SECTION 7

MINIATURE RECEIVER RC1/2

Introduction

The RC1/2 is a miniature transistorised super-regenerative receiver, intended to replace the HR/14 described in Section 5 and is used in television studios by floor managers to enable them to receive speech from the producer in the control cubicle. The receiver is an a.m. type tunable over the band 45 Mc/s to 65 Mc/s. Tuning can be pre-set to two frequencies, which can be selected by a switch.

The receiver is contained in a pressed duralumin case measuring $5\frac{3}{4}$ in. by $2\frac{3}{4}$ in. by 1 in. and its weight is $8\frac{3}{4}$ oz. It is normally supported by a leather strap suspended from the shoulders. The general appearance of the receiver in its case can be seen from Fig. 7.1; this shows the volume control, the channel selector switch and the two holes via which tuning is effected.

The receiver is switched on automatically by the insertion of the headphone plug into the socket on the receiver and the headphone lead acts as an aerial. The receiver is completely constructed on a printed wiring card which also accommodates the battery. The battery is a 2·7-volt mercury-cell type and gives a service life of approximately 100 hours.

Super-regenerative Principle

A receiver for an application such as this needs high sensitivity and good a.g.c., but the quality of the a.f. output need not be high. A super-regenerative type of receiver satisfies these requirements and, because of the simplicity of the circuit, can be made very compact.

A description of the action of a super-regenerative receiver is given in Section 5 of this Instruction, and reference should be made to this for full details, but briefly it may be said that the receiver employs a reacting detector which is forced in to and out of oscillation at a supersonic frequency by a quench oscillator.

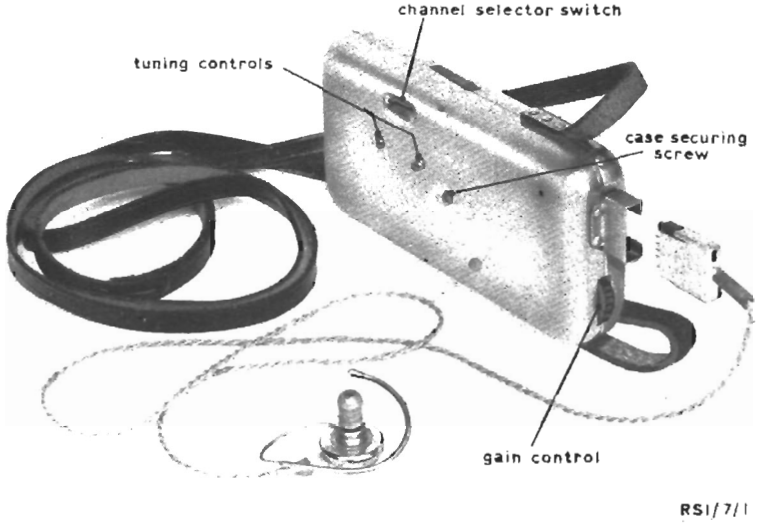

Fig. 7.1. Receiver RC1/2: External View

Circuit Description (Fig. 10)

A complete circuit diagram of the RC1/2 is given in Fig. 10. It employs a total of seven transistors used for the following purposes:

TR1	r.f. amplifier
TR2	detector
TR3	quench oscillator
TR4, TR5, TR6, TR7	a.f. amplifier

An r.f. stage is included primarily to isolate the

detector stage from the aerial, and thus to prevent any mistuning effects due to changes in aerial capacitance which could occur if the aerial were coupled directly to the detector.

TR1 is a common-base amplifier, the base being decoupled by C1. The r.f. input from the earphone lead is applied via C2 to TR1 emitter and the amplifier output from the collector is transferred by C4 to TR2.

TR2 is a common-base connected detector, detection occurring via the curvature of the V_{ce}—I_c characteristic. The primary winding of r.f. transformer T1 is tuned by the trimmer C5 and acts as a tuning circuit; the transformer is included in the collector circuit of TR2, a fixed degree of positive feedback (i.e., reaction) being achieved by including the secondary winding in the emitter circuit. The alternative tuning frequency is obtained by operating switch SA, which replaces C5 by trimmer C6. The collector load resistor is R7, and the a.f. voltage generated across it is applied to TR4 via the r.f. and quench oscillator frequency filter C9, R10, C12 and the blocking capacitor C11.

TR3 is a common-emitter quench oscillator operating at about 90 kc/s. Winding 4-5 of r.f. transformer T2 is tuned by C22, regeneration occurring via the coupling to winding 4-6 included in the base circuit. The secondary winding 3-1 is connected in series with R7 in TR2 collector circuit so as to vary TR2 supply voltage, and by giving winding 3-1 the same number of turns as 4-5 it is ensured that this supply voltage is reduced to zero during each cycle of oscillation.

The a.f. amplifier consists of four *RC*-coupled common-emitter stages TR4 to TR7, with a gain control comprising the variable potential divider R26 controlling the input signal to TR5. The control is fed via capacitor C14 and its output is taken via capacitor C15; thus operation of the control has no effect on the steady potentials on TR4 or TR5 electrodes.

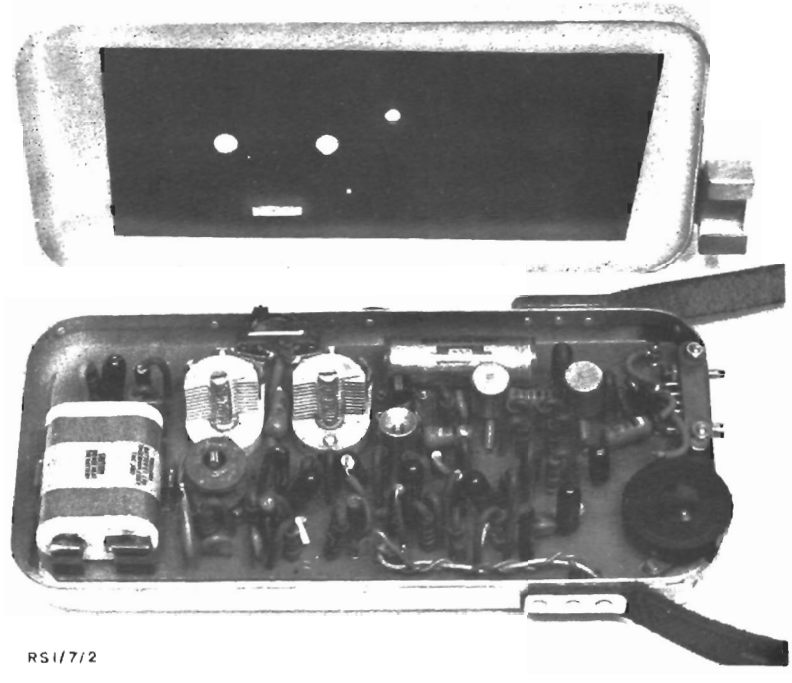

Fig. 1.2. Receiver RC1/2: Interior View

The collector currents of TR4, TR5 and TR6 are all stabilised by potential dividers and emitter resistors, but this method is not adopted for TR7, because all the available supply voltage (2·7 volts) is required across the transistor to enable it to supply the required output. Very little resistance can therefore be afforded in TR7 emitter circuit and stabilisation is achieved by R24 connected between collector and base; this in conjunction with the earphone resistance gives d.c. and signal-frequency negative feedback. C10 is included to by-pass any 90-kc/s signals from the quench oscillator.

The leads to the earphone are required to act as an aerial and the receiver output connections therefore include two r.f. chokes L2 and L3 which have high reactance at Band-I frequencies but negligible reactance at a.f.

Mechanical Construction

The receiver is completely assembled on a printed-wiring board as shown in Fig. 7.2. The battery is also held between contacts attached to the board.

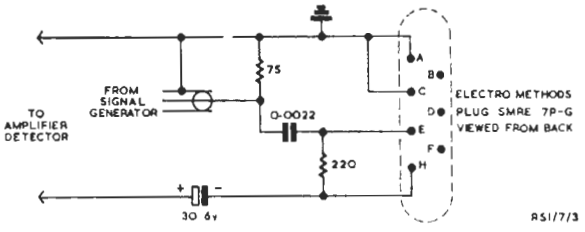

Fig. 7.3. Receiver RC1/2: Test Circuit

Performance

Tests on signal-to-noise ratio and frequency response should be made using the circuit of Fig. 7.3. An r.f. input of 10 μV modulated to a depth of 30 per cent by 1-kc/s tone should give a signal-to-noise ratio of at least 20 dB. For 100 μV input the signal-to-noise ratio should be 40 dB.

The maximum undistorted power output is 0·7 mW into a load of 220 ohms.

The a.f. range is from 200 c/s to 3 kc/s, the response tolerances being as indicated in the following table for an input of 100 μV modulated to a depth of 30 per cent.

Frequency	*Response*
200 c/s	-3 ± 3 dB
400 c/s	$-1{\cdot}5 \pm 3$ dB
600 c/s	-1 ± 2 dB
800 c/s	$-0{\cdot}5 \pm 2$ dB
1 kc/s	0
2 kc/s	-3 ± 3 dB
3 kc/s	-8 ± 5 dB
4 kc/s	-15 ± 6 dB

The total harmonic distortion should be less than −26 dB at 1 kc/s.

The battery drain should be approximately 6 mA at 2·7 volts and at this current the Mallory TM-120 battery should give a life of approximately 100 hours for intermittent or continuous discharge.

Maintenance

Maintenance on site should be limited to renewing the battery and to re-tuning the receiver. If any faults are suspected the receiver should be returned to Equipment Department for attention.

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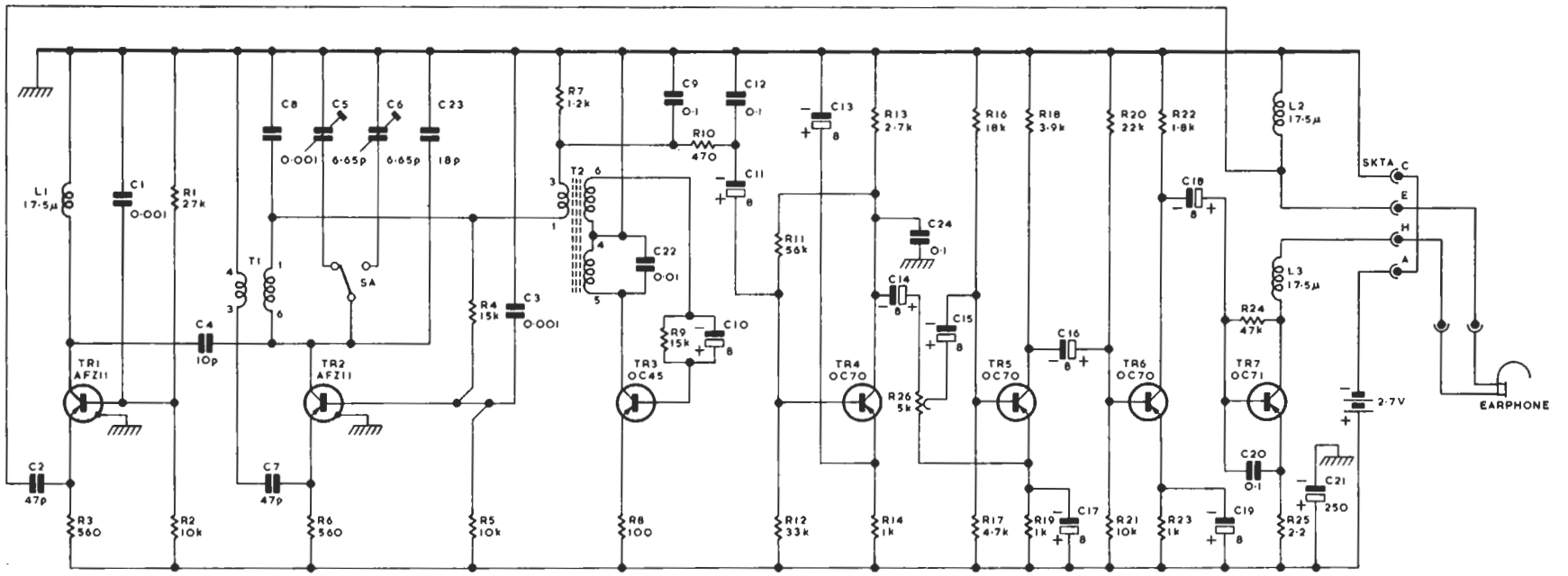

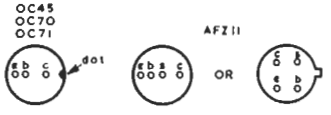

FIG 10

RS.1

MINIATURE TALK-BACK RECEIVER RC1/2 : CIRCUIT