Group P D.C. POWER SUPPLIES

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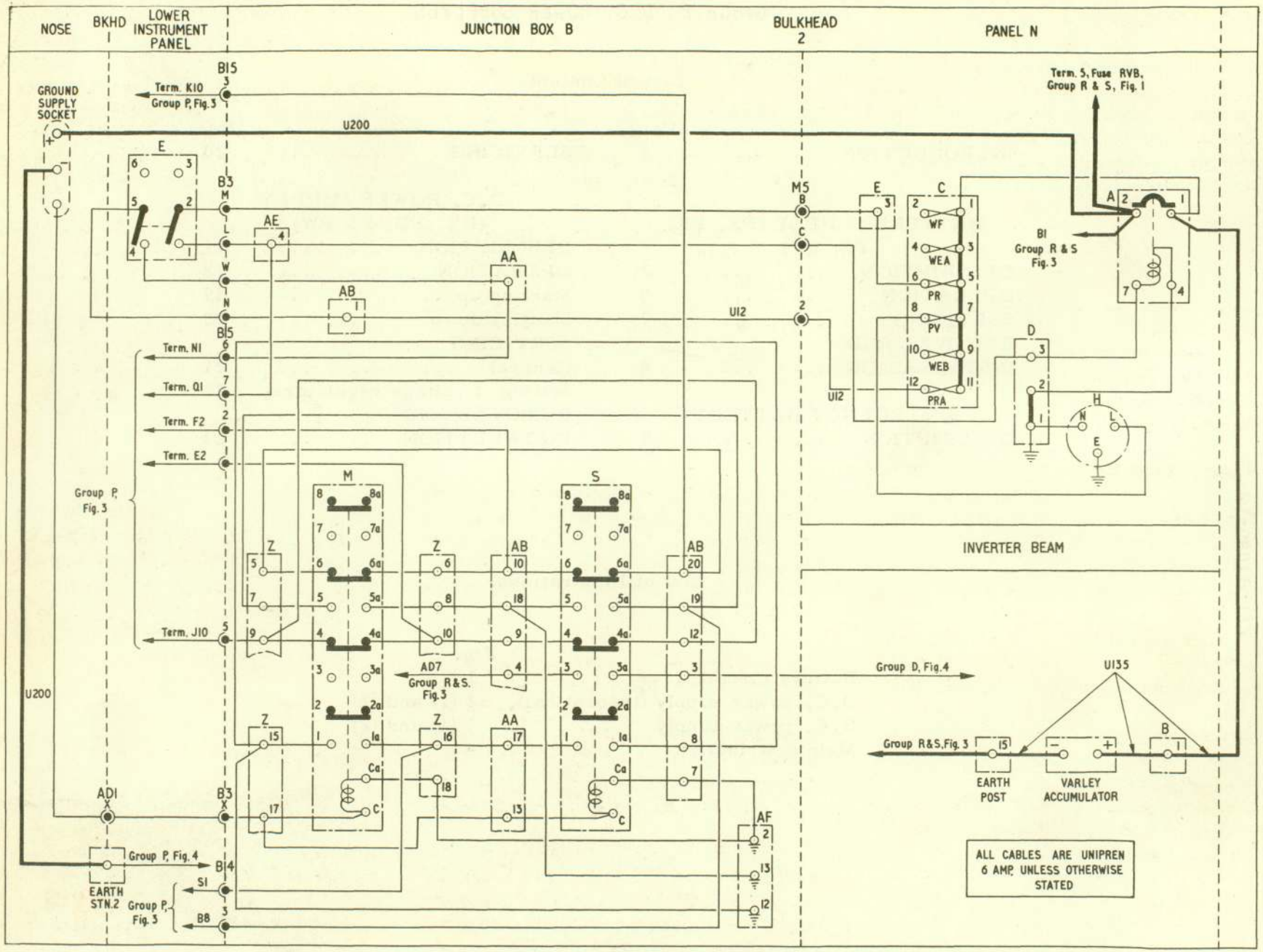

Fig. 1 Battery circuit

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INTRODUCTION

1. This group contains information relating to the battery and d.c. power circuits. Details of the individual items of equipment will be found in the appropriate specialist Air Publication listed below.

Equipment	Air Publication
Battery, Type J Ref. No. 5J/3336)	A.P.4343A, Vol.1 Sect. 11
Relay, Type R	A.P.4343C, Vol.1 Book 2, Sect. 3
Relay, Type S3	A.P.4343C, Vol.1 Book 2, Sect. 3
Emergency battery, (Nife 24-V., 0.4 amp/hr.)	A.P.4343A, Vol.1 Sect. 12
Generator Type 507	A.P.4343A, Vol.1 Sect. 3
Voltage regulator Type 94	A.P.4343B, Vol.1 Book 1, Sect. 1
Control unit Type 1B	A.P.4343B, Vol.1 Book 2, Sect. 7
Contactor Type LDA-200 (Form B.2)	A.P.4343C, Vol.1 Book 2, Sect. 3
Circuit breaker Type LEA-200 (Form B.2)	A.P.4343B, Vol.1 Book 2, Sect. 10

BATTERY SUPPLY (PE, PR, PS, PV)

DESCRIPTION

2. The aircraft battery is a single 24-volt, lead-acid type of 25 amp/hr. capacity, comprising two 12-volt units housed in a plastic outer casing. The battery is mounted in a large carrier tray in the gun bay on the forward face of bulkhead 4. This tray assembly also houses the inverter for the radar supplies, the whole assembly being known as the battery-inverter beam. The connection to the batteries is made by means of a Cannon-type two-pole plug and socket.

OPERATION (fig. 1)

3. A battery isolating switch is positioned on the lower instrument panel and controls the battery isolating relay on panel N. With the switch in the OFF position the relay is inoperative and the aircraft batteries are isolated.

4. An external 24-volt supply may be connected into the aircraft system for ground test purposes, through a three-pin plug located on the port side of the nose. The plug is protected by a hinged cover secured flush with the aircraft skin by two patent fasteners.

5. With an external supply plugged in and switched ON, the two hold-off relays M and S are energized, isolating the aircraft generator circuits and connecting a supply through closed contacts 3-3a in the hold-off relay S to energize the circuit to the R.T. and modulator cooling blowers. Under ground supply conditions a supply is available to the cooling blowers providing that the A.I. Mk.21 inverter switch is ON and that circuit breaker SFA is made (Group R & S, fig. 5).

6. Positioned on panel N is a three-pole battery voltage test socket. The supply to the socket is routed via fuse PV in fuse block C on panel N, while the earth connection is taken to terminal 1 on T.B.D. on panel N. The 3-pole socket terminals are identified, and pins N and E are linked to the earth connection.

Note...

The fire warning and extinguisher supply fuses located in fuse block C, panel N, are fed direct from the aircraft battery, by-passing the battery relay. The circuits are shown in group W fig. 2.

SERVICING

7. A check should be made for security of cable connections to the battery and at the rear of the ground connector plug. The negative heavy-duty earth connection from the ground connector is taken to an earth point on bulkhead 1.

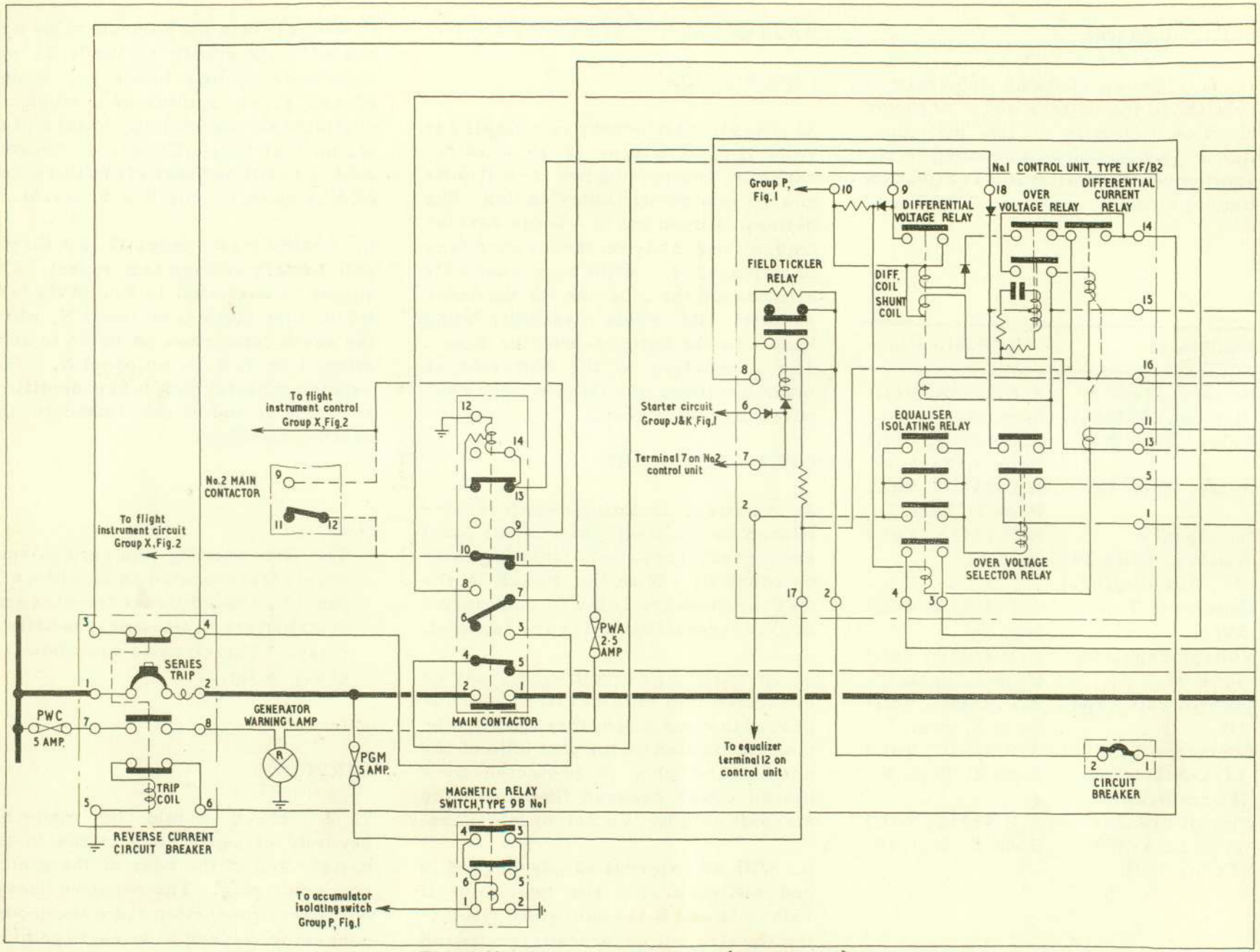

Fig.2 (1) D.c. power supply (theoretical)

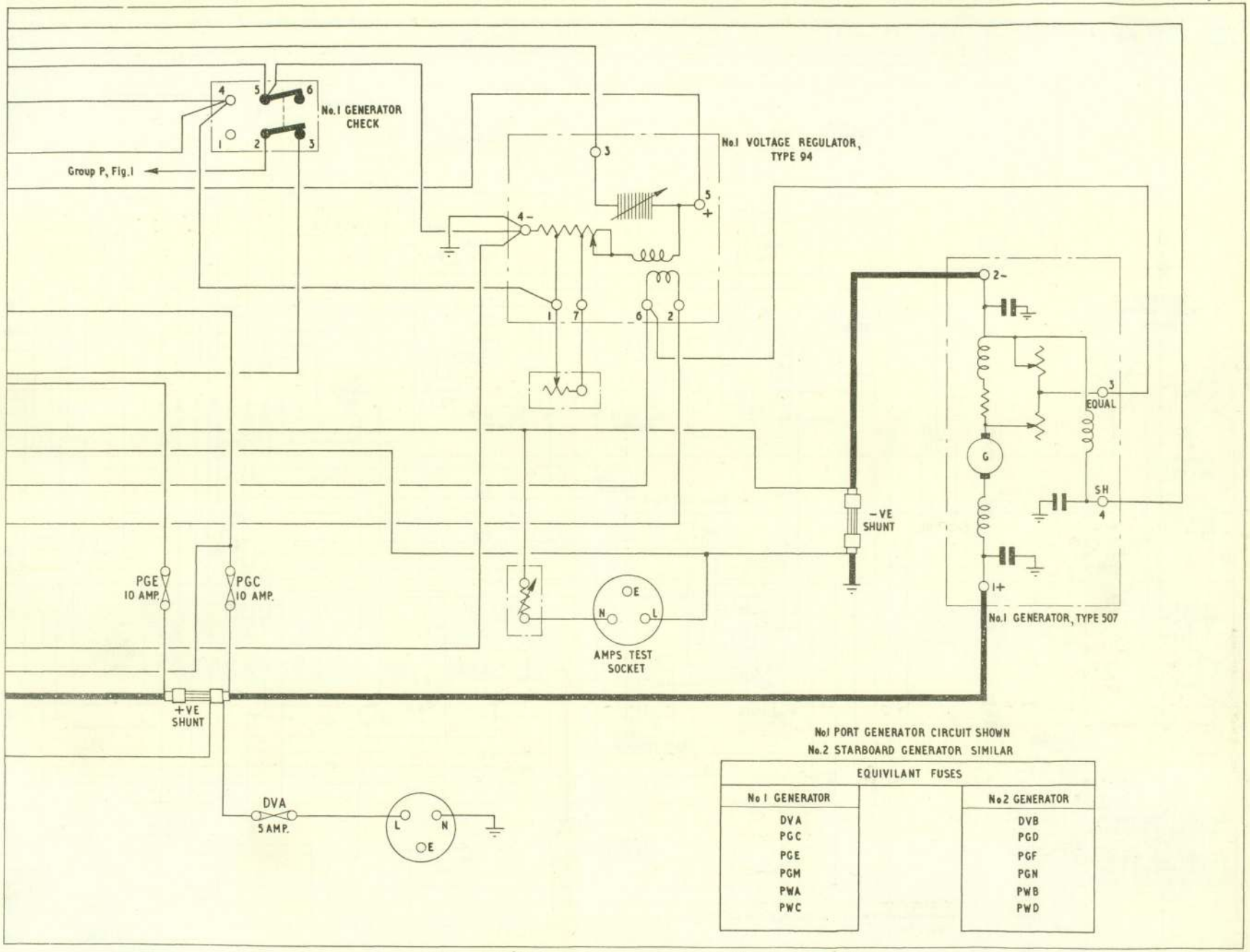

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Fig.2 (2) D.c. power supply (theoretical)

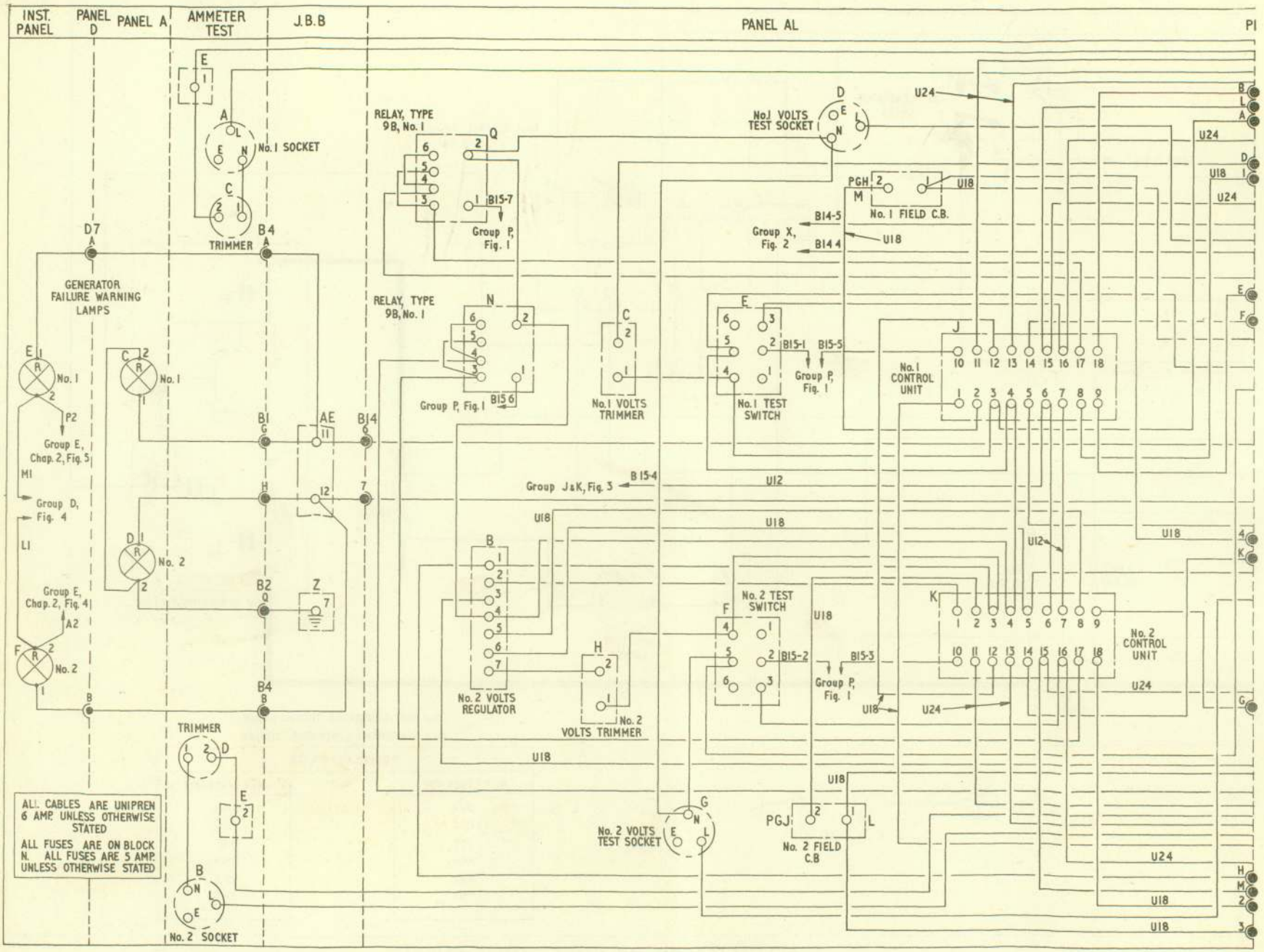

Fig. 3 (I) D.c. power supply

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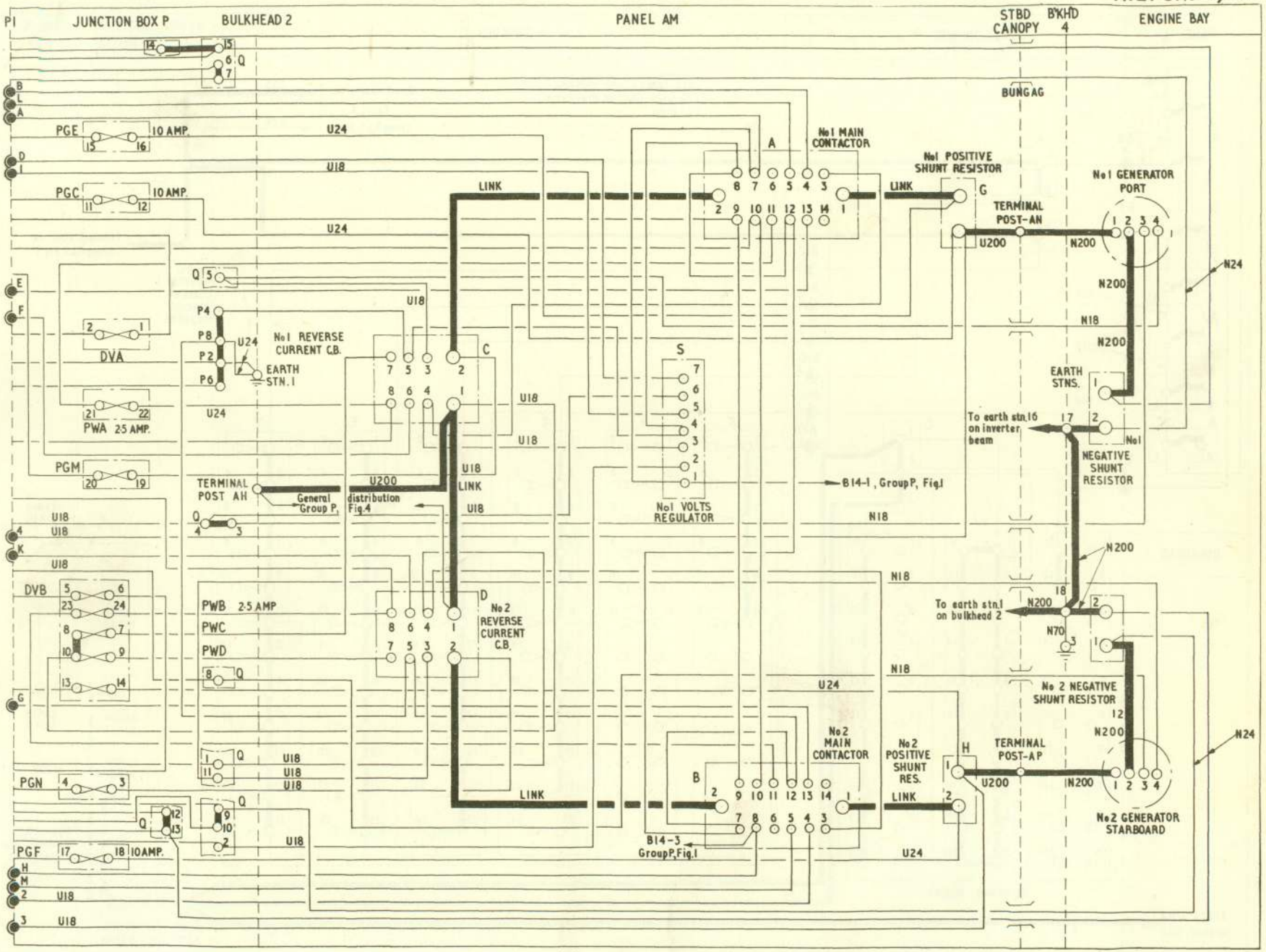

Fig. 3 (2) D.c. power supply

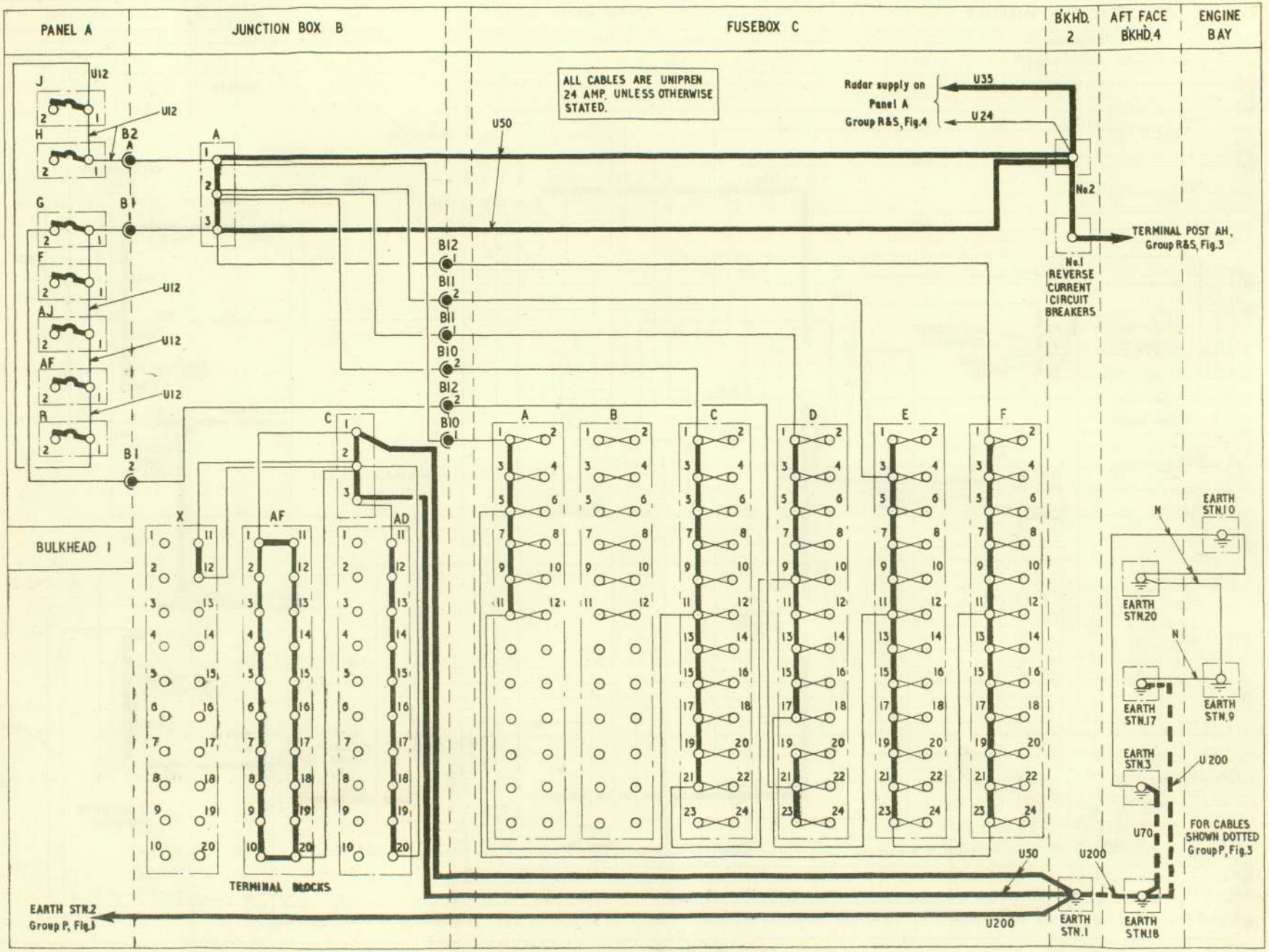

Fig.4 Main distribution

REMOVAL AND INSTALLATION

8. Access to the battery and its mounting is gained through the gun bay doors. These doors should be removed before attempting to lower the battery tray.

WARNING...

The tray assembly, with battery and inverter, forms a heavy unit requiring substantial support before lowering.

Each gun bay door is hinged at its outboard edge by three hooks which engage with hinged brackets secured to the fuselage. The doors are secured by three toggle fasteners mounted on the starboard door which engage with corresponding stirrups on the port door. Care should be taken when refitting the doors to ensure that the ducts to the radar inverter cooling system engage with the intake slots. It is recommended that the starboard side of the battery tray be lowered first by removing the two Pip-pins securing the tray to the starboard fuselage attachment. A safety catch on the starboard side continues to support the beam after removal of the Pip-pins and is released by a lever operated by the right hand thumb whilst still supporting the beam with both hands for lowering. With the starboard end of the beam lowered, the battery connections and securing bolts are accessible. The battery is secured to the tray by two hinged securing bolts which clamp to end brackets on the battery casing. The port beam end attachment has hooked ends which retain the beam in position after removal of the Pip pins on both sides and lowering of the starboard side. To facilitate easy removal of the complete beam assembly a tubular wheel barrow handle is slipped on the port end of the beam and a small wheel attachment is fitted to the starboard side; the complete beam can then be unhooked from the fuselage and wheeled away from the aircraft.

Note...

The connections at the battery must be disconnected first before attempting any disconnections at the heavy duty terminal blocks on the port side of the battery beam. Particular care should be taken to prevent any 'live' terminals or cables shorting to either the aircraft structure or the ships decking. When refitting the beam assembly, make the connections at the terminal blocks BEFORE making the battery connections.

EMERGENCY BATTERY

DESCRIPTION

9. A miniature 24-volt alkaline battery (Stores Ref. 5J/3340) is fitted as an emergency supply and will supply the two emergency lamps in the cabin and provide a supply for the turn and slip indicator. The battery positioned under the cabin false floor has a capacity of 0.4 amp/hr. A hinged panel under the pilot's left rudder pedal gives access to the battery.

SERVICING

10. The routine charging instructions for the emergency alkaline battery are as follows :-

(1) Remove the vent plugs and check the electrolyte level in every cell.
(2) Top-up where necessary with distilled water to just above plate level using a suitable small syringe.
(3) Charge the battery at 0.08 amp. until the battery voltage rises to approximately 35 volts and remains constant for 2 hours.
(4) Leave the battery on open circuit for 24 hours without replacing the vent plugs.
(5) Check the electrolyte levels and top up if necessary with distilled water.
(6) Replace the vent plugs carefully, care being taken not to overtighten.
(7) Carefully clean and dry the battery.

Note...

Batteries may be delivered filled and partly charged by the manufacturers. BEFORE these batteries are fitted in aircraft the pro-

cedure outlines for routine charging must be carried out.

D.C. POWER SUPPLY (DV, PG, PL, PW)

DESCRIPTION

11. Power is supplied by two Type 507, shunt-wound, generators, connected together in parallel. Both generators are driven by a twin-drive gearbox located in the top of the engine accessory bay. Each generator has an output of 200 amp. at 28 volts, maintained over an engine speed range of 4,000 to 10,000 r.p.m. and each is controlled by an individual voltage regulator and control unit. Generator cooling is arranged through ducting from a cowled intake aft of the cabin canopy. Special capacitors are fitted to both the main and field terminals to prevent radio interference; these capacitors are housed within the terminal box of the generator.

12. Other components used in conjunction with the Type 507 generators are as follows :-

Voltage regulator, Type 94 .. 2 off
Control unit, Type 1B .. .. 2 off
Main contactor, Type LDA-200 (Form B.4) .. .. 2 off
Main circuit breaker, Type LEA-200 (Form B.2) .. 2 off
Field circuit breaker, Type A3 .. .. 2 off
Generator failure warning lamps (fitted with dimmer screens) .. .. 4 off
Shunt resistors Type LJC-200 (Form E.2) .. .. 4 off

13. A description of the wide-speed range generating system is given in A.P.4343, Vol.1, Sect.2, while the control unit, Type 1B is described in A.P.4343B, Vol.1, Sect.7.

14. The main contactor, designed to carry a continuous current of 200 amp. across the main terminals 1 and 2, acts as a main switch between the generator and bus-bar. The operating coil has an economy winding which is brought into circuit by an auxiliary pair of contacts when the contactor is energized, thereby reducing the hold-in current required to keep the contactor closed. Additional auxiliary contacts operate subsidiary circuits of the system.

15. The main circuit breaker carries the generator output current across its main terminals. The unit provides protection for fault conditions being provided with an automatic tripping-out device under reverse-current conditions of 300 amp. or over. A manual trip button is also provided. To safeguard the system in the event of a fault occuring within the control equipment, an additional trip coil in the unit will ensure that the circuit breaker is tripped.

16. There are two sets of generator failure warning lamps, one pair positioned in front of the pilot, the other pair being located on the starboard console panel, easily visible to the observer. Both sets operate in parallel, so that, whenever a generator is not connected to the bus-bar, the appropriate warning lamp of each set will indicate this condition.

17. A test panel positioned in front of the voltage regulator units and immediately behind the pilot's head-rest, is provided with test sockets where voltage checks can be made. Also on this panel are the trimmer resistances where final adjustments can be made to generator voltage.

OPERATION

Note...

If the aircraft engine is started before the battery is switched into circuit, damage to the electrical power system may result. It is therefore essential to switch ON the aircraft battery BEFORE disconnecting the ground supply.

18. Under normal circumstances, the main and field circuit breakers and the battery isolating switch will be closed, and the generator TEST/FLIGHT changeover switch to FLIGHT. When the aircraft engine is started, both generators being driven from a common gearbox, will automatically

close on to the bus-bar. To ensure that the generator voltage builds up with correct polarity, a system of field tickling is used to supply separate excitation to the shunt fields of the generators for a period of 5 seconds during starting. Both sets of generator failure warning lamps will go out. If a warning lamp lights after starting it indicates that a fault has developed and the associated generator is no longer supplying power to the bus-bar of the aircraft system.

Starting up

19. When the engine starter push switch is pressed a circuit is completed to energize the field tickler relays for a period of 5 seconds to ensure that the generator voltage builds up with correct polarity. These relays are automatically de-energized after 5 seconds via a pair of contacts in the starter time switch. The generator voltage builds up, closing the main contactors and connecting the generator output to the aircraft bus-bar.

Shutting down

20. When the engine is shut down and the generator speed falls, the generator output drops until a reverse current is drawn from the bus-bar. When this current reaches a value within the limits 20 to 25 amp., the differential voltage relay trips, de-energizing the main contactor, disconnecting the generator from the aircraft bus-bar. The generator failure warning lamps will be ON.

SERVICING

General

21. Servicing information on the generator is given in A.P.4343A, Vol.1, Sect. 3, Chap. 14, while the majority of the other components in the generator system are covered in A.P.4343 B, Vol.1, and A.P.4343C, Vol.1. Apart from occasional trimmer adjustments at the control panels under the cabin canopy to correct small variations in generator output voltage, no special servicing is necessary apart from the routine procedure of checking security of connections and components.

Setting of voltage regulators

22. The following procedure should be carried out when setting the voltage regulators during an engine run.

(1) The aircraft battery master switch ON.
(2) Start engine and remove ground supply.
(3) With engine r.p.m. at 4,000, operate No.1 test switch on panel AL and set voltage to 28.0 volts by adjusting remote trimmer. The voltage should be checked using an approved test voltmeter, having a 0-40 volt range.
(4) Reset switch.
(5) Repeat operation (3) for No.2 test switch.
(6) At varying engine speed (min. to max.) check that voltage of each generator remains within limits 28.0 volts $\pm$ 0.5 volts.
(7) Check at varying engine speeds that generators hold on bus-bar.

Note...

On no account must the regulators be adjusted for voltage setting other than by remote trimmers. The test switches must NOT be operated in flight.

REMOVAL AND INSTALLATION

23. The top engine access panel must be removed to gain access to the two generators which are bolted to the generator drive gearbox. Cable connections are made within a screened box on the side of each generator. All the generator control equipment is positioned on anti-vibration panels in the rear of cabin canopy. Access if from the cabin, as the rear canopy is not normally detachable. These panels, complete with equipment are mounted on guide rails and can be withdrawn forward into the cabin for ease of access. It is recommended that the aircraft be rendered electrically safe prior to removal of any components in the generator system. Refer to A.P. 4320B, Vol.1, Pt.2, Sect.3, for special instructions concerning lubrication of the generator spline drive.