Chapter 1

BOMB RELEASE TEST TRUCK

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LIST OF ILLUSTRATIONS

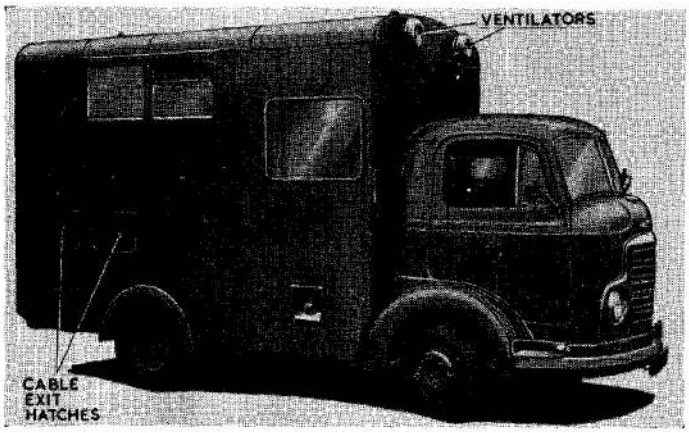


Fig. 1. Bomb release test truck

Introduction

1. The information contained in this chapter relates only to the test equipment fitted in the bomb release test truck. Information on the basic vehicle, a Karrier Bantam Mk. 5, will be found in A.P.1658D.

DESCRIPTION

General (*fig. 1 and 2*)

2. The bomb release test truck (*Stores Ref. 16A. 2160*) provides a means of functionally testing an aircraft 12/24 way or Type 11/12 bomb release system. Victor, Vulcan or Valiant aircraft systems may be checked as required, and each system may be tested in any one of a number of bombing roles. The bomb carriers are tested in the loading bay and not as part of the release system.

3. The method of testing the release system is to provide in the test truck a set of bomb carrier simulators, which take the place electrically of the aircraft bomb carriers, and to arrange that the pulses which the aircraft system would supply to the carriers are fed to these simulators. Each E.M. release on a carrier is represented in the carrier simulator by a relay, which, when operated by a pulse from the aircraft release system, supplies one of a matrix of lamps. The timing and voltage of the operating pulses is recorded on a strip of moving paper by an electronic recorder.

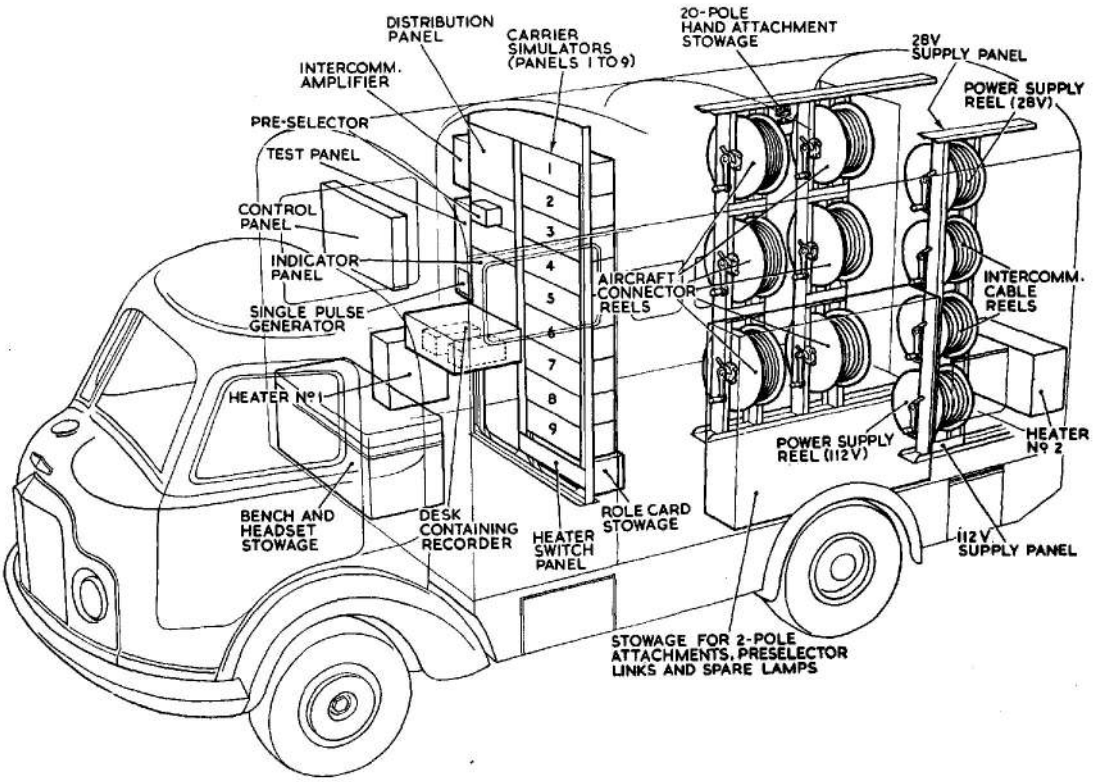


Fig. 2. Layout of equipment in the vehicle

The operation of fuzing and arm. hold-on circuits are shown on a separate matrix of lamps.

4. The test equipment is connected to the aircraft system at the 20-pole butt connectors in the aircraft bomb bay, the connecting cables being unwound from reels mounted in the vehicle. Hand attachments are provided for testing the jettison and bomb door interlock circuits. An intercomm. system is fitted, enabling the operator in the van to communicate with those in the aircraft bomb bay and cockpit. 28V d.c. supply for the test equipment and 112V supply for the space heaters in the van are provided by an electrical servicing trolley. The layout of the equipment in the vehicle is shown in fig. 2.

Carrier simulators

5. The equipment is supplied with nine identical simulators, of which only six are in use at any one time. Three are spare units. The simulators are mounted one above the other in a rack in the control compartment (*fig.* 3).

6. Each simulator contains ten relays, two switches, two indicating lamps and a rectifier and takes the form of a test box. Since each simulator relay represents an E.M. release unit, one simulator has the capacity of a 10-bomb carrier but may be pre-set to simulate a carrier with a lesser number of stations. The type of carrier simulated is determined by the setting of the CARRIER SELECTOR switch on the simulator front panel (*fig.* 4). The illumination of the green lamp above the switch shows that the switch is correctly set for a particular test.

7. It will be appreciated that, with the tiered stowage of carriers in the aircraft bomb bay, a system of interlocks exists in the aircraft whereby the stores on a lower carrier must be dropped before those from an upper carrier can be released. In the test equipment, release pulses are only allowed to the simulators representing upper carriers when those representing lower carriers are empty; i.e. the appropriate simulator relays have closed.

8. The system of interlocks between bomb stations on a carrier is not reproduced in the carrier simulator since the working of the remainder of the aircraft release system is unaffected by these interlocks.

9. The INTERLOCK/MANUAL OVERRIDE switch on the simulator front panel is provided to override the simulator circuit as a means of discriminating during a test

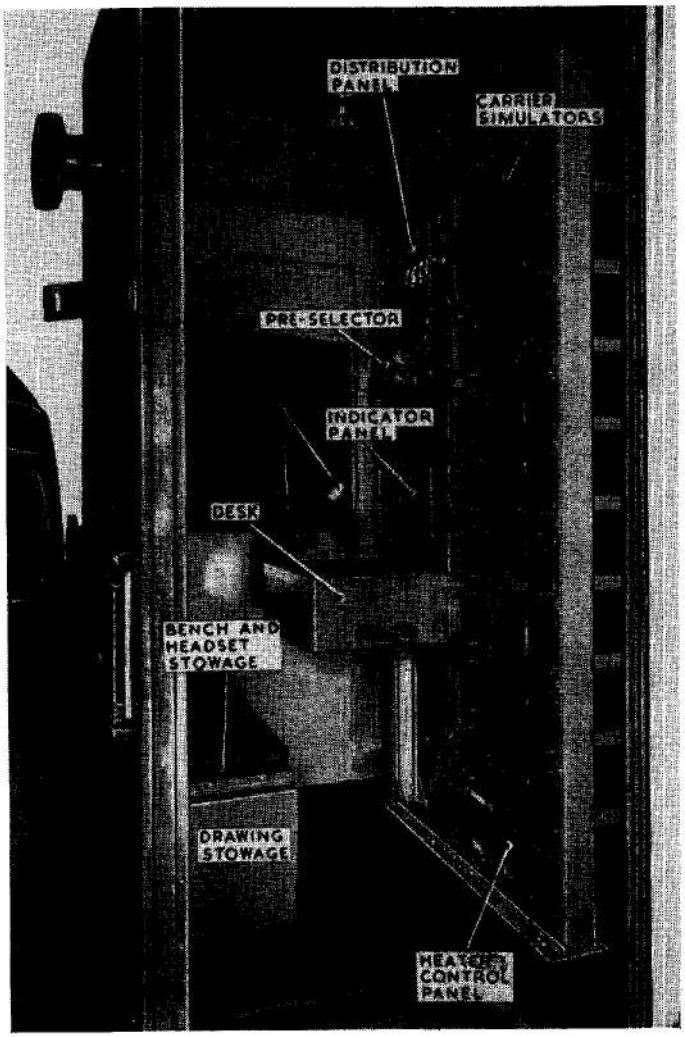


Fig. 3. Operator's position

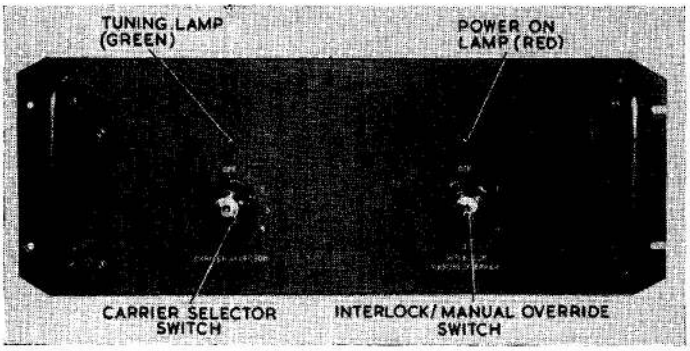


Fig. 4. Simulator front panel

between a faulty interlock or a faulty release line. The red lamp above the INTERLOCK/MANUAL OVERRIDE switch indicates 'power-on' to the simulator and will only be illuminated when the switch is in the OFF position, that is, when the simulator is fully operational.

10. Pulses received from the aircraft by a simulator, in addition to being made to operate certain relays, are also fed to the electronic recorder. Each pulse line in the simulator terminates at a "positive" plate of a multiple metal rectifier. The "negative" sides of the rectifier are commoned and the common output is routed via the distribution panel to the recorder. The rectifier prevents back feed from one pulse line to another.

Distribution panel (*fig. 5*)

11. The distribution panel distributes the signals received from the simulators to the remainder of the equipment. By its circuitry it also enables the equipment to be used for testing various roles on any of the three aircraft types.

12. Arrangement of the circuit to adapt the equipment to a particular aircraft type is by the positioning of four plugs into sockets on the front of the distribution panel. The sockets are arranged in three rows of four marked VICTOR, VULCAN or VALIANT.

13. Arrangement of the circuit to coincide with a particular aircraft bombing role is accomplished by the setting of the ROLE SELECTOR switch on the front of the panel, accompanied by the pre-setting of the relevant simulators (*para.* 6). The data required to set up the equipment in this way is etched on a set of Traffolyte plates, termed ROLE CARDS, which are stowed in a box at the base of the simulator rack. The data on a role card states the aircraft type and role, the numbers of the cables to be connected to the aircraft butt-connectors, and which lights should appear during the test. During setting up for a test the selected role card is attached to the front of the distribution panel over the role selector switch, a cut-out in the role card coinciding with the correct position of the switch for that role.

14. The pulses from each simulator which are to be fed to the recorder are routed via the distribution panel and are commoned at a bus bar in the panel, leaving by a single conductor.

15. The fuzing lines from each simulator are also routed through the distributor panel to the fuzing lamps on the indicator. The nose fuzing lines are tapped in the panel, the tapping being fed to a multiple metal rectifier with a common output. The common output from the rectifier is used to close a relay which allows the recorder to be energized. Thus the recorder may be energized once NOSE FUZING is selected in the aircraft irrespective of the number of simulators in use.

Indicator panel (*fig. 5*)

16. The indicator panel has a display of 90 lamps in the upper matrix and 36 lamps in the lower matrix. The lamps in the upper matrix, the release lamps, are the indicators of simulator relay operation and are arranged in nine rows of ten.

17. The lamps in the lower matrix, the fuzing lamps, are arranged in four rows of nine lamps each. The rows are marked ARM, HOLD-ON, TAIL FUZING, NOSE FUZING and V.T. FUZING. These lamps indicate the completion of the relevant aircraft fuzing circuit to a simulator and each lamp represents a particular simulator, No. 1 to the left and No. 9 to the right. Arm hold-on and tail fuzing lamps glow when the 12/24 way or Type 11/12 selector in the aircraft is moved away from zero. Nose fuzing and V.T. fuzing lamps will show for each carrier station when selected by the appropriate switch in the aircraft.

18. Three switches on the front of the

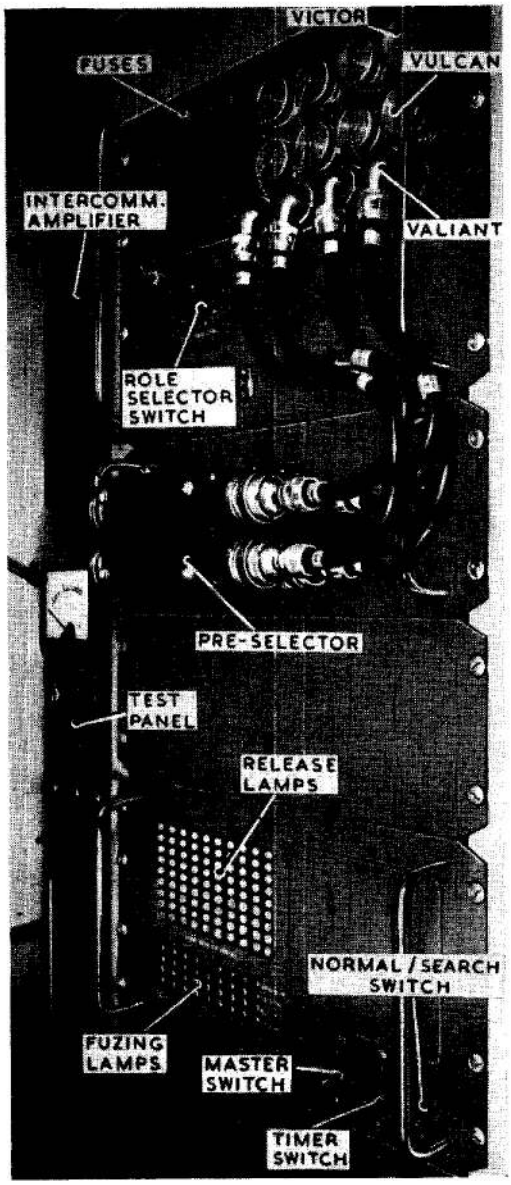


Fig. 5. Distribution and indicator panels

indicator panel are marked MASTER, TIMER and NORMAL/SEARCH. The master switch allows 28V from the servicing trolley to be applied to the equipment. The timer switch is marked SECS., OFF, M/SECS. When the switch is moved to either position from OFF the recorder will warm up. When the nose fuzing line is energized the recorder will run. The NORMAL/SEARCH switch is provided for switching off the recorder when the Type 11/12 search technique is being used to detect a " hung-up " bombslip.

100 way preselector (*fig. 5*)

19. The preselector is a standard item as fitted in the Type 11/12 installation in the aircraft and is described in A.P.4343X, Vol. 1, Sect. 3. It is designed to be fitted in the bomb release circuit between the bomb distributor and the release units and provides a means of connecting any circuit in the distributor to any release unit without alteration of the aircraft wiring. The function of the preselector in the test equipment is to reverse the pattern of release determined by the aircraft preselector so that the release lamps on the indicator panel are illuminated in sequence. The release signals to the indicator panel from the distribution panel are routed through the preselector.

Recorder

20. The recorder consists of two timers, the seconds timer for recording pulses of long duration and the milliseconds timer for recording those of short duration. The only difference between the two units is that in the seconds timer the travelling paper bearing the pulse record is geared to a slower rate ; the circuits are identical.

21. The pulses fed to the recorder (*para.* 14) are switched by the recorder relay to either the milliseconds or the seconds timer according to the dictates of the TIMER switch on the indicator panel. Both units are housed in the operator's desk (*fig.* 6), a box at its rear containing the recorder relay.

22. The travelling paper (Tele-Deltos paper) which is to bear the record is a black, graphite-impregnated, paper faced with white tissue. The paper passes, tissue uppermost, over a contact plate which is at chassis potential. The recording pen, when energised by an H.T. voltage, leaves a trace on the travelling paper by burning away the tissue immediately beneath the pen.

23. A timer (*fig.* 7) is provided with six pens but only three are used for this particular application. Of these three one is energized at 50 c/s, one at one second intervals and the third by each pulse from the aircraft release system. The 50 c/s pen receives its impulses from a tuned 50 c/s reed in the timer. The pen operating at one second intervals remains energized for $\frac{1}{2}$ second and is pulsed by a relay. This relay is operated by a contact system associated with a clock, the clock being driven

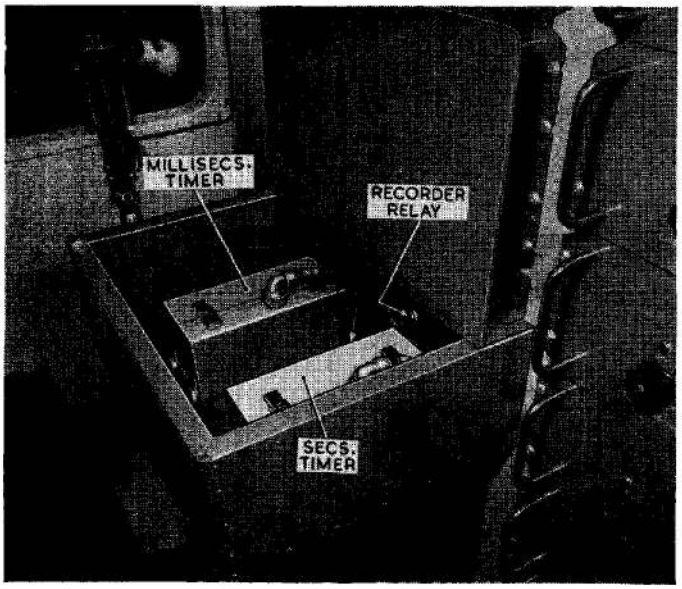


Fig. 6. Recorder

by the motor which operates the travelling paper mechanism. The pulses from the aircraft release system reach the pulse recording pen via a discriminating circuit which will pass only pulses of a certain minimum voltage. Thus the recorder will monitor both the timing and the minimum voltage of the release pulses.

Hand attachments

24. The hand attachments are provided for testing the jettison supply at each carrier station, and the bomb door interlocking circuits in both the emergency-jettison and normal-open condition. The six 2-pole hand attachments each comprise a 2-pole butt-connector fitted with a toggle-clamp and mounted on a handle incorporating an indicator lamp. The single 20-pole attachment comprises a 20-pole butt-connector fitted up in the same way but incorporating four indicator lamps. The attachments are designed to be fitted to the butt-connector in the aircraft bomb bay. The six 2-pole attachments are each fitted to a 2-pole (jettison) butt-connector and the 20-pole attachment to any one of the carrier stations to provide a simultaneous check on fuzing. During a test of the jettison and bomb door interlock circuits the lamps on the attachments are viewed by someone lying on the ground beneath the bomb bay whilst the circuits are operated.

25. When not in use the 2-pole attachments are stowed in a compartment at the side of the vehicle and the 20-pole attachment is stowed between the cable reels in a special form of stowage (*fig.* 8). The stowage comprises a fixed 20-pole butt-connector to which the hand attachment is clamped. The fixed butt-connector is electrically connected to the test panel and the arrangement provides a means of testing both the attachment and the simulator (*para.* 92). A fixed 2-pole butt-connector is also provided in the roof of the van to check the 2-pole attachments, together with a lamp socket for testing filaments.

Test panel

26. The test panel (*fig.* 9) is mounted to the left of the indicator and performs two basic functions. Its primary function is to provide a check on simulator operation and secondarily it supplies a known voltage which will serve as a datum in recorder setting-up.

27. To test simulator operation the test panel is supplied with a device which generates a single pulse, of short duration, to operate the simulator relays. The pulse thus generated is fed to the fixed 20-pole butt-connector (hand attachment stowage)

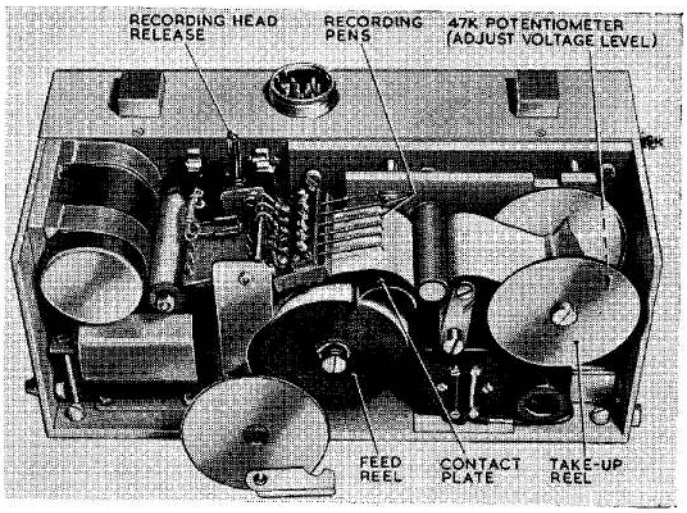


Fig. 7. Timer with cover removed

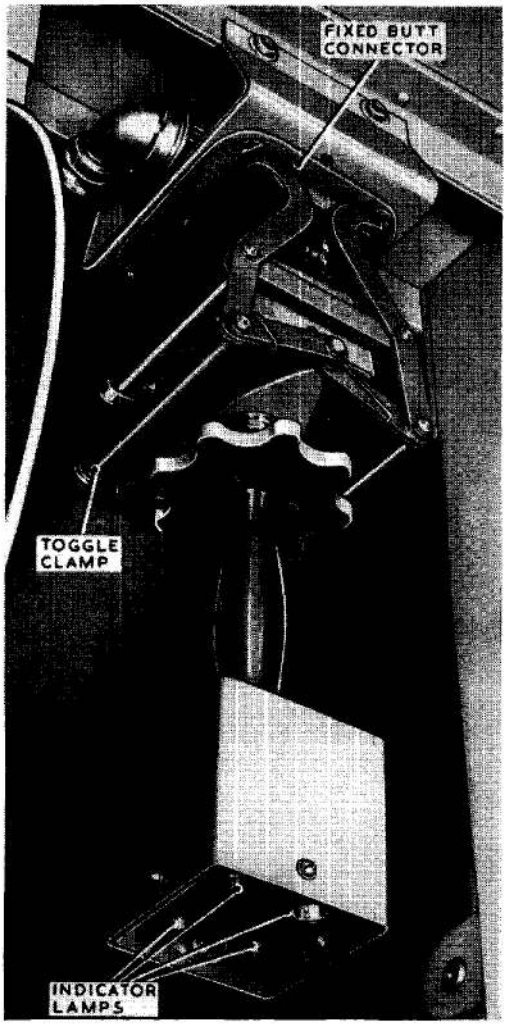


Fig. 8. 20-pole hand attachment (stowed)

in the vehicle, and the simulator to be checked is connected via its normal input connector on the cable reel to this fixed butt-connector.

28. The CARRIER SELECTOR switch on the test panel adapts the test circuit so that the pulse is transmitted to the relays appropriate to the role. Its setting corresponds to the setting of the carrier selector switch on the simulator under test.

29. The NOSE FUZING switch on the test panel substitutes for the aircraft NOSE FUZING switch and controls the switching of the recorder in the same manner (*para.* 15). The ARM. HOLD-ON, TAIL FUZING and V.T. FUZING circuits are energized all the time the master switch is closed and so the respective lamps will glow on the fuzing indicator matrix as soon as the test butt-connector makes contact.

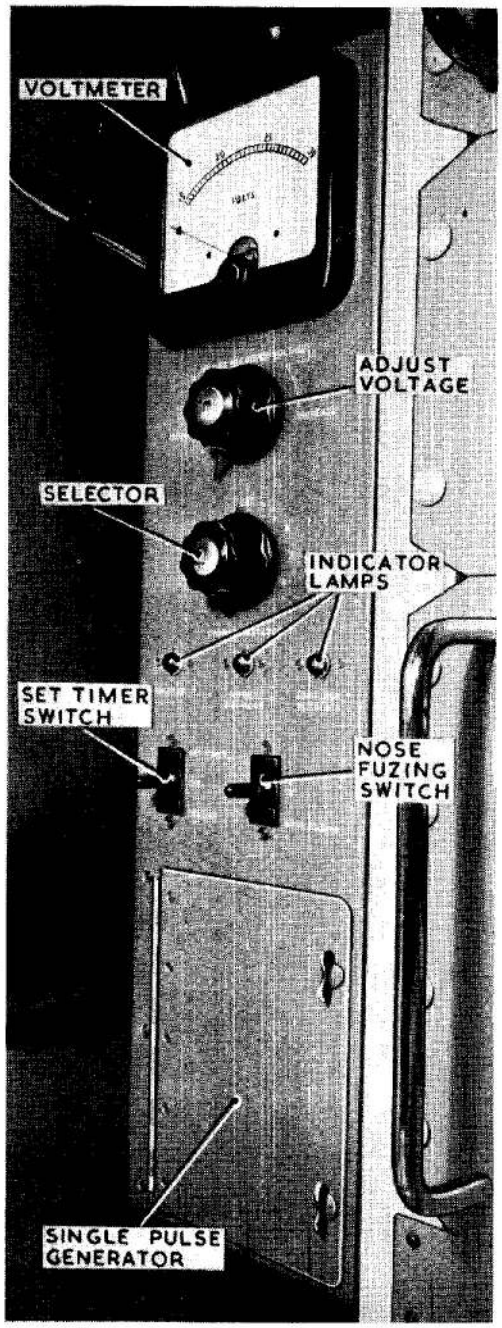


Fig. 9. Test panel

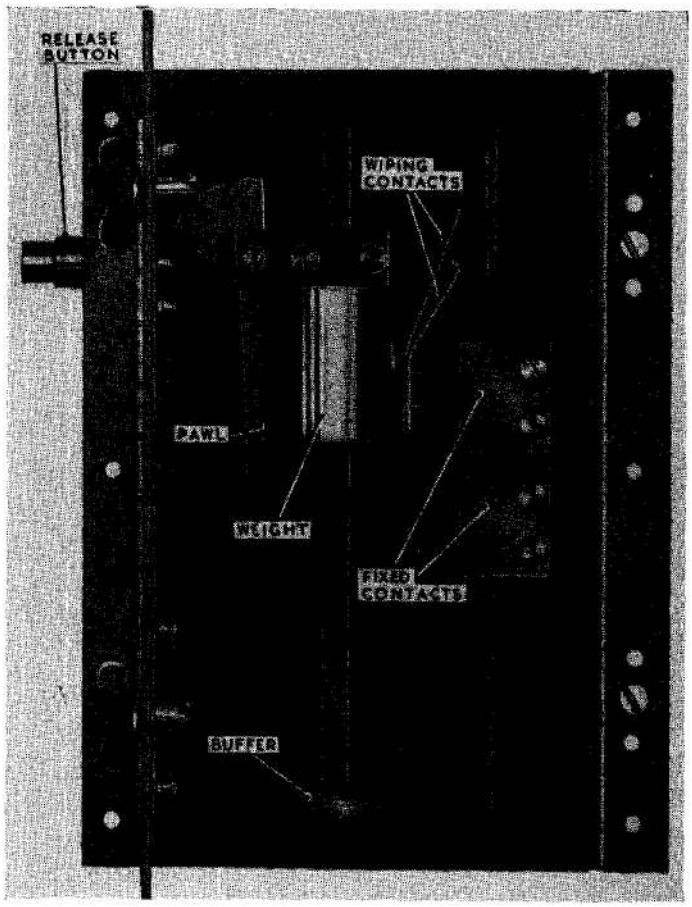


Fig. 10. Single pulse generator

30. The three lamps on the test panel are marked RELEASE, CARRIER INTERLOCK and ADDITIONAL INTERLOCK. The function of the release lamp is to indicate that the single pulse generator has operated. The second and third lamps indicate that the interlock lines through the simulator have been completed by the closing of the appropriate relays for the role selected.

31. The single pulse generator (*fig.* 10) previously mentioned, is situated in the lower portion of the test panel behind a small access door. It is a mechanical device comprising a small weight which, on being released, is allowed a free fall. As it falls, brushes attached to its side wipe against fixed contact blocks. The length and position of these contact blocks are so arranged that electrical contact is maintained for the correct period. A 15-18 m/s pulse of approximately square waveform results.

Note . . .
The contact blocks have been set by the manufacturer and no attempt should be made to adjust them.

32. The use of the test panel for setting up the recorder is confined to the supply of a metered voltage. The method of setting up the recorder is given in para. 103.

Intercomm. amplifier (*fig. 5*)

33. The intercommunication amplifier is of conventional design, the microphone input receiving three stages of amplification, the output stage comprising two pentodes in push-pull. The output transformer secondary is connected to the telephones. There are four Type 3513 sockets connected to the amplifier, two are in the control compartment of the vehicle and two at the termination of the intercomm. trailing cables to the aircraft.

34. The only external control in the amplifier is that of volume which is located on the front panel.

Interconnections

35. Interconnection between units is generally made at the rear of the racks (*fig.* 11) by plug and socket connections. Each cable and each plug and socket is numbered, the numbers appearing on the circuit and wiring diagrams where appropriate.

Cable reels (*fig. 12*)

36. The aircraft connector cables are wound on reels, the reels being numbered 1 to 6 to correspond with simulators 1 to 6. Each reel is fitted with a winding handle and locking pawl. One end of each cable is connected to its respective simulator via a fixed socket above the reel. At the other end of the cable is a 20-pole butt-connector which is fitted with a toggle-clamp to enable it to be held in contact with the carrier butt-connector in the aircraft bomb bay. The butt-connector on the cable is stowed in a compartment provided in the drum forming the centre of the cable reel. This

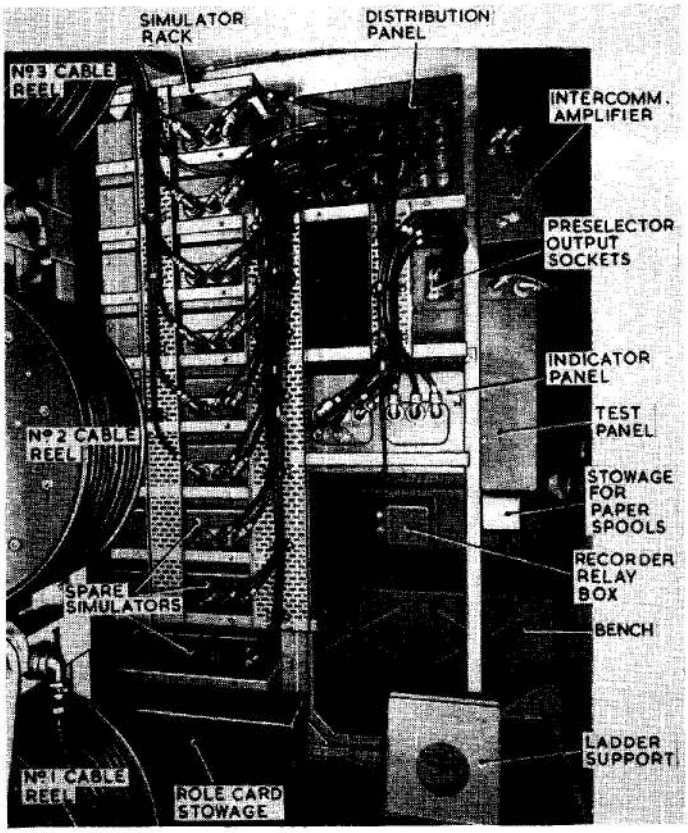


Fig. 11. Interconnections

compartment is only accessible when the cable is fully reeled out and after use the butt-connector is stowed in the drum before the cable is reeled in. The arrangement is intended to prevent the butt connector from being dragged along the ground. Hatches are provided on each side of the van, at floor level, through which the cables are led to the exterior.

37. The intercomm. and power supply cables are also wound on reels mounted on a separate rack. The two centre reels hold the intercomm. cables and the upper one the 28V and the lower one the 112V power supply. The arrangement of the cables on these reels is similar to that previously described for the aircraft connectors.

Vehicle services

38. The control of vehicle services is effected from the control panel which is mounted on the forward bulkhead of the van (*fig.* 13).

Battery charging

39. Because of the specialist nature of the vehicle it is not expected that the engine will be run for sufficiently long periods to allow the engine-driven generator to keep the battery fully charged. Consequently provision is made for the battery to receive a small charging current from the electrical servicing trolley whilst the vehicle is being used for testing.

40. Since the vehicle uses a 12 volt battery with a positive earth system and the supply from the trolley is 28 volts with a separate negative line, switching is introduced to change the polarity of the battery for charging and to isolate the earth system of the vehicle from the trolley supply. The double-pole changeover switch performing this function is mounted on the control panel and is marked MASTER SWITCH. The charging circuit includes a pre-set resistor for adjusting the current, a selenium rectifier for reverse-current protection and a charging indicator lamp.

Lamps

41. The van is fitted with two fixed ceiling lamps for general illumination and an angle-poise desk lamp ; these are supplied at 28V. The two red obstruction lamps mounted on the roof and an emergency interior lamp are supplied at 12V, either from the vehicle battery or from the 28V supply through dropping resistors.

Fans and heaters

42. Two ventilating fans are mounted on the forward bulkhead and a 400 watt heater is fitted at the side of the van close to the operator's desk. A 2,200 watt heater is mounted at the rear of the vehicle. The electric heaters are supplied at 112V from the servicing trolley. A Clayton heater is mounted under the operator's bench for use when the vehicle is moving.

OPERATION

Test procedure

43. The following generalized description

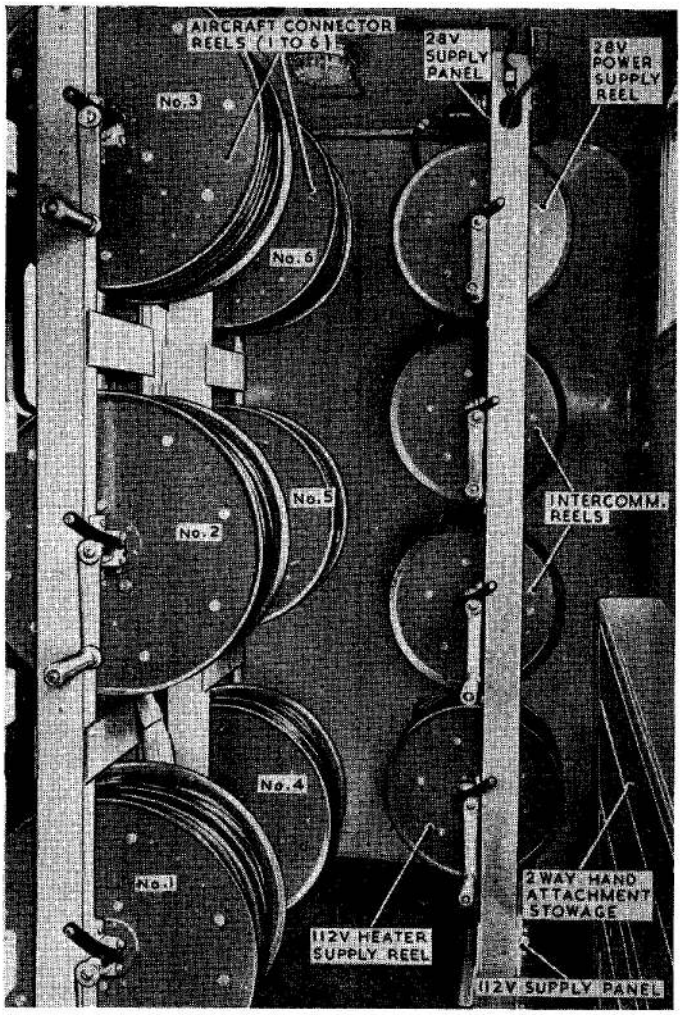


Fig. 12. Cable reels

of test procedure is published as background information. The specific test procedure applicable to an aircraft type will be found in Vol. 4 of the A.P. covering that aircraft.

44. Assuming that the aircraft is serviceable, safe for power and that 112V, 28V, and external hydraulic supplies are available, the van is positioned near the aircraft usually on the port side forward of the wing.

45. 28V and 112V supplies are connected from the electrical servicing trolley to the aircraft and the 28V power supply cable in the van is connected to the 28V trolley output. If heating is required in the van the 112V supply cable should also be connected to the trolley. The power is switched on and the van MASTER SWITCH set to CHARGE.

46. The inverter feeding the aircraft release system is switched on and the bomb doors are opened. The intercom cables are run out from the van, one to the bomb bay and one to the cockpit, and then the required role card is selected from the stowage and the release cables are run out. The release cables detailed on the role card should be run out in order, taking the lowest number first, and 20-pole butt-connectors connected to the stations used in the role to be tested. The first cable is connected to the most forward station in use, the second cable to the next station in use and so on, working towards the aft end of the bomb bay. The 2-pole hand attachments are then connected to the jettison butt-connectors.

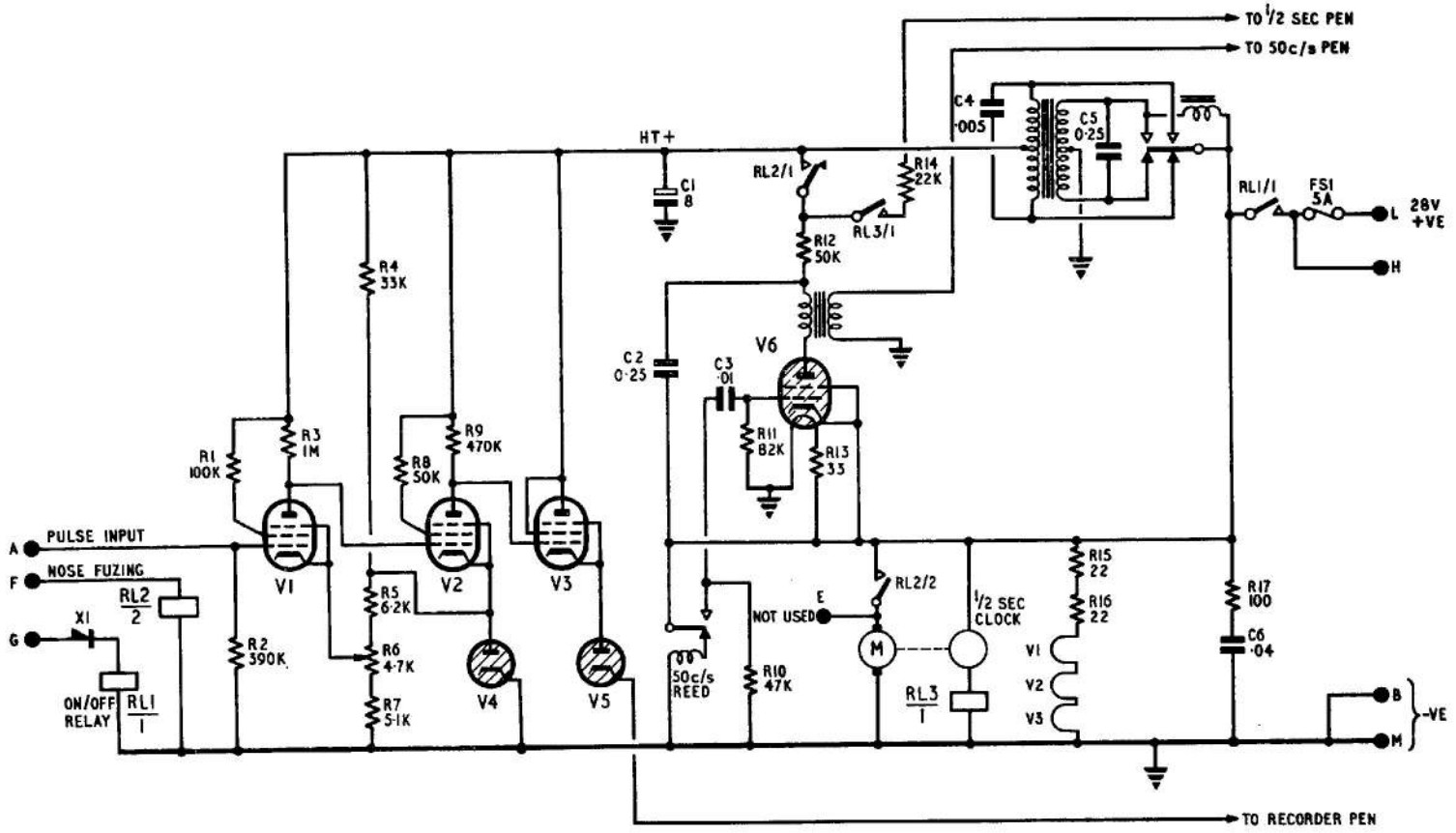
47. The preselector link for the role is fitted to the preselector in both the van and aircraft. These links are numbered and the number is the same as that on the relevant role card. For 12/24 way equipment special links are provided for the van preselector (Type C) to suit the distribution of the Type B preselector in the aircraft. The Type B preselector should be set up for the role.

48. The cables from the van preselector are connected to the correct sockets on the distribution panel for the aircraft under test. The role selector switch is set for the role and the role card fastened over the switch.

49. The equipment MASTER SWITCH, on the indicator panel, is switched on and the power on lamps should glow on all simulators. The carrier selector switch on each simulator is turned until the green tuning lamp glows.

50. Assuming that there is sufficient Teledeltos paper on the recorder reel and that the recorder is set up (*para.* 103), the equipment is ready for a routine test.

51. A check on the fuzing lines is normally



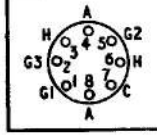
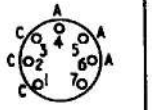
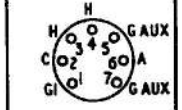
V1 V2 & V3 (CV476)	V4 (CV284) V5 (CV287)	V6 (CV797)
		

Fig. 18. Timer—circuit

second and the output from the anode is taken via a 1 : 3 transformer to the 50 c/s pen. Thus the pen will be energized with a high voltage 50 times per second and will mark the travelling paper at that rate.

Half second timing

88. The motor driving the clock mechanism is supplied from 28V. The clock contains contacts which close once per second and remain closed for half a second. These contacts are in series with the coil of RL.3 and the 28V supply. The operation of RL.3, in time with the clock contacts, switches H.T. through RL.3/1 and R14 to the $\frac{1}{2}$ second pen.

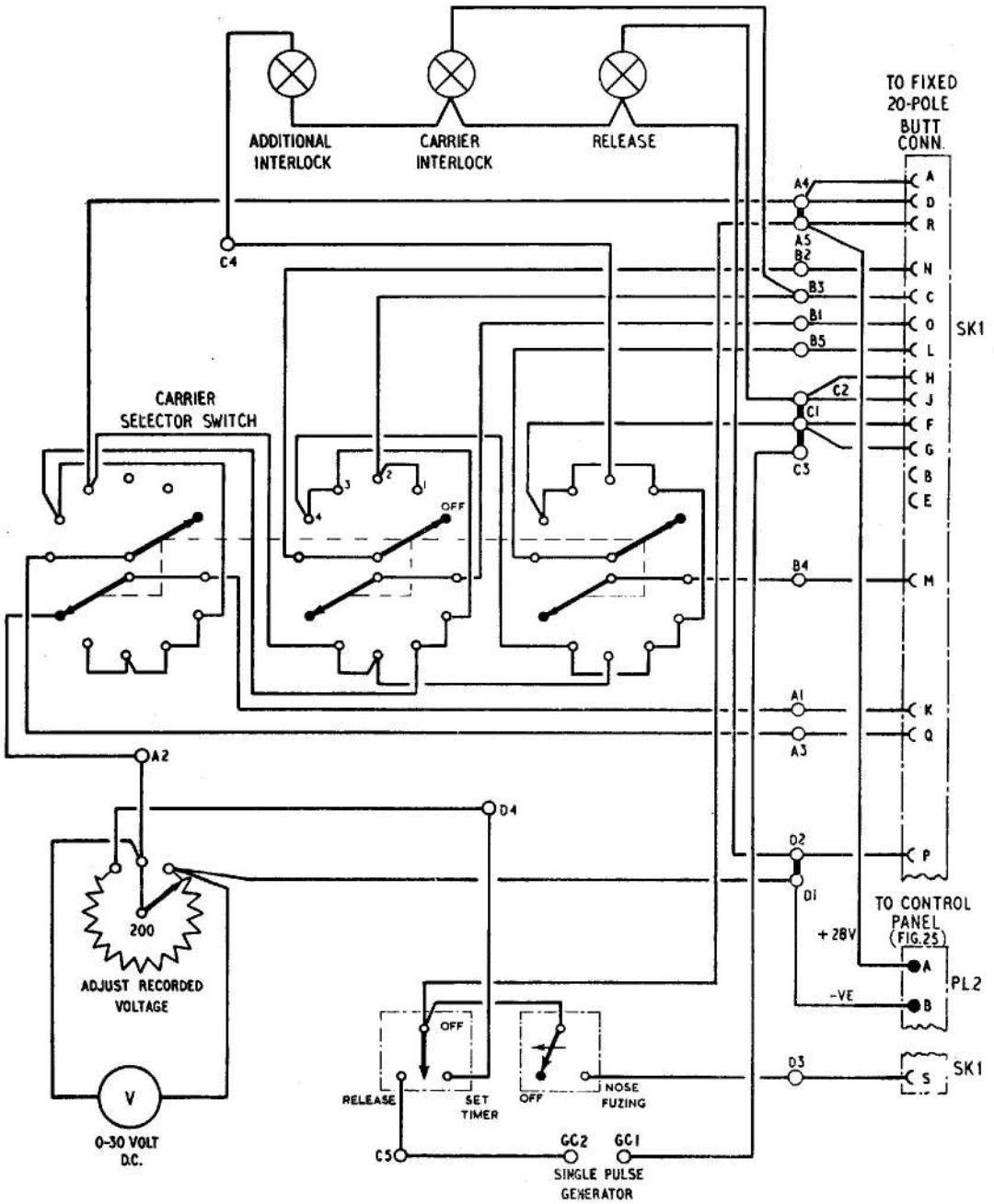


Fig. 19. Test panel—circuit

Release pulse recording

89. With no input to the pulse-recording circuit, V1 is cut off, V2 conducting and V3 cut off. V5 is de-ionized and V4 is acting as a voltage stabilizer.

90. Release pulses of approximately square waveform are applied to the grid of V1. Each pulse, if above a predetermined voltage level, causes V1 to conduct ; the level is set by RV6 and is usually 23·5V. When the leading edge of a pulse cuts on V1, the resulting fall in V1 anode potential lowers the potential on V2 grid sufficiently to cut off V2. The anode of V2 thus rises to H.T. potential, as does the grid of V3. The high resistance afforded by V5 causes V3 cathode potential to rise steeply. This high voltage on V3 cathode is sufficient to cause V5 to ionize and a current to flow through the series circuit formed by the contact plate, paper, pen, V5 and V3.

91. The trailing edge of the release pulse cuts off V1 and V1 anode rises to H.T. cutting on V2. The resulting drop in potential at V2 anode cuts off V3 interrupting the current to the pen. The circuit remains in this condition until the leading edge of the next release pulse arrives at the grid of V1. The pen thus records the duration and timing of the release pulses.

Test panel *(fig. 19)*

Connections

92. The test panel outputs from SK.1 are applied to Pl.1 of the simulator to be tested via the 20-pole fixed butt-connector, to which is connected the aircraft connector from the simulator. The power supplies for the test panel are from the vehicle services control panel.

Potentiometer

93. The potentiometer is supplied via the SET TIMER switch, and the metered output is taken via the OFF contacts of the CARRIER SELECTOR switch to pole K of SK.1 and thence to pole K of Pl.1 on the simulator. The metered voltage is thus fed to the recorder via release 5 of the simulator in circuit.

Release

94. The operation of the single pulse generator (*para.* 31) connects GC2 to GC1 for the period of the pulse. With the SET TIMER/RELEASE switch in the RELEASE position a positive pulse is fed to poles F, G, H, J of SK1, corresponding to releases 1 to 4 of the simulator in circuit. At the same time the release lamp is illuminated for the pulse period and, depending upon the setting of the CARRIER SELECTOR switch on the panel, other release lines are pulsed.

Note . . .

The CARRIER SELECTOR *switch on the panel will be set to the same position as the* CARRIER SELECTOR *switch on the simulator in circuit* (*para.* 106 (7)).

Fuzing

95. The V.T. fuzing, arm, hold-on, and tail fuzing lines are energized via poles A, D and R respectively of SK.1 and the nose fuzing line is energized via the NOSE FUZING switch.

Intercomm. amplifier *(fig. 24)*

96. The 250V H.T. is provided by a rotary transformer supplied at 28V from the vehicle services control panel. The output of the transformer is smoothed by the choke C12 and C13. The valve heaters are supplied in series/parallel from the 28V supply, R20 and R21 providing the necessary voltage adjustment.

97. The microphone inputs (M+ ; M—) to the amplifier are applied across the primary winding of the isolating transformer T1. The output from the secondary of T1 is applied to the grid of pentode V1 (which is strapped to operate as a triode) via coupling capacitor C1. Automatic bias is provided for the valve by R7 de-coupled by C5 ; R3 operates as the grid leak. The amplifier output from the anode of V1 appears across VR1 in series with the grid leak R8. The centre-tap of VR1 is connected to the grid of V2a and thus VR1 acts as a volume control. Automatic bias for V2a is provided by R11, de-coupled by C8. The amplified signal from the anode of V2a is applied, via coupling capacitor C7, to the grid of the phase-splitter V2b. The signal current through this valve produces signal voltages across R16 and R17 which are equal in magnitude but in anti-phase with one another. These signal voltages are applied to the grids of V3 and V4 connected in push-pull and produce unidirectional current changes in the primary winding of T2. The output from T2 secondary is applied to the telephones. C3 and C6 are anode de-

coupling capacitors, acting as a low impedance path for the signal voltages and preventing them from appearing in the H.T. supply.

Vehicle services *(fig. 25)*

98. With no external supply connected to the supply panel, the S3 relay remains unoperated so that when the MASTER SWITCH is in the NORMAL position the vehicle battery is able to supply the Clayton heater and the obstruction and emergency interior lamps. A 12V supply is also taken to the test point.

99. When the external 28V supply is connected S3 relay closes and the vehicle battery is isolated from the remainder of the circuit, all services except the test point and the Clayton heater receiving a supply from 28V. The emergency and obstruction lamps (12V lamps) are fed via 13 ohm dropping resistors

100. When the MASTER SWITCH is switched to CHARGE the vehicle battery receives a charge from 28V supply via : the rectifier (acting as reverse current protection), the charging warning lamp, preset resistor and fuse. The charging current is normally set to 1 amp.

112V heaters (fig. 20)

101. The 112V supply from the electrical servicing trolley to the vehicle serves the two heaters as shown in the circuit diagram. The supply is not used for any other service.

SERVICING

General

102. Apart from a periodical check on the minimum operating voltage of the recorder, servicing work should be required only when a fault is known or suspected.

Setting up the recorder

103. To set up the recorder for minimum operating voltage each timer is set up separately. The procedure for each timer is the same and is as follows :—

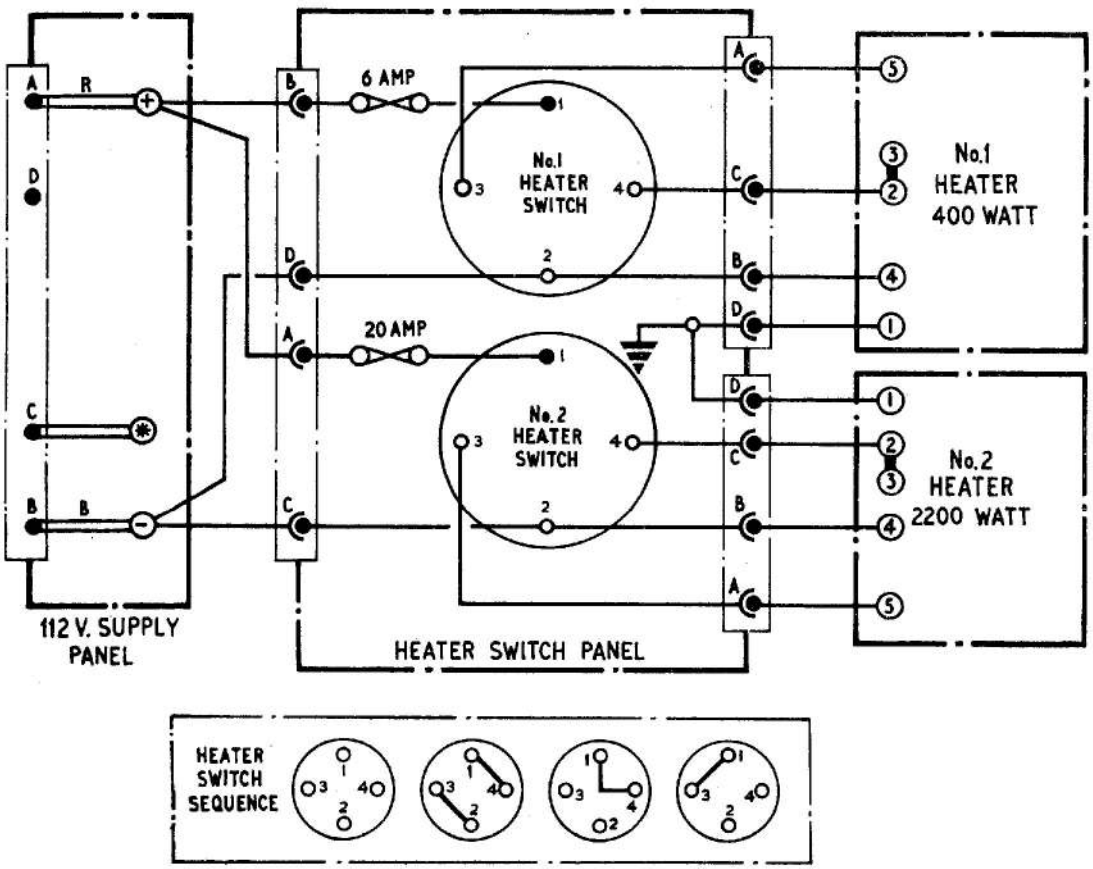


Fig. 20. Interior heaters—circuit

(1) Remove the cover from the timer to be set.
(2) Set the pens to the recording position.
(3) Connect simulator 1 to the fixed 20-pole butt connector (*fig.* 8) using the connector from cable reel 1.
(4) Switch on the equipment MASTER SWITCH on the indicator panel.
(5) Allow at least one minute for the timer to warm up.
(6) Close the SET TIMER switch on the test panel and set the CARRIER selector switch on the test panel to OFF.
(7) Turn the potentiometer knob on the front of the test panel until the voltmeter on the panel reads 23·5V.
(8) Close the NOSE FUZING switch on the test panel and hold closed. The pulse recording pen should record. If it does not, adjust R6(47K) until recording commences.
(9) Release NOSE FUZING switch.
(10) Set the test panel voltage to 23V and close the NOSE FUZING switch. The pen should not record.

Note . . .
The adjustment of R6 should be such that the timer will not operate at 23V but will operate at 23·5V and above.

Functional testing of a simulator

104. When conducting a simulator test with the test panel the equipment is set up in the normal way, a particular role being selected and the CARRIER SELECTOR switch on the simulator set to illuminate the tuning lamp. The aircraft connector from the simulator is connected to the fixed 20-pole butt-connector forming the hand attachment stowage. The test panel outputs will thus be applied to the simulator in the same way as those from the aircraft and the simulator should operate according to its position in the role selected.

105. Since the release pulse from the test panel is applied to all the relevant simulator releases simultaneously, the indicator panel lamps will not operate in a time sequence. In addition, the pattern of lamp operation will not be easily identifiable due to the van preselector distribution. However the number of indicator lamps showing should accord with the number of stations on the carrier being simulated.

Note . . .
The test is confined to the operation of the simulator as part of the role selected, e.g. if the simulator is representing a five bomb carrier in the selected role it will only be tested as such.

Procedure

106. To conduct a simulator test proceed as follows :—

(1) With the external power supply connected attach the 20-pole butt-connector on the cable reel from the simulator to be tested to the fixed 20-pole butt-connector.
(2) Select a role on the ROLE SELECTOR switch such that the simulator under test will represent the type of carrier for which it is required to be tested.
(3) If the fuzing circuits are in order the V.T. fuzing, arm. hold-on, and tail fuzing lamps on the indicator panel should glow. (The test panel is supplied with 28V as soon as the external supply is connected.)
(4) Switch off the TIMER switch on the indicator panel and test the nose fuzing circuit by closing the NOSE FUZING switch on the test panel. The nose fuzing lamp should glow.
(5) Switch off the INTERLOCK/MANUAL OVERRIDE switch on the simulator.
(6) Switch on the equipment MASTER SWITCH on the indicator panel and note that the red lamp on the simulator glows.
(7) Turn the CARRIER SELECTOR switch on the simulator until the green lamp glows, and turn the CARRIER SELECTOR on the test panel to the same position.
(8) Ensure that the weight in the single pulse generator is in the poised position.
(9) Set the release switch on the test panel to RELEASE.
(10) Press the release button at the side of the single pulse generator. The release lamp should glow momentarily and there should then be a light showing on the indicator panel for each bomb station simulated. The CARRIER INTERLOCK and ADDITIONAL INTERLOCK lamps on the test panel may come on together or singly or not at all, according to the position of the CARRIER SELECTOR switches on the simulator and test panel, as follows :—

Switch position 1—Carrier interlock only.
Switch position 2—Both.

Switch position 3—Carrier interlock only.

Switch position 4—Neither.

(11) Turn the CARRIER SELECTOR switch on the simulator to OFF.

(12) Turn the CARRIER SELECTOR switch on the test panel to position 1 and the INTERLOCK/MANUAL OVERRIDE switch on the simulator to position 2. The CARRIER INTERLOCK lamp should glow.

(13) Turn the CARRIER SELECTOR switch on the test panel to position 2 and the INTERLOCK/MANUAL OVERRIDE switch on the simulator to position 2. The CARRIER INTERLOCK lamp should again glow.

(14) Turn the INTERLOCK/MANUAL OVERRIDE switch on the simulator to position 1. The ADDITIONAL INTERLOCK lamp should glow.

(15) Turn the CARRIER SELECTOR switch on the test panel to position 3 and the INTERLOCK MANUAL OVERRIDE switch to position 3. The CARRIER INTERLOCK lamp should glow.

(16) Switch off the MASTER switch on the indicator panel and return the weight in the single pulse generator to the poised position.

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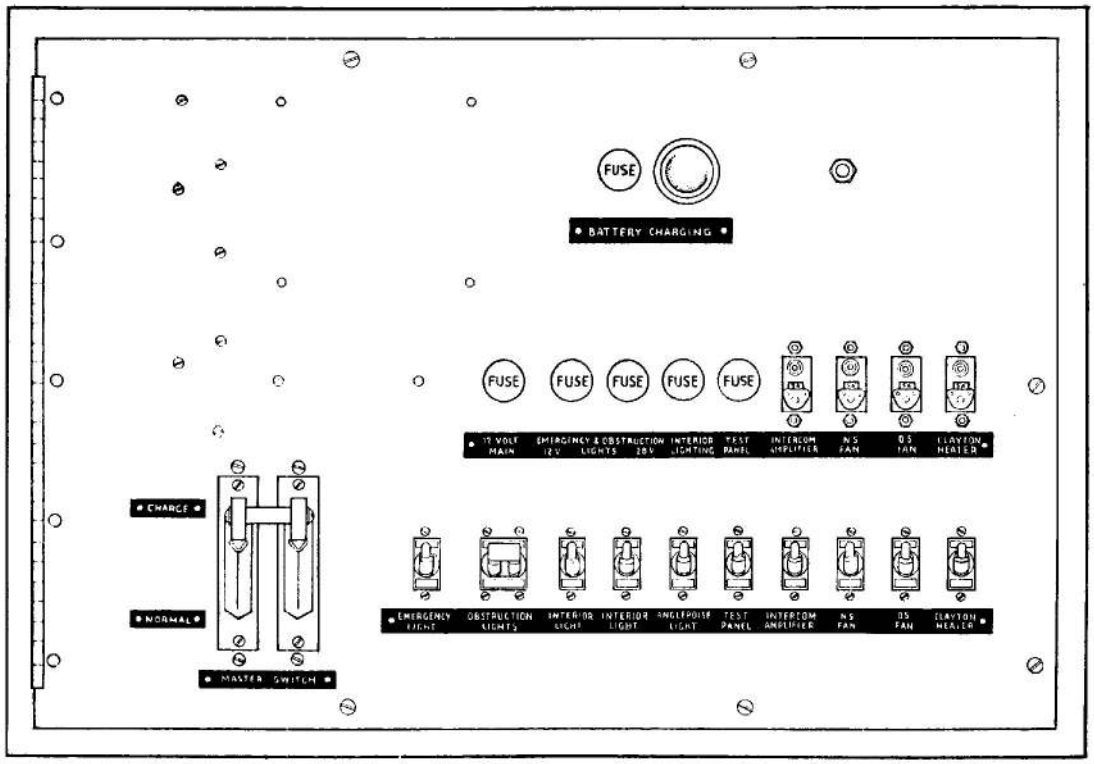

Fig. 13. Vehicle services control panel

the first operation and for this the recorder is switched off at the TIMER switch on the indicator panel. The arm hold-on and tail fuzing lamps should glow as soon as a selection is made in the aircraft on either (a) the bomb aimer's panel with 12/24 way equipment or (b) the switch selector and indicator with Type 11/12 equipment. The operator in the aircraft selects NOSE AND TAIL and V.T. fuzing and the appropriate

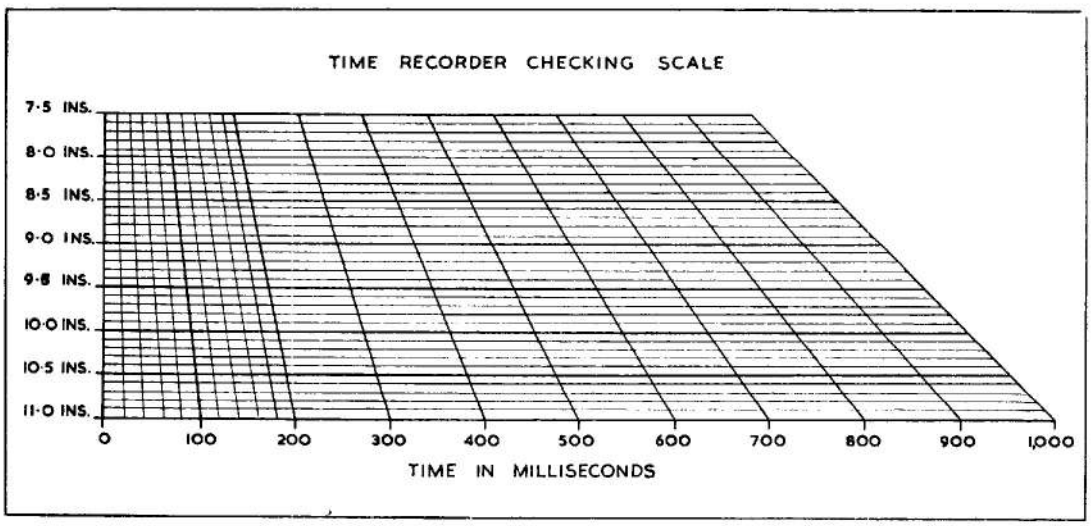

Fig. 14. Recorder checking scale

lamp should glow on the indicator panel in the van. V.T. fuzing is switched off and TAIL fuzing selected when the tail fuzing lamps alone should glow.

52. A preliminary check of release operation is conducted by setting the bomb spacing selector to 600 millisecs and pressing the bomb firing button. The release lights on the indicator panel should appear in sequence. The bomb distributor is reset in the aircraft. The test equipment in the van is reset by switching the equipment MASTER SWITCH to OFF and then to ON. The recorder is switched to either SECS or MILLISECS, depending on the length of pulse required, and a period of at least one minute allowed for the timer to warm up.

53. The bomb spacing unit is set to the required time setting, NOSE AND TAIL fuzing is selected followed immediately by the pressing of the firing button. As soon as the release is completed, TAIL fuzing is selected. A check is made to ensure that the correct release lamps are showing, as detailed on the role card, and the test equipment is again reset. The Tele-deltos paper in the recorder is examined, the pulse length is checked using dividers or the recorder checking scale (*para.* 57), and the serviceability of the release system assessed. The actions detailed in this para. are repeated for other time settings as required and then the test equipment is switched OFF at the MASTER SWITCH and the inverter feeding the release system is switched OFF.

54. A jettison test is normally the final item and is conducted for both ' live ' and ' emergency ' conditions. The live jettison check should be made from both the blind and visual positions, the lamps in all the 2-pole hand attachments should glow at each check.

55. When testing the emergency jettison circuit it is important, for the safety of personnel, that the test procedure is followed which applies to the type of aircraft under test. A generalised description of the procedure is therefore not given here but the necessary information will be found in the Volume 4 of the relevant aircraft handbook.

56. After a test the power supplies are disconnected and the van MASTER SWITCH set to NORMAL. This latter action reconnects the vehicle battery into the vehicle electrical circuit and if neglected then subsequent attempts to start the vehicle engine will prove fruitless.

Interpretation of the record

57. The record shows the release pulses as black lines, of length proportional to the pulse period. Alongside the release pulses is a series of dots at 20 millisecond intervals and beside these is a series of lines each proportional to $\frac{1}{2}$ second in time. The pulse length and period may be checked in two ways.

(1) By the use of dividers to compare the pulse length with the distance between the 20 milliseconds dots.

(2) By the use of the recorder checking scale (*fig.* 14). The scale is transparent and is used in the following manner :—With the scale placed over the record so that the $\frac{1}{2}$ second line is parallel to the horizontal lines on the scale, a horizontal line on the scale is selected which corresponds in length to the distance between the *start* of one $\frac{1}{2}$ second line on the record and the *start* of the next. This line forms accurate 1 second base from which the pulse period can be read.

CIRCUIT

General

58. The block diagram of the test equipment is shown in fig. 15. The circuit is described by units in the following paragraphs.

Carrier simulators (*fig. 21*)

Supplies

59. The 28V d.c. power supply to each simulator is fed through socket 3. The positive from pole A supplies the lower positive rail directly and is connected to the upper positive rail via the OFF contacts of the INTERLOCK/MANUAL OVERRIDE switch. The lower positive rail feeds the lamp-operating contacts of the relays whilst the upper rail feeds through the 150 current limiters, the relay hold-on contacts.

60. With the INTERLOCK/MANUAL OVERRIDE switch OFF and the upper positive rail energized, the red power-on lamp is illuminated. This indicates both that the simulator is ' on ' and that none of the auxiliary contacts is shorted.

Release

61. The release pulses to the simulator are brought in on Pl.1. As a release pulse is fed to its respective relay, the relay closes and

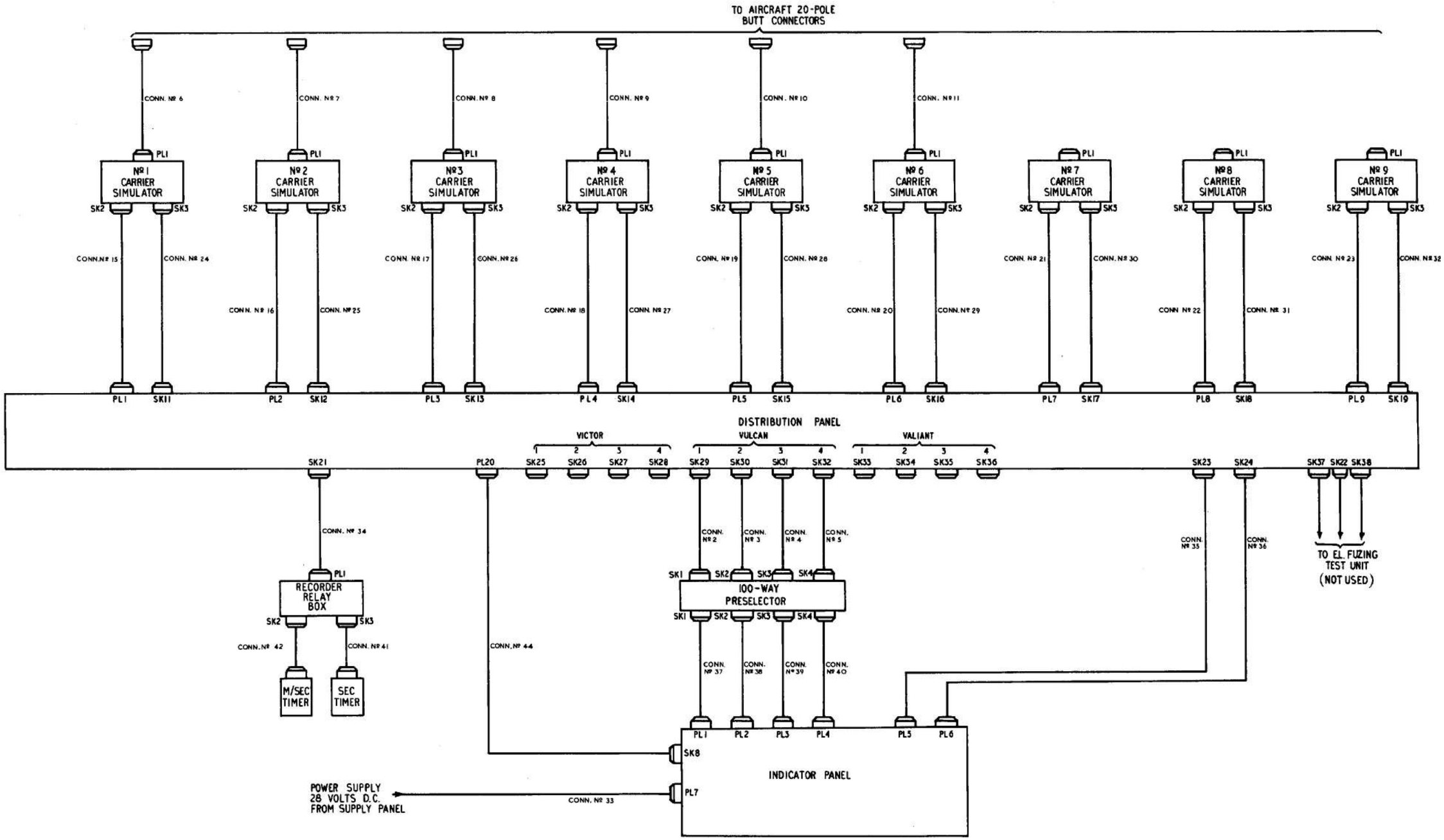

Fig. 15

Aircraft test equipment – block diagram

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Fig. 15

(A.L. 1, Oct. 57)

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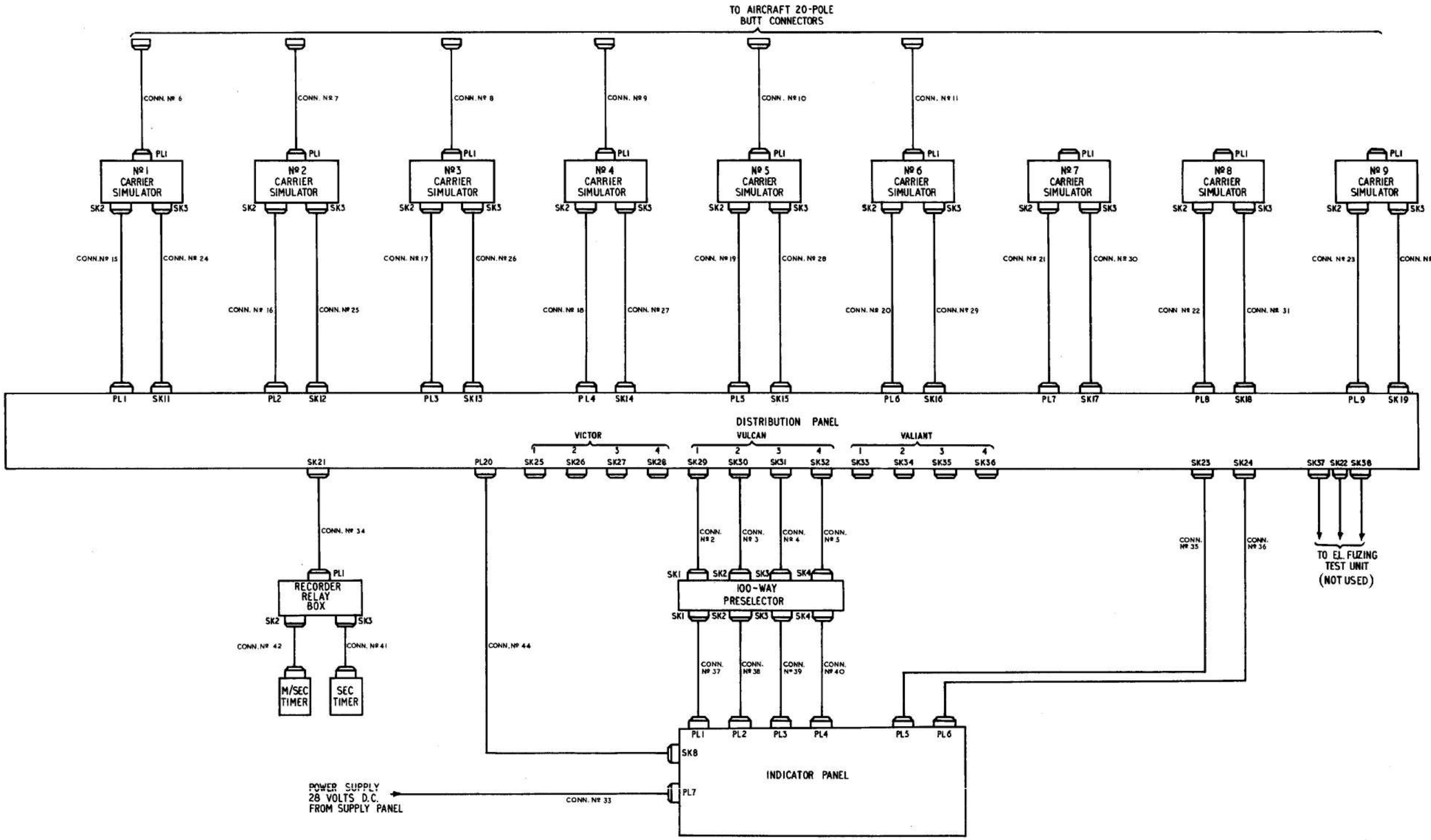

Fig.15

Aircraft test equipment – block diagram

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Fig.15

(A.L.1, Oct.57)

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is held closed by the current through the hold-on contacts. The lamp-operating contacts close and the supply from the lower positive rail is thus fed, via Sk.2 and the distributing circuit in the distribution panel, to an indicator lamp.

62. The release pulses are also fed from the input plug Pl.1, via one section of the multiple rectifier, to pole C of Sk.2 and thence via the distribution panel to the selected timer.

Fuzing

63. The fuzing lines to the simulator also arrive at Pl.1 and are connected directly to the output socket Sk.2.

Carrier interlock

64. The interlocking between simulators representing upper and lower carriers is accomplished by the circuit in which the relay auxiliary contacts are connected. This circuit can be re-arranged by the CARRIER SELECTOR switch. Fig. 16 shows, in diagrammatic form, the interconnections of the auxiliary contacts for the Valiant 21 × 1,000 lb. role. In this role simulators 2 and 4 represent the two upper 3 bomb carriers and simulators 1, 3 and 5 the three lower 5 bomb carriers. When relays 3, 4 and 5 in simulator 3 have been operated by release pulses, the auxiliary contacts will be closed and will allow a positive to the auxiliary contacts of the relays in simulators 1 and 5. When these simulators are 'empty' the interlock relays in the aircraft will close and simulators 2 and 4, representing the upper carriers, will be connected to the release lines.

Interlock override

65. The function of the interlock override is also shown diagrammatically in fig. 16. Its purpose is to enable the operator to distinguish between a faulty interlock circuit and a faulty release.

66. The switch positions 1, 2 and 3 of the INTERLOCK/MANUAL OVERRIDE switch (*fig.* 21) are to adapt the override to the type of carrier simulated as follows :—

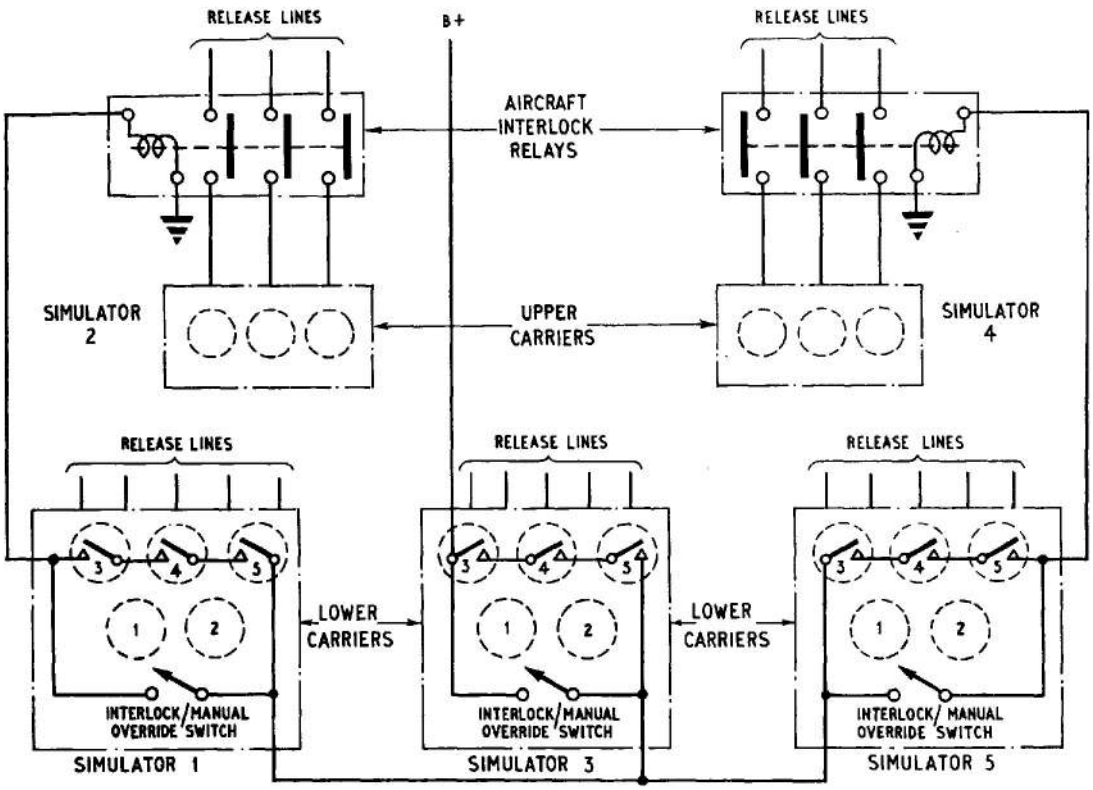

Fig. 16. Interlocking between carrier simulators

(1) Position 1 : Special requirement. Overrides the additional interlock on RL4 and connects pole L to pole M (Pl. 1).

(2) Position 2 : 3, 5 and 7-bomb carriers. Connects pole N to pole O (Pl. 1).

(3) Position 3 : 9-bomb carriers. Connects pole Q to pole C (Pl. 1).

Carrier selection

67. The selection of a simulator to represent a particular type of carrier is accomplished by the setting of the CARRIER SELECTOR switch. The function of the first six sections of this switch (wafers 1, 2 and 3) is to arrange the auxiliary contacts in series in such a way that, when the required number of relays have closed, the circuit to the aircraft interlock is completed. The following table gives the connections for representative carriers ; the letters in the first column accord with those on Pl.1 of the simulator. Thus the use of the table in conjunction with fig. 31 will enable individual circuits to be traced.

68. *Tuning.* The function of the seventh section of the CARRIER SELECTOR switch (wafer 4) is to feed 28V to the green ' tuning ' lamp. For any particular role, only one of the studs on this section is live (the setting of the ROLE SELECTOR switch in the distribution panel will determine which stud receives the supply) so that if the CARRIER SELECTOR switch is turned to this position, the ' tuning ' lamp will glow.

69. Simulators which are not in use during a particular test receive a 28V supply to pole E of Sk. 3, which corresponds to the OFF position of the switch.

Distribution panel (*fig. 22*)

70. The simulator outputs which are in the form of supplies to the release and fuzing lamps and pulses to the recorder, are fed into the distribution panel on plugs 1 to 9 (corresponding to simulators 1 to 9).

71. The supplies to the release lamps (poles

Pole number		*Service carried*		
Mk. 4 *plug and socket*	20-*pole butt-connector*	3 × 1,000 *lb. carrier*	5 × 1,000 *lb. carrier*	7 × 1,000 *lb. carrier*
A	1	V.T. Fuzing	V.T. Fuzing	V.T. Fuzing
B	2	E.L. Fuzing	E.L. Fuzing	E.L. Fuzing
C	3	—	—	—
D	4	Arm. hold-on	Arm. hold-on	Arm. hold-on
E	5	Air burst	Air burst	Air burst
F	6	—	Release 1	Release 1
G	7	—	Release 2	Release 2
H	8	Release 1	Release 3 (via 1)	Release 3
J	9	Release 2	Release 4 (via 1 & 2)	Release 4 (via 1)
K	10	Release 3	Release 5 (via 2)	Release 5 (via 1 & 2)
L	11	Carrier int. 2	Carrier int. 4	Release 6 (via 2 & 3)
M	12	Carrier int. 2	Carrier int. 4	Release 7 (via 3)
N	13	Carrier int. 1, 2 & 3	Carrier int. 3, 4 & 5	Carrier int. 4, 5, 6 & 7
O	14	Carrier int. 1, 2 & 3	Carrier int. 3, 4 & 5	Carrier int. 4, 5, 6 & 7
P	15	Earth & neg.	Earth & neg.	Earth & neg.
Q	16	—	—	—
R	17	Tail fuzing	Tail fuzing	Tail fuzing
S	18	Nose fuzing	Nose fuzing	Nose fuzing
	19	—	—	—
	20	—	—	—

F to O on each plug) are distributed via terminal blocks within the panel to the three sets of four sockets on the panel front (Sk.25 to Sk.36 inclusive). The distribution to the four sockets marked VICTOR accords with the distribution of releases from the preselector in the Victor aircraft system. Similarly the distribution to the sockets marked VULCAN and VALIANT accords with the distribution of releases from the preselector in these aircraft systems.

72. The release pulses to be fed to the recorder enter the distribution panel on pole C of sockets 1 to 9. All the lines from poles C are commoned at a terminal block (D on the diagram). The common line is then routed via the NORMAL/SEARCH switch in the indicator panel to pole E on Sk.21 and thence to the recorder relay and to the selected timer.

73. The supplies for the fuzing and arm. hold-on lamps (poles A, D, R and S) are routed directly to the indicator panel via Sk.23 and Sk.24. The E.L. fuzing lines are connected to Sk.37 and Sk.38; this service is not used. The nose fuzing lines are tapped from TB.4, on the right of the diagram, the tapping being taken through the rectifier to the coil of the relay. When any or all of the nose fuzing lines are energized, the relay will operate and cause H.T. to be switched on in the selected timer.

Role selection

74. The role selection circuit in the distribution panel directs a supply to the green tuning lamp on all the simulators via their respective CARRIER SELECTOR switches (*para.* 68). Each of the nine sections of the ROLE SELECTOR switch serves a particular simulator; section 1 feeds simulator 1, section 2 feeds simulator 2 and so on. The interconnections between the switch studs is so arranged that, for any selected role, each simulator showing a green light is correctly set to represent the carrier required.

Preselector

75. The preselector is connected into the test circuit in the reverse way from the normal. The four cables from the appropriate sockets on the distribution panel (VICTOR, VULCAN, VALIANT) are connected to the normal output sockets on the preselector (those marked TO BOMB STATIONS) and the four sockets marked TO BOMB DISTRIBUTOR are connected to plugs 1 to 4 at the rear of the indicator panel.

76. The aircraft preselector so arranges the output of the bomb distributor that the carrier simulators receive the release pulses in the dropping order. The van preselector reverses this arrangement and its output is delivered in sequence to poles A to Z of Sk.1, followed by poles A to Z of Sk.2 and so on.

77. The link fitted to the van preselector always provides an identical circuit to that fitted to the aircraft preselector. A set of these links is provided with the equipment plus special links to adapt the Type C preselector to the 12/24 way equipment in the Valiant.

Indicator panel (*fig. 23*)

Release lamps

78. The release lamps are fed from plugs 1 to 4 in sequence as explained in paras. 75 and 76 above. The numerical sequence of lamp operation makes the functioning of the release system easier for the operator to follow although complicating the job of tracing a faulty release. If each lamp were to represent a particular release relay, then the order in which the lamps lit would be different for each role and would be extremely difficult for the operator to follow.

Fuzing lamps

79. The arm, hold-on, nose, tail and V.T. fuzing lamps are fed from plugs 5 and 6 and are supplied, via the simulator in use. Immediately a selection is made in the aircraft on either (a) the switch selector and indicator, for Type 11/12 equipment or (b) the start/stop selector, for 12/24 way equipment, a supply is fed to arm hold-on and tail fuzing lamps.

80. The fuzing lamps unlike the release lamps, each represent a service from a particular simulator. Thus in each case the L.H. lamp will always be operated through simulator 1 and the lamp second from the left through simulator 2, etc.

Switching

81. The three switches on the indicator panel control circuits outside the panel. The MASTER SWITCH applies 28V to the distribution panel. The TIMER switch operates the recorder relay (*para.* 82) and

the NORMAL/SEARCH switch, when in the SEARCH position, interrupts the release pulses to the timer.

Recorder relay and timer switching (*fig. 17*)

82. The switching of power supplies and release pulses to either the secs of the millisecs timer is achieved by the recorder relay. The relay is operated by the TIMER switch on the indicator panel. In its unoperated position the recorder relay feeds the milliseconds timer and in its operated position it feeds the seconds timer.

83. Of the top pair of contact sets in the relay the L.H. set switches the 28V from the nose fuzing line to the selected timer and the R.H. set switches the release pulses to the selected timer.

84. The two lower contact sets supply the timer on/off relay (RL.1, *fig.* 18). In the unoperated position (millisecs), the 28V from the millisecs side of the timer switch, which is brought in on pole A of Pl.1, is fed to pole G and RL.1 of the millisecs timer. In the operated position (secs) the contacts perform a double function. The supply is switched by the timer switch from pole A to pole C (Pl.1) and to the relay operating coil. A tapping from the positive side of the relay coil is switched by the lower contact set both to RL.1 in the seconds timer and also back to pole A of Pl.1. The purpose of supplying pole A whether the selection is SECS or MILLISECS is to operate the "recorder on" lamp. This lamp is connected between the millisecs contact of the timer switch and negative (*fig.* 23) so that when MILLISECS is selected the lamp is supplied directly from the switch, and when SECS is selected the lamp is supplied via the recorder relay.

Timer (*fig. 18*)

85. The timer is initially switched on by the operation of RL.1 which allows the supply from pole L to be applied to the power pack, to the 50 c/s tuned reed, and via dropping resistors to the heaters of V1, V2, V3 and V6. The timer is thus allowed to warm up prior to the selection of NOSE FUZING in the aircraft, which action causes RL.2 to be operated. The operation of RL.2 switches H.T. to V6 and 28V to the clock motor.

86. The circuit may be considered as three independent sections:—50 c/s timing, $\frac{1}{2}$ second timing, and release pulse recording.

50 c/s timing

87. The tuned reed supplies 28V to the grid of V6 at a frequency of 50 pulses per

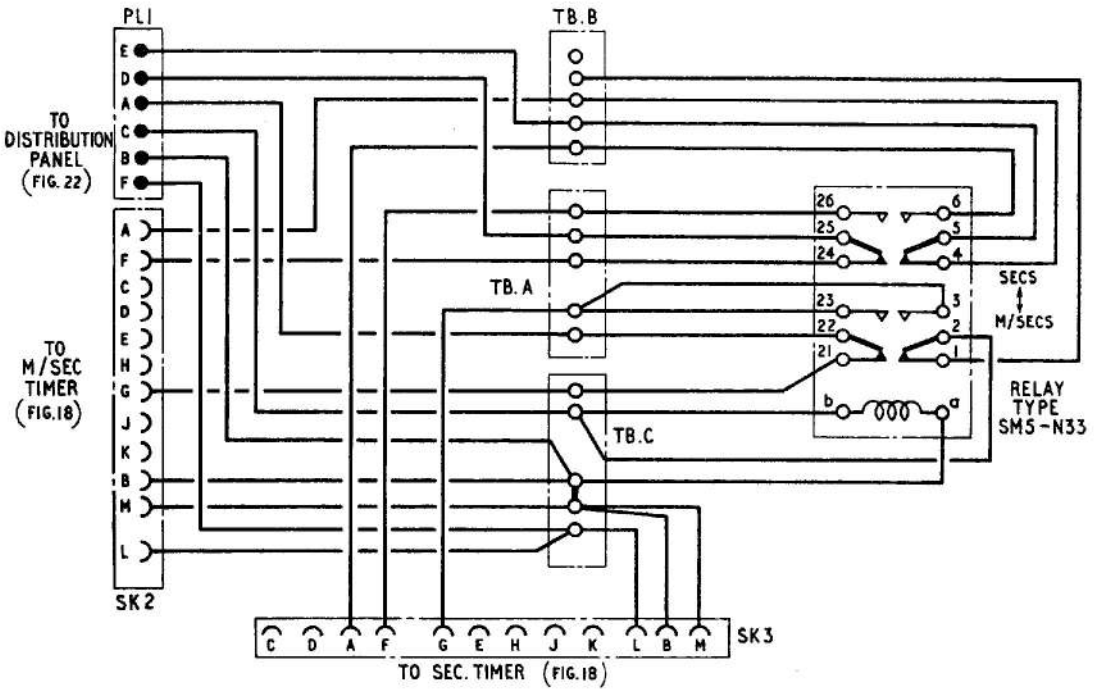

Fig. 17. Recorder relay—circuit

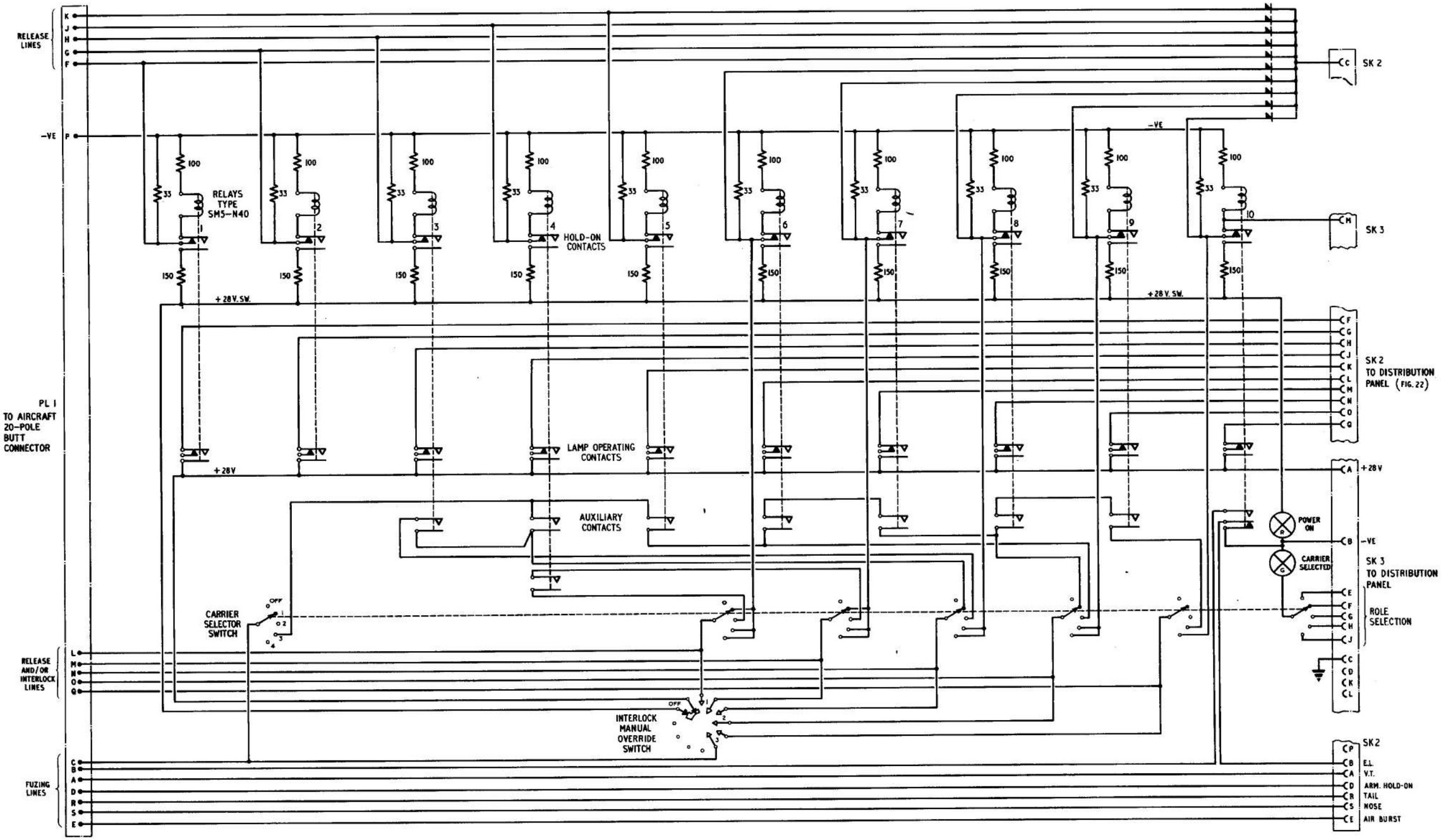

Fig. 21

Bomb carrier simulator – circuit

Fig. 21

(A.L. 1, Oct. 57)

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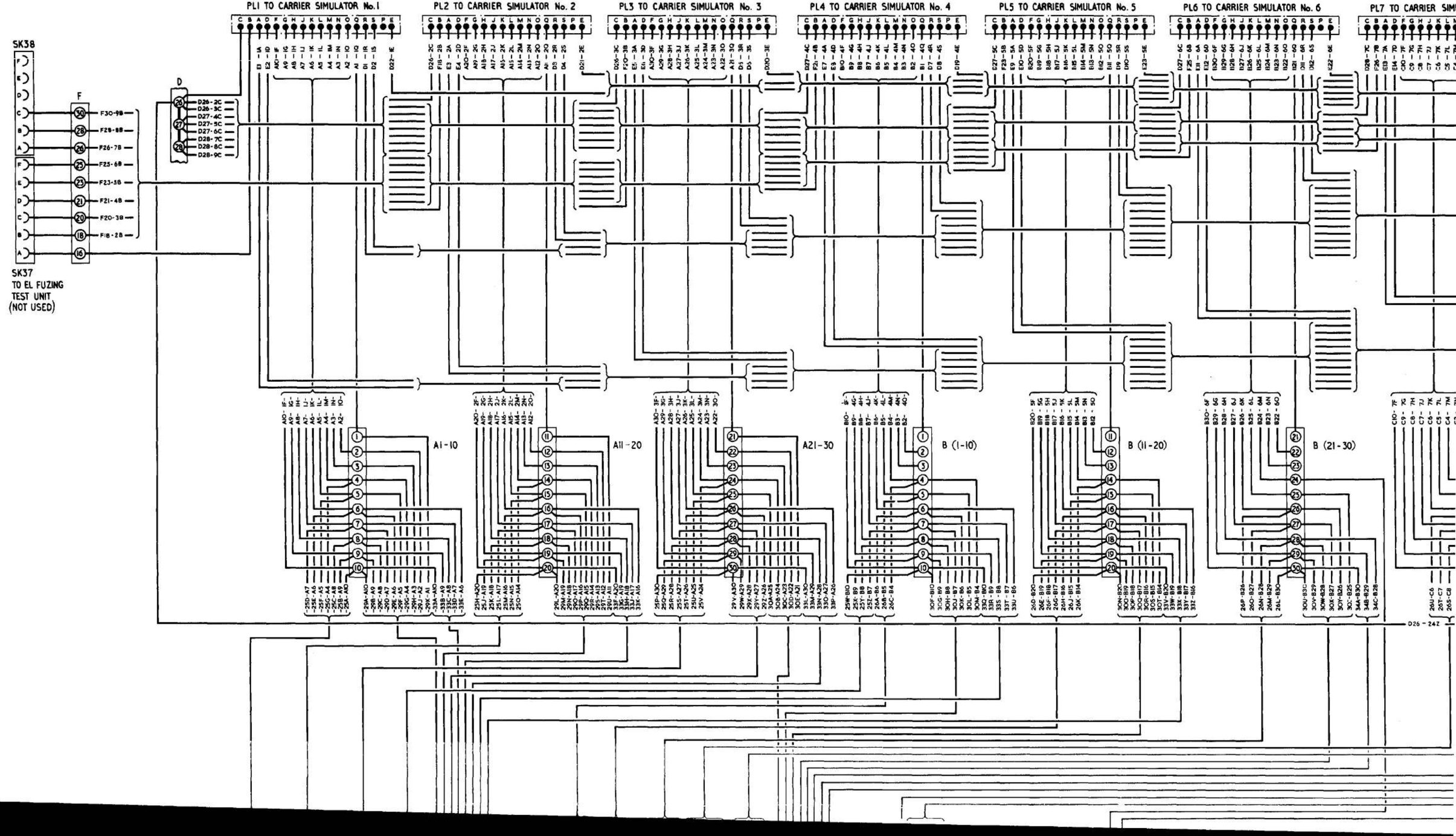
PL1 TO CARRIER SIMULATOR No.1
PL2 TO CARRIER SIMULATOR No. 2
PL3 TO CARRIER SIMULATOR No. 3
PL4 TO CARRIER SIMULATOR No. 4
PL5 TO CARRIER SIMULATOR No. 5
PL6 TO CARRIER SIMULATOR No. 6
PL7 TO CARRIER SIM
SK38
SK37
TO EL FUZING
TEST UNIT
(NOT USED)
A1-10
A11-20
A21-30
B (1-10)
B (11-20)
B (21-30)
D26 - 24Z

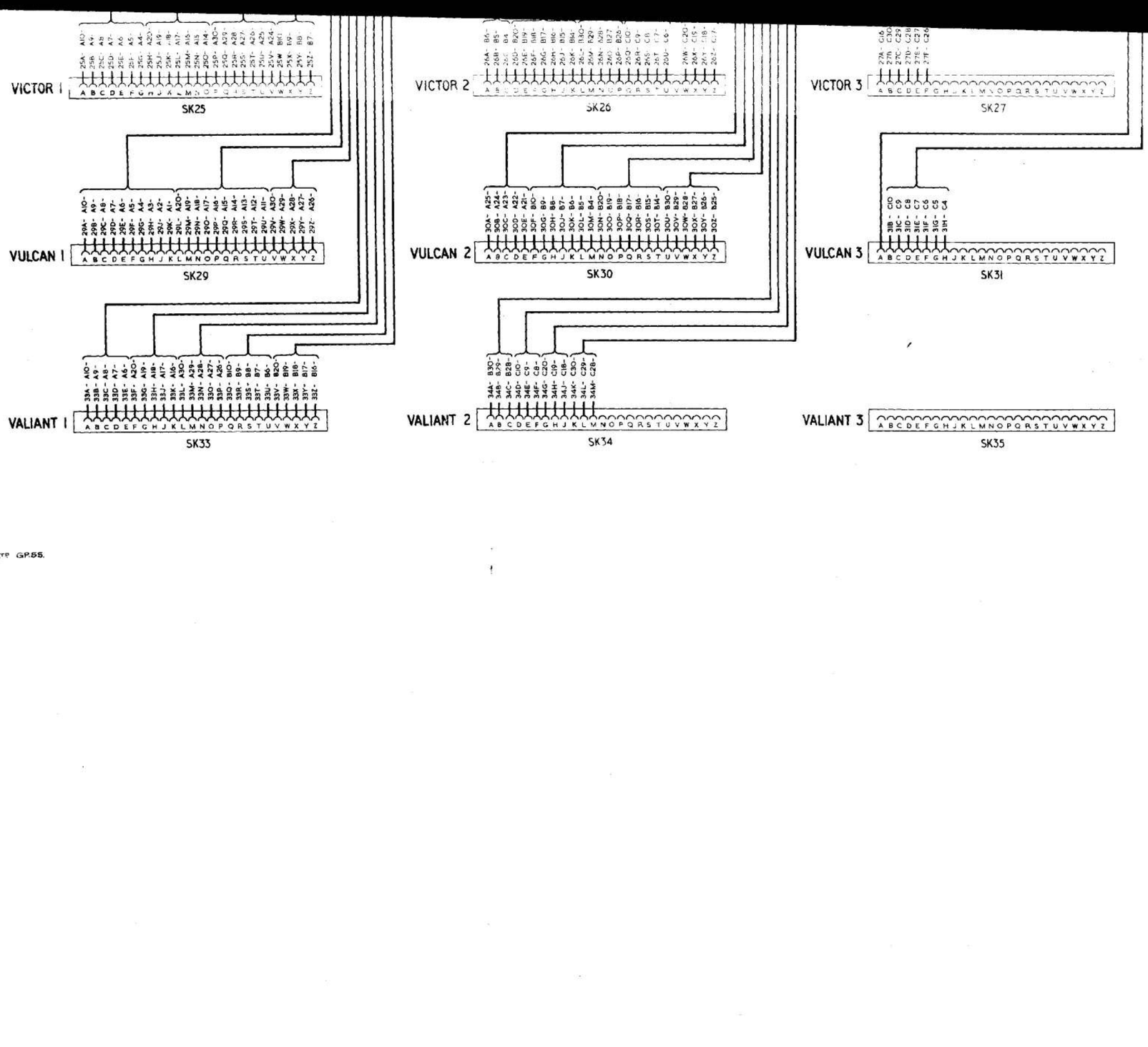

Fig.22

Distribution panel - wirin

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PL6 TO CARRIER SIMULATOR No. 6

PL7 TO CARRIER SIMULATOR No. 7

PL8 TO CARRIER SIMULATOR No. 8

PL9 TO CARRIER SIMULATOR No 9

B (21-30)

C (1-10)

C (11-20)

C (21-30)

D26 - 24Z

R

E

SK23

TO INDICATOR PANEL (FIG.23)

TO INDICATOR PANEL

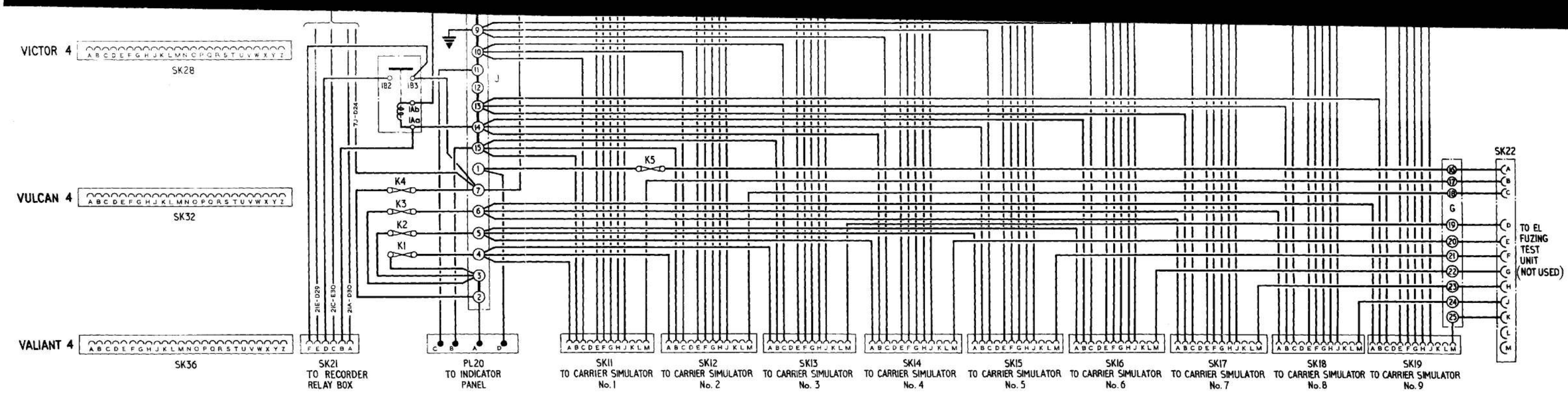
E

SK24

P1 P2 P3 P4 P5 P6 P7 P8 P9

ROLE SELECTOR SWITCH

F G H



Distribution panel - wiring

Fig. 22

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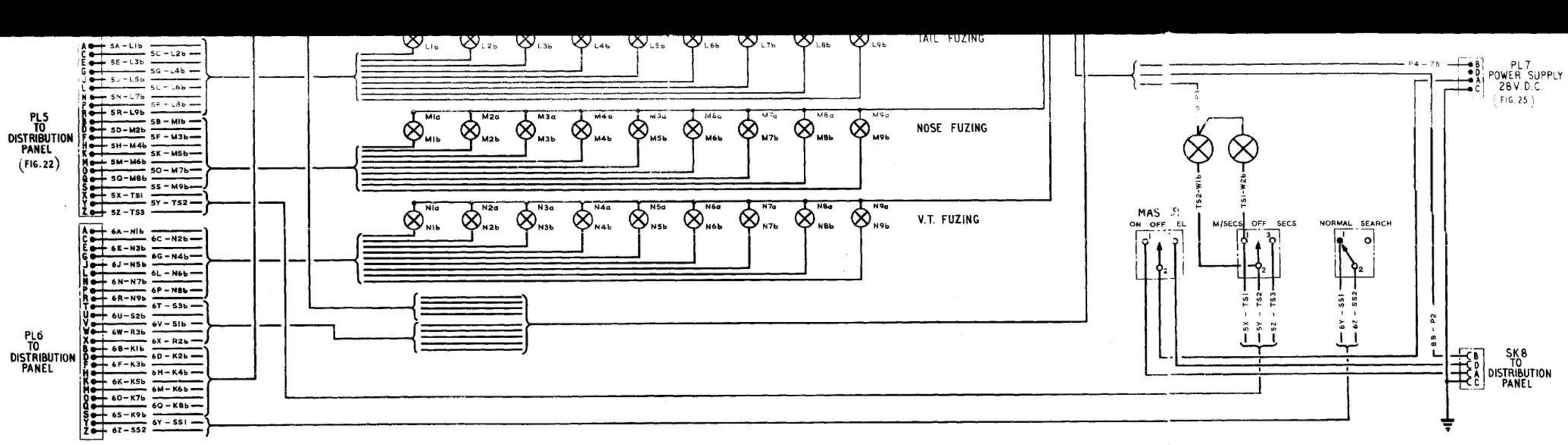

Fig. 23

Indicator panel — wiring

Fig. 23

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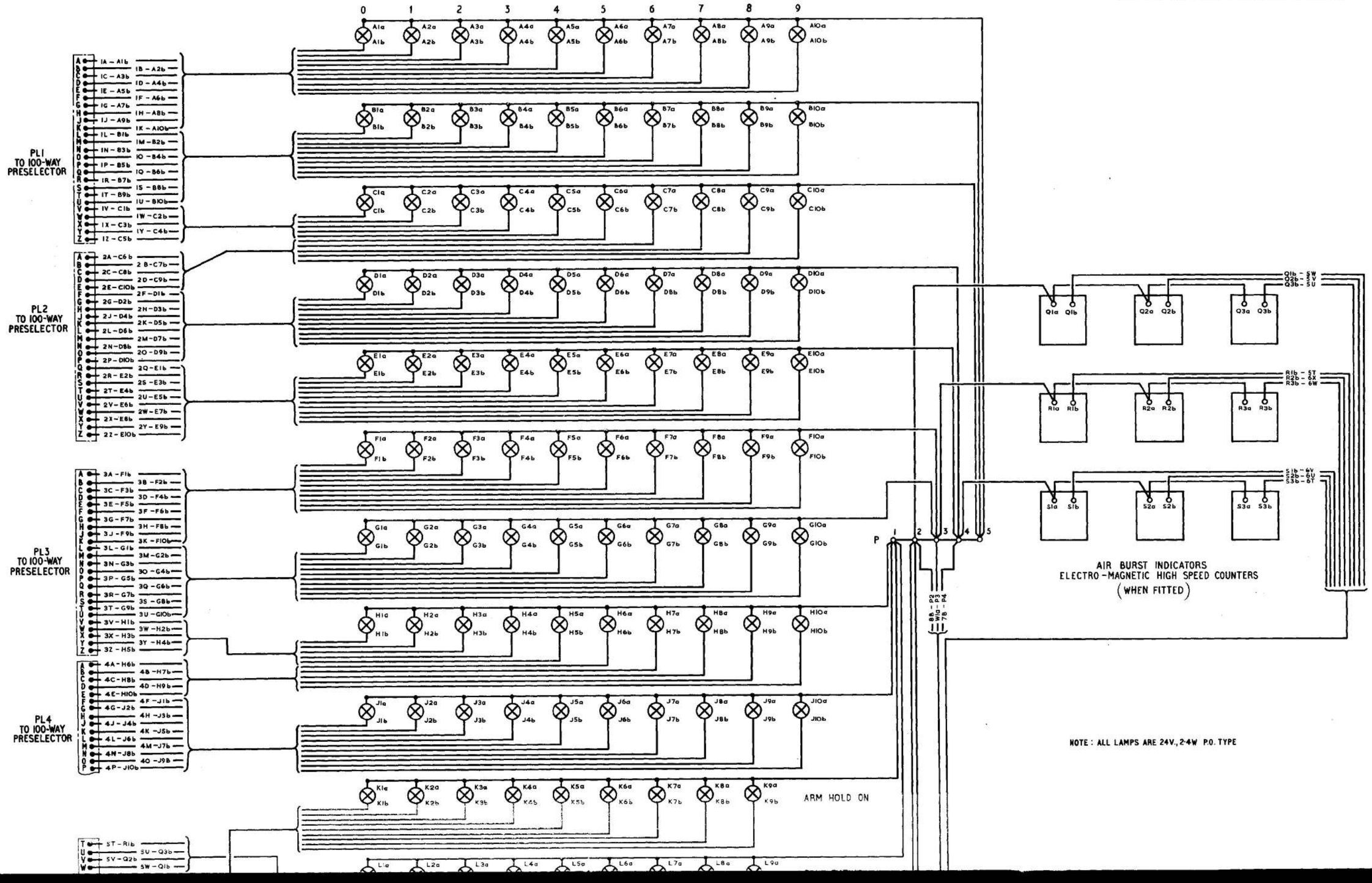
(A.L.1, Oct. 57)


PL1 TO 100-WAY PRESELECTOR
PL2 TO 100-WAY PRESELECTOR
PL3 TO 100-WAY PRESELECTOR
PL4 TO 100-WAY PRESELECTOR
0 1 2 3 4 5 6 7 8 9
ARM HOLD ON
AIR BURST INDICATORS
ELECTRO-MAGNETIC HIGH SPEED COUNTERS
(WHEN FITTED)
NOTE : ALL LAMPS ARE 24V., 2·4W P.O. TYPE

PL1 TO 100-WAY PRESELECTOR

PL2 TO 100-WAY PRESELECTOR

PL3 TO 100-WAY PRESELECTOR

PL4 TO 100-WAY PRESELECTOR

ARM HOLD ON

AIR BURST INDICATORS
ELECTRO-MAGNETIC HIGH SPEED COUNTERS
(WHEN FITTED)

NOTE : ALL LAMPS ARE 24V., 2·4W P.O. TYPE

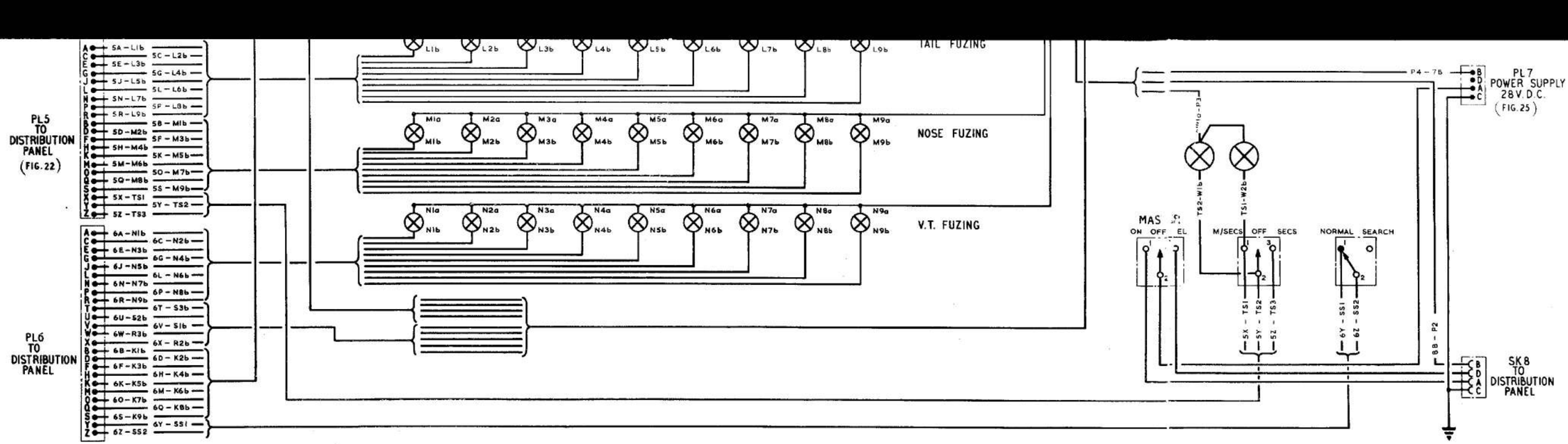


Fig. 23

Indicator panel — wiring

Fig. 23

3819 248550 11/57 250 C. B&S. LTD GP.55.

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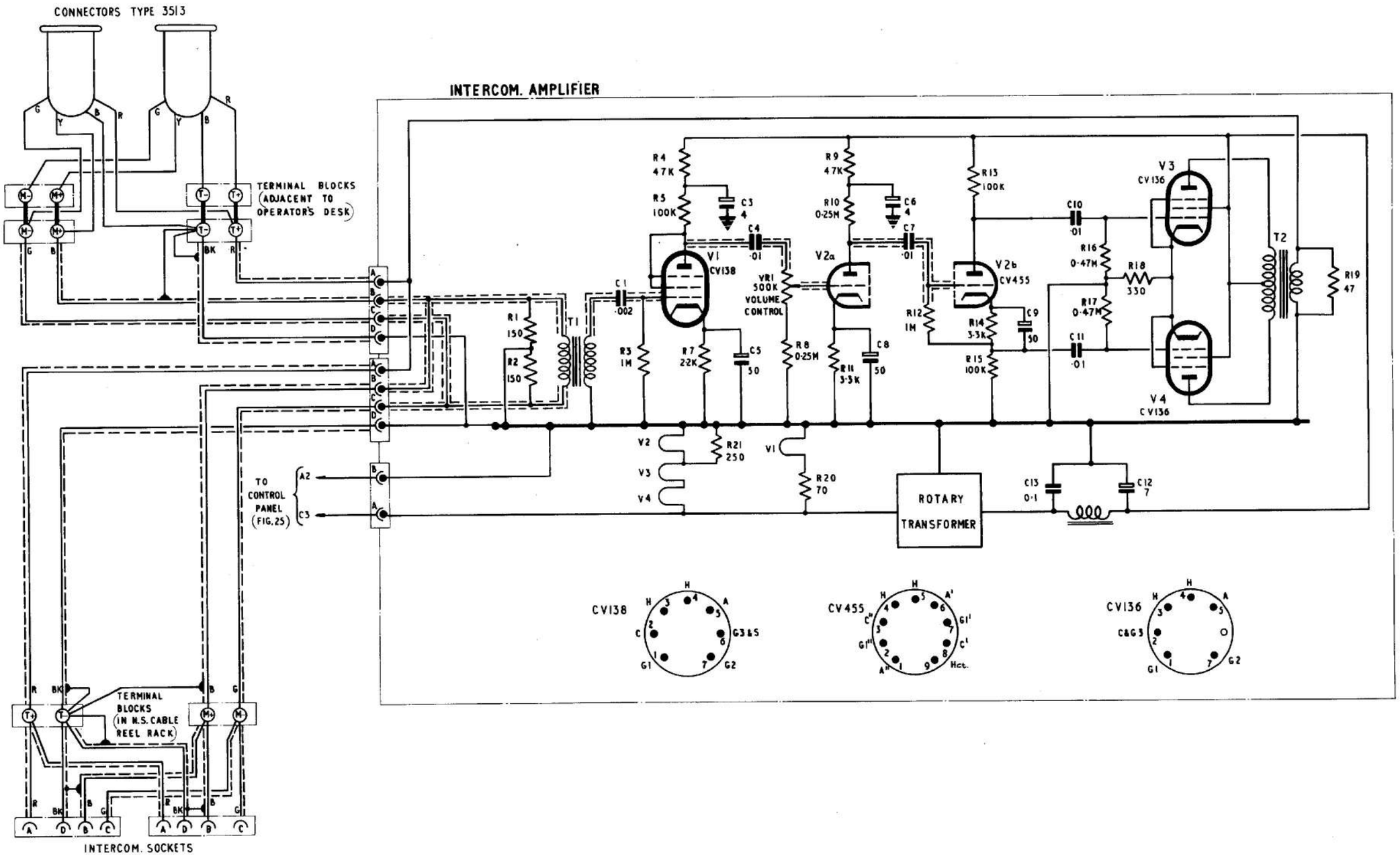

Fig. 24

Intercom. amplifier-circuit

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Fig. 24

(A.L.1, Oct. 57)

3819 248550 11/57 250 C B&S LTD GP.5S.

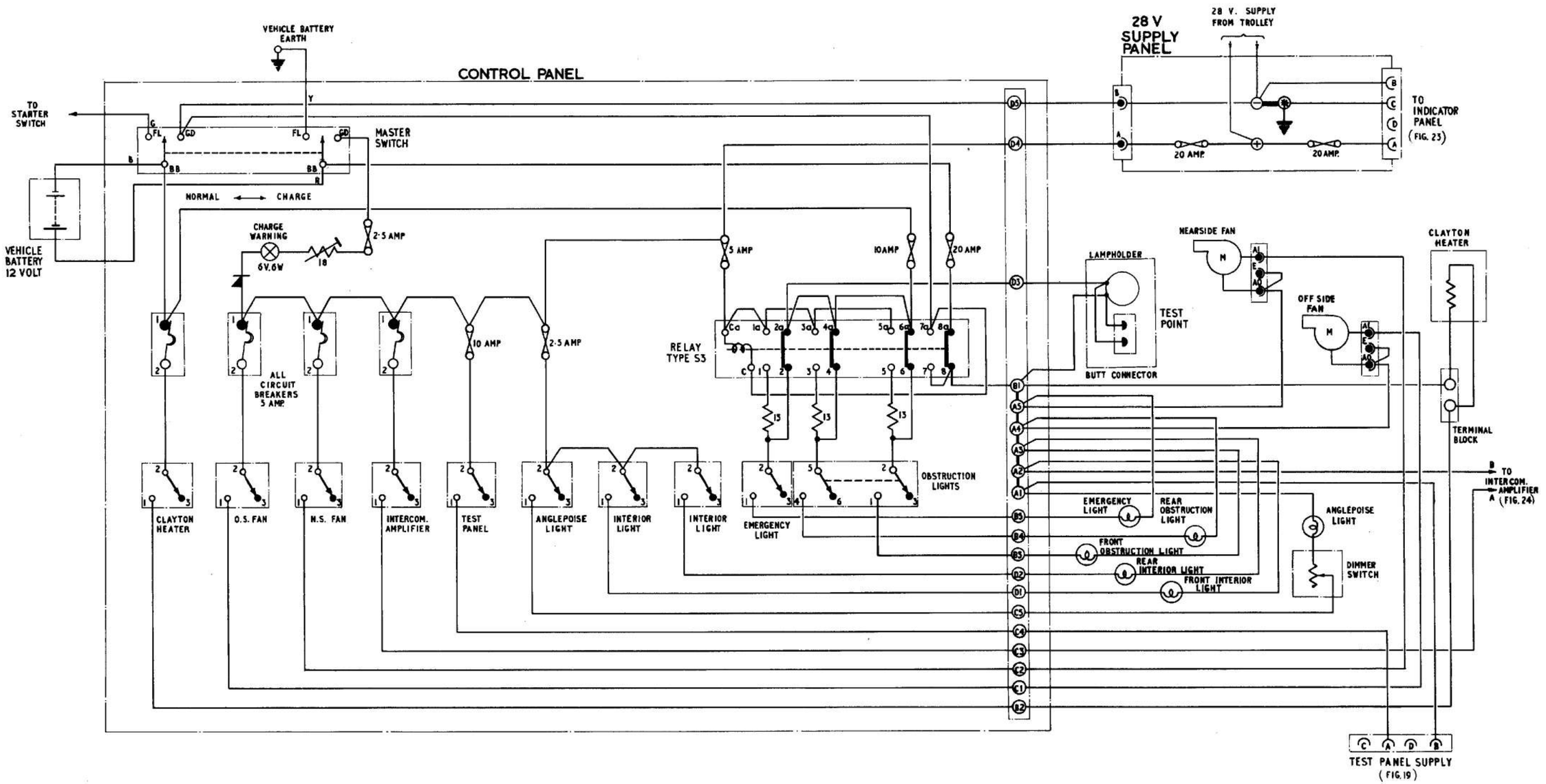

Fig. 25

3519 348550 11/57 250 C.B&S.LTD. G2.55

Fig. 25
(A.L.1. Oct. 57)