AIR PUBLICATION

115D-0301-1

(Formerly A.P. 2527U, Vol. 1)

BRITISH SUPPLEMENT to AMERICAN TECHNICAL ORDERS for RADAR AN/FPS-6

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

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Ministry of Defence

FOR USE IN THE
ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

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PREFACE

This publication contains descriptive, technical and servicing information about the changes made to the original equipment. The information available in the American Technical Orders is not repeated in this publication. The information in A.P.2527UA, Vol. 1 is incorporated in this publication in order to allow all available information on modified equipment to be contained in one book. The information given in A.P.2527UB is not incorporated, as A.P.2527UB refers to the integration of the equipment with other systems and is therefore not appropriate to the purpose of this publication.

LAYOUT OF A.P.115D-0301-1 to -3
BRITISH SUPPLEMENT TO AMERICAN TECHNICAL ORDERS FOR AN/FPS-6

—1 General and technical information

—2 General orders and modifications

—3 Scales of servicing spares

NOTE TO READERS

The subject matter of this publication may be affected by Defence Council Instructions, Servicing schedules (—4 or —5), or "General Orders and Modifications" leaflets in this A.P., in the associated publications listed below, or even in some others. If possible, Amendment Lists are issued to correct this publication accordingly, but it is not always practicable to do so. When an Instruction, Servicing schedule or leaflet contradicts any portion of this publication, the Instruction, Servicing schedule or leaflet is to be taken as the overriding authority.

The inclusion of references to items of equipment does not constitute authority for demanding the items.

Each leaf, except the original issue of preliminaries, bears the date of issue and the number of the Amendment List with which it was issued. New or amended technical matter will be indicated by traingles, positioned in text thus: —◀.....▶ to show the extent of amended text, and thus: — ▶◀ to show where text has been deleted. When a Part, Section, or Chapter is issued in a completely revised form, the triangles will not appear.

◀The reference number of this publication was altered from A.P.2527U Vol. 1 to A.P.115D-0301-1 in January 1969. No general revision of page captions has been undertaken but the code number appears in place of the earlier A.P. reference on new or amended leaves subsequent to that date.▶

LIST OF ASSOCIATED PUBLICATIONS

(AMERICAN)

	Technical Order
Handbook of Operating Instructions	*T.O.*31*P*3-2*FPS*6-1
Handbook of Service Instructions	*T.O.*31*P*3-2*FPS*6-2
Handbook of Overhaul Instructions	*T.O.*31*P*3-2*FPS*6-3
Illustrated Parts Breakdown	*T.O.*31*P*3-2*FPS*6-4
Installation Instructions for Arctic Tower	*T.O.*31*P*3-2*FPS*6-5
Antenna System Radar Set AN/FPS-6	*T.O.*31*P*3-2*FPS*6-12
Installation Instructions for Temperate Tower ...	*T.O.*31*P*3-2*FPS*6-125
Installation Instructions for: *Radar Sets AN/FPS*-6 *AN/FPS*-6*A* *AN/MPS*14	*T.O.*31*P*3-2*FPS*6-165
Modification of Rotary Joints UG-950 *to increase reliability*	*T.O.*31*P*3-2*FPS*6-547

(BRITISH)

Radar AN/FPS-6 *Integration into MRS*	*A.P.2527UB*

CONTENTS OF VOLUME 1

PRELIMINARIES

PART 1—GENERAL INFORMATION

PART 2—SERVICING INFORMATION

Note.—*A list of contents appears at the beginning of each chapter.*

PART 1

GENERAL INFORMATION

SECTION 1

CHANGES TO ORIGINAL EQUIPMENT

Chapter 1

INTRODUCTION

Scope of section

1. The information given in this section consists of limited descriptions of the context and purpose of modifications to the FPS-6 equipment. Detailed descriptions are given of any unconventional circuits introduced by the modifications.

2. Only modifications which affect the operation of the equipment are described. For details of modifications involving the replacement of American items by British items wthout affecting operational characteristics, see A.P.2527U Vol. 2.

CHAPTER 2

ANTENNA SYSTEM

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TOWER ASSEMBLY AB-258

1. The locating and clamping arrangements for the antenna servicing ladder have been modified to make the ladder safer in use and also to accommodate either of the types of ladder which may be supplied. The original locating channels for the legs of the ladder are 3 ft 6 in apart. To accommodate ladders with a spread of 3 ft, a new channel, with end stop, is secured between the two existing channels on each side of the antenna servicing platform. To increase the stability of the ladder, four tie ropes are attached to the base legs. Each wire has a hook for attachment to a ring fitted to the guard rail at each corner of the antenna servicing platform. The tension of each wire is adjustable by means of a stretching screw. Fig. 1 shows in schematic form the fixing arrangements of the ladder.

2. The tower assembly (AB-258), chromolox 2kW heater (HF2X 155) is replaced on failure only, with a suitable replacement item which requires 230V a.c. mains supply. The replacement item is a 3kW fan heater, identified as heater, space, element, Cat. No. 4520-99-115-8157. Fig. 1A shows the modified supply circuit for the replacement fan heater.

MAIN GIRDER ASSEMBLY

3. A precision preset level reference plane is fitted to the main girder assembly to simplify and to increase the accuracy of the antenna levelling procedure. The reference plane has a precision flat surface so that an accurate spirit level (Ref.No.10AF/683) can be used. Three adjusting screws secure the plane to the main girder and after the initial procedure of levelling the plane with respect to the girder, these screws are locked and require no further adjustment. Antenna levelling can then be carried out using the main jack screws only. A full description of this procedure is given in Part 2, Sect.1, Chap.2. The precision surface of the plane is protected by a robust cover which is strong enough, if necessary, to support the weight of personnel servicing the antenna. Fig.2 shows the preset level reference plane.

ELEVATION SELSYN AND ANGLE MARK UNIT

4. The elevation selsyn and angle mark unit has been modified to provide greater reliability and accuracy in the system angle marks. The 9-speed and 72-speed gears of the angle mark gear train are now mounted in an aluminium gear cage. This gear cage is fitted in the angle mark unit gearbox on a hinge pin, near one wall of the box, and secured to an angle bracket on the opposite wall. The angle bracket carries two adjusting screws which are used to make fine adjustment to the meshing of the 9-speed gear with the 1-speed gear. Fig.3 shows the modified unit. The angle mark commutator is fitted to an extension of the 72-speed shaft and the commutator brush is now fixed to a bracket on the gear cage.

5. The elevation selsyn and angle mark unit has been modified by CA.3257/3 to provide a more accurate alignment of the Elevation Synchro B3001 to the antenna electrical zero. This is achieved by providing a more clearly defined null point when capacitors C.3001 and C.3002 are replaced by close tolerance capacitors. Modification CA.3257/3 is applicable only if modification CA.1061/2 is not already embodied.

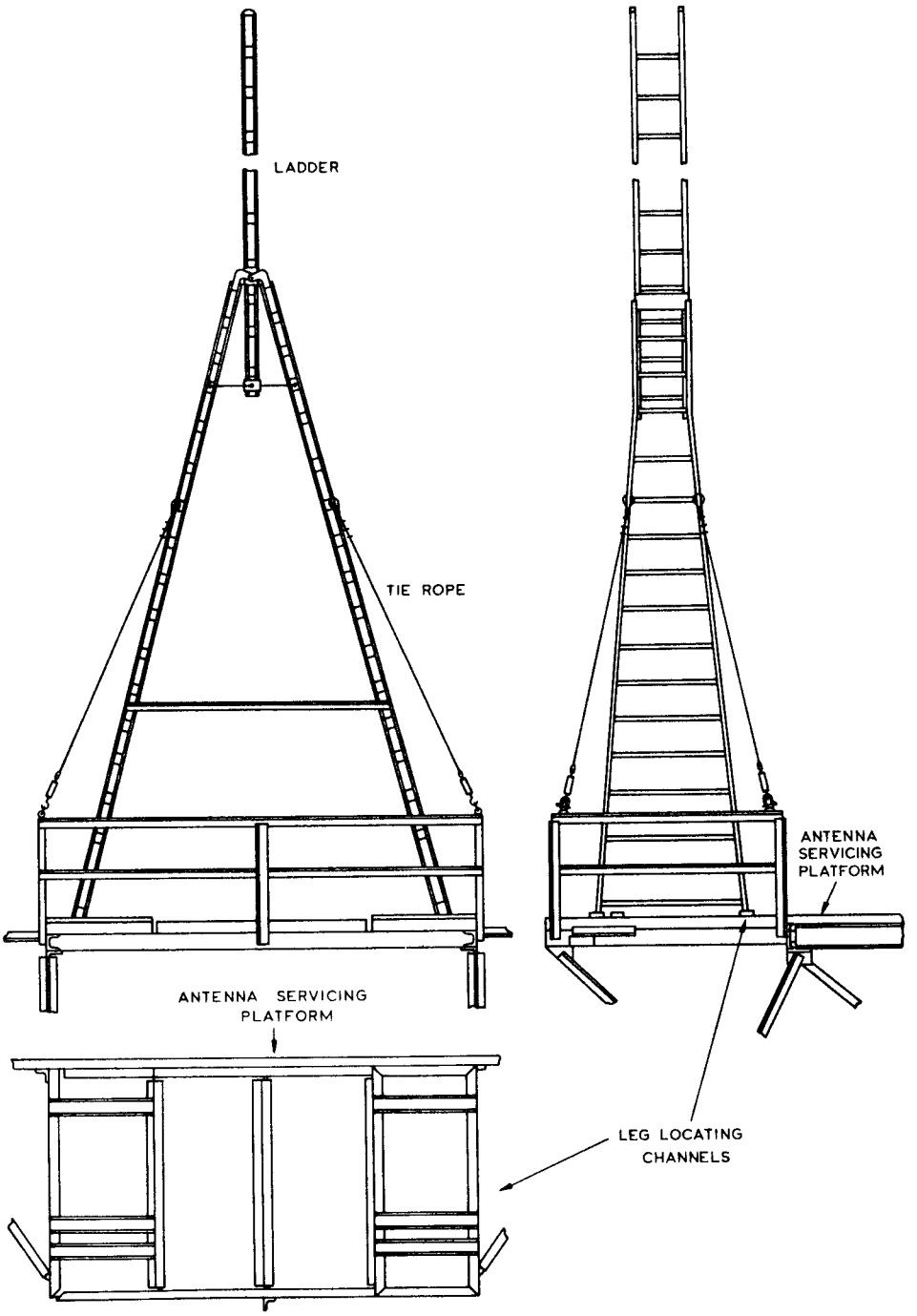


Fig.1. Ladder fixing arrangements

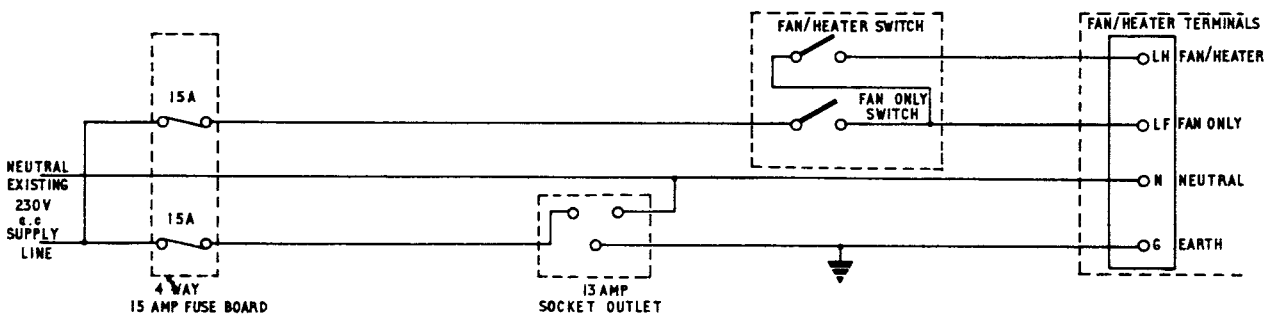


Fig.1A. Fan/heater assembly supply circuit

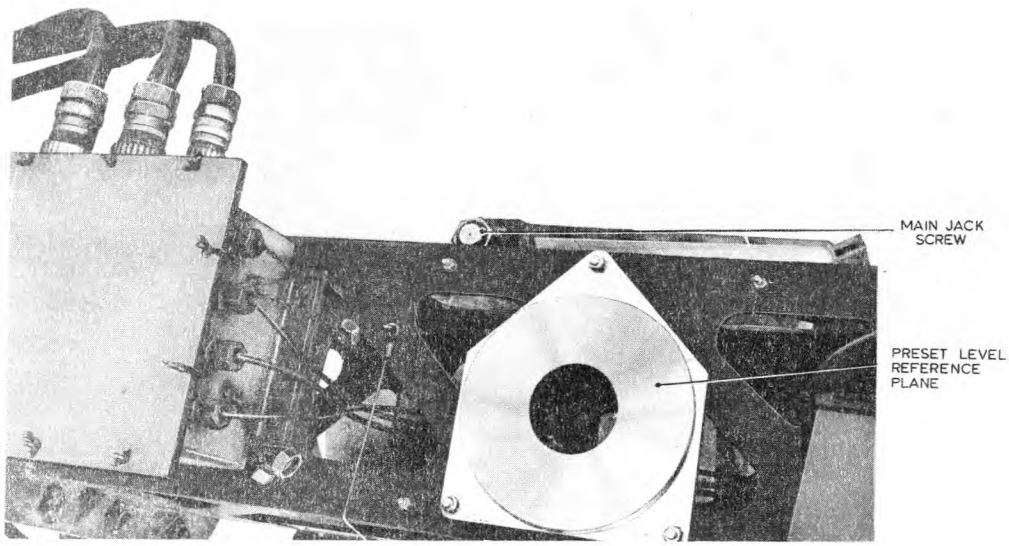


Fig.2. Position of preset level reference plane

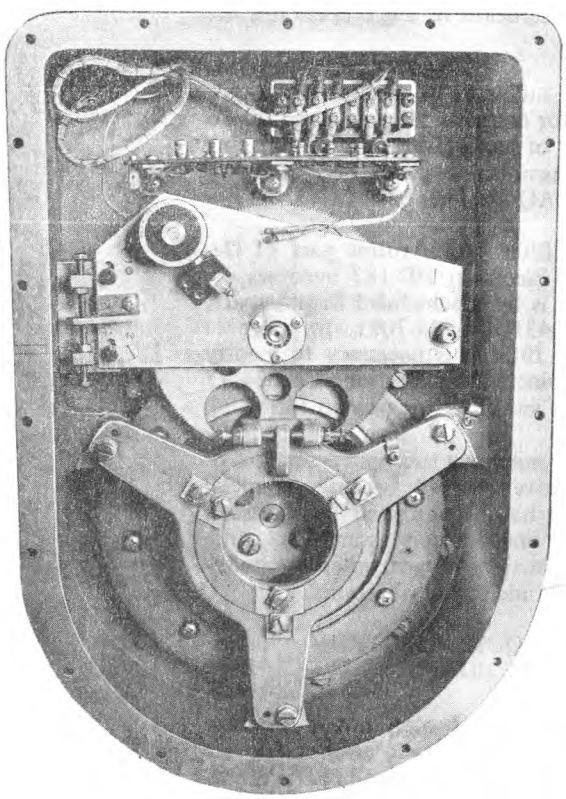


Fig.3. Position of gear cage in angle mark unit gearbox

ROTARY JOINTS UG-950 and UG-960

6. The azimuth (UG-960) and the elevation (UG-950) rotary joints have been modified to provide a better air seal at the joint and greater reliability in operation. A new thrust washer is fitted on the outside of the carbon bearing ring in the static housing of the elevation joint and the lower housing of the azimuth joint. In both joints pressure is maintained between bearing ring and thrust washer by six helical compression springs which replace the original leaf springs. To ensure that the thrust washer does not rotate it is keyed to an anchor plate which is secured to the housing of the joint. Assembly and disassembly instructions are given in Part 2, Sect.1, Chap.2.

CONVERTER SIGNAL DATA TYPE M4

7. In stations with long cable runs between aerial head and control and display equipment the capacitance of the coaxial cables between the elevation synchro and the control indicator C-993 caused frequency variations in the 1500 c/s signal which they carried, so leading to inaccuracies in height readings. To preserve height finding accuracy the control indicator C-993 is removed from the control group assembly and installed in a new unit mounted on top of the r.f. assembly cabinet. This reduces the length of cable between the elevation synchro and the control indicator to a minimum. The elevation data signal in the form of a direct voltage output of the control indicator can then be transmitted by the coaxial cables to the control group assembly without deterioration. The new unit, titled converter signal data Type M4, houses the control indicator C-993 and a new power unit Type M26 which provides stable power

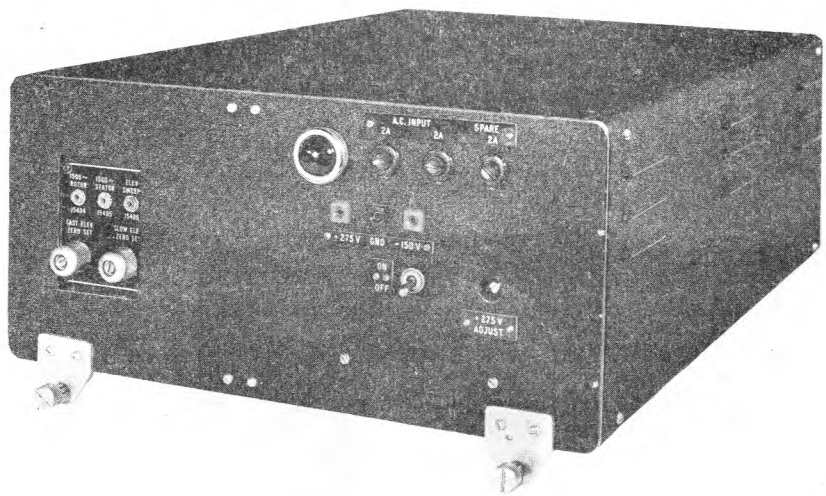


Fig.4. Converter signal data unit Type M4

supplies for the control indicator. Fig.4 shows a general view of the new unit.

8. The tower assembly cables have been modified to provide power, control and data connections to the new unit, as shown in Fig.5. Two new cables carrying synchro data are routed from the cone junction box. A main power supply is obtained via a new cable from a socket fitted to the side wall of the r.f. assembly cabinet for this purpose.

9. Coincident with the modification installing the new unit, special value capacitors which were fitted in positions C3001 and C3002 in the elevation selsyn and angle mark unit have been replaced by standard 0.01μF capacitors.

10. On replacement of transformer T5401 in the control indicator C-993 the elevation data voltage output is increased above specification. The data voltage output is reduced to the required level by increasing the value of resistor R5422.

11. The control indicator C-993 has been modified to improve performance results by reducing the cable balancing capacity. Capacitor banks C5414, C5416 and C5415, C5417 are replaced by two capacitors designated C5414 and C5415 respectively. This modification is applicable only if modification CA.1671/1 is already embodied.

DEHYDRATOR DESICCANT ELECTRICAL HD-187

12. The TANK DRAIN, FILTER DRAIN and OIL DRAIN valves were originally situated at the rear of the unit close to the radar cabin wall. The valves have been transferred to a plate mounted on the front of the unit, for ease of access, and new pipe line assemblies fitted between them and the original unions. The whole unit is raised on two channels to allow the pipe lines to run underneath it. Fig.6 illustrates the new arrangement.

13. The humidity indicator in the dry air output line of the dehydrator contains silica gel crystals. To avoid the possibility of any pulverized crystals being blown into the transmitter, a paper disc humidity indicator (Ref.No.10AQ/861) has been fitted.

◄13a. When the air filter which forms part of Dehydrator, Desiccant Electrical HD-187 becomes defective, replacement is by a scheduled British spare, Filter Air, N.S. No.4310-99-624-7071. In order to incorporate the new filter it is necessary to modify the dehydrator cabinet. Modification CA.3348/7 details the method of mounting the new air filter.

13b. Copper pipes connecting the finned sections of the cooling pipes have cracked because of metal fatigue. This fatigue has been caused by excessive vibrations of some unsupported assemblies. Modification CA.3385/8 provides support where necessary and reduces the amplitude of the vibrations. ►

COOLER, LIQUID, ELECTRON TUBE HD-188

14. The heat exchanger (cooler, liquid, electron tube HD-188) has been modified to ensure adequate protection against phase failure. Circuit breaker S1901 is replaced by a similar item set to trip at a current of 4 amps. The new circuit breaker will trip on phase failure due to current increases on the remaining two phases of the three phase supply.

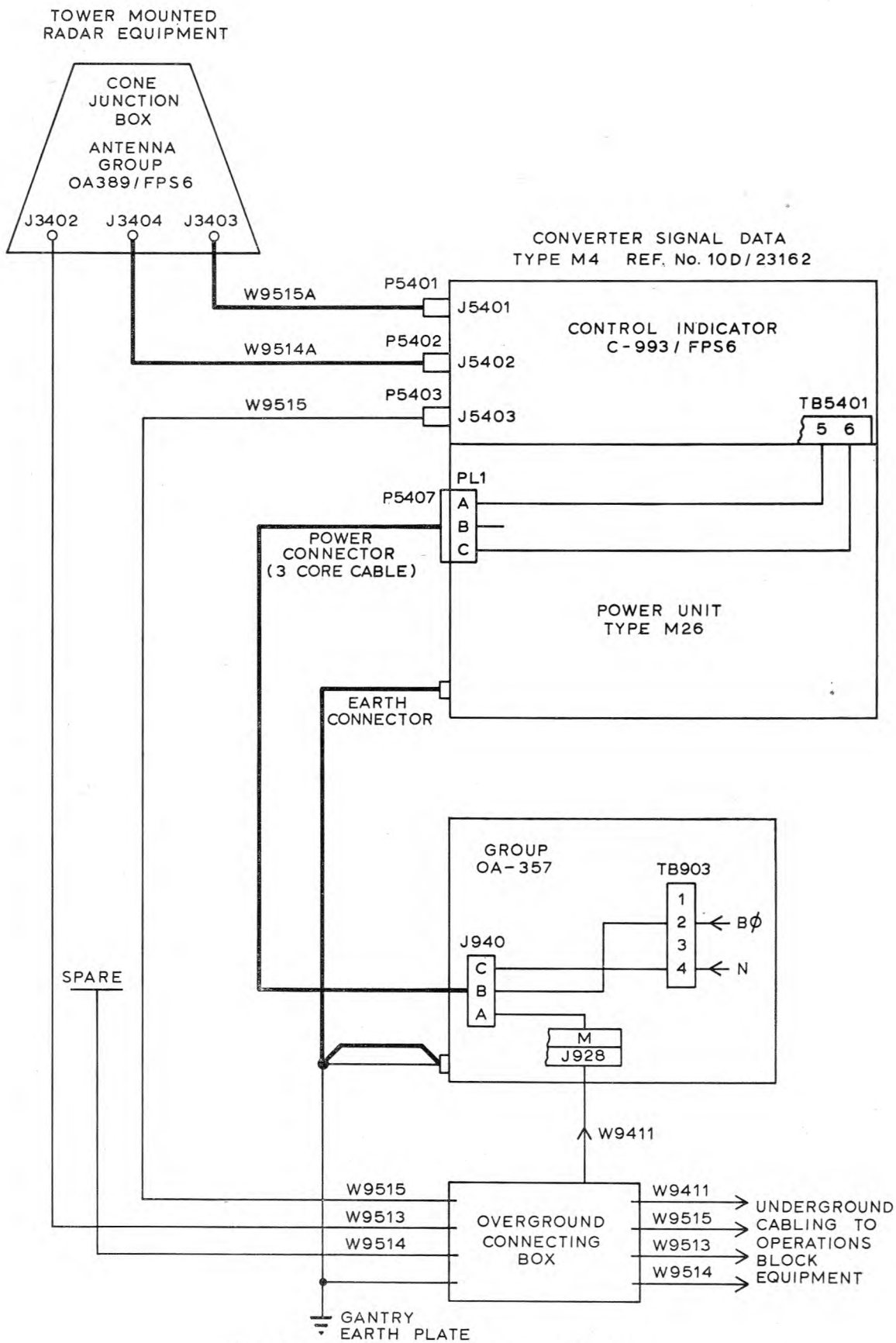
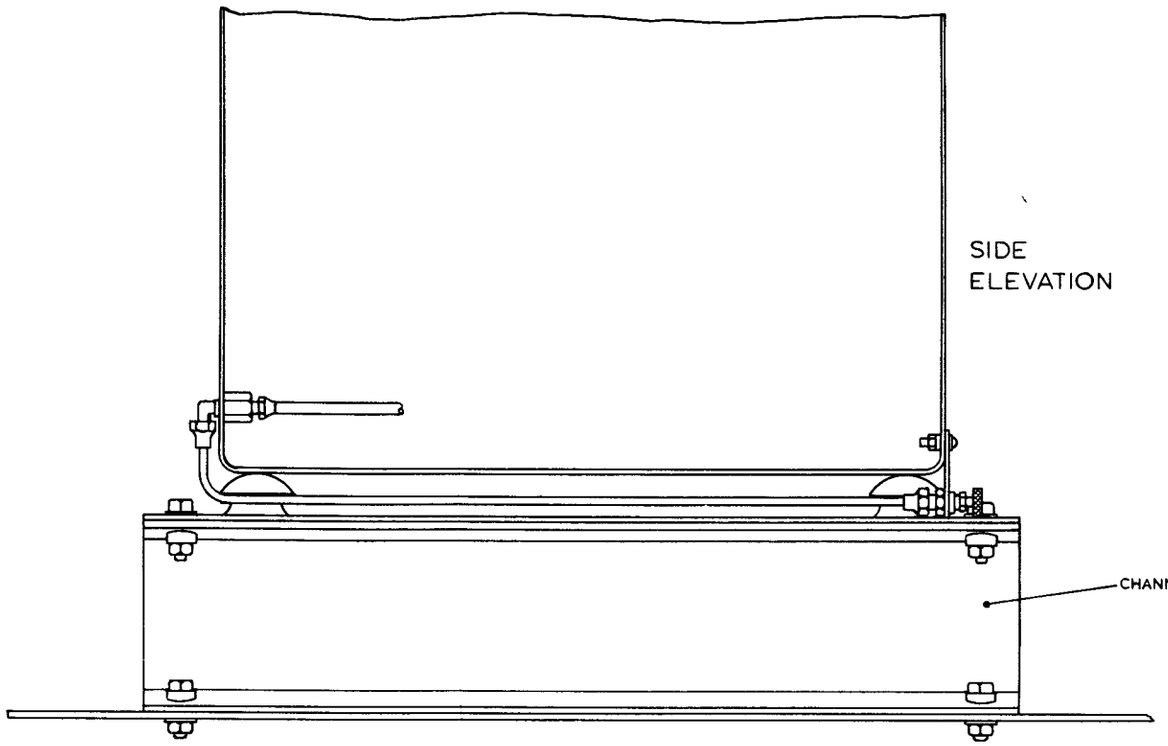
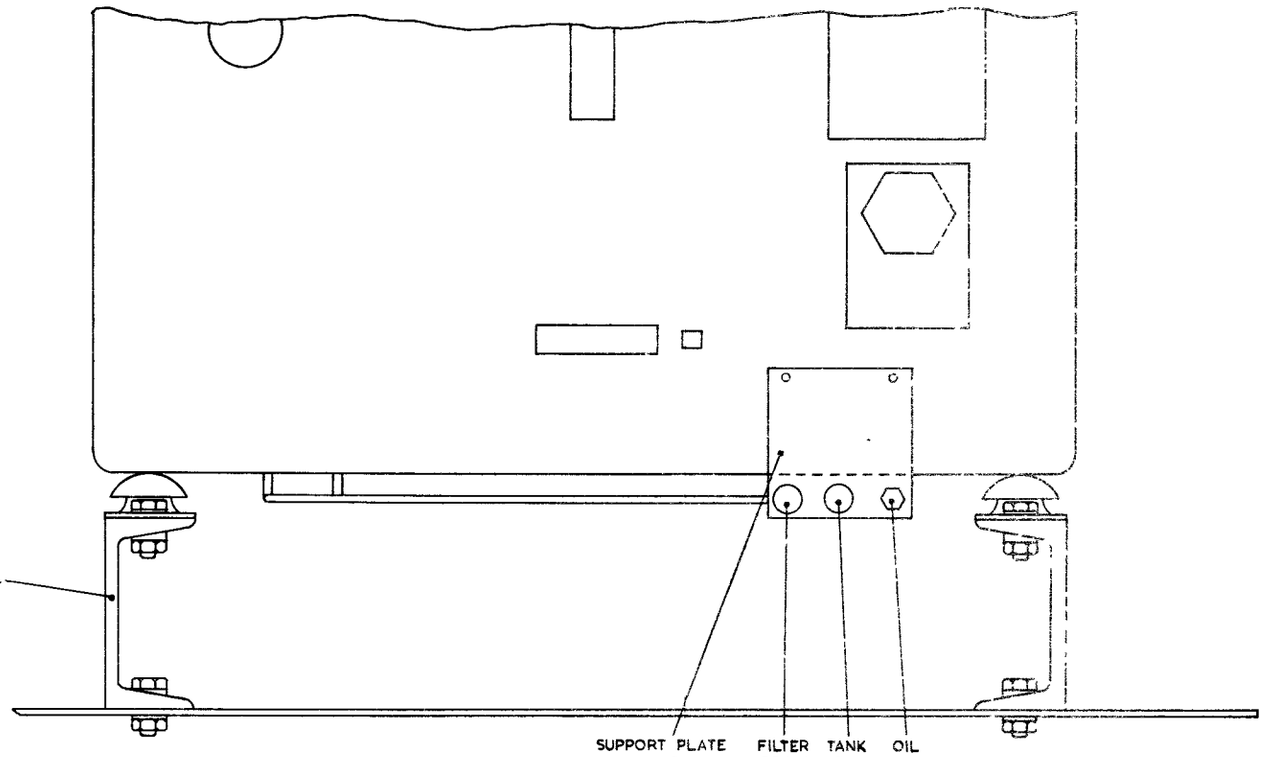
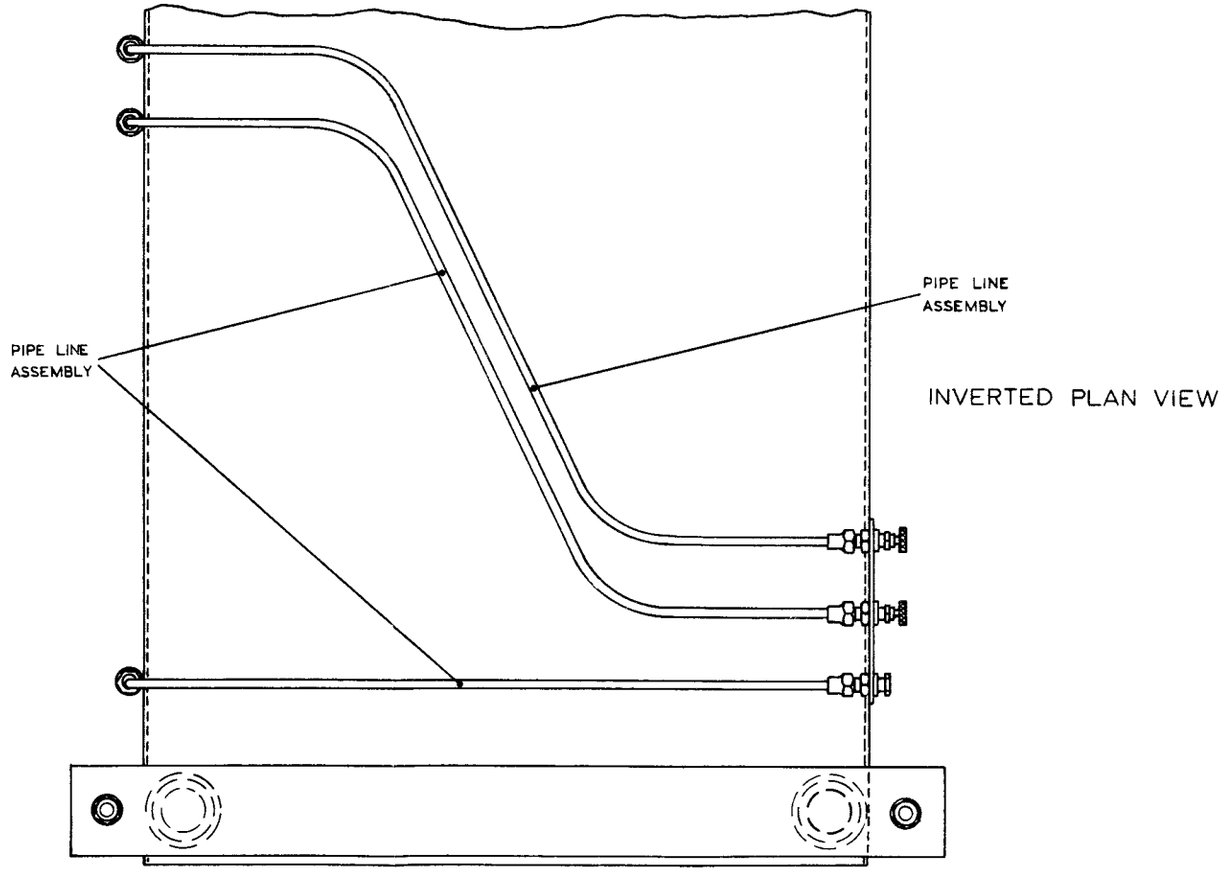


Fig. 5. Modification to tower assembly cables





FRONT ELEVATION



INVERTED PLAN VIEW

Fig. 6 Pipeline arrangement for drain valves **Fig. 6**

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Chapter 3

TRANSMITTER-RECEIVER SYSTEM

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Transmitter Type 15003

1. Modifications to the transmission system include the replacement of American transmitter T-338/FPS-6 by the British transmitter Type 15003 and associated waveguide components. Technical information on these items is contained in Part 1, Sect. 2, Chap. 1 and 2.

Cabinet electrical equipment CY-1108

2. The waveguide system in the cabinet has been modified to improve the protection of the receiver crystals. Waveguide switch SA269/U has been replaced by a low pass filter switch F333/FPS6. The filter prevents the passage of power at the third harmonic of the magnetron frequency which is liable to cause deterioration of the receiver crystals. The switching function helps to protect the crystals from r.f. power accidentally received from nearby transmitters, by isolating the receiver from the aerial when the radar set is not radiating.

3. The filter switch consists of a short coaxial section connecting the TR tube and signal mixer with the waveguide to coaxial transition effected by a probe at each end of the coaxial line. A solenoid controlled linkage rotates the coaxial section so that the probes are either in the position for optimum power transference or at 90° to this position, and effectively isolating the receiver. Tuned slugs on the inner conductor filter out the unwanted third harmonic frequency.

4. The waveguide switch control circuit is shown in Fig. 1. When by-pass switch S915 is OFF, as shown in the diagram, the h.v. interlock between pins 4 and 5 is closed and the 120V waveguide shorting switch supply energizes relay K904. The relay transfers the C phase voltage to solenoid K902 to energize it. When the transmitter is switched off, the 120V shorting switch supply is removed and solenoid K902 is de-energized.

5. When noise source signals are to be introduced into the receiver for test purposes, by-pass switch S915 is put in the ON position. This breaks the h.v. interlock circuit and at the same time applies the C phase voltage to K904, to energize solenoid K902.

6. To prevent third order harmonics reaching the power measuring equipment when making a v.s.w.r. or power check, a lowpass r.f. filter is fitted in the power measuring circuit. The filter Z901 is connected between the output J905 of coaxial switch S905 and the POWER MEASURE socket J904 on the indicator and test panel.

7. Power supply PP-756 (keep alive power supply) has been modified in order to prolong the operational life of the TR cell which it supplies. Resistor R406 is replaced by a variable resistor of 5 megohms in order to reduce the supply current to the TR cell to approx. 100 microamp. The value of R403 is increased to 1 megohm to reduce the drain on mains rectifier CR401. Fig. 2 shows the modified circuit diagram.

8. Transmitter Type 15003 introduces a new h.v. interlock circuit and magnetron current indication

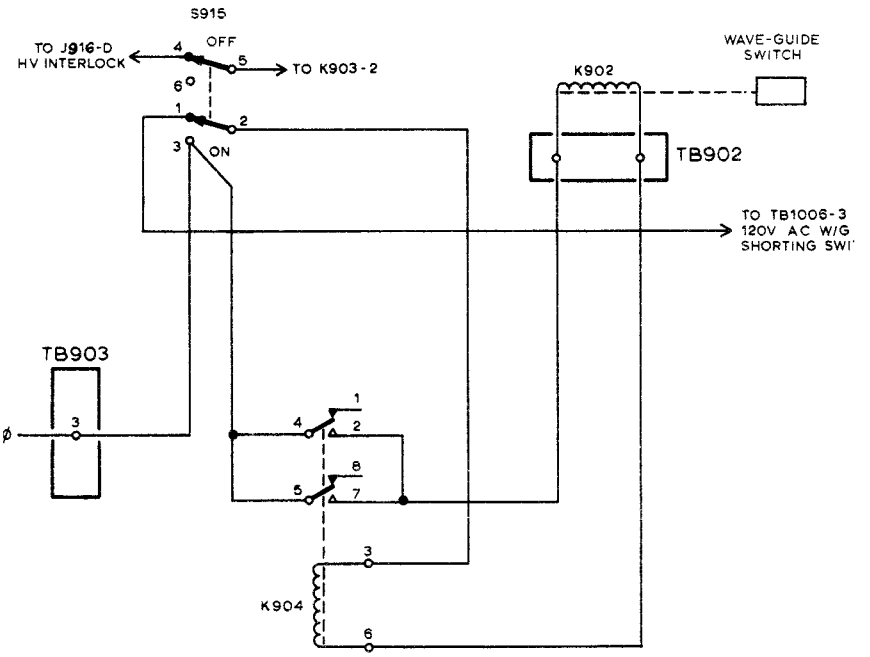
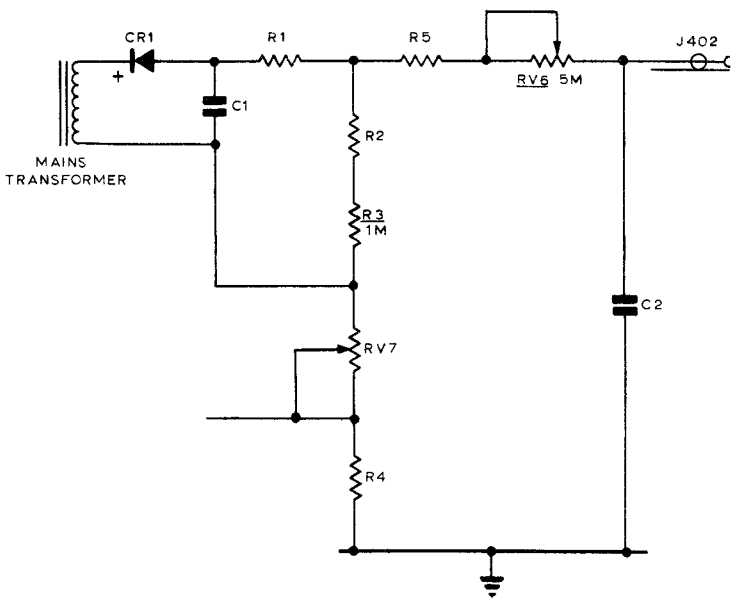


Fig.1. Waveguide switch control circuit



NOTE

ADD 400 TO ALL SYMBOL NOS EXCEPT
JACKS AND TERMINAL BOARDS

Fig.2. Power supply PP.756 part circuit diagram

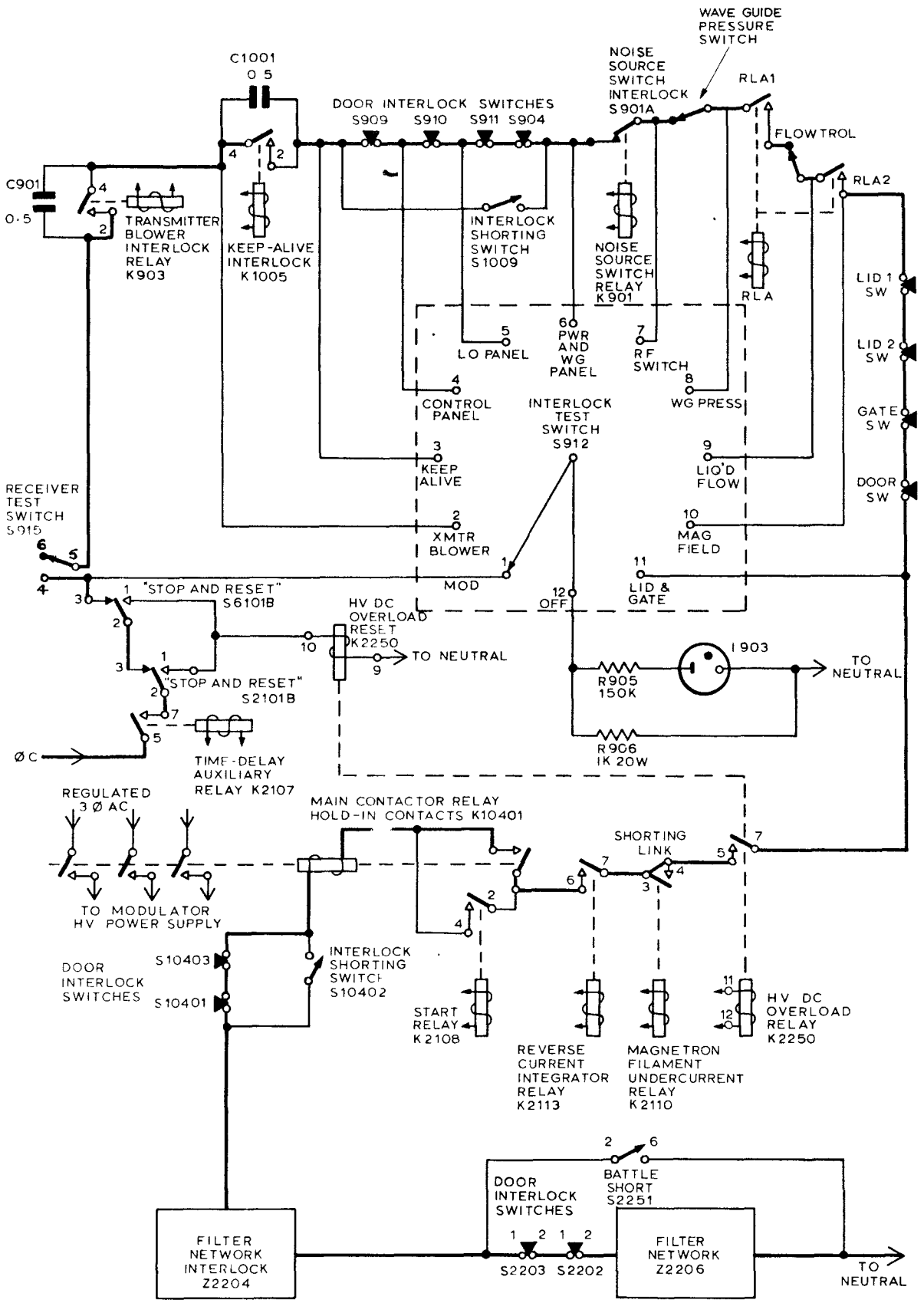


Fig. 3. H.V. interlock circuit

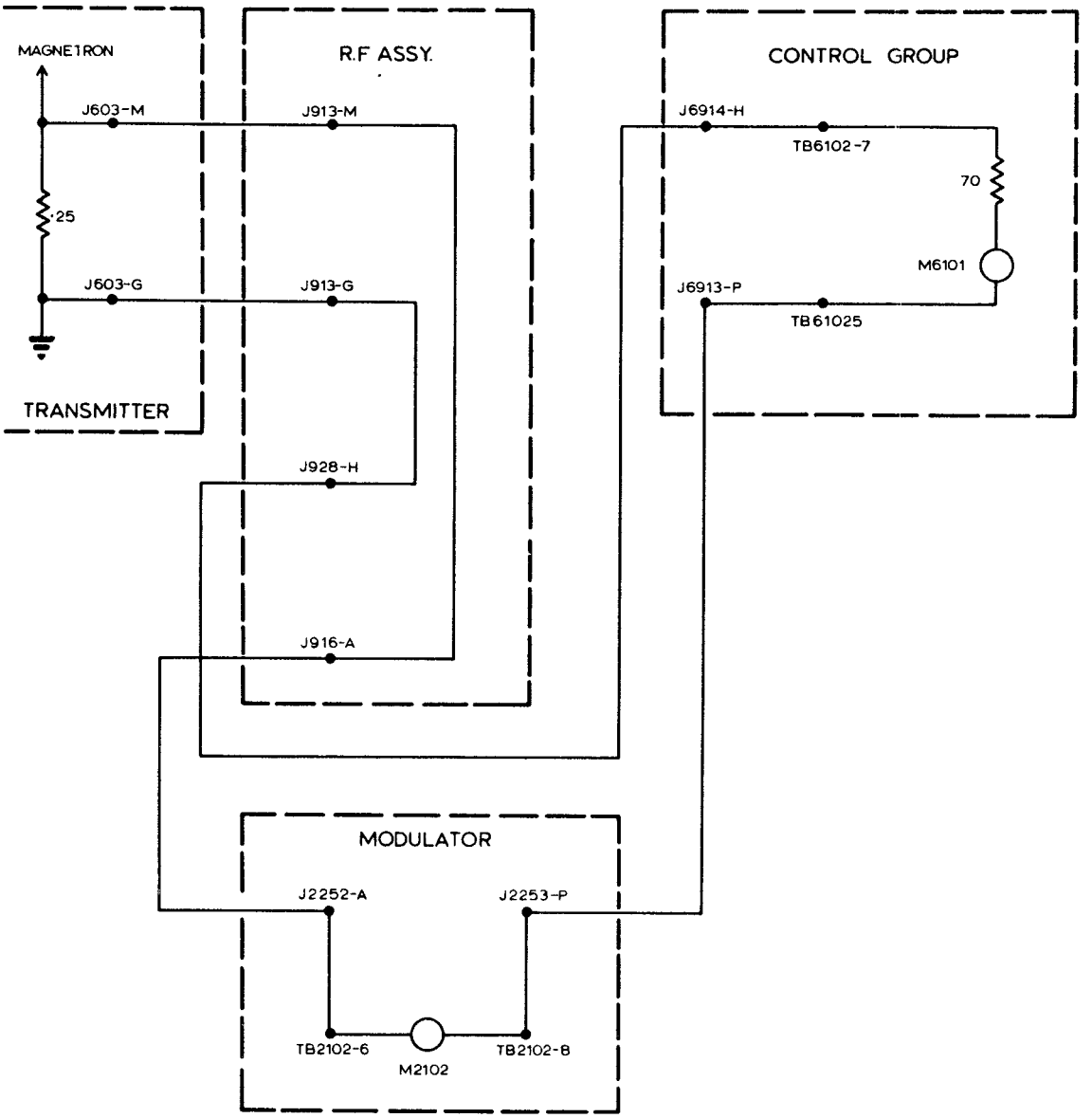


Fig.4. Magnetron current metering circuit

circuit, which involve some modification to the r.f. cabinet wiring. A new plate showing interlock test switch positions is fitted to the interlock test switch on the front panel of the cabinet. Fig.3 shows the complete h.v. interlock circuit. The existing magnetron current meters in the modulator and the control group have been replaced by 0.5 microamp. meters. The circuit has been rearranged so that the meters are connected in series as shown in Fig. 4.

Changes to modulator

9. The mains supply to the trigger amplifier is now fused with a 500 mA fuse with lamp indicator. The fuse, labelled TRIG AMP is mounted on the upper right-hand door of the modulator cabinet. Fig.5 shows the modified circuit connections necessary.

10. When the transmitter Type 15003 is installed a number of modifications are carried out on the modulator assembly. The mains power supply for the transmitter is obtained from a terminal junction box and connector which is connected in the modulator power supply cable. A new pulse forming network Type 150-11, designed to produce a 4.7μs modulation pulse, is mounted at the rear of the modulator. Included in the modulator charging circuit ◀is a▶ new 15 μH r.f. inductor (Type 6013), connected between the anode of V-2201 and the pulse forming network, and a new 0.0125 μF despiking capacitor (Type 14031) connected in position C2204.

11. In transmitter Type 15003 the magnetron heater supply is derived from a mains transformer, and so the magnetron filament supply powerstat is no longer required. The powerstat is made inoperative by the removal of fuse F2 from the modulator control unit which isolates the autotransformer from phase voltage. The magnetron under-current relay also becomes inoperative.

To maintain the h.v. interlock circuit a shorting link is therefore connected between pins 3 and 4 on the relay as shown in Fig. 3.

12. In the thyratron trigger circuit a thyristor is added to eliminate voltage transients at the grid of the thyratron. The thyristor is connected between earth and jack socket 12210 which connects to the thyratron grid.

13. The modulator filament supply powerstat is designed to operate on a 60 c/s supply. To ensure correct operation on 50 c/s, the auto-transformer drive motor shunting capacitance is increased to 5 μF. A 1 μF capacitor is connected in parallel with the existing 4 μF capacitor.

14. Hour-meter M1 on the modulator control unit has also been replaced by a similar meter designed to operate on a 50 c/s supply. To avoid the possibility of cables failing due to excessive temperature rise in the right-hand section of the modulator cabinet, a small deflector is fitted to the cabinet blower outlet. If the deflector is removed for any reason during servicing it must be refitted prior to switching on.

◄ 15. Transformer F.S.C. No.5950-518-0148 (T2250) was originally replaced by Transformer, Variable, Power 10K/21785 which has now become obsolete. The new replacement, Transformer, Variable, Power N.S. No.5950-99-141-9076 necessitates a new method of mounting. In addition the new transformer T2250 has different terminals and terminal identification. Fig. 6 gives details of the interconnections. Modification CA.3349/9 details the method of fixing the new transformer. ►

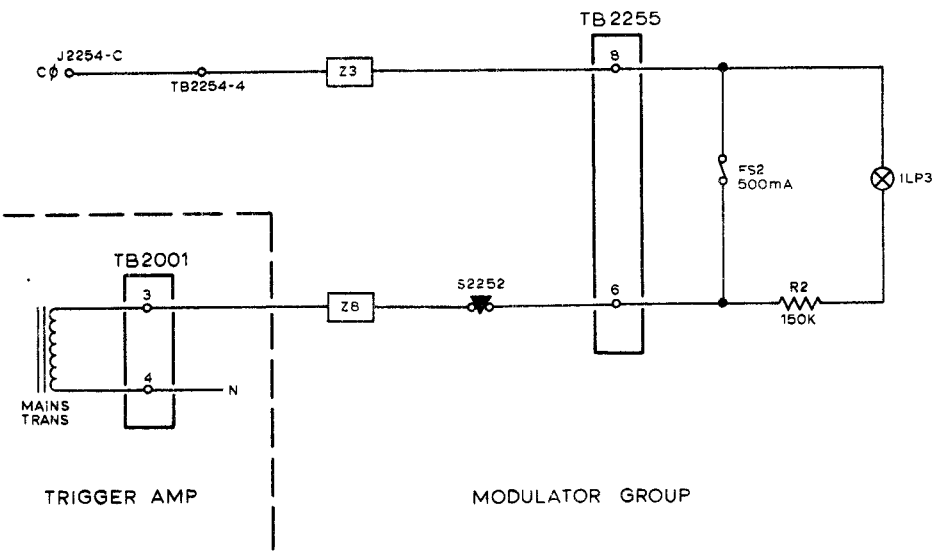
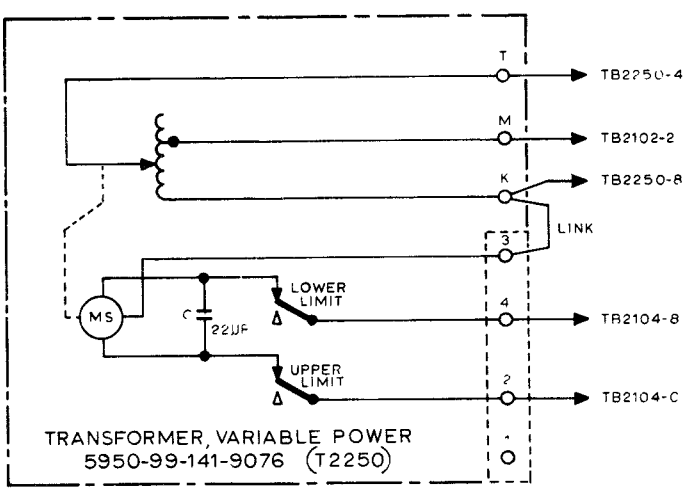


Fig.5. Mains supply to trigger amplifier



◄ Fig.6. Transformer T2250 interconnections ►

Chapter 4

RANGE-HEIGHT INDICATOR

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Cabinet electrical equipment CY-1145

1. The control and display equipments have been modified to allow the anti-jamming facilities to be controlled from the operator's position at the range-height indicator. A switch assembly Type M2 (Fig. 1) is fitted to cabinet CY-1145, which houses the range-height indicator, and is connected via a new 10-way plug and socket (P4220), on the rear panel of the cabinet, to the control group assembly and i.f. amplifier AM-622.

2. When a master switch, S15, in the control group assembly (Part 1, Sect. 1, Chap. 5) is in the REMOTE position, a 28V d.c. supply is fed to the common connection of the three switches in the assembly. Each switch then feeds the supply to one of the anti-jamming circuit relays in the i.f. amplifier. The circuit selected is indicated by lamps which are coloured blue for S.T.C., green for F.T.C. and red for A.V.N.L. Note that an indication is given if the selection is either 'local' or 'remote'. The circuit of the switch assembly and its connections is shown in Fig. 2.

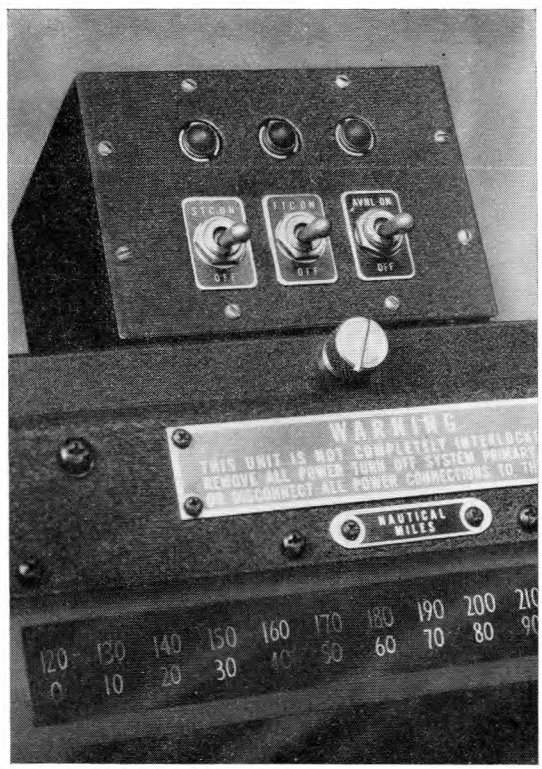


Fig. 1. Switch assembly Type M2 : general view

Indicator range and height IP-188

3. The indicator has been modified to extend the range of displays to 250 nautical miles. To maintain linearity of the sweep waveform over this range, the initial stages of the horizontal sweep circuit are modified as shown in Fig. 3. The resistance of the charging circuit of C4401 is reduced to give a higher aiming potential at the junction of resistors R4403 and R4405, so increa-

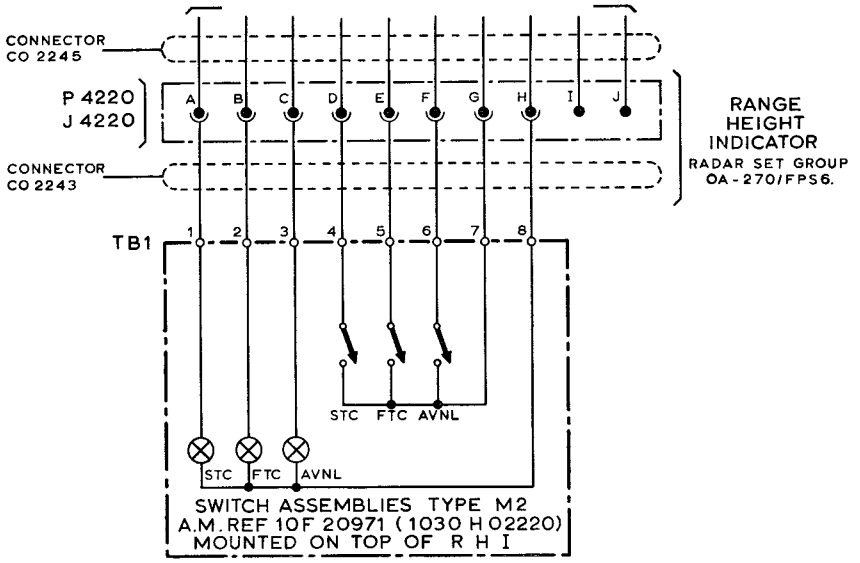
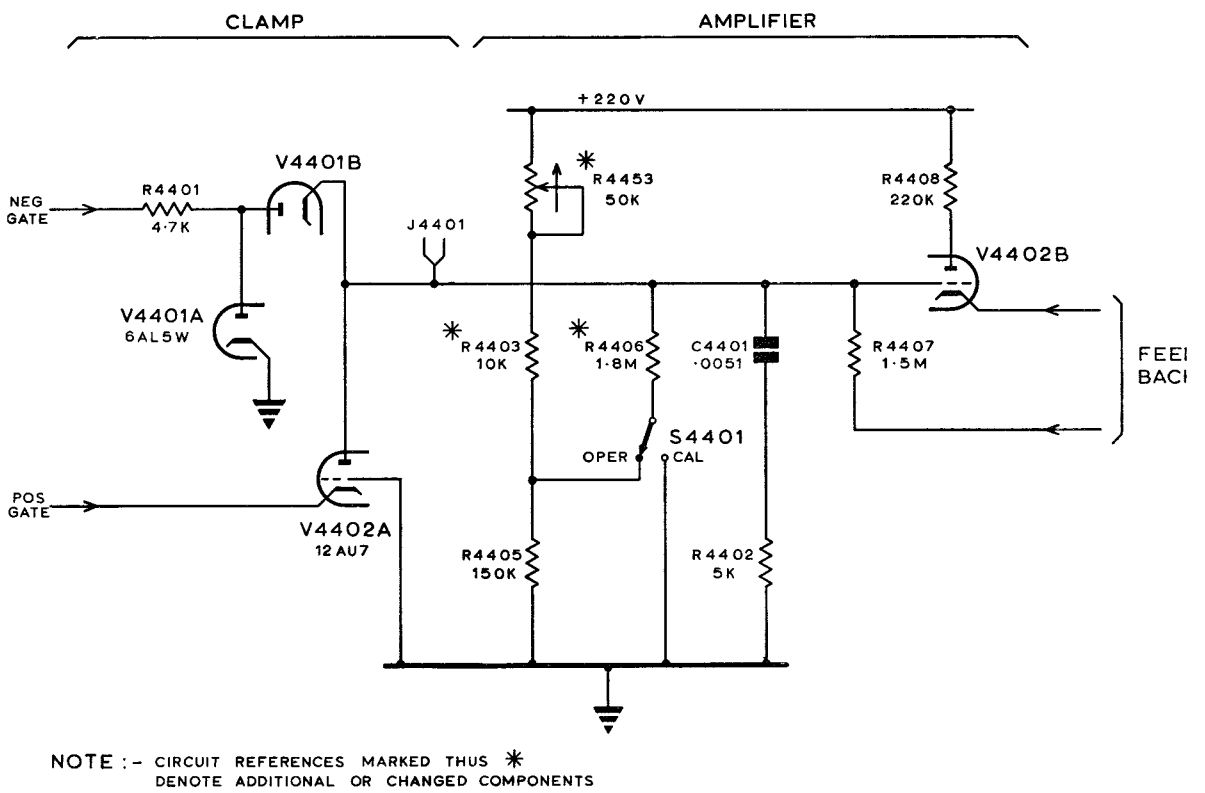


Fig. 2. Switch assembly Type 192 : circuit



NOTE :- CIRCUIT REFERENCES MARKED THUS ✳ DENOTE ADDITIONAL OR CHANGED COMPONENTS

Fig. 3. Horizontal sweep circuit

sing the amplitude of the sweep waveform at the grid of V4402B. The full 250 mile sweep can thus be obtained from the initial linear portion of the charging curve. To avoid overdriving the sweep amplifier stages, R4453 is set for the minimum aiming potential which will give a linear sweep.

4. New range indicating labels and a range delay indicator tape are fitted on the indicator front panel. The ranges indicated are 0-130 and 120-250 miles. The delayed range sweep is extended to 62 miles. The value of R4445, in the range delay circuit, is reduced to 2·7 kilohms, which alters the bias conditions on cathode follower V4405B allowing a 62 mile delayed sweep to be set up.

5. In the gate and intensifier circuit, the length of the positive and negative gates, which control the sweep circuit, is increasd to over 250 miles to ensure stable operation on extended ranges. The value of R4305 is increased to 3·3 megohms. This reduces the discharge rate of C4302 so that the untriggered gate length of multivibrator V4302 is extended to 3,500 microseconds. Similarly the length of the angle marks is increased by extending the gate length of multivibrator V4604A in the angle marker circuit. R4633, is removed from the parallel combination R4633 and R4623, effectively increasing the resistance of the discharge path of C4621.

Power supply PP-828

6. When the unit is used with a 6L6WGB in position V4150 the stability of oscillation is affected, due to slightly different valve characteristics. A 330 pF capacitor C4151 is connected between earth and the screen of the valve to obtain correct operation.

Chapter 5

CONTROL GROUP ASSEMBLY

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Control radar set C-992

1. The control and display equipments have been modified to allow the anti-jamming facilities to be controlled from the operator's position at the range height indicator as well as from control radar set C-992. The group of three selector switches, S6112, S6113 and S6114, are duplicated by a new set mounted on the display equipment. A master control switch, S15, operates a relay, K6102, in control radar set C-992, which puts into circuit one of the selector switch groups. Fig. 1 shows the circuit.

2. With master switch S15 in the LOCAL position, K6102 is de-energized. The 28V supply, from TB6104-4, is fed to the anti-jamming circuit relays in the i.f. amplifier AM-622 via the selector switches in control radar set C-992 and the normally closed contacts of the relay. With master switch S15 in the REMOTE position, K6102 is energized and the 28V supply is routed to the selector switches on the display equipment via the normally open contacts of the relay. At the same time the three switches on control radar set C-992 are isolated.

I.F. Amplifier AM-622

3. The S.T.C. circuit has been modified to utilize a system trigger pulse from range calibrator TS-735 (range mark generator). Fig. 2 shows the new S.T.C. circuit. The action is fundamentally unchanged. With the S.T.C. circuit switched on, under quiescent conditions, CR6 is cut off by a negative bias voltage developed across R108, R109 (S.T.C. DIODE BIAS) and R110. The grid bias of V20, determined by R88 and R91, holds the anode current at a low value.

4. A positive trigger pulse, fed in at J21704, develops a voltage across R93 (S.T.C. FLAT DURATION) large enough to overcome the bias on CR6 causing it to conduct. This action rapidly charges up C54 to a level determined by the setting of R93. At the same time the rapid rise of voltage at the grid of V20 drives the valve into saturation. The anode voltage falls rapidly, the fall being transferred to the output via C53. At the end of the trigger pulse, C54 begins to discharge through R92 (S.T.C. TIME CONSTANT) and R88 causing the voltage at the grid of V20 to fall. The anode voltage remains at a low level as long as the grid voltage is high enough to maintain saturation. The length of time in which this condition is maintained, i.e. the 'flat' duration, depends on the initial charge on C54 which is a function of the setting of R93 (S.T.C. FLAT DURATION). The grid voltage continues to fall along a time constant dependent on R92, the anode voltage rising in the same manner. Thus R92 defines the slope of the rising S.T.C. waveform at the output. The input and output waveforms are shown in Fig. 3.

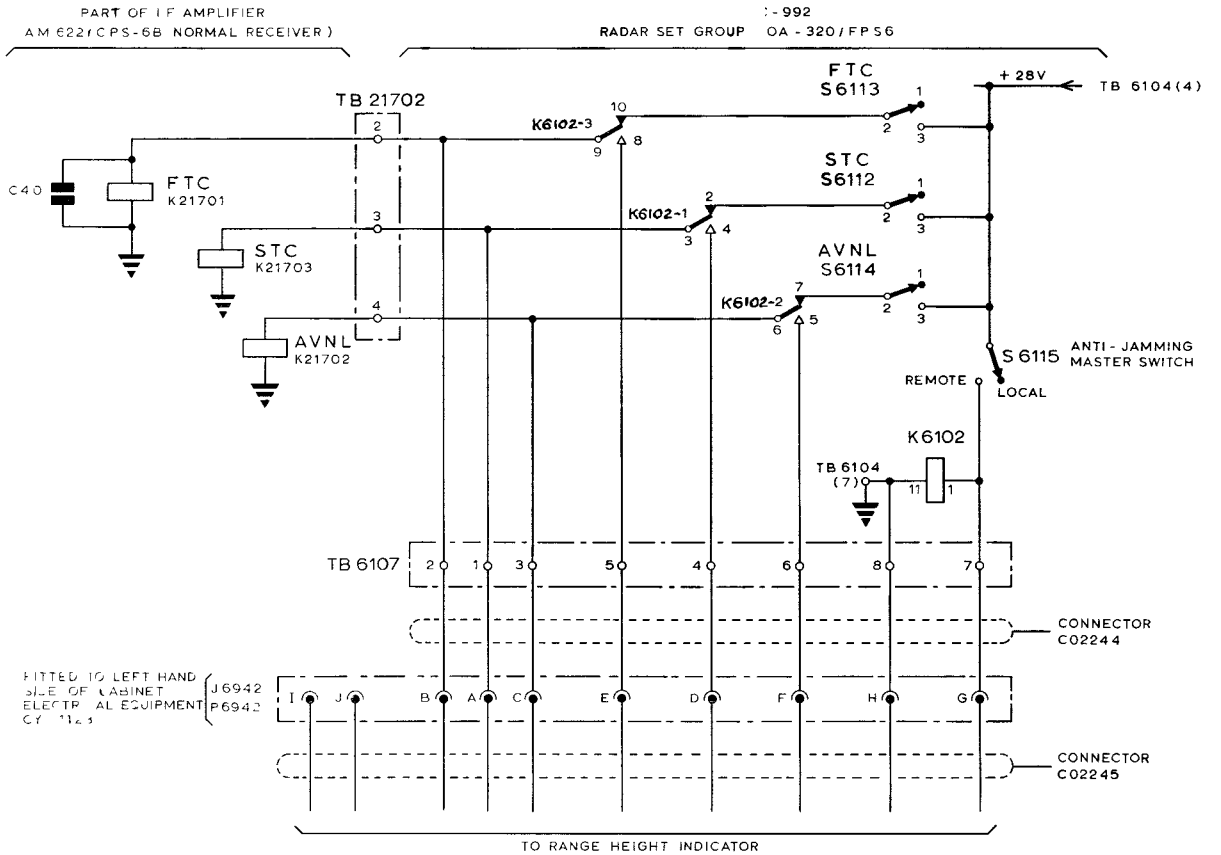


Fig. 1. Remote anti-jamming facilities

5. The system trigger is also fed to a cathode coupled multivibrator V19, via C55. The output of the multivibrator is differentiated to provide a series of pulses for the A.V.N.L. circuit. Setting-up instructions for the S.T.C. circuit are given in Part 2, Section 1, Chap. 5.

Calibrator range TS-735

6. When used on 'Rotor' stations, calibrator range unit TS-735 has been modified to provide greater flexibility in handling a master trigger of reduced amplitude and p.r.f. and for operations involving the use of the 'data mile' (2,000 yd) as the standard unit of distance.

7. The unit is designed to operate using an input trigger of greater than 25V amplitude. In order to use a master system trigger of 20V amplitude, the bias on V1, the input blocking oscillator, has been reduced by changing the value of R5203 to 220 kilohms. To accommodate the lower p.r.f. (240-400 p.p.s.) the value of C5204 has been changed to 6,000 pF.

8. For greater stability in the 5:1 count down and 50 mile range mark circuits under the new operating conditions, the values of R5252 and R5257 have been increased to 100 ohms and C5214 is now 1500 pF.

9. Introduction of the 'data mile' involves replacement of calibrator crystal Y5201 by one operating at a slightly higher frequency. The value of R5220 is reduced to 1 megohm. The two capacitors C5224 and C5225 are replaced by a single capacitor of 3,300 pF.

10. A complete list of the changed items in this unit is given below. Circuit diagrams should be marked to show the changes.

Item	Old Value	New Value
R5203	100k	220k
R5252	47 ohms	100 ohms
R5257	47ohms	100 ohms
R5220	2·2M	1M
C5204	3,300pF	6,000pF.
C5214	1,000pF.	1,500pF.
C5224, C5225	3,630pF.	3,300pF.
XY5201	80·867kc/s	81·959kc/s

11. Setting up instructions for this unit are given in Part 2, Sect. 1, Chap. 5.

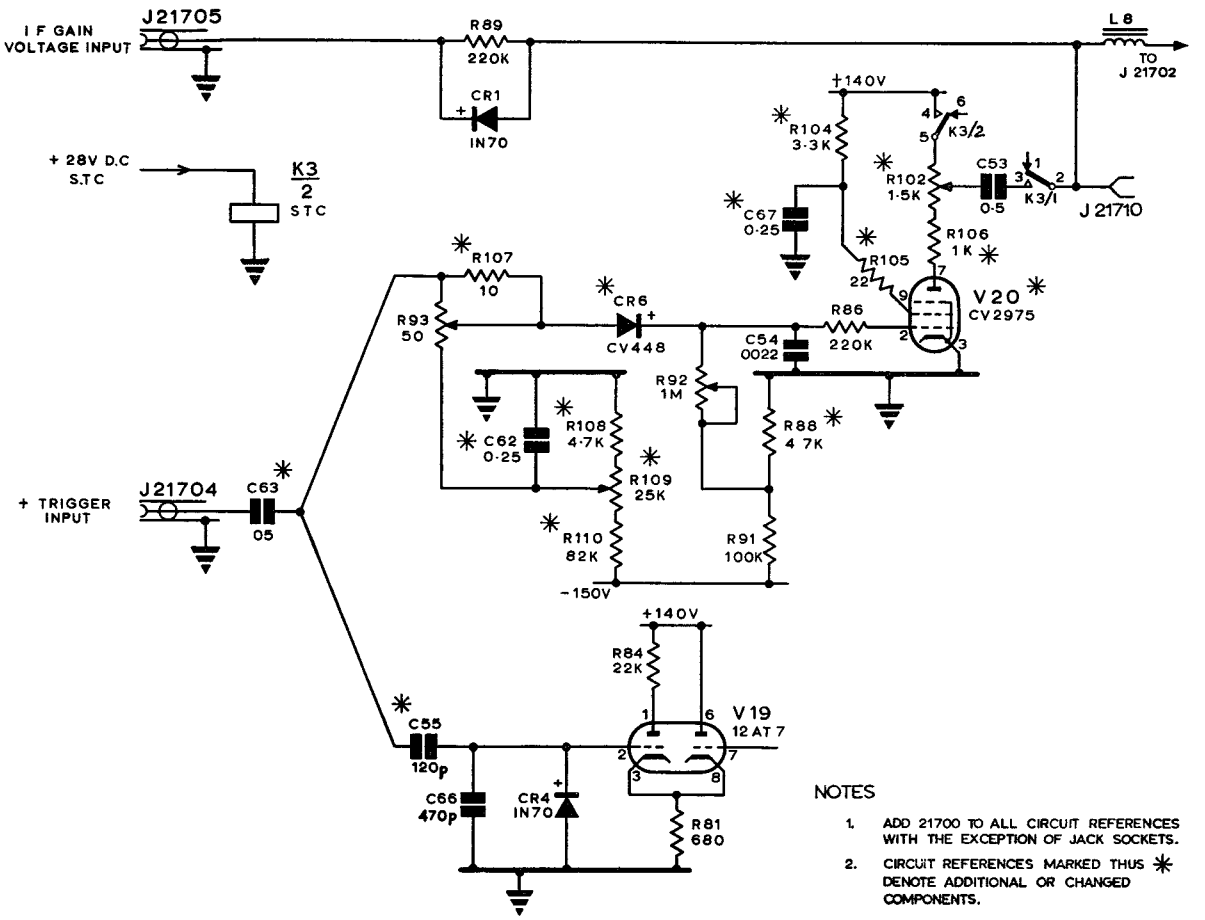


Fig. 2. S.T.C. circuit

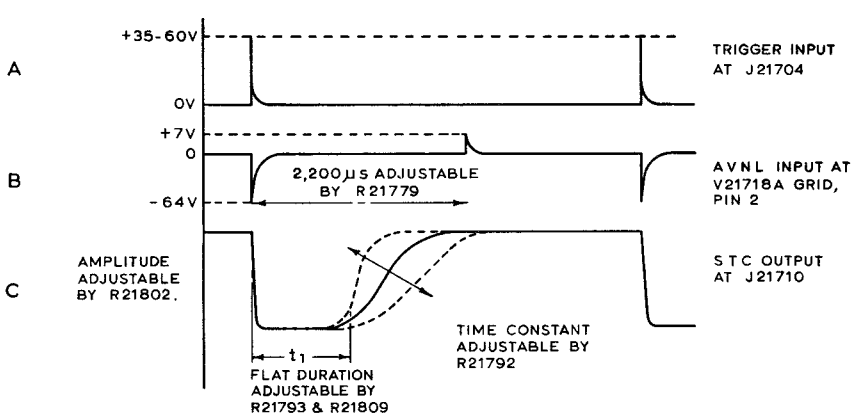


Fig. 3. S.T.C. waveforms

Cabinet electrical equipment CY-11

12. When the selection of the anti-jamming facilities is transferred to the range height indicator an addition is made to the wiring of cabinet electrical equipment CY-1123. A new 10-way cable connector, J6942, is fitted to the left hand wall of the cabinet to accept the wiring to the range height indicator as shown in Fig. 1.

13. Similarly, changes to the cabinet wiring are necessary for the provision of a local system trigger for the i.f. amplifier AM-622 (para 3). Fig. 4 shows the new wiring arrangement. An adaptor plug and 'T' junction are fitted in place of coaxial cable connector J6924. The system trigger is then routed via existing cables and through the 'T' junction, from the range mark generator to the i.f. amplifier.

14. When, as described in Chapter 2, control indicator C-993 is removed from the control group ..... and transferred to a new unit in the tower assembly, the existing connections to the unit are transferred to a new termination panel mounted in generator pulse TD-73. A connection is made from the termination panel to connector J6914(M), as shown in Fig. 5, to provide an actuating circuit for relay K5401 in control indicator C-993.

15. When operating at 50 c/s, the coil of relay K5401 and the 'slow' and 'fast' indicating lamps in control antenna C-991 can form 'sneak' circuits which hold in elevation drive motor contactor K6901 even under overload conditions. The supply to K5401 is therefore broken by an auxiliary switch which is actuated by contactor K6901. Modifications to the cabinet wiring are shown in Fig. 6. Indicator lamps I1 and I2 are similarly isolated by routing the neutral return via the contacts of K6901 instead of direct. Fig. 7 shows the new circuit.

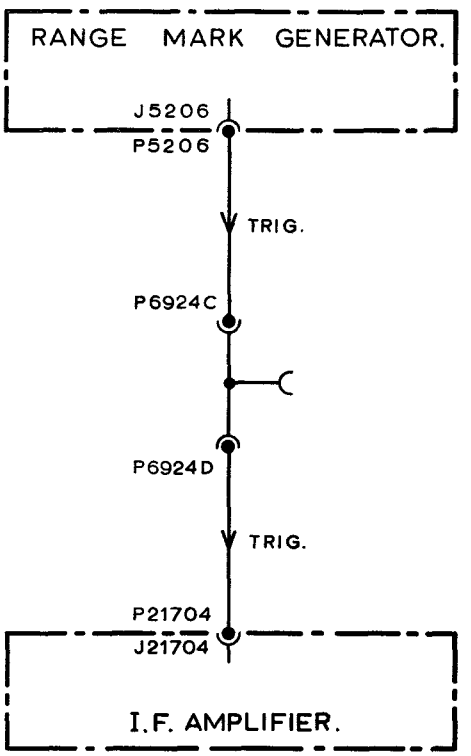


Fig. 4. Local system trigger

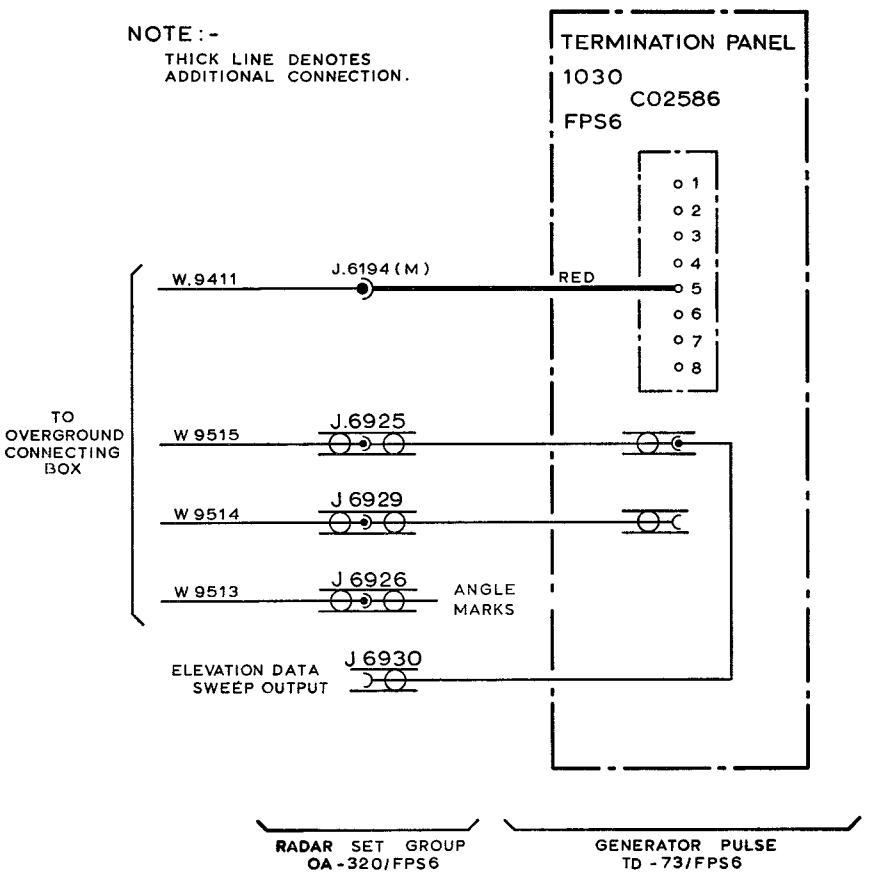


Fig. 5. Relay actuating circuit

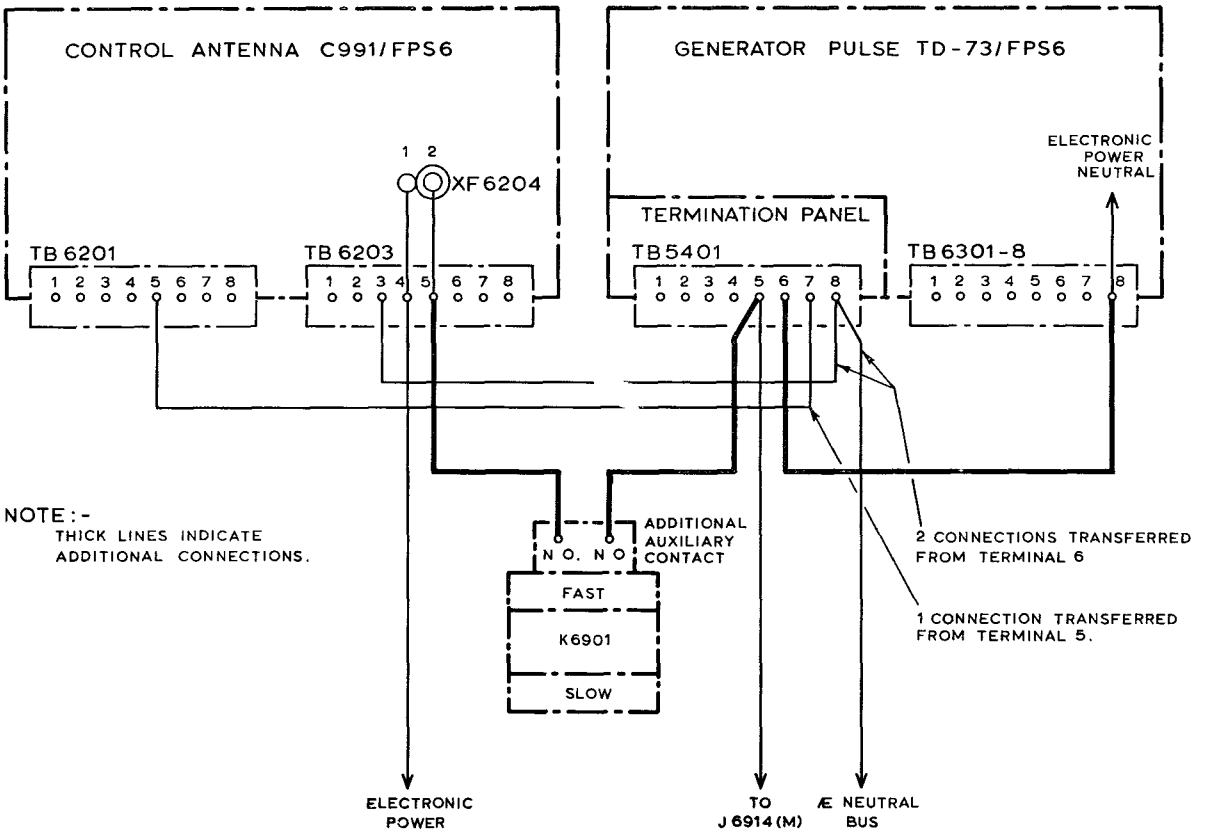


Fig. 6. Auxiliary contactor

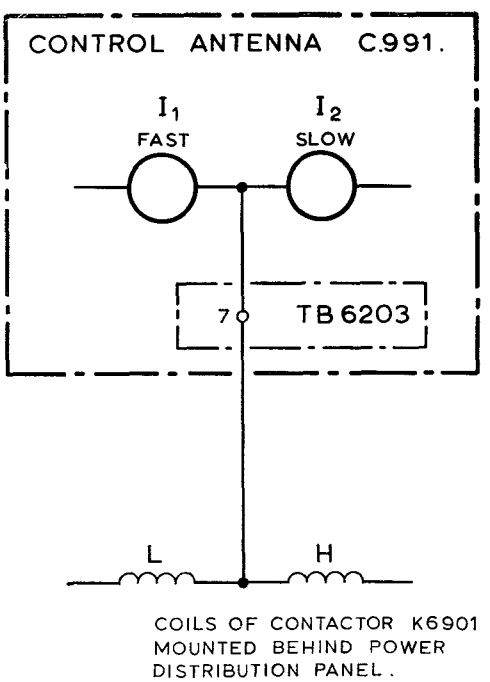


Fig. 7. Indicator lamp circuit

Chapter 6

REMOTE CONTROL AND DISPLAY

General

1. All modifications to this part of the equipment are concerned with integration with existing British equipment. Full details of these modifications will be found in A.P.2527UB.

SECTION 2

TRANSMITTER TYPE 15003

Chapter 1

GENERAL DESCRIPTION

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

General

1. To improve the reliability and performance of radar Type AN/FPS-6 the original American radar transmitter T.338/FPS-6 has been replaced by one of British design, transmitter Type 15003 (Ref.No.10D/20470).

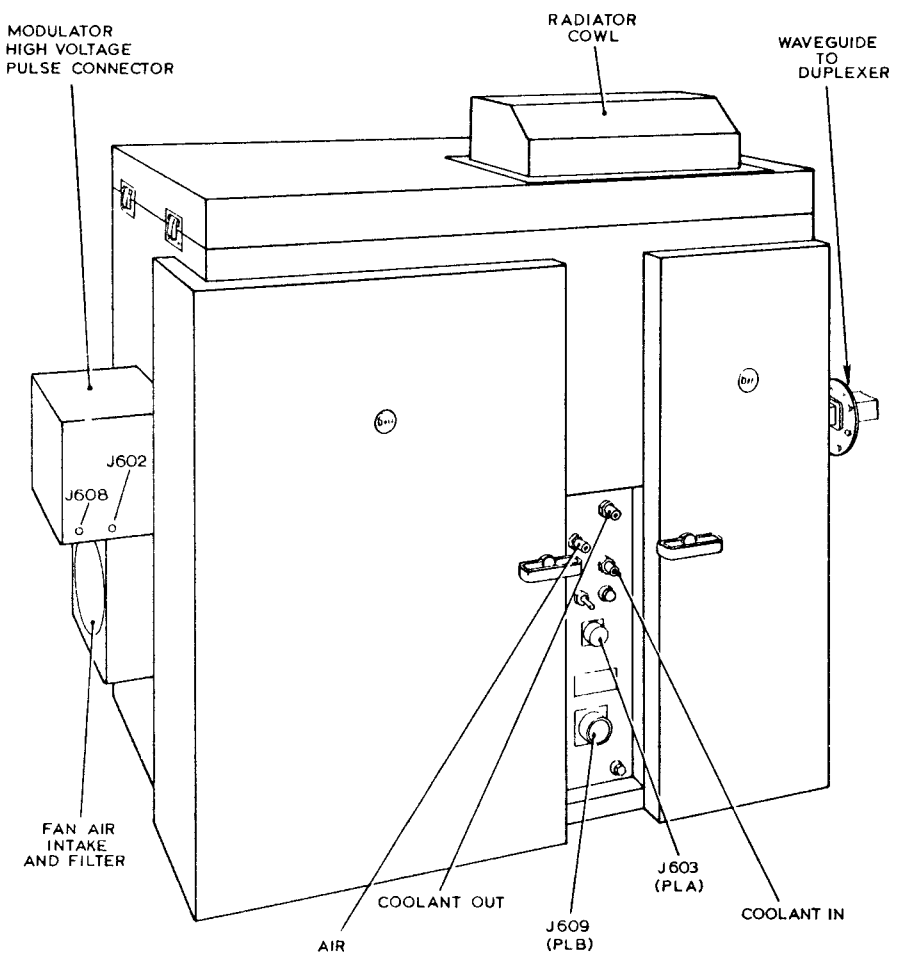


Fig.1. Transmitter Type 15003 - general view

The transmitter has been replaced to permit the use of the Boot Magnetron CV6080 or CV6082. Transmitter Type 15003 is the main item of the modification kit and has been designed to have the same over-all dimensions as the original. All external connectors are of American pattern, thus allowing all existing cables and hoses to be used. A general view of the British transmitter is given in Fig.1.

TRANSMITTER OPERATIONAL PARAMETERS

2. The operational parameters of the transmitter are as follows:–

(1) A p.r.f. of 250Hz or 270Hz.
(2) A pulse duration of 4.7μs.
(3) A measured peak power of 2.0MW minimum.
(4) A single spot frequency in the range 2700–2900MHz.

ITEMS INCLUDED IN THE MODIFICATION

3. The replacement of the transmitter necessitates the changing of other components to allow operation of the Boot magnetron. These components are as follows:–

(1) Seven waveguide sections coupling the transmitter to the duplexer in the r.f. assembly. These include a ferrite isolator.
(2) The pulse-forming network at the rear of the modulator assembly (modulator group OA-329) to provide a 4.7μs modulation pulse.
(3) A terminal junction box and connector in the modulator power supply cable to provide power for the new transmitter.
(4) The magnetron current meters: M6101 on the control C-992 of the control group and M2102 on the control CN-187 of the modulator group. The new meters are 0.500μA scale.
(5) Four 5·6-kilohm resistors in the l.f. amplifier AM-622/CPS-6B of the control group. This causes a reduction in the receiver overall bandwidth which is permitted by the increased transmitter pulse duration.
(6) The end inductance and despiking capacitor in the modulator to enable the equipment to operate at a p.r.f. of 240–400 Hz.

NOTE: The end inductance limits the rate of rise of current through the thyratron to conform to the manufacturer's rating, and the despiking capacitor reduces the rate of rise of voltage applied to the magnetron.

(7) Wiring changes in the cabinet electrical equipment CY-1108 of the r.f. assembly group OA-357 to allow monitoring of the new transmitter interlocks and remote indication of the magnetron current.

TRANSMITTER MAIN COMPONENTS

4. Transmitter Type 15003 consists of the following main components:–

(1) Magnetron oscillator CV6080 (5960-99-037-2404) or CV6082 (5960-99-037-2406).

(2) Electromagnet (Ref.No.10E/13262).

(3) Coupler, magnetron waveguide (Ref.No. 10B/20470).

(4) H.V. modulation pulse transformer 1:3·2 step-up Type 5096 (Ref.No.10K/20273).

(5) Power supply (Ref.No.310D/30002).

(6) Magnetron heater transformer (20V secondary) Type 5095 (Ref.No.10K/20272).

(7) Electromagnet and ferrite isolator liquid coolant system which includes interlocks.

(8) Cabinet cooling fan (Cat. No. 9140-99-999-8318).

(9) Pressurized air cooling system consisting of:–

(a) Compressor, air (Cat. No. 4130-99-107-8091). Pre Mod. CA1857/6 (Ref. No. 10AR/3866).

(b) Radiator type cooler (Cat.No.5999-99-913-7966).

(c) Oil separator (Ref.No.10AS/3098).

(d) Air filter (Ref.No.10AR/3876).

(e) Interlock switch (Ref. No. 10F/20018).

(f) Safety valve (Cat. No. 4820-99-913-7963).

(10) A gate which carries two units as follows:–

(a) Panel (contactor) Type 15012 (Ref. No. 10D/20471).

(b) Panel regulator (Ref. No. 310D/30001).

Post Mod. CA3186/8 Compressor air 4130-99-115-0686 replaces item in para. 4(9)(a) and item in para.4(9)(c) is not fitted. Mod. CA3089/4 to item in para. 4(10)(a) replaces the three 3·3A heating elements in overload relay RLD with three 1·5A elements.

5. Power supply (Ref.No.310D/30002) operates from a 208V, 3-phase, 50Hz mains supply. Its function, in conjunction with panel regulator (Ref. No.310D/30001), is to provide the magnetron electromagnet with a constant level of field current. Power supply (Ref.No.310D/30002) generates the synchronizing pulses from which the thyristor firing pulses are formed in panel regulator (Ref.No.310D/30001).

GATE UNITS

PANEL (contactor) Type 15012

6. The panel (contactor) Type 15012 provides the following services:–

(1) Distribution and switching of mains power to power supply (Ref. No. 310D/30002), air compressor, fan, panel regulator (Ref. No. 310D/30001) and magnetron heater transformer.

(2) Fuse protection for incoming mains and feeds to power supply (Ref. No. 310D/30002), panel regulator (Ref. No. 310D/30001) and magnetron heater transformer, with neon fuse failure indicators.

(3) Thermal overload protection for air compressor.

(4) Magnetron heater switching relay and pilot lamp.

(5) Liquid flow pilot lamp.

(6) Voltage and current metering for essential services.

(7) Thermal overload protection for magnetron field solid state power supply and fan.

Panel regulator (Ref. No. 310D/30001)

7. Panel regulator (Ref. No. 310D/30001) controls the conduction of the thyristor rectifiers in power supply (Ref. No. 310D/30002). In panel regulator (Ref. No. 310D/30001), a voltage representing the actual field current in the magnetron electromagnet is compared with a reference voltage (set on the ◀MAGNET▶ CURRENT control) representing the desired field current. The error, or difference, between these two voltages alters the phase of the thyristor firing pulses, generated within panel regulator (Ref. No. 310D/30001), until the output current from the thyristors is correct again.

Chapter 2

TECHNICAL DESCRIPTION

LIST OF CONTENTS

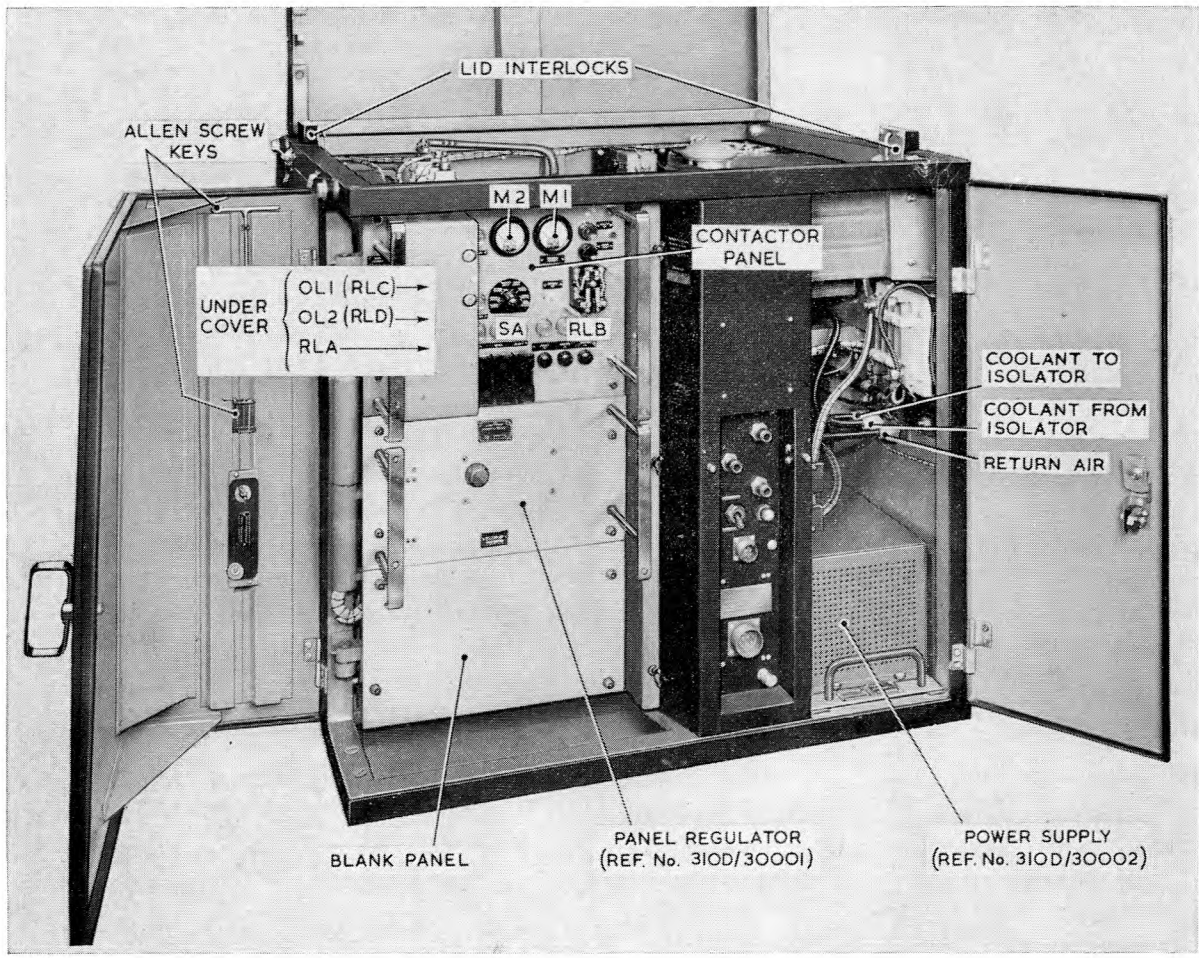
LIST OF ILLUSTRATIONS

Introduction

1. The circuits in transmitter Type 15003, together with the details of other changes necessitated by the replacement of the transmitter, are described in this chapter. The mode of operation of the equipment has not been altered and the British transmitter uses the same services and connectors as the American one. Front views of the transmitter showing component location and identification are given in fig. 1 and 2, a top view in fig. 3 and a functional diagram in fig. 4.

External connections

2. All electrical connections and supplies for the transmitter Type 15003, except for the high-voltage modulation pulse, are fed to two connectors on the front panel input assembly which is situated between the front doors and is recessed about three inches. The panel carries a 4-pole plug (J609), a 14-pole plug (J603), a safety switch labelled OPERATE and SERVICE, a neon indicator lamp and an earth terminal. Also mounted on the panel are three hose connectors marked COOLANT IN, COOLANT OUT and AIR. Mounted on the rear of the panel are two 12-way terminal strips for distribution of the supplies fed to J603 and J609. The high-voltage modulation pulse is fed via a special connector on the left-hand side of the transmitter. Two connectors for monitoring the magnetron current (J602 and J608) are mounted on the front of the metal casing covering the high-voltage connector. On the right-hand side of the transmitter there are three hose connectors, two are connected to reinforced rubber hoses which carry the coolant to and from the ferrite isolator, and the third is connected to the waveguide assembly by a reinforced rubber hose and carries the returned air from the magnetron air cooling system.



◄Fig. 1. Transmitter Type 15003—gate closed►

Primary power supply

3. The transmitter Type 15003 requires a primary power supply of 208V 50 c/s 3-phase with neutral, that is 120V line-to-neutral. The supply is derived from a step-down transformer which is fed with the standard British mains supply of 230V, 50 c/s, 3-phase. The mains are fed into the transmitter via the 4-pole plug J609. The lines are connected as follows:—

(1) Phase A to J609/A.
(2) Phase B to J609/B.
(3) Phase C to J609/C.
(4) Neutral to J609/D.

The mains supply is fed from J609 to TB1 on the rear of the input panel assembly and then to TB1 on panel (contactor) Type 15012.

Control circuits

4. The transmitter is controlled by circuits outside the transmitter. There are no switches on the units other than those required for setting-up and metering purposes. The transmitter is switched on by a contactor (RLA) which is mounted on the panel (contactor) Type 15012. This contactor is energized by a 120V, 50 c/s supply fed from the control group assembly when the XMITTER-RECEIVER switch is put to the ON position and the SERVICE/OPERATE switch is in the OPERATE position. A second control switches off the mains supply to the magnetron heater transformer when the e.h.t. pulses are fed to the magnetron. The detailed connections of the transmitter are shown on the wiring diagram (fig. 14).

Note . . .

The SERVICE/OPERATE *switch (S1) enables servicing to be carried out on the transmitter without the necessity of removing mains plug J609 or disconnecting the mains at a remote switchboard. At the* SERVICE *position RLA is isolated from the* XMITTER-RECEIVER *switch and the neon lamp ILP1 is not lit. If plug J609 should be removed, this obviates the possibility of its being reinserted whilst the* XMITTER-RECEIVER *switch is at the* ON *position and consequent damage from arcing.*

Units mounted on the gate

5. When the left-hand (L-shaped) door is opened, ◄two► units mounted vertically on the

gate can be seen. The gate is the framework carrying the units. It is hinged on the left and can be opened by unscrewing three captive wing-headed bolts on the right-hand side. Each unit is secured to the gate by four socket-headed screws; a screw key is fitted on the inside of the outer door. When the gate is opened the high-voltage interlock circuit is broken. Access to the rear of the units mounted on the gate is obtained by sliding the four spring clips securing each rear cover plate to one side. All connections to the units are made via terminal strips.

PANEL (CONTACTOR) TYPE 15012

6. The panel (contactor) Type 15012 is the top unit on the gate. The unit provides the following services:–

(1) Distribution and switching of the mains power supply to the following units and components:–

(a) Power supply (Ref. No. 310D/30002).

(b) Air compressor.

(c) Fan.

(d) Panel regulator (Ref. No. 310D/30001).

(e) Magnetron heater transformer.

(2) Fuse protection for the incoming mains (FS1, 2 and 3, 30A) and for the feeds to the following units and components:–

(a) Panel regulator (Ref. No. 310D/30001) (FS6, 150mA).

(b) Magnetron heater transformer (FS5, 5A).

◄Fuse FS5 is an anti-surge type. All fuse circuits mentioned have neon fuse failure indications.►

(3) Thermal overload protection for the power supply (Ref. No. 310D/30002) (RLC) and the air compressor (RLD). RLC also provides overload protection for the fan.

(4) Magnetron heater switching relay (RLB) and MAG. HTR. ON indicator lamp (ILP7, red).

(5) Electromagnet coolant LIQUID FLOW pilot lamp (ILP8, ◄WATER CLEAR).►

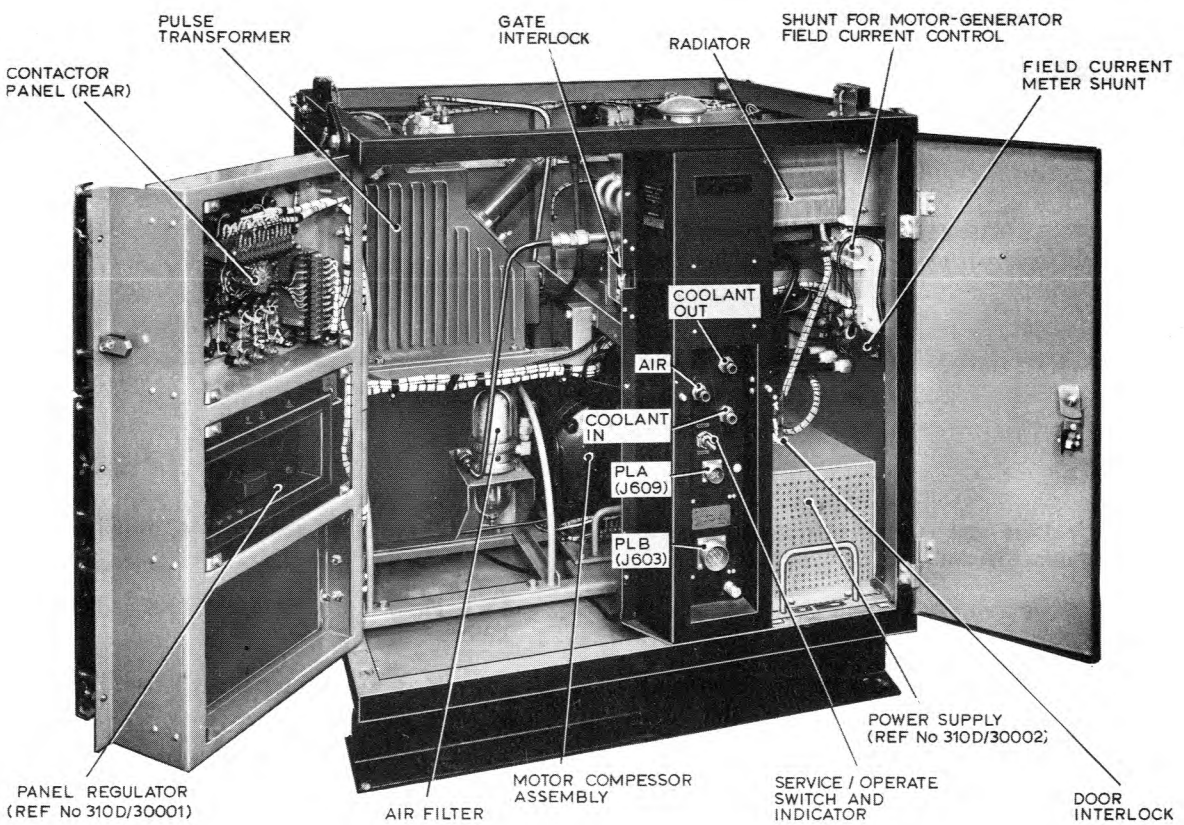


Fig.2. Transmitter Type 15003–gate open

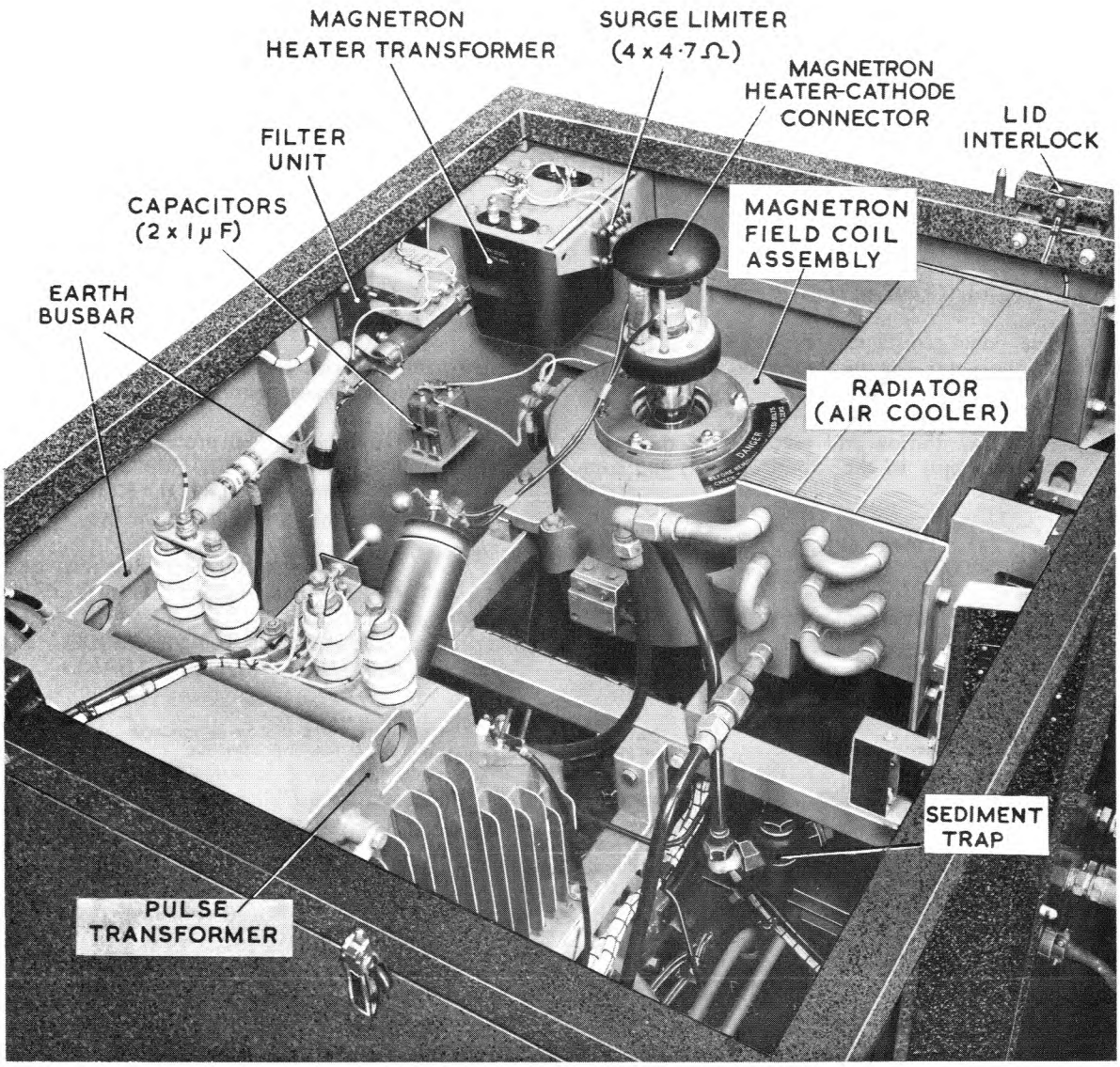


Fig.3. Transmitter Type 15003–top view

(6) Voltage and current metering for essential services (SA and M2).

(7) Magnetron field current meter (M1).

7. Connection to the other units on the transmitter is made via four 12-way terminal strips all of which are mounted on the rear of the unit. The rear view of the component layout of the unit is given in fig. 5 and the circuit diagram in fig. 15.

Power switching circuits

8. The 208V, 50 c/s, 3-phase mains supply is connected to TB1 as follows:–

(1) Phase A to terminals 4, 5 and 6 (commoned).

(2) Phase B to terminals 7, 8 and 9 (commoned).

(3) Phase C to terminals 10, 11 and 12 (commoned).

(4) Neutral to terminals 1, 2 and 3 (commoned).

The three-phase lines are fused at 30A, each of the fuses being shunted by a neon lamp, in series with a 220-kilohm resistor, to provide indication

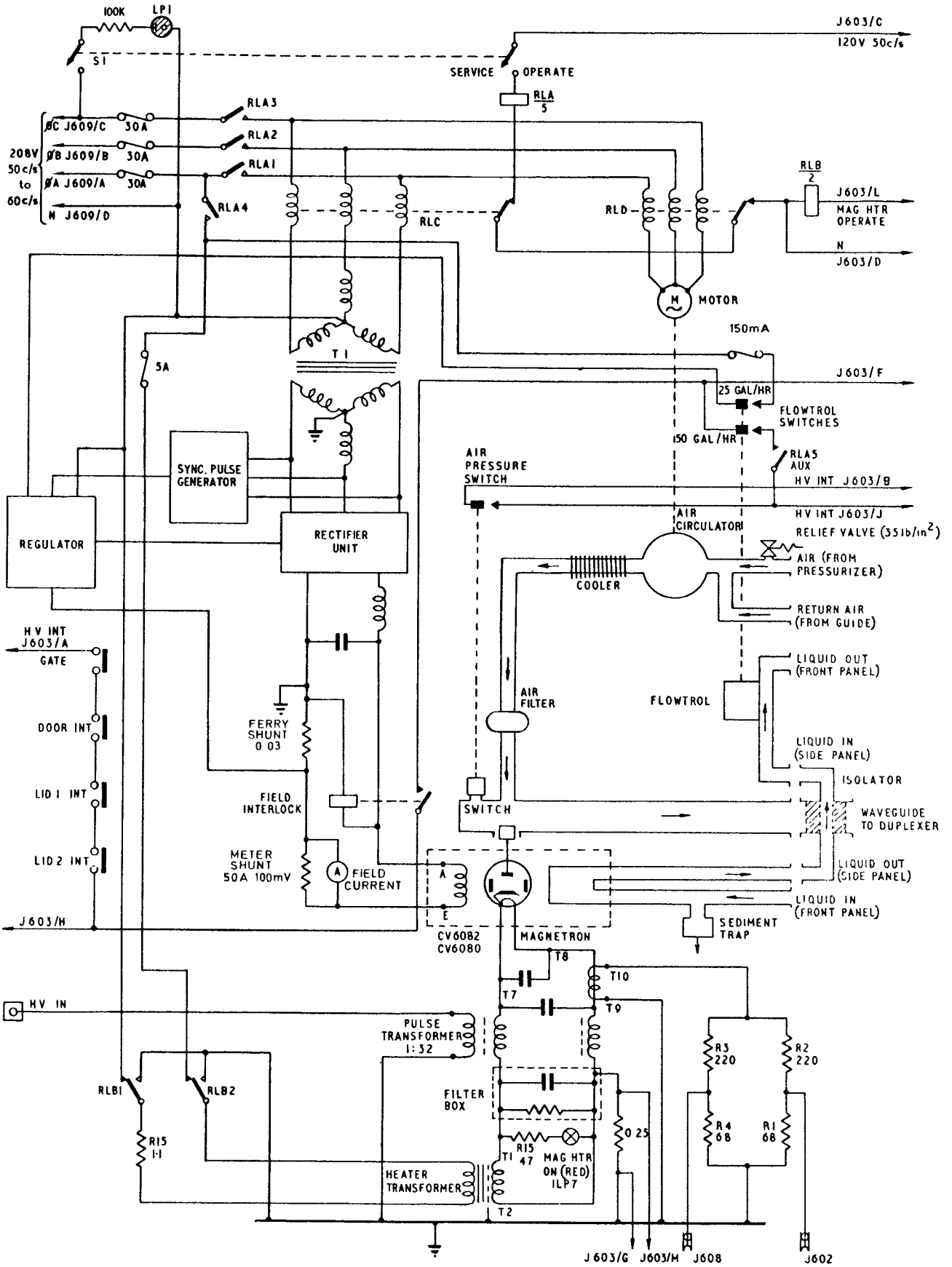


Fig.4. Transmitter Type 15003 - functional diagram

of fuse failure. A connection is taken from each of the three-phase lines to positions 1, 2 and 3 of switch section SA3 for metering purposes. The mains supply lines are then connected to contacts 2, 3, 4 and 5, of contactor RLA.

9. Contactor RLA is energized by a control voltage of 120V, 50c/s fed to the 12-pole plug J603 mounted on the recessed panel between the doors of the transmitter. The control voltage is fed to poles C and D of J603 when the TRANSMITTER-RECEIVER switch on the power distribution panel SB-225/FPS-6 is set to the ON position. When the SERVICE/OPERATE switch (S1) on the recessed panel is at OPERATE the control voltage is connected to terminals 1 and 2 on TB2 via the terminal strip TB2 on the rear of the input panel. The coil of contactor RLA is connected in series with contacts RLD1 and RLC1; RLD and RLC are the overload protection relays for the motor compressor and power supply (Ref. No. 310D/30002), respectively. RLD1 and RLC1 are each shunted by a neon lamp and a 220-kilohm resistor in series; RLD1 by ILP10 marked CIRC TRIP and RLC1 by ILP9 marked FIELD TRIP. Thus if either of the overload protection relays is energized, the mains supply is removed from the whole of the transmitter because RLA will not be energized.

10. The five contacts of RLA are used as follows:–

(1) RLA1 is connected between terminals 3 and 4 on TB2. It is part of the high voltage interlock system and is connected in series with the rest of the transmitter interlocks (para.30).

(2) RLA2 connects phase A of the incoming mains to three circuits as follows:–

(a) To the panel regulator (Ref. No. 310D/30001) via TB2/9. This supply is fused at 150mA by FS6 which is connected in parallel with R6 and ILP6 (FIELD REG). The neutral is connected via TB2/10.

(b) The magnetron heater transformer via TB2/7. This supply is fused at 5A by FS5 which is connected in parallel with R5 and ILP5 (MAG. HTR.). The line is connected to TB2/7 via contact RLB1 and the neutral to TB2/8 via contact RLB2. RLB coil, which is connected between TB3/12 and the neutral, is energized when the magnetron e.h.t. supply is switched on.

(3) RLA3, RLA4 and RLA5 connect phases C, B and A, respectively, to the motor compressor, power supply (Ref.No.310D/30002) and fan via the overload contactors RLC and RLD which have three coils (one per phase) each. All connections to the components mentioned above are made via TB4.

INDICATING CIRCUITS

11. There are two indicating lamps mounted on the contactor panel; one is a red lamp marked MAG. HTR. ON (ILP7) and the other a ◄water clear► lamp marked LIQUID FLOW (ILP8). Neon fuse failure indicators are also fitted on the panel (para.6 to 8). The MAG. HTR. ON lamp is fed with 20V a.c. from the secondary of the magnetron heater transformer and is connected in series with a voltage-dropping resistor R15. The 20V a.c. supply is also fed to the meter switch (SA). When the e.h.t. supply for the magnetron is switched on, RLB is energized and ILP7 will go out because the 120V a.c. supply is disconnected from the transformer primary.

12. The ◄water clear► LIQUID FLOW lamp (ILP8) is fed with 120V from panel regulator (Ref. No. 310D/30001). The phase line feeding the panel regulator (Ref. No. 310D/30001) is connected via the Flowtrol and thus the magnetron field coil coolant must be flowing before the mains supply is connected to the panel regulator (Ref. No. 310D/30001). The 120V a.c. supply for ILP8 will be available only when the mains is connected and thus the lamp gives indication that the coolant is flowing.

METERING CIRCUIT

13. The metering circuit consists of a meter M2, a 4-section switch SA and an instrument rectifier MR1. SA is a 12-position switch, only eight of which are used. The positions are marked as follows:–

(1) ϕA 120V (250V F.S.).

(2) ϕB 120V (250V F.S.).

(3) ϕC 120V (250V F.S.).

(4) MAG. HTR. (50V F.S.).

(5) ◄spare►

(6) ◄+22V (50V F.S.)►

(7) ◄−18V (50V F.S.).►

(8) MAG. CURRENT (500mA F.S.).

14. The a.c. voltages to be metered are fed to switch sections SA3 and SA4, whose contact arms are connected to the input terminals of MR1. The three phases of the incoming mains are fed to SA3/1, 2 and 3 via multipliers R10, R11 and R12, respectively. The neutral line is connected to SA4/1, 2 and 3 so the meter indicates 120V line-to-neutral (208V line-to-line). The 20V a.c. magnetron heater voltage is fed to SA3/4 and SA4/4 via multiplier R14. The ◄three► d.c. voltages metered are fed to switch sections SA1 and SA2 whose contact arms are connected to the meter.◄The +22V supply is fed via R8 (position 6) and the −18V via R9 (position 7).► The magnetron current is

fed via R13 to position 8. The current meter is connected across an 0.25-ohm shunt (4 X 1-ohm in parallel) between terminals 2 and 3 on the pulse transformer. This supply is also connected to J603/M and G for remote indication of magnetron current on meter M6101 on the control, radar set C-992/FPS-6 on the control group assembly and M2102 on the modulator control unit CN-187/FPS-6.

15. Meter M1, the FIELD CURRENT meter, indicates the magnetron field current. It is connected across a ◄100mV► shunt mounted on the right-hand side panel of the transmitter. The meter is calibrated to indicate 50A full scale.

POWER SUPPLY (Ref. No. 310D/30002)

16. Power supply (Ref. No. 310D/30002) is located on the floor of transmitter Type 15003. Its function, in conjunction with panel regulator (Ref. No. 310D/30001), is to provide the magnetron electromagnet with a constant supply of field current. The circuit diagram for power supply (Ref. No. 310D/30002) is shown in fig. 16, with component locations shown in fig. 6.

17. Basically, power supply (Ref. No. 310D/30002) is a three-phase transformer/rectifier network feeding on to a common output line. Halfwave rectification of each phase is achieved by thyristors, SCR1, SCR2 and SCR3, connected across the secondary windings of transformer T1. Smoothing of the combined output is provided by L1, C1.

18. The thyristor is the solid state equivalent of the gas thyratron. It conducts only if the anode is positive with respect to the cathode and a firing pulse is applied to the gate electrode. Once the thyristor starts to conduct, the gate electrode loses control and conduction continues until the anode becomes negative with respect to the cathode. With an a.c. signal, the thyristor conducts on the positive half-cycles and only after a firing pulse has been applied to the gate anode. By varying the instant when the firing pulse is applied to the gate electrode, the thyristor can be made to conduct for a greater or lesser portion of the positive half-cycle. It is in this way that the current flowing through the magnetron electromagnet is controlled.

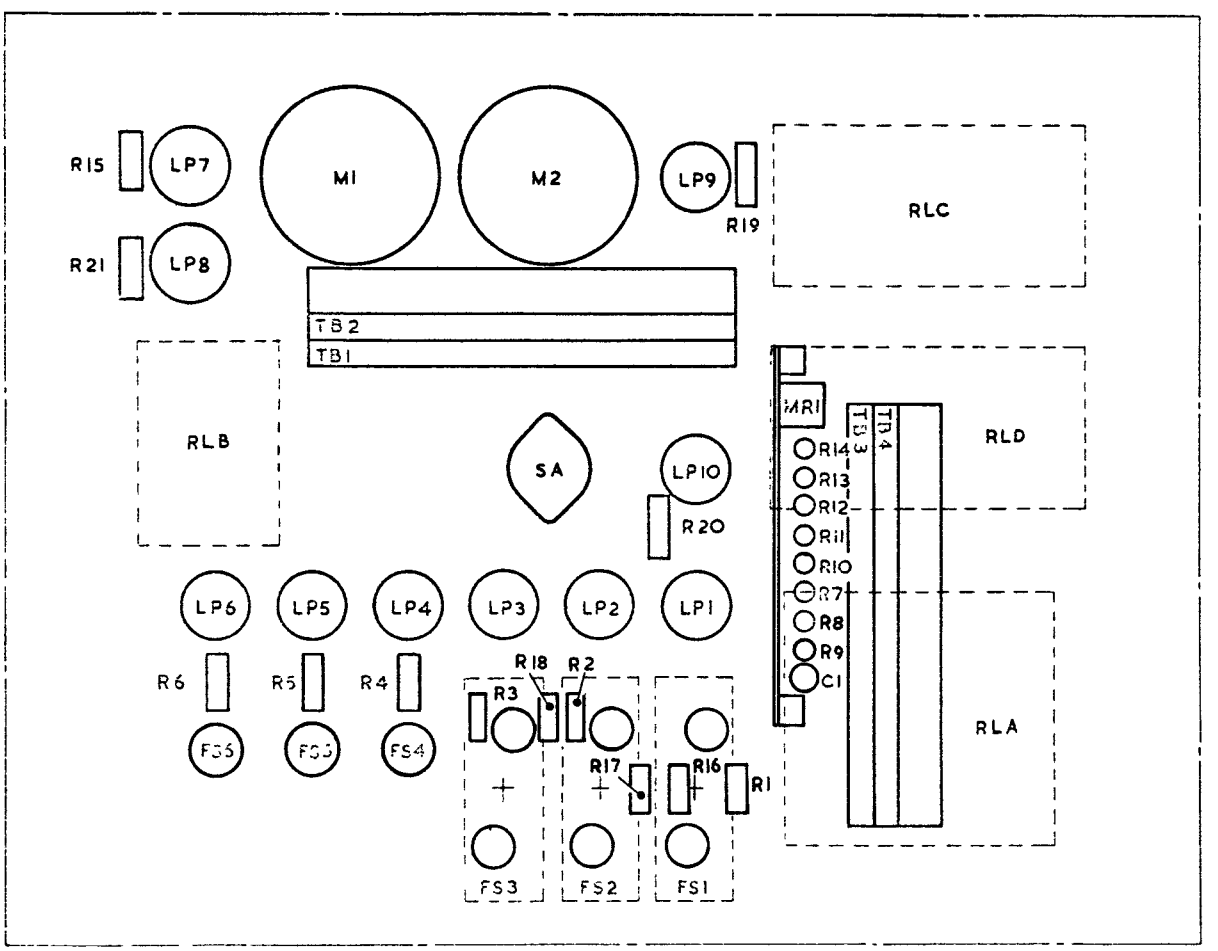
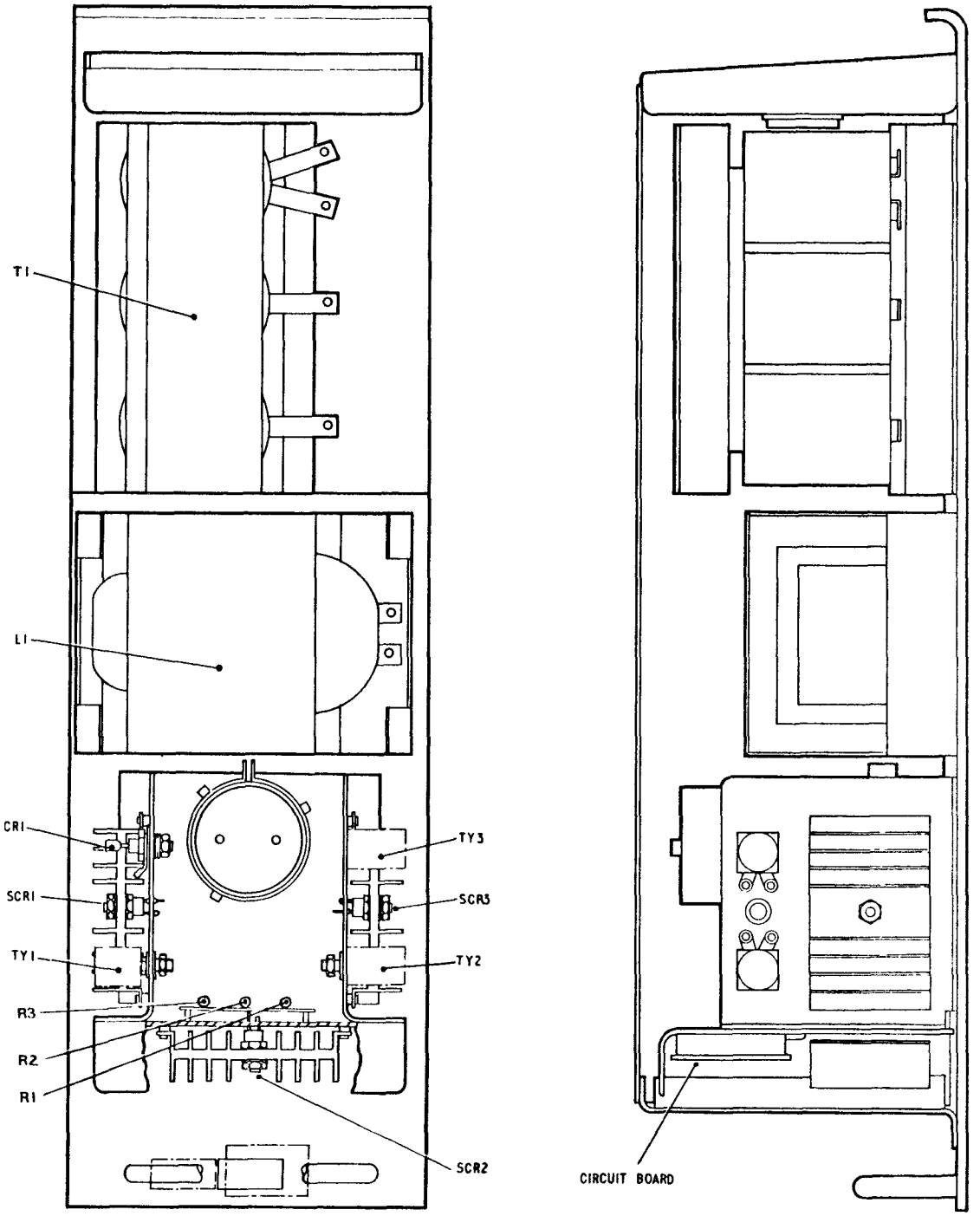


Fig. 5. Panel (contactor) Type 15012 – component location (rear)



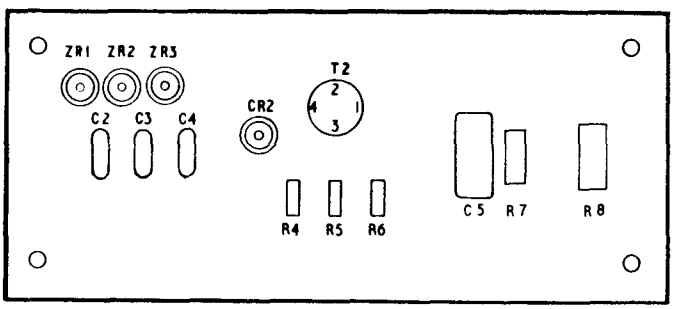


Fig.6. Power supply (ref. No. 310D/30002) – component location

19. The firing pulses for SCR1, SCR2 and SCR3 originate in panel regulator (Ref. No. 310D/30001) which monitors the field current in the magnetron electromagnet. If the field current drifts away from the correct setting, the phasing of the firing pulses is altered (in relation to the phase of the mains supply) until the field current is correct again. Protection for the thyristors against transients is provided by thyrectors (bidirectional selenium avalanche rectifiers) TY1, TY2 and TY3. Protection against sudden reverse voltages is provided by C5 and R7.

20. Zener diodes, ZR1, ZR2 and ZR3, connected across the secondary windings of T1, clip the negative half-cycles at −10V (see fig. 7B, waveform 2). The outputs of the Zener diodes are differentiated by C2, C3 and C4 and fed, via a common output line, to Q8 on panel regulator (Ref. No. 310D/30001).

Note . . .

R24 in panel regulator (Ref. No. 310D/30001) provides the discharge path for differentiating capacitors C2, C3 and C4.

21. The firing pulses from panel regulator (Ref. No. 310D/30001) are fed to the thyristors via transformer T2. The firing pulses are fed to all three thyristors simultaneously but, at any given instance, only one thyristor will have the correct bias conditions for conduction. Circuit protection is provided by CR2, which prevents negative overswing. R4, R5 and R6 limit peak pulse currents at the thyristor gates.

PANEL REGULATOR (Ref. No. 310D/30001)

22. Panel regulator (Ref. No. 310D/30001) is located in the middle position of the gate. It operates in conjunction with power supply (Ref. No. 310D/30002) and its function is to control the conduction of thyristors SCR1, SCR2 and SCR3 in power supply (Ref. No. 310D/30002) so that the correct amount of field current is supplied to the magnetron electromagnet. This is achieved by adjusting the phase of the thyristor firing pulses in relation to the phase of the three-phase mains supply. The circuit diagram for panel regulator (Ref. No. 310D/30001) is given in fig. 17 and typical waveforms, showing the operation of the current control system, are given in fig. 7B.

23. Panel regulator (Ref. No. 30D/30001) comprises a difference amplifier (Q1-Q4), a sync. pulse forming circuit (Q7 and Q8) and a relaxation oscillator (Q5 and Q6). The circuits are powered from a transformer/rectifier/smoothing circuit integral with the unit.

Difference amplifier (Q1–Q4)

24. The input voltage to the difference amplifier is developed across the resistor in series with the magnetron electromagnet (see fig. 16). The voltage represents the magnitude of the field current

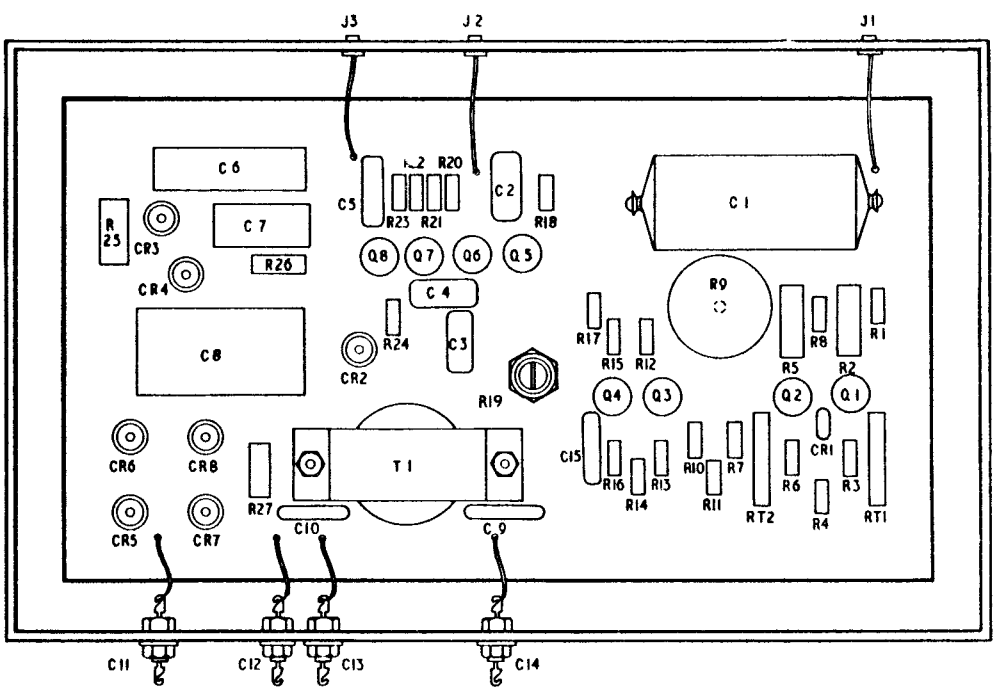


Fig.7A. Panel regulator (Ref. No. 310D/30001) –component location

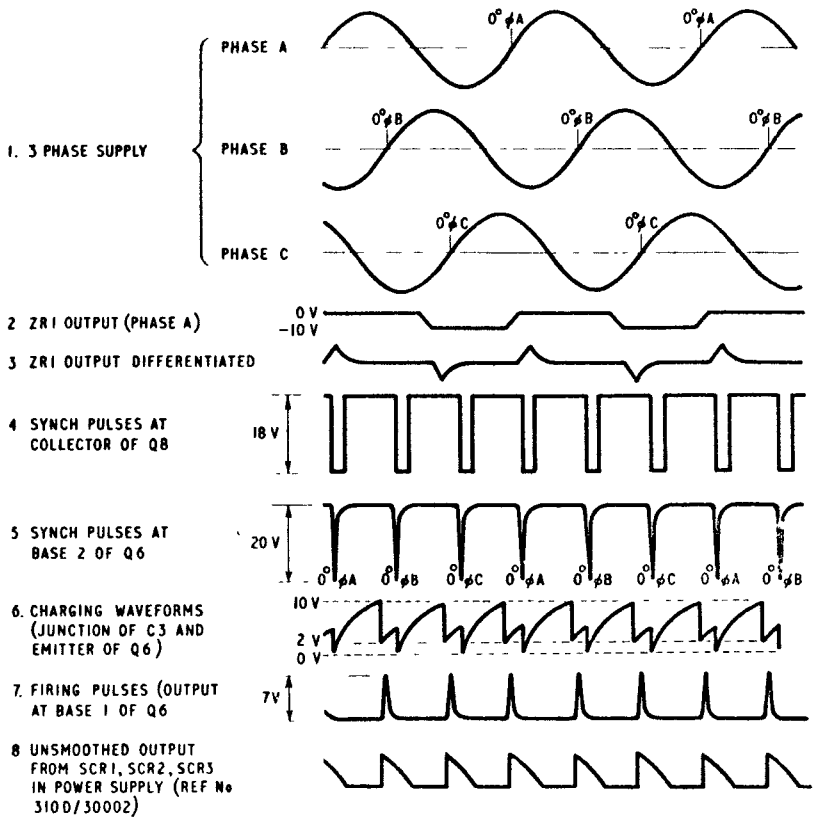


Fig.7B. Panel regulator (Ref. No. 310D/30001) – typical waveforms

in the magnetron electromagnet and is compared, in the difference amplifier, with a reference voltage derived from the◄MAGNET►CURRENT potentiometer. The resultant signal is amplified in Q3 and Q4, then applied to the base of Q5.

Sync. pulse forming circuit (Q7 and Q8)

25. The sync. pulses are derived from the three-phase mains supply. In power supply (Ref. No. 310D/30002), the negative half-cycles of each phase are clipped at −10V (fig. 7B, waveform 2) and differentiated (fig. 7B, waveform 3), before being combined and fed to the base of Q8 in panel regulator (Ref. No. 310D/30001).

26. The positive 'spikes' of the combined input at the base of Q8 trigger Q8 and produce a train of pulses (fig. 7B, waveform 4) at the collector of Q8. The pulses are shaped by C5, R23 and C4, R20 and the result is a train of negative 'spikes' at base 2 of Q6 (fig. 7B, waveform 5) which coincide with the 0° portion of each phase of the mains supply. Q7 acts as an emitter-follower.

Relaxation oscillator (Q5 and Q6)

27. Unijunction transistor Q6 and charging circuit Q5, C3, R18 and R19 together form a relaxation oscillator. With no sync. pulse applied, the bias voltage at base 2 of Q6 is 10V, approximately. C3 is charged up via Q5, R18 and R19 and, when the voltage at Q6 emitter reaches 10V, Q6 becomes forward-biased. C3 discharges via base 1 of Q6. When Q6 emitter voltage drops to 2V approximately. Q6 reverts to the reverse-biased condition. C3 begins to charge up again, and the cycle is repeated.

28. Every time capacitor C3 discharges, a firing pulse is produced. The charging rate (and hence the natural frequency of the relaxation oscillator) is set up initially on R19. The charging rate is also affected by the output from the difference amplifier. As this varies, Q5 conducts to a greater or lesser degree.

29. When a sync. pulse is applied, Q6 is immediately forward-biased and C3 discharges completely. This, in conjunction with the normal operation of the relaxation oscillator, produces a charging action as shown in fig. 7B, waveform 6. The effect of the sync. pulse is to reset the charging circuit at the beginning of each positive half-cycle of the mains supply. The charging rate of C3 is determined by the output from the difference amplifier. If the magnetron electromagnet current is too low, the output from the difference amplifier causes the charging rate of C3 to increase. The firing pulse is produced earlier, the thyristor conducts earlier in the positive half-cycle and the current supplied to the magnetron electromagnet increases accordingly.

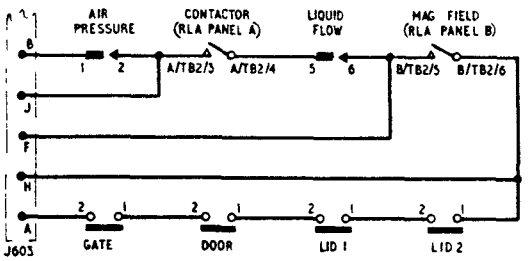


Fig. 8. Transmitter interlocks - simplified circuit

NOTE: The discharge of C3 (after the application of a sync. pulse) causes a firing pulse to be applied to a thyristor, but as the thyristor is already conducting, the pulse has no effect.

INTERLOCK CIRCUIT

30. An interlock circuit is fitted which prevents the e.h.t. supply being switched on when any one of the interlocks is open. There are 8 interlocks fitted as follows:–

(1) One interlock on each side of the lid (referred to as lid 1 and lid 2).

(2) One interlock on the gate.

(3) One interlock on the right-hand door.

(4) The air pressure switch.

(5) The Flowtrol.

(6) A contact (RLA1) of the power supply contactor on the contactor panel.

(7) A contact (RLA2) of the relay on the regulator panel energized by the magnetron field generator output.

The lid, gate and door interlocks consist of a robust metal tongue fixed to the lid etc., which bridges two spring contacts fitted to the transmitter framework; the contacts are made when the lid etc. are closed. A simplified circuit of the interlocks is given in fig.8, and their interconnections can be seen on the wiring diagram (Fig.14).

31. Connections are made to various points on the interlock circuit so that the circuit can be checked by the INTERLOCK TEST switch. This switch is mounted on a panel situated above the control radar set C-1003/FPS-6 and checks the interlocks on the whole of the equipment. The INTERLOCK TEST switch has twelve positions and works in conjunction with a lamp mounted immediately above it. The lamp lights on each position (except OFF) when the circuit is complete. The positions are marked as follows:–

(1) OFF.

(2) MOD.

(3) XMTR BLOWER.

(4) KEEP ALIVE.

(5) CONT PANEL.

(6) L.O. PANEL.

(7) PWR and W.G. PANEL.

(8) R.F. SWITCH.

(9) W.G. PRESS.

(10) LIQ'D. FLOW.

(11) MAG FIELD.

(12) LID and GATE.

The last four positions are used on the transmitter, the connections being brought out of the transmitter of J603.

AIR CIRCULATING SYSTEM

32. The air circulating system on the transmitter consists of an air compressor (circulator), a radiator-type air cooler and an air filter. Pressurized air is fed into the transmitter from the pressurizer and dehydrator unit (dehydrator, desiccant, electric HD-187/FPS-6) at a pressure of 30 lb/in^2 via the hose connector marked AIR on the front input panel. From there it is fed to the circulator, together with the air returned from the waveguide. Thus the unit acts more as a circulator than a pump.

33. The circulator is a sealed unit. The motor is fed with a three-phase supply from the contactor panel and is switched on when contactor RLA is energized. The supply is connected via a three-coil overload protection relay (RLD on the contactor panel) which must be reset manually should it be tripped (CIRC RESET button).

34. The air is fed through the air filter which absorbs any traces of moisture in the air. The absorbent filter in the upper chamber is normally blue but it turns pink if any moisture is present.

NOTE: Post mod CA3186 Compressor air, 4130-99-115-0686 replaces compressor, air 4130-99-115-8091. The new compressor is an improved type having a fully-sealed pressurized crankcase and motor.

35. Just before the air reaches the launching section of the waveguide it operates an air pressure switch consisting of a microswitch which is set to break when the air pressure falls below 27-29 lb/in^2. The switch forms part of the h.v. interlock system and thus prevents the e.h.t. being applied to the magnetron without the correct air pressure.

36. The air enters the waveguide at a point in the launching section directly below the magnetron probe. After cooling the glass window of the magnetron, the air is returned to the circulator

via a flexible hose from a convenient point in the waveguide system, i.e. just before the duplexer. An air pressure gauge, calibrated 0–70 lb/in^2 is fitted on the waveguide section at this point and should indicate a pressure throughout the waveguide system of approximately 30 lb/in^2 for normal working.

COOLANT SYSTEM

37. The coolant for the magnetron field electromagnet coil is fed into the transmitter via the COOLANT IN hose connector on the front input panel assembly. The coolant is fed from the heat exchanger (cooler, liquid, electron tube HD-188). After passing through a sediment trap, it circulates through tubes in the electromagnet assembly (para.38) to an outlet on the right side of the transmitter. From here the coolant is taken to the ferrite isolator via a flexible pipe and returned in a similar manner to an inlet on the same side of the transmitter. In passing from there to the outlet at the front panel, the rate of flow of the coolant, which is determined by the cooler, is monitored by the Flowtrol. The Flowtrol contains a switch operated by a pressure differential across an orifice placed in the coolant flow circuit. The pressure differential moves, a pair of sensitive metal bellows which actuate a microswitch. The Flowtrol has two sets of contacts, one of which trips the e.h.t. should the rate of flow drop below approximately 50 gal/hr. The other contact cuts the mains supply to the regulator panel (and hence the supply to the electromagnet) should the

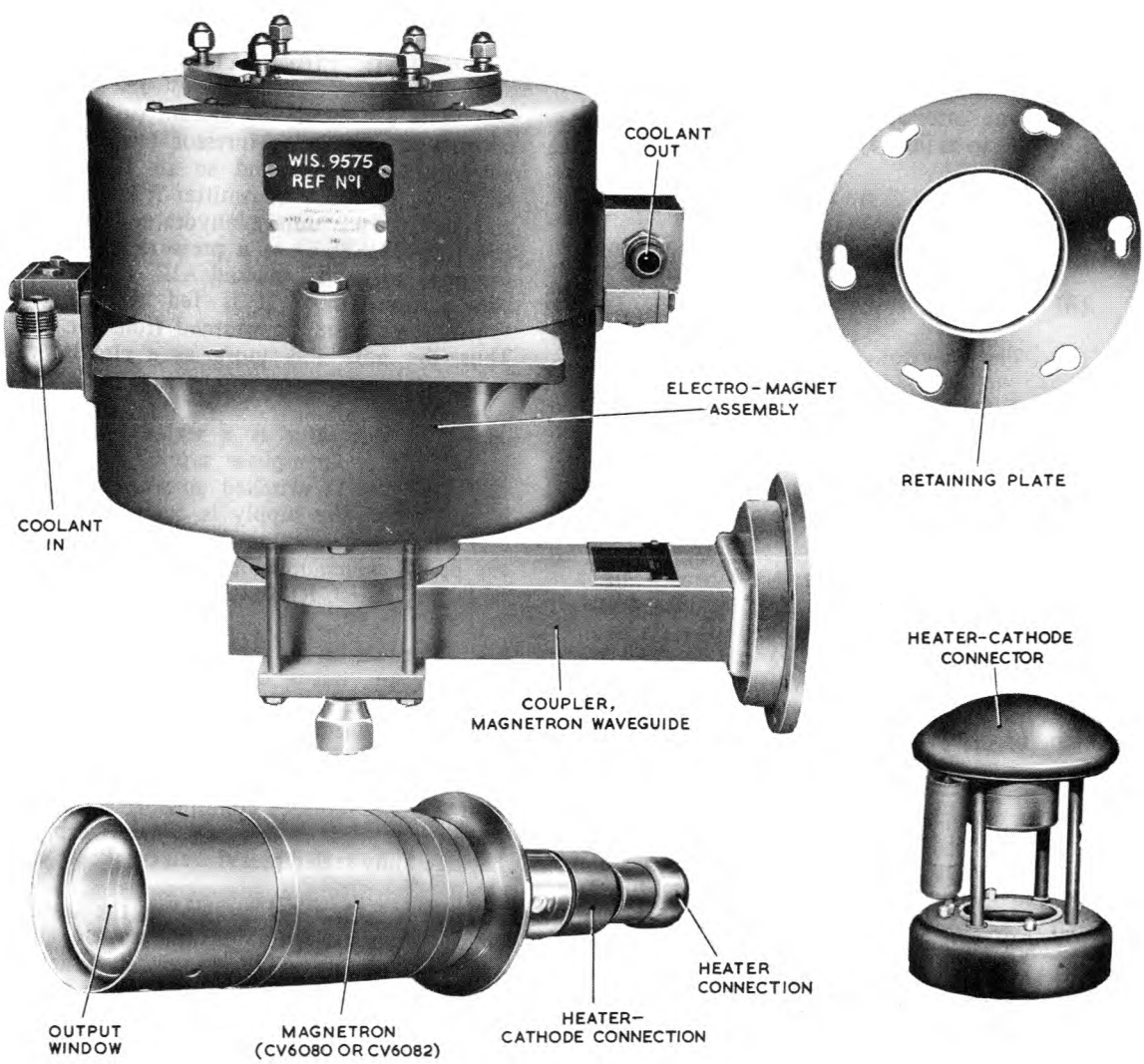


Fig.9. Magnetron and electromagnet assembly - components

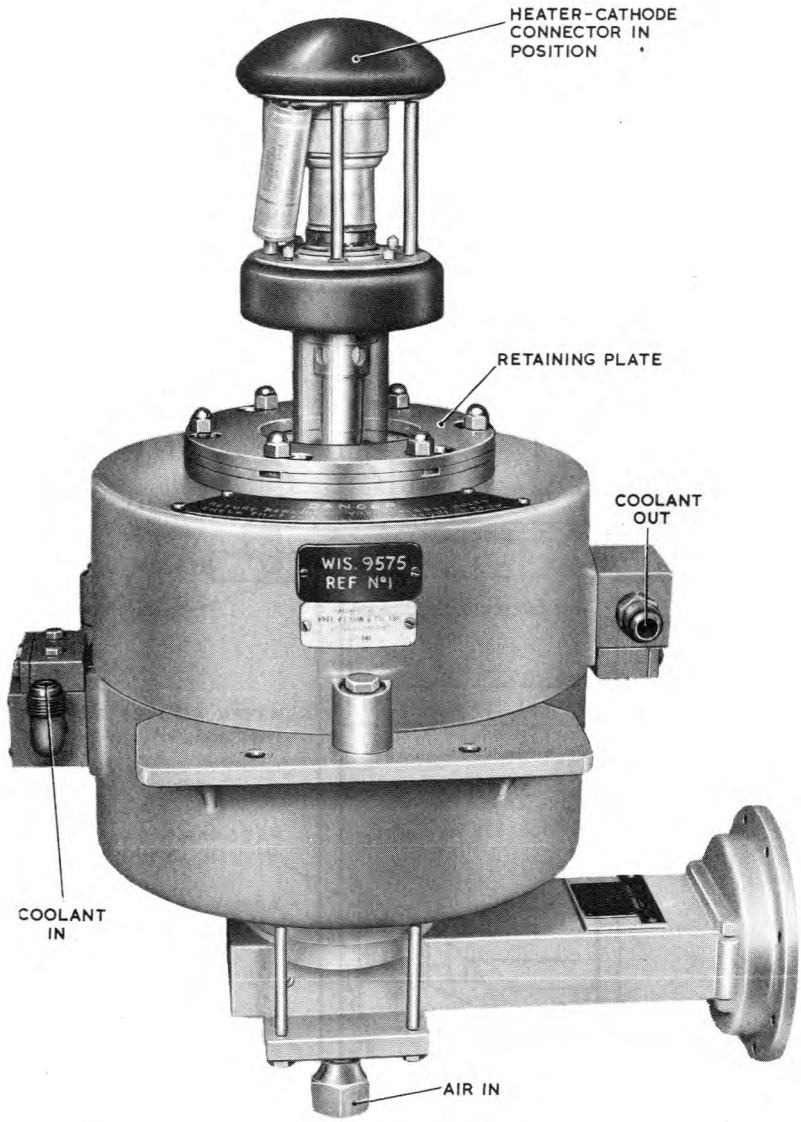


Fig. 10. Magnetron and electromagnet - assembled

rate of flow fall to approximately 25 gal/hour. The coolant is returned to the cooler via the COOLANT OUT hose coupling on the front input panel assembly.

▶◀

E.H.T. CIRCUITS (Fig.14)

38. The high-voltage modulation pulses from the modulator are fed into the transmitter via a special connector on the left-hand side of the transmitter. From there the pulses are fed to terminals T5 and T6 (commoned) on the pulse transformer (Fig.3). The pulse transformer has 1:3.2 step-up turns ratio and the windings are insulated from each other. The secondary winding feeds the magnetron via terminals T7 and T8, T7 being the heater-cathode connection. Four high-stability 1-ohm resistors are connected in parallel between terminals T2 and T3 (earth) and form the shunt for the magnetron current meters on the contactor panel of the transmitter (SA position 8), the modulator and the remote control assembly. A spark gap is connected between terminal T8 (pulse output) and terminal T3 (earth) and is normally set to a gap of 1 in.

39. The magnetron heater transformer is

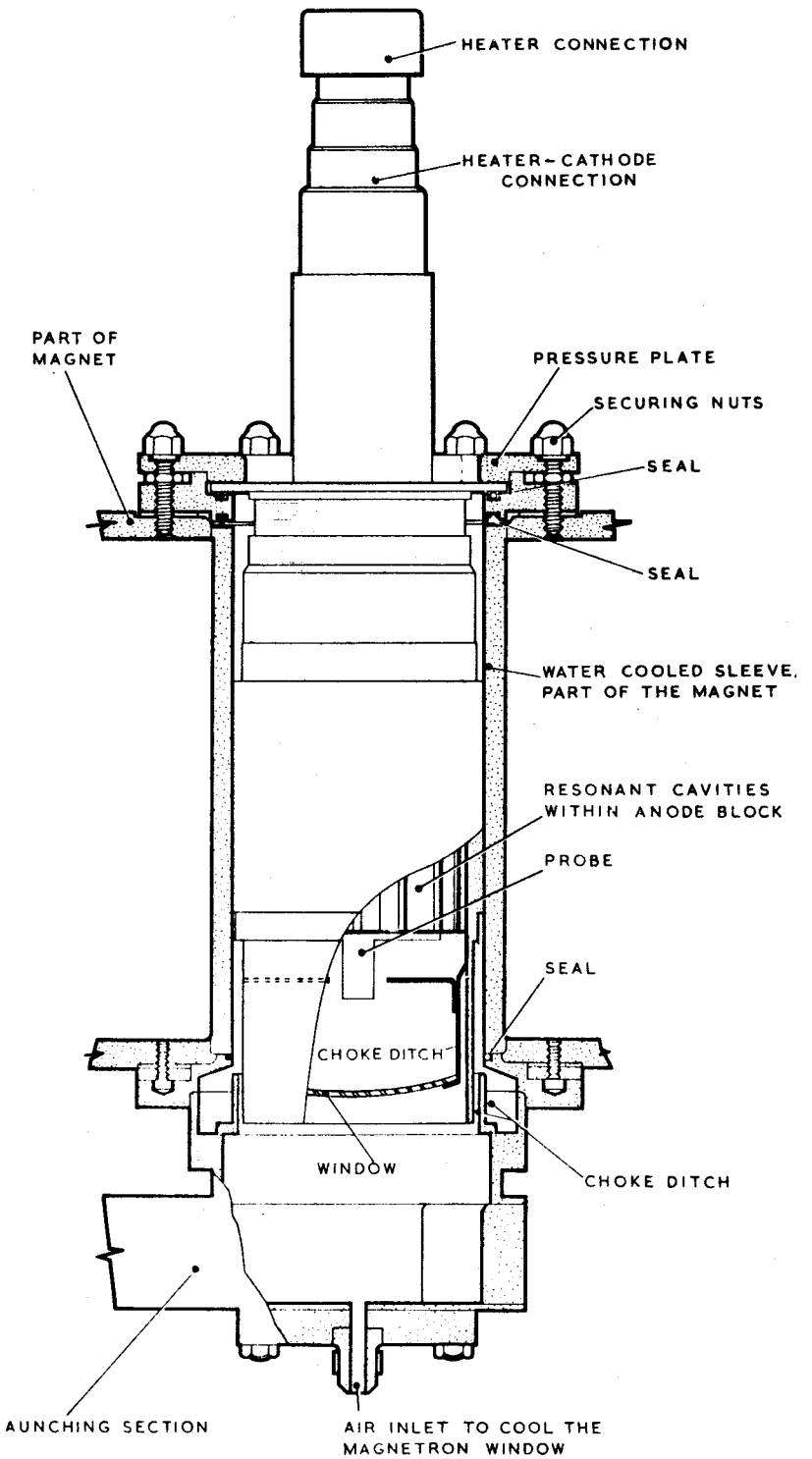


Fig. 11. Magnetron assembly - sectional view

situated in the top right-hand rear corner of the transmitter (fig. 3). The primary is fed with 120V, 50 c/s on terminals 3 (phase A) and 2 (neutral). The secondary provides 20V for the magnetron heater on terminals 34 and 37. This supply is connected to terminals T1 and T2 on the pulse transformer. It is also fed to TB3/2 and 3 on the contactor panel, where it is used to light the MAG. HTR. ON lamp and for metering purposes. A filter circuit consisting of a 2μF capacitor and 33-ohm resistor in parallel (fig. 3) is connected across the secondary winding. The filter prevents pulses being fed back from the pulse transformer secondary to the heater transformer.

◄40.► The magnetron valve and the electromagnet assembly (fig. 3, 9, 10 and 11) are mounted on the right-hand side of the transmitter, at the rear. The magnetron is connected to the pulse transformer by two cores of univin 19 terminating in a special domed connector which has two phosphor-bronze spring rings which fit over corresponding rings on the neck of the magnetron. The upper ring is the heater connection and the lower ring the heater-cathode connection.

◄41.► The magnetron used is a CV6080 or 6082 (fig. 11). These magnetrons can deliver a peak pulse of 2·5MW and are designed for launching an E_{01} wave directly into the waveguide. The magnetron is mounted vertically inside the electromagnet assembly, and the launching section which the magnetron feeds is mounted across the lower face of the electromagnet assembly. The depth of penetration of the magnetron output window into the waveguide is fixed by the construction of the electromagnet and the launching section. The skirt of the magnetron has a slightly reduced diameter towards its lower end. The gap between this and the inner face of the magnet acts as a half-wave choke ditch, which, in combination with that formed between the magnetron skirt and the launcher section, constitutes a short-circuited termination for the magnetron without the technical difficulty of obtaining perfect physical contact. The magnetron window is made of glass and is cooled by a flow of air which enters the launching section through a $\frac{1}{4}$ in. diameter hole opposite the window. The air throughout the waveguide system is maintained at 30 lb/in^2 to reduce the possibility of electrical breakdown.

◄42. The electromagnet is cooled by water flowing through a jacket, which also cools the magnetron by conduction. The jacket consists of an inner sleeve, into which the magnetron fits, and an outer sleeve on which the electromagnet is mounted. Soldered to the outside of the jacket are cooling fins and in the space between these fins

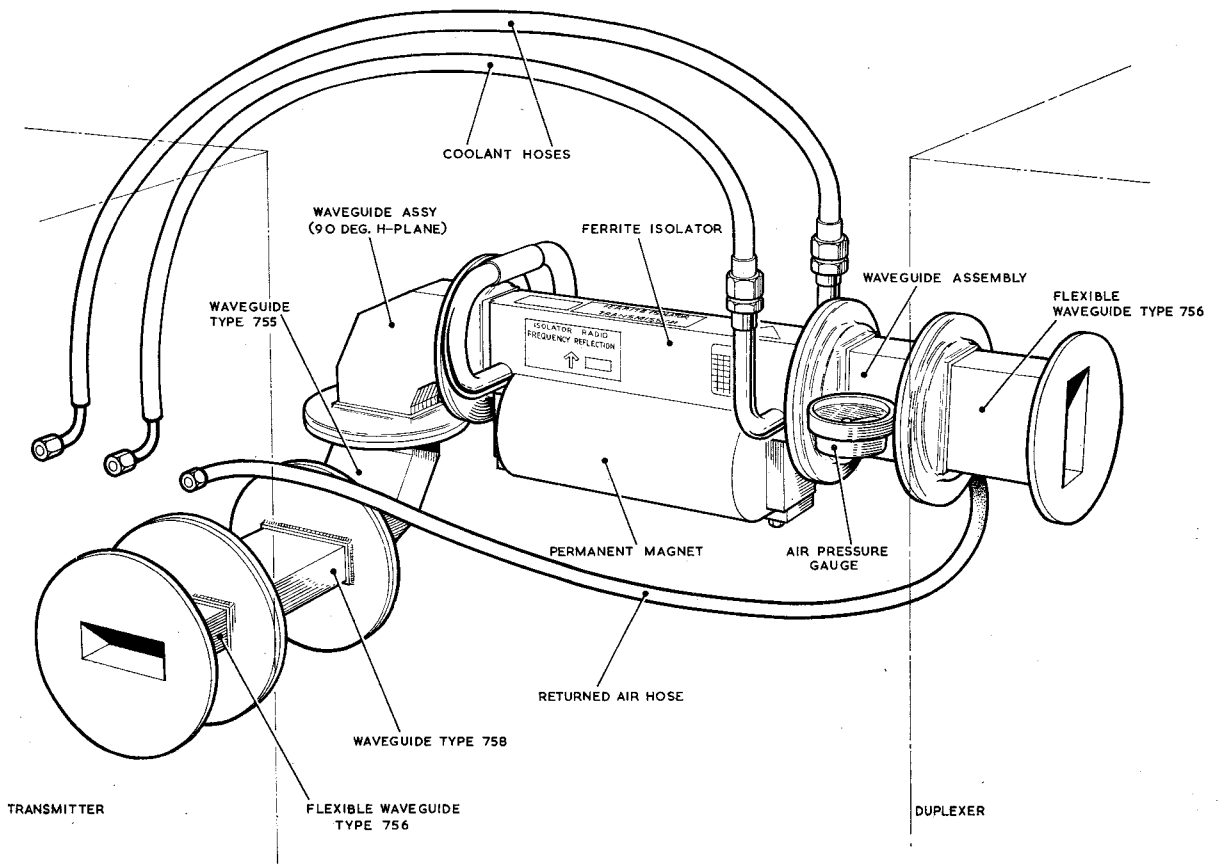


Fig. 12. Waveguide components

the electromagnet windings are wound using copper strip 0·44 in. wide × 0·025 in. thick. The whole assembly is then mounted inside a cast-iron outer case. The electromagnet current is fed from power supply (Ref. No. 310D/30002) situated in the bottom right-hand corner of the transmitter cabinet (fig. 2). The power supply (Ref. No. 310D/30002) is fed from the 208V, 50 c/s. 3-phase supply via the overload contactor RLC on panel (contactor) Type 15012. The power supply (Ref. No. 310D/30002) provides approximately 26-27A for the electromagnet, the amount of current being determined by panel regulator (Ref. No. 310D/30001).►

Waveguide system (fig. 12)

◄**43.**► The waveguide system is pre-plumbed. It has seven sections, one of which is a ferrite isolator. The magnetron launches an E_{01} wave directly into the launching section which is connected to the waveguide system via the flexible section shown. On the section preceding the flexible connection to the duplexer is fitted an air pressure gauge, and a hose coupling through which air is fed to the circulator in the transmitter. The waveguide sections are as follows:—

(1) Waveguide, flexible, Type 756 (Ref. No. 10B/17978)—2 off.

(2) Waveguide section, Type 758 (Ref. No. 10B/17986)—1 off.

(3) Waveguide, corner, E-plane, Type 755 (Ref. No. 10B/17970)—1 off.

(4) Waveguide assembly, 90 deg. H-plane (Cat. No. 5840-99-970-1834)—1 off.

(5) Ferrite isolator (Cat. No. 5840-99-944-9122)—1 off.

(6) Waveguide assembly (Cat. No. 5840-99-970-1832)—1 off.

◄**44.**► The ferrite isolator consists basically of a section of waveguide with strips of ferrite material laid along the length of the waveguide to one side of the E-plane centre-line and with an external permanent magnet mounted so that the static field is parallel to the narrow face of the waveguide. Its function is to minimize the effect of mismatches between the r.f. assembly and the transmitter by the absorption of reverse energy. The isolator has a forward loss of about 0·5dB which means that about 10 per cent (300W mean) of the forward power is also absorbed by the isolator. The absorbed energy (forward and reverse) is dissipated via a water-cooling system, for which purpose a pair of flexible hose connections is made to the side of the transmitter.

Items fitted in the modulator

◄**45.**► When the transmitter Type 15003 is fitted in the radar Type AN/FPS-6, the pulse-forming network in the modulator (modulator group OA-329/FPS-6) must be replaced to provide a 4·7 μs modulator pulse for the magnetron. The main items replaced are as follows:—

(1) Pulse-forming network Type 15011 (Ref. No. 10AE/1837).

(2) R.F. inductor Type 6013 (Ref. No. 10C/25571).

(3) Despiking capacitor 0·0125μF Type 14031 (Ref. No. 10C/25714).

◄**46.**► The pulse-forming network is mounted at the rear of the modulator. The network is a standard L-C combination and consists of seven π-section low-pass filters. The line has a characteristic impedance of 18 ohms and produces pulses of 4·7 μs duration. The r.f. inductor Type 6013 (the end inductance) is connected between the thyratron anode (V2201) and the pulse forming network (Z2201). The new inductor is 15μH and is fitted to reduce the rate of rise of current through the thyratron to conform with the thyratron manufacturer's requirements. The despiking capacitor (C2204) is now 0·0125μF and is replaced to reduce the rate of rise of voltage applied to the magnetron.

Magnetron current meters

◄**47.**► When the transmitter Type 15003 is fitted, monitoring conditions require that the magnetron current meters be replaced. The new meters are both 0-500μA Type 15123 (Ref. No. 10AF/1703). One is mounted on the radar set control C-992 panel (M6101) and the other on the voltage regulator CN-187 panel (M2102). Meter M6101 also has a 70-ohm, 1 per cent, 0·5W resistor (Cat. No. 5905-99-999-0373) connected in series with it.

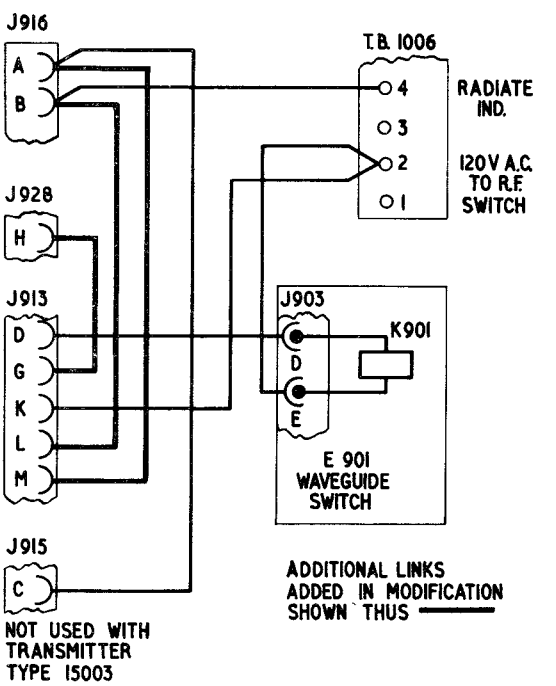


Fig. 13. Wiring links on r.f. assembly

Reduction in receiver bandwidth

◄**48.**► The increased pulse duration used by the transmitter Type 15003 allows a reduction in the overall receiver bandwidth and consequently an increase in gain. This is achieved by changing four resistors in the i.f. amplifier AM-622/CPS-6B. The resistors concerned are R21704, R21708, R21712 and R21716 which are connected in the anode circuits of valves V21701, V21702, V21703, and V21704 respectively. The new resistors are all 5·6 kilohms ± 10 per cent, 0·25W (Ref. No. Z222100).

Wiring modifications for monitoring facilities

◄**49.**► To allow monitoring of the new interlock circuits and magnetron current indication of the transmitter Type 15003, three wiring links have been added in the r.f. assembly framework (cabinet, electrical equipment C7-1108, group OA-357). The links are shown in fig. 13. The links connect the transmitter interlocks to the INTERLOCK TEST switch on the indicator and test panel located above the radar set control panel C-1003. A new plate has been fitted on the switch, and the names of the new transmitter interlocks have been engraved on the new plate to identify the interlock tested in each position.

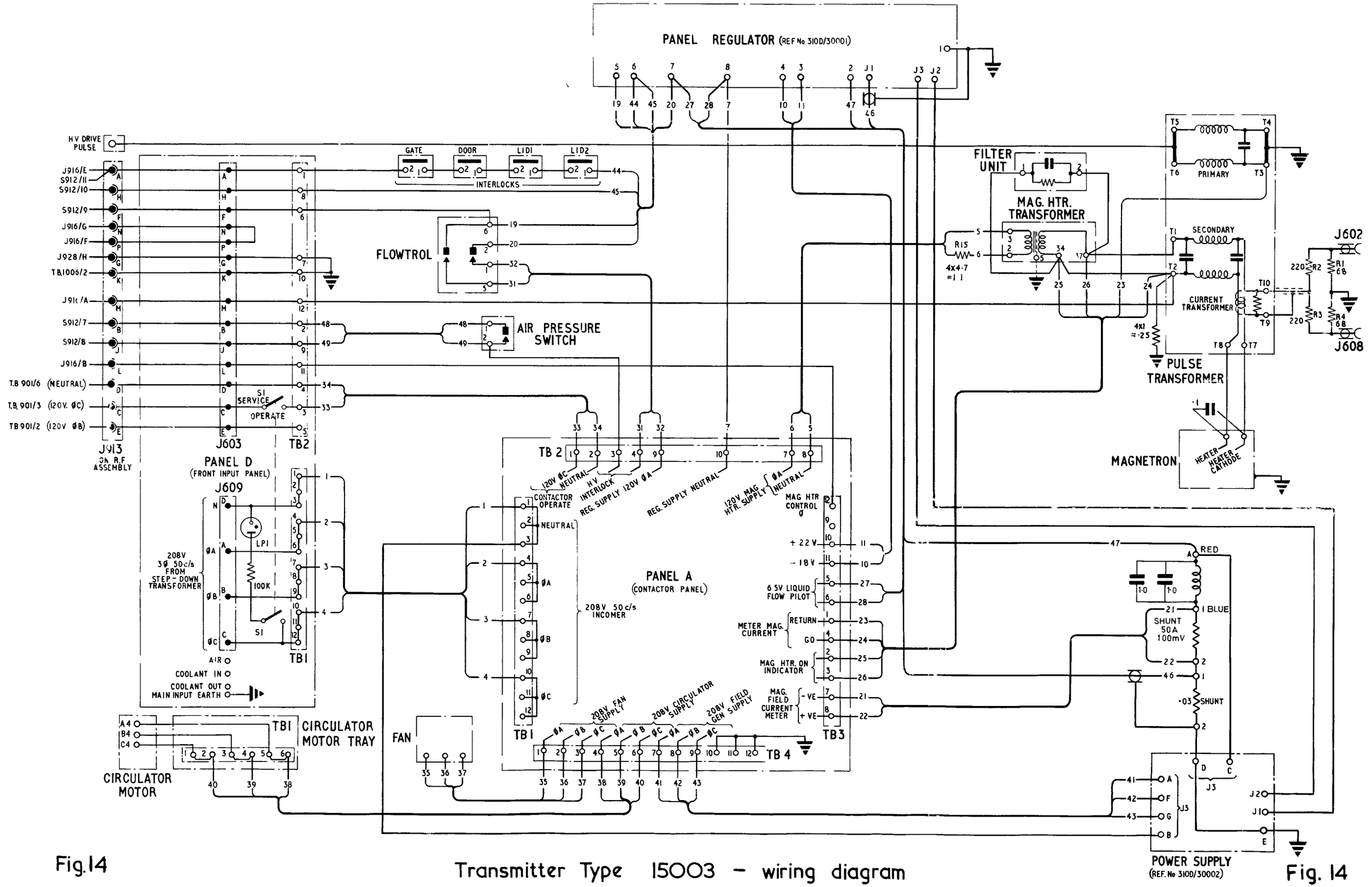
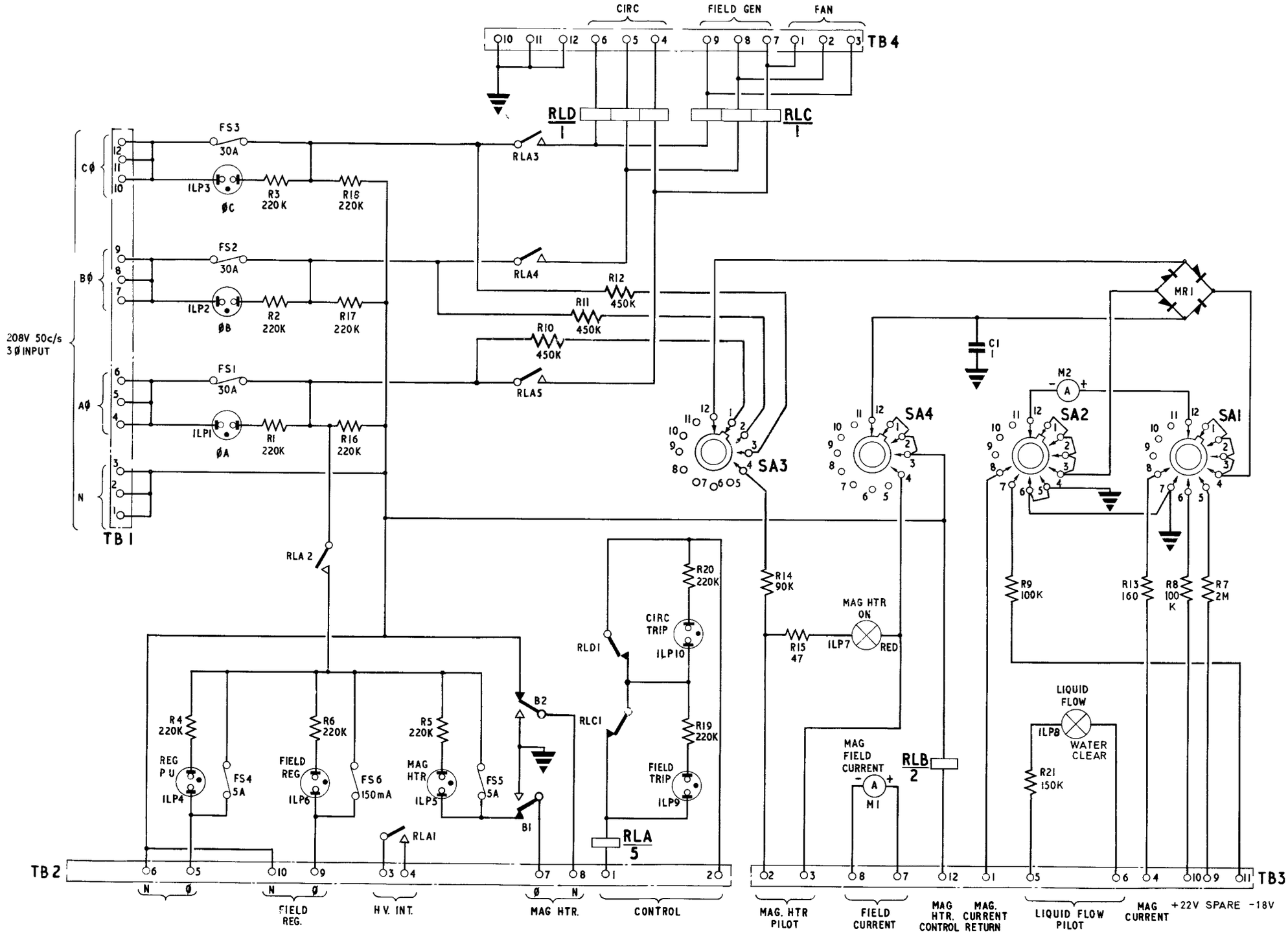


Fig.14

Transmitter Type 15003 – wiring diagram

Fig. 14



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ISSUE 4 Prepared by the Ministry of Technology

Contactor panel Type 15012 - circuit

Fig. 15

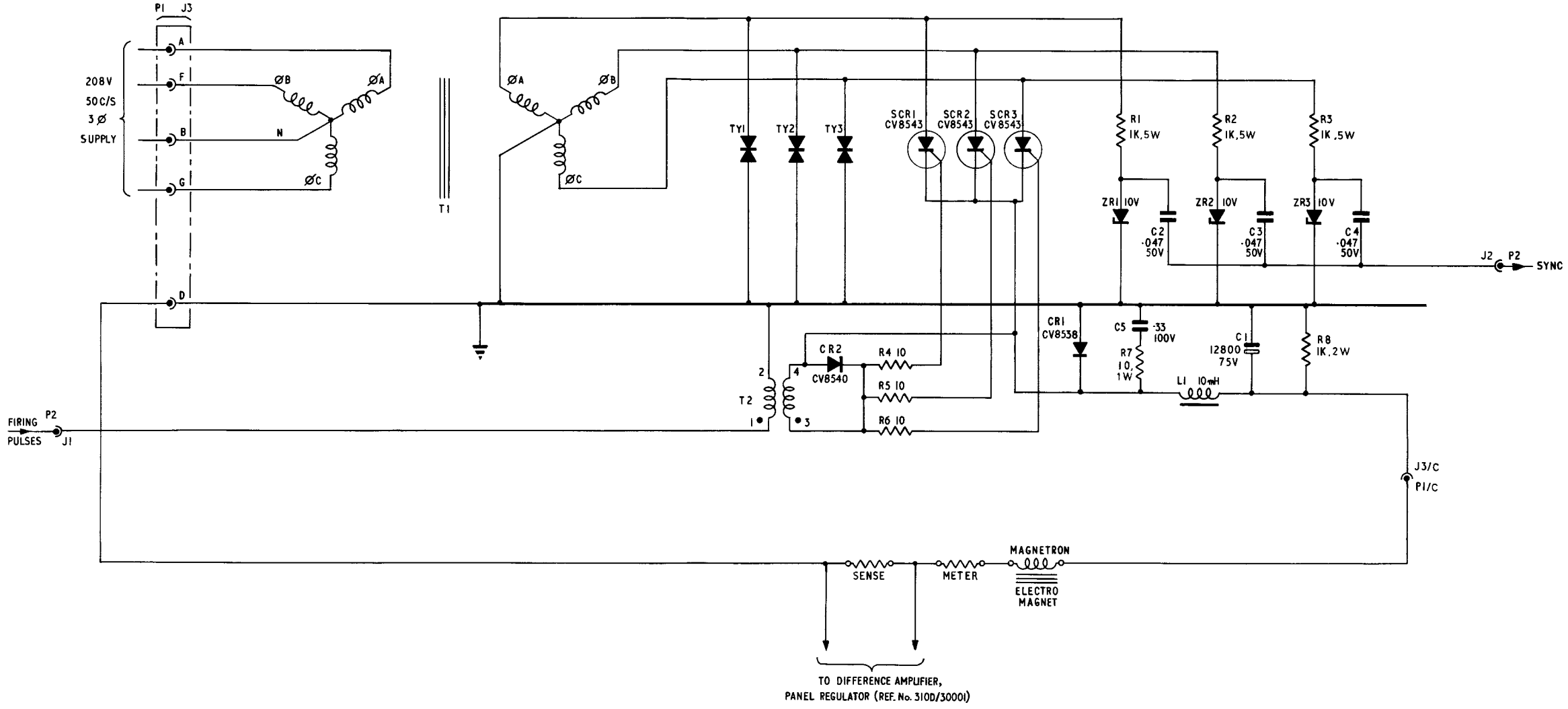

Fig.16

Power Supply (Ref. No. 310D/30002) - circuit diagram

Fig. 16

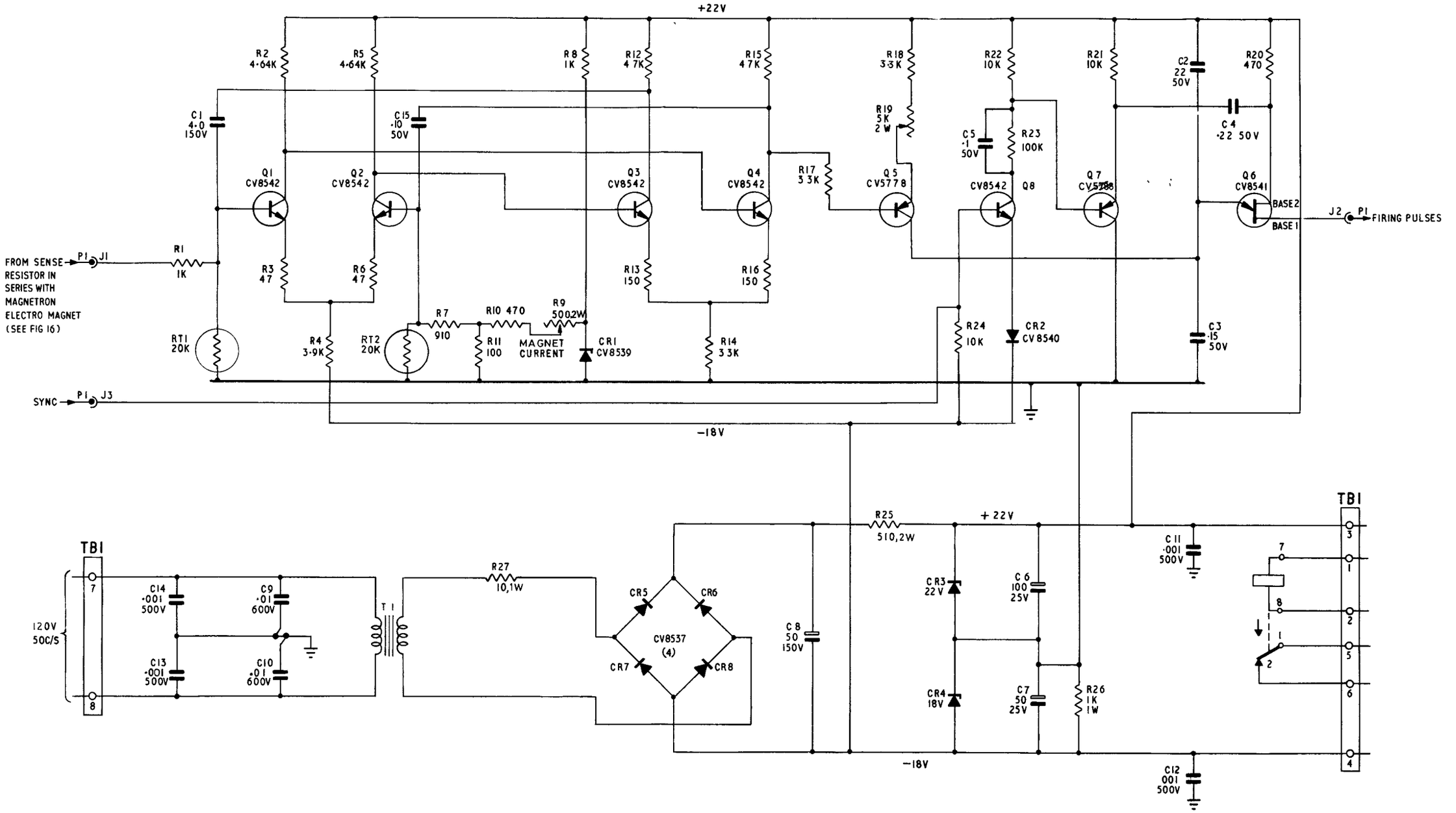

Fig. 17 Panel Regulator (Ref. No. 310D/30001) – circuit diagram Fig. 17

PART 2

SERVICING INFORMATION

SECTION 1

CHANGES TO ORIGINAL EQUIPMENT

Chapter 1

INTRODUCTION

Scope of section

1. This section contains servicing and revised setting-up procedures associated with the modifications described in Part 1.

Chapter 2

ANTENNA SYSTEM

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Levelling of main girder assembly

1. The procedure for levelling the main girder assembly, using the preset level reference plane, is given below. This procedure assumes that the reference plane has already been levelled in relation to the main girder and is locked in position. If, for any reason, the reference plane setting has been disturbed the full procedure given in A.P. 2527U, Vol. 2, Leaflet No. B95, must be carried out.

2. The routine levelling procedure is as follows:-

(1) Disconnect the relevant power supplies to render the antenna completely inoperative.

(2) Rotate the antenna by the hand crank until the main girder is parallel with a line passing through any two of the main jack screws.

(3) Zero adjust a block spirit level (Ref. No. 10AF/683) and set it on the reference plane so that it is parallel to the main girder.

(4) Adjust the two jack screws on the line parallel to the main girder until the spirit level reads zero.

(5) Rotate the main girder through 90 and adjust the third jack screw until the spirit level reads zero again.

(6) Rotate the main girder through 360°, checking the spirit level at 10° intervals. The total excursion of the bubble should not exceed 1 min.

(7) If the girder is not level within these limits, repeat the procedure given above.

(8) When the main girder is level, remove the spirit level and refit the protective cover over the reference plane.

Note . . .

The check nuts on the main jacking screws should be loosened only enough to permit a small rotation of the jack screws. They should be tightened after each adjustment. The operator on the main girder should remain as nearly as possible in one position throughout the levelling procedure and should avoid any unnecessary movement.

Adjustment of angle mark gear train

3. The modified gear train will normally be adjusted on installation. If it is necessary to make

adjustments to the meshing of the 1-speed and 9-speed gears the following procedure should be carried out.

(1) Render the antenna inoperative, and secure the reflector. Remove the cover of the angle mark unit gearbox to expose the modified gear train.

(2) Slacken the nut on the hinge pin and the locknuts on the adjusting screws. Mesh the 1-speed and 9-speed gears by means of the adjusting screws.

Note . . .

No more than finger pressure must be applied to the adjusting screws as the gears must not be overmeshed.

(3) Tighten the nut on the hinge pin and check that the backlash at the surface of the angle mark commutator is less than 1/32 in.

(4) Check that in at least two more positions of the aerial the backlash is approximately the same.

(5) Tighten the locknuts on the adjusting screws and refit the gearbox cover.

4. All the gear shaft bearings are packed with grease on assembly and no further lubrication is necessary.

Disassembly and assembly of rotary joints

5. As described in Part 1, Sect. 1, Chap. 2, the end housing of each rotary joint has a modified sealing arrangement. Disassembly of each rotary joint can therefore be carried out as described in Technical Orders until the point is reached at which the end housing is removed from the joint.

6. Disassembly of the housing can be carried out as follows:-

(1) Carefully remove the leather sealing ring and the flange sealing ring.

(2) Remove the graphite bearing ring. Invert the lower housing and bump it on a wooden surface to remove the steel pressure ring

(3) Remove the six helical compression springs and their supporting shoulder screws.

7. The housing is reassembled by a reversal of the disassembly procedure given. Care must be taken in refitting the steel thrust washer to ensure that it is accurately positioned. The keyway on the underside of the thrust washer must engage properly with the key of the anchor plate which is fixed to the housing. Refit the graphite bearing ring with its broad face to the thrust washer and the chamfered edge uppermost. When correctly assembled the upper face of the graphite ring should stand proud of the adjacent section of the inner housing by approximately 1/32 inch. Fig. 3 shows a cutaway view of the rotary joint.

Converter signal data Type M4

8. This new unit, as described in Part 1, Sect. 1, Chap. 2 contains two units; control indicator C-993 and power supply Type M26. Fig. 4 shows the circuit diagram of the power unit, whilst Figs. 1 and 2 show component locations. The positive voltage is stabilized by a normal series regulating circuit comprising V2, V3, V4 and associated components. The negative voltage output is regulated by V6, the load on this circuit being well within the stabilizing performance of the valve. Transformer T2 provides a stabilized 6·3V a.c. heater supply.

9. The power supply is set up as follows:—

(1) With the unit operating on load, measure the voltage between the +275V and GND sockets. If necessary adjust the +275V ADJUST control to obtain a reading of +275V ±3V.

(2) Check that the −150V supply gives a reading of −142 to −165 volts.

10. As an aid to servicing and location of faults, a list of voltages measured, with respect to earth, at various points in the circuit, is given in Table 1. The voltages listed were measured using a multimeter Type 1.

TABLE 1

Voltage readings—power unit Type M26

Monitor point	Voltage d.c.
V1 cathode, pin 7	+390V
V2 anode, pin 5	+380V
V2 grid, pin 1	+270V
V3 cathode, pin 2	+85V
V5 anode, pin 1 and 6	−350V
V6 cathode, pin 2, 4 and 7	−142V to −165V
Junction of R8 and RV1	+102V
Junction of R9 and RV1	+63V
Junction of R7 and RV1	+77V

Setting up control indicator C-993 in conjunction with R.H.I.

11. Since the control indicator and the R.H.I. may now be widely separated, telephone contact between the two must first be established, so that the effect of control adjustments can be observed and reported.

12. Set up the R.H.I. vertical sweep alignment as follows:—

(1) Select 0-130 mile position on the RANGE SELECT switch.

(2) Press the EL. DRIVE SLOW button to start the antenna nodding at 20 cycles per minute.

(3) At the converter signal data unit adjust the SLOW ELEV. PHASE SHIFT CONTROL until the 0° angle mark generated on the down sweep coincides as near as possible with that generated on the up sweep.

(4) Adjust the SLOW ELEV. ZERO SET control until the 0° angle mark is positioned on the 0° mark on the R.H.I. scale. Check this by momentarily throwing the ZERO CAL. switch

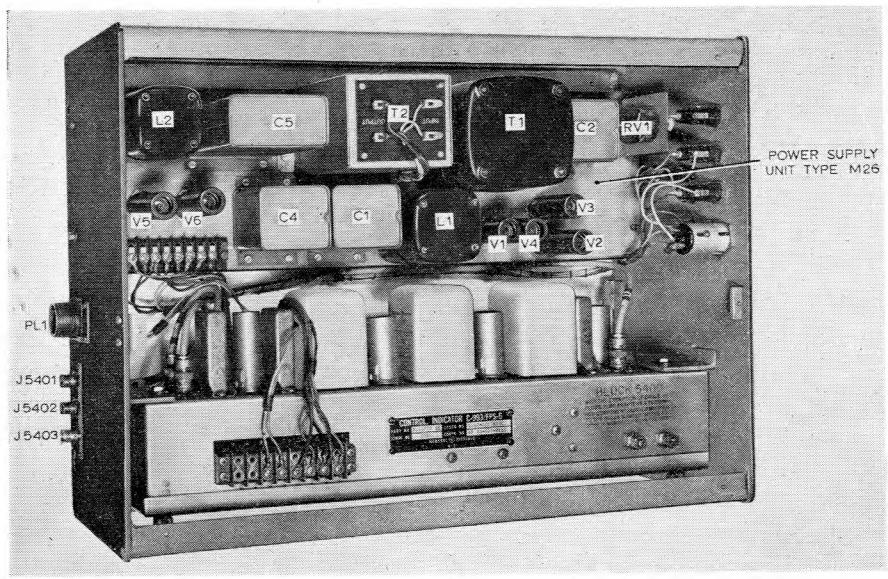

Fig. 1. Converter signal data unit Type M4: Top view

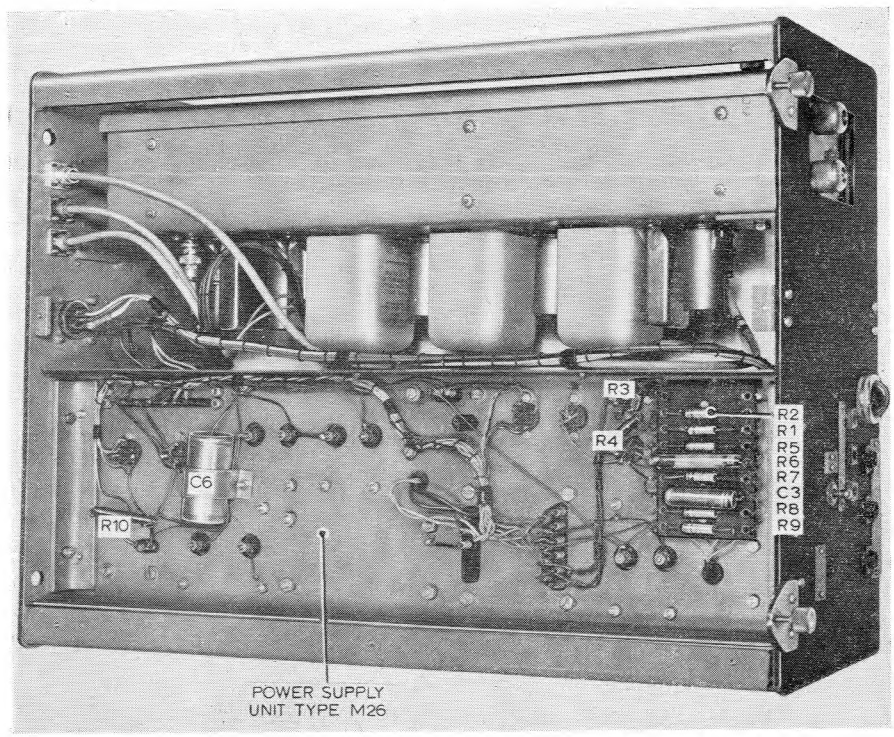

Fig. 2. Converter signal data unit Type M4: underside view

S' angle mark should appear in the same position.

(5) Repeat operations C and D until the up sweep and downsweep angle marks coincide as near as possible.

(6) Start the antenna fast nod (30 cycles per minute) and repeat the setting up procedure using the FAST ELEV. PHASE SHIFT and the FAST ELEV. ZERO SET controls.

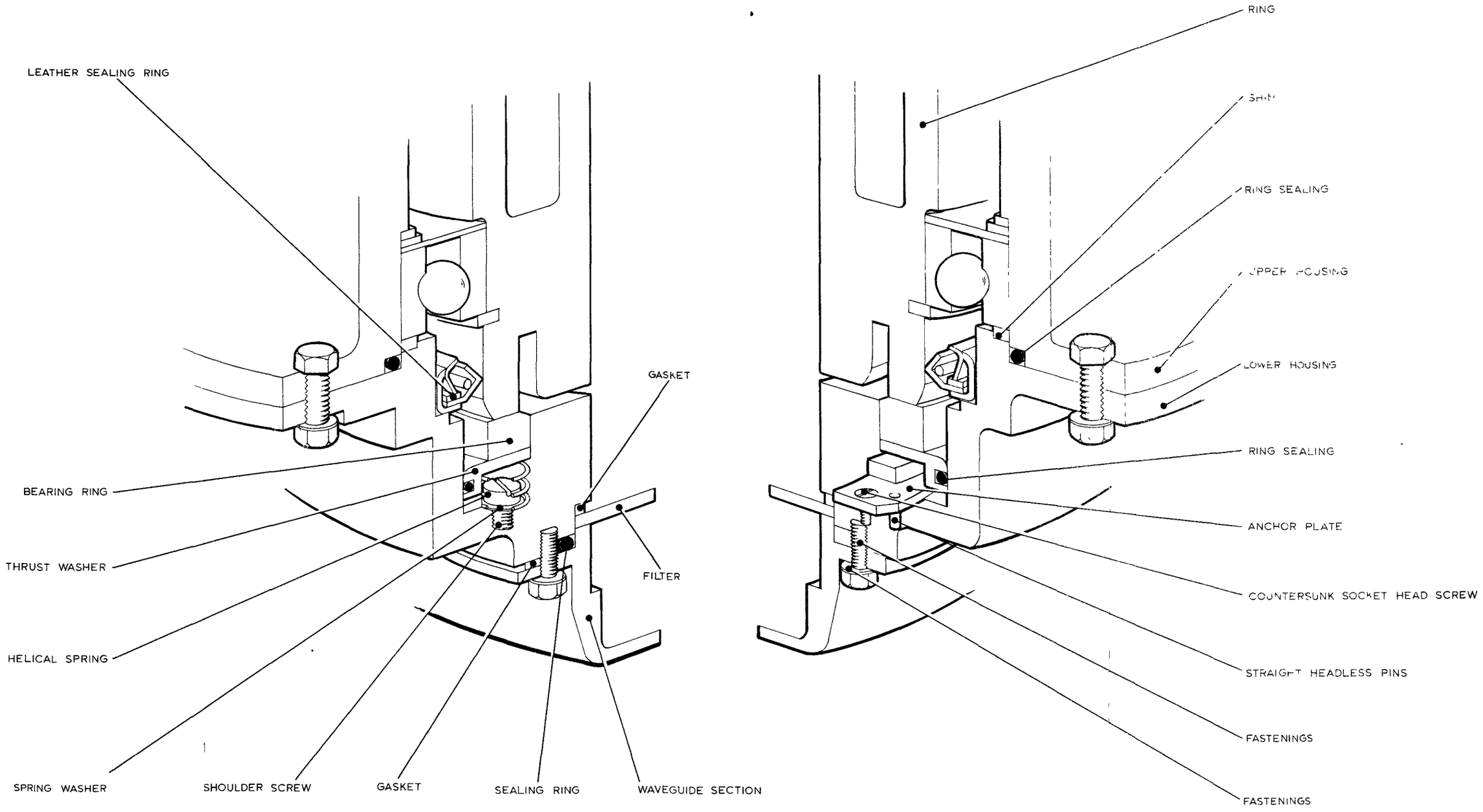

Fig.3

Cutaway view of Rotary Joint

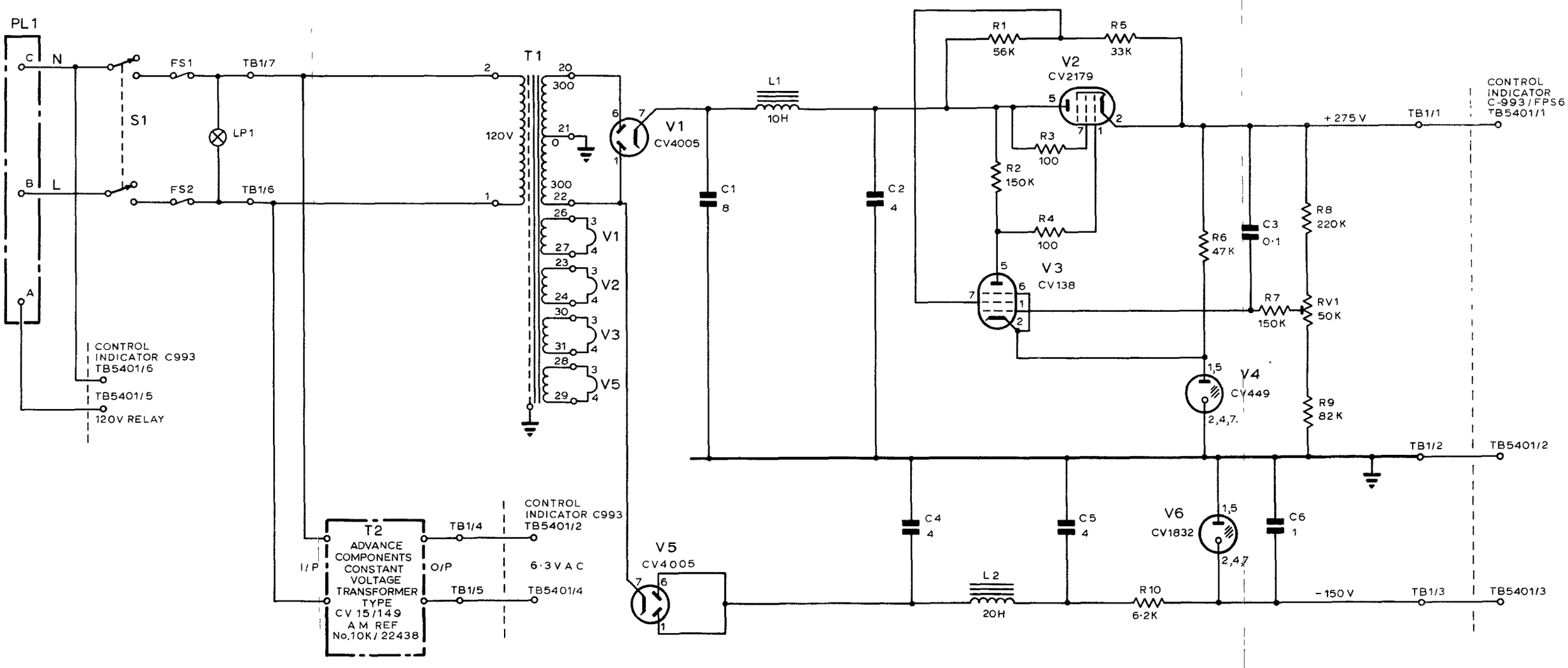

Fig 4

Power unit Type M26 – circuit.

Fig.4

Chapter 3

TRANSMITTER-RECEIVER SYSTEM

Servicing and setting-up

1. The majority of modifications covered in this chapter do not sensibly change the servicing and setting-up procedure at present in use. Full information on servicing and setting-up transmitter Type 15003 is given in Part 2, Sect. 2, Chap. 1.

2. Full receiving systems alignment and testing information is given in A.P.2527U, Vol. 4 and Technical Orders.

3. The modification to keep alive power supply (PP-756) involves the following setting-up procedure.

(1) Switch on control radar set C-1003.

(2) Turn receiver test switch to TR current.

(3) Adjust RV6 on power supply PP-756 until the meter reads 100μA.

Chapter 4

RANGE-HEIGHT INDICATOR

LIST OF CONTENTS

Introduction

1. Extension of the maximum range of display to 250 nautical miles, involves the following setting-up procedure.

> **Note . . .**
> *For ease in locating the physical positions of the chassis controls mentioned in this procedure the abbreviations* LHC *or* RHC *after the control named are used the first time the control is mentioned.*
> LHC *refers to left hand chassis and* RHC *refers to right hand chassis.*

Horizontal sweep alignment

2. (1) Set switches S4703, S4701 (both LHC) and S4401 (RHC) to the CAL position.

(2) Place the following controls to their mid-position:

HOR. SWEEP GEN. LIN.	(RHC)
HOR. SWEEP GEN. ZERO	(RHC)
VERT. SWEEP GEN. ZERO	(LHC)
VERT. SWEEP LIN.	(LHC)

(3) Set the HEIGHT SELECTOR switch to the −5 −60 position and the RANGE SELECTOR switch to the 0-130 position.

(4) If a spot or trace is not visible adjust the 0-130 MILE ZERO, HOR. CENT., and VERT. CENT. 60,000 ft. controls (RHC) until the spot or trace is visible at the lower left corner of the screen.

(5) Adjust the HOR. SWEEP GEN. ZERO until no horizontal sweep is generated. The correct position for this setting is where a movement of the control in either direction will cause a trace on either side of the spot.

(6) Adjust the VERT. SWEEP GEN. ZERO until there is no vertical sweep generated. Tuning the control in either direction should cause a trace to be generated up or down.

(7) Place S4401, OPER-CAL to the OPER. position.

(8) Set the RANGE MARKERS switch to ON, and adjust the RANGE MARKERS potentiometer so that the range marks appear plainly on the trace.

(9) With the RANGE SELECTOR switch in the 120-250 mile position, set variable resistor R4453 fully counter-clockwise. Adjust the GATE LENGTH variable resistor R4304 until the 260 mile marker is the last one visible on the trace. Adjust R4453 until the 250 mile marker coincides with the 250 mile graticule mark. Now set R4304 so that the sweep ends at the 260 mile marker. It may be necessary to adjust the 120 mile DELAY control to obtain the 260 mile marker on the trace.

(10) Return the RANGE SELECTOR switch to the 0-130 position and set the PICTURE WIDTH control to its approximate mid-position.

(11) Adjust the HOR. SWEEP GEN. LIN. for the most uniform spacing of range marks.

(12) Place S4401, OPER-CAL to the CAL position and repeat step (11). Return S4401 to the OPER position.

(13) Adjust the 0-130 MILES ZERO control until the trace begins to limit at its origin. It may be necessary to move the origin to the right with the HOR. CENT. control.

(14) Adjust the HOR. CENT. control so that the origin of the trace lies vertically in line with the zero scale marking on the fixed 0-130 mile range scale.

(15) Adjust the PICTURE WIDTH control so that the trace ends just inside the masked portion of the screen.

(16) Adjust the HOR. SWEEP SPEED control

(RHC) so that thirteen ten mile markers are visible on the trace and vertically in line with the fixed 0-130 mile scale.

(17) Place the RANGE SELECTOR switch at the 120-250 position. Adjust the 120 MILE DELAY control so that the 120 mile marker is at the beginning of the trace.

(18) Adjust the HOR. CENT. control so that the origin of the trace is vertically in line with the 120 mile mark on the fixed 120-250 range scale. Switch the RANGE SELECTOR to the 0-130 position.

(19) Adjust the 0-130 MILE ZERO control so that the origin of the trace is vertically in line with the zero mark on the fixed 0-130 range scale.

(20) Repeat steps 17, 18 and 19 until there is no shift in the trace origin when switching from range to range.

(21) Repeat steps 5 to 20 to ensure that interaction of controls has been reduced to a minimum.

(22) Switch the RANGE SELECTOR from the 0-130 position several times and check that the relative range markers coincide at each range position. If they do not, adjust the HOR. SWEEP LIN. control slightly to make them coincide.

Note . . .

Adjustment of this control will cause interaction with other controls. It will be necessary to adjust the 120 MILE DELAY *control as in* (17) *above. However, if the foregoing procedure is followed closely and patiently, adjustment of the* HOR. SWEEP LIN. control can be kept at a *minimum.*

(23) Switch the RANGE SELECTOR to the DELAY position and rotate the RANGE DELAY hand crank so that the range indicated is 0-62 miles.

(24) Adjust the HORIZ. DELAY ZERO control (RHC) until the 50 mile range marker is vertically in line with the 50 mile mark on the range tape.

(25) Rotate the RANGE DELAY hand crank so that the range tape indicates 150 miles of delay. Adjust the HORIZ. DELAY RATE control so that the 150 mile range marker is aligned with the 150 mile mark on the range tape.

(26) Repeat steps 23 to 25 until errors due to interaction are eliminated.

Intensity compensation

Note . . .

Unless the INTENSITY COMPENSATION *is set up at this point it will be necessary to remove V*4308 *in the alignment of the vertical sweep.*

3. Switch the RANGE and HEIGHT SELECTOR switches to various positions and adjust the INTEN. COMP. control (RHC) for the same degree of trace brilliance in all positions.

Vertical sweep alignment

Note . . .

The antenna must be nodding for the remainder of this procedure.

4. (1) Adjust the VERT. SWEEP GEN. ZERO control (LHC) until the trace does not move vertically when changing the RANGE SELECTOR switch from 0-130 to 120-250.

(2) Place the RANGE SELECTOR switch in the 0-130 mile position and the EARTH CURV. switch S4701 (LHC) to OPER. Check if a vertical sweep is obtained at the nodding rate of the antenna.

(3) Place the ANGLE MARKER switch to the ON position and adjust the ANGLE MARKER control until angle markers appear plainly on the screen. Check that the 0 deg. angle marker is horizontal and that the 5 deg. angle marker is in the same place on the up and down sweeps.

(4) Adjust the VERT. CENT. 60,000 ft. control (RHC) until the origin of the trace is in the lower left-hand corner of the scope mask.

(5) Adjust the VERT. SWEEP LIN. control (LHC) until the 5 deg. angle mark appears as a straight line from corner to corner of the mask.

(6) Adjust the VERT. CENT. 60,000 ft. control until the origin of the trace is horizontally in line with the zero marking on the 5-60 thousand feet scale.

(7) Adjust the PICTURE HEIGHT control (RHC) until the sweep ends just inside the masked portion at the top of the screen.

(8) Adjust the VERT. SWEEP SPEED control (RHC) until each successive intersection which the 10 degree angle marker makes with the range marker is approximately in line with the marks on the fixed -5 -60 height scale.

(9) Place the HEIGHT SELECTOR switch in the -5 -20 position.

(10) Adjust the VERT. CENT. 20,000 ft. control (RHC) until the lower flat edge of the trace is at the lower edge of the mask.

(11) Adjust the 60,000 ft. ZERO control (RHC) until the origin of the trace is even with the 0 on the -5 -20 thousand foot scale.

(12) Repeat steps 9 and 10 until there is no error.

(13) Place the HEIGHT SELECTOR switch in the -5 -60 position and adjust the VERT. CENT. 60,000 ft. control until the origin of the trace is even with the zero on the fixed -5 -60 thousand foot scale. It may be necessary to readjust the PICTURE HEIGHT control as in (7) above.

Chapter 5

CONTROL GROUP ASSEMBLY

LIST OF CONTENTS

Setting-up procedure for modified S.T.C. circuit

1. Monitor test socket J21704 using an oscilloscope Type USM24A or 13A. Check that the input trigger pulse has a peak amplitude of 35 to 60V and is approximately 3 μs long at the mean power value.

2. Trigger the oscilloscope from a 'system trigger' source and monitor the signal at the grid (pin 2) of V21718A. A train of pulses, as shown in Part 1, Sect. 1, Chap. 5, Fig. 3, should be seen.

3. Set R21809 fully counter-clockwise to put maximum negative bias on CR6. Then set R21793 fully clockwise for maximum 'flat' duration of the S.T.C. waveform. Set the time constant resistor R21792 and the S.T.C. amplitude resistor R21802 to their mid positions.

4. Switch the S.T.C. circuit on and connect the oscilloscope to test socket J21710. With reference to Part 1, Sect. 1, Chap. 5, Fig. 2, adjust R21802 for a waveform of approximately 20V amplitude. Adjust R21809 to obtain a pulse 'flat' time of 800 μs and then lock the control.

5. The pulse 'flat' time should now be variable between 0 and 800 μs by adjustment of R21793. The actual flat duration of the pulse will depend on conditions at the radar site and should be set accordingly.

Servicing check

6. Under normal operation the following voltages and currents are as measured at the pins of V21720.

Anode (Pin 7)	108V d.c.	16 mA
Screen (Pin 9)	130V d.c.	3-5 mA

Modifications to calibrator range TS-735

7. The following procedure ensures the modified range mark generator operates satisfactorily from the master system trigger of 250 p.p.s.

8. At cabinet electrical equipment disconnect P6921 from J6921 to remove the station system trigger. Connect an oscilloscope USM24 to J5202 and check that the trigger generator blocking oscillator is free running at about 225 p.p.s. Fit a T adaptor UG-274/U to J6921 and ensure that a 68 ohm termination adaptor E6937 is fitted to socket J6937.

9. Connect P6921 to one arm of the T adaptor and connect the oscilloscope SYNC. INPUT to the other arm. Display the calibrator range trigger pulses by connecting TEST TRIG. socket J5202 to the vertical input of the oscilloscope. Adjust the TRIG. DISCRIMINATOR control R5202 until the trigger pulses displayed are stable and locked to the station system trigger frequency. Lock the TRIG. DISCRIMINATOR control and remove the test equipment. Re-connect P6921 to J6921.

Setting up range marks

10. Connect the vertical input of an oscilloscope USM-24 to the CALIBRATOR COUNTING socket J5208. Adjust the CALIBRATOR COUNTING control R5222 to obtain 5 trigger pips on each counting cycle.

11. Remove the oscilloscope lead and connect it to the CALIBRATOR GATING socket J5207. Set the oscilloscope sync. to INT. The waveform displayed should be a series of square waves of between 65V and 70V amplitude. Now connect the vertical input of the oscilloscope to the GATED 5 AND 10 MILE MARKS socket J5209. A series of gated 5 and 10 mile markers should be displayed. The amplitude of the 10 mile markers should be between 25 and 55V. Adjust the CALIBRATOR AMPLITUDE control

R5224 until the 5 mile marks are 2/3 of the 10 mile marks to ensure identification.

12. Remove the trigger input to the range mark generator by disconnecting the lead to J5201 thus allowing the unit to free run at 225 p.p.s. Disconnect the oscilloscope vertical input from socket J5209 and reconnect it to one of the two CALIBRATOR OUTPUT sockets J5210 and J5211. The display should show a series of alternately gated 5 and 10 mile range marks. Adjust the SYNC. and SWEEP REP. RATE controls until the 5 mile marks are interlaced with the 10 mile marks.

13. Adjust the 10 MILE OSC. control L5202 until all alternate 5 mile marks are exactly superimposed on the 10 mile marks. Disconnect the vertical input of the oscilloscope and reconnect it to the 10 MILE OSC. socket J5212. Adjust the 10 MILE OSC. control R5244 to obtain 10 mile marks of 50V peak amplitude.

14. Now connect the vertical input of the oscilloscope to socket J5213. A series of superimposed 50 and 10 mile marks should be displayed. Adjust the 50 MILE COUNTING control R5254 until the 50 mile markers coincide with every fifth 10 mile mark. Adjust the 10 MILE MARKERS control R5251 until the amplitude of the 10 mile marks is four-fifths of that of the 50 mile marks. Remove the test equipment.

Chapter 6

REMOTE CONTROL AND DISPLAY

General

1. As described in Part 1, Sect. 1, Chap. 6, modifications to this part of the equipment are essentially connected with integration with existing British equipments. Servicing information will be found in A.P.2527UB.

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SECTION 2

TRANSMITTER TYPE 15003

Chapter 1

SETTING-UP, OPERATING AND SERVICING INSTRUCTIONS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

SETTING-UP INSTRUCTIONS

Magnetron field current

1. The only supply that can be adjusted on transmitter Type 15003 is the magnetron field current. The correct field current for the type of magnetron in use can be found from the field strength/field current (gauss/amps) conversion table fixed on the top of the magnetron heater transformer. The field current must be set up in the following manner:–

(1) On panel (contactor) Type 15012 set switch SA to position 8 [MAG.CURRENT (500MA F.S.)].

(2) On panel regulator (Ref. No. 310D/30001), adjust the MAGNET CURRENT control until the reading on the MAG. FIELD CURRENT meter (M1) is the same as that shown on the field strength/field current (gauss/amps) conversion table.

2. At this field current (approx. 27A) the field strength for either the CV6080 or CV6082 is 1580 gauss.

OPERATING INSTRUCTIONS

Switching on

3. Radar type AN/FPS-6 is switched on in the following manner:–

(1) Switch on the main breaker at the M.P.B.W. switchboard. This connects 400/230V, 50 Hz, 3-phase 4-wire supply to the step-down transformer whose output is 208V line-to-line (i.e. 120V line-to-neutral).

(2) In the tower radar enclosure, switch off the following:–

(a) Modulator group OA-329 (S2250).

(b) Pressurizer and dehydrator HD-187 (S1805).

(c) Cooler, liquid, electron tube HD-188 (S1901).

(d) Group OA-357.

(i) Control assembly, C-1003 (S10-08).

(ii) Power unit PP-755 (S1101).

(e) Transmitter Type 15003. (SERVICE/OPERATE switch to SERVICE).

(3) Set all gantry-switchbox circuit breakers to the ON position.

4. At the control group assembly, switch on as follows:–

(1) On panel, power distribution SB-225 set the following switches to the ON position (note that with all switches the ON position is up):–

(a) ELECTRONIC.

(b) ANTENNA POWER.

(c) HV. IND. REG.

(d) MODULATOR.

(e) XMITTER-RECEIVER.

(f) CONTROL GROUP.

(g) JUNCTION BOX.

(h) R.H.I. (if fitted).

Check that as each switch is set to the ON position the amber light above it lights.

5. At pulse generator TD-73 set the monitoring switch to each of its six positions in turn and check that in each position 120V is indicated on the LINE VOLTAGE meter.

Note . . .

At stations where modification CA1449 has not yet been incorporated, the frequency meter is still of American design and cannot be used because its range is restricted to 55-65 Hz. Similarly, where modification CA1293 has not yet been incorporated, the hour meter is for 60 Hz operation and will read therefore only 5/6 of the actual running time.

6. At power supply unit M-1360 set the following switches to the ON position and check that the appropriate indicating lamp lights:–

(1) POWER (green lamp).

(2) –150V DC (amber lamp).

(3) +140 and +275V DC (red lamp).

(4) +28V DC (blue lamp).

If it is necessary to open any of the panels, the INTERLOCK SHORT switch (red lamp) also should be set to the ON position.

7. At power supply unit MX-1359, check the d.c. voltages by putting the switch in each of its three positions marked +275V, +140V and –150V. If necessary, adjust the voltages by means of the appropriate control situated adjacent to the switch.

8. At antenna control C-991, press one of the ELEVATION DRIVE buttons to start the elevation drive motor, SLOW (red lamp) or FAST (amber lamp) according to requirements. Also press the AZIMUTH DRIVE START button (red lamp).

Note . . .

The 500V D.C. (red lamp) MX1360 will light after 15 seconds.

9. In the tower radar enclosure carry out the daily checks of the air pressurizing and circulating system defined in the servicing instructions. Leave switch S1805 of the pressurizer and dehydrator set to ON.

10. Carry out the daily checks of the electromagnet cooling system defined in the servicing instructions. Leave the cooler, liquid, electron tube switch S1901 set to ON.

11. With MOD. CONT. POWER switch on Modulator Group OA-329 in the ON position:–

◄ (1) Check that MOD FIL SUPPLY is 120V a.c. ±2.5V. If necessary adjust CURRENT AND VOLTAGE REGULATOR potentiometer R2106.

(2) Adjust FILAMENT VOLTAGE SENSITIVITY potentiometer R2116 until transformer T2250 start to hunt. Adjust R2116 until MOD FIL SUPPLY remains steady at 120V a.c. ±2.5V. ►

◄ (3) ► Set INTERLOCK SHORT (S2251) to ON. Indicator I 2250 (red lamp) should light.

◄ (4) ► Check that the reading on thyratron reservoir voltage meter M2201 agrees with the figure shown on the label above reservoir control T2203.

Note . . .

Final adjustment of reservoir voltage will be made under RADIATE condition. However, if Modification CA.1686/8 is incorporated, British valve, electronic CV. 8563 obviates use of the reservoir, voltage control, and the reservoir, voltage meter M.2201 has no significance.

12. Set the transmitter SERVICE/OPERATE switch to OPERATE, and:–

(1) Check that the LIQUID FLOW indicator is lit (WATER CLEAR lamp).

(2) Check that the MAG HTR ON indicator is lit (red lamp).

(3) Open the L.H. access door, set the meter selector switch in turn to each of its eight positions and observe appropriate readings on the meter (M2) above the switch.

13. At group OA-357, set control C-1003 POWER switch (S1008) and power supply PP-755 POWER switch (S1102) to ON, and check:–

(1) That indicator I 1008 (red lamp) lights.

(2) That indicator I 1108 (green lamp) lights.

(3) That PLATE switch S1 104 is at ON and indicator I 1107 (red lamp) is lit.

(4) Power supply voltages at meter M1102, selecting voltages as required by meter selector switch S1101. The +300V, +375V and +140V d.c. shall be adjusted as necessary.

14. Fifteen minutes after switching on the modulator, check that:–

(1) READY indicator (amber lamp) is lit.

(2) At Group OA-357 INTERLOCK TEST indicator I 903 will light for all positions of INTERLOCK TEST switch S912, except OFF.

(3) REV. CURRENT indicator (blue lamp) is lit.

15. At transmitter Type 15003 observe the magnetron field current. Adjust if necessary, in accordance with para. 1 and 2.

16. Connect up the spectrum analyser Type 1A using the special cable supplied to display the output from the DIRECTIONAL COUPLER jack of Group OA-357. Use INPUT 2 of the spectrum analyser. Connect summation bridge URM 23 to measure POWER RADIATED.

17. At modulator OA-329 press the RADIATE/STOP switch to RADIATE. The RADIATE (red) lamp will light, and the READY AND REV CURRENT lamps will go out. At the transmitter the MAG. HTR ON indicator will go out.

18. Hold the HV RAISE/LOWER switch to RAISE until the correct magnetron current reading is obtained on the MAG. CURRENT meter at the regulator, current and voltage CN-187. The specified current is 182mA. Note the final setting.

Note . . .

HV current at M2104 of OA-329 must not be raised above 750mA.

19. (1) Adjust the frequency, spectrum gain, and Y-shift controls of the spectrum analyser to display the transmission spectrum.

Note . . .

Two spectra can be displayed. The spectrum of higher frequency is correct and can be verified from knowledge of transmission frequency.

(2) The spectrum should be sensibly symmetrical with insignificant side lobes. It should be 400–600kHz wide to first minima, with side lobes 8 to 12dB down.

Note . . .

With the SPECTRUM GAIN and Y-SHIFT SPECTRUM controls, adjust the spectrum to be 5 cm in height. In this condition the first side lobes will be just visible.

(3) Using summation bridge URM23 measure the radiated power. This should be 2·7 to 3 kW mean at the magnetron, i.e. 2·4 to 2·85 kW allowing for loss in the ferrite isolator.

(4) Using a suitable oscilloscope, observe the magnetron cathode current pulse at the TEST TRIGGER jack of group OA-357. This pulse should be positive, of 4·5 to 5μs duration substantially stable and free from jitter.

20. To achieve the conditions outlined in para. 19 it may be necessary to make slight readjustment to the magnetron field current.

21. At the modulator, check the thyratron operation. There should be no tendency for internal arcing to occur or for the anode assembly to over-heat.

22. Remove the test equipment and close all access doors of the complete AN/FPS-6 equipment. Set all interlock short switches to OFF.

23. The control, radar set, C-992 of the control group assembly provides remote control of the equipment. When controlling the transmitter from this unit observe that:–

(1) The READY, REV. CURRENT and RADIATE/STOP AND RESET controls and indicators of this unit function as those of the modulator.

(2) The magnetron current is to be raised until the reading of the MAG. CUR. meter of the C-992 is 182 mA.

(3) The LOCAL/REMOTE switch is set to REMOTE (red lamp lit), and receiver controls set as desired.

24. If a step-transformer is fitted, the transmitter running-up procedure detailed in para.23 may be used. If a step-transformer is not fitted, then the transmitter must be run up from the tower radar enclosure. This is necessary because the 50 Hz supply must be between 112V and 128V (i.e. 120V nominal ±6 per cent) to operate regulator panel Type 15013 and, although the correct voltage may be indicated at the M.P.B.W. switchboard, the cable voltage drop may reduce the potential applied to the units to less than 105V. The voltage therefore must be checked on the built-in meter on the contactor panel and the e.h.t. run up from the modulator control panel. In this event the HV RAISE-LOWER switch (S2120) must be raised to HV RAISE and the RADIATE-STOP AND RESET switch (S2101) raised to RADIATE. Watch the MAG. CURRENT meter (M2102) until the correct current (182 mA) is indicated and then release both switches.

SERVICING INSTRUCTIONS

25. Transmitter Type 15003 is of robust construction and is intended for continuous operation. However, the efficiency of the equipment must depend to a considerable extent on careful maintenance and the immediate investigation of signs of unserviceability.

Daily checks

26. Open the left-hand door of the transmitter to reveal the three units mounted on the gate. On the contactor panel check the voltage supplies by means of the switch (SA) and the built-in meter above it. The switch has 8 positions marked as follows:–

(1) ϕA 120V (250V F.S.).

(2) ϕB 120V (250V F.S.).

(3) ϕC 120V (250V F.S.).

(4) MAG. HTR (50V F.S.).

(5) ◄Spare.►

(6) ◄+22V (50V F.S.).►

(7) ◄–18V (50V F.S.).►

(8) MAG. CURRENT (500mA F.S.).

None of the supplies except (8) is adjustable except by variation of the mains supply With the pre-mod CA.1857/6 circulator fitted, before carrying out any further checks, open the left-hand gate of the transmitter and ascertain that there is a slow drip of oil in the sight glass of the oil separator, indicating that oil is being returned to the circulator.

27. Check that the eight neon lamps (clear covers) on the contactor panel are unlit. Six of these lamps are mounted above fuses and when lit indicate that the fuse immediately below has ruptured. The lamps indicate as follows:–

(1) ILP1 for FSE (ϕA 30A).

(2) ILP2 for FS2 (ϕB30A).

(3) ILP3 for FS3 (ϕC 30A).

(4) ILP4 for FS4 (REG.P.U.5A) ◄NOT CONNECTED.►

(5) ILPL for FS5 (MAG. HTR 5A).

(6) ILP6 for FS6 (FIELD REG.◄150mA►).

The other two clear lamps are marked ◄FIELD►TRIP (ILP9) and CIRC. TRIP (ILP10) and are lit when thermal overload contactors RLC and RLD are operated by an overload in the power supply and circulator circuits respectively. The overload contactors are situated beneath a metal cover on the left-hand side of the contactor panel. They are reset manually by pressing the appropriate RESET button which is accessible through a hole in the cover. The power supply overload also carries the mains supply for the fan so this circuit as well as the power supply must be checked if the ◄FIELD► TRIP lamp lights.

28. When the transmitter is first switched on there is a 15-minute delay before the e.h.t. supply can be run up. Check that when the transmitter is first switched on the two lamps in the top right-hand corner of the contactor panel light. The lamps are marked MAG. HTR. ON (red lamp ILP7) and LIQUID FLOW (◄water clear► lamp ILP8). Check that when the RADIATE-STOP AND RESET switch is set to RADIATE the MAG. HTR. ON lamp is extinguished.

Interlock checking

◄29.► If the h.v. interlock circuit on the transmitter is not complete, the e.h.t. cannot be applied to the magnetron. To save time checking each interlock, facilities are provided for checking all the interlocks on the equipment by means of a switch and a lamp. The INTERLOCK TEST switch is mounted on the indicator and test panel which is situated above control, radar set C-1003. It is a 12-position switch and works in conjunction with a lamp mounted immediately above it. When the switch is rotated the lamp will light at each position if the interlock circuit is complete. The interlocks checked in each position are as follows:–

(1) OFF.

(2) MOD.

(3) XMTR. BLOWER.

(4) KEEP ALIVE.

(5) CONT PANEL.

(6) L.O. PANEL.

(7) PWR AND W.G. PANEL.

(8) R.F. SWITCH.

(9) W.G. PRESS.

(10) LIQ'D FLOW.

(11) MAG. FIELD.

(12) LID AND GATE.

The last four positions are used for the transmitter.

Replacement of the magnetron.

◄30.► When replacing the magnetron the following procedure must be used:–

(1) Remove the heater-cathode connector.

WARNING ...

Remember to de-pressurize the air system before attempting to remove the magnetron.

(2) Slacken the ring of six dome-headed nuts on the retaining plate.

(3) Turn the retaining plate clockwise to the end of the keyhole slots and lift it off.

(4) Lift the magnetron vertically out of the electromagnet assembly.

(5) Ensure that the new magnetron is absolutely clean and remove the polystyrene transit cap. Fit a new sealing ring (Cat. No. 5330-99-101-5635) at the top of the electromagnet. Excess oil in the waveguide must be investigated.

(6) Insert the magnetron into the electromagnet assembly and push vertically downwards.

(7) Replace the retaining plate, turn it slightly counter-clockwise and tighten the ring of six dome-headed nuts.

(8) Replace the heater-cathode connector.

Waveguide system

◄31.► In the event of the ferrite isolator needing replacement the open ends of the replaced unit should be sealed against the ingress of magnetic dust.

Air pressurizing and circulating system.

◄32.► Pressurized air at a pressure of about 30 lb/in^2 is fed to the transmitter where it is circulated by a sealed motor compressor. If an overload occurs on the circulator, contactor RLD on the contactor panel is operated and a lamp (ILP10) lights.

◄33.► Check the air pressure system as follows:–

(1) Put pressurizer and dehydrator HD-187 ON-OFF switch to ON.

(2) Check the pressurizer pressure gauge for build-up to 30-32 lb/in^2.

(3) Check all waveguide joints and hose connections for leaks.

(4) Check that the pressurizer air flow indicator reads less than 0.4 ft^3/min.

(5) Check that the waveguide air pressure gauge indicates 28-30 lb/in^2.

THREE-MONTHLY CHECK

◄34.► The whole oil separator is cleaned as follows:–

(1) Uncouple the input airpipe and the drip pipe from the oil separator and circulator, and the output airpipe from the air filter.

(2) Remove the frame containing the oil separator and air filter from the transmitter.

(3) Disconnect the oil separator from the air filter.

(4) Using a ring spanner, slacken off the hex nut on the separator dome, before removing the separator from the frame.

(5) If the hex nut does not slacken fairly easily, do not use undue force, but remove the separator from its frame and dismantle the sight glass indicator, taking care not to damage the gasket or lose any pieces which are spring-loaded. Tilt the separator until the valve pin falls out of the sight indicator feed. Using two 'G' clamps, firmly clamp the separator to the bench and remove the hex nut with the ring spanner.

(6) Remove the domed cover and the four sections of the separator, taking care to stack them in the reassembly order.

(7) Thoroughly cleanse the base with petrol and dry with a clean cloth. Flush out the interior of the separator with petrol until perfectly clean, and blow dry.

(8) From the top separator section on the stack, take the aluminium saucer, wash with petrol, and dry on a clean cloth. Reassemble the saucer into its original position with correct orientation.

(9) Fit a new 'O' ring (ring, sealing, toroidal, 5 1/2 in. Cat. No. 5300-99-915-0638) after lightly smearing with grease DEF2261 or DTD866.

(10) Take the top section from the stack of sections and press out the large felt (filter air conditioning, Cat. No. 4130-99-915-0637) and two small bleed felts (Cat. No. 5330-99-945-0238). Coming from the input end of the separator, these are likely to be heavily loaded with oil and dirt and should be discarded. Thoroughly clean the casting with petrol and dry with a clean cloth.

(11) Fit a new large felt to the casting. Proceed by working the felt first over the centre boss and then into the recess until the outside is almost flush with the casting. Fit new bleed felts by working them carefully into the two 1/2 in. holes, using a 1/2 in. diameter pin to press them level but not home tight.

(12) Reassemble the section, orientating correctly.

(13) Repeat the operations described in para. (8) to (12) until all sections have been reassembled.

(14) Dismantle the sight-glass indicator (if not already removed in operation (5)) and clean as for monthly servicing.

(15) Wash and dry the domed top, paying particular attention to the ports. Fit the top to the separator. Wash and dry the nut, check the sealing ring (ring, sealing, toroidal, Cat. No. 5330-99-943-6945) and replace if necessary. Smear the thread of the pillar, the nut and the sealing ring with grease. Fit the nut and ring, and tighten down.

(16) Reassemble the sight-glass indicator and components, fitting a new gasket if required.

(17) Reassemble the separator to the frame and the frame to the transmitter.

◄35.► The purpose of the air filter is to remove any solid particles and to absorb any moisture in the air. The air filter is normally blue. If there is moisture present, it will turn pink and the cause should be investigated (e.g. check the dehydrator in the pressurizer or see if moisture is entering the waveguide).

◄36.► The air filter does not normally require servicing more often than at three-monthly intervals. This check is best carried out when the complete ►◄ air filter assembly is removed from the transmitter. If it is found necessary to renew the absorbent filtering element (Cat. No. 4130-99-945-9131) in the upper chamber, it can be taken out by removing the upper bowl (Cat. No. 4730-99-914-7824) which is held in place by a clamp ring. The absorbent filtering element can be dried out and re-used. When dry, the colour will revert to blue.

NOTE: Since the element dries on the outside first, the colour will change before the element is dry all the way through. Be sure to allow sufficient time for the element to dry out completely. The recommended oven temperature is 150-175 deg. F.

◄37.► The sintered metal filter element (Cat. No. 4130-99-945-9132) also can be removed for cleaning by first removing the upper bowl. Wash in a cleaning solvent and blow out with compressed air. The upper and lower transparent bowls may be cleaned with petrol or paraffin.

Note . . .

No other solvents, such as alcohol, carbon tetrachloride, thinners or aromatic hydrocarbons may be used as these will destroy the bowls.

The 'O' rings (Cat. No. 5330-99-946-3687) should always be renewed when, for any reason, the unit is dismantled. When the baffle in the lower bowl assembly needs renewal, the complete lower bowl and baffle assembly (Cat. No. 4730-99-914-7823) should be returned to the manufacturer.

◄38.► If for any reason the air filter needs to be removed from the transmitter before its periodic inspection is due, the following procedure should be adopted:–

(1) Switch off the transmitter and release the air pressure.

(2) Remove the screws at the left-rear and centre-front of the air filter framework.

(3) Ease the unit to the left and disconnect the pipe and hose connectors on the right of the unit.

(4) Disconnect the coupling from the hose at the front of the unit.

(5) Remove the unit from the transmitter and service according to the instructions for three-monthly inspection.

Adjustment of the waveguide air-pressure switch.

◄39.► To ensure that the e.h.t. is not applied to the magnetron without the correct air pressure in the waveguide system, the waveguide air-pressure switch should be adjusted to open at pressures below 28 lb/in^2, as follows:–

(1) Switch off the power to the transmitter and unfasten the rubber cover over the pressure switch (Ref. No. 10E/20018) mounted below the waveguide launching section.

(2) Slide the rubber cover back and remove the screws connecting the two cables. Connect the cable ends together and insulate the join to prevent accidental shorting to earth.

(3) Fit a 4 BA x 1 in screw in the screw hole farthest from the periphery of the body of the switch.

(4) Insert a screwdriver of suitable diameter into the remaining screwhole of the switch and locate it in the slot of the grub screw at the base of the threaded hole. Besides adjustment the screwdriver provides electrical contact for this test.

(5) Connect a continuity tester between the screwdriver and the long 4 BA screw.

(6) Run up the pressurizer and check that the meter indicates continuity when normal pressure is reached. The screwdriver should be held to avoid intermittent contact due to vibration of the equipment.

(7) When the gradually-decreasing resistance reading becomes steady, check the pressure on the gauge situated on the waveguide system to the duplexer.

(8) The pressure should be 30 lb/in^2 gauge. If the reading is low, turn the grub-screw adjustment counter-clockwise by means of the screwdriver, checking for continuity after each adjustment. Repeat this procedure until the switch closes at 30 lb/in^2 gauge.

(9) If the pressure rises above 30 lb/in^2 gauge before the switch closes, turn the screwdriver clockwise until the contacts close.

(10) With the pressure switch set to close at 30 lb/in^2 gauge, reduce the air pressure by switching off the pressurizer and dehydrator and note that, when the air pressure has dropped to 28 lb/in^2 gauge, the pressure switch contacts are open. If necessary, readjust the grub-screw setting (counterclockwise), and recheck to para. (8), (9) and (10).

(11) To ensure satisfactory operation, recheck several times.

(12) Check that all power to the transmitter is switched off, then remove the test connections, screwdriver and 4 BA x 1 in screw from the switch. Reconnect the switch and refit the rubber cap.

Note . . .

As the existing pressure gauge (70 lb/in^2) is in an awkward position for this check to be carried out by one man, it is recommended that this should be removed and a pressure gauge scaled to 50 or 60 lb/in^2 be used, attached by an extension pipe to the existing meter fitting. This allows the test gauge to be arranged in a convenient position near the transmitter. The original meter should be replaced after setting-up the pressure switch.

Electromagnet coolant system.

◄40.► The coolant is fed through hoses to the transmitter and thence to the isolator from the heat exchanger (cooler, liquid, electron tube HD-188). The system is checked as follows:–

(1) Check that all hose connections and flare nuts are tight.

(2) Open the coolant valves at the heat exchanger.

(3) Set the heat exchanger circuit breaker to the ON position.

(4) Check all connections for leakage over a period of 15 minutes.

(5) Check the level of the coolant in the heat exchanger and top up as necessary. Bleed the air.

Flowtrol (fig. 2)

◄41.► The Flowtrol operates by virtue of the pressure drop across an orifice in the main flow pipe. This pressure drop actuates a bellows assembly which displaces the operating bar to the left. When the pressure drop is greater than that corresponding to a flow rate of 50 gal/hr, terminals 5 and 6 are shorted by S1. When the pressure drop is less than that corresponding to 50 gal/hr, terminals, 4 and 5 are shorted by S1. Similarly, terminals 1 and 2 are shorted by S2 when the flow rate exceeds 25 gal/hr, and terminals 2 and 3 are shorted by S2 when the flow rate is less than 25 gal/hr.

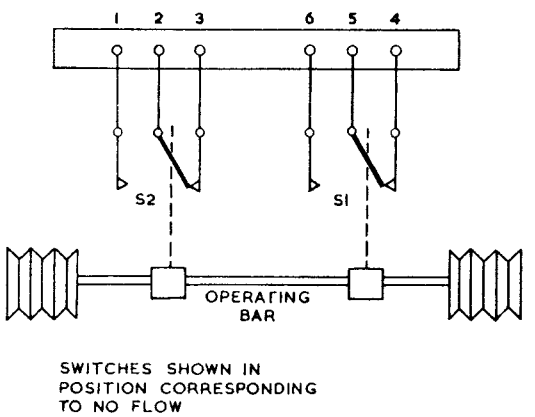

Fig.◄1► Flowtrol adjustment

To set up the Flowtrol to operate as above, proceed as follows:–

(1) Remove the cover of the Flowtrol and connect a buzzer between terminals 5 and 6.

(2) Set the restriction by adjusting the screw on the orifice unit to a height of $1\frac{1}{8}$ in from the top surface of the screw to the top surface of the orifice unit.

(3) Set the coolant flow at 60 gal/hr, slacken the two screws holding S1 microswitch mounting plate and adjust the position of the microswitch until the buzzer circuit is made. Reduce the flow gradually and check that the microswitch circuit breaks as the flow rate passes 50 gal/hr. Readjust the position of the ◄microswitch► as necessary to break the buzzer circuit at this point, and lock S1 mounting plate.

(4) Connect the buzzer between terminals 1 and 2. Set the coolant flow at 50 gal/hr and adjust the position of microswitch S2 (as with S1) until the buzzer circuit is made. Reduce the flow gradually and check that the buzzer circuit is broken as the flow rate passes 25 gal/hr. Readjust the position of the microswitch as necessary to break the buzzer circuit at this point, and lock S2 mounting plate.

(5) Replace the cover of the Flowtrol.