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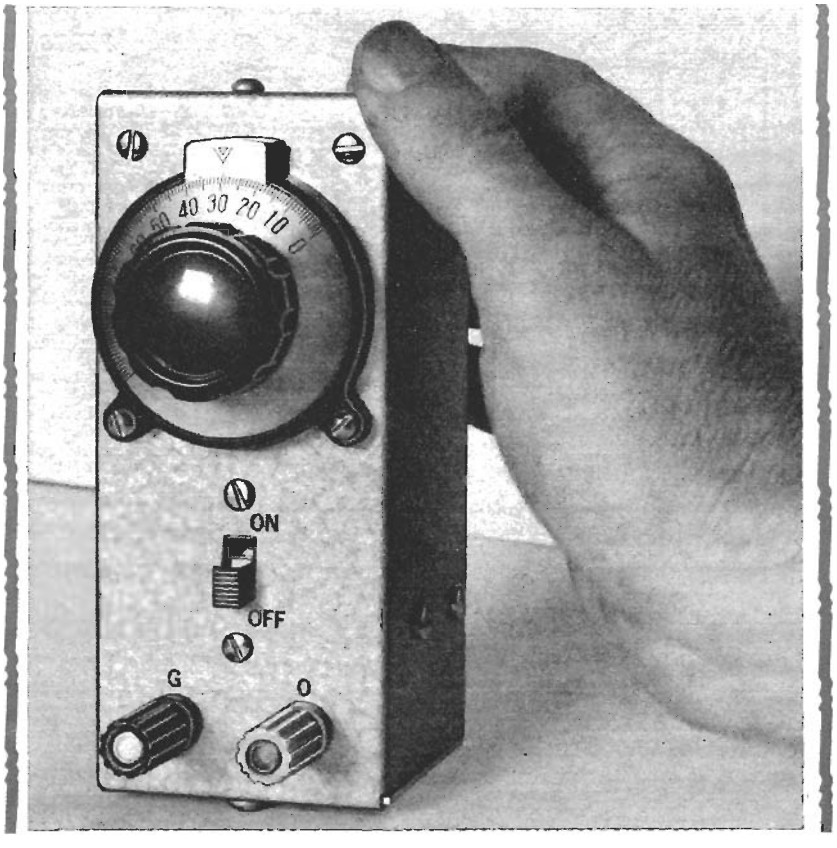


Beginner's Signal Generator

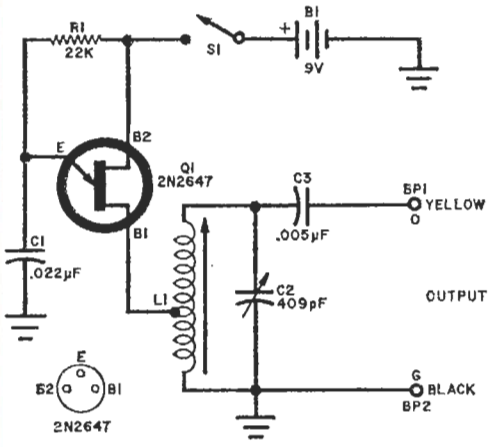
LOW-COST BCB OPERATION FOR A FIRST PROJECT

EVERY RECEIVER, whether simple or complex, requires some r.f. adjustment if it is to operate with maximum sensitivity and selectivity. In fact, the simple superhet receivers that are most often built by beginners usually require more attention than do complex communications receivers.

Unfortunately, most radio beginners lack the necessary test equipment to adjust their receivers properly. The biggest handicap is not having access to a signal generator that provides a signal source with modulation that is unvarying in both frequency and amplitude. There are many excellent signal generators available commercially; but, as the beginner soon learns, the investment required for a generator can be many times the cost of the receiver.

Since most beginners build an AM receiver as their first radio project, the "Beginner's Signal Generator" described here is designed for low cost and BCB operation. While it does not have the elaborate adjustments and advantages of a conventional signal generator, it does provide a modulated signal that can be tuned to any spot in the AM broadcast band. The initial adjustment of the Beginner's Signal Generator is simpler than that of a regenerative receiver.

How It Works. The r.f. signal is generated in the tuned circuit consisting of capacitor *C2* and coil *L1* (see Fig. 1).



PARTS LIST

B1—9-volt transistor battery
BP1, BP2—Banana plug (one yellow, one black)
C1—0.022-μF, 100-volt mylar capacitor
C2—409-pF miniature tuning capacitor (Allied Radio No. 43A3524, or similar)
C3—0.005-μF disc capacitor
L1—AM loopstick coil (see text)
Q1—2N2647 unijunction transistor
R1—22,000-ohm, ½-watt resistor
S1—S.p.s.t. slide or miniature toggle switch
1—5" x 2¼" x 2¼" aluminum utility box
1—2" vernier dial (Lafayette Radio Electronics No. 99T6030)
Misc.—Battery connector; printed circuit board (or perforated phenolic board and "flea" clips); sheet aluminum for variable capacitor L-bracket and battery holder; 4-40 x ¼" machine screws; ½"-long metal spacers; standard L-brackets for circuit board mounting; hardware; hookup wire; solder; etc.

Fig. 1. Operating frequency is function of L1 and C1. Time constant of R1 and C2 allows Q1 to function as relaxation oscillator. R.f. output is taken off from BP1 and BP2.

The coil chosen for this application is a high-Q "loopstick" which provides maximum efficiency in the generation of tunable BCB signals.

Resistor *R1* and capacitor *C1* allow the unijunction transistor (*Q1*) circuit to operate as a relaxation oscillator with a repetition rate of about 750 pulses per second. The sharp current spike produced at the *B1* terminal of *Q1* each time it fires triggers the *L1-C2* tuned circuit into oscillation. These oscillations gradually decrease in amplitude until *Q1* fires again. This process repeats at a rate of 750 times a second. Thus the r.f. signal generated in the tuned circuit (adjustable in frequency by changing *C2*) and the 750-Hz audio signal both appear at the output. The latter is heard through the speaker or headphones of the receiver being tested.

Construction. The prototype Beginner's Signal Generator was built into a 5" × 2¼" × 2¼" aluminum box. The power switch, tuning dial for *C2*, and output binding posts *BP1* and *BP2* are located on the front of the box. The first step in construction is to cut or drill the component mounting holes in the front of the box as shown in Fig. 2. (Note: if you prefer, you can substitute a miniature toggle switch for *S1*. In this case, drill the appropriate size round hole for the rectangular hole shown and eliminate the small holes at the top and bottom of the rectangular opening.) Mount *S1, BP1,* and *BP2* in their respective holes.

Next, referring to Fig. 3, fabricate an L bracket from aluminum stock. Use a #32 drill for the two holes on the crossbar and four holes at the base of the T piece. Then bend the metal along the

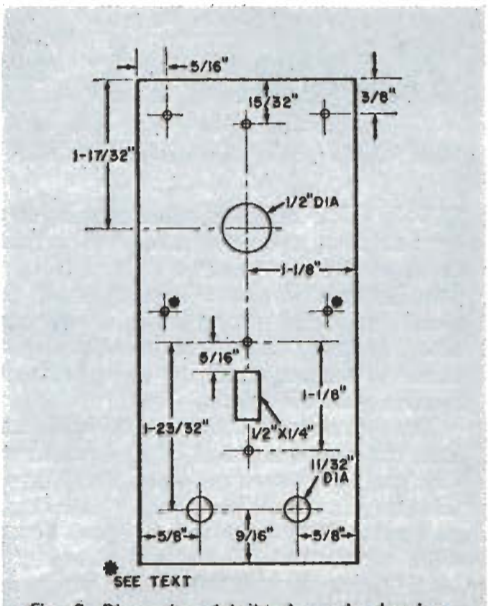


Fig. 2. Dimension details shown in drawing are for machining front of the utility box.

axis shown by the broken line. Use 4-40 hardware to fasten the bracket to the inner surface of the box front and to the frame of *C2*. Now check the mounted parts to make certain that the dial aligns accurately with the shaft of the capacitor and that the vernier dial, when temporarily slipped into place, does not bind against the front of the box. Then mount battery *B1* against the side of the box, using two ½" spacers, #6 hardware, and an aluminum bar (see Fig. 4).

While Fig. 4 shows *C1, L1, Q1,* and *R1* mounted on a printed circuit board, it is simpler and less expensive to mount and wire these parts together on a 1¾" × 1⅝" perforated phenolic board. To simplify wiring, use "flea" clips.

Layout on the circuit board is not critical. However, make sure that *L1* is located as far as possible from any metal when the board is mounted inside the box. Mount the circuit board to the side of the box with a pair of L brackets and machine hardware.

Referring back to Fig. 1, wire together the components, being particularly careful with the orientation of *Q1*'s leads and the polarity of *B1*. (Note: a tapped coil is best for *L1,* but if only an untapped coil is available, you can close-wind 8-12 turns of #28 enameled wire over the center of the untapped coil windings. Use as few turns as possible to prevent lowering the Q of the coil and producing too broad a signal, but as many turns as needed to provide an adequate signal level in a good-quality receiver. Now, connect one end of the new winding to the *B1* terminal of *Q1* and the other end to case ground.)

Finally, mount the vernier dial on the capacitor shaft. To do this, first completely mesh the capacitor plates. Remove but reserve the screws on the shaft collar of the vernier dial and slip the vernier onto the shaft of *C2*, orienting it as shown in the photo on the first page of this article. Set the vernier dial to its zero index.

With the vernier dial properly oriented, mark the two mounting hole locations on the front of the box. Remove the dial without disturbing its setting. Then drill the two #32 holes in the positions indicated by your markings. Replace the dial and anchor it down with 4-40 hardware. Finally, replace the shaft collar setscrews, driving them through the hole at the bend of the capacitor L bracket. Then assemble the box.

Testing and Use. When the generator is completely assembled, make an output lead by connecting a banana plug to one end of a 24"-long piece of flexible test cable. Do not remove the insulation from the other end of this test cable since it must *never* be physically connected to any point in the receiver.

Plug the output lead into the yellow binding post (*BP1*) on the generator and lay the free end of the cable near the antenna coil of any available AM receiver. Make sure the vernier dial is set to the zero index. Set the receiver dial to the low end of the AM band or 535 kHz.

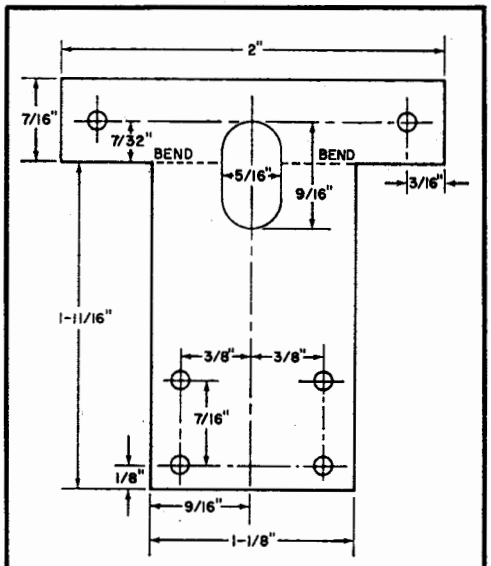


Fig. 3. Bracket for mounting C2 should be fabricated from 22-gauge aluminum stock.

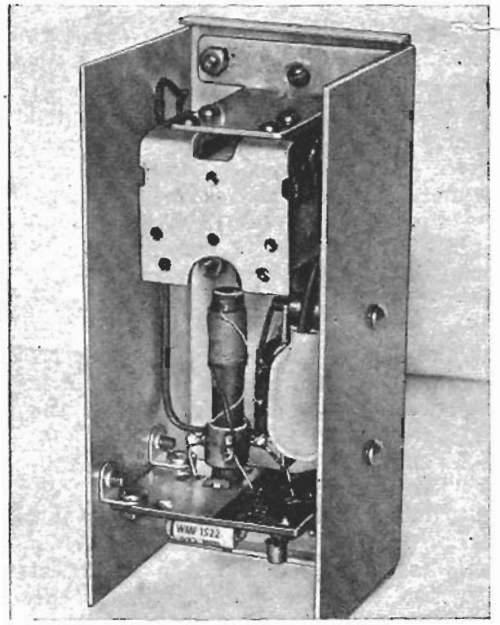
Turn on the power to the receiver, and set the volume control so that you hear a soft rushing sound coming from the receiver speaker. Now switch on the power to the signal generator and use a tuning tool to adjust the slug on *L1* (for this step you will have to temporarily remove the rear of the generator box), until you hear the 750-Hz audio tone in the speaker. If the tone tends to become very loud, do *not* readjust the receiver volume control setting. Instead, put some

distance between the generator's output cable and the receiver's antenna.

Continue to adjust the slug of *L1* for maximum signal strength, putting more distance between the receiver and generator as needed. Proper adjustment of *L1* must be made while the tone coming through the speaker is at a low level, since a loud signal tunes too broadly.

In use, regardless of what type of AM broadcast band receiver is under test, always set the volume control of the receiver for maximum and adjust the sound level by changing the distance between the receiver and generator.

In the event you are testing a low-gain receiver and can barely hear the audio tone even when the generator output cable is actually touching the receiver's antenna coil, connect another cable from receiver chassis ground to the black binding post on the generator. This will significantly increase the signal level. However, if the signal level is adequate without this connection, do not use the extra cable. Also, under no circumstances should an a.c./d.c. tube-type receiver be connected in this manner as the chassis of the receiver is likely to be 117 volts a.c. "hot."



Orient C2 mounting bracket as shown at top, and use small L brackets for mounting circuit board.

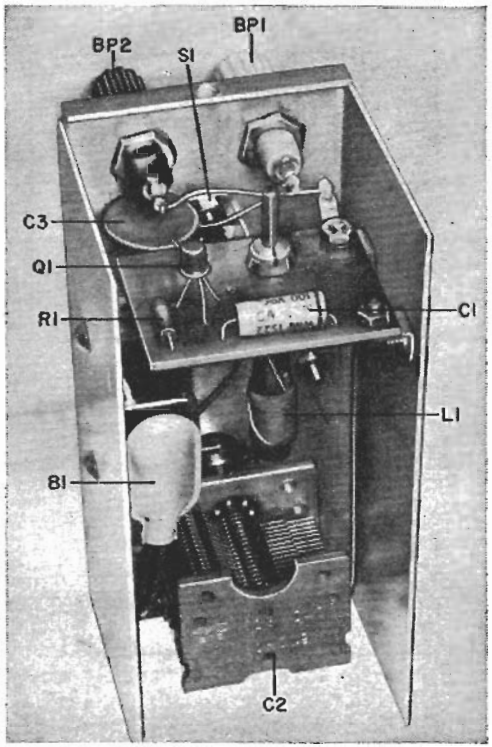


Fig. 4. Mount battery to side of box with length of aluminum stock, ½" spacers, and #6 hardware.

Always make tests at low sound levels with minimum coupling between the generator's output cable and receiver's antenna coil. Otherwise, the output of the generator will tend to "swamp" the receiver and you will be unable to tune the R.F. (if any) and I.F. stage(s) on the nose. Result: a badly misaligned receiver and poor selectivity. -30-