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2. Select "File – Print" or click on the printer icon. This will bring up the print dialog box.

3. Select the correct printer if necessary.

4. In the area marked "Print Range" click on the radio button marked "Pages from..", then enter the first and last page numbers worked out in step 1 into the "from" and "to" boxes.

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Richard Hankins, VMARS Archivist, Summer 2004

W.O.CODE No.12052

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USER HANDBOOK
for
WIRELESS SENDER C11

WARNING

When this equipment is operated on an AC supply the voltage employed is sufficiently high to endanger human life. Every reasonable precaution has been observed in design to safeguard operating personnel. Do not tamper with supply leads and switch the power supply off before removing connectors. In case of electric shock refer to the inside front cover of this handbook.

PUBLISHED UNDER THE AUTHORITY OF THE SIGNAL OFFICER-IN-CHIEF THE WAR OFFICE, WHITEHALL S.W.1.

AUGUST 1957

FIRST AID IN CASE OF ELECTRIC SHOCK

1. ***SWITCH OFF.*** If this is not possible, ***PROTECT YOURSELF*** with dry Insulating material and pull the victim clear of the conductor.

DON'T TOUCH THE VICTIM WITH YOUR BARE HANDS until he is clear of the conductor, but ***DON'T WASTE TIME.***

2. *(a)* Lay patient face down with head to one side, arms bent and forehead on his hands, to keep mouth and nose clear. **See Fig. 1**

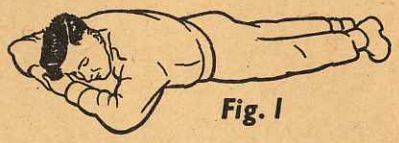

Fig. 1

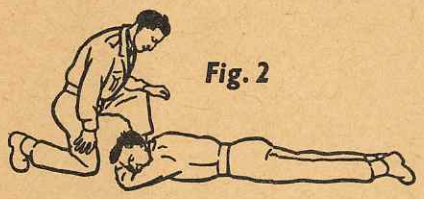

Fig. 2

(b) Give one or two firm thumps with flat of hand between his shoulders.

(c) Kneel at his head, one knee near the head and your other foot alongside the elbow. **See Fig. 2**

(d) Place your hands on his shoulder blades with thumbs touching on the mid-line and fingers pointing towards his feet. **See Fig. 3**

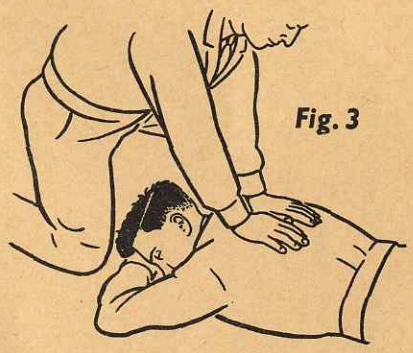

Fig. 3

3. *(a)* Bend forward with arms straight and apply your weight lightly **See Fig. 4** counting "One, Two, Three" This movement takes $2\frac{1}{2}$ seconds.

Fig. 4

(b) Release pressure gradually and slide your hands to grip him just above his elbows, counting "Four". **See Fig. 5**

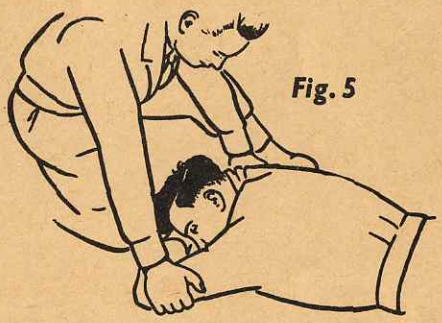

Fig. 5

(c) Draw his arms and shoulders towards you by leaning backwards with your arms straight till you feel resistance, but without lifting his chest off the ground, counting "Five, Six, Seven". This movement takes $2\frac{1}{2}$ seconds. **See Fig. 6**

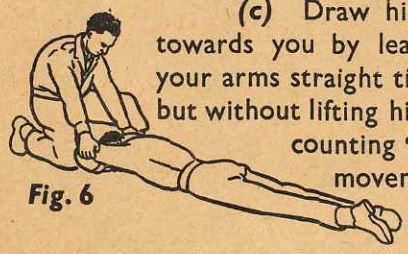

Fig. 6

(d) Lay his arms down and slide your hands on to the shoulder blades, counting "Eight".

4. ***Keep repeating paragraph 3 with rhythmic rocking nine times to the minute until breathing is re-established.***

5. When breathing is re-established, omit the back pressure and continue the arm raising and lowering alone, at the rate of 12 times to the minute, counting "One, Two, and Three" whilst raising and "Four, Five, and Six" whilst lowering.

6. While Artificial Respiration is being applied, have someone else:-

(a) Loosen patient's clothing. *(b)* ***SEND FOR DOCTOR.*** *(c)* Keep patient warm.

7. ***DO NOT GIVE LIQUIDS UNTIL PATIENT IS CONSCIOUS.***

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USER HANDBOOK
for
WIRELESS SENDER C11

WARNING

When this equipment is operated on an AC supply the voltage employed is sufficiently high to endanger human life. Every reasonable precaution has been observed in design to safeguard operating personnel. Do not tamper with supply leads and switch the power supply off before removing connectors. In case of electric shock refer to the inside front cover of this handbook.

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AUGUST 1957

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ASSOCIATED PUBLICATIONS

WO Code No. 12051 User handbook for Reception set R210

EMER TELS D.120-9 Technical handbook for Wireless sender C11

Users should be in possession of the vehicle installation user handbook for the particular wireless station of which Wireless sender C11 forms a part.

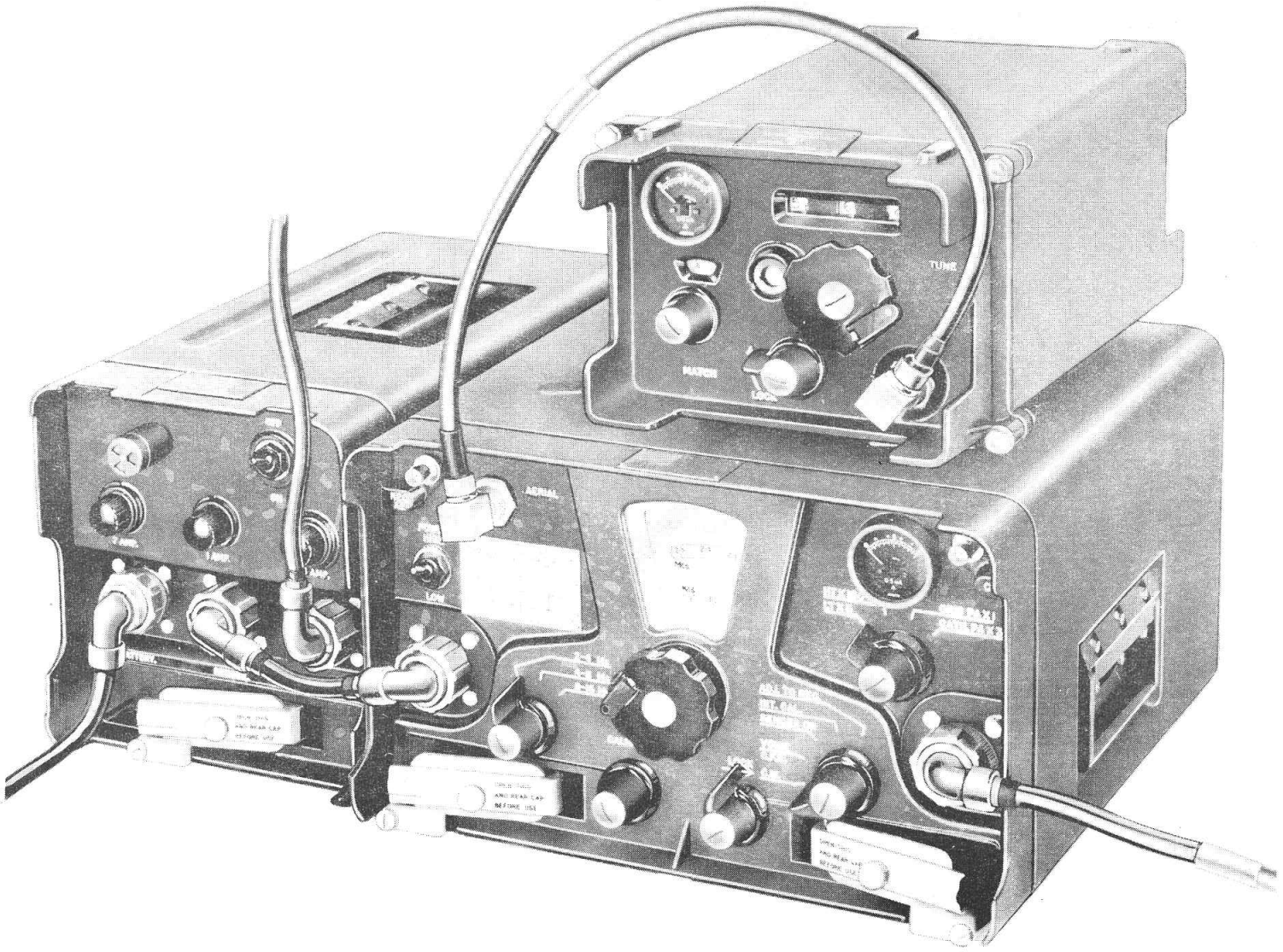


FIG. 1

CHAPTER I

GENERAL DESCRIPTION

Section 1. Purpose and facilities

The Wireless sender C11 is a portable high frequency sender covering the frequency band between 2 and 16 Mc/s. It is designed primarily for mobile operation in certain AFV installations and in command and wireless vehicles at Brigade, Division and Corps levels. It can also be used for general purposes such as truck-ground installations, etc.

Its associated receiver is Reception set R210. A general view of the Wireless sender C11, together with its DC power supply unit and aerial tuning unit, is shown on the facing page.

Transmission systems are provided for voice (AM), hand-keyed CW telegraphy with break-in working, and carrier frequency shift (CFS) operation through a CFS adapter unit.

With the aid of a 100 kc/s crystal calibrator, built into the sender, the operator is able to set up the equipment to any required channel within the limits of the frequency coverage without recourse to netting and without radiating from the aerial.

Wireless sender C11 and its associated receiver are operated in conjunction with standard vehicle control boxes and wireless control harness types 'A' and 'B', through which connections are made to the various microphones, headphones, and send-receive pressel switch circuits. The keying unit for hand-keyed CW working forms part of the type 'B' harness.

The AF amplifier incorporated in the sender can be used for intercommunication purposes in vehicle installations.

A separate Aerial tuning unit No. 7 is provided, and is connected to the sender by means of a 72-ohms coaxial cable. The length of this cable is not critical but must not exceed 300 feet. A meter built into the aerial tuning unit enables adjustment to be made for maximum aerial current. In vehicle installations the aerial tuning unit is connected to an Aerial base No. 31, to which rod or wire aerials are attached.

Detailed instructions for installing the equipment and for connecting power supply, aerial and control harness, are contained in the user handbook for the relevant vehicle installation.

Sender and DC power supply unit both contain built-in cooling systems, with air inlets on the front panels and outlets at the rear.

Aerial tuning unit No. 7 is a sealed unit. The sender and the supply unit are shower-proof, but are not hermetically sealed. Dimensions and weights of the three main units are shown below.

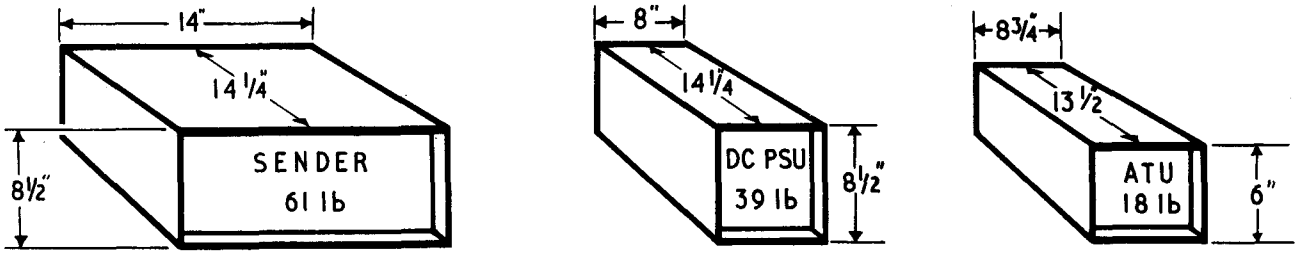


FIG. 2. WEIGHTS AND DIMENSIONS.

Section 2. Frequency ranges

Continuous frequency coverage is provided from 2 Mc/s to 16 Mc/s in three ranges:

Range	1	2 - 4 Mc/s
"	2	4 - 8 "
"	3	8 -16 "

Scale calibration is provided as follows:

Range	1	2.5 kc/s
"	2	2.5 "
"	3	5 "

Section 3. Range of working

On high power the sender has a voice range of approximately 25 miles over average terrain.

This figure, based on moving vehicles using 8-ft. rod aerials, should hold good for any frequency channel and any time of day or night. It should be increased considerably when vehicles are well sited and connected to more efficient aerials.

Distances of approximately twice the voice range should be obtained when CW is used.

A switch on the front panel enables the sender to be operated on either low power or high power, the ground range on low power being about one half of that on high power. Low power should be used when full range is not required.

Section 4. Power supply and consumption

Power supplies for the sender are obtained from a separate power supply unit. The supply unit in general use will be the battery driven DC unit, but a mains driven AC unit may be included in certain installations. Supply unit and sender are connected by means of a 12-point Mk 4 connector supplied with the sender. See fig. 1.

The DC power supply unit obtains its input supply from a nominal 24-volt DC source such as a 24-volt vehicle battery or vehicle electrical system. As the voltage of this supply source is liable to vary greatly, the unit has been designed to allow for the variation, and to keep its output within reasonable limits.

Working on a 24-volt DC supply, the power consumption of the sender on 'send' is 20 amps. When the installation is on 'receive' the sender power supply unit supplies two amps for the associated Reception set R210. Stand-by current, with sender heaters on, is three amps.

The AC power supply unit (Supply unit rectifier No. 30) operates from single phase AC mains or field generators at 100-125 or 200-250 volts, 45-65 c/s. This unit, when it is installed, also supplies power for the associated Reception set R210, the receiver power supply unit being inoperative when the complete installation is working from AC mains.

As the AC supply unit is likely to be encountered in only a very small number of installations it is not included in the general description and instructions for operating a Wireless sender C11, but is dealt with separately in Chapter 4. See page 43.

Section 5. Performance

(1) Power output

With the system switch at voice/CFS, power output from the sender on high power, measured into a 72-ohm resistive load, is of the order of 50 watts at any frequency in the band. On low power the output is between 5 watts and 12 watts. The power delivered to a rod aerial varies from 20 to 50 watts, depending upon frequency.

(2) Frequency setting accuracy

Frequency error, after setting up to any channel, and using the 100 kc/s crystal calibrator, does not exceed ± one part in 10,000 of the nominal frequency.

(3) Frequency drift

If the sender is allowed to warm up for 15 minutes with the heaters only switched on (power supply unit switch ON), and is then tuned on high power with the system switch at voice/CFS, the frequency drift during the next hour should not exceed one part in 10,000 of the initial frequency. Normal changes in ambient temperature have no material effect upon the frequency.

(4) Inter-communication amplifier

The AF amplifier incorporated in the sender is designed to feed up to five sets of headphones.

Section 6. Controls and connections

Control positions and connector terminations of the various units are shown in figs. 3, 4, 5 and 6, and the tables on the following pages give briefly the description and purpose of each control.

TABLE 1. Sender

Fig. 3 ref.	Control	Description and purpose
A	REC AE (SKT.D)	Coaxial socket termination for aerial interconnection between receiver and sender.
B	AERIAL (PL.C)	Coaxial plug termination for connection to the aerial tuning unit.
C	Scale window	A mask, controlled by the range switch, exposes a portion of the Mc/s range selected by the switch and a fine tuning scale calibrated 0 to 100 kc/s.
D	Main tuning control	This control has a direct drive to the 100 kc/s scale and is geared by reduction drive to the variable capacitor.
E	CFS (SKT.G)	Coaxial socket to connect CFS adapter unit when required.
F	Meter (M.1)	Shows LT or HT voltage, or grid or cathode current of the power amplifier, as selected by switch (G).
G	Four-position Meter switch (S.D)	Selects condition for meter reading.
H	12-point socket (SKT.B)	12-point Mk 4 fixed socket termination for connection to control harness.
J	Five-position system switch (S.B)	CW - for keyed CW, with side-tone oscillator to help operator. Rotary transformer runs. VOICE/CFS - connects for AM. Send-receive switching and rotary transformer controlled by pressel or CFS adapter unit. SENDER ON - At "send" without using pressel or key. INT CAL - Beat note between outputs of calibrator and master oscillator (MO) connected to headphones. ADJ TO REC - connects headphones to receiver to compare MO frequency with receiver tuning.
K	LOCK	Dial clamp. Dial lighting is switched OFF when this control is in the LOCK position.
L	CALIBRATE	Controls a variable inductance in series with MO coil. Enables operator to tune MO frequency against 100 kc/s crystal.
M	Three-position range switch (S.A)	Range change switch. The first position covers 2-4 Mc/s, the second 4-8 Mc/s and the third 8-16 Mc/s. This switch also moves the scale window mask to expose the range selected by the switch.
N	Air intake covers (two)	Spring-loaded covers to air intake apertures. When the sender is not in use the covers are kept closed by catches.

Fig. 3 ref.	Control	Description and purpose
O	12-point plug (PL.A)	For inter-connection between sender and supply unit. Carries power supplies to sender and phone lines to receiver via the supply unit.
P	Aerial tuning chart	Enables aerial tune and match readings to be recorded for quick channel selection.
Q	Two-position POWER HIGH-LOW switch (S.C)	At LOW, power output is between 5 and 12 watts. At HIGH, approximately 50 watts.

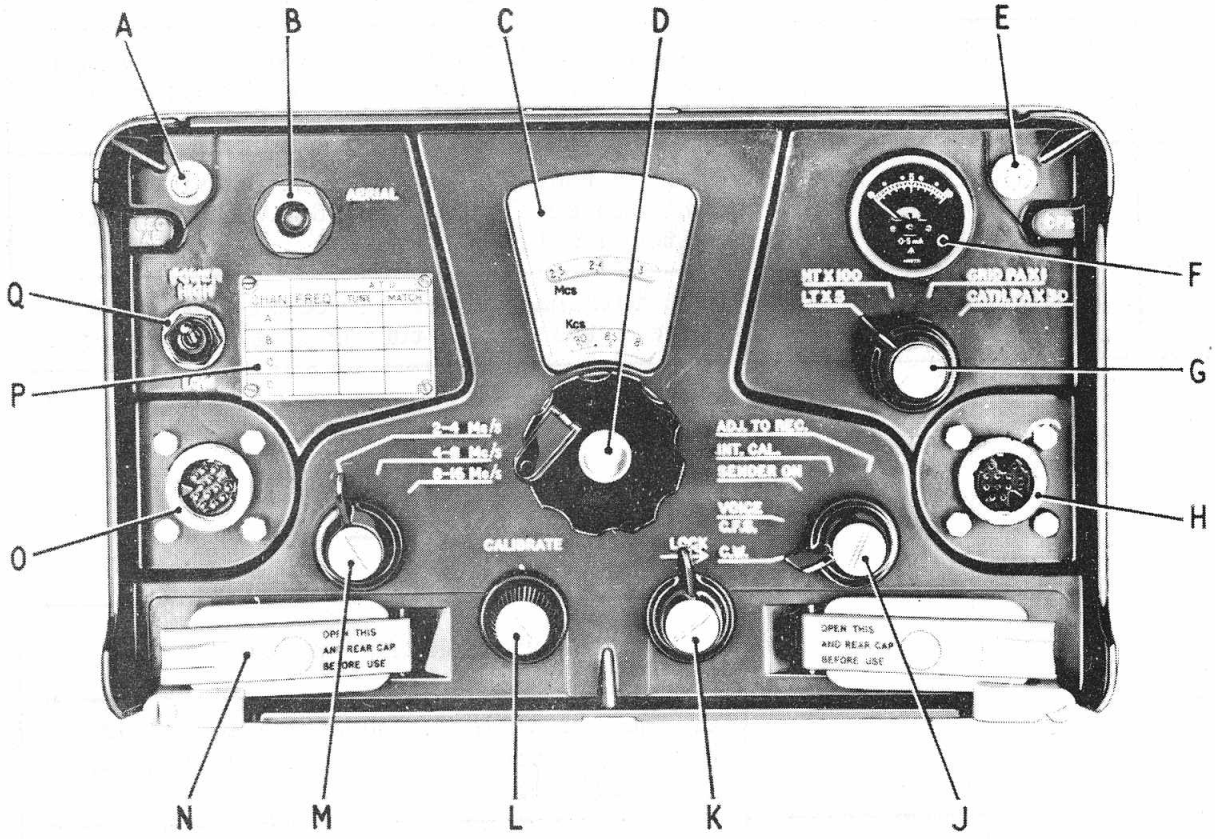


FIG.3

TABLE 2. Aerial tuning unit (front)

Fig. 4 Ref.	Control	Description and purpose
A	MATCH (S.A)	Controls matching capacitor C1.
B	Match indicator	Scale used with the MATCH control; calibrated 0-20
C	Meter (M.1)	Indicates aerial current passing out to the aerial when the sender is being operated.
D	Humidity indicator	Gives a visual indication of dampness by changing colour from blue to pink when moisture is present.
E	Tune indicator	A trip counter controlled by the operation of the TUNE control (F). Indicates tuning position on aerial coil.
F	TUNE (L.1)	Rotation of this control moves the sliding contact on the aerial tuning inductor L1, and rotates indicator (E) accordingly.
G	LOCK (S.B)	When in the LOCK position TUNE and MATCH controls are locked, and dial lighting is switched off.
H	Fixed coaxial plug (PL.A)	Plug termination for the coaxial connector between the aerial tuning unit and the sender.

TABLE 3. Aerial tuning unit (rear)

Fig. 5 Ref.	Control	Description and purpose
A	Aerial terminal	For the aerial lead. When the sender is operating there is a very high voltage on this terminal.
B	Screwed plug	This plug is removed only when the interior of the unit is being dried out in workshops.
C	Earth terminal	For an earth connector to the set carrier or vehicle chassis.

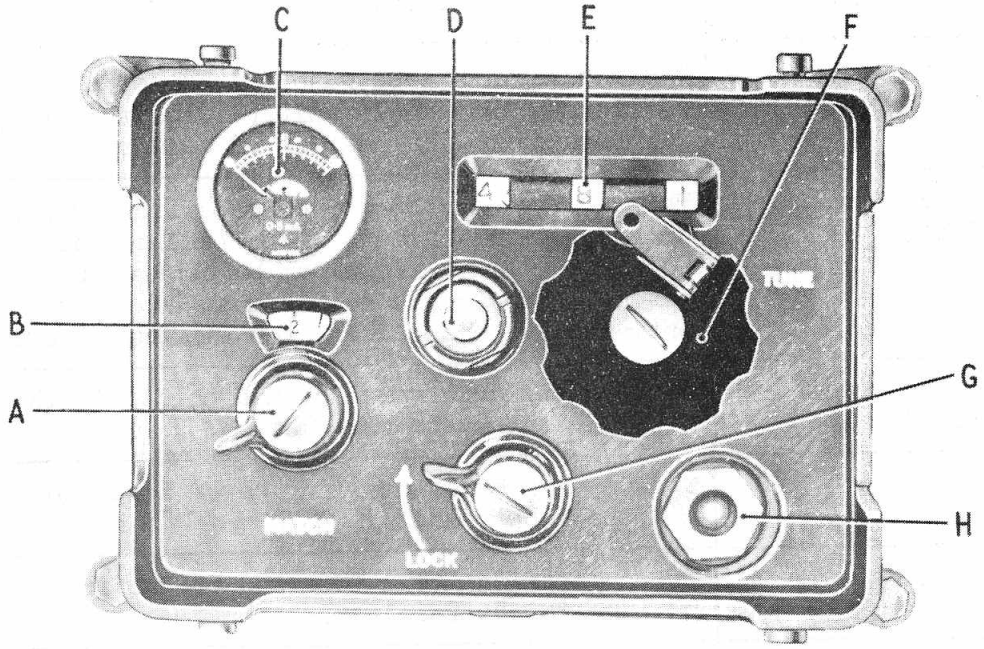


FIG. 4

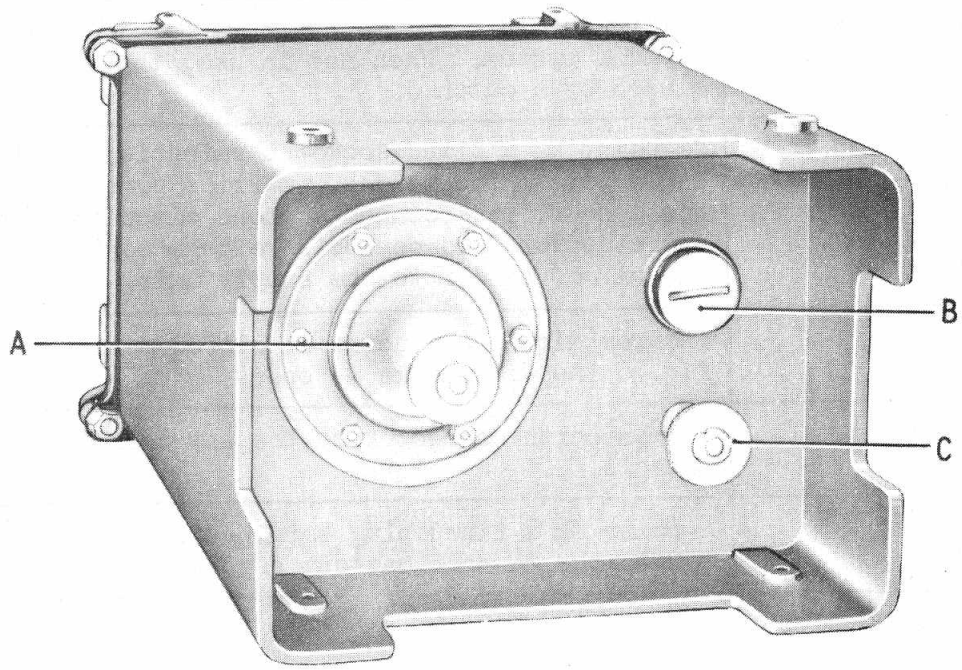


FIG. 5

TABLE 4. DC power supply unit

Fig. 6 Ref.	Control	Description and purpose
A	7 AMP fuse (FS.101)	7-amp cartridge type fuse and holder in the 24-volt DC line to the supply unit (excluding rotary transformer) and to the heaters of sender valves.
B	Red indicator lamp (ILP.101)	The lamp glows when the power switch is ON. A dimming device is fitted to the lamp holder and the degree of illumination can be controlled by rotation of the device. The device must be rotated in an anti-clockwise direction for minimum illumination.
C	1 AMP fuse (FS.103)	1-amp cartridge type fuse and holder in the +HT line from the rotary transformer.
D	OFF-ON switch (SF)	Two-way switch controlling power input to the sender and the supply unit.
E	3 AMP fuse (FS.102)	3-amp cartridge type fuse and holder in the 24-volt DC line to the receiver.
F	RECEIVER (SKT.H)	12-point Mk 4 fixed socket termination for the connector to the receiver. Carries 24-volt battery supply to receiver. Connects voltage control relay to slave relay of receiver PSU, and interconnects phone circuits, etc., between sender and receiver.
G	Air intake cover	Spring-loaded cover to aperture for air intake for cooling system. When not in use, the cover is kept closed by a catch J.
H	SENDER (SKT.A)	12-point Mk 4 fixed socket termination for the connector to the sender. Carries power supplies to the sender, interconnects phone circuits of sender and receiver, and connects voltage control relay circuit of sender to the supply unit.
J	Catch	Secures air intake cover in closed position. In fig. 6 the air intake is open.
K	Earth terminal	For an earth connector to the set carrier or vehicle chassis.
L	BATTERY (PL.J)	4-point Mk 4 fixed plug termination for the connector to the 24-volt battery supply.

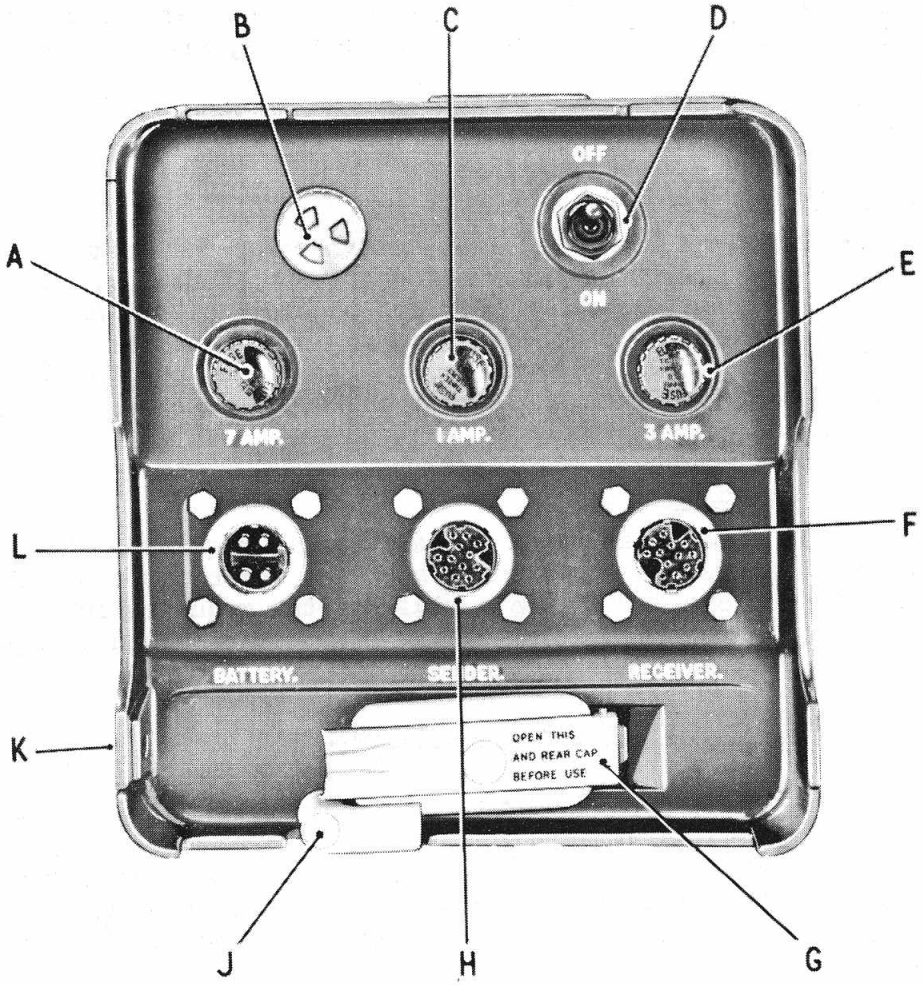


FIG. 6

NOTE

THE AC POWER SUPPLY UNIT
IS DESCRIBED IN CHAPTER 4
SEE PAGE 43

Section 7. Aerials

WARNING There is VERY HIGH VOLTAGE on the aerial system when the sender is in operation. Read the warnings on page 34.

Correct aerial selection is essential if maximum performance is to be obtained from the sender. Choice of aerial will be governed by conditions of use, the nature of the terrain, the distance over which communication is required, and by light or dark hours. Four basic types of aerial can be used: rod aerial, vertical radiator, end-fed horizontal aerial or wire dipole. These aerials, and the variations, are described below.

(1) Antennae rod aerials 8, 12 or 16-ft in height for mobile use

(a) Vertical rod aerial

This aerial is assembled from Antennae rod 'F' sections, each four feet in length. Three diameter sizes are supplied: No. 1, No. 2 and No. 3, No. 3 being the smallest. An 8-ft rod consists of one No. 1 section and one No. 2 section. A 12-ft rod is composed of sections 1, 2 and 3. A 16-ft rod has two No. 1 sections, one No. 2 and one No. 3. The vertical rod aerial is fitted into the socket on Aerial base No. 31, which forms part of the vehicle installation.

(b) Twin 'V' rod aerials

For this type of aerial a 'V' adapter is required. This adapter has two sockets mounted in 'V' form on a spigot which fits into the aerial base on the vehicle. Twin rod aerials of the required length are constructed from Antennae rod 'F' sections as described in paragraph (a) above, and inserted into the adapter.

(2) Vertical radiators for use in ground stations

(a) Mast 27-ft, telescopic, kit No. 1

This lightweight stainless steel mast kit forms a vertical radiator 27 feet in height. When it is so used, the base of the 27-ft mast is connected to the aerial tuning unit. Full description and erecting instructions are contained in a separate user handbook issued with the mast kit.

(b) Aerial, vertical, 34-ft, steel Mk 1

This kit includes a 34-ft telescopic aerial, and a 20-ft telescopic mast which can be extended by the addition of four antennae rod 'F' sections for use as a vertical radiator, together with the necessary ancillary items. Erecting instructions are contained in a separate handbook supplied with the kit. This aerial forms part of the Wireless set Canadian No. 52 vehicle and ground station.

(3) End-fed horizontal aerials

A copper-braid aerial should be used. This aerial is wound on a small reel. It is calibrated in frequencies, so that for any operating frequency

it will only be necessary to withdraw it to the required length and lock the reel. A spigot on the reel enables it to be inserted in the Aerial base No. 31 in place of the rod aerial, connectors between the aerial base and the sender remaining unchanged. The aerial is suspended horizontally by means of a telescopic mast or an improvised support, and for sky-wave working it should be arranged broadside to the direction of the receiving station. For a remote aerial the reel can be fitted to the top of the telescopic mast and the aerial suspended in a similar manner.

(4) Wire dipole aerials

A wire dipole aerial can be used, and a table of frequency and aerial length figures is given in the appendix. The dipole aerial is connected direct to the sender via a coaxial cable, and not to the aerial tuning unit.

(5) Aerial tuning unit No. 7

Aerial tuning unit No. 7, normally mounted adjacent to the sender, can when necessary be detached from the installation and set up near the base of a remote aerial. This unit is hermetically sealed, enabling it to be used in exposed situations or on the ground.

The length of the coaxial cable between the remote aerial tuning unit and the sender should not exceed 300 feet. The connector between the aerial tuning unit and the base of the aerial should be as short as conveniently possible, and must be kept clear of all metal parts, except the terminals to which it is attached.

(6) Installation of aerial equipment

Each installation of which Wireless sender C11 forms a part will also include suitable aerial equipment. Complete instructions for connecting the aerials are contained in the separate user handbook dealing with the installation.

(7) Aerial base No. 31

This aerial base forms part of all Wireless sender C11 vehicle installations. It is illustrated on page 28. The aerial connection to the equipment in the vehicle, except when the aerial tuning unit is used remotely, or when a wire dipole aerial is used, must be made via the Aerial base No. 31. Other types of aerial base should not be used.

(8) Aerial tuning data

Tuning charts are given in an appendix at the end of this handbook. These charts tabulate the settings for the aerial tuning unit TUNE and MATCH controls, against frequency in Mc/s, for each type and length of aerial. They show the frequencies over which the various aerials are effective. The charts should be studied carefully when selecting type and length of aerial to be adopted for a particular operation or installation.

FIG. 7

Section 8. Mechanical construction

The equipment is suitable for installation in wheeled and tracked vehicles, and in ground stations, and for use and storage anywhere in the world. It can be parachute dropped in standard containers, carried by mule pack, or man handled. The units are finished olive drab in colour.

(1) Wireless sender C11

Fig. 7 shows a general view of the sender. The die-cast front panel is designed with a projecting metal flange round its edge to give a degree of protection to controls and connector terminations, all of which are mounted on the front panel. Flush-folding carrying handles are fitted to the sides of the case to facilitate lifting and transportation.

The interior is shown in fig. 8. Various sub-units of the sender are grouped in three sections, each section being secured to the back of the die-cast front panel. The two outer sections can be hinged outwards as shown, in order to improve accessibility.

The master oscillator assembly is contained in a sealed box which forms the centre section. A humidity indicator is fitted in the top cover of this sealed box. To the left of the master oscillator assembly, as seen from the rear, a hinged section carries the AF chassis with the crystal calibrator, IC amplifier and modulator. The hinged section to the right of the master

oscillator carries the RF chassis with buffer amplifier, doubler stages and power amplifier. Two single plug and socket connections are made between the right-hand and left-hand hinged sections. These can be seen in fig. 8.

Internal cooling of the sender is provided by a blower motor situated at the rear of the master oscillator assembly, and shown in fig. 8 attached to the left-hand hinged section. Two air intake apertures, fitted with easily removable air filters, are situated at the bottom of the front panel. See fig. 7. These intakes are fitted with hinged covers which are kept closed by turn-button catches when the sender is not in use, but which must be opened, as shown in fig. 7, when the sender is switched on. The outlet in the rear of the case has a wire mesh screen and is sealed by a screw cap which must be removed when the sender is switched on. Fig. 20 on page 30 shows an outlet open.

A meter on the front panel gives an indication of LT and HT voltages, and grid and cathode current of the power amplifier.

The sender is contained in a pressed steel case which fits over the complete chassis so that the edges of the case fit flush against the rear of the front panel. Four captive screws in the rear secure the case.

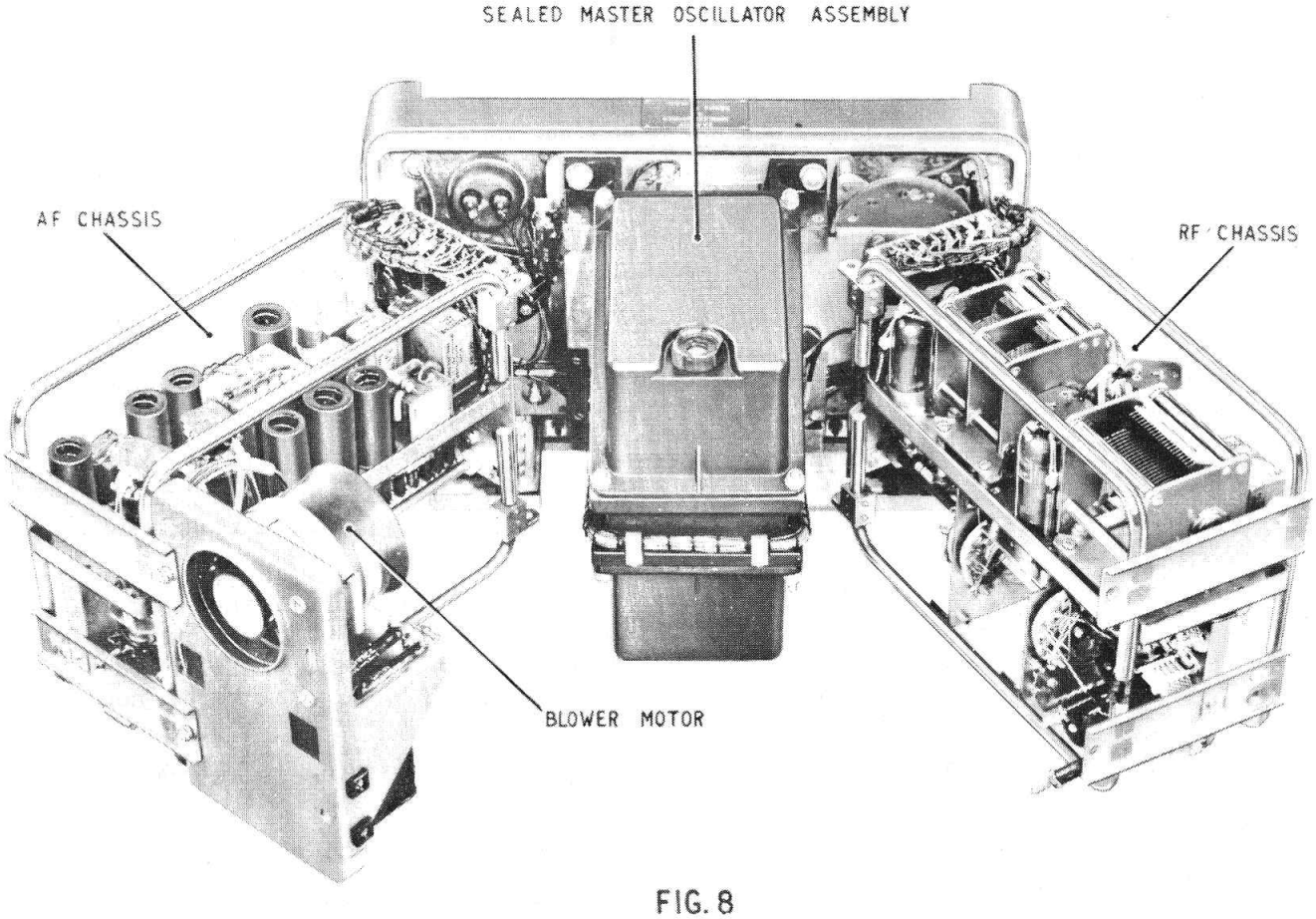


FIG. 8

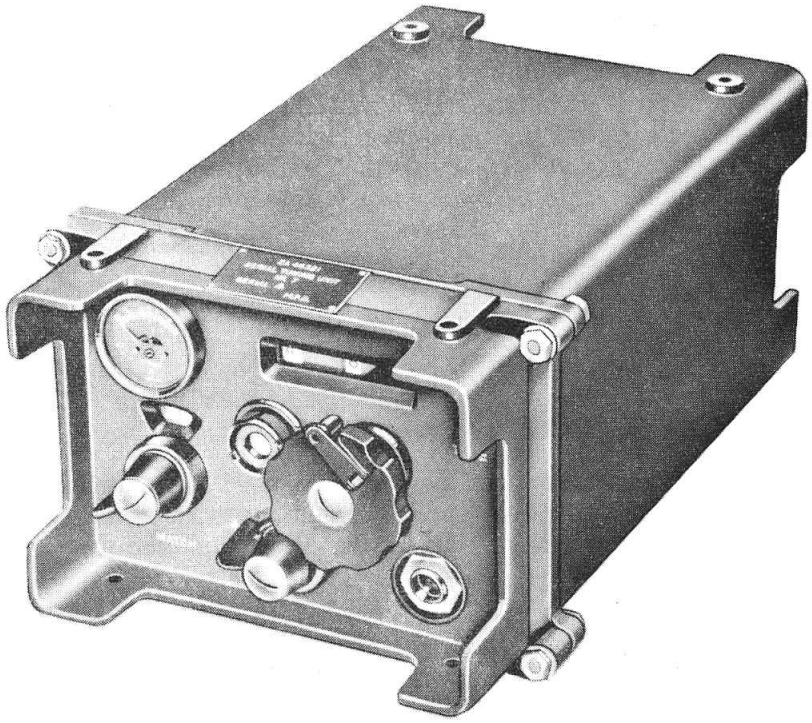


FIG. 9

(2) Aerial tuning unit

Fig. 9 shows a general view of the Aerial tuning unit No. 7. This unit is contained in a die-cast case of sealed design. Tune and match controls and indicator scales, the aerial current meter and the termination for the coaxial connector to the sender are mounted on the front panel of the unit as shown.

Dial lighting is provided and is automatically switched off when the locking device of the tuning control is in the LOCK position. A humidity indicator is fitted in the front panel to give an indication of any excessive moisture in the interior of the unit.

At the rear of the case is fitted a polythene insulated terminal for the connection of the aerial lead. This terminal makes contact with the aerial coil inside the case via a spring clip and the end of the coil shaft. See fig. 10. An earth terminal provided on the rear of the case must be connected to the set carrier or to the vehicle chassis.

A screwed plug fills a hole in the rear panel. This plug is removed only when the interior of the unit is being dried in workshops.

The rear of the aerial tuning unit is shown in fig. 5 on page 7.

Fixing holes in the upper and lower surfaces of panel and case castings can be used when mounting the unit.

The interior of the aerial tuning unit is shown in fig. 10 below. The two-section variable capacitor C1, indicated in fig. 10, rotates through 180 degrees (0-10 on the MATCH indicator scale) with an inductor short-circuited, and then through a further 180 degrees (10-20 on the scale) with the inductor in series with the tuning inductor L1. The change-over is accomplished by a cam-operated switch actuated by the capacitor rotor shaft. The switch blade is so shaped that at the point of change-over the sender output is disconnected momentarily to avoid arcing at the contacts.

Tuning inductor L1 is rotated by means of the TUNE control. A fixed brush makes contact with one end of the coil and a sliding brush moves axially along the coil with rotation to vary the amount of the inductor short circuited.

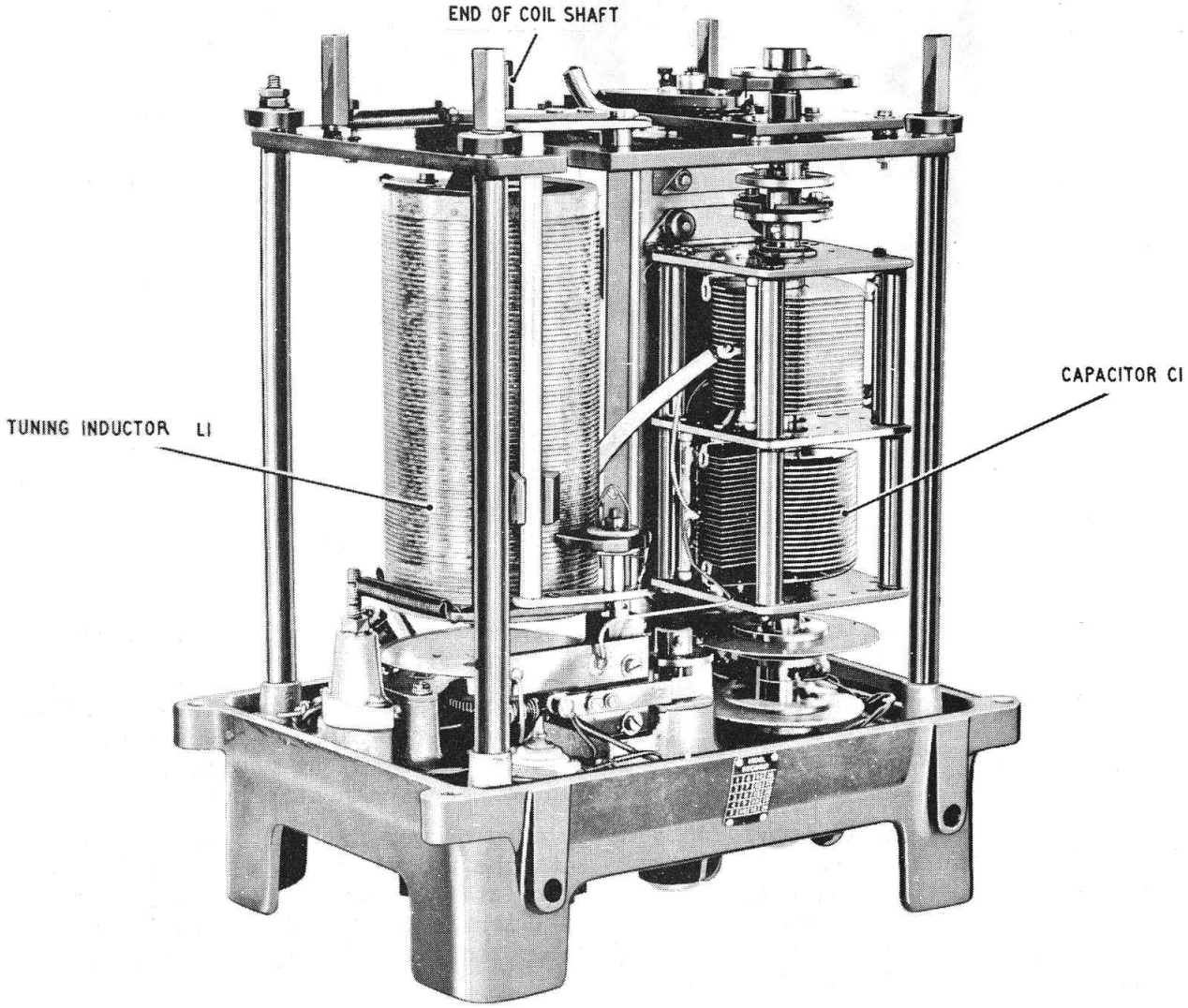


FIG. 10

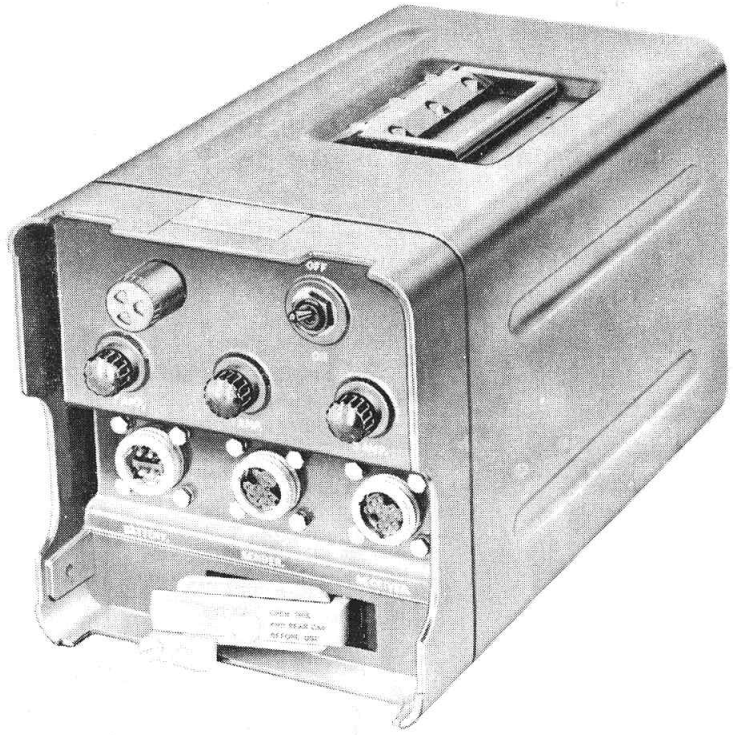


FIG. 11

(3) DC power supply unit

This unit is designated Supply unit, transformer, rotary, input 24 volt, output 530 volt 450 mA, and it is illustrated in fig. 11.

The unit is contained in a pressed steel case fitted with a flush folding carrying handle. It will normally be installed at the side of the sender as shown in fig. 1, the two units being mounted in the same set carrier. A flange on the front panel casting protects the controls and connections.

A cooling system is provided by means of a blower fitted to the end of the rotary transformer shaft. Air is drawn into the unit through a filter in the front panel, and expelled through an aperture at the rear of the case. Both intake and outlet are provided with covers which form effective waterproof seals when closed and secured. Fig. 11 shows the air inlet open. Fig. 20 on page 30 shows the air outlet open.

Three fuse-holders carrying cartridge type fuses of the rating indicated at each position are provided. The 7-amp fuse is in the 24-volt input line to the unit, but excludes the rotary transformer which on starting may take a current approaching 100 amps. The 3-amp fuse is in the 24-volt supply which passes via this unit to the Reception set R210, and the 1-amp fuse is in the HT output line from the rotary transformer.

A red indicator lamp, fitted with a dimming device which can be rotated to control the degree of illumination, is provided. It glows when the supply unit is connected to a 24-volt supply and switched on.

A 4-point Mk 4 panel plug provides means of connection to the battery source, and two 12-point Mk 4 sockets are for connections to sender and receiver, each position being engraved accordingly. Mk 4 connectors, together with the necessary set carriers, resilient mountings, etc., on which the units are fitted for operation, are provided as part of the installation kit.

Fig. 12 shows a rear view of the DC power supply unit with the pressed steel case removed. This case is retained by captive screws in the rear, similar to the case of the sender.

The rubber-mounted rotary transformer and two stabilising valves (CV395) can be seen on the chassis.

The guard frame in which the chassis is constructed is shown in this illustration. This frame allows the unit to be turned on any side without damaging components, and is similar to the frame in which the sender chassis is built.

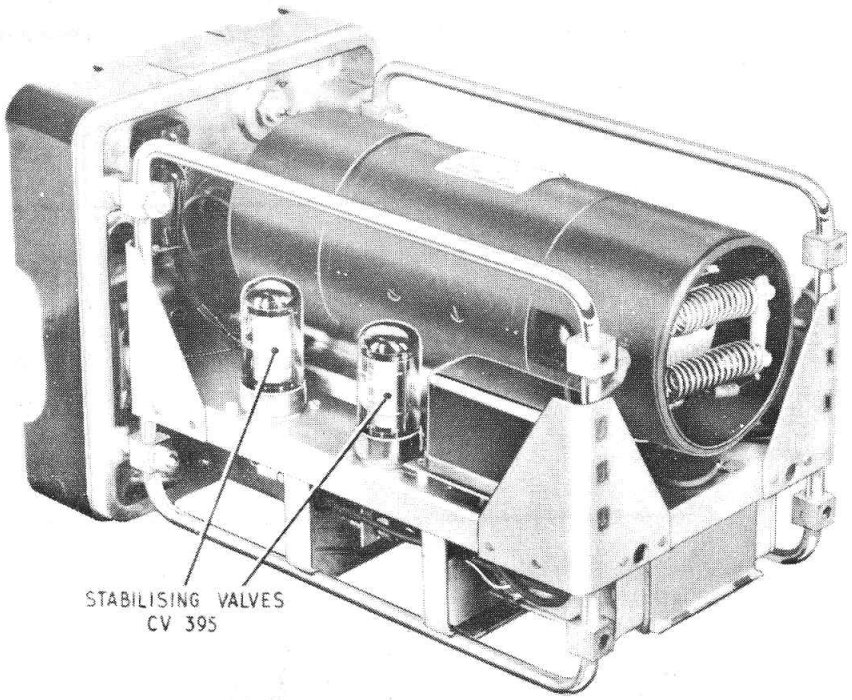


FIG. 12

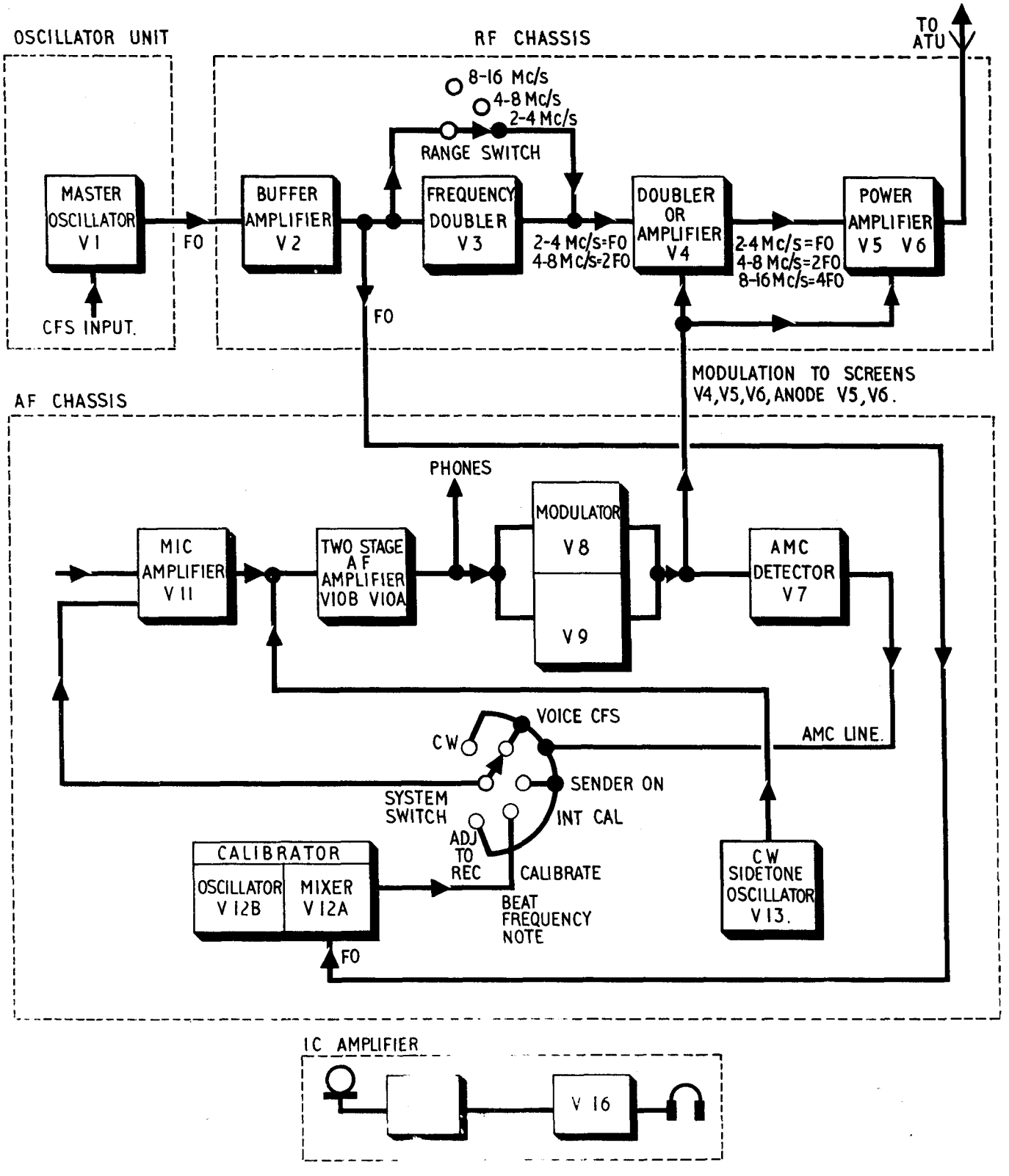


FIG.13. BLOCK DIAGRAM OF WIRELESS SENDER CII.

Section 9. Brief technical description

(1) Sender

A block diagram of the sender is shown in fig. 13. Fifteen valves, one germanium diode and one voltage stabiliser (V14) are used, and the arrangement is as follows:

Master oscillator V1, buffer amplifier V2, a frequency doubler stage V3, a doubler or amplifier V4, and an RF power amplifier V5 and V6. When the range switch is set to 2-4 Mc/s the doubler stage V3 is by-passed as shown in fig. 13. At 4-8 Mc/s the doubler V3 is brought into circuit, V4 still being employed as a stage of amplification. At 8-16 Mc/s V3 operates as on range 2, but V4 now acts as a second doubler and thus the original master oscillator frequency is multiplied by four.

AF input is fed to the microphone amplifier V11, then through a two-stage AF amplifier V10b and V10a to the push-pull modulator stage V8 and V9, the output of which is fed as anode and screen modulation to the power amplifier V5 and V6. See fig. 13.

Part of the modulator output is fed as an automatic modulation control voltage via the AMC detector V7 and the system switch to the microphone amplifier V11, except when the system switch is at INT CAL.

The output of the crystal calibrator V12b and a portion of the output from the buffer amplifier V2 are mixed in V12a. The resulting beat note, amplified by V11, V10b and V10a is fed to the headphones when the system switch is in the INT CAL position.

V13 is employed as a side-tone oscillator to give an audible note in the headphones via the AF amplifier V10a and V10b.

A separate two-valve AF amplifier using V15 and V16 is built into the sender for inter-communication purposes.

Power for this amplifier is obtained via the associated Reception set R210.

(2) Relay operation

Four relays are incorporated in the sender. Fig. 14 shows the relay circuit. In this description, a line under a relay contact indicates that the relay is in an energised or operated condition at that instant. The functions of the relays are as follows:

(a) Relay RLD is a high speed keying relay which operates each time the key or the send-receive pressel switch is pressed, the system switch having been set to CW or VOICE/CFS. In addition, RLD is operated by the system switch when this switch is turned to SENDER ON.

(b) RLD normal or de-energised. Contact RLD1 is open. Valves V3, V4, V5 and V6 are biassed back beyond cut-off.

(c) RLD1 operated. Contact RLD1, in series with RLC1, reduces the negative

bias to valves V3, V4, V5 and V6 by shorting out resistances and causes these valves to function.

(d) Relay RLE operates each time the key or the send-receive pressel switch is pressed. In addition, RLE is operated by the system switch when this switch is turned to the SENDER ON, INT. CAL or ADJ TO REC positions.

(e) RLE normal. Contact RLE1 is open and relay RLC cannot operate.

(f) RLE operated. Contact RLE1 closes and completes a circuit to operate relay RLC.

(g) Relay RLC has four contacts which function as follows when this relay is de-energised :

(h) Contact RLC1 provides an earth for the screen of valve V1. This ensures that the master oscillator is inoperative when the equipment is not switched to "send."

(j) Contact RLC2 connects the operator's headphones to the receiver output as shown in fig. 14.

(k) Contact RLC3 is open. This contact removes the earth connection from relay RLB, and also, at certain positions of the system switch, from relay RLH in the DC power supply unit. See fig. 14.

(l) Contact RLC4 is open. This prevents the blower motor running at full speed when the equipment is at "receive."

(m) RLC operates when RLE is energised as in paragraph (d) above, and the four contacts then function as follows:

(n) Contact RLC1 disconnects the earth from the screen of valve V1 and transfers it to RLD1 and the bias line.

(o) Contact RLC2 transfers the operator's headphones from the receiver output to the sender side-tone.

(p) Contact RLC3 closes. This energises relay RLB, and also, except when the system switch is at CW, relay RLH in the DC power supply unit. Relay contact RLH1, shown in fig. 16 on page 25, closes and the rotary transformer starts running.

(q) Contact RLC4 closes. This shorts out resistance in the blower motor circuit and allows the motor to run at full speed while the equipment is switched to "send."

(r) Relay RLB is the aerial change-over relay. It is energised by contact RLC3, and also by the system switch when this switch is turned to INT CAL or ADJ TO REC. In its normal or receive condition its two contacts function as follows :

(s) RLB normal, contacts RLB1 and RLB2 connect the receiver aerial to the aerial tuning unit.

(t) RLB operates when the set is in the "send" condition, and its contacts function as follows:

(u) Contact RLB1 transfers the aerial tuning unit connection from the receiver aerial to the sender output.

(v) Contact RLB2 earths the receiver aerial.

When the system switch is turned to CW, as shown in fig. 14, relay RLH in the DC power supply unit is energised, and this starts the rotary transformer. Each time the key is pressed, sender relays RLD, RLE, RLC and RLB operate as described on the opposite page, and power is transmitted from V1 via V2, V3, V4, V5, V6 and the aerial tuning unit to the aerial. As the key is released and contact RLD1 opens, valves V3 to V6 become biassed back beyond cut-off and no power is transmitted.

The release of relay RLC is delayed by a capacitor, so that the relay releases only on pauses in CW keying.

With the system switch at VOICE/CFS, sender relays RLD, RLE, RLC and RLB, and the rotary transformer starting relay RLH in the DC power supply unit, are

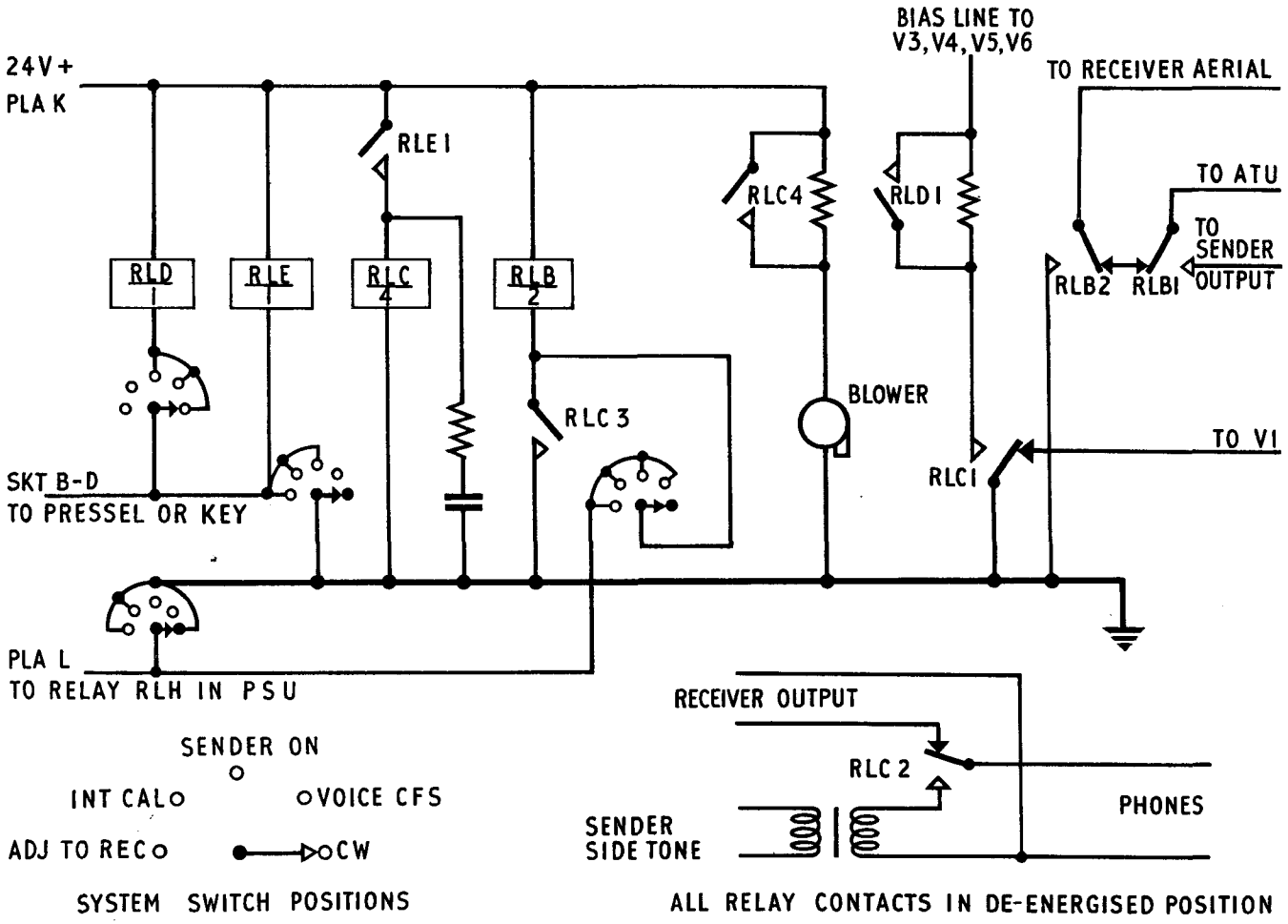


FIG. 14 RELAY CIRCUIT

energised as the equipment is switched to "send" by the operation of the pressel switch.

With the system switch at ADJ TO REC or INT CAL, relay RLD will not operate. Contact RLD1 remains open and, as valves V3 to V6 are biassed back, there is no transmission from the aerial.

(3) CFS operation

When operating on carrier frequency shift (telegraph operation), mark and space impulses are transmitted on different radio frequencies, the higher frequency normally being used for the mark signals. The difference between these two frequencies is the frequency shift. The shifting of the sender frequency from space frequency to mark frequency is effected by changing the frequency of the sender master oscillator. This is done automatically by signals from the CFS adapter unit, which vary the value of the reactance in the master oscillator circuit, causing the master oscillator to shift its frequency in sympathy with the 5-unit code signals from the teleprinter. It can be compared with swinging the tuning dial very rapidly backwards and forwards a very small amount corresponding to the shift.

If a CFS adapter unit is connected to the sender, relays RLD and RLE, and thereby relays RLC, RLB and RLH, are energised by the operation of this CFS adapter.

(4) Switching

The sender can be used on either LOW POWER or HIGH POWER, the condition being controlled by a two-position switch. In the LOW POWER position resistances are introduced into the circuit. These effectively drop the HT voltage to V4, V5 and V6 and change the grid bias voltage to V3, V4, V5 and V6. In the HIGH POWER position the resistances are short circuited.

Two positions of the system switch provide calibrating facilities, the ADJ TO REC position being used when the sender is in operation with the Reception set R210, and the INT CAL position when sender is used without this reception set. With the switch in the ADJ TO REC position, only the master oscillator V1 and buffer amplifier V2 are operative, all other valves being biassed to render them inoperative. The signal is passed out direct to the receiver, which has been previously tuned, and checked against the receiver.

In the INT CAL position, valves V1, V2, V10a, V10b, V11, V12a and V12b only are operative. Strong harmonics from the 100 kc/s crystal oscillator are passed from V12b and fed to a transformer coupled to the grid of V12a. V12a acts as a mixer, its output being mixed with part of the amplified master oscillator output of V2 and passed via V11, V10a and V10b to the phones. Tuning is achieved by the operation of a variable inductor in the master oscillator circuit. This is the CALIBRATE control on the front panel, and it is adjusted for zero beat.

LT and HT voltages of the sender, and grid and cathode currents of the power amplifier can be checked by means of the meter, dependent on the position of the associated 4-position switch. On LT, full scale deflection is 50 volts; on HT it is 1,000 volts. On GRID PA it equals 10 milli-amps, and on CATH PA it equals 300 milli-amps. Thus the actual reading for LT condition should be multiplied by 5, for HT by 100, for GRID PA by 1, and for CATH PA by 30, as shown on the panel.

(5) Aerial tuning unit No. 7

This unit matches the output impedance of the sender to the impedance of the various aerials which can be used. Output voltage of the sender is passed via a coaxial cable to the aerial tuning unit. It is fed to the aerial coil via a special switching device and loading coil, and is tuned by a two-section variable capacitor whose sections are connected in parallel to give the required capacity. The loading coil is in circuit only on the lower frequencies, being switched out automatically by the rotation of the match capacitor spindle to which the rotary switch is connected. This switch is so designed that voltage in the circuit is completely disconnected during the moment of shorting out the loading coil, to prevent arcing.

The wiper contact of the aerial coil is designed so that it has two points of contact bridging three turns of the coil at any position, thus the three turns act as a screen between the dead portion and the live portion of the coil. This is necessary especially when the live portion consists of only a few turns.

A simple leaf switch and cam on the locking device of the tuning control automatically extinguishes the dial lighting when the locking control is in the LOCK position.

An indication of aerial current is provided by means of a toroidal current transformer and crystal rectifier operating in conjunction with the panel meter on the aerial tuning unit.

(6) DC power supply unit

The function of this unit is to provide all the power requirements of the sender from a 24-volt supply. Two outputs are provided: + 530 volts at 450 mA, and a stabilised 300 volts. The 300 volt output is obtained by tapping the 530 volt line and passing through a stabilising circuit and dropping resistances in the sender.

The supply unit requires an input nominally of 24 volts. In practice, however, as batteries may be in a discharged condition, or on "float" charge, actual voltages between 22 and 29 may be encountered.

(7) Voltage control

To limit the variation of the voltage used in the sender, a close margin voltage control relay RLF in the power supply unit operates when the battery voltage rises above 25.5 volts, and releases when this voltage falls below 23.5 volts. Thus the voltage range can be divided into two parts as follows :

Low range (relay RLF normal)	:	20.7 to 25.5 volts
High range (relay RLF operated)	:	23.5 to 29 volts

An overlap of two volts exists between the two ranges. If, when an installation is first switched on, the battery voltage lies within this overlap, the voltage control relay RLF will remain in its normal condition although the voltage figure actually appears in both the low (relay normal) and the high (relay operated) ranges.

If the voltage rises, as with batteries on float charge, relay RLF will operate when the voltage passes through the upper limit of the low range, and will remain operated as long as the battery voltage remains in the high range.

If the battery voltage then falls, relay RLF will remain operated until the voltage falls to the lower limit of the high range, although this voltage

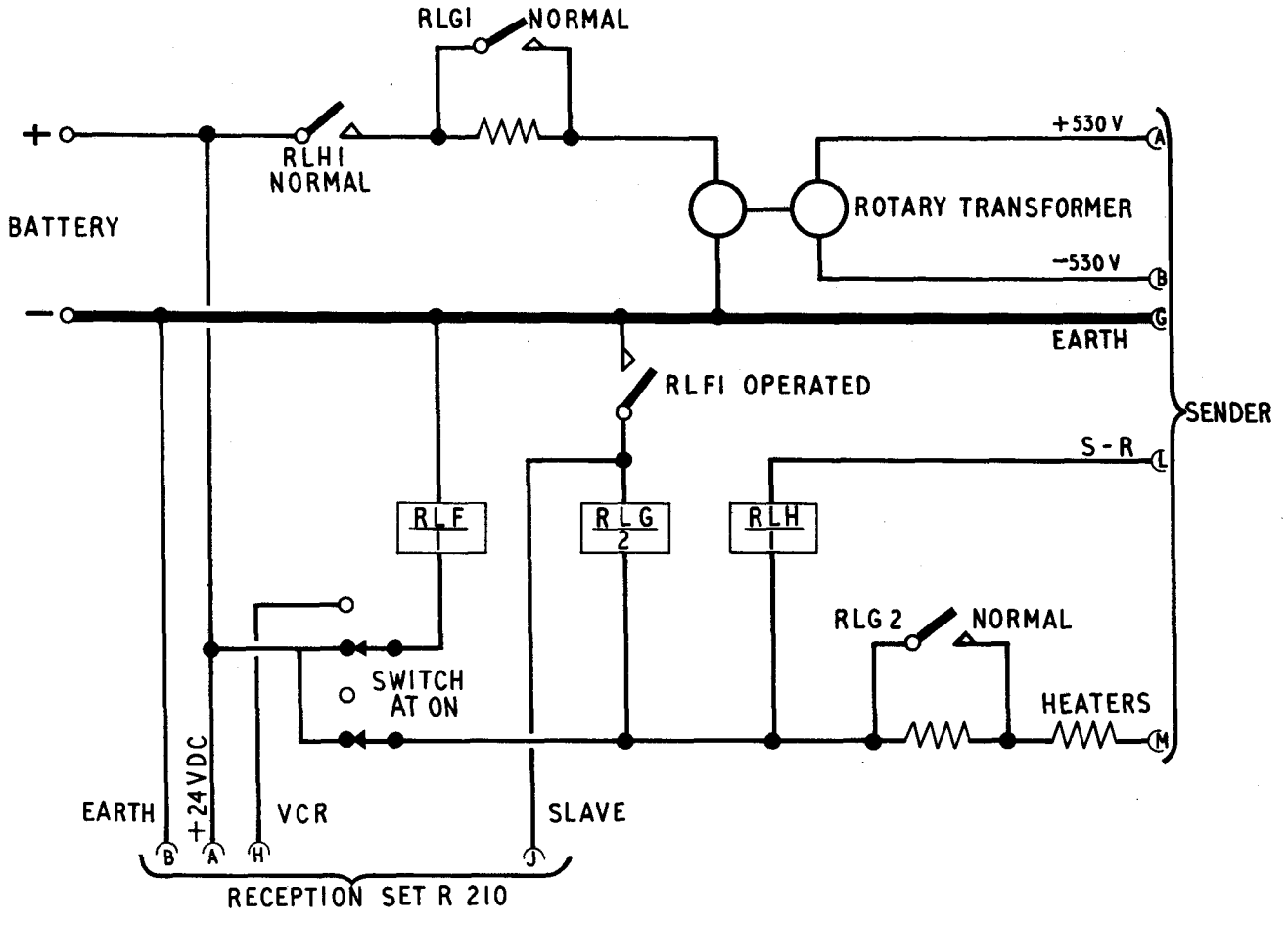


FIG. 15 VOLTAGE CONTROL CIRCUIT (BATTERY VOLTAGE IN HIGH RANGE)

figure is actually below the low range maximum. When the battery voltage drops beyond this lower limit the relay RLF returns to its normal condition, and removes resistances in order to maintain the output from the reduced input.

The accompanying diagrams illustrate high range and low range conditions brought about by the operation of the voltage control circuit in the DC power supply unit. This circuit automatically switches in extra resistances when the input voltage is excessive, and by-passes them when the voltage falls below the high range.

Fig. 15 shows, in simplified form, the voltage control circuit in the DC power supply unit. It indicates the condition of the circuit while the battery voltage lies within the high range, or if it is connected to a battery with voltage above the upper limit of the low range.

As the voltage of the battery is in the high range, relay RLF is operated and the earthed negative side of the supply is disconnected from the slave relay RLG. Relay RLG is therefore unoperated (normal); its contacts are as shown in fig. 15, and the resistances in the primary side of the rotary

transformer and in the 19-volt supply to the heater circuit in the sender are in circuit.

Now assume that the battery voltage is falling, and refer to fig. 16. When the battery voltage drops below the lower limit of the high range, the close margin voltage control relay RLF restores to normal and its contact RLF1 closes to earth relay RLG.

Alternatively if the power supply unit is connected to a battery supply in the low range, relay RLF will remain at normal, and relay RLG is energised as the unit is switched on.

Relay RLG operates. Contact RLG2 closes to short out resistance and allow the full voltage to be passed to the heater circuit. Contact RLG1 closes to short out resistance and allow the full voltage to be passed to the rotary transformer when relay RLH operates.

(8) Rotary transformer starting relay

Relay RLH in the DC power supply unit is the starter relay for the rotary transformer. In fig. 15 it is shown with contact RLH1 at normal. The rotary

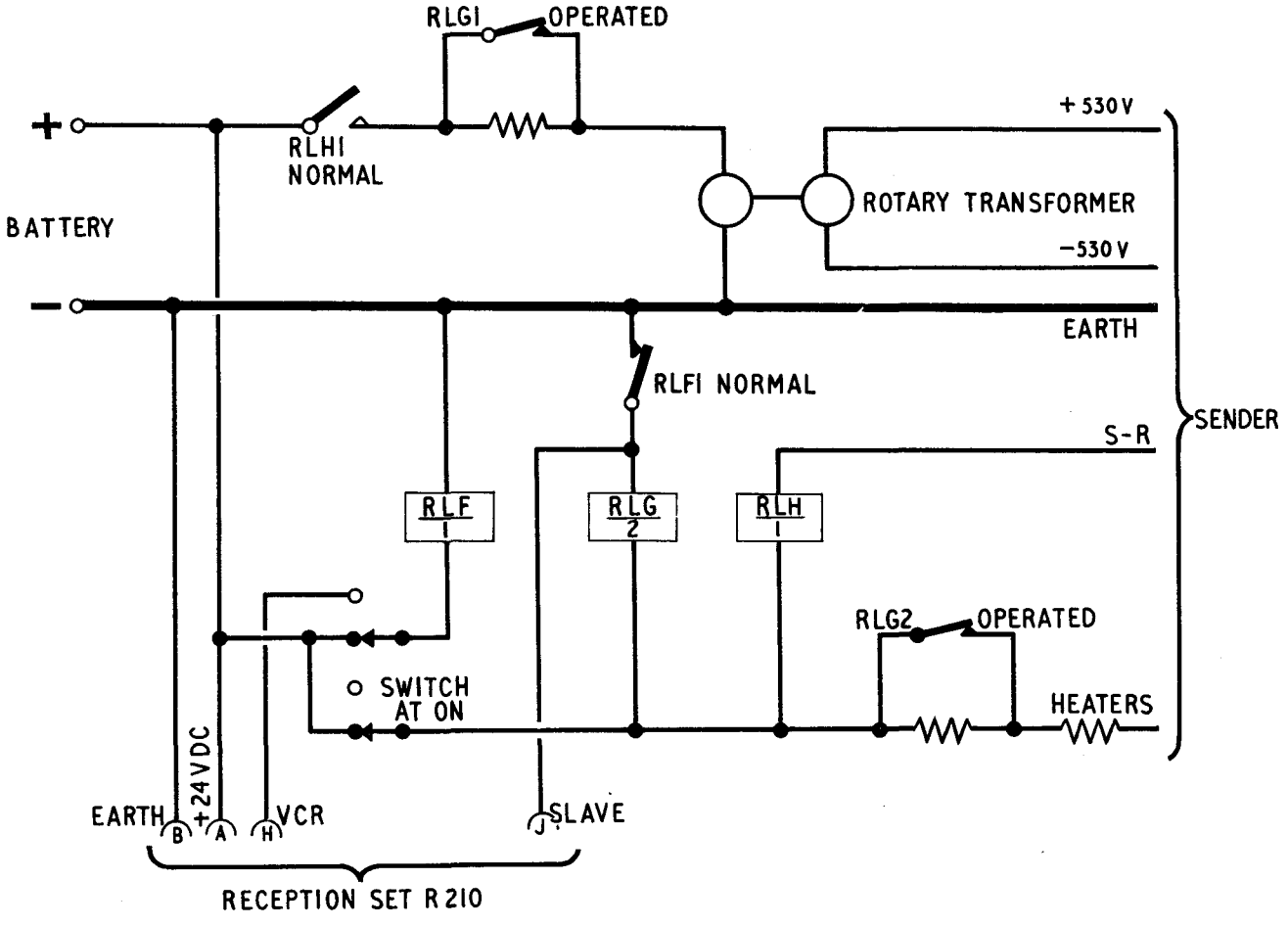


FIG. 16 VOLTAGE CONTROL CIRCUIT (BATTERY VOLTAGE IN LOW RANGE)

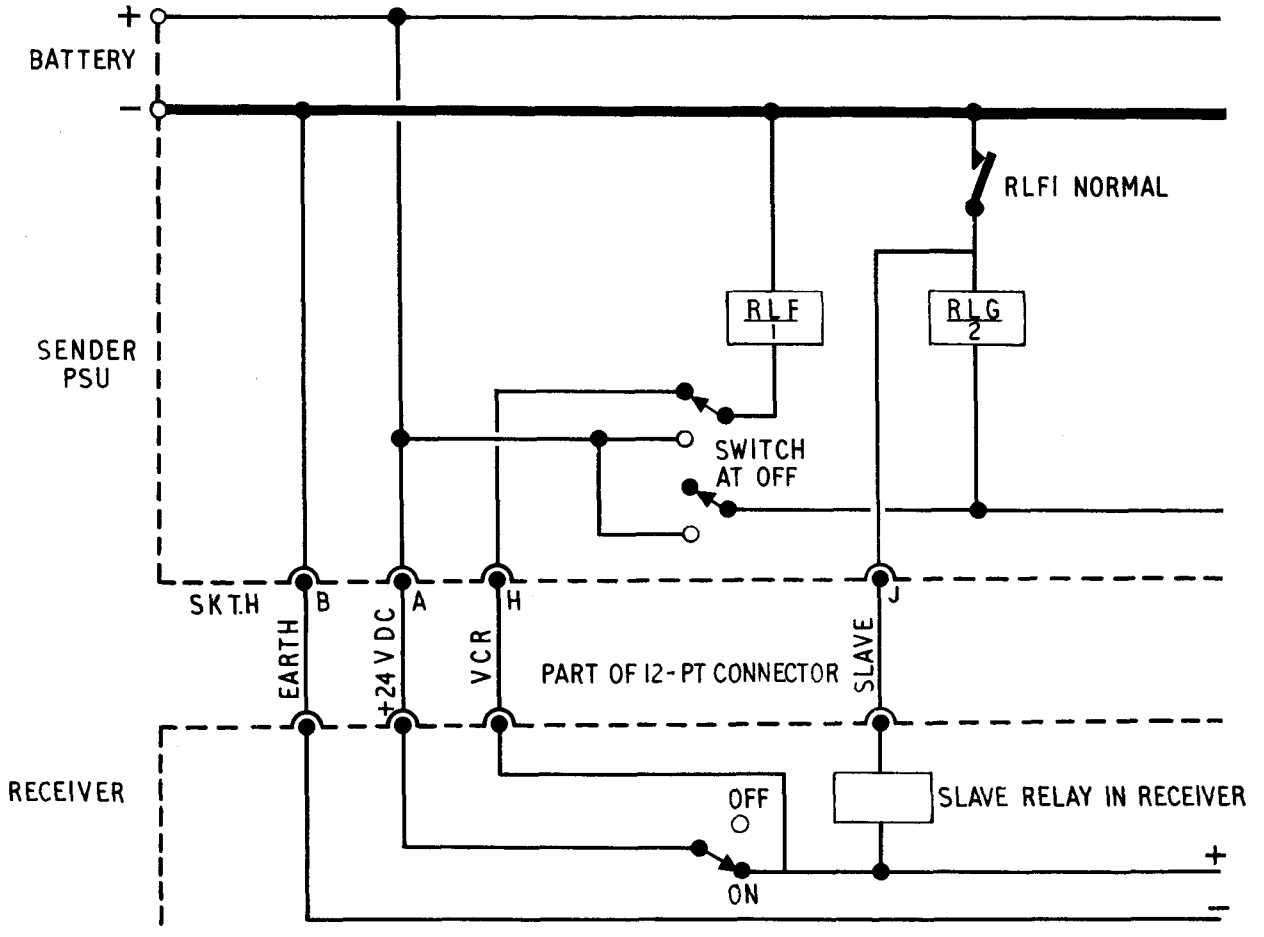


FIG. 17 ENERGISING THE SLAVE RELAY IN THE RECEIVER

transformer starts running when the relay is energised by one of the following operations. See fig. 14 on page 21.

(a) By turning the sender system switch to ADJ TO REC, INT CAL or CW.

(b) By turning the system switch to SENDER ON to operate relays RLE and RLC in the sender.

(c) By the send-receive pressel switch when the sender system switch is at VOICE/CFS

(9) Receiver slave relay

Switching is so arranged that when the sender power supply unit is switched OFF and its associated Reception set R210 is switched ON, the 24-volt supply passing to the receiver via the 12-pt connector energises relay RLF in the sender DC power supply unit. If this 24-volt supply is within the high range, relay RLF operates and contact RLF1 energises the slave relay in the receiver. Fig. 17 shows this condition.

Operation of the slave relay in the receiver changes tapping positions on the vibrator transformer.

If sender power supply unit and receiver are both switched ON, the receiver slave relay works simultaneously with relay RLG in the sender power supply unit.

(10) Inter-unit connections

The power supply source in general use will be 24 volts DC. Fig. 18 shows details of connector terminations in the installation when the sender is connected to a DC supply unit. The function of each conductor in the multi-point connectors is given.

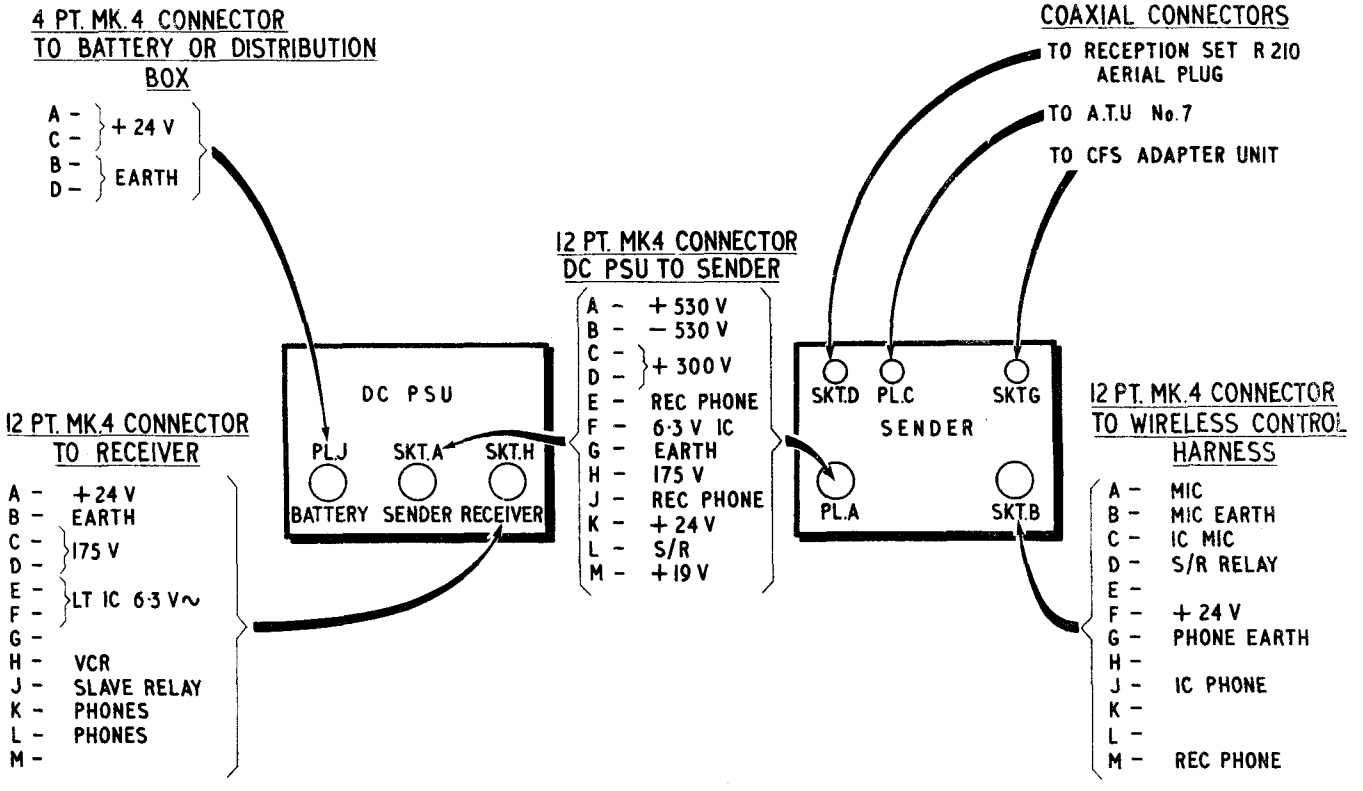


FIG.18 INTER-UNIT CONNECTIONS

When it is required to operate from AC mains or mobile generator an AC power supply unit must be used. A diagram showing inter-unit connections in an AC installation is given on page 46.

THE AC POWER SUPPLY UNIT IS DESCRIBED IN CHAPTER 4. SEE PAGE 43.

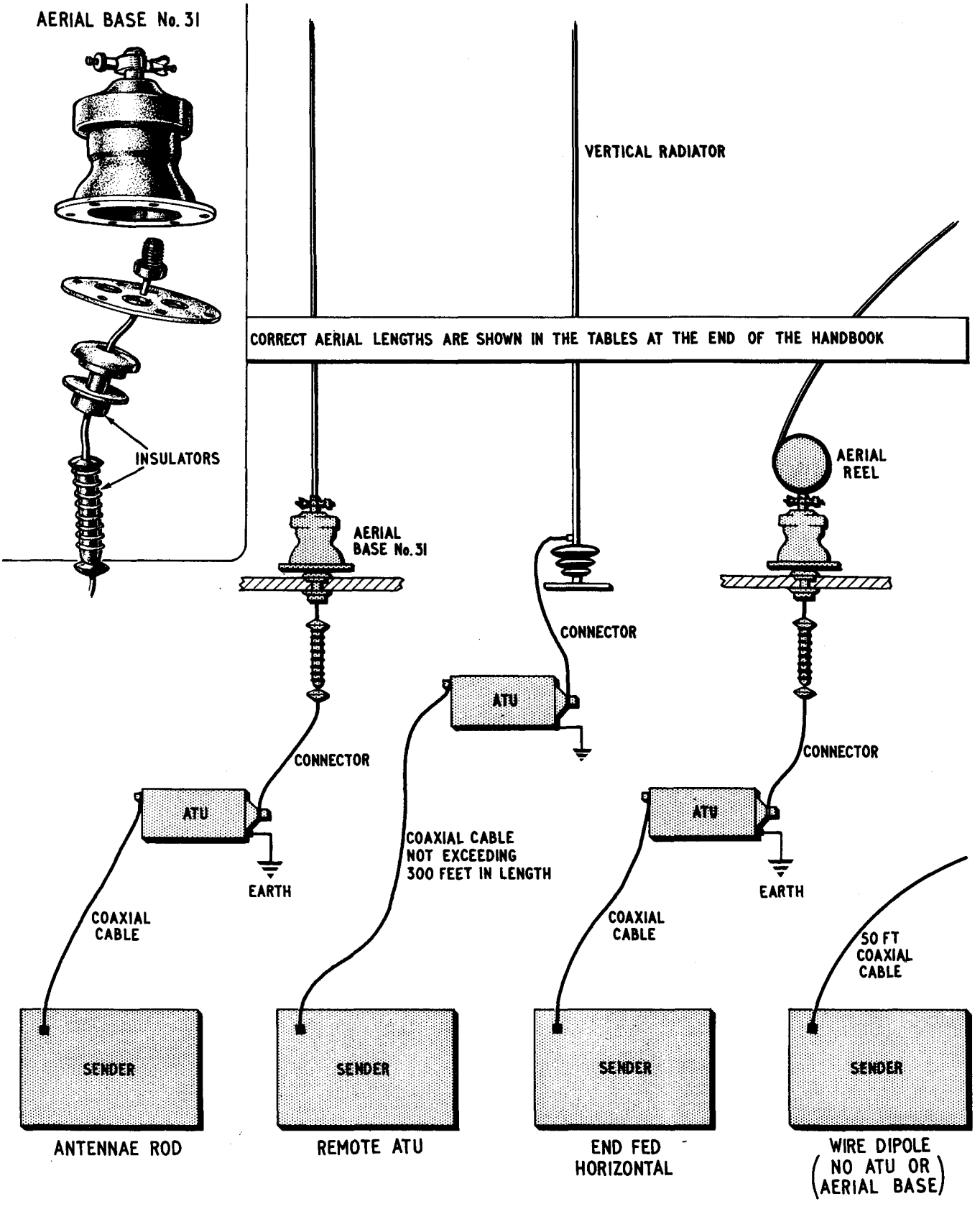


FIG.19 ALTERNATIVE AERIAL ARRANGEMENTS

CHAPTER 2

OPERATION

WARNING

When this equipment is operated on an AC supply the voltage employed is sufficiently high to endanger human life. Every reasonable precaution has been observed in design to safeguard operating personnel. Do not tamper with supply leads and switch the power supply off before removing connectors In case of electric shock refer to the inside front cover of this handbook.

Section 10. Preliminary checking

(1) Installation

Check that the various units comprising the installation are securely mounted.

(2) Connectors

Ensure that all inter-unit connectors and power supply leads are correctly fitted. Complete instructions are given in the user handbook for the relevant vehicle installation.

(3) Wireless control harness

Attach the required number of headsets and a keying unit when required. See that the control units to which these are connected are correctly switched.

(4) Aerials

The user handbook for the vehicle installation includes details of the aerial arrangements in the vehicle. Ascertain that the correct aerial is fitted for the required frequency after reference to the tables given in the appendix to this handbook. Additional information on aerials is given on pages 10 and 11.

IMPORTANT: There is very high voltage on the aerial system. Read the warnings on page 34.

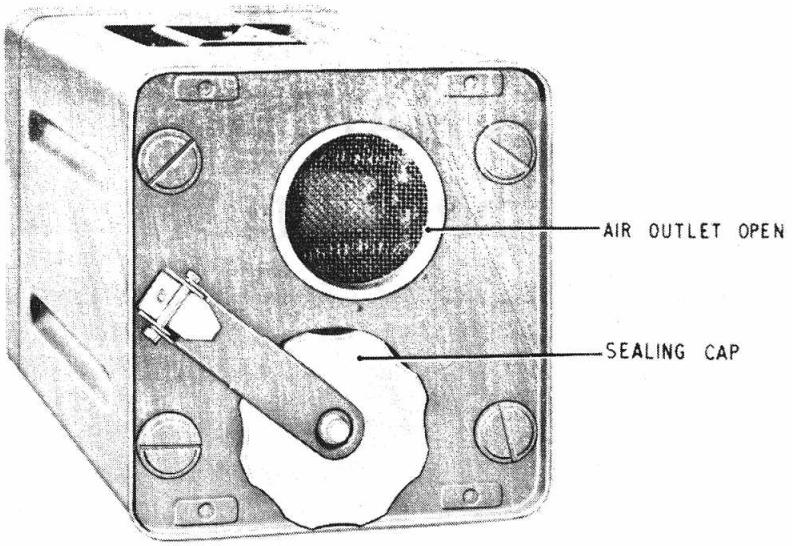


FIG. 20

Section 11. Air intakes

(1) Air inlets and outlets must always be open when the sender is switched on. Release the turn-button catches and open the air inlet covers on the front panel of the sender (two covers) and the power supply unit (one cover).

(2) Unscrew the caps to the air outlets in the rear of the sender (one cap) and the power supply unit (one cap). Swing the caps down to the stowage position as shown in fig. 20 above.

Section 12. Switching on

(1) On the power supply unit, move the OFF-ON switch to ON. The red indicator lamp should light. On the DC supply unit the brightness can be varied by turning the lamp cover.

(2) In a 24-volt DC installation set the sender meter switch to LT and check the battery voltage, multiplying the meter reading by five. The voltage should be between 22 and 29.

(3) Turn the locking devices on sender and aerial tuning unit in an anti-clockwise direction. These locks release the tuning controls and switch on lamps to illuminate the scale windows.

(4) Turn the sender system switch to VOICE/CFS to prevent the rotary transformer running continuously while the sender is switched on.

(5) Switch the wireless control harness ON at the JD9 (Harness type 'A') or the J1 or J2 box (Harness type 'B').

(6) Before tuning, if time permits, allow fifteen minutes for the equipment to warm up. If the sender is brought into use immediately after switching on, the tuning will require checking as it will tend to drift during the first fifteen minutes.

Section 13. Tuning scales

(1) Two scales are visible in the scale window. The upper one is a slow motion dial engraved in Mc/s with tenth divisions, and the lower is a high speed kc/s scale driven directly from the tune control.

(2) On range 1 the mask over the scales is in the lowest position to expose the Mc/s scale calibrated 2 to 4 Mc/s and the Kc/s scale calibrated from 0 to 100 kc/s. For one complete revolution of the lower scale the upper scale moves through one 100 kc/s division. The 100 kc/s crystal calibrator provides one check point for each complete revolution of the tuning control. This check point is clearly marked on the scale by the white figures '00' engraved on a black background. See fig. 21(a).

(3) On range 2 the mask is in its central position to expose the 4-8 Mc/s scale. One revolution of the tuning control now covers 200 kc/s. There is a check point mark at every 100 kc/s.

(4) On range 3 the mask is at the top position to expose the 8-16 Mc/s scale. One revolution of the tuning control now covers 400 kc/s. There is a check point mark at every 200 kc/s.

(5) To read the dial accurately in kc/s, the figures showing on the Mc/s scale should be followed immediately by those showing on the kc/s scale. For example, when 2.1 is showing against the cursor line of the Mc/s scale, '00' will be showing against the cursor of the kc/s scale, the whole reading 2100 kc/s, or 2.1 Mc/s, as at fig. 21 (a).

(6) When the Mc/s scale reading is between figures, the kc/s scale reading will be some part of the 100 kc/s. For example, the Mc/s scale reading between 2.2 and 2.1 and the kc/s scale reading 65, the total reading is 2165 kc/s, or 2.165 Mc/s, as at fig. 21 (b).

NOTE: All aerial tuning operations should be carried out on LOW POWER, with final adjustment on HIGH POWER.

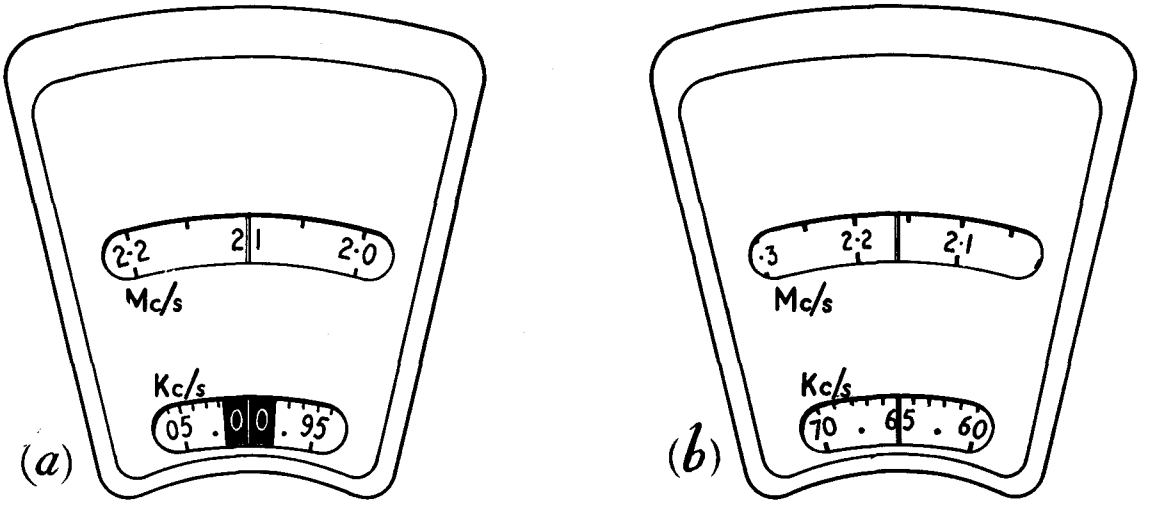


FIG. 21 EXAMPLES OF FREQUENCY SCALE READINGS

Section 14. Sequence of operations to tune the sender

(1) Put the sender range switch to the range in which the required frequency lies.

(2) Set the POWER switch to LOW.

(3) Turn the system switch to INT CAL. With the switch in this position the sender will not transmit.

(4) Rotate the sender tune control until the black check point nearest to the required frequency appears against the cursor on the kc/s scale. A whistle should be heard in the headphones.

(5) Adjust the CALIBRATE control to obtain zero beat.

(6) Adjust the sender tune control to the exact frequency required.

NOTE: When Wireless sender C11 and Reception set R210 are installed together, first tune the reception set to the required frequency as instructed in the receiver user handbook. Then in place of paragraphs (3) and (4) above, turn the system switch to ADJ TO REC, turn the tune control to the required frequency and adjust the CALIBRATE control for zero beat, to align sender and receiver correctly on the same frequency.

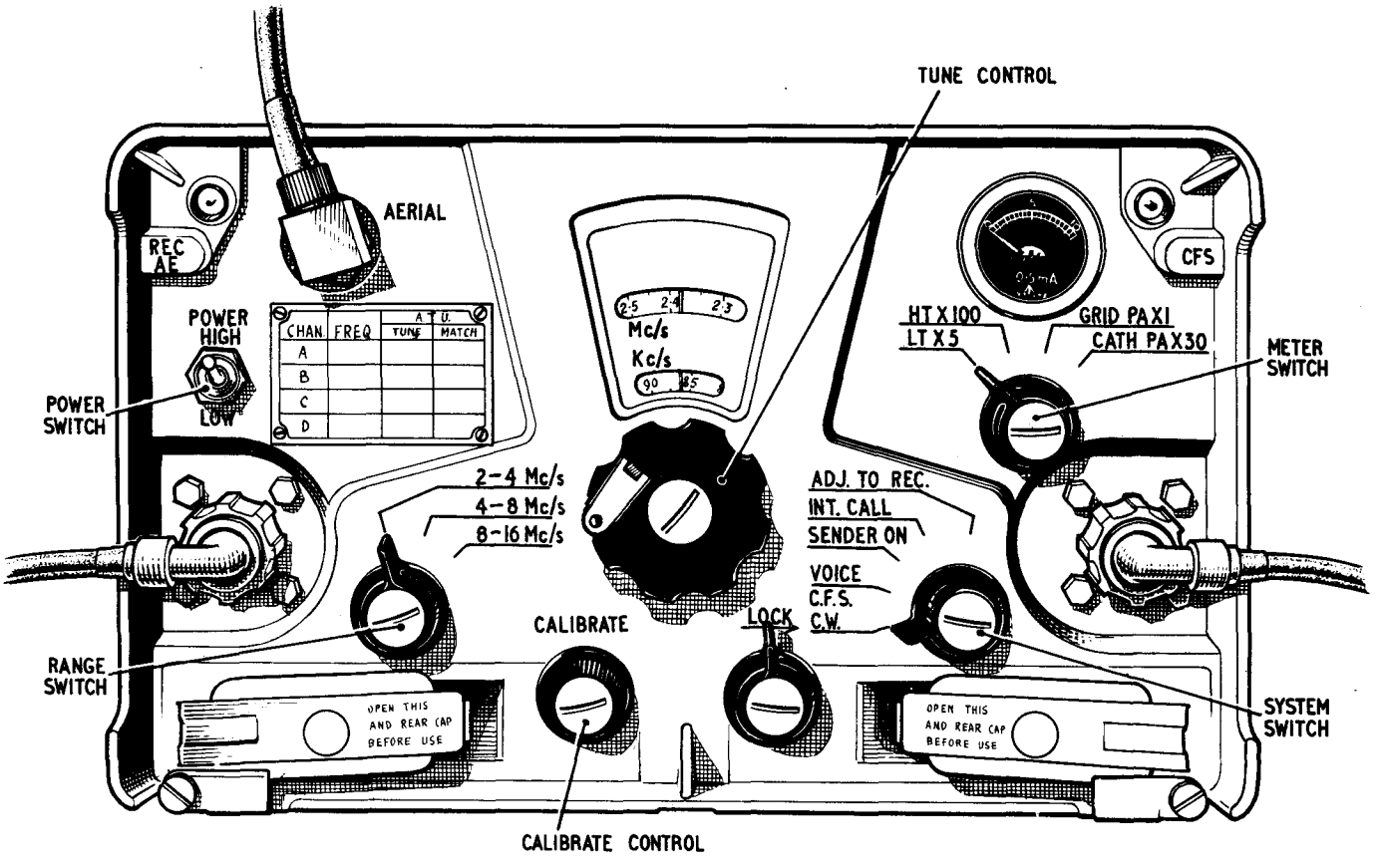


FIG. 22

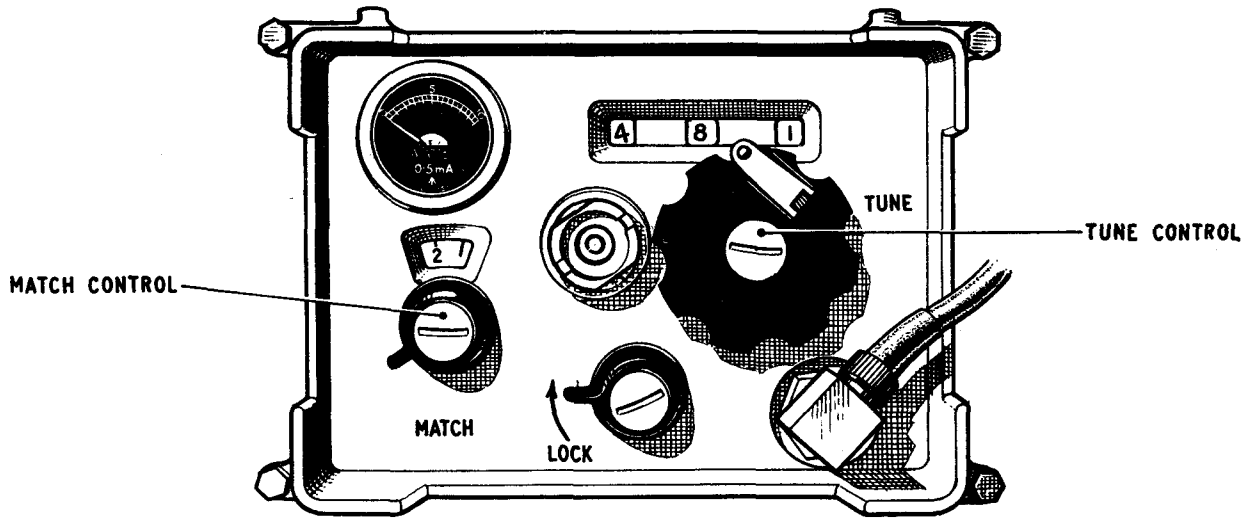


FIG. 23

(7) Turn the sender LOCK control clockwise to lock the position and extinguish dial lighting.

(8) From the aerial tuning charts in the appendix, ascertain tune and match figures for the required frequency, relative to the type of aerial being used. If this frequency lies between the examples given in the chart, select the nearest tune and match figures.

(9) Rotate the TUNE control on the aerial tuning unit until the three figures selected from the TUNE column of the chart appear on the trip counter.

(10) Rotate the MATCH control on the aerial tuning unit until the figures selected from the MATCH column appear on the MATCH scale.

(11) Turn the sender system switch to SENDER ON. This will cause the rotary transformer to run and power will be transmitted to the aerial tuning unit.

(12) Re-adjust the aerial tuning unit TUNE and MATCH controls for maximum meter deflection.

(13) Move the sender POWER switch to HIGH, and again re-adjust TUNE and MATCH controls for a possible increase in aerial current.

(14) When maximum deflection is obtained, turn the LOCK control on the aerial tuning unit to lock TUNE and MATCH controls and extinguish dial lighting.

(15) Setting up procedure is now complete. Turn the sender system switch to VOICE/CFS to stop the rotary transformer running.

(16) To commence transmission, turn the sender system switch to the required method of operation.

(17) Use LOW POWER when maximum range is not required.

(18) Switch the sender power supply unit and the wireless control harness OFF when the installation is not in use.

(19) Aerial tuning unit TUNE and MATCH figures for four frequencies can be recorded on the aerial tuning chart on the sender panel. Write with pencil or pen, and clean off with a cloth.

(20) The following method may be used as a broad guide to adjusting the aerial tuning unit without the aid of tune and match figures. Set the MATCH scale to '5' and the TUNE trip counter to its upper limit (600). Tune downwards until maximum meter deflection is obtained. Then adjust the MATCH control for a possible increase in aerial current. Do not start at the lower end and tune upwards, or the first significant deflection may be spurious.

WARNINGS

There is VERY HIGH VOLTAGE on the aerial system when the sender is in operation.

Do not touch any bare wires on the aerial base, or the insulated aerial terminal on the aerial tuning unit, while the sender is switched on.

Do not allow the connector from the aerial base to the aerial tuning unit to touch any metal parts or it may be burnt. This connector is protected by insulating beads to keep it clear of metal parts.

If the rod aerial on a vehicle is near or touching a power wire, DO NOT reach up and remove the aerial or step out of the vehicle. Just drive the vehicle clear of the wires. NEVER change aerials near overhead wires.

Do not climb onto the roof of the vehicle while the sender is switched on.

Do not pour petrol into the vehicle tanks when the equipment is on "send". An RF potential difference may cause an arc resulting in an explosion.

CHAPTER 3
USER SERVICING

Section 15. Servicing on the task system

(1) No installation can be expected to work properly unless it is kept in first class condition by regular servicing, conscientiously carried out. This servicing is the responsibility of the NCO or man who is in direct charge of the equipment and responsible for its operation, NOT of workshop or repair staffs, though workshop personnel may be called upon to carry out certain servicing tasks.

(2) To guide the NCO or man responsible for servicing, and to ensure that it is done, it has been laid down that signal equipment will be serviced on the task system and that completion of each task will be recorded on Army Form B2661 - Unit servicing log.

(3) A facsimile of this log is reproduced at the end of this handbook. Completion of servicing tasks will be recorded by initialling in the spaces provided on the front of the form; all repairs and replacements will be recorded on the reverse. The form lasts 24 weeks and replacements should be obtained on indent in the normal way. Current and completed forms should be kept in the pocket in the back cover of this handbook.

(4) Servicing tasks to be carried out by the user are listed in the following sections, which show the full servicing required for an installation in continuous use. The frequency with which each task is carried out will be detailed by the commander concerned.

Section 16. Routine servicing tasks

(1) Cleaning

Keep the wireless sender, power supply unit, aerial tuning unit, and all associated equipment clean, dry and free from dust.

(2) Connectors

Examine all connectors for fraying and damaged insulation, paying special attention to terminations. Check that all connectors are correctly fitted and secured by the locking rings. Do not pull on the cables. See that earthing connections are in order.

(3) Controls

Check that all switches and controls work smoothly and firmly through their range of movement.

(4) Meter readings

With the equipment properly connected, switch on the power supply unit and check meter readings at each position of the meter switch. Normal readings on high power and with the aerial properly tuned should be as follows:-

TABLE 5

Meter switch position	Requirement	Actual meter reading
LT X 5	24 volts	4.8
HT X 100	500 volts	5 (at CW with key pressed, or at VOICE CFS with pressel switch pressed).
GRID PA X 1	7 - 10 mA	4 - 8 " " "
CATH PA X 30	240 mA	7 - 9 " " "

(5) Air filters

Remove and clean the air filters fitted inside the air inlet covers on the sender (two filters) and the power supply unit (one filter).

To remove the filter from the air inlet aperture, slacken the screw securing the turn-button catch sufficiently to allow the catch to be turned back slightly to release the cover, which should then be opened wide. Depress the spring clip holding the air filter in position and withdraw the filter.

Turn the filter upside down and tap gently on the floor to remove dust and fluff.

Replace the filter by reversing the removal procedure, and tighten the screw securing the turn-button catch.

Replacement air filters are provided in the spares kit.

(6) Humidity indicators

Inspect two humidity indicators, one in the panel of the aerial tuning unit, and the other in the sealed master oscillator box inside the sender, for which the sender must be removed from its case as described in section 18. Observe the colour of the indicator. If this indicator is blue in colour, similar to the surrounding blue ring, then the desiccator remains serviceable and the interior of the unit is dry. If the indicator has turned pink then the desiccator is exhausted and must be changed, for moisture inside the unit has been absorbed by the drying agent.

Report all units on which the desiccator appears pink, in order that these units can be sent to workshops as soon as possible, where drying apparatus is available and where a replacement desiccator of the correct type can be fitted.

Section 17. Opening a sealed unit

(1) Aerial tuning unit No. 7 and the master oscillator box inside the sender are hermetically sealed and must not be opened by operating personnel.

(2) Royal Signals radio technicians may open a unit for servicing, so far as their technical ability and the equipment and spares in their possession allows, subject to the following conditions:

(a) On the initiative of the technician, when absolutely necessary to restore essential communications, or

(b) On the authority of the officer commanding.

These are the only occasions when Royal Signals radio technicians may break the seals.

(3) Seals should so far as possible only be broken in conditions when the risk of dust or damp getting into the equipment is as small as possible. The equipment must be sent to workshops for testing of the seals, and drying out if necessary, as soon as possible after an emergency opening.

Section 18. Opening the sender and the DC supply unit

REMOVE POWER SUPPLY CONNECTIONS BEFORE OPENING A UNIT.

(1) To remove the sender chassis assembly from its case, stand the sender panel downwards on a smooth level surface. Slacken off the four large captive screws in the rear of the case. Lift the case off the chassis.

(2) The DC power supply unit is opened in a similar manner.

(3) To hinge the sender sub-chassis sections outwards, release six screws ('A' to 'F' in fig. 24 on page 41). Disengage two plugs on the RF chassis ('H' in fig. 24) from sockets on the centre section ('G' in fig. 24).

(4) IMPORTANT: Do not turn system switch or range switch when the sub-chassis sections are hinged outwards, or the drive mechanisms will be moved out of alignment.

(5) Before returning the sender to its case, re-engage the two plugs and sockets and re-fit the six screws holding the hinged sections.

(6) To replace the case, reverse the removal procedure, and tighten the four captive screws.

Section 19. Fault location

(1) It should be remembered that simple little external faults are much more common than internal trouble. If the equipment fails, look for faults in the following order: Firstly see that all switches and controls on wireless equipment and control harness are correctly set. Then check the installation for deranged or damaged connectors. Finally check for internal faults.

(2) The following table is intended for the operator's guidance in locating the simpler faults that may occur.

TABLE 6

	Symptom	Possible fault	Action to be taken
1	With equipment connected and power switch ON. No illumination of DC PSU pilot lamp or sender and ATU dial lamps.	(a) Faulty battery (b) 7-amp fuse blown (c) Lamps blown (d) Internal	(a) Change battery (b) Fit new 7-amp fuse (c) Fit new 12-volt lamp (d) Report
2	With equipment connected and power 'ON'. Put meter switch of sender to LT. No meter reading.	7-amp fuse on DC power supply unit blown.	Fit new 7-amp fuse.
3	With equipment connected and power ON, switch to 'CW'. Rotary transformer fails to run.	(a) Faulty rotary transformer (b) Fault in relay circuit	(a) Report (b) Report
4	As above, but rotary transformer runs. No meter reading with meter switch at HT.	1-amp sender fuse blown.	Fit new 1-amp fuse.
5	As above, but with meter switch at GRID PA. No meter reading.	(a) Faulty valves at either V1, V2, V3, V4 or V5. (b) Internal fault.	(a) Put sender on HIGH POWER and system switch to INT CAL. If whistle is heard then V1 and V2 in order. Put system switch to CW, with sender on HIGH POWER and meter switch to CATH PA. If meter reads high then either V3 or V4 is defective. Switch to range 1. If meter now reads correctly, V3 is defective. (b) Report.
6	As above, but with meter switch at CATH PA. No reading.	V5, V6 defective.	Change valves V5, V6.

	Symptom	Possible fault	Action to be taken
7	As above, but with low reading.	Wrong adjustments on ATU	Check that ATU is properly connected and adjusted.
8	With equipment connected and power ON, with system switch at CW, and HT and LT readings correct. No aerial output when key is pressed.	(a) Inspect valves V1, V2, V3, V4, V5 or V6.	(a) Put system switch to INT CAL. If strong whistle is heard, V1 and V2 are operating. Switch to range 1 and check. If there is output, then V3 is defective. If still no output, check GRID PA and CATH PA. If no meter readings at these positions either V5 or V6 is defective.
		(b) Faulty relays	(b) Report
		(c) Other internal faults	(c) Report
9	With equipment connected, power ON and system switch at VOICE/CFS. No movement in aerial current meter when operator whistles or speaks into microphone, although sender is known to be working on CW. (Aerial current reading <u>should</u> change slightly with speech or whistle).	(a) Faulty microphone	(a) Change the microphone
		(b) Modulator valves suspect	(b) Check in following manner:- If side-tone can be heard in headphones when whistle or speech is produced, V8 or V9 is the defective valve. If no side-tone can be heard, V11, V10a or V10b is the defective valve.
10	With equipment connected and power ON, and with system switch at INT CAL, no whistle is heard.	(a) Valve 12a or V12b faulty	(a) Fit new valve
		(b) Internal	(b) Report

<u>NOTE</u>: Some valves are connected in series, therefore the absence of any glow in a valve heater does <u>not</u> indicate that <u>that</u> particular valve is defective.

Section 20. Replacements

(1) Where a component has been proved faulty and a replacement of the correct type is available, this may be fitted by the user, subject to the special provisions for opening sealed units referred to on page 37. Replacement lamps, valves, fuses, desiccators, and a blower motor assembly are included in the spares kit. As spares are used, replacements should be obtained through normal channels to maintain a complete spares kit. Do not put defective components back in the spares box.

(2) Lamps

All dial lamps are Lamps filament indicating 12-volt 3.6 watt.

Fig. 24 shows the position of the sender dial lamp, which is accessible after removing the sender from its case.

To change the indicator lamp in the DC power supply unit, unscrew the body of the dimming device on the front panel of the unit. Remove the defective lamp and insert a serviceable replacement. Re-fit the dimming device in its original position.

Two dial lamps are fitted in the aerial tuning unit, one behind each dial. As this unit is hermetically sealed, defective lamps should not normally be changed by the user, but should be left until the unit is sent to workshops. If in an emergency the lamps have to be changed, the unit must then be sent to workshops at the first opportunity for drying out and re-sealing.

To obtain access to these lamps, remove the four retaining bolts and nuts holding the case to the front panel. Place the unit face downwards and lift the case off the chassis. Remove the defective lamp, replace with a new one of the same type and return the chassis to the case ensuring that the spring clip in the interior of the case behind the aerial terminal makes good contact with the end of the aerial coil shaft. Replace the four nuts and bolts and tighten securely.

(3) Valves

Valves in the Wireless sender C11 can be changed without the necessity for any internal re-alignment, but the tuning and operating procedure must be checked and re-adjusted each time a valve is changed.

Certain valves are enclosed in metal cans which are removed by giving the can a slight twist anti-clockwise. These cans must always be replaced after changing the valve.

Valve pins are very easily damaged and if they are bent or broken the valve may be rendered useless. Handle valves with care and always ensure that all valve pins are correctly located in the appropriate valve base socket before attempting to insert a valve. Make sure that the valve is firmly fitted, and attach the top cap where necessary.

Fig. 24 indicates the position of all the valves in the sender, and table 7 lists the type numbers. A defective valve must be replaced by a serviceable one of the same type.

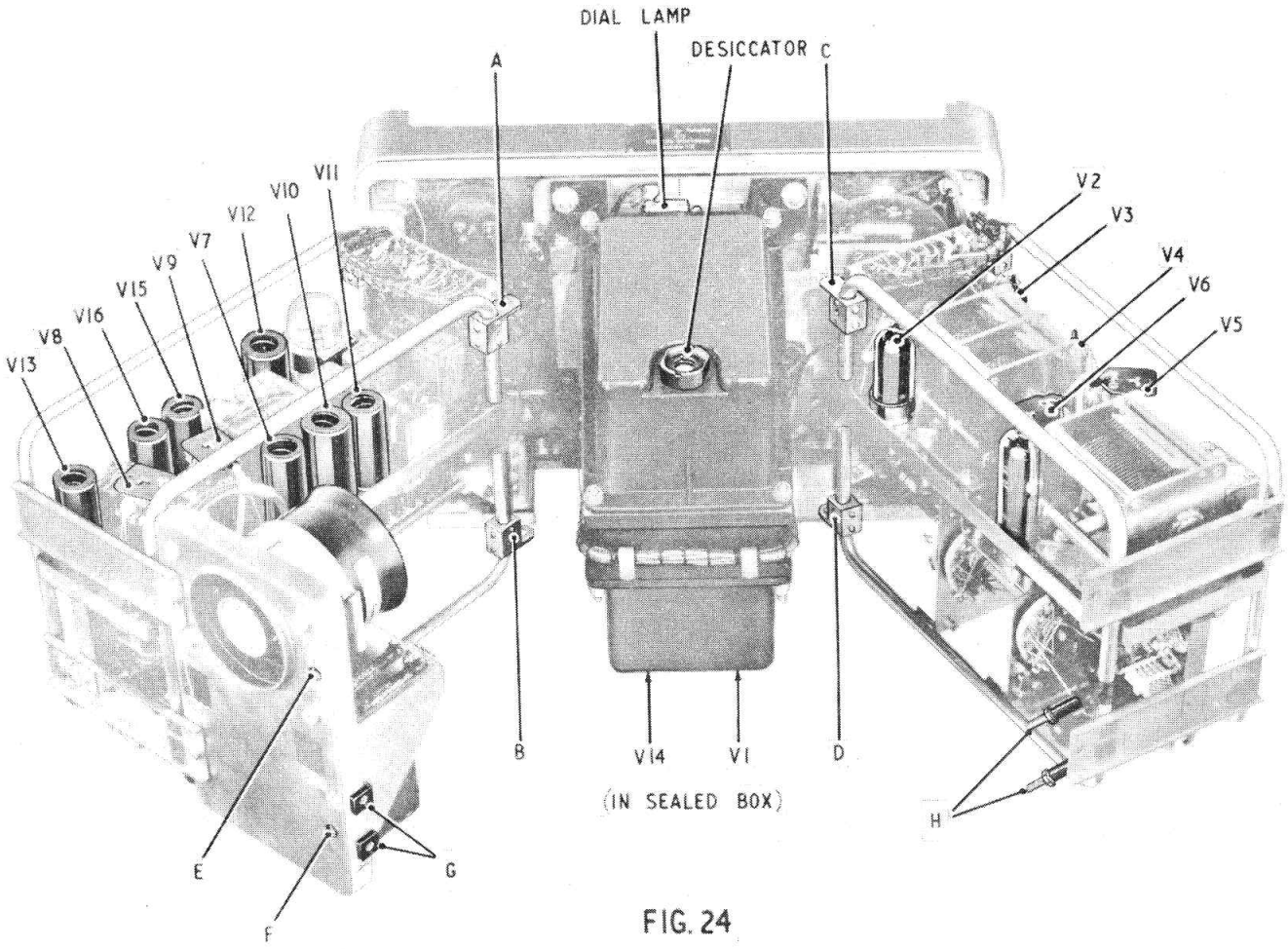


FIG. 24

TABLE 7. List of valves in Wireless sender C11

Ref.	Purpose	Type	Ref.	Purpose	Type
V1	Master oscillator	CV4010	V10a	) Two-stage	CV4003
V2	Buffer	CV4039	V10b	) AF amplifier	
V3	Amplifier/doubler	CV4039	V11	Microphone amplifier	CV4015
V4	Amplifier/doubler	CV4039	V12a	Mixer	CV4003
V5	Power amplifier	CV2347	V12b	Oscillator	
V6	Power amplifier	CV2347	V13	CW sidetone oscillator	CV4010
V7	AMC detector	CV4007	V14	Stabiliser	CV287
V8	) Modulator (in	CV2347	V15	) Intercomm amplifier	CV4010
V9	) push-pull)	CV2347	V16	)	CV4010

(4) Fuses

Three fuses are fitted in cartridge type fuse holders on the front panel of the DC power supply unit. These fuses are rated at 7, 1 and 3 amps respectively, the values being shown on the panel.

If a fuse blows, unscrew the knurled knob of the fuse holder, and withdraw the spent fuse cartridge. Fit a new fuse of the same rating and type. Replace the fuse holder and screw in firmly.

(5) Desiccators

It is important to remember that when a desiccator is removed the interior of the unit is exposed, and moisture may enter through the orifice. Therefore desiccators should be changed only in suitable dry conditions.

A replacement desiccator must be screwed in immediately an exhausted one is withdrawn, and the rubber sealing ring must be positioned correctly to ensure that the sealing is effective. A replacement desiccator should not be taken from its sealed package until the moment it is to be inserted into a unit, or the atmosphere will affect its condition.

If the unit requires drying out it should be sent to workshops as soon as possible, where drying apparatus is available and where a desiccator can be fitted under suitable conditions.

(6) Blower motor

A replacement blower motor assembly may be provided in the spares kit. This can be fitted in place of a faulty motor, and the faulty motor sent to workshops for repair. Fitting instructions are given in the EMER.

Note that if the two connections to the motor are reversed, the fan will be driven in the wrong direction. After changing the motor, check that air is circulating correctly. This can be ascertained by switching on and holding one hand close to the outlet in the rear of the case. There should be a noticeable flow of air from the outlet.

CHAPTER 4

AC PSU

WARNING

When this equipment is operated on an AC supply the voltage employed is sufficiently high to endanger human life. Every reasonable precaution has been observed in design to safeguard operating personnel. Do not tamper with supply leads and switch the power supply off before removing connectors In case of electric shock refer to the inside front cover of this handbook.

Section 21. Description of Supply unit rectifier No. 30

(1) This power supply unit, shown in fig. 25, enables Wireless sender C11 or Wireless

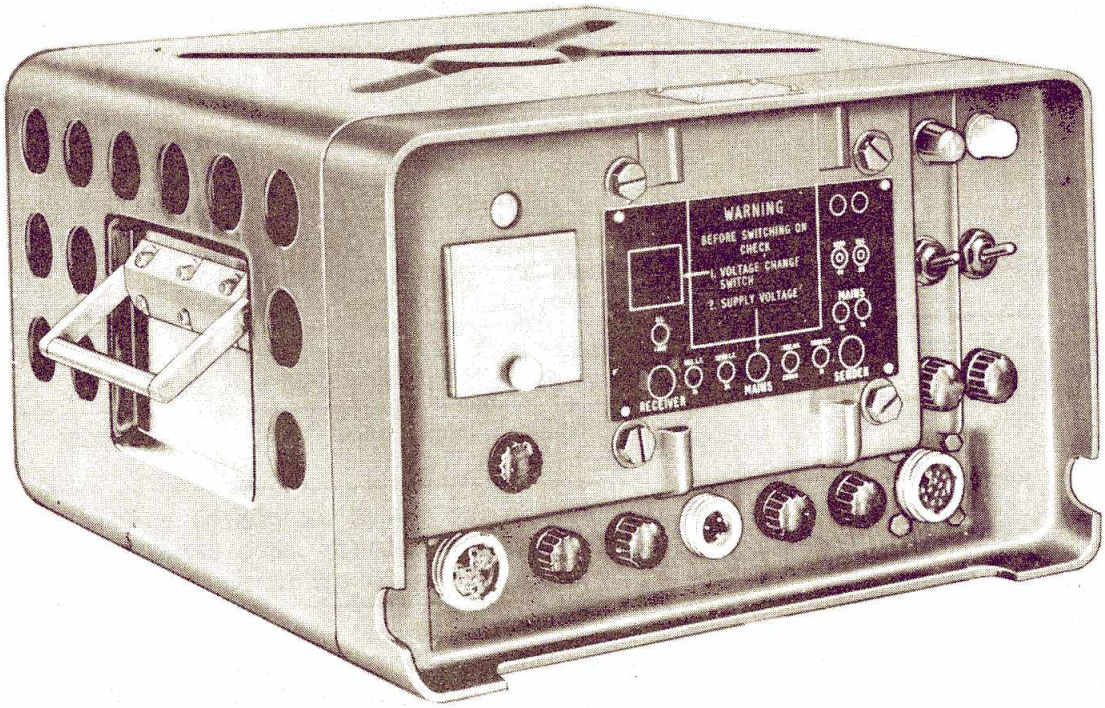


FIG.25 SUPPLY UNIT RECTIFIER No.30

stations C11/R210 to be operated by means of single phase AC mains or field generators, instead of the normal 24-volt battery supply. The input voltage must be within 100-125 or 200-250 volts, at 45-65 c/s. The unit is contained in a pressed steel case similar in construction and having the same dimensions as the Wireless sender C11.

(2) Two separate supply circuits are provided, one for the sender and one for the receiver. Each circuit can be operated separately, or both at the same time, as required. Visual indication of 'power on' is given by separate lamps.

(3) The sender supply circuit provides the following outputs: 19 volts for filaments, a rectified 24-volts DC for the operation of relays and blower motor, a stabilised 300 volts and 530 volts HT. The 300-volt supply is obtained by tapping the 530-volt line and passing through a stabilised circuit and dropping resistors. Resistors connected across the HT smoothing capacitors improve the regulation and discharge the capacitors when the unit is switched off. The receiver supply circuit provides 6.3 volts LT and 175 volts HT. When operating from AC mains the power consumption of the sender on 'send' is approximately 500 volt-amps.

(4) A hinged plate prevents accidental alteration of the input voltage change switch. Voltage setting is indicated in a window above the hinged plate.

(5) Heat generated in the supply unit is dissipated through ventilation holes in the sides and rear of the case.

(6) All controls and connector terminations are mounted on the front of the unit, the identification of each position being given on an engraved plate attached to the panel. Details are given in the following table.

TABLE 8. Supply unit rectifier No. 30

Control	Description and purpose
Sender ON-OFF Switch SG	A double-pole double-throw toggle switch connecting the mains voltage to the primary side of the sender transformer.
Receiver ON-OFF Switch SH	A double-pole double-throw toggle switch connecting the mains voltage to the primary side of the receiver transformer.
Six-position voltage change Switch SJ	A rotary switch selecting voltage taps of 100, 110, 120, 200, 220 or 240 volts.
Plug 3-pt. PLK	For a Mk 4 connector to the AC supply point
Socket 12-pt. Mk 4 SKT A SENDER	Connector for power supply to sender and intercomm amplifier. Also connects receiver phones to sender.
Socket 12-pt. Mk 4 SKT H RECEIVER	Connects HT, LT and bias supply to Reception set R210, and receiver phones brought in for looping to the sender.

Control	Description and purpose
Fuses (cartridge type)	DC - 1A (FS 128) Rec. LT - 7A (FS 131) Send LT - 5A (FS 130) Rec. HT - 250mA (FS 129) Send HT - 1A (FS 127) Mains - 7A (two) (FS 125, 126)
Send lamp (red) (ILP.125)	6 volt lamp indicates sender supply switched on
Receive lamp (white) (ILP.126)	6-volt lamp indicates receiver supply switched on.

(7) The unit measures $14\frac{1}{2}$-in. x 14-in. x $8\frac{1}{2}$-in. and weighs approximately 60 lb.

Section 22. Voltage change switch

(1) Before connecting the AC power supply unit to the AC mains supply, ascertain the correct voltage of the supply. Then refer to the table below. Note the range which includes the local mains voltage, and against it the corresponding voltage setting figure.

(2) On the supply unit, check the figure shown on the indicator above the voltage change switch. If this is the same as that shown in the table against the local voltage, the supply unit is correctly adjusted. If the supply unit is not correctly set, adjust the voltage change switch as follows:

(a) Loosen the knurled screw on the hinged red cover, and lift the cover to expose the screwdriver operated switch.

(b) With a suitable screwdriver, turn the control until the correct voltage setting figure appears on the indicator.

(c) Refit and secure the hinged cover.

TABLE 9. Voltage settings

Local mains voltage	Voltage switch setting
100-105	100
106-115	110
116-125	120
200-210	200
211-230	220
231-250	240

Section 23. Connections and operation

(1) Having adjusted the supply unit to the voltage of the local AC mains, check that both switches are at OFF (raised position). Then attach three connectors, or check that they are correctly fitted.

> Full information on inter-unit connectors is given in the user handbook for the relevant installation.

(2) When Reception set R210 forms part of the installation, connect the appropriate 12-pt. Mk 4 connector between the reception set and the RECEIVER socket termination in the lower left hand corner of the AC supply unit.

(3) Connect the appropriate 12-pt Mk 4 connector between the Wireless sender C11 and the SENDER socket termination in the lower right hand corner of the AC supply unit.

(4) Connect the 3-pt. Mk 4 mains connector to the MAINS plug termination on the panel of the AC supply unit, and to the source of AC supply.

(5) On the AC supply unit, move the SEND and REC switches to ON, and check that the associated indicator lamps glow. Turn back to Chapter 2 (page 29) for tuning and operating instructions.

NOTE: When switching on with the AC power supply unit unloaded, the LT reading on the wireless sender meter will appear unreasonably high. This is due to regulation. The reading will drop to normal when the sender is on SEND.

(6) A diagram showing detailed plug point connections for the AC power supply unit is given in fig. 26.

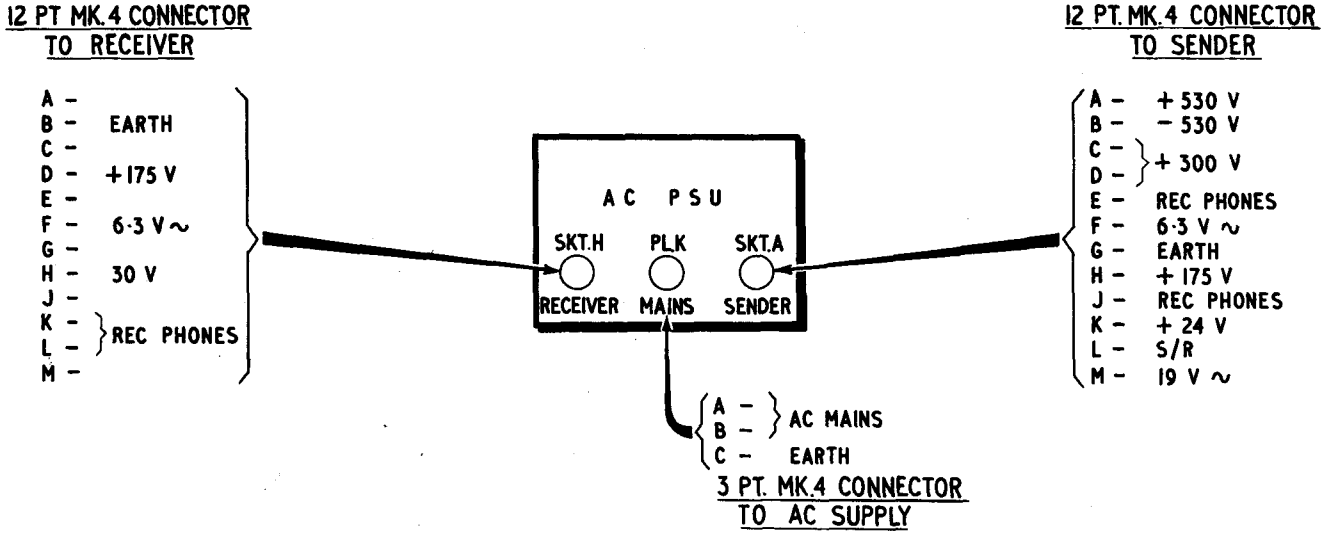


FIG. 26 CONNECTIONS TO THE AC PSU

AERIAL TUNING DATA

1) Various different arrangements of rod and wire aerials can be used with Wireless sender C11. In the table at the foot of this page is shown a list of ten different aerials and their overall frequency coverage.

(2) The setting of tune and match controls on the Aerial tuning unit No. 7 depends upon the type of aerial installed, and upon the frequency on which the sender is to be operated. In the appendix are ten charts giving detailed tune and match figures for a range of specimen frequencies within the coverage of each particular type of aerial. Consult the chart for the type of aerial in use, and make a note of the tune and match figures for the required frequency.

(3) If this frequency lies between the examples given in the chart, select the nearest tune and match figures, and then re-adjust the aerial tuning unit controls to obtain maximum aerial current in accordance with the operating instructions given in Chapter 3. See page 33.

(4) The operator should ensure that he uses the most efficient type of aerial which suits the circumstances.

Types of aerial

Aerial	Frequency coverage in Mc/s	Page
8-ft. vertical rod	2 to 16	48
12-ft. vertical rod	2 to 15	48
16-ft. vertical rod	2 to 12	49
8-ft. 'V' twin rod	2 to 14	49
12-ft. 'V' twin rod	2 to 12	50
16-ft. 'V' twin rod	2 to 10	50
Copper braid aerial	2 to 16	51
Aerial vertical, 34-ft. steel, Mk 1	2 to 6	52
Mast telescopic 27-ft.	2 to 10	52
Wire dipole aerial	3 to 16	53

Appendix - AERIAL TUNING DATA

Vertical rod aerial, 8-ft.

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2.0	2 - 4	387	19
2.5	"	455	9
3.0	"	351	9
3.5	"	284	8
4.0	"	239	7
5.0	4 - 8	178	4
6.0	"	143	3
7.0	"	117	3
8.0	"	099	2.5
10.0	8 - 16	071	3
12.0	"	052	1.5
14.0	"	037	0.5
15.0	"	028	0.5
16.0	"	009	0.1

Vertical rod aerial, 12-ft.

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	577	9
2.5	"	413	8
3	"	318	9
3.5	"	259	8
4	"	217	6
5	4 - 8	162	4
6	"	128	2
7	"	107	2
8	"	089	2
10	8 - 16	061	2
12	"	039	1
14	"	014	0
15	"	005	0
This aerial is not suitable for frequencies above 15 Mc/s.			

Appendix - AERIAL TUNING DATA

Vertical rod aerial, 16-ft.

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	519	8
2.5	"	373	8
3	"	288	8
3.5	"	235	6
4	4 - 8	197	6
5	"	147	3
6	"	114	1
7	"	094	1.5
8	8 - 16	078	1.5
10	"	047	1.5
12	"	012	0
This aerial is not suitable for frequencies above 12 Mc/s.			

Rod aerial, 8-ft. 'V' twin

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	545	5
2.5	"	393	5
3	"	303	6
3.5	"	245	8
4	"	206	7
5	4 - 8	155	5
6	"	123	2.5
7	"	102	2.5
8	"	086	2.5
10	8 - 16	059	2
12	"	034	1
14	"	008	0.5
This aerial is not suitable for frequencies above 14 Mc/s.			

Appendix - AERIAL TUNING DATA

Rod aerial, 12-ft. 'V' twin

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	470	8
2.5	"	340	8
3	"	265	8
3.5	"	216	7
4	"	180	7
5	4 - 8	135	2.5
6	"	106	2
7	"	087	2
8	"	072	2
10	8 - 16	045	1.5
12	"	010	0.5
This aerial is not suitable for frequencies above 12 Mc/s			

Rod aerial, 16-ft. 'V' twin

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	406	4
2.5	"	200	6
3	"	232	8
3.5	"	189	6
4	"	158	6
5	4 - 8	117	2.5
6	"	091	1
7	"	074	1
8	"	060	1
10	8 - 16	022	1
This aerial is not suitable for frequencies above 10 Mc/s			

Appendix - AERIAL TUNING DATA

Copper braid aerial

Note that for frequencies between 4 and 5 Mc/s alternative aerial lengths are available.

Frequency in Mc/s	Sender range switch	Aerial length in feet	ATU TUNE	ATU MATCH	ATU meter reading
2 - 2.5	2-4	93	80	0	2
2.5- 3	"	76	80	0	2
3 - 3.5	"	64	70	0	2.5
3.5- 4	"	55	100	0	3
4 - 4.5	4-8	49	100	2	3
4 - 4.5	"	150	140	2	2.5
4.5- 5	"	44	100	1.8	3.5
4.5- 5	"	132	130	1.6	3
5 - 5.5	"	121	110	1	3.5
5.5- 6	"	109	110	1	3.5
6 - 6.5	"	101	100	1	4
6.5- 7	"	94	90	1	4
7 - 8	"	84	80	1	4
8 - 9	8-16	74	70	0	4
9 -10	"	66	60	0	4
10 -11	"	58	50	0	4
11 -12	"	54	45	0	4
12 -13	"	50	40	1	5
13 -14	"	46	40	0.5	4.5
14 -15	"	43	40	0	4
15 -16	"	40	35	0	4

Appendix - AERIAL TUNING DATA

Aerial vertical 34 ft. steel Mk 1

The aerial is used fully extended

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	287	9
2.5	"	215	7
3.	"	168	6
3.5	"	138	6
4	4 - 8	114	4.5
5	"	081	2
6	"	046	0
This aerial is not suitable for frequencies above 6 Mc/s			

Mast telescopic 27-ft.

The mast is used fully extended but without the addition of antennae rod 'F' sections.

Frequency in Mc/s	Range switch	ATU Tune	ATU Match
2	2 - 4	424	2
2.5	"	315	1
3	"	248	0.7
3.5	"	198	0.2
4	"	162	0
4	4 - 8	162	0
5	"	115	0
6	"	084	0
7	"	074	0
8	"	055	0
8	8 - 16	053	0
9	"	025	0
10	"	005	0
This aerial is not suitable for frequencies above 10 Mc/s			

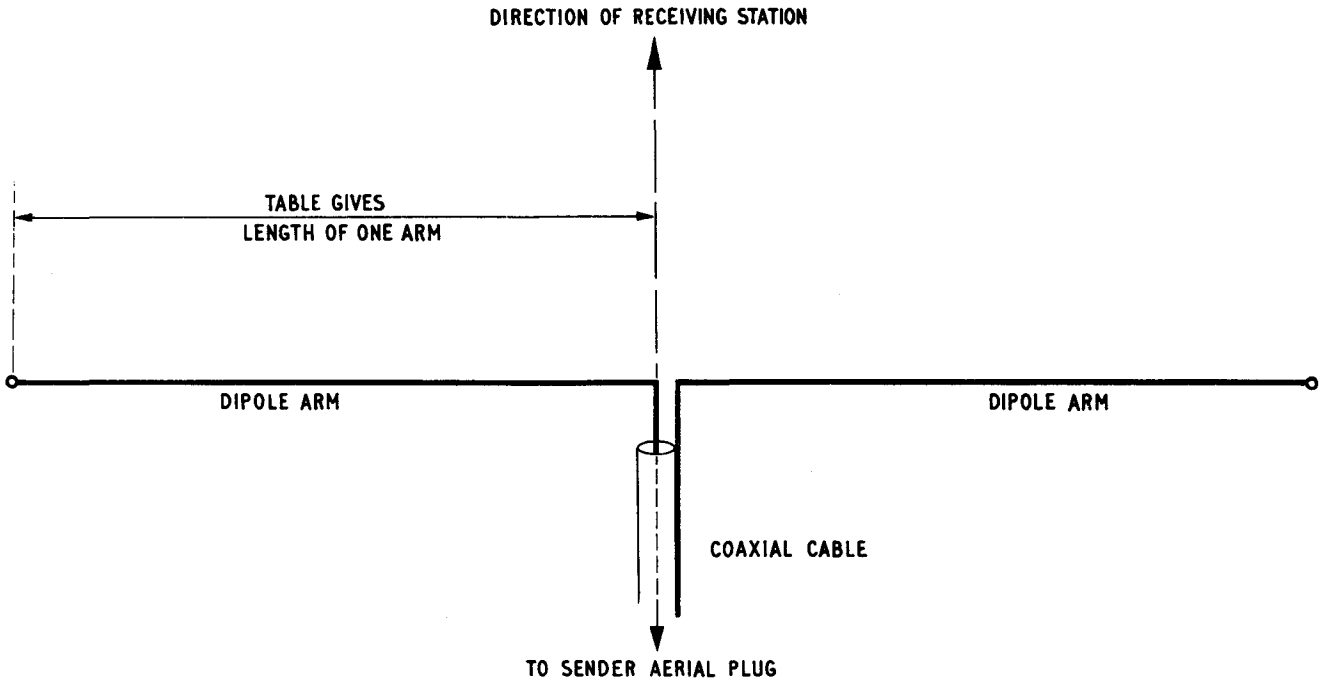
Appendix - AERIAL TUNING DATA

Wire dipole aerials

(1) A chart showing dipole lengths against frequency is given overleaf. These lengths are obtained from the formula:

$$\frac{234}{\text{Frequency in Mc/s}} = \text{Length of each dipole arm in feet}$$

(2) The diagram below shows the method of measuring the length of the dipole. This length must be correctly adjusted in accordance with the table, each arm being of equal length. Note that the table gives the length of one of the arms, and not the overall measurement.



A WIRE DIPOLE AERIAL

(3) To obtain best results the wire dipole should be erected as high as possible, and broadside to the receiving station as shown.

(4) The dipole aerial must be connected direct to the sender AERIAL plug by means of a coaxial cable. This coaxial cable should not exceed 50 feet in length. When a wire dipole aerial is being used the aerial tuning unit is not required.

Appendix - AERIAL TUNING DATA

Length of each dipole arm

Frequency in Mc/s	ft.	in.
3.0	78	
3.1	75	6
3.2	73	
3.3	71	
3.4	68	9
3.5	67	
3.6	65	
3.7	63	
3.8	61	6
3.9	60	
4.0	58	6
4.1	57	
4.2	55	9
4.3	54	6
4.4	53	3
4.5	52	
4.6	50	9
4.7	49	9
4.8	48	9
4.9	47	9
5.0	46	9
5.1	46	
5.2	45	
5.3	44	
5.4	43	3
5.5	42	6
5.6	41	9
5.7	41	
5.8	40	3
5.9	39	6
6.0	39	
6.1	38	3
6.2	37	9
6.3	37	
6.4	36	6
6.5	36	
6.6	35	6
6.7	35	
6.8	34	6
6.9	34	
7.0	33	6
7.1	33	

Length of each dipole arm

Frequency in Mc/s	ft.	in.
7.2	32	6
7.3	32	
7.4	31	6
7.5	31	3
7.6	30	9
7.7	30	6
7.8	30	
7.9	29	9
8.0	29	3
8.1	29	
8.2	28	6
8.3	28	3
8.4	27	9
8.5	27	6
8.6	27	3
8.7	27	
8.8	26	6
8.9	26	3
9.0	26	
9.1	25	9
9.2	25	6
9.3	25	3
9.4	25	
9.5	24	9
9.6	24	6
9.7	24	3
9.8	24	
9.9	23	9
10.0	23	6
10.5	22	6
11.0	21	3
11.5	20	3
12.0	19	6
12.5	18	9
13.0	18	
13.5	17	3
14.0	16	9
14.5	16	
15.0	15	6
15.5	15	
16.0	14	6

This aerial is not suitable for frequencies below 2 Mc/s.

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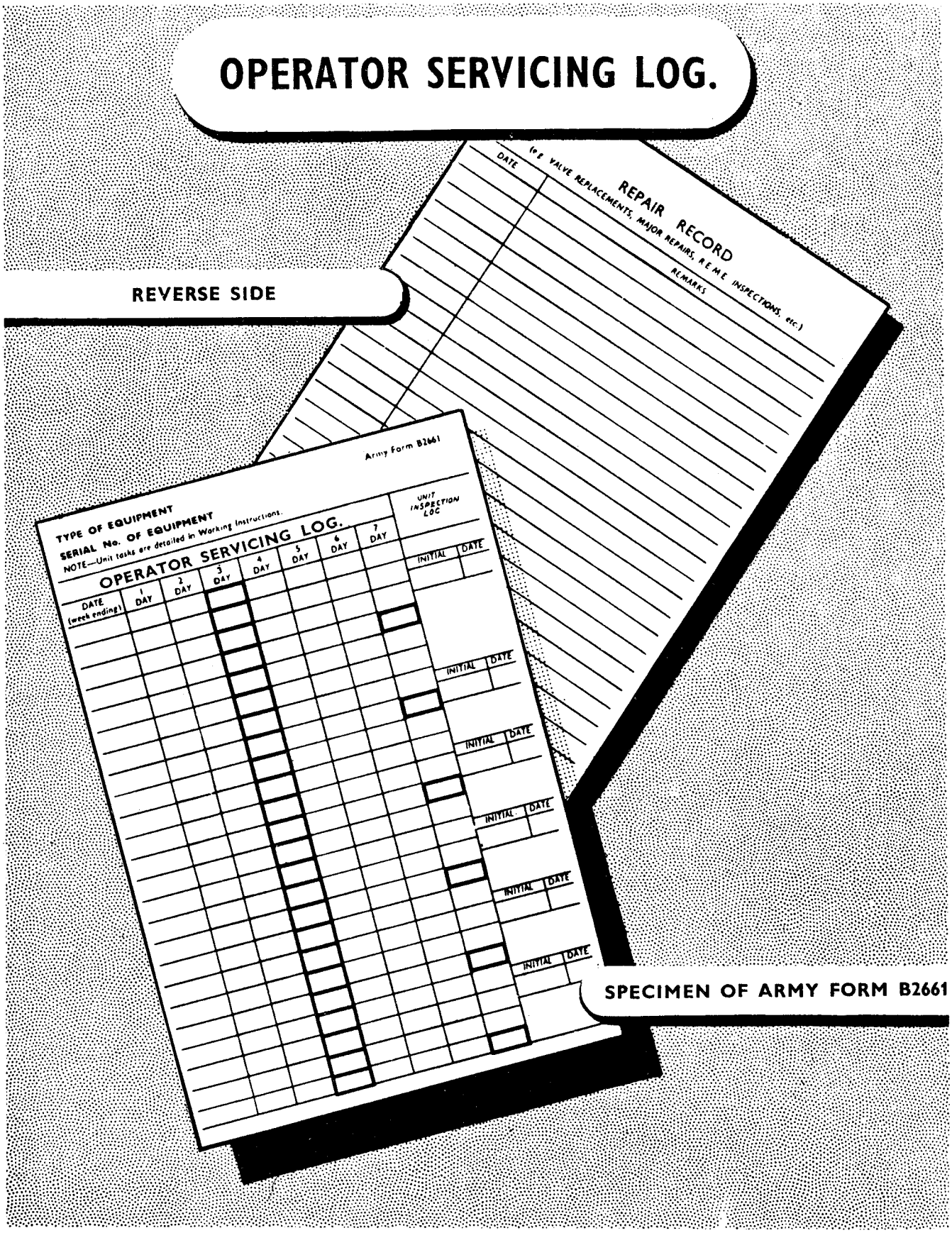
OPERATOR SERVICING LOG.



REVERSE SIDE

SPECIMEN OF ARMY FORM B2661