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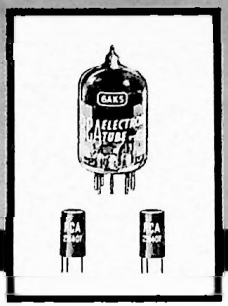


A Low-Cost, One-Tube Walkie-Talkie

With Transistorized Audio Stages

By Martin L. Kaiser, W2VCG

RCA Laboratories, Princeton, N. J.

Interested in small-sized, low-cost walkie-talkies? Then you may find the newly developed 28-megacycle unit described in this article especially suited to your requirements.

An outstanding feature of this walkie-talkie is its economy. Complete with tube, transistors, and batteries, cost of unit is less than $30.

Evolved from numerous units constructed by the writer over the last decade, this walkie-talkie features a unique application of two RCA-2N407 germanium p-n-p alloy junction transistors in combination with an RCA-6AK5 sharp-cutoff pentode.

Under normal operating conditions, the walkie-talkie can achieve a range of about five miles; receiver sensitivity is ½ microvolt.

The 28-megacycle band was selected for the following reasons:

(1) Operation at 28 Mc permits use of a conveniently sized, easily portable antenna.

(2) On the crowded lower-frequency bands, QRM is difficult to overcome with only 1-watt output.

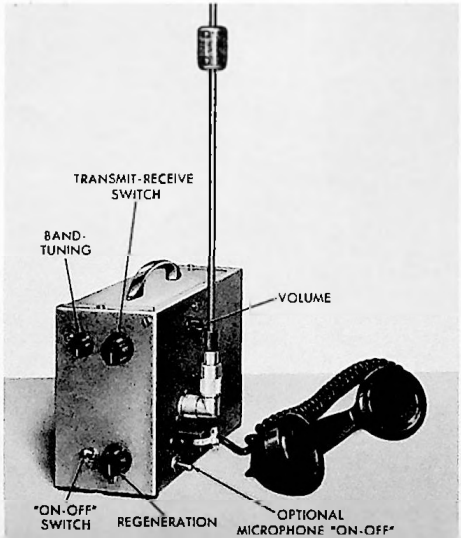
(3) At higher frequencies, coil placement and lead length are extremely critical, and special VHF construction procedures must be followed.

Receiver Circuit

As shown in Figure 1, a single 6AK5 tube is used in the circuits of both a superregenerative receiver and a modulated tri-tet oscillator in the transmitter. The circuit of the regenerative-type receiver is conventional.

Regeneration is obtained by feeding some of the signal from the plate coil (L_6) to the grid coil (L_4). The amount of regeneration is determined by the setting of R_{11}, a 100,000-ohm potentiometer; this control is set just below the point of oscillation. This point will vary with the frequency to which the receiver is tuned. The audio signal appears across the plate-load resistor (R_7) and the volume control (R_6) and is transferred through C_8 to the base of the 2N407 emitter-follower.

Figure 2 shows the chassis layout for all major components. After these components have been mounted, the 6AK5 socket and the TR (Transmit-Receive) switch are connected

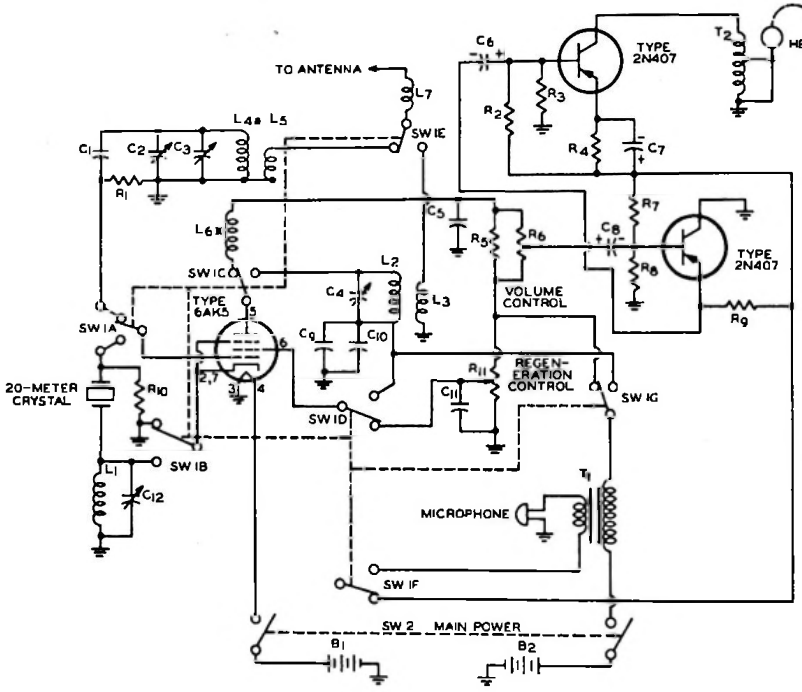


by a small cable consisting of five 4-inch wires. These wires must be connected to pins 1, 2, 4, 5, and 6 at the tube socket. Pins 2 and 7 are connected together at the socket; pin 3 is soldered to the copper support bracket. Leads carrying dc and audio frequencies are soldered to common terminals at the rear of the TR switch, while leads carrying radio frequencies (leads from pins 1, 5, and 6, for example) are soldered to common terminals of the switch nearest the tube.

After these leads are connected to the switch, all coils (L_1 through L_6) are mounted securely. Coil L_1 should be mounted close to the crystal and, together with L_2 and L_3, as far as possible from metal surfaces.

Coverage of C_2, the main band-tuning capacitor, can be determined experimentally. The combination shown in this unit will tune the 28.5-to-29.7 Mc portion of the band.

After L_4 is wound, the windings should be secured with coil "dope." Then, when the



B_1—Two batteries (RCA VS065)
B_2—Two batteries (RCA VS016)
C_1—100 $\mu\mu$f, mica
C_2—Johnson 5M11
C_3, C_4, C_{12}—7-45 $\mu\mu$f (Centralab type 822-BN or equiv.)
C_5—0.005 μf, ceramic
C_6—2 μf/15 volts, electrolytic
C_7—100 μf/15 volts, electrolytic
C_8—4 μf/150 volts, electrolytic
C_9, C_{11}—0.001 μf, ceramic
C_{10}—470 $\mu\mu$f, mica
E and M—Standard telephone headset
L_1—½" inside diameter, 14 turns of No. 20 wire
L_2—½" inside diameter, 6 turns of No. 20 wire
L_3—½" inside diameter, 4 turns of No. 20 wire
L_4—⅝" inside diameter, 8 turns of No. 18 wire
L_5—½" inside diameter, 5 turns of No. 20 wire
L_6—3 turns of number 18 wire on L_4
L_7—¾" long 1" inside diameter, 12 turns of No. 20 wire
R_1—1,200,000 ohms, ½ watt
R_2, R_5—5,600 ohms, ½ watt
R_3, R_9—10,000 ohms, ½ watt
R_4—220 ohms, ½ watt
R_6, R_{11}—100,000-ohm, ½-watt potentiometer
R_7—47,000 ohms, ½ watt
R_8—270,000 ohms, ½ watt
R_{10}—30,000 ohms, ½ watt
$SW_{1A, B, C, D, E, F}$—rotary type, eight-pole, two-position
SW_2—toggle, DPST
T_1—Carbon microphone transformer (Stancor A-4713 or equiv.)
T_2—UTC-A25 transformer, see text
Xtal—20 meter; must fall in band when doubled.

Figure 1: Schematic diagram and parts list of W2VCG's one-tube walkie-talkie with transistorized audio stages.

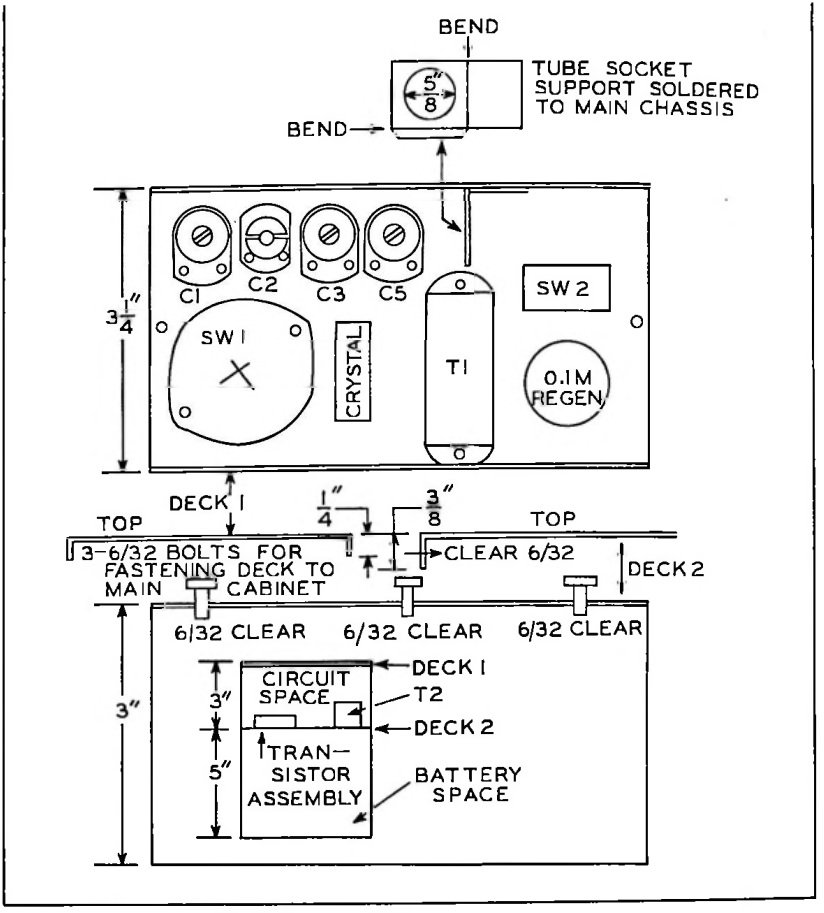


Figure 2: Chassis layout for all major components in author's walkie-talkie.

cement has dried, L_6 is wound in the same direction and on top of L_4 at the ground end. L_6 is cemented securely to L_4. When L_4 and L_6 are wired, the two outermost leads of the coil combination go to the grid and plate circuits of the 6AK5. The end of L_4 nearer L_6 should be grounded, and the other end connected to the grid circuit. The end of L_6 nearer the ground end of L_4 goes to the plate. If this wiring arrangement is not followed, the circuit will not operate.

Audio stages are wired on a separate subassembly, as shown in the photograph on page 5. The audio stages appear in the bottom left portion of the photo; the audio driver transformer is shown at the bottom right.

T_2 is a UTC-A25, although a similar transformer may be substituted. The UTC-A25 has a 600-ohm winding with multiple taps, one of which is 75 ohms. The 600-ohm winding closely matches the impedance of the 2N407 driver, and the 75-ohm tap closely matches the impedance of a standard telephone-headset earpiece. Voltages are fed to the emitters of the transistors and the collectors held at ground potential. This arrangement permits the telephone headset to be connected in the ground lead of the output transistor. The other 2N407 is an emitter-follower which drives the low-impedance base of the audio-output stage from the high-impedance output of the 6AK5. L_7 is wound with uniform spacing on the loading-coil form shown in the antenna diagram, Figure 3. It is then sprayed with a heavy layer of Krylon.

The volume control does not attenuate all the audio, but lowers it to a comfortable level. With the audio gain at maximum, there is sufficient drive to overcome practically all extraneous noise.

After the receiver is wired it should be tested and any necessary adjustment made before the transmitter circuit is wired. The battery drain during the "receive" cycle is 160 milliamperes for the A cells, and about 15 milliamperes for the B cells.

Transmitter Circuit

After the coils for the transmitter are connected, it is good practice during tuning to simulate the side of the chassis by placing a piece of sheet metal next to any coil which will come within 1 inch of the case. When wiring has been completed on the transmitter

section, voltages and currents should be tested. The battery drain should average 200 milliamperes for the A cells and 18 milliamperes for the B cells.

With the TR switch in the transmit position, the 7.5-volt supply is placed across the primary of T_1, which is in series to ground through the 200-ohm microphone of the headset. This connection provides enough power transfer to modulate the unit fully. In the "receive" position, T_1 has no effect on the circuit, except to increase audio choking. The transmitter should be tuned with the aid of a grid-dip meter or some other type of rf detector. To make certain the unit is crystal-controlled, remove the crystal several times while watching rf output. The output should drop to zero when the crystal is removed. C_1 sets the excitation level for the crystal and is fixed at mid-range.

You need not stretch your imagination to find numerous occasions for the use of this novel walkie-talkie. In addition to providing many hours of pleasant entertainment, it can serve as a vital means of communication during emergencies.

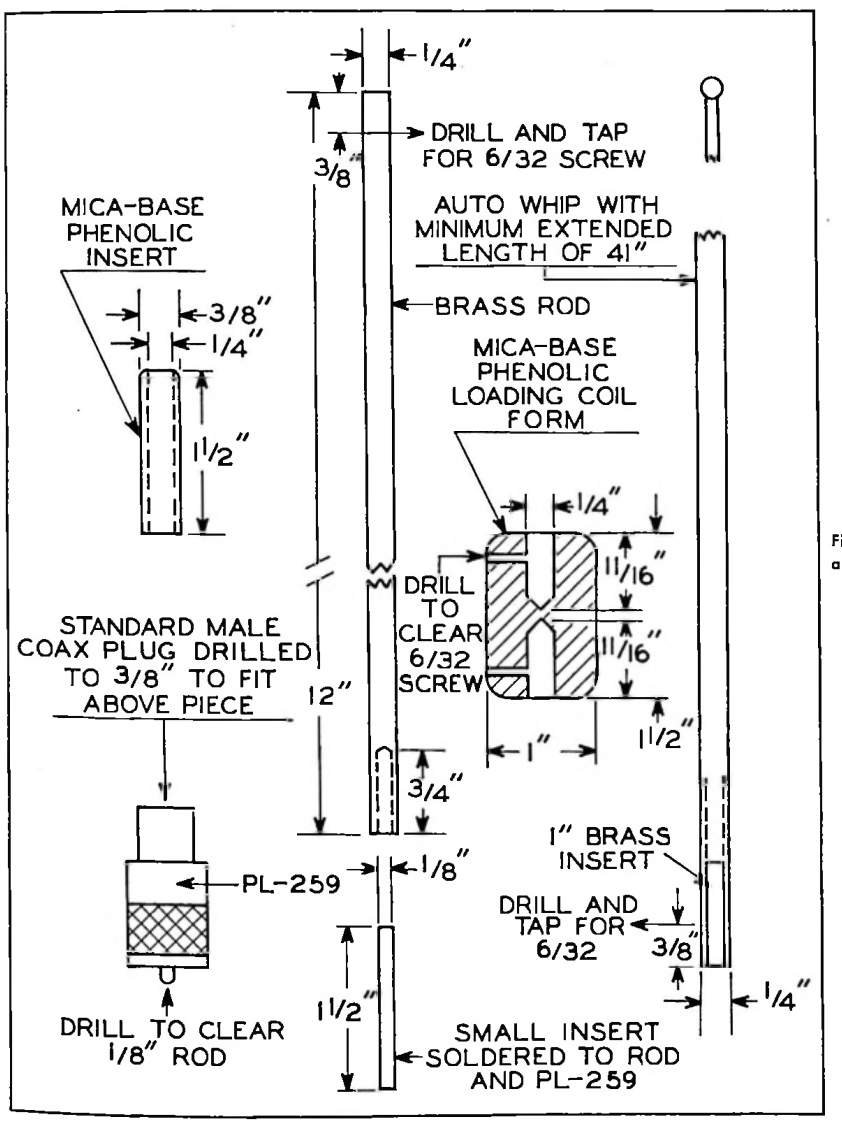
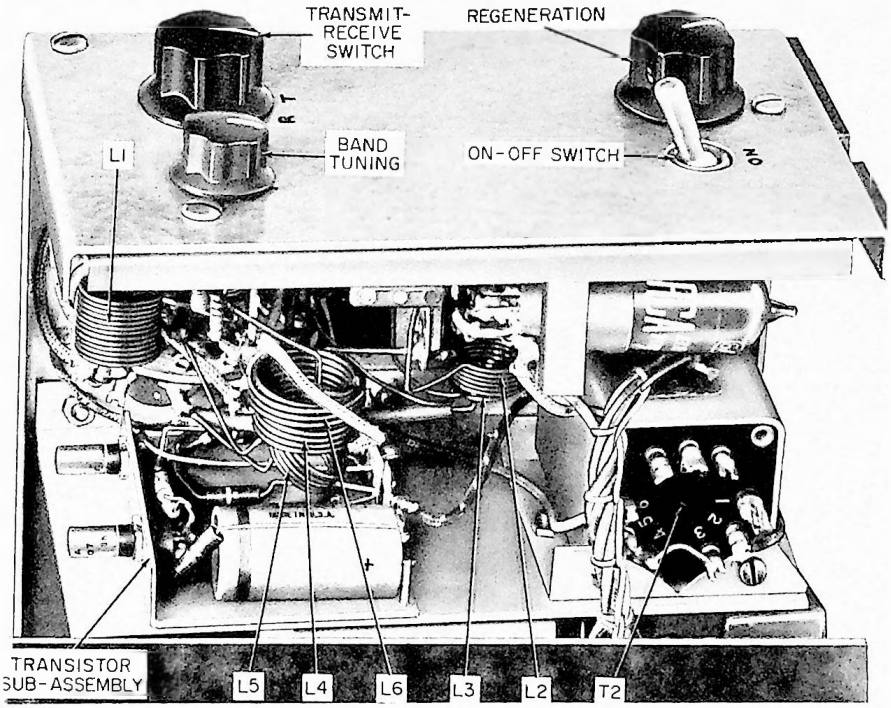
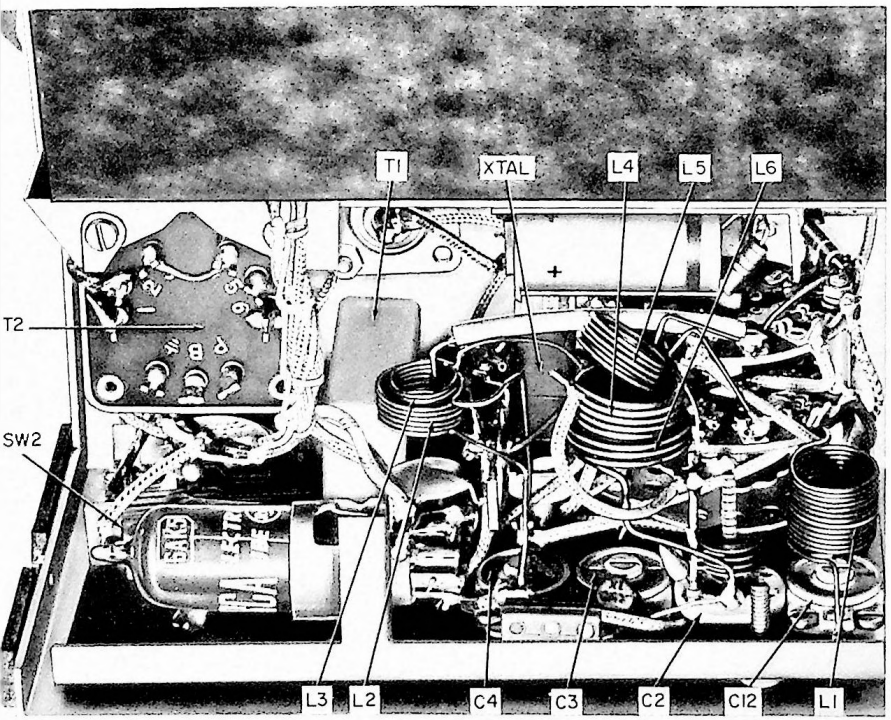


Figure 3: Antenna assembly.



As noted in the text, W2VCG has wired the audio stages on a separate subassembly. This photo shows the audio stages at bottom left, the audio drive transformer at bottom right.



Inside view of walkie-talkie showing placement of components.

From your local RCA distributor, headquarters for RCA receiving and power tubes.

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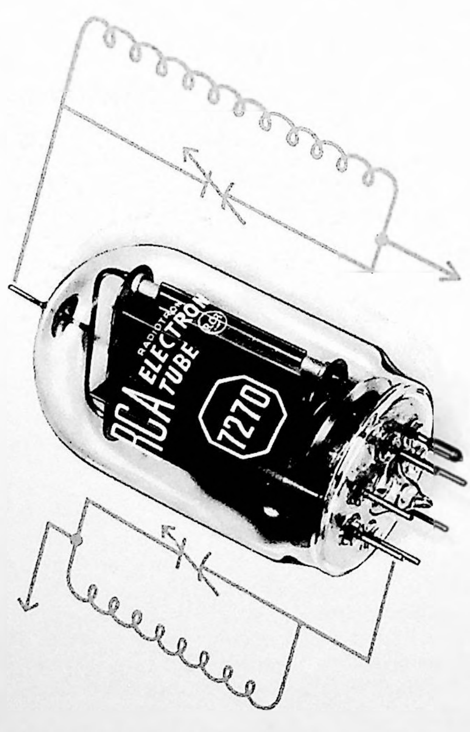

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Check the chart for a quick appraisal of the RCA-7270's capabilities. For a complete technical bulletin on SSB, AM and CW use, qsl, RCA Commercial Engineering, Harrison, N. J.

Typical Operation in Amateur Service to 54 Mc

Type of Service	CW	AM	SSB (AB1)▲
Heater Volts	6.3	6.3	6.3
DC Plate Volts	1250	1000	1250
DC Grid No. 2 Volts	300	400	400
DC Grid No. 1 Volts	−80	−107	−50
DC Plate Ma	225	190	185*
Required Driver Power Output Watts (approx.)	4	4	4.5*
Useful Output Watts (approx.)●	225	130	135*

*Max. Signal Value ▲With Single-Tone Modulation
●Measured at load of output circuit having 90% efficiency

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Another Example of RCA's Contribution to Amateur Radio