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G.S.-M.T. 2 (P)

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500

WIRELESS SETS No. 33
WORKING INSTRUCTIONS

PART II

TECHNICAL DESCRIPTION
AND MAINTENANCE

NOT TO BE PUBLISHED

NOTE

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CHAPTER I.—TECHNICAL DESCRIPTION.

1. General.

The Wireless Set No. 33 is a general purpose medium power sender with R.F. output of about 250 watts on C.W. Provision is also made for operation on M.C.W., and R.T. The sender may also be switched on and off, keyed on C.W. and M.C.W., and modulated by any V.F. system (including teleprinter) over a 600 ohm line by means of a Wireless Remote Control Unit C. The circuit permits " break-in " working with the Reception Set R.107.

The sender is designed to work into loads of 100 and 600 ohms, but aerial systems of other impedances may be used as indicated later in this pamphlet.

The frequency band of 17·5 M.c/s to 1·2 M.c/s is covered in four overlapping main ranges.

The sender may be energised from any available single phase A.C. supply of between 100 volts and 250 volts at 45 to 60 c/s capable of delivering 1·5 kw.

The sender comprises two units, the sender or R.F. Unit and the Power Supply Unit.

Brief circuit descriptions are given below with explanations where necessary. The function of each component is given in the Components List at the end of the text.

2. Sender. (Circuit Diagram Figs. 11 and 12.)

(1) *R.F. Stages.*

There are four R.F. stages, namely, the Master Oscillator, Buffer (amplifier and frequency multiplier), Driver and Power Amplifiers.

(*a*) Master Oscillator (Valve V2A, type A.T.S. 25).

The oscillator is self-excited or crystal controlled according to the setting of the OSCILLATOR switch S2. In the " M.O." position of this switch the oscillator is self-excited (Hartley circuit) and the crystal is disconnected. In the " CRYSTAL" position the crystal is switched into the grid circuit of V2A and the anode circuit is rearranged, while the anode-grid coupling and cathode bypass condenser systems are modified.

The frequency range of the oscillator is selected by the OSCILLATOR RANGE switch S8 which, by rotating a coil turret, connects the appropriate coil in the anode circuit of the valve. The frequency on a given range is determined by the setting of the OSCILLATOR tuning control which rotates the variable two-gang condenser C8A. The four coils (L1A, L2A, L3A, L4A) are so connected that the two sections of C8A are in series or in parallel or that one section only is used across the appropriate coil to facilitate frequency coverage conveniently and maintain a suitable LC ratio on the various ranges. There are also several fixed padding condensers connected to the sections of C8A.

When self-excited the master oscillator is tuned to *half* the required emission frequency. The OSCILLATOR tuning control dial is calibrated to *twice* the oscillator frequency, i.e. to the emitted frequency in this case. When using crystal control of frequency the oscillator is tuned to the fundamental crystal frequency and resonance is indicated by the CRYSTAL TUNING lamp P1A.

The combination R7A/L5A is a grid stopper to lessen the possibility of parasitic oscillations.

(*b*) Buffer (Valve V2B, type A.T.S. 25).

This stage acts as an amplifier and frequency multiplier, being tuned to twice the oscillator frequency when this is self-excited. With crystal control the buffer stage may be tuned to any harmonic of the crystal frequency within the range of the sender. The circuit is arranged so that there is little difference in the output obtained when working on harmonics, even as high as the fourth, of the oscillator frequency.

The frequency range of the buffer is selected by the BUFFER RANGE switch S9 which rotates a second coil turret in the anode circuit of V2B. Tuning is accomplished by the BUFFER TUNING control which rotates the variable two-gang condenser C8B with its two sections connected in series across the coil in use. Resonance is indicated by the BUFFER TUNING lamp P1B which is energised from a winding loosely coupled to the anode coil.

On Range I the turret is wired so that R9B, part of the grid leak resistance of the following valve, is short circuited to give a more suitable value at the higher frequencies.

(*c*) Driver (Valve V3A, type A.T.P. 35).

This stage amplifies the output from the buffer stage at the same frequency.

The frequency range is selected by the DRIVER RANGE switch S10 which rotates a third coil turret in the anode circuit of V3A. Tuning is accomplished by the DRIVER TUNING control which rotates the variable condenser C11A connected across the coil in use. Resonance is indicated by the DRIVER TUNING lamp P1E which is energised from a winding loosely coupled to the anode coil, except on Range I where capacitative coupling from the wiring is utilised.

A resistance made up of R11B and C in parallel is introduced to load this stage correctly.

The sender is keyed in the suppressor grid circuit of V3A. This grid is biased negatively beyond cut-off until contact C1 of the keying relay REL.3A changes over, when the bias becomes zero on C.W. and less negative on the other systems, allowing anode current to pass.

(*d*) Power Amplifier (Valves V4A and V4B, type A.T.P. 100).

This stage has two valves in parallel. The tuned anode circuit is shunt fed across the choke L15A-L30A through the condensers C15A and B.

Modulation is carried out in the suppressor grid circuit of the valves.

The frequency range is selected by the P.A. RANGE Switch S11 which short circuits a suitable amount of the coil L17A. On Ranges 1 and 2 contacts on this same switch serve to isolate the low frequency portion of the coil and one section of the variable two-gang condenser C16A. The condenser is rotated by the P.A. TUNING control with which tuning is carried out. In this case resonance is indicated by a dip in the reading of the P.A. ANODE CURRENT meter M2A. The actual value of the current depends upon the losses and L/C ratio in the anode circuit and will vary with frequency, being in general lower at the dip on the lower frequencies than on the higher frequencies.

In order to keep a satisfactory L/C ratio in the P.A. anode circuit the two higher frequency ranges are each split into two sub-ranges by S11 as in Table I below.

Table I.—FREQUENCY RANGES.

Main Ranges.	P.A. Ranges.	Frequency M.c/s.
1	1A	17·5 — 13·0
	1B	14·0 — 10·0
2	2A	10·5 — 7·5
	2B	8·0 — 5·2
3	3	5·3 — 2·5
4	4	2·55— 1·2

The switch S11 also operates contacts which short circuit part of the choke L30A on Ranges 1 and 2 to avoid trouble due to resonance of this choke on the higher frequencies.

In Fig. 12 the action of switch S11 is shown as follows. Each horizontal set of blocks represents one contact which is made when the blocks are shaded, open when the blocks are unshaded. The condition of each contact for any one of the six settings of the switch is found by reading vertically under the corresponding range number.

The output from the power amplifier is coupled to the load across the OUTPUT terminals by means of taps on the coil L17A. Sixteen taps are provided which enable the P.A. stage to be matched to loads of 100 ohms or 600 ohms at any frequency within the range of the sender. Eight taps on the high

frequency part of the coil are selected by the OUTPUT TAPS switch S13. This switch has a position " 0 " which disconnects the OUTPUT terminal from the coil and this is used when tuning the sender before loading. The OUTPUT TAPS switch S12 provides the remaining eight taps (9 to 16) and has a position " 0 to 8 " at which it must be set when S13 is in use.

The range switching on the coil L17A is done by shorting out the coil from the high potential end so that the limited number of output taps available may be used on as many ranges as possible Thus, while any number of taps can be used to achieve the necessary loading on Range 4 where the whole of the coil is in use, some of the taps become useless on the higher frequencies when they fall on the shorted or disconnected part of the coil. Table II below gives the useful taps on each range and the load impedance limitations, together with optimum taps for 100 ohm and 600 ohm loads.

Table II—OUTPUT TAPS AND LOAD IMPEDANCE LIMITATIONS.

Range.	Useful Taps.	Load Impedances.	100Ω Tap.	600Ω Tap.
1A	1 to 9	100 to 3000 Ω	1	1 or 2
1B	1 to 10	50 to 3000 Ω	3 or 4	4 to 6
2A	1 to 11	30 to 3000 Ω	6	7 or 8
2B	1 to 13	30 to 3000 Ω	8	9
3	1 to 15	30 to 3000 Ω	9	11
4	1 to 16	30 to 600 Ω	14 or 15	16

When loading the sender with an unknown impedance a start is made with tap 1, continuing upwards as necessary, but when the impedance is known the tap required can be more quickly selected.

The choice of the optimum tap can readily be made by observing the reading of the OUTPUT CURRENT meter M1A, which is coupled through T7A to one of the leads to the OUTPUT terminals and which will indicate output currents between 0·3 and 3·0 amps. R.F. The sender is loaded most efficiently when M1A is showing the highest reading for the lowest P.A. anode current shown by M2A.

The OUTPUT CURRENT meter is not calibrated directly in amperes but with figures approximately proportional to the logarithm of the current values, which gives a truer indication of the effectiveness of any increase in the loading of the P.A. stage than would a directly calibrated thermo-ammeter. Meter M1A is a D.C. milliammeter with full scale deflection at 1mA, coupled to the output circuit through suitable filters and a rectifier W3A. The current through the meter is limited by the rectifier W4A shunted across it and R16A.

(2) *Modulator.*

The modulator functions only on M.C.W. and R.T. and is controlled by the setting of the SYSTEM switch S3. There are two valves.

The first valve (V6A, type A.R.P. 34) is arranged to work as an A.F. oscillator for M.C.W. operation and as an amplifier for R.T. For M.C.W. the oscillatory circuit is made up of the choke L18A and condenser C23A connected in parallel and coupled between the anode and control grid of the valve, giving a frequency of about 900c/s. On R.T. the choke and condenser are disconnected, while the control grid of V6A is connected to the input transformer T3A, via a potentiometer R19A. This transformer has two primary windings, one for the microphone and one for V.F. signal over a 600 ohm line.

The second valve (V2C, type A.T.S. 25), resistance-capacity coupled to the first, has its output coupled into the suppressor grid circuit of the P.A. valves V4A and B via the transformer T2A, so modulating the sender.

On M.C.W. the output of the modulator is fixed so that the depth of modulation is about 95% but on R.T. the depth of modulation is regulated by means of the R.T. MOD. CONTROL which adjusts the setting of the input potentiometer R19A.

(3) *Power Supplies.*

The power supplies for the sender are divided into two parts.

The first part, contained in the POWER SUPPLY UNIT, consists of a full-wave selenium rectifier W1A-L, each arm of which comprises five units in series, giving an output of about 275 mA D.C. at 2000 volts. This output is smoothed and fed to the P.A. valve anodes via the PLUGS A and connector between the P.S.U. and R.F.U. The rectifier is fed by a power transformer T6A which is totally enclosed in a cast box to allow for humid tropical conditions and which has a single high voltage secondary winding. The primary, which is tapped at 10 volt intervals for single phase A.C. supplies of between 100 and 250 volts, is also designed to serve as an auto transformer supplying 230 volts to the rest of the power supply situated in the R.F. unit. This arrangement has the advantage of reducing the number of input voltage tapping adjustments to two—one for the above transformer T6A and one for the contactor transformer T5A, also contained in the P.S. Unit. The secondary of T5A energises the contactor REL.5A which then completes the input circuit of T6A.

Two sets of fuses are provided. The first (F1A and F1B) is placed in series with the main power supply to the sender and the second (F1C and F1D) is in series with the 230 volts output of the auto transformer primary of T6A to safeguard this transformer against faults which may occur in the R.F.U. power supplies.

The second part of the power supply, in the R.F. Unit, is fed by the transformer T4A with a primary winding for 230 volts and five separate scondaries. Two of these are high voltage windings for H.T. and G.B. supplies and three are low voltage windings—one for the filaments of

the two H.T. rectifying valves (V5A and V5B), the second for the filaments of the P.A. valves and the third, suitably tapped, for the heaters of the remaining valves.

Rectification for the H.T. supply is accomplished by a full wave circuit using the two valves V5A and V5B (Type A.U.1), each with its two anode in parallel as half wave rectifiers to obtain the requisite output. The smoothed D.C. output is about 500 volts at 400 mA maximum and is split up into two branches. One part feeds the screen grids of the P.A. valves and relay REL.2A, while the second part feeds the anodes and screen grids of the oscillator, buffer, driver and modulator valves and also energises the relay REL1A. The H.T. supply to the screen grids of the oscillator and buffer and the anode of the oscillator is stabilised by V1A and V1B (Type A. W.3) in conjunction with R3A-D.

Four selenium rectifiers (W3A-D), connected to form a full wave bridge, rectify the voltage for the G.B. supply. This supplies negative bias for the driver and P.A. suppressor grids, and the buffer, driver and P.A. control grids. The keying relay REL.3A, H.T. contactor REL.7A and microphone are also energised from this source. The red POWER SUPPLY lamp (P1C) on the R.F. Unit is connected between one side of the driver valve heater and the chassis, while that on the P.S.U. (P1D) is connected through the resistance R26A across a portion of the primary winding of the contactor transformr T5A.

(4) *Switching and Relay Systems.*

(*a*) The power input circuits.

The incoming power supply to the P.S. Unit is controlled by the POWER ON/OFF switch S6. After passing through the main fuses the supply may be broken by the following safety switches :—

(*i*) Door switches (S14 on P.S.U., S15, S16, S17 on R.F.U.) which open when the doors are opened.

(*ii*) Plug A switches (S19 on P.S.U. ; S20 on R.F.U.) which open when the sockets A are not in position.

The circuit may also be broken by the contacts of the H.T. overload cut-out relay REL.6A, which is actuated when excessive current is taken from the 2000 volt supply in the P.S. Unit. Further, a section of the CONTROL switch (S4B) breaks this circuit at " REMOTE ", but the connection is remade by the contacts D1 of the remote control relay REL.4A.

Provided the circuit is not broken in any of these ways the power may be switched through to the primary of T5A by S6, and P1D lights. The secondary of this transformer feeds the coil of the main contactor REL.5A through the POWER SUPPLY ON/OFF switch S5. When this switch is put on the contactor operates and connects the power to the primary of T6A and through that to the primary of T4A in the R.F. Unit. Thus the H.T., G.B. and heater supplies to the R.F. Unit are energised and the POWER SUPPLY lamp P1C lights.

(*b*) The 2000 volt supply.

Although the primary of T6A is energised with the conditions above, the connections from the secondary to the rectifiers

are broken by the contacts of the H.T. contactor REL.7A, as is the H.T. feed to the P.A. valve screen grids by an auxiliary contact of the same contactor. The coil of REL.7A is energised from the G.B. supply through the H.T. ON/OFF switch S7 on the R.F. Unit. This switch also controls the supply to the keying relay (REL.3A) coil, so that the driver stage, as well as the P.A. stage, cannot be operated until this switch is on.

(c) The keying circuit.

There can be no emission from the sender unless the keying relay is activated, thus removing the heavy suppressor bias from the driver valve V3A through the action of the contacts C1.

The relay is activated when the circuit from G.B. supply and S7 is completed to chassis through the relay coil. This circuit may be interrupted as follows :—

(*i*) By the CONTROL switch S4 in the " REMOTE " position, when the necessary energising current is obtained from batteries at the remote control unit over a line plugged in the LINE jack.

(*ii*) By the SYSTEM switch S3, which only completes the circuit in the " TUNE " position. At " C.W." and " M.C.W." the circuit is switched to the KEY jack and only completed when the Morse Key is pressed.

On " R.T." the circuit can only be completed through the microphone when the pressel switch is closed.

(*iii*) By switch S18 which is opened when the RELEASE knob is turned anticlockwise so that switches S11, S12 and S13 may be rotated. This automatically avoids the possibility of these switches being altered with power in the output circuit.

(*d*) The break-in switch and relays.

When the keying relay is unenergised its contact C1 short circuits the coil of relay REL.2A, provided that the NORMAL/BREAK-IN switch S1 is closed (" BREAK-IN " position). This permits the " break-in" facility as follows. When the contacts of relay REL.2A are released :—

(*i*) Contact B1 breaks the coil circuit of relay REL.1A, of which contact A1 cuts off the H.T. supply to the master oscillator valve and contact A2 opens the receiver muting circuit.

(*ii*) Contact B2 changes the connection of the REC'R AE terminal from chassis to the aerial circuit of the sender.

Thus, with switch S1 in the " BREAK-IN " position and the keying relay unenergised, the receiver becomes automatically operative and is connected to the sender aerial, while the H.T. supply to the master oscillator is interrupted so that the oscillator does not interfere with the received signals.

When switch S3 is at "TUNE ", when the morse key is pressed or when the microphone pressel switch is closed, contact C1 moves

over and the coil of relay REL.2A is unshorted. This relay operates instantaneously, disconnecting the aerial from the receiver and operating relay REL.1A, which in turn causes muting of the receiver and the restoration of the H.T. supply to the master oscillator.

When the coil of REL.2A is shorted by contact C1 there is a delay of about 0·25 second before the relay moves to give receive conditions. The use of the auxiliary contact B1 on relay REL.2A for operation of the relay REL.1A ensures the proper sequence of the change-over operations and minimises the possibility of damage to the receiver through a relay fault during break-in working.

In the " NORMAL " position switch S1 is open and this change-over facility is cut out, since the connection between the coil of relay REL.2A and the contact C1 of the keying relay is broken. Hence the H.T. supply to the master oscillator is left on and the receiver is continuously muted. Thus, when the receiver is connected to the sender by its aerial terminals and the muting/sidetone lead, switch S1 must be at " BREAK-IN " for reception.

During periods of high speed keying it is preferable to operate the sender with S1 at " NORMAL" to avoid clipping the beginning of a message after a short interval in the transmission.

(*e*) The System Switch.

The system switch S3 has four positions, " TUNE ", " C.W. " " M.C.W." and " R.T " and nine sections are used.

(*i*) " TUNE ".

In this position, section S3B applies about —70 volts to the suppressor grids of the P.A. valves to limit the anode current when the P.A. stage is driven but untuned. Section S3H completes the coil circuit of the keying relay REL.3A, reducing the keying bias on the suppressor grid of the driver valve and thus avoiding the necessity for keeping the morse key down when tuning the sender.

(*ii*) " C.W.".

In this position, the bias to the P.A. valve suppressor grids is removed and the suppressors are connected to chassis by section S3B. Section S3C connects the keying relay coil to the KEY jack. When the morse key is up the driver suppressor bias is sufficient to cut off its anode current, thus removing the drive from the P.A. stage which, since its control grids are biased beyond cut-off, will also cease to pass anode current. With the morse key down the driver suppressor grid is connected to cathode by section S3E through the contact C1 of the keying relay, and full drive is applicable to the P.A. stage.

(*iii*) " M.C.W.".

In this position, section S3A connects the H.T. supply to the modulator and the 900 c/s tone is introduced in series with the

suppressor grids of the P.A. stage when the morse key is pressed. Section S3B applies the —70 volts bias, which is suitable to permit satisfactory modulation and section S3C maintains the connection between the keying relay and the KEY jack. Section S3D, S3F, S3G and S3K arrange the modulator circuit as an A.F. oscillator and amplifier.

(*iv*) " R.T.".

In this position, Sections S3A and S3B maintain the connections as for " M.C.W.", while Sections S3D, S3F, S3G and S3K rearrange the modulator circuit as a straight A.F. amplifier of inputs from the microphone circuit or the V.F. signals from the LINE jack. The KEY jack is disconnected from the keying relay by section S3C and this relay is actuated by the microphone pressel switch or by currents over the line as applicable.

The section S3E is open except on " C.W. " so that when the keying relay is actuated on other systems a small residual bias remains on the driver valve suppressor grid to reduce the drive to the P.A. stage.

(*f*) Remote Control.

When the CONTROL switch S4 is in the " REMOTE " position, sections S4A and S4C connect the keying relay coil in series with that of the polarised remote control relay REL.4A. The contact D1 of this relay is in parallel with section S4B which is open at " REMOTE " and which is in series with the power input circuit. Hence with remote control of the sender, relay REL.4A takes over the function of power on/off switch, but the power switches S5 and S6 and the H.T. switch S7 must be put on at the sender. One disadvantage is that all the sender supplies are switched on simultaneously from the remote end, so that the switching current pulse which closes the polarised relay REL.4A should be of a short duration to avoid keeping the keying relay contacts closed while the sender warms up. The keying relay, unlike the relay REL.4A which remains actuated until the reverse " switching-off " current is sent over the line, only operates for the " switching-on " and keying currents from the remote control unit. The keying current pulses are in the same direction as the switching on current and pass through the coil of REL.4A without affecting this relay. This coil has resistance R36A in parallel to ensure satisfactory operation of the keying relay REL.3A from the remote point.

V.F. signals from the remote point pass via the condensers C21A and C21B to the 600 ohm primary winding of the modulator input tranformer T3A.

(5) *Sidetone.*

A fraction of the R.F. output at the anodes of the P.A. valves is led off by a small capacity (C28A), formed by the valve V6B grid circuit lead to a rectifying circuit containing the valve V6B (type A.R.P.34) connected as a diode and coupled to the transformer T1A. An average

audio out put of 2 milliwatts is available at the secondary terminals of this transformer when the P.A. stage is modulated 30%. This output is connected to the sidetone plug which is in turn connected to the receiver.

(6) *Connections to the receiver.*

There are five connections to the receiver, two for the aerial and earth and three via the REC'R MUTING & S/T plug for muting, sidetone and chassis connections. The aerial connection terminates at the B2 contacts of REL.2A, which connect it to the sender aerial or earth as described in (4) (*d*). The muting line is connected to earth by A2 contacts of REL. 1A, as also described in (4) (*d*), and sidetone from the sender is carried by the sidetone line and earth.

(7) *Connections to the Wireless Remote Control Unit C.*

The sender and remote control unit are connected by a length of cable D8 twisted. This line is plugged into the sender LINE jack via the Adaptor C. In the sender, the LINE jack is connected to the polarised relay REL.4A coil and via the CONTROL switch S4 to the keying relay REL.3A coil and also to the modulator input transformer via the condensers C21A and C21B. See (4) (*f*).

3. Aerials.

(1) *General.*

The equipment of the Wireless Set No. 33 Station permits the sender to be operated with three types of aerials, viz. :—

(*a*) A half wave dipole aerial centrally fed through a 100 ohm feeder cable with one side earthed.
(*b*) A half wave matched impedance aerial with single wire feeder, commonly referred to as a Wyndom aerial.
(*c*) A single wire end-fed horizontal aerial.

All the above aerials are supported by the 36 ft. steel masts provided.

Normally type (*a*) is connected directly to the feeder cable from the sender, and types (*b*) and (*c*) via the Aerial Coupling Equipment, Aerial Unit G. Type (*b*) may be connected directly to the sender, however, and with certain exceptions type (*c*) also.

When the station is of a permanent nature a half wave dipole fed by a Y-matched feeder of 600 ohms impedance may be used with advantage, especially where the aerial is situated at a distance up to 100 yards from the sender. Such a feeder may be connected directly to the sender. Provision is not made with the station for such an aerial system.

(2) *The Half Wave Dipole Aerial, centrally fed by 100 ohm. feeder.*

Three adjustable aerials of this type are provided, as tabulated below.

Table III—DIPOLE AERIALS.

Name.	Maximum Length.	Frequency Range.
Aerial Dipole No. 6A	26 ft. + 26 ft.	18 — 9 M.c/s.
,, ,, No. 6B	50 ft. + 50 ft.	9·3 — 4·7 ,,
,, ,, No. 6C	98 ft. + 98 ft.	4·8 — 2·4 ,,

To cover the remaining range of frequencies from 2·4 to 1·2 M.c/s. extensions are made to Aerial Dipole No. 6C.

The adjustment for length to suit a given frequency of transmission is made by folding back the arms of the appropriate aerial, clamping pieces being provided for this purpose. The actual length of the aerial in practice should not be exactly one half wavelength due to the end effect but about 95% of this length. The length L in feet is given by the formula :

$L = \frac{467 \cdot 4}{F}$, where F is the frequency of transmission in megacycles per second. The aerial has to be adjusted carefully so that the two arms are of equal length, i.e. one half of that given in the above formula.

The Aerial Dipole No. 6C, the longest, may be erected with the arms at an angle for convenience so long as this angle is not less than 90°.

These aerials are for general use and should cover all normal requirements.

(3) *The Wyndom Aerial.*

An aerial of this type when properly adjusted provides an efficient high angle radiator for long range working by skywave at the higher frequencies. When erected on 36 ft. masts it should not be used at frequencies below 8 M.c/s, as the downlead would then be less than a quarter wavelength. The horizontal length should be the same as that of the dipole and the single wire feeder should be tapped on the horizontal portion at a distance D feet from one end given by $D = \frac{169 \cdot 2}{F}$, where F is the frequency of transmission in magacycles per second. The feeder should hang vertically downwards under the aerial for at least a quarter of a wavelength. The masts should be well spaced and the aerial supported by lengths of rope from the insulators at the ends to minimise the end effect. It generally proves advantageous to experiment with the length of the aerial and the position of the feeder tap to gain maximum efficiency with this type of aerial, especially if it passes near any objects such as trees which must be avoided whenever possible.

When correctly adjusted the impedance of the feeder will be about 600 ohms so that it may be connected directly to the sender, but it is generally better to use the Aerial Unit G to ensure good matching.

The efficiency of this aerial will depend considerably on the earth connection to the sender, or Aerial Unit G if used, and it is preferable to use both an earth pin and earth mat, the latter being buried under the aerial.

(4) *The End-fed Horizontal Aerial.*

This type of aerial may be used for quick erection or where space is limited. When coupled through the Aerial Unit G, the length of the aerial need not be adjusted for frequency, which property makes this a very useful aerial when the frequency of transmission has often to be changed.

An aerial supported between two 36 ft. masts with a horizontal length of about 50 ft. and a downlead of the same length to Aerial Unit G gives satisfactory operation. The Aerial Unit G may be placed at the end of

50 ft. (or 100 ft. at lower frequencies) of feeder cable from the sender or next to the sender, connected via a short length of the low impedance feeder.

If the aerial has to be connected directly to the sender, however, then difficulties may be experienced in loading the sender properly unless certain precautions are taken.

In the first place, on Range 1 the ' lowest ' output tap on the sender corresponds approximately to 100 ohms. An aerial that has an impedance less than 100 ohms (i.e. one that is an odd number of wavelengths long) will therefore, even on the lowest tap, overload the sender output stage. This is shown by the P.A. TUNING control having little effect on the P.A. anode current as it is swung through the tuning point and by the overheating of the P.A. valve anodes. With an aerial of 100 ft. overall length, as described above, the odd quarter wave condition occurs at about 17·5 M.c/s and 12·5 M.c/s. If the odd quarter wavelength point is approached when operating on Range 1 with the aerial connected directly to the sender, then the aerial length should be increased whenever possible ; otherwise it must be decreased.

In the second place, on Range 4 the impedances that can be made to load the sender properly lie between 30 ohms and 600 ohms. Thus an aerial with an impedance greater than 600 ohms (e.g. one whose length is far removed from an odd quarter wavelength) even on the ' highest ' tap will underload the sender. The 100 ft. aerial is a quarter wavelength long at about 2·5 M.c/s, so that on lower frequencies of Range 4 it is necessary to increase the total length of the aerial to approximately 200 ft. unless reduced output is permissible.

The taps on Ranges 2 and 3 should be able to accommodate any aerial for these frequency ranges.

In addition to impedance limitation certain random lengths of wire used as aerial directly coupled to the sender may give rise to difficulties due to their reactance. This may usually be overcome by retuning the P.A. stage of the sender. Sufficient compensation may not be possible at the extremes of the frequency band.

(5) *The Half-wave Dipole Aerial with 600 ohm Feeder.*

Although wire is not provided with the station for making up this type of aerial, it may easily be done if sufficient wire such as R7 or 14 S.W.G. bare copper is available. With this system aerials may be erected up to 100 yards from the sender without serious losses, provided that the necessary adjustments are made correctly. As these vary with frequency a given aerial is theoretically only useful at one radiation frequency, but a 3% variation in frequency will not usually cause an appreciable loss in efficiency and a 10% variation in frequency should not be very serious, unless the feeder line is very long at the higher frequencies. With 36 ft. masts these aerials should not be used for frequencies lower than 5 M.c/s as the dimensions of the system will not then allow it.

The horizontal length of the aerial should be the same as for the centrally fed dipole described under (2) above, i.e. $\frac{467 \cdot 4}{F}$ ft. The feeder

is made up of two conductors, normally of the same wire as the aerial, spaced D inches apart, where D = 75 × d (d = diameter of wire in inches) for 600 ohms impedance approximately. The impedance Z of a feeder made of two parallel air-spaced conductors is given by the formula $Z = 276 \log \frac{2D}{d}$. With 14 S.W.G. wire the spacing required for an impedance of 600 ohms is about 6·25 inches. This spacing is maintained by 'spacers,' made of good insulating material, inserted between the feeder wires at intervals. The feeder should be supported about 10 ft. above the ground, pass well clear of obstructions, and be connected to the aerial from vertically beneath. For proper matching the feeder wires have to be opened fan-wise, to form a Y, where they approach the aerial. The wires should be attached to the aerial symmetrically about the centre of it and a distance $\frac{123}{F}$ feet apart, where F is the frequency of transmission in magacycles per second. The length of the arms of the Y, from where the spacing begins to increase to where the wires join the aerial, should be $\frac{148}{F}$ feet.

4. *Aerial Coupling Equipment.*

(1) General.

This equipment is made up of three units, namely, the Aerial Unit G, the Set Unit G and the Connectors Twin No. 58. The Aerial Unit G permits any normal aerial to be matched to the feeder cable (Connectors, Twin No. 58) which is connected to the sender via the Set Unit G. This latter unit has no electrical significance, serving only as an adaptor to overcome mechanical difficulties. The feeder cables have two conductors sheathed in telcothene and spaced to give an impedance of about 100 ohms, being enclosed in the usual protective outer covers. The cables are terminated with Niphan plugs and sockets so that two or more may be connected in series. When using half wave dipole aerials the cables are coupled directly to the centres of the aerials which gives correct matching, thus dispensing with the Aerial Unit G.

(2) Aerial Unit G (circuit diagram Fig. 20).

While Aerial Unit G is primarily intended for coupling a low impedance feeder of 50 ft. or more in length to a single wire aerial of any length, it can also be used as an aerial coupling unit alongside the sender for matching the output circuit (which is either 100 ohm or 600 ohm) to aerials which have impedances other than these two values, as would be the case if a single wire aerial was used over a wide frequency range.

The unit consists of a coil L1A similar to that in the anode circuit of the P.A. valves in the sender, a two-gang variable tuning condenser C1A, a tuning indicator lamp P1A, a frequency range switch S1, a feeder coupling switch S2, an aerial coupling system made up of S3 and S4, and an aerial current indicator containing the meter M1A. There are also an adaptor for the feeder cable and terminals for connection to the aerial lead and to earth.

RANGE SWITCH S1 is set to the same range as the sender output stage and FEEDER switch S2 is also set to the same reading. This allows the circuit to be tuned to the sender frequency by means of the TUNING CONTROL, which rotates condenser C1A, and the lamp P1A which is coupled to the main coil by a winding L2A and which lights at resonance. At the same time the feeder is correctly coupled to the coil L1A at the given frequency. In Fig. 20 the arrow heads represent switch contacts which make at the switch settings indicated. Switch S1 short circuits or disconnects suitable portions of the coil L1A and also disconnects one section of the condenser C1A on Ranges 1A, 1B, 2A and 2B, the two ganged sections being used in parallel on Ranges 3 and 4.

On Ranges 1A, 1B, 2A and 2B aerial coupling is adjusted by means of a continuously variable tap (lower aerial coupling control S4) while on Ranges 3 and 4 a combination of this variable tap and a series of fixed taps (upper aerial coupling control S3) is available. As in the case of the P.A. tuning coil in the sender the various frequency ranges are obtained by shorting out the coil from the high potential end since the continuously variable tap can then be used on each range. This means, however, that on the higher frequency ranges certain of the fixed taps and then part of the continuously variable tap become progressively unavailable as they fall on the unused portion of the tuning coil. The following table gives the useful taps for the various ranges. Whenever the lower aerial coupling control S4 is in use the upper aerial coupling switch S3 must be put to " L.C. ".

Table IV—AERIAL COUPLING SETTINGS.

Range.	Lower Aerial Coupling.	Upper Aerial Coupling.
1A	0 to 3	Unavailable.
1B	0 to 4	"
2A	0 to 5	"
2B	0 to 8	"
3	to 8	Taps 1 to 3.
4	0 to 8	Taps 1 to 8.

Once the circuit is tuned to the sender frequency the optimum aerial coupling is obtained by means of the AE CURRENT meter M1A which shows maximum reading with the best conditions. This meter is coupled in series with lead to the aerial terminal in exactly the same way as is the OUTPUT METER in the sender, except that there are two degrees of coupling selected by a push-button switch.

The unit is placed underneath the aerial and once adjusted is made weatherproof by closing the lid of the case in which the unit is housed. The feeder cables should be weatherproof so long as

the adaptors are tightly locked in position and the outer cover remains undamaged.

Wireless Remote Control Unit C. (Circuit diagram Fig. 21.)

(1) General.

This unit is normally connected to the sender by a twisted pair (Cable Electric D8 Twisted) and used in conjunction with a remote receiver.

A battery of 48 volts (four Batteries Dry Refill 8 Cell No. 1 Mk. I) is clamped in the unit and by sending impulses of current of the correct polarity over the line it enables the sender to be switched on and off and to be keyed. For modulation, audio frequency currents must be generated by external apparatus such as the Apparatus Telegraph Two Tone (for the teleprinter).

(2) Circuit Description.

(*a*) Connections to the following are made through terminals or sockets :—

(*i*) Morse Key (KEY jack).
(*ii*) Wheatstone Transmitter (AUTO terminals).
(*iii*) Teleprinter (TONE terminals).
(*iv*) Receiver (REC'R MUTING plug).
(*v*) Sender (SENDER LINES terminals).
(*vi*) Additional battery (EXTRA CELLS terminals).

(*b*) Three switches are provided :—

(*i*) SENDER CONTROL (ON-WORK-OFF), S1.
(*ii*) NORMAL/BREAK-IN, S2.
(*iii*) KEY/AUTO, S3.

Switch S1 arranges the polarity of the battery correctly for switching the sender on and off and for keying the sender. The EXTRA cells terminals are in series with the battery so that additional cells may be added when necessary, as when the line is long or in bad condition. Normally these terminals are short circuited.

Switch S2 in the " NORMAL "position short circuits the coil of the high speed relay REL.1A. With S2 in the " BREAK-IN " position the contacts of this relay mute the receiver when the morse key is pressed by short circuiting two pins on the REC'R MUTING plug. When using automatic high speed keying and with teleprinter working the " NORMAL " position of S2 is used, since the relay coil is in series with the line to the sender.

6. *Power Supplies.*

(1) The Power Units A.C./D.C. 2 K.V.A. No. 2 (ONAN).

These units supply power at 230 volts A.C. 50 c/s single phase and also D.C. for battery charging. They are dealt with comprehensively in the Service Manual provided with them. Fig. 22 of this pamphlet shows modifications to the suppression circuit not given in Diagram No. 80250 of the manual.

(2) Batteries secondary portable 12 volts 75 Ah.

Full instructions are given inside the lids of these batteries, which are used when required for working the receivers.

Chapter II.—MAINTENANCE.

1. The Sender.

(1) *General.*

The exterior of the units should be kept as free from dirt and wet as circumstances permit. Since the units are enclosed by perforated panels dust will accumulate inside. At regular intervals, therefore, remove the side, back, top and bottom panels of the R.F. Unit, take out all the valves, and carefully remove all dust and dirt from the interior, paying particular attention to places where high voltage or R.F. leakage may occur.

NOTE.—In the absence of a compressed air supply a good hand pump with connector is a useful means of cleaning in accessible places.

To gain access to the interior of the Power Supply Unit for the same purpose, remove the top lid by unscrewing the bolts fixing it to the front panel and to the perforated sides and back. The top can then be raised in the manner of a lid on the hinges at the back.

Also check the following points :—

(*a*) Knob Fixing Screws : Tighten if necessary the grub screws holding control and switch knobs to shafts.

(*b*) Nuts and Bolts : All nuts and bolts should be checked but in particular those holding together the internal screening between stages and soldering tags to component terminals.

(*c*) Earthing Tags : It is very important to keep tight those bolts by which an earth connection is made to the metal chassis. These will be found to be mainly underneatht he chassis. (See Fig. 3, 13 and 16).

(*d*) Anode Leads and Caps : It is possible that, after much handling, the anode lead may become partially or completely broken at the point where it is fixed to the anode cap.

(*e*) Aerial and Earth Leads and Feeder Cables : The connections to the aerial or feeder leads and to the earth should be checked to make sure the spring loaded terminals are not binding. The feeder cables should be checked occasionally, particularly for an open circuit of one or both of the conductors and for any damage which allows damp to creep inside.

(*f*) Indicator Lamps : After transport or vibration the bulbs may work loose in their holders and should, if necessary, be screwed tightly into the holders.

(*g*) Key, Microphone, Line, Sidetone, Mains and Inter-Unit Connectors.

Examine all these plugs and the sockets into which they fit. Faulty contacts may sometimes be remedied by slightly opening the pins but this operation should be performed with great care.

Examine the leads for breaks and wear particularly at points where they join connecting elements such as plugs, etc.

(2) *Oscillator, Buffer and Driver Range Switches.*

The contact pins and springs should be kept clean and clear of dirt or grit and from any burning caused by the accidental changing of

OSCILLATOR, BUFFER and DRIVER RANGE Switches with the set in operation. The contacts can be cleaned with a burnishing tool or, if one is not available, with a clean rag moistened with carbon tetrachloride. The tension of the contact springs should be adjusted so that the movement of the end of the spring, from the open to the make positions, is approximately $\frac{1}{4}$ or $\frac{3}{16}$ of an inch. If it is made more than this, there is danger of fouling the coils during coil switching. Do not forget the coil shorting contacts on the left-hand side of each coil assembly.

(3) *P.A. Anode Coil and Tuning Coil in Aerial Unit G.*

These coils and contact arms should be kept clean and clear of dust, grit or metal particles. The coil can be cleaned with carbon tetrachloride on a rag. A little Vaseline (highest grade) may be used when absolutely necessary to ease the movement between the arm and the coil turns but, as it is designed to work with very little or no lubricant, any harshness or jamming indicates some fault which should be cured by a proper overhaul of the coil.

The cams and contacts of the P.A. RANGE Switch and also of the RANGE Switch in the Aerial Coupling Equipment, Unit G should be kept clean and free of dirt or metal particles.

(4) *Relays.*

The relays should be inspected from time to time and all dirt and grit removed. In the case of the polarised relay REL.4A care should be taken to see that no particles of grit or iron filings are lodged between the pole pieces and the armature.

The contacts should be carefully examined. If they are dirty, they should be cleaned preferably with a burnishing tool or, if this is not available, with a piece of rag moistened with carbon tetrachloride. In some cases the relay adjustments are critical. No adjustments of contacts should be made except by skilled personnel and then only when absolutely essential.

Operating staff are warned that, when the sender is working, the break-in relay REL.1A, has approximately 250 volts on certain contacts, since one of its functions is to make and break the oscillator H.T. voltage during break-in operation. Care should therefore be exercised when handling the relay when there is power on and the sender is out of its case

If any trouble whatever occurs in the aerial change-over relay REL.2A when urgent traffic is being handled, no attempt should be made to adjust or repair it. Instead, the NORMAL BREAK-IN Switch S1 should be set to NORMAL, the Connector Single No. 21A removed at the sender and at the receiver, and a temporary single wire aerial connected to the OPEN AERIAL terminal of the receiver. Also short circuit the REC'R AE terminal on the sender to earth in this eventuality.

(5) *Switches.*

Apart from the coil switches, which have already been mentioned in Sections (2) and (3) above, the rest of the switches are mainly of the "Magnum" type. The contacts of these switches should be kept clean and

as a result of the way these switches have been mounted, it is comparatively easy to see whether there is a bad contact which may result if the metal of the moving member has become fatigued. Great care should be taken in adjusting these contacts if a poor contact is discovered.

With the valves replaced in the R.F. Unit, proceed to check the performance of the sender against the following test figures in (6) to (9) below, *BUT WITH EXTREME CARE AS THERE WILL BE HIGH VOLTAGES PRESENT.* All voltages below were measured with an Avometer, Model 7. (500 ohms per volt).

6) *Voltages Measured at Anode Caps of Valves.*

(*a*) Put SYSTEM switch to " C.W." and press key down.

(*b*) Now put oscillator out of action by putting OSCILLATOR switch to " CRYSTAL " and removing any crystal from the holder.

(*c*) Voltages with respect to chassis will then measure approximately :—

(*i*) Oscillator Anode=240 volts.

(*ii*) Buffer Anode =650 ,,

(*iii*) Driver Anode =650 ,,

(*iv*) P.A. Anodes [see (*e*) below].

(*d*) Put SYSTEM switch to " R.T. " and measure Modulator Output Valve Anode Voltage which should be 275 volts (approx.).

(*e*) It is unlikely that a voltmeter is available for measuring directly the voltage on the P.A. Anodes but if it is, the reading will be approximately 2,500 volts.

The voltage can be obtained indirectly, however, by measuring the current through the bleeder resistances across the High Voltage Supply which will be found mounted horizontally at the right-hand side of the P.S. Unit (Fig. 17). The wire between the chassis and the rear end of the bottom resistance R25B is removed and a milliammeter with a full scale deflection of 50 milliamperes substituted. As the total bleeder resistance is 100,000 ohms, the voltage will be equal to the current indicated by this meter multiplied by 100.

(7) *Control and Suppressor Grid Bias Voltages.*

(*a*) Remove both A.U.1. rectifier valves (V5A-B) from holders on lower deck of R.F. Unit.

(*b*) Put H.T. switch to " OFF " . (All stages *except* the P.A. stage can then be measured).

(*c*) Put SYSTEM switch to " C.W." when voltages with respect to chassis are approximately as follows :—

(*i*) Driver control grid = —190 volts.
suppressor = —300 volts Key Up.
0 volts Key Down.

(*ii*) Buffer control grid = — 40 volts.

(*iii*) P.A. [See (*g*) below

(*d*) Put SYSTEM switch to " M.C.W."

(*i*) Driver control grid = —190 volts.
suppressor = —250 volts. Key Up.
= —50 volts. Key Down.

(*ii*) Buffer control grid = —40 volts.

(*iii*) P. A. [See (*h*) below.]

(*e*) The same figures as (*d*) should also be obtained with SYSTEM switch put to " TUNE " and " R.T. ".

(*f*) Put H.T. Switch to ON and *take great care as the P.A. stage and components will now have over 2,000 volts D.C. on them.*

(*g*) SYSTEM switch to " C.W. ".

(*i*) P.A. control grid Key up = —82 volts.
Key down = —87 volts.

(*ii*) P.A. suppressor = 0 volts.

(*h*) SYSTEM switch to " M.C.W."

(*i*) P. A. grid Key Up = —82 volts.
Key down = —82·5 volts.

(*ii*) P. A. suppressor = —70 volts.

(*i*) The same figures as (*h*) should be obtained with SYSTEM switch to " TUNE " or " R.T."

(8) *Screen Grid Voltages.*

(*a*) Put H.T. switch to " ON ".

(*b*) Undriven.

P. A. Screen = 350 volts.
Driver Screen = 300 volts.
Buffer Screen = 200 volts.

(9) *Valve Anode, Screen and Control Grid Currents under Working Conditions.*

These current figures will vary slightly from band to band and also from one end of a band to the other. The figures listed below are average values.

(*a*) Oscillator Valve (V2A).

(*i*) Anode Current = 25 mA.
(*ii*) Screen Current = 5 mA.
(*iii*) Grid Current = 0·2 mA.

(*b*) Buffer Valve (V2B).

(*i*) Anode Current = 27 mA.
(*ii*) Screen Current = 10 mA.
(*iii*) Grid Current = 0·75 mA.

(*c*) Driver Valve (V3A).

(*i*) Anode Current = 60 mA.

(*ii*) Screen Current = 15 mA.

(*iii*) Grid Current = 3·5 mA.

(*d*) P.A. Valves (V4A and V4B).

*(*i*) Anode Current anode detuned and unloaded on " C.W." = 450 mA.

(*ii*) Anode Current, anode detuned and unloaded on " TUNE " = 250 mA.

(*iii*) Anode, current, anode tuned but unloaded on " C.W." = 65 mA.

(*iv*) Anode current, anode tuned but unloaded on " TUNE " = 50 mA.

(*v*) Anode current, anode tuned and loaded on " C.W." = 240 mA.

(*vi*) Anode current, anode tuned and loaded on " TUNE " = 130 mA.

(*vii*) Screen current on " C.W." = 160 mA.

(*viii*) Screen current on " TUNE " = 160 mA.

(*ix*) Control grid current = 22 mA.

(*e*) Modulator Output Valve (V2C).

(*i*) Anode current = 35 mA.

(*ii*) Screen current = 10 mA.

* This measurement normally not to be made as serious harm may result to the P.A. valves.

(*f*) Modulator Amplifier Valve (V6A).

(*i*) Anode current = 3 mA.

(*ii*) Screen current = 2 mA.

(*g*) Neon Stabiliser Current (V1A and V1B) = 20 mA.

(*h*) Total Anode Current from 2,000 volt Supply (Measured in series with centre tap of 2000—0—2000v. winding on T6A)

(*i*) On " TUNE " = 150 mA.

(*ii*) On " C.W." = 270 mA.

(*i*) Total Anode Current from 500 volt Supply (Measured in series with centre tap of 500—0—500v. winding on T4A).

(*i*) On " TUNE " = 350 mA.

(*ii*) On " C.W." = 360 mA.

(*k*) Total Bias Supply Current (Measured in series with L29A).

(*i*) Key Down = 103 mA.

(*ii*) Key Up = 105 mA.

(*m*) Microphone Current = 20 mA.

2. **Aerials and Earth Connections.**

(1) The aerials should be lowered from time to time and the following points checked :—

(*a*) See that the aerial lengths are correct. In the case of the ajustable dipole aerials make sure that the clamping piece on each arm is tight and that the arms are of equal length.

(*b*) See that the insulators at the aerial ends are securely attached and in good condition.

(*c*) See that the aerial feeders are firmly attached to the aerials. In the case of the adjustable dipoles examine the adaptor at the centre and make sure that the locking ring on the cable plug is tight. If it is loose see that no dirt or wet is left inside the adaptor before tightening. Examine the feeder cable for damage and check the continuity of the conductors inside.

(*d*) Examine the mast gear generally.

(2) Inspect the earth connections and see that the leads to the pins or mat are in good condition. If there is corrosion at the earth pin terminal clean this and the wire connection thoroughly and reconnect. Protect against future trouble by binding with insulation tape.

3. **Other Apparatus.**

The Reception Set R 107 and the Power Units A.C D.C. 2 K.V A. No. 2 (ONAN) are dealt with in their own booklets, but see also Fig. 22 in connection with the latter.

The batteries have instructions pasted inside their lids.

Chapter III.—FAULT FINDING.

1. Location of Faults.

(1) General	(*a*) The following tests are intended rather to indicate how a fault may best be localised rather than that they should indicate the actual faulty component itself. Having ascertained in what part of the sender the fault probably exists, components where possible can receive the ordinary electrical tests such as insulation, continuity, resistance, value, etc., depending on the test apparatus available. (*b*) In tracing faults, use should be made of the fact that the sender has more than one frequency range. By going over to another range, it should be possible to ascertain whether the fault is peculiar to one range only, in which case the possible causes are immediately limited, or whether it applies to all ranges when the following tests can be made, in addition to those in Chapter II.
(2) Contactor REL 5A does not operate (*i.e.* no click heard from contactor on putting down POWER SUPPLY switch S5 on R.F. Unit) and no inidication from red lamp P1D on P.S. Unit although switchboard meter reads correctly and POWER switch S6 on P.S. Unit is down.	(*a*) Safety circuit open through doors being left open. (*b*) CONTROL switch in "REMOTE "instead of "LOCAL" position. (*c*) Top pair of fuses F1A B burnt out or missing. (*d*) Adjustment screws not inserted correctly in row of sockets in front of P.S. Unit. (*e*) Inter Unit Connector plugs and sockets incorrectly inserted or leads damaged. (*f*) Overload Relay tripped and not reset. (*g*) Faulty POWER switch S6.
(3) Contactor REL. 5A goes on (as indicated by click) but POWER SUPPLY indicator lamp P1C on R.F. Unit does not light.	(*a*) POWER SUPPLY Indicator Lamp P1C loose in socket or faulty. (*b*) Lower pair of fuses F1C-D burnt out or missing.

	(*c*) Adjustment screws loose or incorrectly inserted in lower row of sockets in front of P.S. Unit.
	(*d*) Pin 9 or 10 on either Plug B not making in corresponding socket.
(4) Contactor REL. 5A does not operate though power is connected and red POWER lamp lights on P.S. UNIT.	(*a*) Bad contact between 10-way inter-unit connector plugs and sockets B.
	(*b*) Faulty POWER SUPPLY switch S5 or REL. 5A coil.
(5) H.T. Contactor REL. 7A does not work (indicated by absence of click from P.S. Unit) on putting H.T. switch S7 to "ON".	(*a*) 10-way inter-unit connector plugs and sockets B making bad contact.
	(*b*) Plunger of H.T. contactor sticking up through too much friction.
	Lubricate slightly with very thin oil.
	(*c*) Faulty H.T. switch S.7 or resistance R30A, R31A.
(6) No output from sender although there is a reading on P A ANODE CURRENT meter and DRIVER and BUFFER TUNING lamps light.	(*a*) Range switches set on wrong numbers.
	(*b*) OUTPUT TAPS switches of P.A. coil on wrong portion of coil. It is possible to get some output and appearane of loading when these are on a shorted part of the coil. Refer to the Table II giving the number of Maximum Useful Tap.
	(*c*) Faulty aerial system—try dummy aerial.
(7) No output from sender and no reading on P. A. ANODE CURRENT meter though BUFFER and DRIVER TUNING lamps light.	(*a*) It is possible there is a break in the anode circuit of the P.A. valve since the DRIVER LAMP indicates that the P.A. valve should be receiving grid drive. Check the connection to the anodes of the P.A. valves V4A-B particularly where it is joined to the anode feed condensers (C15A-B) by a short flexible connection.
	(*b*) Check continuity and end connections of P.A. anode feed choke, L15A-L30A.

(8) No output from sender, no P. A. Anode Current and no light from DRIVER TUNING lamp, although key is presssed.	(*a*) The sender may be on "C.W." or "M.C.W." in which case there will be no reading of P.A. ANODE CURRENT, no DRIVER TUNING lamp indication, and no output if there is a break in the keying circuit. Confirm sender is working by switching to "TUNE" and then check external keying circuit and S3C contacts. (*b*) The RELEASE knob on P.A. Coil Assembly may not be making good contact. Move it backwards and forwards quickly. If the fault is here and persists, it will be necessary to remove P.A. Coil assembly.
(9) No output from sender and no Readings on P. A. ANODE CURRENT meter and no indication from BUFFER or DRIVER TUNING lamp.	(*a*) Check RANGE switch positions and make sure that OSCILLATOR and BUFFER RANGE switches have engaged correctly into the 'click' position. It is possible that, if the tension of the contact springs has been made excessive, the coil turret may have come to rest against one or more of the springs giving the appearance of having reached its correct operating position. Under this condition one or more of the contacts may not be making contact. (*b*) OSCILLATOR switch may be set wrongly. Check that it is in "M.O." position or "CRYSTAL" position according to which method of control is being used. (*c*) Check that, in case of crystal operation, the CRYSTAL indicator lamp is making good contact in its holder, as a bad contact here will open the crystal circuit.
(10) No output from sender on one range and no reading on P. A. ANODE CURRENT meter though DRIVER TUNING lamp lights.	(*a*) Confirm by going over to another range that the trouble is confined to one range only. Then examine the range cams and contacts of the P.A. coil for signs

of a bad contact on the range concerned, or of break in the wire joining the contact to the tapping on the coil.

(*b*) Check that, in the case of the higher frequency bands, i.e. 1, 2 and 3, the contacts shorting out the unused part of the coil are also making good contact. A fault here would be indicated if output was obtained from the sender on the required range but the setting of the P.A. tuning condenser was different from the expected setting.

(*c*) Check that the OUTPUT TAPS switches of the P.A. coil are on the correct part of the coil. (See Table II).

(11) No output from sender on one range and no reading on P. A. ANODE CURRENT meter and no indication from DRIVER or BUFFER TUNING lamp.

(*a*) Examine the contact pins of the coil concerned in both Oscillator and Buffer Coil Turrets. Examine also the contact springs, for while defects here should show up on all ranges, it is possible that a weak or strained spring might give a bad contact on one range only if there is a discrepancy in the size of one of the contact pins due to wear or excessive burning.

(*b*) Examine wires joining contact pins to the eyelets on the coil former, particularly at the soldered joints at each end of the wire.

(*c*) In the case of the higher frequency ranges, i.e. 1, 2 and 3, it is useful to remember that if there is a fault in one of the Oscillator and/or Buffer coils, use can sometimes be made of one of the other range coils. This is possible because the buffer valve will not only work as a doubler, which is its normal function, but also a straight amplifier or as a frequency multiplier for higher order harmonics than the second.

(12) Intermittent results at certain points on the OSCILLATOR, BUFFER and DRIVER TUNING Controls.

If this occurs at the same position or positions of the TUNING Control, it is possible for the moving end vanes of the variable condenser to be touching the adjacent fixed vanes. Always set condenser vanes fully into mesh before taking it out or putting it back into the sender.

(13) Sender works on C.W. but not on M.C.W. and R.T.

(*a*) Check whether the sender operates satisfactorily on "TUNE". If it does, this indicates that the bias circuit for the suppressor grid of the P.A. valve is in order. If it does not work satisfactorily either by giving low or no output or by giving full output, the various resistances comprising the bias potentiometer should be tested also the contacts of the SYSTEM switch.

(*b*) If the sender operates satisfactorily on "TUNE" the modulator should be checked by connecting a pair of high resistance headphones to the output winding of the modulator output transformer, while a signal is being fed into the modulator either externally, when the SYSTEM switch must be at "R.T." or internally when the SYSTEM switch must be at "M.C.W.".

(14) Sender woksr on C.W. but not on either M.C.W. or R.T.

(*a*) If the fault is not on both "M.C.W." and "R.T." but is with either one, then the trouble will be confined to the input circuit of the first valve in the modulator and the SYSTEM switch, since the rest of the modulator is common to both systems. The appropriate components should therefore be carefully checked, i.e. the input transformer and the microphone leads and plug in the case of "R.T." or the M.C.W. oscillation circuit in the case of "M.C.W.".

2. Procedure for Dismantling.

(1) *R.F. Unit.*

(*a*) The majority of the components are available through the base-plate of the Unit which can be removed by placing the Unit on its back.

(*b*) Should the component in question be situated between the upper and lower decks, the perforated sides and back should be removed.

(*c*) For components on the top deck, remove also the perforated top of the Unit, taking care when removing same that it does not fall down on top of the Aerial Change-Over Relay mounted on top of the P.A. tuning condenser and the components of the Output Meter Circuit.

(*d*) Should the component in question not be accessible after removing the sides, the top deck can be separated from the bottom deck by the following procedure.

(*i*) If not already done, remove the sides, back and top. Unless it is also desired to have access to the underneath side of the bottom deck, the bottom plate can be left on.

(*ii*) The main electrical connections between the two decks are made by means of the two small tag boards situated in the right and left-hand corners at the back of the top deck. The leads and the tags are numbered, for identification purposes. Remove the 6 leads from the left-hand tagboard viewed from the back of set) leaving the link between tags 8 and 9, and the 10 leads from the right-hand tagboard (viewed from the back of the set). See Figs. 14 and 15.

(*iii*) Unsolder the three leads (two P.A. filament leads and the centre tap) which come directly down from the upper deck to three large tags on the left-hand tagboard of the power transformer T4A on the bottom deck. (Transformer viewed from back of set). This operation is most easily done from the back of the set. Fig. 15.

(*iv*) Disconnect the leads which join the P.A. grid condensers C10-B-C (these are mounted at the back of the Driver Turret) to the junction of the P.A. grid chokes with the P.A. grid stoppers. This is most easily done by unsoldering the leads at latter end rather than at the condenser end. Fig. 14.

(*v*) When the leads have all been disconnected, the top deck is removed from the sender frame as a unit complete with the front panel and the top half of the front vertical frame members.

(*vi*) When removing the top deck, great care should be taken not to foul the P.A. grid circuit tagboard on the horizontal frame member supporting the top deck. For this reason it is best to lift off with the left-hand side (viewed from the front) a little higher than the right-hand side.

(2) *P. S. Unit.*

(*a*) The overload relay REL. 6A, H.T. Contactor REL. 7A and Power Contactor REL.5A are accessible through the door in the panel.

(*b*) If the other components are in question, the top lid should be removed by unscrewing the bolts fixing it to the front panel and to the perforated sides and back. The top can then be raised in the manner of a lid on the hinges at the back.

(*c*) It will in general be unnecessary to remove the perforated sides and back but should this be required, it will be necessary to remove first the carrying handles as these are bolted through the siders.

COMPONENTS LIST.

Sender and Power Supply Unit.

Symbol.	Figures 12 and	Value and Rating.	Type used.		Function and Remarks.
C1A	16	0·01 μF	ZA 1776.	Condensers. Q.I.T.	Shunt circuit B1 contacts REL.2A.
C1B	16	0·01 μF	,,	Condensers. Q.I.T.	V2B anode bypass.
C1C	16	0·01 μF	,,	Condensers. Q.I.T.	V3A screen bypass.
C1D	16	0·01 μF	,,	Condensers, Q.I.T.	V3A anode bypass.
C1E	14	0·01 μF	,,	Condensers, Q.I.T.	V4A screen bypass.
C1F	14	0·01 μF	,,	Condensers, Q.I.T.	V4B screen bypass.
C1G	16	0·01 μF	,,	Condensers, Q.I.T.	Coupling V6A to V2C.
C2A	16	0·01 μF	ZA 1422.	Condensers, Q.I.E.	V2A anode bypass.
C2B	16	0·01 μF	,,	Condensers, Q.I.E.	V2A heater bypass.
C2C	16	0·01 μF	,,	Condensers, Q.I.E.	V2A heater bypass.
C2D	16	0·01 μF	,,	Condensers, Q.I.E.	V2A cathode bypass. (S2 at "M.O.").
C2E	16	0·01 μF	,,	Condensers, Q.I.E.	V2A screen bypass.
C2F	16	0·01 μF	,,	Condensers, Q.I.E.	V2B control grid bypass.
C2G	16	0·01 μF	,,	Condensers, Q.I.E.	V2B heater bypass.
C2H	16	0·01 μF	,,	Condensers, Q.I.E.	V2B heater bypass.
C2J	16	0·01 μF	,,	Condensers, Q.I.E.	V2B screen bypass.
C2K	16	0·01 μF	,,	Condensers, Q.I.E.	V3A control grid bypass.
C2L	16	0·01 μF	,,	Condensers, Q.I.E.	V3A heater bypass.
C2M	16	0·01 μF	,,	Condensers, Q.I.E.	V3A heater bypass.
C2N	14	0·01 μF	,,	Condensers, Q.I.E.	V4A heater bypass.
C2P	14	0·01 μF	,,	Condensers, Q.I.E.	V4A heater bypass.
C2Q	14	0·01 μF	,,	Condensers, Q.I.E.	V4A, V4B control grid bypass.
C2R	14	0·01 μF	,,	Condensers, Q.I.E.	V4B heater bypass.
C2S	14	0·01 μF	,,	Condensers, Q.I.E.	V4B heater bypass.
C2T	2, 13	0·01 μF	,,	Condensers, Q.I.E.	M1A R.F. bypass.
C2U	16	0·01 μF	,,	Condensers, Q.I.E.	Shunt circuit morse key contacts
C2W	2, 13	0·01 μF	,,	Condensers, Q.I.E.	M2A bypass.

Condensers—concld.

Symbol.	Figures 12 and	Value and Rating.	Type used.		Function and Remarks.
C3A	16	70pF±5%	ZA 0916 or ZA 10186	Condensers, Y.7.F. (T.C.C.M2). Condensers, Y.7.G (T.C.C.M W.)	Padding condenser V2A tuned circuit.
C4A	16	50pF±2½%	ZA 11713	Wireless Sets No. 33, Condensers, Padding No. 1	Padding condenser V2A tuned circuit. (Two in Series.)
C4B	16	50pF±2½%			Padding Condenser V2A tuned circuit. (Two in Series.)
C5A	16	50pF±5%	ZA 10185	Condensers, Y.5.N.	Padding condenser V2A tuned circuit.
C5B	16	50pF±5%	ZA 10185	Condensers, Y.5.N.	Coupling V2A to V2B.
C6A	16	100pF±2½%	ZA 11714	Wireless Sets No. 33, Condensers, Padding No. 2	Padding condenser V2A tunded circuit. (Two in Series.)
C6B	16	100pF±2½%			Padding condenser V2A tuned circuit. (Two in Series.)
C7A	16	30pF±2½%	ZA 0932	Condensers, Y.3.H.	Coupling anode to control grid V2A (S2 at "M.O.").
C7B	2, 13	30pF±2½%	ZA 0932	Condensers, Y.3.H.	M1A equalising circuit.
C8A	1, 16	500pF+500pF max. variable.	ZA 0919	Condensers, Variable, 2 gang. X.5.B.	Tuning V2A anode circuit.
C8B	1, 16	500pF+500pF max. variable.	ZA 0919	Condensers, Variable 2 gang. X.5.B.	Tuning V2B anode circuit.
C9A	16	450pF	ZA 11153	Condensers, X.45.B.	V2A cathode bypass.
C10A	16	50pF	ZA 1399	Condensers, Y.5.E.	Coupling V2B to V3A.
C10B	15	50pF	ZA 1399	Condensers, Y.5.E.	Coupling V3A to V4A.
C10C	15	50pF	ZA 1399	Condensers, Y.5.E.	Coupling V3A to V4B.
C10D	2, 13	50pF	ZA 1399	Condensers, Y.5.E.	W3A series res. (R5D) bypass.
C11A	1, 16	500pF max. variable.	ZA 0920	Condensers, Variable, X.5.C.	Tuning V3A anode circuit.

C12A	16	0·005μF	ZA 1438	Condensers, R.5.E.	V3A suppressor bypass.
C13A	2, 13	0·004μF. 100v. 5A. R.F. max. 15 KVA + 2500v. D.C.	ZA 1512	Condensers, R.4.E.	P.A. valve anodes bypass.
C14A	14	0·002μF	ZA 1516	Condensers, R.2.J.	V4A suppressor bypass.
C14B	14	0·002μF	ZA 1516	Condensers, R.2.J.	V4B suppressor bypass.
C15A	2, 13	0·001μF	ZA 1505	Condensers, R.1.U.	Coupling P.A. valve anodes to tuned output circuit.
C15B	2, 13	0·001μF	ZA 1505	Condensers, R.1.U.	Coupling P.A. valve anodes to tuned output circuit.
C16A	1, 2, 13	220pF + 500pF max. variable.	ZA 11109	Condensers, Variable, 2-gang. X.22 + X.5.A.	Tuning P.A. output circuit.
C17A	16	4μF. 1000v. D.C.	ZA 1485	Condensers, 4F.	Smoothing 550v. H.T. supply (to P.A. Screen).
C17B	16	4μF. 1000v. D.C.	ZA 1485	Condensers, 4.F.	V2C screen bypass.
C18A	16	8μF 1000v. D.C.	ZA 1480	Condensers, 8.G.	Smoothing 550 volt H.T. supply.
C18B	16	8μF. 1000v. D.C.	ZA 1480	Condensers, 8.G.	Smoothing 550 volt H.T. supply.
C19A	16	4μF. 400v. D.C.	ZA 1669	Condensers, 4.L.	Smoothing 300 volt bias supply.
C19B	16	4μF. 400 v. D.C.	ZA 1669	Condensers, 4.L.	Smoothing 300 volt bias supply.
C20A	16	0·1μF.	ZA 0913	Condensers, P.1.A.C.	V6A screen bypass.
C21A	16	1μF. 250v.	ZA 0912	Condensers, 1.Y.	Coupling line to modulator.
C21B	16	1μF. 250v.	ZA 0912	Condensers, 1.Y.	Coupling line to modulator.
C22A	16	0·02μF.	ZA 0914	Condensers, Q.2.F.	Coupling anode V6A to tuned A.F. circuit (S3 at "M.C.W.").
C23A	16	0·04μF.	ZA 0915	Condensers, Q.4.A.	Tuning A.F. Circuit of V6A.
C24A	16	0·01μF.	ZA 1622	Condensers, Q.1.M.	Coupling control grid V6A to tuned A.F. circuit (S3 at "M.C.W.")
C25A	16	25μF. 50v.	ZA 10189	Condensers, 25.E.	Microphone supply bypass.
C26A	5, 17	4μF. 3000v. D.C.	ZA 11107	Condensers, 4R.	Smoothing 2000 volt H.T. supply.
C26B	5, 17	4μF. 3000v. D.C.	ZA 11107	Condensers, 4.R.	Smoothing 2000 volt H.T. supply.
C27A	16	2·2pF.	ZA 0917	Condensers, Z.2.A.	Coupling anode to control grid V2A (crystal).
C28A	2, 13	Capacity of valve Grid Circuit lead			Coupling sidetone from P.A. to V6B.
C29A	14	0·001μF.	ZA 1400	Condensers, R.1.K.	V6B cathode bypass.

Fuses.

Symbol.	Figures 12 and	Value and Rating	Type used		Function and Remarks.
F1A	4, 17	6A. for 250v.—15A. for 100v.	XB 10014	Fuses, Slydlok, 15 Amp. No. 5.	Incoming power supply fuse.
F1B	4, 17	6A. for 250v.—5A. for 100v.	XB 10014	Fuses, Slydlok, 15 Amp. No. 5.	Incoming power supply fuse.
F1C	4, 17		XB 10014	Fuses, Slydlok, 15 Amp. No. 5.	Power Supply to T4A fuse.
F1D	4, 17		XB 10014	Fuses, Slydlok, 15 Amp. No. 5.	Power Supply to T4A fuse.

Inductances.

L1A	15	26T±26T unspaced litz. 3×10× ·0028.	ZA 11765	W/Sets No. 33, Inductances No. 1.	Tuned anode coil V2A (Range 4).
L2A	15	16T+8T dia. spaced 23 S.W.G. enam.	ZA 11766	W/Sets No. 33, Inductances No. 2.	Tuned anode coil V2A (Range 3).
L3A	15	12T+5½T dia. spaced 18 S.W.G. enam.	ZA 11767	W/Sets No. 33, Inductances No. 3.	Tuned anode coil V2A (Range 2).
L4A	15	8½T+3½T dia. spaced 18 S.W.G. enam.	ZA 11768	W/Sets No. 33, Inductances No. 4.	Tuned anode coil V2A (Range 1).
L5A	16	12T of 22 S.W.G. on R7A.	ZA 11726	W/Sets No. 33, Grid Stoppers No.1.	Parasitic oscillation stopper V2A.
L5B	16	12T of 22 S.W.G. on R7B.	ZA 11726	W/Sets No. 33, Grid Stoppers No. 1.	Parasitic oscillation stopper V3A.
L6A	16	1·5mH.	ZA 1106	Chokes, R.F. No. 25.	R.F. choke cathode V2A.
L6B	16	1·5mH.	ZA 1106	Chokes, B.F. No. 25.	R.F. choke control grid V2B.
L6C	16	1·5mH.	ZA 1106	Chokes, R.F. No. 25.	R.F. choke control grid V3A.
L6D	14	1·5mH.	ZA 1106	Chokes, R.F. No. 25.	R F. choke control grid V4A.
L6E	14	1·5mH.	ZA 1106	Chokes, R.F. No. 25.	R.F. choke control grid V4B.
L7A	15	52T unspaced litz.	ZA 11756	W/Sets No. 33, Inductances No. 5.	Tuned anode coil V2B (Range 4).
L8A	15	2T dia. spaced 23 S.W.G. enam.			Coupling P1B to tuned ct. V2B (Range 4).

L9A	15	26T dia. spaced 23 S.W.G. enam.	ZA 11757	W/Sets No. 33, Inductances No. 6.	Tuned anode coil V2B (Range 3).
L10A	15	1T dia. spaced 23 S.W.G. enam.			Coupling P1B to tuned ct. V2B (Range 3).
L11A	15	10T dia. spaced 23 S.W.G. enam.	ZA 11758	W/Sets No. 33, Inductances No. 7.	Tuned anode coil V2B (Range 2).
L12A	15	1T dia. spaced 23 S.W.G. enam.			Coupling P1B to tuned ct. V2B (Range 2).
L13A	15	6T dia. spaced 17 S.W.G. enam,	ZA11759	W/Sets No. 33, Inductances No. 8.	Tuned anode coil V2B (Range 1).
L14A	15	½T 23 S.W.G.			Coupling P1B to tuned ct. V2B (Range 1).
L15A	2, 13	90T spaced 0·4 mm. enam.	ZA 11271	Chokes R.F. No. 59.	Part of R.F. Choke P.A. output circuit.
L16A	14	12T spaced 1 mm. on R13D.	ZA 12083	W/Sets No. 33, Grid Stoppers No. 2.	Parasitic oscillation stopper V4A.
L16B	14	12T spaced 1 mm. on R13E.	ZA 12083	W/Sets No. 33, Grid Stoppers No. 2.	Parasitic oscillation stopper V4B.
L17A	2, 13	7T of ¼" tube + 19T of 1/8" tube.	ZA 11993	Inductances, tapped 40. μH.	Tuned P.A. output coil.
L18A	16	1 H tapped.	ZA 0921	Chokes, A.F. No. 51.	Tuned coil A.F. osc. V6A (M.C.W.).
L19A	15	37T unspaced 0·5 mm. copper.	ZA 12086	W/Sets No. 33, Inductances No. 9.	Tuned anode coil V3A (Range 4).
L20A	15	3T unspaced 0·5 mm. copper.			Coupling P1E to tuned ct. V3A (Range 4).
L21A	15	19T spaced 0·6 mm. copper.	ZA 12087	W/Sets No. 33, Inductances No. 10.	Tuned anode coil V3A (Range 3).
L22A	15	1T 0·6 mm. copper enam.			Coupling P1E to tuned ct. V3A (Range 3).
L23A	15	8T spaced 0·6 mm. copper enam.	ZA 12088	W/Sets No. 33, Inductances No. 11.	Tuned anode coil V3A (Range 2).
L24A	15	1½T spaced 0·6 mm. copper enam.			Coupling P1E to tuned ct. V3A (Range 2)
L25A	15	4T spaced 1·5 mm. copper enam.	ZA 12089	W/Sets No. 33, Inductances No. 12.	Tuned anode coil V3A (Range 1).
L26A	13	90T 0·3 mm. wound on R37A.	ZA 12082	W/Sets No. 33, Filters No. 1.	M1A equalising circuit.

Inductances—concld.

Symbol	Figures 12 and	Value and Rating.	Type used.		Function and Remarks.
L27A	5, 17	20 H 0·275A. D.C.	ZA 11106	Chokes, Al.F. No. 71.	Smoothing 2000v. H.T. supply.
L28A	3, 15	12 H 0·25A. D.C.	ZA 0922	Chokes, A.F. No. 52.	Smoothing 550v. H.T. supply (to P.A. screen).
L28B	3, 15	12 H 0·25A. D.C.	ZA 0922	Chokes, A.F. No. 52.	Smoothing 550v. H.T. supply.
L29A	3, 15	15 H 0·1A. D.C.	ZA 0923	Chokes A.F. No. 53.	Smoothing 300v. bias supply.
L30A	2, 13	260T of 0·4 mm. enam.	ZA 11272	Chokes, R.F. No. 60	Part of R.F. Choke P.A. anode ct.

Jacks.

J1A	1, 16		ZA 4394	Jacks, Microphone, No. 2.	Morse key jack.
J1B	1, 16		ZA 4394	Jacks, Microphone, No. 2	Line jack.

Lamps.

P1A	1, 15	6v. 0·06A.	WB 0071	Bulbs. 6-volt J.	Crystal tuning indicator.
P1B	1, 15	6v. 0·06A.	WB 0071	Bulbs. 6-volt J.	Buffer tuning indicator.
P1C	1, 15	6v. 0·06A.	WB 0071	Bulbs. 6-volt J.	Power Supply indicator (R.F.Unit).
P1D	4, 17	6v. 0·06A.	WB 0071	Bulbs. 6-volt J.	Power Supply indicator (P.S.Unit).
P1E	1, 15	6v, 0·06A.	WB 0071	Bulbs. 6-volt J.	Driver tuning indicator.

Meters.

M1A	1, 2, 13	0—1mA D.C.	ZA 10995	Ammeters, D.C. 2 in. 1mA. No. 2.	Output current meter.
M2A	1, 2, 13	0—500mA. D.C.	ZA 10996	Ammeters, D.C. 2 in. 500mA. No. 2.	P.A. anode current meter.

Rectifiers (Metal).

W1A-E W1F-L	5, 17		ZA 11112	Rectifiers, Selenium, No. 12.	2000 volt supply rectifiers. 2000 volt supply rectifiers.
W2A-D	3, 15		ZA 3198	Rectifiers, Selenium, No. 9.	300 volt bias supply rectifiers.
W3A	2, 13	5 mA	ZA 5875	Rectifiers, Metal, 5mA	Output current meter rectifier.
W4A	2, 13		ZA 4920	Rectifiers, Selenium, No. 2.	Output current meter limiter.

Relays.

REL.1A	3, 15	1000 ohm coil, 8·5—20m A: 1 make, 1 change-over.	ZA 11115	Relays W.T. No. 32.	Oscillator H.T. Switch and receiver muting.
REL.2A	2, 13	1000 ohm coil, 15—20mA : 1 make, 1 change-over.	ZA 11270	Relays W.T. No. 36.	Rel.1A switch and receiver aerial change-over.
REL.3A	3, 15	2×1000 ohm coils, 8—20mA: 1 change-over (High Speed)	ZA 3193	Relays W.T. No. 5A.	Keying Relay.
REL.4A	3, 15	2×500 ohm coil, 10mA : 1 make polarised.	ZA 3196	Relays W.T. No. 23.	Remote control relay (power switch).
REL.5A	5, 17	100 volt A.C. coil 2 make.	ZA 11113	Relays W.T. No. 30.	Main power contactor.
REL.6A	5, 17	300mA : 1 break.	ZA 11114	Relays W.T. No. 31.	Overload and cut-out 2000v. supp-
REL.7A	5, 17	3 make - 1 break.	ZA 11116	Relays W.T. No. 33.	H.T. Contactor.

Resistances.

R1A	3, 15	15,000Ω 12 watt.	ZA 3192	Resistances, Tubular, 15,000 ohms, No. 3.	REL.1A coil dropping resistance.
R1B	3, 15	15,000Ω 12 watt.	ZA 3192	Resistances, Tubular, 15,000 ohms, No. 3.	REL.1A coil dropping resistance.
R1C	3, 15	15,000Ω 12 watt.	ZA 3192	Resistances, Tubular, 15,000 ohms, No. 3.	REL.2A coil dropping resistance.
R1D	3, 15	15,000Ω 12 watt.	ZA 3192	Resistances, Tubular, 15,000 ohms, No. 3.	REL.2A coil dropping resistance.
R1E	16	15,000Ω 12 watt.	ZA 3192	Resistances, Tubular, 15,000 ohms, No. 3.	V3A screen dropping resistance.
R2A	16	100Ω ½ watt.	ZA 6040	Resistors, No. 3A, ½-W 100 ohms.	Shunt circuit B1 contacts of REL.2A.
R2B	16	100Ω ½ watt.	ZA 6040	Resistors, No. 3A, ½-W 100 ohms.	Shunt circuit contacts of morse key.

Resistances—contd.

Symbol.	Figures 12 and	Value and Rating	Type used		Function and Remarks.
R2C	16	1000 Ω ½ watt.	ZA 6040	Resistors, No. 3A. ½-W. 100 ohms.	V2C control grid stopper.
R3A-D	3, 15	5,000 Ω 12 watt.	ZA 4830	Resistances, Tubular, 5000 ohms, No. 2.	Four in series-parallel : V1A, V1B dropping res.
R4A	16	0·25M Ω ½ watt.	ZA 10978	Resistors, No. 4A. ½-W. 250,000 ohms.	V1A striking resistance.
R5A	16	100 Ω 2 watt.	ZA 3185	Resistors, No. 2A. 2-W. 100 ohms.	V2A anode stopper.
R5B	16	100 Ω 2 watt.	ZA 3185	Resistors, No. 2A. 2-W. 100 ohms.	V2B anode stopper.
R5C	16	100 Ω 2 watt.	ZA 3185	Resistors, No. 2A. 2-W. 100 ohms.	V3A anode stopper.
R5D	2, 13	100 Ω 2 watt.	ZA 3185	Resistors, No. 2A. 2-W. 100 ohms.	W3A series resistance.
R6A	16	50,000 Ω 2 watt.	ZA 6479	Resistors, No. 2A. 2-W. 50,000 ohms.	V2A control grid leak.
R6B	16	50,000 Ω 2 watt.	ZA 6479	Resistors, No. 2A. 2-W. 50,000 ohms.	V3A suppressor potentiometer (part of).
R7A	16	500 Ω ½ watt.	ZA 6472	Resistors, No. 3A. ½-W. 500 ohms.	Parasitic oscillation stopper V2A (with L5A).
R7B	16	500 Ω ½ watt.	ZA 6472	Resistors, No. 3A. ½-W. 500 ohms.	Parasitic oscillation stopper V3A (with L5B).
R8A	16	400 Ω 2 watt.	ZA 3186	Resistors, No. 2A. 2-W. 400 ohms.	V2A cathode bias resistance.
R9A	16	20,000 Ω 2 watt.	ZA 5028	Resistors, No. 2A. 2-W. 20,000 ohms.	V2A screen dropping resistance.
R9B	16	20,000 Ω 2 watt.	ZA 5028	Resistors, No. 2A. 2-W. 20,000 ohms.	Part of V3A control grid leak (except Range 1).
R10A	16	150,000 Ω 2 watt.	ZA 3188	Resistors, No. 2A. 2-W. 150,000 ohms.	V2B control grid leak.

R11A	16	10,000Ω 12 watt.	ZA 4833	Resistors, Tubular, 10,000 ohms, No. 6.	V2B screen dropping resistance.
R11B-C	16	10,000Ω 12 watt.	ZA 4833	Resistors, Tubular, 10,000 ohms, No. 6.	Two in parallel loading V3A anode ct.
R12A	16	10,000Ω 2 watt.	ZA 8134	Resistors, No. 2A. 2-W. 10,000 ohms.	V3A control grid leak.
R12B-C	5, 17	10,000Ω 2 watt.	ZA 8134	Resistors, No. 2A. 2-W. 10,000 ohms.	Two in series shunting REL. 7A coil.
R13A	16	100Ω 1 watt.	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V3A suppressor stopper.
R13B	14	100Ω 1 watt.	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V4A suppressor stopper.
R13C	14	100Ω 1 watt.	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V4A screen stopper.
R13D	14	100Ω 1 watt.	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V4A control grid stopper (with L16A).
R13E	14	100Ω 1 watt.	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V4B control grid stopper (with L16B).
R13F	14	100Ω 1 watt	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V4B screen stopper.
R13G	14	100Ω 1 watt.	ZA 3184	Resistors, No. 2A. 1-W. 100 ohms.	V4B suppressor stopper.
R14A-D	3, 15	4,000Ω 12 watt.	ZA 4829	Resistances, Tubular, 4,000 ohms, No. 2.	P.A. screens supply dropping res.
R15A	14	5,000Ω 3 watt.	ZA 5031	Resistors, No. 2A. 3-w. 5,000 ohms.	V4A control grid leak.
R15B	14	5,000Ω 3 watt.	ZA 5031	Resistors, No. 2A. 3-w. 5,000 ohms.	V4B control grid leak.
R16A	13	300Ω 1/4 watt.	ZA 11118	Resistors, No. 3A. 1/4w. 300 ohms.	M1A series resistance.
R17A	3, 15	3,000Ω 12 watt.	ZA 4828	Resistances, Tubular, 3,000 ohms, No. 3.	T2A secondary load.
R18A	16	500Ω 1 watt.	ZA 5011	Resistors, No. 2A. 1-W. 500 ohms.	V2C cathode bias resistance.
R19A	3, 15	50,000Ω max. graded variable.	ZA 3117	Resistances, Variable, 50,000 ohms, No. 7.	V6A input control on R.T.
R20A	16	100,000Ω 1 watt.	ZA 5018	Resistors, No. 2A. 1-W. 100,000 ohms.	V6A screen dropping resistance.

Resistances—concld.

Symbol.	Figures 12 and	Value and Rating.	Type used.		Function and Remarks.
R20B	16	100,000 Ω 1 watt.	ZA 5018	Resistors, No. 2A. 1-W. 100,000 ohms.	V6A screen potentiometer with R20A.
R21A-C	3, 15	2,500 Ω 12 watt.	ZA 4827	Resistances, Tubular, 2,500 ohms, No. 1.	Three in series for Mod.H.T. dropping res.
R22A	16	50,000 Ω 1 watt.	ZA 5017	Resistors, No. 2A. 1-W. 50,000 ohms.	V6A anode dropping resistance.
R23A	16	300 Ω ½ watt.	ZA 6459	Resistors, No. 3A. ½-W. 300 ohms.	V6A cathode bias, res. (except M.C.W.).
R23B	16	300 Ω ½ watt.	ZA 6459	Resistors, No. 3A. ½-W. 300 ohms.	V6A cathode bias res.
R24A	16	50,000 Ω ½ watt.	ZA 6346	Resistors, No. 3A. ½-W. 50,000 ohms.	V6A control grid leak on M.C.W.
R24B	2, 13	50,000 Ω ½ watt.	ZA 6346	Resistors, No. 3A. ½-W. 50,000 ohms.	V6B load.
R25A-B	5, 17	50,000 Ω 280 watt.	ZA 4835	Resistances, Tubular, 50,000 ohms, No. 6.	Two in series as bleeder across 2000v. supply.
R26A	17	70 Ω ½ watt.	ZA 11119	Resistors, No. 3A. ½-W 70 ohms.	P1D series resistance.
R27A	16	60 Ω ½ watt.	ZA 3183	Resistors, No. 3A. ½-W. 60 ohms.	V2B control grid stopper.
R27B	15	60 Ω ½ watt.	ZA 3183	Resistors, No. 3A. ½-W. 60 ohms.	P1E damping resistance (Range 1).
R28A	3, 15	2,000 Ω 12 watt.	ZA 3189	Resistances, Tubular, 2,000 ohms, No. 3.	Part of bias supply potentiometer.
R29A	3, 15	1,000 Ω 12 watt.	ZA 4825	Resistances, Tubular, 1,000 ohms, No. 3.	Part of bias supply potentiometer.
R29B	3, 15	1,000 Ω 12 watt.	ZA 4825	Resistances, Tubular, 1,000 ohms, No. 3.	Part of bias supply potentiometer.
R30A	3, 15	500 Ω 12 watt.	ZA 4822	Resistances, Tubular, 500 ohms, No. 2.	Part of bias supply potentiometer.
R31A	3, 15	750 Ω 12 watt.	ZA 11117	Resistances, Tubular, 750 ohms, No. 1.	Part of bias supply potentiometer.

R32A	16	10,000 Ω 1 watt.	ZA 5016	Resistors, No. 2A. 1-W. 10,000 ohms.	V3A suppressor potentiometer (except C.W.).
R33A	16	20,000 Ω ± 5% ½ watt.	ZA 6442	Resistors, No. 3-B. ½-W. 20,000 ohms.	V2C control grid resistance.
R34A	16	30,000 Ω ± 5% ½ watt.	ZA 6443	Resistors, No. 3B. ½-W. 30,000 ohms.	V2C control grid leak.
R35A	3, 15	3,500 Ω 12 watt.	ZA 3190	Resistances, Tubular, 3,500 ohms, No. 2.	Part of bias supply potentiometer.
R36A	15	2,000 Ω ½ watt.	ZA 6516	Resistors, No. 3A. ½-W. 2,000 ohms.	Shunting REL.4A coil.
R37A	2, 13	150 Ω 2 watt.	ZA 5023	Resistors, No. 2A. 2-W. 150 ohms.	M1A equalising circuit.

Switches.

S1	1, 16	Single pole on/off.	ZA 6683	Switches, On-Off S. P. No. 1.	Normal/Break-in Switch.
S2	1, 16	2S.p. change-over, 1 S.p. on/off.	ZA 10744	Switches, 3 pole, 2 Way, No. 2.	Oscillator (M.O/Crystal) Switch.
S3	1, 16	12S.p. on/off 4 position.	ZA 11121	Switches, 6 Pole, 4 way, No. 2.	System switch.
S4	1, 16	2S.p. change-over, 1 S.p. on/off.	ZA 11052	Switches, 3 Pole, 2 Way, No. 3.	Control Switch (Local/Remote).
S5	1, 16	Single Pole on/off.	ZA 6683	Switches, On-Off No. 1.	Power Supply Switch (R.F.U.).
S6	4,5, 17	Double Pole on/off 250v. 20A.	ZA 4327	Switches, On-Off D. P. No. 9.	Power Switch (P.S.U.).
S7	1, 16	Single Pole on/off.	ZA 6683	Switches, On-Off, S.P. No. 1.	H.T. Switch.
S8	3, 15			Part of turret M.O. Anode.	Oscillator Range.
S9	3, 15			Part of turret Buffer Anode.	Buffer Range.
S10	3, 15			Part of turret Driver Anode.	Driver Range.
S11	13	14 Pole 6 position.			P.A. range switch.
S12	1	Single Pole 9 position.		Part of Inductances Tapped 40 μH.	Output taps on L17A.
S13	1	Single Pole 9 position.			Output taps on L17A.
S14	5 ,17	Single Pole on/off.	ZA 11745	W/Sets No. 33, Switches, Gate.	Safety switch P.S.U. door.
S15	15	Single Pole on/off	ZA 11745	W/Sets No. 33, Switches, Gate.	Safety switch R.F.U. door (bottom).
S16	15	Single Pole on/off.	ZA 11745	W/Sets No. 33, Switches, Gate.	Safety switch R.F.U. door (bottom).
S17	2, 13	Single Pole on/off.	ZA 11745	W/Sets No. 33, Swtiches, Gate.	Safety switch R.F.U. door (top).
S18	13	Single Pole on/off.	ZA 12097	Part of Inductances Tapped 40 μ H. Contact Assembly No. 1.	Safety switch P.A. release knob.

Switches—concld.

Symbol.	Figures 12 and	Value and Rating.	Type used.		Function and Remarks.
S19	5, 17	Single Pole on/off.	Part of Plugs Single No. 29, ZA 11124.		Safety switch Plug "A" socket P.S.U.
S20	2, 13	Single Pole on/off.			Safety switch Plug "A" socket R.F.U.

Transformers.

T1A	16		ZA 6970	Transformers, Telephone, No. 3	Coupling sidetone from V6B to rec'r plug.
T2A	3, 15	1·6 : 1 Pri. current 50mA D.C. max.	ZA 5132	Transformers, Telephone, No. 11.	Modulator output transformer.
T3A	16		ZA 6903	Transformers, Line and Microphone, No. 3.	Modulator input transformer.
T4A	3, 15	Primary. 230 volts A. C. 45—60 c/s. Secondaries. 500—0 500v. 0·4A 300v. 0·1A. 5—0—5v. 1·1A. 6—3. 15—0—3. 15—6v. 1 & 3A 4v. 7A.	ZA 11122	Transformers, Power 200 VA. No. 3.	R.F. Unit power transformer. H.T. rectifier winding. Bias rectifier winding. V4A & V4B filament winding. V3A & V2A-C, V6A-B heater windings. V5A-B filament winding.
T5A	5, 17	Primary 200—150—100—0—10—20—30—40—50v. A.C. at 45—60 c/s. Secondary 100v. 0·15A.	ZA 3156	Transformers, Power, 15 VA. No. 1.	REL.5A energising transformer.

T6A	5, 17	Primary 200—150—100—0—10—20—30—40—50v. A.C. at 45—60 c/s. Secondary. 2000—0—2000v. 0·275A.	ZA 11123	Transformers, Power. 1·1 KVA. No. 1.	P. A. valve anode H.T. supply.
T7A	13	Primary 2T, Secondary 17T screened windings.	ZA 12056	W/Sets No. 33, Transformers, Meter.	Output current meter transformers.

Valves.

V1A-B	3, 15, 16		ZA 7013	Valves, W.T. Type AW3.	Stabiliser for H.T. to V2A and to V2B screen.
*V2A	3, 15, 16		ZA 3496	Valves, W.T. Type ATS25.	Master Oscillator.
*V2B	3, 15, 16		ZA 3496	Valves, W.T. Type ATS25.	Buffer amplifier and frequency multiplier.
*V2C	3, 15, 16		ZA 3496	Valves, W.T. Type ATS25.	Modulation amplifier.
V3A	3, 15, 16		ZA 7012	Valves, W.T. Type ATP35.	Driver.
V4A-B	2, 13, 14		ZA 5189	Valves, W.T. Type ATP100.	Two in parallel as power amplifiers.
V5A-B	3, 15, 16		ZA 7001	Valves, W.T. Type AU1.	Two in push-pull as 500v. rectifiers.
V6A	3, 15, 16		ZA 3493	Valves, W.T. Type ARP34.	M.C.W. oscillator and modulator amplifier.
V6B	2, 13, 14		ZA 3493	Valves, W.T. Type ARP34.	Connected as diode for sidetone rectifier.
*V2A-C			ZA 10813	Valves, W.T. Type ATS25A.	To be used in place of ATS25 when available.

COMPONENT LIST.

Condensers. — Aerial Coupling Equipment—Aerial Unit G.

Symbol.	Figures.	Value and Rating.	Type used.		Function and Remarks.
C1A	6, 19, 20	220pF + 500pF max. variable.	ZA 11109	Condensers, Variable, 2 gang, X.22 + X.5.A.	Tuning condenser (with L1A).
C2A	19, 20	30pF ± 2½%	ZA 0932	Condensers, Y.3.H.	M1A equalising circuit.
C3A	19, 20	50pF	ZA 1399	Condensers, Y.5.E.	W1A series res. (R2A) bypass.
C4A	19, 20	0·01 μF	ZA 1422	Condensers, Q.1.E.	M1A R.F. bypass.
Inductances.					
L1A	19, 20	90T of 0·3 mm. wound on R1A.	}	Inductances Variable, No. 6.	Tuning coil (with S1 and C1A).
L2A	19, 20				Coupling P1A to L1A.
L3A	19, 20			Part of Aerial Coupling Equip: "G" Filters No. 1.	M1A equalising circuit.
Lamp.					
P1A	6, 19, 20	6v. 0·06A.	WB 0071	Bulbs. 6v. J.	Resonance indicator.
Meter.					
M1A	6, 19, 20	0-1mA D.C.	ZA 10995	Ammeters, D.C. 2-in. 1mA. No. 2.	Aerial Current meter.

Rectifiers.

W1A	19, 20	5mA.	ZA 5875	Rectifiers, Metal, 5mA.	M1A rectifier.
W2A	19, 20		ZA 4920	Rectifiers, Selenium, No. 2.	M1A current limiter.

Resistances.

R1A	19, 20	150 Ω 2 watt.	ZA 5025	Resistors, No. 2A, 2-W. 150 Ω.	M1A equalising circuit.
R2A	19, 20	100 Ω 2 watt.	ZA 3185	Resistors, No. 2A, 2-W. 100 Ω.	W1A series resistance.
R3A	19, 20	300 Ω ¼ watt.	ZA 6459	Resistors, No. 3A, ½-W. 300 Ω.	M1A series resistance.

Switches.

S1	19, 20	12 pole 6 position.		Part of L1A Coil Assembly.	Range switch.
S2	19, 20	Single pole 6 position.			Coupling feeder to L1A.
S3	19, 20	Single pole 9 position.			Coupling aerial to L1A.
S4	19, 20	Continuously variable tap on L1A.			Coupling aerial to L1A (S3 at "VAR. TAP").
S5	19, 20	Push-button on/off	ZA 12154	Aerial Coupling Equip. "G" Switches, Push, No. 1.	M1A sensitivity control.
S6	19, 20	Push-button on/off.	ZA 12155	Aerial Coupling Equip. "G" Switches, Push, No. 2.	Unshort-circuits P1A for tuning.

Transformer.

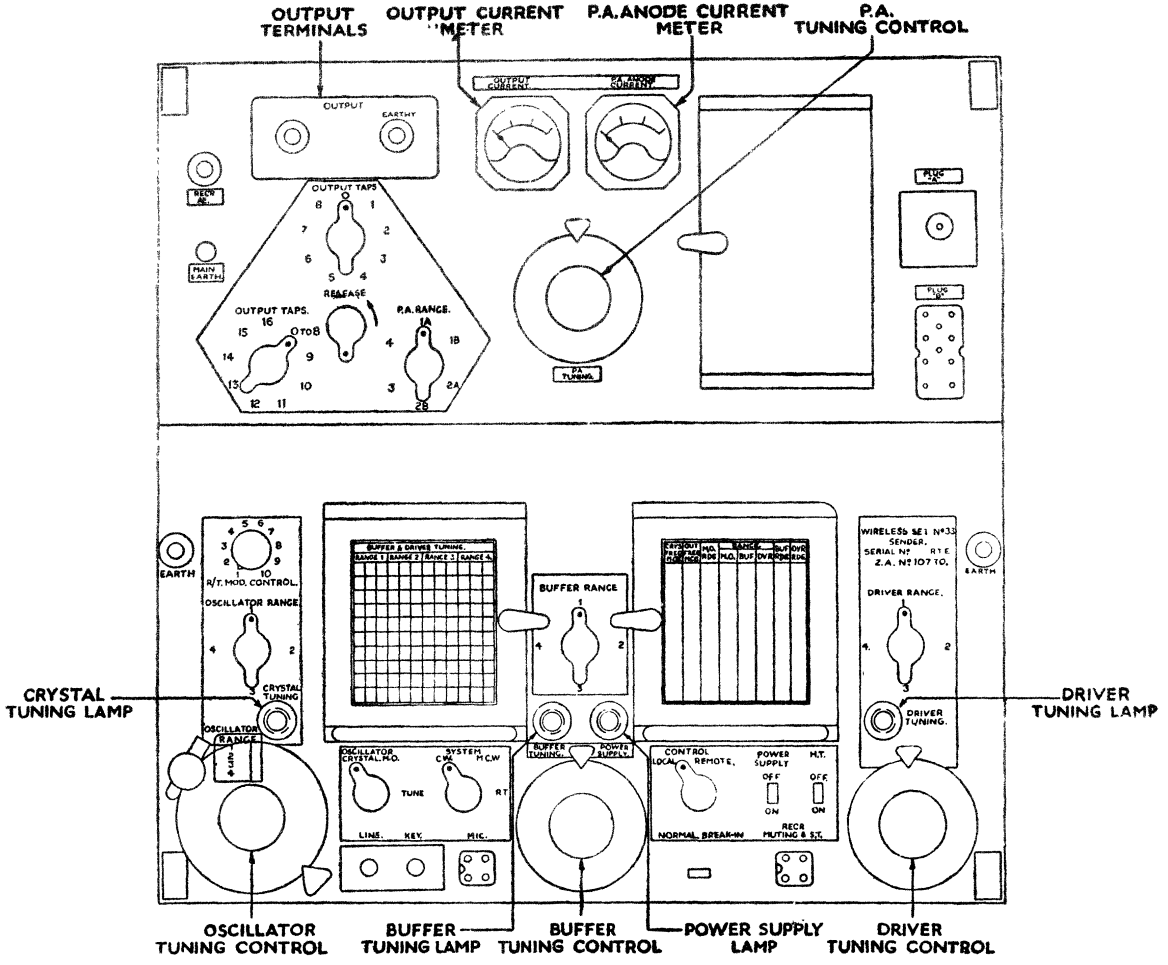
T1A	19, 20	Primary 7½T + 2½T Secondary 18T screened.	ZA 12139	Aerial Coupling Equip. "G" Transformers, Meter No. 1.	Aerial current meter transformer.

Batteries.

Wireless Remote Control Unit C.

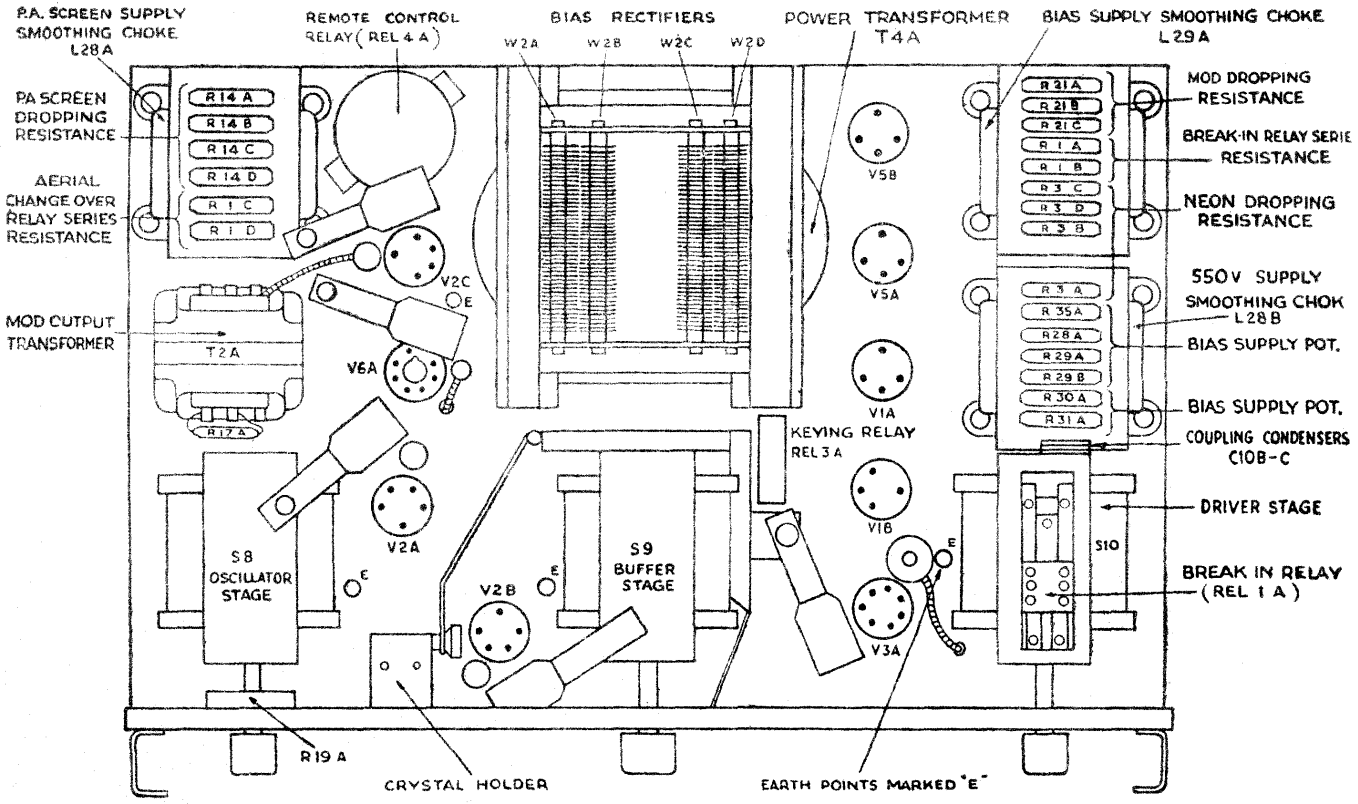
Symbol.	Figures.	Value and Rating.	Type used.		Function and Remarks.
B1A-D	18, 21	12 volt.	WB 0027	Batteries, Dry, Refills, 8-Cell, No. 1 Mk. I.	Four in series to operate sender REL.4A.
Relay.					
REL. 1A	18, 21	2 × 1000 Ω coil. 1 change-over.	ZA 3193	Relays W.T. No. 5A.	Receiver muting relay.
Switches.					
S1	9, 18, 21	2 change-over—1 on/off. 3 position.	YA 0905	Keys. No. 216 Black.	Sender control (ON-WORK-OFF).
S2	9, 18, 21	Single pole on/off.	ZA 3106	Switches, S.P. 2-way, No. 4.	Short circuits REL.1A coil on "NORMAL".
S3	9, 18, 21	Single pole change-over.	ZA 3106	Switches, S.P. 2-way, No. 4.	Switches KEY or AUTO to sender lines.
Wireless Set No. 33—Dummy Aerial.					
P1A-B		230—250v. 250 watt.	XA 1053	Lamps, Electric, Radiator. C.F. solid, Cap. D.E. 230/250v. 250 Watt.	Dummy Aerial Load.

N.W.R.—1175/18—1942-43—500 C.



FRONT PANEL LAYOUT OF R.F. UNIT.

FIG. 1



CHASSIS LAYOUT OF R.F. UNIT BOTTOM DECK

FIG. 3

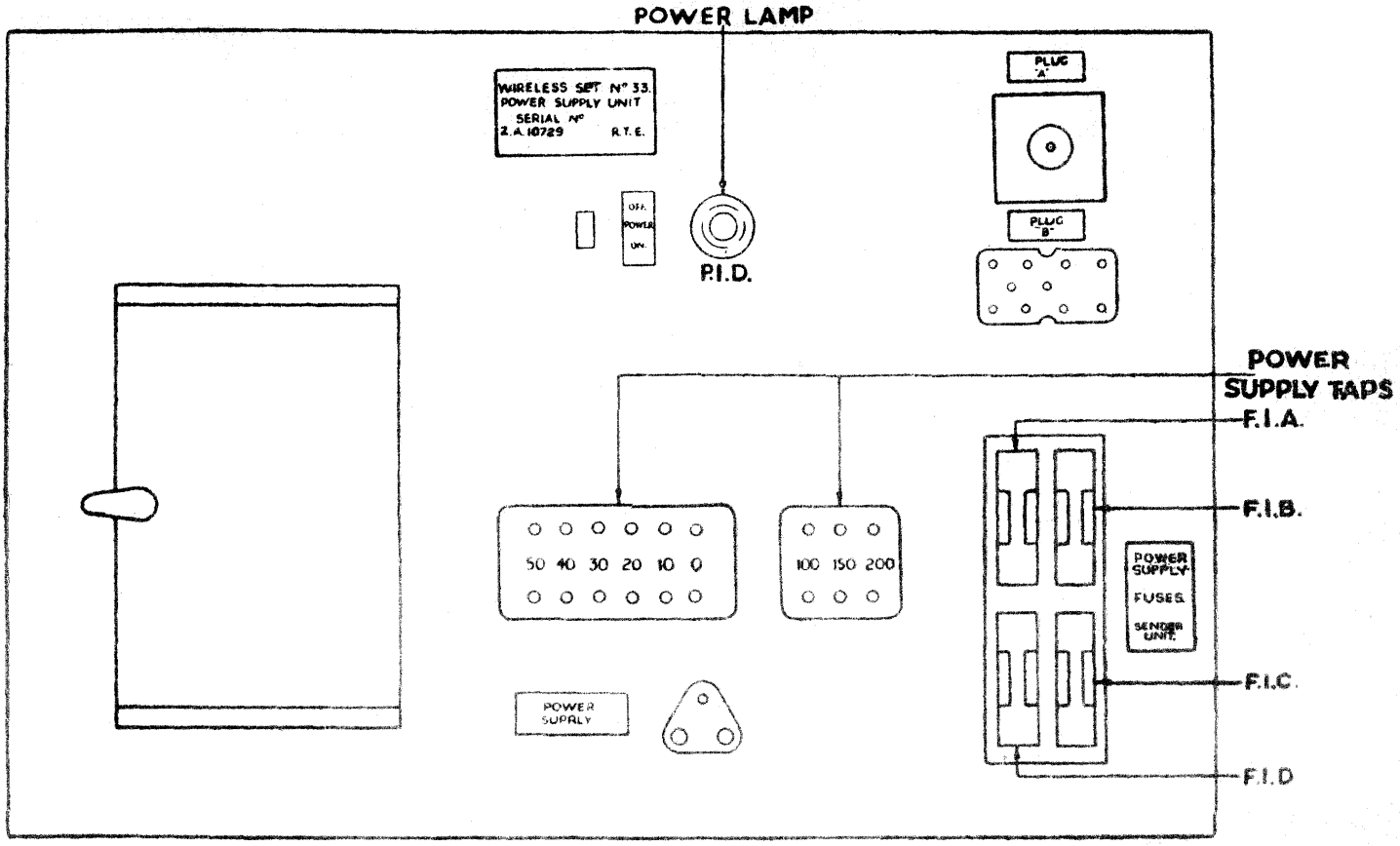
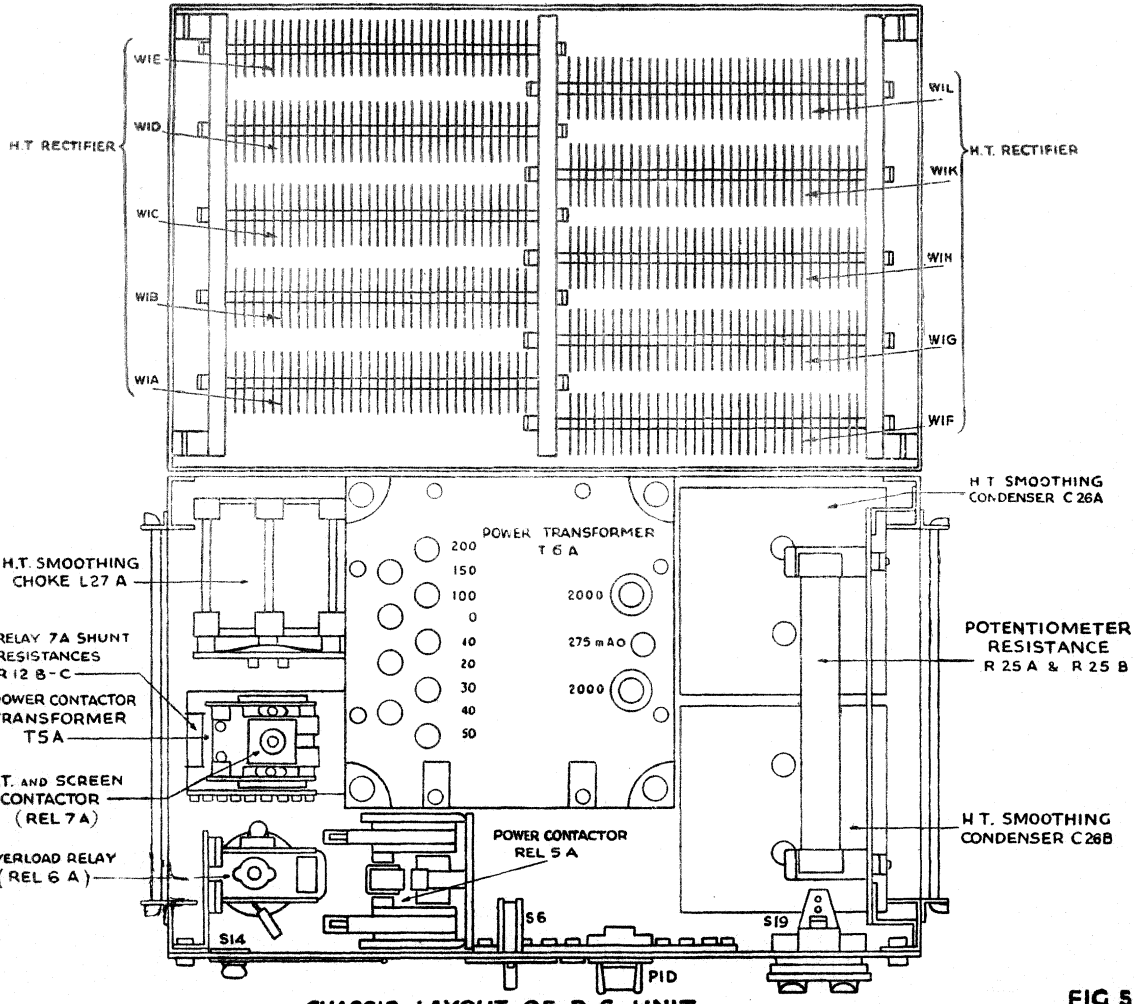


FIG. 4

FRONT PANEL LAYOUT OF P.S. UNIT.



CHASSIS LAYOUT OF P.S. UNIT

FIG 5

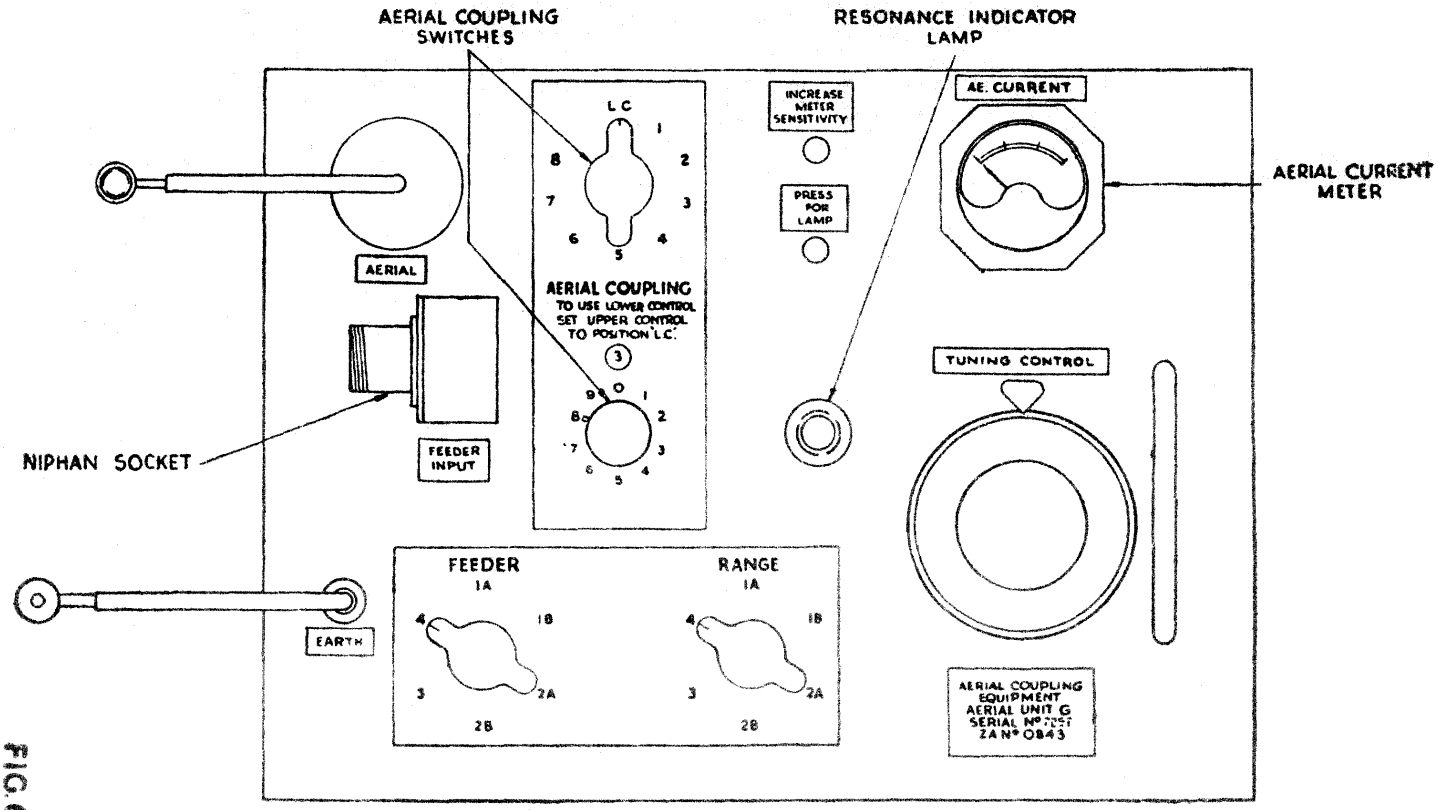


FIG. 6

FIG. 6
FRONT PANEL LAYOUT OF AERIAL UNIT G

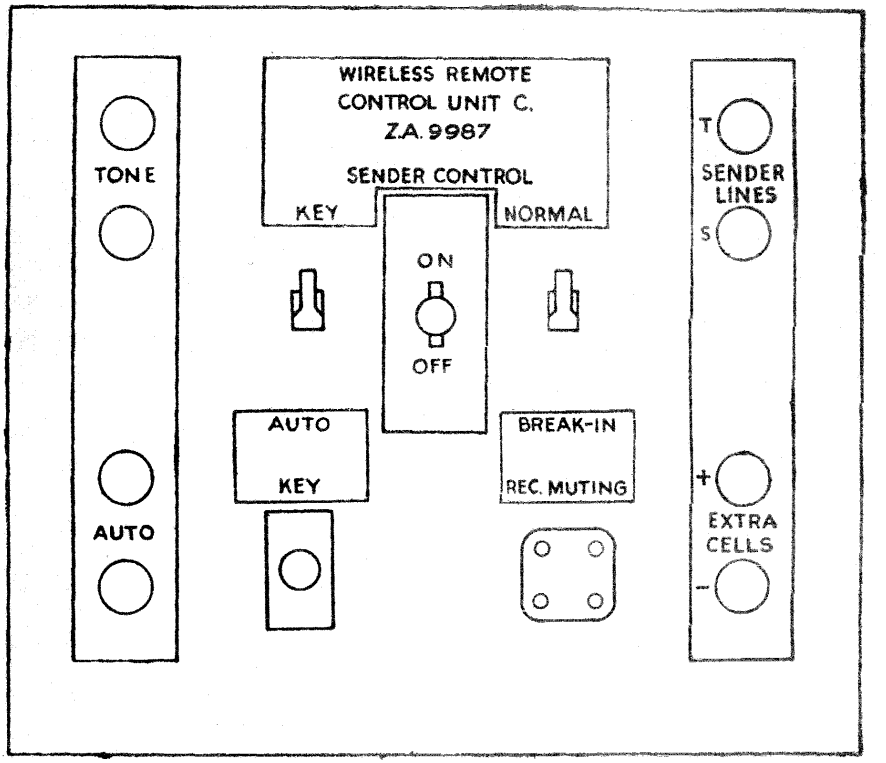
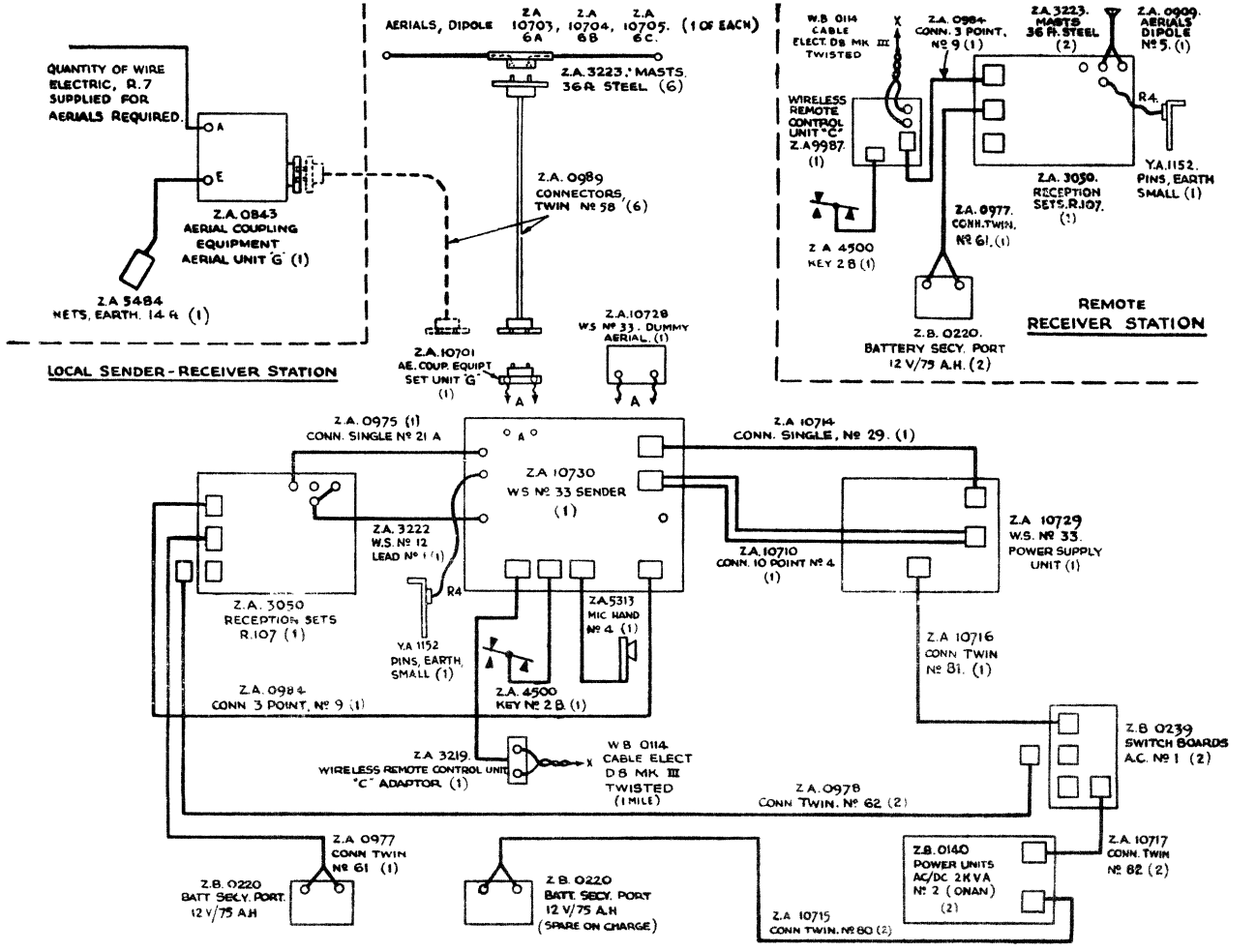


FIG 7

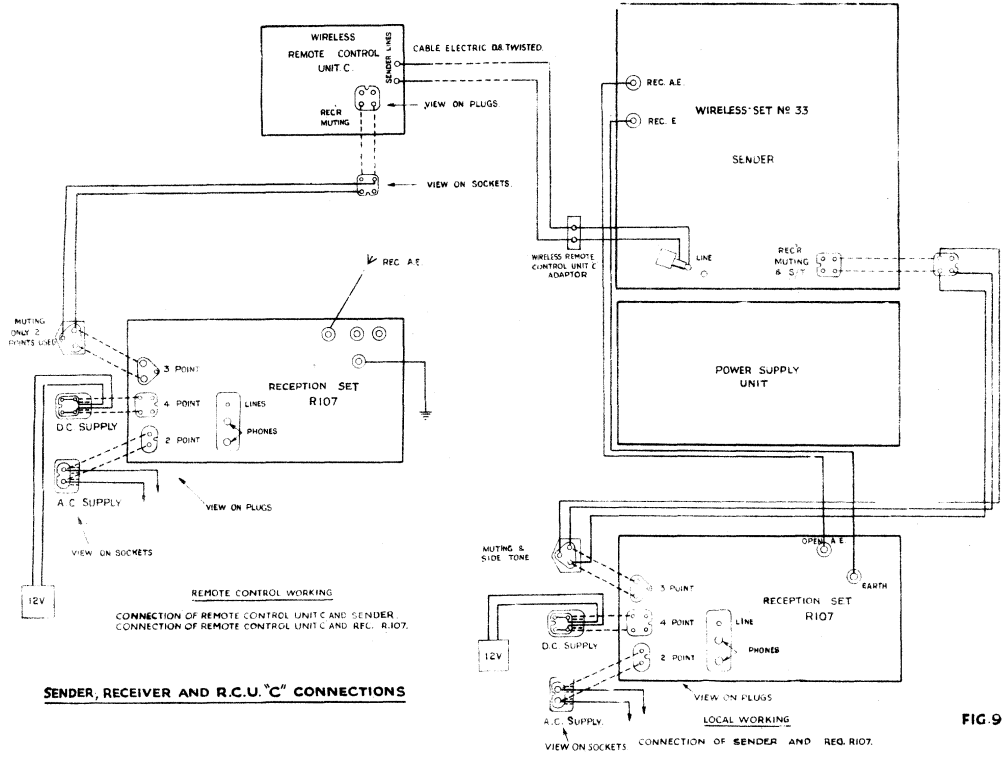
FRONT PANEL

OF WIRELESS REMOTE CONTROL UNIT C.



WIRELESS SETS No 33 GROUND STATION LAYOUT

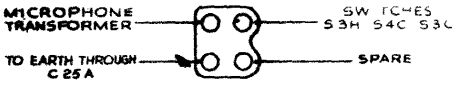
FIG 8



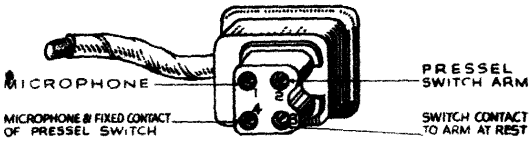
SENDER, RECEIVER AND R.C.U. "C" CONNECTIONS

FIG.9

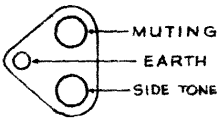
MICROPHONE PLUG
(VIEWED FROM BACK OF PANEL)



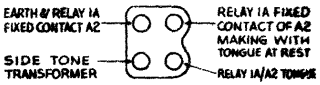
MICROPHONE HAND Nº4



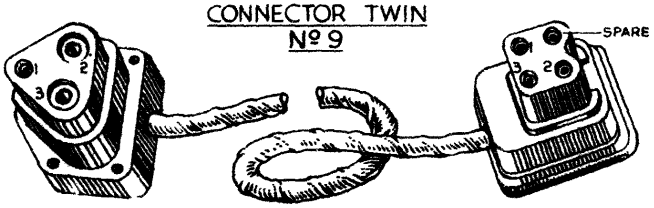
MUTING PLUG ON R107
(VIEWED FROM BACK OF PANEL)



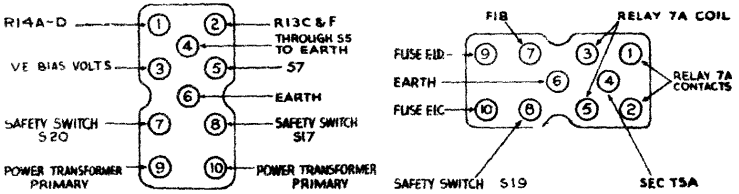
MUTING PLUG
(VIEWED FROM BACK OF PANEL)



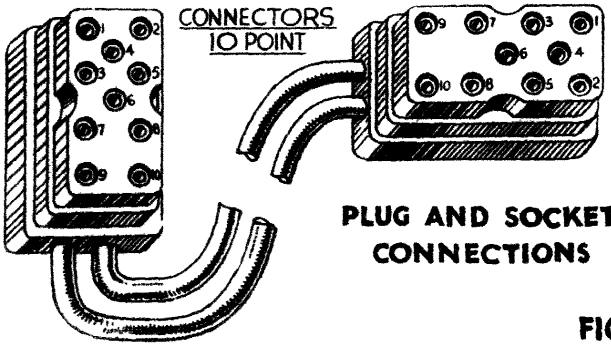
CONNECTOR TWIN
Nº 9



ON R.F.U — PLUGS B — ON P.S.U.
(VIEWED FROM BACK OF PANEL)

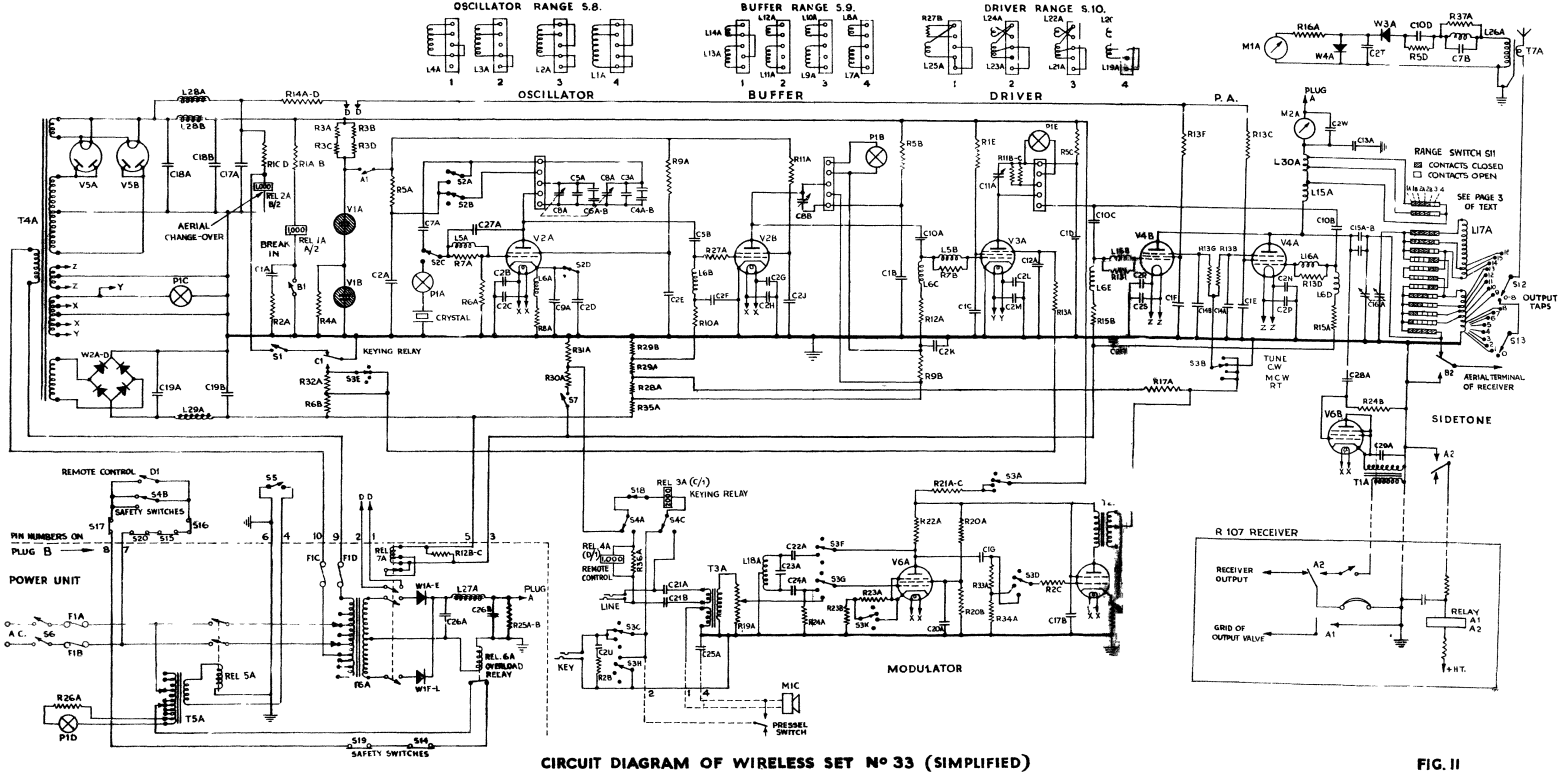


CONNECTORS 10 POINT



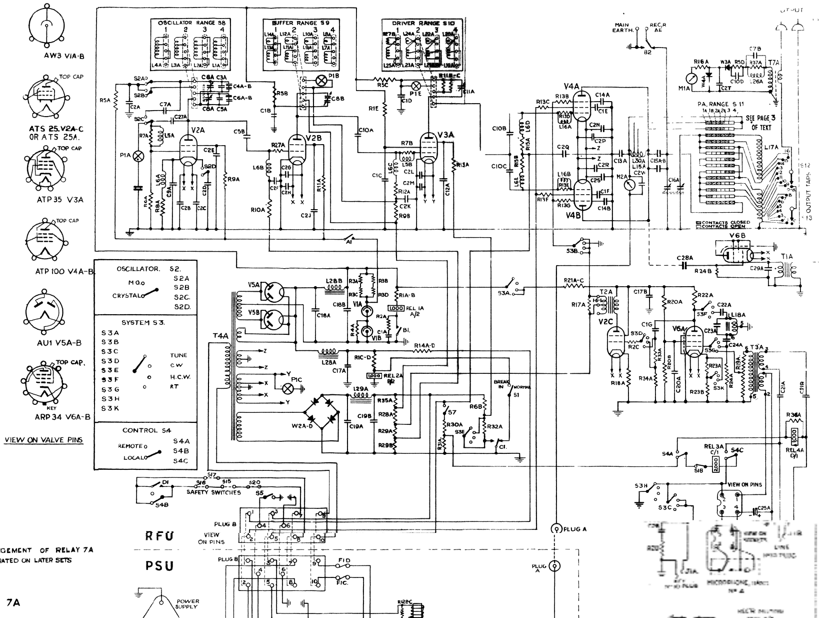
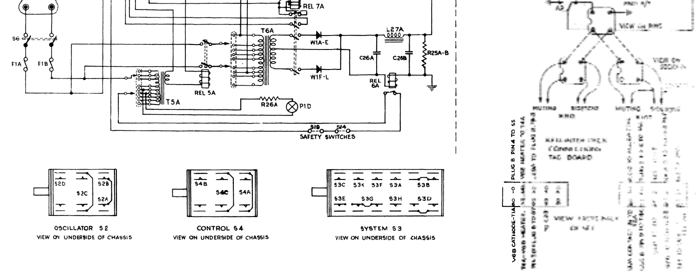
PLUG AND SOCKET CONNECTIONS

FIG.10



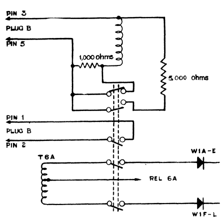
CIRCUIT DIAGRAM OF WIRELESS SET Nº 33 (SIMPLIFIED)

FIG. 11

BELOW IS A NEW ARRANGEMENT OF RELAY 7A THAT WAS INCORPORATED ON LATER SETS

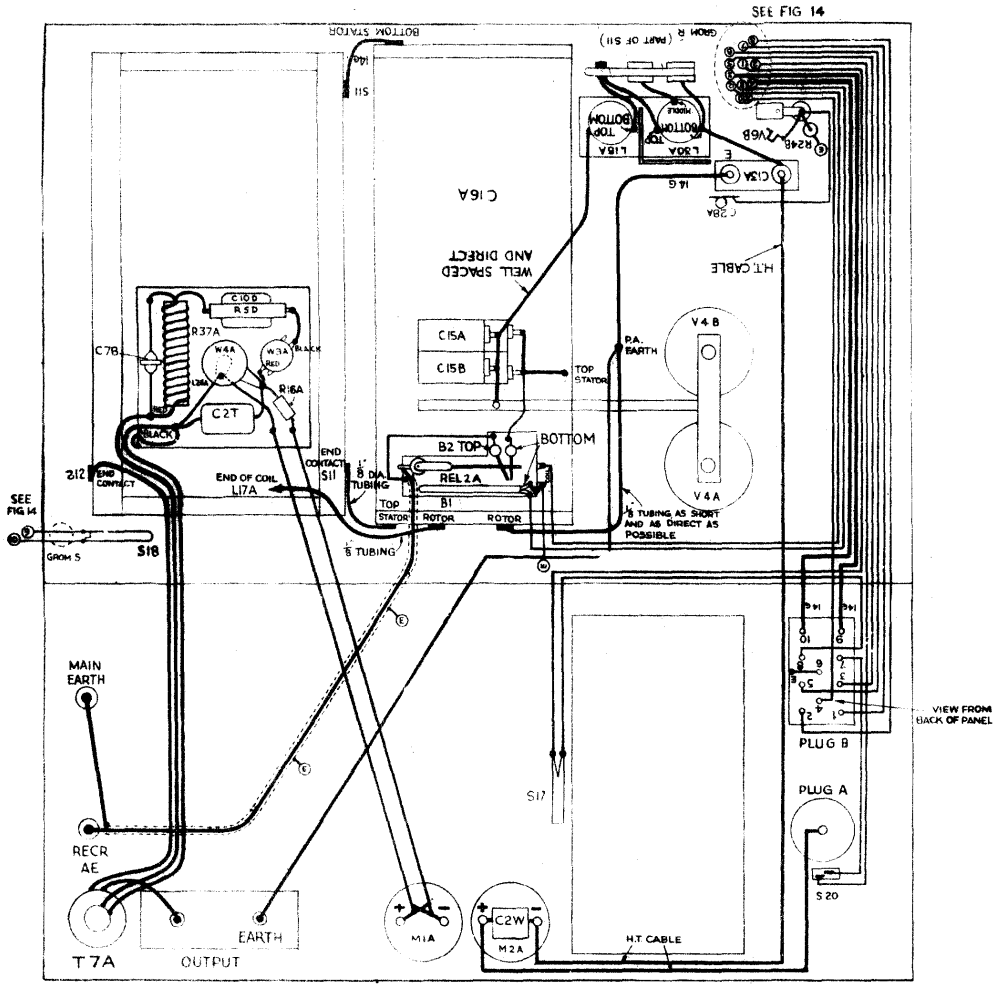
RELAY 7A



KEY TO LOCATION OF COMPONENTS WHICH WILL BE FOUND VERTICALLY ABOVE DESIGNATION IN THIS CHART.

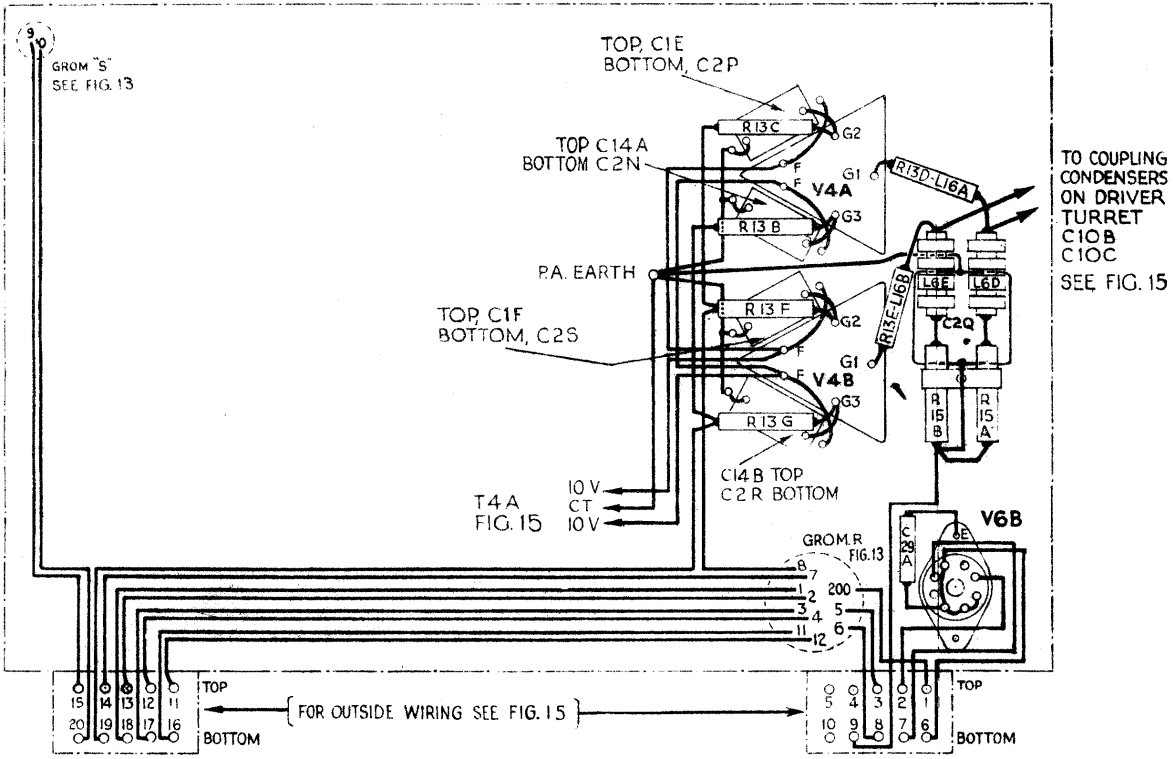
CONDENSERS	C8A, C3A, C4A-B, C1B, C2F, C2G, C2J, C8B, C18B, C10A, C1A, C1D, C2M, C12A, C11A C10B, C2Q, C2P, C1E, C13A, C	[illegible]
	C7A. C5A, C6A-B. C2H, C17A, C19B, C1C, C2K, C2L, C10C, C14A, C14B, C	[illegible]
	C9A, C2B, C2D, C2E, C5B, C18A C19A, C2N, C1F, C2W,	[illegible]
	C2A, C2C, C27A, C26A C26B, C2S, C2R, C	[illegible]
RESISTANCES.	R5B, R3A-D, R5C, R29B, R12A, R11B-C, R13 R15B, R15A R21A-C,	[illegible]
	R7A, R6A R9A R27A, R11A. R29A, R35A, R1A-B, R14A-D, R6B, R13C, R13B, R13E, R2C,	[illegible]
	R5A R8A R10A, R4A, R10D, R26A, R12B-C, R7B, R30A, R32A, R13F, R13D, R17A, R18A R34A	[illegible]
	R1E, R27B, R2A, R9B, R28A. R31A. R25A-B, R13G,	[illegible]
RELAYS & SWITCHES	D1, S4B, S16, S17, S15, S20, S9, A1, REL2A, REL1A, S14, S3E. REL6A, S1, S3B, S3D	[illegible]
	S2A, S2C, S6, S2D, S2B, S8, S5, REL.5A. B1, REL7A, S7, S10, S19, C1, S3A, S3H	[illegible]
CHOKES & TRANSFORMERS.	T4A, L6B, L13A, L12A, L10A, L28B, L29A, T6A, L23A, L5B, L20A, L6D, L16A, T2A,	[illegible]
	L4A, L3A, L2A, L1A, L14A, L11A, T5A, L9A, L8A, L7A, L28A, L25A, L24A, L22A, L21A, L19A L27A, L6E, L16B, L15A,	[illegible]

CIRCUIT DIAGRAM. WIRELESS SET No33. SENDER

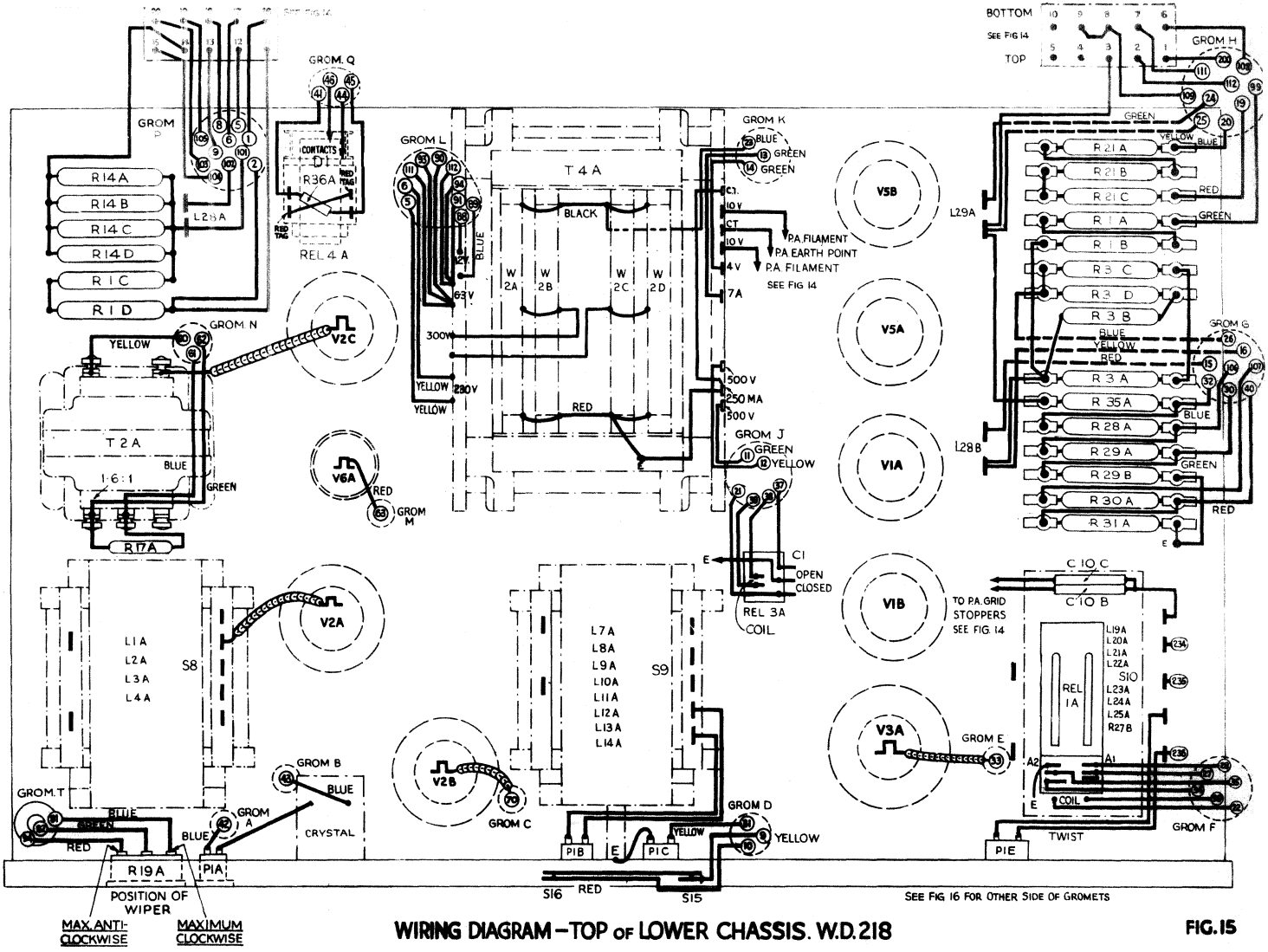


R.F. UNIT — WIRING DIAGRAM, TOP DECK AND FRONT PANEL

FIG 13

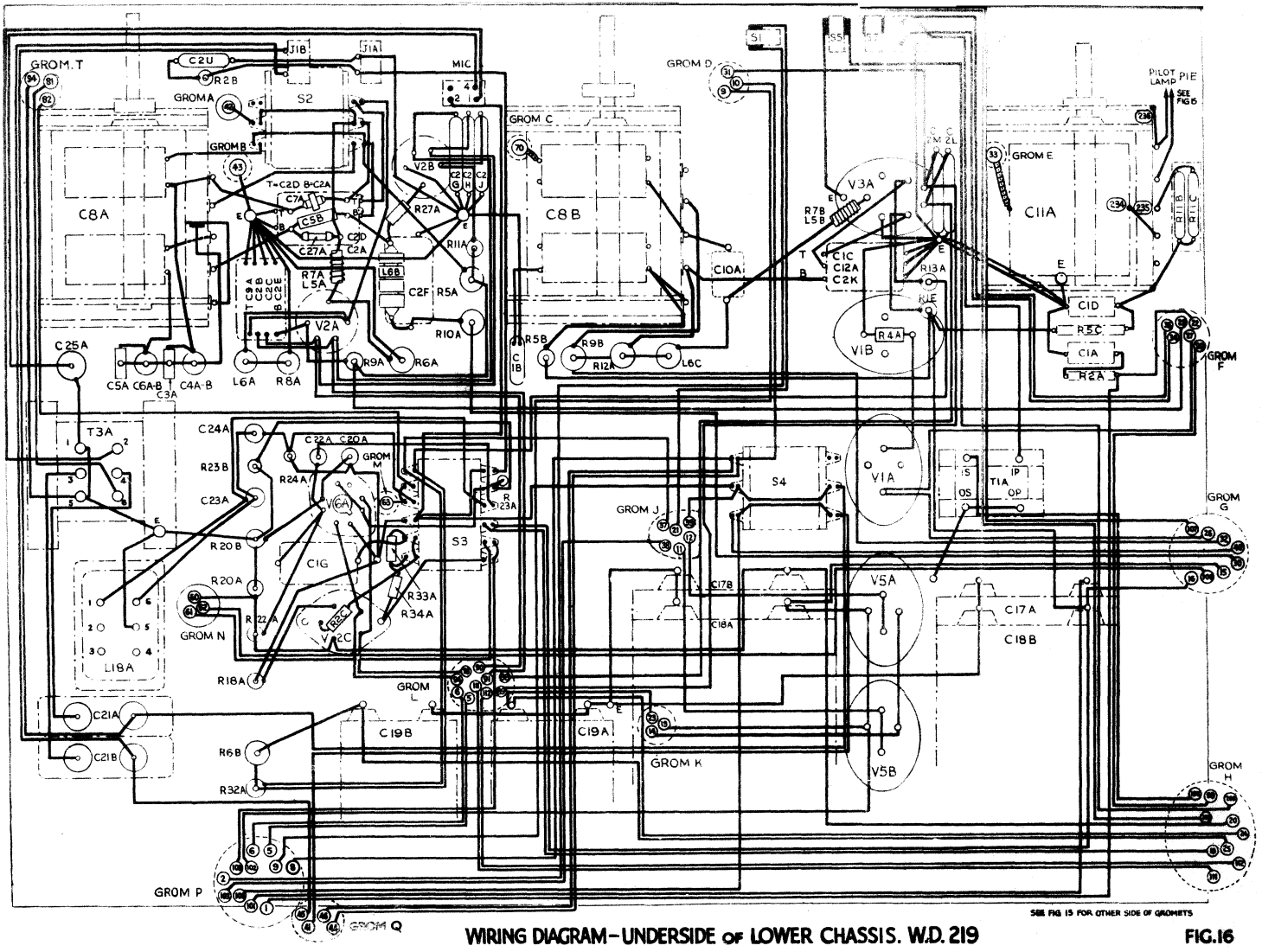


WIRING DIAGRAM R.F. UNIT – UNDERSIDE, TOP DECK. **FIG.14**



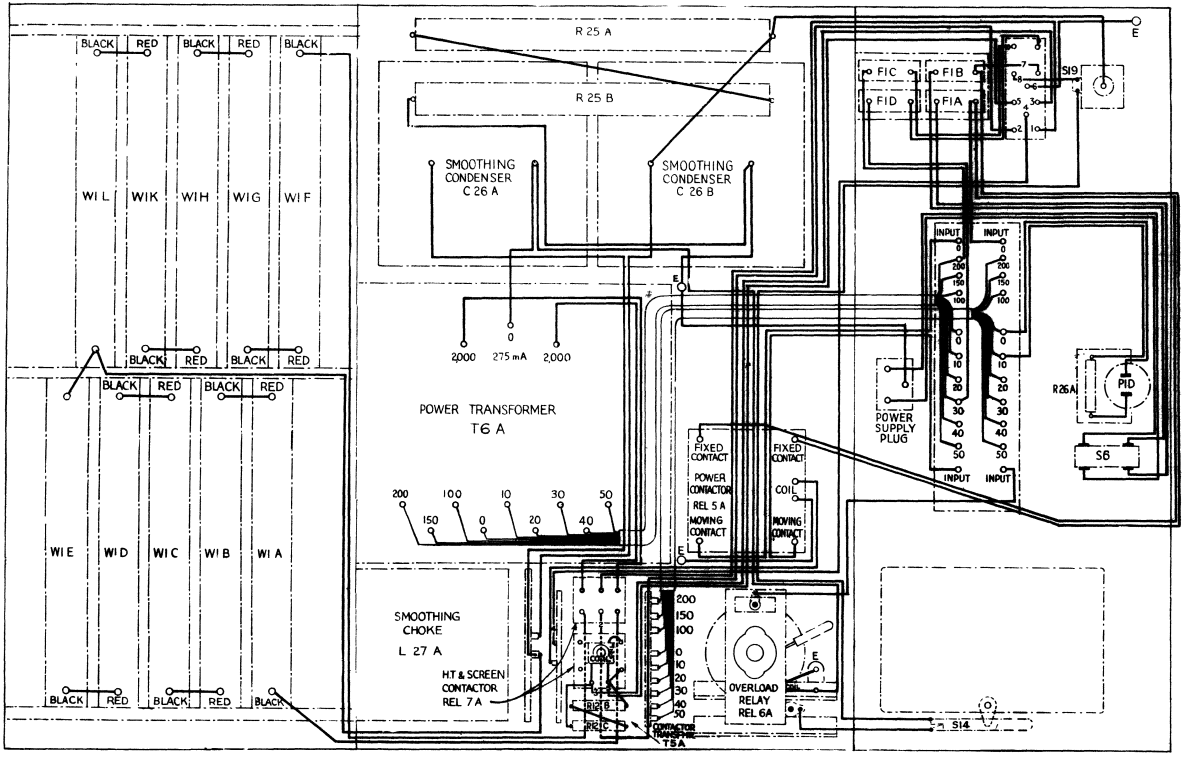
WIRING DIAGRAM – TOP OF LOWER CHASSIS. W.D.218

FIG.15



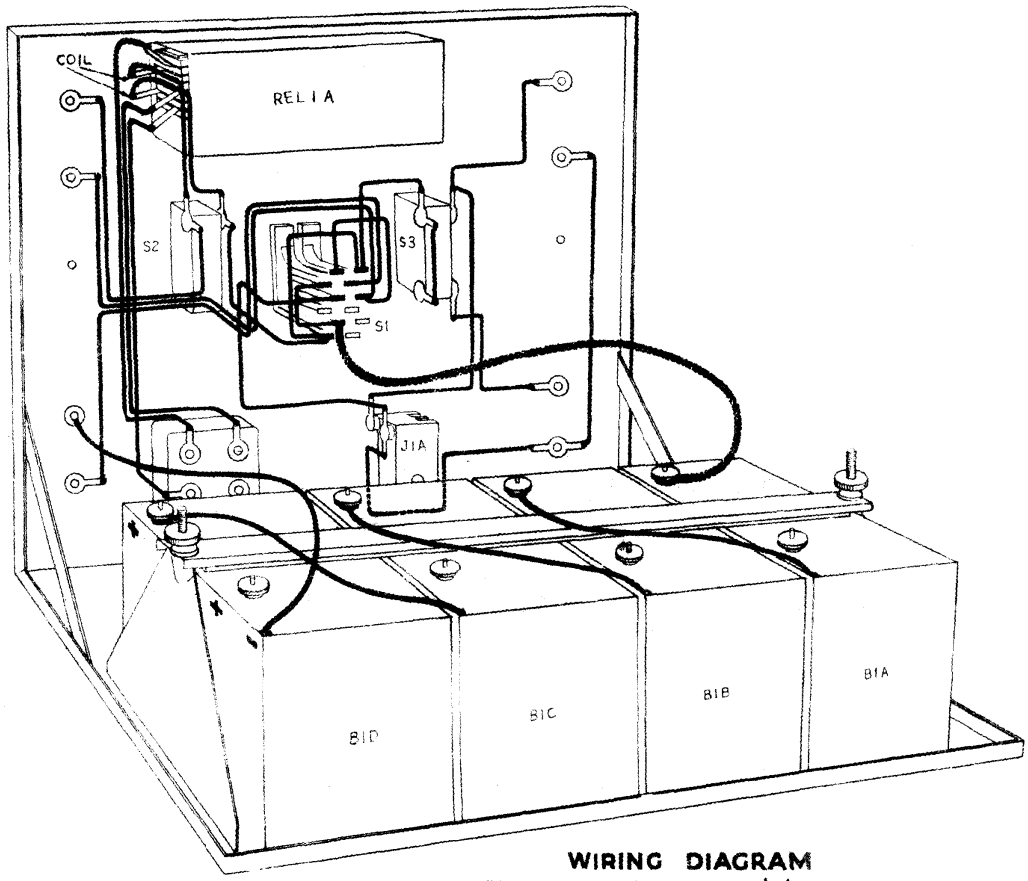
WIRING DIAGRAM – UNDERSIDE OF LOWER CHASSIS. W.D. 219

FIG.16

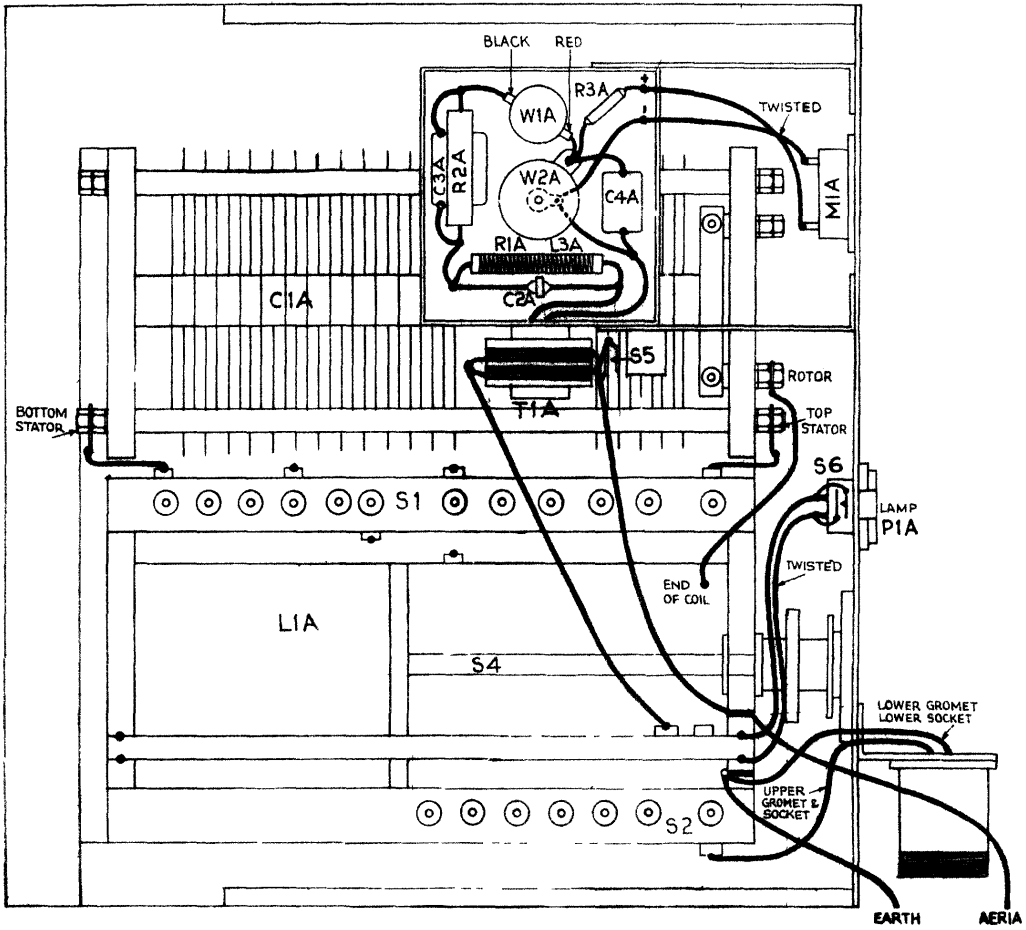


WIRING DIAGRAM — POWER SUPPLY UNIT

FIG. 17

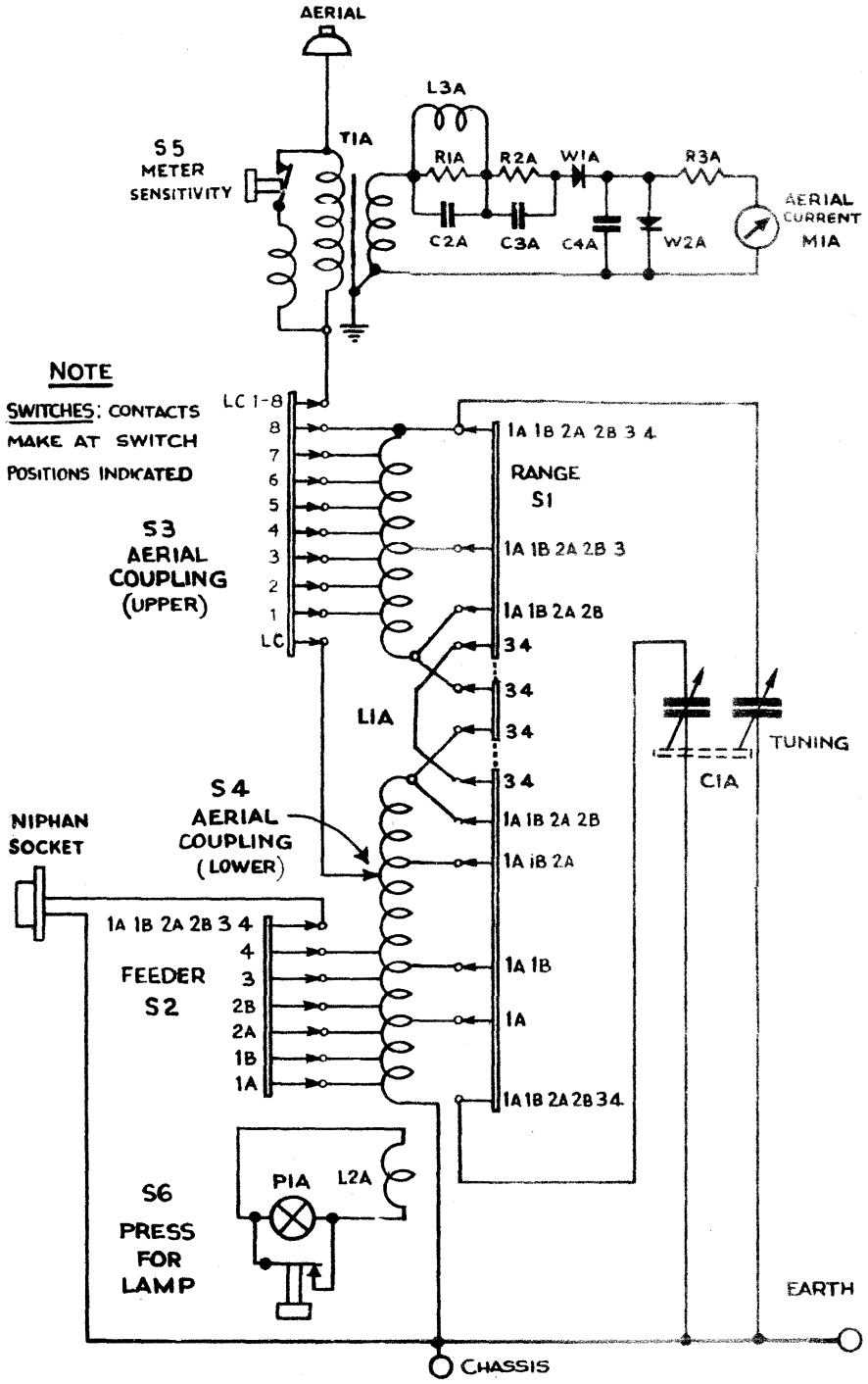


WIRING DIAGRAM
REMOTE CONTROL UNIT 'C' ZA 9987 **FIG. 18**



WIRING DIAGRAM – AERIAL UNIT 'G'

FIG 19



CIRCUIT DIAGRAM. AERIAL UNIT "G" FIG. 20

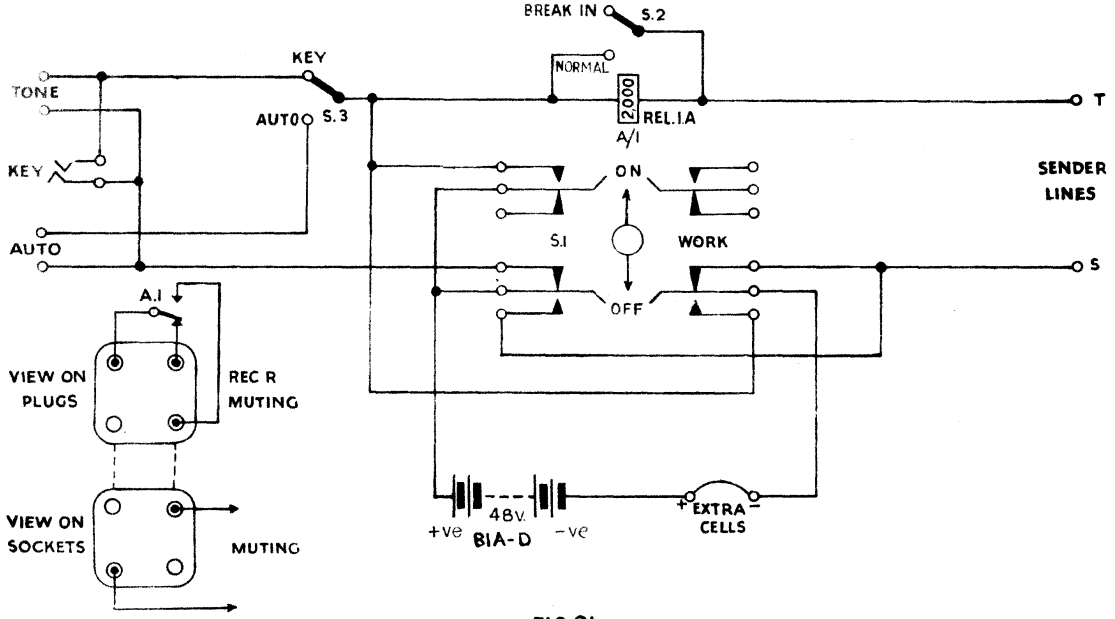
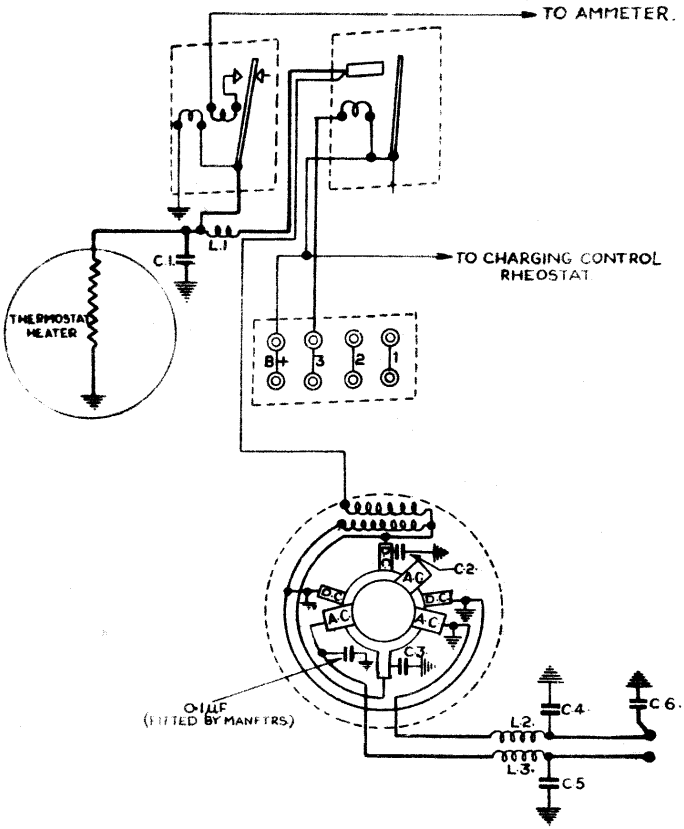


FIG. 21

CIRCUIT DIAGRAM
OF WIRELESS REMOTE CONTROL UNIT C

FIG. 21



L 1. 60 TURNS OF WIRE ELECTRIC N° 14 SWG D.S.C. INDUCTANCE AT 1000 C/S NOT LESS THAN 60 μH

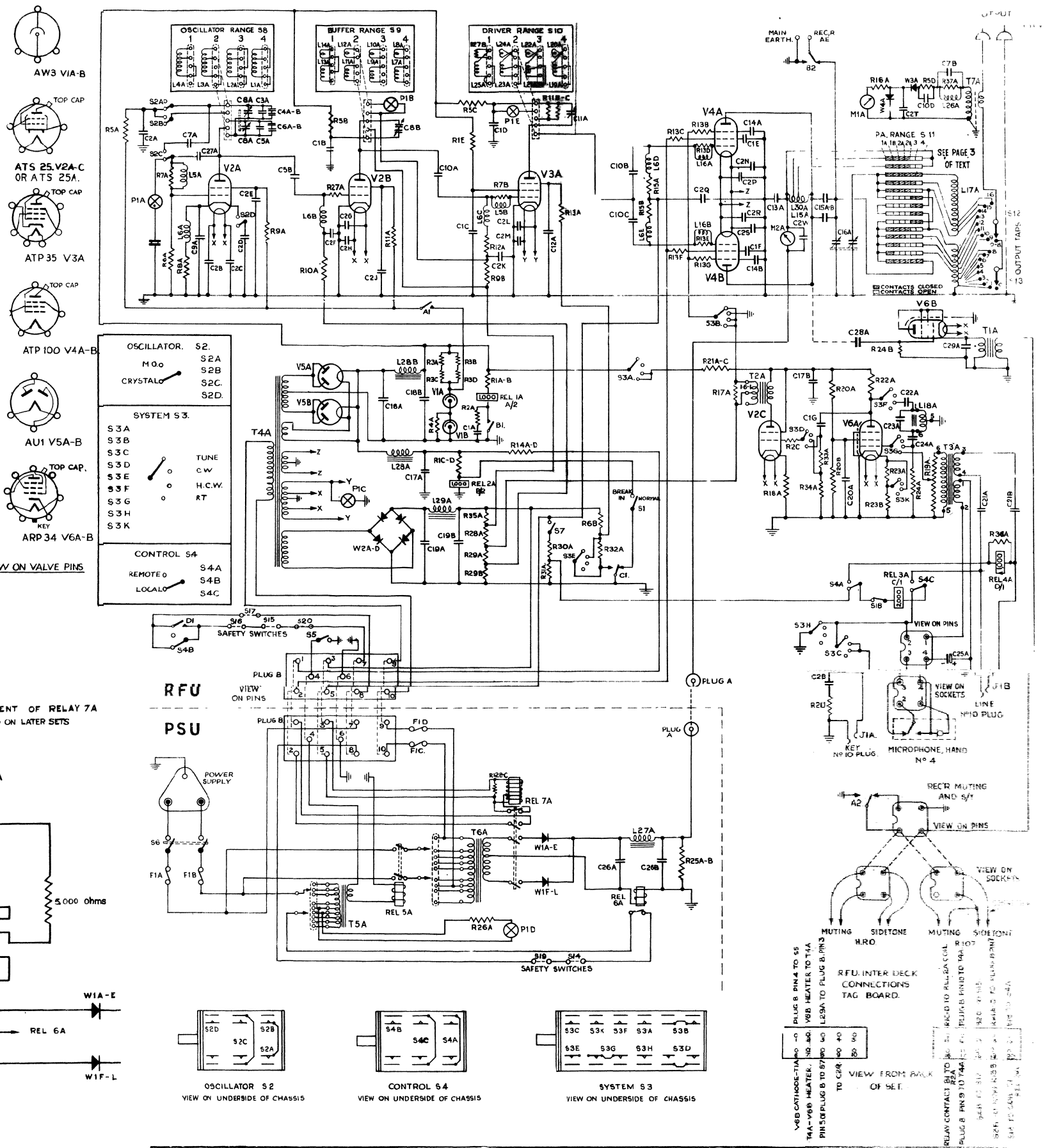
L 2 } AS L 1.
L 3 }

OR 85 TURNS OF WIRE ELECTRIC N°16 SWG D.S.C. INDUCTANCE AT 1000 C/S NOT LESS THAN 150 μH.

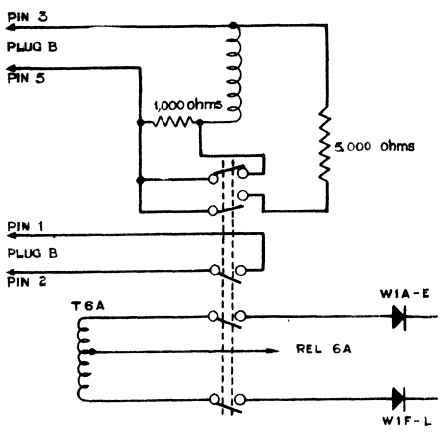
C 1., C 4., C 5 = 0·1 μF.
C 6 = 0·1 μF. OR 1·0 μF.
C 2., C 3. = 1·0 μF.

MODIFICATIONS TO DIAGRAM N° 80250 IN SERVICE MANUAL.

OF POWER UNIT 2KVA N°2 (ONAN) FIG. 22



BELOW IS A NEW ARRANGEMENT OF RELAY 7A THAT WAS INCORPORATED ON LATER SETS



OSCILLATOR S2
VIEW ON UNDERSIDE OF CHASSIS

CONTROL S4
VIEW ON UNDERSIDE OF CHASSIS

SYSTEM S3
VIEW ON UNDERSIDE OF CHASSIS

KEY TO LOCATION OF COMPONENTS WHICH WILL BE FOUND VERTICALLY ABOVE DESIGNATION IN THIS CHART.

CONDENSERS	C8A, C3A, C4A-B, C1B, C2F, C2G, C2J, C8B, C18B, C10A, C1A, C1D, C2M, C12A, C11A, C10B, C2Q, C2P, C1E, C13A, C5A-B, C16A, C2T, C10D, C7B, C29A, C7A, C5A, C6A-B, C2H, C17A, C19B, C1C, C2K, C2L, C10C, C14A, C14B, C7B, C20A, C28A, C24A, C9A, C2B, C2D, C2E, C5B, C18A, C19A, C2N, C1F, C2W, C2U, C22A, C25A, C21A, C21B, C2A, C2C, C27A, C26A, C26B, C2S, C2R, C3, C23A,
RESISTANCES	R5B, R3A-D, R5C, R29B, R12A, R11B-C, R13F, R15B, R15A, R21A-C, R20A, R16A, R24B, R37A, R5D, R7A, R6A, R9A, R27A, R11A, R29A, R35A, R1A-B, R14A-D, R6B, R13C, R13B, R13E, R2C, R20B, R22A, R23A, R19A, R36A, R5A, R8A, R10A, R4A, R10D, R26A, R12B, C, R7B, R30A, R32A, R13F, R13D, R17A, R18A, R34A, R33A, R23B, R24A, R1E, R27B, R2A, R9B, R28A, R31A, R25A-B, R13G, R2B,
RELAYS & SWITCHES	D1, S4B, S16, S17, S15, S20, S9, A1, REL 2A, REL 1A, S14, S3E, REL 6A, B1, S3B, S3D, S2, S4A, S18, S3G, S3K, S4C, S12, S2A, S2C, S6, S2D, S2B, S8, S5, REL 5A, B1, REL 7A, S7, S10, S19, C1, S3A, S3C, A2, S3F, REL 3A, S11, S13, REL 4A
CHOKES & TRANSFORMERS	T4A, L6B, L13A, L12A, L10A, L28B, L29A, T6A, L23A, L5B, L20A, L6D, L16A, T2A, L18A, L26A, L17A, L4A, L3A, L2A, L1A, L14A, L11A, T5A, L9A, L8A, L7A, L28A, L25A, L24A, L22A, L21A, L19A, L27A, L5E, L16B, L15A, L30A, T3A, T7A, T1A

CIRCUIT DIAGRAM. WIRELESS SET No 33. SENDER.