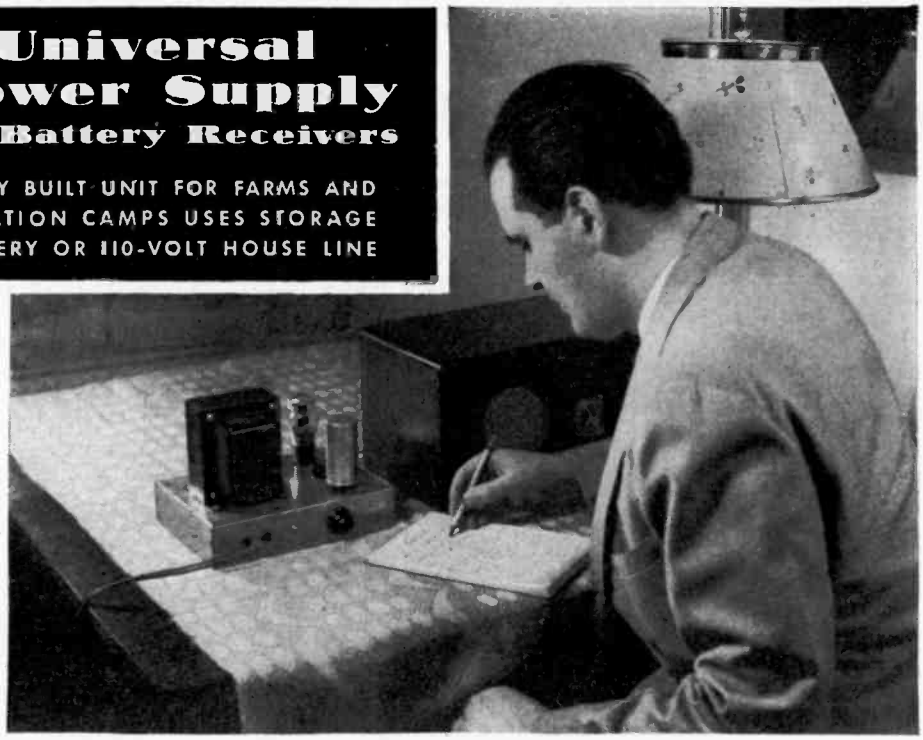
Television antennas should be mounted on a wooden or an iron mast of substantial design, securely anchored to the building. They are usually furnished properly matched for the 45 to 55-millicycle "vision" transmitters. If your local television station operates on a different frequency, the metal rods must be cut to the overall lengths shown in the accompanying table. Regardless of its design, the antenna will have to be rotated until the maximum signal strength is obtained, which is usually when the quarter-wave rods are at right angles to a line between the antenna and the transmitter. Several commercial antennas are fitted with flexible couplings which simplify this adjustment.



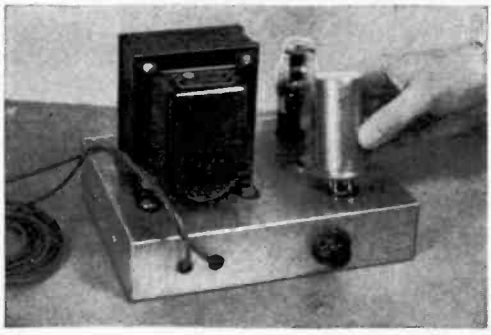
Several types of antennas. A two-way telephone between the set and antenna helps to make adjustments

Universal Power Supply for Battery Receivers

EASILY BUILT UNIT FOR FARMS AND VACATION CAMPS USES STORAGE BATTERY OR 110-VOLT HOUSE LINE



Operating a battery radio with the power supply



The vibrator is mounted on top of the chassis with the transformer, rectifier tube, and 110-volt socket

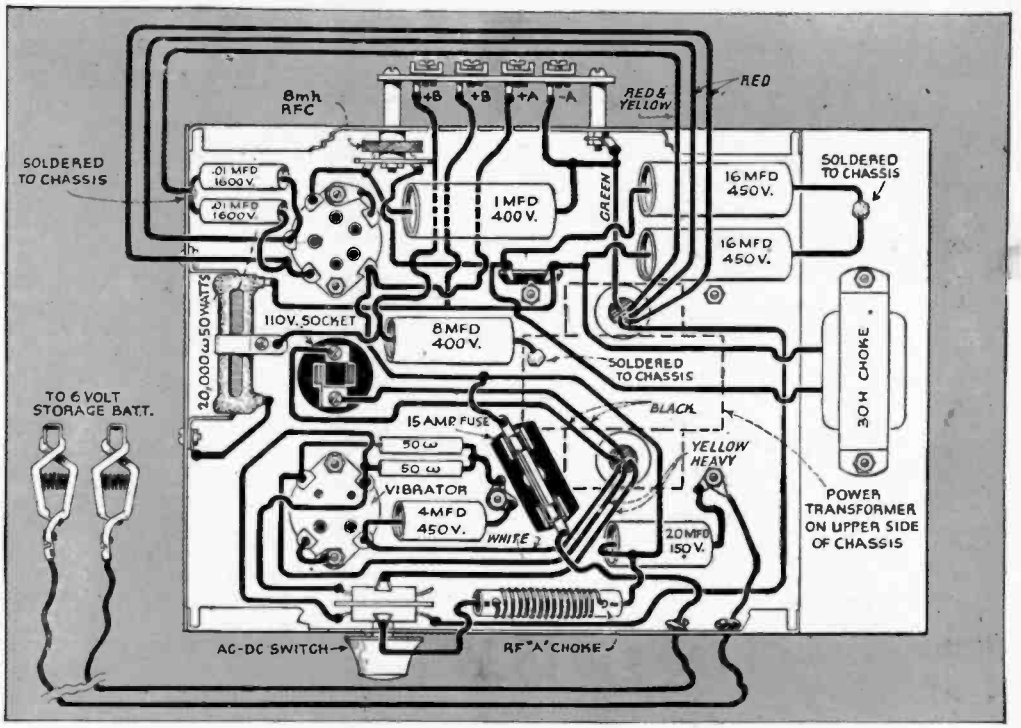
One six-volt battery is all that is needed. It can be either a storage battery or a dry-cell unit

NO MORE worrying about "B" batteries for that battery-operated radio at the summer camp or on the farm if this universal power supply is hooked to the set. One 6-volt battery is all that is needed. And, by simply snapping a switch, the power supply can be converted to operate a battery set on 110-volt A. C.

Easy to build, this vibrator unit steps up the 6-volt power to from 100 to 300 volts for the tube-plate current. It will operate any receiver or amplifier circuit using six-volt tubes where the total B drain is not more than 100 milliamperes.

Four-tube battery receivers with 1.5-volt tubes also may be operated with this unit if the tube filaments are connected in series (4 x 1.5 volts=6 volts). However, this may be done only when the vibrator is operated off a 6-volt battery, as the heater voltage is A. C. when the unit is connected to a 110-volt line, and the unit must NOT be used on 110-volt D. C. current.

The pack is built on a steel chassis measuring 2" by 7" by 9". On top are mounted the power transformer, four-prong vibrator, 84 rectifier tube and 110-volt socket. Beneath the chassis are the chokes, resistances, and condensers.

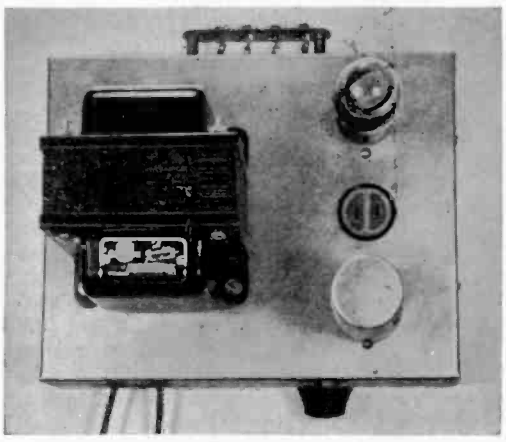


Schematic drawing of power-supply circuit. It will operate a 20-watt CW or 12-watt phone transmitter

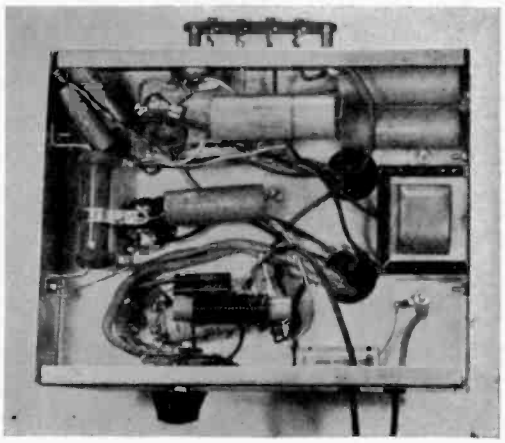
The 30-henry filter choke should pass at least 100 milliamperes to avoid overheating and damage to the windings. The 8-millihenry radio-frequency choke and 1-mfd. bypass paper condenser in the "B +" lead, and the "A" choke and 25-mfd. condenser in the "A —" lead provide the necessary RF filtering to prevent interference with the receiver. The "A" choke can be easily made at home by winding closely 20 turns of No. 14 enameled wire on a bakelite tubing with an outside diameter of ½".

A little vibrator static may be experienced when the unit is connected to a 1.5-volt battery receiver, but with 6-volt tubes no hum or vibrator static is noticeable. In each case the power-supply chassis should be connected to a good external ground and the receiver's ground connection disconnected.

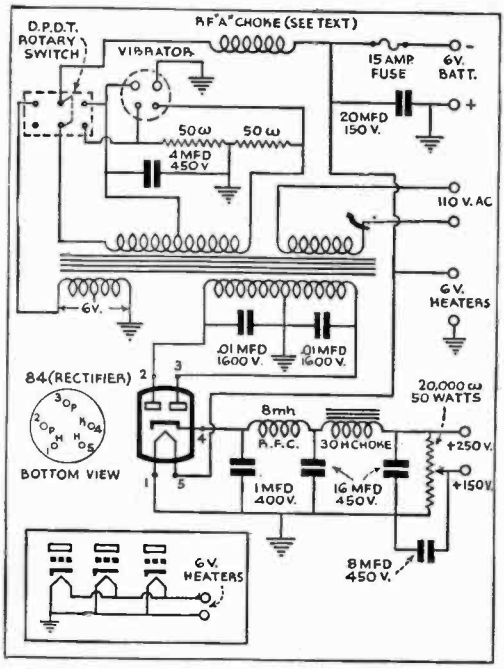
The grounded side of the tube heaters



The special power transformer makes it possible to operate a battery set on a 110-volt A.C. supply



Bottom view of chassis, showing the positions of the various chokes, resistances, and condensers



Wiring diagram for power pack. It's easy to build

must be connected to the grounded side of the 6-volt heater connections on the power unit. Do not use a "B —" lead to the unit. The "B —" connection is automatically made through the grounded 6-volt heater lead.

With an inexpensive vibrator, it is advisable to use the 300-volt tap when running the power supply off a 6-volt battery, because an inexpensive vibrator will have a low output.

PARTS FOR POWER SUPPLY

Special 6-115-volt power transformer.
Full-wave rectifier tube 84.
Four-prong vibrator.
Steel chassis, 2" by 7" by 9".
Rotary D. P. D. T. switch.
Fuse and holder, 15 ampere.
Filter choke, 30 henry, 200 ohm.
Semivariable resistor, 20,000 ohm, 50 watt.
R. F. choke, 8 millihenry.
Carbon resistors (two), 50 ohm, 1 watt.
Electrolytic condenser, 20 mfd., 150 volt.
Electrolytic condenser, 4 mfd., 450 volt.
Electrolytic condensers (two) 16 mfd., 450 volt.
Electrolytic condenser, 8 mfd., 450 volt.
Paper tubular condenser, 1 mfd., 400 volt.
Oil-impregnated condensers (two) .01 mfd., 1,600 volt.
Five-prong wafer socket.
Four-prong wafer socket.
Wire, tubing, 110-volt socket, etc.

MIDGET RADIO USES TWO DETECTORS

GREATER EFFICIENCY from the detector stage is achieved in this simple detector set by using separate tubes for detection and regeneration. It is so efficient that in some localities it will operate a small magnetic speaker.

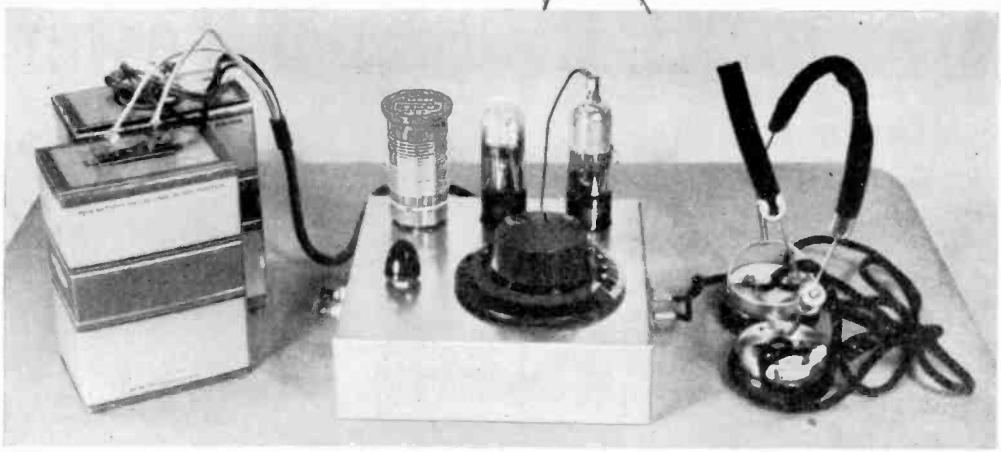
When using a screen grid or even a pentode in the detector stage, it is necessary to apply a low "B" voltage on the screen, sometimes as low as 22 volts, so the tube cannot be operated at maximum efficiency. However, with this arrangement of a separate triode tube for regeneration, 67½ or even 90 volts can be applied to the screen.

The one-tube detector stage may also be used as a medium-power audio amplifier for a crystal pick-up. The pick-up must have an output of at least 1½ volts, preferably 3 volts. The clip on the grid cap of the 1N5G is removed and one lead (unshielded) of the pick-up is connected to it, while the other lead (shielded) is connected to the chassis. Phones, a small magnetic speaker, or a PM speaker (5-inch) may be used to listen to phonograph recordings.

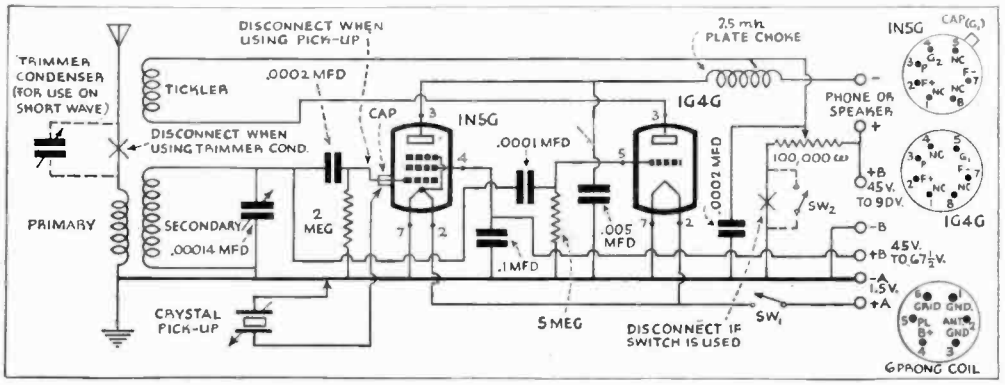
A 100,000-ohm potentiometer is used to control regeneration. One side of the control is grounded to the chassis. As this puts a resistance across the "B" battery, even when the receiver is not in use, and causes the "B" battery to run down sooner, it is advisable to include a switch, as shown in the diagram (SW2). Instead of buying two S.P.S.T. switches, a D.P. S.T. may be used.

Any good antenna and ground installation may be used with this set. However, if the amateur has not, as yet, an antenna rigged up he can test the set with a 20-foot piece of wire lying on the floor. Short waves may be received on this radio with suitable plug-in-coils. In this case it is advisable to use a small trimmer condenser in the antenna lead (.00005 mfd. or 50 mmfd.)

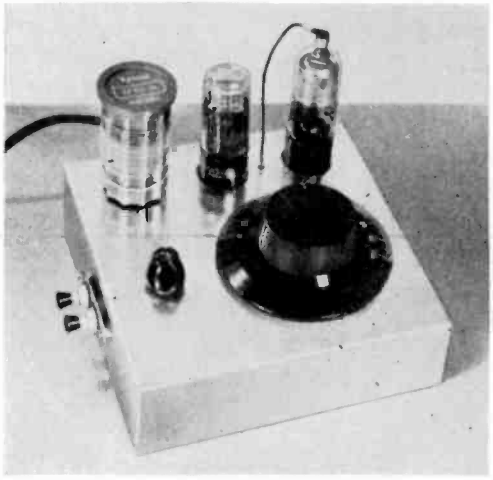
A 7" by 7" by 2" steel cadmium-plated chassis is used, and, by mounting the tuning controls as shown in the photographs, the metal panel can be dispensed with, thus cutting down the cost.

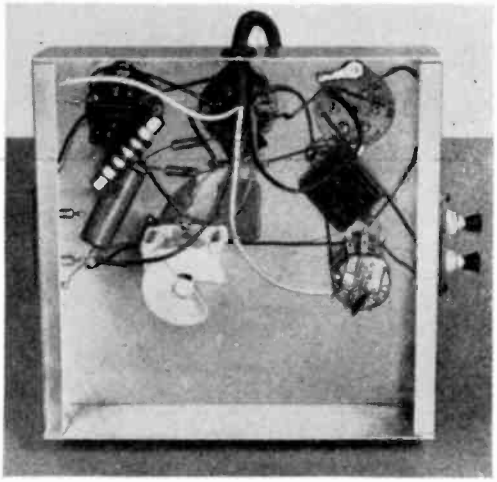


Separate tubes for detection and regeneration give this simple receiver its remarkable efficiency



How the circuit is wired. Any good antenna and graund installation may be used with this set

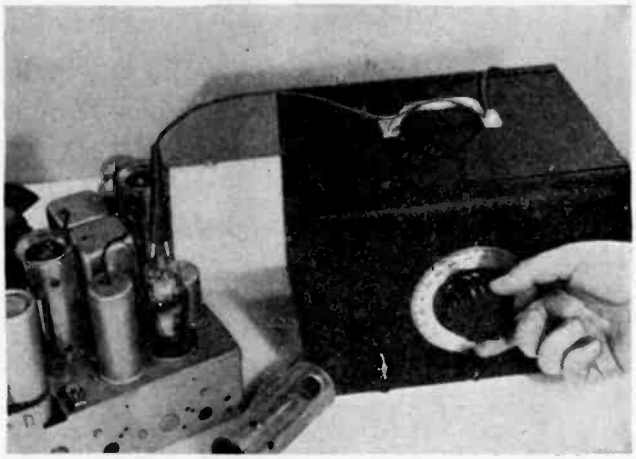




Top and bottom views of chassis. By mounting the controls thus, the metal panel is dispensed with

Portable AC-DC Signal Tester

Oscillator Can Be Used as Wave Meter on Broadcast Band



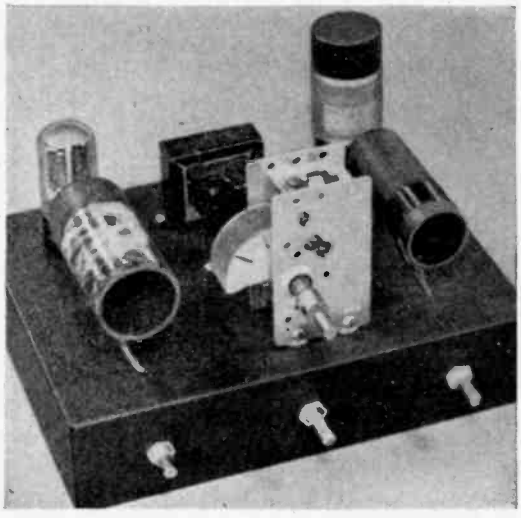
Oscillator shown in use with test prong hooked to screen grid cap

INEXPENSIVE to build, this portable AC-DC test oscillator recommends itself to present conditions, for it may be used either in the shop or taken out on calls. It operates on both AC and DC current and there is no need to worry about which current a customer might have. The latest tubes are used and the output is a pure, audible sound that can be heard easily through the speaker of the set being tested.

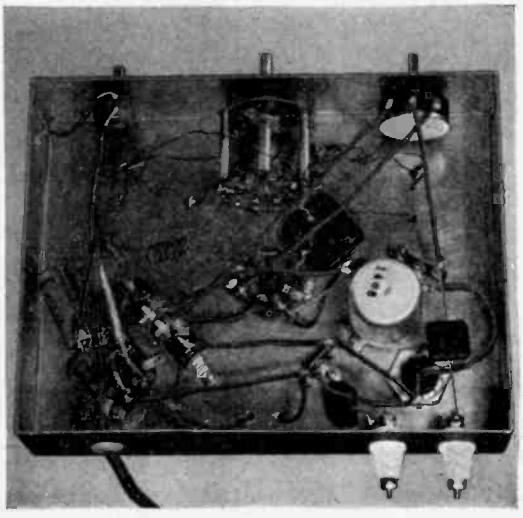
This oscillator will align the I.F. stages of any superheterodyne having a frequency between 300 kc. and 850 kc. Most I.F. stages are peaked at about 456 kc. Additionally it will serve as a wave meter for the broadcast band, enabling one to identify unknown, distant, or local stations. A simple two-tube circuit is used, consisting of a half-wave rectifier (25Z6-GT/G) and a parallel-feed oscillator of the electron-coupled type, (6SK7).

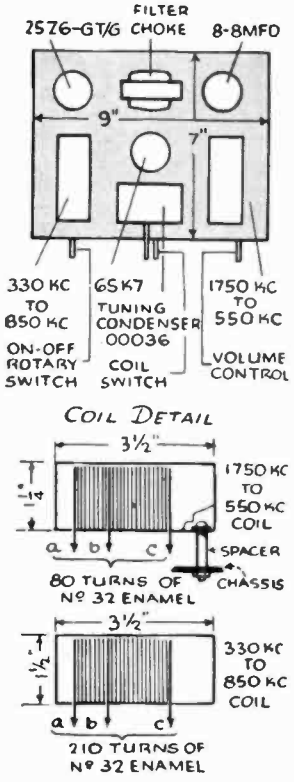
Two coils are needed for this operation, one to cover the 300-kc. to 850-kc. band and the other the broadcast band (1,750 kc. to 550 kc.). Directions for making these coils are in the accompanying sketch. Before using, the oscillator must be completely inclosed in a steel cabinet. A .05-mfd. condenser grounds the cabinet to the chassis. Do not ground the cabinet directly to the chassis, for there is danger of a short, especially where the oscillator is being used on a DC line. The .02-mfd. condenser must be mica insulated and not paper insulated, unless it is non-inductively wound. The simplest way to calibrate the oscillator for

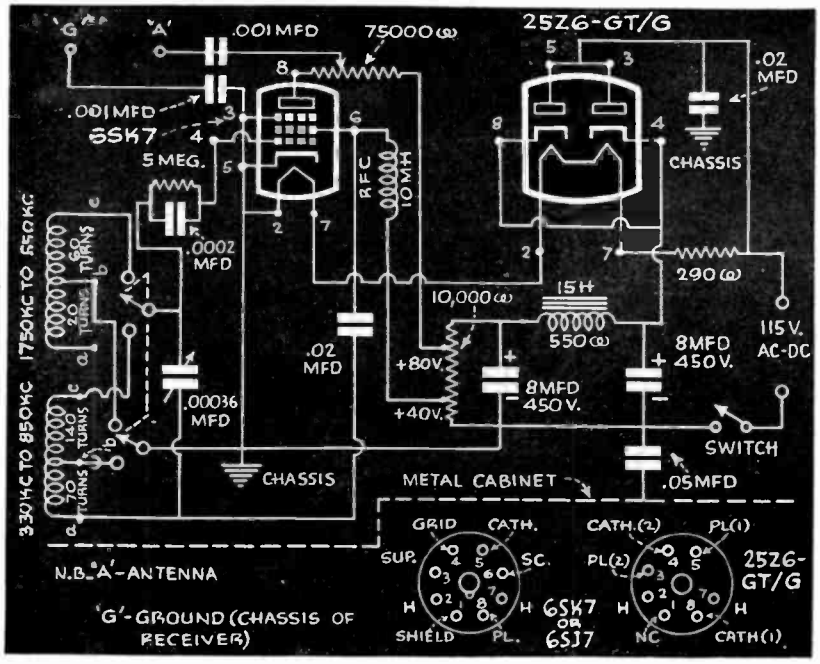
Below, front view of coils on chassis and other parts



Bottom view of chassis, illustrating wiring of unit



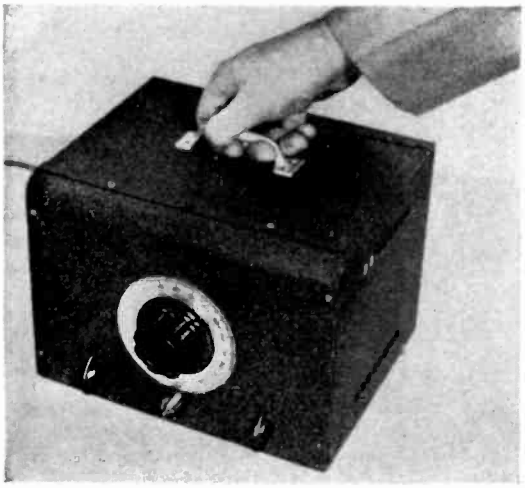




As shown in the wiring diagram, two taps ore used on resistor. These can be moved up and down resistor until correct voltages are obtained. Directions for making coils are given in detail at left. Coils are mounted on chassis with a 1¼" machine screw and a ¾" brass spacer

aligning a superheterodyne is to use a good radio receiver having an I.F. frequency of 456 kc. Then remove the grid clip from the first I.F. tube and connect point "A" on the oscillator to the grid cap of the I.F. tube. Rotate the dial until a signal is heard in the speaker. This point on the dial will correspond to the I.F. frequency of the receiver. In order to align the I.F. stages of other sets, tuned to 456 kc., switch the oscillator on and turn the dial to the correct position for 456 kc. The oscillator is now sending out a note tuned to 456 kc. Next, adjust the trimmers on the I.F. coil cans, until the note is heard.

Cobinet with dial, bross handle and two self-tapping screws appeors below. Note its compactness



LIST OF PARTS

Cabinet, 7½" by 8" by 10¼". Black wrinkle finish.

Cadmium-plated chassis, 2" by 7" by 9".

Tuning condenser, .00036 mfd.

Coil form, 1½" diameter by 3½" long.

Coil form, 1¼" diameter by 3½" long.

Filter choke, 15 henrys, 550 ohms.

Dual electrolytic condenser, 8+8 mfd., 450 volts.

Octal tube sockets (two).

Rotary switch, S.P.S.T.

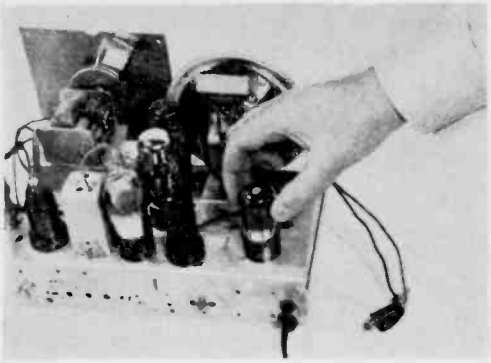
Variable resistor, 75,000 ohms.

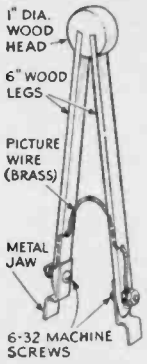
Wire-wound resistor, 10,000 ohms, 25 watts.

Porcelain binding posts (two).

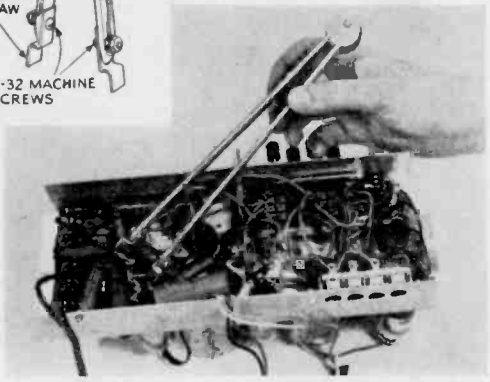
Tubes: 25Z6-GT/G and 6SK7.

Servicing Your Radio

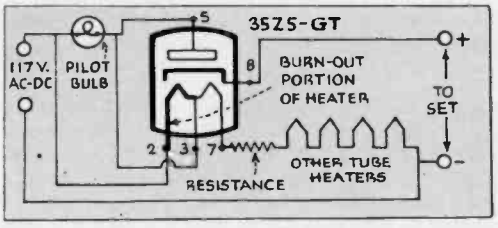




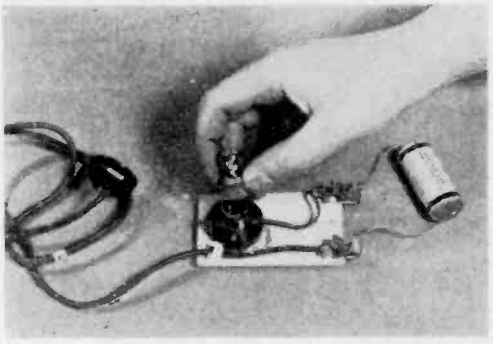
WORK CAN BE SPEEDED UP in servicing old radios with this gadget made from wooden photo tongs, such as is used on wet prints. Switch on the receiver and begin shorting the different fixed resistors. When the defective one is shorted, reception improves.



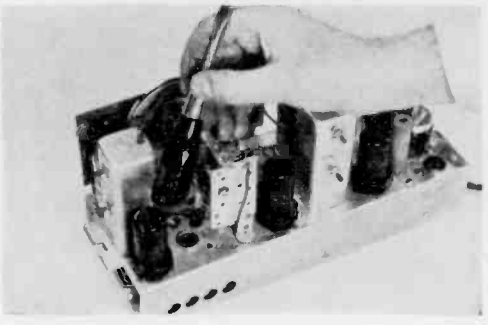
SOME SERVICEMEN HAVE TROUBLE with the AC-DC receivers that use the 35Z5-GT rectifier tube. This is shown by the pilot bulb blowing out when a new tube is inserted and the set is switched on. When these blowouts occur, the section of the tube's heater—just across the pilot bulb—is defective. As the set is switched on, the pilot bulb carries the load and, of course, blows out. The remedy is to replace the 35Z5-GT.



WPB HAS REDUCED TUBE TYPES by some 349 varieties, because they made up only about 1% of the total yearly sales. Smaller GT tubes will replace the larger G types, without loss in output. Sets formerly using a 25Z6-G, or a 25Z6-GT, will now obtain identical results with the 25Z6-GT/G tube.

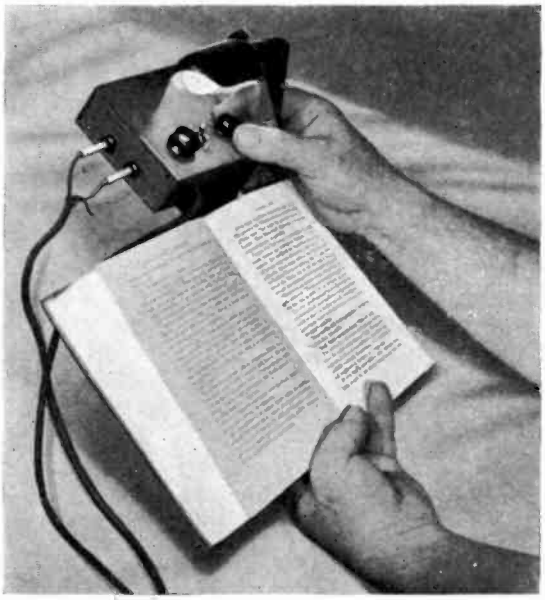


INTERMITTENT AND FADING RECEPTION on some AC-DC receivers and phone combinations is caused by faulty construction of new single-ended tubes, without grid caps. To test for this trouble, tap all tubes with a wooden screwdriver handle, as shown below, and the defective one will induce static. It should be replaced.



A HANDY DEVICE TO HAVE on the workbench is this homemade neon condenser tester. It will work with either paper tubular or mica condensers of any capacity. If the condenser being tested is good, the neon will flash once. But if the condenser is leaky or shorted the neon will glow and sputter, showing it should be replaced. Tester works on DC or 90-v. battery.

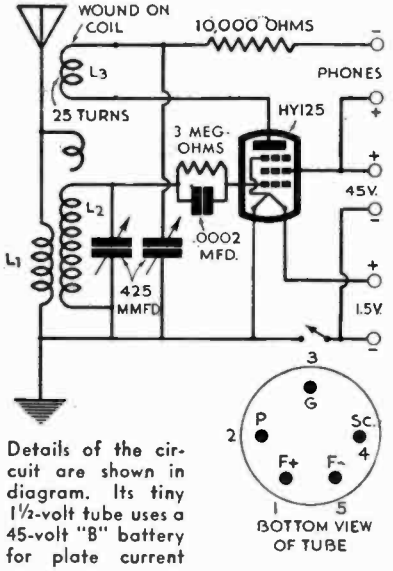
Book-Light Radio



Controls are handy as you read with this radio turned on

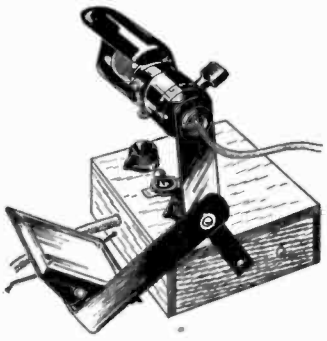
MOUNTED on the bracket of a book light, this tiny broadcast receiver will be found extremely useful while reading after you've gone to bed. Earphones, two small batteries, aerial, and ground complete the set. Instead of the usual radio-frequency choke in the plate lead, a 10,000-ohm, half-watt resistor is used, while a padding condenser with a maximum capacity of .0004 mfd. forms the tuning condenser. A similar padding condenser is used as a regeneration control. The tuning coil (L_2) is a midget-type antenna coil such as used in A.C.-D.C. receivers, wound with thirty turns of double-silk-covered wire around the lower end. This unit comprises the ticker coil (L_3).

The cabinet is ⅜" thick walnut, 1½" by 3½" by 3¾", glued together and shellacked. Fiber board may be nailed on the back, and the unit fastened to the stem of the book lamp with a single bracket.

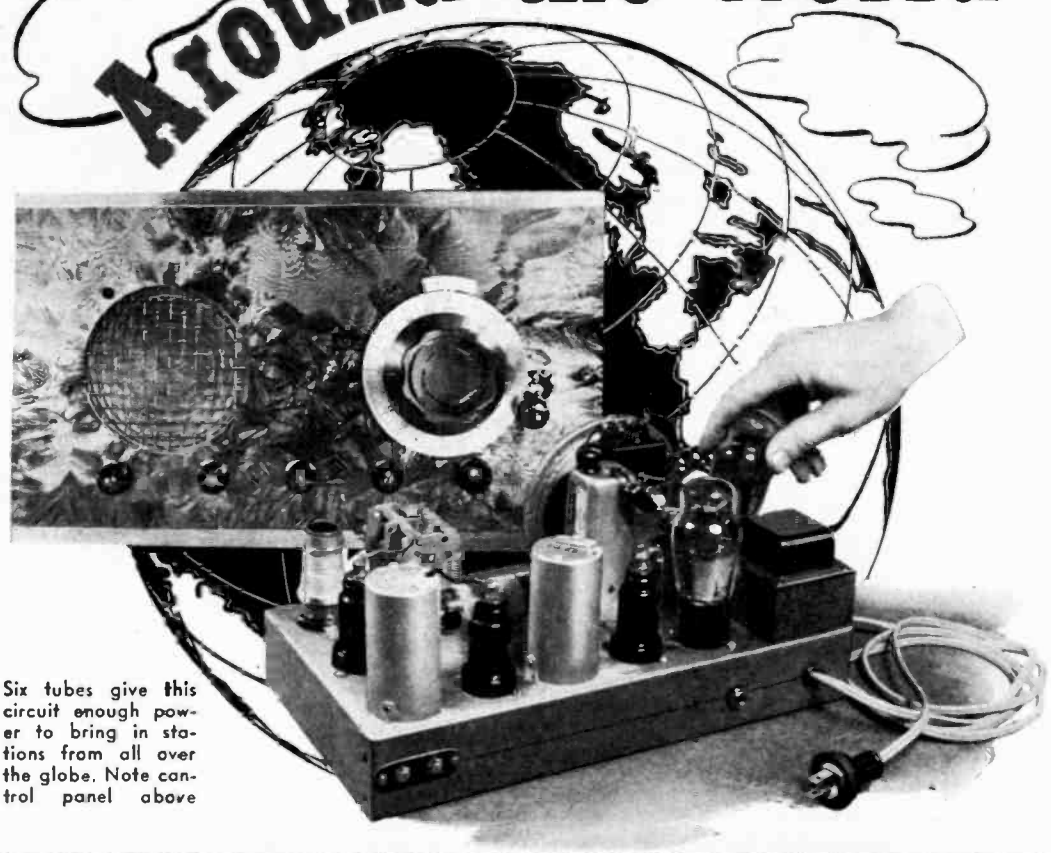


Details of the circuit are shown in diagram. Its tiny 1½-volt tube uses a 45-volt "B" battery for plate current

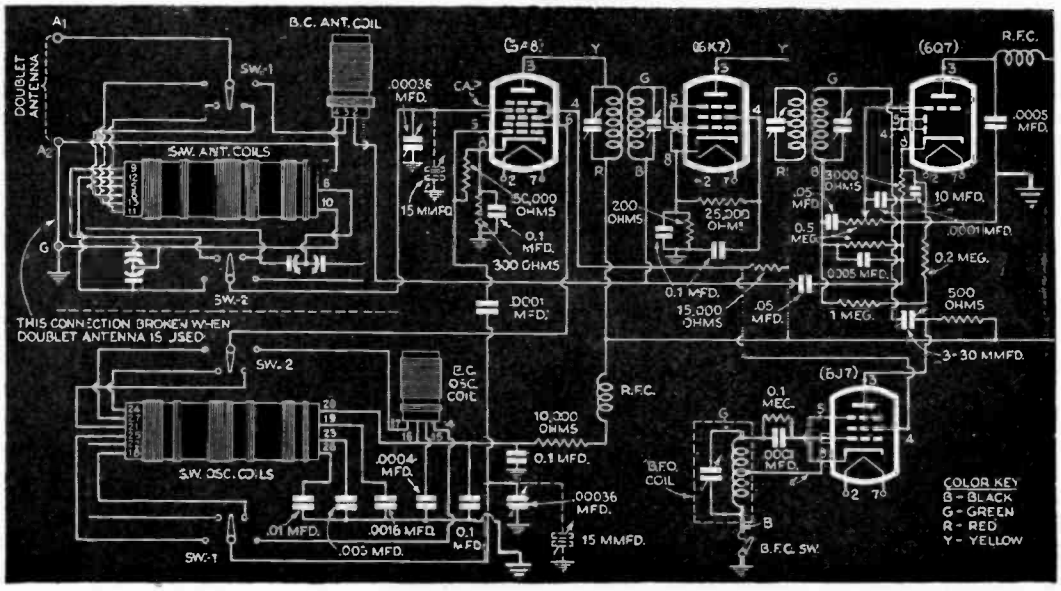
Padding condensers replace the usual-type tuning condensers. Note cabinet details at right



Around-the-World



Six tubes give this circuit enough power to bring in stations from all over the globe. Note control panel above



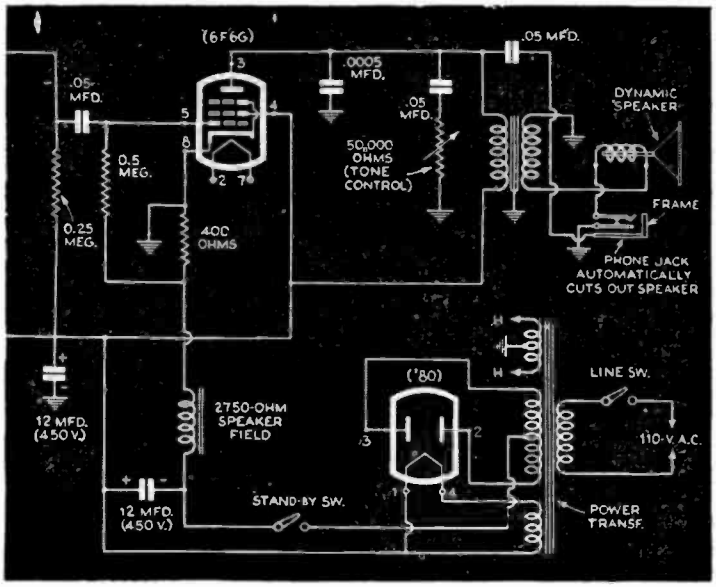
Receiver COSTS $20 TO BUILD

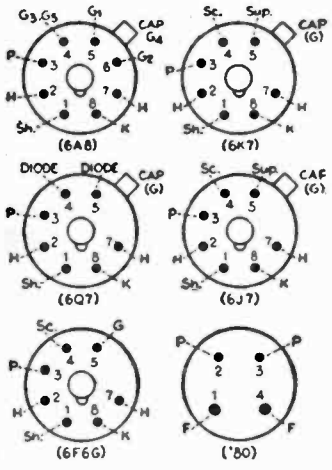
TWENTY DOLLARS will build this powerful six-tube communications receiver, which includes all the more important features necessary for good all-around reception. Although only six tubes are used, two of these are dual-purpose tubes (the 6A8 which acts as a combined first detector and oscillator, and the 6Q7 which serves as the second detector and first audio amplifier) resulting in eight-tube performance. This set has plenty of power to bring in short-wave stations from any part of the globe.

The set includes many of the outstanding features of the latest models

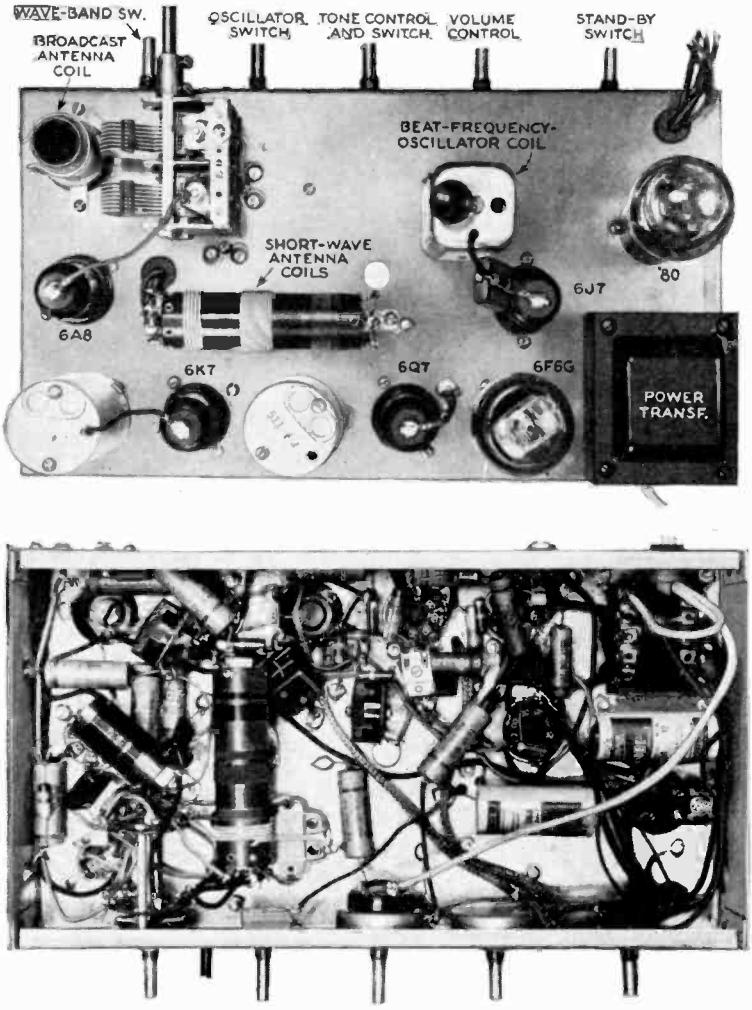
The circuit covers the entire range from twelve meters up to 550 meters. This range is divided into four bands (550 to 200 meters, 200 to 75 meters, 75 to 35 meters, 35 to 12 meters) by means of a selector-type switch which is noiseless in operation. Among its other features are a sensitive, self-contained dynamic speaker, a stand-by switch, a beat-frequency oscillator with pitch control and on-off switch, automatic volume control, a full-range tone control, and provisions for the use of either a doublet or L-type antenna.

No band spread has been used in the original design as satisfactory results were obtained by the small friction-drive vernier





COMPLETE WIRING DATA for the circuit and the tubes are given in the diagrams at the left and above. A supersensitive band spread is shown in dotted lines



dial shown next to the outer rim of the large tuning dial. Most readers will find this system sufficient for their needs, especially as this vernier control costs only ten cents! However, those who wish to add an electrical band-spread system may do so. It involves only a slight additional cost of from one to two dollars, and consists merely of wiring a two-gang tuning condenser having a very low maximum capacity (approximately fifteen micromicrofarads) across the main two-gang tuning condenser as shown by dotted lines in the diagram. It can be mounted between the speaker and main tuning control. This system is used only for the short-wave bands and becomes inoperative on the broadcast band.

All-metal tubes are used in all stages but the last. In this stage (the output or second audio amplifier) an

PARTS FOR THE COMMUNICATIONS RECEIVER

All-wave coil kit.
Two-gang tuning condenser, .00036 mfd. (two).
Two-gang tuning condenser, 15 mmfd. (two) (see text).
Beat-frequency coil.
One 4-prong and five octal wafer sockets.
Tone control, 50,000 ohm; and switch.
Volume control, 500,000 ohm.
S.P.S.T. rotary stand-by switch.
Five-inch dynamic speaker, 2,750 ohm.
Power transformer.
Two radio-frequency chokes, 2.5 mh.
Padder condenser, 3-30 mmfd.
Two carbon resistors, ½ meg., ½ watt.
Carbon resistor, 1 meg., ½ watt.
Carbon resistor, 250,000 ohm, ½ watt.
Carbon resistor, 200,000 ohm, ½ watt.
Carbon resistor, 100,000 ohm, ½ watt.
Carbon resistor, 50,000 ohm, ½ watt.
Carbon resistor, 25,000 ohm, 1 watt.
Carbon resistor, 10,000 ohm, ½ watt.
Carbon resistor, 15,000 ohm, 1 watt.
Carbon resistor, 3,000 ohm, ½ watt.
Carbon resistor, 500 ohm, ½ watt.
Carbon resistor, 400 ohm, 1 watt.
Carbon resistor, 300 ohm, ½ watt.
Carbon resistor, 200 ohm, ½ watt.
Five tubular condensers, 1 mfd., 400 volts.
Five tubular condensers, .05 mfd., 400 volts.
Tubular condenser, .01 mfd., 400 volts.
Three mica condensers, .0005 mfd.
Three mica condensers, .0001 mfd.
Two electrolytic condensers, 12 mfd., 450 volts.
Electrolytic condenser, 10 mfd., 25 volts.
Mica condensers, .003 mfd., and .0016 mfd. (included in coil kit).
Converter tube 6A8.
Amplifier tube 6K7.
Amplifier tube, 6J7.
Detector-amplifier tube, 6Q7.
Power-amplifier tube, 6F6G.
Rectifier tube, 80.
Dial, 4-inch, with vernier attachment.
Vernier dial, 3-inch (see text).
Miscellaneous: Five dial knobs; aluminum panel and chassis, phone jack; wire.

octal glass tube is used. The same thing applies to the 80, or rectifier, tube.

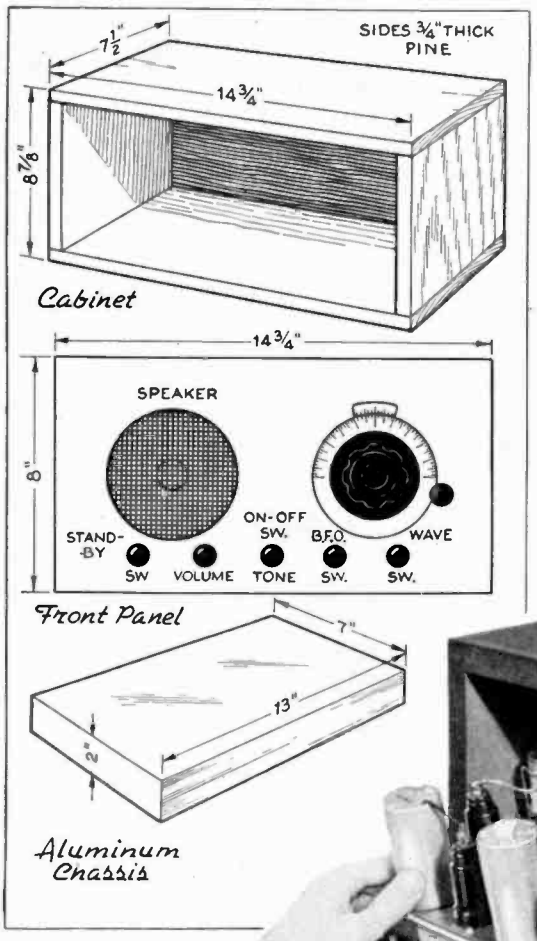
The purpose of the beat-frequency oscillator is to introduce oscillation into the intermediate-frequency stage so that when tuning to weak or distant stations they will not be missed. With this oscillator in operation, a slight whistle is heard each time a station is passed, much the same as that heard when tuning a one or two-tube receiver with the regeneration control full on.

Another helpful feature is the stand-by switch. This control cuts out the plate and screen voltages and silences the set but does not disconnect the heaters of the tubes so that the set can be switched back into immediate operation without any waiting for the tubes to heat up.

The intermediate-frequency transformers are of the tuned-grid, tuned-plate type, and are adjusted to the proper frequency before leaving the factory. This adjustment allows for normal stray capacities found in the average receiver, and, unless excessive capacities are introduced such as grid-wire shielding, only a slight touch of the trimmers is necessary to align the intermediate-frequency amplifier. However, an oscillator should be used to align the set on the short waves. This will be done for a nominal sum by your local radio service man.

The cabinet for this set should not cost more than fifty cents and is easily built at home. It is made of white pine three quarters of an inch thick and consists of only four sides, with no front or back. As the aluminum panel overlaps the chassis in length, it will prevent the chassis from sliding in too far, and at the same time provides a means of anchoring the whole set firmly in the cabinet by means of screws at each end of the aluminum panel. The back of the cabinet is left open to provide adequate ventilation for the tubes.

To give a dressier appearance to the control panel, apply a coat of brown, crackle-finish lacquer.



Cabinet, panel, and chassis dimensions and arrangement of controls should be followed closely

The back of the cabinet is left open for ventilation. The chassis is slipped in and held in place by screws

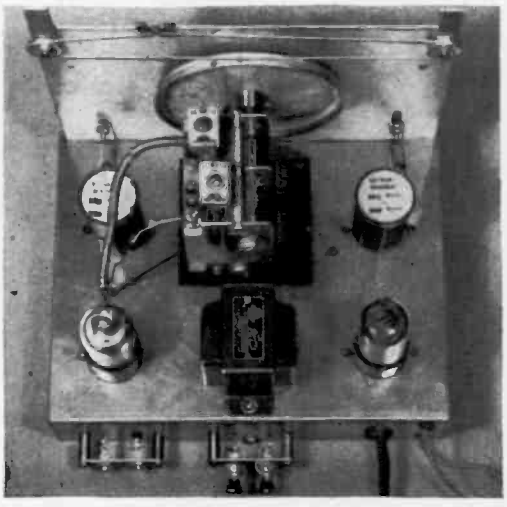
Two-Tube Radio Phonograph

The finished set, ready for use as a radio or phonograph

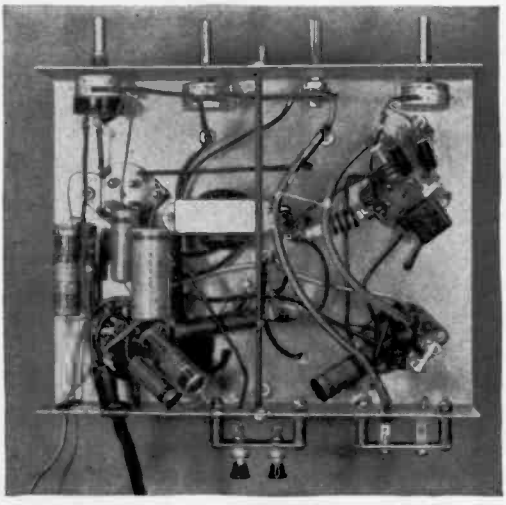
USING only two tubes, this radio-phonograph combination provides output and quality equal to sets using five tubes or more. It boasts all the features found in combinations using eight tubes, for the two-tube chassis incorporates a variable tone control working on both radio and records, a volume control (also working on either radio or records), a phono-radio switch, and a sensitivity control. The latter is really a regeneration control but differs slightly from the conventional type in that it can be adjusted to below the oscillation point and left in that position while tuning through the entire broadcast band. Usually a regeneration control must be reset as each station is tuned in. Another advantage is that it does not detune the set.

The reader should be able to duplicate this phonograph combination, including the commercial walnut cabinet, for $27.50. This price includes tubes, pick-up, and phonograph motor.

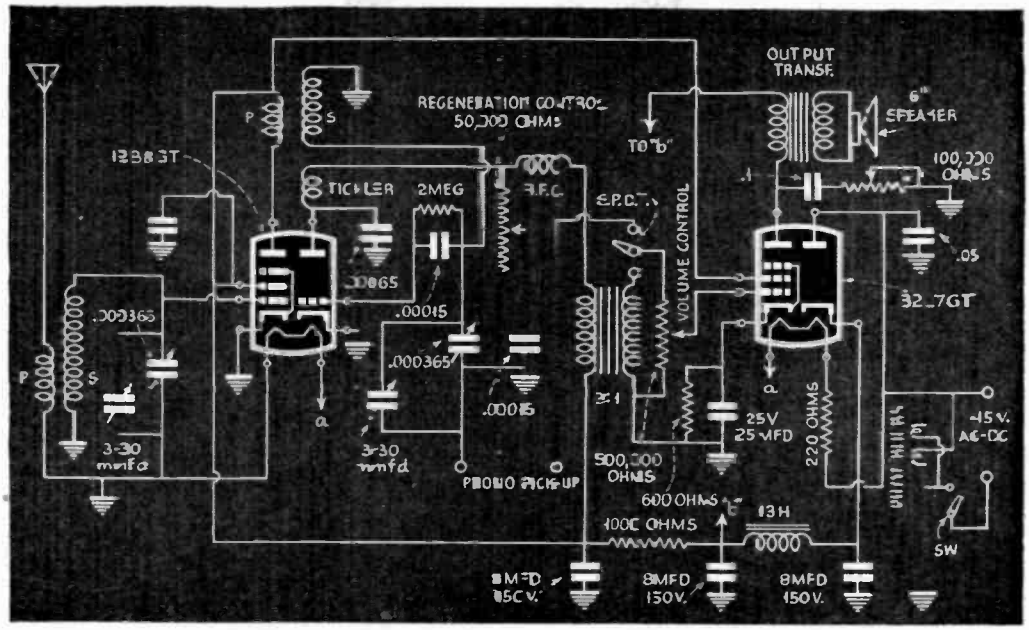
Fundamentally, the circuit is a tuned radio-frequency receiver using a triode in the detector stage, and a 3:1 shielded transformer in the audio stage. Plug-in coils have been used in both the antenna and radio-frequency circuits. They are tuned by two .000365-mfd., ganged variable condensers. To balance the circuits satisfactorily, the original trimmers on the condensers should be replaced by two others of a slightly higher capacity (3 to 30 mmfd). The coils chosen must have a range of 185 to 360 meters (with a .00014-mfd. condenser). With the .000365-mfd. tuning con-



Extreme simplicity marks the layout of the parts on top of the chassis. Coils and tubes are accessible



This view of the underside of the chassis will assist the builder in making the various connections



Complete wiring details are shown in this diagram. Be sure all connections are carefully soldered

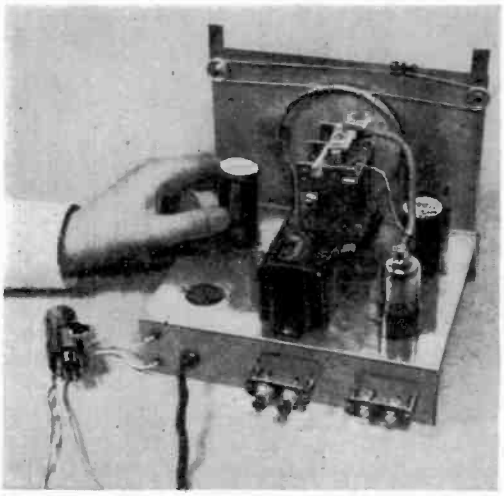
densers, they will cover the entire broadcast band up to 550 meters. A four-prong coil is used in the antenna stage, and a six-prong coil in the radio-frequency stage.

In wiring the six-prong coil, be sure that the winding over the grid winding is used as the primary. The third winding is, of course, the tickler. If the set does not oscillate, the connections to the tickler winding should be reversed.

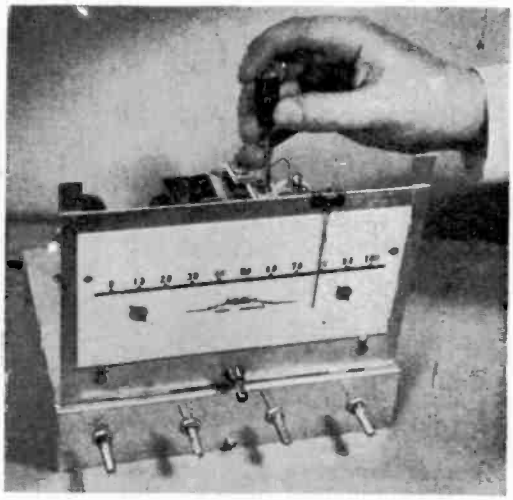
The .00065-mfd. capacity placed between the plate of the triode and chassis consists of two fixed mica condensers wired in parallel—one having a capacity of .0005 mfd. and the other .00015 mfd. However, any combination of capacities which totals .00065 mfd. may be used.

Regeneration is controlled by a 50,000-ohm variable resistor in series with a .00015-mfd. fixed mica condenser. Tone is controlled by means of a 100,000-ohm variable resistor and a .1-mfd. tubular condenser in the plate lead of the output pentode.

The phonograph pick-up is connected into



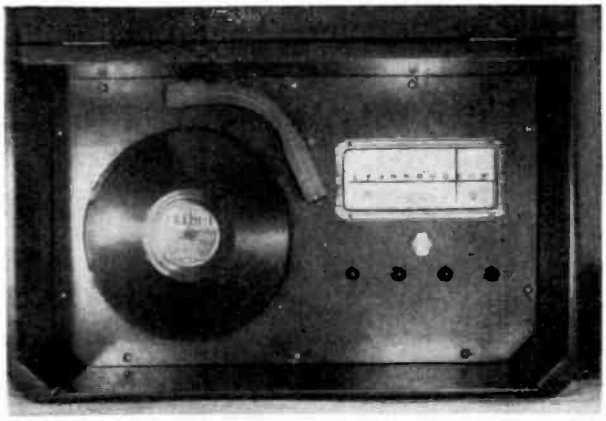
Another view of the completed chassis. Actually, it hangs perpendicularly when installed in the cabinet



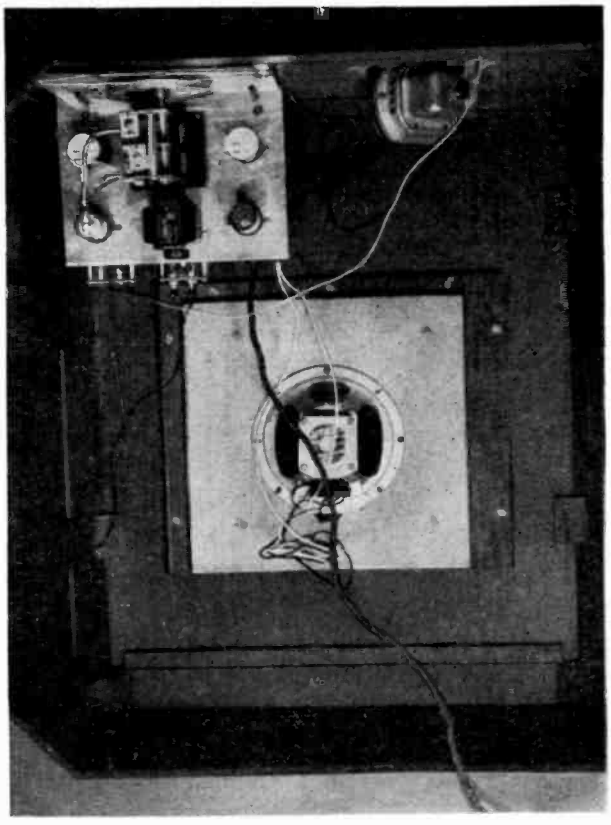
All of the controls are neatly grouped for convenient manipulation when the cabinet lid is raised

LIST OF PARTS

Six-inch permanent-magnet speaker.
Output transformer.
Radio-phonograph cabinet.
Radio-frequency and detector tube, 12B8GT.
Output and rectifier tube, 32L7GT.
Line cord and resistor, 220 ohm.
Four-prong plug-in coil.
Six-prong plug-in coil.
Two-gang tuning condenser.
Eight-inch slide-rule dial.
Aluminum chassis, 2″ by 7″ by 9″.
Audio transformer, 3:1 ratio.
Variable resistor, 50,000 ohm.
Variable resistor, 100,000 ohm.
Variable resistor, 500,000 ohm.
S.P., D.T. rotary switch.
Filter choke, 13 henry.
Radio-frequency choke, 2.5 mh.
Crystal pick-up.
Phonograph motor.
Trimmer condensers, two, 3—30 mmfd.
Electrolytic condensers, three, 8 mfd.
Tubular paper condensers, two, .1 mfd.
Electrolytic condenser, 25 mfd., 25 volt.
Tubular paper condenser, .05 mfd.
Mica condensers, three, .00015 mfd.
Carbon resistor, ½ watt, 2 meg.
Carbon resistor, 1 watt, 600 ohm.
Carbon resistor, 2 watt, 1,000 ohm.
Mica condenser, .0005 mfd.
Green pilot bulbs, two, 110 volt.



Top view showing phonograph turntable, radio dial, and controls



View from behind the set, showing how the parts are mounted

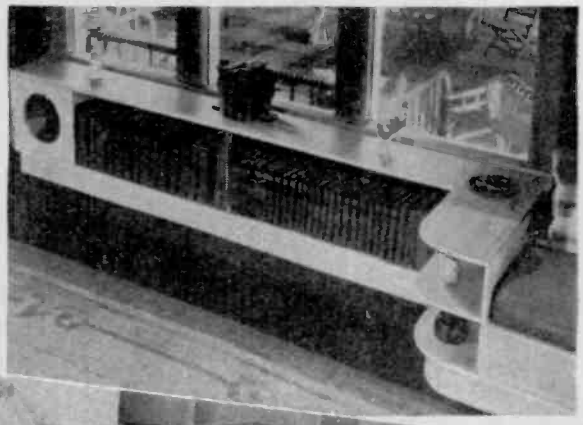
the grid of the output pentode. A single-pole double-throw rotary switch cuts out the secondary of the audio transformer when the pick-up is used. It is important to use a crystal pick-up with this circuit, as a magnetic type will not give sufficient volume.

Three 8-mfd. electrolytic condensers, a 13-henry choke, and a 2-watt, 1,000-ohm resistor, make up the filter network. In the wiring diagram, note that the "B" positive side of the output transformer is connected to a point between the filter choke and the 1,000-ohm resistor.

Built to match the walls, one cabinet holds the phonograph and radio, the other the loudspeaker

Cabinet Ideas for Radio Builders

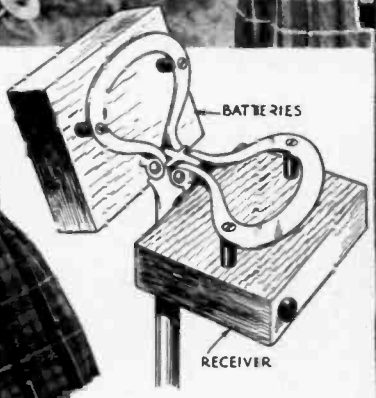
WITH unmounted radio chassis, home owners handy with tools can build cabinets to harmonize with the decorative scheme of a particular room. Four suggestions are shown in the photographs on this page. At the top, twin cabinets were built of knotty pine, one housing the radio and phonograph and the other the loudspeaker. Other schemes pictured are a unit built into the end of a divan, a modernistic cabinet separating a living room and foyer, and a cabinet for an entrance hall.



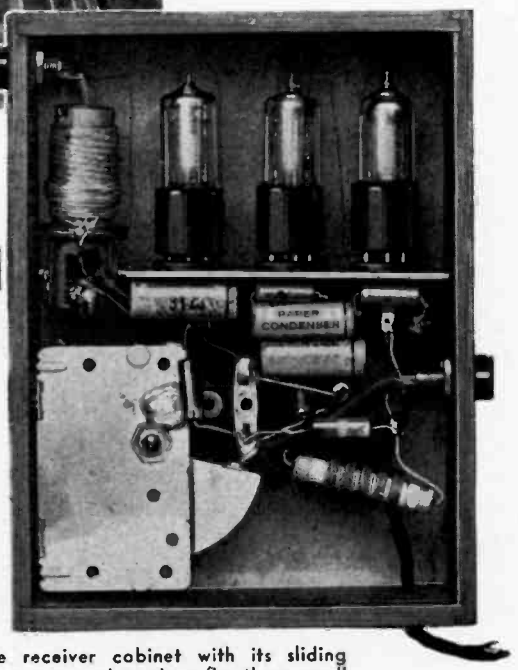
Here are three other methods of adapting the radio to the architectural and decorative scheme of an individual room

SPORTS RADIO Is

CONSISTING of a compact yet powerful battery receiver mounted on a conventional cane-seat which can be purchased for a dollar or two, the radio illustrated forms a handy set for hikers, sports spectators, and campers. The circuit, designed around three of the new American-made midget tubes, consists of a pentode regenerative detector, resistance coupled to a pentode amplifier which in turn is resistance coupled to a second audio-amplifier stage. Regeneration is controlled by a 25,000-ohm potentiometer. Since the commercial type of antenna coil shown in the diagram has no tickler



Cabinets mounted on the handles of the cane-seat house the set and batteries



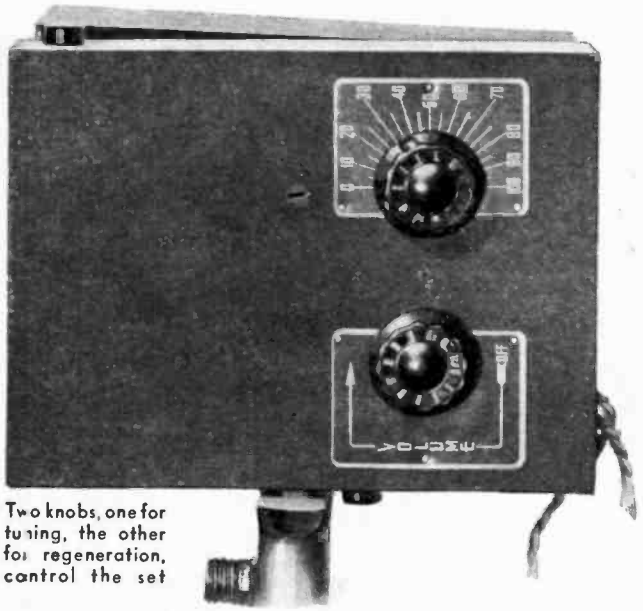
The receiver cabinet with its sliding cover removed to show the three small tubes, tuning condenser, and chassis

Combination Cane and Seat

winding it will be necessary to provide one by winding approximately thirty-five turns of No. 38 double-silk-covered wire around the lower end of the long, flat grid coil.

With the maximum of 45 volts of "B" voltage used, ½ watt, or even ¼ watt, resistors can be used, while a maximum rating of 200 volts is sufficient for the .01 mfd. by-pass and coupling condensers. These condensers can be of the paper or tubular type. All other condensers, however, should be of the mica variety.

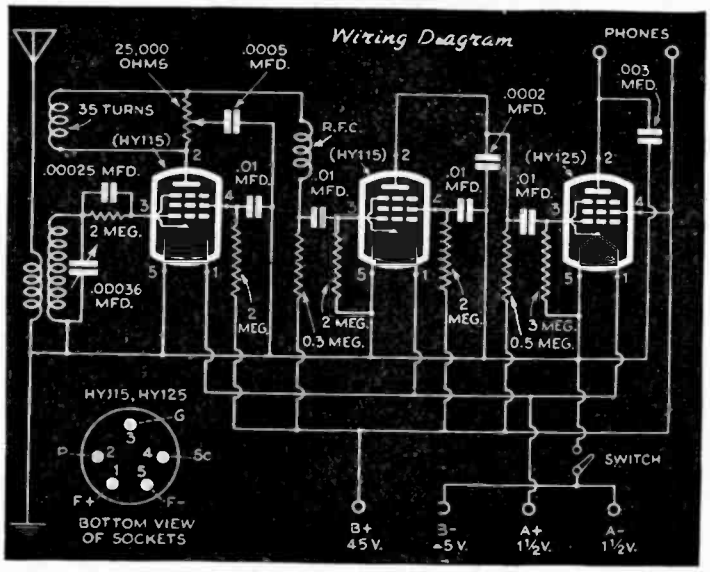
The receiver and its battery supply are housed in two cabinets each 1⅝" by 4¼" by 5½" and mounted on the handles of the cane. Sliding panels serve as covers and make it an easy matter to change batteries or make repairs. The cabinets are fastened to the aluminum handles by means of long bolts and metal bushings.

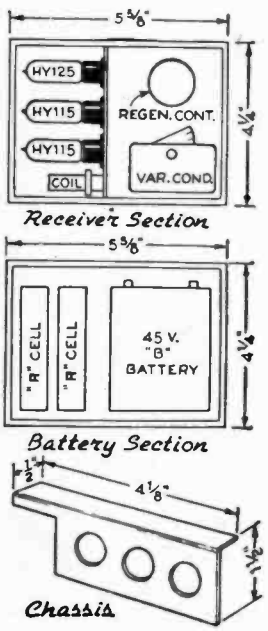


Two knobs, one for tuning, the other for regeneration, control the set

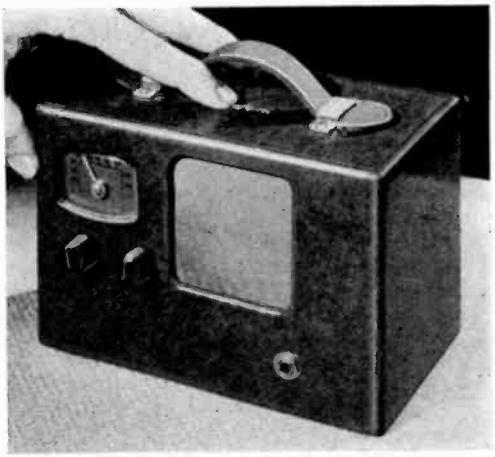
Two 1½-volt cells connected in parallel serve as the "A" battery supply, and may be obtained as a single unit or by breaking open a four-cell "A" battery. The midget 45-volt "B" battery fits snugly beside the "A" cells in the battery cabinet.

For an antenna, a steel fence, the metal cane, or a 35′ piece of wire will serve.





How the circuit should be wired and cabinets and chassis constructed



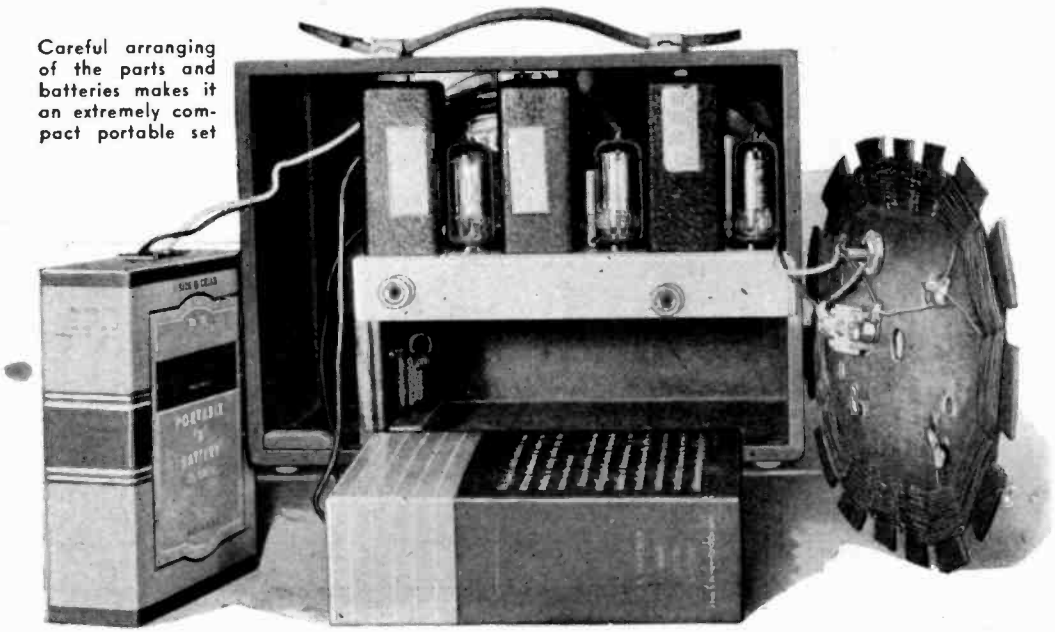
The completed radio, ready to take to vacationland

Midget Portable

FOR YOUR VACATION

FOR SET builders who want a really compact vacation receiver here is the answer. Built around five of the newest midget tubes, the set illustrated requires only two small batteries and weighs only 7¼ pounds complete with loudspeaker and built-in antenna. The superheterodyne circuit is particularly powerful and gives exceptional tone and volume.

The 4¾" by 5⅞" by 8¼" cabinet was built up of 3/16" pressed composition wood, although plywood could be used as well. When the top, bottom, and two end pieces have been cut to size and carefully trued up, each of the four joints should be fastened



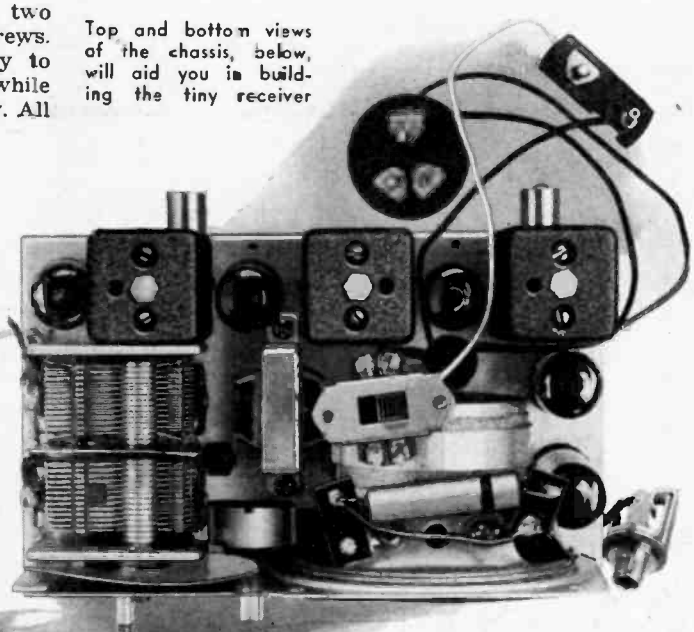
Careful arranging of the parts and batteries makes it an extremely compact portable set

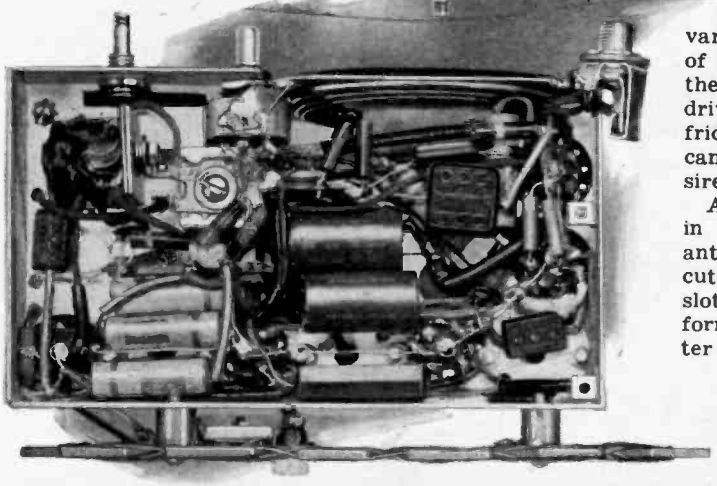
with cellulose cement and two ¼" round-head wood screws. These screws serve mainly to hold the pieces together while the cement dries thoroughly. All holes should be countersunk so the screw heads can be covered with wood putty. As a finish the case can be given two coats of clear lacquer with a sanding before and after the first, and a final rubbing down with pumice and rottenstone after the second, followed with wax.

The receiver itself is built on a 1/16-inch aluminum chassis. The various parts should first be spotted in place and the mounting and connection holes drilled.

A homemade vernier dial is used to drive the

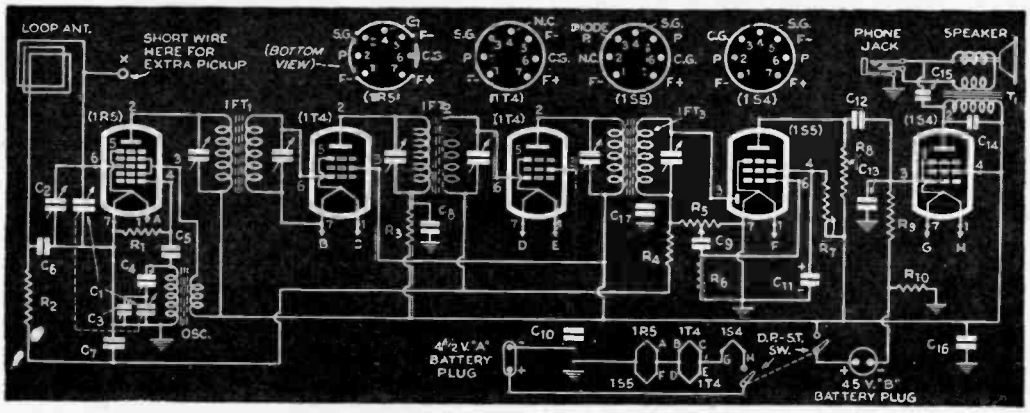
Top and bottom views of the chassis, below, will aid you in building the tiny receiver



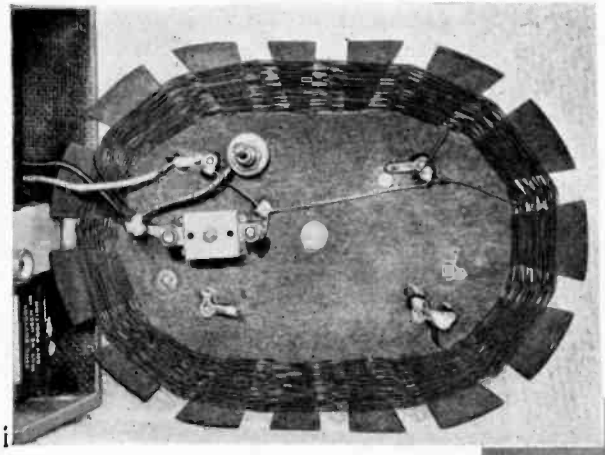


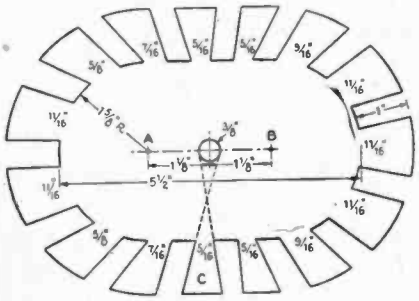
variable condenser. It consists of a celluloid disk fastened to the shaft, and turned by the drive shaft taken from an old friction dial. A regulation dial can be used, of course, if desired.

A fiber form should be used in winding the built-in loop antenna. The tabs should be cut 1" deep all around with the slots ⅜" wide. In making the form first mark the 5½" center line. Then with points A and B as centers, draw semicircles with a 1⅝" radius joining them top and bottom. Place the ⅜"

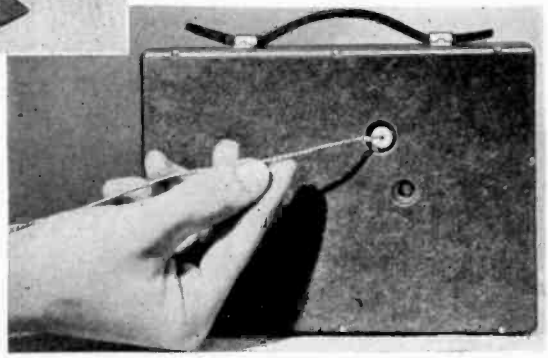


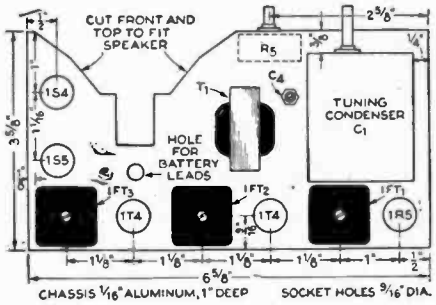
Follow this wiring diagram carefully. The symbols refer to the text and the parts list on the next page





You should have no trouble making this directional loop antenna. Note the extra connection below for attaching a supplementary antenna when desirable





diameter circle at the center of the oval. The figures on each tab show the widths at the inner ends. Starting at tab C, mark the sides by lines such as those shown dotted. Proceed all around the oval in this manner, then cut out the openings. The loop contains 34 turns of No. 24 D.S.C. wire wound on opposite sides of adjacent slots.

A 30-mmfd. trimmer condenser (C_2) should be fastened to the loop form so that it can be reached through a hole drilled in the back of the case. A terminal for the connection of a short wire for extra pick-up in poor localities also should be provided. The loop should be fastened to the rear of the chassis with two screws.

An on-off switch is provided at the top of the case under the handle. For reception of weak signals, or in locations where quiet must prevail, headphones are required. A jack on the front panel is included.

When the set is in use, the loop antenna will be found highly directional, minimum signal pick-up occurring when the plane of the loop is at right angles to the station being received. This minimum, or "null point," can be used for approximate direction finding in the woods or on a boat.

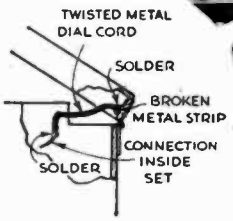
LIST OF PARTS

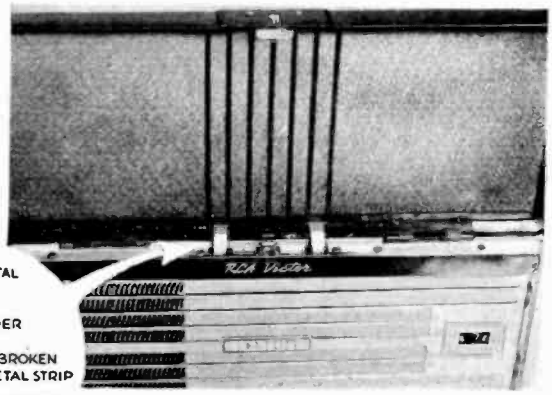
Condensers: C_1.—Two-gang variable, 350 mmfd. each section.
C_2.—Trimmer, 3-30 mmfd.
C_3.—(On C_1).
C_4.—Padder, 500 mmfd.
C_5, C_{11}.—Mica midget, 50 mmfd.
C_6, C_7, C_8, C_9, C_{12}.—Paper, .01 mfd., 400 volt.
C_{10}.—Paper, domino type, 25mfd., 200 volt.
C_{11}, C_{16}.—Midget electrolytic, 10 mfd., 50 volt.
C_{13}.—Mica midget, 100 mmfd.
C_{14}.—Mica midget, .004 mfd.
C_{15}.—Paper, .05 mfd.
Resistors: R_1.—100,000 ohm, ½ watt.
R_2.—.25 meg., ½ watt.
R_3.—20,000 ohm, ½ watt.
R_4.—2 meg., ½ watt.
R_5.—Variable, .5 meg.
R_6.—10 meg., ½ watt.
R_7.—3 meg., ½ watt.
R_8.—1 meg., ½ watt.
R_9.—.5 meg., ½ watt.
R_{10}.—200 ohm, ½ watt.
Transformers: T_1.—Midget, output, 8,000 to 3 ohm.
IFT_1.—Iron-core, input, intermediate frequency.
IFT_2.—Iron-core, interstage, intermediate frequency.
IFT_3.—Iron-core, output, intermediate frequency.
Miscellaneous: Batteries, 3-inch permanent-magnet speaker, five tubes sockets, ¼ pound No. 24 D.S.C. wire for loop, case, etc.

Servicing Your Radio

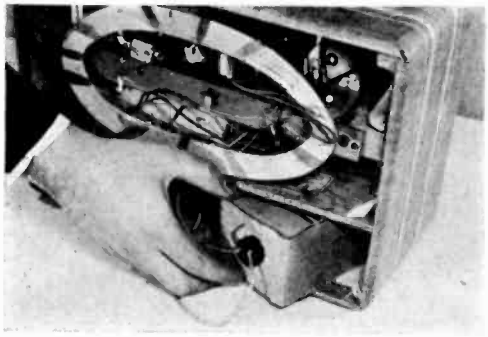
TESTS ON BATTERIES from a portable receiver should always be made with a voltmeter—it is the only testing instrument that will show accurately the effective voltage of a battery. It is risky business to use any other device, including a flashlight bulb or an ammeter, since many of them are likely to affect the life of a battery materially. An ammeter —especially bad to use for this purpose— has a low resistance and will short a battery when placed across it. Invariably it will also give a high reading even when a battery is badly run down.

STRIPS CONNECTING THE LOOP ANTENNA inside the cover of some midget portable receivers are likely to wear and break off near the hinge as a result of frequent opening and closing of the lid. When such a break occurs, reception stops. These metal strips can be repaired, however, with short lengths of twisted metal cord like that used in repairing radio dials. Remove the broken part of the original metal strips at their connection with the two wires inside the set; then solder one end of the cord to each of these wires, and solder the other end to that portion of the strips connected to the antenna.



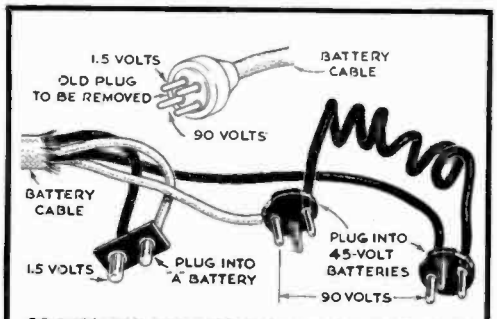


Where a loop-antenna connection is likely to break. Repair it as shown at the left



BATTERIES THAT DO NOT FIT TIGHTLY in their compartment will not knock about if wrapped in corrugated cardboard. A round hole cut in one piece of the material will permit insertion of the battery plug. To conserve your battery, turn off the receiver when it is not in actual use. If you have a three-way set, use electric current when possible. Batteries kept outside the case at 60-deg. temperature may last 18 months.

THREE SEPARATE PLUGS can be substituted for a single battery-pack plug, as shown in the drawing below, to permit use of separate "A" and "B" batteries with a portable if a battery pack cannot be obtained. In removing any plug from a battery, always grasp the plug itself. Never tug on the wire, for this may pull the insulation back, and a short caused by wires touching can render a battery useless in 15 minutes.



CONNECTING SEPARATE PLUGS TO BATTERY CABLE

How the electric speaker set fits conveniently on the head of a bed

BED RADIO

CONVENIENTLY hung over the back of a bed, this small radio will bring programs within easy control of late night readers or convalescents. The cabinet and chassis layout have been carefully planned in order to compress the complete set in as small a space as possible without loss of efficiency.

Measuring 7½" square, and with a depth of only 2¾", the cabinet houses a powerful tuned-radio-frequency receiver with a radio-frequency detector, and audio and rectifier stages. Yet only two tubes are used—an important factor in reducing the overall size. One tube, the 12B8GT, contains an RF pentode and high-mu triode, which are used for the RF and detector stages, respectively. The other tube, the 25A7GT, contains the pentode output amplifier and the half-wave rectifier.

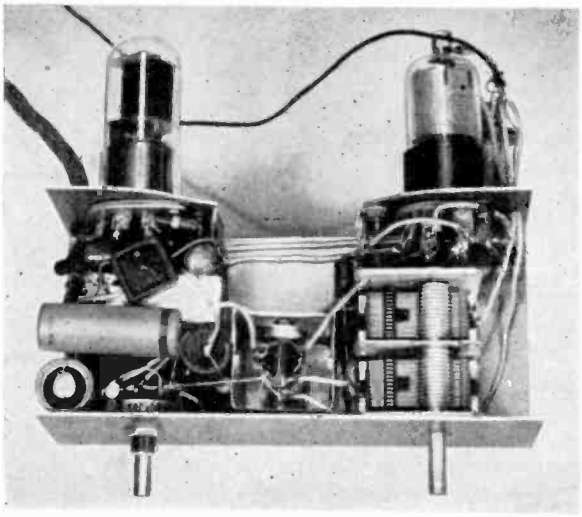
Instead of these tube types, the reader may use the newer low-drain models, the 25B8GT and the 70L7GT. If these tubes are used, the line-cord resistor will have to be changed to one having a built-in resistance of 135 ohms instead of 220 ohms. Also, the connections to the 70L7GT tube differ slightly. Connections to the 25B8GT are similar to those of the 12B8GT. No other changes are necessary in the circuit.

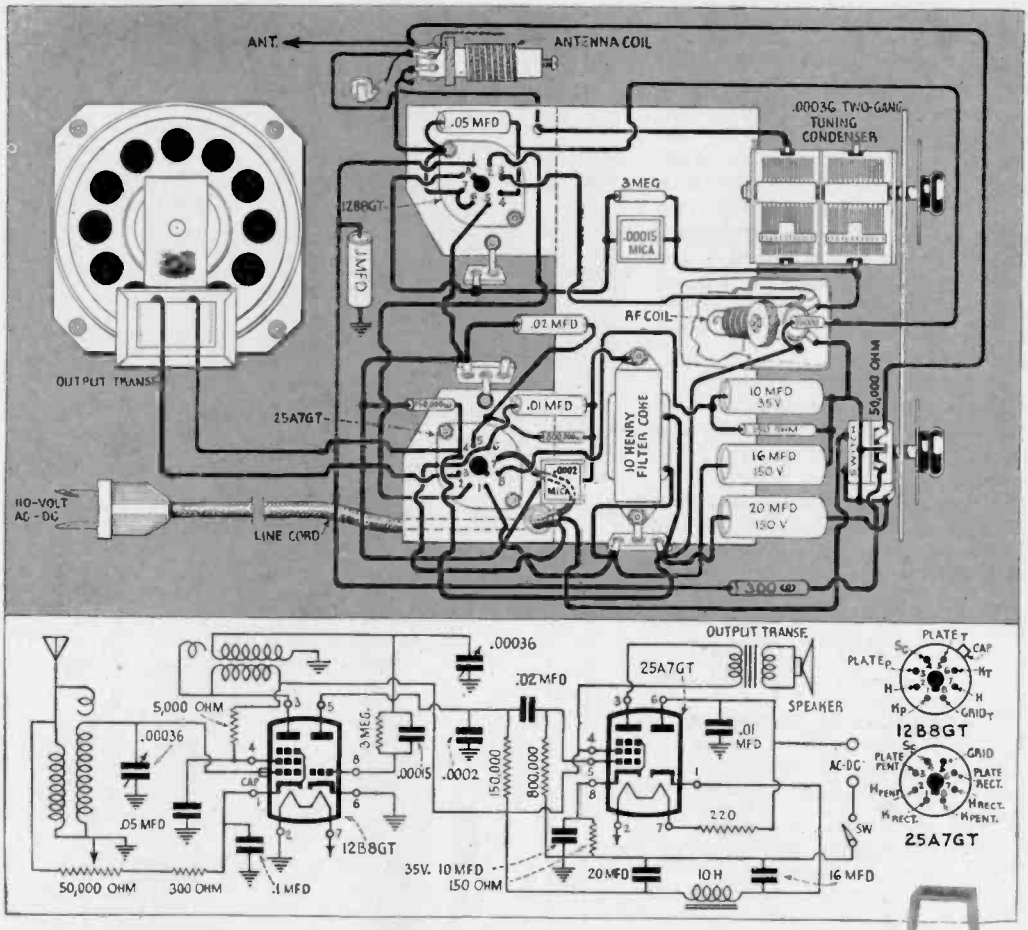
A compact two-gang variable condenser tunes the antenna and the RF coils. The antenna coil is unshielded, and is mounted right next to the 12B8GT tube. The RF coil, though shielded, is mounted in an unconventional way — upside down. However, it is still thoroughly shielded and in this new position makes the wiring of the set a lot easier. The small screw on top of the can, which holds the coil in place, is unscrewed and passed through a hole in the chassis to anchor the shielding can and coil securely in place.

Volume is controlled in the conventional manner, by varying the grid bias on the RF tube, using a 50,000-ohm potentiometer between the antenna and cathode of the RF pentode. A 300-ohm, ½-watt fixed resistor in series with the potentiometer keeps the tube always slightly biased. Ganged with the 50,000-ohm volume control is the S.-P., S.-T. on-and-off switch. To provide greater stability in the RF stage, the screen of the pentode (12B8GT) is decoupled by means of the 5,000-ohm, ½-watt resistor and the .05-mfd. tubular by-pass condenser.

The cabinet is constructed of pine, with

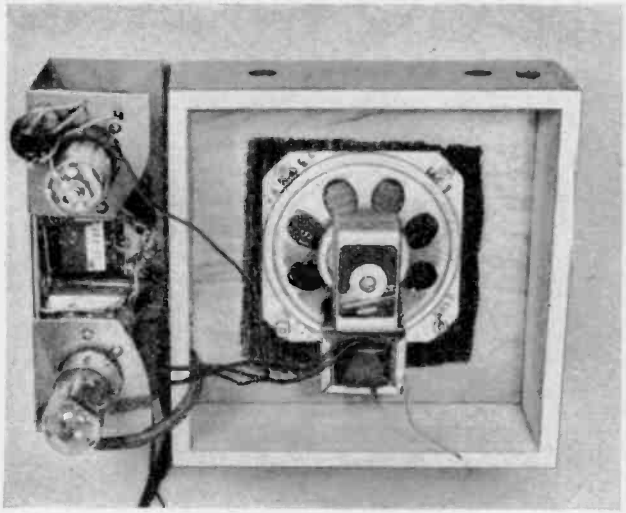
The wired chassis looks like this before being placed in the cabinet. Careful designing makes it extremely compact

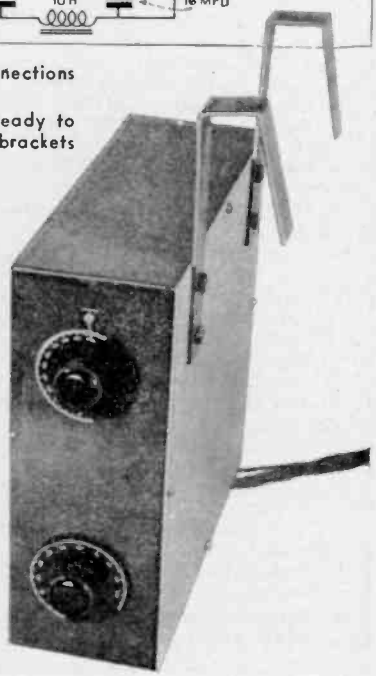




The pictorial diagram above makes it easy to follow the wiring connections

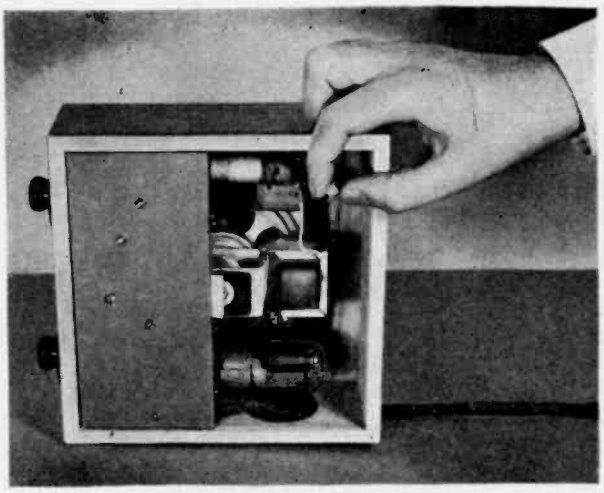
View below shows the cabinet and speaker, with chassis ready to be installed. Right, angle view of the finished set and brackets



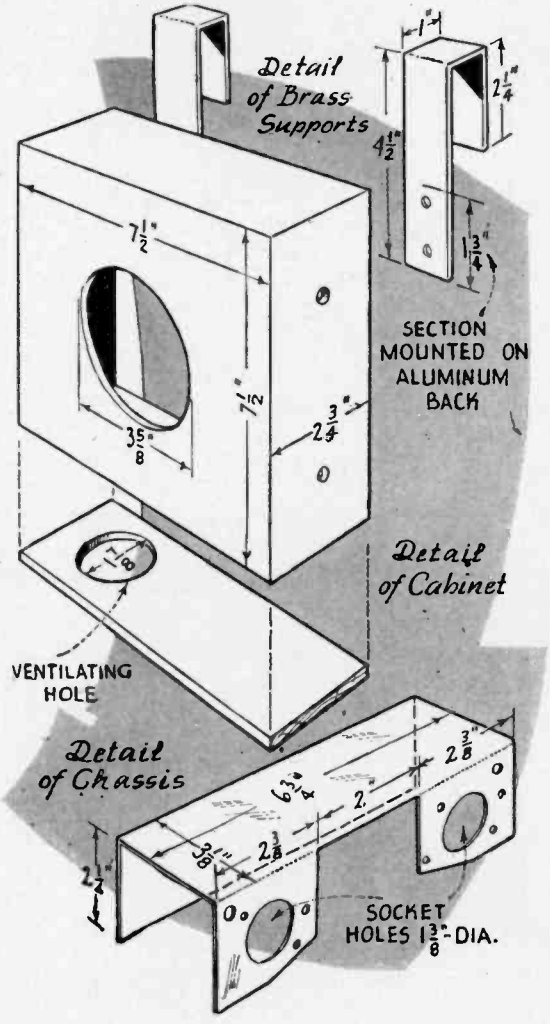


the sides ⅜" thick and the front about 5/16". A round hole of 3⅝" diameter is cut in front for the speaker and decorated with a round escutcheon from a tuning dial. The escutcheon may be purchased separately at any large radio store. Aluminum 1/16" thick is used for the back. To it, two brass strips ¾" wide, previously bent in a vise, are attached—each with two 6/32 machine screws and hex nuts. The angles shown in the drawing will do for most low-backed beds.

The large ventilator hole on the bottom side of the cabinet prevents the heat generated by the tubes from remaining inside the cabinet and melting the wax insulation on the tubular condensers, or causing damage to the finish on the bed (if wood) by heating up the aluminum back.



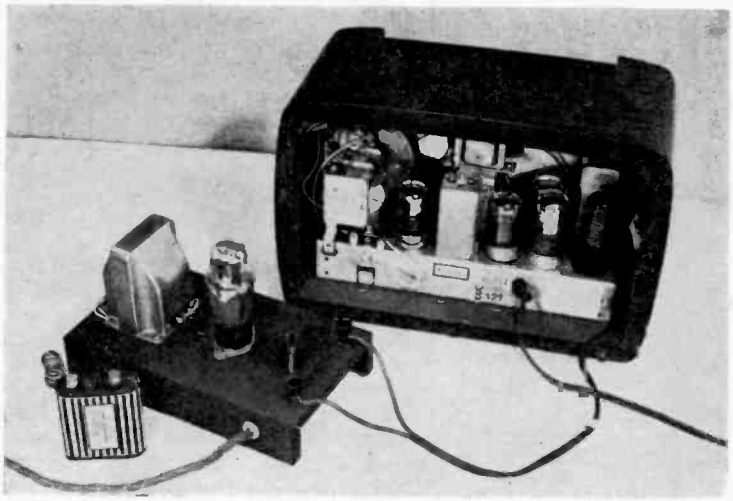
Rear panel before mounting. Chassis and cabinet details below



LIST OF PARTS

Two-gang tuning condenser, .00036 mfd.
Antenna coil, unshielded.
RF coil, shielded.
Filter choke, 10 henry.
Line cord, 220 ohm (see text).
12B8GT tube (see text).
25A7GT tube (see text).
Permanent-magnet speaker, 4".
Output transformer.
Potentiometer, carbon, 50,000 ohm.
S. P. S. T. switch.
Octal wafer sockets (two).
Carbon resistor, 150 ohm, 1 watt.
Carbon resistor, 300 ohm, ½ watt.
Carbon resistor, 5,000 ohm, ½ watt.
Carbon resistor, 150,000 ohm, ½ watt.
Carbon resistor, 800,000 ohm, ½ watt.
Carbon resistor, 3 meg., ½ watt.
Electrolytic condenser, tubular, 10 mfd., 25 volt.
Electrolytic condenser, tubular, 16 mfd., 150 volt.
Electrolytic condenser, tubular, 20 mfd., 150 volt.
Tubular condenser, .1 mfd., 400 volt.
Tubular condenser, .05 mfd., 400 volt.
Tubular condenser, .02 mfd., 400 volt.
Tubular condenser, .01 mfd., 400 volt.
Mica condenser, .00015 mfd.
Mica condenser, .0002 mfd.

Suppressor Built from Junked Parts Reduces Man-Made Static



Left, the unit connected to a small AC-DC receiver. It may be used with almost any type of radio

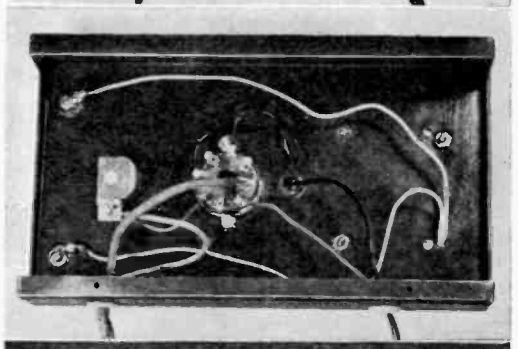
A top view of the unit is shown in the first photo below. Few connections are necessary, as can be seen in second photo. Drawing shows how the static suppressor is hooked up to a receiver

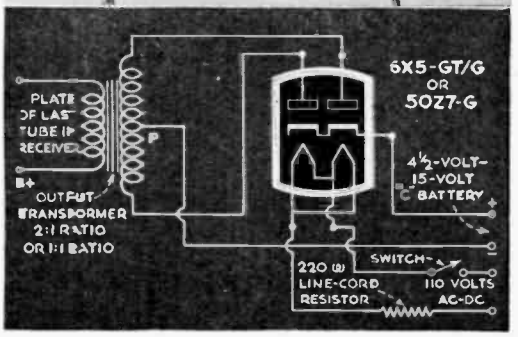
OWNERS of sets ranging all the way from headphone "one-lungers" to 12-tube console models may find good use for this static suppressor. Easily attached across the output circuit, it will in most cases reduce severe man-made static by at least 50 percent. There is a slight loss of volume, but this can be overcome by turning the volume control.

The unit comprises a full-wave rectifier tube (such as the 6X5-GT/G or 50Z7-G), a push-pull output transformer, a 220-ohm line-cord resistor, a S.P.S.T. toggle or rotary switch, and a 4½-volt "C" battery. The secondary of the output transformer must have a high resistance. One of the old output transformers used with magnetic speakers will do admirably, and may be retrieved from the junk box. A class "B" interstage transformer might be tried, but make sure that the primary winding passes enough current. It is useless to attempt to use a transformer with an 8-ohm secondary.

Any kind of chassis, wood or metal, may be employed. The transformer, eight-prong tube socket, and switch are mounted on the top of the chassis. Drill ½" holes in the back for the line cord and the two leads to the "C" battery. The secondary leads of the output transformer (primary side if it is a class "B" interstage transformer) are connected to two plastic binding posts, which provide connections to the set.

Remove the radio chassis from the cabinet. Connections are then made to the plate of the last tube and the B+ lead. The leads from the unit to the radio chassis should not exceed 3' or 4'.





LIST OF PARTS

Chassis, metal or wood
Full-wave rectifier tube 6X5-GT/G or 50Z7-G
Eight-prong octal wafer socket
Output transformer (see text)
Small "C" battery, 4½ volts
Line-cord resistor, 220 ohms
Binding posts (2)
Rotary or toggle switch, S.P.S.T.

BATTERIES POWER COMPACT

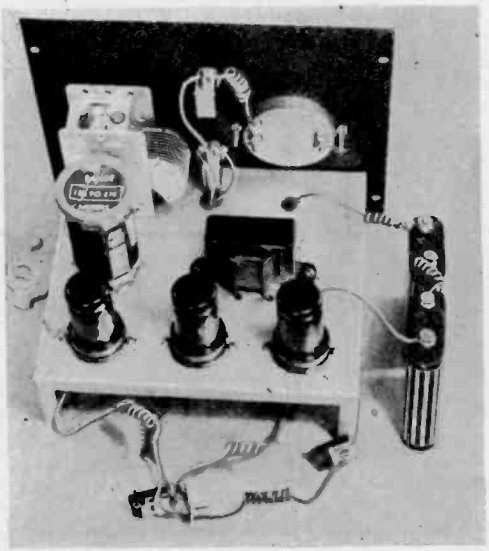
EMERGENCY RECEIVER

This portable set, designed for defense organizations, picks up near-by broadcasts without the use of a ground

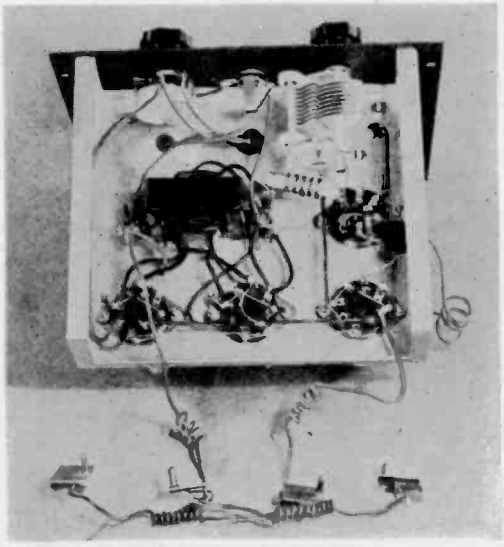
DESIGNED to meet the requirements of defense organizations, this is a portable emergency short-wave receiver that eliminates the use of bulky "B" batteries without sacrificing power, quality, selectivity, or sensitivity. Instead of the usual 90- to 135-volt "B" batteries, the metal carrying case comfortably encloses, in addition to the usual "A" battery, two small "C" batteries which reduce the plate voltage to eight or nine and cut the filament voltage in half. Since the "emission life" of a tube is greatly lengthened when operating at a reduced voltage, the life of the tubes in this novel receiver may be at least doubled.

The new single-ended, all-metal 6.3-volt AC-DC tubes (6SJ7) or the single-ended glass type 1½-volt battery tubes (1SA6GT) can be interchanged in the set without any rewiring. The choice of either tube depends on whether you want a husky tube that will take more abuse in the field or a tube that will conserve the batteries to their limit. The metal tubes consume more electricity, but they are more robust for portable use and are slightly more sensitive. The glass tubes conserve electricity, but they are not so serviceable in the field.

Filament voltages are extremely critical in both types of tubes and any variation—even as little as 1/10 of a volt—will reduce the power of the receiver. In fact, if the tubes are



Tubes shown here are the new all-metal, 6.3-volt 6SJ7 type, but battery 1SA6GT tubes will serve

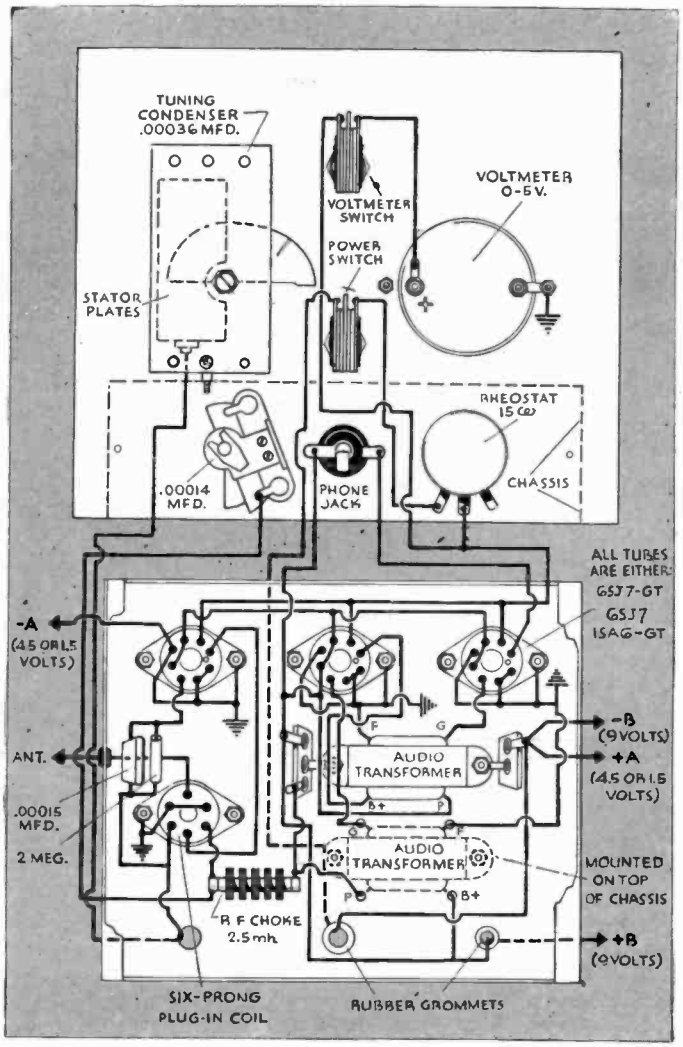


View of the receiver chassis from the underside, showing the wiring and connection to phone clips

operated at their normal voltages, the set will stop functioning. For this reason a voltmeter is placed on the front panel for a visual indication of the "A" batteries' current. The knob directly under the voltmeter operates a 10- to 15-ohm rheostat which controls the filament supply.

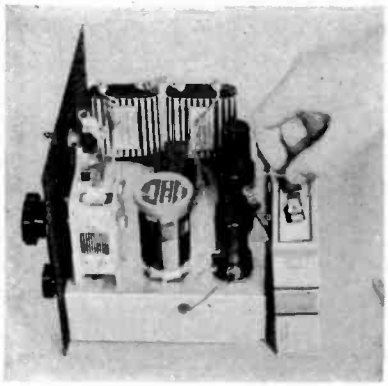
But for special tube connections, the set is built with a standard detector plus two audio-frequency amplifying stages. Interstage coupling is achieved by means of two unshielded 1:3 audio transformers, one mounted above the chassis and one below. The output of the receiver is fed directly into a pair of magnetic 2,000- to 4,000-ohm headphones. These phones can be plugged into the front of the panel.

Plug-in coils enable an operator to tune in on various wave bands ranging from 16 to 1,000 meters. This includes ship-to-shore, broadcast, aviation, police, foreign, and domestic transmission. If

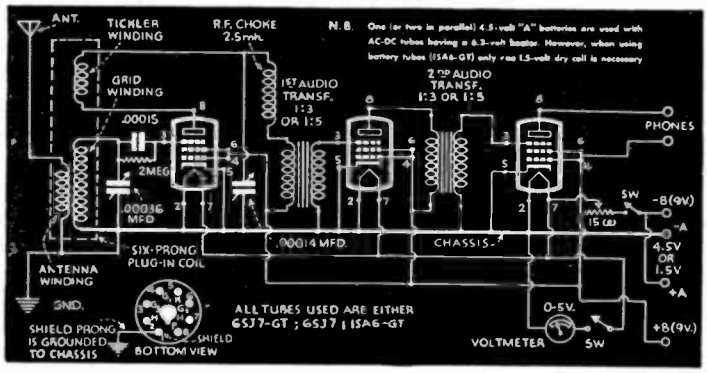


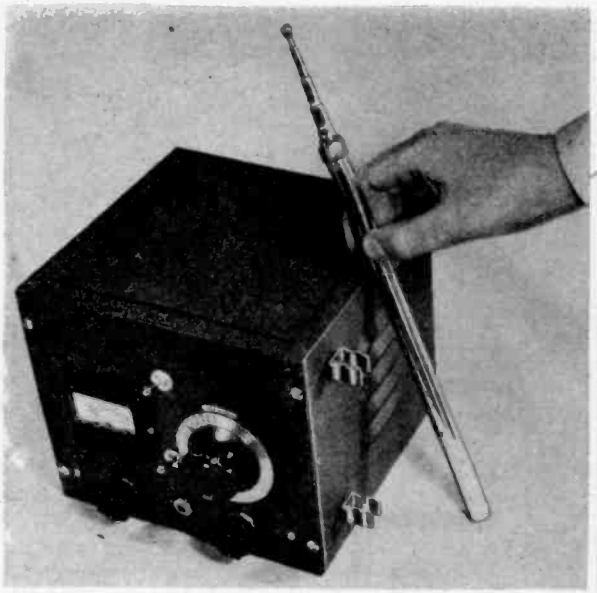
Pictorial diagram of the compact, portable emergency receiver. This shows in detail the placing of the parts both on the chassis and on the front panel. In making the connections, solder should be used

Two midget "C" batteries with low voltage replace the bulky "B" battery, lengthening the "emission life" of the tubes

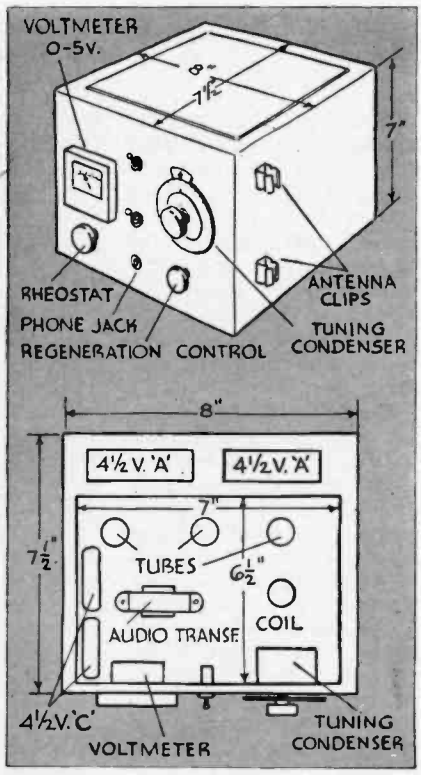


Below is a complete wiring diagram in simplified form to be followed in making connections. A tickler-winding coil is used in the antenna





Clips on the cabinet next to the tuning condenser hold the telescopic, metal antenna when the radio is in operation. These clips must be fully insulated from the metal cabinet



the set should fail to oscillate on a particular band, this may be remedied by increasing the capacity of the variable condenser used for regeneration to .00036 or by increasing the number of turns on the tickler winding. It should be noted that the coil specified by the manufacturer for use as the tickler winding is used instead as the antenna winding.

Batteries and headphones can be housed in the metal carrying cabinet. When the operator is ready to use the set, he merely removes the headphones from the case and plugs them into a jack on the front of the panel. Two inexpensive luggage straps, purchased from the five-and-ten-cent store, can be placed around the cabinet for carrying purposes.

The antenna consists of a telescopic metal rod similar to those used on cars. It is clipped to the cabinet next to the tuning condenser when the set is in operation. The clips must be fully insulated from the metal cabinet, which is connected to the ground circuit.

If the receiver is operated within 20 or 30 miles of a transmitter, it will work efficiently without a ground connection. For distant or weak stations, however, a ground must be used. A suitable ground can be made by connecting 5′ of insulated wire to a metal rod about 5″ long and 1½″ in diameter. The wire should be connected to either the front panel or the chassis and the rod inserted in the ground.

The emergency receiver shown in the illustration was constructed for about $15, but changing conditions in the radio-equipment field make it impossible to give any definite figures on cost. The set has been tested under adverse conditions where reception was faint on similar radios and has given excellent results.

LIST OF PARTS

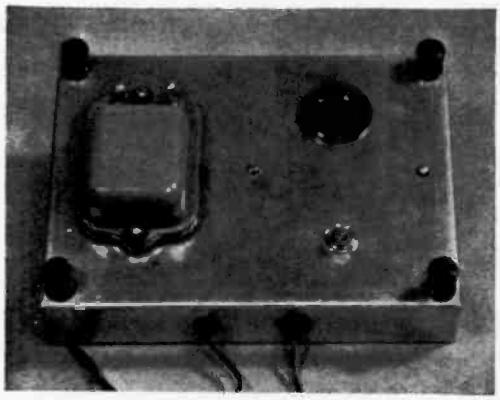
Black wrinkled steel cabinet, 7″ by 7½″ by 8″.
Cadmium-plated steel chassis, 2″ by 5½″ by 7″.
Telescopic chrome-plated antenna.
Tuning dial, 2¾″ diameter.
Octal wafer sockets (3).
Six-prong coil socket.
Six-prong broadcast and short-wave coils.
Tuning condenser, .00036 mfd. or .00014 mfd.
Regeneration condenser, .00014 mfd. or .00036 mfd.
Audio transformers (2), unshielded, 1:3 or 1:5 ratio.
Ground clamp and wire.
RF choke, 2.5 millihenrys.
Rheostat, 10-15 ohms.
Voltmeter, 0-5 volts.
Toggle switches (2).
Phone jack and plug.
Mica condenser, .00015 mfd.
Carbon resistor, 2 megohms, ½ watt.
Midget "C" batteries (2), 4½ volts.
"A" battery, 1½ or 4½ volts.
Pentode amplifier tubes (3), 6SJ7 or 1SA6GT.

The operator taps out a code message on an ordinary telegraph key. Below he sights along the barrel to aim the flash light

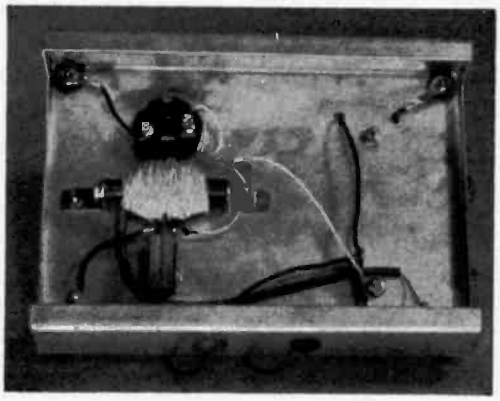
LIGHT-BEAM TRANSMITTER

CODE MESSAGES that can be detected only with a specially built receiver may be sent with this light-beam transmitter. With a 3- or 4-cell flash light, preferably of the type with which the light rays can be focused into a spot, messages can be sent up to 200 feet. By increasing the voltage of the buzzer circuit from 7½ to 22½ volts and using a more powerful light, this range can be increased.

The transmitter works on the same principle as a radio broadcast transmitter. The light waves from the flash light act as the carrier wave, and the code signals tapped

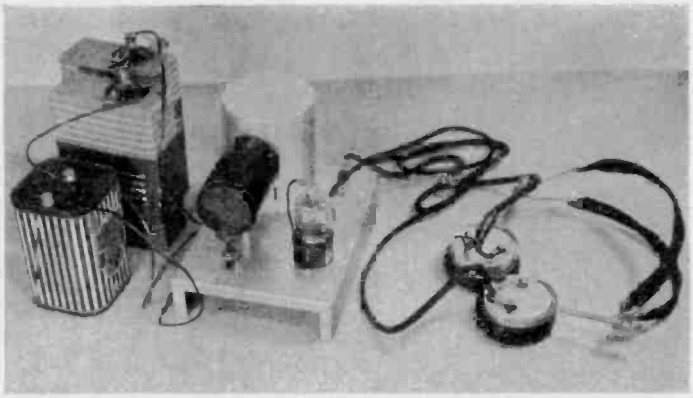


The top of the transmitter. Note rubber grommets



Bottom view shows handmade coupling transformer

The receiver, showing the photo-electric cell shield and the magnifying glass, connected by a black tube

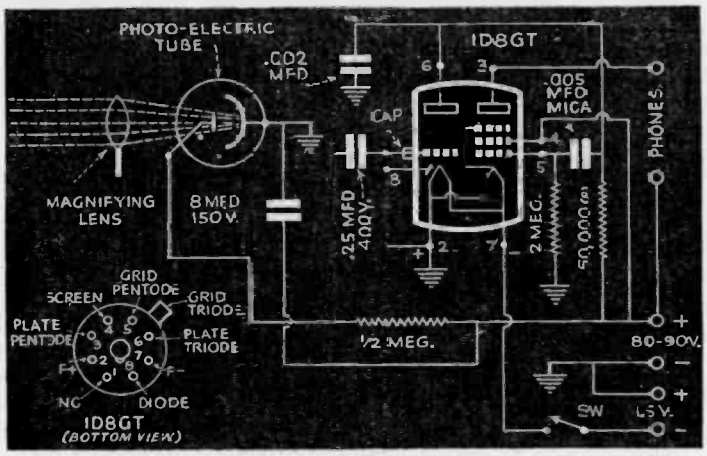


out on the telegraph key are superimposed on this light beam. Light variations forming the message are invisible, and to all appearances the rays from the flash light form a steady beam.

With this device, messages can be sent through windows, foliage, or anything that allows at least part of the light beam to reach the receiver.

A gas-filled photo-electric tube is used as a detector in the receiver, and this is followed by a two-stage, resistance-coupled audio amplifier. The photo cell transforms the modulated light beam into sound which is amplified by the audio stages.

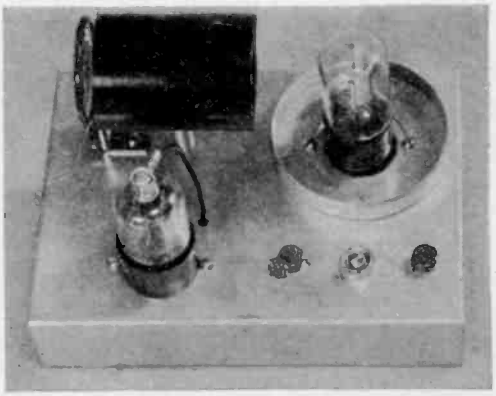
As a matter of fact, any good audio amplifier can be used after the detector stage. Care must be taken, however, to see that the photo tube never has more than 90 volts on its plate, to avoid damaging the tube.



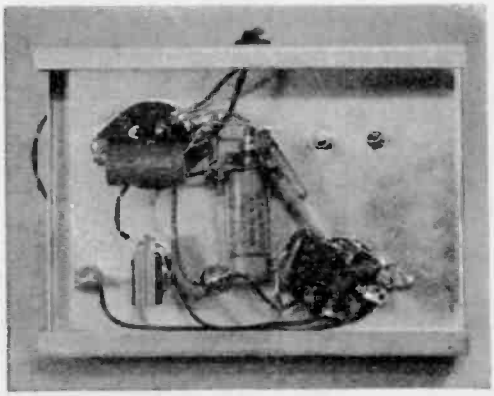
Schematic diagram of the receiver, with a bottom view of the 1D8GT tube

To focus the rays of light from the transmitter, a magnifying glass is placed 4" from the curved cathode inside the photo tube. To enable the receiver to work in a lighted room or outdoors (if the sun is not too bright) a black composition tube, 1¾" in diameter and 2½" long, is placed between the can and the magnifying lens.

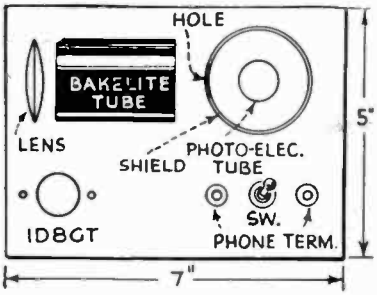
For the amplification a 1D8GT tube with



The top of the receiver with the shielding taken off



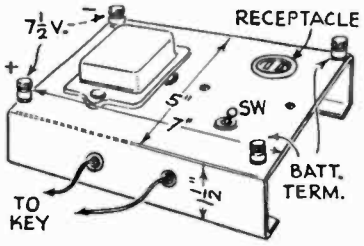
A bottom view, showing the condensers and resistors

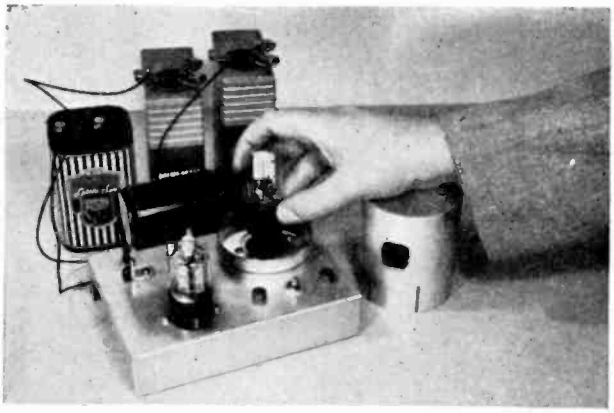


a 1.4-volt filament is used. To operate the receiver, two 45-volt "B" batteries and a 1½-volt "A" battery are needed.

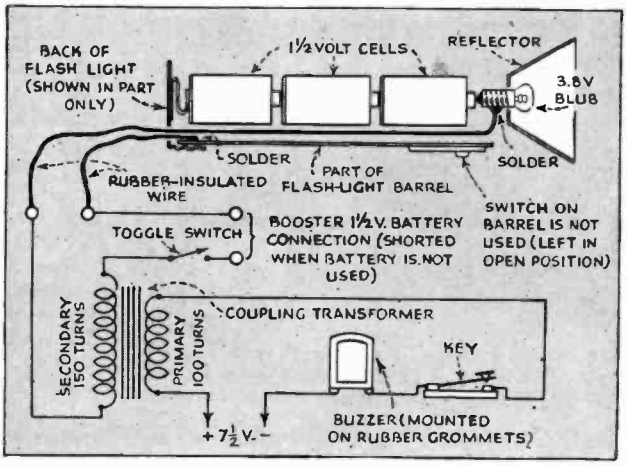
If the photo-electric cell fails to operate during reception of a signal, discharge the .25-mfd. condenser by shorting it.

To make the coupling transformer used in the transmitter, use an iron core made from an old chisel or a hollow iron shaft about ½" in diameter. Around this wind 100 turns of No. 24 d.c.c. wire and then another 150 turns of the same wire to form the primary and secondary windings.





Putting the photo-electric tube in place. Note the hole in the shield. At the left is the detail of the receiver chassis



The transmitter circuit. The chassis detail is at the left

LIST OF PARTS FOR THE LIGHT-BEAM SET

Transmitter

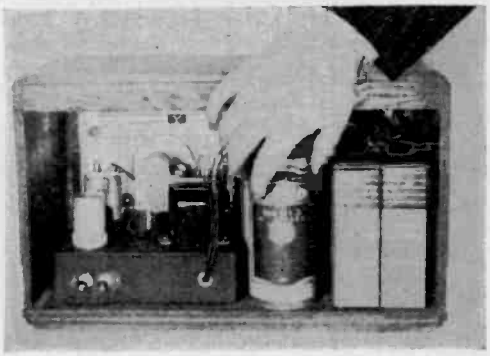
Three-cell flash light (with metal barrel)
Four-section tripod.
Metal chassis (7" x 5" x 1½").
Household buzzer.
7½-volt "C" battery.
Telegraph key.
Special coupling transformer.
S. P. S. T. toggle switch.
Four insulated binding posts.
Spool of No. 24 d. c. c. wire.

Receiver

Photo-electric cell, type 923.
Dual amplifier tube, type 1D8GT.
Four-prong socket, wafer type.
Eight-prong socket, wafer type.
Metal chassis (7" x 5" x 1½").
Coil shield.
Electrolytic condenser, 8 mfd., 150 v.
Paper tubular condenser, .25 mfd., 400 v.
Paper tubular condenser, .002 mfd., 400 v.
Mica condenser, .005 mfd.
S. P. S. T. toggle switch.
Insulated 'phone terminals.
Carbon resistor, 500,000 ohms, ½ watt.
Carbon resistor, 50,000 ohms, ½ watt.
Carbon resistor, 2 megohms, ½ watt.
Two portable "B" batteries, 45 v.
Midget "little six" "A" battery, 1½ v.
Black tubing 2½" long.
Pair of head 'phones, 2,000 or 4,000 ohms.
Approximate cost of receiver parts is $5.84.
Transmitter, 3.10.
Batteries for both sets, 1.86.
Prices include tubes.

BLACKOUT RECEIVER

Battery-Operated Set with Only Two Tubes Costs Little to Run

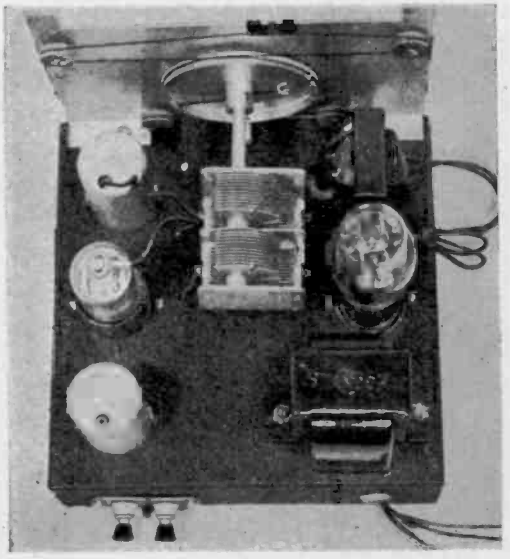


This is a back view of the cabinet shown above at right. The 2" by 7" by 7" chassis is on the left, and the "A" and "B" batteries are seen at the right

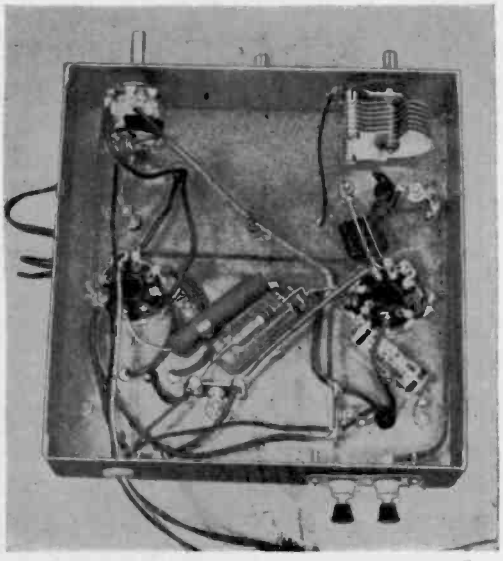
ALTHOUGH two tubes usually are needed just for the push-pull stage in a receiver, here is one with only two tubes multiplied into an RF stage, a high-mu detector stage, and a push-pull output stage using two pentodes! Powered by dry batteries, this receiver is especially useful in the home in case of a blackout and is extremely economical to operate.

The 3A8-GT tube is a combination RF pentode and a high-mu triode detector, while the 1E7-G tube is a twin pentode. The filaments of the 3A8-GT are connected in series (2.8 volts), and operated straight off a 3-volt "A" supply without a filament re-

Below, a top view of the chassis. Note the small push-pull output transformer behind dial at the left



Bottom view of the receiver chassis. The wiring is simple and should be an easy job even for a beginner



sistor. However, the filaments of the 1E7-G draw 2 volts at .24 amperes so that it is necessary to insert an 8-ohm semivariable resistor in series with the filament prong (No. 7) of the tube and the chassis.

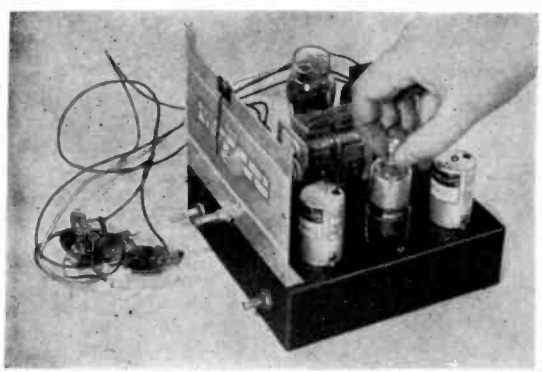
No "C" battery is required, the necessary voltage being obtained through a resistor placed in the "C" return lead of the push-pull audio transformer. For best results and greatest volume the plate voltage ("B"-battery supply) should be increased from the usual 90 to 135, which means the use of three instead of two 45-volt "B" batteries. However, excellent results can be obtained with just two 45-volt "B" batteries. No ground is necessary.

A 250,000-ohm variable resistor in the screen circuit of the 3A8-GT's pentode controls the volume. Tuning is accomplished by means of a two-gang, .00036-mfd. tuning condenser. On the right side facing the cabinet is a third control—a .0001-mfd. variable condenser connected across the antenna tuning condenser. As it is not always possible to obtain perfect tracking across the entire broadcast band with a battery receiver, this additional trimmer condenser is used to balance the RF and detector stages. It does not have to be set for each station—just portions of the broadcast band. The small trimmer condenser already on the antenna tuning condenser is not used and is left at minimum capacity.

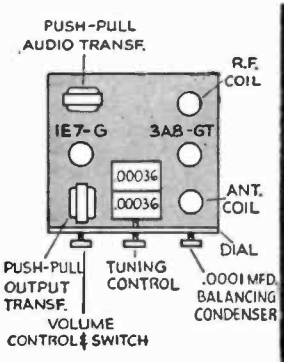
The cabinet measures 8½" by 9½" by 15½" to accommodate the batteries and a six-inch, permanent-magnet speaker. The chassis is 2" high and 7" square.

LIST OF PARTS

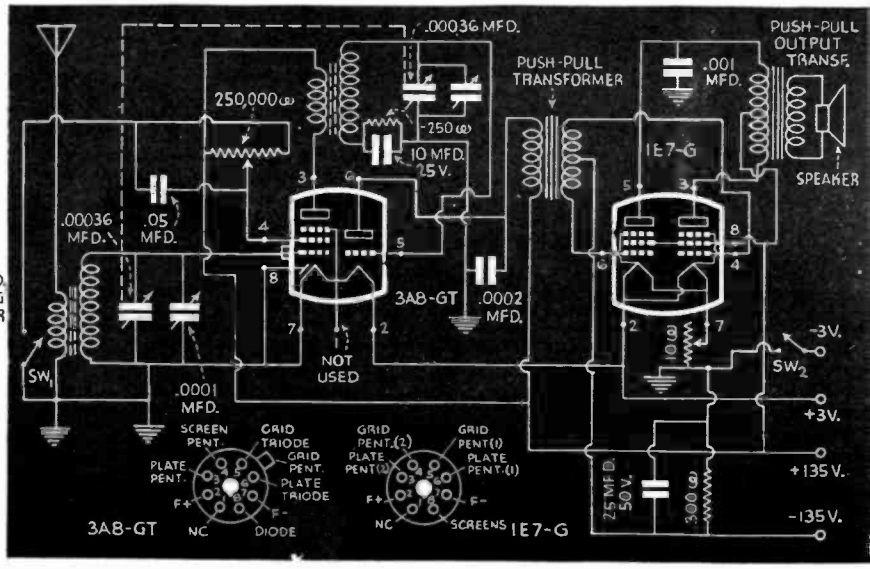
Cabinet, 8½" by 9½" by 15½".
Black wrinkle chassis.
PM speaker, 6". Slide-rule dial.
Push-pull output transformer.
Push-pull interstage transformer.
Tuning condenser, 2-gang, .00036 mfd.
Iron-core shielded antenna coil.
Iron-core shielded RF coil.
Variable condenser, .0001 mfd.
Tubes: 3A8-GT and 1E7-G.
Octal sockets.
Variable resistor, 250,000 ohm.
Coverplate switch, 3-position.
Paper tubular condenser, .05 mfd.
Electrolytic condensers, 25 mfd., 50 volt, and 10 mfd., 25 volt.
Semivariable resistor, 10 watt, 8 ohm.
Antenna-ground binding post.
Carbon resistor, 300 ohm, ½ watt.
Mica condenser, .0002 mfd.
Mica condenser, .001 mfd.



Left, view of chassis showing the 3A8-GT tube being placed in its socket. At its left and right are the antenna and RF coils. Wiring is diagrammed below

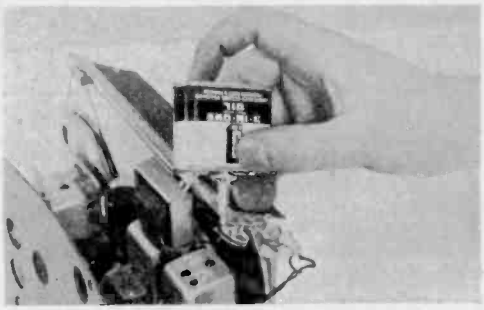


The layout of the various parts of the receiver is shown in the drawing above, actually a top view of the chassis. Follow it carefully in building the set

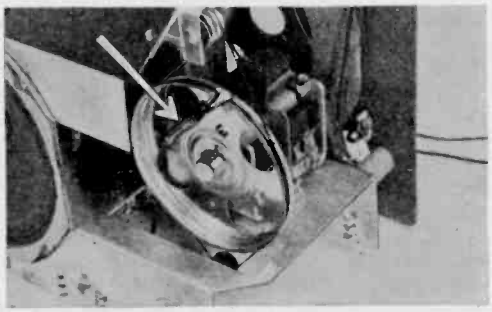


Servicing Your Radio

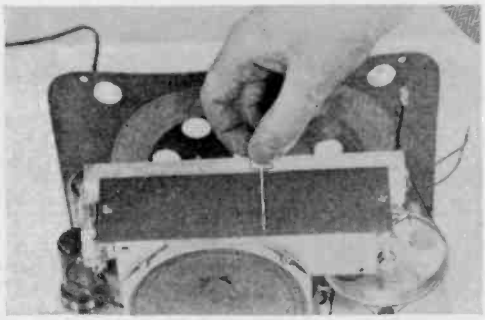
DIAL troubles often can be corrected easily. Many of the older AC-DC midgets have a direct-drive dial, in which the tuning knob is mounted right on the shaft of the tuning condenser. The only thing that can go wrong with this type is a loosening of the knob, which is remedied by tightening the set screw. Slightly more complicated are the friction drives using a belt or cord. The photographs below show various troubles encountered on these sets, and how they can be eliminated.



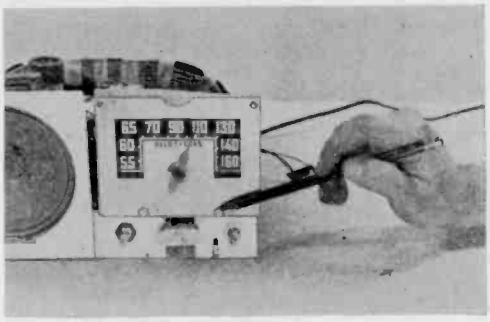
A squeaky slide-rule dial is remedied easily by a little oil on the wheels over which the dial cord runs. Oil very lightly with a light lubricant, being careful not to get any oil on the cord itself



In some friction-drive dials, the cord is kept taut by a spring behind the dial plate as shown above. To tighten the cord, it is necessary only to remove the spring and make another knot in the drive cord

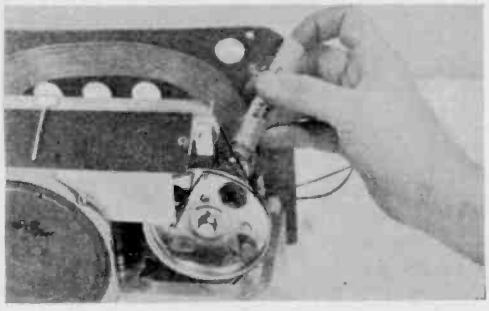


If the pointer is not calibrated properly with the frequency marks on the dial, it is an easy matter to move it to the correct position. Once it is set properly for one station, it will be correct for all



To get at a spring behind the dial plate as shown in the photograph above, it is necessary to take off the plate. To do this, loosen the two hex nuts indicated by the pencil in this illustration

A slipping belt, when it is not too serious, can be remedied by applying a special wax obtainable in stick form. Rubbed lightly on the belt as shown, it usually is found to give a smoother-working dial

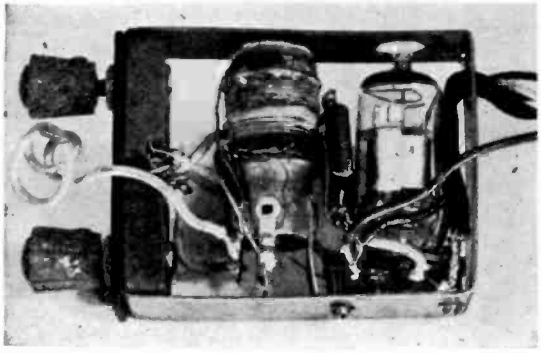


If moving plates touch fixed plates in a tuning condenser, loud static is produced whenever the dial is touched. On most condensers this can be corrected by adjusting with a screw and lock nut

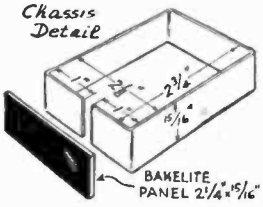
Vest-Pocket Receiver

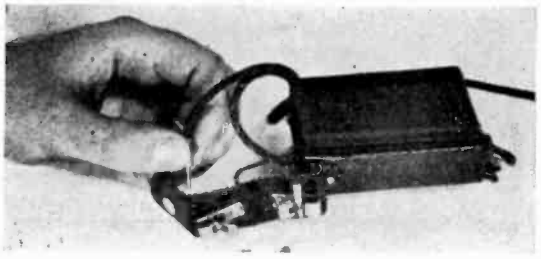
Really small enough to fit into the vest pocket

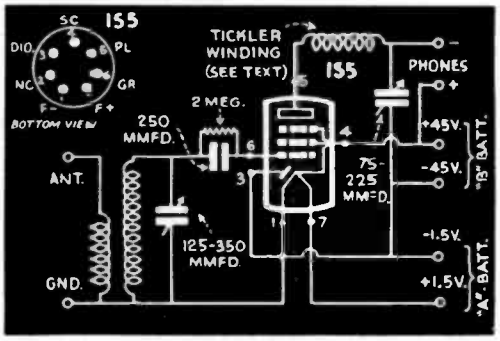
BUILT into a simulated-leather playing-card case, this one-tube receiver is powerful enough to get distant stations. The tube is the new all-glass 45-volt miniature diode pentode (1S5) with the unused diode portion grounded directly to the chassis or "A" minus. A "vest pocket" 45-volt "B" battery should last three or four months and an ordinary flashlight "A" battery will give several hours of use. Padder (compression) condensers less than 1" square are used, one for tuning and one for regeneration. They tune only about half the broadcast band, so the capacity most desirable should be decided before purchasing. An unshielded antenna coil, to which a tickler winding may be added by winding 15 to 20 turns of No. 30 d.c.c. wire to the lower portion of the grid winding, is satisfactory. Oscillation may be reduced by decreasing the turns or stepped up by reversing the connections to the tickler coil. No ground is used. The aerial is 20' or 30' of loose insulated wire.



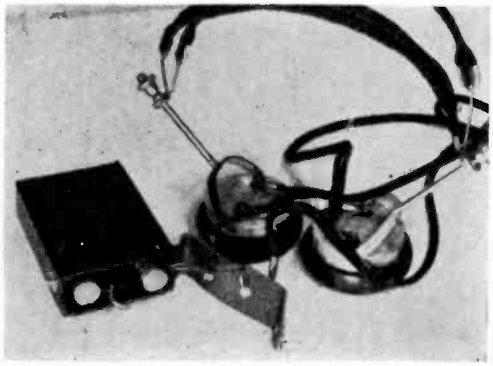
Two padder condensers, one 1S5 glass pentode, an unshielded antenna coil, and two batteries are used. Two Fahnestock clips on the card-case cover connect to phones. No ground is necessary





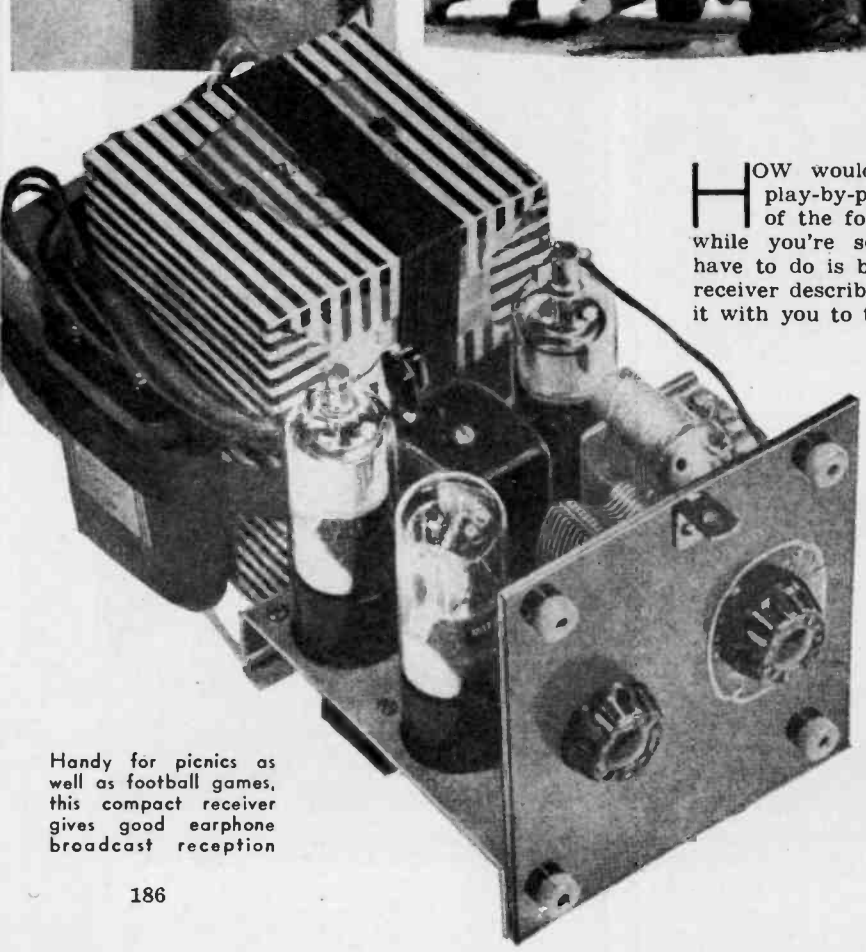


Above, a complete wiring diagram for the one-tube receiver, and below, the radio in its tiny case, showing tuning and regeneration controls, phones hooked up, and (between knobs) antenna connection



Football-Fan's Radio

WITH THIS COMPACT RECEIVER, YOU CAN LISTEN TO THE BIG-GAME BROADCASTS AS YOU WATCH THE PLAYS



Handy for picnics as well as football games, this compact receiver gives good earphone broadcast reception

HOW would you like to hear a play-by-play radio description of the football games you see—while you're seeing them? All you have to do is build the compact radio receiver described on these pages, take it with you to the next big game, and tune in on the radio broadcast of the game while you watch. When the final whistle blows, you'll know a lot more about the plays you saw than will your neighbors in the football stands.

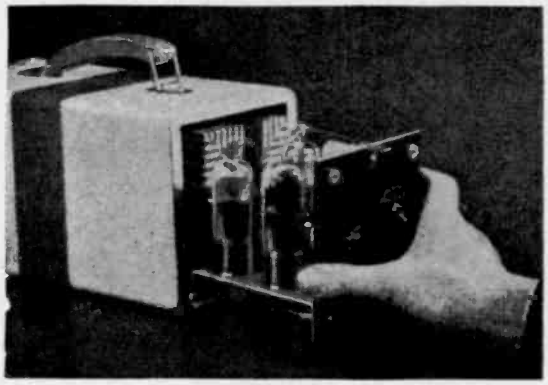
The cabinet of the receiver, designed to look like a vacuum bottle, is compact enough to be carried under the arm, and contains both the receiver circuit and the batteries. Open at one end and closed at the other, it measures 4½" by

Several spectators at a football game can use this receiver at once. Compact and provided with a convenient handle, the receiver has its own built-in battery supply, and operates on a short antenna

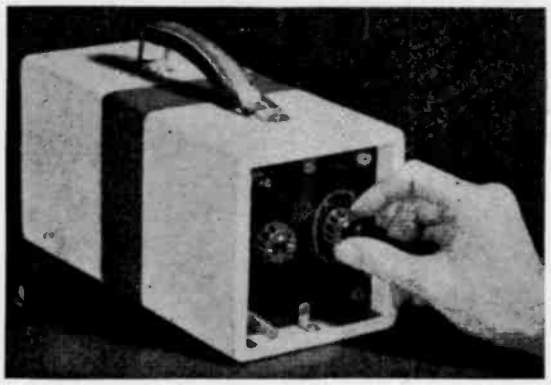
5" by 10" and is constructed of pine ⅜" thick. Shellac can be used to seal the grain, while a few coats of enamel provide a durable and attractive finish. If desired, the case can be finished in the colors of the builder's favorite school or college.

To complete the realistic appearance of the outfit, the cap from a regular vacuum bottle is fastened to the closed end of the cabinet. This can be bolted permanently in place, or, as was done in the original shown, it can be used to house additional plastic drinking cups. If this is done, a disk of wood shaped to be a snug fit in the outer cap must be bolted to the cabinet. If a particularly neat job is desired, coarse threads can be cut into the wood disk to take the threads on the inside of the cap.

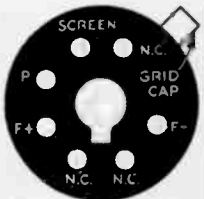
The circuit chosen is a standard three-tube, tuned-radio-frequency hook-up. However, instead of using 2-volt battery tubes, the author decided to employ the new 1½-volt tubes, because of their extremely low filament consumption. The parts are mounted



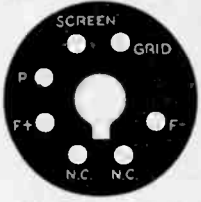
Batteries and circuit are slipped into the open end of the cabinet. The chassis holds the batteries in place



To allow the vacuum-bottle cabinet to stand upright, the control panel should be recessed, as shown above

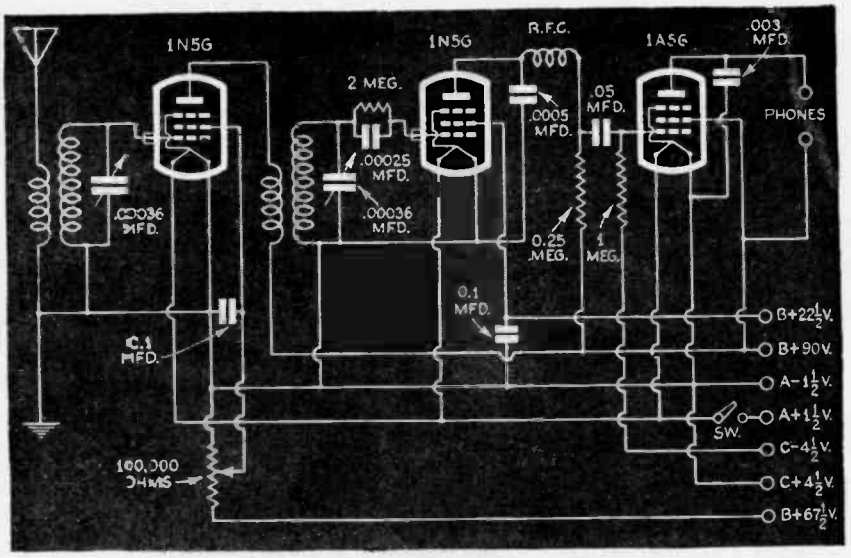


1N5G (BOTTOM VIEW)
N.C.-NO CONNECTION



1A5G (BOTTOM VIEW)

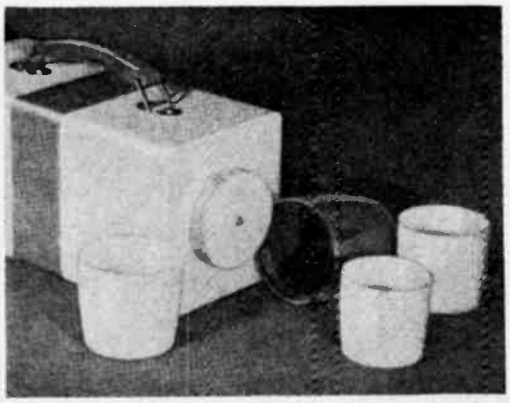
Tube-base diagrams showing the connections to be made for the tubes used in the circuit



Wire the circuit carefully and make sure that all soldered connections are tight

on a midget aluminum chassis measuring 1" by 4½" by 4½".

A two-gang variable condenser is used to tune the radio-frequency and detector stages, and a small radio-frequency choke in the plate circuit of the detector tube prevents any stray radio-frequency currents from entering the audio-frequency stage and causing distortion. The antenna coil, a regular commercial unit removed from its shielding can, can be mounted directly onto the back of the control panel just above the two-gang tuning condenser. The radio-frequency coil, which should be shielded, is mounted between the two pentode tubes. A 100,000-ohm variable resistor inserted in the screen lead to the radio-frequency tube controls the volume of the receiver by varying the screen voltage to that particular tube.



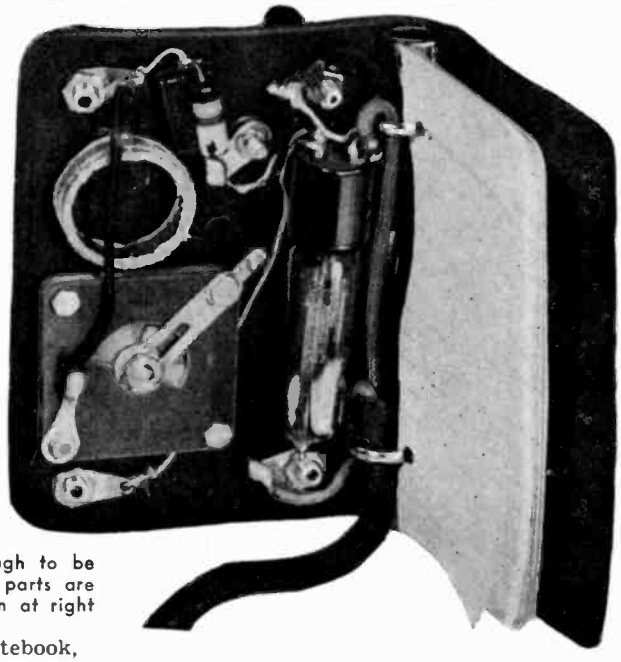
If a wood disk is used to hold the cap in place, additional cups can be carried inside the cap

The "A," "B," and "C" batteries, bound together with a heavy black elastic band, can be slipped into the cabinet after being connected up to the six-way battery cable of the receiver. The set is then placed inside of the cabinet in front of the batteries, and anchored securely in position by four small brackets. Four insulated plugs mounted on the face of the control panel provide connections for the antenna, ground, and phones. A twenty-five-foot antenna, of the type commonly used with small A.C.-D.C. receivers, is recommended.

LIST OF PARTS NEEDED

Two 1N5G tubes.
One 1A5G tube.
Two-gang condenser, .00036 mfd.
Two tubular condensers, .1 mfd.
Tubular condenser, .05 mfd.
Mica condenser, .003 mfd.
Mica condenser, .0005 mfd.
Mica condenser, .00025 mfd.
Resistor, 2 meg., ½ watt.
Resistor, 1 meg., ½ watt.
Resistor, 250,000 ohm, ½ watt.
Radio-frequency choke.
Radio-frequency coil.
Antenna coil.
Three octal sockets.
Switch and volume control.
Six-way battery cable.
Miscellaneous:—Four banana plugs and jacks, dials, knobs, batteries, chassis, cabinet, panel, earphones, etc.

Pocket Radio
BUILT INTO A
Notebook



A one-tube receiver that is small enough to be carried in your coat pocket. How the parts are mounted inside the book cover is shown at right

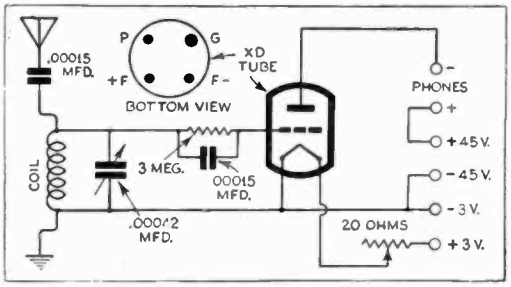
BUILT into a 3" by 4" loose-leaf notebook, this tiny one-tube, earphone radio can be carried easily in your coat pocket. Its single tube, a midget triode measuring less than 3", requires but 3 volts for its filament and 45 volts for its plate.

Because of limited space, no socket is used, connections being soldered directly to the pins at the base, and the tube is sewed to the front cover to hold it in place.

A small, .00042-mfd. insulation-spaced variable condenser tunes the set. It measures 1¼" square, and has a depth behind the cover of only ⅜".

The tuning coil is a high-impedance primary coil of the type used to replace burned-out primary windings in standard A.C.-D.C. receivers. However, you must unwind approximately 100 turns to make the coil suitable for receiving stations between 200 and 550 meters.

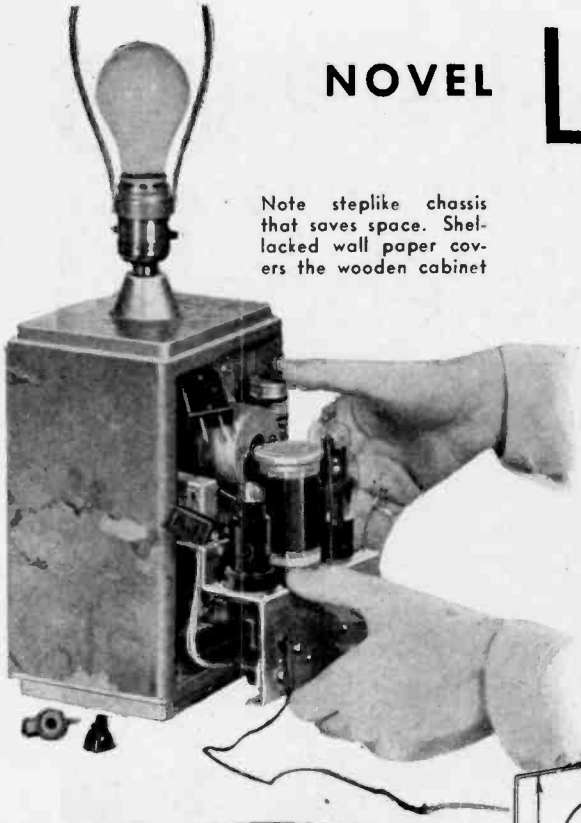
Current is supplied by the new midget "A" and "B" batteries, also small enough to fit in your coat pocket, and four small jacks provide connections for the antenna, ground, and phones.



LIST OF PARTS NEEDED

MIDGET tuning condenser, .00042 mfd., paper-spaced instead of air-spaced. High-impedance primary coil. Two mica condensers, .00015 mfd. each. Resistor, 3 meg., ½ watt. Midget detector tube (see text). Rheostat, 20 ohms. Midget 45-volt "B" battery. Midget 3-volt "A" battery. Battery cable, three-way, about 3' long. Four jacks and plugs. Five soldering lugs. Small black loose-leaf notebook. Earphones, dial, knob, etc.

NOVEL Lamp Radio IS EASY TO BUILD

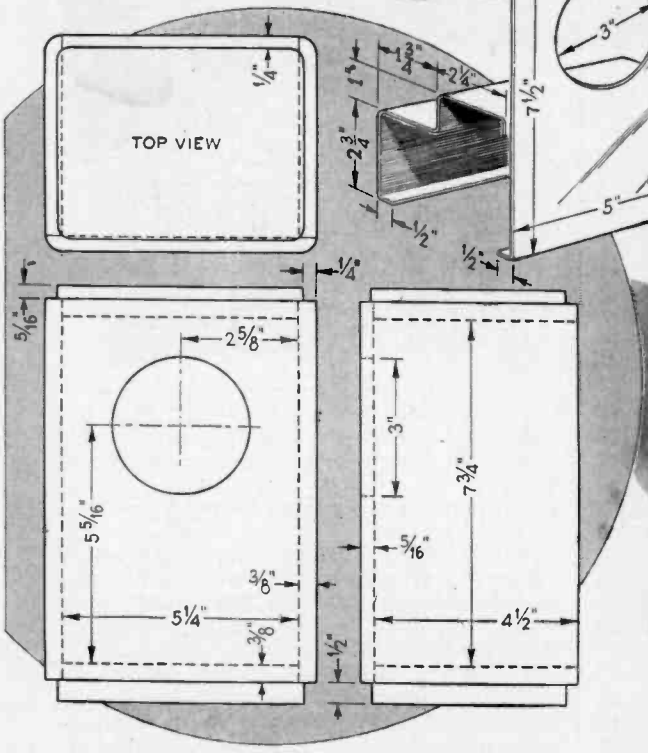


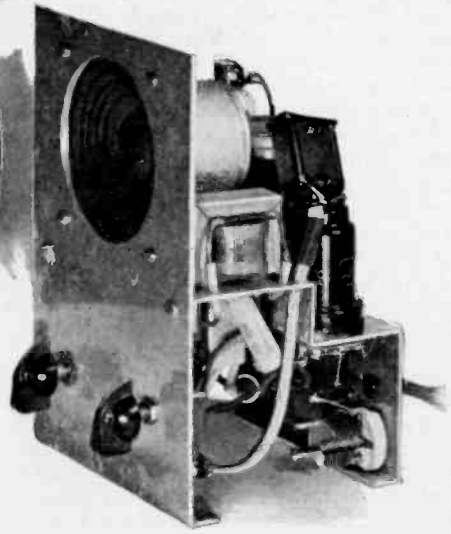
Note steplike chassis that saves space. Shellacked wall paper covers the wooden cabinet

COMBINING a reading light and a broadcast receiver, this Chinese lamp radio will form a useful as well as an attractive addition to a living room, a bedroom, or a den. It is easy to assemble, and the use of a modern dual-purpose tube makes the necessary parts few in number and inexpensive.

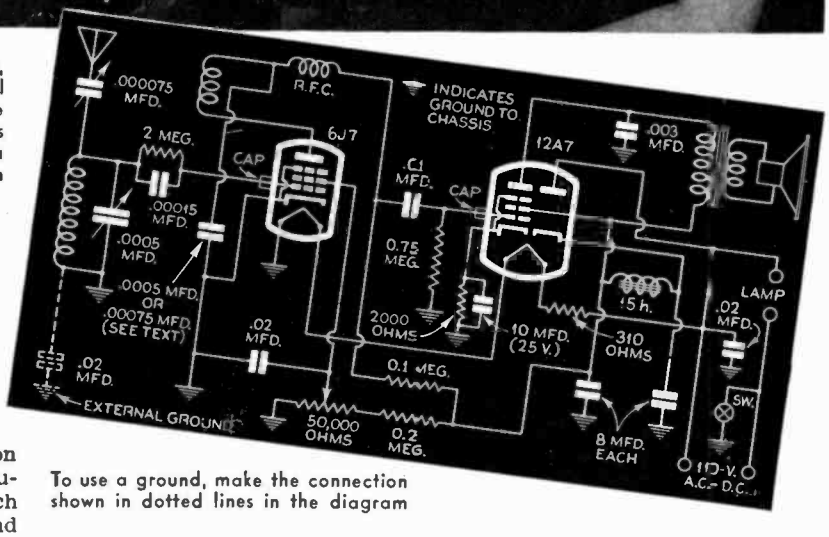
You don't even have to be an artist to apply its artistic finish. Select any attractive wall paper of Chinese pattern and simply glue it to the wood cabinet. When the glue dries, apply a coat of thin, colorless shellac. The light fixture can be bought at a hardware store, and a lamp shade to blend with the wall paper can be almost as inexpensive as you wish.

The parts for the compact, two-tube radio cir-





Chinese in design, the radio lamp will harmonize with the usual furnishings in a living room, a bedroom, or a den



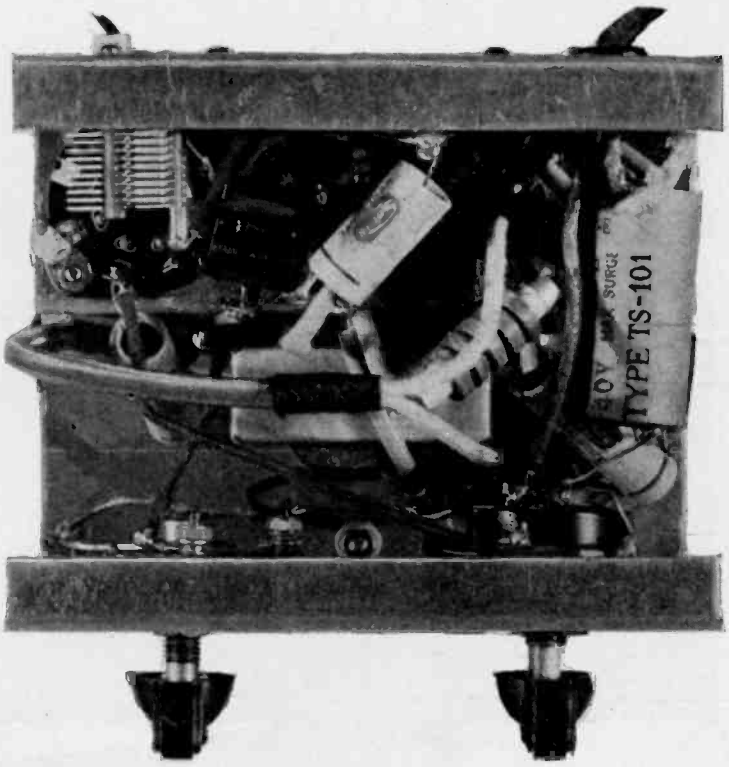
To use a ground, make the connection shown in dotted lines in the diagram

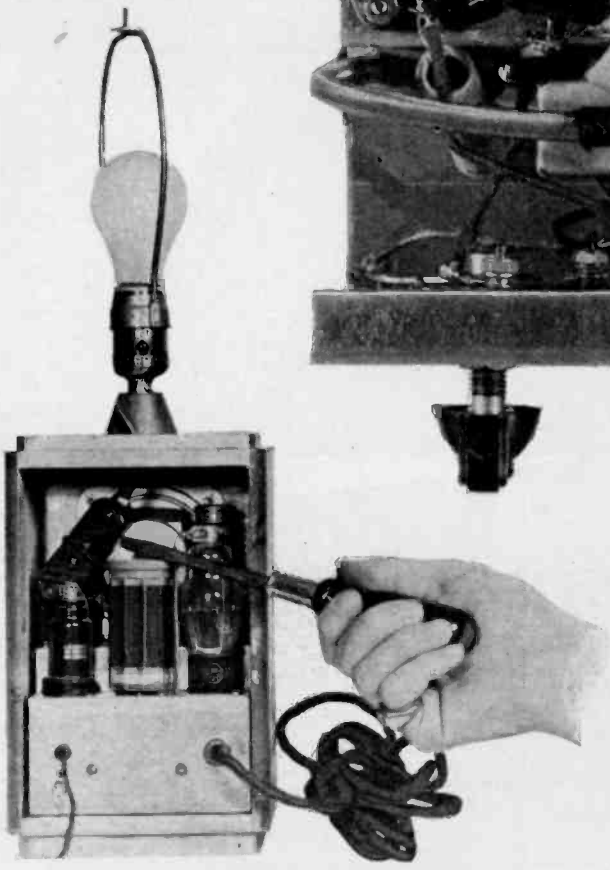
cuit are mounted on "steps" on the aluminum chassis which should be cut and bent to shape according to the diagram. The combination lamp base and radio cabinet is made of pine and is detailed in the drawings. Round the edges of the cabinet with a file and sandpaper before adding the wall paper, and you will avoid any homemade appearance in your finished job.

Atop the first step of the chassis mount the tube sockets and the tuning coil, and on the second step place the midget output transformer and the dual electrolytic condenser. Between these two parts, the 3" permanent-magnet dynamic speaker can be fastened to the front panel. A novel tuning condenser whose moving plates are not air-spaced, but separated by thin layers of specially treated paper, is only ¾" thick and fits behind the aluminum panel where its control knob balances that of the combination volume control and switch. The tuning condenser has a capacity of .0005 mfd., which is higher than standard types. Because of this, however, only one plug-in tuning coil covers the entire broadcast band from 200 to 550 meters, even though the actual wave-length range of the coil is from 135 to 270 meters when used with a .00014-mfd. condenser.

The two-tube design uses a high-frequency, all-metal pentode as a regenerative detector, resistance-coupled to a sensitive, glass power pentode containing a half-wave rectifier. Adequate filtering is provided by the 15-h. choke

Bottom view of wired set showing arrangement of parts. Below, screw driver points to the two-way connector that permits easy removal of the chassis





LIST OF PARTS

Line-cord resistor, 310 ohm.
Midget choke, 15 h.
Plug-in coil, 4-prong (see text).
Padding condenser, .000075 mfd.
Tuning condenser, .0005 mfd.
Dual electrolytic condenser, 8 and 8 mfd.
Dry electrolytic condenser, 10 mfd., 25 v.
Volume control and switch, 50,000 ohm.
Mica condensers, .0005, .0003, and .00015 mfd.
Tubular condensers, .02 (two), and .01 mfd.
Plate choke, 2.5 mh.
Resistors, 2 meg., ½ watt, and 100,000 ohm, ½ watt.
Resistor, 200,000 ohm, ½ watt.
Resistor, 750,000 ohm, ½ watt.
Wire-wound resistor, 2,000 ohm, 1 watt.
Miscellaneous. — Chassis, midget sockets, output transformer, indoor antenna, speaker, tubes, etc.

and dual, 8-mfd. electrolytic condenser. Regeneration and volume are regulated by a 50,000-ohm variable potentiometer, coupled with the switch.

Should the set fail to oscillate over the entire wave band, increase the capacity of the .0005-mfd. fixed condenser connected between the radio-frequency choke and the chassis, by wiring another fixed condenser of .00025-mfd. capacity in parallel. The original model worked well without a ground, but if you wish to try one, connect it through a .02-mfd. condenser as shown by the dotted lines in the circuit diagram. The condenser must be used to insulate the ground from the chassis and protect the tubes, which are also grounded through the chassis to the electric-wiring system.

A two-way plug, placed just above the metal pentode as shown in the photographs, connects the wires from the lamp socket with the current-supply cord leading to the radio, making it easy to disconnect the wiring for removal of the chassis from the set.

HOW TO TEST, SERVICE AND BUILD RADIOS AT HOME