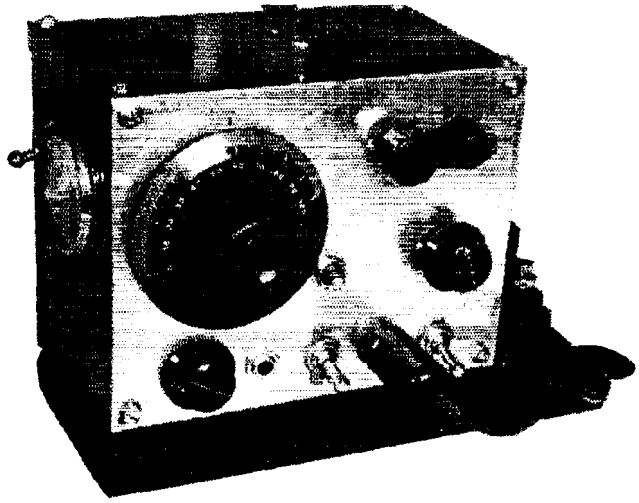

The completed flea-power transmitter-receiver for 40 meters, mounted on a baseboard along with the key for convenience.

A Flea-Power Portable C.W. Station

Building a Handbag-Size Transmitter-Receiver

BY LOUIS D. BREETZ,* W3KDZ, W8QLP

A LONG-LIVED desire to work a flea-power rig was realized not long ago when the author completed the small portable transmitter-receiver shown in the photographs. The set is easily portable and is capable of performing on batteries (dry A batteries or car storage battery, and B batteries) or some rectified a.c. supply, such as the power from the car radio or the home b.c. radio set. When power is taken from the car radio or home b.c. set, the power audio tube is removed (if it's a 6L6, 6F6 or similar tube) and filament and plate power is brought out to the rig by plugging a cable into that socket with the leads connecting to the appropriate tube-socket terminals.

Because the author wanted the set to be capable of using b.c. set power, indirectly-heated-cathode tubes are used. Although these tubes are not so economical when operating the heaters from batteries, there are only two tubes in the set (one for the transmitter and one for the receiver) and therefore the filament drain is not too great. About 10 hours of operation has been obtained from the 6-volt Eveready Hot-Shot A battery and the three 67.5-volt Minimax B batteries and there is still a lot of life left in them. Only c.w. operation was contemplated because of the simple requirements, and since the all-around usefulness of the 7-Mc. band is well known, the set was designed for this band.

The entire assembly — transmitter-receiver, batteries, key, 'phones, antenna wire and miscellaneous items — is carried in a canvas zipper bag. It is hardly recognizable as a complete radio station, and therefore one travels with it very inconspicuously.

Circuits

The rig (see Fig. 1) is built around two tubes. The receiver uses one section of a 6SL7 as a regenerative detector and the other as an audio amplifier. The transmitter uses one section of a 6SN7 as a Pierce crystal oscillator and the second section as an r.f. amplifier. Since the amplifier is resistance-coupled to the oscillator there is no danger of oscillation in the amplifier stage. An impedance-matching antenna tuner is incorporated in the set to permit using odd lengths of radiator wire. The transmitter is link-coupled to the antenna tuner and the antenna is always connected to the tuner. The receiver input is connected through a toggle switch to the antenna tuner when receiving, or is switched off when transmitting.

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Construction

The transmitter-receiver is contained in a cabinet approximately 6½ by 5½ by 4 inches that can be constructed of sheet metal or of bakelite. The entire unit is mounted on a baseboard ¾ by 3¾ by 9 inches which is long enough to accommodate the permanent mounting of the key. On one end of the cabinet is mounted the milliammeter and a switch, S_1, to shunt the meter after the tuning procedure has been completed.

The panel is made of sheet aluminum 1/32 by 6½ by 5½ inches. The tuning dial for the receiver is of the plain non-vernier type, since plenty of electrical bandspread is available (the 40-meter band covers from 25 to 75 on a 100-division dial). It is located in the upper-left quadrant of the panel. In the upper right are the

• If pushing a kilowatt from the armchair gets boring now and then, why not take a breather with this low-power layout you can carry in one hand? W3KDZ and many others will tell you there's nothing like it.

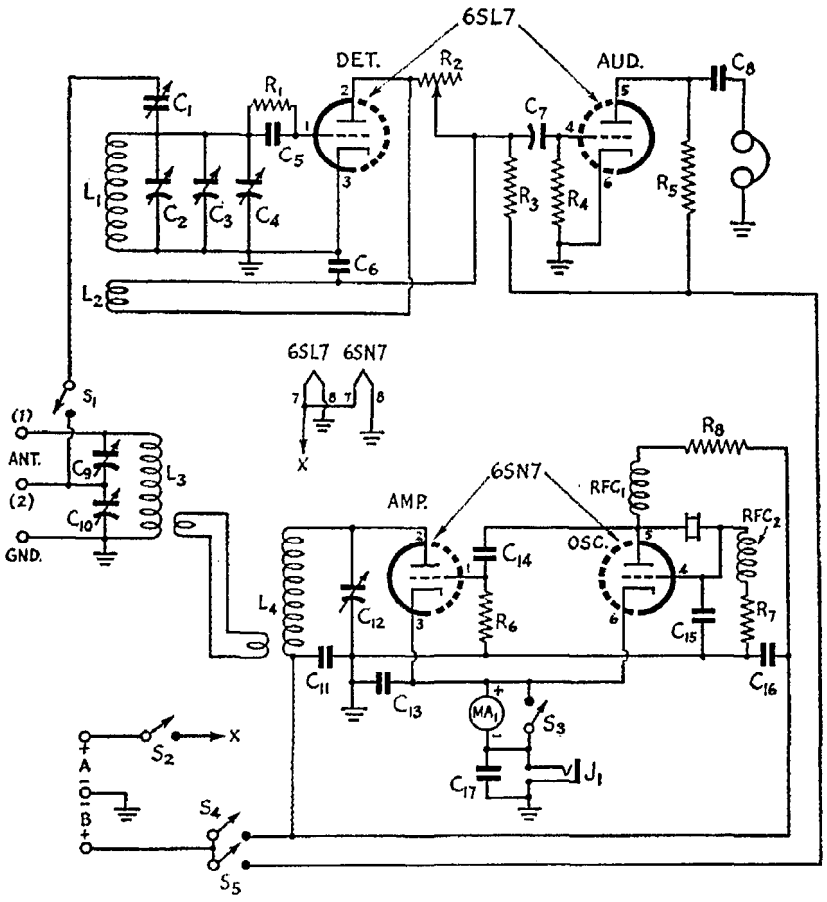


Fig. 1 — Circuit diagram of the flea-power portable.
C_1 — 3–12 $\mu\mu$fd. zero-temp. trimmer (Erie type 557).
C_2 — 15-$\mu\mu$fd. variable (Bud CE-2020).
C_3 — 75-$\mu\mu$fd. zero-temp. mica or ceramic.
C_4 — 8–50-$\mu\mu$fd. zero-temp. trimmer (Erie type 557).
C_5 — 220-$\mu\mu$fd. mica.
C_6, C_{11} — 470-$\mu\mu$fd. mica.
C_7, C_8 — 0.25-μfd. 300-volt paper.
C_9 — 140-$\mu\mu$fd. variable (Millen 20140).
C_{10} — 100-$\mu\mu$fd. variable (National PSE-100).
C_{12} — 75-$\mu\mu$fd. variable (National PSE-75).
C_{13}, C_{16}, C_{17} — 0.022-μfd. mica.
C_{14} — 22-$\mu\mu$fd. mica.
C_{15} — 47-$\mu\mu$fd. mica.
R_1 — 1 megohm, ½ watt.
R_2 — 10,000-ohm potentiometer.
R_3 — 33,000 ohms, ½ watt.
R_4, R_5 — 0.1 megohm, ½ watt.
R_6 — 15,000 ohms, ½ watt.
R_7 — 10,000 ohms, ½ watt.
R_8 — 8200 ohms, 2 watts.
L_1 — 25 turns No. 30, 5/16-inch diam.
L_2 — 3 turns hook-up wire wound over ground end of L_1.
L_3 — 44 turns No. 30, ½-inch diam.

controls for the antenna tuner. Below the antenna tuning controls is the transmitter plate tank condenser knob. In the center of the panel is the toggle switch S_1 which switches the receiver on or off from the antenna tuner. The bottom row, left to right, includes the regeneration control, R_2, which also has the rotary switch, S_2, attached to turn on all filament power. Next is the 'phone jack for the receiver, then the toggle switch S_5 for the receiver on-off control, the jack for the key and the toggle switch S_4 for transmitter on-off control.

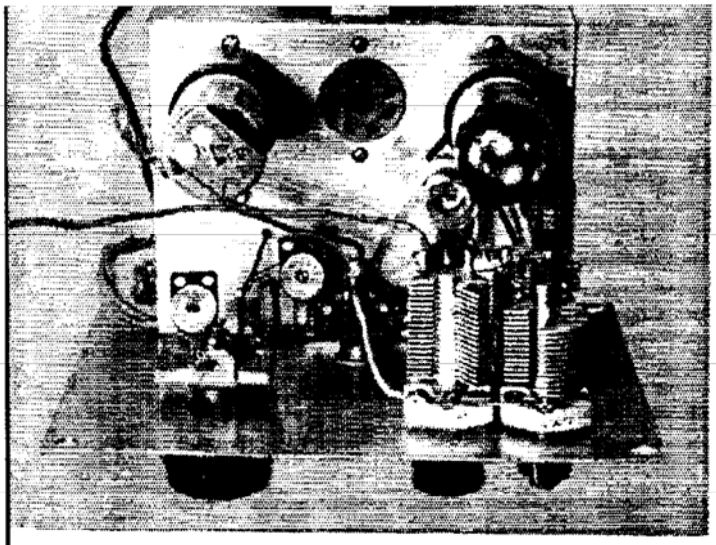
The chassis is of the open-end type. It is 1⅜ inches deep by 4⅞ inches long by 3⅞ inches wide. It is made of 1/32-inch aluminum. Looking down on top, one sees on the left the receiver tuning condenser (the receiver coil is directly underneath the chassis), and behind is the 6SL7 receiver tube. The middle tube socket serves merely as a terminal board. To the right is the 6SN7 transmitter tube and crystal. To the left of the crystal is the plate tank coil and in front of that lies the antenna-tuner coil. Above these items are the two antenna tuning condensers.

Adjustment

No trouble should be encountered in making the receiver perform satisfactorily once the proper polarity of the tickler coil, L_2, is found. If both coils are wound in the same direction, the connections should be as shown in Fig. 1, with the plate connected to the outside end of the tickler winding, and the grid connected to the outside end of L_1. If the windings are not in the same direction, these connections must be reversed. Regeneration is controlled by R_2 which simply shunts the tickler winding. This control is one that needs little adjusting once it is set properly. Too much feed-back should not be used, since this reduces the sensitivity. C_1 is a variable coupling condenser for the receiver. It should be set to the maximum capacitance that will permit smooth oscillation of the detector over the band.

The transmitter tuning procedure is the conventional one of tuning the plate tank for mini-

W3KDZ's low-power portable station with batteries and all accessories can be carried easily in a canvas zipper bag.



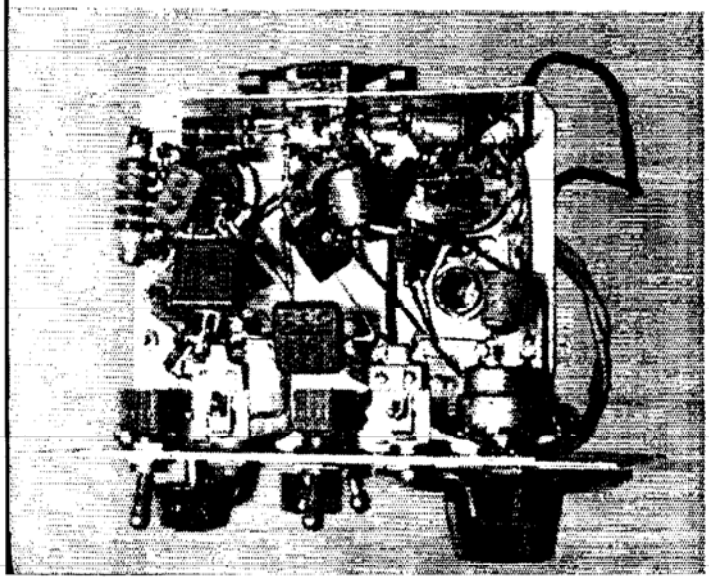
Top view of the miniature 40-meter portable station, showing the placement of the tubes and tuning condensers. The two variables in the antenna coupler are to the right.

mum plate current and adjusting the antenna tuner to resonance, "redipping" the plate tank and repeating until the proper load is obtained. Since the meter reads oscillator and amplifier currents simultaneously, maximum amplifier power output may not always coincide exactly with the plate-current dip shown on the meter, but they will be close.

If the transmitter is turned off and the receiver is turned on (S_5 closed) and adjusted for a weakly-oscillating condition, and the receiver is tuned across the band, a sharply tunable whistle will be heard in the 'phones as the receiver crosses the frequency of the crystal in the transmitter oscillator. This occurs because the oscillating detector is sending a signal into the antenna tuner which is coupled to the transmitter plate tank and then through the tube interelectrode capacitance and C_{14} to the crystal. This excites the crystal (if the crystal is an active one) and it oscillates weakly. This oscillation can be heard as a sharply tunable pip-like whistle in the receiver and serves very usefully to locate the operating frequency on the receiver dial. Evidence of this crystal oscillation excited by the regenerative detector can be obtained by tuning the station communications receiver to the crystal frequency and then tuning the detector across the frequency very slowly. It is easy to distinguish between the variable note from the regenerative detector and the stable note from the crystal. The strongest pip condition prevails when the antenna tuner itself is lightly loaded but tuned to resonance along with the plate tank (with an inefficient radiating system, or no antenna at all connected to it, for instance). Since little power can be thus radiated, it leaves a maximum of power from the oscillating detector to excite the crystal.

The antenna impedance is matched by obtaining the proper ratios of C_9 to C_{10} if terminal *2* is used. (Terminal *2* is used for odd lengths of radiator, terminal *1* for antennas half-wave multiples in length). The combination of C_9, C_{10} and L_3 must always be resonant.

Typical of the thrills experienced working with low power was the contact with W1FAF in Cranston, R. I., from the location of W8QLP in Youngstown, Ohio. The power was taken from an a.c. supply. The final amplifier ran at 240 volts and 13 ma. (about 3 watts input). The antenna was a U-shaped piece of wire about 35 feet long running inside the house from one room to another on the second floor. W1FAF gave a 569 report. (Incidentally, this contact was made at 5 P.M. during a January thunderstorm.) On battery power, with a half-wave end-fed wire stretched inside a second-floor apartment in Washington, W3SKM in Mt. Pleasant, Penna., gave a 559 report. The final amplifier was running at 135 volts, 10 ma. — an input of 1.35 watts. Another QSO at noon from Youngstown with W4JLK and W4PRC in Alexandria, Va., was reported 579 by W4MZN and W3SQP in Roanoke. The total input to the unit, including receiver, was 2 watts.



Looking underneath the flea-power portable. Most of the small components are mounted by their leads without other support. The regeneration control is the potentiometer to the right on the panel.