Receiver Fits Shirt Pocket

Subminiature tubes in a standard regenerator

By THOMAS J. JUDGE

Whole receiver is no taller than a standard fountain pen.

THE set described here was built around three subminiature tubes, using an orthodox circuit consisting of a regenerative detector followed by two stages of audio amplification. Permeability tuning, used with a built-in loop antenna, covers the entire broadcast range from 550 to 1,500 kc. A small 22½-volt B-battery and two standard penlight cells (used in parallel) provide the power supply. All parts are mounted on a 1/16-inch phenolic plate and enclosed in a case of 1/16-inch black Plexiglas. A slide-rule-type dial is mounted on the top end of the chassis, adjacent to the three control knobs. The over-all size of the unit is only ¾ x 2⅞ x 5⅜ inches.

To keep the size of the unit to a minimum and also to provide a simple and neat-looking job, no wiring was used to make connections. Instead, all connections were cut from a piece of .012 phosphor bronze, after which each piece was tin-plated. Small silver-plated eyelets and small turret-type lugs were used to fasten the various pieces to the chassis and also to provide means of anchoring the resistors and capacitors.

Subminiature sockets were cemented to the chassis to provide a ready means of replacing the tubes. In addition, fixed clips are provided for the batteries, simplifying replacement. All components are so arranged that replacement can be made with the utmost ease.

The circuit used in this set is quite orthodox with the exception of the method employed for regeneration. Referring to the circuit diagram, note that one winding of the feedback coil is in series with the plate of the detector tube. The other winding is in series with the loop antenna. This arrangement provides very good gain and at the same time reduces to a minimum the effects of detuning caused by body capacitance.

The smallness of the receiver can be readily seen in the photograph of the assembled set and a standard fountain pen. The other photos show the chassis, both front and back views, when removed from the case. Note that the bottom portion of the case is cemented to the chassis.

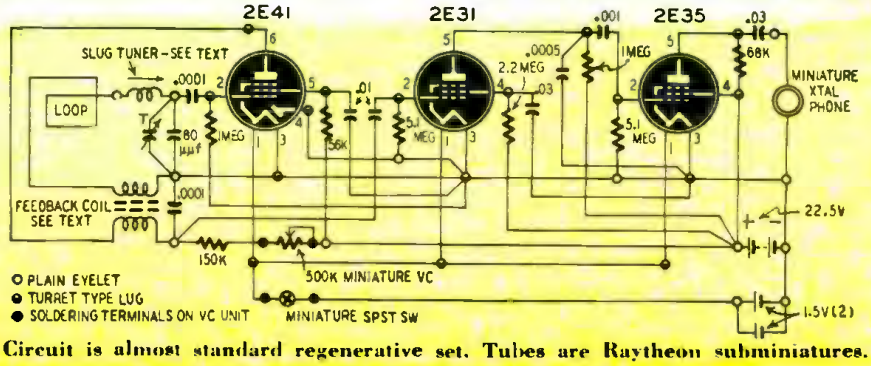
Construction of a really small receiver such as this presents a number of problems not usually encountered. Because of the small working space each part must be added with great care.

Anyone interested in building such a receiver should first acquaint himself with each component to be used. With patience and care, a scale drawing should then be made showing the exact location of each component. This drawing can be used as a guide in forming and drilling the chassis and case.

A certain amount of time should be spent learning how to bend and cement plastics, which, with a little practice, are very easy to work with.

The complete circuit is shown in the drawing. The photographs reveal how most of the connections are made. The loop consists of 14 turns of No. 34 enameled wire wound on the 1/16 x ½-inch strip cemented around the outer edge of the chassis. The regeneration transformer consists of a drilled and tapped powered-iron core ⅜ inch in diameter and 7/16 inch long. A single layer of Scotch tape was first wrapped around the core, and the plate winding, 60 turns of No. 40 enameled wire, was then wound. Coil dope was painted on, and, after it dried, grid winding, of 25 turns of the same size wire, was added. All leads were left fairly long until after assembly to the chassis and until after all the necessary operating tests were made.

The permeability tuner consists of a phenolic tube of ¼ inch outer diameter and 1 11/16 inches long. Small pieces of Plexiglas 1 1/16 inch thick and ⅜ inch



Circuit is almost standard regenerative set. Tubes are Raytheon subminiatures.

square were drilled and cemented to both ends of the tubing for mounting. The space between the two end pieces was covered with a single layer of No. 43 enameled wire. A powdered-iron slug 1½ inches long and 15/64 inch in diameter provided with wire hooks on both ends completed the unit. For good efficiency the slug must fit snugly within the tubing. Start with an oversized slug and carefully turn it dowr until a snug fit is provided. Small grooves 1/16 inch wide, 5/8 inch long, and 1/32 inch deep are cut in the chassis, after which the ends of the tuning unit are placed and cemented to the chassis.

The driving element of the tuner consists of standard dial cord, tension spring, a small piece of black Plexiglas, and a drive pulley. Turret-type lugs are used to guide as well as to retain in place the dial cord. The pointer is made from black Plexiglas cut in a U shape. The upper side of the piece acts as the pointer, while the lower half connects to the dial cord. The drive pulley was turned down from a piece of ¼ x ½-inch brass rod. It is ¼ inch outside diameter and ⅛ inch wide, with a groove approximately 1/32 inch wide and 1/32 inch deep. The balance of the rod is turned down to ⅛ inch and the tuning knob is mounted on it. In mounting the drive pulley, a 1/16-inch piece of Plexiglas was riveted to the chassis to provide sufficient bearing surfaces. This can readily be seen in the lower photograph at right.

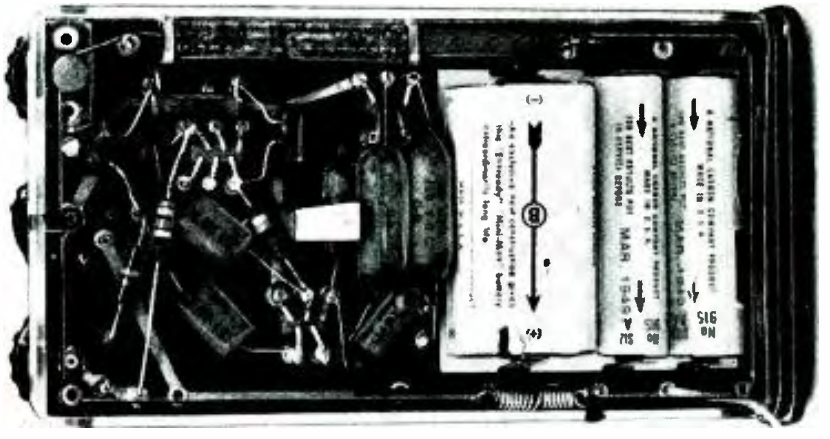
The tuning knob was made by using the outer part of a standard IRC miniature volume control with a piece of phenolic plate cemented on the inside. A hole approximately ⅛ inch in diameter was then drilled through the center. A small drilled and tapped hole provided a way of securing the knob to the tuning shaft.

The trimmer capacitor was made from a 1/16 x ¼ x 13/16-inch phenolic plate, two pieces of .012 phosphor bronze, and a thin piece of mica taken from a small standard trimmer. After cutting and forming the various pieces, a hole was drilled and tapped in the chassis as well as in the additional piece of phenolic plate. The pieces were fastened to the chassis with small eyelets, a small brass screw providing means for tuning.

The photographs show the method of completing the various connections with the phosphor bronze strips. These connections are cut and drilled in accordance with the scaled drawing. They should then be tin-plated to prevent corrosion.

Referring to the photos, you will note that the bottom portion of the case, a piece of ⅛-inch black Plexigias, is fastened to the chassis. A groove 1/16 inch wide, 1/16 inch deep, and 2⅝ inches long was cut in this piece. The chassis is made long enough so that its bottom end can be inserted in the groove and cemented in place. After the body of the case was formed and cemented together a section 1/16 inch wide and 1/16 inch deep was cut off the inner edges of the bottom piece to provide a satisfactory fitting between the case and the bottom piece.

This side of chassis shows how the tube "pins" are bent and pushed in sockets.



Chassis is flat piece of phenol plate. Note metal strips used for connection.

The upper portion of the case is also made from ⅛-inch black Plexiglas. After cutting the necessary openings for the three knobs, an opening ⅛ inch wide and 1⅝ inches long was provided for the tuning dial. A piece of clear Plexiglas 1/16 x ¼ x 1¾ inches was used for the face of the dial, with the numbers 5, 7, 9, 13, and 15, properly spaced, engraved on it. This piece was cemented over the opening mentioned above. To provide sufficient space for the dial pointer, it was necessary to remove a small portion from the underside of the top piece adjacent to the opening provided for the tuning dial. After this, the top piece was cemented to the main body of the case.

The chassis slides into the case from the bottom and they are locked together with a small phosphor bronze spring attached to the chassis. This spring engages a slot cut on the inside of the case. A small hole, large enough to accommodate the point of a pencil, is drilled through the case opposite the spring. To remove the chassis from the case it is necessary only to insert the point of a pencil in the hole, pushing the spring away from the chassis and releasing the lock.

Parts list for Three-tube Radio

Resistors: 2—5.1, 1—2.2, 2—1 megohm; 1—150,000, 1—68,000, 1—56,000 ohm, 1/3-watt. 1—500,000-ohm control, IRC type H.

Capacitors: 2—.03, 2—.01, 1—.001, 1—.0005 µf, 100-volt, paper, hearing-aid type; 1—80 µµf, 2—.001 µf, ceramic.

Miscellaneous: 1—IRC type SH fingertip switch, 1—hearing-aid-type crystal phone; 1—Raytheon 2E31, 1—2E35, 1—2E41 subminiature tubes, 1—Eveready type 412, 22.5-volt hearing-aid battery or equivalent, 2—type 915 or equivalent penlight cell, assorted eyelets and turret-type lugs.

SLUG-TUNED PUSH-BUTTONS

A number of receivers use slug-tuned push-button tuning assemblies consisting of a number of coils, each tunable over a narrow sector of the broadcast band. Frequently it is desirable to increase the resonant frequency of one or more of these coils.

To do this, cut a small brass slug from a volume control shaft or other round stock and insert it into the coil form. Locate the best position for the slug, tape it for a snug fit, and cement it in place. Use the powdered-iron core for precise tuning.

——*B. F. LaDue*