TYPE TAJ

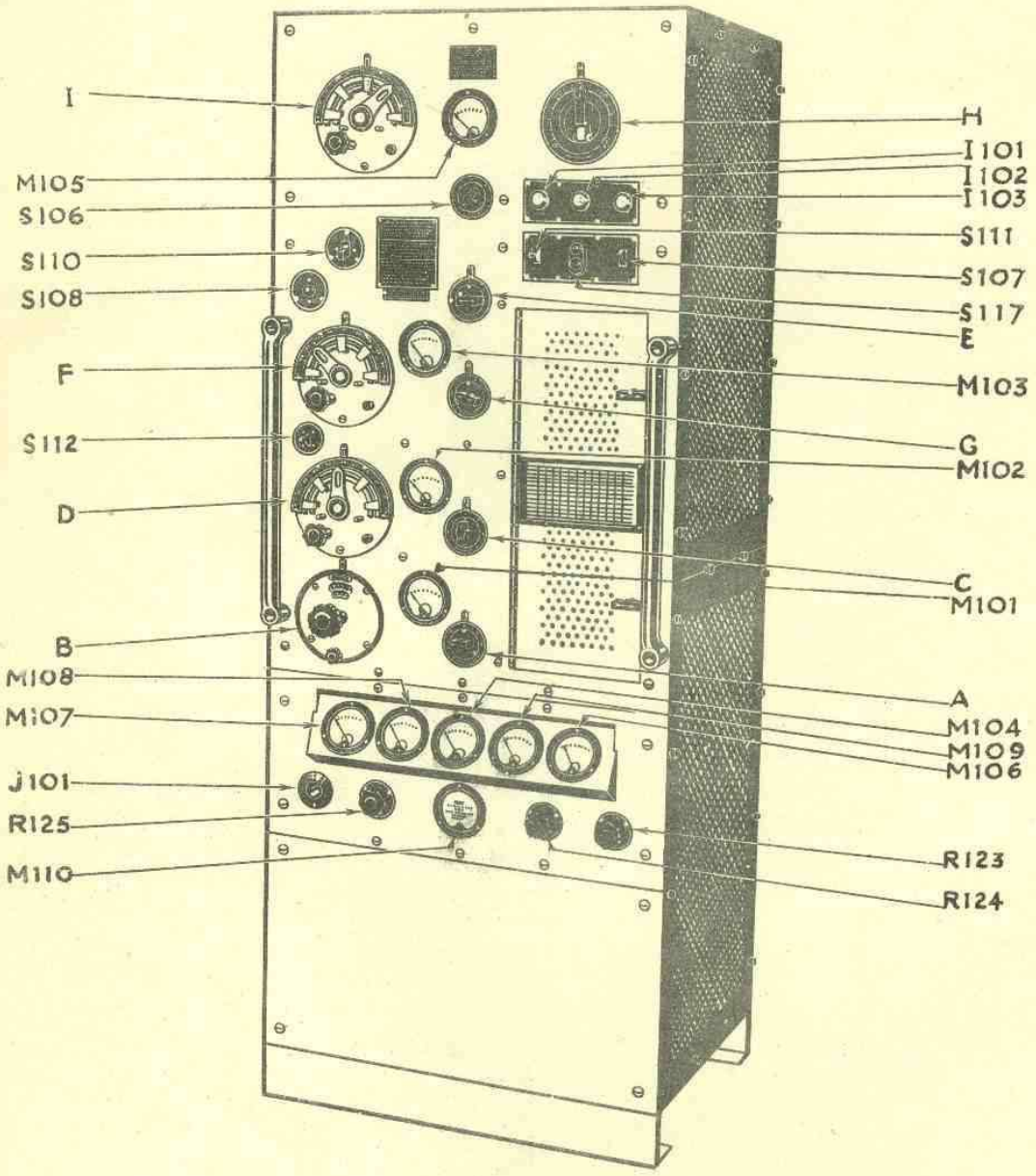

FIG. a

TYPE TAJ

1. GENERAL.

Transmitter TAJ is an American designed set. Several versions of the set have been produced, the main differences being in their power supplies. The following description is of the 230 volts D.C. model that is, at present, the only version being fitted in H.M. Ships.

Frequency Range :	175 - 600 Kc/s.
Type of Transmission :	C.W. or M.C.W.
Power Output : (Maximum)	C.W. 500 watts) Continuously variable down to 25% M.C.W. 250 watts) of full power.
Power Supply :	230 volts D.C., from Ships Mains, to supply a Motor Generator Unit having outputs of 3,000, 1,500 and 1,200 volts D.C. for Anode and Screen Grid supplies, 115 volts D.C. for Grid Bias supplies, and, 160 volts 60 cycle A.C. for Filament heating.
Keying :	The Keying Relay is capable of operation up to 100 words per minute for C.W. transmissions, and, up to 50 words per minute for M.C.W. transmissions.
Associated Wavemeters :	Wavemeter Outfits GJ or GN.

2. CONSTRUCTION.

Transmitter TAJ consists essentially of the following three units, their approximate dimensions have been appended to enable a rough appreciation of their size to be obtained.

1. Transmitter Unit :	Height	72 inches
	Width	27 "
	Depth	22 "
2. Motor Generator Unit :	Height	20 "
	Width	18 "
	Length	72 "
3. Magnetic Controller :	Height	19 "
	Width	14 "
	Depth	10 "

3. CONTROLS AND FITTINGS (See Fig. a).

Control "A" (S101). M.O. Band Change. A seven position switch to select the appropriate tapping on the Master Oscillator tuning inductance for the required frequency band.

Control "B" (C103). M.O. Tuning. Adjusts the variable tuning condenser to tune the Master Oscillator tuned circuit working in conjunction with Control "A".

Control "C" (S102). I.P.A. Band Change. A seven position switch to select the appropriate tapping on the Intermediate Power Amplifier tuning inductance for the required frequency band.

Control "D" (C113). I.P.A. Tuning. Adjusts the variable condenser to tune the tuned circuit of the Intermediate Power Amplifier working in conjunction with Control "C".

Control "E" (S103). P.A. Band Change. A seven position switch to select the appropriate tapping on the Power Amplifier tuning inductance for the required frequency band.

Control "F" (C126). P.A. Tuning. Adjusts a variable tuning condenser to tune the Power Amplifier tuned circuit working in conjunction with Control "E".

Control "G" (S104). Antenna Coupling. A six position switch to select the requisite value of capacity coupling between the Power Amplifier and Aerial tuned circuits.

Control "H" (S105). Antenna Band Change. A fifteen position switch to select the appropriate value of inductance in the aerial circuit to cover the required frequency band. Positions 1 to 12 select tappings on the Aerial Tuning Inductance and connect the whole of the Aerial Tuning Variometer in series with the selected portion of the Aerial Tuning Inductance. Position 13 cuts out the Aerial Tuning Inductance leaving the whole of the Aerial Tuning Variometer in circuit. Positions 14 and 15 further reduce aerial inductance by selecting appropriate taps on the stator coil of the Aerial Tuning Variometer.

Control "I" (L111). Antenna Tuning. Adjusts the setting of the rotor coil of the Aerial Tuning Variometer for tuning the aerial circuit in conjunction with Control "H".

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SWITCHES.

Tune-Operate Switch (S106). Three position switch. Position 1 - H.T. supply complete to Master Oscillator Valve only for tuning the Master Oscillator Stage. Position 2 - Master Oscillator Valve H.T. circuit complete - High Voltage Generator Shunt Field Coil connected to 115 volts output of Bias Generator through the High Voltage Generator Field Regulator and an additional series resistance to reduce output voltage; this reduced output results in reduced H.T. being applied to the Intermediate Power Amplifier and Power Amplifier Valves for tuning their respective circuits. Position 3 - High Voltage Generator Shunt Field series resistance is cut out of circuit. Full H.T. applied to all stages for operating the transmitter.

Emission Switch (S107). Two positions. "C.W." - breaks the supply to the filament of the Audio Oscillator Valve for C.W. transmissions. "M.C.W." - completes the supply to the filament of the Audio Oscillator Valve for M.C.W. transmissions.

Overload Reset Button (S108). When pressed completes the supply to the Master Oscillator and Intermediate Power Amplifier and Power Amplifier Overload Reset bobbins. Used to reset the respective overload relays after they have operated.

Emergency Stop Switch (S110). A double pole master switch for stopping the Motor Generator Unit and removing all power from the transmitter unit in the event of an emergency.

Remote-Local Control Switch (S111). Two positions, "Local" - isolates the remote control circuits enabling the set to be controlled and operated from the front panel, for testing and tuning purposes. "Remote" - Connects up the remote control circuits enabling the transmitter to be controlled and operated from the remote control positions. It should be noted that, even with this switch to "Remote", primary control over the starting circuits remains in the hands of the operator at the transmitter, as the control switch in the remote positions is connected in series with the Start-Stop Switch (S117) on the transmitter panel.

Test Key (S112). When depressed it completes the circuit to the Keying Relay, thus causing the transmitter to oscillate. Fitted for testing and tuning purposes.

Start-Stop Press Buttons (S117). Two buttons marked "Start" and "Stop" to start or stop the Motor Generator Unit.

METERS.

M.O. Plate Current (M101). Milliammeter connected in series with the Master Oscillator Valve negative H.T. return to indicate anode current.

I.P.A. Plate Current (M102). Milliammeter connected in series with the Intermediate Amplifier Valve H.T. supply to indicate anode current.

P.A. Plate Current (M103). Milliammeter connected in series with the Power Amplifier Valve H.T. supply to indicate anode current.

A.O. Plate Current (M104). Milliammeter connected in series with the Audio Oscillator Valve negative H.T. return to indicate anode current.

Antenna Current (M105). Ammeter, connected between the bottom of the aerial tuned circuit and earth, to indicate aerial current.

Filament Voltage (M106). Voltmeter connected across the filament of the Power Amplifier Valve. The Main Filament Rheostat (R123) should be adjusted to obtain a reading of 11 volts in this meter.

Bias Voltage (M107). Voltmeter connected across the output of the Bias Generator. The Bias Field Regulator (R125) should be adjusted to obtain a reading of 115 volts in this meter.

M.O. Plate Voltage (M108). Voltmeter, connected across the output of the Low Voltage Generator, to indicate the potential being applied to the anode of the Master Oscillator Valve.

Plate Voltage (M109). Voltmeter, connected across the output of the High Voltage Generator, to indicate the potential being applied to the anode of the Power Amplifier Valve.

Filament Hours (M110). A meter, calibrated 0 - 99, 999 hours, connected across the filament supply to the Power Amplifier Valve to indicate the time the filament has been alight.

INDICATING LAMPS.

Power (I101). Lamp, with a red shade, connected in parallel with the Starting Contactor, Lamp will light when the "Press" button, of the Start-Stop Switch is pressed, indicating the power is being applied to the Motor Generator starting circuits.

Bias (I102). Lamp with a blue shade, connected across the output of the Bias Generator. Lamp will light when Motor Generator Unit is running and an output is being obtained from the Bias Generator.

Plate (I103). Lamp, with a red shade, connected across the output of the Bias Generator. Lamp will light under the same conditions as the Bias Indicating Lamp. Plate Indicating Lamp indicates that the output of the Bias Generator is available for supplying the field winding of the High Voltage Generator.

MISCELLANEOUS.

Main Filament Rheostat (R123). In series with the supply to the primary of the filament transformer. To adjust the filament voltage to 11 volts as shown by the Filament Voltmeter (M106).

Main Field (R124). A variable resistance connected in series with the supply to the field winding of the High Voltage Generator. Used to vary the output voltage to control the power of transmissions.

Bias Field (R125). A variable resistance connected in series with the supply to the field winding of the Bias and Low Voltage Generator. Used to adjust the Bias and Low Voltage output to their correct operating values.

Frequency Meter Audio Output (J101). A socket for plugging in a pair of headphones. Used when tuning the Master Oscillator stage by the Heterodyne Method.

4. OPERATION.

This section details all the necessary steps required to be taken to bring the transmitter to the ready to transmit condition. It is assumed that the set has previously been tuned by wavemeter and that tabulated adjustments are readily available.

(a) Set the following controls to the adjustments given for the frequency required :

Control "A" M.O. Band Change.
Control "B" M.O. Tuning.
Control "C" I.P.A. Band Change.
Control "D" I.P.A. Tuning.
Control "E" P.A. Band Change.
Control "F" P.A. Tuning.
Control "G" Antenna Coupling.
Control "H" Antenna Band Change.
Control "I" Antenna Tuning.

(b) Set the Remote-Local Switch to "Local".

(c) Set the Tune-Operate Switch to "3".

(d) Set the Emission Switch to "C.W." or "M.C.W." as required.

(e) Press the "Start" button of the Start-Stop Switch, the Motor Generator Unit should now start.

(f) Adjust the control marked "Main Filament" until the "Filament Voltage" meter reads exactly 11 volts.

(g) Adjust the "Bias Field" regulator so that the "Bias Voltage" meter reads 115 volts. The "M.O. Plate Voltage" meter should now read approximately 1200 volts.

(h) Adjust the "Main Field" regulator so that the "Main Plate Voltage" meter reads the voltage laid down commensurate with the power output required.

(i) Stop the Motor Generator Unit by pressing the "Stop" button of the Start-Stop switch.

(j) Set the Remote-Local switch to "Remote" and press the "Start" button of the Start-Stop switch.

The transmitter is now available for control from the remote position, the starting of the Motor Generator Unit being controlled by the Control Switch and the Keying Relay being operated by the Morse Key.

5. TUNING.

(a) General. The transmitter is designed for tuning by the "Heterodyne" method. To enable tuning to be readily achieved, with the operator standing in a convenient position in front of the set, a socket, marked "Frequency Meter Audio Output" is fitted on the front panel of the transmitter, into which Headphones can be plugged. The connections to this socket should be connected to the output of the Heterodyne Detector Valve of Wavemeter G73, or, to the appropriate socket in Oscillator G35, depending on which wavemeter outfit is being used.

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In this description it is assumed that Wavemeter G73 is being used, the same tuning procedure will have to be followed if Wavemeter Outfit GJ is being employed, the only exception being that Oscillator G35 would first have to be set to the correct frequency in conjunction with Wavemeter G62.

A coupling is taken from the anode of the Master Oscillator Valve and fed to the "R/F Input" socket on Wavemeter G73.

The R/F Input is mixed with the R/F oscillations of the Oscillator Stage of the G73, and the "beat frequency" is detected in the Heterodyne Detector Stage and passed on to the headphones being worn by the operator.

(b) Tuning Transmitter.

(1) Adjust Controls "A" to "G" tabulated in the section headed "Operation" to approximate settings for the frequency desired. These can be obtained, by interpolation, from the table of typical adjustments given in the Handbook on the set.

(2) Set the Remote-Local Switch to "Local".

(3) Set the Emission Switch to "C.W.".

(4) Set the Tune-Operate switch to "3".

(5) Press the "Start" button of the Start-Stop Switch, the Motor Generator Unit should now start.

(6) Adjust the "Main Filament" rheostat until the "Filament Voltage" meter reads exactly 11 volts.

(7) Adjust the "Bias Field" regulator so that the "Bias Voltage" meter reads 115 volts. The "M.O. Plate Voltage" meter should now read approximately 1200 volts.

(8) Adjust the "Main Field" regulator so that the "Main Plate Voltage" meter reads 3000 volts.

(9) Set the Tune-Operate Switch to "1".

(10) Switch on and calibrate WAVEMETER G73 to the appropriate frequency. See detailed instructions on page G**A**7

(11) Press the Test Key. Slowly rotate Control "B" until a "dead space" is obtained in the Headphones.

(12) Set the Tune Operate Switch to "2".

(13) Slowly rotate Control "D" for a minimum reading in the "I.P.A. Plate Current" meter.

(14) Adjust controls "H" and "I" as far as they will go to the right thus ensuring that the aerial circuit is well on the capacitive side of resonance.

(15) Adjust Control "F" to obtain a minimum reading in the "P.A. Plate Current" meter.

(16) The aerial circuit now remains to be tuned. The setting of Control "H" cannot be predetermined as it will depend on the characteristics of the aerial being used. Different positions of Control "H" should be tried, at the same time, rotating Control "I" until a maximum reading in the "Antenna Current" meter indicates that resonance has been obtained. The "P.A. Plate Current" meter will read approximately 200 milliamps when the Power Amplifier Stage is being correctly loaded.

(17) Adjust Control "G" to obtain a maximum reading in the "Antenna Current" meter.

(18) Set the "Tune-Operate" switch to "3". The "P.A. Plate Current" meter should now show approximately 350 milliamps, if it reads over or appreciably under this figure, Control "G" should be adjusted until the reading is approximately correct.

6. TECHNICAL DESCRIPTION.

(a) General. Transmitter TAJ is based on the Master Oscillator, Intermediate Power Amplifier, Power Amplifier principle. The frequency coverage of 175 - 600 Kc/s is obtained by variable taps on the tuning inductances in the various tuned circuits.

The Master Oscillator employs a Type 860 valve in an electron coupled circuit, the screen grid of the Valve functioning as the anode for a conventional Colpitts Oscillator circuit. The anode of the Master Oscillator Stage is capacity coupled to the grid of a second Type 860 valve termed the Intermediate Power Amplifier, this stage, employing a parallel tuned anode circuit, functions mainly as a buffer to prevent inter-action between the Master Oscillator and Power Amplifier tuned circuits. The Intermediate Power Amplifier tuned circuit is coupled to the grid of a Type 861 valve operating as the Power Amplifier by means of a tap taken from the junction of two condensers joined across the tuned circuit.

The Power Amplifier uses a parallel tuned anode circuit, part of whose tuning capacity is connected across the circuit in the form of a "capacity bridge", the latter being tapped by means of a switch to provide correct aerial excitation. The aerial is tuned by a Variometer with a loading inductance in series. For M.C.W. transmissions, a separate oscillator is provided consisting of a Type 860 valve with a Hartley Circuit tuned to approximately 800 cycles. A portion of the tuning coil is common to the H.T. supply to the Intermediate Power Amplifier, so that when the oscillator is being used the H.T. supply to the anode of the Intermediate Power Amplifier is modulated at 800 cycles.

Power for the transmitter is obtained from a Motor Generator Unit that is fed from the 230 volts D.C. ship supply. The control circuits necessary to start the machine are contained in an Electric Controller.

(b) Control Circuits (Fig. b).

Power for supplying the Motor Generator Unit, Motor starting circuits and Keying circuit is obtained from the 230 volts D.C. ships mains.

The D.C. supply is fed direct to a double pole switch (KS) in the Magnetic Controller, this switch, termed "Knife Switch" performs the function of a Mains Switch and is normally left in its "On" position.

Further consideration of the control circuits is best approached by reviewing the sequence of operation of the various circuits consequent on pressing the "Start" button of the Start-Stop Switch (S117), assuming that the Remote Local Switch (S111) is to "Local".

The supply is taken from the Knife Switch through fuses (F1, F2) to the Emergency-Stop Switch (S110), the positive is then fed through contact "C" of the Remote Local Switch (S111), contact "A" of the Start-Stop Switch (S117), Cage-Door Switches (S114, S115), fitted as safety devices on the transmitter access doors, bobbin of the Starting Contactor (K104), contact "I" of the Starting Contactor, and through two current controlling resistances (R139)(R140) to the negative supply. A parallel fed from the Cage Door Switch (S114)(S115) supplies the Power Indicating Lamp (I101) with its associated series resistances (R101A)(R109), the negative return being taken direct to the Emergency-Stop Switch (S110).

When the Starting Contactor (K104) is energised, its contacts function as follows : Contact "I" removes a short circuit from two economy resistances (R137, R138) that are in series with the supply to the bobbin of the Starting Contactor. Contact "H" completes the circuit through the Low Voltage Generator Shunt Field Winding via the contacts of the Master Oscillator and Intermediate Amplifier Overload Relays (K106, K105) and the Bias Field Regulator (R125). Contact "G" completes the supply to the bobbin of the Line Contactor (K102) through contact "P" of the Main Overload Relay (K101).

When the Line Contactor (K102) operates, the supply to the Motor is completed through contact "K" bobbin of the Main Overload Relay (K101), the Motor Series Starting Resistance (R1), the Down ("D") and Up ("U") coils of the Accelerating Contactor, Motor Armature Winding, Motor Series Field and back to the negative supply lead through contact "L" of the Line Contactor (K102). Magnetic Blow-out Coils (B01, B02) are inserted in each lead to prevent arcing across the "K" and "L" contacts of the Line Contactors (K102) when the contactor throws off. Contact "L" also supplies the shunt bobbin of the Accelerating Contactor (K103) through its associated series resistance (R2), the return being via contact "M". Contacts "K" and "L" also supply the Motor Shunt Field.

The action of the Accelerating Contactor is as follows. The two magnetic circuits (a) the series bobbin ("U") and the shunt bobbin (K103) that tend to keep the contacts in their "Up" or "Make" position, and (b) the series bobbin ("D") that tends to keep the contacts in their "Down" or "Break" position, are so proportioned that when the bobbins are subjected to a relatively high current, the pull of the series bobbin ("D") predominates, thus holding the contactor in the open position. As the current in the coils is reduced, the pull exerted by the series bobbin ("D") falls off more rapidly than that of the push exerted by the combined magnetic fields of the series bobbin ("U") and the shunt bobbin (K103) and at a predetermined value the "push" overcomes the "pull" and the contactor closes. When the contactor closes, contact "O" short circuits the series bobbin "D" so that the pushing on power of the series bobbin "U" and shunt bobbin (K103) is not affected by the pulling power of the series bobbin ("D"). The current decrease necessary to operate the Accelerating Contactor is obtained by making use of the natural fall in current as the Motor runs up, the magnetic balance between the Accelerating Contactor Bobbins is so adjusted that the contactor operates when the Motor reaches its normal running speed, contact "O" then functions as described above, and, in addition, short circuits the Starting Resistance (R1) thus placing the supply to the Motor in its normal Motor running condition.

A further function of the Accelerating Contactor is to complete the negative return for the Keying Circuit potentiometer (R114), therefore it follows that the transmitter cannot be keyed until the Motor Generator Unit has reached its normal running speed.

The complete circuit for the Keying Relay (K103) is as follows : the positive is taken from the Emergency-Stop Switch (S110) and fed through the Test Key (S112), auxiliary contacts on the following switches, Master Oscillator Band Change Switch (S101), Intermediate Amplifier Band Change Switch (S102), Power Amplifier Band Change Switch (S103), Antenna Coupling Switch (S104), Antenna Band Change Switch (S105), and the Tune-Operate Switch (S106), the bobbin of the Keying Relay (K103), a current controlling series resistance (R121) and then to a tapping on the Keying Circuit potentiometer (R114).

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When it is desired to operate the transmitter from a remote position, the Remote-Local Switch (S111) is placed in its "Remote" position and the control circuits then function as follows: The positive supply passes through contact "F" of the Remote-Local Switch (S111), the Control Switch in the Remote Control position, contact "D" of the Remote-Local Switch (S111), contact "B" of the Start-Stop Switch (S117) and then on as described for Local control. It will be observed that the "Start" button of the Start-Stop switch, on the transmitter unit, must be pressed before the control circuits can be operated from the Remote Control position, thus the operator at the transmitter retains primary control even though the Remote-Local Switch (S111) is to "Remote".

The Morse Key, in the Remote Control Position, is connected in parallel with the Test Key (S112) when the Remote Local Switch (S111) is in its "Remote" position, thus the Keying Relay (K103) will operate, when the Morse Key is pressed, in exactly the same manner as described above for Local Control.

(c) OVERLOAD ARRANGEMENTS.

(i) Main Overload Relay. The bobbin of the Main Overload Relay (K101) is in series with the positive supply to the Motor, its contact "P" operating against the tension of a spring, is so adjusted that it will not break until the current through the bobbin reaches a certain predetermined value. When the latter condition arises, contact "P" breaks the supply to the Line Contactor (K102), thus stopping the Motor Generator Unit. Contact "P" of the Main Overload Relay will be retained in its break position by a mechanical interlock, the release of which can only be effected manually by opening the door of the Magnetic Controller and pressing the Reset Button. (See Fig. b).

(ii) Master Oscillator and Intermediate Amplifier and Power Amplifier Plate Overload Relays (K106, K105). The bobbins of these two relays are connected in series with the negative high potential return of the Master Oscillator and Intermediate Amplifier and Power Amplifier supplies, in the event of an excessive current flowing through either of these bobbins, the relay concerned operates and breaks the circuit to the Low Voltage Generator Shunt Field, (see Fig. d).

These contacts are held in the off position by mechanical interlocks, to reset the relays, a press button (PB1) is depressed and a supply obtained from the 160 volts A.C. Output of the Motor Generator Unit is fed to the Reset Bobbins (K106A, K105A), these relays release the mechanical interlocks thus allowing the overload relays to revert to their normal positions.

(d) RADIO FREQUENCY CIRCUITS (FIG. c).

(i) Master Oscillator. This stage employs a Type 860 Valve (V1) functioning as an Electron Coupled Oscillator.

The frequency determining components are connected in the form of a Colpitts circuit and consist of the following: tuning inductance (L101) with seven tappings, adjusted by means of the M.O. Band Change Switch (S101), main fixed tuning condensers (C101, C102) and the variable condenser (C103) for fine tuning. Condenser (C157) connected across the circuit is a bi-metal compensating condenser with a large negative temperature coefficient. The purpose of this condenser is to increase the frequency stability of the Master Oscillator with respect to ambient change and heat developed by the normal operation of the transmitter. The top of the tuned circuit is connected to the grid of the valve through the grid condenser (C104) and grid leak resistance (R131, R132), the latter provides a small operating bias on the grid due to the voltage drop across them consequent on grid current flowing. The bottom of the tuned circuit is connected to the screen grid of the valve, through R/F by-pass condenser (C105) and the centre point of the filament is connected via R/F by-pass condensers (C119)(C120) to the junction of the two main tuning condensers (C101, C102). Thus the screen grid of the valve is functioning as the anode of a conventional Colpitts Oscillator circuit and the R/F component of valve current will be modulated by the R/F voltage variations on the screen grid.

(ii) Intermediate Power Amplifier. The anode of the Master Oscillator is capacity coupled (C107) to the grid of a Type 860 valve functioning as the Intermediate Power Amplifier. This stage employs a parallel tuned circuit connected between anode and filament, the high potential end of the tuned circuit is connected to the anode of the valve through a D.C. blocking condenser (C110) and the low potential end is connected to the centre point of the filament via R/F by-pass condensers (C117,C118). The tuned circuit consists of a tapped inductance (L106), two fixed condensers (C111, C112) and a variable condenser (C113). The required tapping on the inductance is selected by the I.P.A. Band Change Switch (S102).

(iii) Power Amplifier. The R/F potential developed across the fixed condenser C112 is used to excite the grid of the Type 861 Power Amplifier Valve (V3), the filament return being through earth via its R/F by-pass condensers (C115,C116). The Power Amplifier has a parallel tuned circuit connected between anode and filament consisting of a tapped inductance (L109), variable condenser (C126) and the seven fixed condensers (C125, C127 to C132). A suitable tapping on the inductance, to cover the frequency range required, is selected by the P.A. Band Change Switch (S103), the variable condenser is for fine tuning, and the fixed condensers, connected in the form of a capacity potentiometer, are to enable the coupling to the aerial circuit to be adjusted by the Antenna Coupling Switch (S104) to match the impedance of the aerial circuit to that of the Power Amplifier Valve. A Static Discharge Coil (L110) is connected across the portion of the capacity potentiometer, that is common to the Power Amplifier and Aerial tuned circuits, to drain to earth any static potentials that may build up across the condensers due to charges being picked up by the aerial.

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CONTROL CIRCUITS

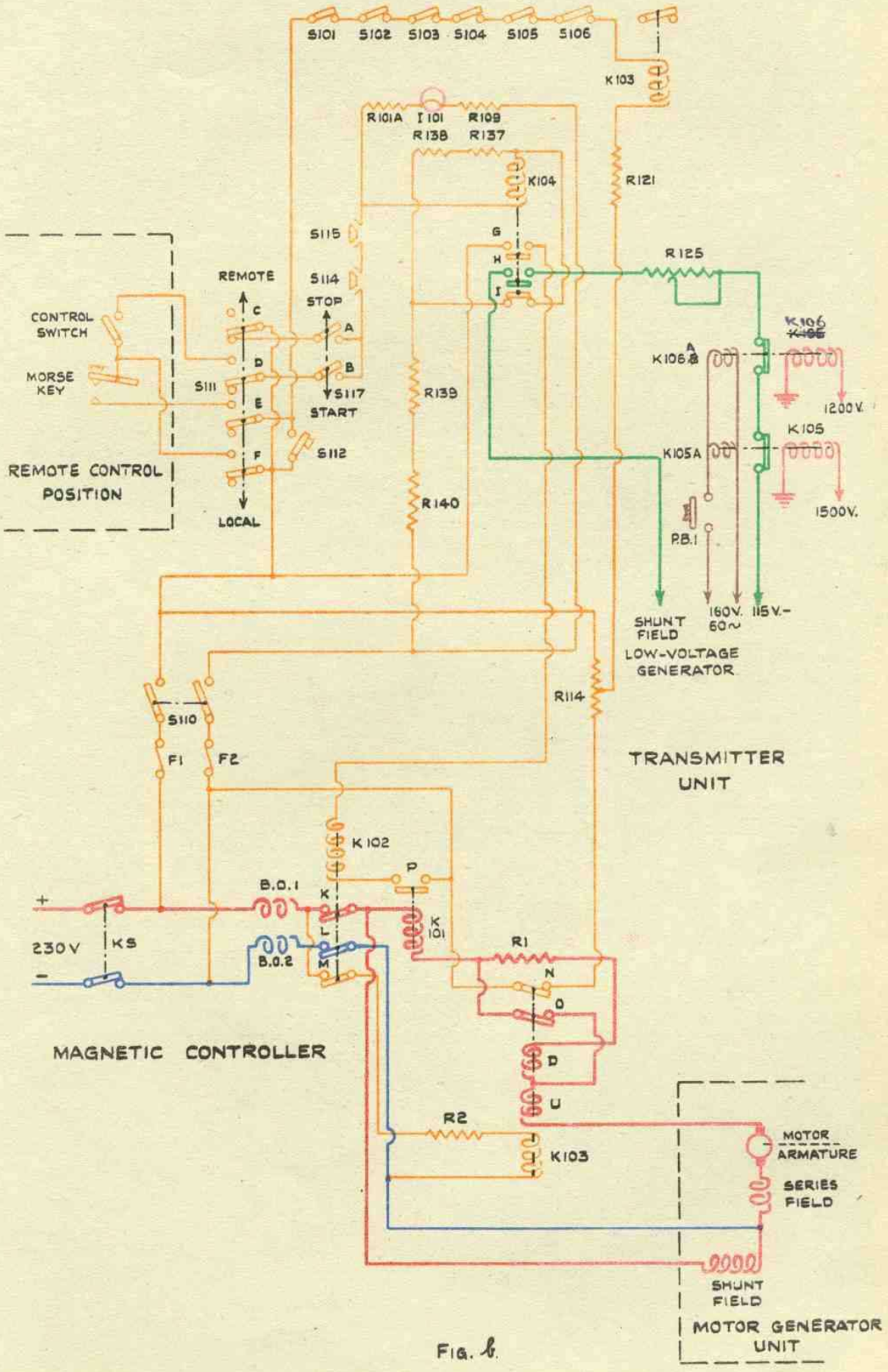


Fig. 6.

(iv) Aerial Circuit. The aerial is tuned by a tapped loading coil (L112) and a variometer (L111). The loading coil has thirteen tappings, twelve are taken to the studs on the main portion of the Antenna Band Change Switch (S105) and the thirteenth to the secondary arm of the same switch. The Antenna Band Change switch has fifteen positions, the last three being taken to the stator coil of the variometer.

Reference to Fig.C* shows that with the Antenna Band Change Switch in any of its first twelve positions, tuning is effected by the selected portion of the loading coil and the variometer in series, but when the switch is moved to any of its last three positions, the loading coil is isolated, to eliminate dead-end effect, and either all or a portion of the variometer is used for tuning.

Fine tuning in all cases is effected by adjustment of the rotor coil of the variometer, this is controlled by the Antenna Tuning Knob.

The low potential end of the variometer is taken to earth through the selected portion of the coupling capacity potentiometer and the Antenna Current Meter (M105).

7. POWER SUPPLIES (Fig. d).

Motor Generator Unit.

(a) D.C. Motor. The D.C. Motor is a shunt wound machine fed from the 230 volts D.C. ships supply; its starting resistance and control circuits are contained in the Magnetic Controller, their action being described in the section headed "Control Circuits".

A pair of slip rings are mounted on the armature shaft. The armature winding is tapped at two points and connected to the slip rings. A.C. power output of 160 volts is available from the slip rings for filament heating.

(b) Bias and Low Voltage Generator. The Bias and Low Voltage Generator is coupled to the common shaft rotated by the D.C. Motor; the unit has a double winding armature with two commutators. It is a compound wound generator with inter-pole windings in series with the series field windings. The shunt winding is excited by the output of the Bias Commutator, the current being controlled by the Bias Field Regulator (R125). The two outputs, when the Bias Field Regulator has been correctly adjusted, give 115 volts D.C. and 1200 volts D.C.

(c) High Voltage Generator. The High Voltage Generator is connected to the common shaft. It is a compound wound machine; its series field being connected in series with its inter-pole and armature windings, and the shunt field being separately excited from the 115 volts output of the Bias and Low Voltage Generator. Voltage output is adjustable by the Main Field Regulator (R124) which is connected in series with the shunt field winding.

The generator has two armature windings which are connected to two separate commutators. The outputs, both of which are rated at 1500 volts, are connected in series, so that there is available from the unit both 1500 volts and 3000 volts outputs.

(d) Filament Supplies. The 160 volt 60 cycle A.C. output of the Motor Generator Unit is used to supply heating current for all valves in the set. From the slip rings it is taken to the primary windings of the two filament transformers connected in parallel; the supply has a fuse (F1) in one lead and the Filament Rheostat (R133) in the return lead, the latter is adjusted to give a reading of 11 volts in the voltmeter (M106) connected across the filament leads to the Type 861 Power Amplifier Valve. The supply to the primary of the Master Oscillator Valve Filament Transformer (T105) has an R/F Choke Coil (L114A, L114B) in each lead with the supply side of each Choke Coil connected to earth by an R/F by-pass condenser (C108, C114); this arrangement is to protect the armature winding of the motor from high R/F currents.

The secondary winding of this transformer is connected direct to the filament of the Type 860 Master Oscillator Valve; each side of the secondary winding is connected to the primary winding by R/F by-pass condensers (C152, C153) to protect the secondary winding from R/F currents.

The Main Filament Transformer (T104) has three secondary windings, each is centre tapped as is the secondary of the Master Oscillator Filament Transformer (T105), the purpose of these centre taps is described under the paragraph headed Anode and Screen Grid Supplies.

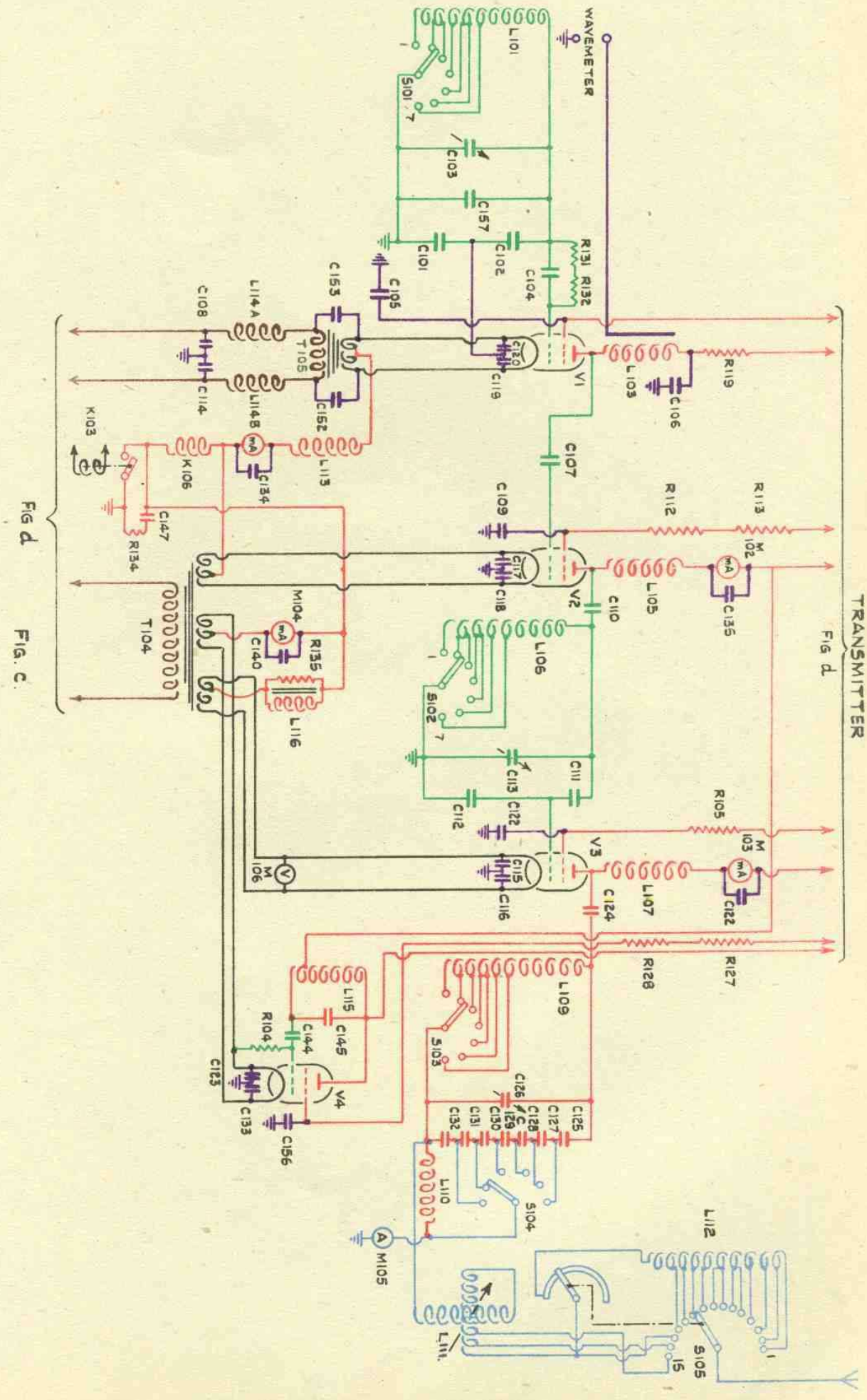
Number One winding is used to supply the filament of the Type 860 Intermediate Power Amplifier Valve.

Number Two winding supplies the filament of the Type 860 Audio Oscillator Valve via the Emission Switch (S107). The latter completes the supply to the filament when in the "M.C.W." position, and, when to "C.W.", it disconnects the filament supply and brings into circuit a compensating resistance (R126), thus a constant load is maintained on the supply irrespective of the position of the Emission Switch.

Number Three winding supplies direct the filament of the Type 861 Power Amplifier Valve, across the filament is connected the Filament Voltmeter (M106).

TYPE TAJ

RW51



(e) Grid Bias Supplies. The 115 volt D.C. output of the Motor Generator Unit, in addition to supplying the Bias and Low Voltage and High Voltage Generator Shunt Field Windings, is used to provide the necessary operating bias to the grids of the Intermediate Power and Power Amplifier Valves.

The positive output from the generator is directly earthed, and the negative is fed to the grid of the Intermediate Power Amplifier through a dropping resistance (R102) and to the grid of the Power Amplifier through dropping resistance (R103) and R/F Choke Coil (L108). Across the 115 volt output of the generator is connected the Bias Indicating Lamp (I102), the Plate Indicating Lamp (I103) and the Bias Voltmeter (M107).

(f) Anode and Screen Grid Supplies. The 1200 volts output of the Bias and Low Voltage Generator is utilised to provide Anode Potential for the Type 860 Master Oscillator Valve and Screen Grid potential for all valves. The 1200 volt negative is connected to the negative of the High Voltage Generator and the common lead is taken to earth through the bobbin of the Power Amplifier Plate Overload Relay (K105). A potentiometer (R115, R116, R117, R118) is connected across the 1200 volts output, the high potential end supplies the anode of the Master Oscillator Valve via a dropping resistance (R119) and an R/F Choke Coil (L103), the screen grid of the Intermediate Power Amplifier via dropping resistances (R112, R113), and the screen grid of the Power Amplifier via its associated dropping resistance (R105). A centre tap on the 1200 volts potentiometer is utilised to provide the necessary potential for the screen grid of the Master Oscillator Valve. A further tap on the potentiometer at the junction of resistances R117 and R118 is used to supply a positive potential to the filaments of all valves when the Keying Relay (K103) is de-energised, to facilitate their rapid closing down.

The 1500 volts output of the High Voltage Generator is fed to the centre of the inductance forming part of the Audio Oscillator tuned circuit, the top of this inductance is connected to the anode of the Audio Oscillator and also to the anode of the Intermediate Power Amplifier via its anode current milliammeter (M102) and R/F Choke Coil (L105).

The 3000 volts output of the High Voltage Generator is fed to the anode of the Power Amplifier Valve via anode current milliammeter (M103) and R/F Choke Coil (L107). The Plate Voltmeter (M109) is connected across this output.

8. Keying Circuit. The system of keying employed is to complete the H.T. negative return, for all valves, to earth when the Keying Relay (K103) is energised. The Keying Relay also removes the positive potential, obtained from the 1200 volts potentiometer, from the filaments of all valves.

The H.T. negative returns from the centre tappings on the secondary windings of the filament transformers are all fed to the Keying Relay (K103) through their own particular circuits as described below.

Master Oscillator. Through R/F Choke Coil (L113), M.O. anode current milliammeter (M101) and the bobbin of the Master Oscillator (and Intermediate Power Amplifier Overload Relay (K106)).

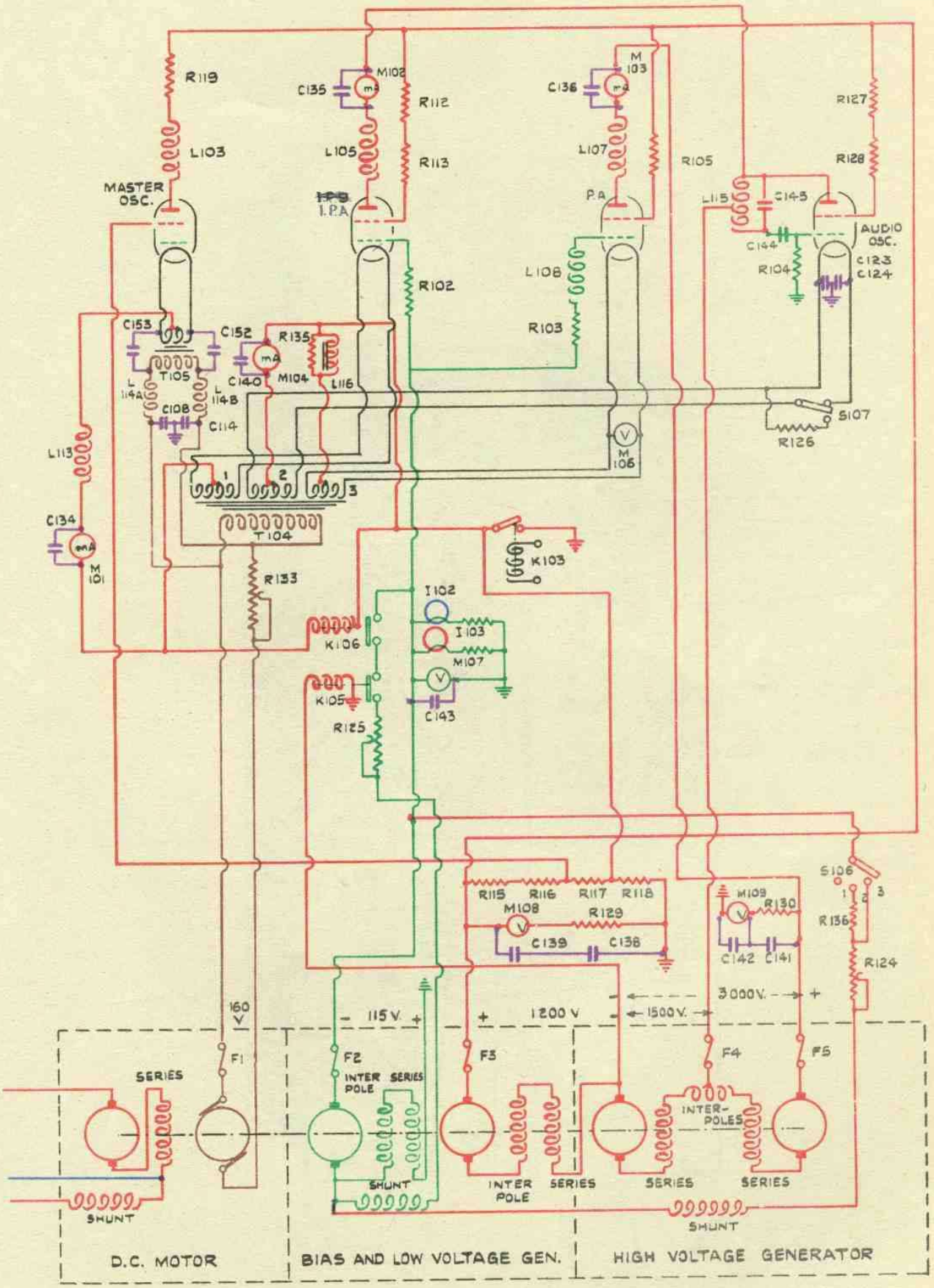
Intermediate Power Amplifier. Through the bobbin of the Master Oscillator and Intermediate Power Amplifier Overload Relay.

Power Amplifier. Through an A/F Choke (L116) and resistance (R135) connected in parallel to prevent key click interference.

Audio Oscillator. Through the Audio Oscillator anode current milliammeter (M104).

TYPE TAJ

POWER SUPPLIES



MOTOR GENERATOR UNIT

FIG. d