The S-72 is a portable 4-band receiver.

Radio Set and Service Review

Hallicrafters Model S-72

HALLICRAFTERS model S-72 is an eight-tube, four-band, three-way portable receiver of AM and c.w. signals between 550 kc and 30 mc. Housed in a brown leatherette-covered case 12¼ inches high, 14 inches wide, and 7¼ inches deep, it can be operated from 117-volt a.c. or d.c. lines or from its pack-type battery. This set has such features as electrical bandspread, automatic noise limiter, b.f.o., and phone jack, but it is definitely not a full-fledged communications receiver as were the Sky Traveler and Sky Ranger.

The tube line-up consists of a 1T4 r.f. amplifier, 1U4 mixer, 1R5 oscillator, two 1U4 i.f. amplifiers, 1U5 second detector, first a.f. amplifier, and a.v.c., 3V4 power amplifier, and 1U5 b.f.o. The r.f. amplifier is wired to use a loop antenna for broadcast reception and standard antenna coils and a telescoping rod for shortwave.

The oscillator is connected as a triode with grids Nos. 2, 3, and 4 connected to the plate. A 7-μμf capacitor and 47-ohm resistor connect the oscillator plate to the mixer grid to provide local oscillator injection voltage. Resistance coupling being used between the i.f. stages, there are only two i.f. transformers in the set. The second detector and audio sections of the set are conventional. The phone jack disconnects the speaker when the phones are plugged in. Phones of 500 ohms or higher impedance can be used.

The b.f.o. is a triode-connected 1U5. Stray capacitance (and possibly feedback through the power supply) provides coupling between the second detector and b.f.o.

The automatic noise limiter is a shunt-diode type using the diode of the 1U5 b.f.o. tube.

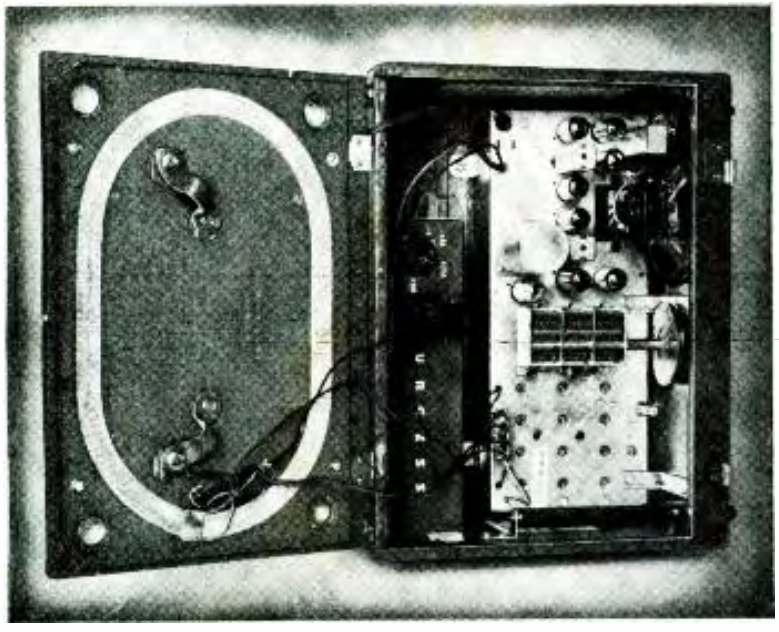
The controls are TUNING, BANDSPREAD TONE, BAND SELECTOR, VOICE-CODE, ON-OFF-VOLUME, and A.N.L. (automatic noise limiter). In the model examined, one of the first off the production line, the bandspread capacitor is a compression-type mica trimmer (C37 in the diagram) shunting the oscillator section of the tuning capacitor. The shaft of this control has a metal projection which opens the tone switch S3 when the bandspread control is set at zero for normal broadcast reception. Moving this control through six divisions on the dial closes S3 and connects a 470-μμf capacitor between the plate of the first a.f. amplifier and ground. The manufacturer states that the tone switch has been eliminated and a three-section bandspread capacitor installed on models now in production.

The VOICE-CODE control is a combination r.f. gain control and a.v.c.-b.f.o. switch. When it is turned clockwise as far as it will go, the set operates at maximum sensitivity because the r.f. and first i.f. screens are operated at the full voltage developed across R8, the r.f. gain control. Switches S2-b (a.v.c.) and S2-c (b.f.o.) are open. Turning the control counterclockwise applies B-voltage to the b.f.o. and grounds the a.v.c. line.

Although the S-72 is primarily designed as a general-purpose portable, its electrical bandspread and b.f.o. put it several jumps ahead of others in the same class. It was compared with several a.c.-operated communications receivers and was able to hold its own on almost any signal which did not require a Q-5'er or crystal to pull it in. A good long-wire antenna increases the average signal level about four S-points over the whip antenna and brings weak signals well above the noise.

The model tested has a tendency to be microphonic when the speaker is used while receiving signals in the 11 to 30 mc range. This is caused by acoustic feedback between the speaker, the oscillator tube, and its section of the tuning capacitor.

This set could be adapted for amateur service by taking the b.f.o. and a.v.c. switches off the r.f. gain control and replacing them with a d.p.s.t. switch. The addition of a standby switch and provisions for a doublet-type antenna would make this receiver ideal for field-day operations.

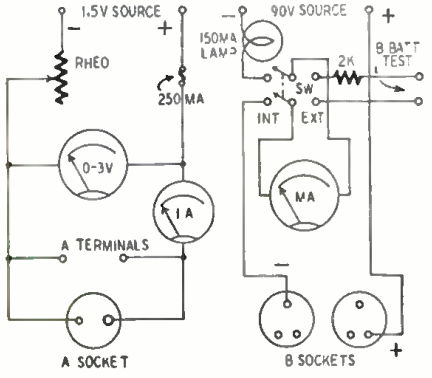


A single pack supplies A- and B-power. A broadcast loop is inside back cover.

Turn dial across local stations. A dip in the total B-current indicates normal a.v.c. action. (This is some help in alignment.)

With class-B-output sets, tune in a local station, and increase volume. One look at the heavy peaks of B-current will show your customer how to conserve B-batteries by holding volume down when not required.

To check for open filaments in individual tubes, turn A-voltage to about 1 volt. Remove tubes one at a time. A



Figs. 1 (left) and 2—A and B circuits of the battery receiver testing panel.

slight increase in A-voltage each time indicates a closed filament.

Testing batteries

One-and-one-half-volt cells of all kinds may be tested across the A-terminals (Fig. 1). The rheostat must be in the off position. B-batteries may be tested by throwing the switch in Fig. 2 to EXT and connecting the B-bat test terminals to the battery. One thousand ohms in series with any milliammeter converts the latter to a voltmeter of the same scale. Hence, a 50-ma meter, for instance, becomes a 50-volt meter, and draws sufficient current to throw a good test load on the suspected battery. A 2,000-ohm, 5-watt resistor may be used to measure to 100 volts.

Two-volt sets

If 2-volt sets are commonly serviced, a 2-volt storage cell should be used for A-supply. This will also serve for 1½-volt tubes. For really old models, an extra B-socket may be necessary (there is one on the panel in the photo), and voltage taps at 22½ and 67½ volts.

For car radios and 6-volt vibrator sets, a 6-volt supply may be connected to terminals on the panel, in series with an old-style automobile ammeter. Shorted or open A-connections, sticky vibrator points, and bad buffer or filter capacitors may be detected by observing the current drain.

Modifications or improvements of this arrangement will suggest themselves to the individual technician. Circuits could be installed for other types of sets using 4½- or 9-volt A-batteries. An alternative is to install a switch to open the voltmeter circuit, or to put a multiplier resistor in series with it.

AF-Ultrasonic Frequency Meter

DESCRIBED in *The Review of Scientific Instruments*, this electronic frequency meter measures frequencies between 20 cycles and 160 kc, independently of amplitude and waveform.

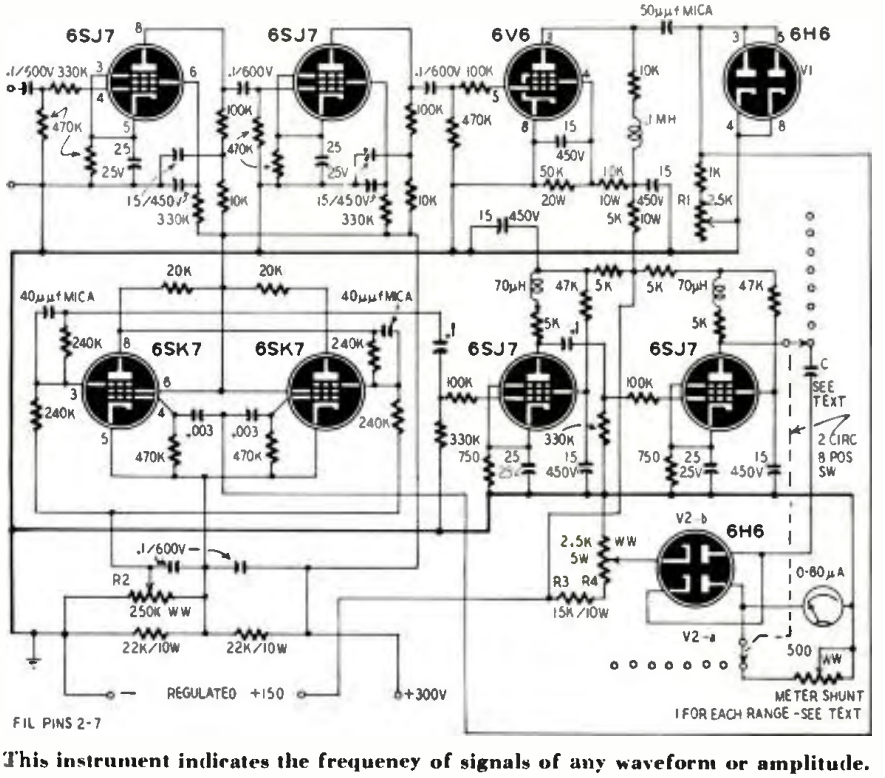
The signal is applied to the input terminals and amplified by two 6SJ7 high-gain amplifiers. A 6V6 is driven beyond cutoff and to saturation so it clips the positive and negative halves of the signal and produces square waves of the same frequency as the input signal. The square waves are differentiated and applied to a diode clipper V1 which removes the positive pulses. The negative pulses are applied to the control grids of a pair of 6SK7's in a modified Eccles-Jordan multivibrator circuit. This circuit is so connected that one tube is cut off and the other conducting at all times. The multivibrator "flips" when a negative pulse is applied to the grid of the nonconducting tube. A positive pulse has no effect on the circuit. The first negative pulse "flips" the multivibrator and the next makes it "flop;" thus, two negative triggers are required to make the multivibrator go through one complete cycle.

The output of the multivibrator is a square wave one-half the frequency of the input signal, thus simplifying high-frequency compensation and increasing the useful range of the meter. Because the multivibrator output is distorted at high frequencies, it is fed to cascade-connected 6SJ7's working as clippers. These produce square waves whose amplitude is constant, regardless of the input frequency and amplitude.

The square waves are applied to a 6H6 discriminator through capacitor C, which is charged through diode V2-a, resistors R3, R4, and the output impedance of the second 6SJ7 clipper during the positive half of the square wave. During the negative half of the cycle, C discharges through V2-b, the meter, and the clipper impedance. If the time constants of the charge and discharge circuits are equal, the meter current is determined by the size of C and the frequency of the square wave. Therefore, the meter can be calibrated to read directly in cycles per second.

Ranges are switched with a 2-circuit, eight-position rotary switch that changes the value of the charging capacitor C and the meter shunts. The high-frequency ends of the ranges are 160, 800, 1,600 cycles and 8, 16, 40, 80, and 160 kc when C equals .05, .01, .005, .0019, .0005, .00025, .00018, and .00009 μf. All meter shunts are 500-ohm potentiometers.

To adjust the instrument, apply an audio signal to the input terminals. Use a scope to check the triggering pulses at the grids of the 6SK7 multivibrators. A sharp negative pulse should be observed. Adjust R2 for a square wave when the scope is connected between ground and either plate of the multivibrator. Adjust R1 for reliable triggering action. Adjust R4 until the meter reads off scale (about 100 μa) at the full-scale frequency of one of the ranges. Bring the meter back to full scale with the appropriate shunt. Calibrate the scales with a wide-range a.f. signal generator.



This instrument indicates the frequency of signals of any waveform or amplitude.