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Chapter 4

PORTABLE BOMB CIRCUIT (AIRCRAFT) TEST SET

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LIST OF ILLUSTRATIONS

Introduction

1. The portable bomb circuit test set (Ref. No. 5G/3197) provides facilities for functionally testing aircraft bomb release and fuzing installations. The particular systems provided for are the 12/24 way (Valiant and Canberra) and the Type 11/12 (Victor and Vulcan). The test set simulates, in a simple form, the circuits of bomb carriers, and enables up to five 7-store carriers to be simulated.

2. The equipment, which is designed for ease of transportation, comprises a test box and connector storage boxes supported in a framework (*fig.* 1). The test box contains five banks of relays, with seven relays in each bank. The relays simulate electrically release units, and are operated by release pulses from the aircraft. Indication of operation is given by a matrix of indicator lamps. Provision is made for testing the serviceability of the fuzing circuits by banks of red indicator lamps. The lamps are operated by the fuzing and arm hold-on positives from the aircraft.

3. The test box is connected to the aircraft system at the 20-way butt connectors in the bomb bay by the five 20-way connectors provided. Hand attachments are also provided to test the jettison and fuzing circuits.

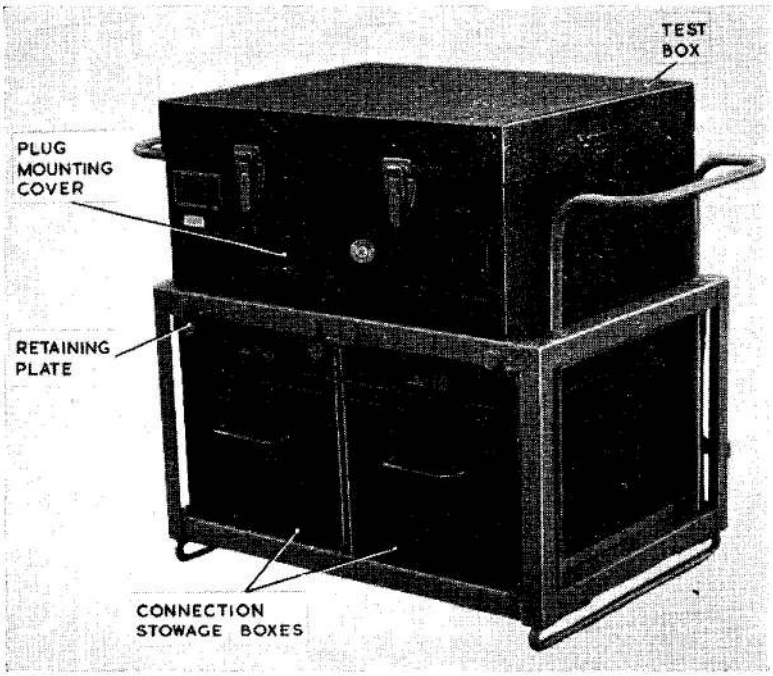


Fig. 1 Portable bomb circuit test set

DESCRIPTION

General

4. The test box is supported by a channel section frame and the connector boxes stowed in a rack below the test box (*fig.* 1). The frame is fitted with a tubular carrying handle at each end and rests on skids formed from aluminium bar. The connector boxes are held in the rack by retaining plates, which are secured to the front cross member by knurled-headed bolts. To gain access to the connectors, the bolts are slackened off, the retaining plates turned through 90 deg., and the bolts tightened down. The connector boxes should then be withdrawn halfway and the hinged lids opened.

5. Some early models of the test box differ physically from the models described above and are illustrated in fig. 3. In these models the test box is supported by folding legs which can be extended when the test box is in use. For transportation the legs are folded and the connector boxes stowed on the top of the test box.

Test box

6. The test box comprises an alloy case with a detachable lid, the lid being secured by four snap fasteners. The top panel of the box carries the controls and indicators, and the internal components, comprising relays, resistors and rectifiers, are mounted on a hinged Paxolin tray. At the front left-hand corner of the test box is the recorder housing. The corner is hinged and can be folded down to give access to the recorder interior and mounting. The recorder is secured to its mounting bracket by two knurled-headed bolts.

7. The controls and indicators mounted on the test box panels are as follows:—

(1) RELEASE LAMP MATRIX. The matrix comprises 35 green indicator lamps covered by a mask and sliding role card (*fig.* 2). Each lamp represents a release unit and is operated by the corresponding relay. The transparent plastic role card (*fig.* 5) numbers the lamps in order of operation to suit a particular installation.

(2) FUZING INDICATORS — are coloured red and arranged in five rows, one for each carrier station. Each row consists of ARM HOLD-ON, TAIL FUZING, NOSE FUZING, and V.T. FUZING indicators, and are operated by

the fuzing and arm hold-on positive supplies direct from the aircraft.

(3) INTERLOCK INDICATORS are provided for stations in 1, 3 and 5. The green indicators are operated by the carrier interlock positives, which are switched to the indicators and the aircraft interlock relays by simulator relays 1E, 3E and 5E (*fig.* 8).

(4) MASTER AND RESET SWITCH—is a single-pole toggle switch connected in the positive line of the 28V supply to the test box. Mounted adjacent to the switch is the amber POWER ON indicator, which is fed from the 28V supply via the MASTER SWITCH.

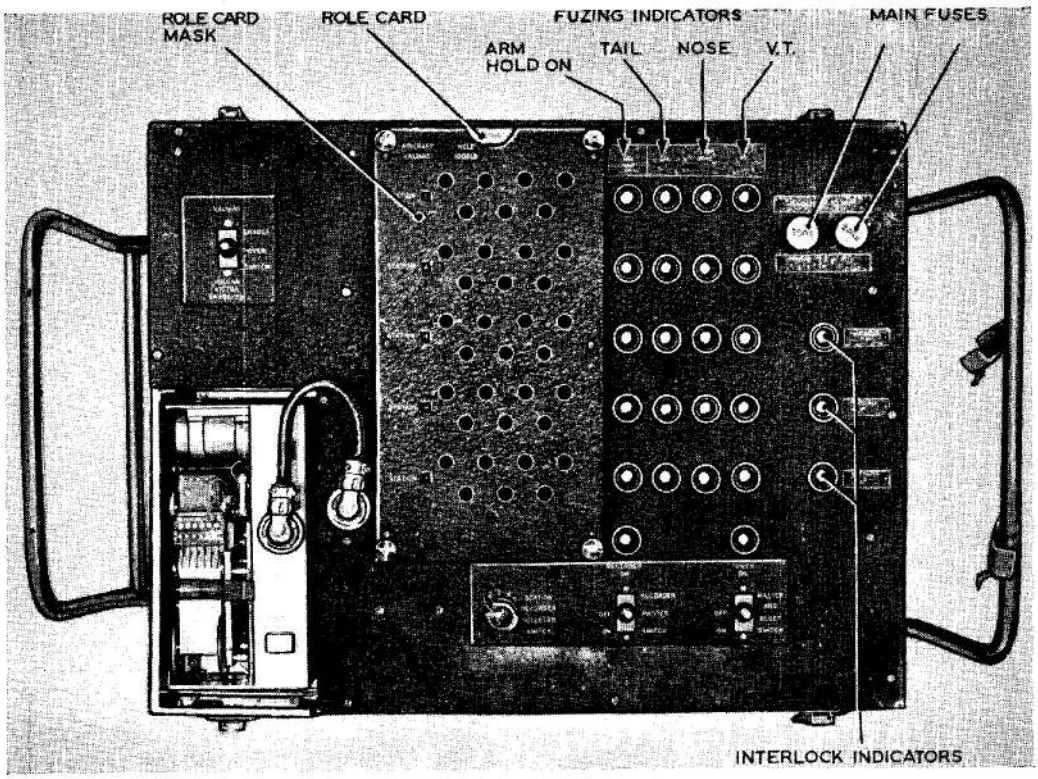


Fig. 2 Indicator and control panel

(5) RECORDER MASTER SWITCH—is a single pole toggle switch which when set to ON completes the 28V supply to the recorder via poles G and L of the recorder connector (*fig.* 7), and also switches the supply to the blue RECORDER ON indicator. The presence of the 28V positive supply at poles G and L of the recorder prepares the unit for operation by heating the valves and energising the transformer-vibrator power unit.

(6) STATION RECORDER SELECTOR—is a five-way switch which enables the recorder to be set into operation by the nose fuzing positives from any of the five stations. The selected positive energises relay U (*fig.*7), and a 28V supply is switched to pole F of the recorder. The recording track is thereby set in motion and the 50 c/s pen energised.

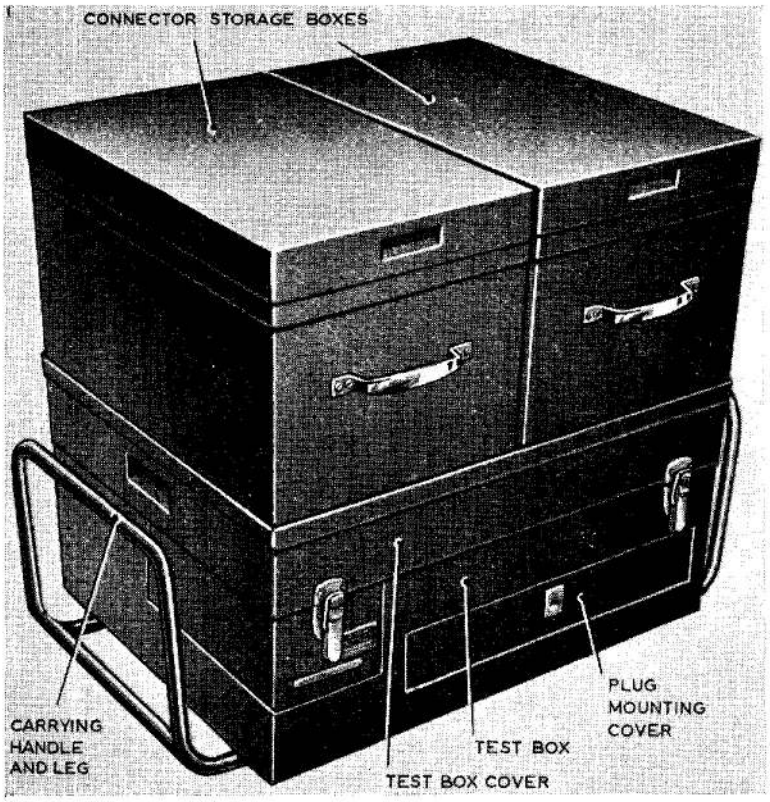


Fig. 3 Test set (early model)

(7) CHANGE-OVER SWITCH—is a single-pole switch marked VALIANT/VULCAN, VICTOR, CANBERRA. In the VALIANT or OPEN position the test set is prepared to simulate a 5-store carrier; when the switch is closed (VULCAN, VICTOR, CANBERRA position) relays V, W, X, Y and Z are energised and the operation of the RELEASE INDICATORS is arranged to represent a 7-store carrier.

(8) RECORDER SOCKET—is a 12-pole socket mounted adjacent to the recorder housing. A short 12-way connector is provided for linking the test box to the recorder.

7a. The carrier station and input supply plugs are mounted on a recessed panel on the front of the test box. Five carrier stations are provided for, the plugs being numbered 1 to 5.

Connector set

8. The connector set comprises five 18-way connecting cables, 30 ft long, and a 2-way input supply connector. The station connectors are terminated at the test box end by 18-pole Mk. 4 sockets, and at the bomb station end by 20-pole butt connectors. The butt connectors are mounted in hand clamps which enables them to be attached to the carrier station butt connectors in the bomb bay. The 28V input supply connector is 60 ft long and terminated at the test box end in a 2-pole Mk. 4 socket.

Hand attachments

9. The hand attachments are provided for testing the jettison, arm hold-on and fuzing supplies in conjunction with the bomb door interlocking circuits. The five jettison attachments each comprise a 2-pole butt connector fitted with a hand clamp and incorporate an indicator lamp. The 20-pole hand attachment incorporates four indicator lamps and checks the fuzing and arm hold-on supplies. The four lamps are coloured as follows: V.T.—green; arm hold-on—red; tail fuzing—yellow; and nose fuzing—blue.

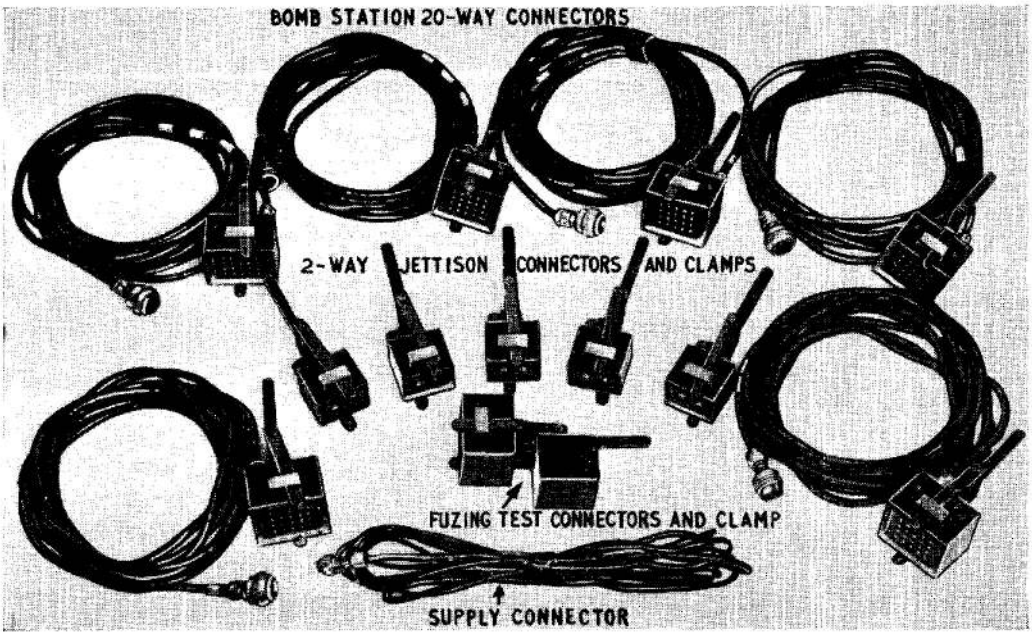


Fig. 4 Connectors

Recorder

10. Recorder used with the test set is the Event Type 10. The travelling paper (teledeltos paper) which is carried by two reels, the feed reel and the take-up reel, is a black graphite-impregnated, faced with white tissue. The reels are driven by a permanent magnet motor and the paper, tissue uppermost, passes over a contact plate which is at chassis potential. The recording pens when energised, leave a trace on the paper by burning away the tissue immediately below the pen.

11. The recorder is fitted with six pens, but only two are used in the Type 10 units. One of these is energised at 50 c/s and marks a dot on the paper every 20 milliseconds, the second pen traces a line during the ON period of the release pulse.

OPERATION

General

12. The test set is connected to the aircraft 20-pole butt connectors in the bomb bay by the 18-way connectors, the five 18-pole plugs on the test box being connected to the stations indicated by the role card. The 28V d.c. supply to the test box must be connected to the same source as the aircraft. The following describes only the functioning of the test set, and for a detailed test procedure reference must be made to the Volume 4 of the appropriate Aircraft Handbook.

13. The test set can simulate up to five 7-store carriers. Each carrier in the test box is simulated by a bank of relays, one relay for each release unit. The relays are operated by release pulses from the aircraft and the matrix of lamps gives indication of satisfactory operation. The release pulses only operate the relays, the relay hold-on supply and the supply to the release indicators is taken from the separate 28V source. The associated carrier fuzing and arm hold-on indicators are arranged alongside the release lamps and are operated by the fuzing and arm hold-on positives from the aircraft.

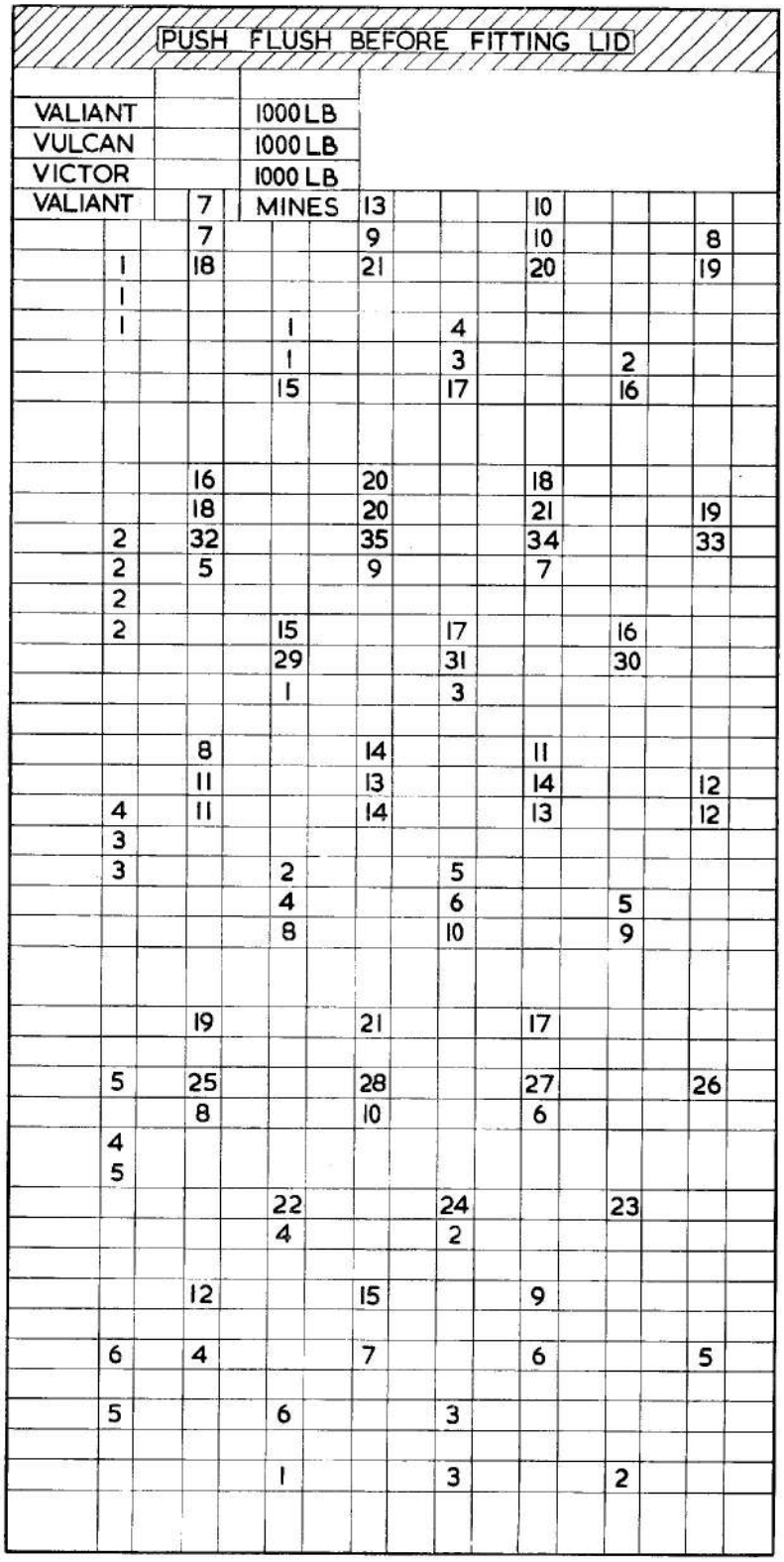


Fig. 5 Role card

14. The order in which the release unit on the various carriers operate is determined by the pre-selector unit in the aircraft, but for the purposes of describing the operation of the test box, in the first relay bank it will be assumed that the release units operate in sequence.

Release test 5-store

15. With the CHANGE-OVER SWITCH set to VALIANT the test box is prepared to simulate a 5-store carrier, i.e. only the first 5 relays in the bank are used. The first release pulse will arrive at pole F of PL1 (*fig.* 7) and energise relay 1A. The two pairs of contacts on the relay will close, one pair to switch on the indicator 1A1 and a second pair to complete the 28V d.c. hold-on supply to the relay coil. When the second pair of contacts make, the third pair of contacts open to interrupt the pulse supply to the relay coil; the pulse supply however remains loaded by a resistor.

16. Relays 1B, 1C, 1D and 1E will operate in a similar manner when the release pulses arrive at poles G, H, J and K of PL1, switching on indicators 1B2, 1C3, 1D4 and 1E5.

Release test 7-store

17. With the CHANGE-OVER SWITCH set to VULCAN, VICTOR, CANBERRA, relays V, W, X, Y and Z will be energised and the relay banks prepared to simulate a 7-store carrier. Considering again the first relay bank, the first two release pulses to arrive energise relays 1A and 1B and switch on indicators 1A1 and 1B2. When the release pulse arrives at relay 1C, the relay is energised and switches on indicator 1F6 via the operated contacts 5 and 6 of relay V. Indicator 1F6 is situated alongside indicator 1B2 and represents the third store in the bottom tier of a 7-store carrier. Indicator 1C3, representing the first store in the upper tier, is switched on by relay 1D, via contacts 2 and 3 of relay V when the fourth release pulse arrives. Similarly relay 1E switches on indicator of 1D4 via contacts 22 and 23 of relay V. The remaining indicators 1E5 and 1G7 are switched on by relays 1F and 1G respectively; the relays being operated by the sixth and seventh release pulses.

Carrier interlock

18. An additional set of contacts on relays E and the interlock indicators at banks 1, 3 and 5, are provided to check the supply to the carrier interlock relays in the aircraft, and to switch the aircraft interlock supply to this relay. The interlocking between carriers is arranged so that the release lines to the upper carriers at stations 2 and 4 are isolated by relays, and no stores can be released from these carriers until the relays are energised. The interlock relays are energised when the upper tier of stores on the lower carriers have been released, the positive supplies to operate the interlock relays are routed via the interlock switches in the release units. The additional contacts of relays 1E, 3E and 5E in the test box simulate the function of these switches and when closed the aircraft interlock relays should be energised and the release circuits to stations 2 and 4 complete.

Fuzing tests

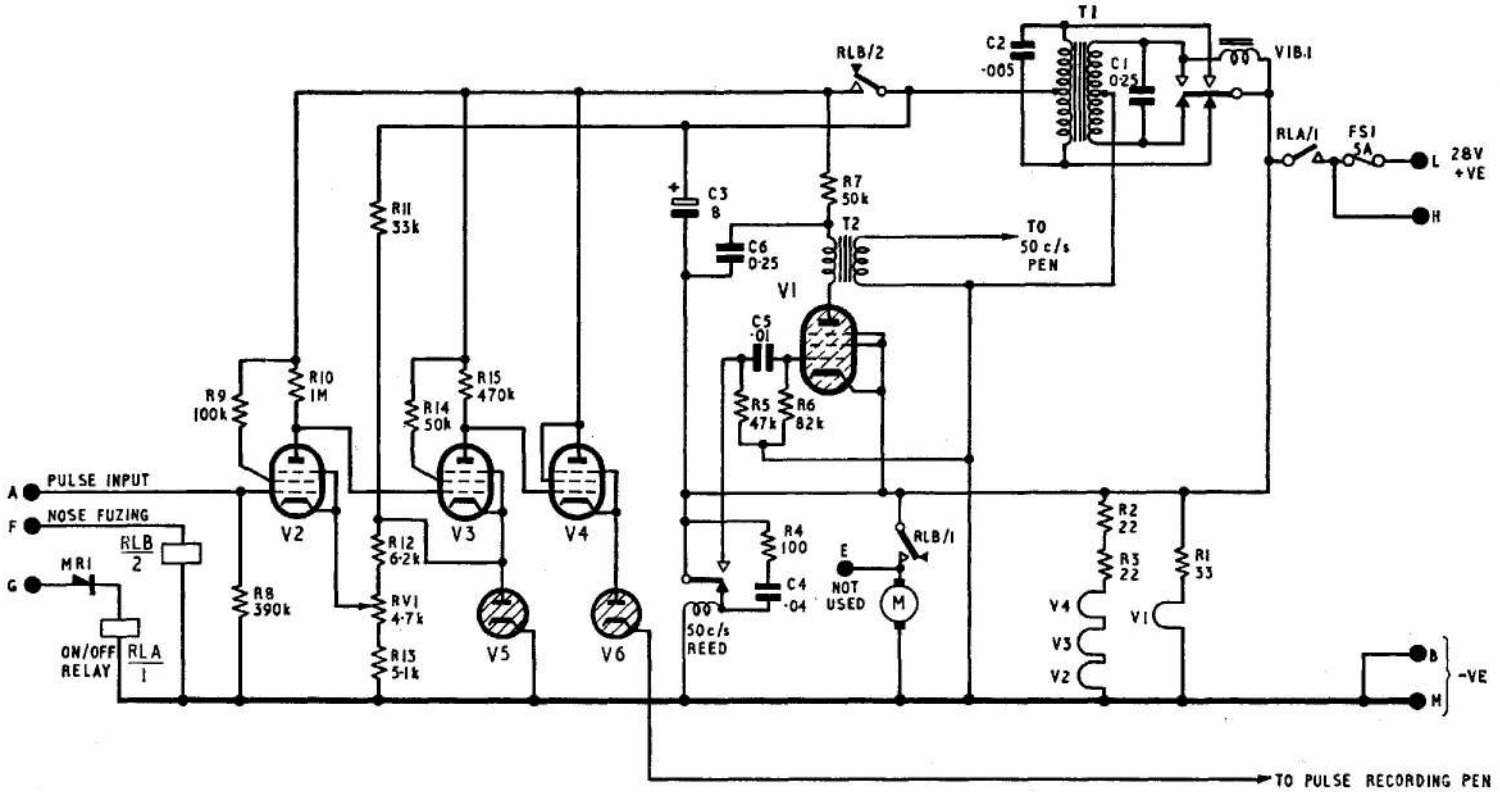
19. Each 20-pole butt connector in the aircraft bomb bay carries nose fuzing, tail fuzing and arm hold-on positive lines. These lines are carried to the test box on poles S, R and D of the 18-way connector, and when the appropriate selection is made at the aircraft the corresponding fuzing and arm hold-on indicators should light. The arm hold-on and tail fuzing lamps should light as soon as selection is made at either (*a*) the bomb aimer's panel on 12/24 way equipment or (*b*) a switch selector and indicator on Type 11/12 equipment.

Tests using hand attachments

20. The hand attachments are provided to test the fuzing and jettison supplies in conjunction with the operation of the bomb doors. It is important that these tests should be conducted strictly in accordance with the procedure laid down in Volume 4 of the relevant Aircraft Handbook.

Use of recorder

21. When it is required to check the length and spacing of the release pulses the recorder MASTER SWITCH is set to ON. This completes a 28V positive supply to poles G and L of the recorder plug (*fig.* 7) and prepares the recorder for operation by heating the valves and energising the vibrator-transformer power unit. The recorder motor is set into motion and the 50 c/s pen energised when NOSE FUZING is selected in the aircraft. NOSE FUZING therefore must be



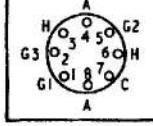
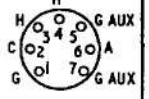
V2 V3 & V4 (CV476)	V5 (CV284) V6 (CV287)	V1 (CV 797)
		

Fig. 6 Recorder—circuit

selected immediately prior to the operation of the release circuits. The 50 c/s pen marks the paper with dots at 20 millisecond intervals and provides the time base against which the pulse duration and spacing can be checked.

Recorder operation

22. When the recorder MASTER SWITCH is set to ON a 28V positive supply is switched to poles G and L of the recorder, relay RLA (*fig.* 6) operates and contacts RLA/1 close to complete the supply to the valve heaters and power unit. When NOSE FUZING is selected in the aircraft, relay U is energised and a positive supply appears at all F of the recorder energising relay RLB. Contacts RLB/2 complete the h.t. supply to the valves, and contacts RLB/1 switch on the recorder motor, setting the recording track in motion.

23. With no pulse input to the recorder valve V2 (*fig.* 6), is biased to cut-off, V3 is conducting and V4 is cut-off. The gas-filled diode V6 is de-ionized and V5 functions as a voltage reference. The release pulses, which are approximately square in waveform are applied to the grid of V2 (*fig.* 6). The pulse, if above a pre-determined voltage level, will cause V2 to conduct; this level is set by RV1. With V2 conducting V3 is switched off and the potential of the grid of V4 rises to H.T. The potential on the cathode of V4 rises, causing V6 to conduct, and a current to flow in the circuit formed by the contact plate, paper, pen, V6 and V4.

24. The trailing edge of the pulse switches off valve V2, and the current flowing through the pen circuit ceases. The circuit remains in this condition until the next release pulse arrives at the grid of V2. The pen thus records the duration and spacing of the release pulses.

50 *c/s timing*

25. The tuned reed supplies 28V to a grid of V1 at a frequency of 50 cycles per second, and the output, via transformer T2 is taken to the 50 c/s pen. The pen will be energised by a high voltage 50 times per second, causing a dot to appear on the travelling paper every 20 milliseconds.

Interpretation of the record

26. The record shows the release pulses as black lines, the length indicating the duration of the pulse. Alongside the pulse record are a series of dots at 20 millisecond intervals. The length of the pulse and the period of the pulse can be checked by dividers using the 20 millisecond dots as a reference scale.

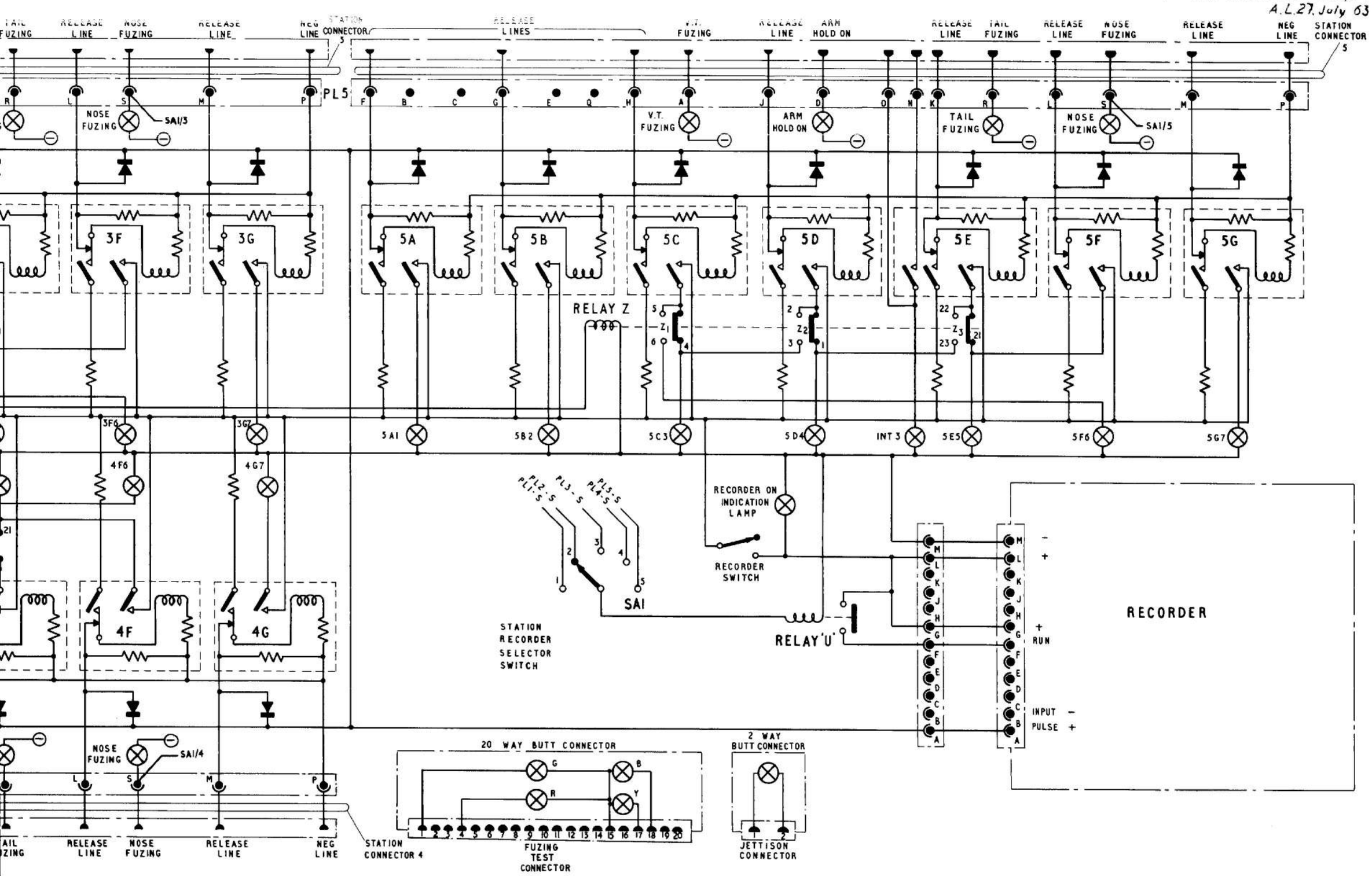
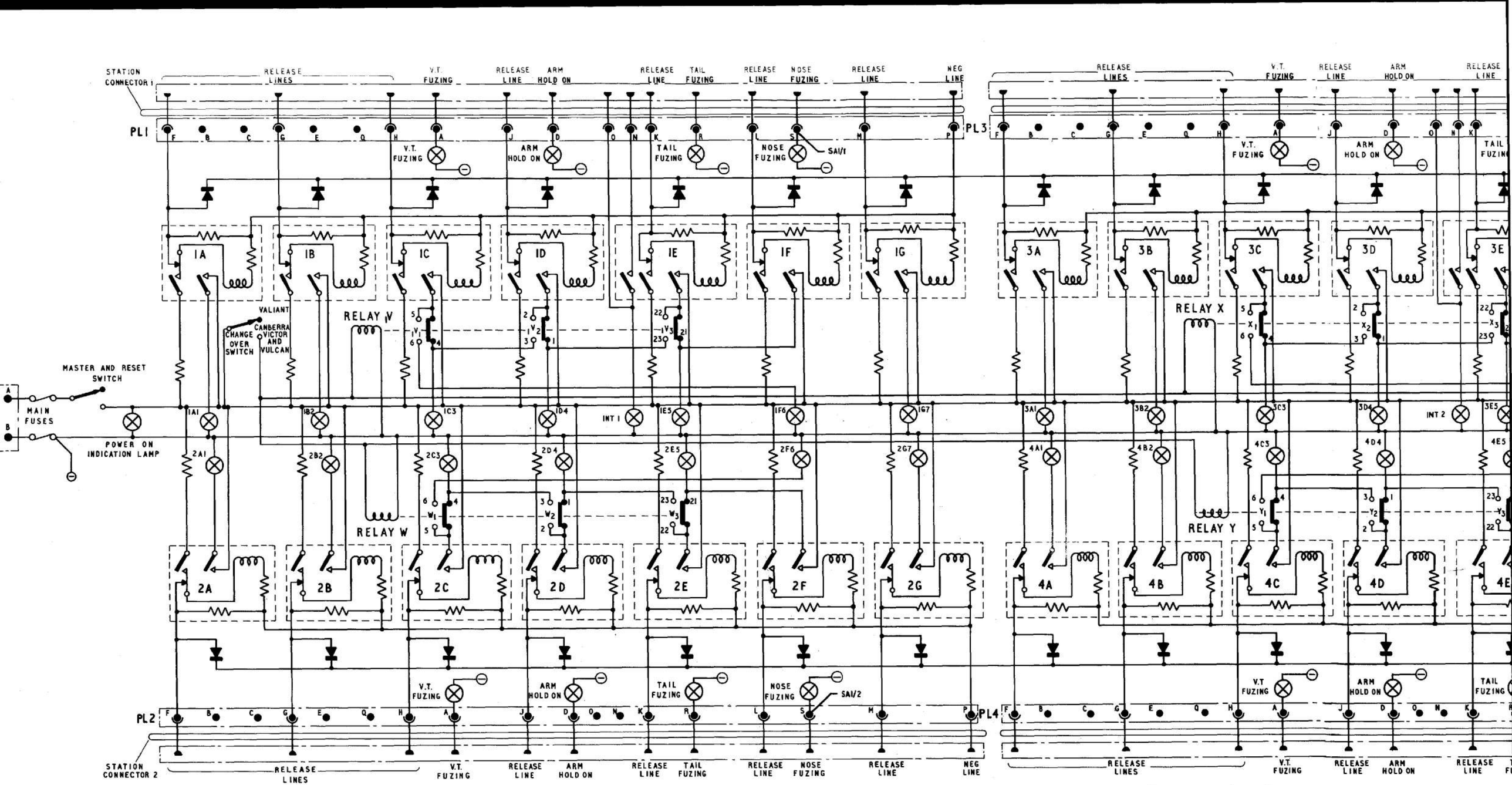

TAIL FUZING
RELEASE LINE
NOSE FUZING
RELEASE LINE
NEG LINE
STATION CONNECTOR 5
RELEASE LINES
V.T. FUZING
RELEASE LINE
ARM HOLD ON
RELEASE LINE
TAIL FUZING
RELEASE LINE
NOSE FUZING
RELEASE LINE
NEG LINE
STATION CONNECTOR 5
PL5
NOSE FUZING
SAI/3
V.T. FUZING
ARM HOLD ON
TAIL FUZING
NOSE FUZING
SAI/5
3F
3G
5A
5B
5C
5D
5E
5F
5G
RELAY Z
3F6
3G7
4F6
4G7
5A1
5B2
5C3
5D4
INT 3
5E5
5F6
5G7
4F
4G
PL2-S
PL1-S
PL3-S
PL5-S
PL4-S
SAI
RECORDER ON INDICATION LAMP
RECORDER SWITCH
STATION RECORDER SELECTOR SWITCH
RELAY 'U'
RECORDER
RUN
INPUT
PULSE
NOSE FUZING
SAI/4
20 WAY BUTT CONNECTOR
2 WAY BUTT CONNECTOR
FUZING TEST CONNECTOR
JETTISON CONNECTOR
STATION CONNECTOR 4
RELEASE LINE
NOSE FUZING
RELEASE LINE
NEG LINE

Fig. 7



Bomb circuit test set— circuit

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