RC28

TYPE 57DMR
FRONT VIEW

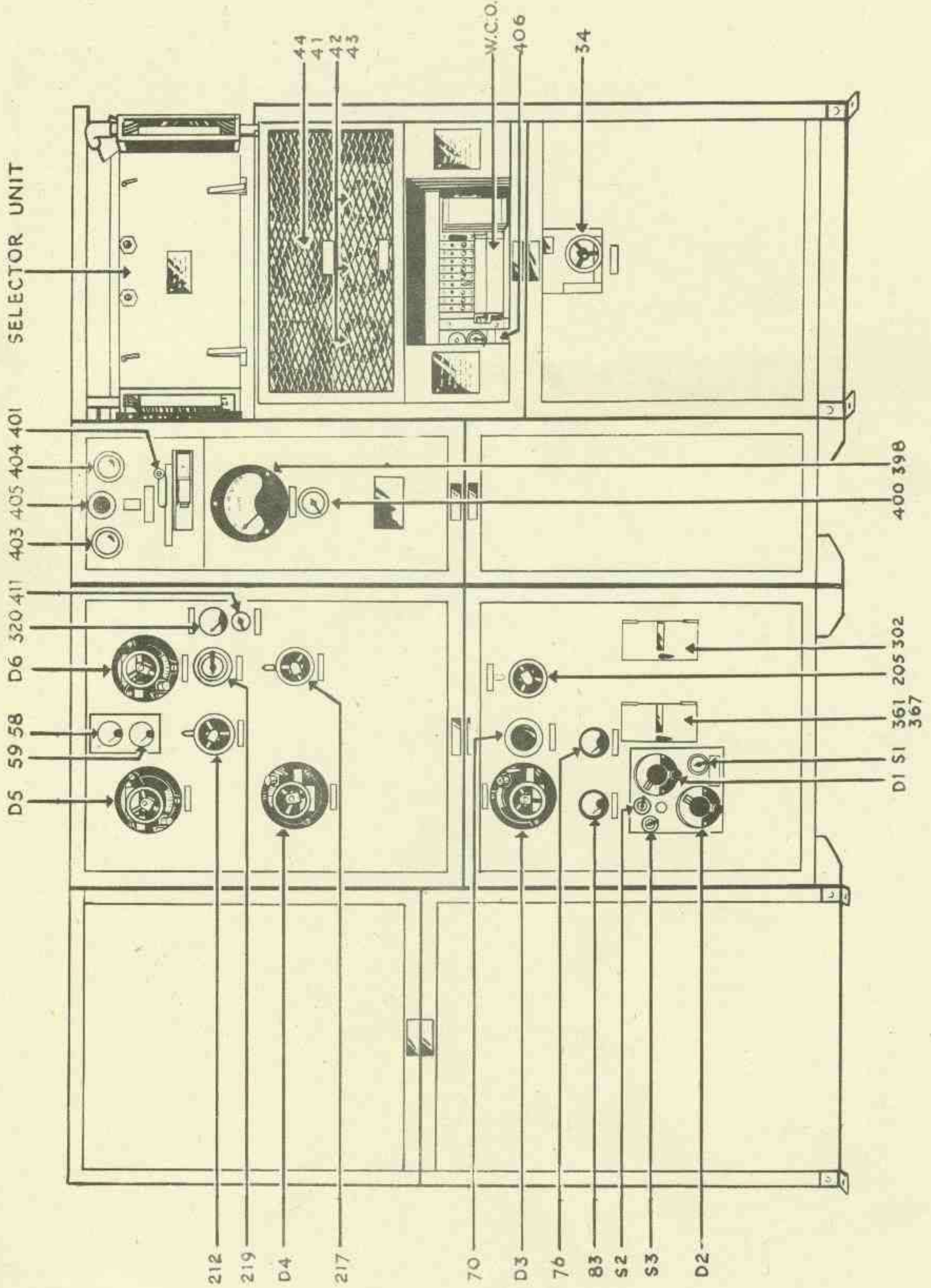

FIG. a

1. GENERAL.

Type 57DMR is an H/F transmitter designed as the main W/T and R/T transmitter for capital ships and cruisers fitted with C.W.S.

Date of design	1939
Modified	1943
Frequency range	3,000/21,000 Kc/s.
Character of transmission	CW - MCW - R/T.
Power Supply	400 volts 50 cycles 3 phase A.C.
Power to Final Stage	7 - 10 kW.
Power in Aerial	2 - 4 kW.
Type of Aerial	Unipole.

The circuit consists of a Partial Crystal Control Master Oscillator Unit, Intermediate Amplifier and Output Stage. A tuned unipole aerial is inductively coupled to the Output Stage.

No provision is made for self-excitation.

The transmitter is capable of hand or automatic signalling, the latter up to speeds of 150 w.p.m. A Monitor Unit is provided to operate a Check Undulator in ships which are fitted for high speed working.

Arrangements are not provided for "listening - through" on the transmitter aerial.

The control of power and character of transmission, is effected by means of contactors, operated by the C.W.S. dialling system.

2. CONSTRUCTION.

The various components are built into eight panels, the fronts of which form the front of the transmitter. (See Fig. a).

Access to the rear of the panels, and to the transmitting valves, is by means of a gate fitted with safety contacts.

The space occupied by the transmitter panels and enclosure is approximately nine by five feet.

The bottom left hand panel forms a support for the Main Rectifying Panel and accommodates the main H.T. transformer. A Stowage Rack for spare valves may also be mounted in this stand.

The upper panel contains the three main rectifying valves, filament transformer, smoothing circuit, smoothing condenser, discharge switch and a small transformer to enable the rectifier valves filament voltage to be measured by a common filament voltmeter.

The next lower panel contains the Intermediate Stage, the modulation contactors and six removable units comprising :-

(i) Master Oscillator Unit, which contains the Crystal Oscillator, Variable Frequency Oscillator, the Mixer and Trebler Stages.

(ii) Master Oscillator Filament and Grid Bias Supply Unit.

(iii) Master Oscillator H.T. Supply and Absorber Unit.

(iv) Keying and M.C.W. Modulator Unit.

(v) Intermediate Stage Screen and Suppressor, and Output Stage Grid Bias Supply Unit.

(vi) Main Absorber Grid Bias Unit.

The upper panel contains the Output Stage transmitting valves, their associated circuit and filament transformer; aerial tuning circuit and the main absorber valve, together with its filament transformer. It also contains the Tuning Indicator Unit, and where required, the High Speed Monitor Unit.

The next upper panel, from the left, contains the Trunk Sealing Switch, Aerial Earthing Switch, three indicator lamps and a filament voltmeter with selector switch. The R/T amplifier is also accommodated in this panel.

In the lower panel are the three Intermediate H.T. rectifier valves, filament transformer, Intermediate H.T. transformer and smoothing circuit.

The controlling panel is the next and contains the Selector Unit, Power Contactors and three ammeters, one connected in each supply phase. A voltmeter is also fitted which indicates the supply voltage selected by the power contactors. The pre-set filament resistances are mounted at the rear of the panel together with the C.W.S. - Direct Control change-over switch. The Wave-change order indicator is also located in this panel.

The supply panel forms the lower part and contains the Main A.C. Supply Switch, the Control Circuit Supply Transformer and the Main Auto-transformer.

A base platform is secured to the deck and the panels are "floated" between the platform and the deck above by resilient mountings. By this means the valves and components in the panels are protected from severe vibration and concussion. (Not shown in Fig. a).

3. CONTROLS.

V.F.O. FREQUENCY CONTROL (D1). Varies the capacity of the V.F.O. tuning condenser (C12). The dial is calibrated in divisions against frequency covered by Variable Frequency Oscillator. Used in conjunction with the V.F.O. Range Switch (S1) to set the calibrated frequency.

V.F.O. RANGE SWITCH (S1). A two-position switch marked, 1.0 - 1.5 and 1.5 - 2.0 indicating the frequency band, in Mc/s, covered by the V.F.O. in each of the two sub-ranges.

MIXER TUNING CONTROL (D2). Varies the capacity of a two-gang condenser (C26, C43). Used to tune the Mixer and Trebler stages to the frequency fixed by the setting of the V.F.O. and M.O. Range Switch (S2).

M.O. RANGE SWITCH (S2). This control has five positions, and selects the crystal, the crystal oscillator tuned circuit and the appropriate coil in the Mixer and Trebler Stages. Used to select the frequency band, to which the Mixer and Trebler Stages will be tuned in conjunction with the Mixer Tuning control (D2).

TREBLER SWITCH (S3). A two-position switch marked BLUE AND RED. In the BLUE position, the Mixer Stage provides frequencies between 2 - 7 Mc/s and the output is connected direct to the Intermediate Amplifier Stage. In the RED position, the R/F output of the Mixer Stage is passed through the Trebler Stage and then to the Intermediate Amplifier, providing frequencies between 7 - 21 Mc/s.

MASTER OSCILLATOR ANODE AMMETER (83). Measures the anode and screen current taken by the Crystal Oscillator Valve. (V4). Provides a check on the operation of the Crystal Oscillator Stage.

MASTER ABSORBER INDICATOR (76). Indicates the total current taken by the MASTER OSCILLATOR UNIT and its absorber circuit when the keying relay is in the "mark" and "space" positions. Used when adjusting the Master Oscillator Absorber potentiometer (367) so that the current remains constant when keying.

MASTER OSCILLATOR ABSORBER POTENTIOMETER (367). Varies the grid bias of the pilot valve which, in turn, varies the current taken by the Master Absorber valve. Used to maintain a constant load on the Master Oscillator H.T. rectifier circuit when keying.

MAIN ABSORBER ADJUSTING RHEOSTAT (361). Varies the grid bias applied to the grid of the Main Absorber Unit pilot valve (19) which, in turn, controls the grid bias applied to the Main Absorber Valve (17). Used to maintain a constant load on the Main Rectifier system.

CWS - DIRECT CHANGE-OVER SWITCH (302). Provides a means of changing over the keying bias from the keying relay to the direct control key.

INTERMEDIATE STAGE RANGE SWITCH (205). A six position switch which varies the amount of inductance used in the intermediate stage. Used in conjunction with condenser (206) to tune the stage to the required frequency.

INTER. STAGE FINE TUNING (D3). Varies the capacity of the intermediate stage tuning condenser (206). Used in conjunction with the range switch (205).

INTERMEDIATE ANODE AMMETER (70). Measures the anode current taken by the intermediate amplifier valves (12, 13). Used to tune :-

(i) Mixer Stage.
(ii) Mixer and Trebler Stages.
(iii) Intermediate Stage.

OUTPUT STAGE RANGE SWITCH (212).	A six position switch which varies the inductance of the Output Stage coil. Used in conjunction with the Output Stage Tuning Condenser (213 D4) to tune the stage to resonance.
OUTPUT STAGE FINE TUNING (D4).	Varies the capacity of the Output Stage Tuning Condenser (213).
AERIAL COUPLING CONTROL (D5).	Alters the plane of the Coupling Coil with respect to the Output Stage tuning inductance thus controlling the transfer of power from the Output to the Aerial Circuit.
AERIAL COARSE TUNING (217).	A six position range switch for varying the amount of inductance in the aerial circuit.
AERIAL FINE TUNING CONTROL (D6).	Varies the capacity of the Aerial Tuning Condenser (218). Used in conjunction with the Aerial Coarse Tuning Switch to tune the aerial circuit to the required frequency.
SERIES - PARALLEL SWITCH (219).	Used to connect the Aerial Tuning Condenser (218) in series or parallel with the Aerial Tuning Inductance (216) and Coupling Coil (215).
OUTPUT STAGE ANODE AMMETER (59).	Indicates the anode current taken by the Output Stage valves. Used to tune :- (i) Intermediate Stage. (ii) Output Stage. (iii) Aerial Circuit.
MAIN ABSORBER INDICATOR (58).	Indicates the total current supplied by the Main Rectifier system to the Output Stage and Absorber valve, when the keying relay is in the "mark" position, and to the Absorber Valve when the keying relay is to "space". Used when setting the Main Absorber Unit adjusting rheostat (361) in order to maintain a constant load on the Main Rectifier system under keying conditions.
TUNING INDICATOR (320).	A micro-ammeter which indicates the amplitude of the power in the aerial circuit. Used to tune the Aerial Circuit to resonance.
TUNING INDICATOR SENSITIVITY SWITCH (411).	A four position switch to alter the load resistance of the Tuning Indicator Rectifier valve (30). This increases or decreases the ratio of the current shown by the tuning indicator (320).
TRUNK SEALING SWITCH (401).	Earths the Aerial and completes the screening of the aerial trunk. This allows the various stages of the transmitter, except the aerial circuit, to be tuned or tested, without outside radiation. Auxiliary contacts on the switch control :- (i) A Red and Green lamp indicator circuit which shows the position of the switch. Red indicating "Aerial earthed, Trunk sealed" and Green "Aerial connected, Trunk open". (ii) Tune - Test Switch (406) keying circuit. (iii) An indicator circuit which causes a neon lamp to give long flashes at the W/T Control Unit or Units connected to the transmitter when the trunk is sealed. (See page DA13 para. 34). (iv) The operation of the Aerial Isolating Switch (402). The Aerial Circuit is completely broken when the trunk is sealed by this switch. (v) The "Safe to Transmit" plate also forms part of the Trunk Sealing Switch and when removed prevents the switch being placed to the Green position.
WHITE INDICATING LIGHT (405).	Is used when the transmitter is being operated by "Direct Control". (See page DA19 para. 46 and Fig. DA6).
FILAMENT VOLTMETER (398).	A common voltmeter, used in conjunction with a three position selector switch (400) to read the filament voltage of the main rectifier valves, main absorber valve or output stage valves.
SELECTOR UNIT.	(See page DM4).
H.T. SUPPLY VOLTMETER (44).	Measures the A.C. voltage applied to the primary of the Main H.T. transformer.
H.T. SUPPLY AMMETERS (41, 42, 43).	Indicate the current taken by the Main H.T. transformer from each phase.
WAVE CHANGE ORDER INDICATOR .	(See page DM5).
TUNE TEST SWITCH (406, 407).	A two pole three position switch and jack providing a local means of switching on the transmitter, at normal power, for tuning and testing. (See page DN4).
MAIN A.C. SUPPLY SWITCH (34).	Completes the 400 volt 3 phase A.C. supply to the transmitter. A quick release in the form of a red push, is provided on the switch.

4. OPERATION.

(i) Normal Operation.

All power for the transmitter is taken from the 3-phase, 400 volt, 50 cycle supply which is fed into the Main Supply Switch (34). On making this switch, supplies are completed to the Selector Unit, Trunk Sealing Switch indicating lamps and to the heater circuit of the valves in the Master Oscillator Unit. A steady neon light should show on the W/T Control Unit connected to the transmitter. This light will flash intermittently if the cage door is open or the Trunk Sealing Switch is in the "Sealed" position.

An interval of at least 50 seconds should be allowed for the valve heaters to reach working temperature.

Assuming that the transmitter is correctly tuned and adjusted, the Control Switch on the W/T Control Unit can now be made. The "Green" lamp, on the W/T unit will light and the H.T. and filament contactors (36, 393) will operate. The type of transmission should then be dialled, C.W., M.C.W. etc. The required power is now dialled, the neon lamp goes out, and the transmitter is ready for use.

(ii) Emergency Operation.

The "Normal - Emergency" switch is situated above the relays in the Selector Unit. When placed to "Emergency", the dialling circuit is disconnected and the transmitter is switched on with the power fixed at "Normal". The Control Switch, on the W/T Control Unit, must be made to complete the keying circuit and the transmitter is then ready for use.

Power cannot be altered and the transmitter can only be switched off by the "Normal - Emergency" switch, being placed in the "Normal" position. If it is required to alter the type of transmission, this must be done by altering the position of the Modulation Contactors (394, 395) by hand.

(iii) Direct Control.

The C.W.S. - Direct Control Switch is situated at the rear of the Controlling Panel and enables the transmitter to be controlled from the Direct Control Position without using the Selector Unit; the C.W. - M.C.W. Modulation Contactors being operated by hand as for "Emergency" operation.

When the switch is placed in the Direct Control position, its handle can be withdrawn and provides the key to operate the Direct Control C.O.S. for transmitters. This switch is set to the Type 57 position as indicated by the number 57 appearing in the circular window near the switch key. The high speed relay (303) is then disconnected and the Direct Control morse key substituted by changing over the C.W.S. - Direct C.O.S. (302) situated in the right hand pocket of the Master Oscillator and Intermediate Stage panel.

The two switches, in the Direct Control Board, and the two adjacent keys, control one transmitter in each transmitting room. (See page DA19 and fig. DA6).

The Modulation Contactors may be locked in any required position, when hand operated, by means of a screwed plug fitting. Removing the plug from its normal, or "A" position, breaks the bobbin circuit of the contactor and replacing the plug in the "B" or "C" socket, mechanically locks the contactor in the selected position.

No provision has been made for using R/T when the transmitter is being operated by Direct Control.

(iv) Tuning.

A Calibration Book is provided with the Master Oscillator Unit in which is given the calibration charts for the V.F.O. dial settings, the Mixer Range Switch settings, and the Mixer Tuning Control adjustments for the frequencies covered by the transmitter.

By means of a nomogram, also supplied in the Calibration Book, the adjustments of the Intermediate Stage and Output Amplifier can be approximated.

To ensure the back-lash on the V.F.O. slow motion dial is always taken up in the same direction:-

(a) Read off the calibrated dial setting for the desired frequency.

(b) Engage the vernier dial at least two main scale divisions below the calibration figure.

(c) Rotate the vernier control clockwise until the exact dial setting is obtained.

(v) Setting a frequency below 7 Mc/s.

The following procedure is to be carried out when setting a required frequency for the first time.

(a) Trebler switch to BLUE.

(b) Read off the V.F.O. range and dial setting from the V.F.O. calibration charts. (Page 9 - 18 of the Calibration Book).

(c) Read off the M.O. range, Mixer Tuning Control setting, Intermediate and Output Stage ranges from the nomogram. (Page 19 - 20 of the Calibration Book).

(d) Set the respective controls to the readings obtained, observing the method of taking up backlash when setting the V.F.O. dial.

(e) Close the cage door (35) and open the Trunk Sealing Switch (401).

(f) Make the Main A.C. Supply Switch (34), and wait for at least 50 seconds to allow M.O. unit valve heaters to reach working temperature.

(g) Make the Control Switch on the W/T Control Unit. This operation completes the circuit for all transmitter valve filaments, grid bias and keying voltages and H.T. supply at "Normal" power.

(h) Dial modulation. For tuning, C.W. should be used.

(i) Dial "Normal" power.

(j) Depress key and tune the Intermediate Stage by the Inter-Stage fine tuning control (D3) for a maximum reading on the Output Stage Anode ammeter (59).

(k) With the Aerial Coupling Control (D5) set to minimum coupling, tune the Output Stage with the Output Stage fine tuning control (D4) for minimum reading in the Output Stage Anode Ammeter (59).

(l) Vary the Aerial Fine tuning control (D6) in conjunction with the Aerial Coarse Tuning (217) until an increase of current is indicated on the anode ammeter (59) or a reading is observed on the Tuning Indicator (320). The most sensitive indication is obtained when the Tuning Indicator Sensitivity Switch (411) is set to give approximately half scale deflection.

(m) Increase coupling slightly and retune Output Stage for minimum current in anode ammeter (59).

(n) Check the adjustment of the Aerial Fine Tuning control (D6) to obtain maximum reading on the Tuning Indicator (320).

(o) Increase coupling as requisite, to obtain the necessary power output and re-check the tuning of the Output Stage for minimum reading in the Anode Ammeter (59).

The transmitter is now ready for use.

(vi) Setting a frequency above 7 Mc/s.

(a) Trebler Switch to RED.

(b) Divide the required Output Frequency by three to obtain the frequency of the Mixer Stage. Read off the V.F.O. range and dial setting for this frequency from the calibration curve.

(c) Read off the M.O. range, Mixer Tuning Control setting and Intermediate and Output stage ranges from the nomogram. Continue from (v) (d) above, the instructions given for setting frequency below 7 Mc/s.

NOTE :- (i) The adjustments obtained for any frequency should be entered in the space provided on pages 1 - 8 of the Calibration Book. The adjustments will then be available for resetting the transmitter to this frequency in future.

(ii) See Page RB2 for instructions for tuning the aerial circuit of H/F transmitters.

(iii) Under no circumstances should either the Aerial Coarse Tuning Control (217) or the Series - Parallel Switch (219) be moved while the transmitter is oscillating.

(iv) The V.F.O. range switch (S1) may be moved when power is "ON" providing the key is not depressed. The Trebler Switch (S3) and M.O. Range Switch (S2) must not be moved with power "ON".

(v) Small alterations in frequency up to ±10 Kc/s, may be made on the V.F.O. without retuning the later stages.

5. TECHNICAL DESCRIPTION.

(a) Master Oscillator Unit. (Fig. b).

The unit contains four stages :-

(i) Variable Frequency Oscillator.
(ii) Crystal Oscillator.
(iii) Mixer Stage.
(iv) Trebler Stage.

(i) Variable Frequency Oscillator.

A Colpitts circuit, using an indirectly heated beam tetrode valve, ATS25A, (V1), is used as the V.F.O. The frequency range of the oscillator, 1 - 2 Mc/s, is covered in two sub-ranges, 1•0 - 1•5 Mc/s and 1•5 - 2•0 Mc/s.

The sub-range in use is selected by the V.F.O. range switch (S1) which short circuits a portion of the tuning inductance (L1) on the higher frequency band and introduces a small padding condenser (C7).

By an arrangement of series and parallel condensers (C9, C10), the main tuning condenser (C12) provides a practically linear variation of frequency with angle of dial rotation. The frequency coverage of sub-range is thus equally spaced over the V.F.O. Frequency Control Dial (D1). The value of the ceramic fixed condensers (C9, C10) have been chosen to reduce to a minimum the variation of frequency due to temperature changes.

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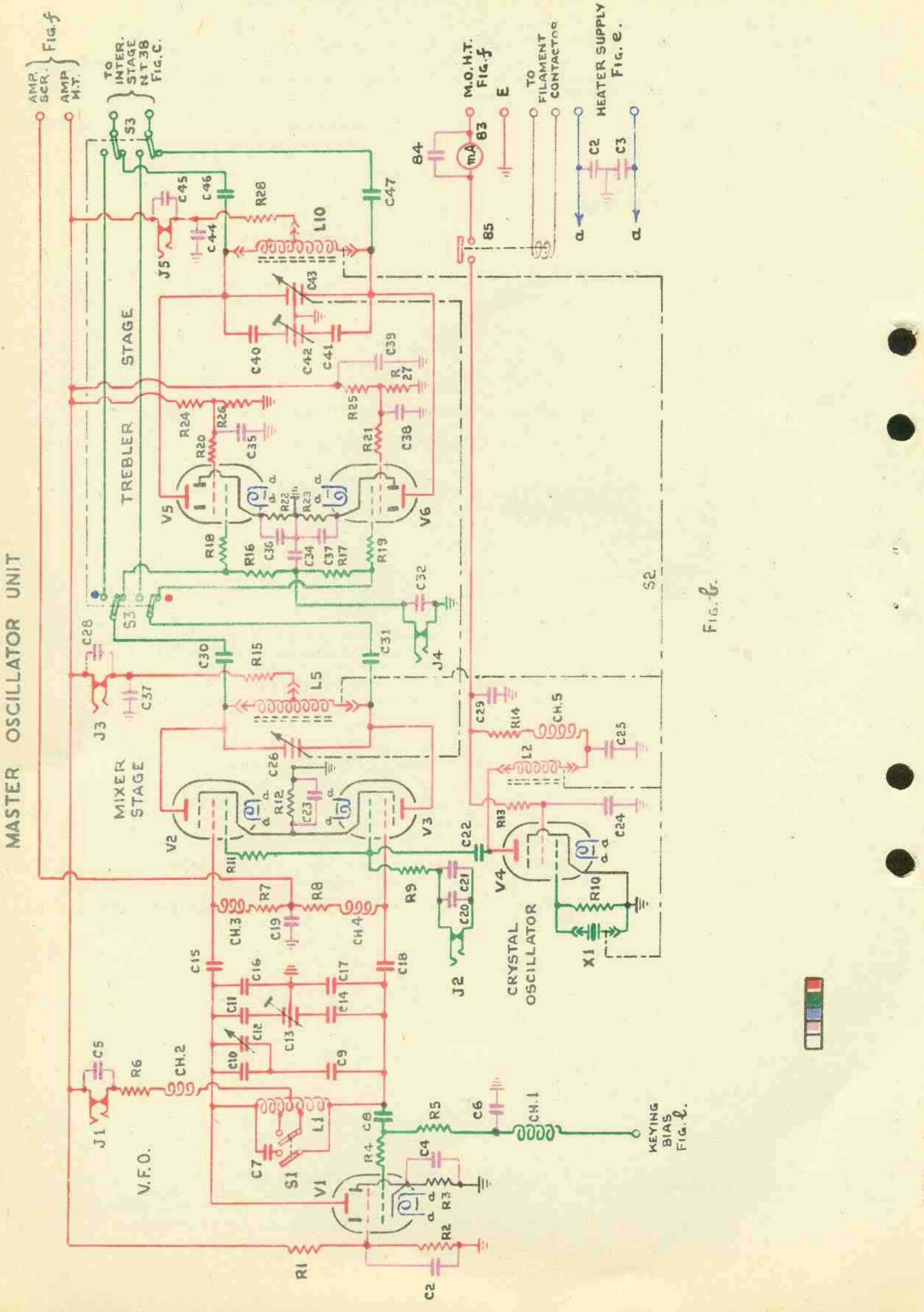

Fig. G.

A trimmer condenser (C13), accessible from the front of the unit by removing a small plate, is used at the initial calibration to adjust the end points of each sub-range to approximately 10 and 90 division of the V.F.O. frequency control (D1).

The condensers (C11, C14, C16, C17) form the capacity network, the centre point of which is earthed to make the cathode connection to valve V1.

The valve (V1) is biassed by the cathode resistance (R3) which is decoupled by the by-pass condenser (C4). The grid is coupled to the tuned circuit by the coupling condenser (C8) and the grid stopper resistance (R4).

Keying is effected by applying a negative potential to the grid of the V.F.O. valve (V1). The keying bias is of such a value that the valve (V1) is closed down in the "space" position of the keying relay. In the "Mark" position, the keying bias is suppressed and the grid of the valve connected to cathode via the grid resistance (R5) and earth.

The R/F choke (Ch1) prevents leakage of R/F energy to earth, via the keying bias supply lead, when the keying relay is in the "mark" position.

The H.T. voltage from the M.O. H.T. and Absorber Unit (Fig. f) is applied via a dropping resistance (R6) and R/F choke (Ch2) to a centre tap on the tuning inductance (L1). A jack (J1) allows the current taken by the valve (V1) to be checked with an external meter. The screen grid potential is provided via a potentiometer (R1, R2), the screen being maintained at earth potential, with respect to R/F, by the condenser (C1).

The R/F output of the V.F.O. is capacity coupled to the screen grids, connected in push pull, by the coupling condensers (C15, C18).

(ii) <u>Crystal Oscillator.</u>

An indirectly heated VT52 pentode valve (V4) is used in the Crystal Oscillator Stage.

One of three crystals, together with the appropriate iron dust core coil (L2), is selected by the M.O. Range Switch (S2). The coil (L2) is tuned to the crystal frequency by the inter-electrode capacity of the valve (V4).

The H.T. and screen grid voltage is provided from a tap on the H.T. potentiometer (177, 178) supplied by the M.O. unit H.T. and Absorber Circuit (Fig. f). The anode voltage is reduced to a suitable value by the resistance (R14), and the screen voltage by resistance (R13). The supply lead is decoupled by the R/F choke (Ch5) and by-pass condenser (C25).

The crystal circuit will oscillate continuously providing power is "ON" and the filament contactor (393) is made. A check on the performance of the crystal oscillator is provided by the milliammeter (83) in the H.T. supply lead.

A delay relay is fitted in the H.T. supply to the crystal oscillator. The relay provides approximately two second delay after the filament contactor (393) has operated before completing the H.T. supply to valve (V4). The interval is sufficient to allow the keying bias to become operative and prevent spurious signals being radiated during the initial switching of the transmitter.

The output of the crystal oscillator is capacity coupled to the control grids, connected in parallel, of valves V2, V3, by condenser (C22).

(iii) <u>Mixer Stage.</u>

The mixer Stage uses two indirectly heated VT52 pentode valves (V2, V3) connected in push pull.

The frequency of the V.F.O. and that of the crystal oscillator is electronically mixed by valves (V2, V3) and the resultant frequency selected by the tuned circuit consisting of the coil (L5) tuned by condenser (C26). The coil (L5) is of the iron dust core type, and is one of five, selected by the M.O. range switch (S2) to allow the Mixer Stage to cover a frequency range of 2 - 7 Mc/s.

The M.O. range switch (S2) also selects the appropriate coil in the Trebler Stage.

The Mixer Tuning Control (D2) varies the capacity of the tuning condenser (C26) and the condenser (C43) which tunes the Trebler Stage. The two stages are thus simultaneously tuned by the two controls of the Mixer Tuning (S2, D2).

Two jacks are provided in the Mixer Stage. Jack (J3) to read the anode current of valves (V2, V3) and jack (J2) the grid current. The latter is also used to check the performance of the crystal oscillator.

The screen grid voltage is provided from a tap on the H.T. potentiometer (177, 178) supplied by the M.O. unit H.T. and absorber circuit (Fig. f).

The R/F output of the Mixer Stage is capacity coupled by condensers (C30, C31) to either the control grids of the Trebler Stage or, the control grids of the Intermediate Stage valves, depending upon the position of the Trebler Switch (S3). For frequencies below 7 Mc/s, the switch (S3) is placed to BLUE and for the higher frequencies, the switch (S3) is used in the RED position, thus introducing the Trebler Stage. The Mixer output is then trebled before being passed on to the Intermediate Stage.

(iv) <u>Trebler Stage.</u>

The Trebler Stage uses two indirectly heated beam tetrode ATS25A valves (V5, V6) connected in push-pull. The power supplies are completed to the valves whether the Trebler Stage is in use or not. By this

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INTERMEDIATE AND OUTPUT STAGES

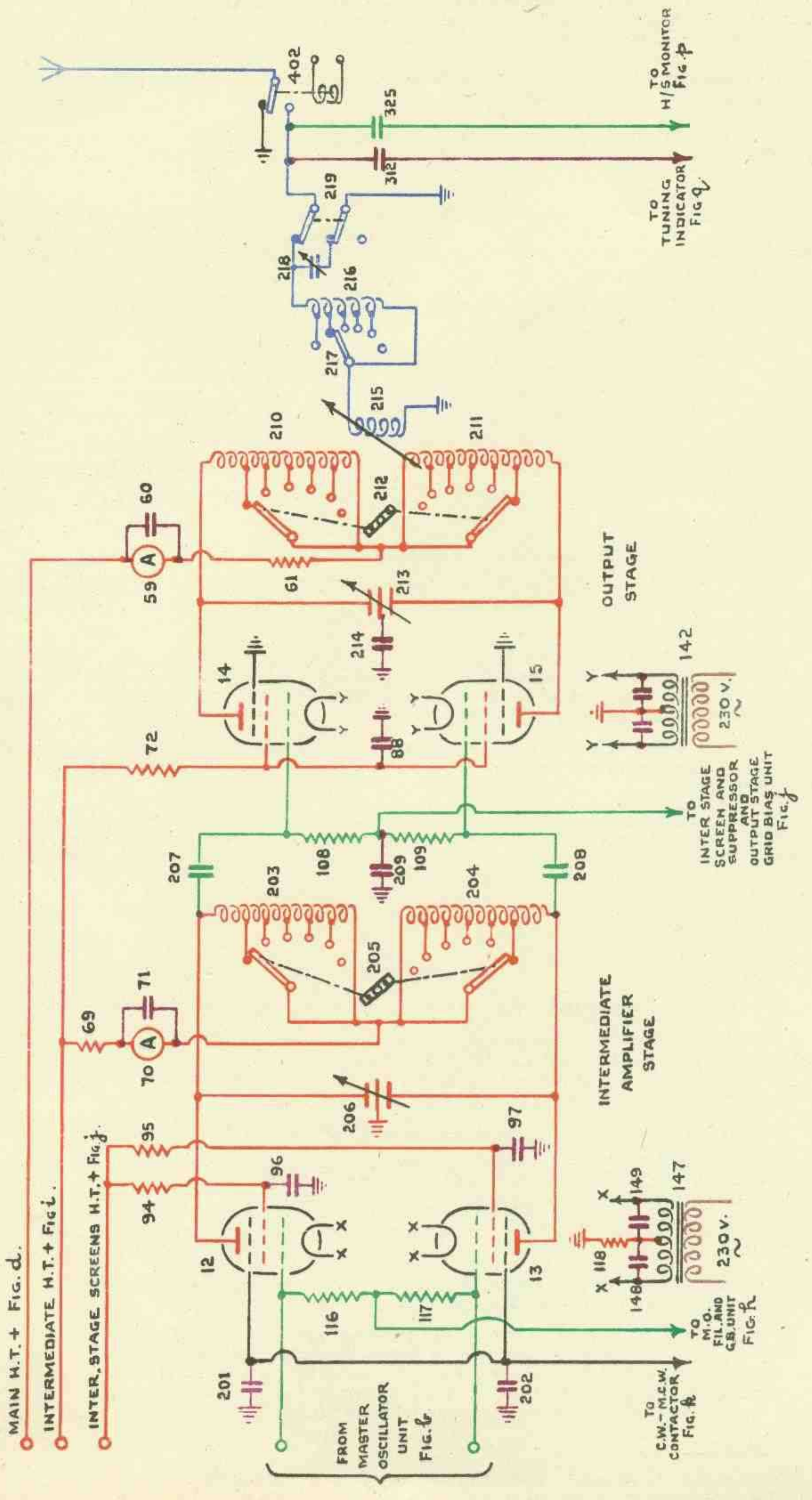

FIG. C

arrangement, the supply voltages to the other stages in the unit are maintained at a constant value. When the Trebler Stage is not in use, the valves (V5, V6) are self-absorbing.

The anode inductance coil (L10) is selected by the M.O. range switch (S2) and tuned by the condenser (C43) which is ganged to the Mixer Stage tuning condenser (C26).

Jacks (J4, J5) are provided for reading the grid and anode current respectively of the valves V5, V6.

The trimmer condenser (C42), accessible from the rear of the unit is used at the initial calibration for capacity ganging the Trebler Stage to the Mixer Stage and is then locked.

The anode and screen grid voltage is supplied by the M.O. unit H.T. and absorber circuit (Fig. f). The screen grid voltage is reduced to a suitable value by the potentiometers (R24, R26) and (R25, R27).

The heater circuit of all valves in the Master Oscillator Unit are supplied from a heater transformer (412). The supply to this transformer is completed by the Main Supply Switch (34) (Fig. c). The heater circuit is thus completed with the supply to the Selector Unit.

(b) Intermediate and Output Stages. (Fig. c).

(i) Intermediate Stage.

Two NT38 pentode valves (12, 13) connected in push-pull are used in the Intermediate Stage.

The R/F output of the Master Oscillator Unit is connected to the control grids of valves (12, 13). A fixed control grid bias is provided by the M.O. Filament and Grid Bias supply unit (Fig. h). In addition to the fixed grid bias, automatic grid bias is provided by the resistance (118) in the negative H.T. return lead to the centre tap of the filament transformer (147).

Suppressor grid modulation is used and is applied to the suppressor grids of the valves (12, 13). A negative bias is obtained from the Intermediate Stage screen and suppressor grids, and Output Stage grid bias unit (Fig. j) and connected to the suppressor grids by the modulation contactor (394) when in the R/T / MCW position. The type of modulation is selected by the modulation contactor (395) which connects the output of the R/T amplifier (Fig. n) or M.C.W. Oscillator (Fig. m) to vary the standing suppressor grid bias at audio frequency. (See Fig. k).

In the C.W. position of the modulation contactor (394), the suppressor grids of valves (12, 13) are disconnected from the bias supply and earthed.

The tuned circuit consists of the air core coil (203, 204) which is tuned by the condenser (206). The amount of inductance used in the intermediate circuit is controlled by a six position switch (205). The switch selects an equal amount of inductance either side the centre point, the turns not in use being short circuited by the action of the switch. A symmetrical circuit is thus maintained irrespective of the frequency being used.

The H.T. supply is obtained from the Intermediate H.T. rectifier (Fig. i) and is applied via the dropping resistance (69) and anode ammeter (70) to the centre tap of the tuning coil (203, 204).

The screen grids of valves (12, 13) are supplied from the Intermediate stage screen and suppressor grids, and Output Stage grid bias unit (Fig. j) via the voltage dropping resistances (94, 95) respectively. By-pass condensers (96, 97) maintain the screens at earth potential with respect to R/F.

As the Intermediate H.T. rectifier (Fig. i) and Screen grid H.T. rectifier (Fig. j) are both supplied from the power contactors (38, 39, Fig. d) the ratio of screen voltage to anode voltage will remain the same, irrespective of the power selected by the contactors (38, 39).

The valve filaments are supplied by the transformer (147), this being controlled by the filament contactor (393).

The R/F output from the Intermediate Stage is capacity coupled by condensers (207, 208) to the Output Stage.

(ii) Output Stage.

Two NT69 pentode valves (14, 15) connected in push-pull are used in the Output Stage. Electrically, the circuit is identical with that of the Intermediate Stage. The tuning inductance (210, 211), controlled by a six position range switch (212) is tuned by the Output Stage fine tuning condenser (213, 214).

The H.T. supply from the Main H.T. Rectifier (Fig. d) is fed via the anode ammeter (59) and resistance (61) to the centre tap of the output coil (210, 211). The screen grid H.T. voltage is obtained from the Intermediate H.T. rectifier and is supplied via the dropping resistance (72). The screens are by-passed to earth by the condenser (88).

The control grids are supplied with grid bias from the Intermediate stage screen and suppressor, and output stage grid bias unit (Fig. j), via the grid resistances (108, 109).

The suppressor grids are connected directly to earth.

The control grid bias, screen grid voltage and main H.T. supply voltage are dependent upon the power selected by the power contactors (38, 39) and will bear a constant ratio, one to the other, irrespective of the power being used.

The filaments of the output valves (14, 15) are supplied by the filament transformer (142) which obtains its supply via the filament contactor (393).

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MAIN H.T. RECTIFIER AND ABSORBER CIRCUIT

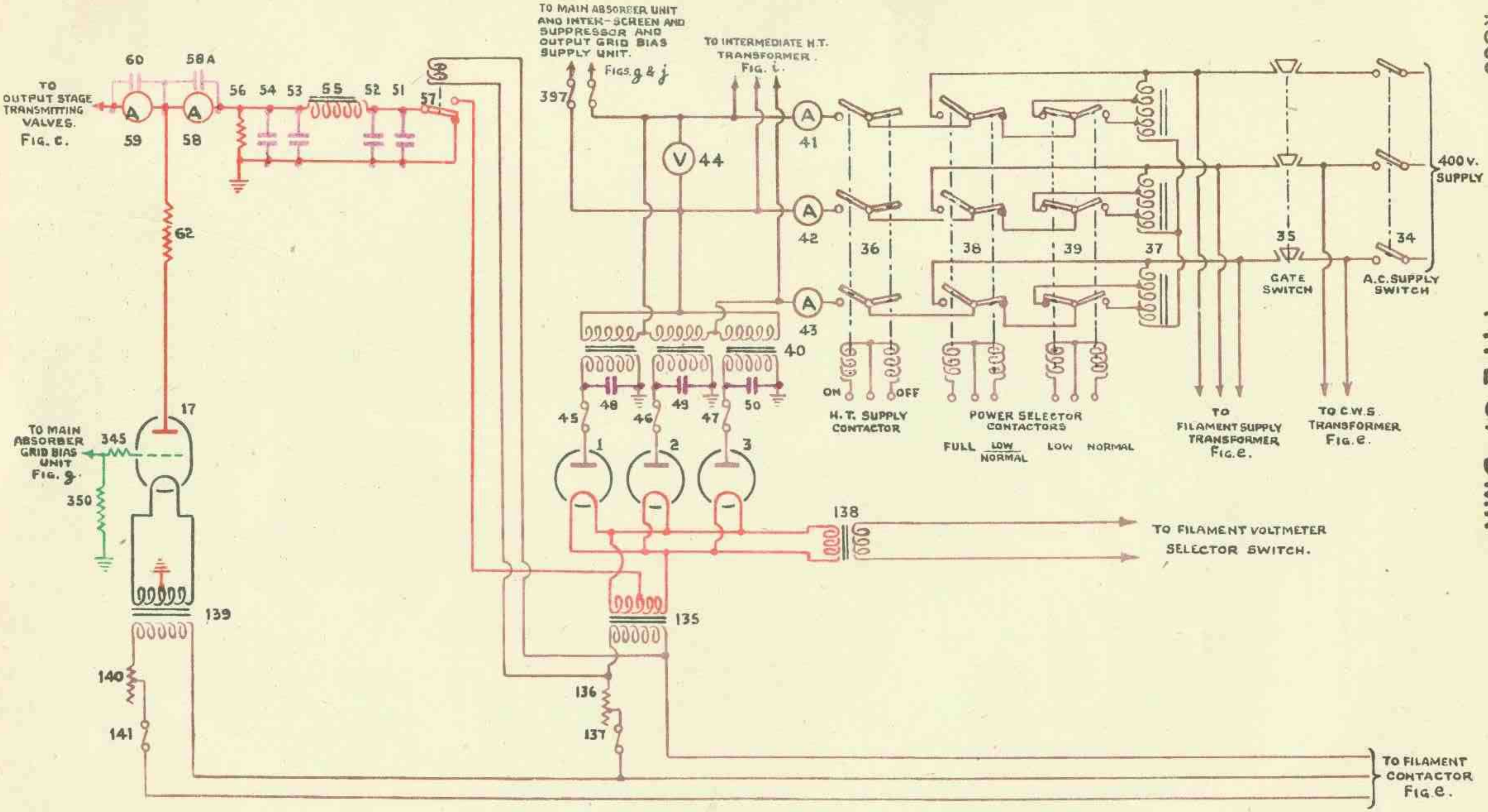


Fig. d.

(c) Aerial Circuit. (Fig. c).

A tuned unipole aerial is used, mutually coupled to the output coil (210, 211) by the coupling coil (215). The number of turns used in the coupling coil (215) is fixed, but the plane of the coil may be varied, with relation to the output coil (210, 211) by the coupling control (D5).

Rough tuning of the aerial circuit is by means of a six position switch (217), the turns of the aerial coil (216) not required being short circuited by the action of the switch (217). Condenser (218) provides fine tuning of the aerial circuit. By means of switch (219) the condenser (218) may be placed in series or parallel with the aerial and coupling coils (216, 215) enabling the aerial system to be current or voltage fed.

The H/S Monitor, (Fig.p), if fitted, and the Tuning Indicator (Fig. q) are capacity coupled to the aerial circuit by condensers (325, 312) respectively.

The Aerial Isolating Switch (402) provides a means of isolating the aerial system from the transmitter. The bobbin circuit of the switch is interrupted by auxiliary contacts on the cage door (35) and trunk sealing switch (401). With the trunk sealed, the aerial is disconnected from the transmitter and earthed, allowing tuning or testing to be carried out, without outside radiation.

(d) Power Supplies.

General.

All power supplies are obtained from the Central W/T Power Supply System, which consists of a 3-phase, 400 volt, 50 cycle supply. The supply is selected from any one of three 60 kVA motor alternators, by a selector switch on the Power Supply Board, fitted in the Transmitter Room, and is connected to the transmitter by a fuse switch fitted in the distribution board.

(1) Main H.T. Supply. (Fig. d).

The power supply is completed to the transmitter by making the Main Supply Switch (34) and closing the cage door, thus completing the gate switch (35). Power is then supplied to the auto-transformer (37), the filament supply transformer (392) and the C.W.S. transformer (384). (See Fig. a).

The auto-transformer (37) has two tappings on each of the windings, and, by means of Power Contactors (38, 39), three voltages can be selected from the supply to feed the main and intermediate H.T. transformers (40, 63). The Main Absorber Unit (Fig. g) and Inter-screen and suppressor, and Output grid bias supply unit (Fig. j) are also supplied from the Power Contactors (38, 39). The voltages selected are 400, 200 and 100 volts, corresponding to Full Power, Normal Power and Low Power.

The 230 volts A.C. supply to the bobbin circuit of the Power Contactors (38, 39) is provided by the C.W.S. transformer (384) and is controlled by the Power Relays in the Selector Unit operated by the dialling system. (See page DN2).

The H.T. Supply Contactor (36) completes the selected supply voltage to the Main and Intermediate H.T. transformers (40, 63), the Main Absorber unit and the Interscreen and suppressor, and Output grid bias supply unit. The 230 volt A.C. supply to the bobbin circuit is normally completed by the "SET ON" Power Relay, which is operated by placing the Control Switch, in a W/T unit, to the "ON" position. The supply may also be completed by the Emergency-Hand Switch, Tune-Test Switch when the trunk is sealed, or when the transmitter is being operated in Direct Control by the Power Control Switch. (See pages DN5 and DA20).

The voltmeter (44) indicates the voltage, selected by the Power Contactors (38, 39).

The primary winding of the main H.T. transformer (40) is connected in delta and the secondary winding in star with the neutral point earthed. Each of the three secondary windings is connected to the anode of a NU26C rectifying valve (1, 2, 3). The resultant rectified H.T. supply is developed between the filaments of the three rectifying valves and the earthed neutral point. R/F by-pass condensers (48, 49, 50) are connected between the anode of each valve and earth to protect the windings of transformer (40).

The filament supply is obtained via the Filament Supply transformer (392) and the Filament Contactor (393). (See Fig. e). The bobbin circuit of this contactor (393) is operated in parallel with that of the H.T. Contactor (36).

A preset resistance (136) controls the primary voltage of the filament transformer (135). The filament voltage applied to the rectifier valves (1, 2, 3) may be read on a common filament voltmeter (398), the H.T. potential, on the filaments, being isolated from the voltmeter (398) by the transformer (138).

The H.T. supply is taken from the centre tap on the filament transformer (135) to the H.T. Smoothing Condenser, Discharge switch (57). When the filament supply is completed, the short circuit across the smoothing condensers (51, 52, 53, 54) is removed and the H.T. supply connected to the smoothing circuit. Opening the Cage Door breaks the filament supply, the bobbin circuit of switch (57) is de-energised and the smoothing condensers (51, 52, 53, 54) are short circuited and discharged.

The H.T. smoothing consists of a capacity input filter, the condensers (51, 52) acting as reservoir condensers, and one stage of choke-capacity filter formed by the choke (55) and smoothing condensers (53, 54). A loading resistance (56) has the effect of stabilising the load on the rectifying system.

TYPE 57 DMR

FILAMENT SUPPLY CIRCUIT

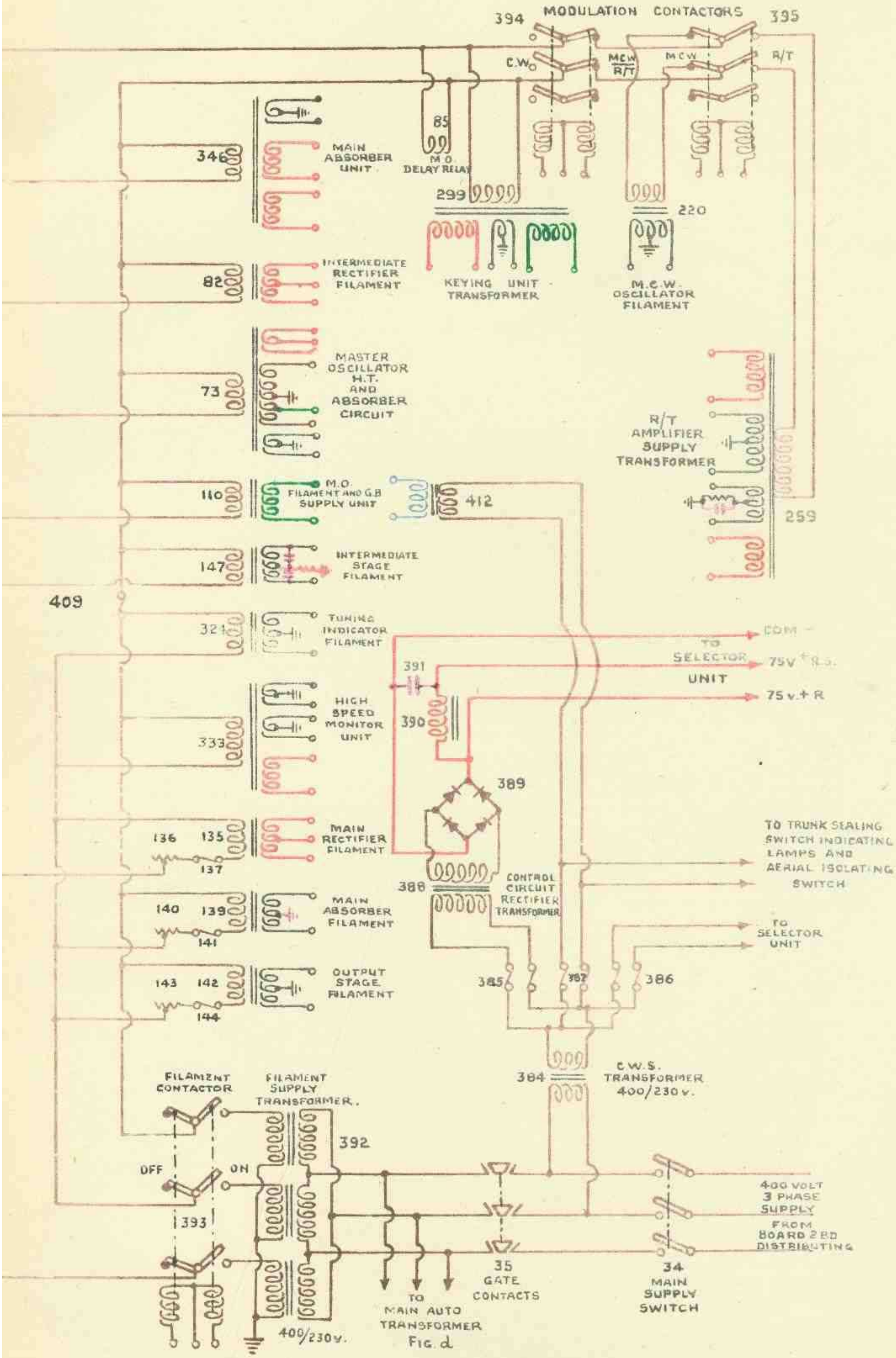


Fig. e.

To maintain a constant load on the rectifier supply and thereby ensure a constant supply voltage, when keying, an absorber valve (17) is used. The main absorber valve (17) is a NT90 triode and together with the main absorber resistance (62) is connected in parallel with the H.T. supply to the output stage valves (14, 15). By suitable grid bias arrangements, the absorber valve (17) passes current during the "Spacing" intervals and is closed down when the keying relay is to "Mark". The value of the absorber resistance (62) is such that the power absorbed in the "Spacing" condition closely approximates that taken by the transmitter when radiating, thus the loading conditions and H.T. voltage remain practically constant.

The grid resistance (350) is used to apply a negative potential to the control grid when the valve (17) is passing current.

The absorber filament transformer (139) is supplied in parallel with the rectifier filament transformer (135), but is connected to another phase to balance the loading of the supply phases. The centre point of the filament transformer is connected to negative H.T. and earth by the centre tap. The pre-set resistance (140) allows the small changes of filament voltage, between different valves of the same type, to be accommodated.

The ammeter (58) measures the total current taken by the absorber valve (17) and output stage valves (14, 15). The anode ammeter (59) measures the current taken by valves (14, 15) from the main H.T. rectifier. By checking the reading of the meter (58), under keying conditions, the bias applied to the control grid of valve (17) can be so adjusted that the load taken from the main rectifier system remains constant under "marking" and spacing conditions. (See section (d) (iv)).

The C.W.S. transformer (384) is connected to the supply side of the gate contacts (35). (See Fig. c). It is a step down transformer and is used to provide a 230 volt A.C. supply to the Master Oscillator Unit heater transformer (412), Control Circuit Rectifier transformer (388), Selector Unit, Power Relay Contacts, (in Selector Unit), Trunk Sealing Switch indicating lamps (403, 404), bobbin circuit of Aerial Isolating Switch (402) and the Direct Control Indicating Lamps (405).

The M.O. unit heater transformer (412) supply is completed on making the Main Supply Switch (34).

The Control Circuit Rectifier transformer (388) supplies a metal rectifier (389) which has two separate outputs.

(i) Provides 75 volts, smoothed by the choke-capacity filter circuit (390, 391) to operate the bobbin circuit of the keying relay (303).

(ii) Supplies 75 volts, unsmoothed, which is used to operate the relays in the Selector Unit.

A common negative is used for the two supply voltages. (See page DM4).

The Selector Unit contains a transformer and metal rectifier which provides 230 volts D.C. to operate the neon indicating lamps at the W/T units and Central Control Exchange. (See page DA7 para. 15, and page DN8).

The 230 volts A.C. supplied to the Power Relay contacts in the Selector Unit, is the operating voltage for the bobbin circuits of the Power Contactors. (See page DN5).

By auxiliary contacts fitted in the Trunk Sealing Switch, the 230 volt A.C. supply is switched to one of two indicating lamps. Red and Green shades are fitted over the lamps which, when alight, indicate the trunk is "Sealed" or "Open" respectively.

The supply to the bobbin circuit of the Aerial Isolating Switch (402) is controlled by auxiliary contacts on the cage door and Trunk Sealing Switch (401). When the cage door is closed and the aerial trunk "open", the bobbin circuit is energised and the aerial system connected to the transmitter. Opening the cage door or "Sealing" the aerial trunk interrupts the bobbin circuit supply. The Aerial Isolating Switch (402) returns to its rest position, isolating the aerial system from the transmitter, and connecting the aerial to earth.

The Direct Control indicating lamps are controlled by the Key change-over switch fitted on the Direct W/T Control Board situated in the R.C.O. (See pages DA20, DA21).

(ii) Filament Supply. (Fig. c).

The Filament Supply transformer (392) reduces the supply voltage from 400 volts to 230 volts 3-phase. The Filament Contactor (393) controls the supply from transformer (392) to the primary windings of the various filament and supply transformers. The bobbin circuit of contactor (393) is supplied and controlled in parallel with the H.T. contactor (36).

The supply to the transformer primary windings is divided between the three phases to obtain a balanced load. A single phase is tapped off the 3-phase supply and passing via the filament supply fuses (409) supplies 230 volts to the Modulation Contactors (394, 395) and miscellaneous transformers.

The various transformers are described in conjunction with the circuits in which they are used.

The bobbin circuits of the modulation contactors are operated by 230 volts A.C. and are normally controlled by the dialling system. They may be set by hand, and locked in the desired position by a plug and socket.

The Modulation Contactors complete the following duties to arrange the different modes of transmission :-

TYPE 57 DMR

MASTER OSCILLATOR UNIT H.T. AND ABSORBER CIRCUIT

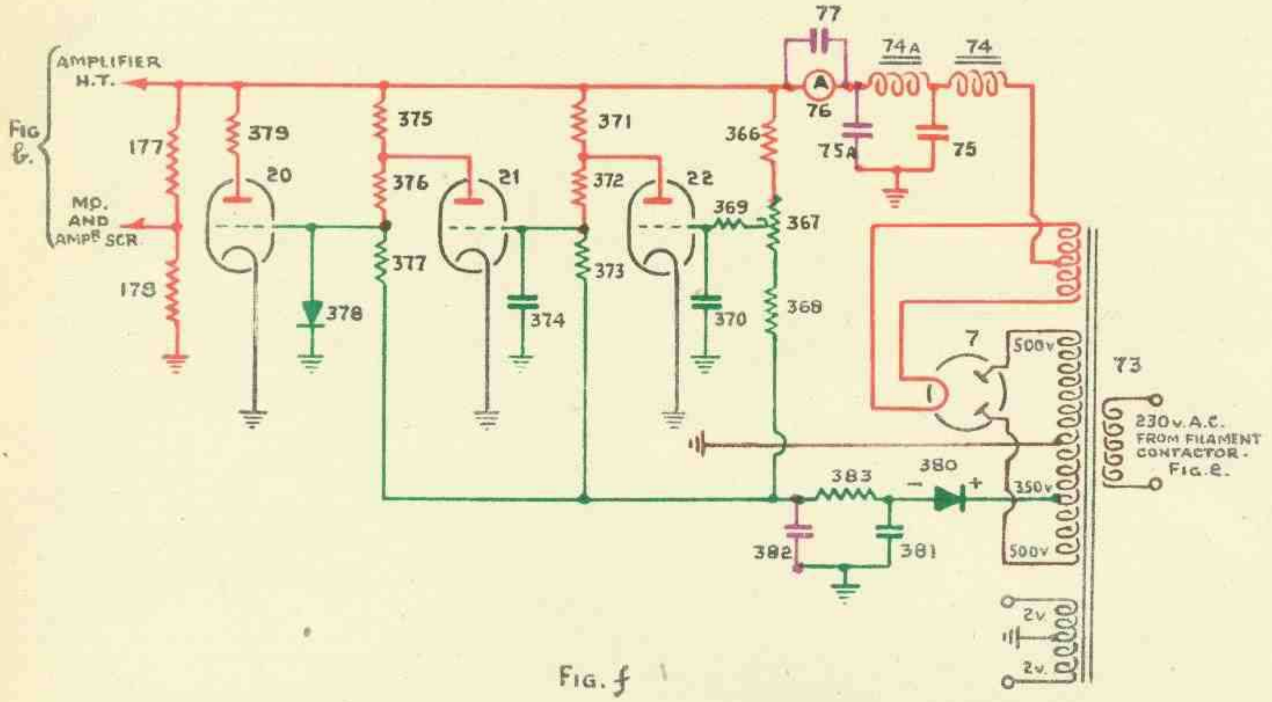


FIG. f

MAIN ABSORBER UNIT

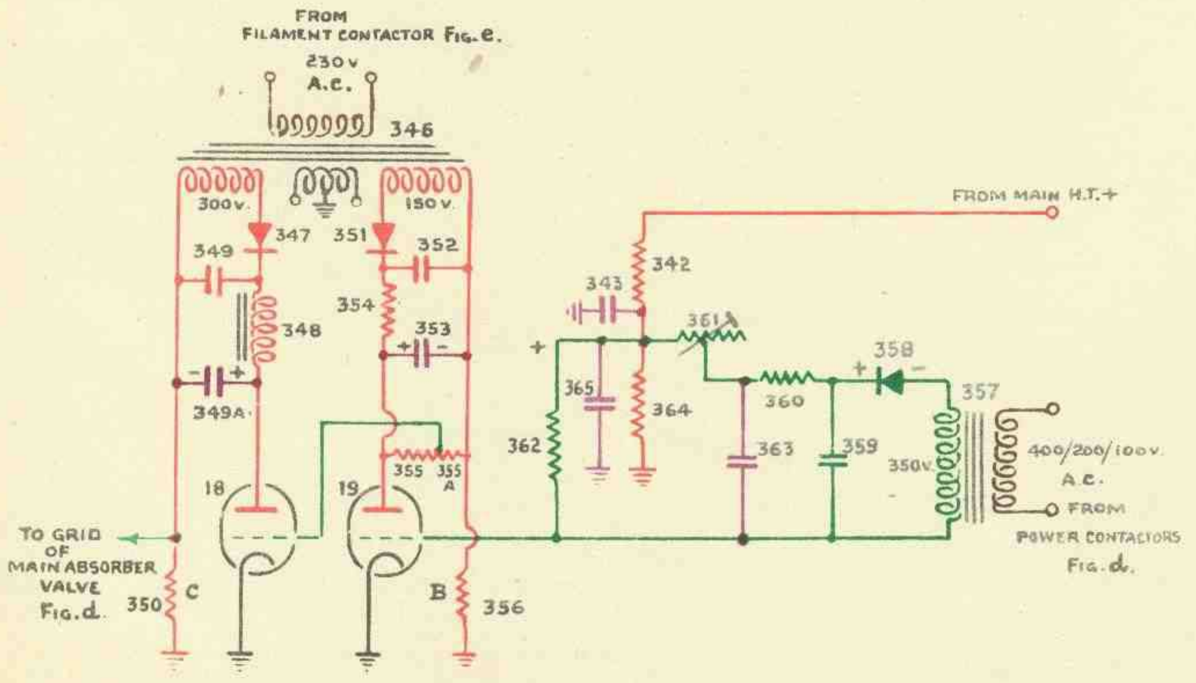


FIG. g.

TYPE OF TRANSMISSION.	MODULATION CONTACTOR.	OPERATION.
C.W.	394	Earths suppressor grids of Intermediate valves (12, 13). Disconnects Suppressor Grid Bias Rectifier output. Disconnects 230 volt supply to modulation contactor (395).
M.C.W.	394	Connects suppressor grids of valves (12, 13) to suppressor grid bias rectifier output. Connects 230 volt A.C. supply to modulation contactor (395).
	395	Connects 230 volt A.C. supply to M.C.W. oscillator filament transformer (220). Connects output of M.C.W. oscillator across the Suppressor Grid Bias Rectifier output potentiometer (124, 125).
R/T	394	Connects suppressor grids of valves (12, 13) to suppressor grid bias rectifier output. Connects 230 volt A.C. supply to modulation contactor (395).
	395	Connects 230 volt A.C. supply to R/T amplifier supply transformer (259). Connects output of R/T Amplifier across the Suppressor Grid Bias rectifier output potentiometer (124, 125).

NOTE: The "CALL UP" method of transmission is not used when P.C.C. Master Oscillator Unit is fitted.

(iii) Master Oscillator Unit H.T. and Absorber Circuit. (Fig. f).

The H.T. supply for the M.O. unit is obtained from a full wave rectifying system using a NU12 valve (7).

To stabilise the load on the rectifier, and thus provide a steady voltage under keying conditions, an absorber valve (20) is connected in parallel with the M.O. unit supply.

The operation of the absorber valve (20) is controlled by two NR15A valves (21, 22) which are connected to act as D.C. amplifiers to produce the required grid bias for valve (20).

The H.T. transformer (73) is supplied with 230 volts from the filament contactor (393). Three secondary windings supply the filament of the rectifying valve (7), the H.T. potential for the anodes of valve (7) and the filaments of valves (20, 21, 22). The H.T. supply is taken from a centre tap on the rectifier valve filament winding and is smoothed by two stages of choke-capacity filter (74, 75, 74A, 75A). The centre tap of the H.T. winding is connected to earth. A further tap on the H.T. winding provides the required voltage, between earth and tapping point, to operate a grid bias rectifier (380). This is in the form of a half wave metal rectifier, the output being smoothed by the resistance (383) and condenser (382). Condenser (381) operates as a reservoir condenser. The filament winding for valves (20, 21, 22) is centre tapped to earth but in Fig. f the filament is directly earthed to simplify the action of the circuit.

Across the H.T. supply is a potentiometer consisting of resistances (366, 367 and 368). Resistance (368) is connected via the grid bias rectifier (380) to the earthed tap of the transformer winding which is negative H.T. The bias applied to valve (22) via resistance (368) will be in opposition to the potential obtained from the H.T. potentiometer (366, 367, 368), thus by means of a pre-set potentiometer (367) the necessary potential for the grid of valve (22) can be obtained.

The grid potential applied to valve (22) controls the amplitude of the current flowing from the filament of valve (22) to the anode and then by the circuit consisting of dropping resistance (371), master absorber indicator (76), smoothing circuit (74, 74A, 75, 75A), rectifying valve (7), centre tap of H.T. winding to earth and back to filament. This circuit will provide the main path for the valve current but an alternative path is provided from the anode of valve (22) via the resistances (372, 373), grid bias smoothing resistance (383), bias rectifier (380), to a tap on the H.T. winding, via a part of the winding to the earthed centre tap and back to filament. The current flowing by this alternative path will be a fixed proportion of the total valve current and will vary as the current flowing across the valve is increased or decreased.

A fixed value of negative bias is applied between grid and filament of valve (21) by the rectifier (380) and its associated smoothing circuit via resistance (373). This standing potential will be increased by the voltage developed across resistance (373) by the valve current passing through it. The greater the amplitude of current passing across valve (22) the more negative will the grid of valve (21) become.

Negative bias from the rectifier (380) is applied to the grid of valve (20) via the resistance (377).

Marking.

When the keying relay (303) is operated the V.F.O. valve (V1) in the M.O. unit draws current. The additional current supplied by the H.T. rectifier causes a momentary fall in potential across the H.T. potentiometer (366, 367, 368). The fall in H.T. potential will cause the grid of valve (22) to become more negative, as the supply from the grid bias rectifier (380) is of a constant value. Less current will flow across the Pilot Valve (22).

The grid bias applied to the Intermediate Valve (21) is directly proportional to the current flowing through the resistances (372, 373), and as the current has been reduced the grid bias applied to valve (21) is less negative. A reduction in bias will cause an increase in valve current flowing across valve (21) and through the resistances (376, 377). With an increased current a more negative potential is applied to the grid of the Absorber valve (20) reducing the absorber valve current. This fall in absorber valve current compensates for the additional current taken by the V.F.O. valve which started the cycle of operations, thus stabilising the total load taken from the rectifier system.

Spacing.

With the pre-set resistance (367) correctly adjusted, the potential applied to the grid of valve (22) will be of such a value that current will flow through the valve (22).

The valve current flowing through the resistances (372, 373) provides a negative potential for the grid of valve (21) which in turn reduces the current flowing through valve (21) and the resistances (376, 377). A less negative potential is thus applied to the grid of the Absorber Valve (20). The Absorber Valve current is thereby increased compensating for the reduced load taken by the M.O. Unit in the "Spacing" condition.

The correct adjustment of the pre-set resistance (367) will be indicated when the Master Absorber indicator (76) remains steady when "keying".

A tap on the H.T. potentiometer (177, 178) is taken to a terminal marked M.O. H.T. and supplies the Anode and Screen Grid of the Crystal Oscillator valve (V4) and also the H.T. potential for the screen grids of valves (V2, V3) in the Mixer Stage.

The terminal marked Amplifier H.T. supplies the anodes of valves (V2, V3) in the Mixer Stage and the anodes and screen grids of the V.F.O. valve (V1) and valves (V5, V6) in the Trebler Stage.

A metal rectifier (378) between the grid of the NR47 valve (20) and earth is introduced as a precautionary measure to protect the Absorber valve (20). The metal rectifier (378) prevents the grid becoming positively biassed on first switching on. This may happen due to the unequal time taken by filaments of valves of different types to reach their working temperature.

(iv) Main Absorber Circuit. (Fig. g).

The operation of the Main Absorber Valve (17) is controlled by a two stage D.C. amplifier consisting of valves (18, 19) working in conjunction with a half wave metal rectifier (358).

A fixed H.T. potentiometer (342, 364) connected between the main H.T. supply and earth provides the source of the positive potential. This positive potential is oppposed by a negative grid bias obtained from a half wave metal rectifier (358). The output of the rectifier (358), is smoothed by the resistance (360) and condensers (363, 359), and its value will depend upon the current passing through the grid bias shunt resistance (362). The rectifier current, and thus the potential developed across resistance (362) is controlled by the adjustable resistance (361).

This potential is used to control the grid bias applied to the grid of valve (19) which, in turn controls the amplitude of the current flowing across the valve (19).

The main path for the valve current is from filament across the valve to anode and via the smoothing resistance (354) to the reservoir condenser (352), then via the bias resistance (B) to earth and back to filament. An alternative path is provided from the anode via resistances (355, 355A) and bias resistance (B) to earth and back to filament. A fixed proportion of the total valve current will pass through the resistances (355, 355A) developing a potential which is used to bias the grid of valve (18). The greater the amplitude of current flowing across valve (19) the more negative will be the grid bias applied to valve (18).

The H.T. supply for the NR15A Pilot Valve (19) is obtained from the transformer (346) supplied by the filament contactor (393) and rectified by a half wave metal rectifier (351). Smoothing is provided by the resistance (354) and condensers (352, 353).

The grid bias for the NR47 Intermediate valve (18) is provided by the resistances (355, 355A, 356) which are in series with the Pilot valve (19).

The H.T. for the Intermediate Valve (18) is obtained from a second H.T. winding on transformer (346) and rectified by the half wave metal rectifier (347). Smoothing is provided by the choke-capacity filter (348, 349A) and the reservoir condenser (349). The resistance (350) is in series with the NR47 valve (18) and provides the grid bias for the main absorber valve (17).

The filaments of valves (18, 19) are supplied from the third secondary winding of the transformer (346). In Fig. g the filaments are shown connected directly to earth to simplify the action of the circuit. In practice the filaments are earthed via the centre tap of the filament winding.

Marking.

When the keying relay (303) is depressed the potential of the main H.T. supply is momentarily reduced by the current taken by the output stage valves (14, 15). The fall in positive potential across potentiometer (342, 364) allows the negative bias from the rectifier (358) to predominate causing the grid of valve (19) to become more negative. The current flowing through valve (19) is reduced and less current will flow through the resistances (355, 355A, 356). The bias applied to the grid of valve (18) is therefore less negative.

An increase of valve (18) current, which flows through resistance (350) causes the grid of the main absorber valve (17) to become more negative. This reduces the absorber current which in turn restores the potential on the H.T. supply line.

Spacing.

The H.T. voltage rises momentarily as the load on the main rectifier is reduced. A rise in positive potential across potentiometer (342, 364) causes the grid of valve (19) to become more positive. Anode current is increased, causing an increase in the current flowing through resistance B, (356). This provides a larger negative bias to be applied to the grid of valve (18), resulting in a reduction of current flowing through resistance C, (350). The negative potential applied to the grid of the absorber valve (17) is thus reduced allowing an increase in absorber valve current. This increase of current provides the added load to the main rectifier to stabilise the H.T. voltage.

The total current provided by the Main Rectifier is shown by the Main Absorber Indicator (58) and when resistance (361) is adjusted correctly the reading of the meter will remain constant under keying conditions.

The supply to the transformer (357) supplying the grid bias rectifier (358) is controlled by the power contactors (38, 39), thus both positive and negative sources of potential vary in unison as the power setting is altered.

(v) M.O. Filament and Grid Bias Supply Unit. (Fig. h).

The heater circuits of all valves in the M.O. unit are supplied by transformer (412). The supply to this transformer is completed by the Main Supply Switch (34). (Fig. e).

The Intermediate Stage control grid bias is provided by this unit. Transformer (110) supplied by the Filament Contactor (393) provides the voltage which is rectified by a half wave metal rectifier (111). The output is smoothed by a resistance-capacity filter (113, 114) the condenser (112) acting as a reservoir condenser. The output voltage is stabilised by the resistance (115) the positive end of which is earthed.

MASTER OSCILLATOR

FILAMENT AND GRID BIAS SUPPLY UNIT (MODIFIED FOR P.C.C.)

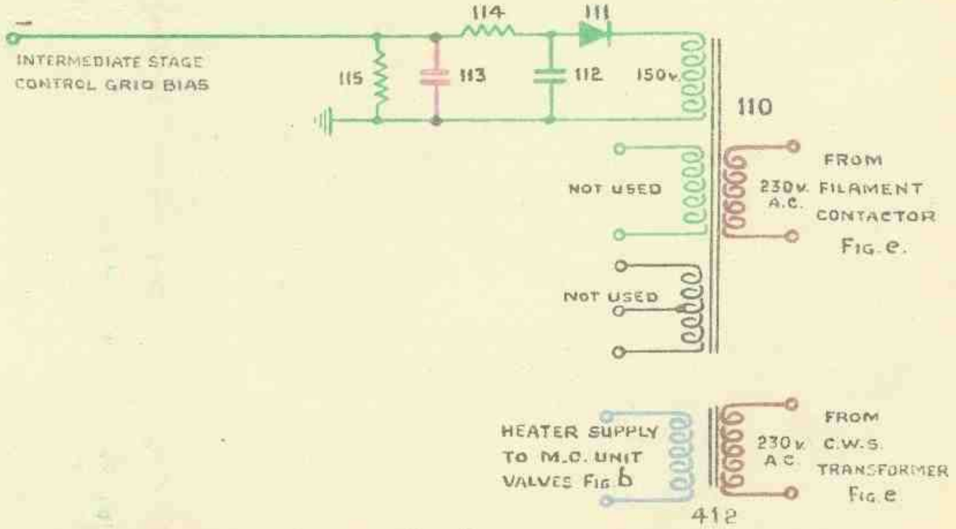


Fig. h.

(vi) Intermediate H.T. Rectifier. (Fig. i).

The supply to the Intermediate H.T. transformer (63) is controlled by the Power Contactors (38,39). The primary winding is connected in delta and the secondary in star with the neutral point earthed. One end of each secondary winding is connected to the anode of a NU13A rectifying valve (4, 5, 6), the resultant rectified voltage being developed between filament and the earthed neutral.

The filament transformer (82) is supplied via the Filament Contactor (393).

The H.T. supply is taken from the centre tap of the secondary of the filament transformer (82) and smoothed by a choke-capacity filter circuit (64, 65, 66, 67). A stabilising resistance (68) is connected across the output of the rectifier system.

(vii) Intermediate Stage Screen and Suppressor Grids and Output Stage Grid Bias Unit. (Fig. j).

The following supplies are obtained from the unit :-

(i) Suppressor grid bias for valves (12, 13), in the Intermediate Stage.
(ii) The delay-voltage for the automatic gain control valve (24) in the R/T Amplifier.
(iii) Control grid bias for valves (14, 15) in the Output Stage.
(iv) H.T. voltage for the screen grids of valves (12, 13) in the Intermediate Stage.
(v) H.T. supply to the M.C.W. oscillator valve (16).

The supply to the transformer (89) is controlled by the Power Contactors (38, 39) and will vary according to the power selected. The five voltages supplied by transformer (89) will thus vary in step with the power being used.

The transformer (89) has three secondary windings. The voltage supplied by the first winding is rectified by a half wave metal rectifier (119) and smoothed by a resistance-capacity filter (121, 122), and reservoir condenser (120). A tap on the potentiometer (124, 125) connected across the output of the filter, provides the delay voltage for the A.G.C. control valve (24).

The suppressor grids of valves (12, 13) are connected, via the modulation contactors (394, 395) and a series resistance (123), to the full output of the rectifier system. (See Fig. k). The series resistance (123) operates in conjunction with the potentiometer (124, 125) and prevents the A/F selected by contactor (395), being by-passed to earth by the smoothing condensers (120, 121).

The second winding provides the output stage grid bias. A full wave metal rectifier (102) connected as a bridge is used. Smoothing is provided by a choke-capacity filter (103, 105). The bias is supplied via a tap on a fixed potentiometer (106, 107).

A full wave metal rectifier (90) is used to provide the screen voltage for valves (12, 13), the choke-capacity filter (92, 93) providing the smoothing. The output of this rectifier also supplies the M.C.W. oscillator valve (16).

INTERMEDIATE H.T. RECTIFIER

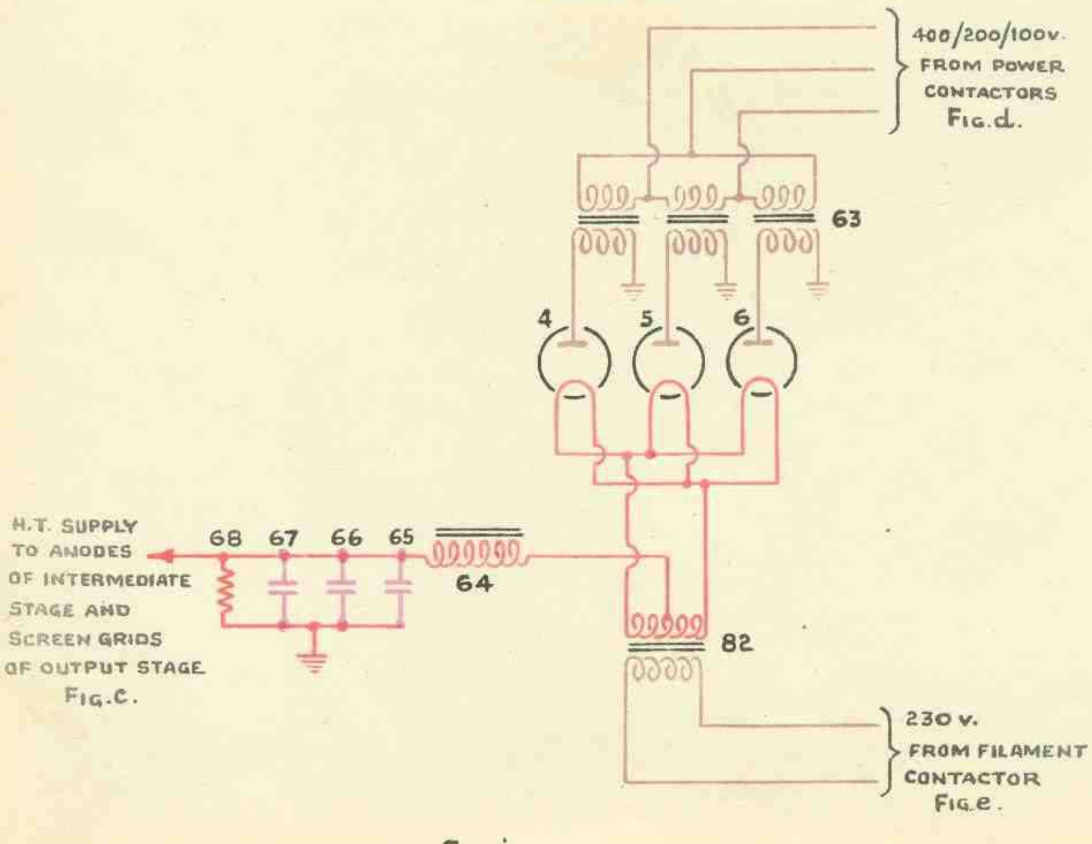


Fig. i.

INTERMEDIATE STAGE SCREEN AND SUPPRESSOR GRIDS AND OUTPUT STAGE GRID BIAS UNIT

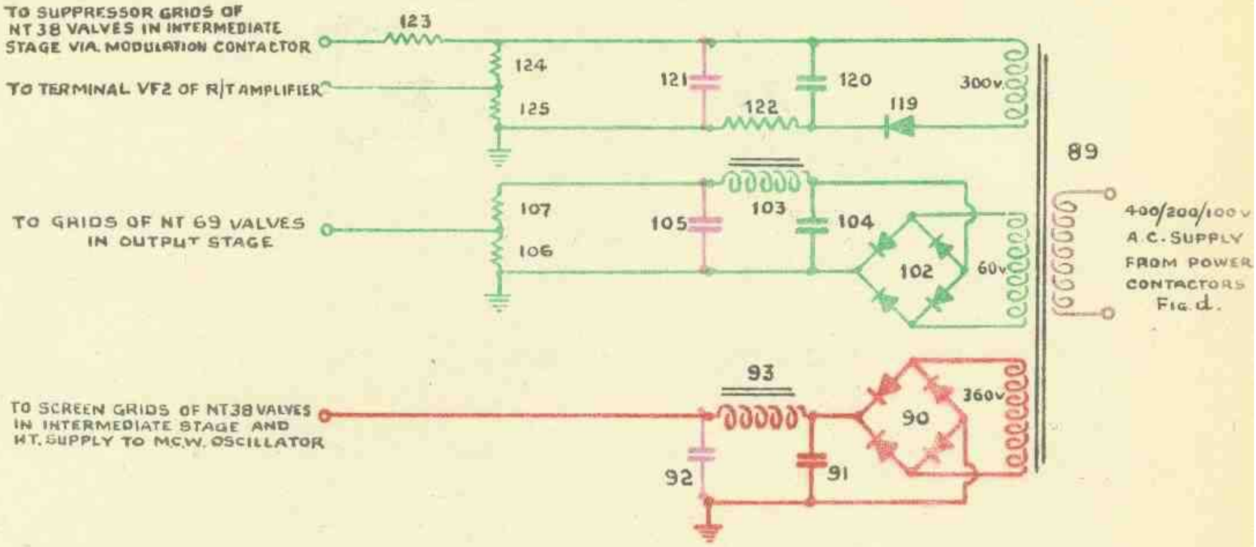


FIG. j.

MODULATION CIRCUIT

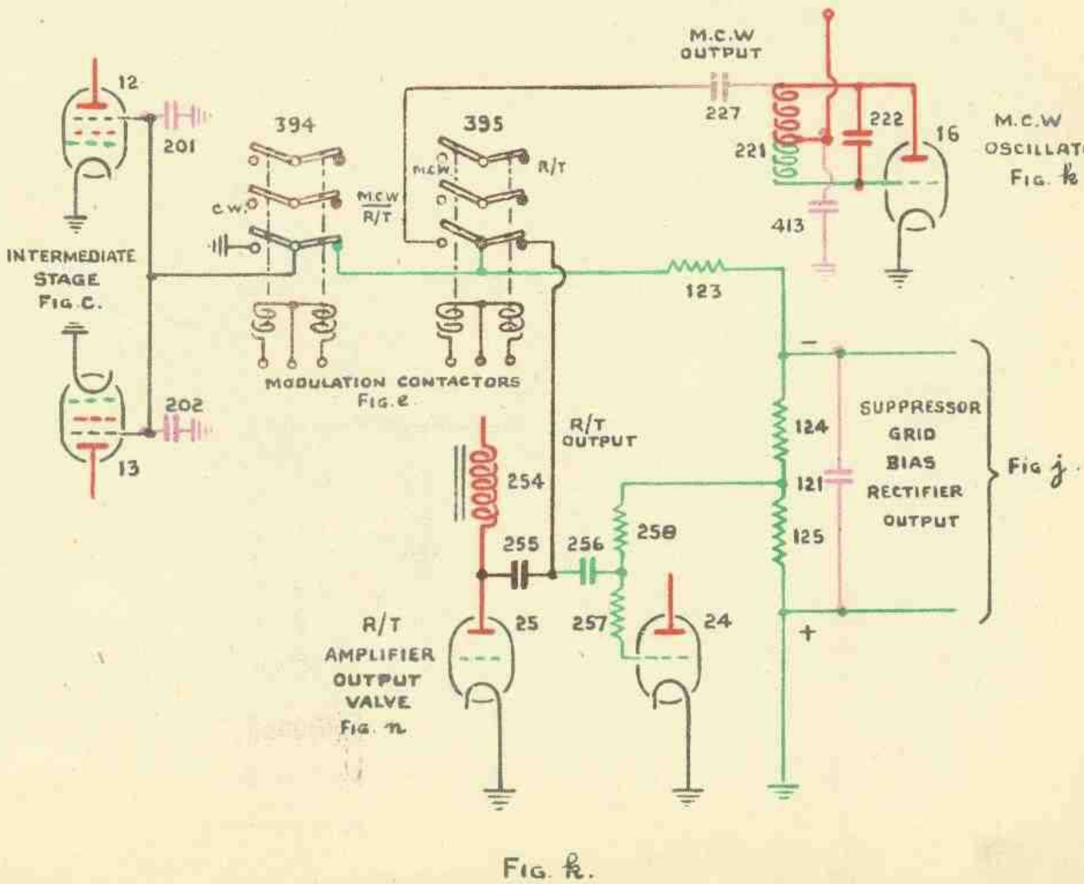


FIG. k.

TYPE 57 DMR

KEYING UNIT

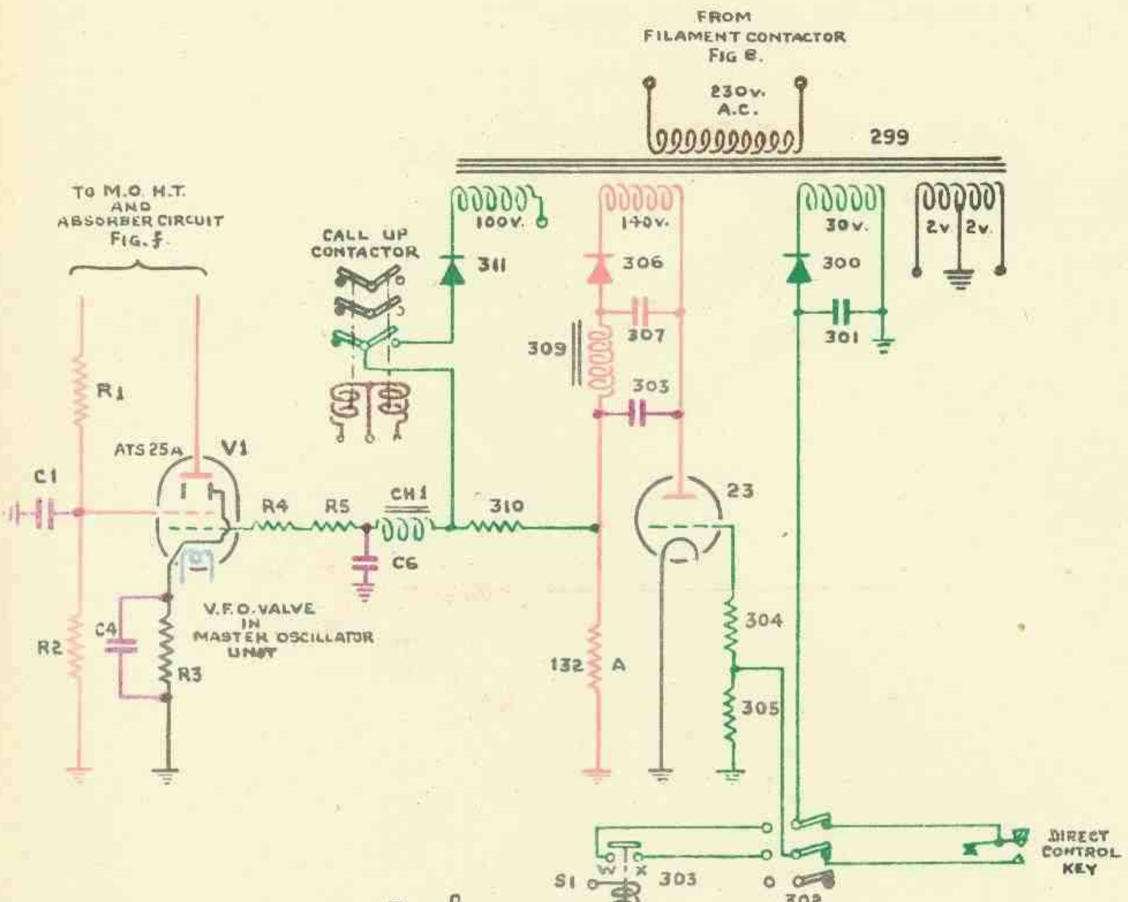


Fig. ℓ.

M.C.W. MODULATOR UNIT

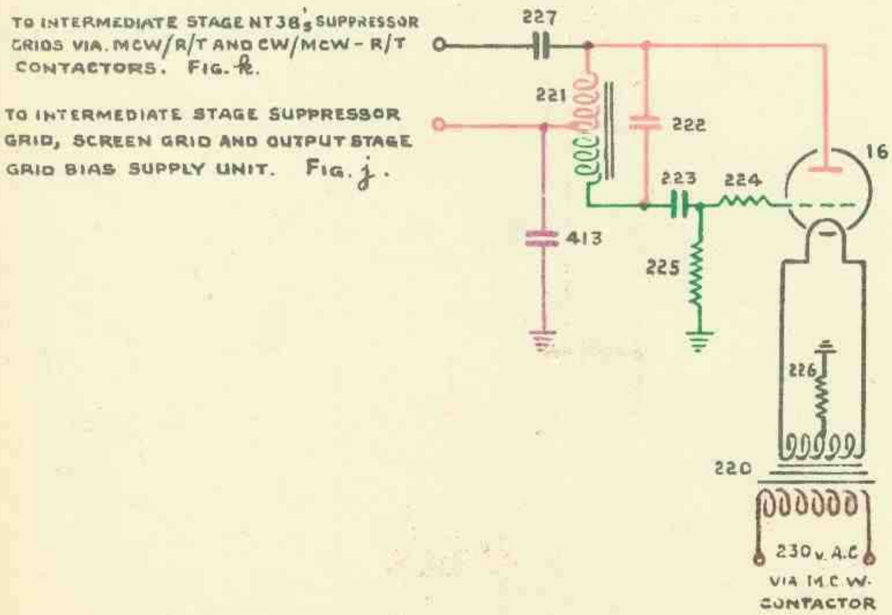


Fig m.

(viii) Keying Unit. (Fig. l).

The Keying unit provides the keying bias to operate a Keying Valve (23) which in turn controls the grid bias applied to the control grid of the V.F.O. valve (V1) in the M.O. Unit.

The keying unit transformer is supplied by the filament contactor (393) and has four secondary windings. The first winding supplies the filament voltage for the NR47 Keying Valve (23). In Fig. 1, the filament is shown connected directly to earth, to simplify the action of the circuit, but in practice the centre tap of the filament winding is earthed.

The second winding provides the keying bias for operating the keying valve (23). A half wave metal rectifier (300) is used in conjunction with the reservoir condenser (301).

The H.T. supply for the keying valve (23) is obtained from the third winding. The rectified output of the metal rectifier (306) is smoothed by the choke capacity filter. The anode of valve (23) is connected to the positive output of the rectifier, the negative being connected to earth via the keying resistance (132). The resistance A is thus in series with the valve (23).

The fourth winding is disconnected when a P.C.C. M.O. unit is used.

The keying circuit incorporated in the C.W.S. equipment is used to operate the bobbin circuit of the Keying Relay (303). The contacts of the relay make and break a negative bias which is provided by connecting resistance (305) across the output of the rectifier (300). The bias is of such a value that when applied to the grid of valve (23) the valve is back off beyond cut off.

Marking.

When the keying relay (303) is closed, a negative potential is applied to the grid of valve (23). This bias is sufficient to prevent any current flowing through the valve. As resistance (132) is in series with the valve, no current will flow through the resistance "A". There is, therefore, no voltage drop across "A" and the potential at both ends of the resistance (132) is the same. As one end of the resistance (132) is connected to earth, both ends are at earth potential. The grid of valve (V1) is connected to resistance (132) and will be at earth potential, the condition required to allow this valve and its associated circuit to oscillate.

Spacing.

In the "Space" position, the circuit of the grid bias rectifier is disconnected from the grid of valve (23). With the grid bias removed, the grid and filament will be at earth potential and current will flow across the valve (23) and also through resistance "A". The current flowing through the resistance will produce a difference of potential across the resistance, depending upon the value of the resistance and the amount of current flowing. One end of the resistance "A" being connected to earth, will remain at earth potential, and the other will be at a potential negative with respect to earth.

The negative end of resistance "A" being connected to the grid of valve (V1) will bias the grid negatively. The voltage developed across resistance "A" is designed to be sufficient to close the valve (V1) down and thus prevent its associated circuit oscillating.

(e) M.C.W. Modulator Unit. (Fig. m).

The M.C.W. oscillator consists of a Hartley circuit using a directly heated NR47 valve (16).

The choke (221) is tuned to approximately 1000 c/s by the fixed condenser (222). Condenser (223) is the grid condenser and grid resistance (225). Automatic grid bias is provided by resistance (226).

The H.T. supply from the full wave metal rectifier (90), (Fig. j), is connected to a tap on the choke (221).

The filament transformer (220) obtains its supply from the filament contactor (393), the modulation contactor (395) making the connections when M.C.W. is selected. (See Fig. e).

The A/F output is capacity coupled by condenser (227) to the suppressor grid bias potentiometer (124, 125) via the modulation contactor (395). (See Fig. k).

(f) R/T Amplifier. (Fig. n).

The R/T Amplifier comprises a five stage resistance-capacity coupled amplifier with delayed automatic gain control. The amount of delay is varied with the power being used, being increased on normal and full power.

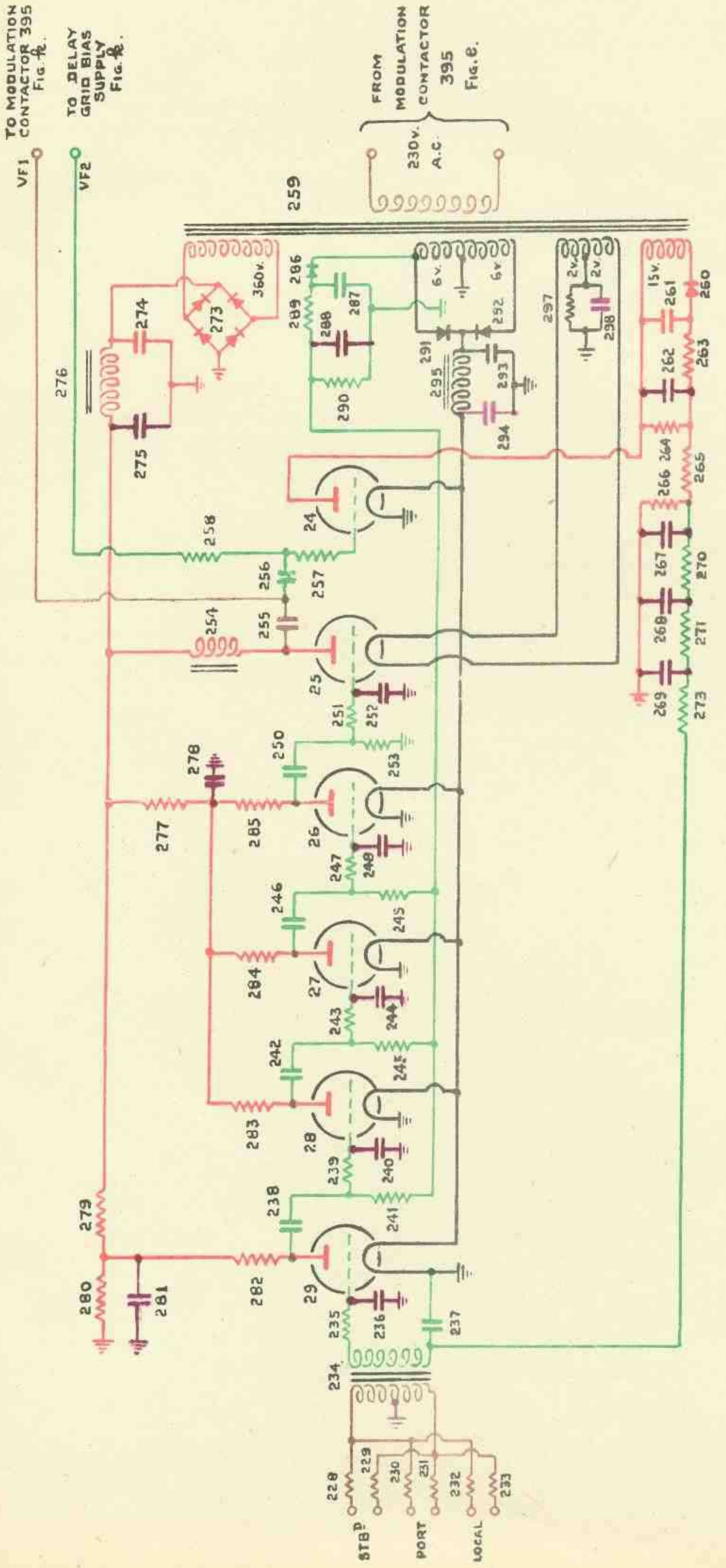
The input to the amplifier is arranged to accommodate three input channels, these being connected to the input transformer (234) via the protecting resistances (228 to 233). (See Page DA16 para. 41, and Page DA11 Fig. DA4). The primary winding is centre tapped to earth to provide a balanced input to the amplifier.

R/F filter circuits (239, 240, 243, 244, 247, 248, 251, 252) are provided in the grid circuits of each of the amplifying stages.

RC50

TYPE 57 DMR

R/T AMPLIFIER



The output of the amplifier is choke-capacity coupled (254, 255) to terminal marked VF1, from which the amplified speech output is connected to the suppressor grids of valves (12, 13) via the modulation contactors (395, 394).

Part of the A/F output is coupled by condenser (256) to the grid of the A.G.C. valve (24). Positive peaks of modulation, that are in excess of the negative delay voltage, will cause current to flow across the valve (24). The negative return of the H.T. supply is connected to earth via two resistances (265, 266). The valve current passing through resistances (265, 266) will develop a voltage which is used as the grid bias potential, after it has been smoothed, for the first amplifier valve (29).

The over-all gain of the amplifier is thereby controlled to provide a uniform output, at a level determined by the transmitter power setting and corresponding delay bias.

The value of the delay bias is provided automatically by the tapping on the potentiometer (124, 125). (See Fig. k). The current flowing through the potentiometer will depend on the power selected. (Section (d) (vii), para. 2). The delay voltage developed across resistance (125) will therefore be comparatively small for low power and will increase as the power selected is increased. A small delay voltage will mean an increase in A.G.C. valve current and a larger grid bias to the first amplifying valve (29).

When using full power the delay voltage will be large, resulting in a smaller A.G.C. valve current and thus a smaller grid bias to valve (29) and a larger over-all gain from the amplifier.

The power supplies for the amplifier are self-contained. The transformer (259) is supplied from the filament contactor (393) via the modulation contactors (394, 395). (See Fig. c).

The H.T. supply is provided by a 360 volt secondary winding and is rectified by a full wave metal rectifier (273), connected as a bridge, the output of the rectifier being smoothed by a choke-capacity filter (276, 275), condenser (274) acting as a reservoir condenser.

The L.T. is provided from a 12 volt secondary winding and is rectified by the full wave rectifier (291, 292). Smoothing is by the choke (295), condenser (294) and reservoir condenser (293). The filaments are supplied with a smoothed D.C. voltage of 4 volts. The centre point of the filament winding is connected to earth and forms the negative return for the filaments of all valves, with the exception of the output valve (25).

Grid bias for valves (28, 27, 26) is obtained from a half wave metal rectifier (286) which is connected across one half of the filament secondary winding. Smoothing is by a resistance capacity filter (289, 288). Resistance (290) is a loading resistance for the metal rectifier (286) and condenser (287) a reservoir condenser.

Automatic grid bias for the output valve (25) is obtained by the resistance (297) connected between earth and the centre tap on the 4 volt filament winding of the output valve (25).

The H.T. supply for the A.G.C. valve (24) is provided by a 15 volt winding and a half wave metal rectifier (260), and is smoothed by resistance (263) and condensers (261, 262). The rectifier load is resistance (264).

(g) <u>H/S Monitor Unit.</u> (Fig. p).

Where a check is required on the quality of automatic high speed signalling, a high speed monitor unit may be fitted. The unit is capacity coupled to the aerial circuit and provides an output for driving a check undulator.

The circuit consists of a diode rectifier valve (31) and two stages of D.C. amplification.

Power supplies for the unit are self-contained and are obtained from a transformer (333) supplied by the filament contactor (393). (Fig. e).

One end of a 200 volt secondary winding is connected to the junction of two half wave metal rectifiers (334, 338) and the other end is connected to earth via an earthing capacity (341).

The rectifier (334) provides the H.T. supply for valves (32, 33) and rectifier (338) the grid bias for the NR47 output valve (33).

The H.T. supply is smoothed by a choke-capacity filter (335, 337) and is connected to the anode of the output valve (33) via the "marking" coil of the Check Undulator.

The grid voltage is smoothed by a resistance-capacity filter (339A, 340) and connected to the grid of the output valve (33).

<u>Marking.</u>

The positive half cycles of an incoming signal, applied to the anode of the NU3 rectifying valve (31), cause a current to flow across the valve. The current returning to the centre tapped filament winding of valve (31) produces an IR drop across resistances (326, 327). The grid of the NR15A intermediate valve (32) is connected to the junction of the two resistances and the IR drop produced by resistance (327) is applied to the grid. This potential is negative with respect to filament resulting in the grid of valve (32) becoming more negative. The valve current flowing across valve (32) is reduced and less current will flow through resistances (330, 331). The IR drop across resistance (331) will therefore be less and the grid of the output valve will become less negative and the current flowing through the output valve (33) is increased. The output valve current flows through the "marking" coil of the undulator and will have the effect of bringing the siphon arm, against the tension of a spring, to the "mark" position.

Spacing.

With no signal applied to the anode of valve (31), the anode and filament are at the same potential, thus there is no IR drop across the resistances (326, 327).

The grid and filament of valve (32) are at the same potential and current flows through the valve (32) and resistances (330, 331). The IR drop across resistance (331) causes the bias on the output valve (33) to become more negative. This reduces the valve current and, therefore, the current flowing through the undulator marking coil. The tension of the spring overcomes the pull of the coil and returns the siphon arm to the "space" position.

The condenser (328) is an R/F by-pass condenser to short circuit the input to the D.C. amplifier, with respect to radio frequency.

(h) Tuning Indicator. (Fig. q).

The tuning indicator provides a means of tuning the aerial system to resonance.

It consists of a rectifier valve, capacity coupled to the aerial system and a meter to indicate when the rectified current is a maximum.

To accommodate various degrees of power in the aerial circuit, the sensitivity of the meter may be varied by introducing loading resistances of different values which will control the value of the current indicated by the meter (320).

A single meter (320) is used as the indicating device, and as the current will vary over wide limits, a variable shunt in the form of a metal rectifier (318) is used in parallel with the meter (320) and its fixed resistance (319).

The resistance of the metal rectifier (318) varies inversely to the current flowing through it. Thus, with a large rectified current flowing, the shunt resistance (318) is small, and a larger proportion of the current will flow through the shunt. With a small current, the shunt resistance (318) is increased and a small proportion will flow through the shunt.

The indicator (320) will thus operate over very wide limits.

The transmitter frequency is capacity coupled from the aerial circuit to the anode of the NU3 rectifying valve (30). The positive half cycles of the applied frequency will cause current to flow through the fixed loading resistance (314), variable loading resistance (315, 316, 317), or direct to meter resistance (319), and to filament via centre tapped filament winding. The amplitude of the current will depend upon the magnitude of the applied voltage and the value of the loading resistances.

The applied voltage will be a maximum when the aerial system is in resonance with the transmitter frequency and the output circuit correctly loaded by the aerial system. (See Page RB2).

The correct loading resistance is being used when the meter is in its most sensitive condition which is indicated by half scale deflection.

R/F is by-passed across the meter indicator (320) by condenser (321). Condenser (313) is a R/F by-pass condenser connected across the input to the rectifier valve (30).

The filament transformer (324) is supplied from the filament contactor (393). (See Fig. c).

TYPE 57 DMR

HIGH SPEED MONITOR UNIT

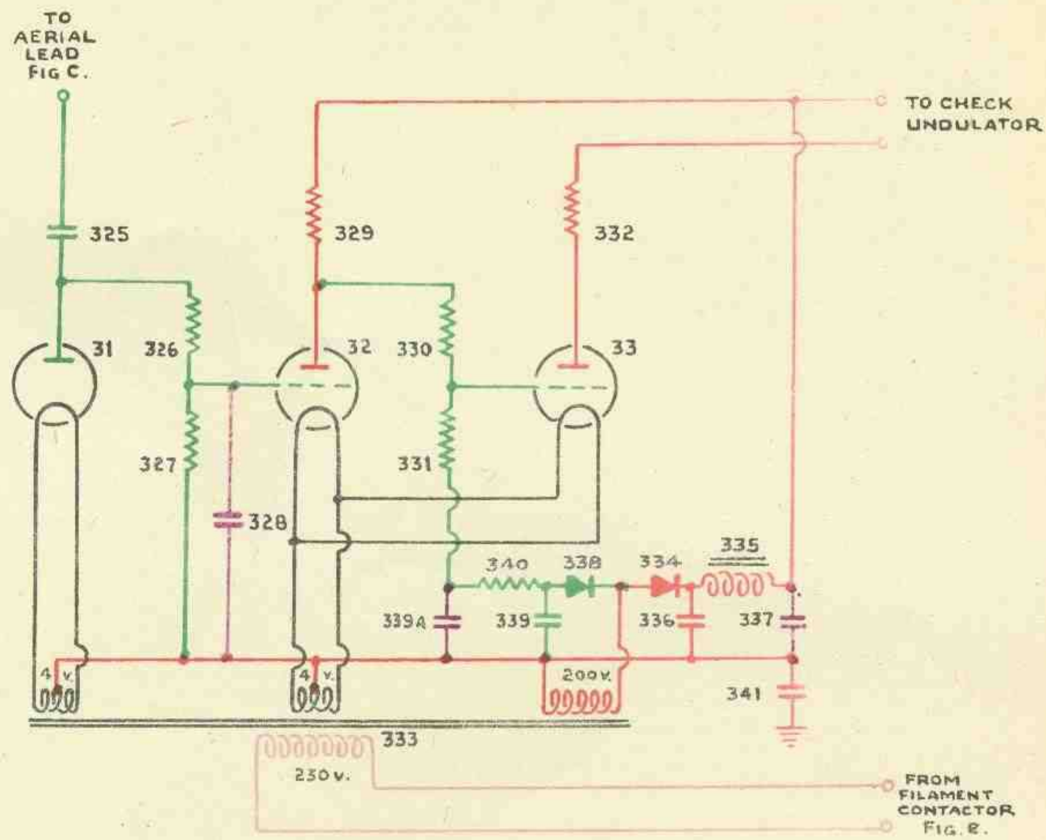


Fig. p.

TUNING INDICATOR

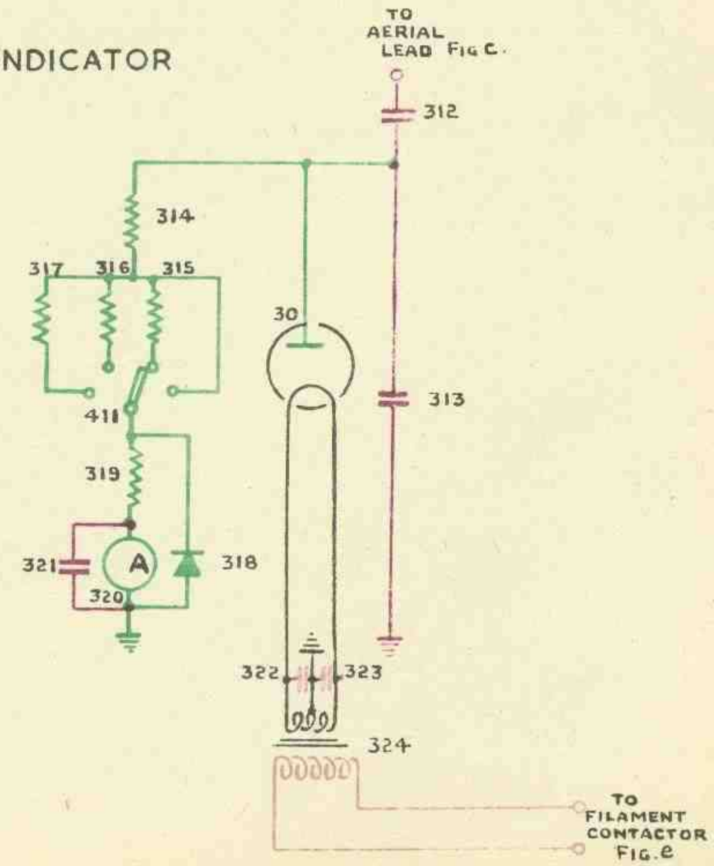


Fig. q.