RX 2

TRANSMITTER T1083 RECEIVER R1082

LAYOUT FOR SHIP USE

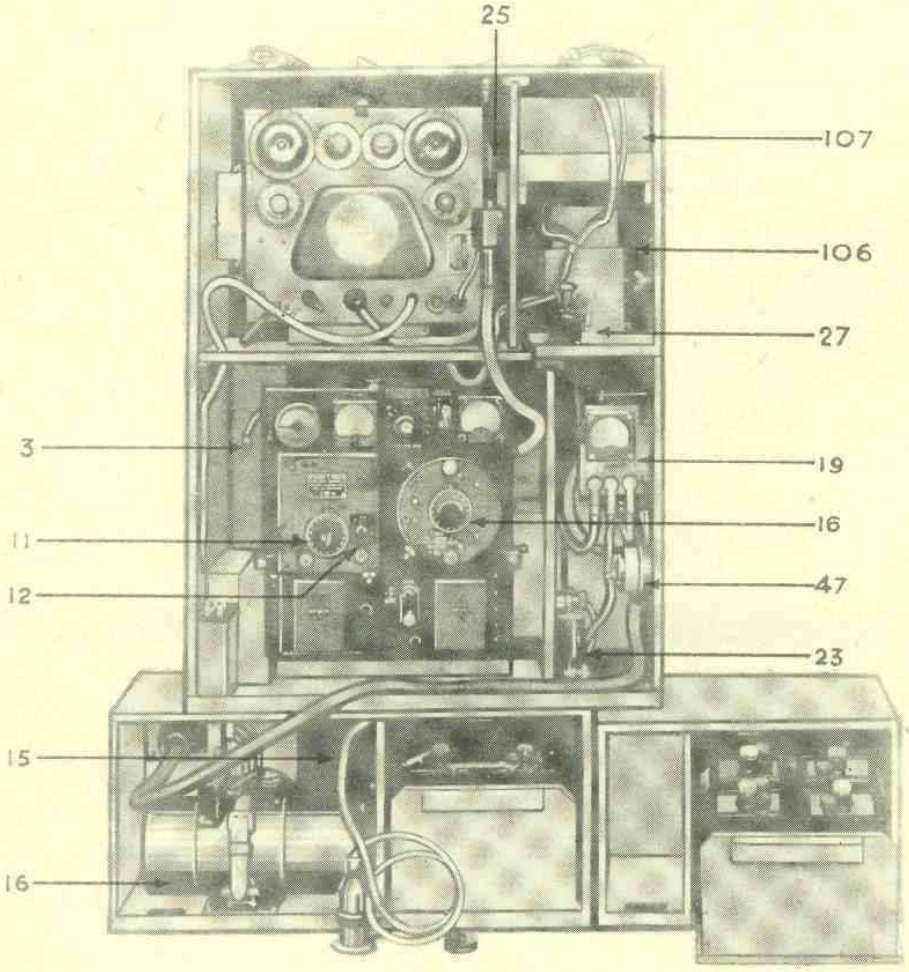

Fig. a

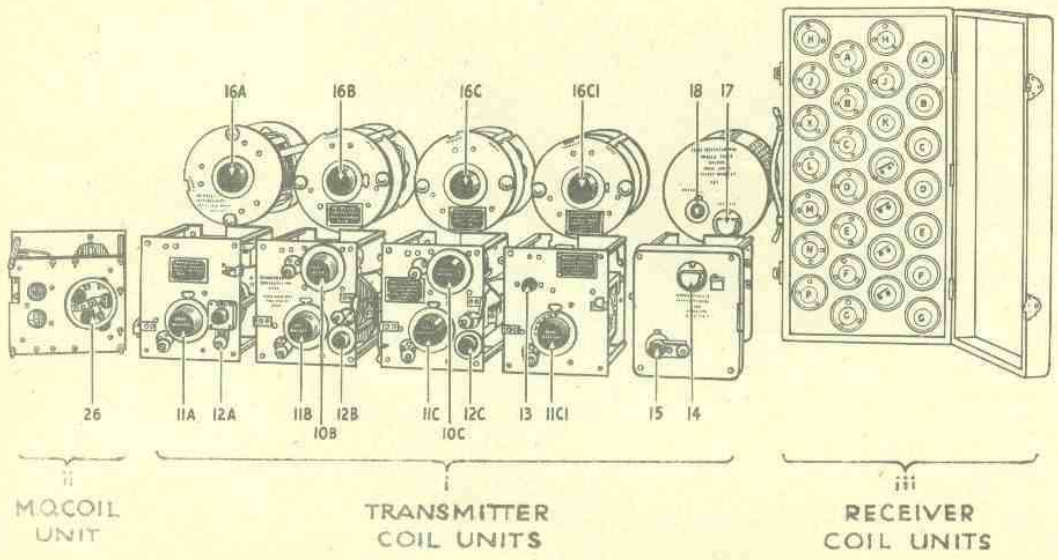

Fig. b

TRANSMITTER T1083 RECEIVER R1082 RX3

1. R.A.F. Transmitter (T1083) and associated receiver (R1082) were originally designed for use in aircraft, but have since been superseded by more modern sets.

The transmitter and receiver are, however, retained in the service as

(a) An emergency set fitted aft in Destroyers and

(b) As a transportable set for use by landing parties.

Both transmitter and receiver use plug-in coils and the frequency ranges covered are as follows :-

Transmitter	(136 - 500 kc/s. (1.5 - 15 mc/s.	Receiver 111 kc/s to 15 mc/s.

but when used as a transportable set a full outfit of coils is not provided and the ranges available are

Transmitter	1.5 - 10 mc/s	Receiver 1.5 - 12.2 mc/s.

The transmitter is Master Oscillator driven with one amplifier stage and the receiver is of the "straight" type employing reaction. Simplified diagrams are given in Figs. d, e and f.

A range of about 50 miles can be expected on the 136 - 500 kc/s band: with a suitable aerial this may be increased to 150 miles. On the higher frequencies the range is variable.

The transmitter was originally designed for transmission on C.W., I.C.W. and R/T., but provision is normally made for transmission on C.W. only, although the additional stores required for I.C.W. transmission may be found in the sets supplied to ships.

Power supplies are obtained from accumulators with a dry H.T. battery for the receiver. H.T. for the transmitter is obtained from an 80 watt battery-driven motor-generator. In the emergency set a Type F generator driven from a 24-volt supply contained in Battery Outfit B.B.E. is used while the transportable set uses a Type E generator driven from a portable 12 volt battery.

Duplicate batteries are supplied with the Transportable set and each outfit will give approximately 8 hours operation, assuming a ratio of transmission to reception time of 1 - 3. A petrol driven generator is provided for charging batteries. All the equipment supplied for the transportable set is packed into two handcarts.

Fig. a shows the equipment as supplied to a ship and Fig. c shows the transmitter and receiver as supplied for a transportable station.

2. TRANSMITTER COIL UNITS (FIG. b).

Five sets of coil units are supplied, (three only for transportable stations) each set consisting of a M.O. coil unit and an amplifier Stage Coil unit. The units are lettered A - D with an additional set lettered C1. Each coil is marked with the frequency band that it covers. The bands are as follows :-

Coil Unit	D	136 - 500 kc/s (Not supplied with transportable stations)
"	" C1	1.5 - 3 mc/s
"	" C	3 - 6 mc/s
"	" B	6 - 10 mc/s
"	" A	10 - 15 mc/s (Not supplied with transportable stations)

The M.O. Coil units plug into the left-hand compartment of the transmitter, and the Amplifier Coil units go into the right-hand compartment. Fig. c shows range B coils units in use. The M.O. Coil units have square tops with a number of controls, while the Amplifier coil units have circular tops, and with the exception of range D units, only one control. All the controls on the M.O. units are fitted with clamping nuts. A description of the controls is given in para. 3.

To assist in removing the M.O. units from the transmitter, two small arms are fitted on the top of the units and are so designed that when pressed downward together, the coil unit is forced outwards sufficiently to loosen it from the contact pins and permit it to be removed without difficulty. These arms must be upright when inserting a unit as otherwise it cannot be pressed right in.

Retaining catches for the coil units in both compartments are fitted on the transmitter panel.

With the exception of the unit for range D, the frequency band covered by each Amplifier Coil Unit is split into two parts, different contacts being used for each half of the band. Two cut-away slots are provided on the tops of the coil units and these slots engage with a guide on the transmitter panel, thus providing two positions in which the unit may be inserted.

The positions are marked A and B, A being the higher frequency position. The frequency band covered by each position is indicated against the slots, the band in use being that indicated against the slot engaged by the guide.

The M.O. Coil units for ranges A, B and C are provided with a coupling switch (26) with two positions marked A and B, which alters the number of turns in the coupling coil (12). The switch is situated on the base of the unit and the position in use must correspond with the A or B position of the Amplifier Coil i.e. if the frequency to be used requires the Amplifier coil to be inserted in position B, then the M.O. coil switch must be in position B. (See Fig. B(ii)).

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LAYOUT FOR TRANSPORTABLE STATION

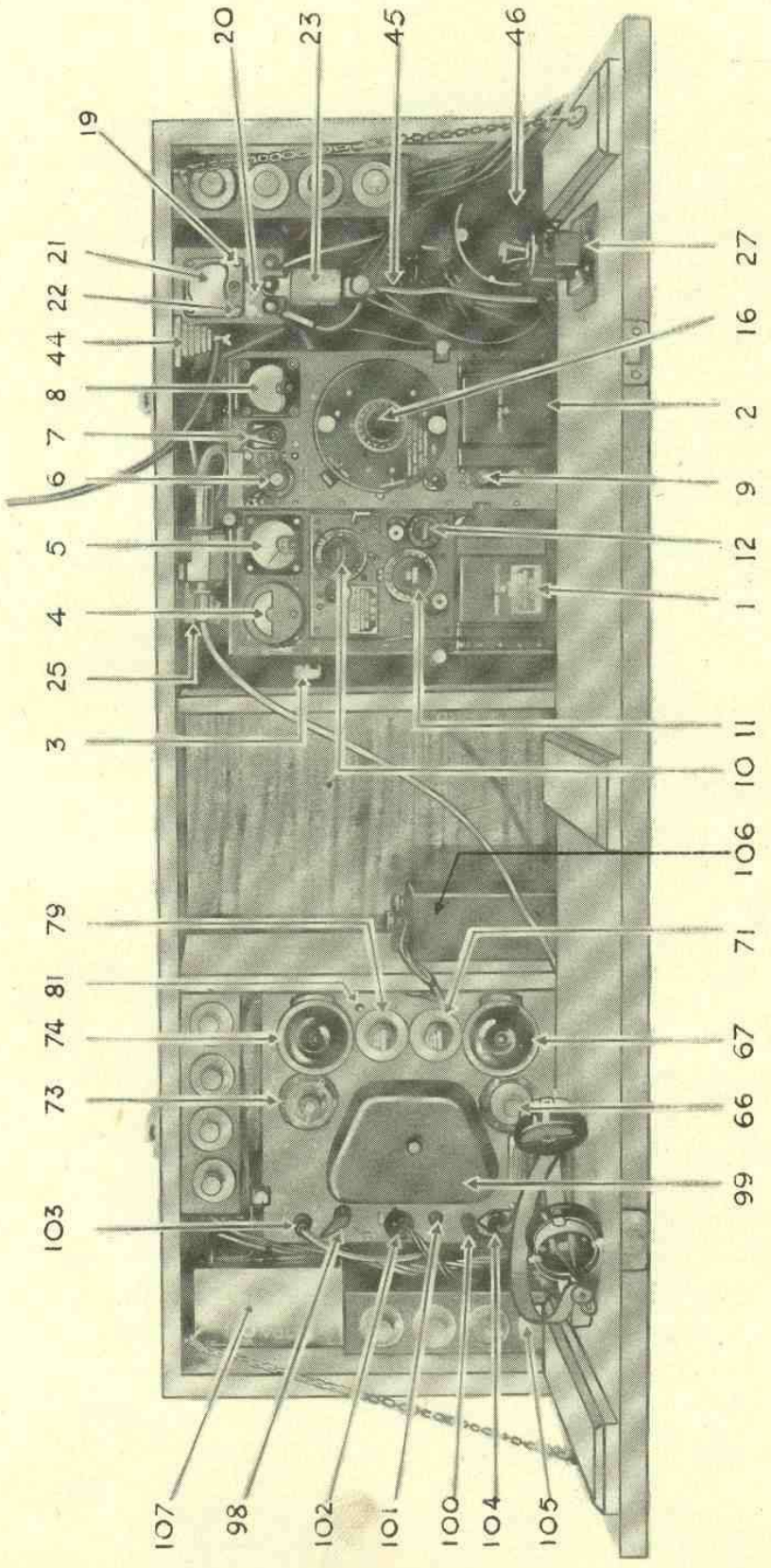

FIG. C

3. TRANSMITTER (Controls and Fittings).

The item numbers quoted should be identified on the photographs in Figs. A, B and C.

SEND-RECEIVE SWITCH (3) — A switch controlled by an arm on the left-hand side of the transmitter. When in the "send" position (up) the switch connects the aerial and power supply circuits to the transmitter and switches on the H.T. generator. When moved to the "Receive" position (down) the switch transfers the aerial to the receiver and switchns off the transmitter. (See also para. 7 "Listening Through Unit" for details of the aerial connection when the listening-through unit is in use.)

OSCILLATORY CURRENT AMMETER (4). An ammeter (0 - 3 amps) marked M.O. which indicates the oscillatory current in the M.O. circuit.

ANODE CURRENT (TOTAL INPUT) MILLIAMMETER (5). — A milliammeter (0-150 mA) marked "Total Input" which is connected in the negative H.T. lead. When the Grid Bias switch (6) is in the "Tune" position the meter registers the anode current taken by the M.O. valve; when all switches are set to the transmit position and the morse key is pressed (or the Grid Bias Switch set to "R/T") the meter indicates the total anode current taken by the transmitter valves. The meter can also be used as a tuning indicator when making final adjustments to the amplifier circuits with the amplifier valve in use, as a "dip" will occur in the meter reading when the output stage is brought into tune with the M.O. Stage.

GRID BIAS SWITCH (6) — An eleven position switch marked "Amplifier Grid Bias" which controls the bias applied to the output valve and consequently the power output of the set. The switch has two sectors marked C.W. and R/T respectively, each sector having five positions. In either sector movement of the switch from position 1 to 5 progressively decreases the grid bias and increases the power output. With the switch in the R/T positions the morse key is short-circuited and a continuous "long" i.e. the "Carrier Wave" is radiated. Positions 3, 4 and 5 on the R/T side are marked in Red and should NOT be used for R/T as in these positions a strong carrier with negligible modulation is transmitted. A middle position between the C.W. and R/T sectors is marked "Tune" and with the switch in this position the morse key is short circuited and a large bias is applied to the amplifier valve sufficient to render it inoperative. It should be noted, however, that until the set is neutralised, slight radiation will take place.

AERIAL CONDENSER SWITCH (7) — A four position switch which is used to insert up to four condensers in series with the aerial in order to increase its natural frequency, when necessary, and thereby assist in tuning the Amplifier stage. The switch is marked "Series AE Condenser" and the positions are lettered A to D. It is adjusted in conjunction with the Amplifier Tuning Control to give maximum radiation.

AERIAL AMMETER (8). — An ammeter (0 - 2.5 amps) marked "Aerial Current" which is connected in the aerial circuit and gives an indication of the current in the aerial.

NEUTRALISING CONDENSER (9). — A variable condenser with a small control knob marked "NEUT" and a drum type scale graduated from 0 - 100. The neutralising circuit in which this condenser is connected is used to prevent feed-back from the amplifier circuit and consequent interference with the stability of the M.O. as a controller of the transmitted frequency. When neutralising the condenser is adjusted until the neutralising ammeter (21) reads zero.

M.O. TUNING (11A)(11B)(11C) (11C1)(14)(15)(All M.O. COIL UNITS). — Tuning controls by means of which the M.O. circuit and hence the transmitted frequency is adjusted. On Range D coarse and fine tuning is provided.

M.O. COUPLING (12A)(12B)(12C) (M.O. COIL UNITS B & C) — Controls the coupling between the M.O. and Amplifier circuits by varying the position of the coupling coils. At the higher frequency end of the range covered by the coil in use the coupling should be loose; at the lower frequency end a tight coupling (higher dial reading) may be used.

M.O. COUPLING SWITCH (26A)(26B) (26C)(M.O. COIL UNITS A, B & C). — See para. 2.

M.O. GRID TUNING (10B)(10C) (M.O. COIL UNITS, A, B & C) — Control a varioneter in the grid circuit of the M.O. Stage and is adjusted to give a maximun reading in the M.O. Oscillatory Current Ammeter (4). The upper half of the dial is calibrated roughly in kc/s and an approximate M.O. tuning adjustment can be obtained by setting this dial to the required frequency and tuning on the M.O. Tuning Control for maximun reading in the M.O. Oscillatory Current Ammeter (4).

RANGE SWITCH (13) (M.O. COIL UNIT C1) — A two position switch which brings in an additional fixed tuning condenser in the M.O. oscillatory circuit. The switch positions are marked A & B and the range over which each position is used is marked on the unit.

AMPLIFIER TUNING (16A)(16B)(16C) (16C1)(17)(18) — Tuning controls by means of which the Amplifier Oscillatory Circuit (the aerial circuit) is tuned. On Range D coarse and fine tuning controls are provided.

TRANSMIT-TUNE SWITCH (20) — A double pole two-way switch marked "Transmit-Tune" which, in the "tune" position, connects the neutralising ammeter (21) and the pea lamp (22) in the earth lead of the transmitter.

NEUTRALISING AMMETER (21) — An ammeter (0 - 0.5) which is used when neutralising the transmitter and also when tuning, on all ranges except on range D. The pea lamp (22) is in series with the meter and acts both as a fuse and an indicating device. (See also Neutralising Condenser (9)).

SERIES EARTH CONDENSER (23) — A detachable condenser which is inserted (if necessary) in the transmitter earth lead to increase the natural frequency of the aerial circuit when using coil units A and B (i.e. on frequencies above 6,000 kc/s). The hook terminal is connected to the earth (centre) terminal on the neutralising unit (19) and the earth lead is connected to the other terminal. This condenser may not be required when using a small aerial.

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SERIES CHOKE (24).	A detachable choke which is inserted in the "Key Com" lead to prevent unwanted oscillations being set up in this part of the circuit when using coil unit C1. (i.e. on frequencies 1.5 to 3 mc/s). The hook terminal is connected to the "Key Com" (right hand) terminal on the neutralising unit and the "Key Com" lead is connected to the other terminal.
GENERATOR STARTER (45)	An electrically operated starter for the motor generator. The starter is controlled by the "send-receive" switch (3).
MOTOR GENERATOR (46)	An 80 watt - 1200 volt motor generator which is driven from the 12 volt accumulator and supplies H.T. for the transmitter.
C.W. - I.C.W. SWITCH (47)	A tumbler switch which brings into circuit an interruptor disc in the generator in order to produce I.C.W.

4. TUNING (TRANSMITTER).

The procedure for tuning is given in detail in Para. 5 and in order that the reason for the different operations may be understood the following brief outline of the requirements and how they are met is given below :-

(a) The Master Oscillator Circuit must be tuned to the required frequency in one of three ways.

(i) By putting on known adjustments (NOT a very reliable method on H/F).
(ii) By the reception method, the receiving adjustment having been obtained previously by tuning the receiver to the station it is desired to call.
or (iii) By wavemeter.

The third method might be used in a ship but in a temporary shore station a wavemeter is unlikely to be available. Of the remaining alternatives the reception method is the most satisfactory and is the one described in detail.

(b) The Amplifier tuned circuit (the aerial circuit) must be brought into tune with the M.O. circuit. This can be achieved in three ways.

(i) By rendering the Amplifier valve inoperative and feeding forward energy from the master valve. The neutralising condenser (9), which is normally adjusted to prevent this happening, is deliberately thrown out of adjustment for this operation. It follows that when the Amplifier circuit is tuned to the M.O. Circuit the feed forward will be a maximum and hence in this method the amplifier circuit is tuned for maximum reading in the neutralising ammeter (21).
(ii) The amplifier circuit can be coupled to the receiver via the listening through unit and brought into tune with the receiver. When the amplifier circuit is tuned to the same frequency as the receiver the sensitivity of the receiver will increase and signals will be louder.
or (iii) The amplifier valve can be operative and the circuit tuned for maximum radiation. This method suffers from the disadvantage that when the key is pressed with the circuit out of tune the anode current (total input) may be dangerously high and there is also a danger of tuning to a harmonic. On Range D this method has to be used but approximate adjustments may be obtained by tuning to the receiver before the key is pressed.

A combination of all three methods is used in practice.

(c) The transmitter must be neutralised to prevent the frequency stability of the master circuit being upset by feed-back from the output circuit. There is only one way to do this and it is exactly the same operation as method (i) in the tuning of the Amplifier circuit, with the addition of the adjusting of the neutralising condenser to balance out the feed forward. No provision is made for neutralising on Range D.

It should be appreciated that an alteration to almost any one of the transmitter controls will alter the frequency of the master circuit, so that constant readjustment of this circuit during tuning is necessary.

5. PROCEDURE FOR TUNING.

(a) Tune in on the receiver the station it is desired to call (see para. 8 for detailed procedure). If it is necessary to search for the station use "free receiver" i.e. listening-through unit (25) not in use.
(b) See that the "Send-Receive" switch (3) is down to "Receive" and connect up the listening-through unit, if not already in use. This has the effect of coupling the receiver to the transmitter.
(c) Insert the appropriate coil units in the transmitter, set all controls to zero, and see that the coupling switch (26) on the base of M.O. units A, B & C is set to the correct position for the frequency required, i.e. the lettered position used (A or B) must be the same as the lettered position in which the Amplifier coil has to be inserted to cover the frequency required, as determined by the ranges marked on the Amplifier coil. C1 M.O. Coil Unit has a range switch (13) on the top of the unit and this must also be set to the range required.
If using Coil units A or B see Note (i) below.
If using Coil unit C1 see note (ii).
(d) If using coil units B or C (3-10 mc/s) set the M.O. Grid Tuning (10) to the frequency required, using the calibrated half of the dial.
(e) Set the Grid Bias Switch (6) and the "Transmit-Tune" switch (20) on the Neutralising unit to "Tune". With the Grid Bias switch in this position the morse key is shorted and the Amplifier valve is biassed to such an extent as to be inoperative.

(f) Set the Neutralising Condenser (9) to zero or 100 (unnecessary if using Range D). This throws the neutralising circuit out of balance and permits "feed-forward" to take place.

(g) Obtain approximate Amplifier adjustments as follows :-
(i) Tune in any station on or near the required frequency.
(ii) Put the Aerial Condenser Switch (7) to the position which gives loudest signals. (This will always be position "D" when using range D.)
(iii) Adjust the Amplifier Tuning Control (16) to give maximum signal strength.

If no stations at all are working omit operation (g) and try all positions of the aerial condenser switch and Amplifier Tuning Control when carrying out operation (n), as outlined under Amplifier Tuning Method (i) (see para. 4). For range D only use Amplifier Tuning Method (iii) in operation (s) below.

(h) If using Coil Units A, B or C adjust the coupling control (12) in accordance with the following rough guide; If working near the higher frequency end of the range covered use a loose coupling - if near the lower end, use a tight coupling (about No. 7 or 8).

(j) See that the receiver is adjusted to the station it is desired to call and then un-plug the receiver aerial lead at the receiver. Check that the receiver is still oscillating and then turn the reaction control clockwise a small amount so as to increase the setting beyond that normally required for reception. Decrease the setting of the volume control (71).

(k) Move the Send-Receive Switch (3) upwards to the "Send" position. The H.T. Generator should start. The reading on the Total Input milliammeter should be about 20 milliamps on Range D and about 15 - 30 milliamps on the other ranges.

(l) Adjust the M.O. Tuning Controls and tune the M.O. circuit to the receiver dead-space. When using Ranges B and C adjust the Grid Tuning (10) as necessary to keep a reading showing in the M.O. Oscillatory Current Ammeter (4) i.e. keep the M.O. stage oscillating. Provided the receiver reaction and volume controls are correctly adjusted a clear C.W. note will be heard as the M.O. is brought into tune, and there will be no difficulty in tuning so that the frequency of the note heard decreases until it vanishes in the "dead-space", only to re-appear again on the other side if the tuning movement is continued.

(m) If using Ranges B or C slightly readjust the M.O. Grid Tuning (10) to give maximum reading in the M.O. Oscillatory Current Ammeter (4) and then again adjust the M.O. circuit to the receiver dead-space, if necessary.

(n) Adjust the Amplifier Tuning Control (16) for maximum reading in the Neutralising Milliammeter (21). If operation (g) was carried out correctly very little re-adjustment will be necessary. If, on Ranges A, B, C and C1, it is desired to try for better results by using another aerial condenser switch position, the direction of movement of the Amplifier Tuning in order to follow up when the switch is moved from D towards A (right to left) will be anti-clockwise (right to left) and vice versa. A hum may be heard in the telephones as the circuit is brought into tune. Should it be found that positions C or D give best results on frequencies above 6,000 Kc/s when the Series Earth Condenser (23) is in circuit (See note (1)) try removing condenser and retune. The Series Earth Condenser may not be required with a short aerial.

(o) Increase (or decrease if previously set to 100) the setting of the Neutralising Condenser (9) until the neutralising ammeter (21) reads zero or give minimum deflection. The hum referred to in (n) above will decrease as the condenser is adjusted. If correctly adjusted further movement of the condenser will increase the ammeter reading. The transmitter is now neutralised.

(p) Readjust the M.O. circuit to the receiver dead-space, if necessary, and if using coil units C1 or D lock all controls by means of the clamping nuts provided.

(q) Put the neutralising unit "Transmit-Tune" switch (20) to "Transmit" and the Grid Bias Switch (6) to C.W.1.

(r) Plug in the receiver aerial so as to be able to listen-out before pressing the morse key.

(s) Press the Morse Key (27) and make a final adjustment to the Amplifier Tuning (16) or (18) to give maximum reading in the Aerial Ammeter (8) (or alternatively minimum reading in the Total Input Milliammeter (5)). The reading on the Total Input milliammeter should not exceed 70 mA.

(t) If using Ranges A, B or C, adjust the coupling control (12) to the position of optimum coupling by decreasing the coupling until the aerial current begins to drop and then increasing the coupling slightly. It will be necessary to readjust the M.O. Tuning after altering the coupling and this must be done by again unplugging the receiver aerial, pressing the morse key and tuning to the receiver dead-space. It may also be necessary to make a slight adjustment to the amplifier tuning (16) to give maximum aerial current. On completion lock all controls by means of the clamping nuts provided and plug in the receiver aerial lead.

(u) Adjust the grid bias switch (6) as necessary, to give the output required. C.W.1 is the position of lowest power and C.W.5 the highest. Never use more power than the circumstances require.

(v) If using R/T set the Grid Bias Switch (6) to R/T 1 or 2 (never use studs 3, 4 and 5, which are marked in red). Speak into the microphone and check that a "kick" occurs in the Aerial Ammeter reading. This will indicate that the carrier wave is being modulated.

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NOTE :

(i) For frequencies above 6,000 Kc/s (coil units A & B) insert the series Earth Condenser (23) (unless known to be unnecessary in the earth lead on the Neutralising Unit.) The hook terminal goes to the centre terminal on the unit and the earth lead displaced goes to the other terminal on the condenser. This condenser is not likely to be required with a small aerial.

(ii) For the range 1.5 - 3 mc/s (coil unit C1) insert the series choke (24) in the "Key Com" lead on the Neutralising Unit. The hook terminal goes to the right hand terminal on the Neutralising Unit, and the lead displaced goes to the other terminal on the choke.

(iii) If the M.O. adjustments are taken from a chart, or are obtained by using a wavemeter, the tuning procedure will follow the same lines as detailed above, the known adjustment taking the place of that obtained by tuning to the receiver dead-space.

(iv) When the listening-through unit is in circuit the receiver must always be switched on during transmissions, in order to bring into operation the limiter valve, which acts as a safe device for the receiver.

(v) Some radiation will take place all the time a "feed forward" current reading is showing in the neutralising milliammeter prior to neutralising, and it must not be assumed that this is a safe method of tuning when W/T silence is in force.

(vi) When switching from "send" to "receive" take care that the "send-receive" switch arm is pushed right down to the "Receive" position and not left midway in the "Off" position.

(vii) The M.O. Tuning dials are so graduated that an increase in dial reading produces a decrease in frequency.

6. RECEIVER PLUG-IN COILS.

The receiver frequency range of 111 kc/s to 15 mc/s is covered by means of fourteen sets of plug-in coils. (7 sets only in transportable outfits, giving a frequency range of 1.5 - 12.2 mc/s).

In each set are two coils, one marked "Anode" and painted green and the other marked "Aerial" and painted red. The coils are lettered A - P (omitting I and O). In sets of later manufacture, Coil H is replaced by a coil H1, which is fitted with a switch with two positions covering ranges 1500 - 1800 kc/s and 1800 - 3000 Kc/s. This coil was introduced at the same time as C1 Range coil unit in the transmitter, in order to cover the band 1.5 - 3 mc/s with one set of receiver coils.

The frequency ranges covered by the coils are as follows :-

A	15 - 12.2 mc/s *		H	2.5 - 1.5 mc/s.	
B	12.2 - 9.5 "		J	1500 - 1200 kc/s)	
C	9.5 - 8.5 "		K	1200 - 785 kc/s)	
D	8.5 - 7		L	785 - 470 kc/s)	*
E	7 - 6		M	470 - 280 kc/s)	
F	6 - 4		N	280 - 170 kc/s)	
G	4 - 2.5		P	170 - 111 kc/s)	
H1	3 - 1.5				

* not supplied with the transportable station.

These ranges are marked on the inside of the valve cover on the receiver but coil H1 range is not always included. (Coils A, J, K, L, M, N, P, are not supplied with transportable sets). Some of the range coil boxes carry a plate on the side of the box giving details of the ranges. Aerial Coils L, M, N and P are fitted with a two-pin socket which was originally provided for connecting up a D/F Loop Aerial in aircraft. J and K Aerial coils are sometimes supplied with these sockets and when so fitted the coils are marked J* and K*. (See Fig. B(iii)).

7. RECEIVER. Controls and Fittings.

The item numbers quoted should be identified on the photograph in Fig. C.

ANODE COIL (73) — A plug-in coil which completes the tuned anode circuit of the 1st valve. Anode coils are painted green.

ANODE TUNING (74) — The principal tuning control on the receiver. The dial is fitted with a slow-motion device and controls a condenser in the anode circuit of the 1st valve. Tuning is sharp.

REACTION CONTROL (79) — A potentiometer which varies the H.T. voltage applied to the detector valve. When the knob is turned clockwise the detector valve can be made to oscillator and this oscillatory condition is used to provide local oscillations for C.W. reception. The reaction control is also used to improve selectivity and sensitivity.

VOLUME CONTROL (71) — A potentiometer which varies the H.T. voltage applied to the screen of the 1st valve, thereby controlling the gain of the valve.

AERIAL TUNING (67) — The aerial circuit tuning condenser. Tuning is relatively flat.

AERIAL COIL (66)	A plug-in coil which completes the Aerial circuit. Aerial coils are painted red.
COVER FOR VALVES (99)	This cover can be removed by unscrewing the centre nut. Underneath are the five receiving valves. On the inside of the cover is a list of the frequency ranges of the plug-in coils.
AERIAL PLUG-IN POSITIONS (104)(105)	Alternative aerial plug-in positions giving tight or loose coupling to the receiver. Each position connects the aerial to the receiver through a condenser, a small capacity being used for the loose coupling position and a larger capacity for the tight coupling.
TELEPHONE JACK (100)	Connection for telephones.
I/C JACK (101)	A plug-in position for inter-communication in aircraft.
POWER PLUG AND SOCKET (102)	A plug fitting which connects the H.T. and L.T. power supplies to the receiver.
ON-OFF SWITCH (98)	A double pole two-way switch which makes and breaks the H.T.+ve and L.T.+ve leads. Care should be taken to see that the switch is to "OFF" when the receiver is not in use in order to conserve battery supplies.
EARTH CONNECTION (103)	A plug connection for the receiver earth lead. The lead is taken to the earth terminal on the neutralising unit (19).
LISTENING THROUGH UNIT (25)	A small unit of moulded material provided with three connections. Two of these connections are taken to the transmitter and one to the receiver. When they are connected in this way the receiver is permanently connected to the aerial via a fixed condenser incorporated in the unit and when transmission is in progress the operator is able to receive during pauses in his transmission, i.e. he is able to listen-through.

During reception the transmitter aerial inductance (tuned to the same frequency) is connected to the receiver aerial inductance resulting in an increase in sensitivity and selectivity beyond those normal to the receiver.

To prevent damage to the receiver during transmission a limiting valve (55) is connected across the receiver input circuit and for this reason the receiver must always be switched on when tuning the transmitter with the listening-through unit in circuit.

Listening-through is not possible when transmitting R/T.

By removing the milled receiver aerial plug from the listening-through unit and mating it with the milled socket connected to one of the transmitter leads, the receiver is connected directly to the send-receive switch and is then completely disconnected from the aerial when transmitting. This manner of connecting up the receiver is referred to as giving a "free receiver". (See Fig. d).

8. <u>OPERATION</u> (RECEIVER)

(a) Plug in the aerial and anode coils which cover the required frequency. A table showing the frequency range covered by each coil is printed inside the valvecover situated on the front of the receiver panel.

(b) Insert the receiver aerial plug in the tight coupling position (60) on the receiver and connect the other end of the aerial lead to the listening-through unit if the listening-through unit is to be used. If "free receiver" is required connect the aerial lead to the milled plug which is on one of the two leads running from the transmitter to the listening-through unit. "Free receiver" should be used when searching (See para. 7 above).

(c) See that the earth plug (103) and power supply plug (102) are in position and that the H.T. and L.T. batteries are connected up.

(d) Put the battery switch (98) to the "ON" position. The dial lamps should light up. Put on the telephones.

(e) Turn the volume control (71) clockwise to the maximum volume position.

(f) Starting with the reaction control (79) turned fully anti-clockwise <u>slowly</u> increase reaction by turning the control clockwise until the receiver starts to oscillate. This will be indicated by a "plop" in the telephones and a slight rushing sound. To check that the receiver is oscillating place a finger momentarily on the oscillation testing pin (81) situated close to the reaction control. A "click" indicates that it is oscillating. The receiver normally has a quiet background and a low "noise level" does not indicate that the receiver is faulty or insensitive.

(g) Tune on the aerial and anode condensers (67) (74), keeping the dials in step and slightly readjusting the reaction control, as necessary, to maintain oscillations, until the desired signal is heard. The anode tuning is sharp and the aerial tuning relatively flat. Searching, especially on the higher frequencies, should be carried out by means of the slow motion anode tuning dial, the aerial circuit being subsequently brought into tune.

TRANSMITTER TIO83 RECEIVER RIO82

SIMPLIFIED DIAGRAM OF TRANSMITTER TIO83 SHOWING RANGES B & C

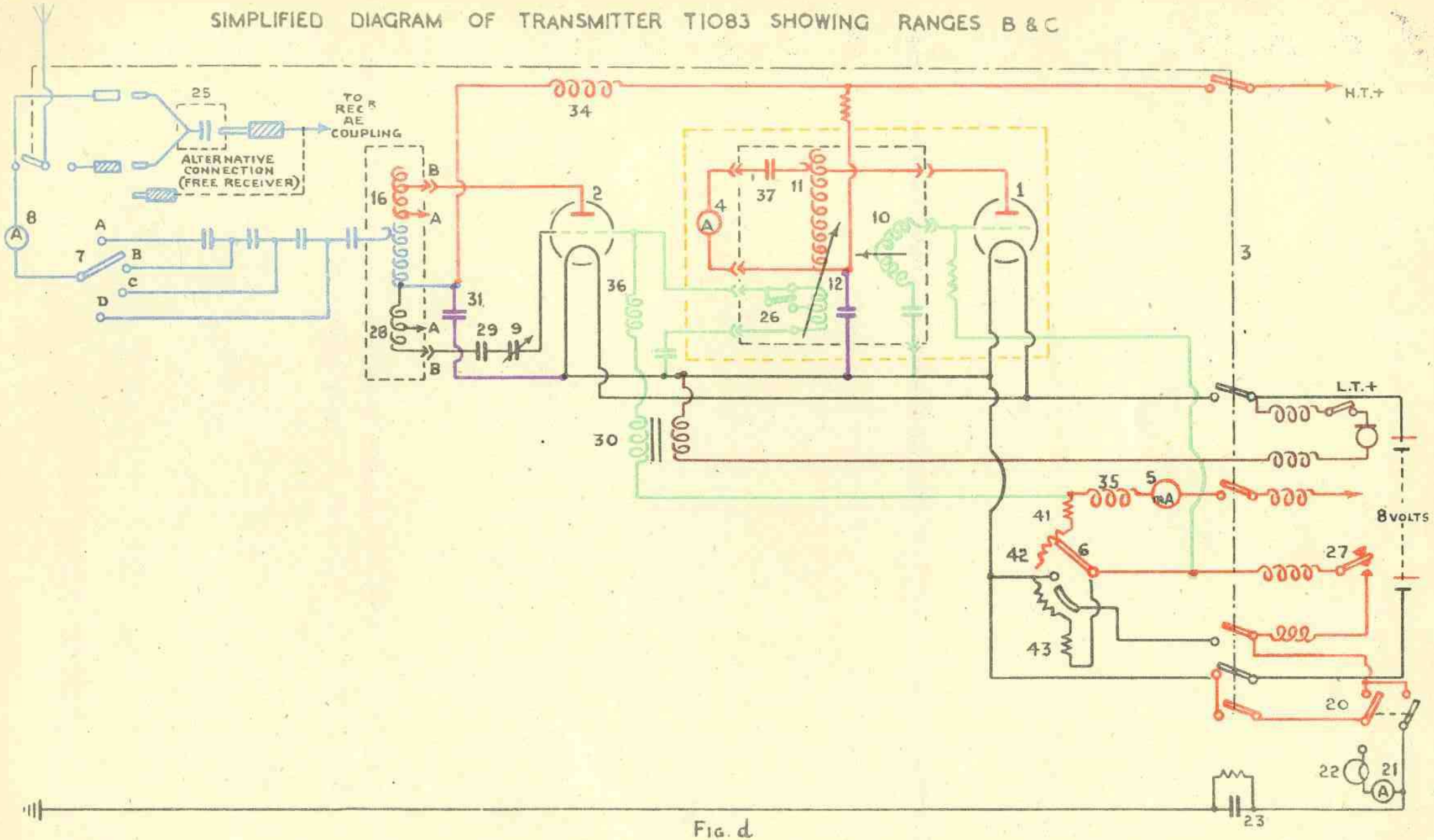


Fig. d

(h) If a strong signal is being received an increase in selectivity can be obtained by first reducing the signal strength by means of the volume control (71) and then increasing the strength by careful adjustment of the reaction control (79). The volume control should be used to limit very strong C.W. signals as otherwise there is a possibility that the local oscillations may be "pulled into step" with a consequent loss of the heterodyne note. For very strong signals use the alternative (loose coupling) aerial terminal to obtain maximum selectivity. A re-adjustment of the aerial tuning condenser will be necessary if the aerial coupling is changed.

(j) If a weak C.W. signal is being received maximum sensitivity is obtained when reaction is reduced to the lowest value which will maintain oscillations. Make a final slight adjustment of the tuning controls after re-setting the reaction control.

(k) If a weak I.C.W. signal is being received on the higher frequencies set the volume control to maximum and the reaction control so that the receiver is on the verge of oscillation. Under these conditions the correct tuning of the aerial circuit will be accompanied by a tendency of the receiver to oscillate. When this indication (that the aerial and anode circuits are in tune) is obtained, reduce the reaction as necessary.

(l) If the signal being received is R/T or strong I.C.W. decrease the reaction until the receiver is just not oscillating, readjusting the tuning as necessary.

NOTE : Care must be exercised in using the reaction control that excessive reaction does not occur. Excessive reaction will produce a loud howl.

BRIEF TECHNICAL DETAILS.

(Further details will be found in Air Publication 1186, Section I, Chapter 5 and Section 3, Chapter 2).

9. TRANSMITTER. GENERAL DESCRIPTION.

The transmitter consists of a Master Oscillator Stage and one Amplifier Stage. Frequency ranges of 136 - 500 kc/s and 1.5 - 15 mc/s are covered by five sets of plug in coil units. The type of circuit employed changes with the coil unit in use and details are given in paras. 11 to 15 below.

Two type VT25 valves (8 volt 2.2 amps) are used.

A switch (7) is provided on the transmitter by means of which one, two or three small condensers may be included in the aerial circuit to raise its natural frequency. Position A gives the highest, and Position D the lowest natural frequency.

External to the transmitter a further condenser (23) may be connected in the earth lead when difficulty is experienced in reaching the highest frequencies. This condenser is shunted by an inductive resistance so that no steady charge can accumulate. Such a charge would raise the chassis of the transmitter to a potential other than earth potential.

The neutralising winding (28) is provided to prevent feed-back in the amplifier circuit. (See Admiralty Handbook of W/T (1938) Vol. II para. K40). The winding is connected back to the grid of the amplifier through the fixed condenser (29) and the variable condenser (9) and neutralisation is effected by adjustment of the condenser (9). The fixed condenser is connected in series to prevent damage in the event of an accidental short-circuit in the variable condenser.

Keying is effected by joining H.T. negative to L.T. negative through the bias unit as shown in Fig. D. It will be seen that the oscillator is keyed as well as the amplifier.

The chokes (34)(35) in the H.T. positive and negative leads are for the purpose of preventing R/F energy from reaching the generator, and also to prevent any tendency for this circuit to resonate. The choke (36) in the grid circuit ensures that the R/F drive from the oscillator is not short-circuited via the microphone transformer and the bias circuit.

For R/T, modulation is effected by connecting the secondary of a microphone transformer (30) in series with the amplifier grid-bias arrangement. There is thus imposed on the steady grid bias a component which alternates at speech frequency (see Admiralty Handbook of W/T (1938) Vol. II para. N23).

A circuit diagram of the transmitter showing ranges B and C is given in Fig. D and simplified diagrams showing ranges A, C1 and D are given in Fig. E.

10. POWER SUPPLY.

H.T. supply is obtained from an 80-watt motor-generator (25)(80 mA. 1200 volts) driven from a battery while the 8-volt filament supply is obtained from four 2 volt accumulators (49) connected in series.

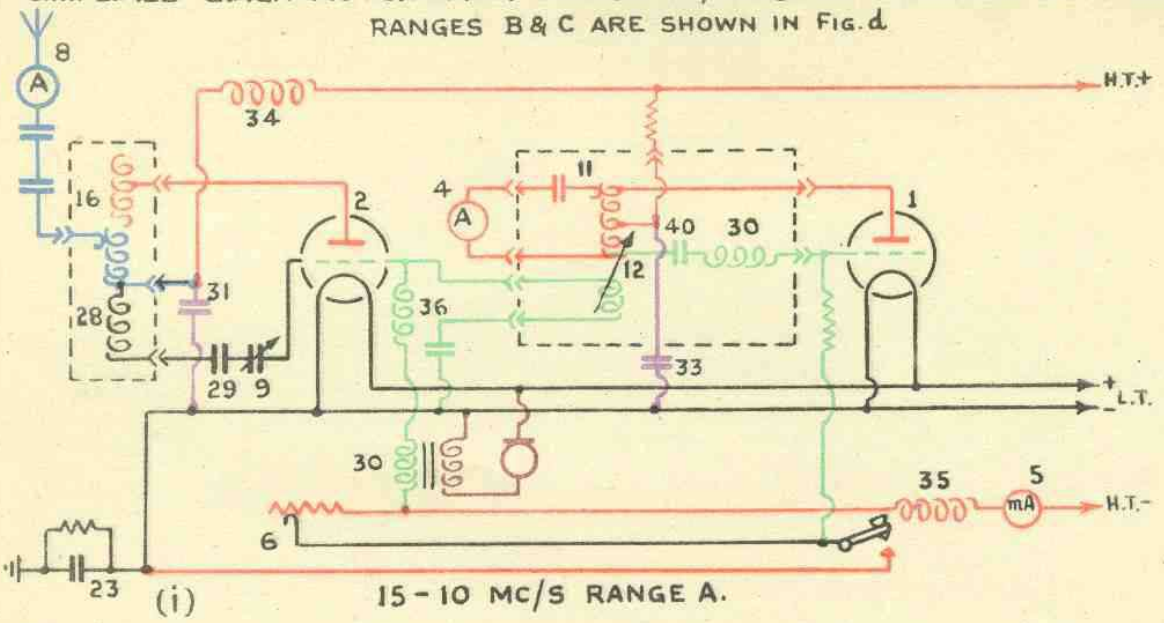
In ship installations, a Type F motor-generator is used and is driven from a 24-volt battery contained in Battery Outfit BB2. Transportable sets use a Type E motor-generator which requires only 12 volts input and this is obtained from a portable battery.

The receiver filament supply is obtained from a separate 2-volt accumulator (106) and a 120-volt dry battery (107) is used to provide H.T. (see also para. 1).

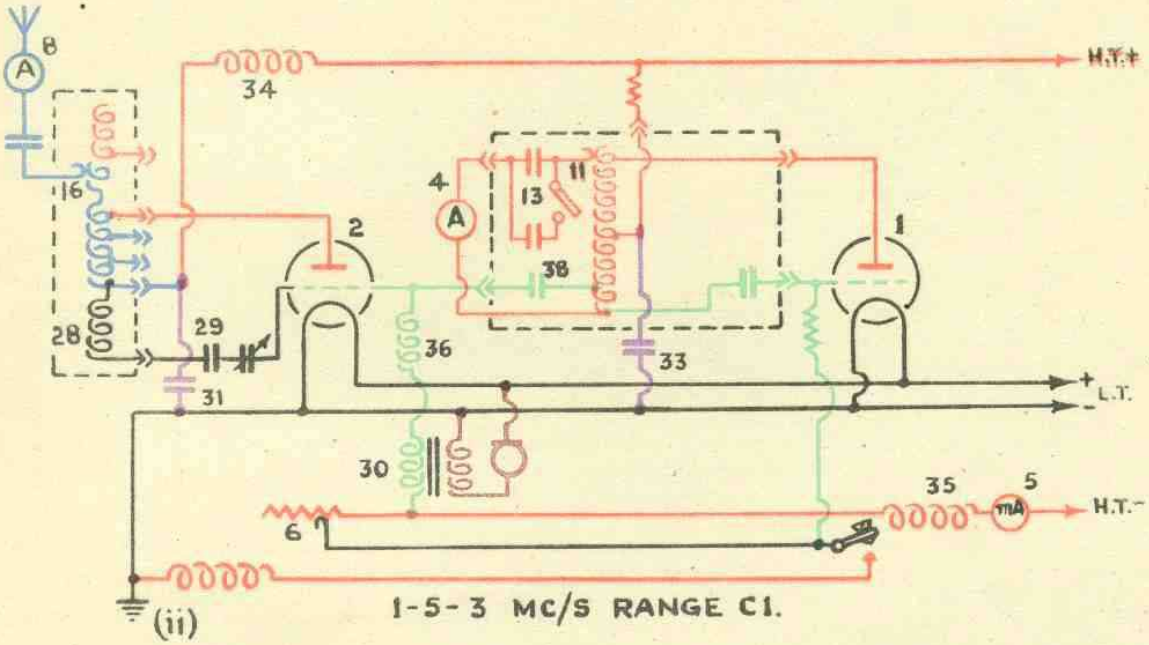
TRANSMITTER T1083 RECEIVER R1082

SIMPLIFIED DIAGRAMS SHOWING RANGES A, C1 & D. OF TRANSMITTER T1083

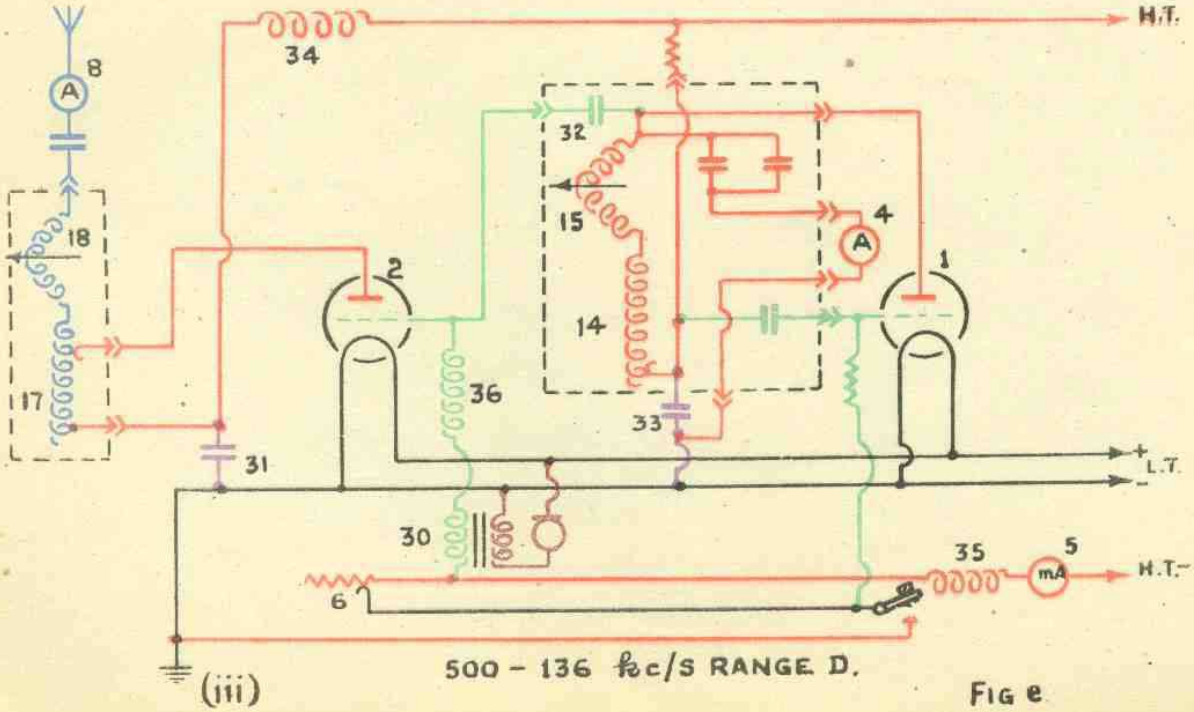
RANGES B & C ARE SHOWN IN Fig. d



(i) 15 - 10 MC/S RANGE A.



(ii) 1-5-3 MC/S RANGE C1.



(iii) 500 - 136 kc/S RANGE D.

Fig e

11. TYPE OF CIRCUIT.

Range	Master		Amplifier	
	Oscillator Circuit	Grid Excitation	Oscillator Circuit	Grid Excitation
A	Between Anode and Grid (Hartley Oscillator)	Direct inductive via blocking condenser.	Between Anode and filament.	Mutual Inductive from Master Circuit. (Variable)
B & C	Between Anode and filament.	Via Cga of valve controlled by partially tuned grid circuit.	Between Anode and filament.	Mutual Inductive from Master Circuit. (Variable).
C1	Between Anode and Grid (Hartley)	Direct inductive (via blocking condenser)	Between Anode and filament.	Direct inductive via coupling condenser.
D	Between Anode and Grid (Colpitts Osc)	Capacitive	Between Anode and filament.	Capacitive

12. RANGE D. (See Admiralty Handbook of W/T (1938) Vol. II para. K9)

Referring to Fig. E(iii) it will be seen that on the lower frequencies the master oscillator circuit is a Colpitts oscillator in which reaction is obtained by applying the R/F p.d's of the by-pass condenser (33) between grid and filament. The inductance is tapped and a fine tuning variometer (15) is included. The amplifier circuit incorporates a tapped coil (17) and fine tuning variometer (18). The coupling between amplifier and master-oscillator is through a coupling condenser (32). A neutralising arrangement is not provided on this frequency band.

13. RANGES B AND C.

Fig. D shows the circuit for Ranges B and C. It will be seen that the oscillator becomes a tuned-anode partially tuned-grid circuit in which reaction is obtained through the anode-grid capacitance of the valve. The anode inductance is shunted by a condenser (37) through a variable tapping point (11). The grid circuit is tuned by a variometer (10). The amplifier circuit incorporates an inductance with a variable aerial tap (16) and a neutralising winding (28). The coupling between amplifier and master oscillator is provided by the coupling coil (12).

14. RANGE C1.

The circuit for range C1 is shown in Fig. E(ii). The master oscillator circuit is a series Hartley, the inductance between anode and grid being shunted, through a variable tapping point (11), by a fixed condenser, or two condensers in parallel as determined by the position of the range switch (13). (See Admiralty Handbook of W/T (1938) Vol. II K7 and K24).

The amplifier circuit is similar to that in Ranges B and C except that the grid of the amplifier valve is connected by a condenser (38) to a tapping point on the master circuit inductance.

15. RANGE A.

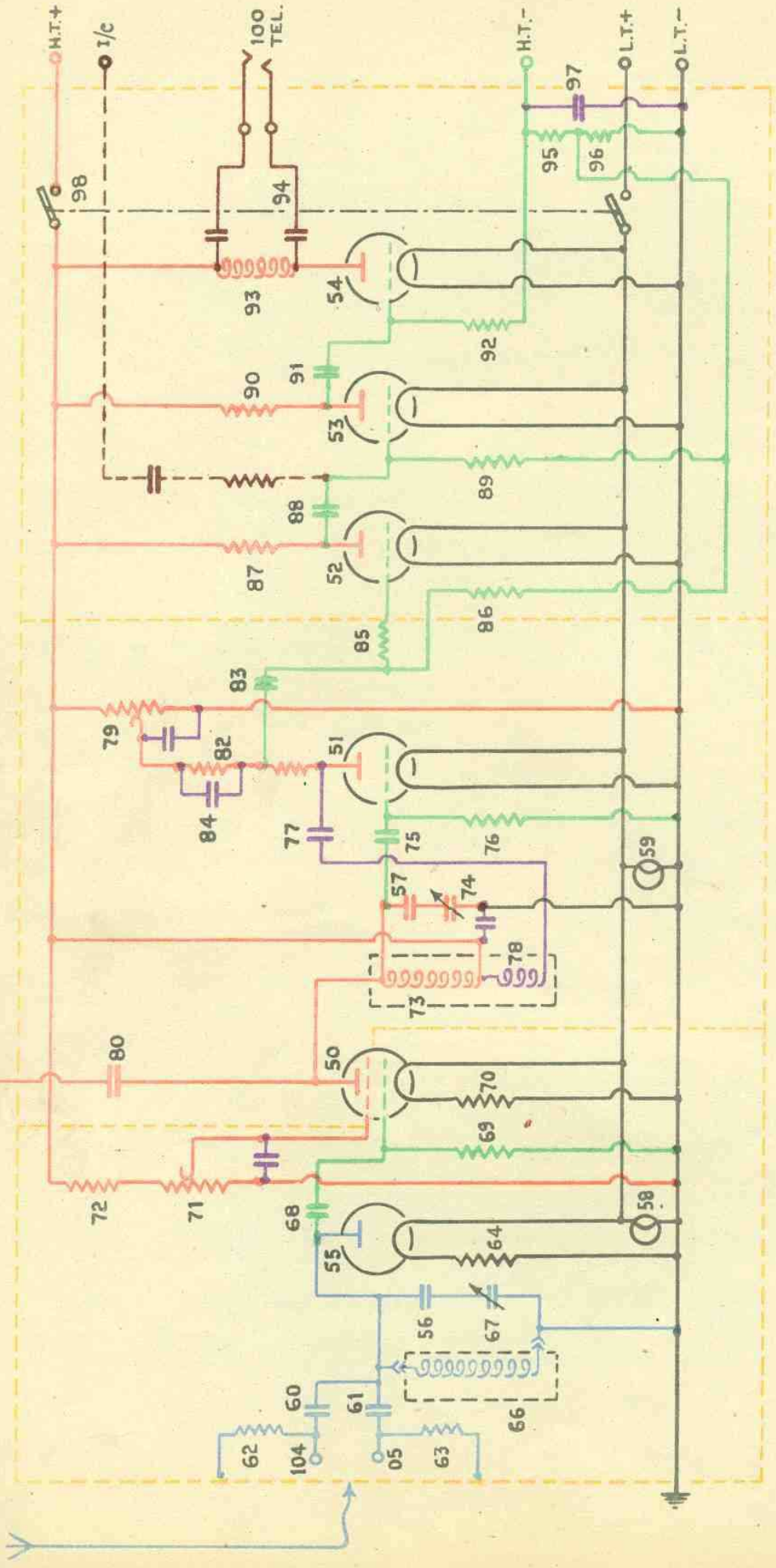
For range A (Fig. E(i)) the amplifying circuit remains the same as for B and C (an inductance with a variable aerial tap and a neutralising winding) but the master oscillator circuit is now changed to a form of Hartley circuit, the anode inductance being shunted by a condenser through a variable tapping point (11), and the grid circuit being coupled to the end of the inductance through a choke (30) and condenser (40).

16. BIAS CONTROL.

The way in which grid bias is controlled is shown in Fig. D. A suitable fraction of the resistances (41)(42)(43) is connected between H.T. negative and filament, and the IR drop across these resistances is used as grid bias. The resistance (41) is always in circuit; it ensures that the bias will never fall below a safe minimum value. The switch arm (6) selects a tapping on resistance (42) and includes a suitable fraction of (42) in series with (41). When the arm is moved into the position "TUNE" the resistance (43) is put in series with resistances (41) and (42). In this position the bias is so great that the amplifier valve is inoperative.

The arm has ten positions marked C.W., 1, 2, 3, 4 and 5 and R/T 1, 2, 3, 4 and 5 respectively. As the arm is moved from stud 1 to stud 5 in either the C.W. or the R/T quadrant the bias is progressively decreased and the input and output of the amplifier are correspondingly increased. When the arm is moved into any of the five R/T positions it not only selects a suitable steady bias but also short-circuits the key.

TRANSMITTER T1083 RECEIVER R1082



SIMPLIFIED DIAGRAM OF RECEIVER R1082

Fig. 5.

17. NEUTRALISING UNIT.

A neutralising unit consisting of a double pole two-way switch and a sensitive thermo-ammeter in series with a pea lamp is connected in the earth lead external to the transmitter. The pea lamp serves both as a visual indicator and a fuse. In the "Transmit" position the switch connects the transmitter filament negative lead to earth; in the "Tune" position the filament circuit is connected to earth via the ammeter and pea lamp.

18. GENERATOR STARTER.

The generator starter consists of two electro-magnetic switches, one being double-pole and the other single-pole, and a resistance element of .220 ohm. When the send-receive switch is put to send the solenoid operating the double-pole switch is energised from the 12 volt accumulator. Both contacts close, and the 12-volt supply is connected across the motor-generator (the resistance being in series with the L.T. armature) and the motor-generator starts up. The solenoid of the single-pole switch is connected across the L.T. armature of the motor-generator and as the motor-generator speeds up the voltage across the armature increases. When it reaches about 8 volts, the single-pole switch closes and short-circuits the series resistance element thus allowing the motor-generator to run up to full speed. When the Send-Receive switch is put to "OFF" or "Receive" the solenoid of the double pole switch is de-energised and the switch opens thus breaking both sides of the supply to the motor generator.

19. RECEIVER. GENERAL DESCRIPTION.

A five valve circuit is employed, comprising a screen-grid R/F amplifying valve (50) a triode detector (51), two A/F amplifying valves (52) and (53) and an output valve (54). A limiter valve (55) is included to prevent the receiver from being damaged by transmissions from the T1083 when the listening-through unit is in use. This valve is situated inside the receiver and is not accessible from the front.

The frequency range of 111 kc/s to 15 mc/s is covered by a number of plug-in coils (see para. 6). A circuit diagram of the receiver showing the aerial and anode coil circuits for coils A, B, C, D and E is given in Fig. f. When using any of the remaining coils, spreader condensers (56) and (57) are not in circuit. In addition coils J*, K*, L, M, N & P introduce further slight circuit changes. The aerial coils have iron cores and separate aerial coupling coils with centres earthed. The ends of the coupling windings are brought out to socket connections on the tops of the coils and enable a screened loop to be used for D/F. Anode coils L, M, N and P have their inductances split into two portions, the anode of valve (50) being tapped at the junction of the two positions.

Power Supplies are obtained from a 120 volt dry H.T. battery (107) and a 2 volt accumulator (106). Two panel lights (58) and (59) are connected across the filament circuit.

20. VALVES AND METHODS OF COUPLING.

R/F Amplifier (50)	VR18 Screen-grid - Tuned Anode Capacity
Detector (51)	VR27 Triode - Resistance Capacity
1st A/F Amplifier (52)	VR21 Triode - Resistance Capacity
2nd A/F Amplifier (53)	VR21 Triode - Resistance Capacity
Output Stage (54)	VR22 Triode - Choke Capacity to Telephones
Limiter valve (55)	VU33 Diode

21. AERIAL CIRCUIT.

Two alternative aerial connections (104) and (105) are provided, one of which connects the aerial inductance to the aerial through a small condenser (61), whilst the other connects up the aerial through a larger condenser (60), thus giving a choice of aerial coupling, the former "loose" and the latter "tight". Both aerial terminals are provided with leak resistances (63) and (62) to prevent the possible accumulation of heavy static charge on the aerial. As the receiver is intended to be connected up so as to provide for "listening through" during the intervals in transmission the possibility of the generation of excessively high currents and voltages in the aerial inductance coil and high voltages on the grid of the R/F valve must be guarded against. For this reason a diode valve (55) is connected across the input of the receiver. It will be seen that a resistance (64) is included in the negative filament lead which causes a permanent negative bias to be applied to the anode. For normal reception the value of this bias is such as to make the valve virtually an infinite resistance having no effect upon the sensitivity. The application of excessive voltages such as those set up by the transmitter causes the anode to become positive and the valve to act as a low resistance shunt across the receiver.

The aerial inductance (66) is tuned by means of the variable condenser (67) in series with the fixed "spreader" condenser (56).

22. R/F AMPLIFIER STAGE.

The aerial inductance (66) is coupled to the R/F amplifier valve (50) by means of a fixed coupling condenser (68). A grid leak resistance (69) is connected to the control grid of the valve and a bias resistance (70) included in the negative filament lead.

The potential of the screen grid is controlled by means of an adjustable resistance (71) which is connected across the H.T. supply in series with resistance (72). This adjustable resistance is used as a Volume Control and the control knob on the panel is marked "Volume". The plug-in anode coil (73) is tuned by means of the condenser (74), the dial of which is marked "Anode Tuning".

23. DETECTOR STAGE.

Coupling between the R/F Stage and the detector valve (51) is by means of the condenser (75). A grid leak (76) is connected between the grid of the detector valve and negative L.T.

From the anode of the detector valve a connection is taken through the condenser (77) to a reaction coil (78) wound on the same former as the anode inductance (73). Reaction is controlled by means of the potentiometer (79) which controls the voltage applied to the anode of the detector valve.

An oscillation testing pin (81) on the panel of the set is connected through the small condenser (80) to the anode end of the inductance (78) and provides a means of ascertaining whether the receiver is oscillating or not. If the detector valve is generating oscillations a click will be heard when the testing pin is momentarily touched with the finger.

24. A/F STAGES.

Resistance-capacity coupling (82) and (83) is employed between the detector valve and the first audio-frequency valve. A grid stopper resistance (85) is included in the grid circuit of the valve (52) in order to prevent R/F voltages from being applied to the audio-frequency amplifier and the valve is biassed through the resistance (86). The valves (52) and (53) are also resistance-capacity coupled by means of the resistance (87) and condenser (88), bias for valve (53) being obtained through the resistance (89). The valves (53) and (54) are resistance capacity coupled by means of resistance (90) and condenser (91), bias being applied to the output valve (54) through the resistance (92). Choke capacity output (93) and (94) is employed. The resistance (95) and (96) in series are connected between the L.T. and H.T. negative terminals, to provide automatic bias for the audio-frequency and output valves, half of the p.d. being tapped off to the grids of the valves (52) and (53) and the full p.d. being applied to the grid of the output valve. A condenser (97) to by-pass audio-frequency is provided across the resistances.