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MINISTRY OF SUPPLY

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

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EXECUTIVE ORDER 11652

CANBERRA P.R. MK. 3 VX. 181
(2 AVON 1)

CARRIAGE AND RELEASE OF FLASHES, PHOTOGRAPHIC,
AIRCRAFT, 4.5 INCH FUZED M111-A2

INCLOSURE 2 TO REPORT No. 115054

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15th Part of Report No. A.A.E.E./861/2

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

24 MAR 1954

Canberra P.R. Mk.3 VX.181
(2 Avon 1)

Carriage and release of flashes, photographic,
aircraft, 4.5 inch fuze M111-A2

A. & A. E. E. Ref: A.A.E.E./5937/2/1
M. O. S. Ref: 7/Armts/1388/706
Period of trial: December, 1953 to January, 1954

Report No.		Progress of issue of Report	Title
10th Part	A.A.E.E./861/2	WE.173 - Cockpit appraisal	
11th	do.	WE.173 - Brief handling tests on a production aircraft with special reference to lateral and directional behaviour	
12th	do.	VX.181 - Acceptance trials of armament installation and 16 $\frac{1}{2}$ inch photo flash	
13th	do.	WE.135 - Jettisoning of wing tip tanks in flight	
14th	do.	VX.181 - Functional trials of 8 inch low terminal velocity photographic flash	

Summary

1. Trials for the carriage and release of flashes, photographic, 4.5 inch from the Canberra P.R.3 aircraft have been completed.

2. It is recommended that the Canberra P.R.3 aircraft be cleared for the carriage and release of eight flashes, photographic, aircraft, 4.5 inch, subject to the essential modifications and requirements in para.8 being incorporated and within the following limitations:-

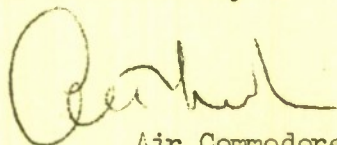
2.1 Carriage

2.1.1 Flare bay doors closed - to maximum permissible speed and height of the aircraft through normal manoeuvres to the maximum g limitations of the aircraft.

2.1.2 Flare bay doors open - to 300 knots I.A.S. from 5,000 feet to 10,000 feet in straight and level flight and in angles of dive and climb of 5° through normal manoeuvres to the maximum g limitations of the aircraft.

2.2 Release. Up to and including 280 knots I.A.S. from heights of 5,000 feet to 10,000 feet in straight and level flight and in angles of dive and climb of 5°.

This Report is issued with the authority of



Air Commodore,
Commanding A. & A. E. E.

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2.

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1. Introduction

1.1 Clearance for the carriage and release of live 4.5 inch photographic flashes from Light Series Carriers on the Canberra P.R.3 aircraft was requested in Ministry of Supply Trials Pro-forma R.D.Arm.4/164 dated 30th October, 1953.

2. Object of trial

2.1 The object of the trial was to determine that live 4.5 inch photoflashes could be released satisfactorily from Light Series Carriers attached to the Canberra P.R.3 flare beam.

3. Description of installation

3.1 Aircraft bombing installation. The bombing installation of the Canberra P.R.3 aircraft is described in A.P.4326C, Vol.1, Sect.3, Chap.1 and in para.3 of the 12th part of A. & A.E.E. Report No. 861/2.

3.2 Light Series Carrier installation. Two Light Series Carriers, Mk.3 (Stores Ref. 11A/572) fitted with the following modifications were used for the trials:-

3.2.1 Modification 737. Strengthening stays (A.P.1664A, Vol.2, Part 1, Leaflet A14 refers).

3.2.2 Modification 1217. Crutch pads but on rear crutches only (A.P.1664A, Vol.2, Part 1, Leaflet A16 refers).

3.2.3 Modifications 1231 and 1299. Cable cleats (A.P.1664A, Vol.2, Part 1, Leaflet A22 refers).

3.2.4 Nose fuizing. Fitment of four No.2 Mark 1 fuizing units (5D/1478) to permit live and safe fuizing of the photoflashes. This modification is described in Appendix C and Figures 2 and 3 of Addendum No.3 to the 21st Part of A. & A.E.E. Report No. 861/1 dated 16th January, 1953.

4. Method of trial

4.1 Ground examination

4.1.1 Two Light Series Carriers were installed in the aircraft and four 4.5 inch photoflashes loaded to each carrier.

4.1.2 Photographs of the installation were taken and the clearance angles measured.

4.1.3 Static release tests were made.

4.2 Arming of aircraft

4.2.1 The photoflashes were prepared in accordance with A.P.1661E, Vol.1 (2nd Edition) Section 11, Chap.2 and Appendix 3; retarder plates were not fitted. All tail vanes were inspected for damage or distortion before loading.

4.2.2 The photoflashes were loaded by hand and fitted to the carriers, nose forward.

4.2.3 The fuizing wire of the No.2 Mark 1 fuizing unit was connected to the No.8 safety wire by a standard Buggins clip. Two No.2 Mark 1 Safety Clips (12G/1068) were fitted to the fuizing wire so that one foot of wire was extended permanently. This method of fuizing was found necessary and satisfactory when releasing 4.5 inch photoflashes from a Canberra B.2 aircraft.

4.3 Air trials

4.3.1 Handling and carriage tests. The aircraft was flown up to the following speeds and heights:-

(i) With flare bay doors closed - to the maximum permissible heights and speeds with normal manoeuvres to plus 4g (Indicated).

(ii) With flare bay doors open - to 350 knots I.A.S. in straight and level flight and in angles of climb and dive of 5° between 5,000 feet and 10,000 feet through normal manoeuvres to plus 4g (Indicated).

(iii) Cine films were taken of the stores in the flare bay at speeds over 280 knots I.A.S.

4.3.2 Release tests

(i) Inert and live photoflashes were released in straight and level flight and in angles of climb and dive of 5° at speeds from 220 knots I.A.S. to 300 knots I.A.S. and heights from 5,000 feet to 10,000 feet.

(ii) Cine films were taken of all releases.

5. Results of tests

5.1 Ground examination

5.1.1 It was necessary to modify the flare beam and the electric wiring of the flare beam and Light Series Carriers in order to fit and operate the Light Series Carriers. Details of the modification are at Appendix A.

5.1.2 A photograph of the installation is at Fig.1.

5.1.3 Clearance angles were:-

(i)	Climb	58°
(ii)	Dive	15°
(iii)	Roll	23°

5.1.4 All static release tests were satisfactory.

5.2 Air trials

5.2.1 Handling and carriage tests

(i) The handling of the aircraft fitted with eight photoflashes, with flare bay doors open and closed, was satisfactory.

(ii) Details of the sorties flown are given in Table 1 of Appendix B.

(iii) Films taken by a camera in the flare bay showed that vibration of the photoflashes was excessive at speeds over 300 knots I.A.S. with the flare bay doors open.

5.2.2 Release tests

(i) Details of all releases are given in Table 2 of Appendix B.

(ii) Films of the releases showed that the photoflash tended to become unstable when released at speeds over 280 knots I.A.S.

(iii) Films of the releases also showed that if the photoflash left tail first from the flare bay the tail was blown back into the flare bay and the photoflash tended to topple. Allowing the photoflash to gain momentum, by giving it a foot of free fall before the safety wire was withdrawn, prevented this. In two instances where it did happen, it was considered that the fuze wire had been retracted into the fuze unit, and to prevent this, two No.2 Mark 1 Safety Clips were fitted on the fuze wire. The details are shown in Figure 2.

(iv) All the photoflashes released cleanly and satisfactorily from the aircraft.

(v) Of the 48 live photoflashes released, two did not function. No reason for this was found as the stores fuzed correctly and the films showed that they had a normal attitude when they left the aircraft. They were released over the sea and did not function on impact.

6. Conclusions

6.1 It is concluded that, subject to the incorporation of the essential modifications and requirements enumerated in para.8, the Canberra P.R.3 aircraft may be cleared for the carriage and release of eight flashes, photographic, aircraft, 4.5 inch, carried nose forward on Light Series Carriers attached to the flare beam.

7. Recommendations

7.1 It is recommended that, subject to the incorporation of the essential modifications and requirements enumerated in para.8, clearance be given for the carriage and release of eight flashes, photographic, aircraft, 4.5 inch from Canberra P.R.3 aircraft, the flashes to be carried nose forward on two Light Series Carriers attached to the flare beam. The limitations are as follows:-

7.1.1 Carriage

(i) Flare bay doors closed - to maximum permissible speed and height of the aircraft through normal manoeuvres to the maximum g limitations of the aircraft.

(ii) Flare bay doors open - to 300 knots I.A.S. from 5,000 feet to 10,000 feet in straight and level flight and in angles of dive and climb of 5° through normal manoeuvres to the maximum g limitations of the aircraft.

7.1.2 Release. Up to and including 280 knots I.A.S. from 5,000 feet to 10,000 feet in straight and level flight and in angles of dive and climb of 5°.

8. Essential modifications and requirements

8.1 The Light Series Carriers must be fitted with four No.2 Mark 1 Fuzing Units and modified electrically to permit live and safe fuzing.

8.2 The Canberra P.R.3 flare beam must be modified to permit two Light Series carriers to be attached to it.

8.3 The electrical circuits of the flare beam and Light Series Carriers must be modified to permit the photoflashes to be fuzed and released by the aircraft fuzing and release switches.

8.4 Two No.2 Mark 1 Safety Clips must be fitted to the fuzing lanyard in such a position that there is at least 1 foot of free drop for the photoflash before the safety wire is withdrawn.

8.5 The tail vanes of the photoflashes must be examined for damage and distortion before loading. Stores with damaged or distorted tail vanes must not be used.

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Proposed modification to Canberra P.R.3 flare beam
to permit fitment of two Light Series Carriers

1. This modification provides for the fitting of two Light Series Carriers to the Canberra P.R.3 flare beam and for the necessary rewiring to permit the carriers to be operated by the normal aircraft release and fuze switches.

2. Parts required

<u>Sect.</u>	<u>Ref.</u>	<u>Nomenclature</u>	<u>Quantity</u>
11A	572 or 3531	Carriers, Light Series, Mark 3 or 12	2
11A	3690	Adaptor Beam, L.S. Front	2
11A	3691	Adaptor Beam, L.S. Rear	2
5D	1478	Fuizing Units, No. 2 Mark 1	8
28D	3326	Bolts, Steel, H.T. .95" x $\frac{1}{4}$ " B.S.F.	8
28D	9435	Bolts, Steel, H.T. 1.25" x $\frac{1}{4}$ " B.S.F.	8
28M	13280	Nuts, H.T.S., castellated, $\frac{1}{4}$ " B.S.F.	16
28W	12253	Washers, M.S. .270" Int. .52" Ext.	16
23P	5213	Pins, split, $\frac{3}{64}$ " x 1".	16
5E	2108	Cable, duvin.	As required
5E	2114	Cable, quintuvin.	As required
5E	2116	Cable, septuvin.	As required
5C	-	Switches, 2 position	2
5C	590	Plugs, 2 pole	2
5C	591	Sockets, 2 pole	2
5C	432	Blocks, terminal	2

3. Sequence of operations

3.1. The flare beam to be drilled in the positions shown in Figure 3 to take the eight 1.25" x $\frac{1}{4}$ " B.S.F. bolts. The bolts are used to fit the beam adaptors in position.

3.2. The two Light Series Carriers to be attached to the beam adaptors by the eight .95" x $\frac{1}{4}$ " B.S.F. bolts.

3.3. The electric wiring of the flare beam and Light Series carriers to be modified to conform to the wiring diagram in Fig. 4.

Table 1 - Flight Handling and Carriage Tests

Sortie No.	Load	Conditions of sortie					Remarks
		Indicated air speed (kts)		Altitude (feet)	Details		
		Flare bay doors closed	Flare bay doors open				
1	8 Flashes Photographic 4.5 inch - Fuzed M111-A2 - Inert	0.8 I.M.N.	-	35,000	To maximum permissible height and speed of aircraft through normal manoeuvres to plus 4g (Indicated)	(i) Stores and installation satisfactory. (ii) Aircraft maximum height limited by U/S pressurization system	
2	- do -	-	250 270 280 300	5,000 7,000 9,000 10,000	Straight and level flight, and angles of dive and climb of 5° with normal manoeuvres up to plus 4g (Indicated)	(i) All flashes rigid on carriers (ii) Fuzing arrangements secure (iii) Stores released satisfactorily on ground test after flight.	
3	- do -	-	310 330 350	5,000 7,500 10,000	- do -	(i) Films taken during sortie showed that stores vibrated excessively when bomb doors were open at speeds over 300 knots.	

Table 2 - Flight Release Tests

Sortie No. (a)	Load (b)	Object of sortie (c)	Conditions of release			Details of release (f)	Observations (g)
			I.A.S. (kts) (d)	Altitude (feet) (e)			
1	8 flashes, photographic aircraft, 4.5 inch Fuzed M111-A2	Single release of eight flashes Two at each height.	220 220 250 250	5,000 6,000 8,000 10,000		Straight and level flight, angles of climb and dive of 5°.	(i) Seven flashes released satisfactorily. (ii) One flash (No.5) hung up for approx. two seconds due to suspected over-crutching. (iii) Stores from rear carrier pitch more than those from front carrier.
2	- do -	- do -	280	5,000 6,000 8,000 10,000		- do -	(i) All stores released satisfactorily. (ii) Stores commence to wobble after they are clear of aircraft. (iii) Stores from rear carrier pitch more than those from front carrier.
3	- do -	- do -	300	10,000 8,000 6,000 5,000		- do -	(i) Six stores released satisfactorily. (ii) No.2 E.M. Release Unit U/S. (iii) No.8 was over-crutched - Released satisfactorily when crutching was eased. (iv) Stores pitch violently on release, particularly those from rear carrier.
4	8 live flashes, photographic, 4.5 inch Fuzed M111-A2	- do -	280	5,000 6,000 8,000 10,000		- do -	(i) All stores released satisfactorily and exploded at correct height. (ii) Stores pitch and wobble at release. (iii) No.6 store pitched violently - Left tail first.
5	- do -	- do -	300	10,000 8,000 6,000 5,000		- do -	(i) All stores released and exploded. (ii) Stores pitch violently particularly those from rear carrier.

Table 2 (Continued)

(a)	(b)	(c)	(d)	(e)	(f)	(g)
6	-- do --	-- do --	280	10,000 8,000 6,000 5,000	-- do --	(i) All stores released and exploded satisfactorily.
7	-- do --	-- do --	280	5,000 6,000 8,000 10,000	-- do --	(i) All stores released and exploded satisfactorily.
8	-- do --	-- do --	280	10,000 8,000 6,000 5,000	-- do --	(i) Six flashes released and exploded satisfactorily. (ii) No.7 and No.8 stores released satisfactorily but did not explode. (iii) No.5 flash pitched violently on release - Left tail first.
9	-- do --	-- do --	280	5,000 6,000 8,000 10,000	-- do --	(i) All flashes released and exploded satisfactorily.

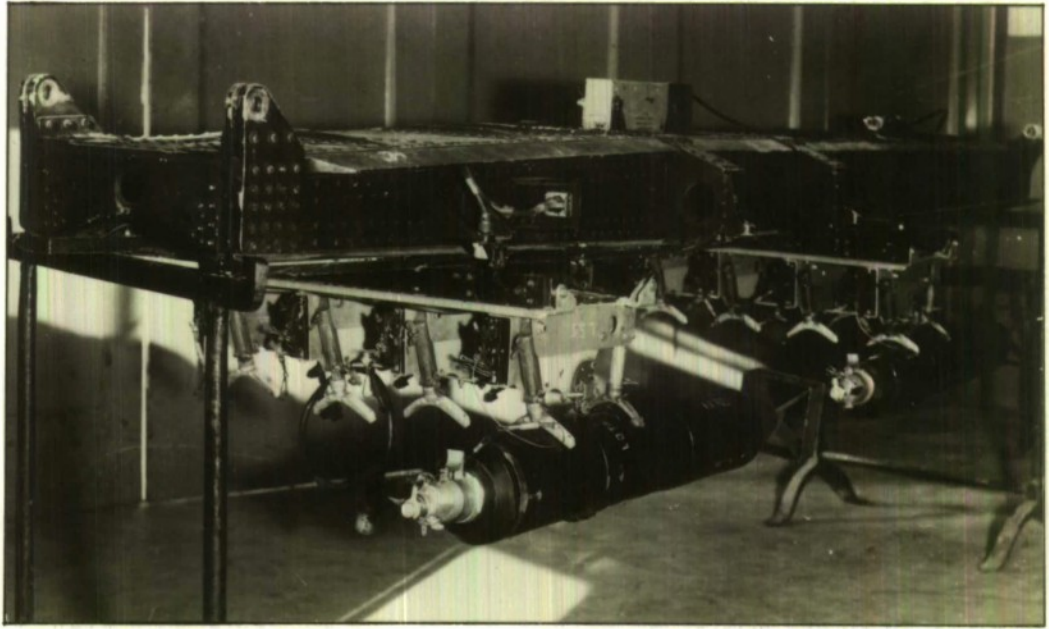


FIG.1 LIGHT SERIES CARRIERS FITTED TO FLARE BEAM

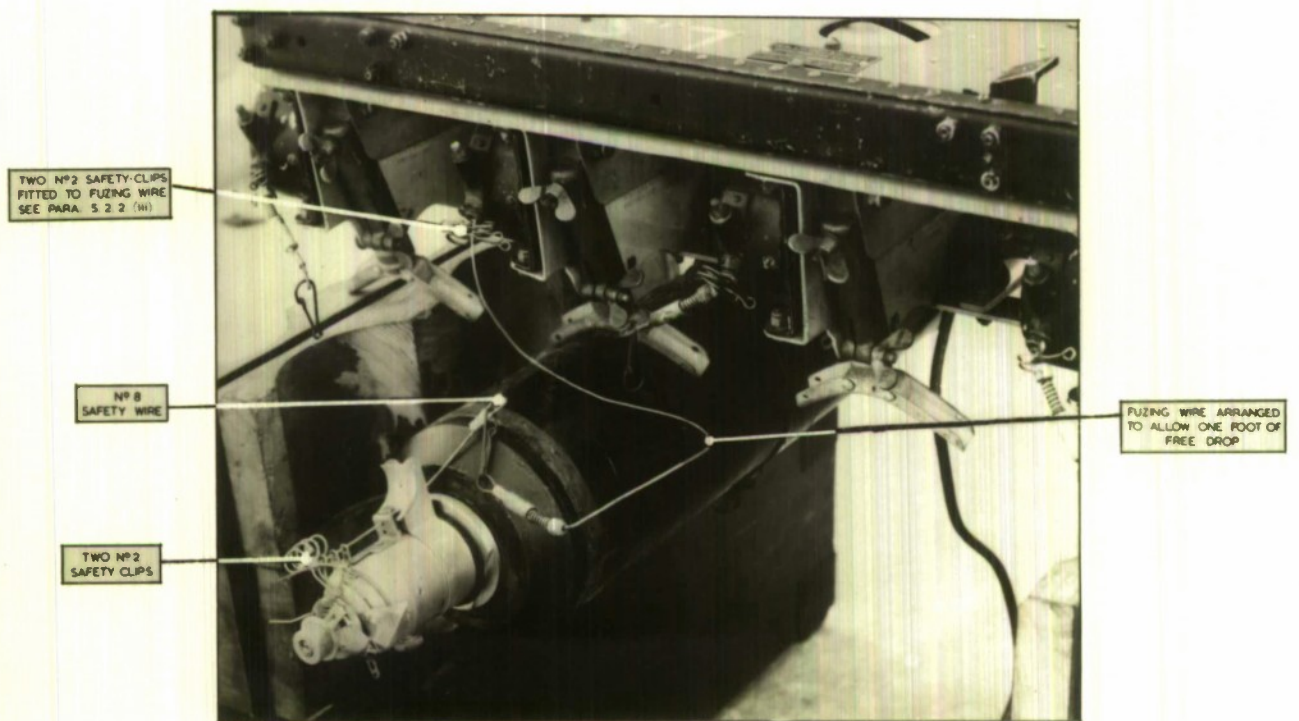
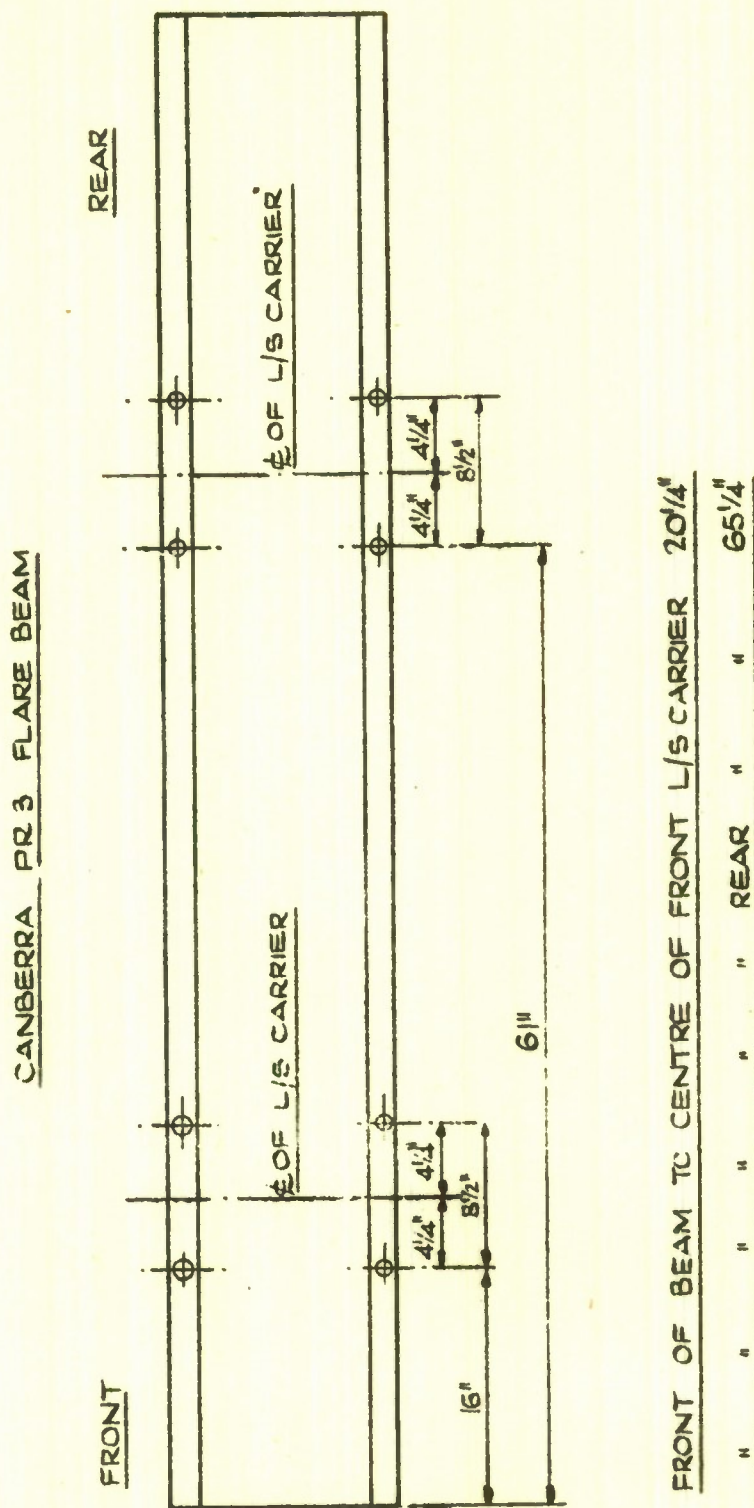


FIG. 2 FUZING ARRANGEMENTS- 4.5 INCH PHOTO FLASH

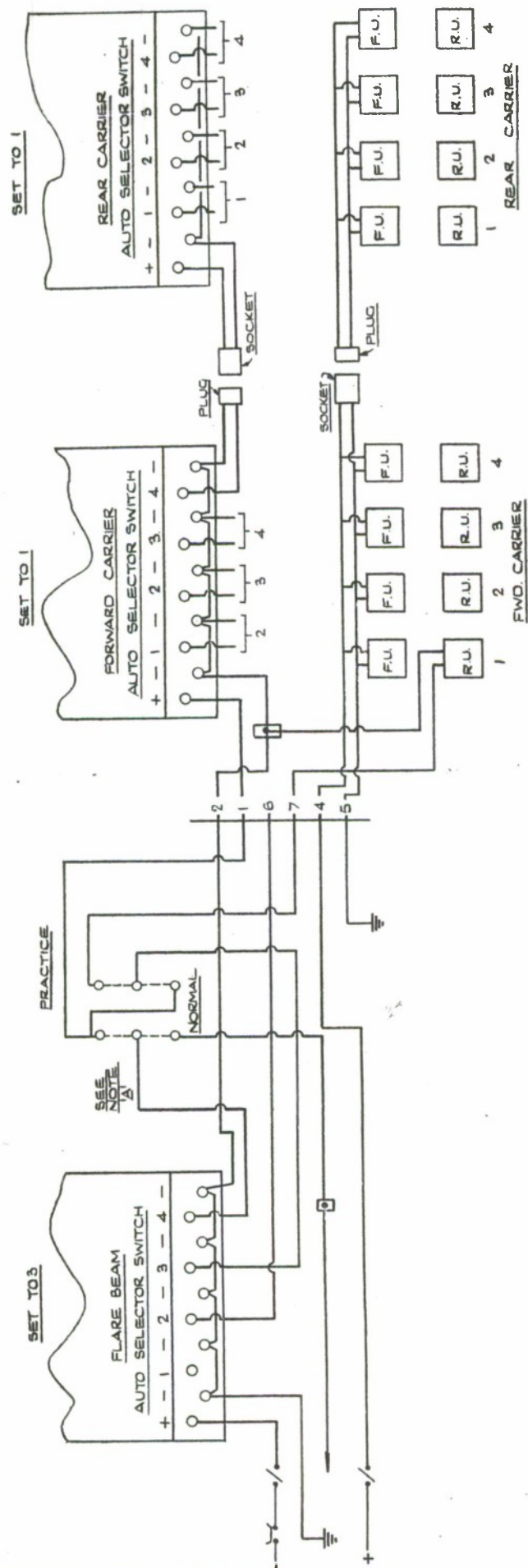
FIG. 3.



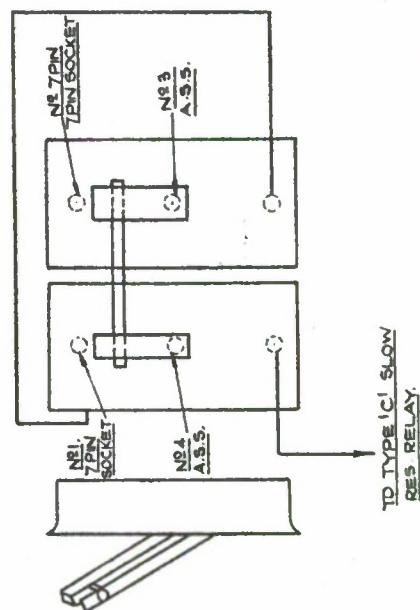
FRONT OF BEAM TO CENTRE OF FRONT L/S CARRIER	20 1/4"
" " " " " REAR	65 1/4"

POSITION OF HOLES FOR BEAM ADAPTOR. SECURING BOLTS.

FIG. 4



NOTE 'A' THESE ARE TWO 2 POSITION (WITH TOGGLE'S LINKED) SWITCHES.



FLARE BEAM & L.S. CARRIER WIRING AS MODIFIED TO
CARRY EIGHT PHOTOFLASHES 4-5"



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photographic, aircraft, 4.5 inch fuzed M111-A2
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