WIRELESS SET No. 38 Mk 1, II, & II*.

1. General Description.

The No.38 Set is a light-weight portable sender and receiver designed for short range R/T working. The frequency band covered is approximately 7.3 Mc/s to 8.8 Mc/s obtained in a single range on a calibrated tuning control common to both sender and receiver. Sender and receiver are automatically adjusted to the same frequency thereby simplifying netting.

The set is carried on the left breast next to the respirator and the supporting sling is secured to the webbing equipment by means of a brace hook and ring. A body belt, also fastened by means of a hook and ring secures the set at the lower end.

Mk II and Mk II* sets can be used in infantry tanks for short range communication between the tanks and supporting infantry. In this case they are used in conjunction with the W/S No.19 Inter-com-amplifier, a special control unit being fitted for the purpose.

The aerial used consists of a single vertical rod comprising one or three Antennae rods "F" sections. The maximum range obtainable using one 4' rod is approximately 2 miles over flat open country, while up to 5 miles range may be expected with the full 12' aerial.

The power supply is derived from dry batteries. All valve filaments are heated by means of a 3 volt dry battery and a 150 V layer type provides the H.T. Both batteries are housed in a single pack (Battery Dry HT/LT 150/3 volts).

L.T. Consumption in Receive .23 A on Send .45 A.
H.T. " " " 9 mA " " 14 mA.

Five valves are employed two of which are common to both sender and receiver circuits. The set which is built up on a single chassis is housed together with the HT/LT battery, in the case of Mk I Sets, in a light metal case. The battery for Mk II and Mk II* sets is carried in a haversack on the operator's back. In the latter case a battery of somewhat larger capacity may be used.

Two aerial sockets, the tuning control, and a combined send/receive on/off switch are located on the top panel. The 'phones and throat microphone are connected to the set via a junction box which, in the case of a Mk I set, is attached to it by means of a 4 way flexible cable. For Mk II & Mk II* sets a modified junction box is supplied which is carried in the haversack with the battery. Connection between the junction box and battery is made by means of a four point plug, while a 6-core cable terminating in a plug connects the battery and audio equipment to the set.

2. Circuit Description.

On receive the set employs four R.F. pentodes (ARP12) in a superheterodyne circuit comprising R.F. amplifier, mixer and separate local oscillator, and a reflexed I.F. and A.F. amplifier. Signal detection and A.V.C. are carried out by means of a Westector Type W X 6.

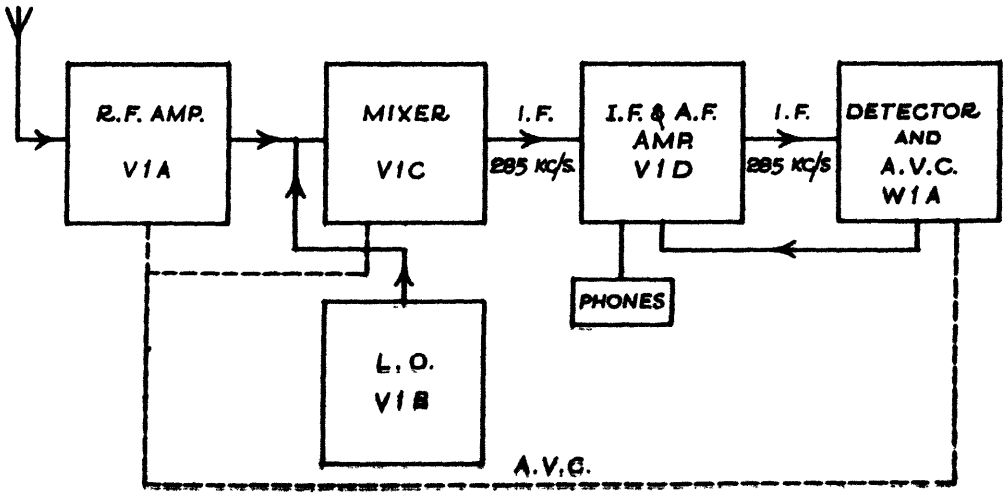


Figure 1.
Block Diagram of No.38 Set on "Receive".

When functioning as a sender the signal frequency is produced by the local oscillator stage which is followed by a single power amplifier. The latter is grid modulated by the output from the A.F. amplifier now functioning as a modulator stage.

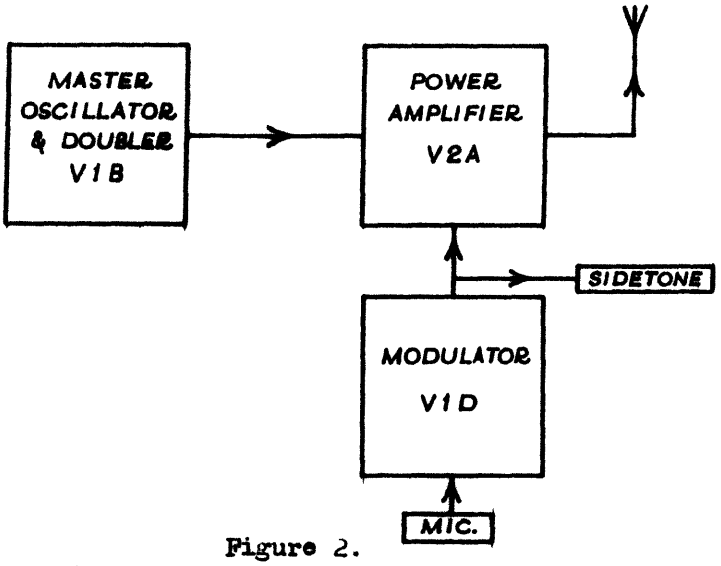


Figure 2.
Block Diagram of No.38 Set on "Send".

(a) The Sender.

(i) M.O. and Doubler Stage.

V1B an ARP 12 operates as an electron coupled oscillator in a frequency doubling circuit. The screen control grid and filament functioning as an inverted Hartley oscillator in conjunction with the inductance coil L5 tuned by C4B produce oscillations at half the carrier frequency. The tuned anode circuit consisting of L3 tuned to the second harmonic of the grid circuit frequency by C4A provides drive for the P/A stage at carrier frequency via the coupling condenser C5E. C4A and B are two sections of a three-gang variable condenser (TUNING Mc/s control). L3 and L5 have dust-iron cores which are adjustable for trimming purposes, and their associated tuned circuits include the parallel trimmers C1C and C1D respectively.

H.T. to anode is fed direct from H.T. + 150 via S1F a section of the ON/OFF, SEND/RECEIVE switch and L3. C13A (4μF) shunted by C6E (.01μF) decouples the H.T. Screen voltage is reduced to approx.40 V by means of the feed resistor R4B (.1 MΩ) decoupled by C6C (.01μF). R1A is shorted out on send. Self-bias is provided by C5C (100μμF) and R5A (50,000Ω).

(ii) Power Amplifier.

The P/A valve V2A is a double pentode with electrodes strapped internally, type A.T.P.4. The output circuit consists of an anode coil L1 tuned to carrier frequency by C3A, the 3rd section of the 3-gang assembly, and the parallel trimmer C1B.

H.T. is applied to the anode via S1F, S1B, R2A (600Ω) decoupled by C15A (.01 F) and L1. The anode of V2A is tapped up the coil L1 for impedance matching. The screen is supplied with H.T. direct from R2A. The control grid is biased back to the bottom-bend by means of the resistor R10A in the H.T.-lead which provides a standing bias of 16 volts negative.

Neutralization is carried out by means of the few extra turns on L1 which are coupled to the grid of V2A via C2A and C5B.

(iii) Modulator Stage.

The audio frequency output from the throat microphone is amplified by the valve V1D type ARP12 operating as an A.F. amplifier (modulator) before application to the P/A grid for modulation. The microphone output is applied to the grid of V1D via the microphone transformer T1. The primary of T2 forms the A.F. load in this stage and output is taken to the grid of the P/A valve via C6F (.01μF), S1E and the modulation choke L10.

The tuned circuits L7B and C7B in the grid and L7C, L8 and C7C in the anode have negligible effect on the operation of V1D on send as they tune to 285 Kc/s and therefore offer a low impedance to audio frequencies. Sidetone is derived from the A.F. voltages induced in the secondary of T2.

(b) The Receiver.

(i) R.F. Stages.

The received signal is amplified before frequency changing by V1A, an ARP12, operating in a tuned anode R.F. amplifier. The aerial is coupled to the tuned grid circuit via C5A. This circuit, which forms the P/A tuning circuit on send, comprises L1, C3A, C1B and C15A.

H.T. to V1A anode is fed via S1F and the anode coil L3. The latter, we have already seen, is tuned to signal frequency by C4A. Screen voltage at approximately 45 V is applied via R4A decoupled by C6A.

The control grid is isolated from the H.T. on the grid coil L1 by the grid condenser C5B. Grid return to filament is through the leak R3A and the A.V.C. network.

V1B on receive functions as the local oscillator the output of which must be signal frequency + I.F. i.e., S + 285 Kc/s. This increase in frequency when switching from send to receive is accomplished by shunting the oscillator tuned circuit with a tracking coil L6 and the compensating condensers C16A, C2B and C9A. In the case of Mk I & II sets the grid circuit of V1B oscillates at half the output frequency i.e. $\frac{1}{2}$ (S + I.F.) but in Mk II* sets the values of the components in the compensating network are such that oscillations are produced at output frequency (See Fig.IV).

The oscillator output is developed across the tuned circuit L3, C4A etc. which we have seen is common to the R.F. amplifier output & is tuned to signal frequency. This common load will therefore supply two separate inputs to the mixer valve V1C, i.e., signal frequency from V1A and signal + I.F. from V1B. This is only possible with a low value of I.F.

Screen voltage on V1B is reduced to approx. 20V on receive by removing the short on R1A.

Oscillator and R.F. amplifier outputs are applied to the mixer valve V1C which functions as a detector. The resultant difference frequency is selected by the tuned primary of the I.F. transformer L7A.

(ii) Reflex Amplifier, Signal Detector and A.V.C.

The valve V1D, an ARP12, operating in a reflex circuit on receive, amplifies both I.F. output from the 1st detector or mixer and A.F. output from the signal detector.

I.F. output from the mixer stage is applied to the grid circuit of V1D via the 1st I.F. transformer secondary L7B. The anode load in this case is the tuned circuit comprising the primary of the 2nd I.F. transformer L7C, L8 and C7C.

The secondary of the I.F. transformer is associated with a series diode detector circuit in which a metal rectifier W1, type W X 6, is used. R6B (47000Ω) and C5F (100μμF) are the diode load and condenser respectively.

The A.F. voltage developed across R6B is re-applied to the grid of V1D by way of the voltage divider consisting of R7C, R5B and R7B. R4C, C8A and C8B from an I.F. filter. The A.F. signal is handled by this stage in similar fashion to the microphone output as already detailed, the amplified signal appearing in the secondary of T2 and operating the phones. C8D is the anode I.F. decoupling condenser.

The D.C. component of the signal detector output is applied as A.V.C. voltage to V1A and V1C via the filter circuit comprising R7D and C6B. As there is no D.C. blocking condenser in the A.F. input circuit of V1D, the D.C. component will be applied as partial A.V.C. voltage to this valve.

H.T. to the anode of V1D is applied from the H.T.+ line through S1F, the primary of T2, L8 and L7C. Screen volts are dropped to approximately 30 volts by the feed resistor R1B (.18 MΩ) decoupled by C10A (1μF).

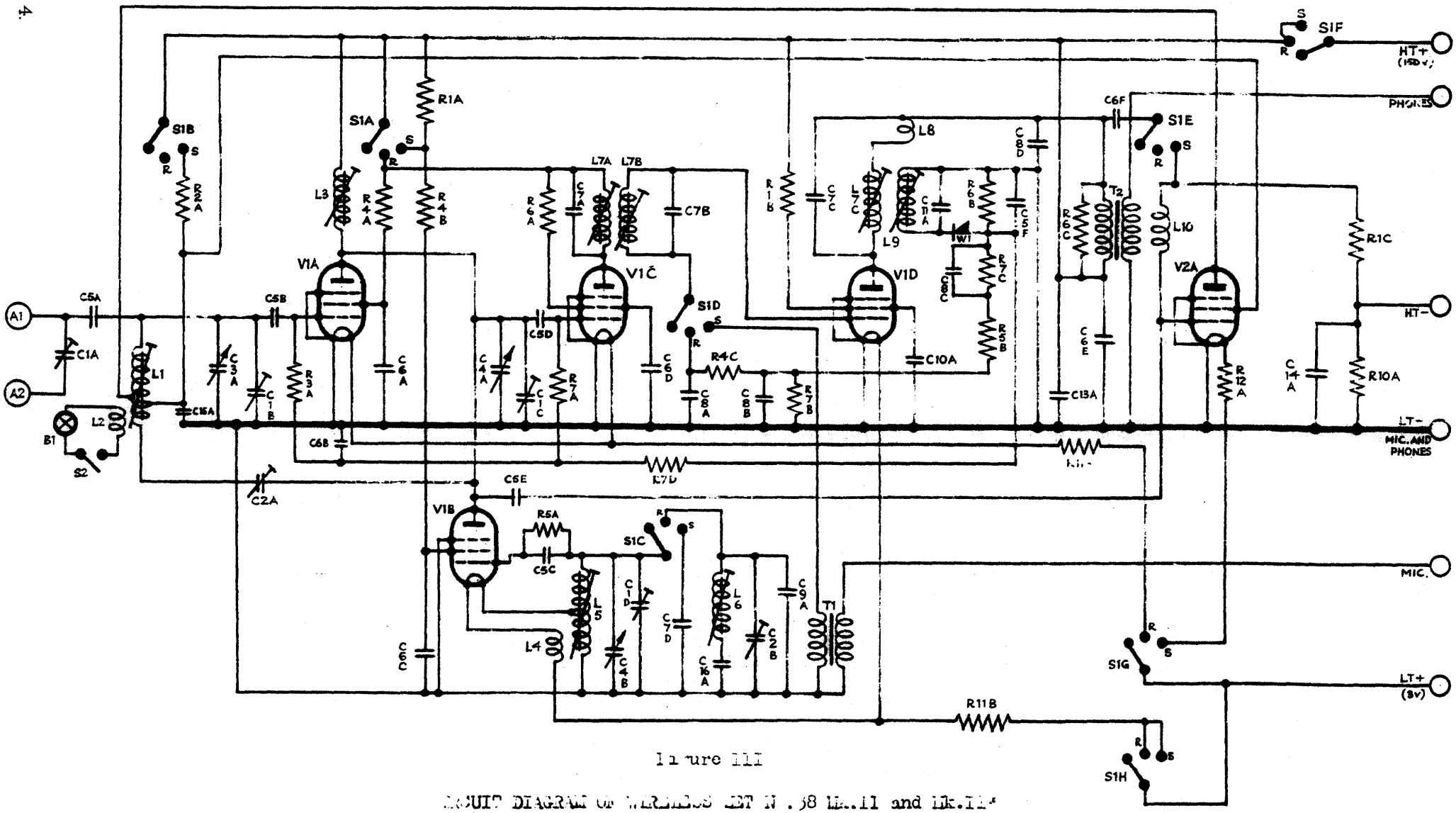


Figure III

CIRCUIT DIAGRAM OF WIRELESS SET No. 38 Mk.II and Mk.II*

CIRCUIT OF OSCILLATOR IN W/S NO 38 MK II*

Figure 4.

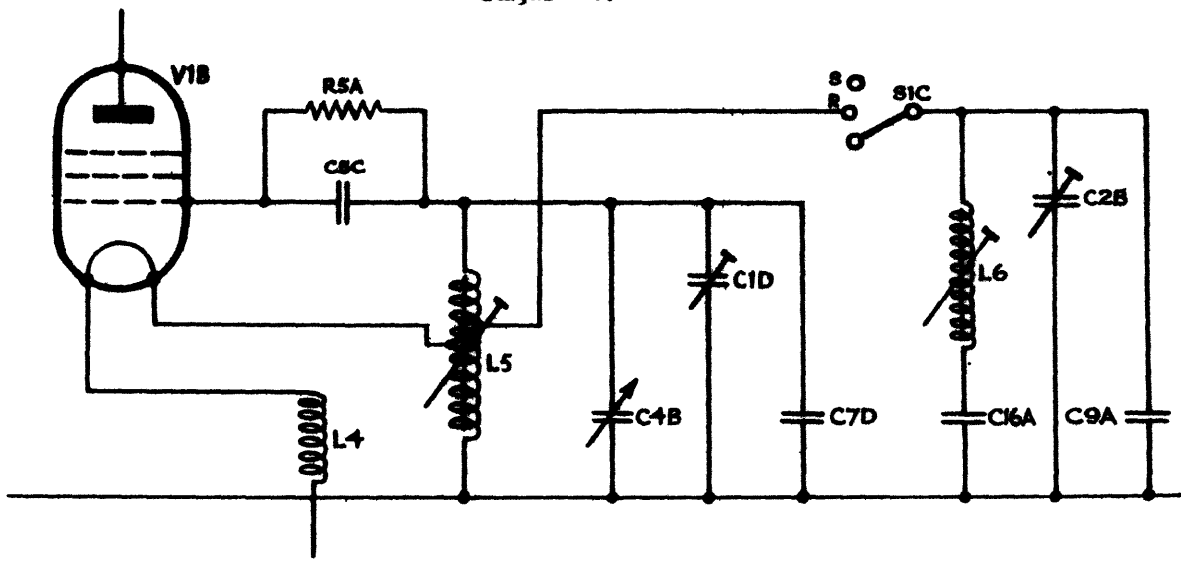
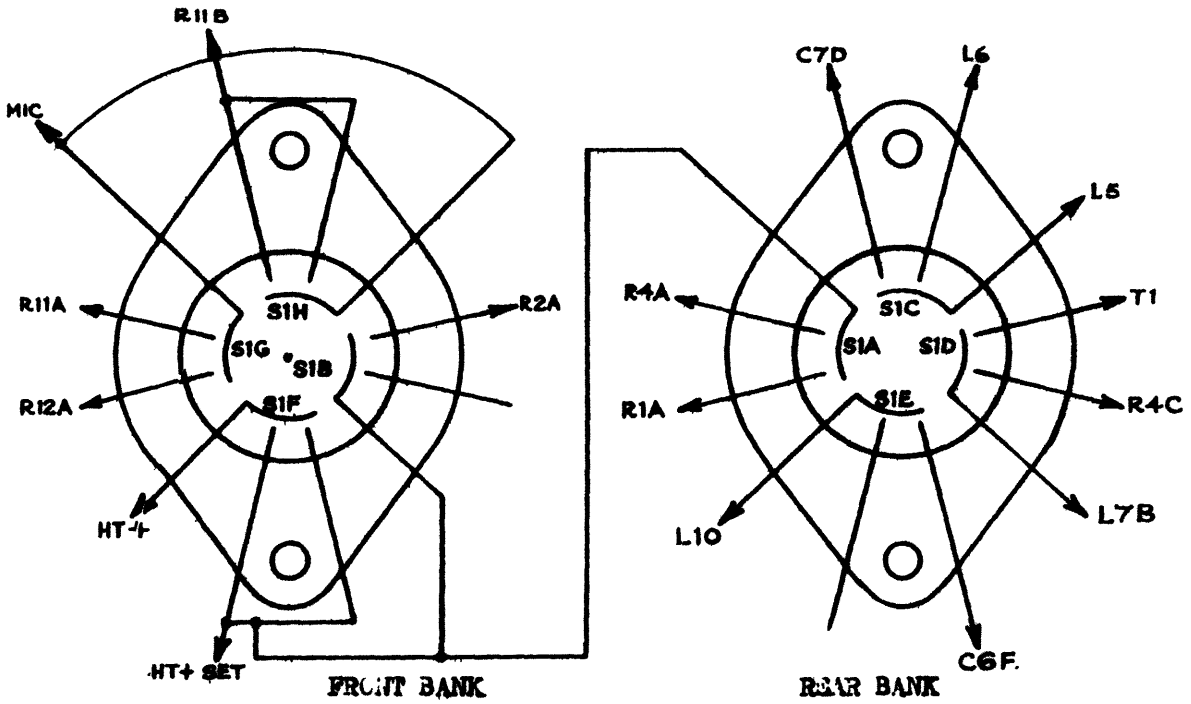
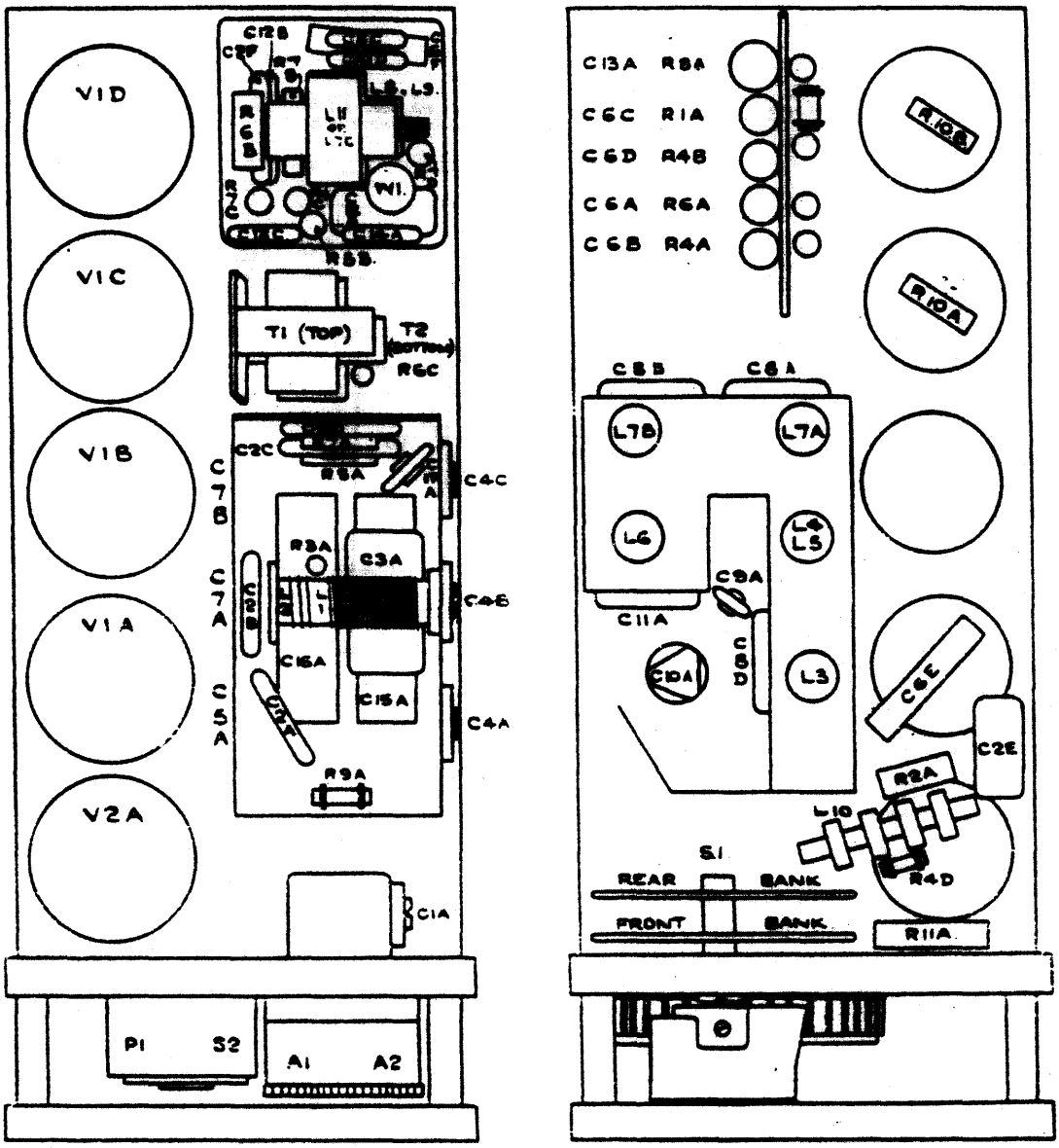


Figure 5.

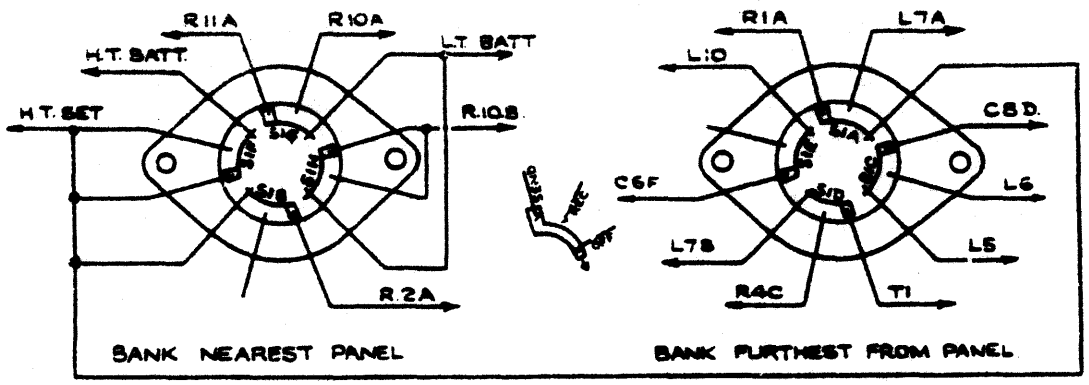


OFF-RECEIVE-SEND SWITCH. S1A-H
REAR VIEW.



TOP CHASSIS VIEW

UNDER CHASSIS VIEW



SEND/RECEIVE/OFF SWITCH, S1. REAR VIEW

CONTACTS SHOWN AT "SEND"

WIRELESS SET Nº 38.