RESTRICTED

R.A.A.F. PUBLICATION No. 615
JANUARY 1945

THE AUSTRALIAN BEAUFIGHTER MK 21 DESCRIPTIVE MANUAL

ISSUED FOR THE INFORMATION
AND GUIDANCE OF ALL CONCERNED

BY COMMAND OF THE AIR BOARD

SECRETARY

AIR FORCE HEADQUARTERS, MELBOURNE, S.C 1

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AMENDMENT RECORD SHEET.

The AMENDMENTS promulgated in the undermentioned Amendment Lists have been made in this publication.

AMENDMENT LIST		AMENDMENTS MADE BY	DATE
No.	DATE		

AMENDMENTS—*(continued.)*

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No.	DATE		

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List of Sections

A detailed contents list is provided at the front of each Section and Chapter; and an Index, to facilitate quick reference, is contained after section 9 of this volume.

Leading Particulars

Name	Australian Beaufighter Mk. 21.
Type	Twin-engined mid-wing monoplane.
Duty	Attack aircraft.

PRINCIPAL DIMENSIONS:

(Aircraft in rigging position unless otherwise stated.)

Span	57 ft. 10 in.
Length	41 ft. 4 in.
Height—To top of rudder	15 ft. 10 in.
,, —To top of radio mast (tail down)	13 ft. 4 in.
,, —To tips of propellers (tail down)	15 ft. 6 in.
,, —To tips of wing above ground (tail down)	9 ft. 0 in.

Main Plane:

Aerofoil section	R.A.F. 28 (Basic)
Chord— 1 ft. 4 in. from centre line	11 ft. 6 in.
,, —26 ft. 8 in. from centre line	5 ft. 6 in.
Incidence	2½ deg.
Dihedral—To datum	6 deg. 30 min.
,, —To top of front spar	4 deg. 19 min.
Ailerons—span	7 ft. 11 in.
,, —chord (maximum)	2 ft. 1¼ in.

Tail Unit:

Tail plane—span	20 ft. 5 in.
,, ,, —chord (Max. including elevator)	5 ft. 10 in.
,, ,, —(Tail Plane Only)	3 ft. 3½ in.
,, ,, —incidence	0 deg.
,, ,, —dihedral	12 deg.

AREAS:

Main plane, including ailerons (net)	451 sq ft.
Ailerons, total	26.5 sq. ft.
Trim tabs (two)	0.57 sq. ft.
Tail plane	101.75 sq. ft.
Elevators, total	38.5 sq. ft.
Trim tabs (two)	1.53 sq. ft.
Balance tabs (two)	1.85 sq. ft.
Fin	13.0 sq. ft.
Rudder, total	25.7 sq. ft.
Trim tab, total	1.25 sq. ft.
Flaps, total	57.1 sq. ft.

RANGES OF MOVEMENT OF CONTROL SURFACES:

(Refer Section 4, Chapter 2, Figure 3, for full details.)

Ailerons	Up—Max., 9⅛" (28° 15'); Min., 8½" (26° 16'). Down—Max., 5-7/16" (17°); Min., 4⅞" (15°).
Trim tab, starboard	Each way—Max., 1⅛"; Min., 9/16" (20° ± 5°).
" port . .	Adjustable on ground.
Elevators	Up—Max., 16⅞"; Min., 16⅜" ($32^{\circ}\ ^{+0^{\circ}}_{-1^{\circ}}$).
	Down—Max., 12"; Min., 11-3/16" ($22^{\circ}\ ^{+0^{\circ}}_{-1^{\circ}}\ 30'$)
Trim tabs . .	Up—Max., 1¾"; Min., 1⅝". Down—Max., 1-11/16"; Min., 1-9/16".
Balance tabs . .	Remain parallel with datum.
Rudder	Each way—Max., 13⅝"; Min., 12-5/16"–12-15/16" normal.
Trim tab	Each way—Max., 1-7/16"; Min., 1-5/16".
Flaps	Max., 22¼" (58° ± 3°).

ALIGHTING GEAR:

(All pressures refer to loading weight of 25,000 lb. at take-off).

Undercarriage:

Track	18 ft. 0 in.
Shock-absorber legs	Vickers oleo-pneumatic.
Air pressure	515 lb. sq. in.
Fluid	DTD 44D 4.62 pints.
Wheels	Dunlop AHO/A61.
Tyres	Dunlop pattern treaded tyre (10 ply).
Tubes	Dunlop 1 W.8 heavy duty.
Tyre pressure	52 lb. sq. in.
Brakes	Dunlop twin pneumatic.

Tail Wheel Unit:

Shock-absorber leg	N.2600 Oleo-Pneumatic fitted with hydraulic shimmy damper.
Air-pressure	160 lb. sq. in. (approx.).

(A pressure indicator has been developed for the tail wheel strut, and when this device is fitted, pressures for various take-off loadings will be controlled by the pointer on the indicator.)

Fluid	DTD 44D.1¾ pints (approx.).
Wheel	Dunlop AHO/A62.
Tyre	Dunlop (8 ply) 9.00-5¼.
Tube	Dunlop aero heavy duty 9.00-5¼.
Tyre pressure	50 lb. sq. in.

LEADING PARTICULARS—(*continued.*)

HYDRAULIC AND PNEUMATIC SYSTEMS:

Hydraulic System:

Fluid	DTD 44D.
Capacity of systems	8 gals. (approx.).
Main relief valve opens	1,200 lb. sq. in.
Hand pump relief valve opens	1,250 to 1,300 lb. sq. in.

Pneumatic System Pressure:

At compressor and cylinder	450 lb. sq. in.
After reducing valve	220 lb. sq. in.

ENGINES:

Hercules XVIII	(See A.P. 1728E).
Fuel	100 octane.
Oil	100 S.A.E. Specification DTD 472.

PROPELLERS:

Type	de Havilland, hydromatic 55/14, see A.P. 1538D.
Operation	Constant speed, full feathering.
Propeller blade angles	27° low pitch.
" " "	93° fully feathered.

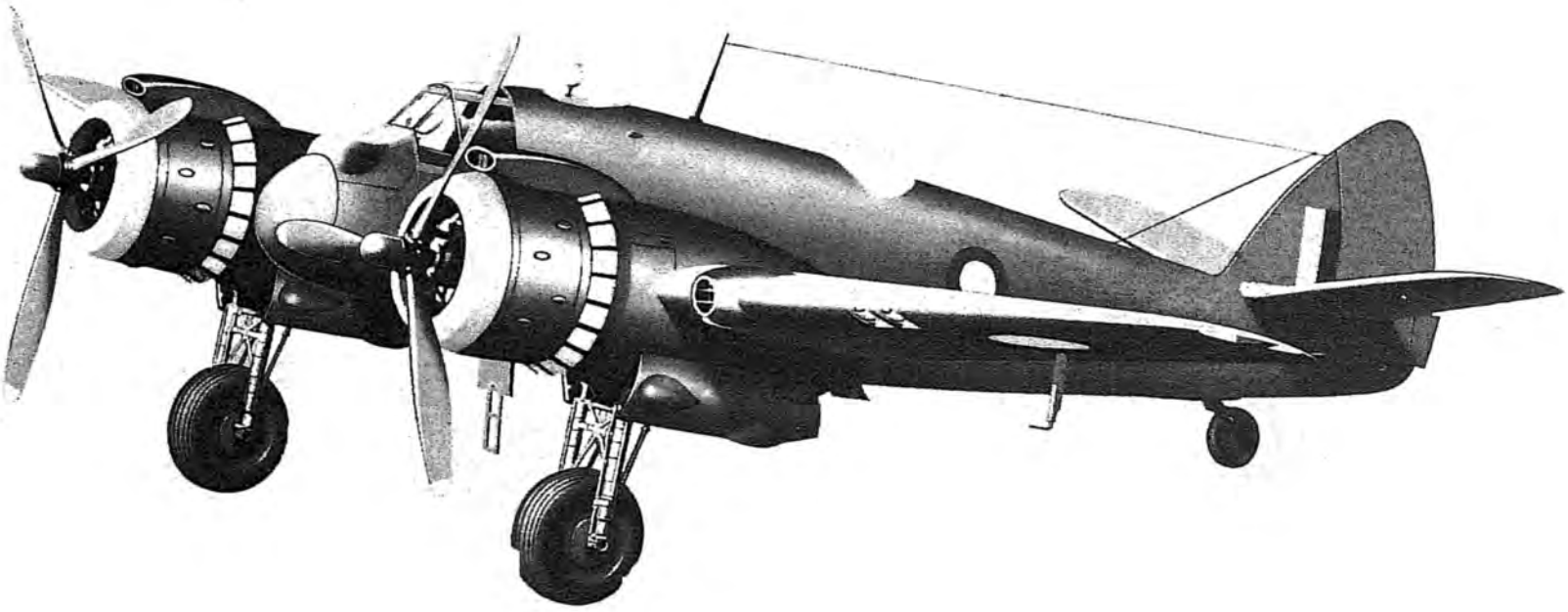
TANK CAPACITIES:

Fuel:

Centre plane tanks	(2) 188 gals. each.
Nacelle tanks	(2) 29 gals. each.
Outer plane tanks (main)	(2) 87 gals. each.
Outer plane tanks (extreme outer)	(2) 50 gals. each.
Total fuel (without auxiliary tanks)	708 gals.

Oil:

Two tanks	Oil—20 gals. each. For engine, 19 gals. Reserve for emergency feathering, 1 gal. each. Air space—2 gals. each.
Total oil	40 gals.



AUSTRALIAN BEAUFIGHTER MK 21.

Introduction

1. The Australian Beaufighter Mk. 21 aircraft is an all-metal mid-wing monoplane fitted with two fourteen-cylinder Hercules Mk. XVIII engines. It is equipped as an attack aircraft, and provision is made for carrying a 2,000 lb. bomb or mine when required; bomb carriers are also fitted under the port and starboard wings. For long range flights, an auxiliary fuel drop tank, can be carried in place of the 2,000 lb. bomb or mine.

2. The fuselage, main plane, tail plane and fin are of light alloy stressed-skin construction. The fuselage is a semi-monocoque structure with lipped channel Z-section formers and extruded light alloy beaded angle-section stringers. There are keel members and diaphragms along the bottom of the fuselage which are strengthened locally to carry the concentrated loads from the 20 mm. guns, and 2,000 lb. bomb or mine. The main plane is a two-spar cantilever structure tapering in chord and thickness. It is constructed in three portions; the port and starboard outer planes, and a centre plane that passes through the fuselage, to which it is bolted. The fin and dihedral tail plane are also cantilever structures built mainly of alclad. The ailerons, rudder and elevators have tubular spars, alclad ribs, and fabric covering. Armour plating is fitted in the nose and at the rear spar. Bullet proof glass is fitted to the windscreen centre panel.

3. When not carrying a 2,000 lb. bomb, access to the fuselage is by means of two hatches in the underside of the fuselage; one just aft of the pilot's cockpit, and the other near the observer's station. The hatches are also parachute exits. Additional emergency exits consist of a knock-out panel on the starboard side of the cockpit and hinged hoods over the pilot and observer. When a bomb or mine is being carried, the pilot's hatch cannot be used as a means of entering the aircraft.

4. The alighting gear consists of two independent undercarriage units under the engine nacelles, and a tail wheel unit. The three units are retractable, and operated hydraulically. The undercarriage units retract backward into the engine nacelles, and the tail wheel unit forward into a recess in the fuselage. Electric visual indicators, and a horn in the Pilot's cockpit indicate the respective positions of the three units. Each main unit has two oleo-pneumatic shock-absorber legs, and the tail wheel a single oleo-pneumatic shock-absorber leg. Dunlop pneumatically-operated twin brakes are fitted to each main wheel.

5. The flying controls are orthodox in operation; the pendulum-type rudder pedals and spectacle-type control column being connected to the control surfaces by chains and cables. For directional and longitudinal trimming, controllable tabs are inset in the trailing edges of the rudder and elevators. For lateral trimming, a controllable tab is fitted to the starboard aileron and another, adjustable on the ground only, is fitted to the port aileron. The elevators are fitted with an additional pair of balance tabs. Hydraulically-operated split trailing-edge flaps extend from the fuselage sides to the ailerons.

6. The engines are attached to the centre plane by steel tube mountings and are fitted with controllable cowl gills. Hydromatic constant-speed, full feathering propellers are fitted. The normal fuel supply is carried in eight tanks; two in the centre plane, one in each nacelle, and two in each outer plane; (the two outer tanks are alternative to four .5-in. wing guns). The fuel can be jettisoned from all tanks, with the exception of the nacelle tanks. The oil coolers are mounted in ducts in the leading edges of the outer planes, whilst the oil tanks are carried in the engine nacelles. All the installed tanks are protected by self-sealing coverings. The engines have electric starters, hand turning gear being provided for maintenance work.

INTRODUCTION—*(continued.)*

7. The armament consists of four 20 mm. guns in the underside of the fuselage, and four .5-in. wing guns which are situated in the outer wings, two per wing. The guns are fired by a trigger on the starboard side of the control column hand-wheel. Automatic belt-feed is provided for the 20 mm. guns. The rear defence installation, for the use of the observer, is a .303 machine gun which fires through an opening in the rear of the observer's hood. A push-button switch is mounted on the starboard throttle control lever for releasing the 2,000 lb. bomb and under-wing projectiles. Pyrotechnic equipment in the fuselage comprises a signal pistol with an upward firing tube, and stowage for cartridges.

8. Power for the electrical installation, consisting of the usual services, the bomb and auxiliary fuel tank releases and the gun firing is derived from two 24 volt, 1,500 watt generators driven by the engines.

9. The wireless installation comprises two types of equipment:—

(i) A general purpose installation using AT5/AR8 equipment controlled by the Observer and remotely controlled by the Pilot. The equipment is mounted just aft of the rear entry hatch.

(ii) A V.H.F. installation using TR. 5043 equipment, is controlled by the pilot and remotely controlled by the observer. The equipment is mounted on the port side, just aft of the pilot.

Intercommunication facilities are available with either of the above equipments.

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SECTION 1.

PILOT'S CONTROLS AND EQUIPMENT.

EMERGENCY EXITS AND EQUIPMENT.

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

SECTION 1.

Pilot's Controls and Equipment

Emergency Exits and Equipment

CONTENTS.

CONTENTS—(*continued.*)

ILLUSTRATIONS.

Pilot's Controls and Equipment

Emergency Exits and Equipment

INTRODUCTORY.

1. This section gives the location, and where necessary explains the function and operation of the controls and equipment in the pilot's cockpit; also of equipment located elsewhere, but with which the pilot should be acquainted. The layout of the various items and instruments is illustrated and referenced in Figs. 1 to 5, and a diagram showing the disposition of the emergency exits, is illustrated in Fig. 6.

FUEL AND OIL.

2. The fuel and oil to be used for the engines is as follows:—

Fuel .. Specification 100 octane
Oil .. Specification D.T.D. 472, (S.A.E. 100 Redband).

FUEL SYSTEM.

Fuel Tanks:

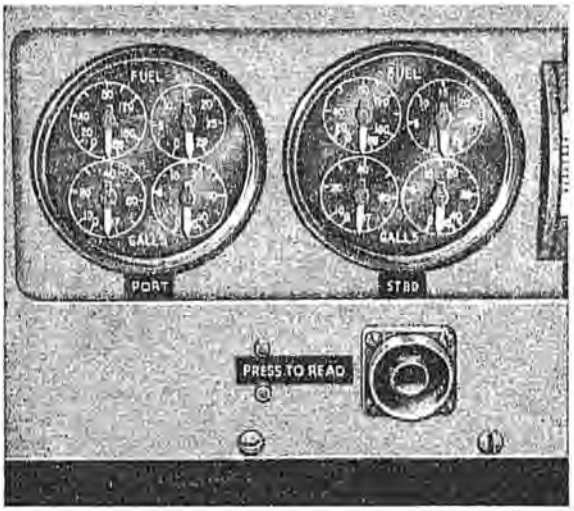
3. The normal fuel supply is carried in eight tanks, two in the centre plane, one in each nacelle, and two in each outer plane, as shown in Fig. 7. All tanks are self-sealing. The two outer tanks are alternative to four .5-in. wing guns.

Auxiliary Fuel Tank:

4. An Auxiliary fuel tank, for long duration flights, can be fitted underneath the fuselage, replacing the 2,000 lb. bomb or mine. This tank has a capacity of 200 galls., and is fitted in exactly the same manner as the 2,000 lb. bomb. The tank is controlled by an auxiliary control lever, with a black knob situated outboard of the fuel cock controls on the starboard side of the pilot's cockpit. This tank can be jettisoned in the same manner as the 2,000 lb. bomb. For further information refer to Para. 53. Installation of this tank is shown on the fuel system diagram Sect. 8, Fig. 2.

Fuel Gauges (Fig. 3—No. 9):

5. Eight fuel contents gauges, mounted in two groups of four, are located on the port



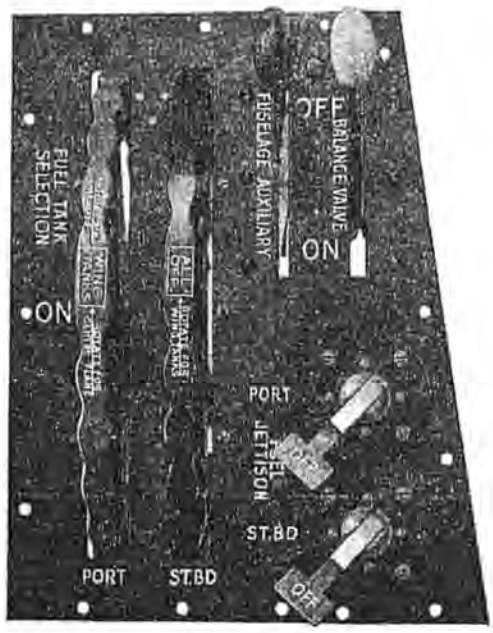
side instrument panel. These register the quantity of fuel in the eight tanks. A push-button switch, situated directly beneath, controls the gauges.

Fuel Cock Controls (Fig. 4—No. 24):

6. The selection, auxiliary, and balance cock controls for the fuel system are mounted on a panel below the sill tube on the starboard side of the pilot's cockpit. The position and operation of these controls is as follows:—

(i) The two selection handwheels are mounted near the inboard edge of the panel, and are indicated by the lettering "FUEL TANK SELECTION" written parallel with the slots. The handwheel, controlling the starboard tanks' cock is coloured green, and the handwheel controlling

the port tanks' cock is coloured red. With Vickers 3-way cock installed, each handwheel has three positions clearly marked on the rim; "WING", "CENTRE PLANE", and "ALL OFF". The direction to rotate the handwheel for alternative positions is also indicated on the rim.



Correct location of cock should be felt on the handwheel. This should be an indication of correct selection and not the position of the marks on handwheel in relation to "ON" mark.

(ii) The fuselage auxiliary fuel tank control lever (Fig. 4—No. 26) is distinguished by a black hand-knob, and the lettering "FUSELAGE AUXILIARY" written parallel with the lever slot. The "ON" position of the lever is at the aft end of the slot.

NOTE:—*When using fuselage drop tank, move lever to "ON" position before turning main plane tanks "OFF." When drop tank is nearly empty, turn main tanks "ON" before moving drop tank lever to "OFF" position.*

(iii) The balance cock control lever (Fig. 4—No. 25) is situated beside the fuselage auxiliary tank lever; it is distinguished by a white hand-knob, and the lettering "BALANCE VALVES" written parallel with the lever slot. The lever is in the "ON" position when at the aft end of the slot.

Fuel Jettison Levers (Fig. 4—No. 23):

7. The port and starboard fuel jettison levers are located together at the right hand rear corner of the fuel cock control panel. To jettison fuel, pull the lever up to the "ON" position. When the lever is in the "ON" position, the valve is lifted off its seat to allow fuel to escape from the tank and emerge into the airstream through a funnel leading to the undersurface of the main plane, at rear of engine nacelles. An approximate minimum pneumatic pressure of 80 lb./sq. in. is required to operate the valve (see Sect. 9, Para. 37).

OIL SYSTEM.

8. Each engine has a similar but entirely separate oil system. A self sealing oil tank (one for each engine) is under the nacelle top panel. The capacity of each tank is 20 gallons; 19 gallons for engine and 1 gallon reserve for emergency feathering of the propeller, plus 2 gallons air space. Oil pressure and temperature gauges are located on the pilot's instrument panel (see Fig. 2). An installation and pipe-line diagram is described and shown in Sect. 8, Para. 16 and Fig. 5 respectively.

HYDRAULIC SERVICES.

General:

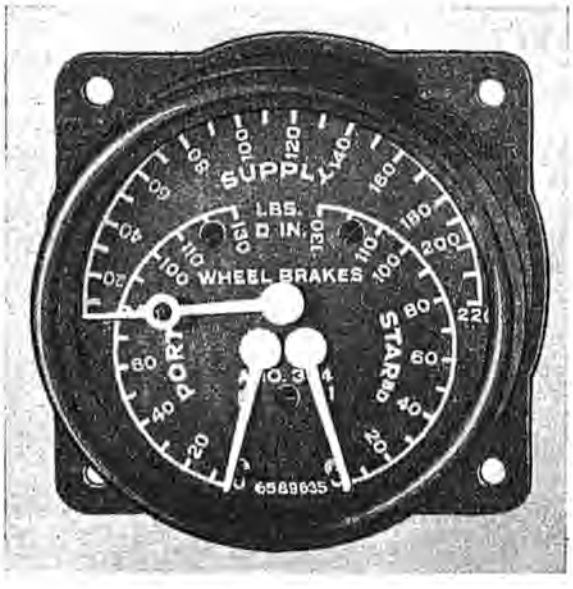
9. The hydraulic system operates the alighting gear and flaps. Normally, fluid under pressure is supplied to the actuating jacks by two pumps, one driven by each engine. A hand pump (Fig. 4—No. 22), mainly for servicing, but also for emergency operation of the alighting gear and flaps, is provided on the starboard side of, and adjacent to the pilot's seat. The controls for operating the hydraulic system are situated on the port side of the pilot's instrument panel.

Selector Control (Fig. 3—No. 13) :

10. The power control lever has a white hand-knob and is situated outboard of the flaps indicator. This lever operates a valve which directs the fluid, either for the operation of the alighting gear and flaps, or through the by-pass. For alighting gear and flaps operation, the lever should be down, in the "ON" position; but unless these services are being used, it should be in the "OFF" position, when the aeroplane is flying. When on the ground, however, it is important that the lever should be left in the "ON" position. A by-pass valve operated by compression of the port undercarriage shock absorber strut, limits the pressure to 600 lbs./sq. in. under these conditions reducing the load on the pumps.

PNEUMATIC SYSTEM.

11. The pneumatic system, which is supplied from two air bottles mounted aft of the observer's wireless crate, provides the pressure for operating the wheel brakes, the 20 mm. gun and .5-in. gun firing, and fuel jettison valves.



TRIPLE PRESSURE GAUGE

The compressor is driven by the starboard engine and supplies pressure to the two air bottles. A pressure gauge is fitted to each bottle, and the Triple Pressure Gauge (Fig. 4—No. 28) located aft of rudder trim tab control, indicates the pressure of the main supply after it has passed the reduction valves, and the pressure released by each wheel brake relay control.

ELECTRICAL SYSTEM.

Battery Master Switch:

12. The Battery master switch, controlling the accumulator supply to the aircraft electrical services, is mounted on the starter relay box, situated immediately below "J.B.8.B." at the rear of the front spar. This master switch must be turned to the "ON" position, before the electrical services of the aircraft may be operated.

Cockpit Emergency Light Switch (Fig. 4—No. 12) :

13. The emergency cockpit light (Fig. 1—No. 6), which is mounted above the flying instrument panel, is controlled by the rear switch of the three unit switch box on the starboard switch panel. This light is fed from a single cell, 2 volt accumulator, situated on the floor beside the emergency hydraulic hand pump.

NOTE:—*This light must be used only in the case of emergency.*

Generator Supply:

14. The D.C. supply is from two 1500-watt 24-volt shunt wound generators driven by the engines. The generators charge into two 12-volt, 40-amp. hour accumulators mounted in trays behind the front spar, port side. For starting, there is an external supply socket on the starboard side under the aircraft fuselage forward of the front spar, covered by a hinged flap in the skin. Power-failure warning lamps on the fuse panel light when the generators are not charging and go out as the revolutions mount up to normal cruising speed.

AIRCRAFT CONTROLS.

Primary Controls:

15. These are conventional in design, and the pendulum type rudder pedals are adjustable for reach by a handle (Fig. 1—No. 12) under the instrument panel. The spectacle type handwheel (Fig. 5) mounted on the control column operates the elevators.

Primary Controls Locking Gear:

16. Locking gear for the primary flying controls is stowed just above the handrail on the port side of the rear fuselage (refer Sec. 3, Fig. 1, and Sect. 4, Chap. 1, Fig. 2). The method of locking the controls is as follows:—

(a) Hold the control column in the central position.

(b) Insert the eyebolt of the locking gear through the hollow bolt at the bottom of the column, and secure with the pin.

(c) Attach the aft end of the gear by the quick-release pin to the top of the bracing tube on the port side of the pilot's seat.

(d) Fix the clip to the aileron handwheel.

(e) Fix the clip to the rudder pedals.

Flying Instruments:

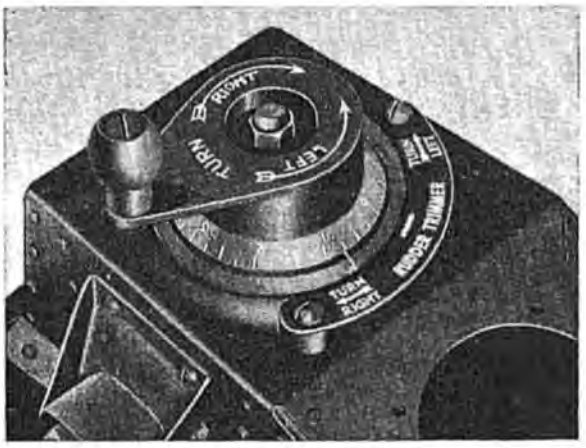
17. The usual instruments are mounted on the pilot's instrument panel and are detailed in Fig. 2. A vacuum pump mounted at the rear of each engine provides power for the vacuum operation instruments. Automatic change-over is provided in case of failure of one pump.

Elevator Trim Tabs Control (Fig. 4—No. 29):

18. The trim tabs on the elevators are controlled by a handwheel at the top of a column mounted on the starboard side of the cockpit. The handwheel is mounted, fore-and-aft, on the outboard side of its column. When the handwheel is rotated towards the position marked "NOSE DOWN," the action of the tabs tends to depress the nose of the aeroplane and to relieve the pilot of the prolonged effort of countering any slight "tail heavy" tendency. This operation causes the tabs to be raised, and the load on the tabs then forces the elevators down slightly. When the handwheel is rotated towards the position marked "NOSE UP", the effect is reversed. An indicator (Fig. 4—No. 27), showing the position of the tabs, is mounted partly on the starboard shelf, and partly on the rear of the column supporting the handwheel.

Rudder Trim Tab Control (Fig. 4—No. 30):

19. The trim tab on the rudder is controlled by a handle mounted in a horizontal position on the starboard side, close to the base of the pilot's instrument panel. When the handle is turned clockwise, in the direction marked "TURN RIGHT", the action of the tab tends to turn the aeroplane to starboard, thereby relieving the pilot of the prolonged effort of countering any slight tendency of the aeroplane to turn to port. This operation



causes the tab to be moved to port and the air load on the tab then forces the rudder slightly to starboard. When the handle is turned anti-clockwise, in the direction marked "TURN LEFT", the effect is reversed. An indicator, showing the position of the tab, is incorporated on the handle.

Aileron Trim Tab Control (Fig. 4—No. 21):

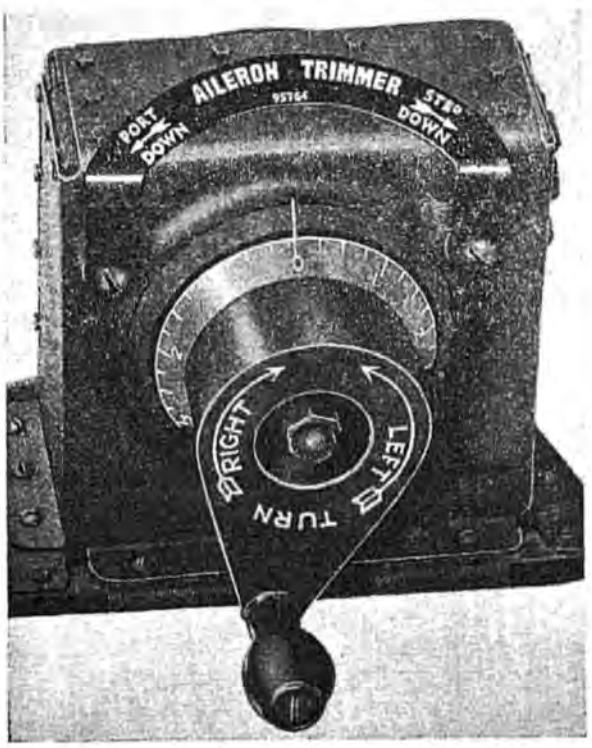
20. The trim tab on the starboard aileron is controlled by a handle, mounted on the starboard side, in line with the back of a pilot's seat. To counteract any tendency of the aeroplane to fly with the port wing high, the handle should be rotated to port in the direction marked "PORT WING DOWN", and vice versa. To depress the port wing, the tab is raised and the air load on the tab then forces the starboard aileron down slightly. An indicator showing the position of the tab is incorporated in the handle. The tab on the port aileron can only be adjusted on the ground.

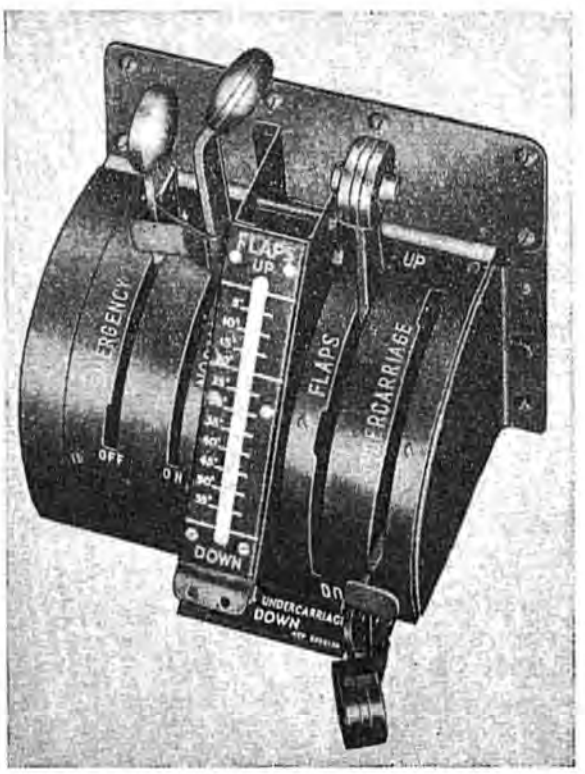
Undercarriage Controls (Fig. 3—No. 16):

21. The undercarriage and tail wheel control lever is situated on a quadrant on the port side just below the pilot's instrument panel. It has a black hand-knob and controls the raising and lowering of the undercarriage and tail wheel units. The movement of the lever is in the same direction as the movements of the units, i.e., "UP" to raise the units, and "DOWN" to lower them. Before the alighting gear can be operated the hydraulic power lever must be in the "ON" position (see Para. 10).

Undercarriage Control Safety Lock (Fig. 3—No. 17):

22. To prevent the control lever from being inadvertently moved to the "UP" position when the aeroplane is on the ground, a safety lock is provided on the control lever.





The lock consists of a spring loaded thumb catch which engages with a pin on the control box when the control lever is in the "DOWN" position. The thumb catch must be depressed before the lever can be moved towards the "UP" position, but when the lever is returned to the "DOWN" position the catch will automatically engage the pin.

Undercarriage Radius Rod Locking Pins:

23. In addition to the undercarriage control safety lock, a further positive means of preventing inadvertent retraction of undercarriage, when the aeroplane is on the ground, is provided by locking pins that are fitted, directly by hand from the ground, into the knuckle joints of the inboard radius rod on each undercarriage unit. A red flag is attached to each pin, and the pins must be removed before flight. If the pins have been accidentally left in position, the red flags can be seen by the pilot. When not in use, the locking pins are stowed in a bag on the starboard side, aft of the observer's seat (see Sect. 3—Fig. 1—No. 22).

Alighting Gear Position Indicators (Fig. 3—No. 11) **and Warning Horn:**

24. Three electrical position indicators are fitted in a group on the port side instrument panel above the throttle levers. The indicator on each side is for the corresponding undercarriage unit and the one in the centre is for the tail wheel unit. The indications given, when the units are in various positions, are as follows:—

Wheel locked up - "UP" shows on red background.

Wheel locked down "DOWN" shows on green background.

Between locks or indicator off - Black and White dazzle lines.

The indicator switch (Fig. 4—No. 1) for the three alighting gear indicators is beside the ignition switches, and is interlocked with them by an extension bar which prevents the ignition switches being "ON" when the indicator switch is "OFF". When the indicators are switched on, the bar is withdrawn from the ignition switches. There is also, in the nose of the fuselage, an electrical warning horn which sounds if the engine throttle levers are closed beyond the one-third open position, and remains in operation with the throttle levers in this position until the alighting gear units are locked down.

Flaps Control and Position Indicator (Fig. 3—Nos. 14 & 15):

25. The flap control lever, situated beside the undercarriage control lever, has a red knob, and controls the lowering and raising of the split trailing-edge flaps. Its movement is in the same direction as the movement of the flaps, i.e., "DOWN" to lower the flaps and "UP" to raise them, and it should be returned to the neutral position after operation. To lower the flaps to a lesser degree than full down, the lever should be placed in the "DOWN" position until the indicator, at the left of the lever, shows that the flaps are lowered to the desired position; the lever should then be returned to the gate in the middle of the quadrant, thus shutting off the control valve.

Hand Pump (Fig. 4—No. 22):

26. A hydraulic hand pump, which operates the complete system, is fitted to the floor on the starboard side of the pilot's seat, and is operated by a handle with a red hand grip. To operate the pump, the handle should be extended by pulling the hand-grip up, and locking it in the extended position by twisting the hand-grip in a clockwise direction. The pump is provided mainly for servicing purposes on the ground, but can also be used in flight, to operate the emergency hydraulic system if the engine pumps fail.

Emergency Selector Lever (Fig. 3—No. 12):

27. An emergency selector lever which has a red hand-knob is situated on the extreme port side of the hydraulic control unit. This lever operates a valve which directs the fluid from the hand pump, for the operation of either the normal hydraulic system, or the emergency system.

NOTE:—*The EMERGENCY selector must never be "ON" unless the hydraulic power lever is "OFF" and an interlock prevents this.*

The operation of the emergency selector lever is as follows:—

(i) For emergency lowering of the flaps and alighting gear through separate pipe-lines. To use this system the hydraulic power lever (Fig. 3—No. 13) must be set "OFF" and the "EMERGENCY" selector "ON". This will lower the flaps as well as the alighting gear when their control levers are set to either the "UP" or "DOWN" positions; with the flap control lever at the mid position the alighting gear only will come down, and to subsequently lower the flaps, the flap lever must be set to "DOWN".

(ii) For ground operation of the normal hydraulic system as an alternative to the engine-driven pumps when these are not running. For this purpose the EMERGENCY selector must be "OFF" and the power lever "ON".

Wheel Brakes:

28. The pneumatic twin brakes are operated by a lever (Fig. 5—No. 22) on the starboard side of the handwheel. For parking, a spring-loaded catch (Fig. 5—No. 1) retains the lever in the "ON" position to engage, depress lever, then set the catch and release the lever. To disengage, depress the lever, and the catch springs clear.

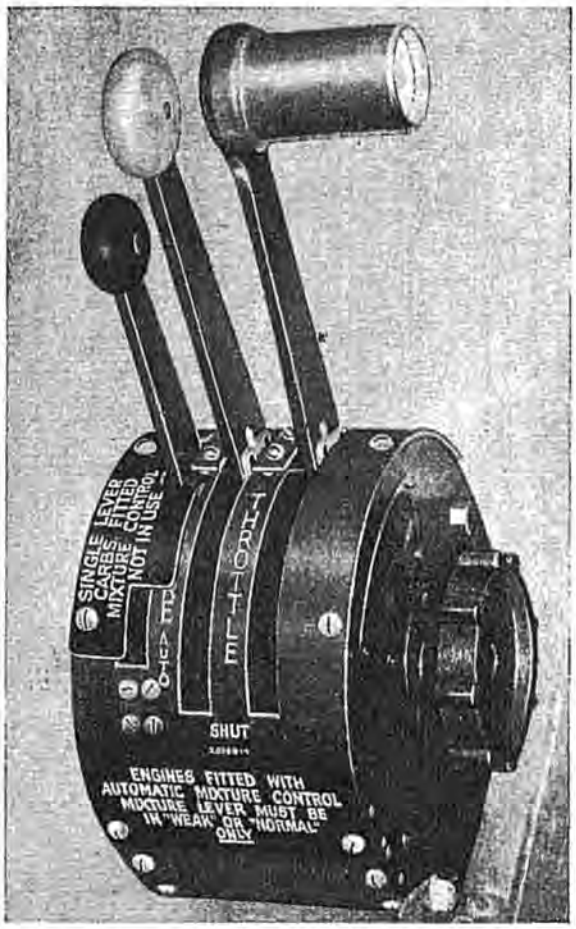
Pressure Head:

29. The pressure head operates the rate of climb indicator and the airspeed indicator. These instruments are mounted on the pilot's instrument flying panel (see Fig. 2). The heating circuit switch (Fig. 4—No. 7) is mounted on the starboard switch panel. The pressure head is mounted beneath the port wing.

ENGINE AND STARTING CONTROLS.

Throttle and Automatic Mixture Controls:

30. Two throttle control levers (Fig. 3—No. 20) and a single mixture control lever (Fig. 3—No. 23) are mounted on a quadrant on the engine control panel, at the left hand side of the pilot's seat. The throttle lever slots are marked (at positions from rear to front) "SHUT", "CRUISING", "RATED", and "TAKE OFF" positions. A single lever carburettor with automatic mixture control is fitted to the Hercules Mk. XVIII engine; the



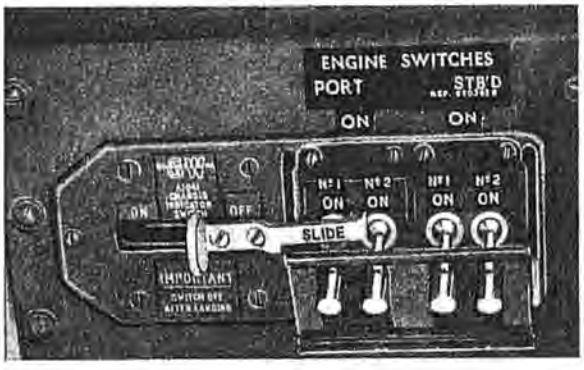
mixture control lever is fixed by a stop plate and is inoperative. An adjuster for stiffness of the controls is provided on the side of the quadrant; the friction discs of which must be kept perfectly dry.

Propeller Speed Controls (Fig. 3—No. 24) :

31. These levers are outboard of the throttle and mixture controls. The controls operate conventionally; the forward end of the quadrant is marked "INCREASE R.P.M." and the extreme left end, "DECREASE R.P.M.". An adjuster for stiffness of the controls is provided on the outboard side of the quadrant; the friction discs of which must be kept perfectly dry. De Havilland hydromatic fully feathering propellers are fitted; for positive coarse pitch, the levers are moved to the extreme aft position.

Ignition Controls (Fig. 4—No. 2) :

32. The two magnetos, mounted at the rear of each engine, are controlled by separate switches; the four switches being combined in a single unit on the starboard side, beside



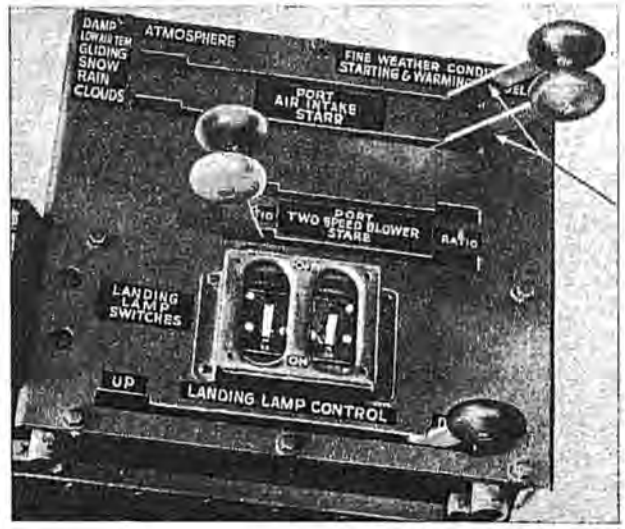
the alighting gear indicator switch. A bar fitted to the alighting gear indicator switch prevents the ignition switches being turned "ON" when the indicator switch is "OFF".

Two-speed Supercharger Controls (Fig. 3—No. 27) :

33. The two-speed supercharger controls are mounted in a quadrant aft of the throttle and mixture controls on the engine control panel. There are two positions only to which the levers should be moved; forward to fully supercharged marked "S", and rearward to medium supercharged marked "M". The levers are spring-loaded to prevent them being inadvertently left in any position other than "S" or "M". The impellor is cropped to give maximum performance at low altitude. "S" gear must NOT be engaged during flight at altitudes below 5,000 feet. Generally speaking, "S" gear will only be required at higher altitudes when the required performance cannot be obtained in "M" gear. Since the majority of requirements will be met by "M" gear, the supercharger clutch mechanism will seldom be used. It is therefore very important that the clutches be kept free from sludge by the momentary engagement of "S" gear, both before flight and after landing. The r.p.m. must NOT EXCEED 1,500 during the change-over and "M" gear must be re-engaged before the engine is opened up or shut down. It is essential that an engine is not run more than 10 hours without exercising the clutches, as any subsequent operation of the clutches might result in serious damage due to accumulated sludge.

Carburettor Air-intake Controls (Fig. 3—No. 25) :

34. The air-intake shutter levers, situated on the outboard side of the two speed supercharger controls, control the supply of either hot or cold air to the carburettors.



The lever for the port engine air intake has a red knob, and that for the starboard has a green knob. In the forward position of the levers, cold air is supplied, and in the rearward position, hot air is supplied.

Cowling Gill Controls (Fig. 3—No. 30):

35. The two switches for controlling the electric motors which operate the cowling gills, are situated on the engine control panel aft of the supercharger control. The switches have three positions, "OPEN", "OFF", and "CLOSE". To operate the switches, the knobs must first be depressed and then turned either to "OPEN" or "CLOSE" as required. Red warning lights (Fig. 3—No. 29) adjacent to the switches indicate when the electric motors are in operation. The lights remain on until the gills are fully opened or closed, or the switch knobs are turned to the "OFF" position and pulled out after use. The port gills can be operated independently of the starboard gills and vice versa.

Carburettor Cut-out Controls (Fig. 3—No. 33):

36. The carburettor cut-out controls are in a control box with a spring-loaded hinge cover, fitted to the top of the front spar on the port side. The controls have a red knob for the port engine, and a green knob for the starboard. The cover is opened in the forward direction. When the controls are pulled up, the fuel supply to the engine is cut off, enabling the engines to be stopped before the magnetos are switched off.

Priming Pump (Fig. 4—No. 20):

37. A hand priming pump is provided on the starboard side of the cockpit adjacent to the pilot's seat, and is used for engine starting only (see Sect. 8, Fig. 2). Three positions of the plunger knob are marked on the mounting flange; "ON RIGHT", "ON LEFT", and "OFF". To operate the pump, push the plunger knob down, turn to the position required, and operate the plunger.

NOTE:—*After use, it is important that the plunger knob be locked in the "OFF" position.*

Auxiliary Fuel Pump Switches (Fig. 4—No. 6):

38. The switches for the auxiliary fuel pump of each engine are mounted on the pilot's starboard switch panel. The auxiliary pumps are used for priming the carburettor, and in flight, if the engine driven pumps fail. They should be used also on take-off, in addition to the engine driven pumps. (Refer Sect. 8, Para. 7).

Engine Starter and Booster Controls (Fig. 4—No. 9):

39. The engine starting and booster pushbuttons are mounted on the pilot's starboard switch panel. For electric starting, push the starter buttons and booster buttons simultaneously. When hand starting, push the booster buttons only.

SEATS, DOORS AND WINDOWS.

Pilot's Seat:

40. The pilot's seat is constructed to take a seat type parachute, and is adjustable for height by means of a lever on the left-hand side; the lock for securing the seat at the desired height can be released by turning the twist grip at the end of the lever. A seat-collapsing lever is fixed to the right-hand side of the seat pan, for use by the pilot, to make an emergency exit when not carrying a 2,000 lb. bomb or mine. To collapse the seat, the lever should be raised and pressure applied by the shoulders to the top of the seat back. This action breaks the junction of the seat back and pan, and straightens them out for the next exit operation. To return the seat to the normal position, pressure should be applied to the bottom of the seat back.

Entrance With, and Without, 2,000 lb. Bomb or Mine Installed:

41. For Pilot—Entrance to the fuselage is through a hatch, in the underside of the fuselage, between the centre plane spars. To open the hatch, a handle just forward of the hatch is pulled. This releases the bottom catch, and the hatch is swung open and pushed home into the top catch. Entrance can then be made by the ladder attached to the hatch. Two hand grips and two handrails are provided. The hand grips are situated, one on the starboard keel member, and one on the

port bracing tube for the front spar. The handrails (Fig. 1—No. 9) are near the top of the fuselage. To shut the hatch, release the top catch, either from the inside by the handle on the starboard side just above the floor, or from the outside by the handle just forward of the hatch. Swing the hatch shut and push home into the bottom catch. The hatch is opened from inside by pulling a lanyard attached to a lever on the port side of the fuselage, just aft of the front spar; this releases the bottom catch. The hatch is then pulled up, by the lanyard attached to it, and pushed into the top catch.

When a 2,000 lb. bomb or mine is carried, the pilot can enter the aircraft through the roof window, which is opened by an external lever on the port side, or through the observer's parachute hatch.

A similar hatch for the observer is provided in the underside of the rear fuselage, just aft of the observer's seat, and is operated in a similar manner to the pilot's parachute hatch, except that there is no lanyard attached to the lever. For further information on entrance and exit hatches and levers, refer Para. 64 and Fig. 6.

Direct Vision Panels (Fig. 1—No. 4):

42. On each side of the pilot's windscreen are direct-vision windows for use if the windscreen is obscured. The windows open inward on hinges at the outboard sides, and are retained in the closed position by lever catches.

COCKPIT EQUIPMENT.

Sunblinds (Fig. 1—No. 8):

43. A sunblind is provided above the pilot's head; it is fitted with a tab and hook, to enable it to be pulled forward and secured in an eye at the forward end of the wire rails on which it slides.

Water Bottles:

44. Two water bottles are provided and stowed on the port side of the rear fuselage (refer Sect. 3, Para. 13, and Fig. 1).

Flying Rations:

45. A container for the flying rations is provided aft of the rear spar (refer Sect. 3, Para. 12).

Pilot's Safety Harness:

46. A Sutton safety harness is fitted to the pilot's seat, to which the shoulder straps are anchored by a special fitting on the seat back. The incorporation of this fitting allows the pilot to lean forward without unfastening his harness. The extension is obtained by operating a lever, attached to a channel which extends outward from the rear of the pilot's seat on the starboard side. On top of the channel, running parallel to the lever, are the instructions: "PUSH TO RELEASE SUTTON HARNESS", "RETURN TO LOCKED POSITION". When the pilot leans back again, the catch automatically snaps home into position.

OPERATIONAL EQUIPMENT.

Reflector Gun Sight (Fig. 1—No. 7):

47. A reflector gun sight is mounted on a bracket attached to the starboard side of the windscreen sill, by means of a slot in the bracket, and knurled locking screw. The sight can be clamped in its operational position, or stowed clear of the pilot's vision. The socket (Fig. 2—No. 31) and the dimmer switch (Fig. 2—No. 3) for the gun sight are mounted on the pilot's instrument panel.

20 mm. Gun Firing Controls (Fig. 5):

48. The 20 mm. and .5-in. wing gun firing controls are embodied in the one switch on the starboard side of the control column wheel and are operated as follows:—Move the selector switch which is situated on the port side of the cockpit, beneath the alighting gear indicator to the desired position, i.e., "Cannon" or "Wing gun", release the safety catch (No. 3), press the cocking button (for 20 mm. guns only) (No. 4), and press the firing trigger (No. 6).

2,000 lb. Bomb Fusing Switches (Fig. 4—No. 14) **and Isolating Switch:**

49. The nose and tail fusing switches are situated on the starboard aft switch panel,

adjacent to the wing bomb selector switches. The 2,000 lb. bomb or mine type "A" isolating switch (Fig. 3—No. 1) is located on the pilot's port aft switch panel.

2,000 lb. Bomb Release (Fig. 3—No. 19):

50. The isolating switch and tail fusing switch must first be placed in the "ON" position. The bomb is then released by pressing the pushbutton mounted on the starboard throttle control lever.

NOTE:—*The wing bomb, port and starboard switches must be in the "OFF" position and the R.P. Master switch (Fig. 3—No. 3) must be in the "UP" position before releasing the 2000 lb. Bomb.*

2,000 lb. Bomb Jettison:

51. The same procedure as for 2,000 lb. bomb release (see Para. 51), but the TAIL FUSING SWITCH (Fig. 4—No. 14) MUST BE IN THE "OFF' POSITION.

Mine "A" or Auxiliary Fuselage Fuel Tank Release:

52. The isolating switch (Fig. 3—No. 1) must first be placed in the "ON" position. The mine "A" or auxiliary fuselage fuel tank is then released by pressing the pushbutton (Fig. 3—No. 19) mounted on the starboard throttle control lever.

NOTE:—*The wing bomb, port and starboard, selector switches (Fig. 4—No. 16) must be in the "OFF" position and the R.P. Master switch (Fig. 3—No. 3) must be in the "UP" position before releasing the mine or fuselage tank.*

Mine "A" Jettison:

53. The mine jettison lever (Fig. 4—No. 19) is situated on the upper longeron on the starbord side adjacent to the pilot's seat. Place the isolating switch in the "ON" position. In jettisoning the mine, it is important that the mine jettison lever be pushed down to release the arming lanyard, before pressing the pushbutton (Fig. 3—No. 19) on the throttle control lever. (For further information see Sect. 4, Chap. 1, Para. 26.)

NOTE:—*Care must be taken to see that the wing bomb selector switches (Fig 4—No. 16) are in the "OFF" position and the R.P. Master switch (Fig. 3—No. 3) is in the "UP" position.*

Wing Bombs and R.P. Release, and Selector Switches:

54. The R.P. Master switch (Fig. 3—No. 3) is situated on the port side aft switch panel; above the switch is marked "BOMBS" and below are the letters "R.P."; the switch is pushed up for bombs and down for R.P. release. A warning light (Fig. 3—No. 4) is provided above the selector switch and lights when the selector switch is in the "BOMBS" or "R.P." position. Two wing bomb selector switches (Fig. 4—No. 16) are provided on the starboard aft switch panel; these switches allow the pilot to select either port or starboard wing bombs. An R.P. selector switch (Fig. 3—No. 2), situated below the R.P. Master switch, allows the pilot to choose either a pair, or the whole salvo (8) from the carriers.

Port and Starboard Wing Bombs Release:

55. Put the wing bomb selector switches (Fig. 4—No. 16) in the "DOWN" position; the R.P. Master switch in the "UP" position. Then press pushbutton (Fig. 3—No. 19) on the throttle control lever.

NOTE:—*Make sure that the isolating switch (Fig. 3—No. 1) is in the "OFF" position when releasing wing bombs or R.P., to prevent simultaneous release of the 2,000 lb. bomb or mine "A."*

R.P. Release:

55a. Put wing bomb selector switches (Fig. 4—No. 16) in "UP" position; R.P. Master switch (Fig. 3—No. 3) in "DOWN" position. Care must be taken to see that isolating switch is switched "OFF".

See "Note" above.

Wing Bomb Jettison, and Container Jettison Pushbutton Switches:

56. The wing bomb jettison switch (Fig. 4—No. 18) and the container jettison switch (Fig. 4—No. 17) are situated on the

starboard aft switch panel; both have hinged flaps. To jettison, lift appropriate flap, and press the pushbutton.

RADIO.

Wireless Installation:

57. The wireless installation comprises two types of equipment.

(i) A general purpose installation comprising the AT5/AR8 and D/F facilities.

(ii) A V.H.F. installation using TR.5043 (SCR522) equipment.

The following items are situated in the pilot's cockpit:—

(i) Remote Control Unit for AT5/AR8 —See Fig. 3, Key 5.

(ii) Controller Type 5003—See Fig. 3, Key 6.

(iii) Mic/Tel Socket—See Fig. 1, Key 11.

Intercommunication facilities are available on either the AT5/AR8 or the TR.5043, selection being made by the Remote Control Unit. With the selector switch set to:—

"Normal" I/C is provided on the TR.5043.

"Call" I/C is provided on the AT5/AR8.

NOTE:—*For further details of the Wireless installation refer to Section 6, Chapter 3.*

Radar:

58. The following RADAR equipment is fitted:—

SCR 695 at Observer's station on the starboard side under direct control of the observer. The destruction button and pilot's control switch are shown in Fig. 3, Key 32. For installation details see Section 6, Chapter 3, and the corresponding section of the Electrical Service Manual R.A.A.F. Pub. 607.

LIGHTS AND SIGNALLING EQUIPMENT.

Navigation and Resin Light Switches:

59. The navigation (Fig. 4—No. 10) and resin light (Fig. 4—No. 11) switches are situated on the pilot's starboard switch panel.

Downward Identification Light Switch (Fig. 4—No. 5):

60. The downward identification light switches are situated on the starboard side of the pilot's switch panel.

Landing Lamp Controls:

61. The landing lamp control lever (Fig. 3—No. 28) and switches (Fig. 3—No. 26) are on the inboard side of the two speed supercharger levers, situated on the port side of the pilot's seat, and control the dipping of both landing lamps in the leading edge of the port wing. To depress the lamp beam, the lever is pushed forward.

Verey Signal Pistol:

62. The Verey pistol is situated on the starboard side towards the top of the fuselage, just rear of the observer's hood, and is fired upward through an opening provided in the fuselage top (refer Sect. 3, Para. 9 and Fig. 1).

Aldis Lamp:

63. The Aldis lamp is situated in the rear fuselage on the port side, forward of the observer's seat (refer Sect. 3, Para. 10, Fig. 1).

EMERGENCY EXITS AND EQUIPMENT.

Emergency Exits:

64. The pilot's entrance hatch is also used as a parachute exit when not carrying a 2,000 lb. bomb or mine. To open, pull the bottom catch release lanyard, and the airstream will open the hatch and force it into the top catch. The observer's hatch is opened in the same manner by a lever instead of a lanyard.

A further emergency exit is provided on the starboard side of the cockpit, by a special window which can be jettisoned. The window is held shut by plunger bolts in catch brackets at each end, and is jettisoned by pulling aft the release handle in the centre, and pushing the window outward.

A hatch in the cockpit roof also provides exit. It is hinged on the starboard side, and opens outward. The hatch is held shut by a plunger bolt in catch brackets at each end on the port side, and may be opened by first

releasing the locking arrangement and then pulling down the handle in the centre. It should not be used as a parachute exit unless exit is impossible by

(A) Pilot's Entrance Hatch.
(B) The Side Panel.
(C) The Observer's Hatch.

To open, pull lever down and back. To lock hatch, push lever forward and up. The observer's hood can also be used, and opens in a similar manner. (See Fig. 6.)

Dinghy Release Control:

65. A multi-seat dinghy is provided in a blow-out stowage, built into the trailing edge of the port wing. The dinghy is secured to the interior of the stowage by a painter cord of low breaking strength. A pack containing rations, drinking liquid, paddles and recognition devices, is provided in the dinghy compartment, and connected to the dinghy lifeline by the lanyard provided on the pack. For the emergency release of the dinghy, three manual controls (see A. B. and C., Fig 6) are provided in the following positions:—

(A) Internally on the port side, immediately aft of the pilot's left shoulder.
(B) Internally on the port side, below the observer's hatch.
(C) Externally, near the leading edge of the fin.

An immersion switch is also provided, which operates automatically on contact with water.

Fuel Jettison Control (Fig. 4—No. 23):

66. The fuel jettison control levers are situated on the pilot's fuel cock control panel, on the starboard side. These levers control the pneumatically operated jettison valves on the main inboard and main outboard tanks (see Sect. 8, Para. 15).

Fire Extinguishers—Electrically Operated (Fig. 2—No. 17):

67. There are two shielded pushbuttons, on the starboard side of the pilot's instrument panel, for releasing electrically the contents of the cylinder mounted on the front face of each bulkhead. Also impact and gravity switches are mounted on a bracket aft of the fuselage nose cap, on the starboard side; the gravity switch is inoperative when the undercarriage is retracted. Further details are given in A.P. 1464B.

Fire Extinguishers—Hand Operated (Fig. 1—No. 3, and Fig. 6):

68. A hand operated fire extinguisher is located on the port side above the pilot's seat, and another on the starboard side of the fuselage above the pilot's lower entrance hatch.

Axe:

69. An axe, for cutting a way out of the fuselage in an emergency, is stowed on the starboard side of the rear fuselage aft of the front spar. (See Sect. 3, Para. 17, Fig. 1.)

First-aid Outfit:

70. A first-aid outfit is provided, and stowed forward of the rear spar in the rear fuselage. (See Sect. 3, Para. 18, Fig. 1.)

Destruction, SCR. 695:

71. (i) The pushbuttons (Fig. 3—No. 32) for the SCR. 695 destruction are situated forward of the carburettor cut-out controls, on the port side to the rear of the pilot's seat. Covering the buttons is a spring-loaded flap marked "DANGER". A master switch is located inboard of the destruction pushbuttons.

(ii) To operate, lift spring-loaded flap and press pushbuttons simultaneously.

(iii) An inertia switch is situated on the starboard side of the rear fuselage, rear of the observer's seat, and operates on heavy crash impact.

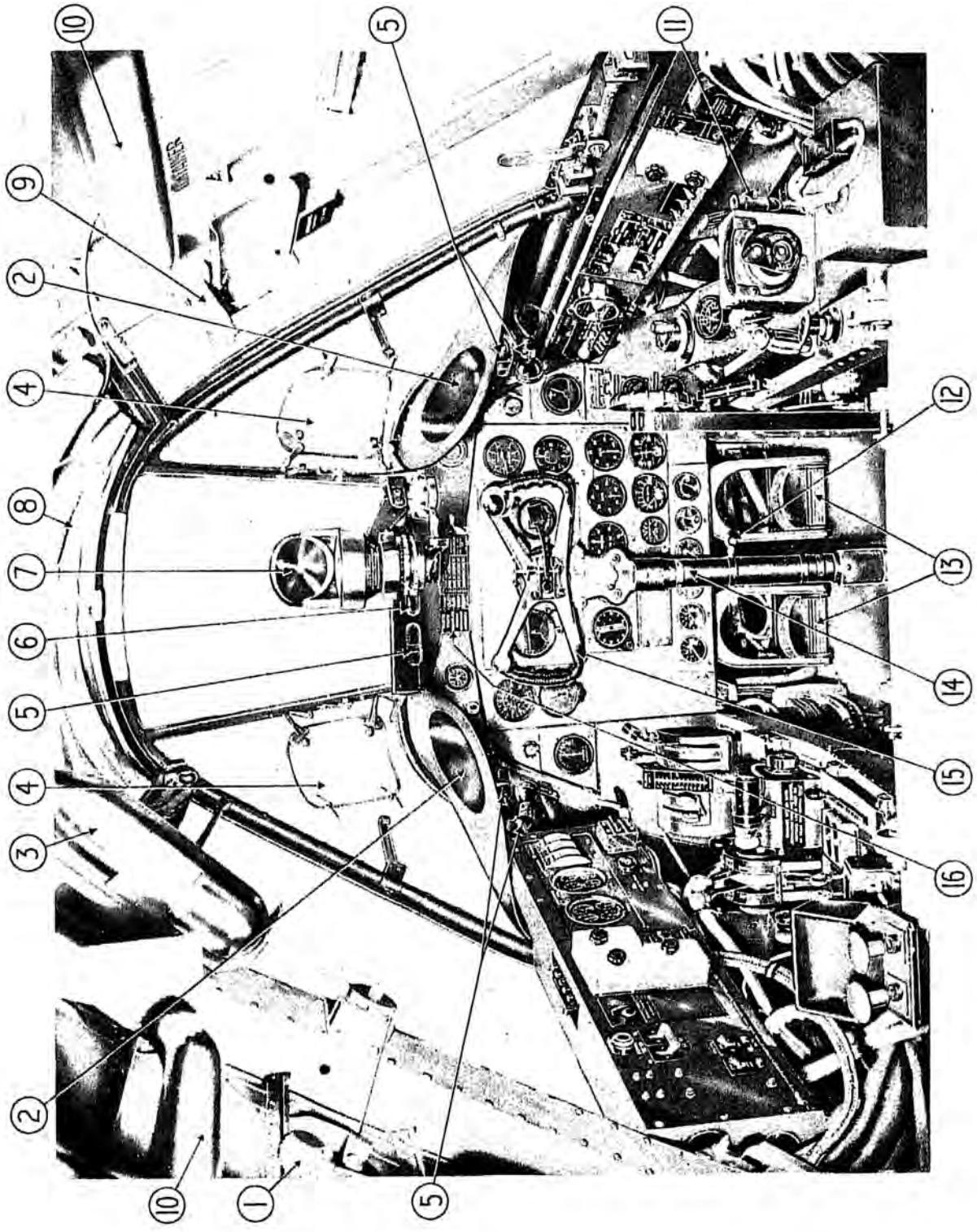
Distress Switch (Fig. 3—No. 32):

72. A distress switch is situated outboard of the destruction switches, and is used only in case of emergency over friendly territory.

GENERAL VIEW OF COCKPIT.

Key to Fig. 1.

1. Ditching exit lever.
2. Anti-glare screens.
3. Extinguisher bottle.
4. Direct vision panels.
5. Flood lights.
6. Emergency flood light.
7. Reflector gun sight.
8. Sun blind.
9. Sanitary bottle bracket.
10. Handrails.
11. Mic/Tel. Socket.
12. Rudder adjusting handle.
13. Rudder pedals.
14. Control column.
15. Control handwheel (see fig. 5).
16. Engine limitation chart.

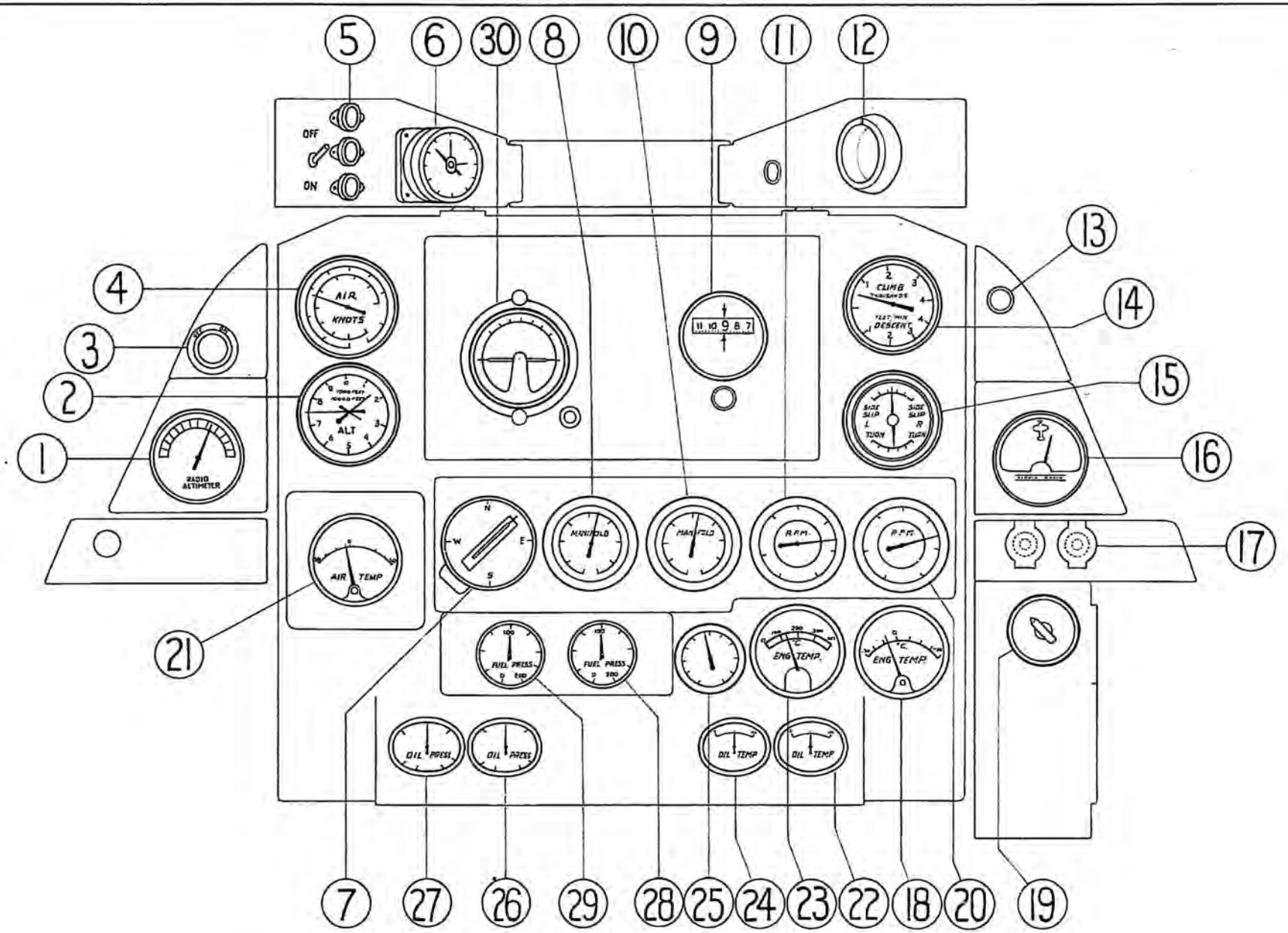


GENERAL VIEW OF COCKPIT.

PILOT'S INSTRUMENT PANEL.

Key to Fig. 2.

1. Radio Altimeter.
2. Sensitive Altimeter.
3. Rheostat, reflector gun sight.
4. Airspeed Indicator.
5. Warning lights and switch, radio altimeter (used only with radio altimeter installation).
6. 8–day clock.
7. Remote indicating Compass.
8. Port engine manifold pressure gauge.
9. Directional gyro.
10. Starboard engine manifold pressure gauge.
11. Port engine speed indicator.
12. Watch guard.
13. Socket for reflector gun sight.
14. Rate of climb indicator.
15. Turn and bank indicator.
16. Visual indicator (used only when blind approach is fitted with V.H.F).
17. Fire extinguisher switches.
18. Engine temp.
19. Air temp. switch.
20. Starboard engine speed indicator.
21. Air temp. gauge.
22. Starboard engine oil temp. gauge.
23. Engine temp. gauge.
24. Port engine oil temp. gauge.
25. Suction gauge.
26. Starboard engine oil pressure gauge.
27. Port engine oil pressure gauge.
28. Starboard engine fuel pressure gauge.
29. Port engine fuel pressure gauge.
30. Artificial horizon.



PILOT'S INSTRUMENT PANEL

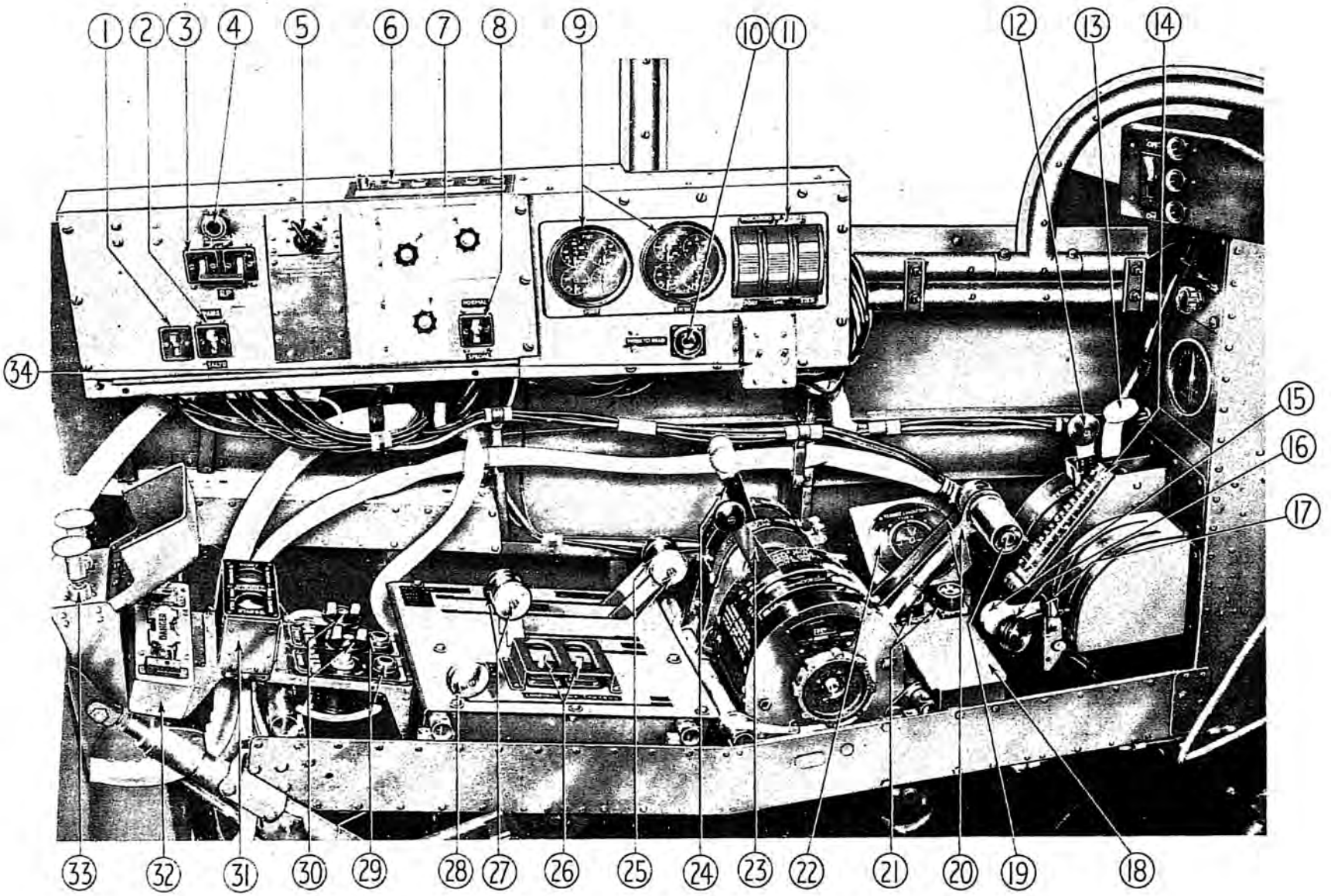
2

2

PORT SIDE OF COCKPIT.

Key to Fig. 3.

1. 2,000 lb. bomb, Mine "A" or auxiliary fuselage tank isolating switch.
2. R.P. Selector switch.
3. R.P. Master switch.
4. Warning lamp.
5. Remote Control Unit for AT5/AR8 (Pilot).
6. Controller for T.R. 5043.
7. Dashboard dimmer switches.
8. Switch for Remote Contactor (T.R. 5043).
9. Fuel contents gauges.
10. Fuel contents gauges pushbutton switch.
11. Undercarriage and tail wheel indicator.
12. Hydraulic emergency lever.
13. Hydraulic power selector control lever.
14. Flaps indicator.
15. Flaps control lever.
16. Undercarriage control lever.
17. Undercarriage safety lock.
18. Airscrew feathering data.
19. Mine "A," bomb, R.P. and auxiliary fuselage tank release pushbutton.
20. Throttle control levers.
21. Sockets for remote contactor TR. 5043.
22. Remote contactor TR. 5043.
23. Mixture control lever.
24. Airscrew speed controls.
25. Air intake controls.
26. Landing lamp switches.
27. Supercharger control levers.
28. Landing lamps control lever.
29. Warning light cowl gills.
30. Cowl gills switches.
31. Airscrew feathering switches.
32. SCR. 695 Destruction and control switches.
33. Engine cut-out controls.

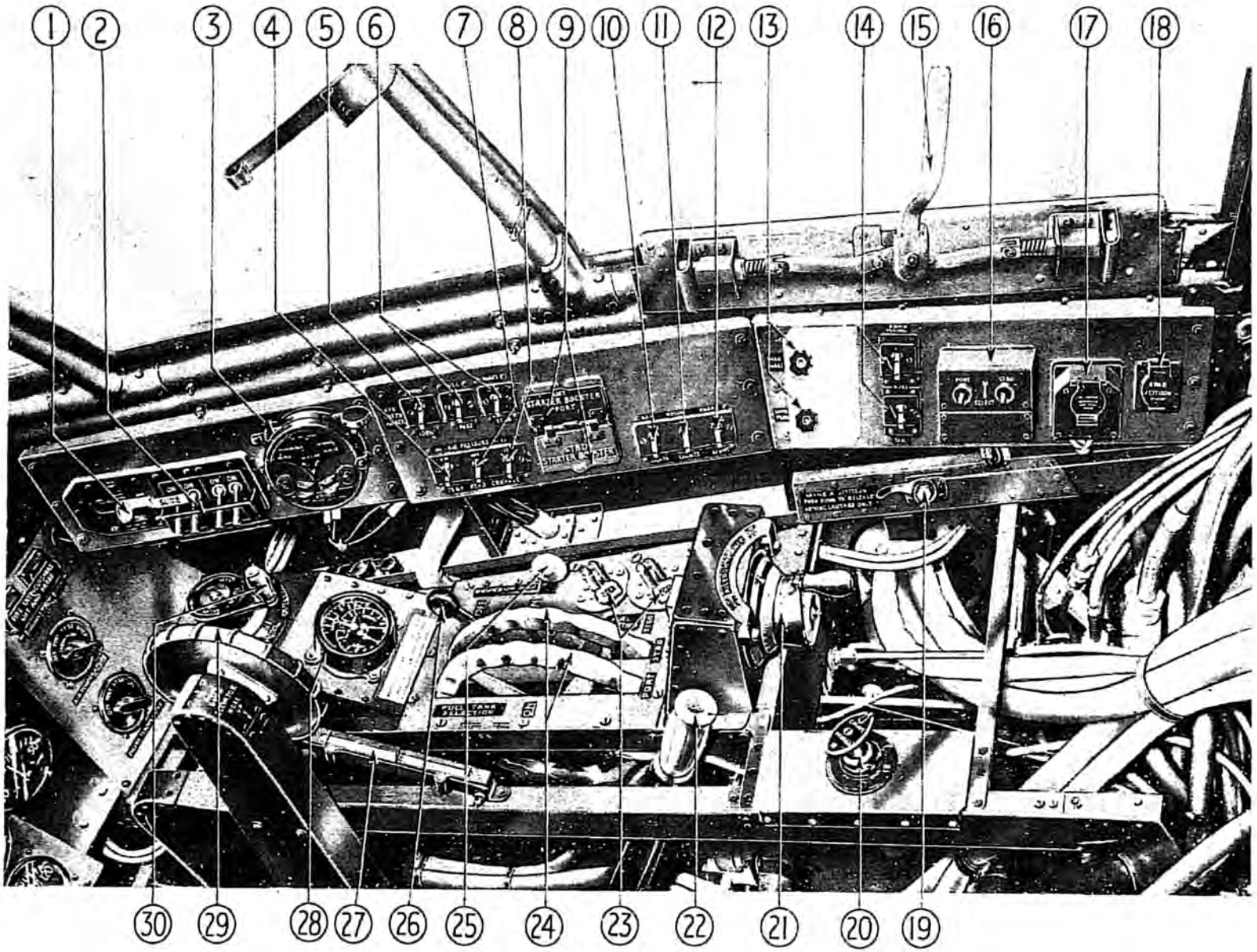


PORT SIDE OF COCKPIT.

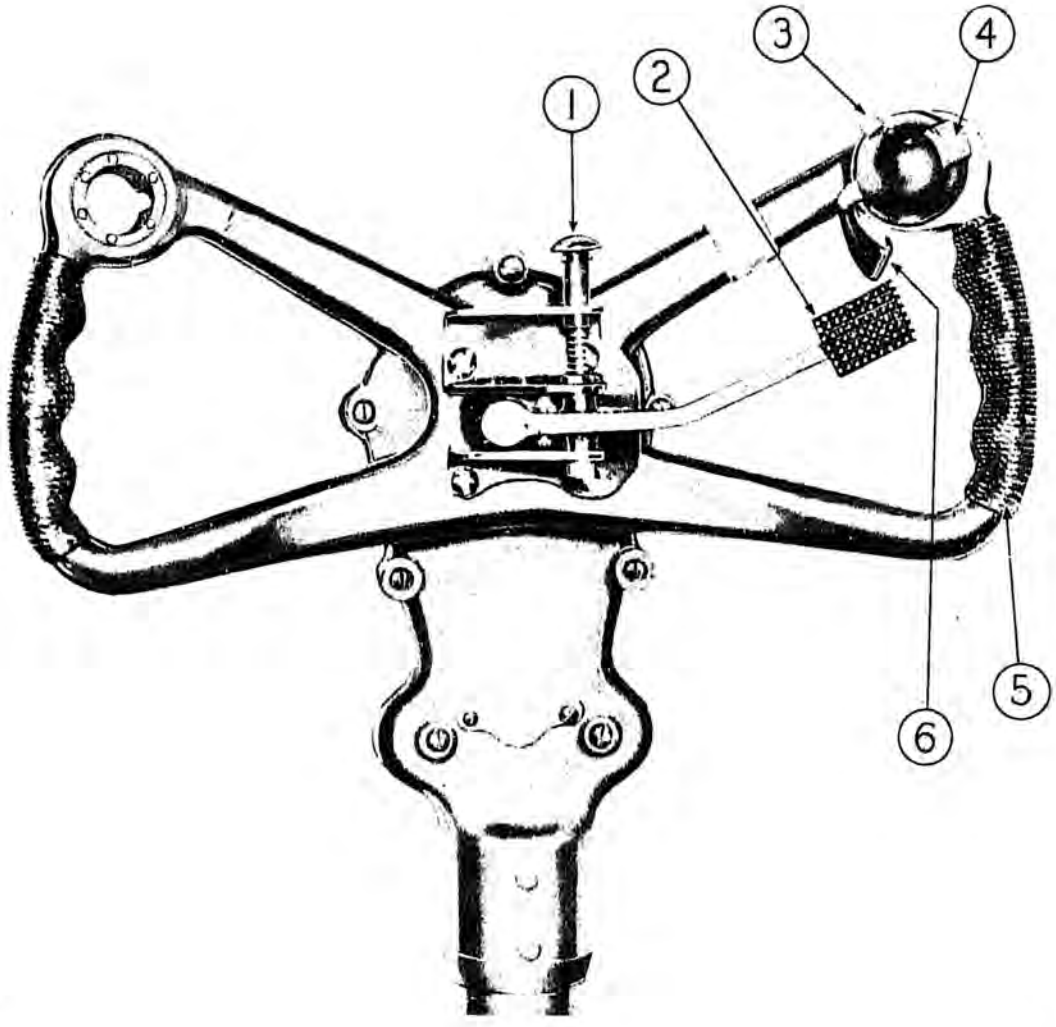
STARBOARD SIDE OF COCKPIT.

Key to Fig. 4.

1. Chassis master switch.
2. Ignition switches.
3. Identification signal switch box.
4. Oil temperature switch.
5. Downward identification light switch.
6. Auxiliary fuel pump switches.
7. Pressure head heating circuit switch.
8. R.I. Compass switch.
9. Engine starting and booster push-buttons.
10. Navigation light switch.
11. Resin light switch.
12. Emergency light switch.
13. Dimmer switches.
14. Bomb, nose and tail, fusing switches.
15. Emergency exit lever.
16. Wing bomb selector switches.
17. Container jettison pushbutton.
18. Bomb jettison pushbutton.
19. Mine "A" arming lanyard jettison lever.
20. Engine primer.
21. Aileron trimmer tab control.
22. Hydraulic hand pump.
23. Fuel jettison levers.
24. Fuel cock control handwheels (Port and Stbd.)
25. Balance cock control lever.
26. Auxiliary fuel tank control lever.
27. Elevator indicator.
28. Triple pressure gauge.
29. Elevator trimmer tab control.
30. Rudder trimmer tab control.



STARBOARD SIDE OF COCKPIT.

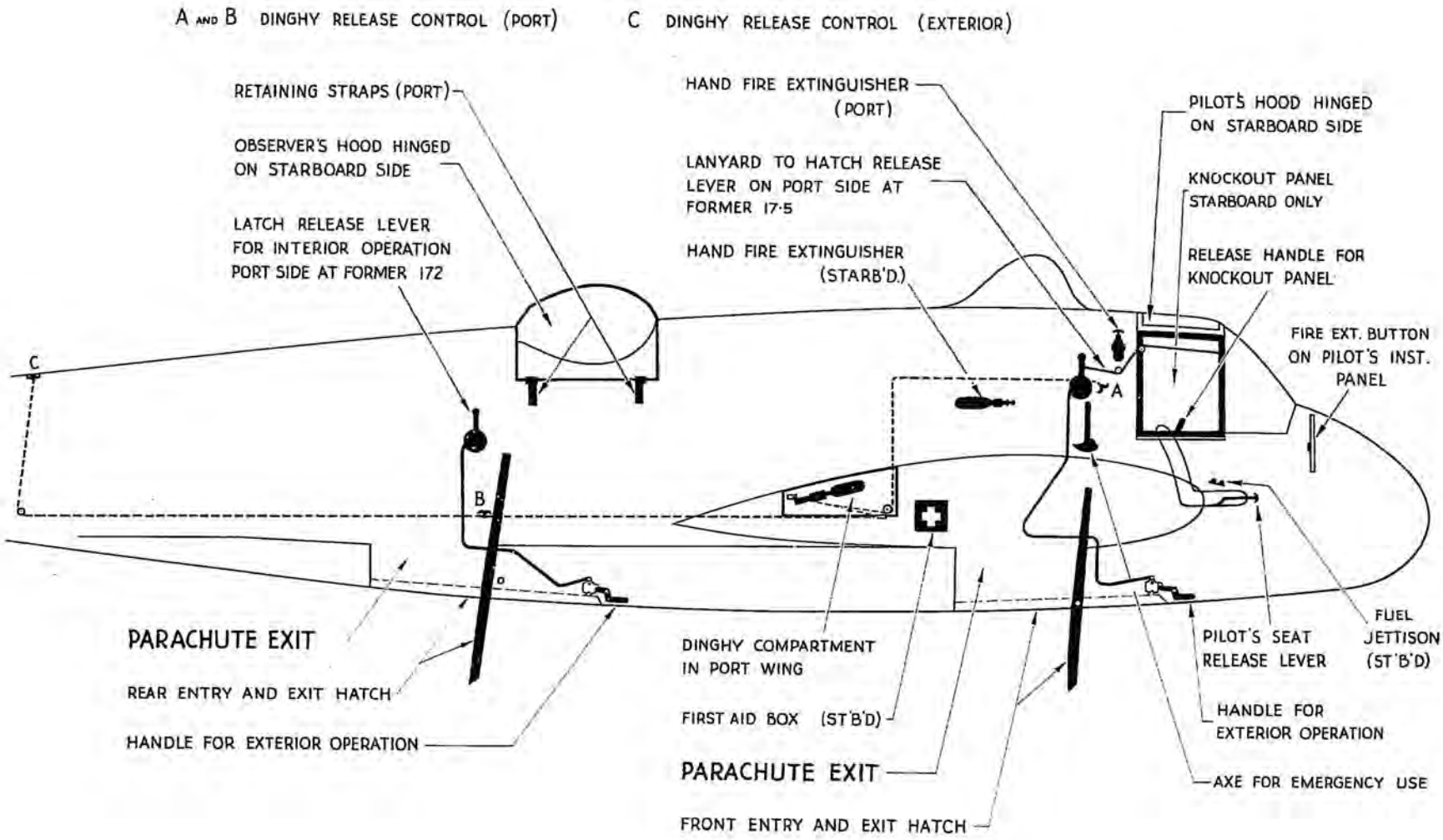


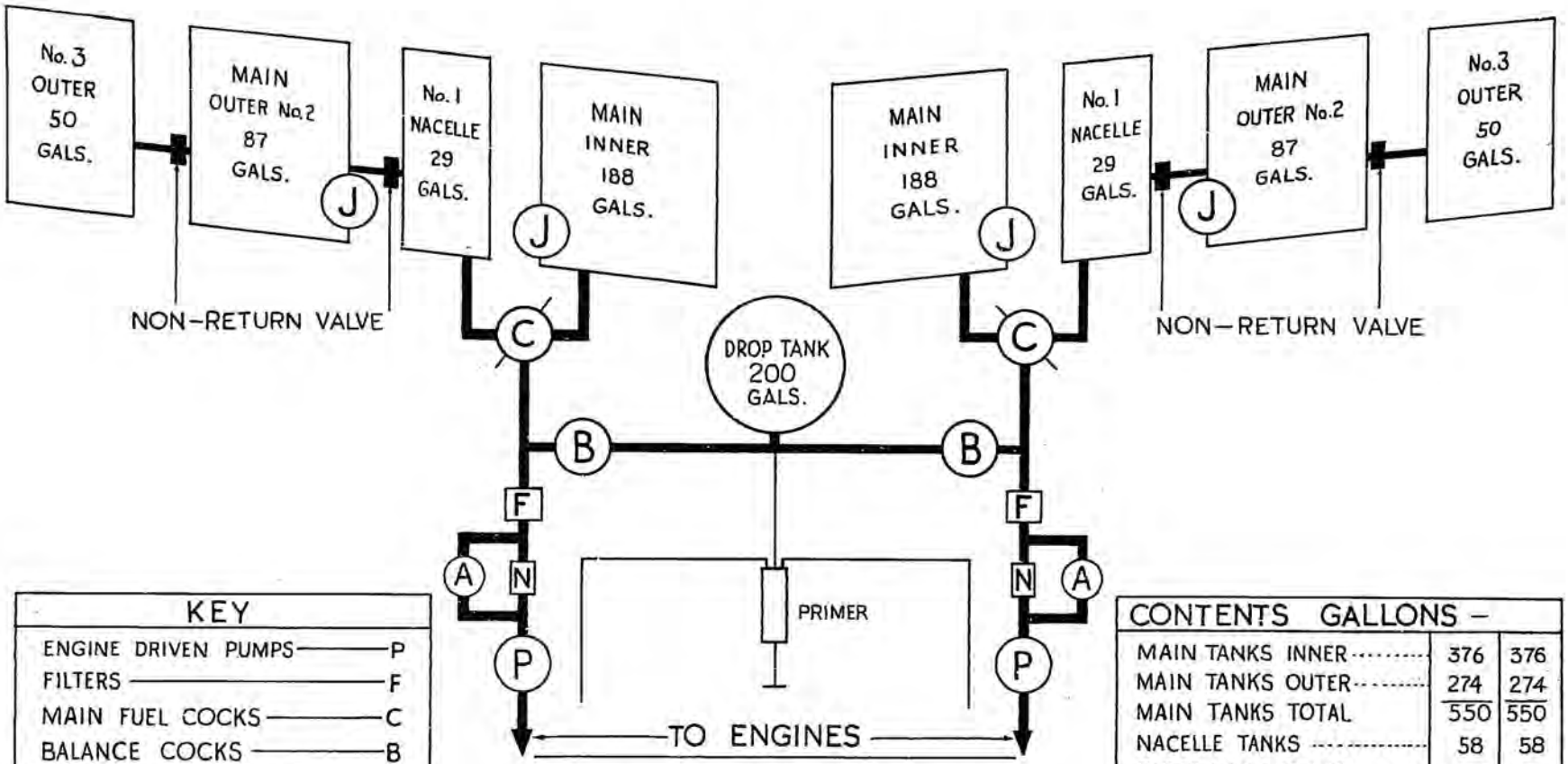
5 5

HAND WHEEL CONTROL.

Key to Fig. 5.

1. Locking pin, wheel brake lever.
2. Wheel brake lever.
3. Safety catch—gun firing trigger.
4. Gun cocking button.
5. Aileron control handle.
6. Gun firing trigger.


A AND B DINGHY RELEASE CONTROL (PORT)
C DINGHY RELEASE CONTROL (EXTERIOR)
RETAINING STRAPS (PORT)
OBSERVER'S HOOD HINGED ON STARBOARD SIDE
LATCH RELEASE LEVER FOR INTERIOR OPERATION PORT SIDE AT FORMER 172
HAND FIRE EXTINGUISHER (PORT)
LANYARD TO HATCH RELEASE LEVER ON PORT SIDE AT FORMER 17·5
HAND FIRE EXTINGUISHER (STARB'D.)
PILOT'S HOOD HINGED ON STARBOARD SIDE
KNOCKOUT PANEL STARBOARD ONLY
RELEASE HANDLE FOR KNOCKOUT PANEL
FIRE EXT. BUTTON ON PILOT'S INST. PANEL
C
A
B
PARACHUTE EXIT
REAR ENTRY AND EXIT HATCH
HANDLE FOR EXTERIOR OPERATION
DINGHY COMPARTMENT IN PORT WING
FIRST AID BOX (ST'B'D)
PARACHUTE EXIT
FRONT ENTRY AND EXIT HATCH
PILOT'S SEAT RELEASE LEVER
FUEL JETTISON (ST'B'D)
HANDLE FOR EXTERIOR OPERATION
AXE FOR EMERGENCY USE



KEY	
ENGINE DRIVEN PUMPS	P
FILTERS	F
MAIN FUEL COCKS	C
BALANCE COCKS	B
FUEL JETTISON VALVES	J
NON-RETURN VALVES	N
AUXILIARY PUMPS	A

FUEL JETTISON

THE JETTISON CONTROL OPENS THE JETTISON VALVES ON ALL FOUR MAIN TANKS. FUEL WILL ALSO DRAIN FROM THE No.3. OUTER TANKS THROUGH THE OUTER JETTISON VALVES ——— BUT SLOWLY

CONTENTS GALLONS –		
MAIN TANKS INNER	376	376
MAIN TANKS OUTER	274	274
MAIN TANKS TOTAL	550	550
NACELLE TANKS	58	58
OUTER WING TANKS	100	*
DROP TANK	200	200
TOTAL ALL TANKS	908	808

* OUTER WING TANKS INTERCHANGABLE WITH ·5" WING GUNS.

FOR DETAILED DIAGRAM SEE FIG.2 SECTION 8

FUEL SYSTEM DIAGRAM

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SECTION 2.

PILOTS NOTES.

Section 2.

Pilots Notes

To be issued at a later date.

THE

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

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SECTION 3.

CONTROLS AND EQUIPMENT AT CREW STATIONS.

SECTION 3.

Controls and Equipment at Crew Stations

CONTENTS.

ILLUSTRATIONS.

Controls and Equipment at Crew Stations

INTRODUCTION.

1. This section gives the location and where necessary explains the function and operation of the controls and equipment at the observer's station (which extends aft from the rear spar). The layout of the various items is illustrated and referenced in Fig. 1. Each item is given with an individual reference number, and a key to the items referenced faces the illustration.

OBSERVER'S STATION.

Observer's Seat:

2. The observer's seat (16) is constructed to rotate and to take a seat type parachute. A spring-loaded catch, operated by hand, is situated on the right-hand side of the seat and engages with slots in the top of the seat-mounting to lock the seat in either a forward or aft position. A lap type safety belt is fitted to the seat.

Observer's Hood:

3. A streamlined observer's hood is provided in the fuselage over the observer's seat. It is also used for an emergency exit, the hood being held in position by hinges on the starboard side, and two quick release clamps on the port side. It is opened by releasing the locking straps, pulling the catch lever inboard and pushing the hood outward.

Observer's Instrument Panel:

4. The observer's instrument panel incorporates the following:—

Generator Warning Lights . .	(82)
Remote Compass Indicator . .	(83)
Voltmeter	(84)
Sensitive Altimeter	(85)
Airspeed Indicator	(86)
Air Temperature Indicator . .	(87)

ARMAMENT.

20 mm. Gun Control:

5. The 20 mm. guns are mounted under the floor, outboard of the keel members; two are situated on the port side and two on the starboard side. They are operated by a push-button on the starboard side of the control column wheel.

20 mm. Gun Loading:

6. To effect loading Mk. I feed (30), a unit and three loading drums are required for each gun. The unit and loaders are employed as described in A.P. 1641F. On the forward port and starboard aft gun feeds, a loader with a left hand belt is used, and on the port aft starboard forward gun, a right hand belt is used. Refer Sect. 4, Chap. 1, Para. 10.

Observer's .303 Machine Gun:

7. Through an opening in the rear of the observer's hood a .303 machine gun (18) is mounted. Stowage for ammunition boxes (28) is provided at the right hand side of the observer's seat.

RADIO.

8. The radio installation comprises two types of equipment, which are installed in the aircraft in the following positions:—

(i) TR. 5043—Situated forward of armour plate doors, port side.
(ii) AT5/AR8—Situated rear of observer's seat.
(iii) SCR.695—Situated at the rear of the observer's seat, on the starboard side.

For further information and control of the radio installations, refer Section 6, Chap. 3, also R.A.A.F. Publication No. 607.

EMERGENCY EQUIPMENT.

Verey Pistol:

9. The Verey pistol (19) is situated on the starboard side towards the top of the fuselage, just aft of the observer's hood, and is fired upward through an opening provided in the fuselage top. Stowage for six cartridges is provided adjacent to the pistol. A stowage box for twenty cartridges is attached to the wireless crate, below the wireless (AT5/AR8).

Aldis Lamp:

10. The Aldis lamp (61) is situated in the rear fuselage on the port side, forward of the Observer's seat.

Parachute Stowage:

11. Stowage for parachute (65) is positioned on floor, aft of aerial winch (63).

Flying Rations:

12. The container for flying rations (31) is situated aft of the rear spar, on the floor in front of the foremost 20 mm. ammunition boxes.

Water Bottles:

13. Two water bottles (49) are provided, and stowed on the port side, just forward of and in line with the observer's table.

Sanitary Bottles:

14. The pilot's sanitary bottle (2) is stowed on the starboard side, just aft of the front spar. The observer's sanitary bottle (70) is stowed aft of the observer's seat on the port side.

Dinghy Stowage:

15. A dinghy, with emergency equipment, is stowed in a compartment (79) built into the trailing edge of the port wing. Details of the dinghy release controls are given in Sect. 1, Para. 65 and Fig. 6, and Sect. 4, Chap. 2, Fig. 12.

Fire Extinguishers:

16. In case of fire, manual extinguishers are provided, one (7) on the starboard side below the handrail and one (59) on the port side above the pilot's seat. The electrical fire extinguisher system is described in Sect. 1, Para. 67.

Axe:

17. An axe (1) for cutting a way out of the fuselage is stowed on the starboard side, just aft of the front spar.

First-Aid Outfit:

18. A first-aid outfit is provided (33), stowed on the starboard side, forward of the rear spar, on the floor.

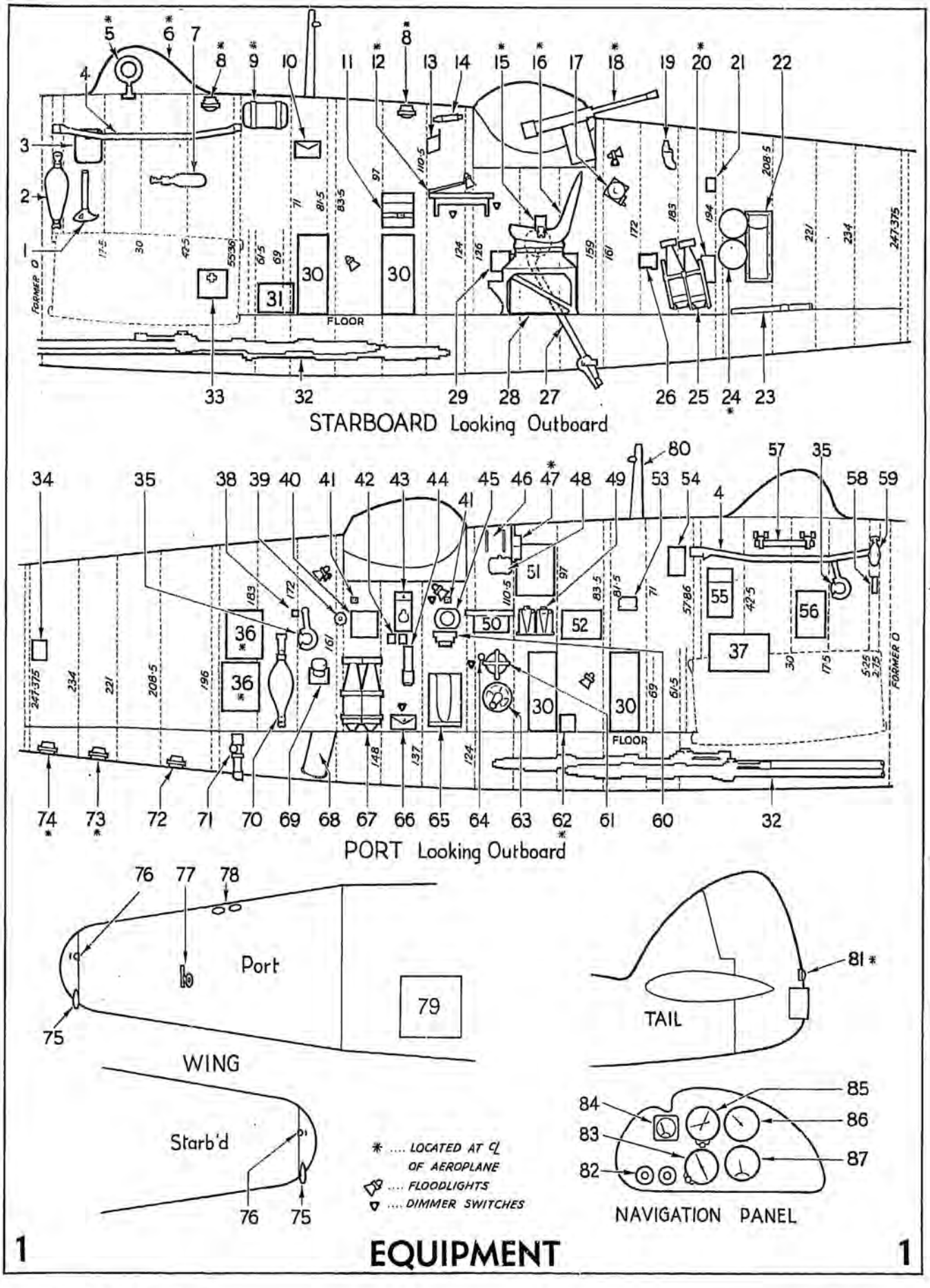
Emergency Exit Levers:

19. A lanyard, positioned above the pilot, is attached to a lever (35) which opens the hatch for an emergency exit. For the observer's exit, a lever (35) above the drift recorder, opens the parachute exit. A more detailed sketch is shown in Sect. 1, Fig. 6.

EQUIPMENT.

Key to Fig. 1.

1. Axe.
2. Pilot's Sanitary Bottle.
3. Writing Pad.
4. Handrail.
5. D.F. Loop.
6. Cupola.
7. Fire Extinguisher.
8. Cabin Lamps.
9. Hydraulic Fluid Reservoir.
10. Stowage for Aerial Mast Cover Plates.
11. Valve Box.
12. Observer's Table and Lamp.
13. A.S.I. Correction Card.
14. Incendiary Bomb.
15. Observer's Safety Belt.
16. Observer's Seat.
17. D.F. Loop Control and Azimuth Indicator.
18. Observer's Rear Defence Gun.
19. Upward Firing Verey Pistol.
20. Cartridge Stowage Box.
21. Cartridge Stowage Box.
22. Stowage for Undercarriage Locking Pins.
23. Starter Handle.
24. Air Bottles.
25. Flame and Smoke Floats.
26. Graviner Crash Switch.
27. Trailing Aerial Fairlead.
28. .303 Ammunition Box.
29. Junction Box No. 7.
30. Ammunition Boxes, 20 mm., Port and Starboard.
31. Flying Rations.
32. Guns, 20 mm., Port and Starboard.
33. First-aid Kit.
34. Junction Box No. 6.
35. Pilot and Observer's Emergency Levers.
36. Wireless Crate AT5/AR8.
37. Wireless Crate TR.5043.
38. Clip for D.F. Loop Plug.
39. Reel for Flame Float.
40. Control Unit.
41. Observer's Hatch Retaining Straps.
42. Compass and Deviation Card Holder.
43. Remote Control Unit AT5/AR8 (Observer's).
44. Stowage for Tail Drift Sight.
45. Louvre.
46. Stowage for Blackout Cover and Sunblinds.
47. Observer's Navigation Panel.
48. Observer's Computor.
49. Water Bottles.
50. Observer's Instrument Stowage Box.
51. Fuse Box and Instrument Panel.
52. 20 mm. Gun Relay Panel.
53. Inverter R.I. Compass.
54. Contactor Box.
55. Voltage Regulator Panel.
56. Junction Box No. 3.
57. Controls Locking Gear Stowage.
58. Card Holder.
59. Fire Extinguisher.
60. P.8 Compass.
61. Aldis Lamp.
62. Tool Locker.
63. Spare Aerial Reel.
64. Mic/Tel. Socket.
65. Parachute Stowage.
66. Pouch for Tail Drift Sight Lead.
67. Flame and Smoke Floats.
68. Flare Chute.
69. Drift Recorder.
70. Observer's Sanitary Bottle.
71. Tail Drift Sight.
72. Downward Identification Lamp.
73. Downward Identification Lamp.
74. Downward Identification Lamp.
75. Resin Lights.
76. Navigation Light (Wings).
77. Pressure Head.
78. Landing Lights.
79. Dinghy Stowage.
80. V.H.F. Antenna Mast.
81. Navigation Light (Tail).
82. Generator Warning Lights.
83. Remote Compass Indicator.
84. Voltmeter.
85. Sensitive Altimeter.
86. Airspeed Indicator.
87. Air Temperature Indicator.


STARBOARD Looking Outboard
PORT Looking Outboard
FLOOR
FORMER O
Port
WING
Starb'd
TAIL
79
* .... LOCATED AT ℄ OF AEROPLANE
.... FLOODLIGHTS
.... DIMMER SWITCHES
NAVIGATION PANEL
1
EQUIPMENT
1

THE

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

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SECTION 4.

INSTRUCTIONS AND NOTES FOR GROUND PERSONNEL.

SECTION 4 — CHAPTER 1.

Handling and General Preparation

CONTENTS.

ILLUSTRATIONS.

Handling and General Preparation

1. Information on handling the aeroplane on the ground and on preparing it for flight is given in this chapter.

GROUND HANDLING AND EQUIPMENT.

Forward Towing:

2. (i) Attach the shackle on each lead of the towing cable to the towing eye on the inboard legs of the undercarriage (see Fig. 1).

(ii) Place the hooked ends of the steering arm into the towing eyes on the tail wheel fork. Release, with cable control, the spring-loaded securing pawls at the hooked ends.

(iii) Turn the propellers into their lowest position if a low building is to be entered.

(iv) Ground personnel to take up the following positions:—

(a) One man to be in charge for directing operations.

(b) One man to control the braking system in the cockpit. If use of the braking system is considered unnecessary, the flying controls should be locked. (See Sect. 1.)

(c) One man at the tail wheel steering arm handle.

(d) Enough men at the towing cables, according to the nature of the ground to be covered.

Care must be exercised to ensure that each wing tip, the fixed aerial, and the propellers do not foul anything.

(v) If the aeroplane is to be towed by a tractor, one man in the cockpit (for braking system), one man on the tail wheel steering handle, and two men to look out for obstructions, are all that will be required.

Backward Towing:

3. (i) Place the hooked ends of the tail wheel towing arm into the towing eyes at each side of the tail wheel. Release, by the Bowden control, the spring-loaded pins at the hook ends.

(ii) Attach the shackle on each side of the towing cable to the two bar eyes.

(iii) Turn the propeller blades into their lowest position if a low building is to be entered.

(iv) Similar to forward towing, with the exception of the man at the tail wheel steering bar.

WARNING.

Backward towing must be done carefully, otherwise the stern frame may be strained, or actually collapse. Particular care should be taken, when towing by tractor, to take as straight a course as possible and, if a sharp turn is unavoidable, to make it slowly and gently. Direction must not be changed by pushing on the tail plane or the rear of fuselage, steering must be carried out through the towing arm.

Parking and Locking Flying Controls:

4. Instructions for parking the aeroplane and for locking the flying controls are given in Sect. 1, the equipment is shown in Fig. 2.

Picketing:

5. A mooring eye is incorporated in the lower bolt of both centre plane front spar joints. The eye is accessible through a sliding panel in the underside of the wing. A mooring eye is also fitted on each side of the fuselage, between formers 330 and 332 (see Sect. 7, Chap. 1, Fig. 1). A strap is supplied for holding down the tail of the aeroplane. The strap is passed over the fuselage just forward of the fin (see Fig. 1).

Weather Protection Covers:

6. Ground covers (see Fig. 1) are provided for the pilot's cockpit and the fuselage nose, the observer's hood, the propeller spinners, and the engines.

PREPARATION FOR FLIGHT.

Refuelling:

7. Each fuel tank is filled through its large quick-release filler cap which is capable of receiving two hoses. The filler caps are reached through doors in the upper surface of the wing.

NOTE:—*When the two extreme outer fuel tanks are fitted, the dihedral angle of the wings necessitates strict observance of the following:*

(i) Refuel main wing tanks (No. 2 outer) and replace filler caps. (No. 1 outer tanks are filled through No. 2 outer tanks).

(ii) When the extreme outer tanks are full, on no account must the filler caps of main outer tanks be opened, otherwise an overflow of the fuel into the wings will occur.

(iii) All filler caps must be petrol tight.

NOTE:—*The filler caps of the nacelle tanks (No. 1 outer) are NOT to be removed.*

Refilling Oil Tanks:

8. Each of the two oil tanks is filled by removing its large quick-release filler cap. The filler caps are reached by removing doors in the upper surface of the engine nacelles.

9. The tanks should be filled with the aeroplane tail down. When the oil level reaches the base of the filler neck, the tank is full (20 galls.), and the correct air space (2 gallons) has been allowed. There is a dipstick in the top of each tank.

RE-ARMING.

20 mm. Gun Loading—Mk. 1 Feed:

10. To load a Mk. 1 feed, a feed unit and three loading drums will be required for each gun. The unit and loaders are loaded as described in A.P. 1641 F. On the port forward and starboard aft gun feeds, a loader with left hand belt is used; on the port aft and starboard forward guns, a right hand belt is used. The loading procedure in the aeroplane is as follows:—

Feed Units:

11. (i) Release the catches on the feed chute by operating the triggers.

(ii) Telescope the end of the feed chute.

(iii) Pull the knob connected to the magazine catch lever.

(iv) Lift the rear end of the empty unit and remove.

(v) Assemble the loaded feed unit in the reverse order to (iv). The unit should have one half link hanging from it.

See that the magazines' catch lever is home and do not re-assemble the feed chute.

Ammunition Boxes and Feed Chute:

12. (i) Remove the lids from the ammunition boxes.

(ii) Take the right or left hand loader and place it on top of the ammunition box on the opposite side, i.e., if loading to port, place the loader on the starboard side, and vice versa.

NOTE:—*This loader must have a circlip or half link on the end of the belt.*

(iii) Feed the belt into the box. The nose of the shells should be forward.

(iv) Take a second loader, join the belt to the one already in the box and feed it into the box.

(v) Repeat with the third loader. This will overfill the box and the belt should be piled up in layers on top.

(vi) Now take the first layer and feed the belt into the chute.

IMPORTANT:—*Ensure that the double links of the clips are leading, that the clips are underneath, and that the shells are pointing in the correct direction (See Item iii) as they pass over the roller.*

(vii) Continue feeding the belt into the chute until there is sufficient belt at the unit end to connect to the feed.

(viii) Connect the belt to the feed unit by removing the first shell in the belt, placing the links together and replacing the shell in the links.

(ix) Re-assemble the telescopic part of the feed chute to the feed unit.

WARNING:—*Ensure that all links are at the correct position on the shell, and that the shells are in correct alignment. This must be observed when joining belts.*

13. Repeat the above operations for the other three guns.

LOADING 2,000 LB. BOMB OR MINE "A".

General:

14. The aircraft is adapted to carry a 2,000 lb. bomb (see Fig. 3), a 17.86 in. Mk. I to Mk. IV mine, or alternatively a 15 in. Mk. V mine. The bomb or mine is slung under the fuselage. Four crutch pads, mounted on braced struts, are attached to the underside of the fuselage. As the locating socket, for the bomb or mine locating lug, is fixed to the underside of the pilot's floor entrance hatch, this hatch must be closed before the bomb or mine can be loaded.

NOTE:—*With a bomb or mine in position, the pilot's hatch cannot be used for entrance or for an emergency exit.*

15. Mines are loaded similarly to the 2,000 lb. bomb, with the exception that the sizes of the slings differ. The 13 inch 2,000 lb. bomb requires a smaller sling than the 15 inch Mk. V mine, and the 17.86 inch Mk. I to Mk. IV mines require a longer sling than the Mk. V type.

16. If loading a mine, the word "mine" to take the place of the word "bomb" in paras. 17-23, as the operations are similar with the exception of the size of the slings (see Para. 15).

17. The bomb is suspended in a sling; tensioning gear being fitted at one side, and the release slip with an electro-magnetic release unit fitted at the opposite side. (For operational controls, see Sect. 1.)

18. Sling retraction gear is fitted for the purpose of drawing the sling taut against the fuselage when the bomb is released, thus preventing the end of the sling damaging the aircraft by whipping. This gear consists of a length of elastic cord anchored at one end to a bracket on the underside of the fuselage; the other end passes through a fairlead and is free to extend. When the bomb is loaded, the free end is stretched round the bomb and attached, by means of a quick-release pin, to an eye near the trunnion end of the sling. When the bomb is released, the elastic cord contracts and pulls on the sling until the trunnion end is brought to rest against the fairlead, fixed to the underside of the fuselage.

Preparation of Aircraft:

19. The operations described hereunder should be done before wheeling the bomb into position. Test the operation of the electro-magnetic release mechanism as follows:—

(i) Insert trunnion end of sling into jaws of release slip and check electro-magnetic release unit.

(ii) Put bomb selector switch "ON" (see Sect. 1, Fig. 3) and make sure the warning lamp lights.

(iii) Press release button, mounted on starboard throttle control lever, put isolation switch in "OFF" position (see Sect. 1, Fig 3, No. 1), and check to make sure that release mechanism functions.

20. Inspect the crutch pads and release slip for any mechanical faults, and ensure that the locknuts on the crutch pad adjusters are secure.

Loading Operations for 2,000 lb. Bomb:

21. The loading of a 2,000 lb. bomb is illustrated in Fig. 3. In loading a bomb, three men are required; one at each handle of the winch (see Fig. 4) for lifting the bomb, and the third man, in charge of operations, ensures that the locating lug of the bomb correctly engages the locating socket on the aircraft.

22. See that the bomb is bearing evenly on all the crutch pads, is square under the aircraft when viewed from ahead, and is not bearing hard under the locating socket.

23. Before the final check is made, the adjustable crutch steady pads should be securely locked.

Fusing of Bomb:

24. When the bomb is securely located in position, connect bomb fuse to the fusing unit. The fusing unit is mounted under the fuselage, in a guideway, aft of the rear crutches; so that its position may be conveniently adjusted.

Mine Parachute:

25. Attach the lanyard for the operation of the mine parachute to the eye bolt (J. Fig. 3) located on the underside of the fuselage above the rear end of the mine.

Mine Arming:

26. Connect the arming lanyard of the mine to the cut-out pin (M, Fig. 3) on the underside of the fuselage. The pin is connected by a Bowden cable to a lever mounted at the starboard side of the cockpit. Refer Sect. 1, Para. 51.

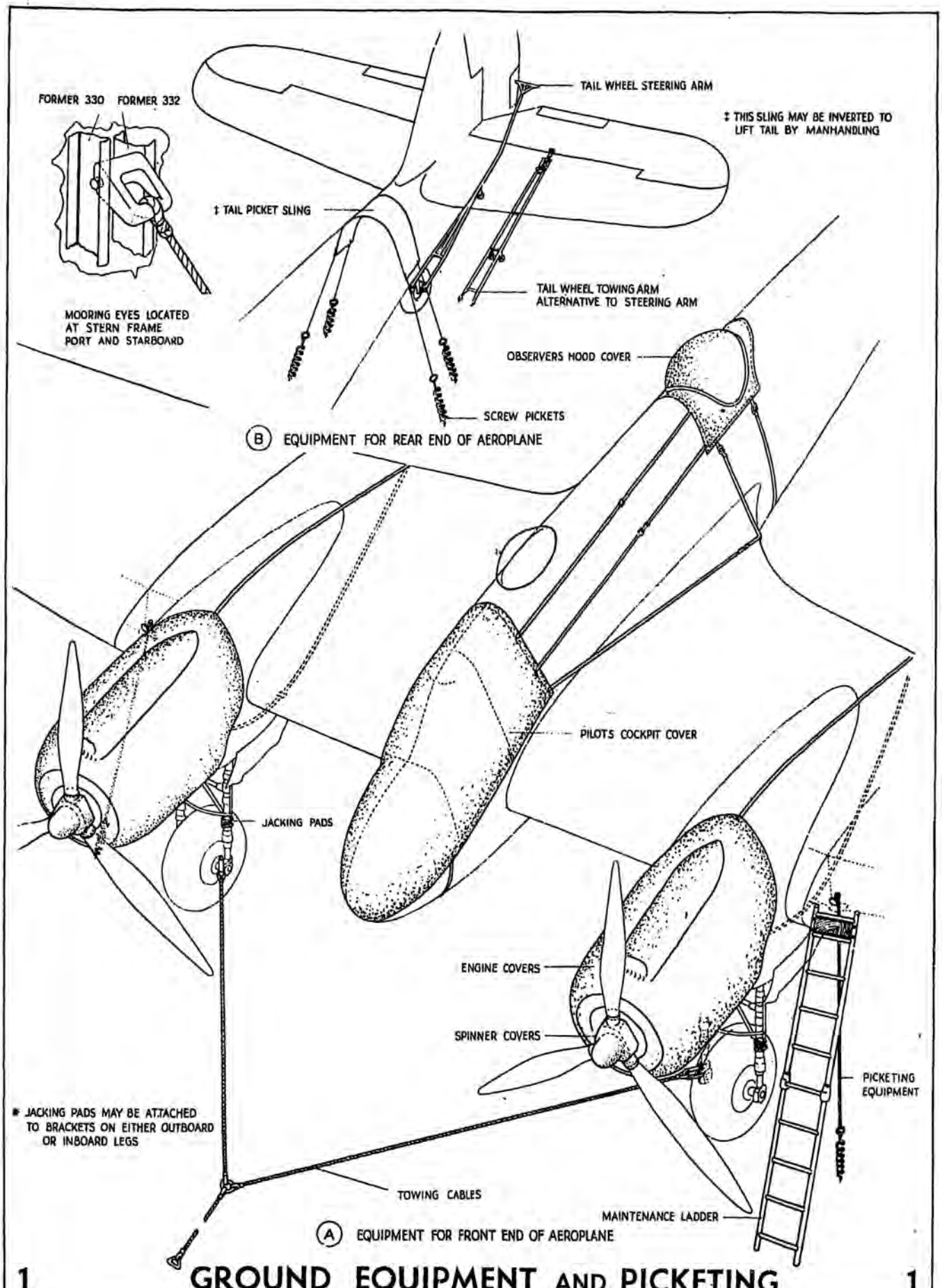
.5 INCH WING GUN ARMAMENT.

General:

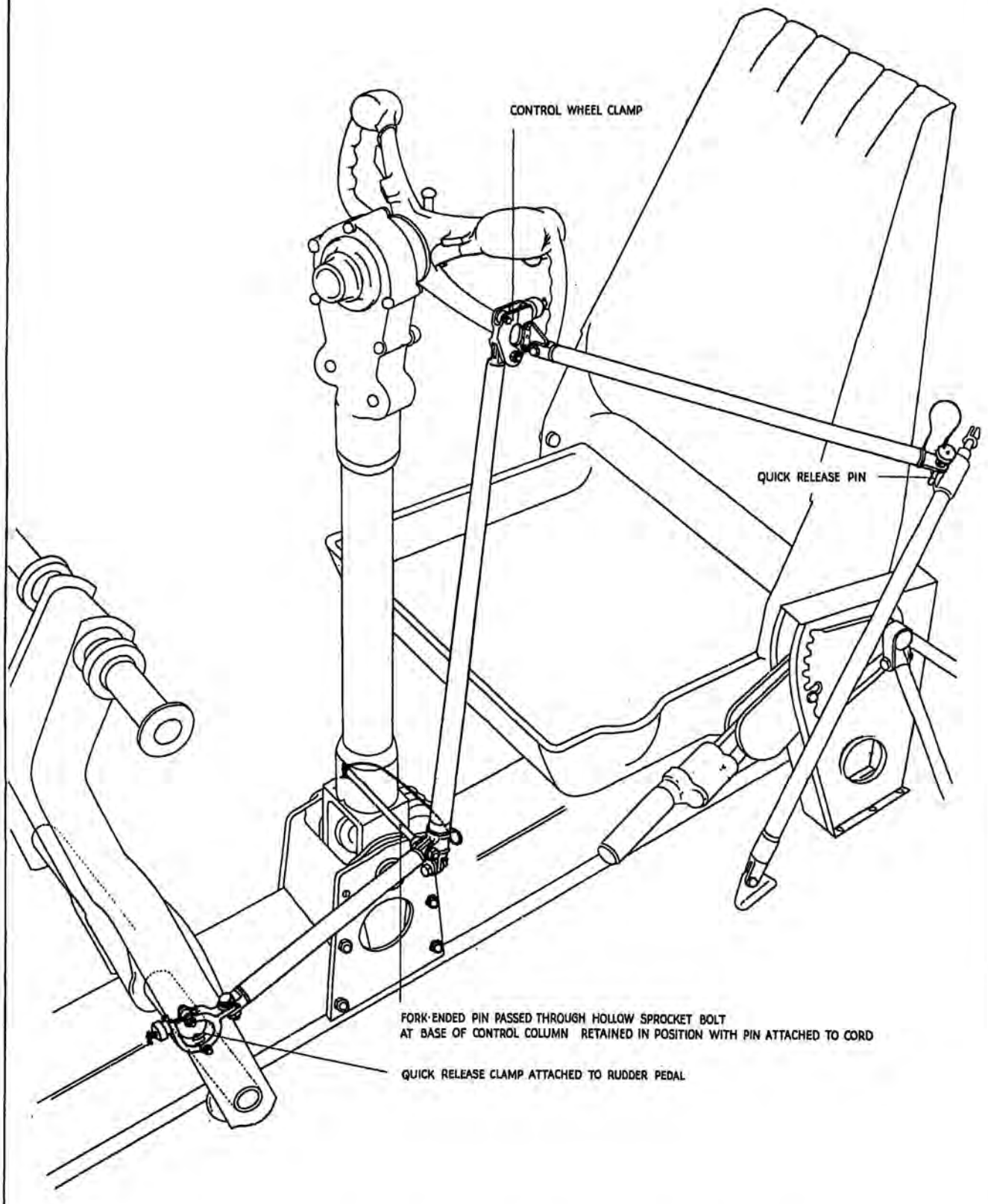
27. Two fixed gun type wing mountings between ribs 6 and 8 in each wing are designed to carry one .5-inch Browning gun, each (see Fig. 5). The wing guns are an alternative fitment to the extreme outer fuel tanks, and two existing studs are utilized. Two ammunition boxes (1) are situated between the outboard gun and rib 10, and are supported by brackets to ribs 8 and 9. Ammunition for inboard gun passes through a removable chute (2) from the forward box; while ammunition for outboard gun feeds over a rubber collared roller (3) from the aft box. Each gun is charged manually (4) before the aircraft leaves the ground. Electro-pneumatic firing is controlled by a button on pilot's control handles and a selector switch. Gun recoil is absorbed by an Edgewater adaptor (5) which is pivoted to allow vertical harmonization. For lateral harmonization, the half-inch nut (6) on the rear mounting stud (7) is loosened, and the whole chassis (8) pivoted on the front mounting stud by means of the two adjusting nuts (9) on the eyebolt (10). For vertical harmonization, the harmonizing fork is released and the hand-wheel beneath the chassis operated. During harmonizing, blast tube (11) movement is accommodated by a sliding panel (12) on the leading edge. If necessary, a chassis may be changed from wing to wing, as the gun chassis (8) ammunition boxes (1) and inboard gun feed chute (2) are not handed, and spent cartridge (13) and link chutes (14) which are handed, are each attached by only two bolts.

LIFTING CRASHED AIRCRAFT (Cases 1 and 2).

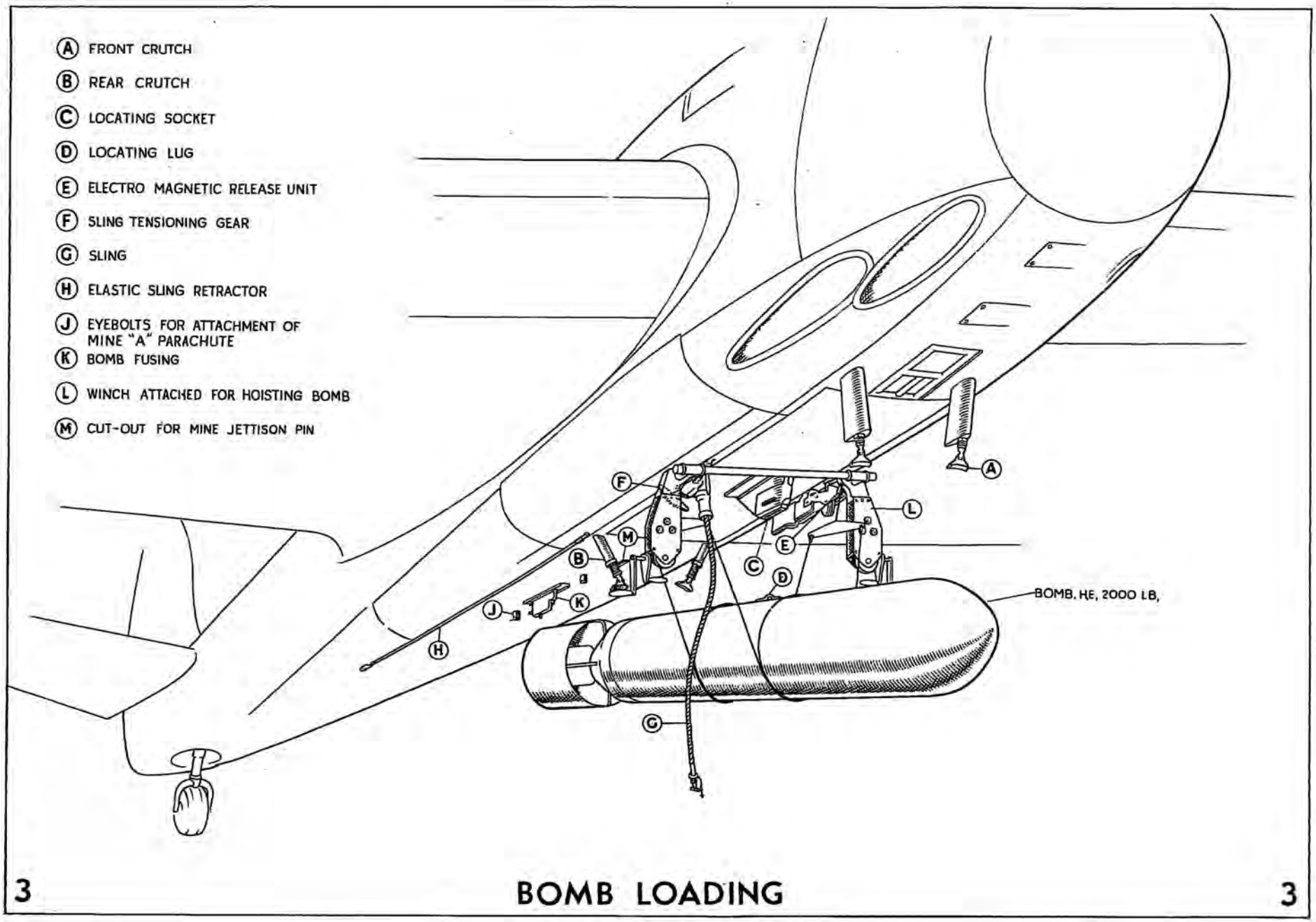
28. Operations under this heading are illustrated and described in Figs. 6 and 7.



1 GROUND EQUIPMENT AND PICKETING 1



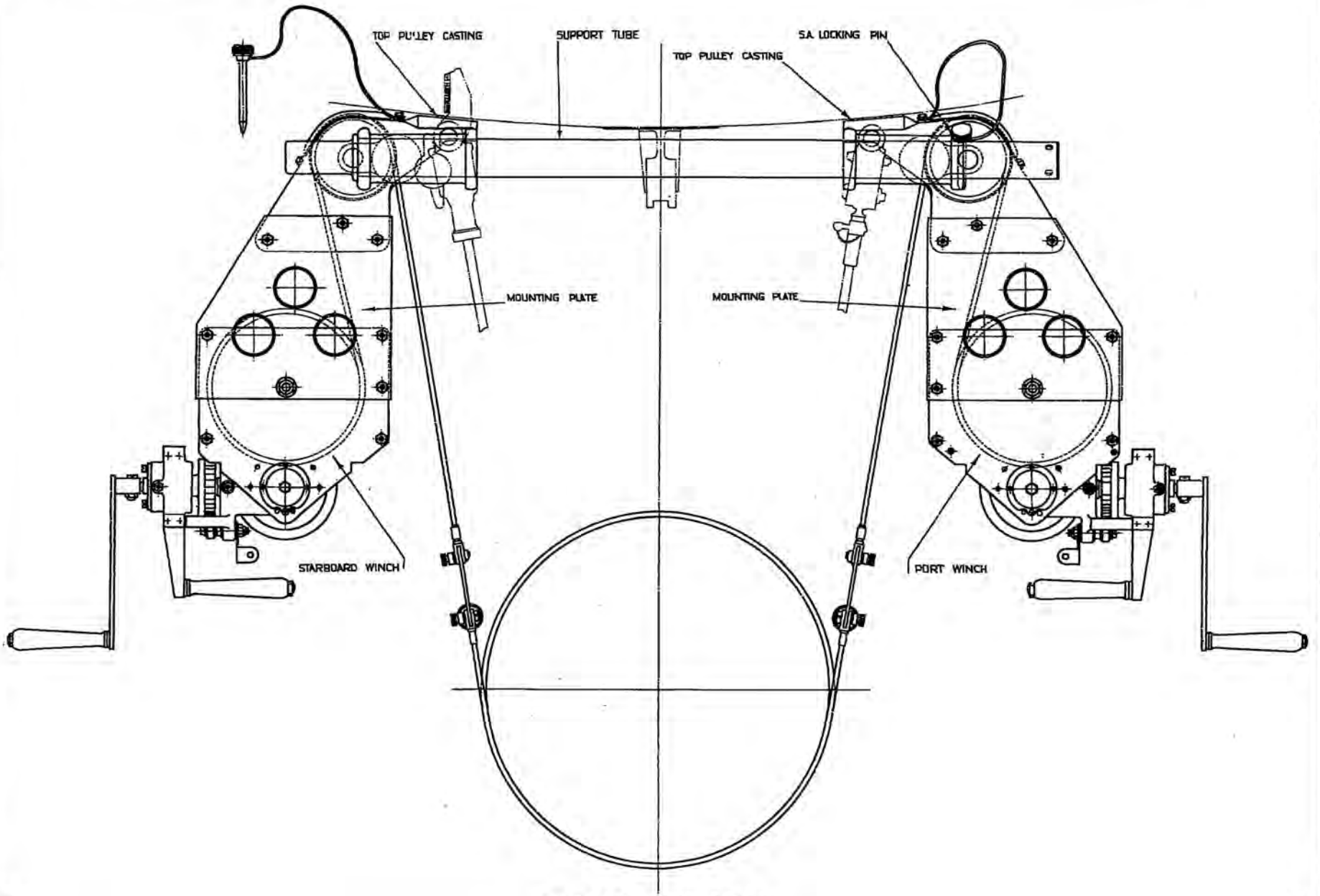
2 FLYING CONTROLS LOCKING GEAR 2



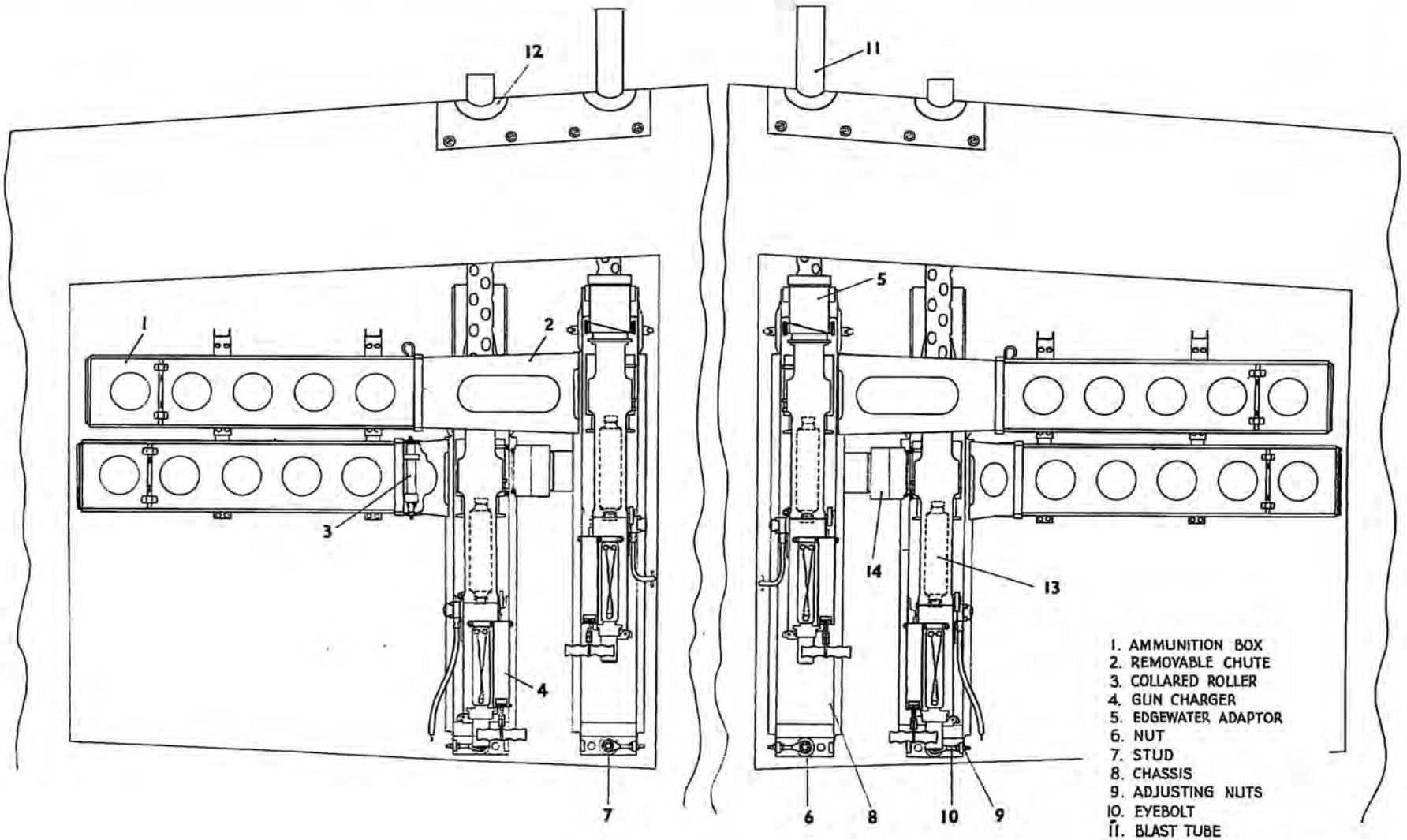
3

BOMB LOADING

3


TOP PULLEY CASTING
SUPPORT TUBE
TOP PULLEY CASTING
S.A. LOCKING PIN
MOUNTING PLATE
MOUNTING PLATE
STARBOARD WINCH
PORT WINCH

BOMB WINCH



5 ·5in. WING GUNS 5

LANDING WITH BOTH UNDERCARRIAGE WHEELS RETRACTED

LIFTING

1. Jack at centre-plane jacking points (view A)
2. Raise jacks evenly till there is clearance for the trolleys—approximately 36in.
3. Pull the trolleys under the nacelles by ropes and lower the aircraft. If possible rest the wheels on the centre of the trolleys otherwise use the undercarriage frame attachment points. Lash loosly (view B) *
4. Remove jacks.
5. Attach the longest possible towing bridle, by strops around each propeller hub (view C).

TOWING

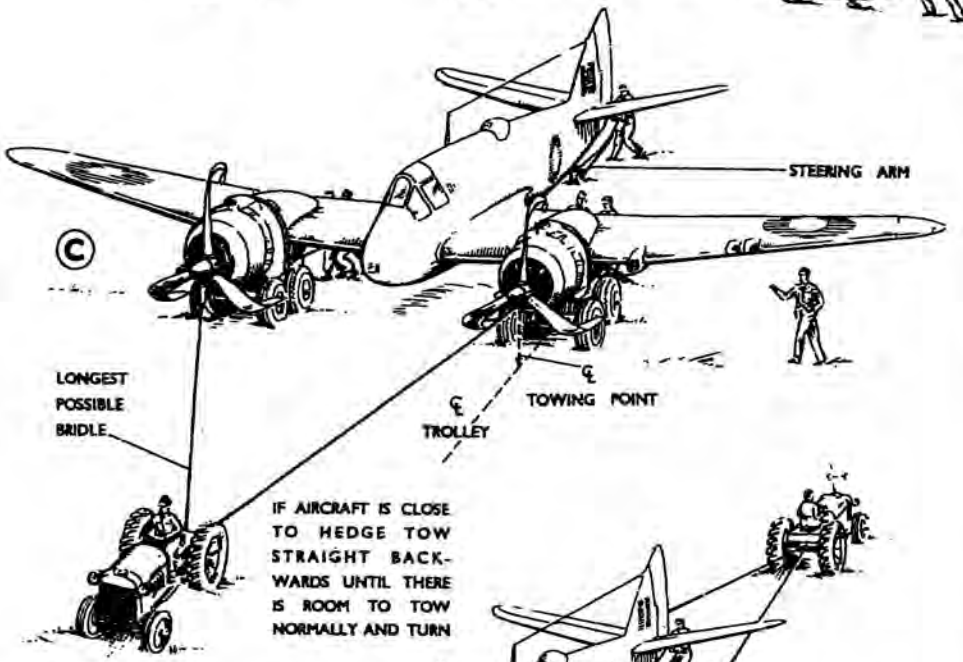
6. Six men to take up the position shown in view C. together with a leader to direct operations.
7. Tractor must tow as evenly as possible on both cables.
   (i) When towing straight forward the man on the steering arm keeps the fuselage in the line of movement; the men on the trolleys keep the latter square to the nacelles.
   (ii) Turning is done by steering the tail and helping round on the trolleys.

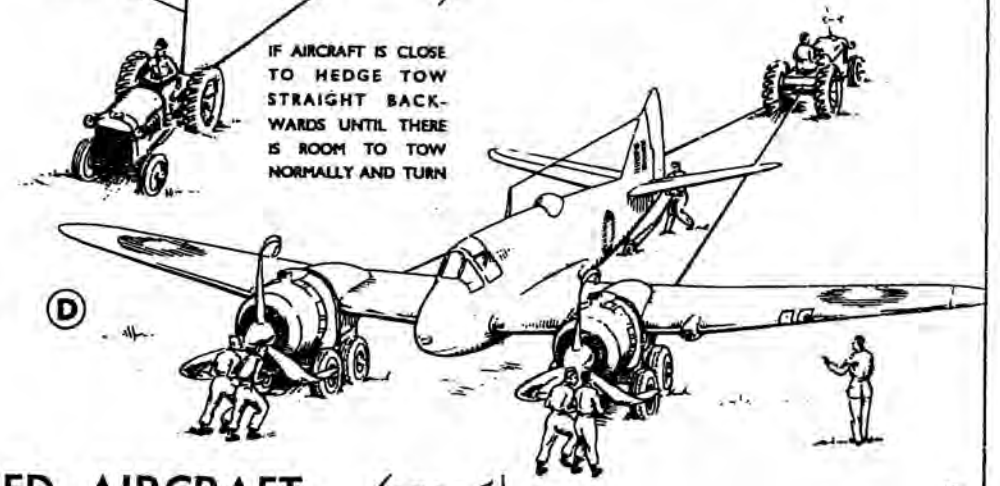
THE TRACTOR MUST NEVER BE USED TO PULL THE AIRCRAFT ROUND.

** THE AIRCRAFT MUST BE LASHED TO THE TROLLEYS SO THAT IT CANNOT COME OFF, BUT THERE MUST BE ROOM FOR MOVEMENT TO TAKE UP ANY UNEVENNESS OF THE GROUND AND TO ALLOW FOR TURNING. IF THE TAIL WHEEL IS DAMAGED LASH THE TAIL ON A TAIL TROLLEY AND STEER FROM IT.*

EQUIPMENT REQUIRED

8 TON HIGH-LIFT JACKS (2 REQUIRED)
6 TON SALVAGE TROLLEYS (2 REQUIRED)
3 TON TAIL TROLLEY (1 REQUIRED)
(if tail wheel is damaged)





LIFTING CRASHED AIRCRAFT *(case 1)*

6

LANDING WITH ONE UNDERCARRIAGE WHEEL RETRACTED

LIFTING

1. Jack at starboard centre-plane jacking point (view A)
2. Raise jack evenly till there is clearance for the trolley —approximately 36in.
3. Pull the trolley under the nacelle by ropes and lower the aircraft. If possible rest the wheel on the centre of the trolley otherwise use the undercarriage frame attachment points. Lash loosly (view B) *
4. Remove jack .
5. Attach the longest possible towing bridle, by strops around each propeller hub (view C).

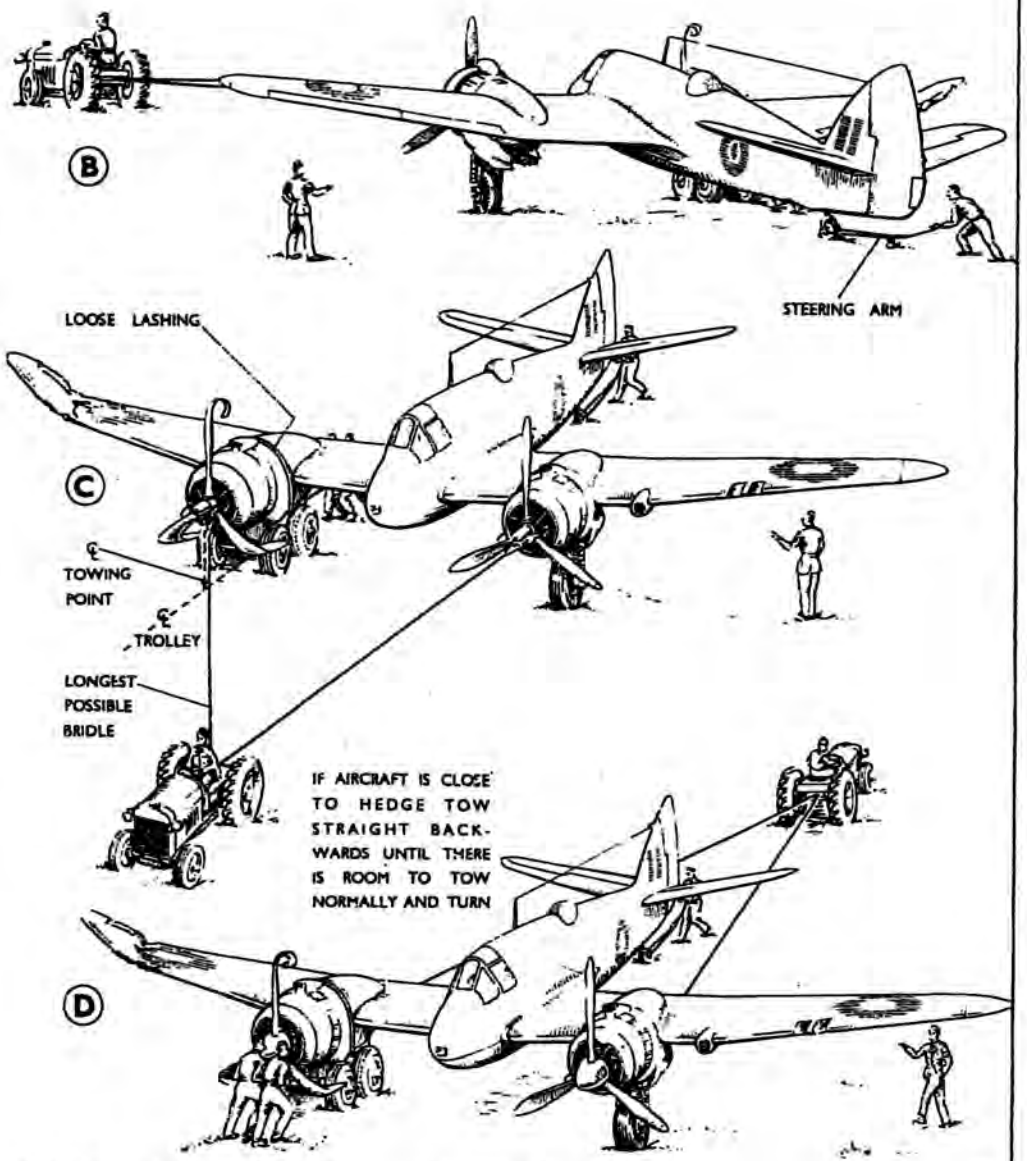
TOWING

6. Four men to take up the position shown in view C. together with a leader to direct operations.
7. Tractor must tow as evenly as possible on both cables.
   (i) When towing straight forward the man on the steering arm keeps the fuselage in the line of movement; the men on the trolley keep the latter square to the nacelle .
   (ii) Turning is done by steering the tail and helping round on the trolley .

** THE AIRCRAFT MUST BE LASHED TO THE TROLLEYS SO THAT IT CANNOT COME OFF, BUT THERE MUST BE ROOM FOR MOVEMENT TO TAKE UP ANY UNEVENNESS OF THE GROUND AND TO ALLOW FOR TURNING. IF THE TAIL WHEEL IS DAMAGED LASH THE TAIL ON A TAIL TROLLEY AND STEER FROM IT.*

EQUIPMENT REQUIRED

8 TON HIGH-LIFT JACK (ONE REQ.)
6 TON SALVAGE TROLLEY (ONE REQ.)
3 TON TAIL TROLLEY (ONE REQ.)
(if tail wheel is damaged)



LIFTING CRASHED AIRCRAFT *(case 2)*

SECTION 4 — CHAPTER 2.

Maintenance

CONTENTS.

CONTENTS—(*continued.*)

ILLUSTRATIONS.

Maintenance

1. This chapter describes the procedure for certain maintenance operations.

Jacking and Trestling:

2. The equipment for, and methods of raising the aeroplane for maintenance work are shown in Fig. 1. The use of the methods shown is recommended for wheel changing (see Sect. 5, Fig. 15), although the local jacking pads (indicated on Fig. 1 by an asterisk) may be used for such work. The pads for the undercarriage are attached to brackets on the undercarriage legs (see Sect. 7, Chap. 3, Figs. 1 and 2); the attachment being inserted from below and held in place by a split-pin. The tail of the aeroplane can likewise be raised by a standard 8-ton screw jack, using a special jacking cap fitted to the pad behind the tail wheel.

Former Stations and Inspection Panels:

3. The inspection doors are shown in Fig. 5. For the position of the fuselage formers (see Sect. 7, Chap. 1, Fig 1).

Lubrication:

4. The lubrication points are shown in Figs. 6 and 7. All ball and roller bearings are packed with anti-freezing grease before assembly, and should not need further lubrication. Some of the bearings have felt grease retaining washers, which should be inspected periodically and renewed if necessary. Bowden cables should be lubricated with graphite wax.

RIGGING.

General:

5. Since the main plane, fin and tail plane are fixed cantilever structures, it is only possible to check the alignment of the structure. The settings and ranges of control surface movements can be adjusted. All the main rigging data are given in Fig. 2, while the control surface ranges are shown in Fig. 3.

RIGGING SEQUENCE.

6. Trestle the aeroplane with one of the minimum combinations shown in Fig. 1; then check the alignment of the structure as shown in Fig. 2, on which the location and numbers of rigging boards, etc., are given.

(i) Level the aeroplane transversely with a straight-edge and spirit level on the datum pegs at each side of the former 110.5.

Repeat at the datum pegs on former 183. Place a third straight-edge on top of the first two and level longitudinally.

(ii) Check centre and outer plane incidence. Check the dihedral of the outer plane with a straight-edge and clinometer on the front spar.

(iii) Check tail plane incidence, port and starboard. Check tail plane as for outer plane (ii) above.

CONTROL SETTINGS.

General:

7. The ranges of movement of the control surfaces and tabs, together with their tolerance, are shown in Fig. 3, while the location of the adjustment is shown in Fig. 4, and the access doors in Fig. 5. Detailed illustrations of the control runs are given in Sect. 7, Chap. 5.

Elevators:

8. (i) Set the control column 2° 45′ forward of the vertical with the jig stick, Part No. 77510. (See Fig. 4.)

(ii) Shorten the forward push-pull rod, as much as possible, by means of forward adjustment point (A). Set elevators neutral by adjusting length of rear push-pull rod at rear adjustment point (A), taking care to see that the rocking shaft levers when operated do not foul the flange of the adjacent formers.

(iii) Check the range with column against stops (B) in the cockpit, and adjust the latter if necessary. One complete turn on the adjusting screw gives approx. 7/16 in. (1") at the elevators. Operate the column between each check.

(iv) Check that the balance tab is in line with the elevator when the latter is in its neutral position.

Rudder:

9. (i) Mark a line on the ground true to the aeroplane fore-and-aft datum.

(ii) Set the rudder pedals neutral with a clamp (see Fig. 4).

(iii) Set rudder to line on ground, by a plumb line. Strain the rudder to port against the cables and return slowly. Measure the offset. Repeat to starboard.

(iv) Adjust the rudder by turnbuckle (C), so that the movements in (ii) are within the limits given in Fig. 3.

(v) Check the range (measured from plumb line to line on ground), with the rudder lever against stops (D) in the cockpit, and adjust if necessary. One complete turn on the adjusting screw gives approx. $\frac{3}{8}$ in. ($\frac{1}{2}$") at the rudder. Operate the pedals between the check.

Ailerons:

10. (i) Set the control column hand wheel neutral by fitting blocks of correct length between stops (E) (see Fig. 4). Adjust the chains, if necessary, by chain tensioners (K), until levers on relay quadrant are symmetrical on centre line of aeroplane.

(ii) Set the ailerons neutral by adjusting the cables at turnbuckles (F).

(iii) Check the range with the hand wheel against stop (E), and adjust if necessary on the length of rod (G).

(iv) Repeat (ii) if any adjustment has been made at (G), operating the hand wheel between each check.

NOTE.—*This paragraph gives a bare outline of the sequence of operations; they may have to be repeated several times before correct setting is obtained.*

Trim Tabs:

11. (i) Set the cockpit indicator neutral.

(ii) Set the trim tab in line with the control surface by adjusting cables at turnbuckle (H) (see Fig. 4).

(iii) Check the tab movement and adjust if necessary on the length of rod (J).

(iv) Repeat (ii) if an adjustment has been made at (J).

NOTE:—*This sequence applies to all trim tabs.*

Aileron Adjustable Tab, Port:

12. The tab on the port aileron is set after the final flight tests. Should it be necessary to reset the tab, loosen the retaining screws, reset the tab, and tighten the screws.

Flaps:

13. Check that the flaps close just as the jack piston reaches the end of its stroke. If necessary, synchronize the port and starboard flaps by means of the adjusters in the balance cables behind the rear spar. (See Fig. 4.) Check indicator Teleflex cable for freedom of movement.

ALIGHTING GEAR.

General:

14. The undercarriage and tail wheel mechanism should be kept free from the accumulation of mud; particularly at the knee joints of the radius rods. The undercarriage locking catches must be examined periodically to ensure that they fall freely into place. In damp weather they should be examined for mud and grit, and lubricated if necessary, after each flight. The ground safety locking pins must always be fitted to the undercarriage when any work on the aeroplane is being done.

REMOVAL OF WHEELS.
Undercarriage Wheels:

15. With the undercarriage in the down position and the safety locking pins in position, proceed as follows:—

(i) Assemble the jacking pad (see Para. 2).

(ii) Disconnect the brake system at the wheel connections.

(iii) Jack up the undercarriage until the load is just taken off the tyre.

(iv) Remove the four bolts and axle cap from the bottom of each shock-absorber leg.

(v) Jack up further until the leg is clear of the axles.

(vi) Remove the wheel complete with axle.

(vii) Remove the bolt through the end fitting and axle.

(viii) Remove the end fitting.

(ix) Withdraw the axle complete with brake gear.

NOTE:—*Care must be taken on assembly that the two rear cap bolt nuts are uppermost on each leg.*

Tail Wheel:

15A. (i) Jack up the aeroplane (see Para. 2).

(ii) With the tail wheel in the down position, remove the split pin and bolt in both wheel arch arms (see Sect. 7, Chap. 3, Fig. 5, Dia. A).

(iii) Withdraw the axle.

(iv) Remove the complete wheel.

ADJUSTMENT TO UNDERCARRIAGE CATCHES.

16. Trestle, or jack, the aeroplane approximately in rigging position. Before commencing adjustment, check to see that the distance between the knuckle pins and lower hinge pins are 20 in. plus or minus one half turn of the lower end fittings. With the undercarriage extended, make sure that the lifting pin is at the forward end of the slot (A) in the lifting bracket (see Fig. 8). The clearance between the latches and the catch jaws should be 0.015 in. to 0.025 in., adjust this clearance by means of light-alloy shims (B) fitted under the latch brackets on the shock-absorber leg. Adjust the mesh of the catches by the screwed fork end (C) of the link rod; make sure that the bottom catches are not depressed when the latch is fully engaged. Slowly retract the undercarriage to the limits set by the cylinder extension piece.

CAUTION.—Ensure that:—

(i) The link rods do not foul the body of the top catches.

(ii) The axle caps do not contact the adjustable stops.

(iii) The adjustable stops are not screwed too far into their fittings.

(iv) The catch plunger housing is not screwed too far in, causing the latch to foul.

NOTE.—*If fouling occurs between the link rod and the top catch body the cylinder extension piece may be screwed out a further two complete turns (maximum) to limit the undercarriage travel (see para. 18).*

17. Adjust the top catches, ensuring that both catches are evenly adjusted and that the piston end fittings is in contact with the adjustable extension piece.

Adjust the top catch plunger to provide a clearance of approximately 1/32 inch between top of plunger and the latch face.

Adjust the top catch strut to give a clearance of 0.030/0.050 inch between the face of the top catch plunger and the latch. The faces may be squared laterally by allowing the undercarriage to "hang" on the catches.

Tighten the lock nut on the plunger housing and ensure that adequate clearance is provided between the lock nut and the link rod.

Adjust the nacelle stops to clear the axle by 1/16 to $\frac{1}{8}$ inch and lock.

Ensure that the rear axle cap bolts are assembled with the nuts uppermost to prevent fouling the nacelle structure.

Adjust the "up" and "down" position electrical indicator switches (see Fig. 8) to ensure that correct indications are given.

After any undercarriage adjustment raise and lower the undercarriage at least two complete cycles to prove that all components function correctly, and to ensure that the various adjustments remain constant.

ADJUSTMENT OF JACK CYLINDER STOP.

18. The extension piece on the jack cylinder (see Sect. 9, Fig. 13) is adjusted by releasing the locknut and turning the extension piece (which screws into the stop nut) until the undercarriage is in the required position. The lock and stop nuts must be re-locked with wire after final adjustment. For further details refer to Alighting Gear Manual R.A.A.F. Publication No. 636.

UNDERCARRIAGE LIMITS.

19. After any undercarriage maintenance operation, during which the jack and the radius rods have been disconnected, the following limits should be observed on re-assembly:—

(i) Clearance between the piston and end cap (jack connected and extended with the catches locked) should be 0.030 in. to 0.080 in. extra travel (see Sect. 9, Fig. 13). Adjustment is by the end fitting and the locknut.

(ii) The radius rods must not be more than $\frac{1}{8}$ in. out of line between the top and bottom attachments.

UNDERCARRIAGE SHOCK-ABSORBER UNIT (VICKERS).

General:

20. The fluid contents of each shock-absorber leg should be checked to the figure given in the Leading Particulars, as it is possible for oil to pass from one leg to the other through the air balance pipe. The Vickers leg is illustrated in Sect. 7, Chap. 3, Fig. 1.

WARNING:—*Before dismantling any part of this type of leg, the air pressure must be released (See Para. 22(ii)). Otherwise a serious accident might result. A spare leg, if left charged must have its safety locking strap in position.*

Faults and Remedies:

21. Once the legs have been filled and charged it is inadvisable to interfere with them, unless there is evidence of leakage. The following notes will assist in the location of faults:—

(i) If, on inspection, an aeroplane is found to have undercarriage legs compressed more than $\frac{1}{2}$ in. beyond the normal position, the air pressure is low and the legs should be re-charged with air.

(ii) Failure to compress to within $\frac{1}{2}$ in. of the normal position, the pressure is high and should be adjusted (see Para. 25).

NOTE:—*For the fore-going reasons, it is advisable to make a record of the exposed piston lengths for each aeroplane, with correctly filled and charged legs, at varying loads.*

(iii) If the aeroplane wallows badly when taxi-ing, and the air pressure is correct, the oil level is low. Add oil (see Para. 24).

(iv) If the undercarriage is harsh, although the air pressure is correct, the oil level is high. Check the oil level (see Para. 23).

(v) Excessive oil on the piston and attachment fittings indicates worn gland packings. The leakage can be temporarily cured by tightening the gland nut with the special spanner, but the gland rings must be renewed as soon as possible (see Para. 26).

(vi) A shock-absorber unit that has stood in one position for some time may have a sluggish action owing to the oil having dissolved the surface of the gland rings, causing temporary adhesion. This fault should cure itself after a little taxi-ing, but if it does not, the rings should be removed and cleaned.

(vii) New shock-absorber frames are supplied correctly filled with oil, but not charged with air. The oil level should be checked when fitting, as the oil may have passed through the air balance pipe, from one leg to the other.

Oil Level Check:

22. The oil level should be checked only when the aeroplane has not been moved for some time, as froth forms on the top of the oil under load and a check under these conditions would be valueless.

To check the oil level:—

(i) Jack the aeroplane with the wheels clear of the ground.

(ii) Release the air pressure through the air valve cap by slackening it slightly.

(iii) Wait a few minutes for the oil to settle and slowly re-charge with air to a pressure of 50 lb./sq. in. (see Para. 23).

(iv) Taking one leg at a time, slacken the oil level plug a turn or two. If this results in a fine mist escaping, the oil level is correct. If only air escapes, the level is too low, and if a jet of oil is ejected the level is too high.

23. If the oil level is too high it must be reduced as follows:—

(i) Slacken the oil level plug and pass air slowly into the cylinder (at low pressure) until oil ceases to escape with the air.

(ii) Shut off the air supply and allow two or three minutes for the oil to settle, before repeating (i) above.

(iii) Repeat (i) and (ii) until only a fine mist escapes.

NOTE:—*If the air is passed through the strut too rapidly, it will cause a suction effect and will empty the leg too much.*

24. If the oil level is too low, pump in a surfeit of oil through the oil level plug, and then adjust the level by blowing off the surplus oil (see Para. 22).

Air Charging:

25. Jack up the aeroplane with legs fully extended. Charge the shock-absorber unit through the air valve on either leg to the pressure given in the Leading Particulars. Tighten all valves securely on their seats after charging, and replace the dust caps. The safety locking strap fitted between the air valve, and the gland nut, must be in position and locked with wire.

Renewal of Packing Rings:

26. For this operation the shock-absorber frame must be removed from the aeroplane, and the wheel axle must be detached (see Sect. 5). The renewal procedure is as follows:—

(i) Release the air pressure (see Para. 22, Item (ii)) and then remove the plug together with the safety strap.

(ii) Remove the locking bolt and unscrew the axle bearing (see Sect. 7, Chap. 3, Fig. 2, Detail D).

(iii) Unscrew and withdraw the gland nut (using spanner Part No. 15-90287), together with the gland nut sleeve (see Sect. 7, Chap. 3, Fig. 3).

(iv) Withdraw the piston. If this is difficult, replace the oil level plug and force the piston out by pumping oil into the air valve.

(v) Fit the new gland rings. These should be soaked in hydraulic oil, D.T.D. 44D, for at least 12 hours prior to fitting.

(vi) Drain the cylinder thoroughly, and wash all parts of the leg thoroughly prior to re-assembly.

(vii) Close the air valve and oil level plug, and then pour into the cylinder the quantity of oil given in the Leading Particulars.

(viii) Insert the top of the piston, taking care not to displace the oil, and tap the new packing rings into position with a hard-wood drift, being careful not to damage the feather edges of the ring.

(ix) Tighten the gland nut, using slight force only, but sufficiently to bed the rings, and then loosen it about one turn to allow the rings to expand.

(x) Replace the axle bearings, safety locking strap, etc., and carry out the oil level check and air-charging procedure as already described.

TAIL WHEEL SHOCK-ABSORBER UNIT.

General:

27. The tail wheel shock-absorber unit is of the N2600 type, which is a re-designed version of the original Lockheed oleo pneumatic shock-absorber, fitted with shimmy eliminator. The shimmy eliminator is attached with a bearing to the plunger tube and connected with a scissor link system to the bottom end of the retracting bracket. There is also a self-centering cam which returns the tail wheel to a central position before retracting into the boot of the aircraft. The fluid content of the unit is 1¾ pints of oil to specification D.T.D. 44D. For a description of the operation of the strut, see Sect. 7, Chapter 3, Paras. 15 to 23, and Fig. 8. For adjustment of tail wheel jack, see R.A.A.F. Publication No. 636.

Faults and Their Remedies:

27a. If the action of the leg is excessively harsh and the plunger tube does not move or only moves a short distance from the extended position when taxi-ing, either the air pressure is too high, or the leg contains too much fluid. If the action of the leg is spongy and slow in recovery, and the plunger tube does not extend to its normal position, the air pressure or the fluid level is too low. The above faults should be corrected by re-charging and re-inflating (see Para. 27 (b) and 27 (c) respectively). When loss of air pressure occurs, the air valve should be checked for leaks by squirting fluid around all joints. Leakage around the valve may be remedied by tightening the valve body with care, so as not to strain the threads; leakage through the valve may be corrected by fitting a new valve core, or alternatively, by replacing with a new body and core.

Charging:

27b. With the aeroplane supported so that the wheel is clear of the ground, the leg should be charged as follows:—

(i) Release the pressure in the leg by reversing the air valve cap at the top of the fork, and fully compress the plunger tube manually (manually refers to tail wheel unit only) and a projection inside the cap will keep the valve depressed. It is essential that the needle be depressed and the leg fully compressed during the charging operation.

(ii) Charge the fluid gun, taking care not to draw in air. If the fluid gun has been out of use for a considerable period, the gland will have become dry and should be soaked with fluid before being used.

(iii) Remove one of the two fluid filler plugs at the top of the cylinder, screw the fluid gun extension piece into the orifice and force fluid into the leg until no more will enter. This operation will require considerable effort.

(iv) Remove the other fluid filler plug and gently force fluid from the gun until a clear stream, free from air bubbles, emerges from the orifice.

(v) Unscrew the gun and extension piece, replace both fluid filler plugs securely and lock them with wire. When tightening the fluid filler plugs, care should be taken not to strain the threads.

Inflation:

27c. With the aeroplane supported so that the wheel is clear of the ground, the leg can be inflated as follows:—

(i) Remove the air valve cap.

(ii) Screw the hose connection from the air pump or cylinder to the air valve, and inflate the leg to a pressure of 160 lbs. per sq. in. When checking the air pressure a gauge and adaptor should be used.

(iii) Unscrew the pump hose and replace the air valve cap.

(iv) Check the air valve for leaks.

NOTE:—*Care must be taken to see that the strut is tested again when the load is on the wheel.*

(v) With the load on tail wheel, the air pressure in the strut is to be checked by reading the riding height indicator attached to the link mechanism (see Sect. 7, Chap. 3, Fig. 7), with the aircraft at maximum take-off weight, the indicator should point to the top limit of the graduations with the tail load supported on the strut. A check should be taken again with the aircraft at landing weight, to see that the indicator reads within the required limits with the tail load supported on the strut.

NOTE:—*Failure to observe these conditions can result in serious damage to the self-centering cams.*

Measurements.

27d. The depth of the tail wheel shock-absorber unit between the top and bottom is as follows:—

Extended	$38\frac{1}{8}$ in.
Compressed	$33\frac{5}{8}$ in.
Maximum travel equals . .	$4\frac{1}{2}$ in.

ENGINE INSTALLATION.

FUEL AND OIL SYSTEM.

Cleaning Fuel Tanks:

28. (i) Drain and remove the fuel tank (see Sect. 5).

(ii) Secure the lower arm of the contents gauge unit to the top portion inside the tank.

(iii) Remove the cocks from the sump and plug the holes.

(iv) Clean each tank thoroughly by flushing with filtered petrol.

(v) Remove the plugs from the sump holes and unfasten the lower arm of the contents gauge unit, prior to re-fitting the tank.

Cleaning Carburettor Filters:

29. (i) Remove locknut from the filter on the firewall to release the filter housing.

(ii) Remove the filter gauge and clean with filtered petrol.

NOTE:—*In the event of metallic particles being found in the filter, their origin must be traced, the pipe-lines thoroughly flushed, and the worn part renewed.*

Cleaning Fuel Pressure Regulators:

30. (i) Remove the nuts (L) around the top cover (C) which will then spring up (leaving the bolts in position) and the cover will be free (see Sect. 8, Fig. 3).

(ii) Remove the diaphragm (O), taking care not to damage the flange faces.

(iii) Unscrew the plug cap (S) and remove the piston valve stem and the conical valve (V), together with their respective springs (Y and W).

(iv) Wash all parts with filtered petrol. For cleaning, the valve seat (U) need not be removed.

NOTE:—*The assembly instructions given in Sect. 5 should be followed when replacing the parts after cleaning.*

Cleaning Oil Tanks and Filters.

31 (i) Drain the oil tank (see Sect. 5) while the oil is hot to ensure complete emptying.

(ii) Remove the filter from the tank sump by lifting the rod attached to it through the top of the tank, and clean with filtered petrol.

(iii) Remove the oil tank (see Sect. 5).
(iv) Plug all the holes in the sump and tank.
(v) Wash the tank with flushing oil.
(vi) Remove the plugs from the holes prior to reassembling the tank, and make sure that all the flushing oil has cleared before filling with new oil.

Cleaning Oil Coolers.

32. (i) Drain and remove the oil coolers (see Sect. 5).
(ii) Plug the inlet, or outlet pipe end.
(iii) Wash out with flushing oil.

Air Lock in Fuel System.

33. It is essential that there should not be any air in the fuel system. Care should be taken that all air is expelled, particularly from the suction balance pipe, after even minor work has been done on the fuel system.

To Expel Air from Balance Pipe:

34. (i) Close all fuel cocks.
(ii) On one engine (e.g., port) disconnect, at the filter, the suction pipe from the fuel pump to filter.
(iii) Open the suction balance cocks.
(iv) Open a fuel cock on the opposite side (e.g., starboard) to the engine from which the pipe has been disconnected.
(v) Wait until the fuel flows steadily and freely from the filter; then with the fuel still flowing, connect the pipe to the filter.

To Expel Air from the Main Fuel System:

35. (i) Shut all fuel cocks.
(ii) Disconnect, at the filter, the suction pipe between the filter and the fuel pipe.
(iii) Open a fuel tank cock on the same side as the engine from which the pipe has been disconnected.
(iv) Wait until the fuel flows steadily and freely from the filter.
(v) With fuel still flowing from the first tank repeat (iii) and (iv) for the other fuel tanks, then connect the pipe to the filter.

Fuel Pipe-Lines:

36. Ensure that all joints in the fuel pipe-lines are perfectly smooth internally, as sharp edges at joints, nipples, etc., cause aeration of the fuel.

Boost Gauge Fuel Trap.

37. The fuel trap must be kept free from the accumulation of moisture and dirt which settles at the bottom of the trap, otherwise the boost gauge reading will be seriously affected. A screw at the bottom of the trap provides access for cleaning and drainage.

ENGINE CONTROLS.

38. The layout, settings and adjustment points of the various controls are shown in the illustrations in Sect. 8.

39. The engine controls must be adjusted so that the cockpit levers come up against their stops before the systems are strained. Particular attention is to be paid to the throttle controls to see that the throttle levers line up with their locations on the quadrant, when in the "CRUISE", "RATED", and "TAKE-OFF" positions. The friction adjuster, on the throttle and mixture controls and on the propeller governor control, should be examined periodically for slackness or wear, and adjusted or renewed as necessary.

Propeller Governor Controls.

40. A diagram showing the layout of the propeller governor controls is given in Sect. 8, Fig. 7; the arrangement of the control lever unit is also shown. Adjustable stops are provided at the "INCREASE R.P.M." position of the levers; further adjustments can be made by altering the positions of the levers on the splined fittings. The controls must be adjusted so that when the levers are against their stops in "INCREASE R.P.M." position, the arms in the governor units are also contacting their stops.

TELEFLEX CONTROLS.

List of Teleflex Controls Fitted:

41. Maintenance of teleflex controls (M.R.C.) is described in A.P. 1464B, Vol. 1.

The following is a list of the Teleflex controls fitted:—

REF. No.	FROM (operation end)	TO (Remote end)
i	Lever on fuselage port wall	Front entry and exit hatch bottom catch.
ii	Front entry hatch, bottom catch	Top catch assembly.
iii	Lever on fuselage port wall	Rear entry and exit hatch, bottom catch.
iv	Landing lamp control	Bowden cable, connection landing lamps, port.
v	Elevator trim tab handwheel	Tab indicator.
vi	Flap indicator on hydraulic control box ..	Inboard end of port centre plane flap.
vii	Fuel cock controls	Fuel cocks in nacelles, balance cocks in nacelles.
viii	Propeller governor controls	Governor control box on engine.
ix	Two-speed supercharger controls	Levers on engines.
x	Carburettor cut-out controls	Engine connection.

42. The following is a list of the main Teleflex details fitted. The number in the Ref. column refers to the same numbered item in the previous paragraphs.

REF. No.	CABLE No.	OPERATIONAL END	REMOTE END	COUPLING
i	2	One lever single	Sliding eye	—
ii	2	Sliding fork	Sliding eye	Swivel
iii	2	One lever single entry box	Sliding eye	—
iv	2	Sliding fork	Sliding eye	Swivel
v	1	Straight lead box to handwheel	Cable fixed to indicator block	—
vi	2	Cable fixed to indicator block	Sliding fork	Swivel
vii	2	Two double entry boxes	Universal double entry box (at 3 way fuel cocks)	—
			Sliding fork (at suction balance cocks)	—
viii	2	*One lever single entry box	One double entry box	—
ix	2	*Sliding fork	Sliding fork	Swivel
x	1	*Push-pull unit	Sliding fork	Swivel
		*in duplicate.		

HYDRAULIC SYSTEM.

GENERAL.

43. The hydraulic system is described and illustrated, including location of parts and diagrammatic layout, in Sect. 9. Essential data (fluid capacity, etc.) is given in the Leading Particulars. The following paragraphs under FAULTS have been condensed to chart form and shown in Fig. 13.

44. In all maintenance operations on the hydraulic system absolute cleanliness is essential. Clean fluid only should be used when filling or topping up, and the filter in the filler neck of the fluid reservoir should always be in position during this operation. The containers for holding the fluid or for the reception of drained fluid must be scrupulously clean. It is preferable, after the container has been carefully cleaned, for it to be rinsed with a small quantity of clean fluid, which should then be discarded. Whenever the pipe-lines are disconnected, the unions and pipe ends should be blanked off to prevent the entry of dirt. Whenever drain plugs, or other components are removed, they must be carefully examined for dirt before re-assembly.

45. The efficient working of the system depends to a large extent on the complete exclusion of air from the pipe-lines and operating units. The fluid in the reservoir should, therefore, be kept up to the level of the filler neck.

46. *Hydraulic fluid has a deleterious effect on paint, rubber, electric cables, etc., and care must be taken to avoid spilling it on such parts.*

FILLING AND DRAINING.

Filling:

47. The system may be filled either by engine-driven pumps, or by portable pumps (similar in capacity and pressure to those in the aeroplanes) fitted with flexible pipe connections for the two self-sealing couplings at the top of each firewall. The tail of the aeroplane should be on the ground for this operation.

(i) Disconnect the undercarriage and tail wheel jack piston pins.

(ii) Fill the fluid reservoir through the gauze filter.

(iii) PORTABLE PUMPS ONLY: Disconnect the four self-sealing couplings on the firewalls. Fill the four flexible pipes from the pumps with fluid before connecting them to the couplings.

(iv) Start the pumps.

(v) Maintain the fluid level in the reservoir by topping up; operate all units (including the hand pump) several times while filling, to exclude air. (See Para. 55.)

(vi) Re-assemble undercarriage and tail wheel jack piston pins.

(vii) Disconnect flexible pipes and re-assemble at firewall.

(viii) After refilling or topping up, the gauze filter under the filler cap should be examined and, if necessary, cleaned with filtered paraffin.

Draining:

48. The bulk of the fluid can be drained from the system by uncoupling unions or connections at the lowest points of individual pipe runs, depending on the position of the aeroplane. Draining is facilitated by operating the hand pump, control valves and jacks; with the latter, the areoplane must be trestled, or the jack pistons disconnected. The fluid may be filtered and re-used, except at the periodical replacement times.

FAULTS.

Location of Faults:

49. A fault should be located by checking independently the behaviour of each service before removing any component from the system. If any one service responds efficiently to the engine-driven pumps and the hand pump, then the pumps can be taken to be in good order. Investigation of faults should be considered in the following order:— Loss of pressure, air in the system, and increase of load.

Loss of Pressure:

50. (i) Failure of engine-driven or hand pumps; all services inoperative. Repair or renew the unit.

(ii) Internal leaks. Sluggish movement of all services due to excessive wear in engine-driven pumps, the control valves and the jack pistons. Repair or renew the faulty unit.

(iii) External leaks. Signs of these will appear at the unit concerned. Rectify or renew the part (see Para. 53).

Air in the System:

51. Backlash or jerky operation of any of the jacks indicates air in the system (see Para. 55).

Increase of Load:

52. (i) Side load on the jacks and swivel points due to mal-alignment (see Para. 63).

(ii) Presence of dirt on moving parts. Clean, and if necessary, repair or renew the affected part or unit.

Fluid Leakage:

53. The system must be regularly inspected for leakage. This may occur at any of the unions or joints throughout the system. Such leakage can usually be cured by tightening the part concerned. Excessive tightness must be avoided. If leakage persists, inspect and renew as necessary.

54. If the tail wheel or flap jack gland leaks, finger tightening of the gland nut may effect a cure. If necessary, renew the gland packings (see Paras. 57 and 58). Leakage at the undercarriage jack gland can be cured only by renewal (see Para. 56).

Expelling Air:

55. Immediate steps must be taken to expel any air from the system. Expel the air by operating the units with the engine-driven pumps, the hand pump, or portable pumps. The inside of the fluid reservoir should be watched. When bubbles cease to come to the surface and all jacks work smoothly, the system will be free from air.

GLAND RENEWAL.

Undercarriage Jack:

56. (i) Uncouple the lower end of the jack by withdrawing the crosshead bolt through the piston rod end fitting (see Sect. 9, Fig. 13). The jack can then be swung clear about its fulcrum end.

(ii) Release the end fitting locknut and unscrew the end fitting from the piston rod.

(iii) Remove the upper locking wire.

(iv) Remove in one piece (without separating) the stop nut, locknut and the extension piece.

(v) Withdraw the gland ring, packing rings and soft packing.

(vi) Assemble new packings.

Tail Wheel Jack:

57. (i) Remove the jack from the aeroplane (see Sect. 5).

(ii) Release the locknut (see Sect. 9, Fig. 14) and unscrew the end-fitting from the piston rod.

(iii) Remove the locking wire from the gland nut.

(iv) Unscrew the gland nut and withdraw the gland rings, packing rings, and soft packing.

(v) Assemble new packings.

WARNING:—*The gland nut must not be more than finger-tight.*

Flap Jack:

58. (i) Remove the jack from the aeroplane (see Sect. 5).

(ii) Remove the locking wire from the gland nut (see Sect. 9, Fig. 15).

(iii) Unscrew the gland nut and withdraw the gland ring, packing rings and soft packing.

(iv) Assemble new packing.

WARNING:—*The gland nut must not be more than finger-tight.*

CHECKING JACKS.

59. On re-assembly to the aeroplane, each jack should be checked to ensure that full movement is available. The undercarriage limits given in Para. 20 should be observed.

60. If an end cap (see Sect. 9, Figs. 13, 14, and 15) has been removed, examine and if necessary renew the Wills Packing Ring. When replacing the end cap, see that the retaining bolts are tightened evenly.

CLEANING MAIN FILTER.

61. The filter container should be examined and cleaned periodically.

(i) Unfasten the locking wires and unscrew the studs and nuts holding the container.

(ii) Remove the container and clean with filtered paraffin.

(iii) If it is necessary to clean the gauze, unscrew the filter interior.

NOTE:—*If metallic particles are found in the filter, trace their origin and renew the worn parts.*

MISCELLANEOUS.

Swivel Joints:

62. This type of joint rarely gives trouble. If a slight leak develops, it may be cured by tightening the gland nut slightly. If the leak persists, the packing should be renewed. New packing rings must be inserted in their correct order; fit the gland ring, the bearing collars and the gland nut. Ensure that the parts seat evenly, and do not overtighten the gland nut.

63. Check the alignment of the swivel joints. Any slight mal-alignment should be corrected immediately by bending the pipes carefully back into position. If the pipes are badly bent they should be renewed. Do not apply any side load to the swivel joints.

Standard Pipe Unions:

64. When it is necessary to open a joint the system need not be drained of fluid. A tray placed below the joint will catch the leakage (see Para. 53).

Blanking:

65. The following parts are available for blanking pipes and unions:—

DIAMETER	UNION BLANKING CAP	PIPE BLANKING PLUG
1/8" B.S.P. for 3/16" O/D.	Part No. 156887	Part No. 156890
3/8" B.S.P. for 5/16" O/D.	Part No. 156236	B.S. 1811
1/2" B.S.P.	Part No. 156151	Part No. 156244
5/8" B.S.P.	B.S. 4567	Part No. 156245
3/4" B.S.P.	Part No. 156889	Part No. 156892

Expanding Pipe Ends:

66. The ends of replacement pipes can be expanded with the A.G.S. expanding tool equipment Nos. 772 Mk. I or 773 Mk. II, according to diameter.

PNEUMATIC SYSTEM.

GENERAL.

67. The pneumatic system is described and illustrated in Sect. 9.

68. The system should be periodically checked for leakage. The oil trap, the oil and water trap, air cylinders and the air filter should also be examined and any oil or water removed.

Charging Air Cylinders from an Outside Supply:

69. Charge the cylinders, through the valve in the starboard nacelle, to the operating pressure given in the Leading Particulars.

Relay Control Valve:

70. This instrument reduces the air pressure from the reduction valve, to the pressure required by the pilot to apply the brakes for straight or differential braking; the pressure at the individual brakes is indicated on the triple pressure gauge during operation. If the relay valve does not function properly, this will also be indicated on the triple pressure gauge.

Oil Trap and Oil and Water Trap:

71 (a). An oil trap is fitted between the charging connection and the auto-regulator, to prevent the ingress of oil from the compressor. This type has a felt and gauze element to trap the oil which should be taken out and cleaned periodically with petrol and dried off. There is a plug in the bottom for draining, and this should be carried out frequently, the interval being determined by the amount of oil found in the system. Care should be taken to see that the drain plug is not leaking.

71 (b). Any oil or moisture that escapes the oil trap condenses out through the cooling of the air and is removed by the oil and water trap. The drainage of the oil and water trap should be carried out periodically as in the case of the oil trap.

Air Filter:

72. The filter cleans the air from the cylinders. The drain plug should be removed periodically and the felt cleaned when necessary. If oil is present it is an indication that there is oil in one, or both, of the air cylinders, and they must be removed and cleaned.

Wheel Brake Unit:

73. The shoes should not be touched once they are correctly run in. In the event of the shoes having become greasy they should be renewed.

74. Extreme care must be exercised in handling the brake units, both in the store and in assembly. The paper covering should not be removed from the friction face until the brake is in position and ready to receive the wheel. Before fitting the wheel it is essential that all grease should be removed from the brake drum.

Piping:

75. The piping and joints are described in Sect. 9; cleanliness of the joints when handling is essential.

76. When a low pressure joint is disconnected the rubber seal should always be examined for signs of perishing, and renewed if necessary. On re-assembly, the seal must be moistened with water before fitting. In order to prevent the pipe working out during assembly, it should be marked faintly and held firmly in the recess in the connection until the sleeve has been screwed home.

77. When assembling a high pressure joint the expanded pipe end must fit snugly around the olive. The outer sleeve must only be tightened sufficiently to prevent air leakage. Do not forget to slide the outer sleeve and loose collar along the pipe before expanding the end of a new length of pipe.

Blanking:

78. Blanking caps are provided for cutting out the whole, or part, of the armament and the pneumatic system should the occasion arise. Caps to Part Nos. A.H.O. 5118 and A.H.O. 5039 are used in the positions illustrated in Sect. 9.

MISCELLANEOUS.

BONDING.

79. Bonding clamps and clips on metal parts must make good contact, and be perfectly clean and free from paint and grease. The earth connection must be carefully made when installing wireless equipment.

A.S.I. PRESSURE HEAD.

80. The pressure head should be checked periodically with the position and limits given in Fig. 2.

REPLENISHING HATCH DASHPOTS.

81. The two dashpots on each entry and exit hatch (see Sect. 7, Chap. 1) should be periodically removed from the aeroplane (see Sect. 5) and the fluid replenished with oil to specification DTD 44D. In closed position—22½ inch—oil level to be ⅜in. from underside of fork end fitting. Damper to be opened to full stroke 31/32in. and plugs screwed in tightly and locked.

TYRES.

82. The undercarriage and the tail wheel tyres should be kept inflated to the pressures given in the Leading Particulars. The valve interiors should be examined for leakage, and renewed when necessary.

HOSES AND PIPE-LINES.

83. The flexible hose and pipe-lines in all systems should be watched for chafing, torsional strain and, in the case of hose, deterioration from fluid, oil or heat.

UNDERCARRIAGE DOORS.

84. To avoid weakening the shock-absorber cords, when the doors are open for a considerable time, they should be disconnected.

85. The cords must be connected, and the functioning of the doors tested before preparing the aeroplane for flight.

ARMAMENT ADJUSTMENT.

Guns 20 mm.:

86. Vertical, horizontal and fore-and-aft adjustments are provided at the rear of each 20 mm. gun. The adjusting points are accessible when the 20 mm. gun doors (see Sect. 5, Fig. 11) are removed. Adjustment is obtained as follows:—

Vertical:—

(i) Slacken locknut (A) (see Fig. 10).
(ii) Adjust by turning knurled knob (B).
(iii) Securely tighten locknut.

Horizontal:—

(i) Slacken locknut (C).
(ii) Adjust by turning knurled knob (D).
(iii) Securely tighten locknut (C).

Fore-and-aft for port outer and starboard inner:—

(i) Slacken locknut (E) or (F) as required.
(ii) Screw up locknut (F) or (E) as required.
(iii) Securely tighten locknut.

Fore-and-aft, for port inner and starboard outer:—

(i) Slacken locknut (G).
(ii) Screw knurled knob (H) in or out.
(iii) Securely tighten locknut (G).

Gun Feed Ammunition Boxes, 20 mm.:

87. (i) Ammunition boxes (see Fig. 11) must be kept free from dirt and grit. Drain holes (A) are provided at all bottom corners.
(ii) All chutes (B) must be periodically cleaned by drawing through a rag soaked in anti-freezing oil.
(iii) Rollers (C) at top of ammunition boxes should be lubricated as necessary.
(iv) Latch bolts (D), on ammunition box lids, should be oiled occasionally.

Adjustment of Double Anchorage Feed Slide (20 mm. Gun Feed):

88. (i) Remove pin connections (E), (see Fig. 11) from forward end of one tie-rod and adjust slide (F) with other tie-rod by adjusting screw (G) at front end of bridge piece (H), until the line on the gun matches the line on the anchorage slide at (J).
(ii) Adjust the free tie-rod (K) by its adjusting screw until the pin at the forward end enters the anchorage clamp (L), and replace pin connections.

.5-in. Wing Gun Harmonization (Fig. 10):

89. Adjustments for harmonization are carried out in the following manner:—

Lateral—

(i) Remove split pin and slacken slotted nut (E) at rear of mounting (friction washers permit front portion of chassis to move). Adjust the two nuts (F) on eyebolt (G) until chassis is located in desired position. Tighten slotted nut (E) and lock with split pin.

Vertical—

(ii) Slacken nut (H) on special bolt (I). Elevate or depress gun by operating handwheel (J). Re-tighten nut (H) on special bolt (I).

ELECTRICAL.

Specific Gravities for Charged and Discharged Accumulators:

90. At approximately 80°F., the hydrometer reading should indicate the following specific gravities:—

(i) 1,100-1,150 for discharged accumulator.

(ii) 1,300-1,310 for a fully charged accumulator.

In service the accumulator should be returned to the electrical section for re-charging if the specific gravity falls below 1,200.

Voltage Regulator Adjustment:

91. The voltage regulator is set at 29 volts plus 0.5, minus 1.0 volt, and should not be altered by any unauthorised person. Should it be apparent that resetting is necessary for any of the following reasons, the electrical personnel should be notified, and procedure followed as laid down in the Electrical Service Manual, R.A.A.F. Publication No. 607:—

(i) Generator charging below 28 volts;

(ii) Generator charging above 29.5 volts;

(iii) Contacts of the cut-out are persistently becoming pitted.

Accumulator Cut-Out:

92. The accumulator cut-out is set to close at between 26 and 27 volts, and to open on a reverse current of between 5 and 10 amperes. These values should only be checked on the bench and procedure should be as laid down in Electrical Service Manual, R.A.A.F. Publication No. 607.

The air-gaps between the contacts are adjusted as follows:—

(i) Main air-gap at centre of pole, 0.060";

(ii) Main contact gap, 0.030".

It is recommended that the electrical personnel be notified for any maintenance or resetting of the contacts.

Parallel Operation of Generators:

93. (i) Check the voltage regulators independently according to test procedure described in R.A.A.F. Publication No. 607 (Beaufighter Electrical Manual).

(ii) See that the paralleling links are connected to the correct studs.

(iii) Connect at 10-0-10 ammeter across each terminal block B20 and B21 in the fuse and instrument panel.

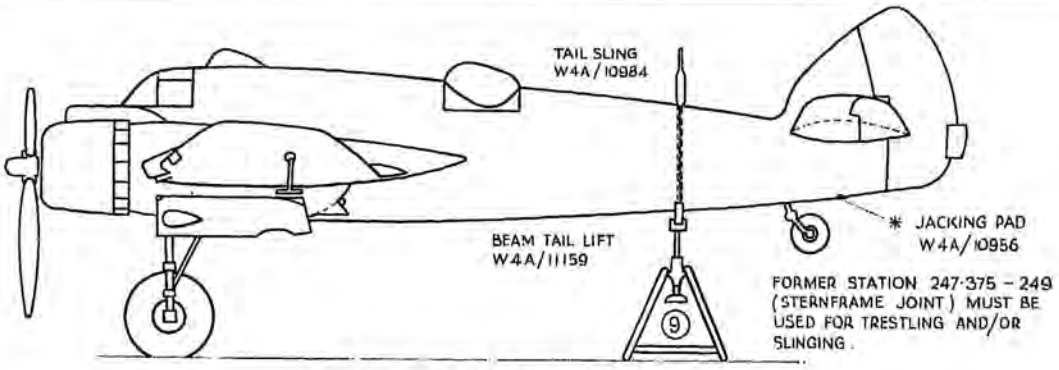
(iv) Run both engines to approximately 2,400 r.p.m. with the battery master switch "OFF". The readings on the ammeters should not exceed 4 amperes. Should the readings be exceeded, the voltage regulators should be adjusted.

(v) Connect a 10-0-70 ammeter across each terminal block B20 and B21.

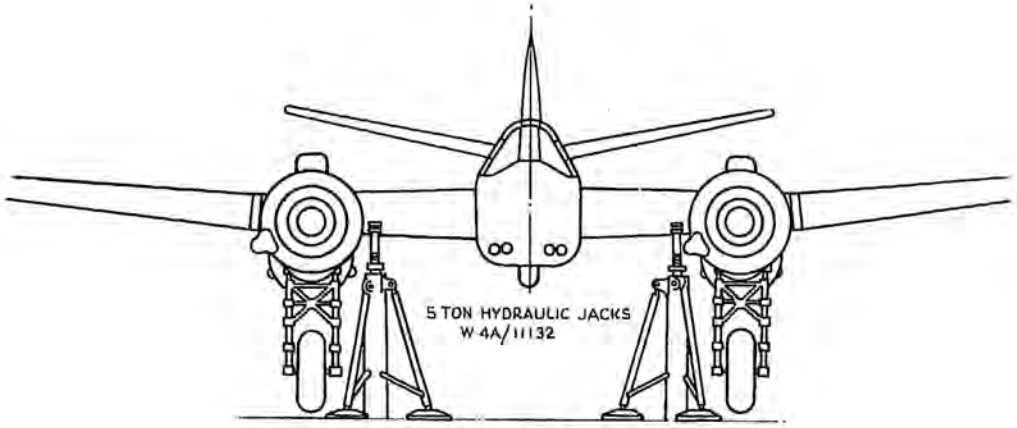
(vi) Switch on the radio equipment and see that the current is shared by each instrument.

(vii) Replace the shorting links on terminal blocks B20 and B21.

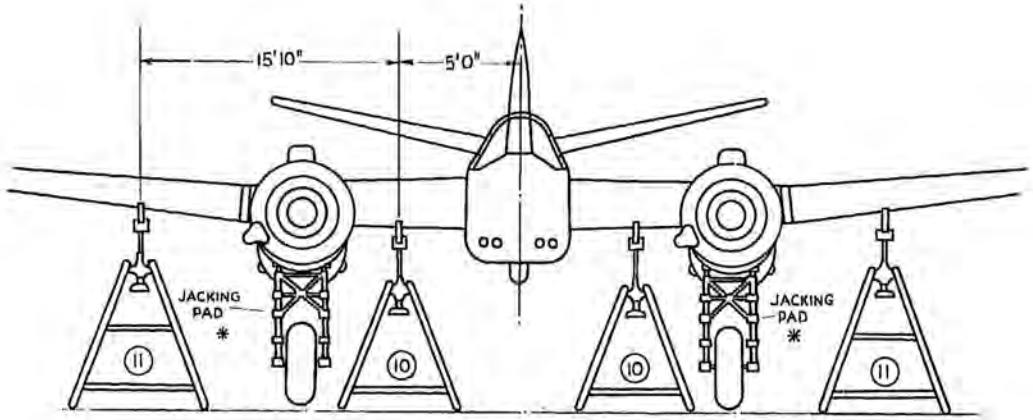
NOTES.



TAIL SUPPORT



METHOD A



METHOD B

METHOD A

TWO HYDRAULIC JACKS W4A/11132 AND
ONE Nº 9 UNIVERSAL JACKING TRESTLE
W 4A/ 10819 UNDER TAIL.

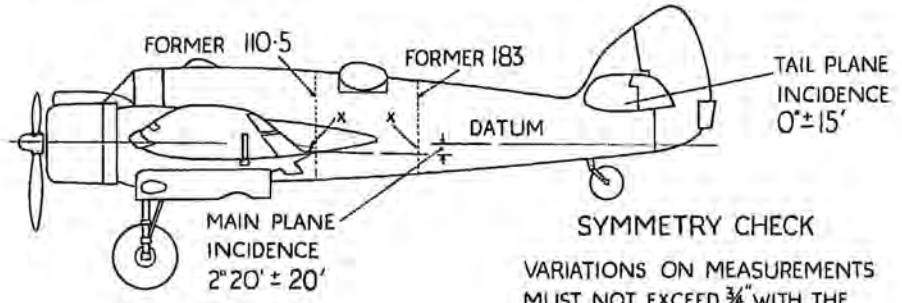
METHOD B

TWO	Nº 10	UNIVERSAL	JACKING TRESTLES	W4A/10820
TWO	Nº 11	"	" "	W4A/10822
AND				
ONE	Nº 9	"	" TRESTLE	W4A/10819

* JACKING PADS FOR RAISING UNDERCARRIAGE AND TAIL TO REMOVE WHEELS.

NOTE : RAISE EACH JACK AND TRESTLE A SMALL AMOUNT AT A TIME TO KEEP LOAD AS EVEN AS POSSIBLE.

1 JACKING AND MINIMUM TRESTLING 1

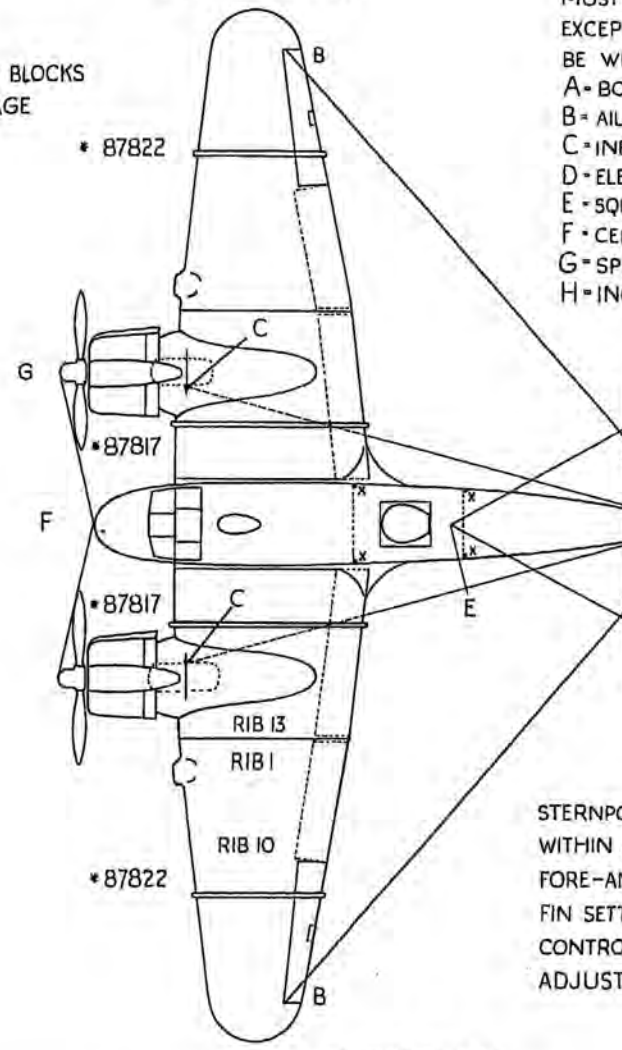


SYMMETRY CHECK

VARIATIONS ON MEASUREMENTS MUST NOT EXCEED ¾" WITH THE EXCEPTION OF F-G WHICH MUST BE WITHIN ½"

A = BOTTOM OF STERNPOST
B = AILERON OUTER HINGE
C = INBOARD END OF AXLE
D = ELEVATOR OUTER HINGE
E = SQUARING PEG, TOP OF FORMER 172
F = CENTRE OF NOSE
G = SPINNER TIP
H = INCIDENCE BOARDS

X = LEVELLING BLOCKS IN FUSELAGE



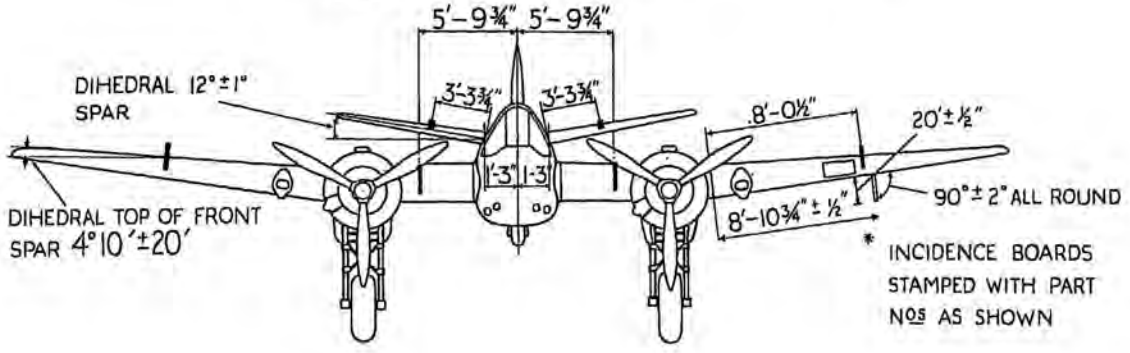
CHECK MEASUREMENT FROM ELEVATOR OUTER HINGE TO TIP OF FIN

STERNPOST TO BE VERTICAL WITHIN 5' LATERALLY AND 15' FORE-AND-AFT

FIN SETTING ZERO TO ℄ ± 15'

CONTROL RANGES, FIG. 3

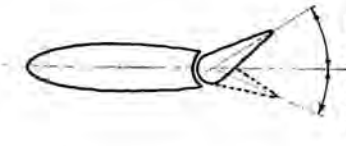
ADJUSTMENT POINTS FIG. 4

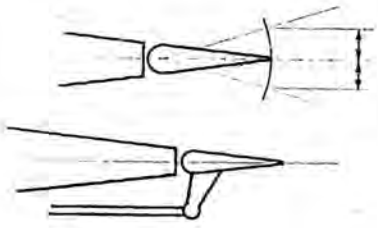


* INCIDENCE BOARDS STAMPED WITH PART NOS AS SHOWN

RIGGING DIAGRAM

ELEVATORS



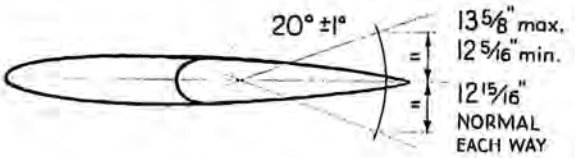


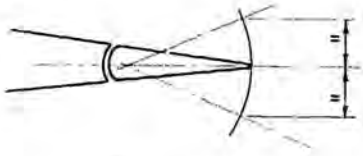
CONTROL COLUMN
2°45' FORWARD OF VERTICAL, ELEVATORS NEUTRAL.
MEASURE AT INBOARD RIB OF EACH ELEVATOR.

TRIMMING TAB
TAB IN LINE WITH ELEVATOR, INDICATOR CENTRAL.
MEASURE AT 90° TO TRAILING EDGE.

BALANCE TAB
IN LINE WITH ELEVATOR WHEN LATTER IS NEUTRAL.

RUDDER

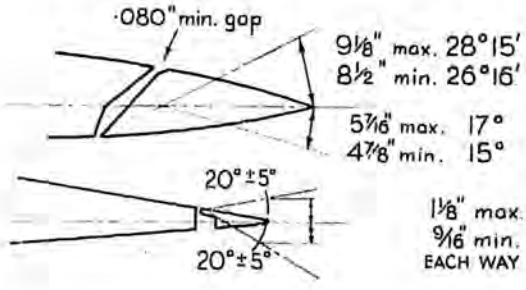




PEDALS CENTRAL, RUDDER NEUTRAL
MEASURE AT RIB 8.

TRIMMING TAB
TAB IN LINE WITH RUDDER, INDICATOR CENTRAL.
MEASURE AT 90° TO TIP OF RIB 10 OF RUDDER.

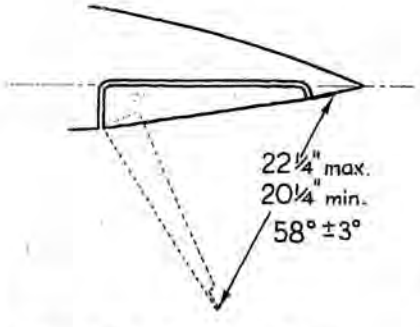
AILERONS



CONTROL COLUMN NEUTRAL, AILERONS TO SHOW ⅛" to 3/16" DROOP BELOW STREAMLINED POSITION AT TRAILING EDGE.

TRIMMING TAB (STARB'D.)
TAB IN LINE WITH AILERON, INDICATOR CENTRAL
(PORT TAB ADJUSTABLE ON GROUND)
MEASURED VERTICALLY AT INBOARD END.

FLAPS



DIMENSION TO BE TAKEN AT POINT OF CONTACT – FLAP TRAILING EDGES TO WING AND CENTRE PLANE WHEN IN CLOSED POSITION.

MEASURE AT CENTRE PLANE JOINT FOR INNER AND OUTER FLAP SECTIONS.
(RIB 1 OUTER PLANE, RIB 13 CENTRE PLANE)
IN THE 30° POSITION, MEASUREMENT IS 10 15/16" ± ¼" AT TRAILING EDGES.

CONTROL ADJUSTMENT POINTS ARE SHOWN IN FIG. 4

ADJUSTING SEQUENCE FOR THE CONTROL SURFACES IS GIVEN IN PARAGRAPHS 7 TO 13.

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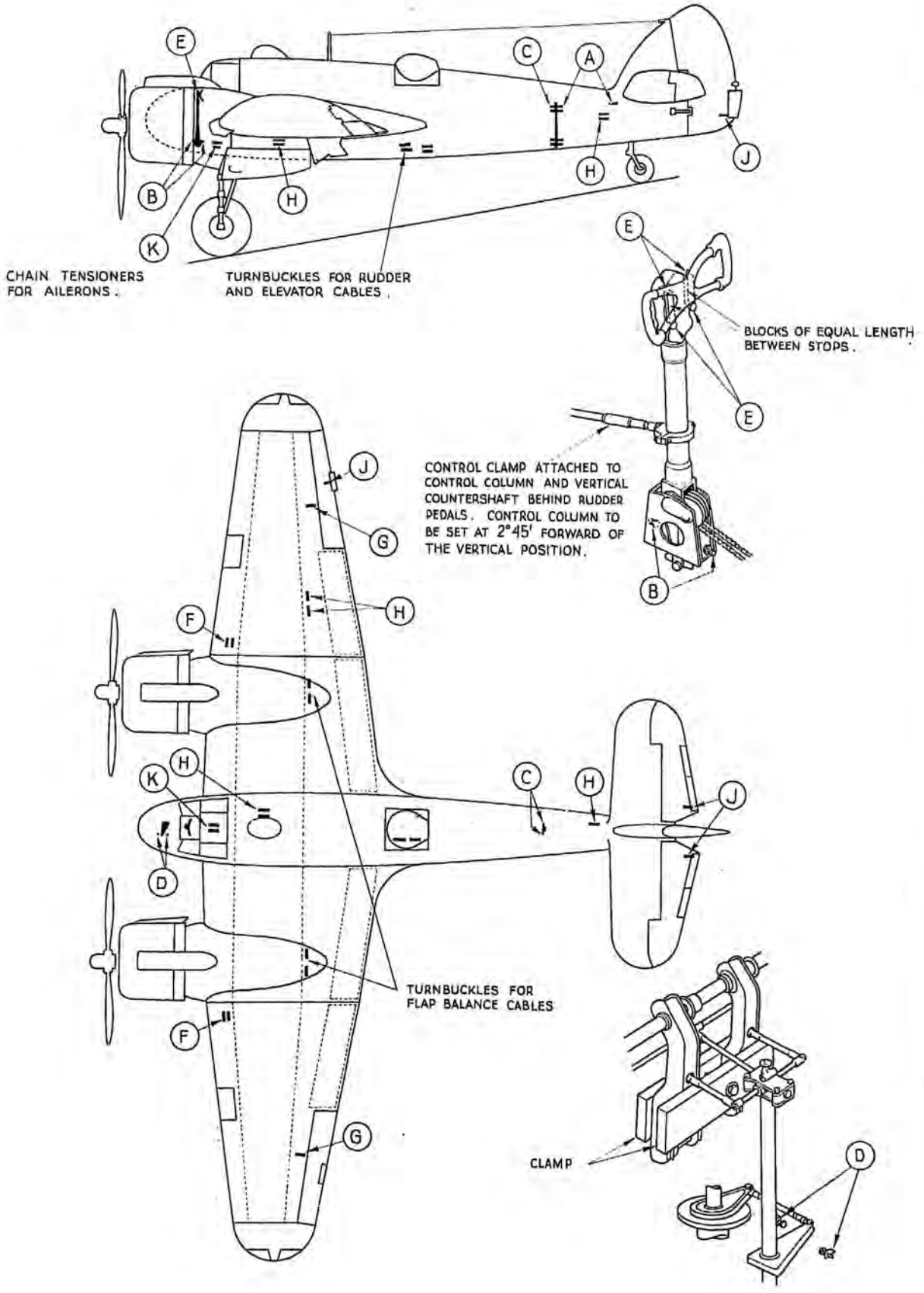
3 CONTROL SURFACE RANGES 3



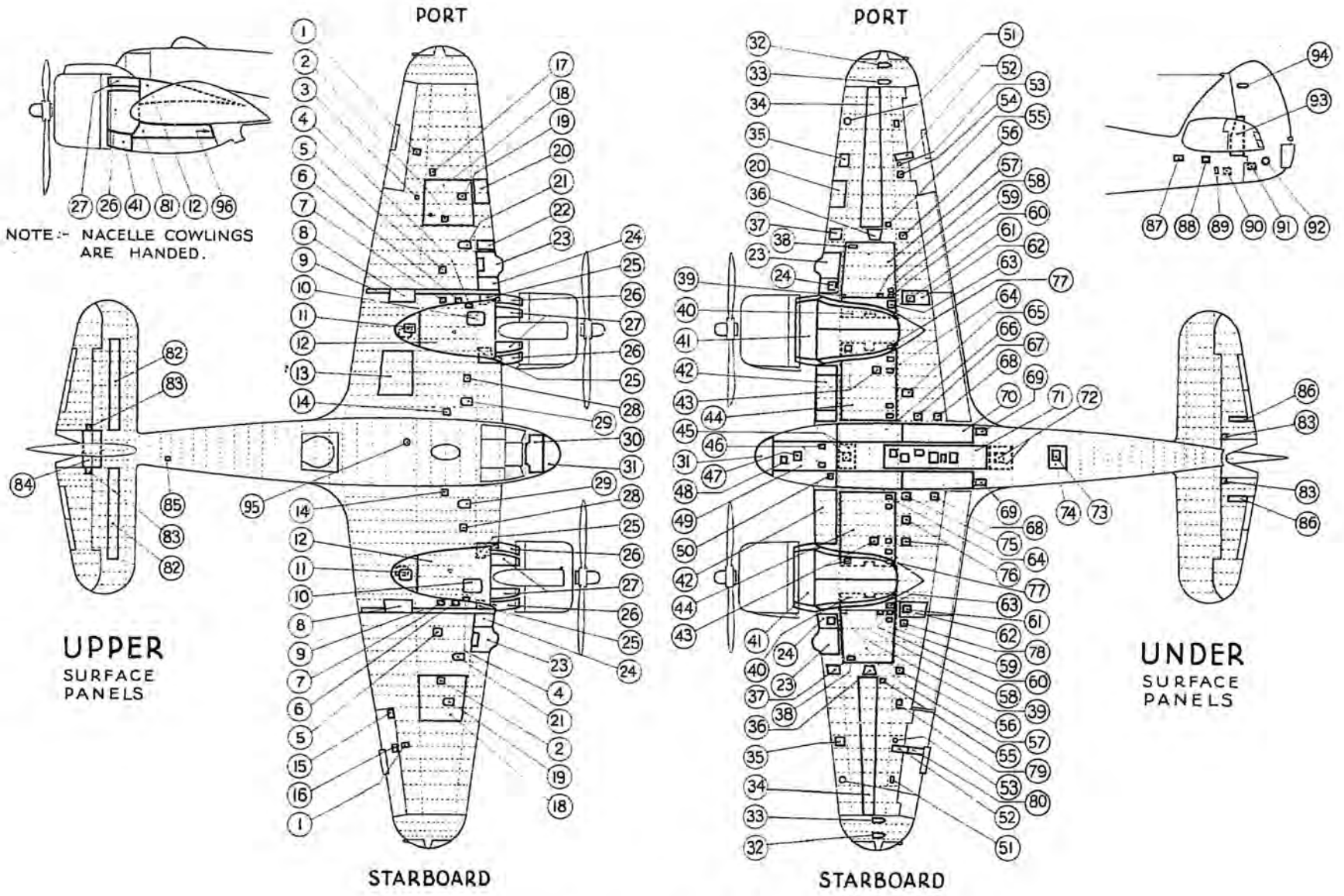
4 CONTROL ADJUSTING POINTS 4

NOTES.

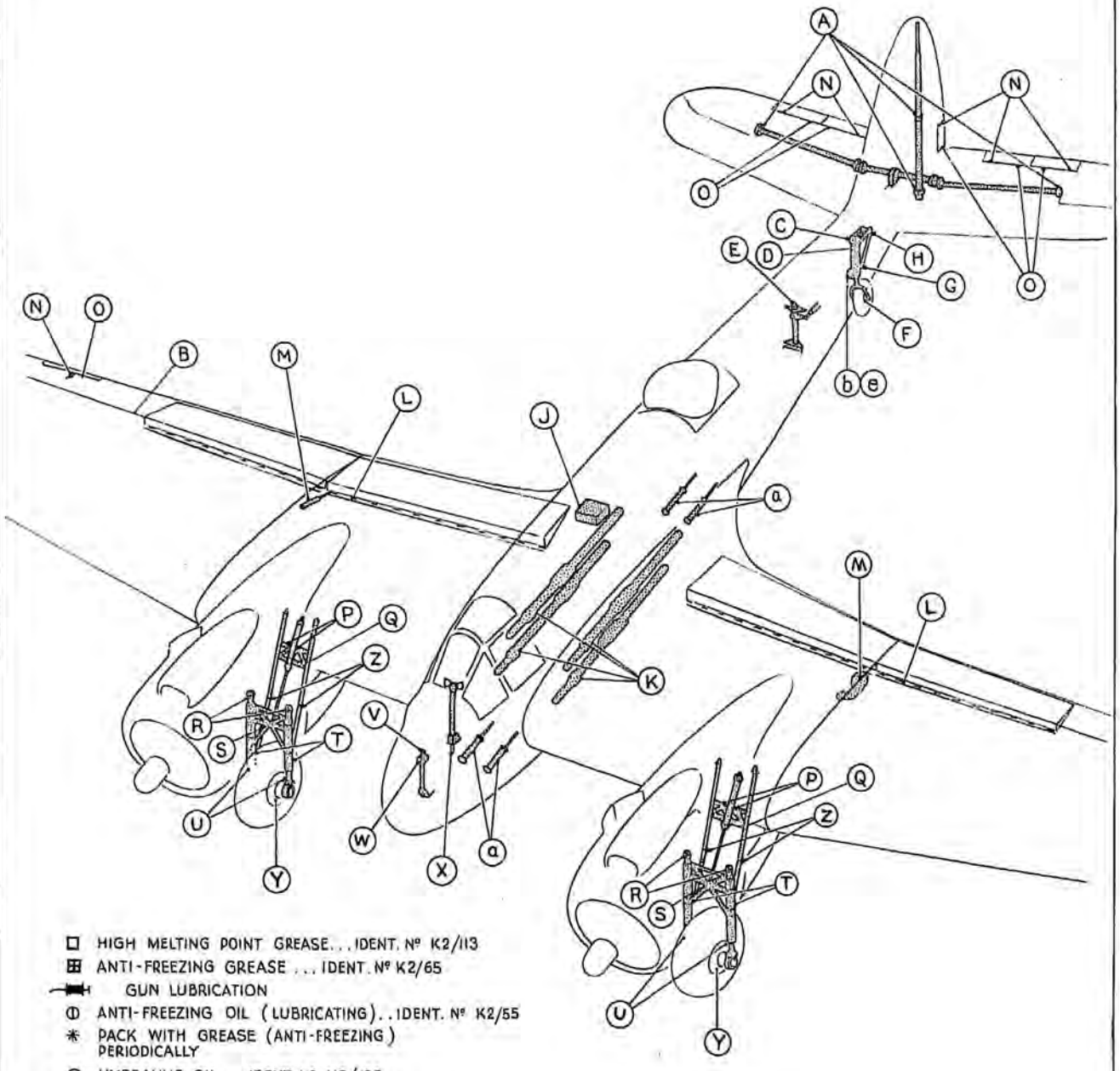
SERVICING PANELS.

Key to Fig. 5.

1. Aileron Actuating Mechanism.
2. Fuel Gauge (No. 3 Tank).
3. 82323 (Assembly Purpose).
4. Filler Neck.
5. Fuel Gauge (No. 2 Tank).
6. Fuel Vent Joint.
7. No. 1 Tank Fuel Contents Gauge.
8. Flap Mechanism.
9. C/P Wing Joint Strips.
10. Oil Tank Filler.
11. Flap Compensation Control.
12. Top Nacelle Fairing Panel.
13. Dinghy.
14. Fuel Gauge (Main Inner Tank).
15. Aileron (Pulleys and Cables).
16. Lubricator Trim Actuator.
17. Pressure Head Connection and Terminal Block.
18. Wing Guns or Outer Tank No. 3.
19. Filler Cap (No. 3 Tank).
20. Landing Lamps.
21. Filler Cap (No. 2 Tank).
22. Camera.
23. Oil Cooler.
24. J.B. 10B and Clip on Oil Pipe.
25. Detachable Nosing Eng. Controls.
26. Side Nose Cowling Panel.
27. Top Nose Cowling Panel.
28. Vent Pipe.
29. Fuel Tank Filler (Inner Tank).
30. Armour Plating.
31. Nose Cap.
32. Navigation and Resin Lt. Screens.
33. Nav. and Res. Light Terminal Blocks.
34. General.
35. Aileron Controls.
36. Tank Connections and Non Return Valve.
37. Aileron Controls No. 1 Bomb Station Plug.
38. No. 3 Tank Connections.
39. Picketing Point.
40. Outer Tank No. 1.
41. Bottom Nose Cowling Panel.
42. Detachable Nosing General Installation.
43. Fuel Tank Connections.
44. Main Fuel Tank (Inner).
45. Front Hatch Mechanism.
46. Crutch Arms.
47. Immersion Switch.
48. Flying Controls.
49. Flying Controls.
50. External Supply Socket.
51. Swarf Removal.
52. Aileron Controls.
53. Aileron Sprocket Bolt Adjustment.
54. Swarf Removal.
55. No. 3 Tank Drain.
56. Aileron Cables.
57. Fuel Tank (Outer No. 2).
58. Fuel Tank Connections.
59. No. 2 Fuel Tank Drain Sump.
60. Fuel Jettison Connections.
61. Flap Jack.
62. Flap Mechanism.
63. Non Return Valve and Fuel Jettison Connections (No. 1 Tank).
64. Fuel Drain (4 on each Main Tank Door).
65. Aileron Flap Cables and Hydraulic Pipes.
66. Forward 20 mm. Gun Door.
67. Aileron Pulleys.
68. Swarf Removal.
69. Breech Block.
70. Aft 20 mm. Gun Door.
71. Flying Controls (inc. 6 Panels):
    From Front:—
    1. Depth Setting Spindle—Forward.
    2. Depth Setting Spindle—Rear.
    3. 20 mm. Gun Links.
    4, 5. 20 mm. Gun Firing Pneumatic Pipes and Rudder, Elevator Flying Controls.
    6. 20 mm. Gun Firing Pipes and Rear Ammunition Chutes.
72. Rear Hatch Mechanism.
73. Flying Controls.
74. Electrical.
75. Aileron Pulleys.
76. Aileron Flap Cables and Hydraulic Pipes.
77. Fuel Jettison Chute Attachment.
78. Aileron Pulleys.
79. Aileron Controls.
80. Aileron Trim Tab Control.
81. Side Nacelle Fairing Panel.
82. General.
83. Elevator Universal Joint.
84. Elevator Control Bearings.
85. Stern Post R. & E. Pulleys and Guides.
86. Tab Lever.
87. Adjust Torque Rods for Elevator Zero Setting.
88. Adjustment M.R.C. Cable Rudder Trim.
89. Picketing Points, Port and Starboard.
90. Rudder Trim M.R.C. Wrap Box. Operating Arms U/C Switches.
91. Rudder Trim M.R.C. Unit-Stbd.
92. Trim Tab Controls.
93. Fin Adjustment and Terminal Blocks Rudder Nav. Light.
94. Mass Balance Weight.
95. Hydraulic Oil Filler.
96. Fuel Jettison Chute Connection.



SERVICING PANELS

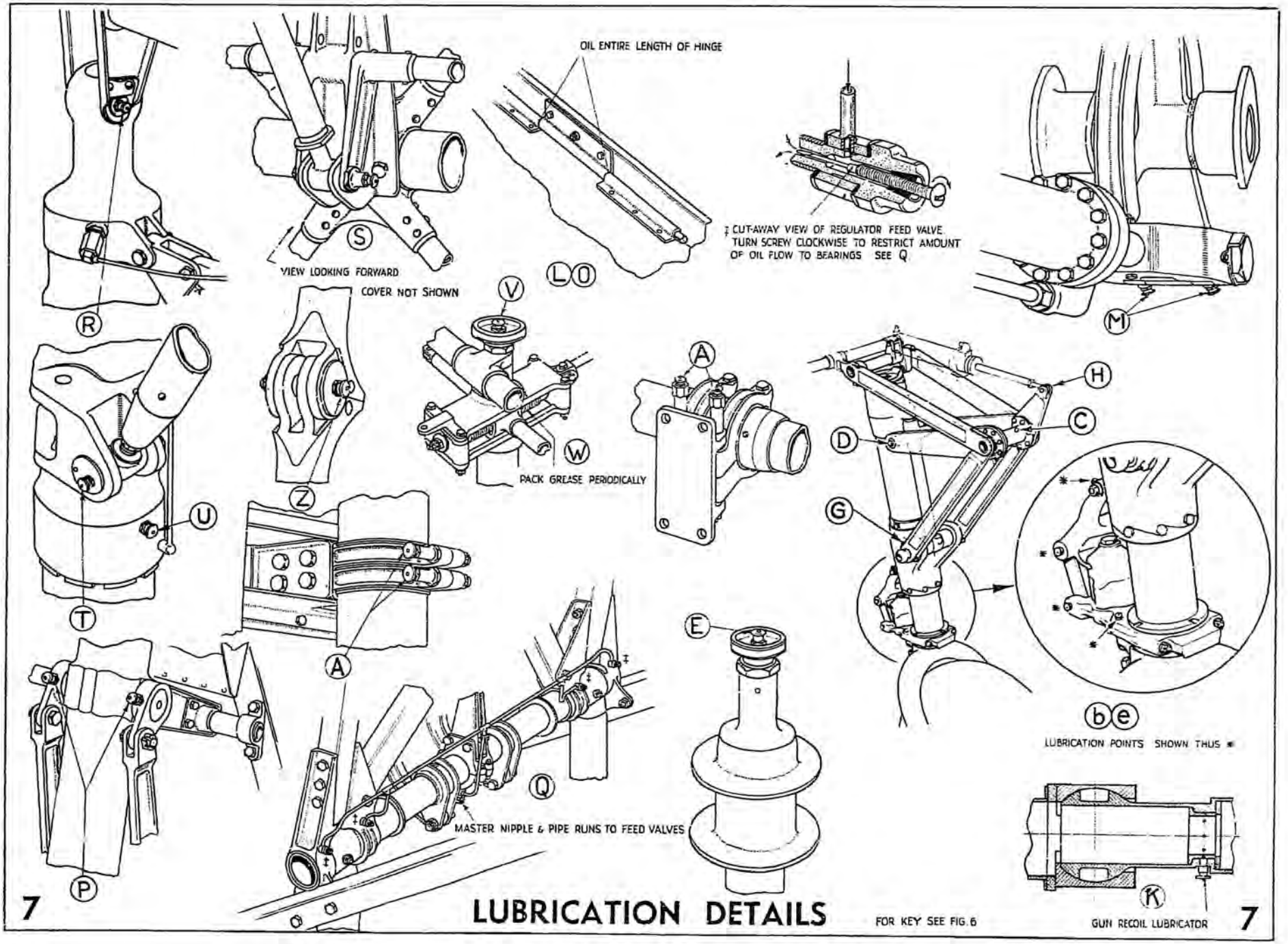


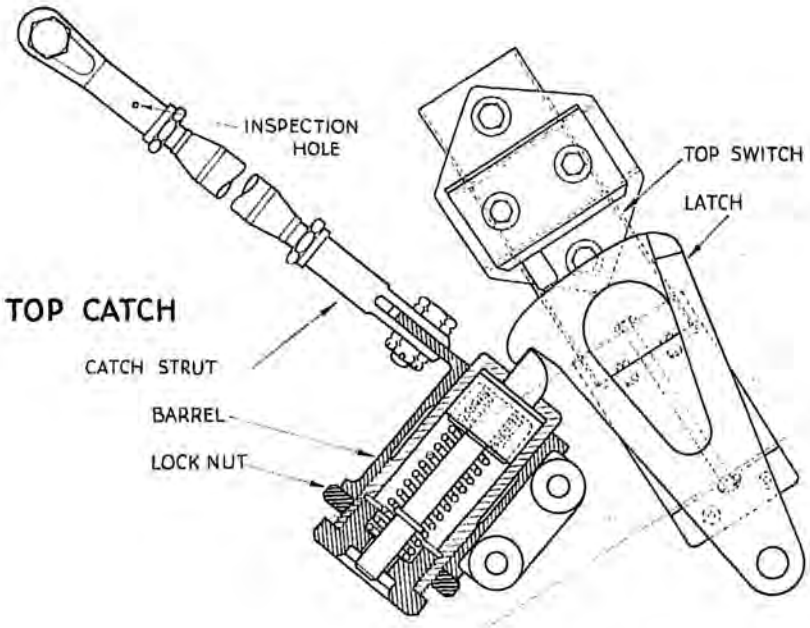
- HIGH MELTING POINT GREASE . . . IDENT. Nº K2/113
- ANTI-FREEZING GREASE . . . IDENT. Nº K2/65
- GUN LUBRICATION
- ANTI-FREEZING OIL (LUBRICATING) . . IDENT. Nº K2/55
- * PACK WITH GREASE (ANTI-FREEZING) PERIODICALLY
- HYDRAULIC OIL . . IDENT. Nº K2/138
- K.2/66 (ALTERNATIVE TO K2/113)

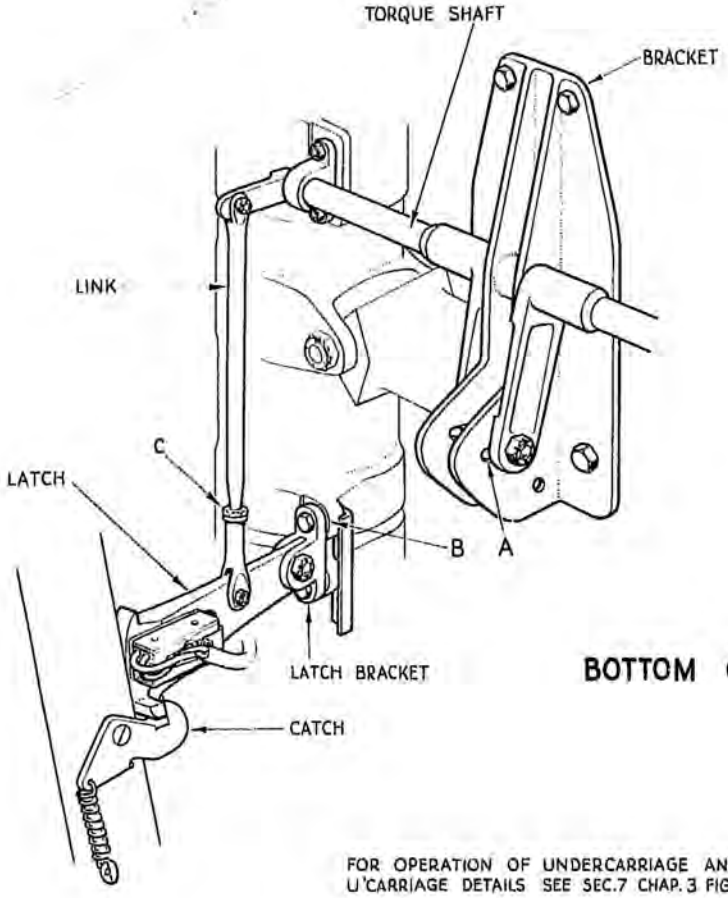
⊕	A	ELEVATOR & RUDDER HINGE BEARINGS [8 POINTS]	
⊞	B	AILERON HINGE BEARINGS [6] *	
⊕	C	RADIUS ARM CROSS MEMBER	
⊕	D	RETRACTING ARM FULCRUM [2 POINTS]	
⊕	E	RUDDER ELEVATOR TORQUE TUBE	
□	F	TAIL WHEEL - HUB BEARING *	
⊕	G	TAIL WHEEL PIVOT BEARING [2 POINTS]	
⊕	H	TAIL WHEEL OPERATING LEVER	
○	J	HYDRAULIC SYSTEM	
⊕	K	GUN RECOIL LUBRICATOR [4 POINTS]	
⊕	L	FLAP HINGES [4]	
⊕	M	FLAP JACK ATTACHMENTS [4 POINTS]	
⊕	N	TAB ACTUATORS	ELEVATOR RUDDER
⊕	O	TAB HINGES	STBD AILERON

⊕	P	U/C JACK TRUNNION ARM BEARING [4 POINTS]	
⊕	Q	U/C JACK TORQUE SHAFT [2 POINTS]	
⊕	R	U/C SHOCK ABSORBER LEG FULCRUM [4 POINTS]	
⊕	S	U/C JACK CONNECTING ROD [2 POINTS]	
⊕	T	RADIUS ARM BOTTOM ATTACHMENT [4 POINTS]	
⊕	U	SHOCK ABSORBER LEGS [4 POINTS]	
⊕	V	RUDDER BAR TORQUE TUBE	
⊞	W	RUDDER BAR ADJUSTING BOX *	
⊕	X	CONTROL COLUMN LEVER	
□	Y	U/C WHEEL - HUB BEARING [2 POINTS] *	
⊕	Z	U/C RADIUS ARM HINGE JOINT [4 POINTS]	
○	a	HATCH DASHPOTS [REMOVE FOR TOPPING UP]	
○	b	TAIL WHEEL DASHPOT	
⊕	e	TAIL WHEEL DASHPOT LINK ASSY [7 POINTS]	

LUBRICATION POINTS

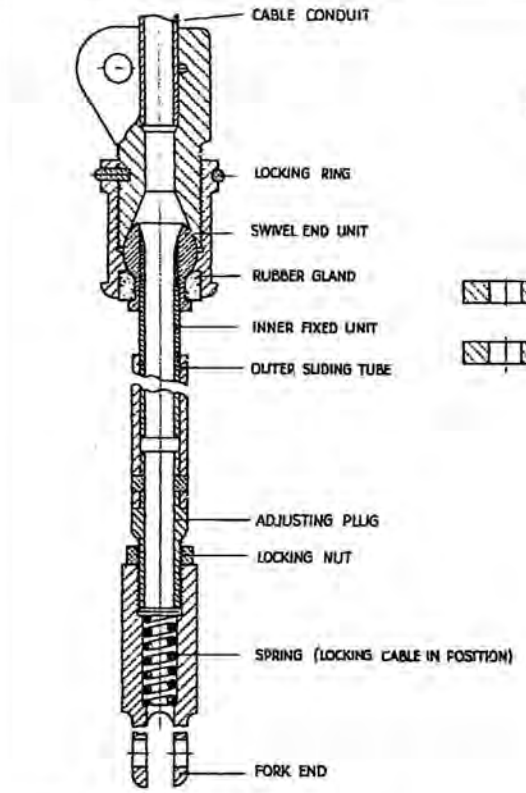

OIL ENTIRE LENGTH OF HINGE
‡ CUT-AWAY VIEW OF REGULATOR FEED VALVE. TURN SCREW CLOCKWISE TO RESTRICT AMOUNT OF OIL FLOW TO BEARINGS SEE Q
VIEW LOOKING FORWARD
COVER NOT SHOWN
PACK GREASE PERIODICALLY
MASTER NIPPLE & PIPE RUNS TO FEED VALVES
LUBRICATION POINTS SHOWN THUS *
GUN RECOIL LUBRICATOR
7
7
LUBRICATION DETAILS
FOR KEY SEE FIG. 6





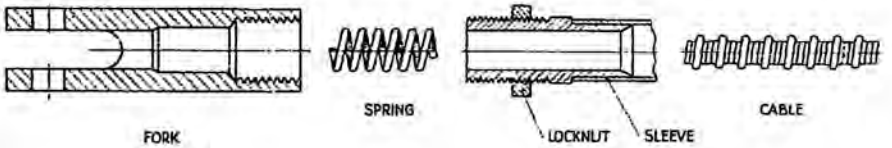
BOTTOM CATCH

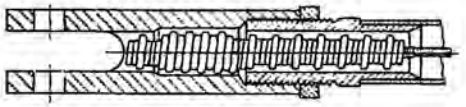
FOR OPERATION OF UNDERCARRIAGE AND U'CARRIAGE DETAILS SEE SEC.7 CHAP.3 FIG.2



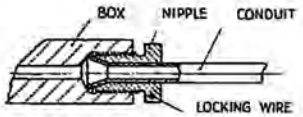
(D) SECTION THROUGH CONTROL END

(A) VIEW SHOWING CONSTRUCTION OF CABLE

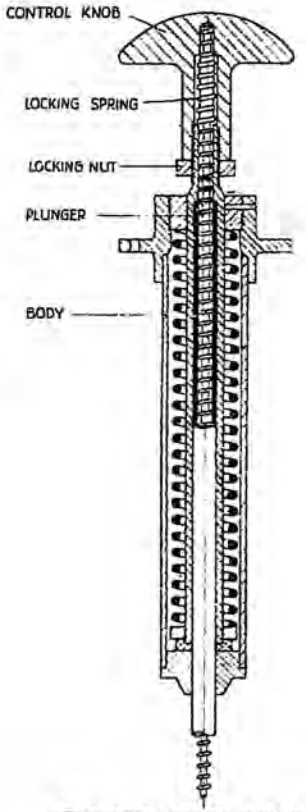




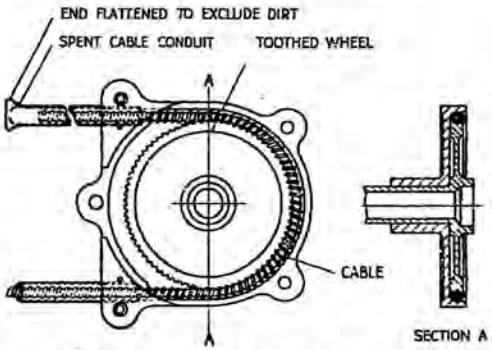
(B) ASSEMBLY



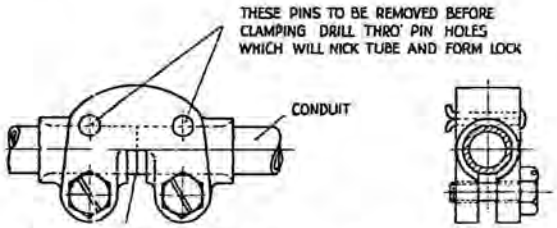
(C) CONDUIT CONNECTOR, (NIPPLE TYPE)



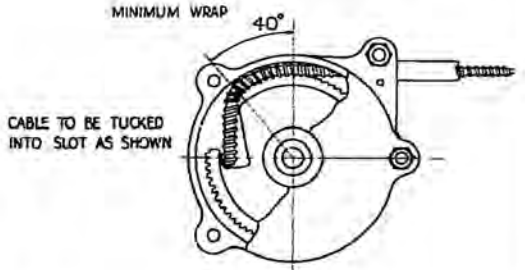
(G) SPRING LOADED PUSH-PULL UNIT (FOR CARBURETTOR CUT-OUT ONLY)



(E) VIEW OF TYPICAL BOX UNIT (COVER REMOVED)

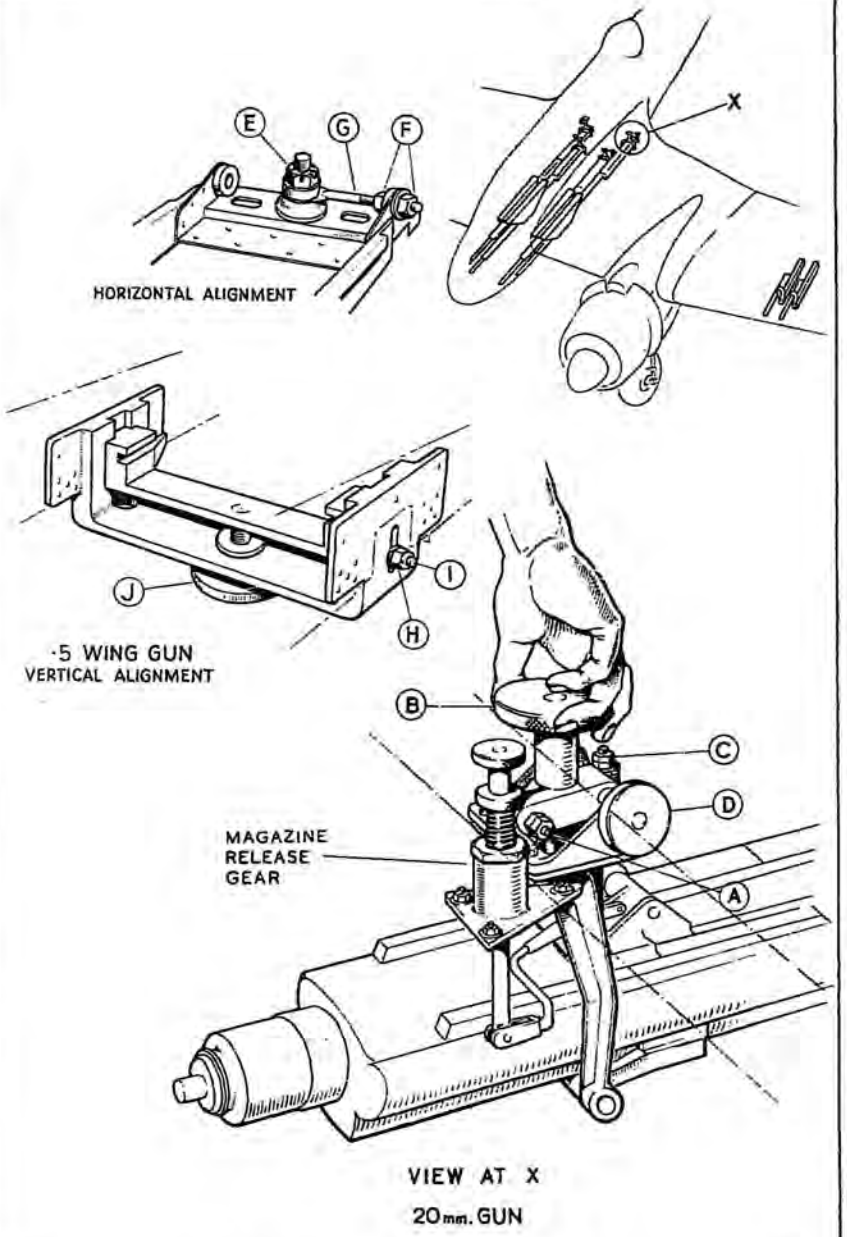


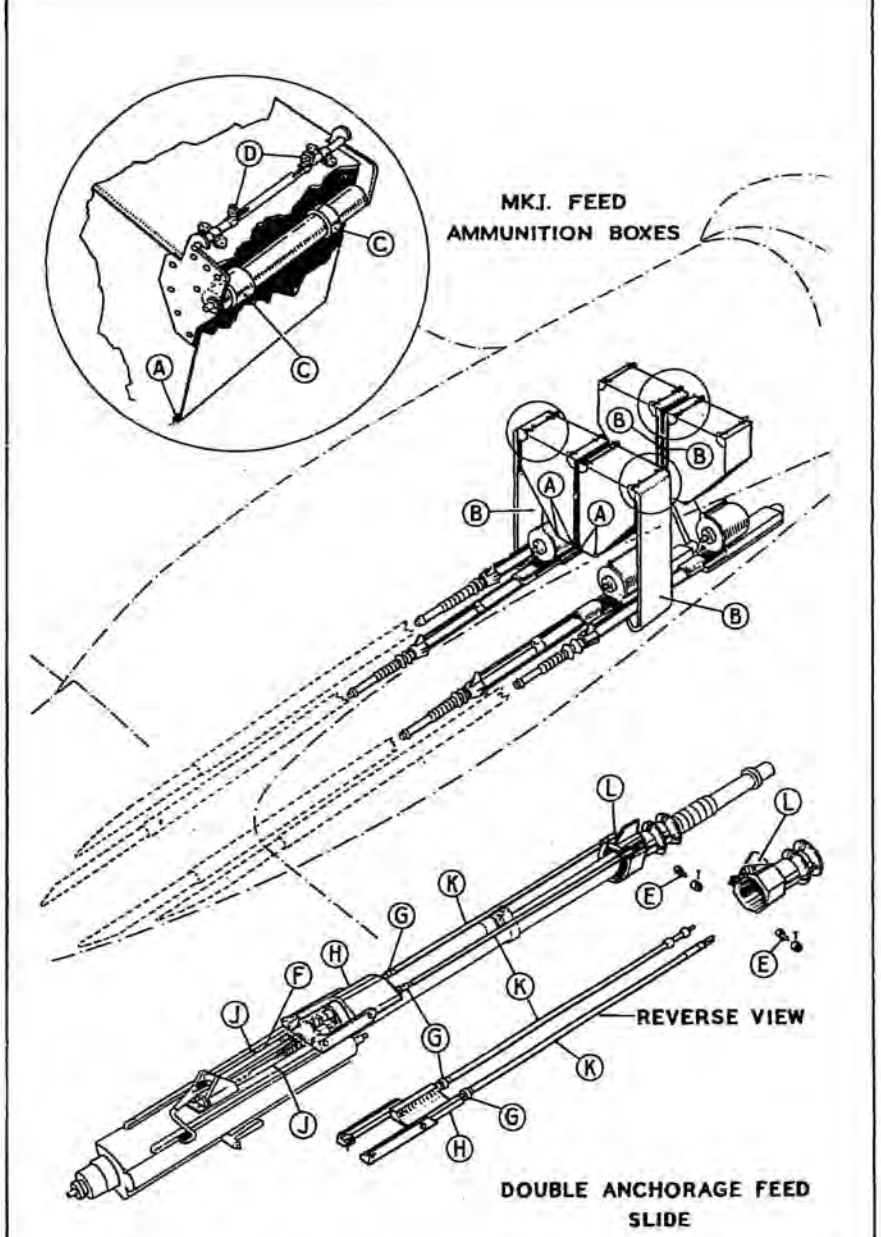
(F) CONDUIT CLAMP CONNECTOR

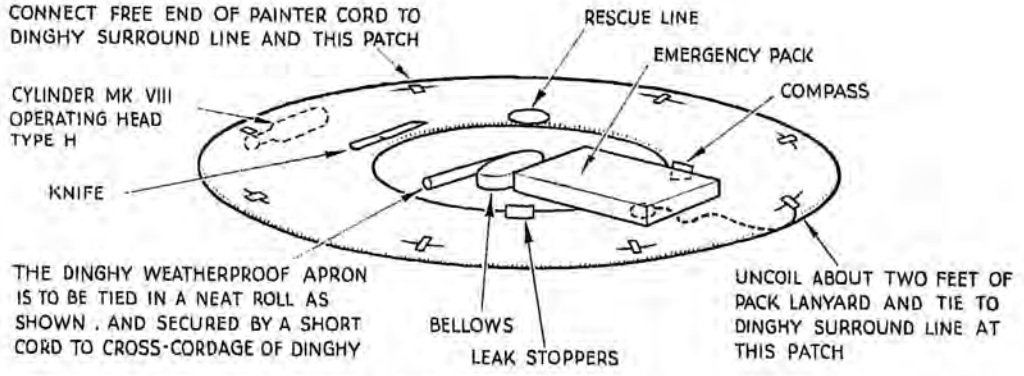


(H) CONTROL BOX

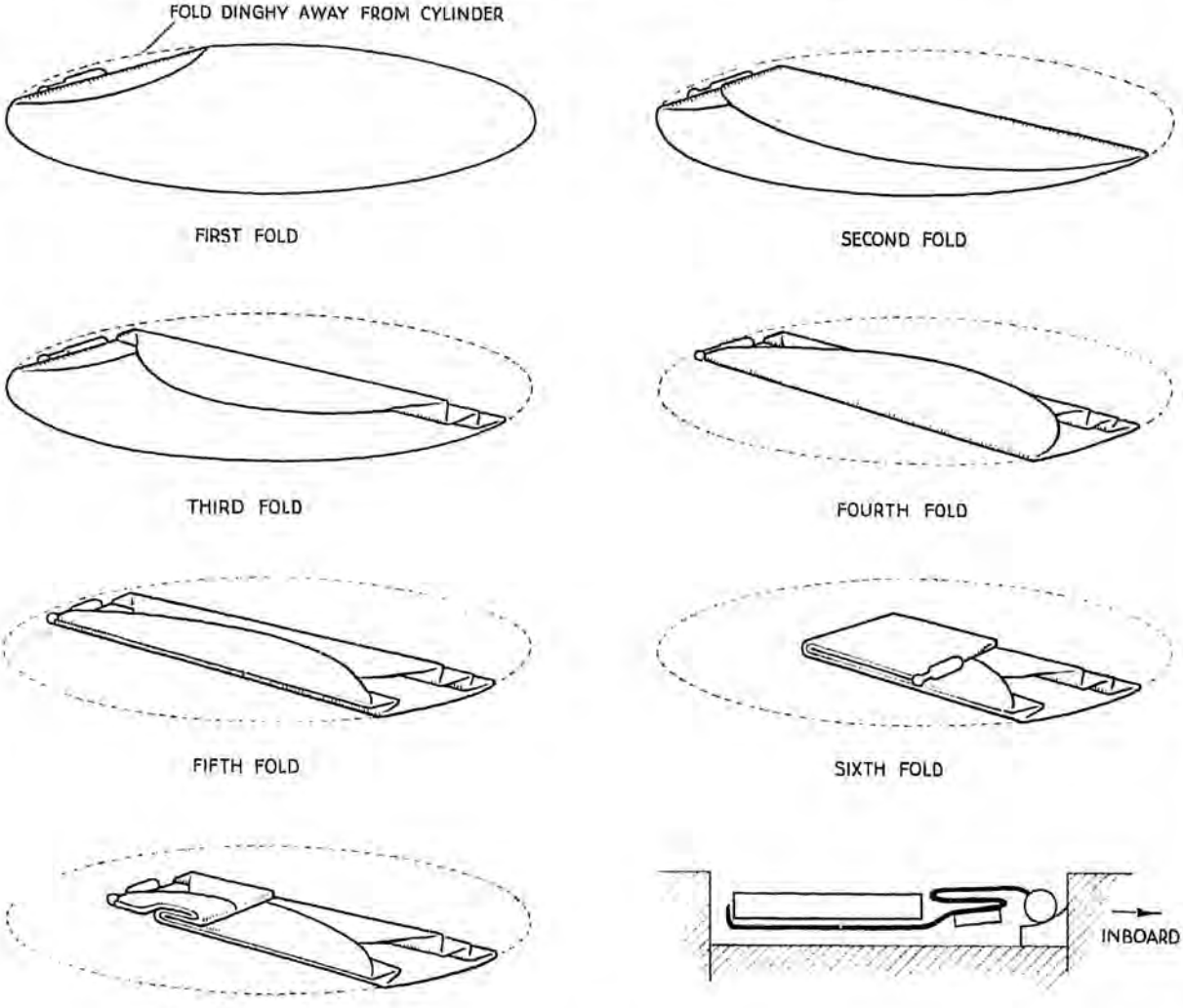
9 **M.R. (TELEFLEX) CONTROL DETAILS** 9


E
G
F
HORIZONTAL ALIGNMENT
X
J
I
H
·5 WING GUN
VERTICAL ALIGNMENT
B
C
D
MAGAZINE
RELEASE
GEAR
A
VIEW AT X
20mm. GUN


D
C
A
C
MK.I. FEED
AMMUNITION BOXES
B
A
B
A
B
B
L
L
E
E
K
G
H
F
J
K
G
REVERSE VIEW
K
J
G
H
DOUBLE ANCHORAGE FEED
SLIDE



THOROUGHLY DEFLATE DINGHY WITH PUMP BEFORE FOLDING
STOWAGE COVER MUST SEAT WITHOUT NECESSITY FOR MORE THAN LIGHT HAND PRESSURE



FOLDING DIAGRAM - DINGHY Type "L"

HYDRAULIC SYSTEM TROUBLETRACING CHART.

SYMPTOMS	POSSIBLE CAUSES	METHOD OF DETECTION	REMEDY
(1) Failure to build up pressure.	(a) Oil level in reservoir low. N.B. Oil level must be above stack pipe.	Examine oil level.	Replenish oil to correct level.
	(b) Faulty engine driven pump.	Operate system by hand pump, checking to see that pressure can be built up in this manner. In the case of Beaufighter having two engine driven pumps, start and run each engine in turn and operate flaps.	Renew engine driven pump. N.B. No attempt must be made to dismantle pump. Any attempt to do so will result in damage to pump unless the special tools necessary are available.
	(c) Leaking pipe line.	Examine all unions and connections for leakage.	Tighten unions: if necessary renew faulty pipe.
	(d) Main relief valve failing to seat	Eliminate a, b & c. Remove component from aircraft.	Dismantle valve. Thoroughly clean and test on test stand: if necessary renew component.
(2) Failure to hold pressure.	Oil escaping past rotary valve, in Master Selector Control.	Eliminate a, b, c and e. Flaps have a tendency to lower when in neutral position.	Adjust rotary valves or renew, if necessary, Master Selector Control.
(3) Erratic movement of jacks.	Air in system.		Expel the air by operating the units with the engine driven pumps, the hand pump, or portable pumps. The inside of the fluid reservoir should be watched. When bubbles cease to come to the surface and all jacks work smoothly, the system will be free from air.
(4) Pressure constant but low.	By-pass valve on port undercarriage failing to seat.	Support aircraft on trestles with oleo legs fully extended. Disconnect pressure pipe to by-pass valve, and blank off. Test system with test rig.	Dismantle and clean by-pass valve, test and if necessary renew component.

Fig. 13.

(a)

HYDROMATIC PROPELLER TROUBLE TRACING CHART.

TROUBLE.	PROBABLE CAUSE.	REMEDY.
1. Inability to attain take-off r.p.m. on the chocks.	1. Wrong setting of governor and incorrect rigging of control system.	Reset governor and re-rig system.
	2. Improper adjustment of high r.p.m. stop in dome assembly.	Reset stop.
	3. Low engine power.	See engine manual.
	4. Erroneous reading tachometers manifold pressure gauge.	Calibrate instruments.
2. Overspeeding on take-off.	1. Wrong setting on governor and/or incorrect relationship between governor and cockpit lever.	Rerig and reset.
	2. Insufficient exercise of propeller mechanism prior to take-off.	More control through constant speed range with engine running.
	3. Back-lash in cockpit control.	Rerig control system.
	4. Too rapid throttle opening.	
	5. Poor or incorrect gaskets between distributor valve and propeller shaft; and between governor base and engine mounting pad.	Install new gaskets.
	6. Sticky governor pilot on relief valve.	Disassemble and clean.
	7. High engine transfer ring leakage.	Replace rings according to engine manufacturer's specification.
	8. Erroneous reading tachometers, manifold pressure gauge.	Calibrate instruments.
3. Poor synchronization.	1. Ignition trouble.	Check with ignition tester or megger.
	2. Poor carburettion.	Consult engine carburettor manual.
	3. Back-lash in governor control system.	Rerig control system.
	4. Sluggish pilot valve.	Disassemble and clean.
	5. Sluggish governor relief valve.	Disassemble and clean.
	6. Sticky piston action in propeller dome assembly.	Remove dome shell, clean and lubricate piston gasket. If piston contact area of dome is scored, polish with wet and dry 300 emery.
	7. Loose piston gasket.	Tighten piston gasket nut.
	8. Variation in engine transfer ring leakage.	Replace rings.

(b)

HYDROMATIC PROPELLER TROUBLE TRACING CHART—(*continued.*)

TROUBLE.	PROBABLE CAUSE.	REMEDY.
4. Leakage.	1. At crankshaft breather :—	
	(*a*) Incomplete engine scavenging or excessive blow-by.	Consult engine manual.
	(*b*) Loose distributor valve.	Tighten distributor valve.
	(*c*) Leaky gaskets.	Replace gaskets.
	2. Dome breather hole :—	
	(*a*) Damaged seal.	Replace seal.
	(*b*) Loose nut.	Tighten nut.
	(*c*) Washer missing.	Install washer.
	3. Interference between pipe in propeller shaft and distributor valve oil transfer plate fillet.	Rework fillet.
	4. Dome retaining nut :—	
	(*a*) Damaged seal.	Replace Seal.
	(*b*) Loose nut.	Tighten nut.
	5. Blades :—	
	(*a*) Damaged packing or moulded chafing ring.	Replace packing and moulded chafing ring by split type chafing ring.
	6. Barrel half seals :—	
	(*a*) Damaged Seals.	Replace seals.
	(*b*) Improper closure of barrel halves.	Remove burrs from parting surfaces of barrel halves.
	7. Barrel spider packing :—	
	(*a*) Damaged packing.	Replace packing.
	8. Rear cone :—	
	(*a*) Damaged spider shaft oil seal.	Replace seal.
	(*b*) Spider shaft oil seal washer improperly installed.	Install in proper sequence :— washer seal, ring.
	(*c*) Spider shaft oil seal washer missing.	Install washer.
	9. General —	
	(*a*) Engine thrust plate.	Consult engine manual.

(c)

HYDROMATIC PROPELLER TROUBLE TRACING CHART—(*continued.*)

TROUBLE.	PROBABLE CAUSE.	REMEDY.
5. Roughness.	1. Spark plugs or ignition.	Replace spark plugs—check wiring.
	2. Propeller unbalance.	Check balance. (Effects will be greater at high r.p.m.)
	3. Blade angles vary.	Correct angles. (Effects will be greater at high r.p.m.)
	4. Blades out of track.	Correct track. (Effects will be greater at high r.p.m.)
	5. Ice on propeller.	Increase r.p.m. for a short period.
	6. Engine part failure.	Feather propeller.
	7. Unknown cause.	Feather propeller.
6. Failure to feather.	1. Batteries low.	Recharge batteries.
	2. Faulty electrical system.	Check power and control circuits of feathering pump.
	3. Failure of push button to remain engaged.	Check wiring on low pressure setting of cut-out switch.
	4. Failure to remain feathered :—	
	(*a*) Push button fails to disengage.	Reset cutout switch.
	5. Incorrect high pitch stop ring setting.	Reset stop ring.
	6. Sheared coupling in feathering pump.	Replace coupling.
	7. Restricted oil supply for feathering pump.	Check feathering pump lines for foreign matter and bleeding.
	8. Excessive leakage :—	
	(*a*) Improper distributor valve installation.	Check for tightness or interference.
	(*b*) Poor or incorrect gaskets between distributor valve and propeller shaft and between governor base and engine mounting pad.	Install new gaskets.
	(*c*) Engine transfer rings.	Replace rings according to engine manufacturer's specification.
	9. Defective feathering pump.	Replace pump.

(d)

HYDROMATIC PROPELLER TROUBLE TRACING CHART—(*continued.*)

TROUBLE.	PROBABLE CAUSE.	REMEDY.
7. Failure to unfeather.	1. Batteries low.	Recharge batteries.
	2. Faulty electrical systems.	Check power and control circuits of feathering pump.
	3. Excessive leakage :—	
	(*a*) Engine transfer rings.	Replace rings according to engine manufacturer's specifications.
	(*b*) Improper distributor valve installation.	Check for tightness or interference.
	(*c*) Poor or incorrect gaskets between distributor valve and propeller shafts and between governor base and engine mounting pad.	Install new gaskets.
	4. Sheared coupling in feathering pump.	Replace coupling.
	5. Restricted oil supply to feathering pump.	Check feathering pump inlet lines for foreign matter and bleed line.
	6. Defective feathering pump.	Replace pump.

SECTION 4 — CHAPTER 3.

Ground Running of Hercules Mk. XVIII Engines

CONTENTS.

Ground Running of Hercules Mk. XVIII Engines

GENERAL.

1. The following paragraphs cover the recommended procedure for starting and ground running of engines subsequent to their installation in the aircraft.

PRELIMINARY PRECAUTIONS.

2. (i) It is important that chocks be placed immediately in front of the wheels prior to all ground tests, and that the chock ropes be run from inside around the front of the chock.
Brakes to be "ON" and the pressure in the air bottle to be at least 200 lbs. per sq. in.

(ii) Fire fighting equipment to be placed on both port and starboard sides of the aircraft at approximately 10 ft. from each engine.

(iii) The tail of the aircraft should be directed away from the open hangar doors to prevent dust and sand from being carried by the slipstream into the hangar.

(iv) The aircraft should be placed head to wind to utilize the maximum cooling effect of the air circulation around the cylinder heads.

(v) Check undercarriage operating lever to see that it is in "SAFE" and in the "DOWN" position.

(vi) Check that the flap control lever is in the "UP" position.

(vii) Check that the tuning jet is locked in the "WEAK" position.

NOTE:—*Should the tuning jet be inadvertently left in the open setting, a serious loss of range will occur and the aircraft might even be lost if it was undertaking a long flight. Furthermore, excessive richness would result at throttle settings above "Cruising Boost."*

PREPARATORY PROCEDURE.

Fuel Tanks:

3. (i) Fill the tanks with 100 Octane fuel.

(ii) Check that all supply and priming cocks are correctly positioned.

Oil Tanks:

4. Fill each tank with at least ten gallons of clean engine oil—DTD 472B.

(i) Prime the oil pipes by removing the main oil feed connection from the engine rear cover and allowing oil to flow from the pipe by gravity before reconnecting it; or alternatively by removing the blanking plug from the oil feed pipe and allowing oil to flow by gravity. Refit and wire lock the plug after priming.

Starting Precautions:

5. Sleeve and junk head seizure; precautions to be observed prior to initial run:

(i) Remove the cylinder head relief valves of all cylinders and inject approximately $\frac{1}{8}$ pints of hot clean engine lubricating oil to Spec. D.T.D. 109 (100 seconds) by means of a syringe through each of the tapped orifices for the relief valves. Care must be taken not to damage the internal thread.

(ii) Turn the engine by hand through one complete revolution to ensure that the sleeves have completed one half stroke.

(iii) Repeat the oil injection (sub-para. ii).

(iv) Turn the engine by hand through at least six revolutions to ensure that the oil has worked in between the junk head and sleeves and that surplus oil is ejected through the cylinder head relief valve.

(v) Replace the cylinder head relief valves and lock to the cylinder head by means of a locking wire.

Oil Priming:

6. When the engine has been newly installed or standing idle for five days or longer, prime in the following manner:—

(i) Lubricate the supercharger gears and bearings by injecting two gunsful of clean, warm (60°C.) engine oil through the nipple above the port magneto on the engine rear cover. Immediately after turn the engine by hand through three or four revolutions to distribute the oil.

NOTE:—*Before use, the oil gun should be washed in petrol, and the oil filtered, as the oil will subsequently be circulated through the engine.*

(ii) Remove the sump filter and leave it out during priming to prevent engine flooding. Connect the priming pump hose in place of the nut securing the oil pressure gauge banjo connection and pump at least 1½ gallons of clean engine oil at 60°C. into the engine at a pressure of approximately 70 lbs. per sq. in. The oil pressure gauge in the cockpit should be carefully watched during priming, as it is imperative that the pressure be confined to between 30 and 90 lbs. per sq. in. To assist circulation, the engine should be turned by hand during the operation.

After priming, detach the oil priming pump and replace the nut securing the oil pressure banjo connection.

The above oil priming operations must be repeated if the engine is not run within four hours after inspection.

(iii) Ensure that the oil level in the carburettor linkage chamber is just below the layshaft bearing, topping up if necessary with oil to Specification DTD 472B.

(iv) With the aircraft in the tail down position ensure that the oil level in the accessory gear box is correct and top up if necessary with oil to Specification DTD 472B.

Controls:

7. Check the throttle, air intake shutter and supercharger controls to ensure freedom of operation. Check that the throttle positions in the cockpit correspond with the carburettor layshaft quadrant.

(i) Ensure that spark plugs and spark plug extensions are tested and that spark plug extensions are correctly fitted.

(ii) Connect trolley battery.

(iii) Switch on master switch to instruments. All engine instruments should read zero except oil temperature and boost pressure. Check cylinder head temperature with air temperature and if a big discrepancy is noticed investigate the cause.

(iv) Field switches to be "OFF".

(v) Drain carburettor boost and mixture control capsule chambers, by removing the drain plug at the bottom of the respective chambers. After draining, fit new tab washers and replace the plugs.

When the mixture control capsule chamber is drained it must be refilled with 75 ccs. of oil to Specification DTD 472B, by removing plug at the upper rear part of the chamber and injecting the oil through the opening. Fit new tab washers and replace the plug.

STARTING PROCEDURE.

Starting Preliminaries:

8. (i) Turn on fuel cocks and fuel balance cocks.

(ii) Prime carburettor by switching on the auxiliary fuel pumps for a maximum period of 5 seconds.

IMPORTANT NOTE:—*If the engine has been idle for less than one week, the carburettor will not require priming. For periods over one week the auxiliary pump should not be operated for more than 3 seconds, except in cases where the carburettor float chamber is known to be empty.*

Whenever the carburettor is being primed, it is essential that the volute casing drain should be watched carefully, if it emits even the slightest quantity of fuel, cease priming IMMEDIATELY then remove the spark plugs from Nos. 7, 8 and 9 cylinders and drain the surplus petrol into a suitable container. The cylinder, sleeves and pistons of cylinders Nos. 7. 8 and 9 must be oiled thoroughly.

Replace the spark plugs and ensure that spark plug extensions are correctly fitted.

(iii) With the ignition switches "OFF' turn the engine crankshaft by hand through three revolutions. Any undue resistance to movement indicates the presence of excess fluid in the bottom cylinders, which must be drained. Again rotate the crankshaft prior to starting and drain if resistance is noticed. Clearing the excess fluid from the cylinders is essential to prevent hydraulic locking, which may cause mechanical failure of pistons or connecting rods during the starting or running of the engine.

(iv) Set supercharger lever to 'M" ratio.

(v) Set the cockpit throttle lever to ½ in. to ¾ in. from the closed position.

NOTE:—*The throttle must never be pump handled, otherwise fuel will be injected into the induction system, involving risk of fire from backfiring or danger of hydraulic lock.*

In no circumstances may fuel be drawn from the supercharger volute drain, either by pump handling the throttle lever or incorrect operation of the carburettor priming or engine priming pumps.

(vi) Set the propeller control lever in fine pitch or maximum r.p.m. position.

(vii) Open cowl gills fully.

(viii) Set the air intake control to "COLD AIR".

(ix) Ensure that ground personnel are situated at least 10 feet from the engine and that no obstacles are liable to obstruct the propeller.

(x) The following signals must be adhered to during all starting and ground running operations:—
Thumb up—All clear.
Thumb down—Stop.
Waving of right hand—Not clear to start.

Starting:

9. Operate the engine priming pump plunger until the suction and delivery pipes and the pump itself are primed. This condition will be accompanied by a sudden increase in the resistance of the pump plunger. Inject 5 pumpfuls of fuel.

IMPORTANT NOTE:—*The volute casing drain should be watched carefully, if it emits even the slightest quantity of fuel, cease pumping IMMEDIATELY, then remove the spark plugs from Nos. 7, 8 and 9 cylinders, and drain the surplus petrol into a suitable container. The cylinders, sleeves and pistons of cylinders Nos. 7, 8 and 9 must be oiled thoroughly. Replace the spark plugs and ensure that spark plug extensions are correctly fitted.*

(i) Switch on the magnetos and press the starter and boost coil buttons. Continue to prime if the atmospheric temperature is low.

NOTE:—*To avoid overheating the starter, do not operate it for longer than 20 seconds at a time, allow at least 30 seconds to elapse after each turning period, and do not make more than four consecutive attempts to start.*

(ii) When the engine is running regularly, release the boost coil button. Screw the cylinder priming pump plunger firmly home to prevent quantities of raw fuel being drawn into the cylinders with consequent damage to the engine.

(iii) Should the engine fail to start after four attempts, switch off the ignition and starter and investigate the trouble.

WARMING UP.

Initial Run:

10. After starting, adjust the throttle to as low an engine speed as possible to avoid damage to the engine should the oil system be functioning incorrectly. The oil pressure should commence to rise immediately after starting. If the oil pressure gauge fails to register, stop the engine and check the oil system.

(i) Allow the engine to idle at 800 r.p.m. for 5 minutes, then open up in steps of 100 r.p.m. to 1,200 r.p.m. and run at this speed for 30 minutes to ensure thorough lubrication of the engine.

Adjust the throttle to hold the engine speed at 1,500 r.p.m. and switch the supercharger to "S" ratio. The oil pressure should drop slightly and return to normal within a few seconds, indication that the oil system controlling M and S gears is functioning correctly.

Change back to "M" ratio when similar oil pressure drop should occur. These ratio changes must be made quickly, as sluggish movement of the supercharger control lever causes dragging or slipping of the supercharger clutch plates.

A careful watch should be kept on cylinder head and oil temperatures. Cylinder head temperatures should not exceed 250°C. Should the spark plugs tend to oil up or soot, momentarily close the throttle and open up to Rated Boost for approximately 5 seconds, after which the plugs should be clear of any oil or soot, and the engine should run steadily.

Open up to 2,400 r.p.m. and check instruments, generators and voltage regulator.

(ii) Shut down engine in accordance with Para. 7—"Shutting Down".

(iii) After initial run, drain oil tanks and oil coolers, remove and examine engine filters and oil tank filters. Clean, examine and replace filters. Fill oil tanks with clean engine oil DTD.472B.

Subsequent Runs:

11. (i) Observe Para. 2, "Preliminary Precautions".

(ii) Field switches must be "ON".

(iii) Start as set out in Para. 4, "Starting Procedure".

(iv) Provided the oil pressure rises immediately, open up rapidly to 1,200-1,500 r.p.m. This helps to keep spark plugs clean. Run at this r.p.m. until the oil pressure has settled down, thereby indicating that the oil system is functioning normally. In very cold weather restrict the first minute's running to 800 r.p.m. in order to avoid damage to the oil cooler or pipe line joints due to high pressure.

(v) When the engine has warmed up, close the throttle for a moment, open up in one smooth decisive movement to RATED BOOST, and run at this boost for a few seconds to clear the sparking plugs. During the operation, see that 2,400 r.p.m. is not exceeded.

Precautions During Ground Running:

12. As the engine does not receive its normal cooling airstream until the aircraft is in flight, ground running should be kept to the minimum possible. Do not run the engines at Rated Boost (R.B.) for longer than necessary and at take-off Boost (T.O.B.) for longer than 3 seconds.

(i) The gills must be fully opened with the aircraft head to wind. Endeavour to restrict the cylinder temperatures to 230°C. and if this figure is con-

siderably exceeded the engine must be run at 800-900 r.p.m. until it has cooled down. In addition, always allow the engine to cool by running at this speed after any full throttle check and before shutting down or proceeding with any further checks. Maximum permissible cylinder temperature during ground running is 250°C.

(ii) When the supercharger is changed from "M" to "S" ratio it is imperative that the engine speed should not exceed 1,500 r.p.m.

(iii) To avoid overheating the engine, do not run with the supercharger in "S" ratio for longer than is absolutely necessary.

Ground Tests:

13. During the following tests, the precautions mentioned in Paragraph 12 should be strictly observed.

Supercharger Controls:

14. (i) Set the propeller control lever to permit maximum r.p.m.

(ii) Adjust the throttle to hold the engine speed at 1,400-1,500 r.p.m. and switch the supercharger to "S" ratio. The oil pressure should drop slightly and return to normal within a few seconds, indicating that the oil system controlling S and M gears is functioning correctly.

(iii) Change back to "M" ratio when a similar oil pressure drop should occur. These ratio changes must be made quickly, as sluggish movement of the supercharger control lever causes dragging or slipping of the supercharger clutch plates.

NOTE:—*Ground running must be kept at a minimum compatible with this check.*

Propeller Controls:

15. To ensure accurate engine speed readings when checking boost, etc., the following tests should be carried out prior to those in subsequent paragraphs.

(i) Set the propeller control lever to maximum r.p.m. position.

(ii) Advance the throttle lever until maximum economical cruising r.p.m. is attained.

(iii) Move the propeller control lever to give a drop of 500-600 r.p.m. and return it to its original position. The r.p.m. should remain constant during the first part of the lever movement, beginning to drop when the position corresponding to maximum economical cruising is reached.

(iv) Check that the original r.p.m. is restored when the control lever is returned, and repeat the test two or three times. The test must be discontinued for investigation if there are any signs of vibration.

NOTE:—*Ground running must be kept at a minimum compatible with this check.*

FEATHERING CHECKS.

De Havilland Hydromatic Airscrew:

16. (i) When the engine has been warmed up, throttle back to 1,100-1,200 r.p.m. and idle at this speed for about 20 seconds.

(ii) Press the feathering button, which will be automatically held in. The blades should feather in 10-15 seconds and the engine speed drop to approximately 600 r.p.m. The button will snap out when feathering is complete.

(iii) Allow the entire engine to run with the propeller feathered for 10 seconds to clear the sump of the oil discharged from the propeller.

(iv) Unfeather the propeller by holding the feathering button in until the engine speed ceases to rise at which time it may be expected to be approximately 800 r.p.m. Release the button, when the r.p.m. should return to approximately 1,000 r.p.m. If it fails to do so a short burst of throttle will restore the propeller to the fine pitch position.

During the operation detailed in Sub-para. (iii), the propeller may partially unfeather itself due to the action of the engine oil pressure, and the blade centrifugal twisting movement, in which case holding the button in (Sub-para. iv) will, firstly, refeather and then unfeather the propeller.

(v) If faulty operation of the feathering equipment is suspected, a more accurate check may be made by stopping the engine immediately the button snaps out after feathering. The blades should commence to unfeather IMMEDIATELY the button is again pressed and held in. Should the blades feather slightly before unfeathering, equipment should be inspected.

NOTE:—*Should the checks in (v) above be found necessary, it is imperative that the sump be drained before attempting to re-start the engine.*

Ground running must be kept at a minimum compatible with this check.

Engine Speed:

17. (i) Set the propeller control lever to maximum r.p.m.

(ii) Move the throttle to "Cruising" (E.C.B.) position.

(iii) Check that the engine speed is approximately 2,500 r.p.m.

IMPORTANT:—*This check must be carried out before the engine is opened up above the maximum economical cruising boost (E.C.B.). It will reveal whether all cylinders are firing and therefore avoid possible damage by opening up with one or more cylinders out.*

BOOST.

Climbing:

18. (i) Set the propeller control lever to allow climbing r.p.m. (2,400 r.p.m.).

(ii) Set the supercharger in "M" ratio.

(iii) Move the throttle lever to RATED Boost (R.B.). A boost of 42 to 43 in. Hg, (plus 6 to plus 6½ lbs. per sq. in. should be obtained). This check must be performed prior to the cruising and take-off boost checks, as any discrepancy in the rated boost would necessitate its re-adjustment.

Cruising:

(i) Move the throttle to the CRUISING position (E.C.B.).

(ii) If necessary adjust the propeller control lever to allow maximum cruising r.p.m. (2,400 r.p.m.). The boost pressure gauge should read 34 in. Hg. (Plus 2 lbs. per sq. in.).

Take-off:

(i) Set the propeller control lever to permit maximum r.p.m. (2,900 r.p.m.).

(ii) Open the throttles fully. Take-off boost 48-49 in. Hg. (9-9¼ lbs. per sq. in.) should be indicated on the boost pressure gauge. Should the barometer be very low when this check is taken, correspondingly low to T.O. Boost pressure will be obtained, because the engine is running at full throttle.

The full 10 lbs. is not obtained until the aircraft is in flight above 200 m.p.h. (i.e., "ram" effect) further, with Vokes air intake it is probable that the full pressure will never be obtained.

(iii) Check that the fuel pressure under take-off conditions is not less than 2 lbs. per sq. in. and not more than 4 lbs. per sq. in. Should 4 lbs. per sq. in. be recorded it is essential that the pressure gauge calibration sheet be checked to ensure that the manufacturing tolerance does not permit a greater pressure than the maximum permissible.

NOTE:—*Ground running must be kept at a minimum compatible with this check.*

OIL PRESSURE.

Ground Setting:

19. Oil pressure must be set and checked by running engine at 2,400 r.p.m. with oil inlet temperature of 70°C. Oil pressure should be 90 lbs. per sq. in.

Ignition:

20. (i) Set the propeller control lever to permit maximum r.p.m.

(ii) Check the r.p.m. and boost obtained at the maximum cruising, maximum climbing and take-off throttle settings.

(iii) Throttle back to Economic Cruising Boost, i.e., plus 2 lbs. per sq. in. (34 in. Hg.). Note the r.p.m.

(iv) Operate the propeller control lever until a drop of approximately 100 r.p.m. is noted.

(v) Switch off each magneto in turn. Rough running or a drop of more than 50 r.p.m. will indicate faulty ignition. A pause of at least 5 seconds must be made between the operation of the two switches.

IMPORTANT:—*Running on one magneto should be limited to a few seconds to avoid fouling the inoperative set of spark plugs.*

NOTE:—*Ground running should be kept to a minimum compatible with this check.*

Slow Running:

21. The slow running mixture strength should be set correctly before attempting to adjust the slow running speed. The slow running mixture screws are situated one on each side of the carburettor upper half, have right hand threads and are screwed inwards to enrichen the mixture.

Having warmed up the engine thoroughly for the boosts already described, and with the propeller control in the maximum r.p.m. position, throttle back to 1,200 r.p.m. Gently pull slow running cut-out control and note effect on r.p.m.; if there is an increase of more than about 30 r.p.m. the mixture strength is too rich and adjustment of the slow running quality screws should be made. If the r.p.m. decreases and the engine tends to fade when slow running cut-out is operated, the indication is that the mixture strength is too weak and adjustment of the slow running quality screws should be made. Now check for a possible flat spot by opening up the engine quickly to the maximum economical cruising boost position. If a flat spot occurs, it will be necessary to enrichen the mixture slightly and open up the engine again. Repeat these operations until no flat spot is encountered. Then wire lock the slow running screws.

When slow running mixture strength has been set correctly, slow running speed may be adjusted to 600 r.p.m. approximately by means of the throttle stop on the port side of the carburettor. Wire lock the adjuster on completion.

NOTE:—*Ground running must be kept at a minimum compatible with this check.*

(i) Over-rich Mixture at Take-off. With the propeller control in maximum r.p.m. position, move the throttle control lever to the Rated Boost position and note that the r.p.m. are approximately 2,900. Open up to Take-off and note if the r.p.m. falls to approximately 2,850. When the above condition exists it is most

likely that a 9,000 c.c. power jet has been fitted and an improvement can be obtained by fitting a 7,000 c.c. jet.

Vacuum:

22. (i) With the starboard engine running at 2,400 r.p.m., adjust starboard vacuum relief valve to 4½ in. maximum.

(ii) With port engine running at 2,400 r.p.m. adjust port vacuum relief valve to 4½ in. maximum.

(iii) With both engines running at 2,400 r.p.m. check adjustments. If necessary re-adjust as in (i) and (ii).

The required gauge reading in flight is 4 in. plus or minus ¼ in. and it is anticipated that this figure will be obtained after ground checks (i), (ii) and (iii) above.

NOTE:—*Ground running must be kept at a minimum compatible with these checks.*

SHUTTING DOWN.

23. (i) Run the engine at 800-900 r.p.m. for 2 minutes to allow the engine to cool and to ensure that a minimum of oil is left to drain into the sump.

(ii) Open up gradually until 1,800-2,000 r.p.m. are attained. Hold the engine at this speed for approximately 5 seconds and then close the throttle slowly, taking a further 5 seconds for this operation.

(iii) When slow running position is reached, pull the cut-out control in the cockpit, and hold it out until the engine stops.

(iv) Switch "OFF" the ignition.

(v) Allow the cut-out control to return to the running position. Release it smartly to ensure its full travel, otherwise difficulty may be experienced due to sticking.

(vi) Turn off the fuel.

NOTE:—*The cowl gills should be left in the fully open position after shutting down.*

SUMMARY OF ENGINE RUN PROCEDURE.

Starting Procedure:

24. (i) Ignition switches—off.

(ii) Turn engine through three revolutions by hand.

(iii) Supercharger lever in "M" gear

(iv) Cockpit throttle lever ½ in. to ¾ in. from closed position.

(v) Propeller control lever in maximum r.p.m. position.

(vi) Cowl gill full open.

(vii) Air intake control to "Cold Air".

(viii) Priming 5 to 6 pumpfuls of fuel.

(ix) Ignition switches—on.

(x) Press starter and booster coil buttons. Prime if engine hesitates.

Initial Run:

25. (i) Run at approximately 800 r.p.m. for ½ minute.

(ii) Immediately check oil pressure.

(iii) Open up to 1,200-1,500 r.p.m. approximately, until efficient lubrication of the engine is assured. Exercise throttle lever periodically to permit 2,400 r.p.m. maximum, to clear sparking plugs.

(iv) Open up to 2,400 r.p.m. and check instrument, generators and voltage regulator.

Subsequent Runs and Ground Checks:

26. Ground running must be kept at a minimum compatible with the requirements of ground checks.

(i) Check oil pressure at start.

(ii) Open rapidly to 1,200-1,500 r.p.m. and run until oil pressure settles.

(iii) Momentarily close throttle, then open to rated boost with a smooth continuous movement of the throttle lever to clear the spark plugs.

(iv) Supercharger Controls—Set the propeller control lever to maximum r.p.m.

Adjust throttle to hold engine speed at 1,400-1,500 r.p.m. maximum and check functioning of two-speed blower controls by snapping the control into high (S) gear.

A momentary drop in oil pressure will indicate that the gear is functioning correctly.

Return control back to low (M) gear and note a similar momentary drop in oil pressure.

(v) Propeller Controls: Adjust throttle lever until maximum E.C.B. r.p.m. is attained. Move propeller control lever to give a drop of 500-600 r.p.m. Check that original r.p.m. is restored when lever is returned.

(vi) Engine Speed: Set propeller to permit maximum r.p.m. Move throttle to E.C.B. position and check that engine speed is approximately 2,500 r.p.m.

(vii) Boosts: Set propeller control lever to allow 2,400 r.p.m. Move throttle to R.B. and check boost 42-43 in. Hg. Throttle back to E.C.B. position and if necessary adjust propeller control to allow 2,400 r.p.m. Check boost 34 in. Hg.

Set propeller control lever to maximum r.p.m. and open throttle fully. Check boost 48-49 in. Hg.

(viii) Fuel Pressure: Under take-off conditions should not be less than 2 lbs. per sq. in. and not more than 4 lbs. per sq. in.

(ix) Ignition: Throttle back to E.C.B. and note the r.p.m. Operate the propeller control lever until a drop of approximately 100 r.p.m. is noted. Switch off each magneto in turn. The drop in r.p.m. should not exceed 50. Pause at least 5 seconds between operation of switches. Restrict period of running on one magneto to a minimum.

(x) Vacuum: Run each engine at 2,400 r.p.m. respectively, and adjust their respective vacuum relief valves to 4½ in. maximum. Run both engines and check reading. If necessary repeat adjustments on each engine.

The required gauge reading in flight is 4 in. plus or minus ½ in.

(xi) Feathering Checks: Throttle back to 1,100-1,200 r.p.m.

Run for 20 seconds. Press feathering button; engine speed will drop to approximately 600 r.p.m. Run with propeller feathered for 10 seconds to clear sump; unfeather by holding feathering button until engine speed ceases to rise (approximately 800 r.p.m.). Release button when r.p.m. should return to approximately 1,000 r.p.m. A short burst of throttle will restore to fine pitch position.

(xii) Slow Running: With engine warmed up and propeller on fine pitch stops run at 1,200 r.p.m. Gently pull slow running cut-out control. If r.p.m. increase more than 30 r.p.m. approximately, mixture strength is too rich. If r.p.m. decrease and engine tends to fade mixture strength is too weak.

Adjust quality screws to weaken or enrichen as required.

Check for flat spots by opening up quickly to E.C.B. Enrich mixture slightly if flat spot occurs and again check. Adjust slow running speed by means of throttle stop. Wire lock quality screws and throttle stop.

(xiii) Oil Pressure: Run engine at 2,400 r.p.m., oil inlet temperature of 70 deg. C. Pressure should be 90 lbs. per sq. in.

Shutting Down:

27. (i) Run at 800 r.p.m. for 2 minutes. Open up to 1,800-2,000 r.p.m. and run for 5 seconds.

(ii) Close throttle slowly, taking a further 5 seconds.

(iii) When slow running position is reached, pull cut-out control and hold it out until engine stops.

(iv) Switch off ignition.

(v) Release cut-out control smartly.

(vi) Turn off fuel.

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SECTION 5.

REMOVAL AND ASSEMBLY OPERATIONS.

SECTION 5.

Removal and Assembly Operations

CONTENTS.

ILLUSTRATIONS.

Removal and Assembly Operations

INTRODUCTION.

1. This section gives a pictorial guide to the best methods for removing and assembling the principal components of the airframe. The engine removal is not covered pictorially. Generally, the removal only is dealt with, as re-assembly is usually a reversal of the removal operations. Where there is any special assembly point, it is covered by a note on the illustration, or by one of the following paragraphs.

2. The numerical sequence of the operations illustrated in this Section indicates the recommended order for the dismantling—although in some cases it will be obvious that it is not essential to adhere to this numerical order.

3. Certain general instructions for removal are given in Paras. 7 and 29; these instructions should be remembered when consulting the illustrations.

ASSEMBLY SEQUENCE.

4. The sequence of assembling a complete aeroplane is illustrated in Fig. 1.

5. The positions of trestles under the main components are shown in Fig. 1, and in each consequence the trestles required for each additional component are shown black. If the aeroplane has to be trestled for assembling a minor component, the minimum trestling shown in Fig. 1 of Sect. 4, Chap. 2, should be used.

DISMANTLING SEQUENCE.

6. After draining the fuel tanks (see Fig. 17), the oil system (see Para. 28), and the hydraulic system (see Sect. 4, Chap. 2, Para. 4). The sequence of dismantling a complete aeroplane is generally the reverse of the assembly sequence.

REMOVAL NOTES.

Disconnect M.R. (Teleflex) Controls:

7. When removing a component in which M.R. controls pass from the particular component to another, the M.R.C. should be disconnected as follows:—

(i) Remove the pins from the outer casing connections nearest to the breaking down point of the two components.

(ii) Slide the connector along the conduit.

(iii) Disconnect the inner core cable at both ends of the control.

(iv) Pull the core cable at the end farthest from the breaking down point until it has passed the break in the outer casing.

(v) Coil the free length of cable and stow it conveniently.

Control and Trim Tab Cables:

8. When disconnecting a cable, a weight should be attached to the end before releasing the cable. This will prevent it from slipping out of the pulleys or unwinding from the cable drums.

ASSEMBLY NOTES.

Flaps:

9. When assembling new flaps, it will be found that the hinge blocks (Part No. 89207A and B) are undrilled. They must be positioned on assembly to suit the hinge brackets (Part No. 89163) on the control frame and drilled. On aeroplanes fitted with a bush at the hinge blocks, new blocks must be shimmed at the bottom only; on aeroplanes without a bush, new blocks must be shimmed both top and bottom.

Aileron Trim Tab (Starboard):

10. When assembling the tab to the aileron, ensure that there is an equal length of chain on each side of the sprocket, when the tab is in the neutral position, before connecting up.

Hatch Check Cables:

11. To assemble a check cable, proceed as follows:—

(i) Open the hatch.

(ii) Attach the cable to the spool, and wind it around the spool in a clockwise direction, looking to starboard.

(iii) Pull the cable off the spool, thus winding up the spring inside the spool.

(iv) Give the spool an extra two turns against the spring.

(v) Connect the cable to the turnbuckle attached to the hatch.

WARNING:—*Take care to fit the collar and split-pin on the outboard side to prevent the turnbuckle fouling the cable rubbing-plate.*

(vi) Adjust the turnbuckle, so that when the hatch is open, the ends of the cable and the centre bolt of the spool are in line.

ENGINE AND ACCESSORIES.

Engine Cowling Removal:

12. (i) Remove the split pins securing the toggle covers.

(ii) Remove the split pins locking the toggle.

(iii) Release the toggle.

(iv) Withdraw the cowling.

12a. The cowling sections are difficult to identify in darkness, and the following notes are intended to assist maintenance crews in ready identification when no lights are permissible.

12b. The bottom panel of the cowling, on both the port and starboard engines, is fitted with toggle trays and should therefore be easily identified. On both the port and starboard engines, the port side panel has a stiffening rib that runs fore-and-aft throughout practically the whole width of the edge adjacent to the tail pipe; whereas the starboard panel has no stiffening rib. This difference is easily discernible, even in the darkness. To ensure that the panel sections are fitted correctly on the engine, the locating-peg holes are always at the forward edge, and the appropriate pegs are attached to the rear edge of the exhaust manifolds. Engine cowling sets are interchangeable between the port and starboard engines.

Cowling Gill Removal:

13. (i) Remove the engine cowling (see Para. 12).

(ii) Remove the drive shaft (see Para. 24).

(iii) Remove the gill plates by operating the spring-loaded catch bolts, two to each plate.

(iv) Remove the bolts from the two joining points of the gill ring.

(v) Remove the six bolts securing the rings to the bracket attached to the rear bank of cylinders.

(vi) Release the chain adjuster.

(vii) Split the rings at the two joining points.

(viii) Rotate the chain until the spring link is visible.

(ix) Disconnect the chain, and wire each end to its respective half of the ring.

(x) Remove the gill ring.

NOTE:—*If the engine is being removed from the aeroplane, the gill ring can be left attached to it, and may be later removed while the engine is supported by the crane. (See Para. 14).*

Engine Removal:

14. (i) Remove the propeller (see A.P. 1538D).

(ii) Remove the frame damper or tail pipe extension from the exhaust tail pipe.

(iii) Remove the nacelle cowling panels.

(iv) Remove the engine cowling (see Para. 12).

(v) Remove the cowling gills (see Para. 13).

(vi) Dismantle the engine control at the engine.

(vii) Drain the oil system (see Sect. 8), and turn off the fuel at the main cock.

(viii) Remove the carburettor (see operations xiv A and B.)

(ix) Dismantle the hand turning gear by withdrawing the bolt in the universal coupling. Pull shaft clear of the coupling.

(x) Disconnect all pipes and cables.

(xi) Disconnect the engine temperature indicator leads. Remove thermo-couple (No. 14 cylinder).

(xii) Remove the four set-screws from the universal coupling shaft to the accessory gear box.

(xiii) Attach the engine sling (see A.P. 1728B or D).

(xiv) Method A: Release the engine from the structure by removing the seven bolts attaching the engine to the mounting ring.

Method B: Release the engine, complete with the engine mounting ring (see note at end of Para. 13), by removing the four bolts attaching the mounting ring to the engine mountings. (Not necessary to remove carburettor.)

ENGINE DRIVEN ACCESSORIES.

Generator Removal (Both Engines):

15. (i) Remove the top cowling panel and intake fairing of the nacelle cowling.

(ii) Disconnect the cable from the terminal block at the bottom of the generator.

(iii) Connect the loose cable to the dummy terminal block on the firewall.

(iv) Remove the four nuts securing the generator to the gear-box and withdraw the generator.

Vacuum Pump Removal (Both Engines):

16. (i) Remove the nacelle cowling panel from the side required.

(ii) Disconnect all pipes from the pump.

(iii) Remove the six nuts securing the pump to the gear-box and withdraw the pump.

Air Compressor Removal (Starboard Engine):

17. (i) Remove the top nacelle cowling panel.

(ii) Remove the oil tank (see Para. 28).

(iii) Slacken the clips on the hose connecting the cooling duct to the generator (see Para. 15 (ii)).

(iv) Remove the two bolts and the clip from the firewall.

(v) Remove the cooling duct.

(vi) Remove the delivery pipe.

(vii) Remove the six nuts securing the compressor to the gear-box and withdraw the compressor.

Hydraulic Pump Removal (Both Engines):

18. (i) Remove the nacelle cowling panel from the side required.

(ii) Disconnect all pipes from the pump.

(iii) Remove the six nuts securing the pump to the gear-box and withdraw the pump.

Engine-speed Indicator Generator Removal (Both Engines):

19. (i) Unscrew and pull out the electrical connecting plug.

(ii) Disconnect the flexible drive at the generator.

(iii) Remove the bolts securing the generator to the structure and withdraw the generator.

20. To remove the generator flexible drive, disconnect the drive from the engine and generator, and remove the drive.

Replacement of Components:

21. Before assembling engine-driven accessories, the joint faces must be cleaned and coated with an approved jointing compound. Check gasket for fractures.

Gear-box Removal (Starboard Engine):

22. (i) Remove the nacelle cowling panels.

(ii) Remove the accessories mounted on the gear-box:—

Generator (see Para. 15).

Vacuum Pump (see Para. 16).

Air Compressor (see Para. 17).

Hydraulic Pump (see Para. 18).

(iii) Remove the four setscrews from the universal coupling shaft.

(iv) Press the universal coupling towards the gear-box to separate the shaft and coupling.

(v) Take the weight of the gear-box and remove the four bolts securing it to the firewall.

Gear-box Removal (Port Engine):

23. (i) Remove the nacelle cowling panels.

(ii) Remove the following accessories mounted on the gear box:—

Vacuum Pump (see Para. 16).

Generator (see Para. 15).

Hydraulic System Pump (see Para. 18).

(iii) Having removed the above, proceed as in Para. 22.

COWLING GILL MOTOR REMOVAL.

24. (i) Remove the nacelle fairing nose panel from the side required.

(ii) Remove the centre from one of the universal couplings of the drive shaft.

(iii) Swing the shaft clear and pull the shaft and the other coupling off the splines.

(iv) Remove the half coupling at the other end by pulling it off the splines.

(v) Remove the bolts securing the motor straps to the structure and withdraw the motor.

ENGINE MOUNTING REMOVAL.

25. When the engine, engine-driven accessories and the gear-box have been removed, the engine mounting may be detached from the aeroplane as follows:—

(i) Remove all the pipe lines, ignition cables, control conduits and rods from the engine mounting.

(ii) Remove the engine temperature indicator leads clear of the engine mounting.

(iii) Remove the drum with the capillaries from the engine firewall, coil and carefully stow in the centre plane.

(iv) Remove the five engine mounting bolts (see Sect. 8) and withdraw the mounting.

FUEL TANKS AND OIL TANKS.

Fuel Tank Removal:

26. (See Figs. 17, 18 and 19.)

Fuel Tank Replacement:

27. When replacing the fuel tank, fit the rubber sealing ring attached to the filler

cap door frame, round the filler cap neck, when the tank is about 1-in. to ½-in. from the fully home position. Before replacing the set-screws around the edge of the fuel tank panels (see Figs. 17, 18 and 19) the shanks must be coated with Bostick to prevent their loosening in flight.

Oil Tank Draining and Removing:

28. (i) Drain the oil tank by unlocking and opening the cock in the bottom of the main feed pipe aft of the engine firewall (see Sect. 8).

(ii) Remove the nacelle fairing from the top of the centre plane.

(iii) Uncouple the pipe connections and the bonding wires.

(iv) Release the two straps and remove the tank.

NOTE:—*When draining oil tanks, it will be necessary to attach a length of flexible hose to enable the oil to be carried away clear of the structure, and into a suitable drainage container.*

Oil Cooler Removal:

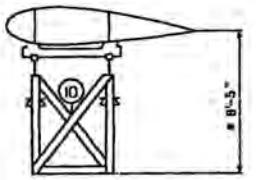
29. After draining the oil system (see Para. 28) the oil cooler can be removed as follows:—

(i) Detach the fairing between nose ribs 1 and 4 by removing the screws.

(ii) Disconnect the two pipe connections to the cooler.

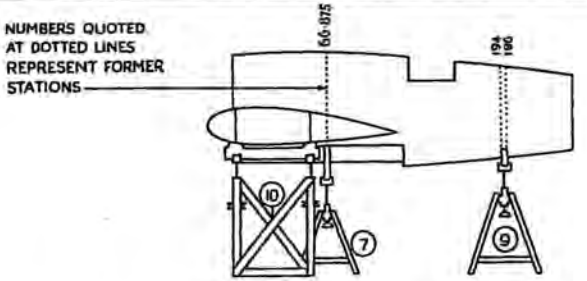
(iii) Slacken the straps at the inner and outer ends of the cooler assembly and slide them on to the ducts.

(iv) Disconnect the bolts and nuts attaching the cooler assembly to the lower end of the support struts, and withdraw the cooler.

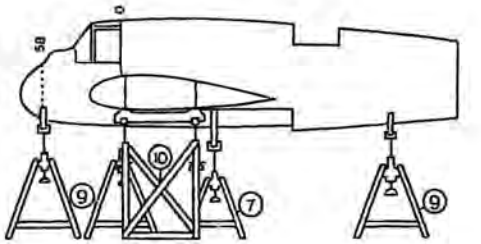


(A) CENTRE PLANE (WITH FLAPS) MOUNTED ON TRESTLES

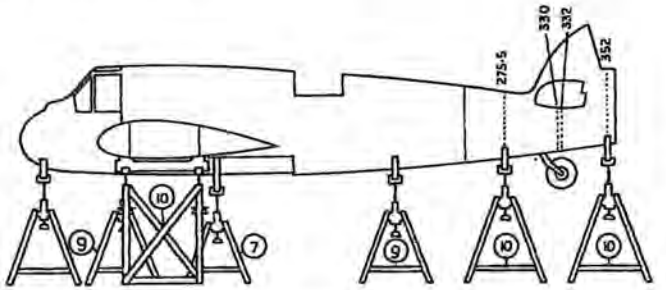
* THIS DIMENSION DENOTES INITIAL ERECTION HEIGHT PRIOR TO OFFERING UP OF REAR FUSELAGE



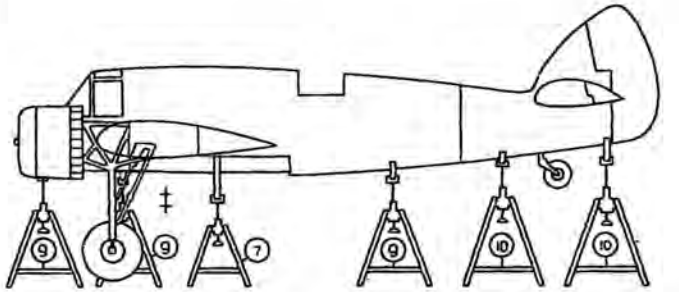
(B) ASSEMBLY OF REAR FUSELAGE AND KEEL MEMBERS TO CENTRE PLANE



(C) ASSEMBLY OF FRONT FUSELAGE TO REAR FUSELAGE

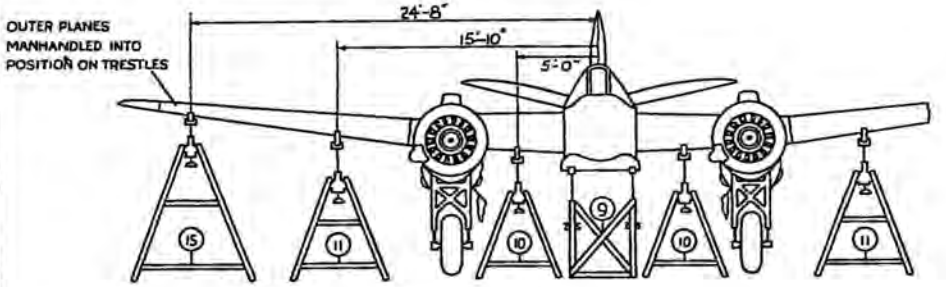


(D) ASSEMBLY OF TAIL UNIT TO REAR FUSELAGE



(E) ASSEMBLY OF RUDDER, ELEVATORS, NACELLE STRUCTURE, UNDERCARRIAGE ENGINE MOUNTINGS, POWER UNITS, ENGINE COWLINGS AND GILLS

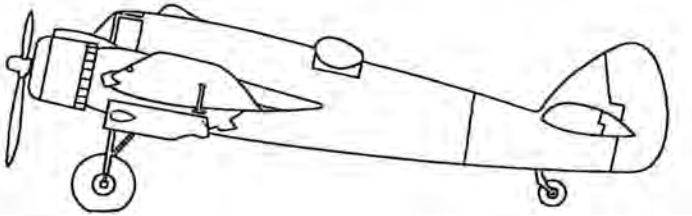
‡ Nº 10 TRESTLES UNDER CENTREPLANE PORT & STARBOARD OMITTED FOR CLARITY



(F) ASSEMBLY OF OUTER PLANES & TIPS, FLAPS, AILERONS, NACELLE FAIRINGS UNDERCARRIAGE DOORS AND OBSERVER'S HOOD

NOTE: BEFORE Nº 9 TRESTLE UNDER FORMER 0 CAN BE USED THE FRONT EXIT HATCH SHOULD BE OPENED

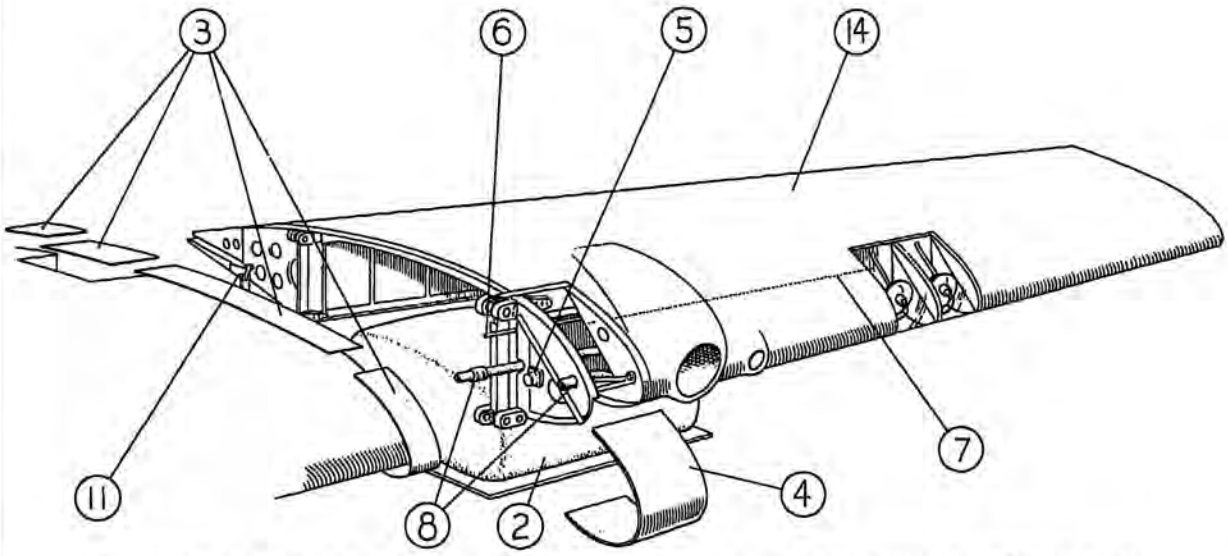
BEFORE Nº 7 TRESTLE UNDER FORMER 66·875 CAN BE USED, PANELS AND GUNS ARE TO BE DETACHED



(G) ASSEMBLY OF DETACHABLE PANELS, ENTRY AND EXIT HATCHES AND AIRSCREWS (TRESTLES REMOVED)

NOTE:- ALL TRESTLES ARE UNIVERSAL JACKING TYPE

ASSEMBLY SEQUENCE



1 TRESTLE COMPONENT – SEE FIG. 1

2 REMOVE FUEL TANK – SEE FIG. 17

3 REMOVE ALL COVER PLATES

4 REMOVE LEADING EDGE PANEL AND DISCONNECT AILERON CABLES – SEE PARA. 8

5 DISCONNECT ELECTRICAL PLUGS

6 DISCONNECT PNEUMATIC PIPES

7 UNCOUPLE LANDING LAMP CABLES SEE PARA. 7 (PORT ONLY)

8 DISCONNECT OIL COOLER PIPES

9 DISCONNECT TRIMMING TAB CABLES – SEE FIG. 3 (STB'D ONLY)

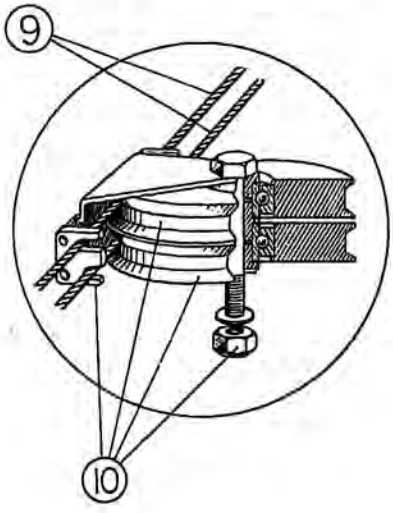
10 REMOVE PULLEYS RELEASE CABLES FROM GUARD AND REPLACE PULLEYS (STB'D ONLY)

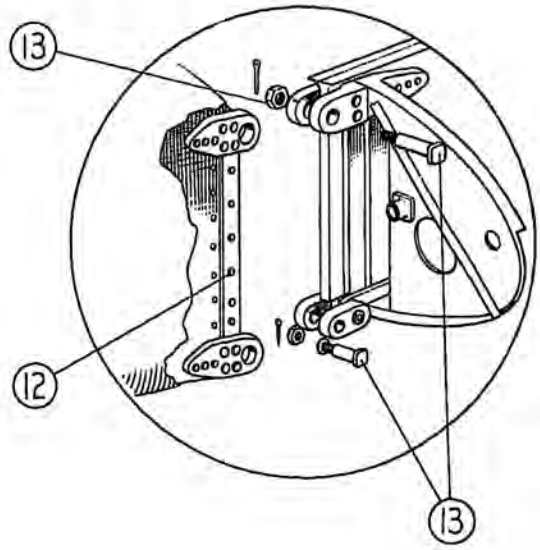
11 DISCONNECT FLAP – SEE FIG. 4

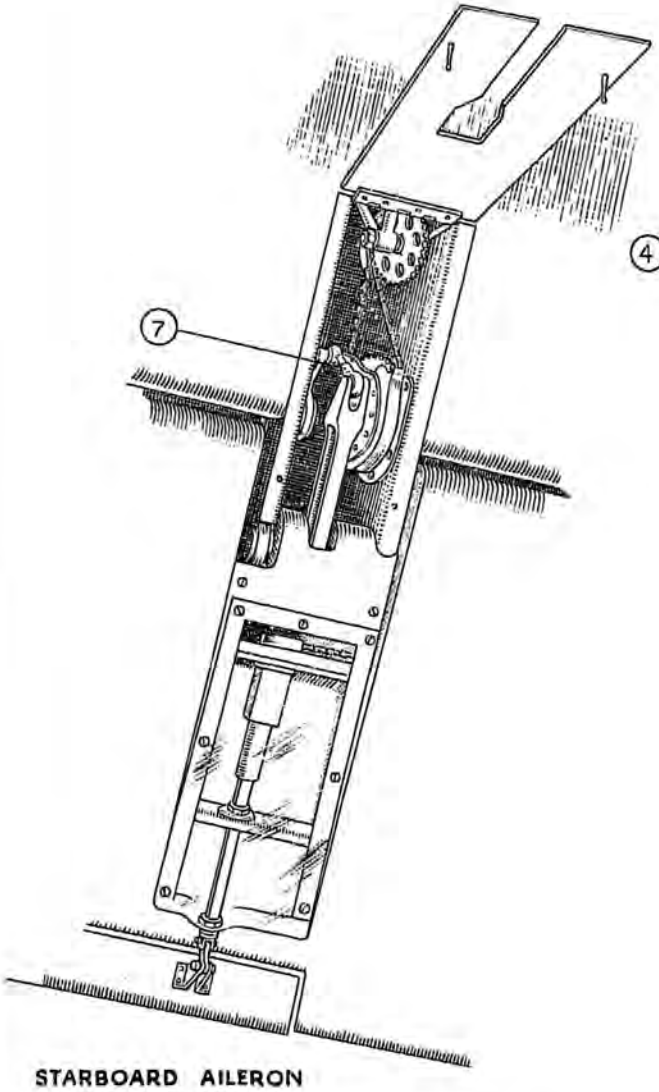
12 REMOVE SIX WEB BOLTS

13 REMOVE FLANGE JOINT BOLTS

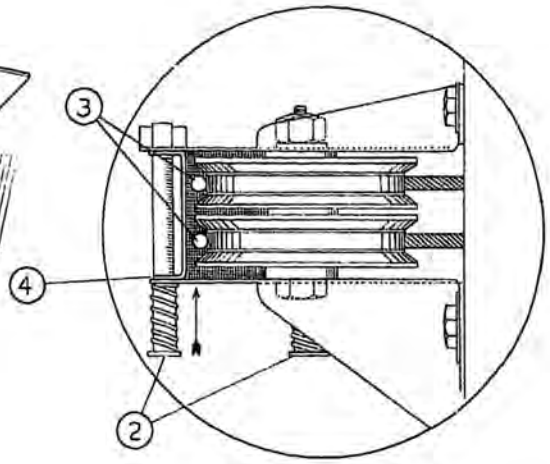
14 REMOVE OUTER PLANE







STARBOARD AILERON
FROM BELOW

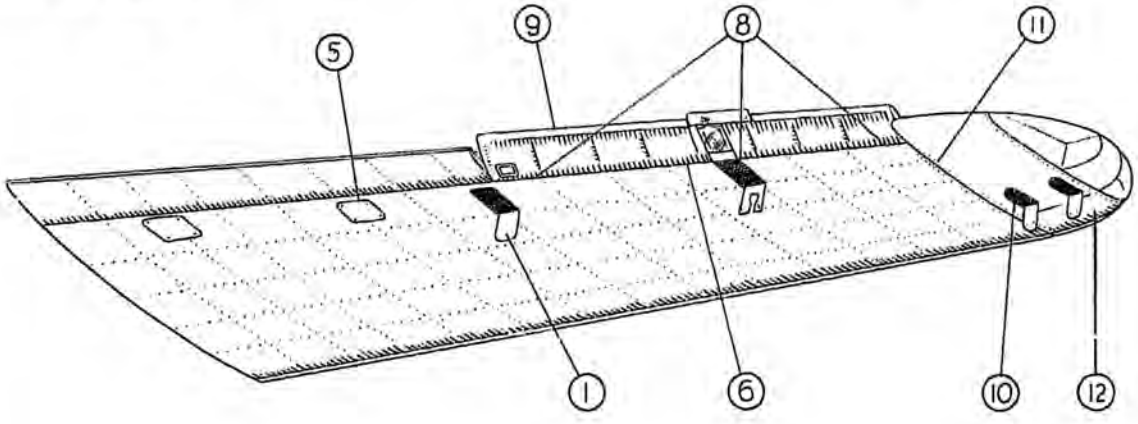


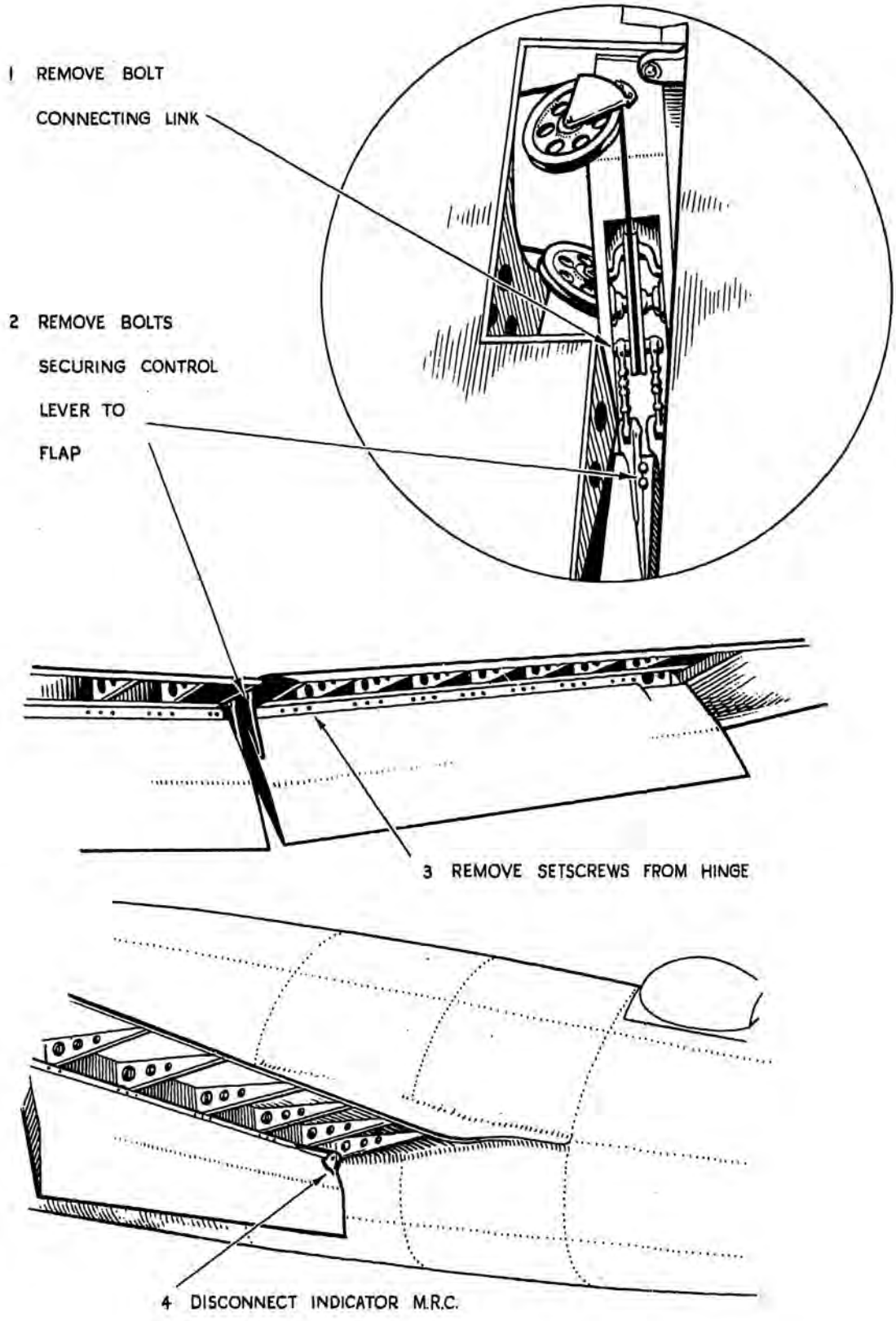
REMOVAL OF AILERON

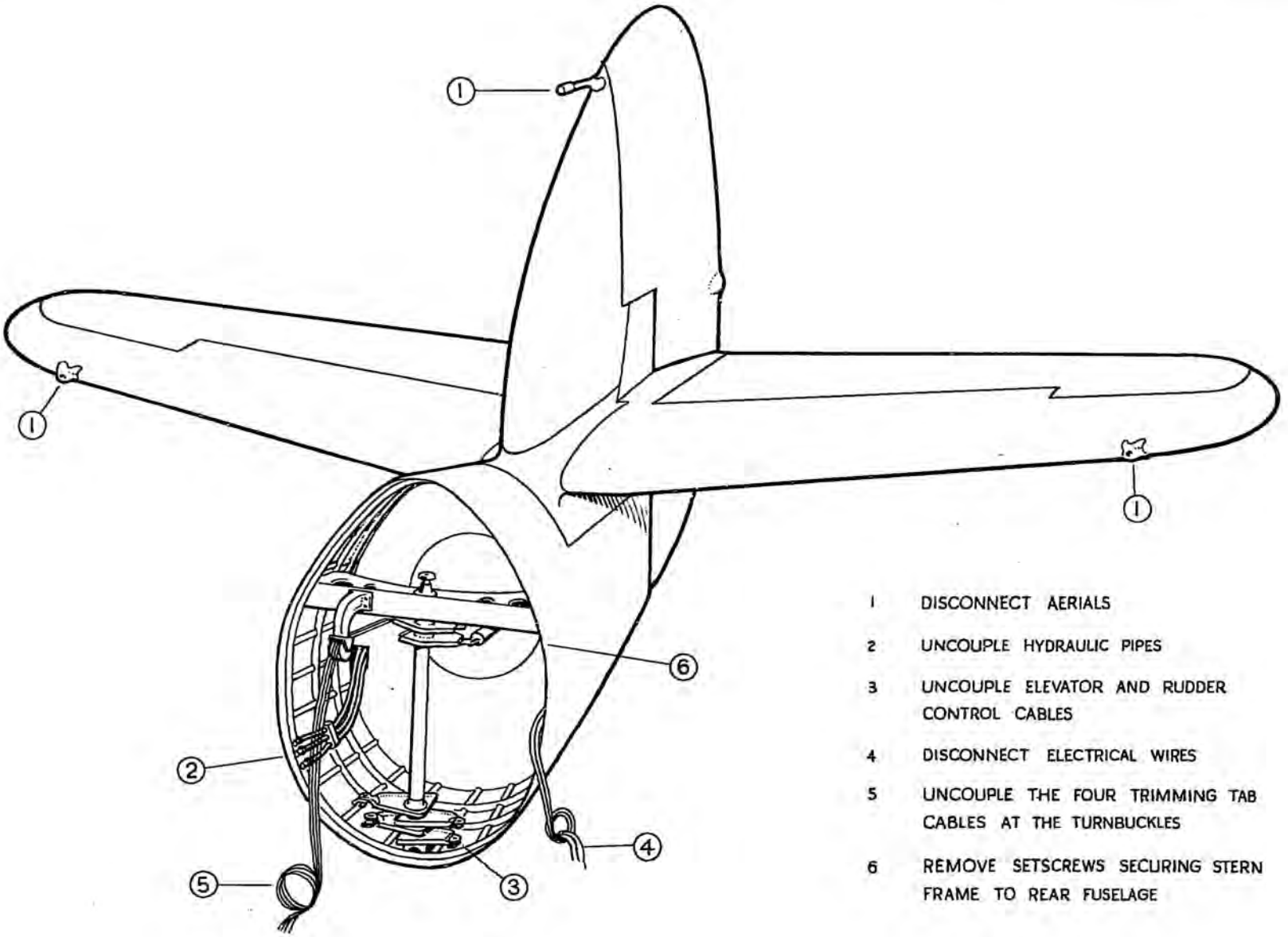
1. OPEN PANEL (ST'B'D ONLY)
2. REMOVE GUARDS FROM BRACKETS BY RELEASING PINS (ST'B'D ONLY)
3. REMOVE THE CABLES (ST'B'D ONLY)
4. REPLACE THE GUARDS (ST'B'D ONLY)
5. DISCONNECT CABLES AT TURNBUCKLES (ST'B'D ONLY)
6. DEPRESS AILERON
7. DISCONNECT CONTROL LINK
8. REMOVE SPLIT PINS AND NUTS FROM THE THREE BEARINGS
9. REMOVE THE AILERON

REMOVAL OF WING TIP

10. DISCONNECT ELECTRICAL CABLES THROUGH PANEL
11. REMOVE SCREWS
12. REMOVE WING TIP




1 REMOVE BOLT
CONNECTING LINK
2 REMOVE BOLTS
SECURING CONTROL
LEVER TO
FLAP
3 REMOVE SETSCREWS FROM HINGE
4 DISCONNECT INDICATOR M.R.C.
SEE PARA. 7 (PORT ONLY)



1 DISCONNECT AERIALS

2 UNCOUPLE HYDRAULIC PIPES

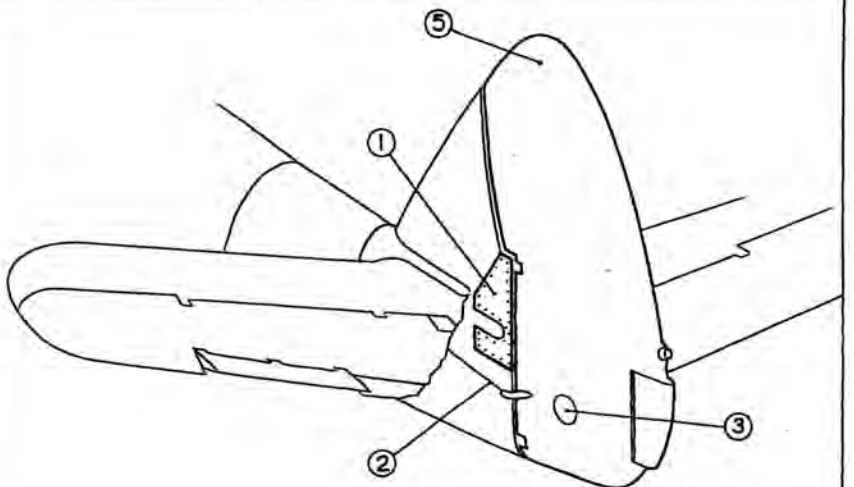
3 UNCOUPLE ELEVATOR AND RUDDER CONTROL CABLES

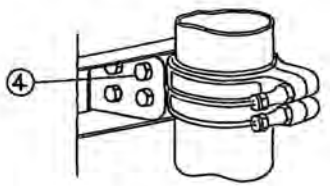
4 DISCONNECT ELECTRICAL WIRES

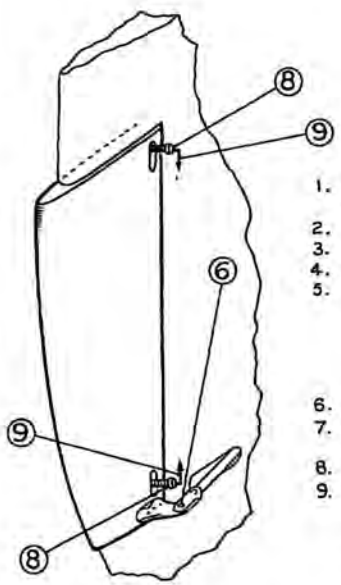
5 UNCOUPLE THE FOUR TRIMMING TAB CABLES AT THE TURNBUCKLES

6 REMOVE SETSCREWS SECURING STERN FRAME TO REAR FUSELAGE

5 **STERNFRAME** 5





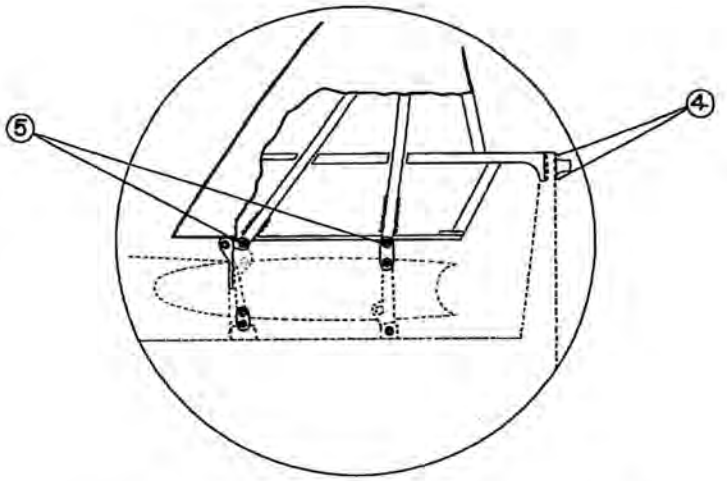


REMOVAL OF RUDDER

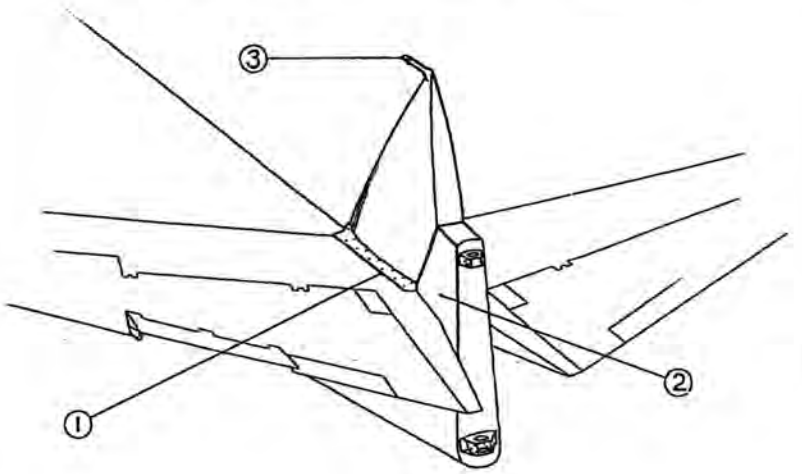
1. REMOVE PANEL AND DISCONNECT ELECTRICAL LEADS AT TERMINAL BLOCK.
2. UNCOUPLE RUDDER CABLES.
3. REMOVE PANEL AND TRIMMING TAB CONTROL.
4. WITHDRAW BOLTS FROM TOP AND BOTTOM HINGES
5. WITHDRAW RUDDER.

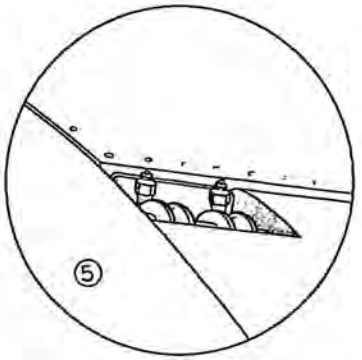
REMOVAL OF TRIMMING TAB

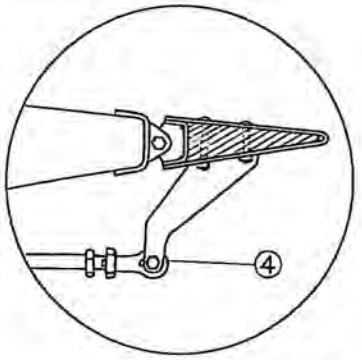
6. DISCONNECT TRIMMING TAB CONTROL
7. REMOVE SPLIT-PIN AND NUT AT EITHER END OF HINGE BOLTS
8. WITHDRAW BOLTS ABOUT HALF WAY
9. REMOVE TRIMMING TAB BY SLIDING BOLTS ALONG SLOTS THUS WITHDRAWING HINGE PINS FROM BEARINGS.



1. REMOVE FILLET
2. REMOVE PANEL PORT AND STARBOARD
3. DISCONNECT AERIAL
4. REMOVE THE FOUR NUTS
5. REMOVE ATTACHMENT BOLTS AND LIFT FIN CLEAR

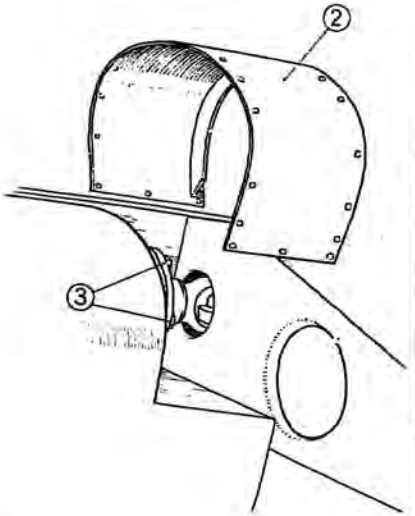


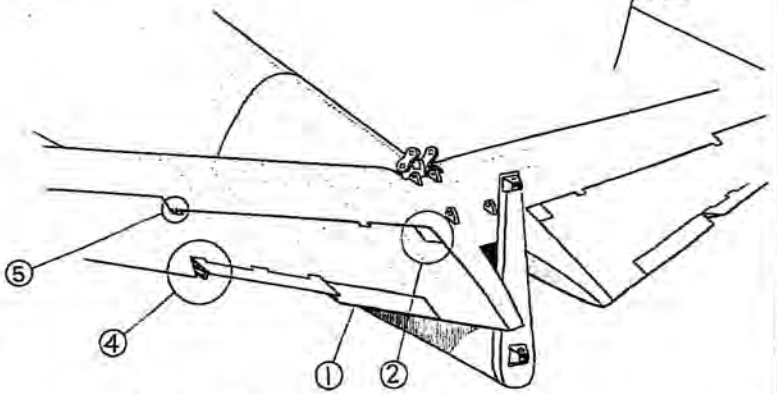




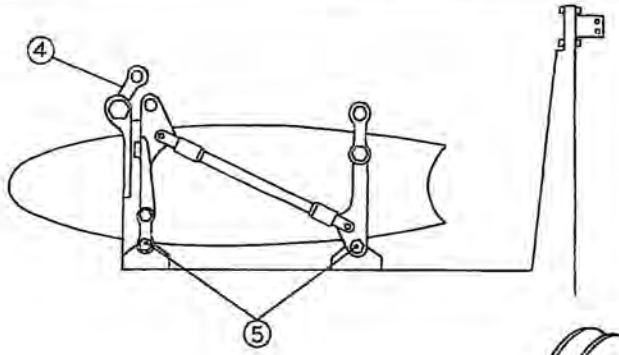
1. DISCONNECT FLEXIBLE DRIVE TO TRIMMING TAB
2. REMOVE COVER PLATE
3. DISCONNECT ELEVATOR TORQUE TUBE (SIX BOLTS)
4. UNCOUPLE BALANCE TAB LINK
5. REMOVE BOLTS FROM OUTER BEARING
6. REMOVE ELEVATOR

FOR REMOVAL OF TRIMMING TABS SEE FIG. 6

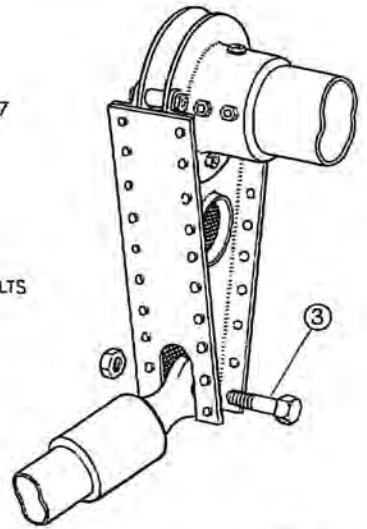




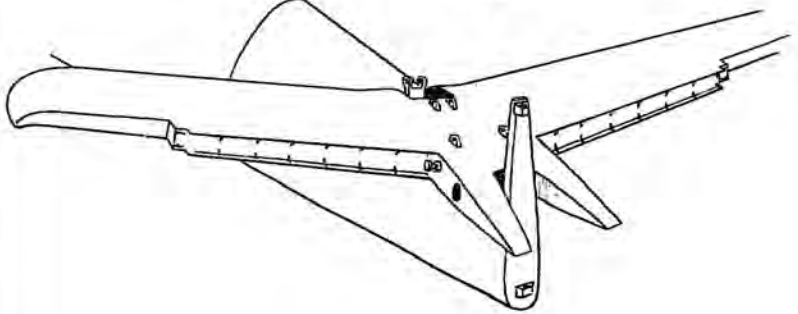
8 ELEVATOR AND TAB 8



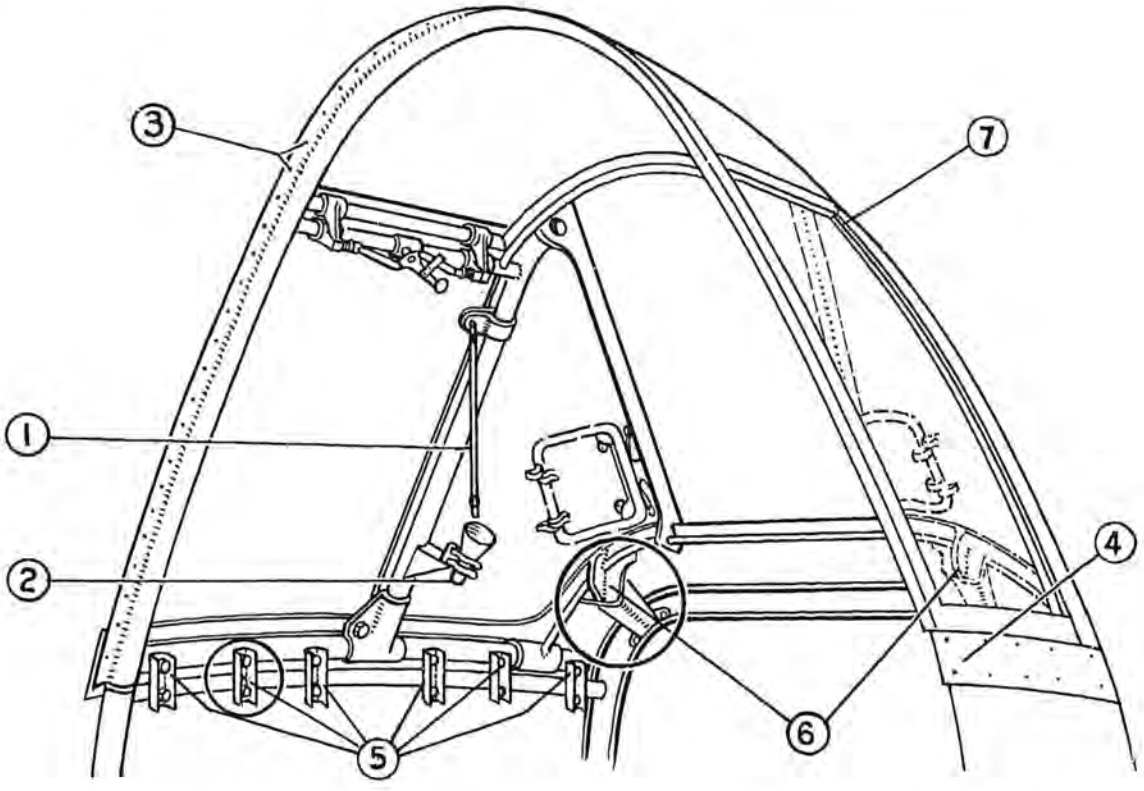
1. REMOVE FIN AND RUDDER SEE FIGS. 6 & 7
2. REMOVE ELEVATORS SEE FIG. 8
3. DISCONNECT ELEVATOR LEVER
4. REMOVE LINK
5. REMOVE FRONT AND REAR ATTACHMENT BOLTS
6. REMOVE TAIL PLANE



WHEN REMOVING TAIL PLANE WITH ELEVATORS AND TRIMMING TAB, FLEXIBLE DRIVES MUST BE DISCONNECTED. SEE FIG 5.



9 TAIL PLANE 9



1 DISCONNECT PILOT'S LANYARD

2 DISCONNECT ELECTRICAL CABLES

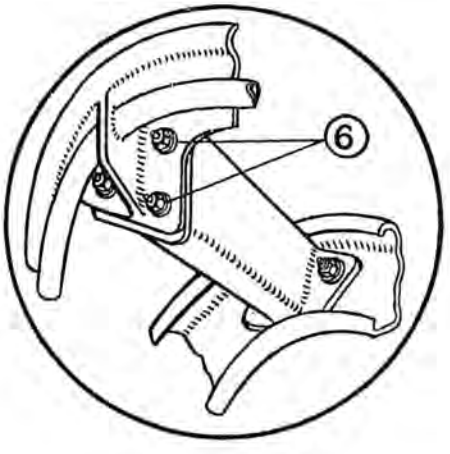
3 REMOVE RIVETS ATTACHING HOOD TO REAR FUSELAGE

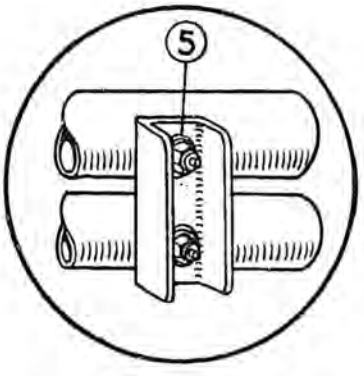
4 REMOVE SEALING STRIP

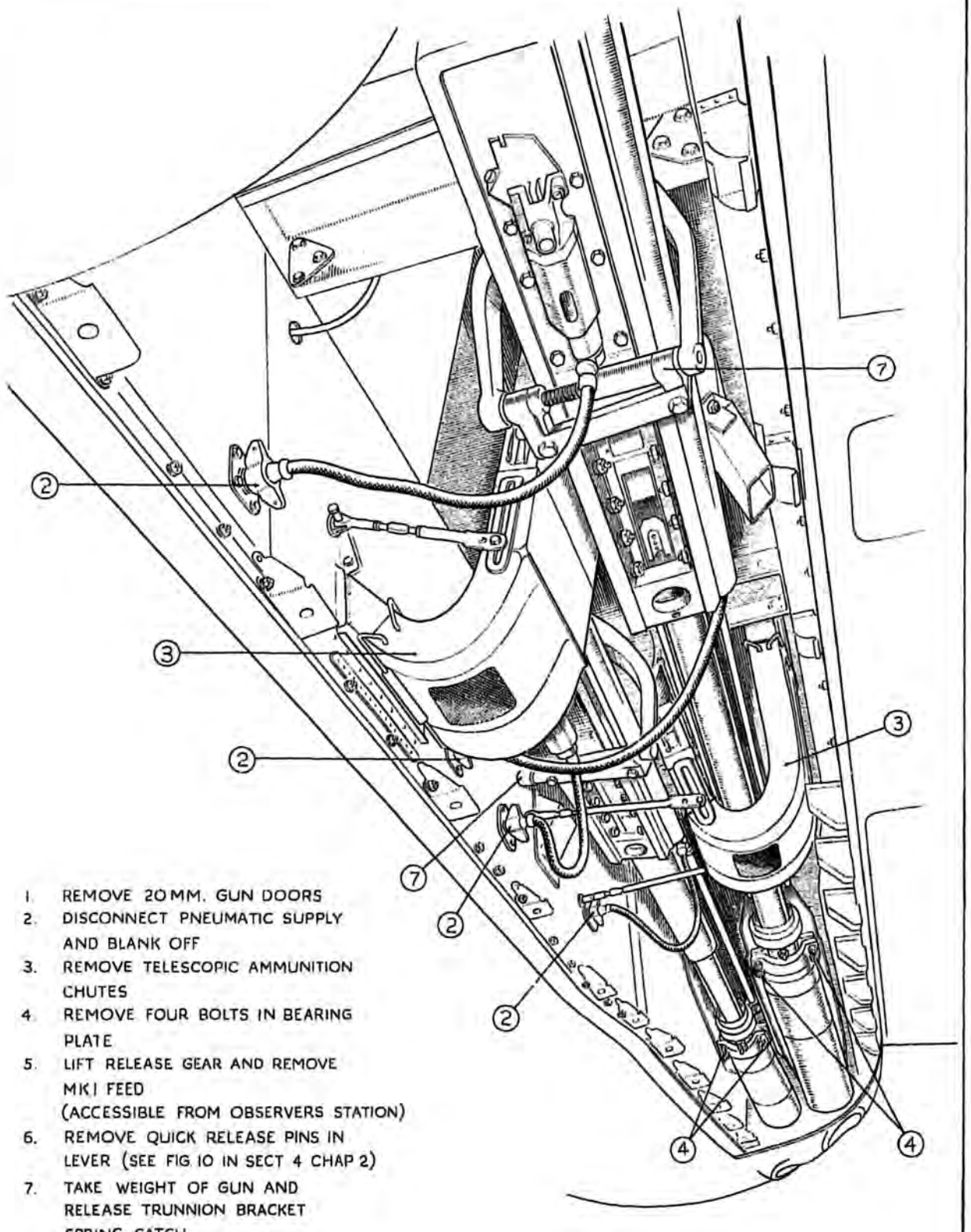
5 REMOVE SETSCREWS

6 REMOVE BOLTS

7 REMOVE HOOD

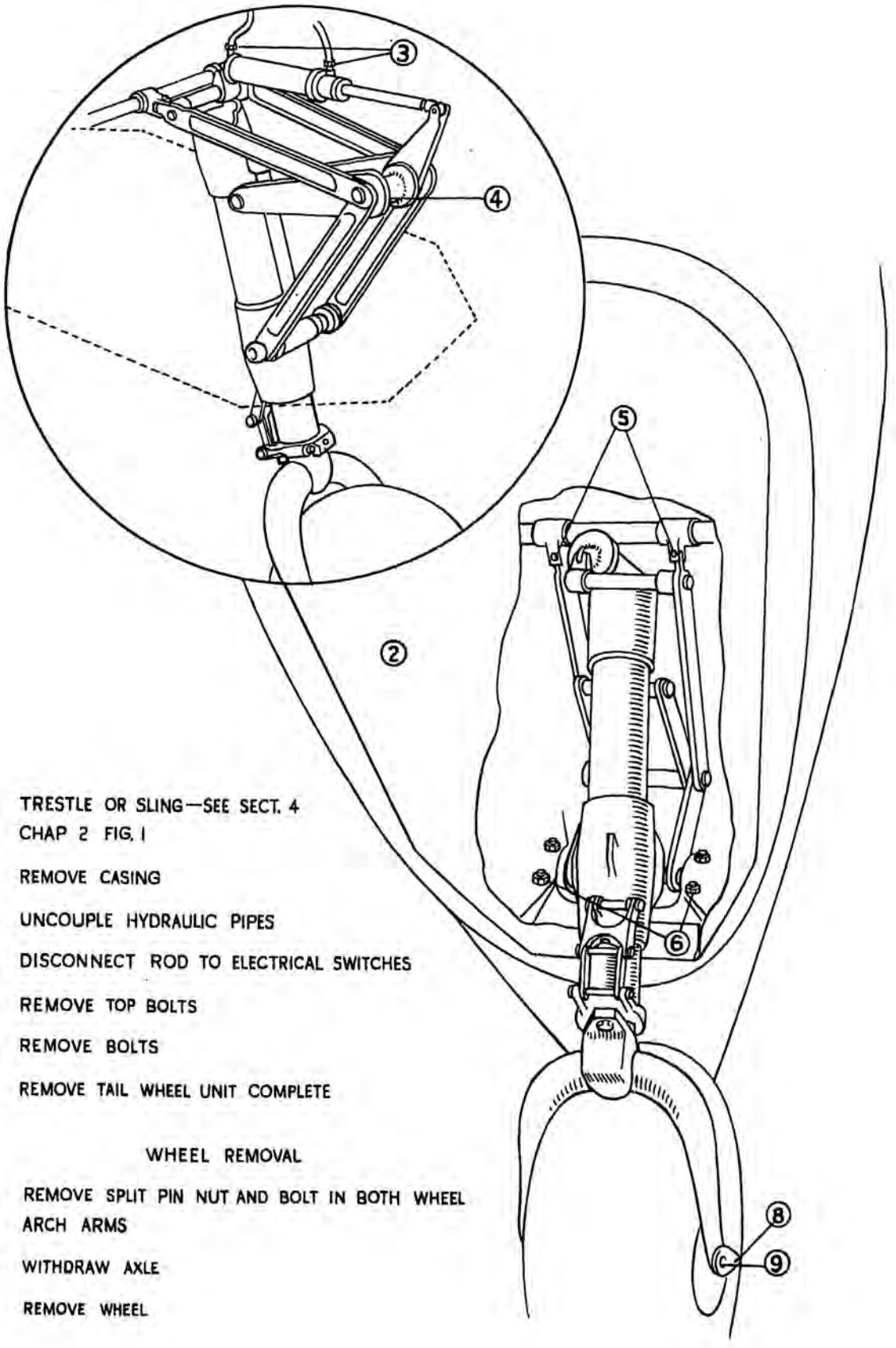






1. REMOVE 20 MM. GUN DOORS
2. DISCONNECT PNEUMATIC SUPPLY AND BLANK OFF
3. REMOVE TELESCOPIC AMMUNITION CHUTES
4. REMOVE FOUR BOLTS IN BEARING PLATE
5. LIFT RELEASE GEAR AND REMOVE MK.I FEED (ACCESSIBLE FROM OBSERVERS STATION)
6. REMOVE QUICK RELEASE PINS IN LEVER (SEE FIG 10 IN SECT 4 CHAP 2)
7. TAKE WEIGHT OF GUN AND RELEASE TRUNNION BRACKET SPRING CATCH
8. WITHDRAW GUN REARWARDS

11 **20mm. GUN Mk.I FEED** 11



1 TRESTLE OR SLING—SEE SECT. 4 CHAP 2 FIG. 1

2 REMOVE CASING

3 UNCOUPLE HYDRAULIC PIPES

4 DISCONNECT ROD TO ELECTRICAL SWITCHES

5 REMOVE TOP BOLTS

6 REMOVE BOLTS

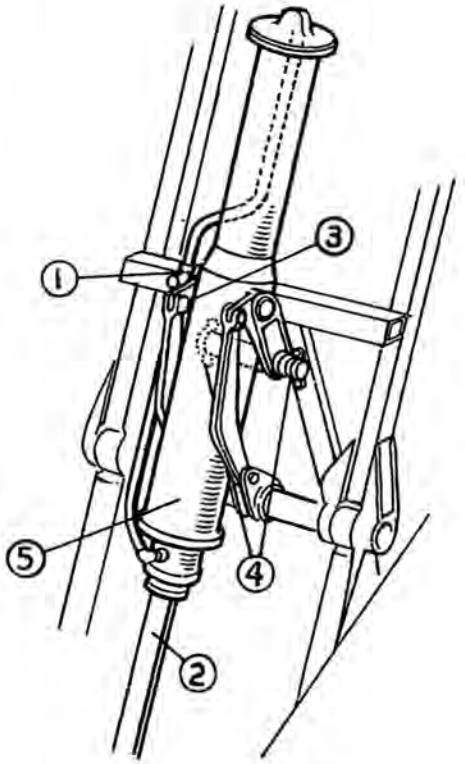
7 REMOVE TAIL WHEEL UNIT COMPLETE

WHEEL REMOVAL

8 REMOVE SPLIT PIN NUT AND BOLT IN BOTH WHEEL ARCH ARMS

9 WITHDRAW AXLE

10 REMOVE WHEEL



U/C JACK

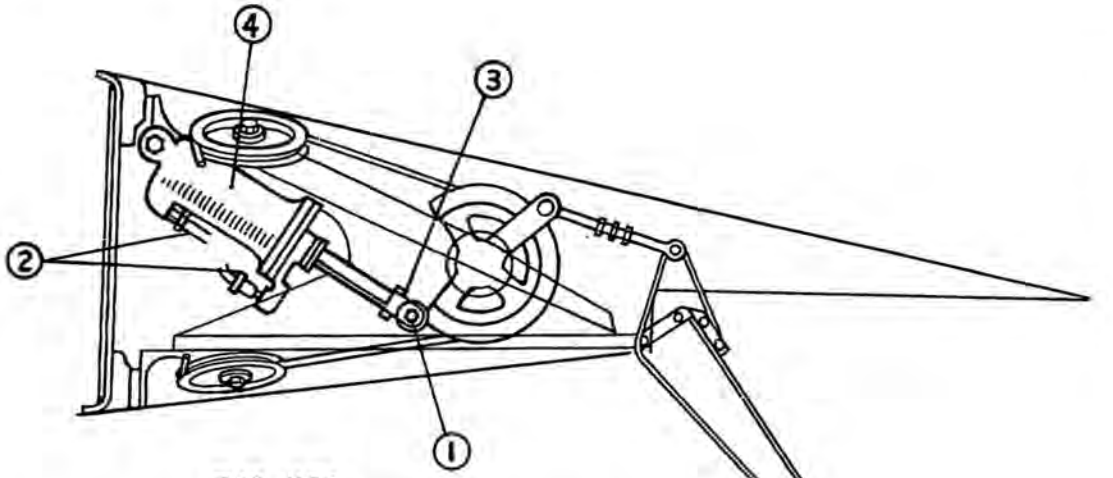
1 DISCONNECT PIPES AT SWIVEL JOINTS

2 REMOVE COVER AND DISCONNECT PISTON ROD — SEE FIG. 15

3 DISCONNECT LEVERS

4 REMOVE FRONT BOLTS

5 REMOVE JACK AND DRAIN



FLAP JACK

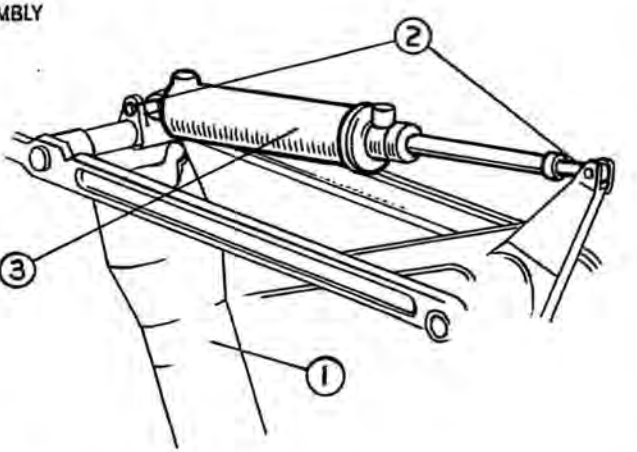
1 LOWER FLAPS UNTIL PINS ARE IN LINE WITH HOLES

2 REMOVE PIPES BETWEEN JACK AND SWIVEL JOINTS

3 STRAIGHTEN THE WASHERS AND REMOVE PINS

4 REMOVE JACK THROUGH CUT-AWAY AND DRAIN

NOTE—USE NEW TAB WASHERS ON ASSEMBLY



TAIL WHEEL JACK

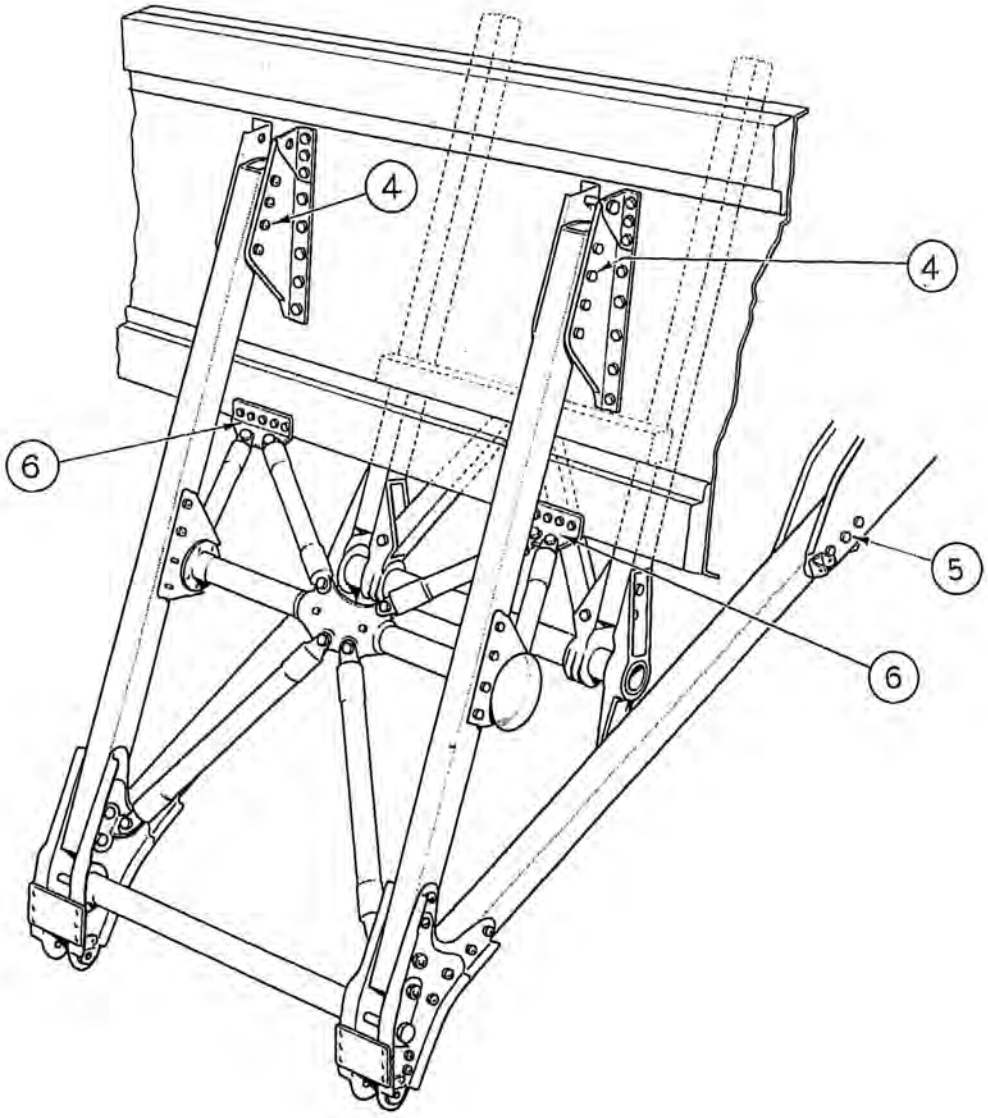
1 REMOVE TAIL WHEEL UNIT COMPLETE—SEE FIG. 12

2 DISCONNECT BOLTS

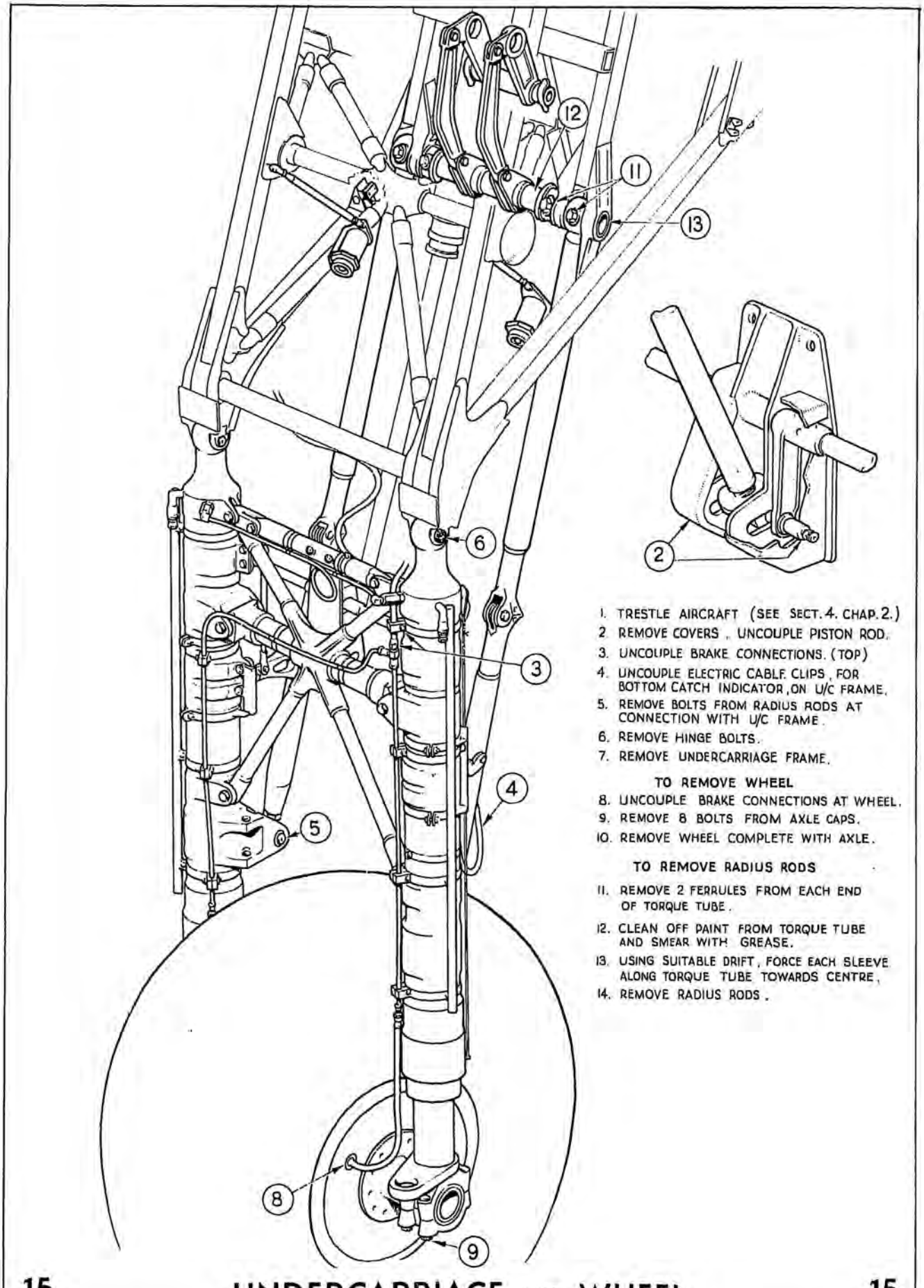
3 REMOVE JACK AND DRAIN

HYDRAULIC JACKS

13



1. JACK OR TRESTLE (SEE FIG. 1. IN SECTN 4. CHAP 2.)
2. REMOVE ENGINE MOUNTING (PARA. 25)
   UNDERCARRIAGE (FIG. 15) U/C DOORS (FIG. 16)
3. DISCONNECT OR REMOVE ALL WIRING, PIPELINES ETC.,
4. " BOLTS IN FRONT SPAR.
5. " " " UNDERSIDE OF CENTRE PLANE
6. TAKE WEIGHT OF STRUCTURE AND REMOVE BOLTS IN TUBULAR MEMBERS.
7. REMOVE STRUCTURE



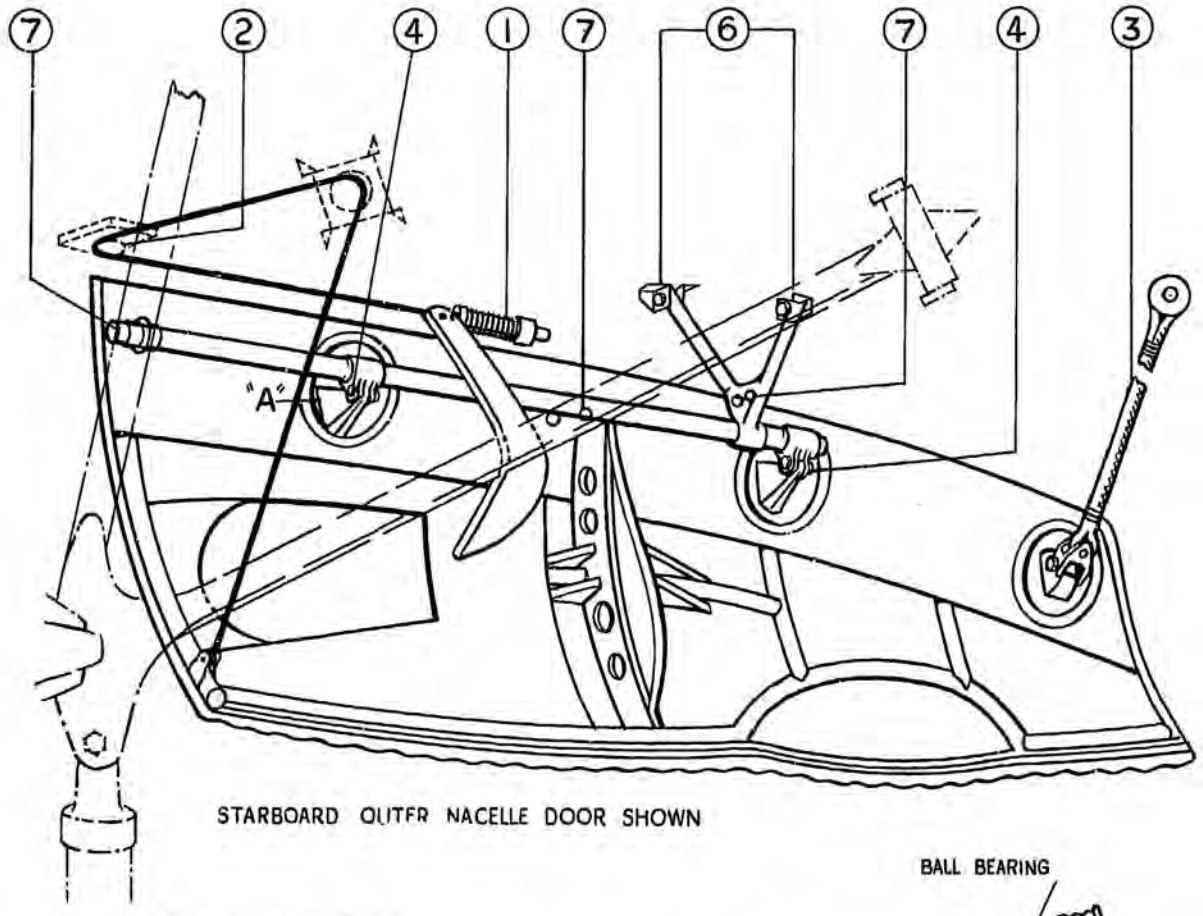
1. TRESTLE AIRCRAFT (SEE SECT. 4. CHAP. 2.)
2. REMOVE COVERS, UNCOUPLE PISTON ROD.
3. UNCOUPLE BRAKE CONNECTIONS. (TOP)
4. UNCOUPLE ELECTRIC CABLE CLIPS, FOR BOTTOM CATCH INDICATOR, ON U/C FRAME.
5. REMOVE BOLTS FROM RADIUS RODS AT CONNECTION WITH U/C FRAME.
6. REMOVE HINGE BOLTS.
7. REMOVE UNDERCARRIAGE FRAME.

TO REMOVE WHEEL

8. UNCOUPLE BRAKE CONNECTIONS AT WHEEL.
9. REMOVE 8 BOLTS FROM AXLE CAPS.
10. REMOVE WHEEL COMPLETE WITH AXLE.

TO REMOVE RADIUS RODS

11. REMOVE 2 FERRULES FROM EACH END OF TORQUE TUBE.
12. CLEAN OFF PAINT FROM TORQUE TUBE AND SMEAR WITH GREASE.
13. USING SUITABLE DRIFT, FORCE EACH SLEEVE ALONG TORQUE TUBE TOWARDS CENTRE.
14. REMOVE RADIUS RODS.



STARBOARD OUTER NACELLE DOOR SHOWN

REMOVAL OF DOOR

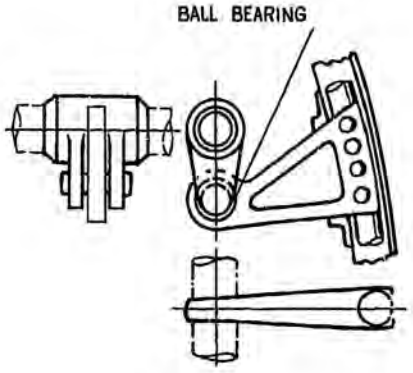
1 SLACKEN TURNBUCKLE

2 DISCONNECT AND PULL CABLES THROUGH PULLEYS

3 DISCONNECT SHOCK ABSORBER CORD

4 TAKE WEIGHT AND REMOVE HINGE BOLTS

5 REMOVE DOOR

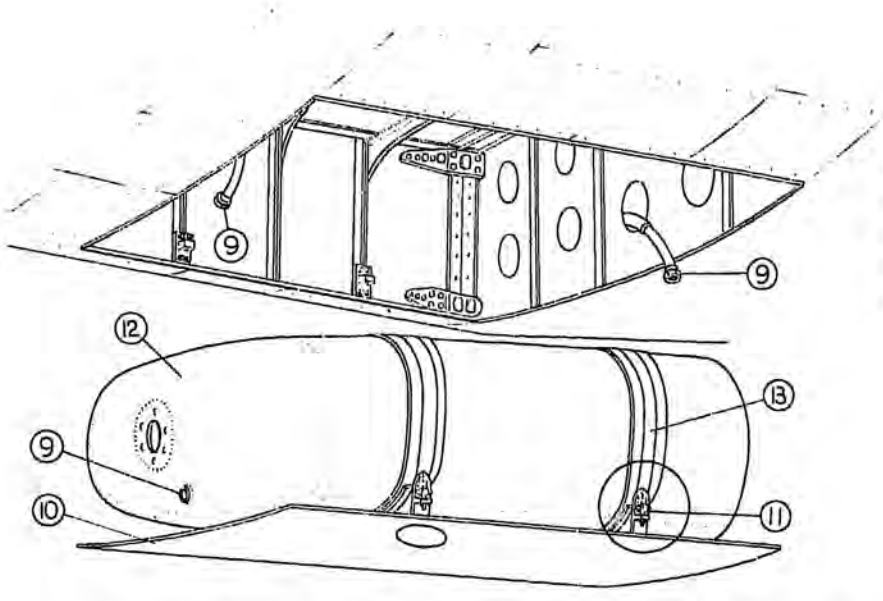


DETAIL "A"

REMOVAL OF BRACKET

6 REMOVE BOLTS IN BRACKET

7 REMOVE BOLTS IN STRUCTURE



OUTER TANK SHOWN
INNER TANK SIMILAR
EXCEPT THAT INBOARD
SIDE OF NACELLE MUST
FIRST BE REMOVED

1 CLOSE SELECTOR COCKS IN COCKPIT

2 DISCONNECT PIPE AT FILTER AND ATTACH SUITABLE HOSE TO DIRECT FUEL TO CONTAINER

3 SELECT TANK OPEN COCK AND DRAIN TANK

4 DISCONNECT VENT PIPE

5 DISCONNECT ELECTRICAL WIRING AT FUEL GAUGE

6 SLACKEN JUBILEE CLIP

7 DISCONNECT JETTISON PIPE

8 DISCONNECT PNEUMATIC PIPE

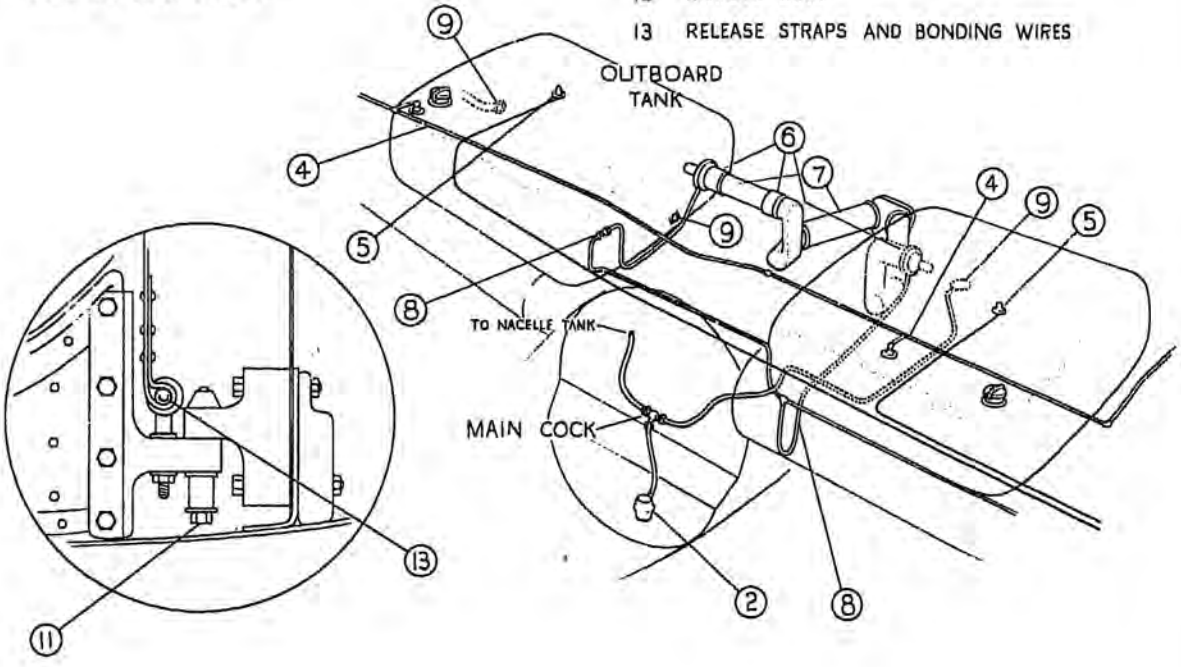
9 OUTBOARD TANK—DISCONNECT PIPES LEADING TO NACELLE TANK AND EXTREME OUTER TANK. INNER TANK, DISCONNECT DELIVERY PIPE LEADING TO MAIN COCK

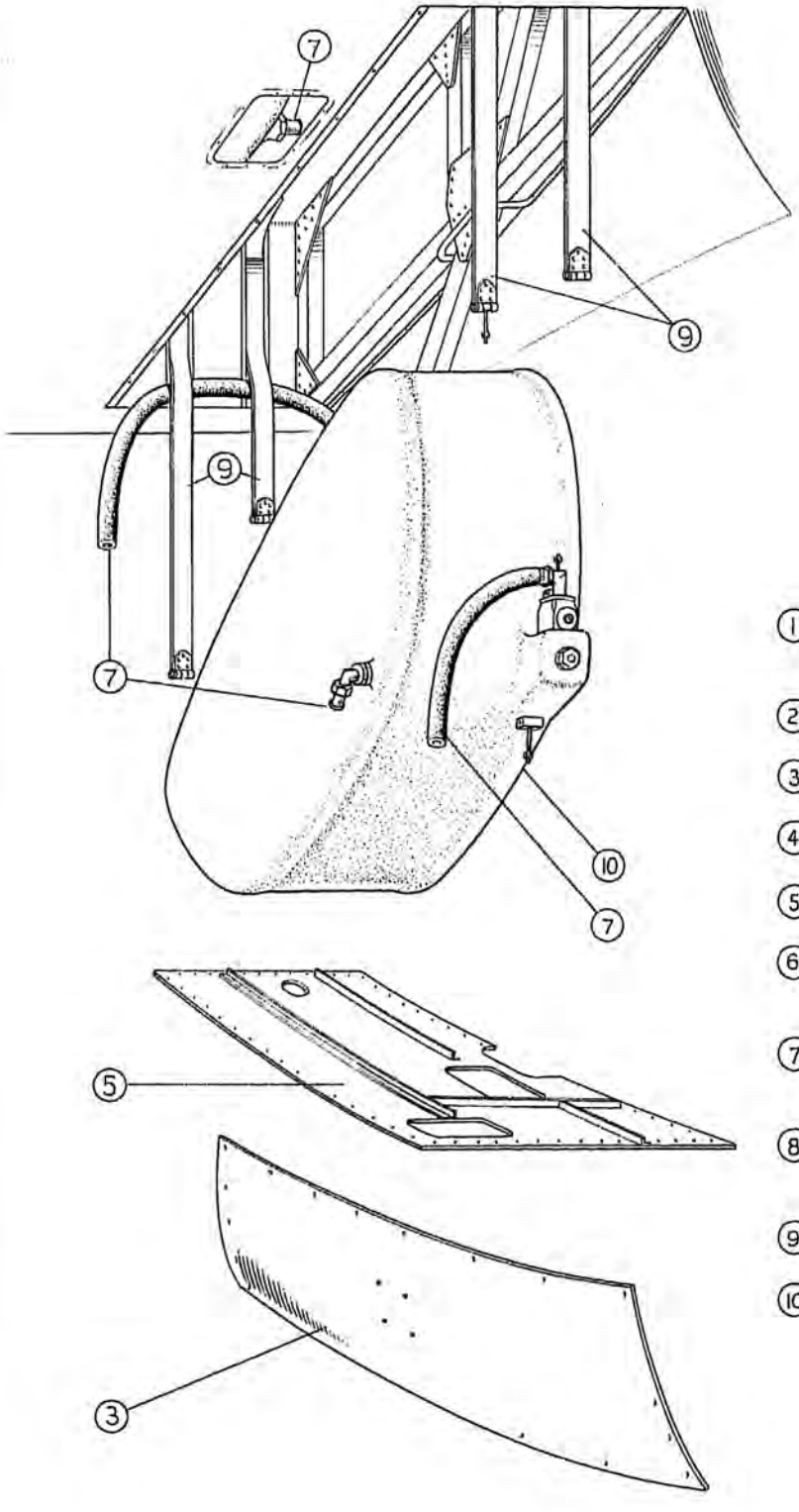
10 SUPPORT TANK AND REMOVE SCREWS AROUND EDGE OF PANEL

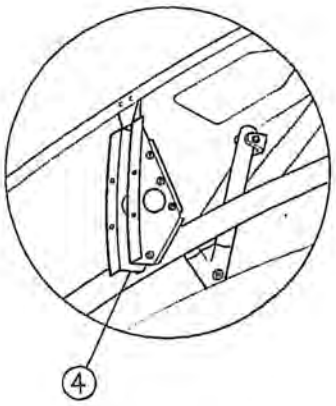
11 REMOVE FOUR MAIN BOLTS

12 REMOVE TANK

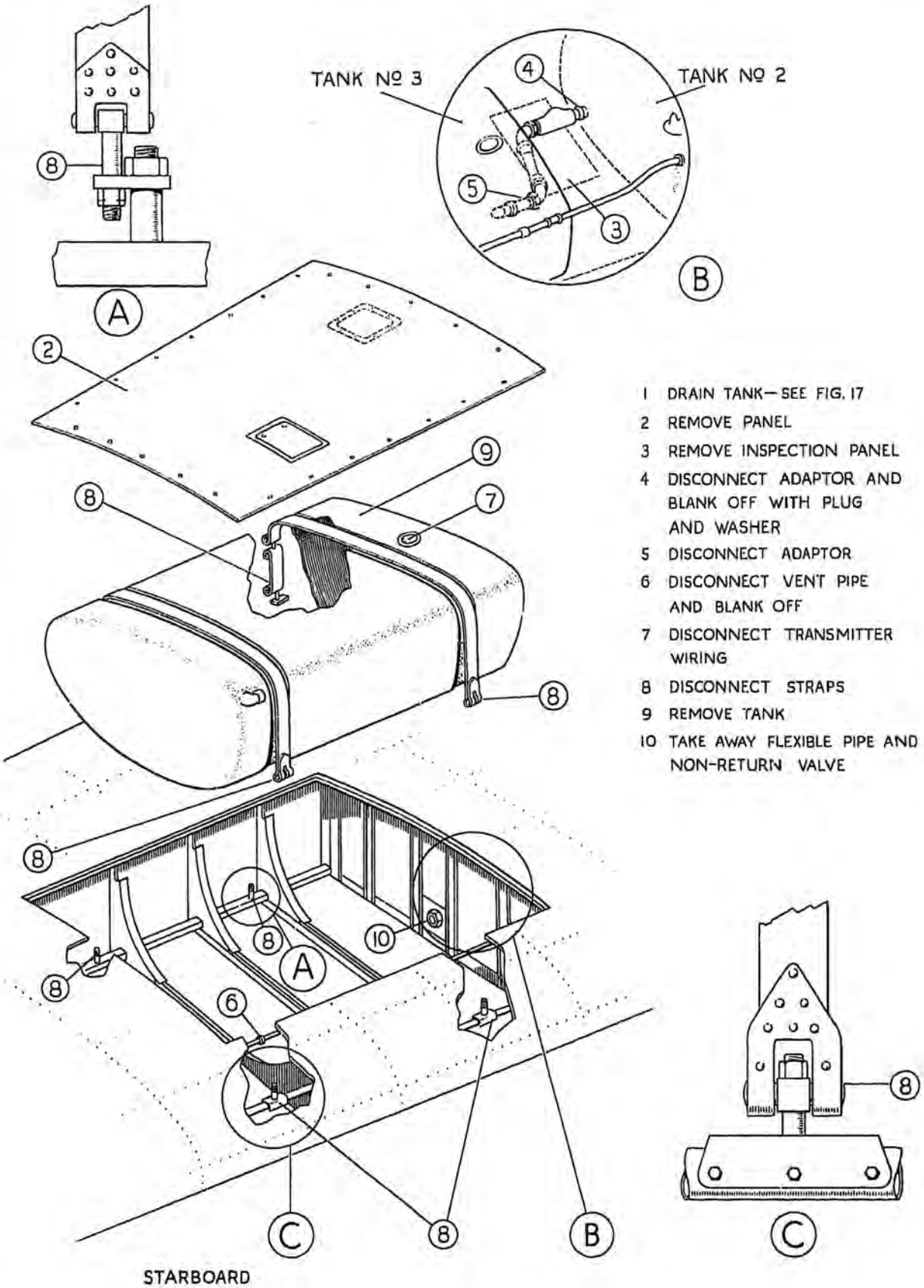
13 RELEASE STRAPS AND BONDING WIRES







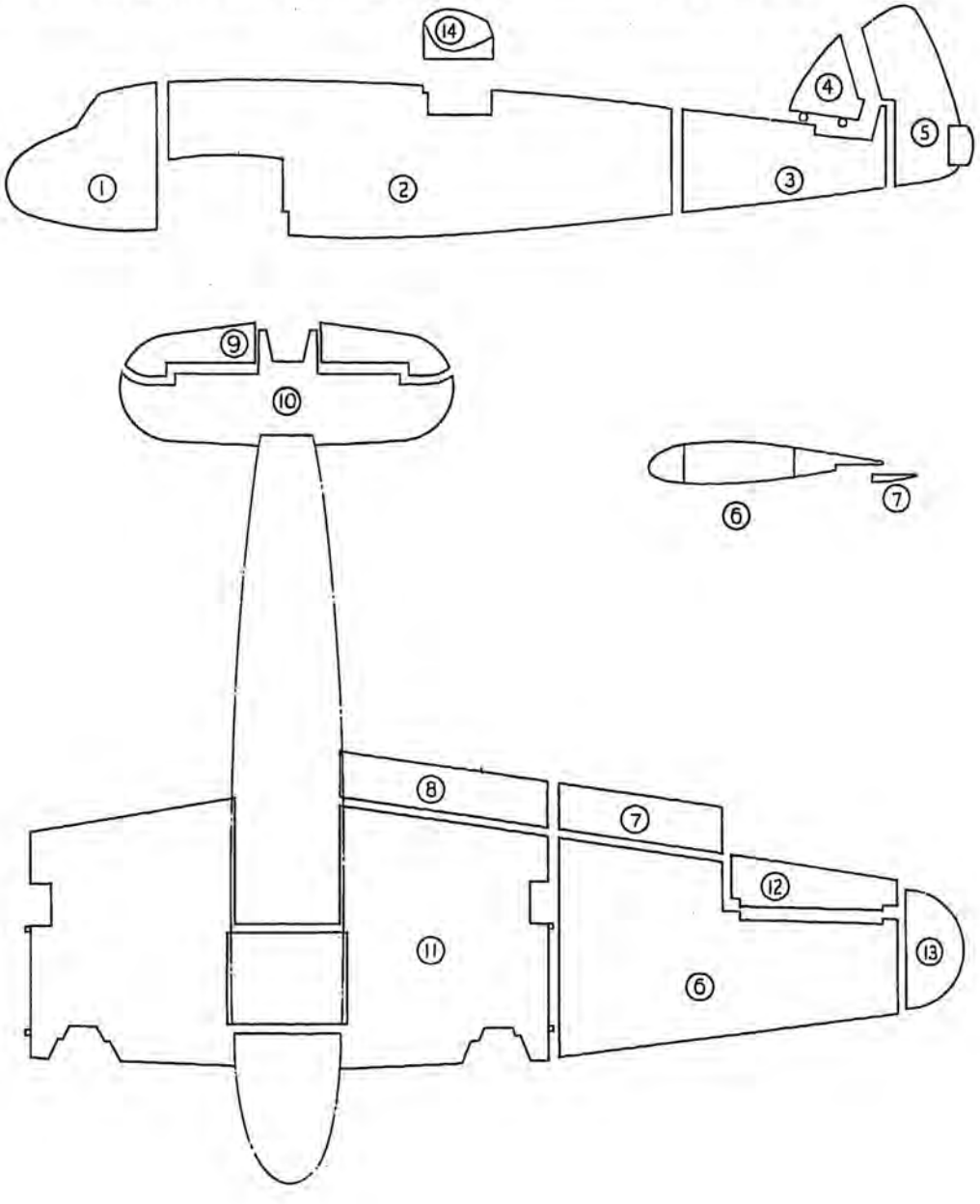
1. CLOSE FUEL COCK FROM COCKPIT
2. DRAIN TANK — SEE FIG. 17
3. REMOVE NACELLE FAIRING
4. DISCONNECT SUPPORT BRACKET
5. REMOVE PANEL
6. DISCONNECT VENT PIPE AND BLANK OFF (NOT SHOWN)
7. DISCONNECT FLEXIBLE PIPES AND BLANK OFF
8. DISCONNECT TRANSMITTER WIRING. (NOT SHOWN)
9. RELEASE STRAPS
10. REMOVE TANK



1 DRAIN TANK—SEE FIG. 17
2 REMOVE PANEL
3 REMOVE INSPECTION PANEL
4 DISCONNECT ADAPTOR AND BLANK OFF WITH PLUG AND WASHER
5 DISCONNECT ADAPTOR
6 DISCONNECT VENT PIPE AND BLANK OFF
7 DISCONNECT TRANSMITTER WIRING
8 DISCONNECT STRAPS
9 REMOVE TANK
10 TAKE AWAY FLEXIBLE PIPE AND NON-RETURN VALVE

19 EXTREME OUTER TANK 19

	COMPONENT	LENGTH	WIDTH	HEIGHT
1	FRONT FUSELAGE	6' - 2"	4' - 7"	6' - 3"
2	REAR FUSELAGE	20' - 8"	4' - 8"	6' - 7"
3	STERN FRAME	9' - 1"	3' - 4"	5' - 3"
4	FIN	4' - 1"	0 - 9"	4' - 1"
5	RUDDER	5' - 0"	1' - 4"	8' - 4"
6	OUTER PLANE	15' - 4"	10' - 4"	1' - 9"
7	OUTER PLANE FLAP	7' - 5"	2' - 1"	0' - 4"
8	CENTRE PLANE FLAP	9' - 2"	2' - 1"	0' - 4"
9	ELEVATOR (EACH)	9' - 1"	3' - 1"	0' - 7"
10	TAIL PLANE	20' - 1"	5' - 10"	2' - 4"
11	CENTRE PLANE	23' - 2"	11' - 8"	2' - 3"
12	AILERON	7' - 11"	2' - 4"	0' - 6"
13	WING TIP	2' - 5"	5' - 5"	0' - 7"
14	OBSERVER'S HOOD	2' - 8"	2' - 11"	1' - 11



THE

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

R.A.A.F. Publication No. 615.

SECTION 6.

ELECTRICAL AND RADIO INSTALLATION.

SECTION 6 — CHAPTER 1.

Electrical Installations

Description and Location of Components

CONTENTS.

Electrical Installations

Description and Location of Components

GENERAL.

1. A description of the electrical installation, together with the location of the main components in the aeroplane, is given in this section. Wiring diagrams, together with accessibility to components and maintenance notes, are given in Chap. 2. For complete instructions reference should be made to R.A.A.F. Publication 607.

2. The installation consists essentially of two 1,500 watt 24V D.C. generators connected in parallel, one on the starboard and one on the port engine, two 12 volt accumulators connected in series, and the various circuits under the headings "Electrical Installation" and "Auxiliary Electrical Installation". The voltage of the system is controlled by two voltage regulators, one in each generator circuit. The various circuits are fused through the fuse and instrument panel and the sub-fuse panel. In the fuse and instrument panel there are 3 banks, A, B and C, and in the sub-fuse panel, banks D and E; also two fuses for the generator and accumulator circuits not incorporated in a bank. The auxiliary installation, supplied from the sub-fuse panel through the auxiliary junction box comprises the R.P., R.I. compass and bombing circuits.

PANELS.

Voltage Regulator Panel:

3. The voltage regulator panel is situated just forward of the rear spar on the port side of the rear fuselage. The voltage regulators are of the carbon pile type and regulate the voltage output of the generators. Other equipment on this panel consists of accumulator cut-outs, two magnetic switches for landing lamps and two power plugs ("W" and "X") for the TR5043 wireless equipment.

Instrument and Fuse Panel:

4. The instrument and fuse panel is mounted in a metal box with a removable lid, and is situated just forward of the observer's station on the port side of the fuselage. The panel contains the main fuses, three banks each of eight fuses, and switches for cutting out the shunt fields of the generators. A bank of terminals for the general services is also provided. There is a fuse allocation and rating chart on the inside of the panel lids.

4a. The sub-fuse panel is mounted in a similar manner to, and immediately forward of, the instrument and fuse panel. Two fuse banks, namely "D" and "E", are mounted on the outside face of the panel. Fuse allocation and ratings are given on the fuse bank lids.

5. Ten junction boxes are fitted in the kit installation. The boxes are numbered J.B.2.B. to J.B.10.B. respectively, and are positioned as follows:—

J.B.2.B.	Rear of vertical armour plate in nose.
J.B.3.B.	Rear fuselage, just aft of front spar, port.
J.B.4.B.	Rear side of starboard bulkhead.
J.B.5.B.	Rear side of port bulkhead.
J.B.6.B.	Aft of rear fuselage, port.
J.B.7.B.	Below observer's panel, starboard.
J.B.8.B.	Rear of front spar, starboard.
J.B.9.B.	On starboard wing joint, Inspection panel 36 (Sect. 6, Chap. 2, Fig. 7).
J.B.10.B	On port wing joint, Inspection panel 36 (Sect. 6, Chap. 2, Fig. 7).

Auxiliary Junction Box on starboard side of fuselage between spars.

STARTER RELAY UNIT.

6. The starter relay unit, situated below junction box No. J.B.8.B., contains two magnetic relay switches for engine starting, and the battery master switch is mounted on the box aft. The engine starter cables extend from the relay units along the forward face of the front spar to each engine nacelle. Cables also extend from this unit to the external starting socket.

ELECTRIC POWER SUPPLY.

7. The power supply for the general electrical services is obtained from two 24 volt 1,500 watt, engine driven Rotax generators, type KX, connected in parallel, one being mounted vertically on the top face of each accessory gear box. The generators charge two 12 volt, 40 ampere hour accumulators connected in series, and mounted on trays immediately behind the front spar on the port side of the fuselage. The generators are of the shunt wound type. Carbon pile voltage regulators type F24 for maintaining a constant voltage irrespective of engine speeds and load fluctuations and to give proper parallel operation, are fitted on the voltage regulator panel. In order to eliminate interference with the wireless equipment, a type W suppressor is connected in each of the generator circuits and fitted on the lower section of the nacelle bulkhead.

COWL GILLS.

8. The cowl gill motor is mounted on the port side of each engine nacelle. The motors are of the series wound type, each driving a shaft through a five stage epicyclic reduction system; a solenoid-released brake is also incorporated, the brake being normally retained in the "ON" position by a spring. The solenoid winding is connected in series with the motor so that, while the motor is running, the brake is off. A switch unit for each motor (including a warning lamp which lights when the motor circuit is completed) is mounted on the port side of the cockpit (see Sect. 1). The switch is of the two way and off type, engraved "OPEN", "OFF" and "CLOSED". To lock the switch when not in use pull the knob out. Further operational instructions are given in Sect. 1, Para. 35.

DINGHY.

9. The aircraft is fitted with electrical equipment for releasing the dinghy from the aeroplane. The dinghy operating head and Crabtree socket are situated under the stowage cover on the port side of the centre plane, aft of the rear spar. The immersion switch, which completes the operating head circuit, is situated in the underside of the front fuselage aft of the nose cap.

ENGINE IGNITION.

10. Two magnetos, mounted at the rear of each engine, are controlled by separate switches, the four switches being combined in a single unit on the starboard side next to the instrument flying panel. The isolating spark gaps, which isolate the booster coil windings when the engines are running, are mounted on the engine mounting tubes adjacent to the magnetos. One is fitted in each of the high tension cables which connect the booster coil with the inboard magneto of the port engine, and the outboard magneto of the starboard engine (see Sect. 8, Para. 24).

ENGINE STARTING AND FEATHERING CIRCUITS.

11. These circuits provide current for the operation of the booster pumps for the hydromatic propellers, and electric engine starting. The push button switches in the pilot's cockpit operate the boost coil and starter, while feathering is carried out by means of the feathering switches, mounted on the port side of the pilot's cockpit just aft of the cowl gill switches. For external starting a B.T.H. type socket is situated on the lower outside of the front fuselage. Engine starting is effected by means of a Rotax type C1231 direct cranking starter which engages with the main engine crank. The starter may be operated either electrically or manually.

For manual operation, a crank handle is used; this handle is stowed beneath the wireless power unit in the rear fuselage. Although feathering is electrically controlled, it is effected by hydraulic fluid under pressure, which is provided by an electrically driven pump located in each engine nacelle.

FUEL PUMP MOTORS.

12. An auxiliary fuel pump is provided for each engine and is connected in the main fuel line. These pumps are driven by Delco type A49 47-A motors, and are operated by a switch on the pilot's starboard switch panel. This circuit is interconnected with the inertia switch of the fire extinguisher circuit by means of a relay. In order to eliminate interference with the wireless equipment, a type B suppressor unit is connected in each circuit. The assembly is mounted on the lower engine mounting tube in the outboard port, inboard, starboard side of each engine nacelle.

FIRE EXTINGUISHERS (ENGINE).

13. Two shielded push-buttons situated on the starboard side of the pilot's instrument panel are used for releasing the contents of the cylinder. The cylinders are mounted on the front face of each fireproof bulkhead. An impact switch and gravity switch are mounted on a bracket aft of the fuselage nose cap on the starboard side; the gravity switch is inoperative when the undercarriage is retracted.

RESIN LIGHTS.

14. These consist of filament lamps in small tubes attached to the trailing edge of the perspex wing tips, port and starboard. The lamps are used for formation-keeping, and have removable colored glass, which can easily be changed. The Resin Lights are operated by the centre section of the lower aft 3 unit switch box mounted on the starboard switch panel in the front fuselage. Alternative coloured glasses are stowed in spring clips on the inner surface of the wing tip inspection cover.

IDENTIFICATION LAMPS.

15. The downward identification lights are controlled by means of a three-way single unit switch, and a signallling switchbox. The three-way switch is mounted forward of two switches controlling the port and starboard fuel pump motors. The three switches are mounted on a panel below the starboard sill tube. The signalling switchbox, mounted on the starboard side of the aircraft forward of the three unit switch, provides for the use of the downward identification lamps through the morsing key or, alternatively, a steady illumination from the lamps. The desired downward lamp (Red, Green or Amber) should be selected on the three-way switch rear of the signalling switchbox. The three downward lamps are mounted on the underside of the fuselage aft of the observer's hatch.

INTERIOR LAMPS.

16. The interior lighting of the aeroplane consists of five flood lamps, with red colour filters each controlled by a separate dimmer switch; three roof lamps, each operated by a push switch incorporated in the lamp cover; and a panel lamp, controlled by a dimmer switch, for the observer. The locations of the lamps and dimmer switches are as follows:—

COMPONENT.	LOCATION.
Pilot's stbd. cockpit floodlight	Stbd. switch panel front fuselage
Pilot's stbd. switch panel light	Above stbd. switch panel
Pilot's port cockpit floodlight	Port switch panel front fuselage
Pilot's port switch panel light	Above port switch panel

INTERIOR LAMPS—(*continued*).

COMPONENT.	LOCATION.
Pilot's dashboard light	On dashboard above pilot's instrument panel
Pilot's emergency dashboard light	Above pilot's instrument panel
Pilot's gunsight socket	Corner of pilot's instrument panel
Forward cockpit light	Roof above pilot's escape hatch
Starboard gun loading floodlight	F83.5 stbd. rear fuselage
Port Gun loading floodlight	F83.5 port rear fuselage
Middle cockpit light	Roof of rear fuselage, F97.
Observer's instrument panel light	Roof of rear fuselage, F124
Observer's compass light	Forward end of observer's hood
Aldis Lamp Socket	Port side rear fuselage
Port rear cockpit light..	Rear end of observer's hood
Tail drift sight socket	In stowage bag near floor on port side of observer's hatch.
Observer's chart lamp	On observer's table
Starboard rear cockpit light	Rear end of observer's hood
Tail drift sight floodlight	On floor starboard side of observer's hatch

EMERGENCY LIGHTING.

17. An emergency lighting system is provided in the pilot's cockpit which may be brought into operation should the battery circuits fail. The emergency light is fed through a switch on the pilot's starboard switch panel from a small 2 volt accumulator.

REFLECTOR GUN SIGHT.

18. The reflector sight socket, on the starboard side of the flying instrument panels, is controlled from a dimmer switch on the port side of the flying instrument panel.

LANDING LAMPS.

19. Two landing lamps protected by a transparent panel, mounted adjacent to each other, are provided on the leading edge of the port outer plane. Both lamp beams can be dipped from the horizontal position (aeroplane tail down) through an arc of 40 degrees, the movement of the lamps being controlled from the cockpit. The filaments are controlled by two single unit switches which in turn operate two magnetic relay switches mounted on the voltage regulator panel.

NAVIGATION LAMPS.

20. The forward switch of the three unit switch-box on the starboard sill tube controls the navigation lamps. The lamps are mounted at the front of the transparent wing tip panels and in the trailing edge of the rudder.

FUEL CONTENTS GAUGES.

21. Each tank has a transmitter which registers on a fuel contents gauge. These gauges are situated in two quadruple indicators at the forward end of the port switch panel,

and are controlled by a push switch just below them. The transmitters are all mounted near the inboard side of their respective tanks, under panels in the upper wing surface.

GUN FIRING.

22. Four 20 mm. guns are mounted in the underside of the fuselage, two on the port side and two on the starboard side, outboard of the keel members. (See Sect. 5, Fig. 11.) The guns fire forward through blast tubes mounted in the front fuselage. The guns are cocked and fired pneumatically by two electro-pneumatic units situated under the floor just forward of former 110.5. The cocking and firing units are controlled electrically by a push-button and trigger respectively, mounted on the starboard side of the control column handwheel. (See Sect. 1, Fig. 5.)

HEATED PRESSURE HEAD.

23. The pressure head is electrically heated and is mounted on the underside of the port outer plane. The rear switch of the three unit switchbox on the starboard sill tube controls the heating element.

ALIGHTING GEAR INDICATORS.

24. The master switch for the under-carriage and tail-wheel indicators is mounted on the starboard side panel adjacent to the flying instrument panel. Its operation is described in Sect. 1, Para. 24. The warning devices consist of three position indicators, labelled "Port", "Tail" and "Starboard", on the port side of the Pilot's instrument panel; also a horn, mounted just forward of the rudder pedals. The undercarriage and tailwheel indicator switches (illustrated in Sect. 7, Chap. 3, Figs. 4 and 6) are located as follows:—

The undercarriage "DOWN" switches are mounted on the inboard starboard, and outboard Port undercarriage locking latch and the undercarriage "UP" switches, on the square member of the undercarriage structure, in the nacelle. The tail wheel switches are on the former next to the tail wheel retracting arm. The indicator switches are operated by the locking catches on the undercarriage and the tail wheel retracting mechanism.

25. Each of the three position indicators consists of two electro-magnetic bobbins and two moving soft-iron cores. The cores are mounted on a spindle to which is attached an arm carrying a mask. When the alighting gear is being retracted or lowered, or the master switch is "OFF", the cores and the mask are centralized by a spring. When either the top or bottom undercarriage catch is locked home, the switch inter-connected with that catch closes, causing the appropriate bobbin to be energized and attract the iron core, thus moving the mask and uncovering the word "UP" or "DOWN", according to the switch that is closed.

26. The warning horn comes into operation through the throttle switch, when the levers are in less than about one-third of the open position, and remains in operation with the throttle in this position until the alighting gear units are locked down.

SECTION 6 — CHAPTER 2.

Electrical Installation

Maintenance Notes and Wiring Diagrams

CONTENTS.

ILLUSTRATIONS.

Electrical Installation

Maintenance Notes and Wiring Diagrams

INTRODUCTION.

1. This section contains the wiring diagrams of the various circuits, notes on the interpretation of the diagrams, access to components, and maintenance notes for equipment peculiar to this aeroplane. A description of the position of the electrical components is given in Chapter 1. For further details refer to Beaufighter Mk.21 Electrical Manual R.A.A.F. Publication No. 607.

2. The wiring of the aeroplane is mainly contained in protected and screened flexible conduits, and metal braided cables, with multi-point plugs and sockets. Where a large conduit is divided into a number of smaller ones a junction box is provided. Part of the wiring for the landing lamps, navigation lamps, and resin lights is contained in open ended light alloy conduits. The positions of the conduits, junction boxes, and other components in the aeroplane are shown in Fig. 1. Schematic wiring diagrams of electrical services are given in Figs. 3 to 6.

INTERPRETATION OF DIAGRAMS.

Circuit Wiring Diagrams:

3. The circuit wiring diagrams show the wiring diagrammatically.

4. The fuses, conduits, junction boxes, plugs and sockets, and the terminals within the junction boxes have identification markings on them consisting of reference letters and/or numbers (see Paras. 5 to 10); these references are indicated on the diagrams.

Referencing of Fuses:

5. The three banks of fuses on the instrument and fuse panels are lettered A, B and C respectively. Each bank contains eight fuses which are numbered 1 to 8. Separate fuses, which do not bear any identification, are the generator main fuses which are mounted on the cover of the fuse and instrument panel. As previously mentioned (Ref. Sect. 6, Chap. 1), there are two other fuse banks D and E mounted on the sub-fuse panel.

Referencing of Conduits:

6. Each conduit bears a number with a prefix letter as follows:—

"F" for fuselage, "P" for port wing and "S" for starboard wing, e.g., F.1 and S.1.

Referencing of Junction Boxes:

7. Each junction box bears a number prefixed by the letter J.B. and suffixed with the letter B., e.g., J.B.2.B.

Referencing of Plugs and Sockets:

8. The faces of the plugs and sockets are identified by a series of letters and/or numbers, the identification for a particular plug pin is repeated on the corresponding plug pin or socket at the other end of the conduit.

Referencing of Terminals in Junction Boxes:

9. The terminals inside the junction boxes have a number prefixed by the circuit reference letter, the number being one of a series of numbers for that particular circuit, e.g., generator circuit reference "A", terminal reference "A.12".

10. It should be noted that the engine speed indicator circuits, and the emergency lighting circuit, are not connected to the aeroplane supply. The engine speed indicators are supplied from separate generators.

SCREENED SYSTEM DETAILS.

General:

11. The screened conduit system is one in which all the wiring is made up in units on the bench, and assembled in the aeroplane by means of multiple plugs and sockets.

12. The screened conduits or cable assemblies contain combinations of 4, 7, 19, and 37 amp. wires, each of which terminate in a metal socket pin, which is assembled in a plastic moulding, and enclosed in a light alloy housing.

13. The junction boxes and panels contain terminals for each of the services passing through them. Mounted on the junction boxes are multiple plugs which accommodate the appropriate socket assemblies.

14. Fault location is assisted by the fact that every wire is designated at both ends. Fault rectification is simplified, in that the entire conduit assembly, or component affected, can be rapidly removed and replaced. The affected item can either be repaired on a bench, or a new part drawn from the store.

Multiple Plugs:

15. These consist of a series of single ended plug pins fitted in a plastic moulding. The moulding is assembled in a plug housing, which has a square base with four holes, by means of which it is secured to the junction box or panel. The pins, which are identified by raised letters, and/or numbers, on both faces of the moulding, are so arranged that the multiple plug cannot be wrongly inserted in the socket assembly.

Multiple Sockets:

16. These consist of a series of socket pins, fitted in a plastic moulding, on both faces of which are raised identification letters and/or numbers. A clearance in the socket assembly serves the dual purpose of ensuring the alignment of the plug pins in their associate sockets, and also permits the multiple sockets to be assembled after the soldered joints have been made. This latter feature is particularly useful when, in carrying out maintenance repairs, it is necessary to examine the joints of the socket assembly.

Multiple Bulkhead Plugs:

17. These consist of a series of double ended plugs fitted in a plastic moulding; one face of the moulding is marked "A". Owing to the reversal of the pin dispositions on the opposite faces of the moulding, the two socket assemblies associated with any one bulkhead plug have oppositely disposed socket pins. The plug is assembled in a double housing bolted together through the disconnection points. The half marked "A" should be located on the forward side of the bulkhead.

Conduits:

18. These consist of "Nylex" tubing with ferrules or plugs at each end. The cables either terminate at the plugs to which they are soldered or have Ross Courtney terminals attached; in both cases they have a rubber sleeve, with the cable number and locations printed on it, for identification and protection, at the terminal point. The conduit No., Part No., Code No., etc., are printed on the "Nylex" close to each end.

Metal Braided Cable Assemblies:

19. These consist of one or more metal braided cables connected at one end to a socket by means of a ferrule and a coupling nut. The other ends of the cables are identified by markers, and are connected direct to the appropriate equipment. The socket pins are wired and marked in a similar manner to that described in Para. 16. Bonding is effected by sweating or by binding with tinned copper wire at the ferrule.

Junction Boxes:

20. These are fitted with a number of multiple plugs; the plugs are bonded to the junction box, and the outlets bear conduit reference numbers that agree with the appropriate conduit run. The box is wired by soldered connections to the plug pins, and thence to the terminals. Each wire is protected by rubber sleeves at both ends; these should cover the soldered joint completely. At the terminal end, the sleeve is brought up close to the tag, thus ensuring protection of the flexible conductors. Terminals to which the wires are connected are similarly marked.

Access to Components:

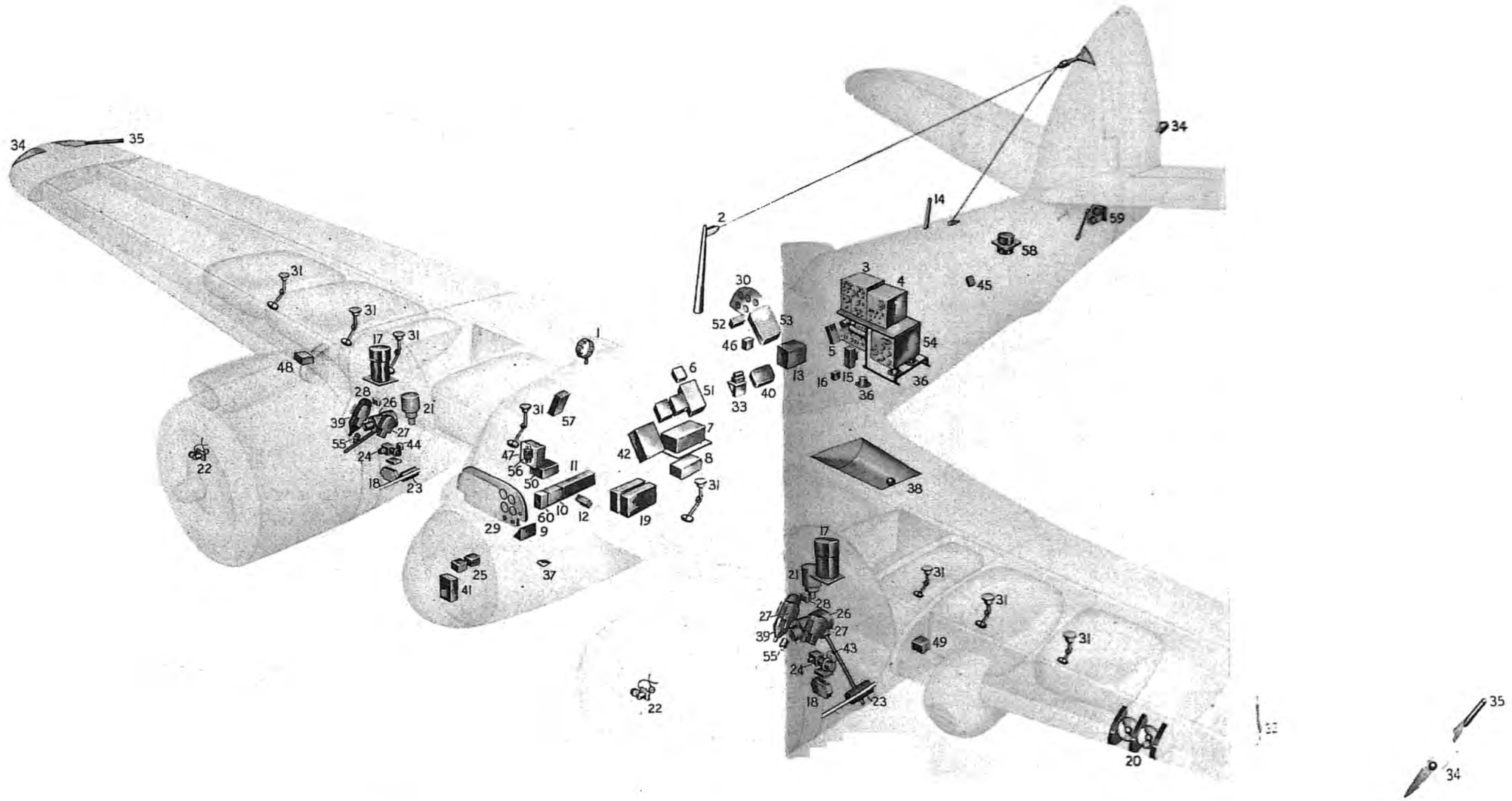
21. Only those items of electrical equipment are given, where the removal of other equipment or of an inspection panel is necessary. The cables for the instruments and switches on the pilot's instrument panel are long enough to allow removal of the units. The position of inspection panels is shown in Fig. 7. Numbers after the following items in the second column are references to this drawing.

LOCATION AND MEANS OF ACCESS TO MAIN COMPONENTS (Refer Fig. 6).

COMPONENTS.	MEANS OF ACCESS.
(i) Junction Boxes J.B. 2 B.	Remove fuselage nose cap (Inspection Panel No. 8) and vertical armour plating.
J.B. 4 B.	Rear side of Starboard Bulkhead.
J.B. 5 B.	Rear side of Port Bulkhead
J.B. 9 B.	Stbd. Wing Joint (Inspection Panel No. 36).
J.B. 10 B.	Port Wing Joint (Inspection Panel No. 36).
(ii) Generator and accumulator circuit	
D.C. generator (Port and Starboard)...	Remove top panel of nacelle and air intake (Inspection Panel No. 20).
(iii) Suppressors	Remove bottom panel of nacelle (Inspection Panel No. 18).
(iv) Cannon firing	
Electro-pneumatic units	Remove panel under fuselage (Inspection panel No. 40).
Cocking button and firing trigger ..	Control hand-wheel, starboard side.
(v) Cowl gills.	
Port engine (Motor and terminal blocks B. 1 and B. 2).	Remove outboard side panel of nacelle (Inspection Panel No. 19).
Starboard engine (Motor and terminal blocks B. 3 and B. 4).	Remove inboard side panel nacelle (Inspection Panel No. 19).
(vi) Dinghy	
Operating head and socket	Remove stowage (Inspection Panel No. 29) cover, on top of port centre plane, aft of rear spar.
Immersion switch	Through inspection panel in bottom of front fuselage, just aft of nose cap (Inspection panel No. 7).
(vii) Engine ignition	
Magnetos and isolating spark gap ..	Remove both nacelle side panels of engine in question (Inspection panel No. 19).
Boost coil	Remove side panel (Port inboard, starboard outboard), of nacelle (Inspection panel No. 19).
(viii) Engine speed indicators	Remove side (Port inboard, starboard outboard) and bottom panel of nacelle. (Inspection panels Nos. 18 and 19).
(ix) Engine starter motors	Remove side panels (Port inboard, starboard outboard), of nacelle. (Inspection panels Nos. 18, 19 and 20.)

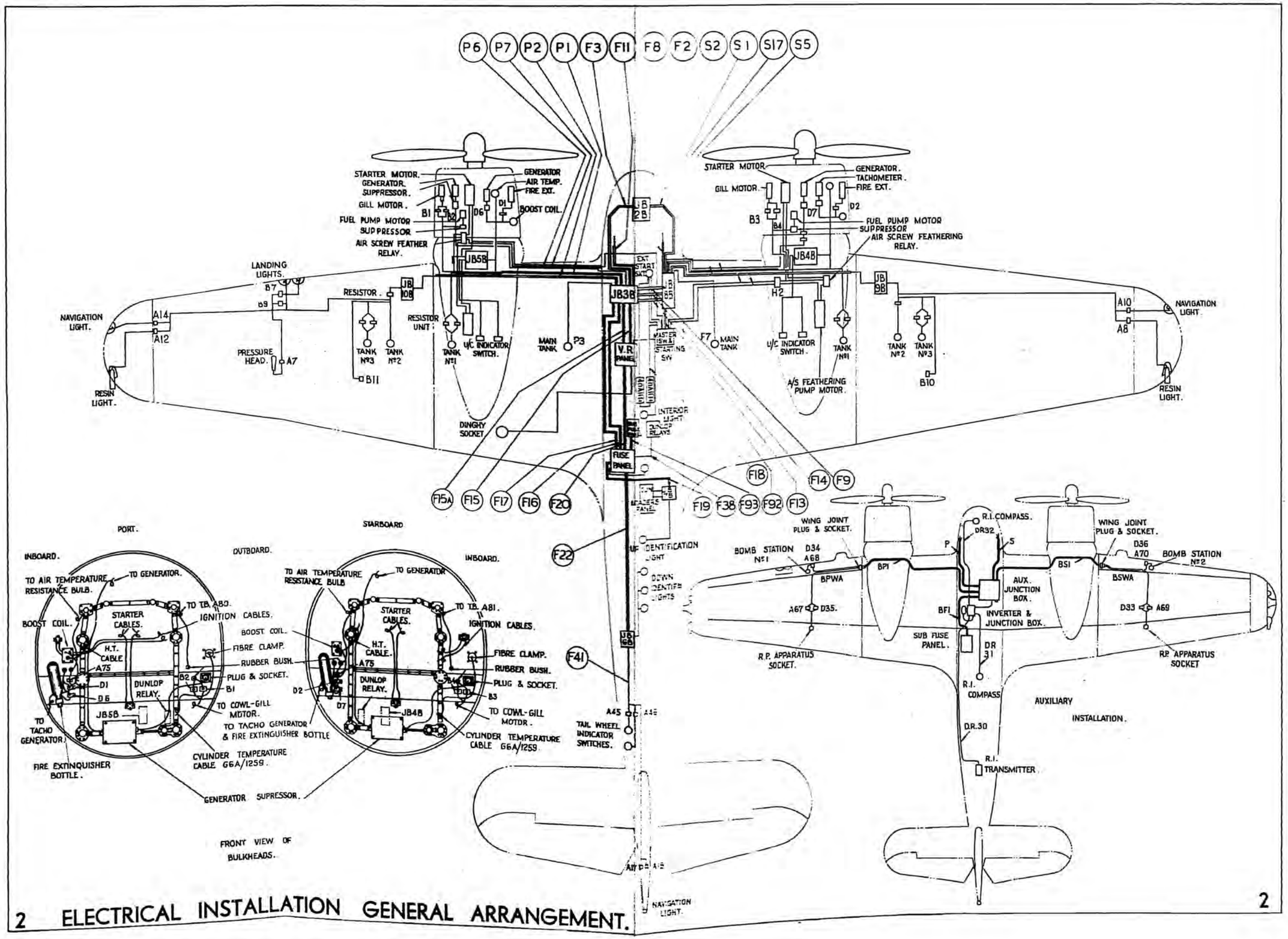
LOCATION AND MEANS OF ACCESS TO MAIN COMPONENTS—*(continued.)*

COMPONENTS.	MEANS OF ACCESS.
(x) Fire extinguisher	
Cylinders	Remove side panel (Port inboard, Starboard outboard) of nacelle. (Inspection panel No. 19).
Gravity switch and impact switch ..	Remove fuselage nose cap and vertical armour plating (Inspection panel No. 8), or accessible from Pilot's cockpit.
(xi) Resin Lights	Attached to the trailing edge of perspex wing tips, port and starboard.
Terminal block A.12, A.14 Port, A.8 and A.10 Starboard	Remove inner inspection panel in underside of wing tip (Inspection Panel No. 2).
Terminal block A.18	Remove large detachable panel each side of rudder spar. (Inspection panel No. 34).
(xii) Fuel contents gauge	
Port and Starboard transmitters ..	Remove small inspection panel on top of Port or Starboard centre plane, and outer plane. (Inspection panels Nos. 30, 28, 26, and 23).
(xiii) Landing lamps	
Inner and outer lamps terminal blocks B.7 and B.9.	Remove transparent panel in leading edge of Port outer plane (Inspection panel No. 4).
(xiv) Navigation Lamps	
Port and Starboard lamps	Same as lamps in (xi)
Terminal Blocks A.10 and A.14.. ..	See (xi).
Terminal Blocks B.7 and B.9	See (xiii).
(xv) Pressure Head	
Terminal Block A.7	Remove inspection panel on top of Port outer plane (Inspection panel No. 35).
(xvi) Alighting gear indicators	
Tail wheel switches, and terminal blocks, A.45 and A.46	Remove inspection panel in stern frame, port side (Inspection panel No. 33).
Undercarriage switches	Visible when undercarriage is down.
Down switches	Outboard Port, inboard Starboard on undercarriage locking latch.
Up switches..	Inboard Port, outboard Starboard on support strut to the oleo leg.
Terminal Block A.2	Under shield just forward of throttle controls on Port side of pilot's cockpit.
(xvii) Horn.	Remove fuselage nose cap and vertical armour plating (Inspection panel No. 8).

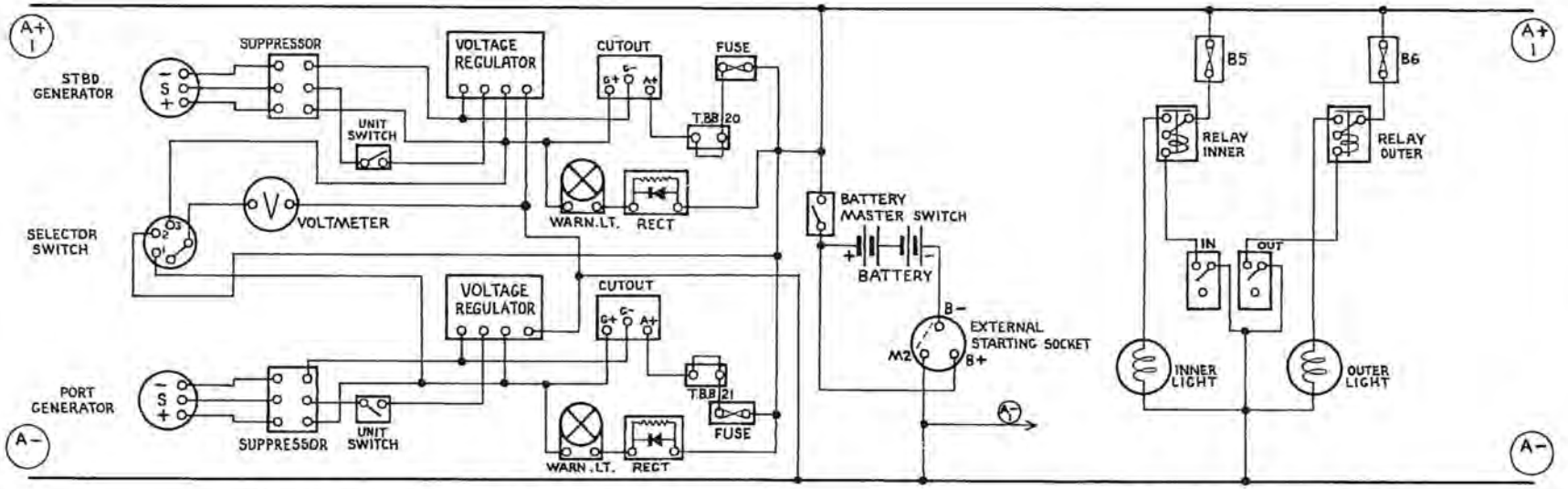


1. D.F. Loop.
2. Aerial.
3. Transmitter type A.T.5.
4. Receiver type A.R.8.
5. Remote Control Panel, Navigator.
6. Voltage Regulator Panel.
7. Transmitter—Receiver Type T.R.5043.
8. Dynamotor.
9. Remote Contactor.
10. Controller, Type 5003.
11. Pilot's Remote Control Unit.
12. Pilot's Switches.
13. Receiver Unit SCR.695.
14. Antenna.
15. Control Unit.
16. Socket Type 108.
17. Generators.
18. Suppressor.
19. Batteries.
20. Landing Lights.
21. Pump Motor—Airscrew Feathering.
22. Governor—Airscrew Feathering.
23. Cowl Gill Motors.
24. Fuel Pump Motor & Suppressor.
25. Inertia Switch and Gravity Switch.
26. Engine Starter Motor.
27. Magnetos.
28. Boost Coil.
29. Instrument Panel—Pilot.
30. Instrument Panel—Observer.
31. Fuel Gauges.
32. Pressure Head.
33. R.I. Compass Inverter.
34. Navigation Lights.
35. Resin Lights.
36. Identification Lights.
37. Immersion Switch.
38. Crabtree socket—dinghy Release.
39. Fire Extinguisher.
40. Cannon Firing Relay Panel.
41. Junction Box—2.
42. Junction Box—3.
43. Junction Box—5 Port. (at Rear of Bulkhead).
44. Junction Box—4 Stbd. (at Rear of Bulkhead).
45. Junction Box—6.
46. Junction Box—7.
47. Junction Box—8.
48. Junction Box—9 Stbd.
49. Junction Box—10 Port.
50. Starter Relay Box.
51. Voltage Regulator Panel.
52. Sub Fuse Panel.
53. Instrument & Fuse Panel.
54. Aerial Coupling Unit.
55. Tachometer Generator.
56. R.P. Equipment.
57. Aux. Junction Box.
58. R.I. Compass Transmitter.
59. Tail Wheel Switch for Undercarriage Indicators.
60. Undercarriage Indicators.

LOCATION OF ELECTRICAL COMPONENTS.



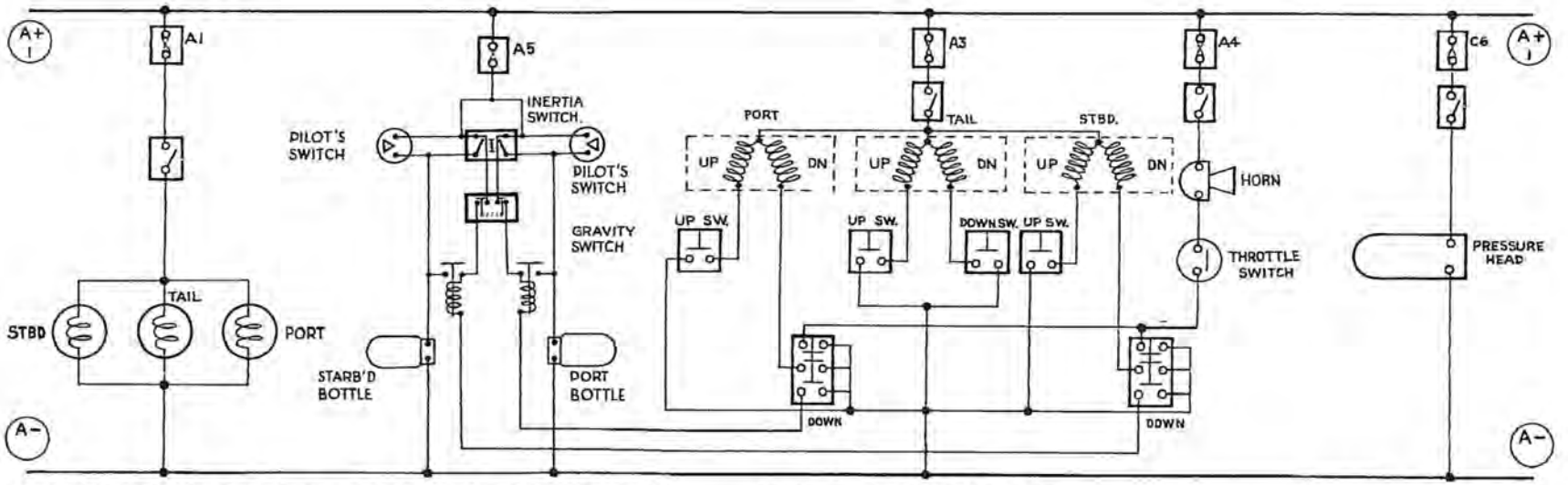
2 ELECTRICAL INSTALLATION GENERAL ARRANGEMENT.



GENERATOR CIRCUIT

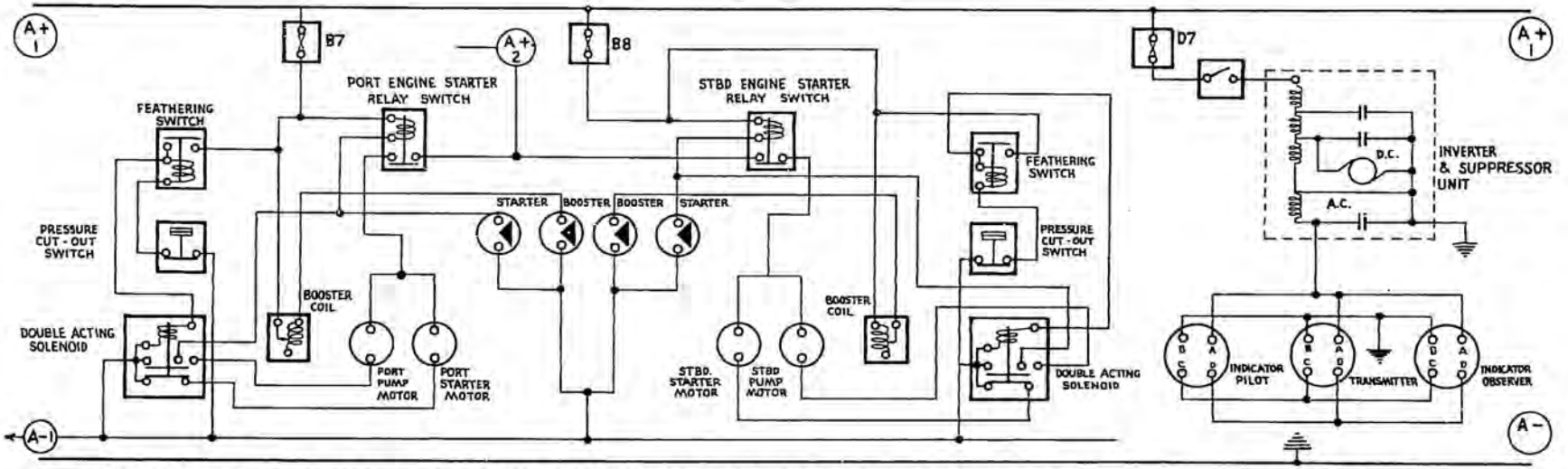
A/C 1 to 300.

LANDING LIGHTS



3 NAVIGATION LIGHTS FIRE EXTINGUISHERS U/C INDICATORS PRESSURE HEAD 3

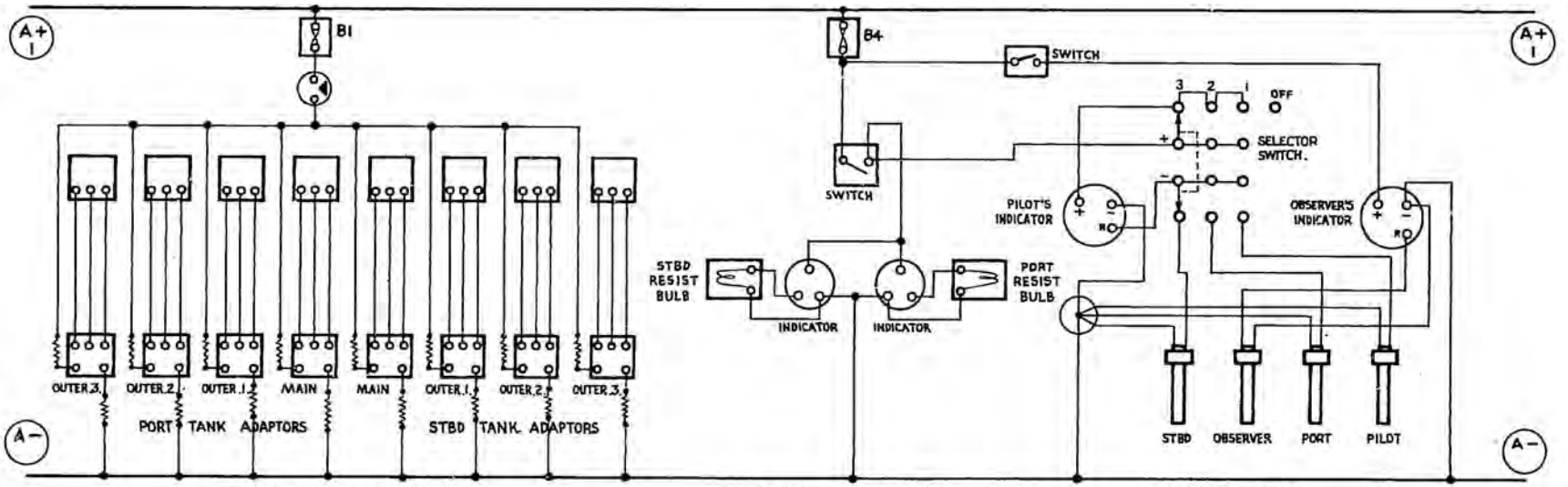
A/C 1 to 300. TO BE AMENDED – RETROSPECTIVE.



ENGINE STARTING, BOOSTER COIL & HYDROMATIC AIRSCREW FEATHERING

R.I. COMPASS

A/C 1 to 300 TO BE AMENDED – RETROSPECTIVE.

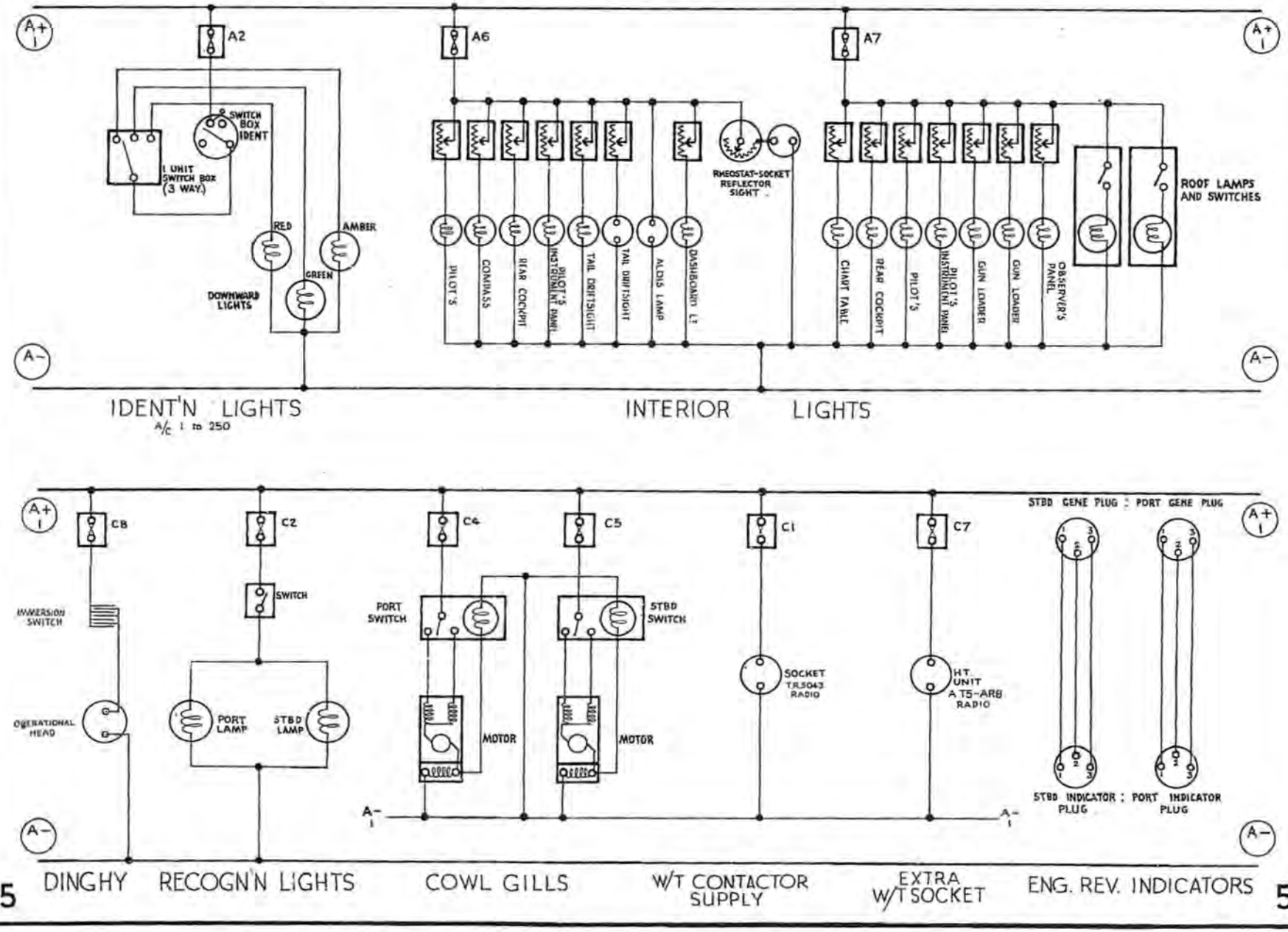


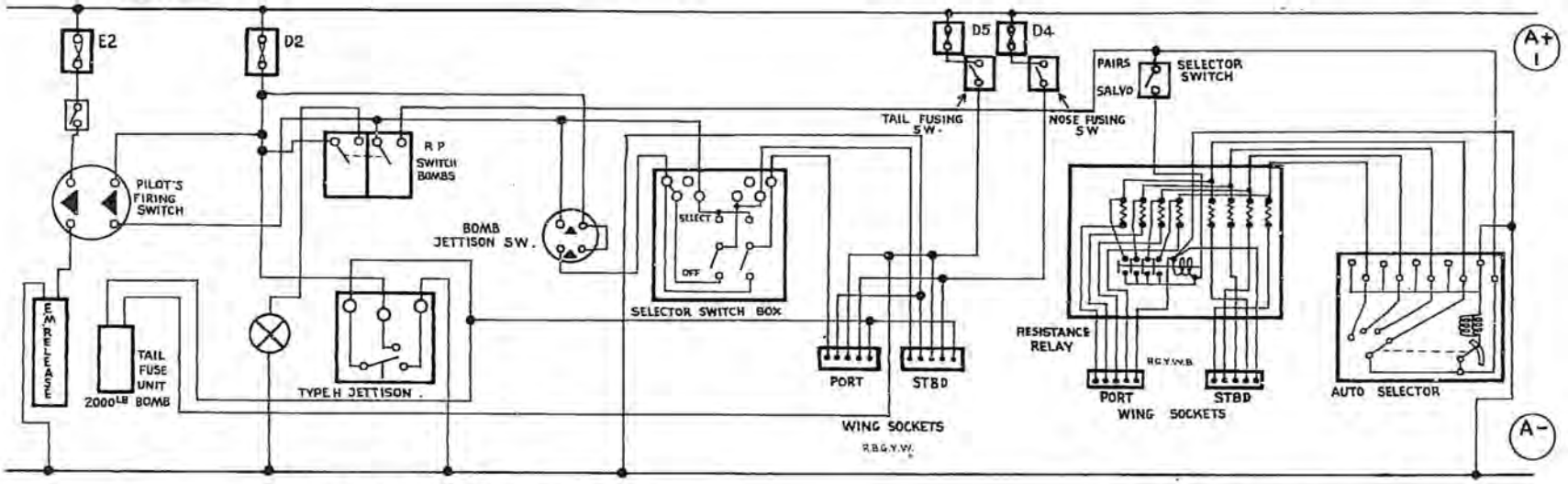
FUEL GAUGES

OIL TEMP.

AIR TEMP.

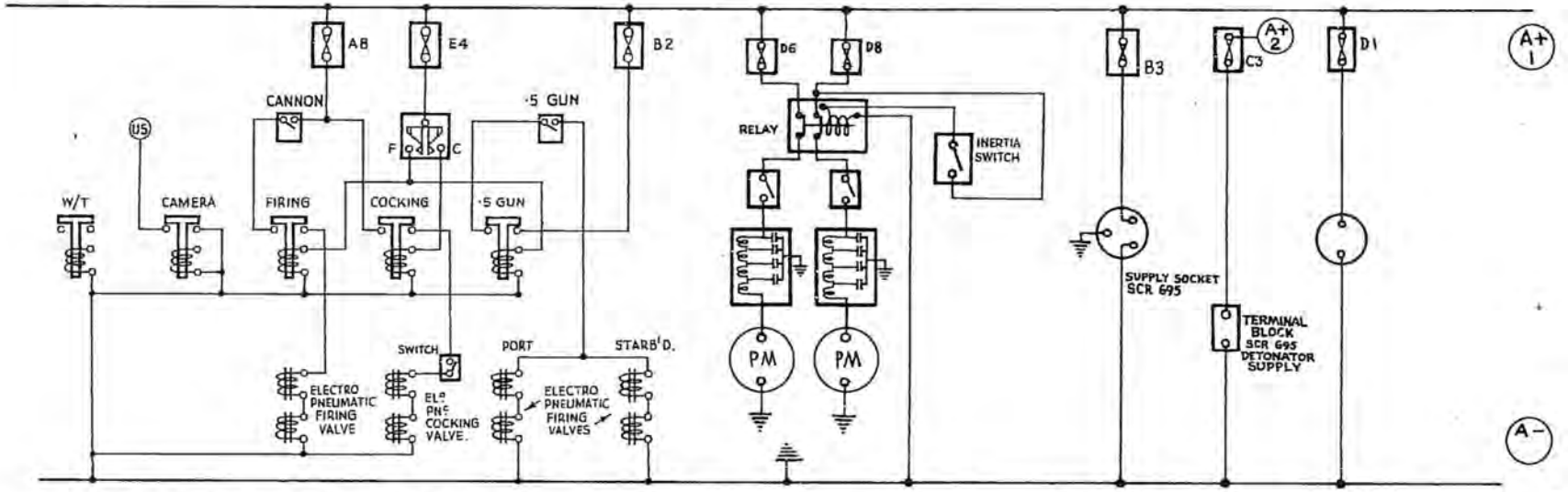
4


A+
A2
A6
A7
SWITCH BOX IDENT
1 UNIT SWITCH BOX (3 WAY)
RED
AMBER
GREEN
DOWNWARD LIGHTS
RHEOSTAT-SOCKET REFLECTOR SIGHT
PILOT'S
COMPASS
REAR COCKPIT
PILOT'S INSTRUMENT PANEL
TAIL DRIFTSIGHT
TAIL DRIFTSIGHT
ALDIS LAMP
DASHBOARD LT
CHART TABLE
REAR COCKPIT
PILOT'S
PILOT'S INSTRUMENT PANEL
GUN LOADER
GUN LOADER
OBSERVER'S PANEL
ROOF LAMPS AND SWITCHES
A-
IDENT'N LIGHTS
A/C 1 to 250
INTERIOR LIGHTS
C8
C2
C4
C5
C1
C7
IMMERSION SWITCH
OPERATIONAL HEAD
SWITCH
PORT LAMP
STBD LAMP
PORT SWITCH
STBD SWITCH
MOTOR
MOTOR
SOCKET T.R.5043 RADIO
H.T. UNIT A.T.5-AR8 RADIO
STBD GENE PLUG : PORT GENE PLUG
STBD INDICATOR PLUG : PORT INDICATOR PLUG
DINGHY RECOGN'N LIGHTS
COWL GILLS
W/T CONTACTOR SUPPLY
EXTRA W/T SOCKET
ENG. REV. INDICATORS
5
5



BOMB & MINE RELEASE

R.P. APPARATUS



6

CANNON & ·5 GUN FIRING

FUEL PUMP MOTOR

SCR 695 SUPPLY

HEIGHT INDICATOR

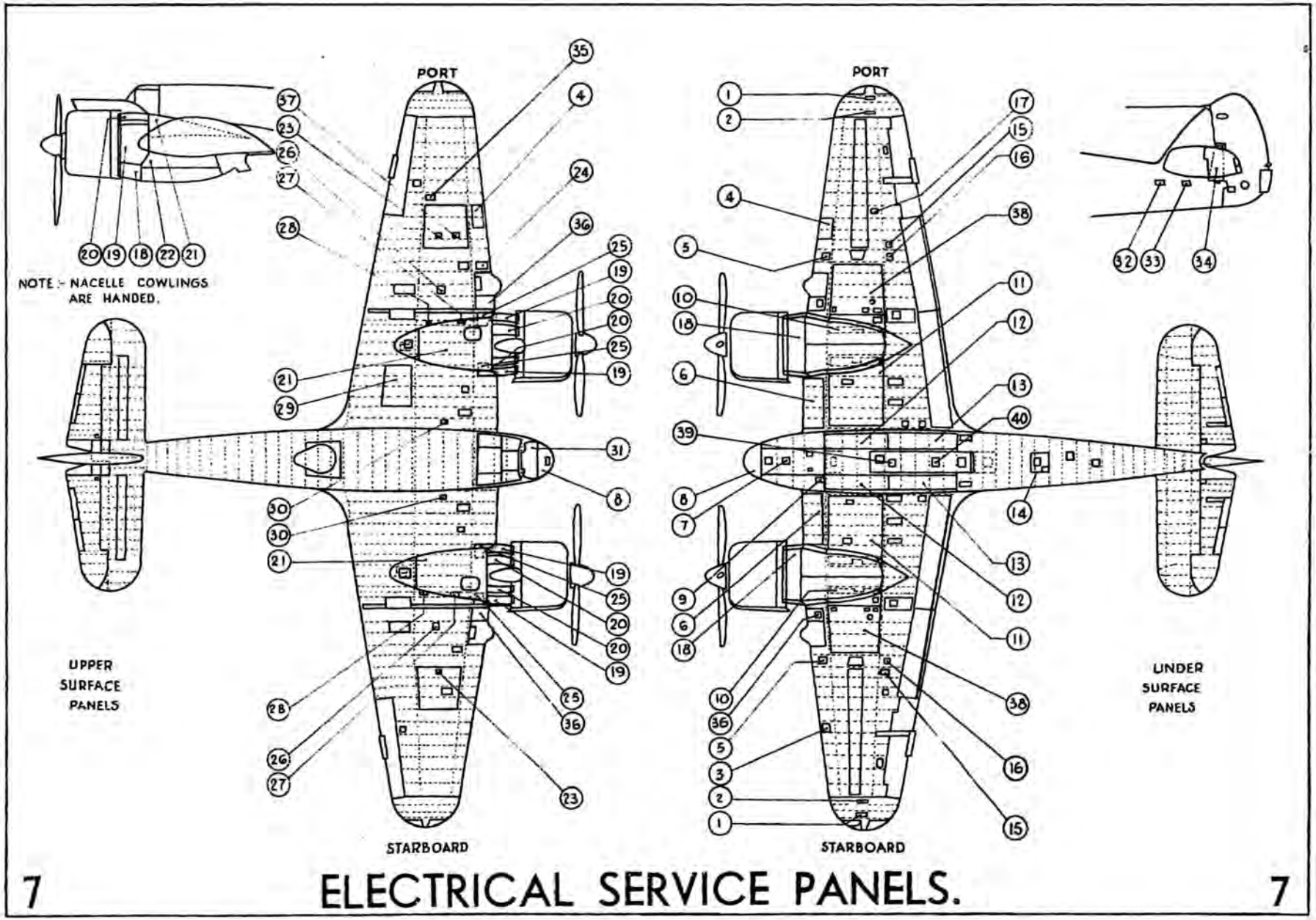
6

NOTES.

ELECTRICAL SERVICE PANELS.

Key to Fig. 7.

1. Wing Tip Lights and Stowage of Resin Lights.
2. Wing Tip Terminal Blocks (General).
3. Conduits (Starboard Side Only).
4. Landing Lamps.
5. Wing Bomb Stations.
6. General Installation, Conduits, etc.
7. Immersion Switch.
8. Junction Box and General Installation (Nose Cap.).
9. External Supply Socket.
10. Undercarriage Nacelle: Undercarriage Switches and Junction Boxes.
11. Main Fuel Tank.
12. Forward 20 mm. Cannon Door. Supply to Bomb Release on Port Side.
13. Aft 20 mm. Cannon Door.
14. Electrical Connections, Identification Lights (Amber).
15. R.P. Installation Socket.
16. R.P. Installation Connections.
17. Pressure Head.
18. Suppressors for Generator and Fuel Pump Motors, Tachometer Generator and Graviner Bottle.
19. General Installation.
20. Carburettor Air Temp. Bulb and K.X. Generator.
21. Top Nacelle Fairing.
22. Side Nacelle Fairing.
23. Fuel Gauge Transmitter and R.P. Installation Connections.
24. Camera Stowage.
25. Fuel Tank Connections.
26. Fuel Gauge Transmitter.
27. Fuel Tank Filler.
28. Fuel Gauge Transmitter.
29. Dinghy.
30. Fuel Gauge Transmitter.
31. Instruments and Undercarriage Warning Device.
32. Electrical Cables to Tail Wheel Indicators and Stern Post.
33. Tail Wheel Indicator Switches and Connections.
34. Connections for Rudder Light.
35. Pressure Head Connections.
36. Wing Junction Boxes and Auxiliary Wiring Plug and Socket.
37. Fuel Tank Filler.
38. No. 2 Outer Wing Tank.
39. Socket for Bomb Tail Fusing Unit.
40. Cannon Firing, Electro-pneumatic Valves.



7 ELECTRICAL SERVICE PANELS. 7

SECTION 6 — CHAPTER 3.

Radio Installation

CONTENTS.

ILLUSTRATIONS.

Radio Installation

GENERAL.

1. The radio installation comprises two types of equipment.

(i) AT5/AR8 Installation.

(ii) T.R. 5043 Installation and one "Radar" Installation.

The following are the R.A.A.F. Publications applicable to the various wireless equipments installed:—

AT5/AR8 (GP) Equipment—R.A.A.F. Publication 275.

TR. 5043 (VHF) Equipment—R.A.A.F. Publication and USA AC Technical Order No. 08-10-105.

See also Beaufighter Order No. 40 or Wireless Order No. 302/A77, and Beaufighter Electrical Service Manual, R.A.A.F. Publication 607 No. SCR 695 Installation-Handbook of Instructions, Ref. CO-08-10BB-1.

AT5/AR8 Installation:

2. The AT5/AR8 is a general purpose communication equipment with separate Medium Frequency (MF) and High Frequency (HF) channels, in which one MF and one HF frequency can be pre-set and subsequently selected by the operation of one switch on the transmitter and one switch on the receiver. Two remote control units have been incorporated in the installation, one in the observer's position, and one in the pilot's cockpit. The equipment may also be locally operated by the observer.

The equipment consists of the following components:—

(i) Transmitter type AT5.
(ii) Receiver type AR8.
(iii) Aerial Coupling Unit.
(iv) Power Unit Type "G".
(v) Junction Box and Cables.
(vi) Mechanical and Electrical Remote Control Units.
(vii) D.F. Loop and Azimuth Remote Control.

TR.5043 Installation:

3. The TR.5043 equipment provides two way radio telephone communication between aircraft in flight and between aircraft and ground stations. Remote control only is provided. The remote control box is provided with four push-buttons for channel selection and an "off" button for switching the equipment off. By means of a press to transmit switch on the observer's remote control box, the observer may transmit on a channel selected by the pilot.

The installation consists of the following components:—

(i) Transmitter-receiver type TR.5043.
(ii) Remote controller type 5003.
(iii) Dynamotor unit, type 5016 or 5016B.
(iv) Junction Box type 5017.
(v) Master Contactor type 2.
(vi) Remote Contactor type 4.
(vii) Microphone adaptor type A.1.
(viii) Microphone adaptor Junction Box.

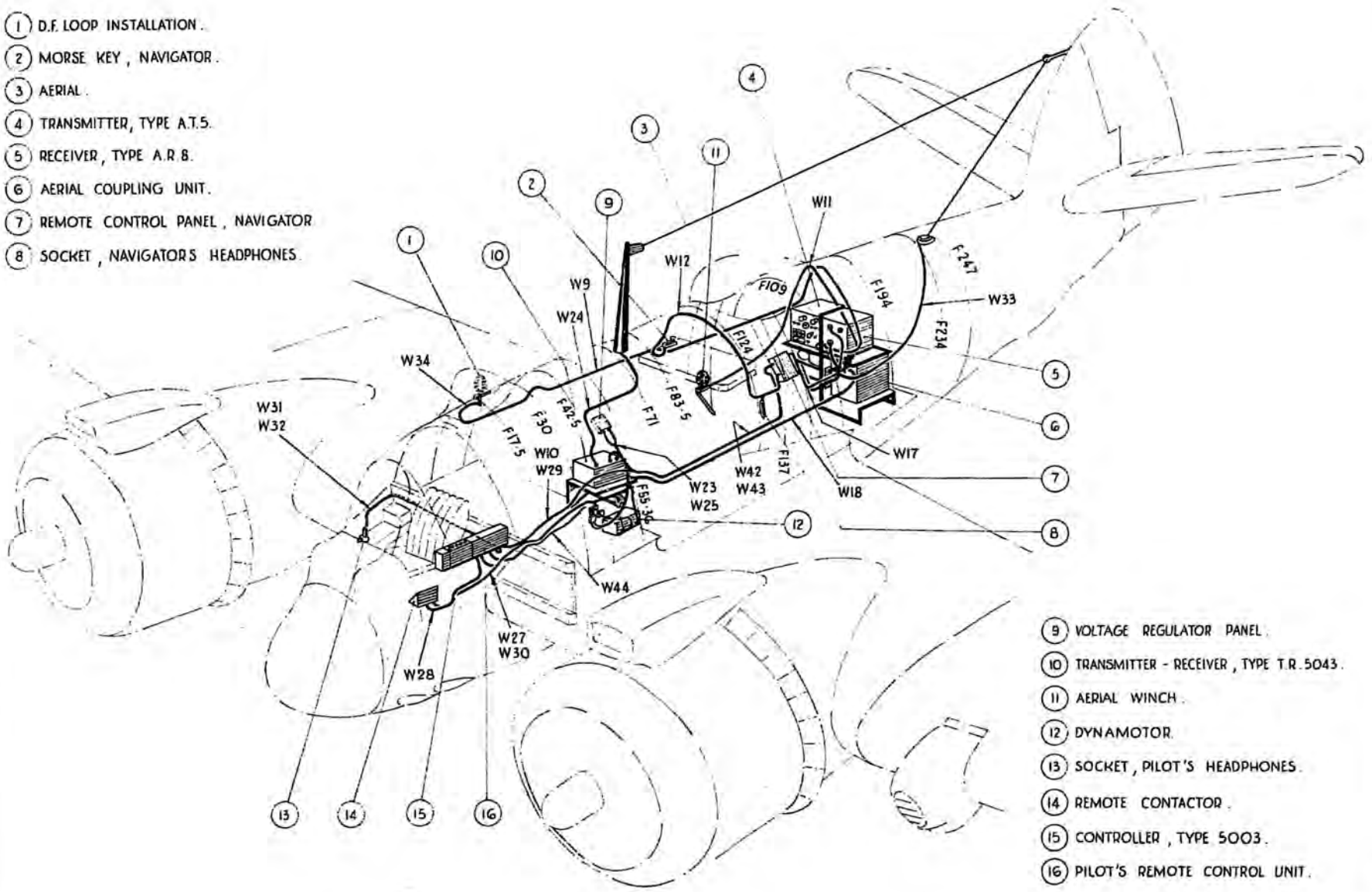
SCR. 695 Installation (Radar):

4. The SCR.695 equipment consists of the following components:—

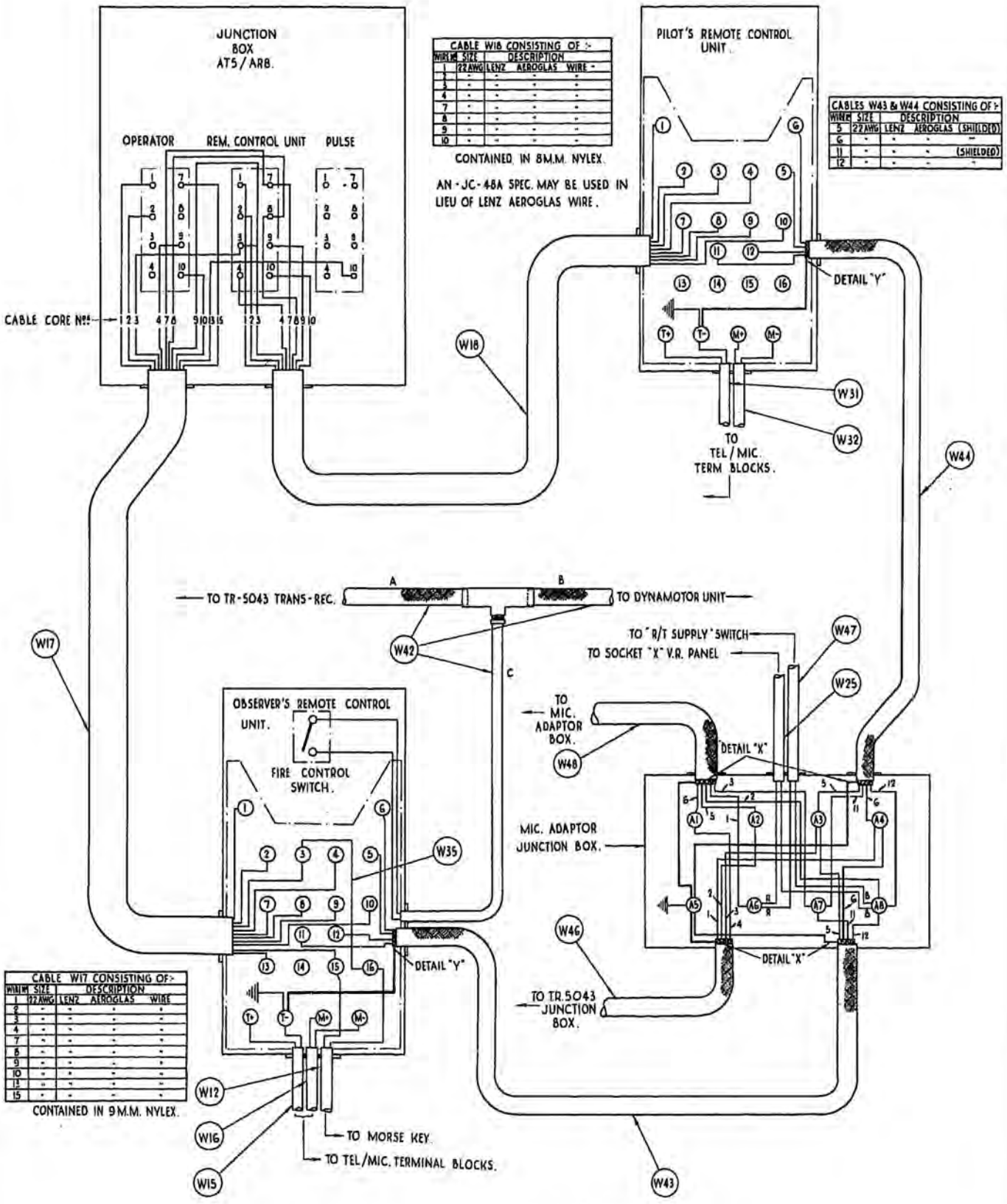
(i) Receiver type BC.966.
(ii) Observer's control panel (Radio Control Equipment, RC-255-A).
(iii) Pilot's switch panel.
(iv) Inertia Switch.

The receiver is operated from remote control units, one in the observer's position and another in the pilot's control structure.

A detonator circuit for the destruction of the receiver is provided and can be fired from the pilot's control units, or by the inertia switch.



RADIO—GENERAL ARRANGEMENT.

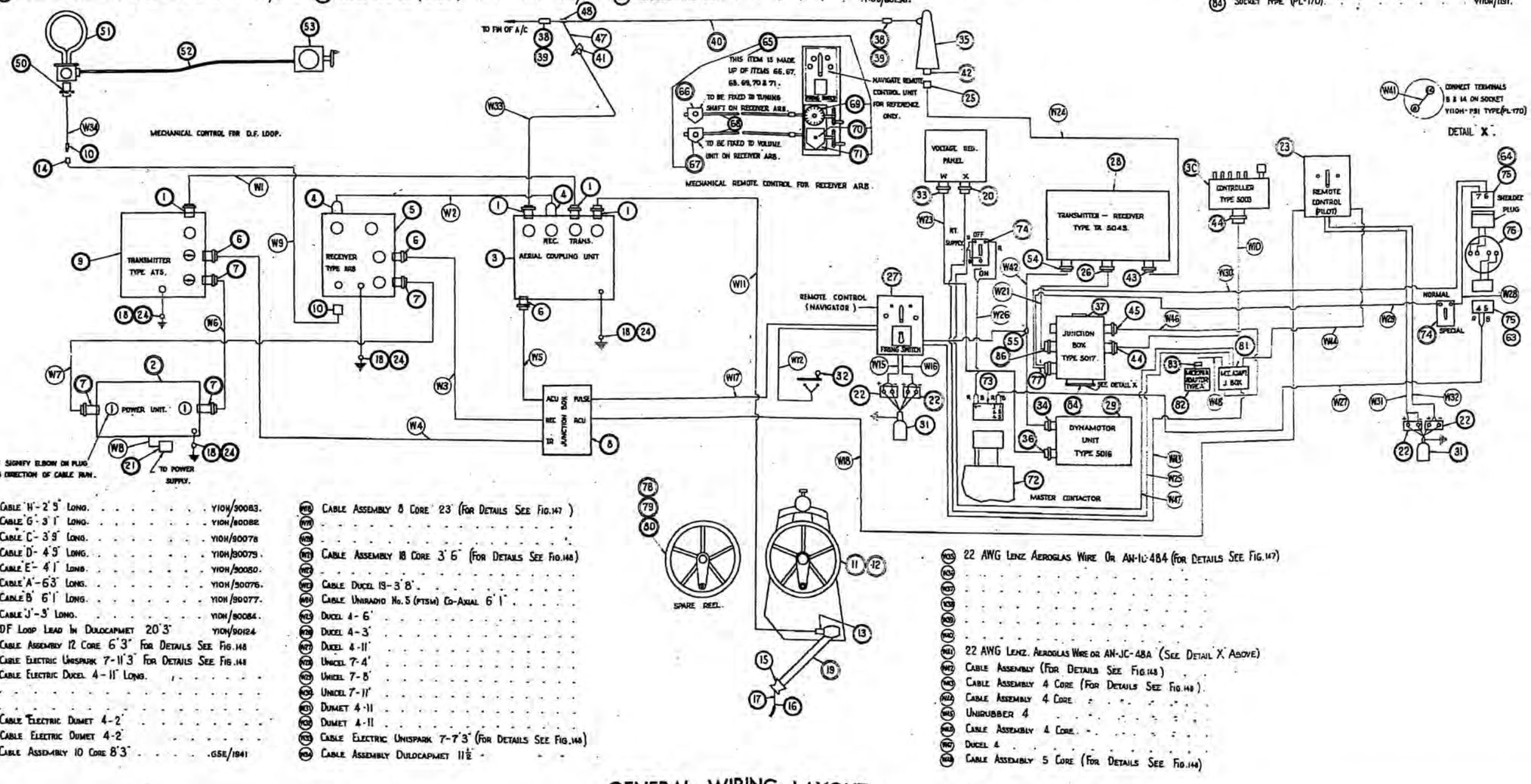


REMOTE CONTROL CIRCUIT.

2

(1)	Bracket Type 40.	Y10H/8531	(18)	Earth Terminal Ross Courtney Type N28A.	(35)	Mast Aerial Fixed. Assy. 84142.	(52)	Drive Shaft Flex For Loop Type Flex. Y10H/90427.
(2)	Power Unit, Type G.	Y10D/70214	(19)	Aerial Fairlead Dennie Tube 1" Slotted. Y10B/7301.	(36)	Socket Type 165 (PL Q172). Y10H/419.	(53)	Indicator Azimuth For Loop Type A3. Y10H/56C56.
(3)	Aerial Coupling Unit.	Y10D/70212	(20)	Plug "X" Type APCS 416 65A/26184	(37)	Junction Box Type 5017. Y10A/240.	(54)	Socket Type W162 (PL Q169). Y10H/416
(4)	Plug Type G8.	Y10H/8516	(21)	Plug Type G. 5C/598.	(38)	Ice Shrouds. Y10B/3121.	(55)	Tee Connection. E193172
(5)	Receiver Type AR8.	Y10D/70213.	(22)	Terminal Block Type. 5C/430.	(39)	Insulator Type 18 No 2. Y10B/8934.	(56)	
(6)	Plug 12 Pin.		(23)	Remote Control Unit. Y10D/70696.	(40)	Wire Aerial Stainless Steel. 21'6". Y10B/8235.	(57)	
(7)	Plug 8 Pin.		(24)	Lug 2 B.A. A6S/1600.	(41)	Insulator (Lead In) Type 16 Y10B/8093	(58)	
(8)	Junction Box.	Y10D/70215.	(25)	Plug Type 159 (S.P). Y10H/182.	(42)	Socket Type 116 SP Y10H/277	(59)	
(9)	Transmitter Type ATS.	Y10D/70211.	(26)	Socket Type W164 (PL-Q170) Y10H/418.	(43)	Plug Type 156 (PL-P173). Y10H/584.	(60)	
(10)	Plug Type 101	Y10H/9872.	(27)	Remote Control Unit (Navig) Y10D/70697	(44)	Socket Type W161 (PL-P169). Y10H/415.	(61)	
(11)	Winch Aerial Type S (CW Reel)	Y10B/9005.	(28)	Trans-Rec. Type TR 5043. Y10D/145.	(45)	Socket Type W150 (PL-Q167). Y10H/404	(62)	
(12)	Reel Aerial Winch Type B.	Y10B/9123	(29)	Dynamotor Unit Type. 5016. Y10K/248.	(46)		(63)	Indication Disc Y10H/11029
(13)	Socket Type 40.	Y10H/8531.	(30)	Controller, Electric Type 5003 Y11CJ/71.	(47)	Wire Aerial Stainless Steel 8" Y10B/8235	(64)	Indication Disc. Y10H/11C31
(14)	Socket.	Y10H/11051	(31)	Socket Type 199. (Alt Y10H/10114) Y 10H/625.	(48)	Ferrule. E193292	(65)	Assy Of Mechanical Remote Control (Items 66,67,68,69,70&71) Y10D/70278
(15)	Aerial Fairlead Retractable.	Y10A/8913	(32)	Keys, Morse Type F. Y10F/7741	(49)		(66)	Tuning Gearbox Type R8812. Y10D/70382
(16)	Aerial Weight Bead Type No 1.	Y10B/7298.	(33)	Plug "W" Type APCS 411 65A/26193	(50)	Plug. AWA/1185585	(67)	Volume Gearbox. Y10D/70605
(17)	Aerial Wire Stainless Steel (Trailing) 235 FT.	Y10B/8235.	(34)	Socket Type 160 (PL.Q171) Y10H/414.	(51)	D.F. Loop Type A4. Y10B/60256.		

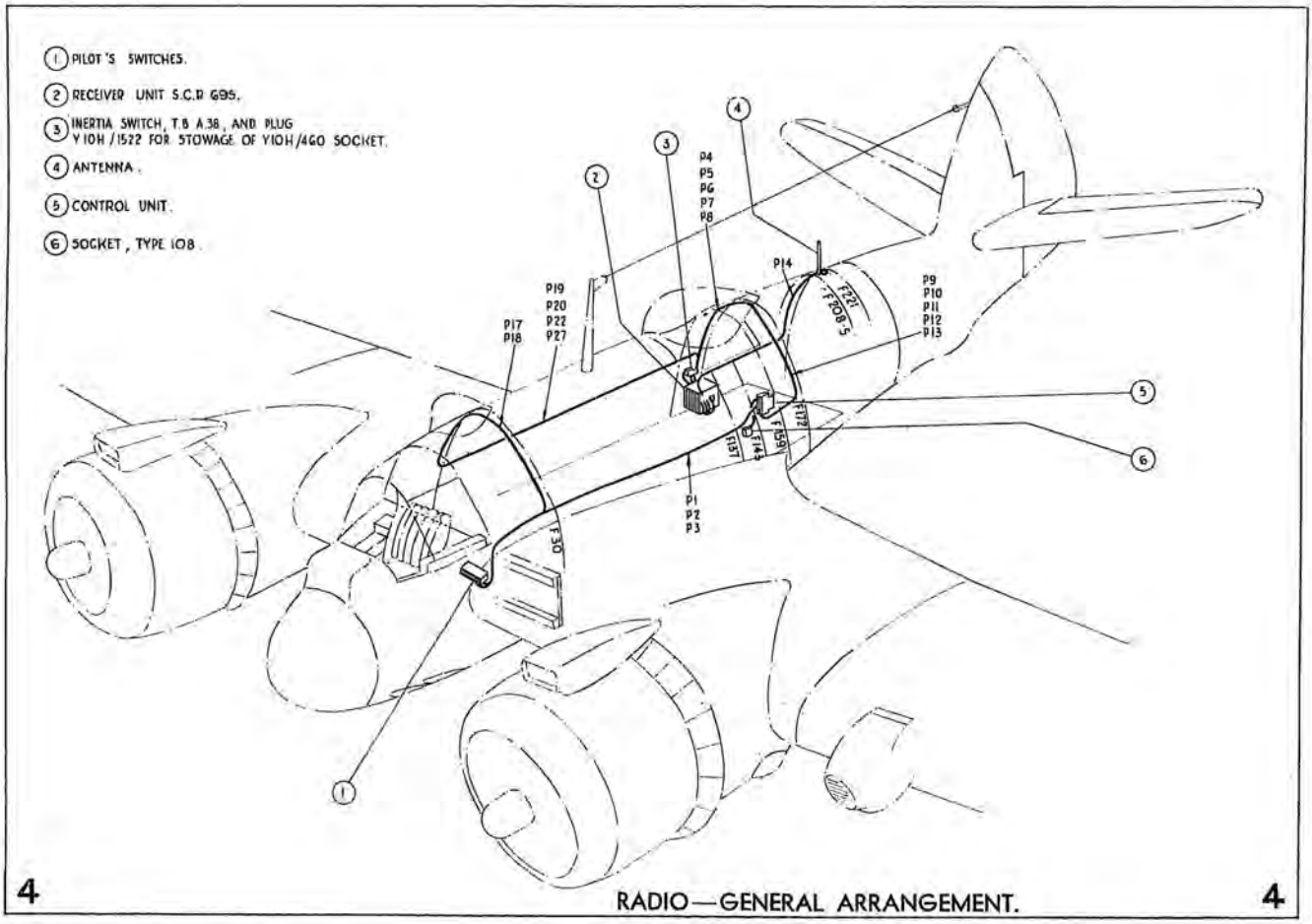
(68)	Drive Shaft Flex Type R9011.	Y10D/70384.					
(69)	Tuning Contr. Gearbox Type 2R8812.	Y10D/70381					
(70)	Volume Contr. Gearbox Type 3R8812.	Y10D/70383					
(71)	Bracket Mounting.	Y10A/55705					
(72)	Master Contactor Type E	Y10A/10994					
(73)	Socket Type 12 (4 Pin)	Y10H/7283					
(74)	Switch Box Type B	65C/545.					
(75)	Socket Type 19 (2 Pin)	Y10H/7457.					
(76)	Remote Contactor Type 4	Y10A/10995.					
(77)	Socket Type W146 (PL.Q165).	Y10H/400					
(78)	Reel Aerial Winch Type B	Y10B/9123					
(79)	Aerial Weight Bead Type No 1.	Y10B/7298.					
(80)	Aerial Wire Stainless Steel (Trailing) 235 FT.	Y10B/8235.					
(81)	Mic. Adaptor Junction Box Assy.	E193511					
(82)	Microphone Adaptor Type A1.	Y10A/56094					
(83)	Socket Type 101/276.	Y10H/90503.					
(84)	Socket Type (PL-170).	Y11OH/1191.					



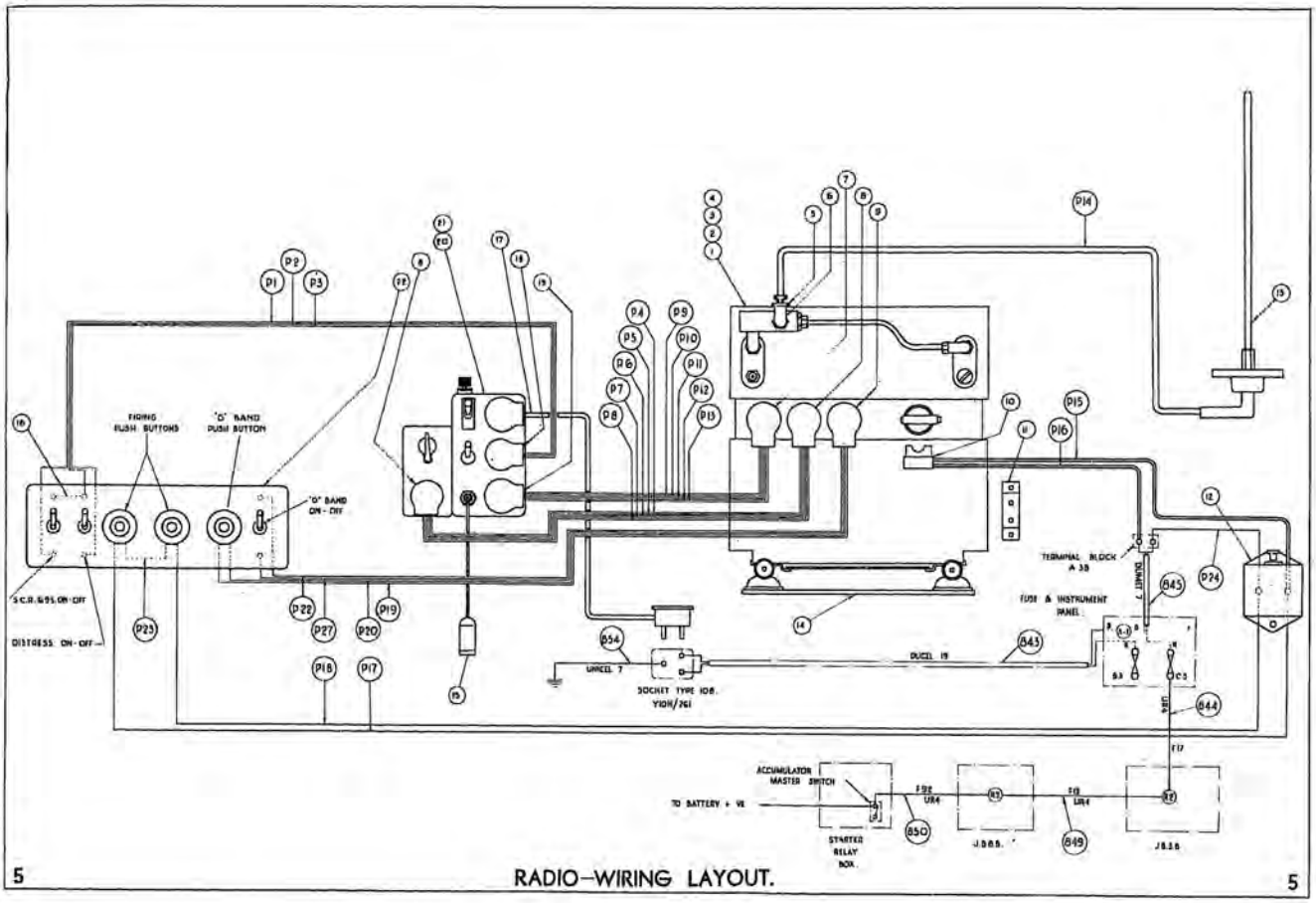
(W1)	Cable 'H'-2'5" Long.	Y10H/90083.	(W18) Cable Assembly 8 Core 23' (For Details See Fig.147)
(W2)	Cable 'G'-3'1" Long.	Y10H/80082	(W19)
(W3)	Cable 'C'-3'9" Long.	Y10H/90078	(W20)
(W4)	Cable 'D'-4'5" Long.	Y10H/90079.	(W21) Cable Assembly 18 Core 3'6" (For Details See Fig.148)
(W5)	Cable 'E'-4'1" Long.	Y10H/90080.	(W22)
(W6)	Cable 'A'-6'3" Long.	Y10H/90076.	(W23) Cable Ducel 19-3'8"
(W7)	Cable 'B' 6'1" Long.	Y10H/90077.	(W24) Cable Uniradio No.5 (FTSM) Co-Axial 6'1"
(W8)	Cable 'J'-3' Long.	Y10H/80084.	(W25) Ducel 4-6'
(W9)	DF Loop Lead In Dulocapmet 20'3"	Y10H/90124	(W26) Ducel 4-3'
(W10)	Cable Assembly 12 Core 6'3" For Details See Fig.148		(W27) Ducel 4-11'
(W11)	Cable Electric Unispark 7-11'3" For Details See Fig.148		(W28) Unicel 7-4'
(W12)	Cable Electric Ducel 4-11" Long.		(W29) Unicel 7-8'
(W13)			(W30) Unicel 7-11'
(W14)			(W31) Dumet 4-11
(W15)	Cable Electric Dumet 4-2'		(W32) Dumet 4-11
(W16)	Cable Electric Dumet 4-2'		(W33) Cable Electric Unispark 7-7'3" (For Details See Fig.148)
(W17)	Cable Assembly 10 Core 8'3"	.GSE/1941	(W34) Cable Assembly Dulocapmet 11½"

(W35)	22 AWG Lenz Aeroglas Wire Or AN-JC-48A (For Details See Fig.147)
(W36)	
(W37)	
(W38)	
(W39)	
(W40)	22 AWG Lenz. Aeroglas Wire or AN-JC-48A (See Detail 'X' Above)
(W41)	Cable Assembly (For Details See Fig.148)
(W42)	Cable Assembly 4 Core (For Details See Fig.148)
(W43)	Cable Assembly 4 Core
(W44)	Unirubber 4
(W45)	Cable Assembly 4 Core
(W46)	Ducel 4
(W47)	Cable Assembly 5 Core (For Details See Fig.148)

GENERAL WIRING LAYOUT.



4 RADIO—GENERAL ARRANGEMENT. 4



5 RADIO—WIRING LAYOUT. 5

THE

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

R.A.A.F. Publication No. 615.

SECTION 7.

DESIGN AND CONSTRUCTION OF AIRFRAME.

SECTION 7 — CHAPTER 1.

Fuselage

CONTENTS.

ILLUSTRATIONS.

Fuselage

General:

1. The fuselage is in three sections, all of which are of all-metal, semi-monocoque construction consisting of alclad formers, mainly of lipped Z-section, extruded light-alloy beaded angle-section stringers, and alclad skin plating. Countersunk aluminium-alloy rivets secure the formers and stringers to the skin, but they are not attached to each other, the formers being notched to clear the stringers.

2. The three sections are the front fuselage, the rear fuselage and the stern frame. The front fuselage extends forward of the front spar of the main plane and houses the pilot, and his controls and equipment; the rear fuselage extends aft to the stern frame and houses the observer and his equipment; the stern frame carries the tail unit and the tail wheel unit.

3. The fuselage formers are numbered according to their distance, measured in inches, from the aft side of the rear former of the front fuselage, which is called former 0. For example, former 27.5 in the front fuselage, is 27.5 inches forward of former 0, and former 298, in the stern frame, is 298 inches aft of former 0. The former stations are shown in Fig. 1.

Front Fuselage:

4. The main structure of the front fuselage is built up of alclad Z-section and channel section formers and skin plating, with extruded beaded angle-section fore-and-aft stringers. Substantial keel members extend forward to former 58 and two longerons are fitted port and starboard. The top longeron and a longitudinal member on each side carry a shelf for the engine auxiliary controls and other equipment. The bottom longeron is adjacent to the floor level. A tubular structure mainly of mild steel provides support for the pilot's seat. From the lower edge of the windscreen and reaching to just forward of former 58, a number of non-magnetic bullet proof armour plates are fitted, giving protection to the front portion of the aeroplane. Forward of the armour plating the nose piece is detachable. The blast tubes for the four guns are mounted under the floor outboard of the keel members. The front entry and exit hatch (see Para. 10) is located between the main plane spars.

5. The roof and part of the sides of the pilot's cockpit are covered with transparent sheeting, and a bullet-proof windscreen is fitted at the front. The framework consists of tubular members of magnesium-alloy castings, and is bolted to the main structure. The transparent sheeting is mounted on rubber strips and secured to the framework by light-alloy cover strips and set-screws. Provision for emergency exit is made by a knock-out window on the starboard side, and a roof window hinged along its starboard edge. The pilot's windscreen is made of Triplex plate glass and forms a bullet-proof screen.

Rear Fuselage:

6. The construction of the rear fuselage is generally similar to that of the main structure of the front fuselage. The cutaway for the observer's hood is situated about midway along its length (between formers 126 and 161). The hood is made of transparent sheeting supported on a tubular frame and, on the starboard side, is hinged for ground emergency exit purposes. The keel members extend the whole length of the rear fuselage. Armour plating is fitted on the front face of the rear spar and extends 20 inches above the spar; two doors with a central handle are fitted above the spar. At the front end of the fuselage between formers 71 and 97, port and starboard, an opening is provided in the floor for the gun loading gear. An opening between keel members situated between formers 159 and 194 is provided for the rear entry and exit hatch (see Para. 11).

7. In the rear fuselage there are a number of double formers consisting of two lipped

channel-sections placed back to back some distance apart, and having a plate riveted across the flanges of the channels on the inboard side; for the position of these, see Fig. 1. The formers at the centre plane spars have hiduminium forked blocks riveted and bolted to the web of the channels at the bottom, for attachment to the box ribs on the centre plane. The rear fuselage is strengthened by three longerons on each side. The top and middle longerons are of channel-section, riveted to the top and bottom angle-sections attached to the skin. The bottom longeron is of lipped channel-section, built up of a face plate and two Z-sections, the top and bottom flanges of which are attached to the skin.

Stern Frame:

8. The stern frame has lipped Z-section formers, beaded extruded angle-section stringers and alclad skin plating. Former 249 at the front end is of lipped channel-section, and formers 308.25, 310.5 and 330-332 for the tail plane attachment are built-up formers. The rear end of the stern frame is formed by a stern post which carries the bottom hinge of the rudder, and is extended upwards to carry the top hinge. A stringer of special section is fitted near the bottom of the structure on each side. An aperture in the underside of the stern frame is boxed in with aluminium-manganese-alloy and acetate sheet, and provides a housing for the tail wheel unit when the latter is retracted. Attachments for the tail wheel unit are provided on formers 308.25 and 310.5, and on former 238. A bridge piece at the top and a bracket at the bottom are fitted between formers 249 and 258 for the rudder and elevator countershafts. The stern frame is attached to the rear fuselage in a similar manner to that described for the attachment of the front and rear fuselage (see Para. 9).

Attachment of Front Fuselage, Rear Fuselage, and Centre Plane:

9. The ends of the skin plating of the front fuselage and the rear fuselage butt together, and are secured by set screws and Simmonds nuts to butt straps underneath. The other attachments are made at the hiduminium blocks on the box ribs of the centre plane. Two blocks, near the bottom of the front fuselage, are riveted to channel-sections which, in turn, are riveted to angle-sections on the skin. The blocks are secured by high tensile steel bolts in steel bushes, to the forward horizontal pair of blocks at the bottom of the centre plane box ribs. At the top, the centre plane is attached to the rear fuselage by bolts in steel bushes through the blocks at formers 2.75, 5.25, 55.36 and 57.86, and by the two pairs of vertical blocks on the box ribs. Extruded and plate angle-sections strengthen the curve of the fuselage over the top surface of the centre plane. The rear pair of horizontal blocks on the box ribs are attached by bolts and steel bushes to a block, riveted to each middle longeron of the rear fuselage.

Front Entry and Exit Hatch:

10. The front entry and exit hatch (see Fig. 2) in the underside of the fuselage between the front and rear spars, consists of a door constructed of a double skin and alclad formers. The door is pivoted midway along its length on a tubular shaft supported on two bearings attached to the keel members. Dashpots are provided, on either side of the hatch, for retarding its movement when used as a parachute exit. The door has a ladder attached to the bottom end, and a foot step with a spring loaded flap, to provide means of entry. Top and bottom catches hold the door in the open or closed position respectively. These catches are operated by three handles, one in the underside of the front fuselage and the other two inside the aeroplane (see Fig. 4 and Sect. 1 for operation). Check cables prevent the door deflecting when opened in the air as a parachute exit. The cables are attached to spring-loaded spools which wind up the cables during the closing of the door.

Rear Entry and Exit Hatch:

11. The rear entry and exit hatch (see Fig. 3) is situated in the underside of the rear fuselage between formers 159 and 194. The construction and operation is generally similar to that described for the front entry and exit hatch. (See Para. 10.)

Seats:

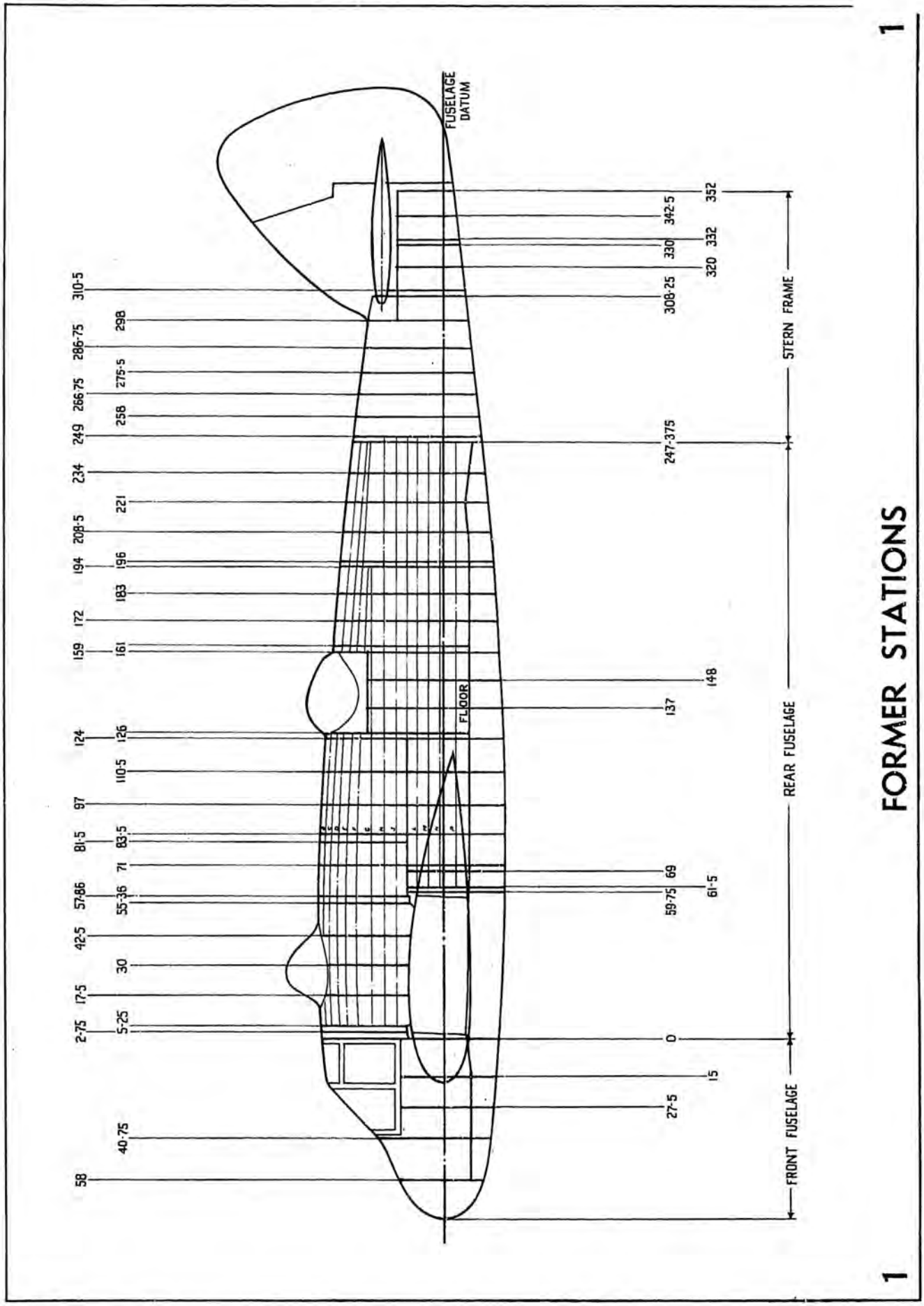
12. The pilot's seat is constructed to take a seat-type parachute, and is adjustable for height. It is attached to a steel and duralumin tube structure extending from the top boom of the front spar in the centre plane, to a plate on the keel member between formers 15 and 27.5 Fixed to the port side of the seat is an adjusting handle by means of which the seat can be raised 4 inches from its lowest position. A twist grip is fitted to the front end of the handle, and when it is rotated an external cam forces down a spring-loaded sleeve and disengages a locking bolt from a toothed quadrant attached to the tube structure. Elastic tension cords are fitted at the back of the seat to relieve the handle of the weight of the occupant and to facilitate raising of the seat.

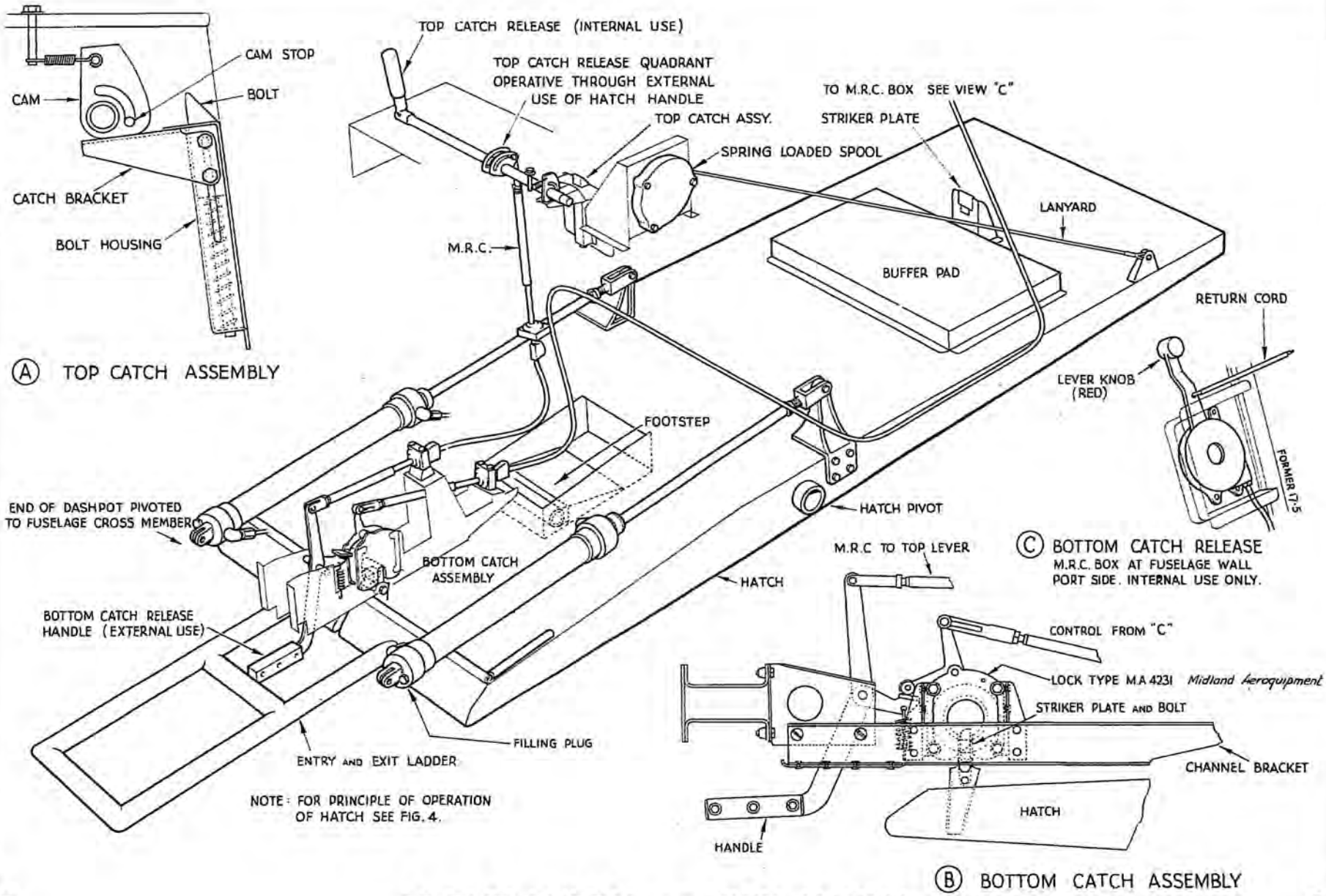
Fixed to the seat pan on the starboard side is a lever for collapsing the seat; when pulled up it releases a catch which allows the seat pan and back to be straightened out by pressure from the pilot's shoulders. (See Sect. 1.)

13. The observer's seat is constructed to take a seat type parachute, and rotates on rollers around a central pivot supported on a mounting constructed of duralumin tube. A catch on the seat which is operated by hand engages with slots in the mounting and locks the seat in either the forward or aft positions. Two foot rests are provided, mounted at the front and rear of the seat mounting.

Emergency Exits:

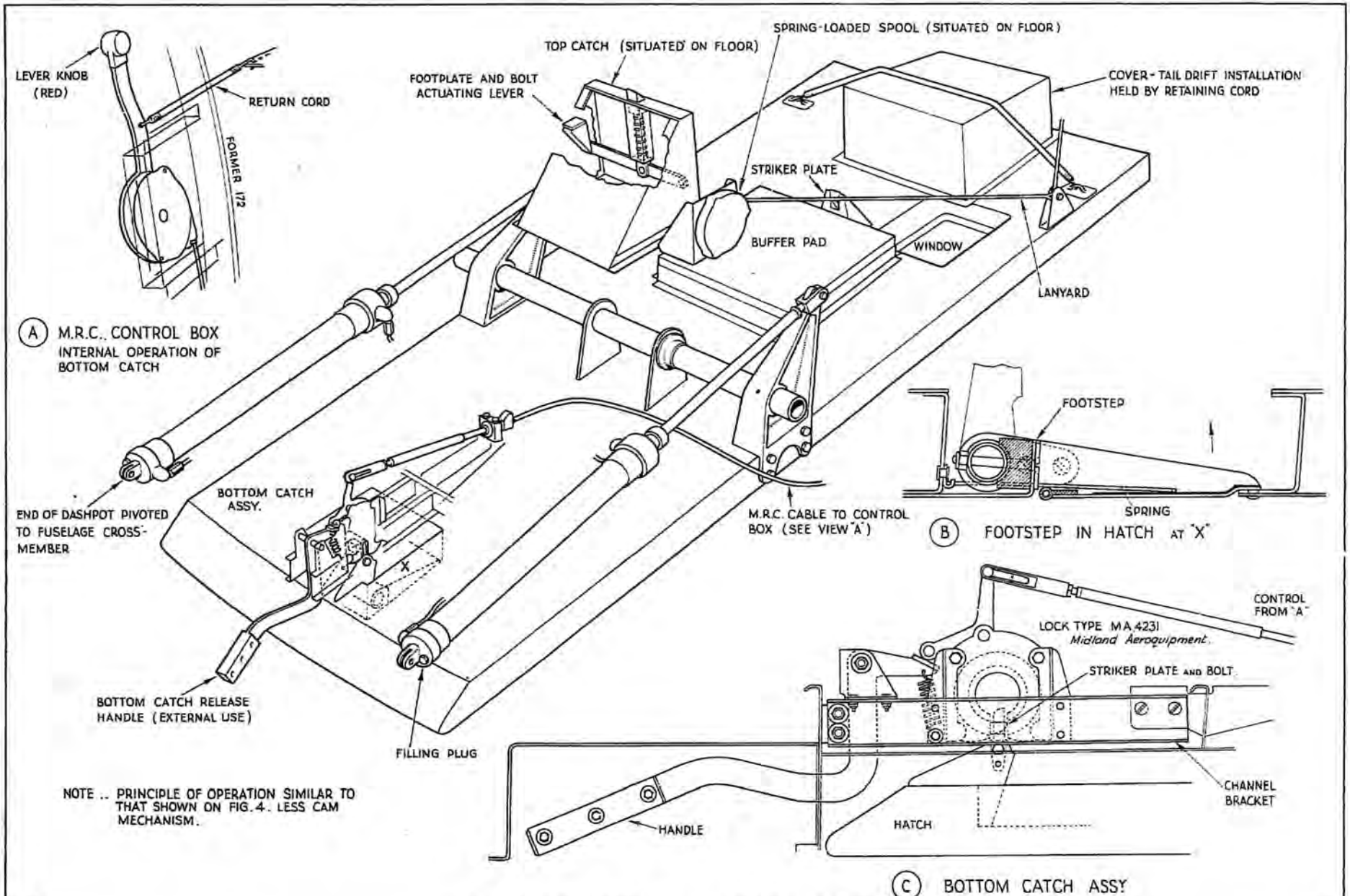
14. The front and rear entry and exit hatches are also used as emergency parachute exits (see Paras. 10 and 11). Ground emergency exits are provided by the pilot's knock-out window, pilot's hood, and the observer's hood, and are illustrated in Figs. 5, 6 and 7. For operating instructions reference should be made to Sects. 1 and 3.


FUSELAGE DATUM
FLOOR
FRONT FUSELAGE
REAR FUSELAGE
STERN FRAME
FORMER STATIONS
1
1
352
342·5
332
330
320
310·5
308·25
298
286·75
275·5
266·75
258
249
247·375
234
221
208·5
196
194
183
172
161
159
148
137
126
124
110·5
97
83·5
81·5
71
69
61·5
59·75
57·86
55·36
42·5
30
17·5
5·25
2·75
0
15
27·5
40·75
58



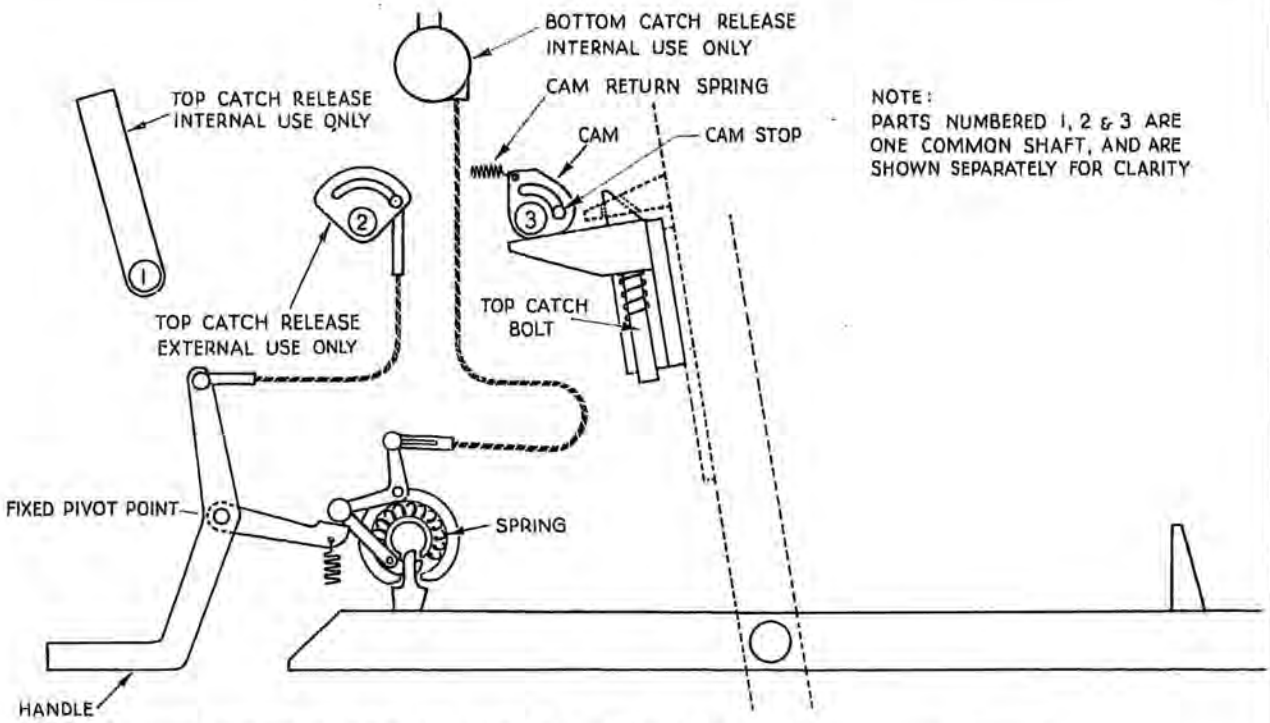
FRONT ENTRY AND EXIT HATCH

2

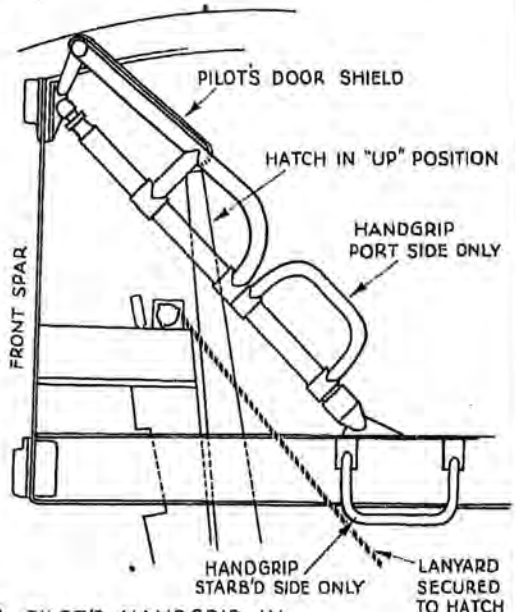


NOTE .. PRINCIPLE OF OPERATION SIMILAR TO THAT SHOWN ON FIG. 4. LESS CAM MECHANISM.

3 **REAR ENTRY AND EXIT HATCH** 3

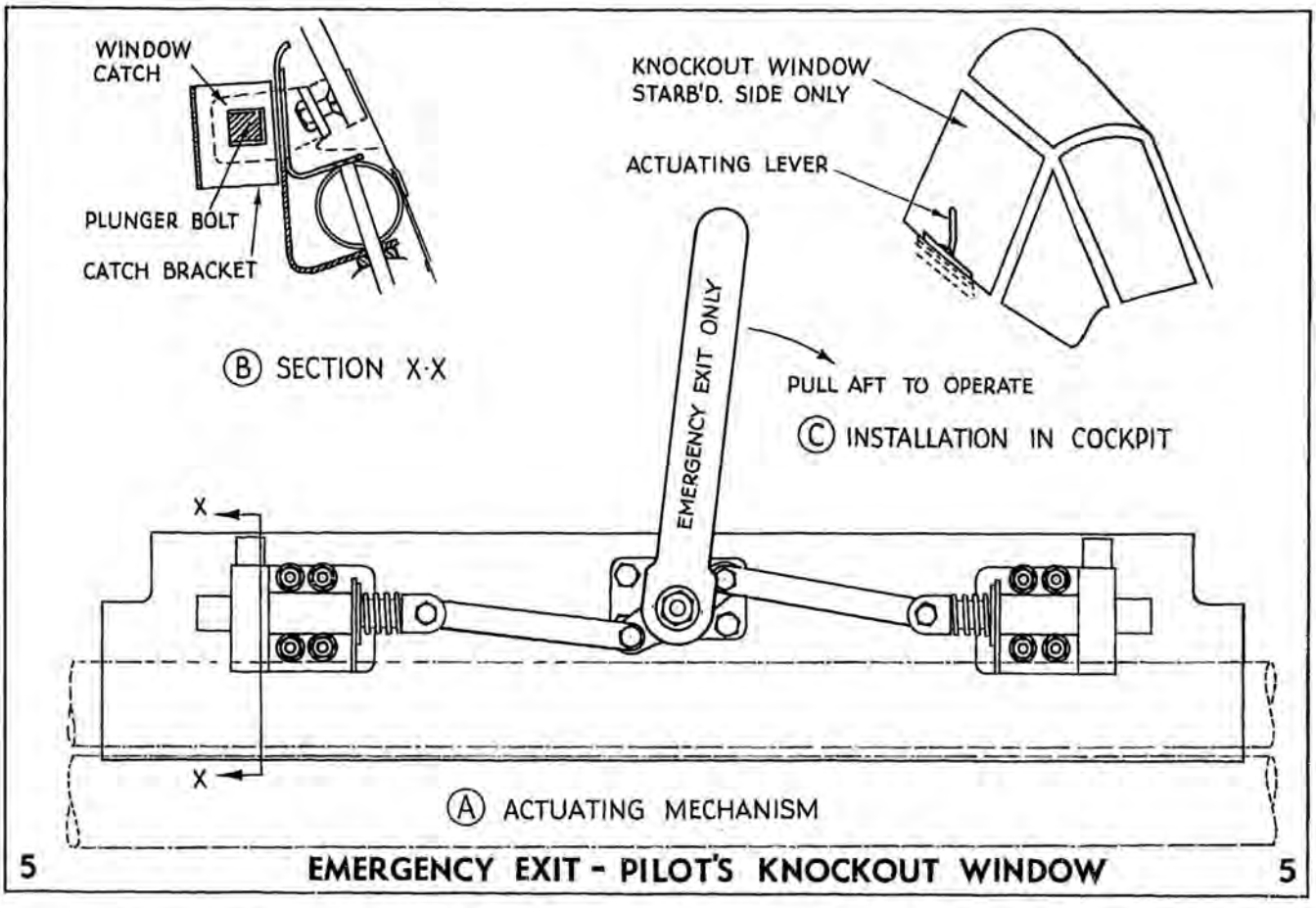


(A) DIAGRAMMATIC VIEW OF CONTROL MECHANISM AT "HATCH CLOSED" OR "UP" POSITION.

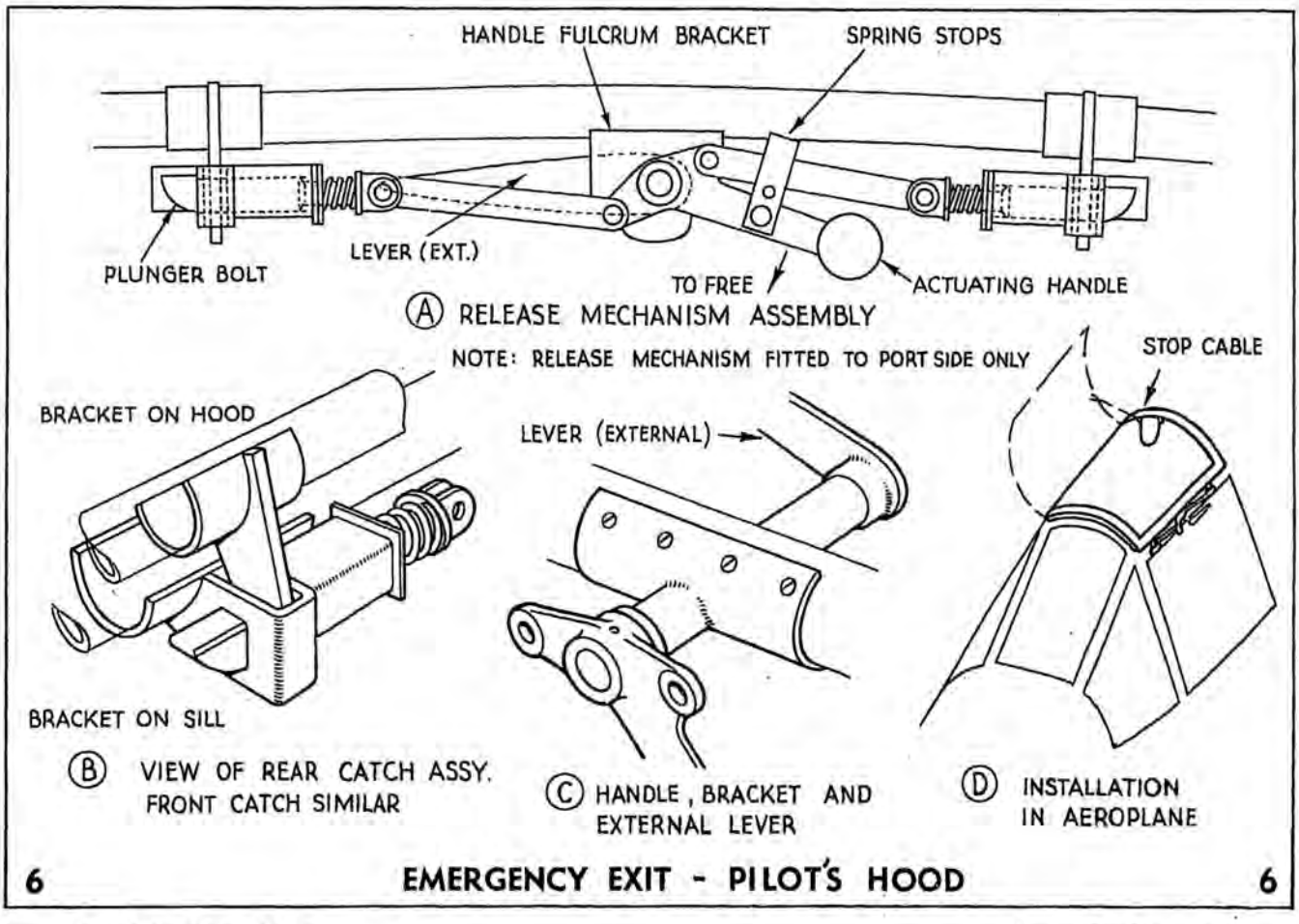


(C) PILOT'S HANDGRIP IN CENTREPLANE

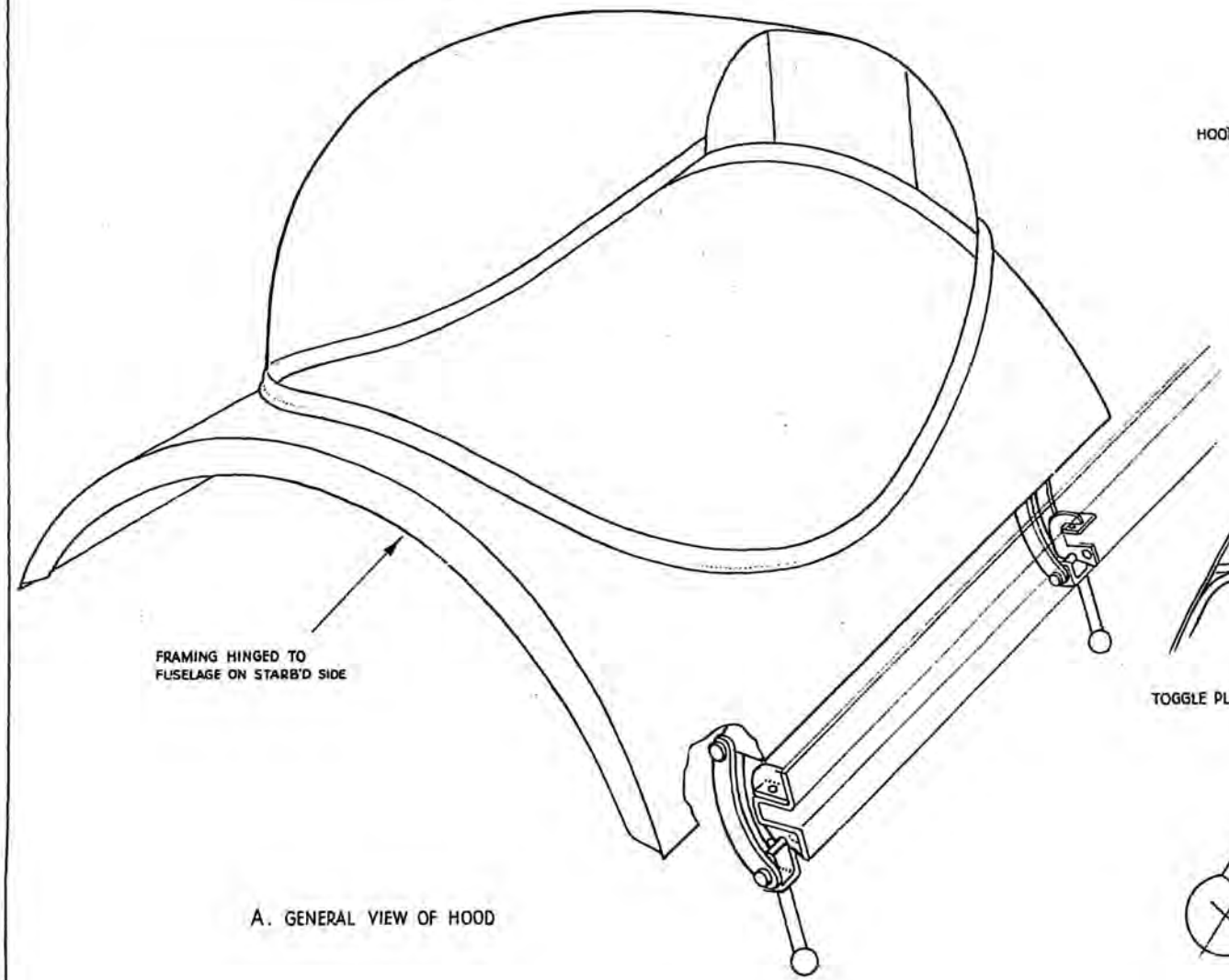
(B) DIAGRAMMATIC VIEW OF CONTROL MECHANISM AT "HATCH OPENING" (BOTTOM CATCH RELEASED)



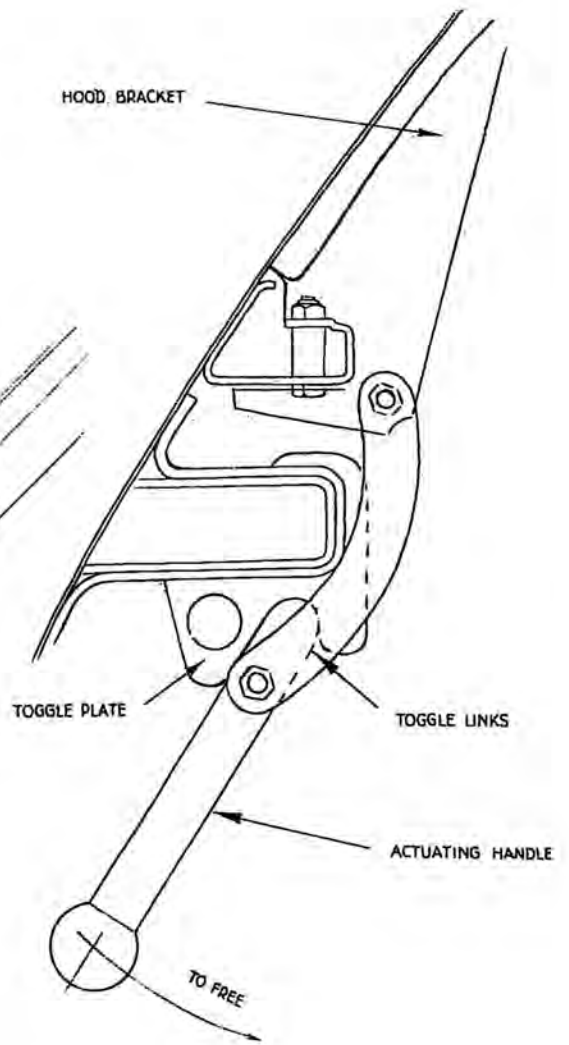
5 **EMERGENCY EXIT - PILOT'S KNOCKOUT WINDOW** 5



6 **EMERGENCY EXIT - PILOT'S HOOD** 6



A. GENERAL VIEW OF HOOD



B. HOOD RELEASE ASSY.

EMERGENCY EXIT - OBSERVER'S HOOD

7

SECTION 7 — CHAPTER 2.

Main Plane

CONTENTS.

Main Plane

GENERAL.

1. The main plane is a cantilever two spar metal-covered structure tapered in chord and thickness and is constructed in three portions, the centre plane and the two outer planes. The centre plane spars are continuous through the fuselage and are bolted to it. Hydraulically-operated split trailing edge flaps are fitted inboard of the ailerons and extend to the fuselage sides. Near the outboard ends of the centre plane are mounted structures of square and circular steel tubes for the engine mounting nacelles, and the undercarriage units. Two main fuel tanks each of 188 gallons capacity, and two nacelle fuel tanks each of 29 gallons capacity are carried in the centre plane. One 87 gallon fuel tank is carried in each outer plane; an auxiliary tank (50 gallons) can also be fitted in the gun bay of each outer plane. Two landing lamps are fitted under a transparent panel in the leading edge of the port outer plane.

CENTRE PLANE.

2. The centre plane has two spars with alclad webs and extruded light alloy booms, alclad ribs and skin covering, and spanwise skin stiffeners of extruded beaded angle-section light alloy similar in section to the fuselage stringers. The main ribs extend between the spars only, and the leading edge and the trailing edge ribs are separate structures. Between the engine nacelles and the fuselage sides, the lower surface of the leading edge is hinged to permit access to the controls on the face of the front spar. Four fittings are provided on each box rib near the fuselage sides for the attachment of the centre plane to the fuselage (see Chap. 1, para. 7); fairing fillets are fitted at the junction of the two parts and secured by woodscrews to a wood strip underneath the skin.

Spars:

3. The spars have a web plate of alclad sheet to which booms of special section extruded light alloy are riveted; an angle-section for the attachment of the skin is also fitted at the booms. Extruded beaded angle-sections are riveted to the inner faces of the web, to provide attachment for the ribs and to form web stiffeners. The ends of the booms are drilled, and have steel bushes for the centre and outer plane joint bolts. End fittings are bolted to each side of the booms, and a web doubling plate is also fitted near the end of the spar.

Ribs:

4. Rib 1 at each fuselage side is of built-up box form and has horizontal forked blocks of light alloy riveted to the bottom corners, and vertical blocks bolted to it at the top corners. These blocks have pressed-in steel bushes for the centre plane to fuselage attachment bolts. The undercarriage attachment ribs have an alclad plate web with top and bottom flanges of alclad lipped angle-section, and are reinforced by a bracing of square light alloy tubes and vertical light alloy extruded beaded angle-sections. The end ribs consist of an alclad plate web with flanged lightening holes and vertical light alloy stiffeners of extruded beaded angle-section, and top and bottom flanges of alclad channel-section riveted on one side. The remaining interspar ribs have no web plate or bracing, but consist of channel and T-sections which are riveted to the skin; the bottom booms are of I-section, and form the bearers for the fuel tanks.

Leading Edge:

5. The leading edge is formed of ribs of plate construction, stiffened diagonally by extruded beaded angle-sections and supported by struts of similar section. The upper surface skin is riveted to the ribs, while the lower surface forms a hinged door. The ribs are bolted to the spar booms, and the skin overlaps the angle-section skin bracket, on the front spar, to which it is riveted.

Trailing Edge:

6. The trailing edge is in two portions and is built up of alclad flanged ribs and skin covering. The ribs are bolted to the spar booms, and the skin overlaps the angle-section skin bracket, in the rear spar, to which it is riveted. The after portion, which is open on the bottom surface for the flaps, is secured by set-screws and bolts in Simmonds nuts to a false spar at the aft end of the forward portion. There is also an extruded beaded angle-section stringer on the top and bottom skin at about mid-chord on the forward portion.

OUTER PLANE.

7. The outer planes are generally of similar construction to the centre plane and are attached to it at the spars. The spars and the trailing edge are of similar construction to those of the centre plane (see Paras. 3 and 6). A sealing strip over the gap between the skin of the centre plane and the outer plane is secured by set-screws. The top booms of the outer plane spars have forked steel-bushed end fittings which interlock with, and are bolted direct to, the centre plane spar end fittings. The steel-bushed end fittings on the bottom boom are secured to the centre plane spars by bolts and link plates on each side. In addition, the webs of the centre plane spars are connected by bolted attachment channels and tie plates.

Ribs:

8. The main interspar ribs have an alclad web plate stiffened by vertical light alloy angle-sections, and flanges of alclad lipped angle-section. The remaining ribs have a top and bottom boom of alclad channel-section interconnected by light alloy extruded beaded angle-sections. At the fuel tank position, both upper and lower booms are of similar construction to those of the centre plane and are described in the latter part of Para. 4.

Leading Edge:

9. The leading edge structure is formed by ribs of two overlapped plates which are stiffened diagonally by flanges and extruded beaded angle-sections and whose front portions are completed by fitting a wood block. The skin of both upper and lower surfaces is riveted to the ribs. The ribs are bolted to the spar booms, and the skin overlaps the angle-section skin bracket, on the front spar, to which it is riveted.

Outer Plane Tip:

10. Each outer plane tip is constructed of diaphragms of flanged plate supported by ribs of similar construction with intermediate ribs of light-alloy extruded beaded angle-section, and alclad skin covering riveted on. It is secured by screws to rib 17 and is detachable. The outer end of the tip is made of transparent sheet, enclosing the navigation and formation keeping lamps which are mounted on the outer end rib.

FLAPS.

11. The main plane flaps are constructed in four sections, the port and starboard plane flaps and the outer plane flaps, and extend from the fuselage sides out to the ailerons. They are operated by two hydraulic jacks, and the port and starboard flaps are interconnected by balance cables to ensure that they operate simultaneously (see Chap. 5, Para. 12).

12. The flaps are constructed mainly of alclad and have channel-section ribs, a Z-section spar at the forward face, channel-section transverse stiffeners at about mid-chord, and a rectangular tube trailing edge. Shallow-headed rivets secure the major portion of the bottom skin covering to the ribs, stiffeners, and the spars. Chobert rivets are used on the top surface and also in the last three rows on the bottom surface. The lower skin surface projects beyond the trailing edge and, when the flaps are raised, closes the rear end of the gap on the under surface of the main plane. Piano type hinges attached to the bottom flange of the flap spar connect the flaps to the false spar of the main plane. A duralumin operating lever is bolted to the outboard end of each centre plane flap, and to the inboard end of each outer plane flap.

AILERONS.

13. Each aileron has a duralumin tube spar; ribs, nosing and trailing edge of alclad sheet, and fabric covering. Two mass-balance weights are fitted in the nose of each aileron, and the hinge points are inset to obtain aerodynamic balance.

14. The flanged alclad plate ribs are secured to the duralumin tube spar by collars and taper pins. Eyelets for the fabric stringing are incorporated in the rib flanges. The alclad sheet nosing is bent around and riveted to the nose of the ribs, and the lead mass-balance weights are riveted inside the nose of the balance portion along its entire length. Outboard and inboard of the trim tab the trailing edge of alclad sheet is riveted to the ribs. A duralumin tube, from the rear outboard corner to an eyebolt through the spar, reinforces the outboard end of the aileron. The fabric covering extends right around the nosing of the aileron. Three ball bearing hinges are provided on each aileron, and are attached to special tail ribs on the outer plane. Protector plates are fitted to the ailerons to prevent the fabric surface being damaged when Rocket Projectiles are fired.

Trim Tabs:

15. The trim tab on the port aileron is made of light gauge stainless steel sheet. The tab is secured to a former between ribs 5 and 7 by countersunk-head screws on the top surface, and by dome-head screws in elongated holes on the underside; thus allowing for a small amount of adjustment, for lateral trimming of the aeroplane, to be made on the ground. The fabric covering of the aileron passes around the former to which the tab is secured but does not pass over the tab.

16. The trim tab on the starboard aileron is operated from the cockpit, and consists of alclad sheet bent to shape and hinged to the trim tab former. An operating lever is fitted to the underside of the tab.

SECTION 7 — CHAPTER 3.

Alighting Gear

CONTENTS.

ILLUSTRATIONS.

Alighting Gear

GENERAL.

1. The alighting gear consists of two independent undercarriage units and a tail wheel unit. All three units are simultaneously raised or lowered by means of hydraulic power; the undercarriage units swinging backwards and upwards into the engine nacelles, and the tail wheel unit moving forwards and upwards into a recess in the underside of the stern frame. The hydraulic system is described in Sect. 9, the controls are described in Sect. 1, and the maintenance instructions are given in Sect. 4, Chap. 2. The indicating and warning devices include three electrical position indicators, one for each unit, and an electrical warning horn. Oleo-pneumatic shock-absorber legs are fitted to the undercarriage and the tail wheel units. Dunlop Twin brakes are fitted to the undercarriage.

POSITION INDICATORS AND WARNING HORN.

2. In the pilot's cockpit, three electrical position indicators, one for each unit, and a warning horn indicate the positions of the alighting gear units. The indicator switches are operated by the locking catches (see Para. 7) on the undercarriage, the tail wheel indicator switch by the tail wheel retracting mechanism, and the horn switch by the engine throttle levers as shown in Figs. 4 and 6. Further information is given in Sects. 1 and 6.

CONTROL SAFETY LOCKS AND LOCKING PINS.

3. The control safety lock and the ground safety locking pins, for preventing inadvertent retraction of the undercarriage when the aeroplane is on the ground, are described in Sect. 1; reference should also be made to Figs. 1 and 2.

UNDERCARRIAGE.

General:

4. Each undercarriage unit (see Fig. 1) has a single wheel carried on an axle between two shock-absorber units which are cross-braced to form a rigid frame. The frame is connected to the engine nacelle structure at pivot points at the top of the shock-absorber units, and is braced in the down position by a pair of knee-jointed radius rods. The upper portions of the radius rods are fixed to a transverse torque shaft supported in bearings on the rear tubes of the nacelle structure.

5. When the undercarriage is retracted, nacelle doors held shut by shock-absorber cords fair in the gap at the bottom of the nacelle, completely enclosing the undercarriage and wheel. As the undercarriage is lowered, the doors are forced open by a rubbing rail on each shock-absorber leg. As the undercarriage retracts, a rubbing plate on each leg engages a cam mounted on each side of the nacelle structure. The action of the cams, through a system of cables, closes the doors.

Retracting Mechanism:

6. Pivoted above the transverse torque shaft (see Fig. 1) are two levers with trunnion bearings on which the cylinder of the hydraulic operating jack is mounted about midway along its length. At the middle of the torque shaft are twin levers which are linked to the jack trunnion levers and bearings. The end of the jack piston rod is connected, by an adjustable end fitting, to a pin working in a pair of slots in a lifting bracket attached to the frame at the junction of the cross-bracing. A pair of knee-jointed radius rods brace the frame in the downward position; the lower portions of the rods are connected by adjustable eye-ends and hinge pins to the hinge brackets near the bottom of the shock-absorber legs, and the top portions are rigidly fixed to the outer ends of the torque shaft.

Locking Catches:

7. Mechanical locking catches are provided for each undercarriage unit in both the lowered and the retracted positions (see Fig. 2). On each shock-absorber leg, a latch, toothed on the upper and lower sides, is pivoted on a bracket below the level of the lifting bracket, and is linked by a connecting rod, torque tube, and lever, to the lifting pin in the slots of the lifting bracket. The latch gear, on the inner and outer legs, is interconnected by the torque tube so that both latches work together. The bottom catch, in which the lower tooth of the latch engages when the undercarriage is lowered, is a spring-loaded lever catch fitted on the lower portion of each radius rod. The top catch, in which the upper tooth of the latch engages when the undercarriage is retracted, is a spring-loaded plunger catch fitted on the rear tubes of each nacelle structure forward of the torque tube.

Operation:

8. When the undercarriage is in the lowered position and hydraulic pressure is admitted to the jack, the piston rod (see Fig. 2, Diag. E) retracts into the jack cylinder, thereby pulling the lifting pin in the lifting bracket along the slots. This movement rotates the interconnecting torque tube and raises both latches, disengaging them from the catches on the radius rods. Continued movement of the jack piston rod brings it against the end of the slots in the lifting bracket, thereby pulling directly on the shock-absorber frame; simultaneous movement of the jack cylinder on its trunnions and pivot levers, rotates the torque shaft, thus breaking the knee-joints of the radius rods. Further inward movement of the jack piston rod and rotation of the jack on its trunnions, folds the radius rods and lifts the frame until the upper tooth of each latch engages with the top catches on the nacelle structure. An adjustable emergency stop for the leg is fitted at the rear end of the rear tube of the nacelle structure.

SHOCK-ABSORBER UNIT, VICKERS.

9. Each shock-absorber unit (see Fig. 3) consists essentially of two members, an upper cylinder containing air under pressure and a lower member (or sustaining ram) sliding within the upper cylinder and forming an oil chamber. Light loads are absorbed by air cushioning only, but heavier loads are absorbed by progressive hydraulic loading, caused by forcing the oil through an annular orifice which decreases in area as the ram moves upwards.

Construction:

10. The top end of the upper cylinder has an integral attachment which provides one of the pivot points for the shock-absorber frame, and is fitted with an air valve, an oil plug and tube, and a hollow plunger. The plunger is tapered and has a small leak hole at the bottom end, and holes for the oil overflow into the plunger at the top end. At the lower end of the upper cylinder, a gland, comprising inter-setting packing rings, support and buffer rings, gland nuts and sleeves, oil retaining ring and oil seal cap, is fitted. The gland nut is locked in position by means of a screw through the lower end of the upper cylinder, and a safety strap interconnects the locking screw and the oil level plug. Before the gland locking screw can be unscrewed, the oil level plug must be removed. A lubrication nipple is provided for the gland, and an oil seal cap with an oil retaining ring is screwed over the lower end of the gland nut.

11. The sustaining ram is a hollow tube with a fitting attached at the bottom end to take the wheel axle (see Fig. 2, Diag. D). Near the top end of the ram is an integral partition that forms the base of the oil chamber, and a piston constructed in two halves is screwed on the top of the ram. The inner diameter of the piston is sufficiently great to allow an annular clearance between it and the tapered outer diameter of the plunger. An annular channel between the halves of the piston is connected by holes to the top and bottom of the piston, and is fitted with a damper valve plate. A collar, on the outside of the ram, bears against a buffer ring above the packing support ring, and acts as a stop for the downward movement of the ram.

Operation:

12. At the beginning of the compression stroke, the load is absorbed simply by further compression of the air in the upper cylinder. When the cone-shaped bottom of the plunger has fully entered the lower oil chamber, the load is absorbed by still further compression of the air, and by forcing the oil displaced from the lower chamber through the annular orifice between the piston and the plunger, and through the leak holes at the bottom of the plunger. As the plunger is tapered, the annular orifice decreases in area as the ram moves upward, and an increasing resistance is superimposed on the resistance of the further compressed air. The annular space below the piston, between the sustaining ram and the wall of the upper cylinder, increases in volume, and oil from above the piston is drawn through the holes in the piston around the damper valve plate; the damper plate being in its lower position, thus allowing greater freedom for the passage of oil around its outer circumference.

13. When the energy of landing has been absorbed by the compressed air and oil displacement, the compressed air energizes the outward stroke of the sustaining ram. The oil in the annular space below the piston is now forced up through the clearance space between the piston head piece and the cylinder wall; the valve plate being raised prevents passage of the oil through the holes in the head piece, thus restricting the flow of oil from below the piston head. This restriction of the flow tends to impede the outward movement of the piston, and ensures a slow and steady recovery from the compression stroke, eliminating any tendency to cause oscillation.

BRAKES.

14. Dunlop pneumatically-operated twin brakes are fitted to the undercarriage wheels. A complete description of this type of braking system is given in A.P. 1464B, Vol. 1, but the system as a particular installation in this aeroplane is described and illustrated in Sect. 9.

TAIL WHEEL UNIT.

General:

15. The tail unit is mounted in a double frame attached to formers 308.25 and 310.5, and to former 298 (see Fig. 5). The rear ends of the top and rear frame members provide bearings for a cross shaft to which the operating lever is connected, and the shock-absorber leg is pivoted centrally at the lower ends of the rear frame members. The cylinder head of the operating jack is pivoted on a fitting which is attached to a cross member at the forward ends of the frame members, and the jack piston rod is connected to the operating lever on the cross shaft. When the piston rod moves inward to retract the tail wheel unit, the cross shaft is rotated and the retracting arms, connected to the cross shaft, move along a retracting slide fitted to the shock-absorber leg and bring the leg over the vertical position, into the horizontal retracted position. For adjustments of tail wheel jack, see R.A.A.F. Publication No. 636.

Shock-Absorber Unit N2600:

16. Generally speaking, the tail wheel shock-absorber unit (see Fig. 7) fulfils three conditions, (a) energy absorption on landing, (b) rotational damping, and (c) self-centering when fully extended, to the fore-and-aft position. It is somewhat similar in construction to the undercarriage shock-absorber unit but is provided with a dashpot for rotational damping, and radial bearings to assist rotation.

Construction:

17. The shock-absorber unit consists of a plunger tube (1) which slides in a cylinder tube (2), the exposed portion of the former being fitted with a tail wheel fork (3), which is retained in position by two high tensile bolts (4). Portion of the wheel fork is fixed inside the plunger tube, which forms an air head and carries two neoprene seals (5). A hole, which passes through the air head, connects with the transverse hole in the fork and is fitted with an air valve (6). Inside the plunger tube is a floating separator (7), fitted with one neoprene seal (8), which isolates

the fluid from the air. The end of the plunger tube, inside the cylinder tube, has a piston (9) fitted with two neoprene seals (10) and a cam bearing (11). This bearing has a neat fitting on the cam tube or metering tube (12). On the bottom end of the cam tube (12) is fitted an end cap (13) fitted with a neoprene seal (14). A flutter plate (15) blanks off the oil orifice holes in the end cap on compression of the strut, or opens them on extension of the strut. A metering effect is obtained by a tapered profile on the cam tube (12), providing freedom of riding for normal taxying, and a maximum resistance at full compression or full extension, so that shock metal-to-metal contact may be obviated. Two sets of coil roller bearings (16 and 17), carried in cages (18 and 19), are fitted inside the lower end of the cylinder tube (2), and retained by a ring (20) secured to the plunger tube and sleeve (21). The bearings are prevented from dropping out of the bottom end of the strut by a retaining ring (22) secured to the retracting bracket by eight screws. A felt wiper ring (23) is fitted inside this retainer ring (22) to exclude dust.

18. The cylinder tube (2) carries a retracting bracket secured to it by eight bolts which pass through into the retaining ring at the bottom end of the strut. On the other end of the cylinder tube is a top socket (24), secured to the tube by six bolts which pass through into the oil head (25). Two oil filler plugs, which screw through the upper portion of the top socket and the oil lead, provide the means of filling the strut with oil.

The cam tube (12) is secured to the oil head (25) by means of a retaining screw (26) and locking washer (27). The alignment of the cam on the cam tube is ensured by using a locking pin (28) which passes into a locating slot in the oil head. This pin ensures the alignment of the strut when fully extended prior to retracting into the aircraft boot.

19. A dashpot assembly, for the elimination of shimmy, consists essentially of a geneva shaft (29), through which passes a rectangular blade (30) with small clearance orifices ground on the outside edge. The movement of this blade inside the oil chamber cover (31) provides the necessary resistance, by the passage of oil through the restricted orifices, to eliminate shimmy of the strut. The geneva pin (32) passes in and out of engagement with the geneva shaft (29); thereby transmitting the rotational movement of the fork to the dashpot assembly.

Oil chambers are provided by the insertion of an oil chamber body (33) in the dashpot cover, the whole unit being secured by two bolts (34). Oil is prevented from leaking along the geneva shaft by a spring-loaded sealing mechanism.

For servicing and topping up, the oil cover plug (35) and plug filling valve (36) are removed and oil is pumped from the bottom of the shaft through the filling hole. The overflow is allowed to pass through the oil chamber cover plug hole until the escaping oil is free from air bubbles, the shaft being slowly rotated all the time. The dashpot is then considered full and ready for service. To prevent oil from leaking back through the plug filling valve (36), a ball valve (37) and spring (38) are provided. The cover plug and the plug filling valve are both locked with 20 gauge locking wire. The dashpot is locked in the yoke (39), in which is located the yoke liner sleeve (40). The yoke is held in position on the plunger tube by the yoke cap (41). The opposite end of the yoke has lugs provided for the attachment of the long link (42) and a short link (43). The long link is attached to the retracting bracket, thereby preventing rotation of the dashpot assembly, and allowing it to move only in a vertical plane.

Operation:

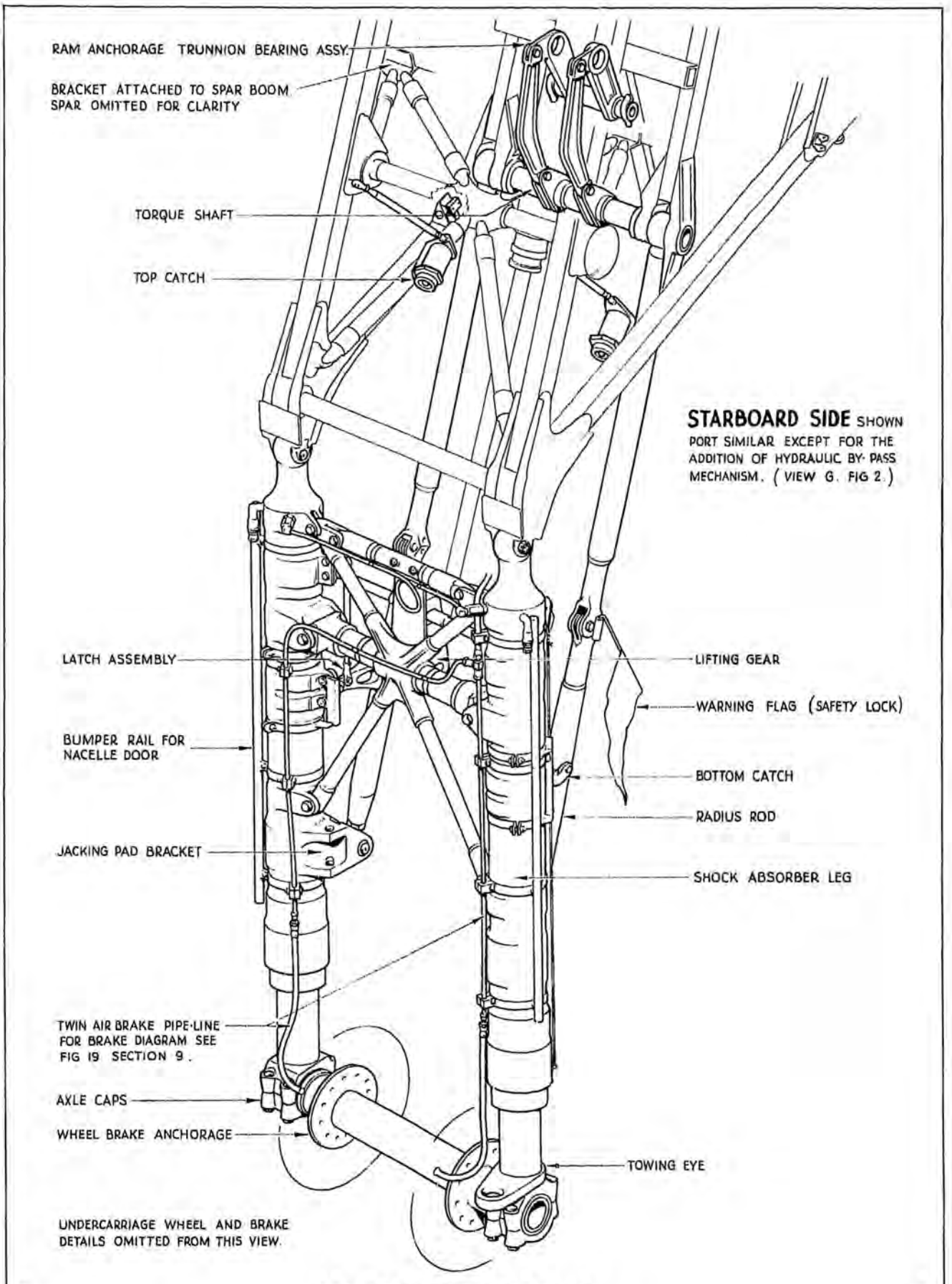
20. When a load is placed on the shock-absorber unit, the plunger tube (1), together with the piston (9), is forced upward and the fluid above the piston is displaced, partly through the orifice holes in the cam tube (12), and partly through the clearances between the cam bearing (11) and cam tube. Oil passing through the cam bearing on compression is prevented from flowing through the orifice holes on the end cap (13) by the flutter plate (15), so that all oil displacement in this instance passes through the cam tube. The

displacement of oil forces the separator (7) downward and compresses the air in the plunger tube.

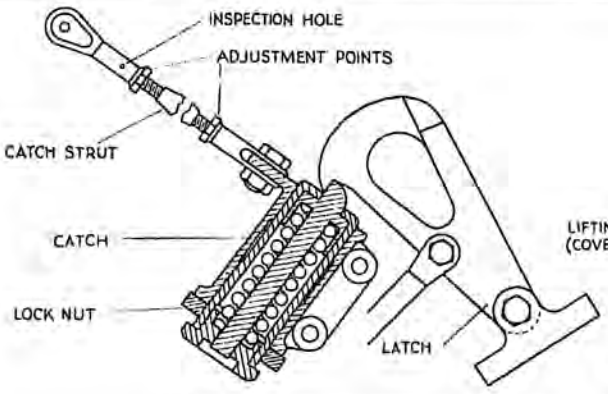
21. When the load is taken off the shock-absorber unit, the compressed air in the plunger tube forces the separator upward, and the fluid above the separator drives the flutter plate away from its seating on the end cap. This allows part of the oil to pass through the clearance between the cam tube and the cam bearing, and part of the oil to pass again through the orifice holes in the cam tube, which function provides resistance in the correct position of closure.

22. When the wheel is deflected from its central position, the fork (3) rotates in conjunction with the plunger tube, while the geneva pin (32) on the fork passes into, and out of, engagement with the geneva shaft (29) on the dashpot assembly. The dashpot assembly is prevented from moving radially by the link attachment. The greater the rotary speed of the fork, the greater the resistance of the dashpot to rotation, due to the velocity of the oil being displaced through the orifice slots (see Fig. 7, section view "AA"); thus the aircraft can be manoeuvred easily, but any severe rotary movement, caused by shimmy, is immediately damped out.

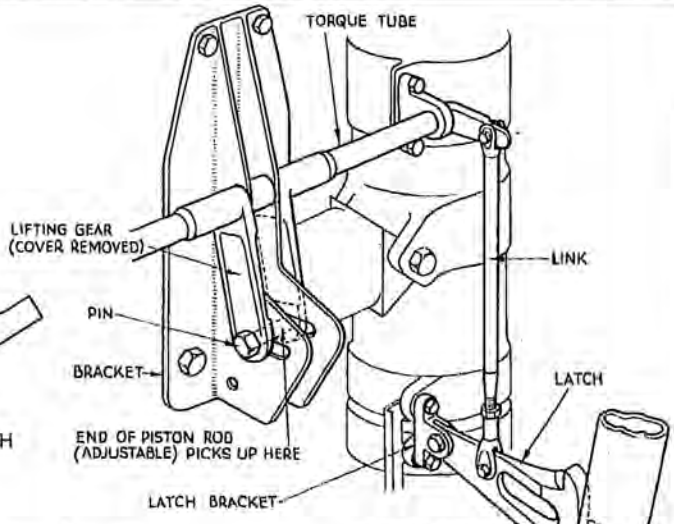
23. The axial, and radial, flexible roller bearings (17) and (16) are provided to assist compression and rotation of the shock-absorber leg, and also to avoid any tendency to bind, with resultant harshness of operation.



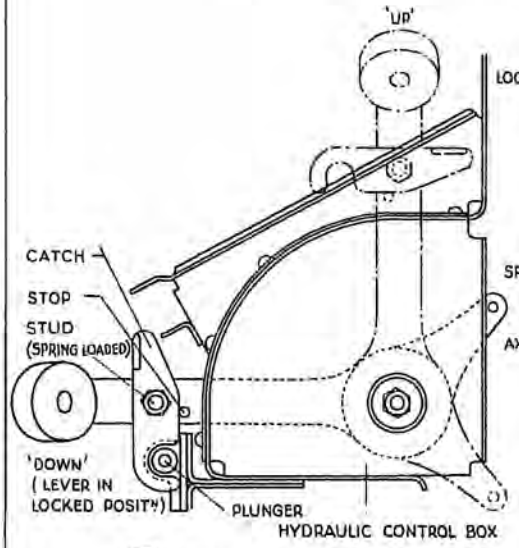
1 UNDERCARRIAGE 1



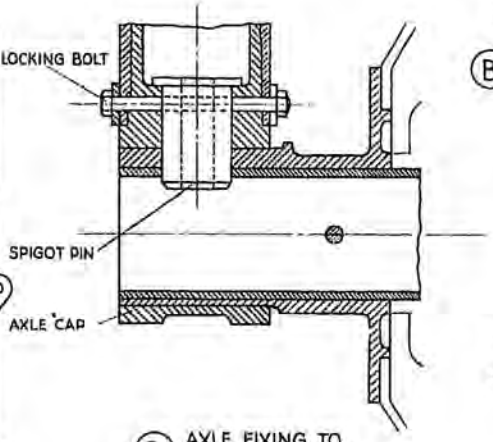
(A) LOCKING OF LATCH AT TOP CATCH



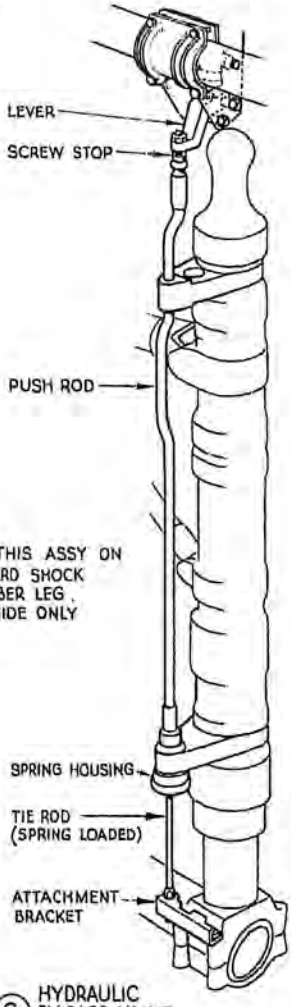
(B) LIFTING AND LATCH GEAR



(C) SAFETY LOCK IN COCKPIT

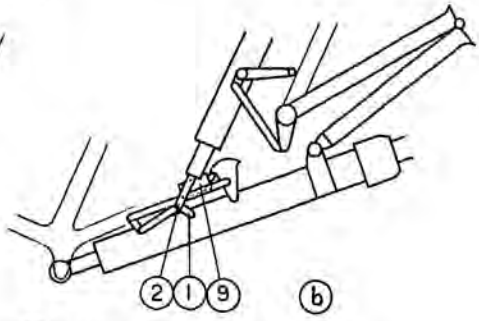


(D) AXLE FIXING TO SHOCK ABSORBER LEG

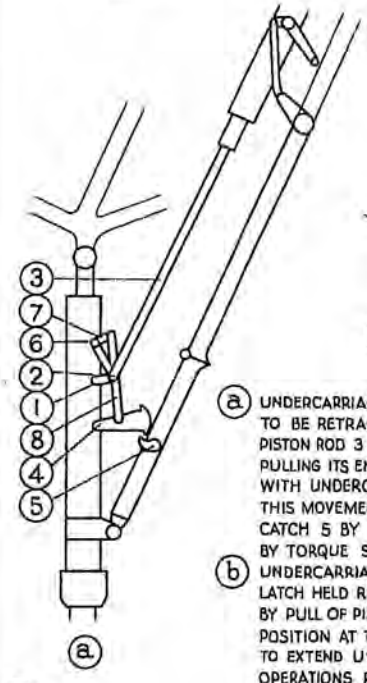


Note:- THIS ASSY ON OUTBOARD SHOCK ABSORBER LEG, PORT SIDE ONLY

(G) HYDRAULIC BY PASS VALVE MECHANISM

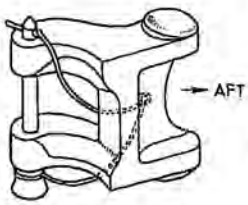


(E) DIAGRAMMATIC FUNCTIONS



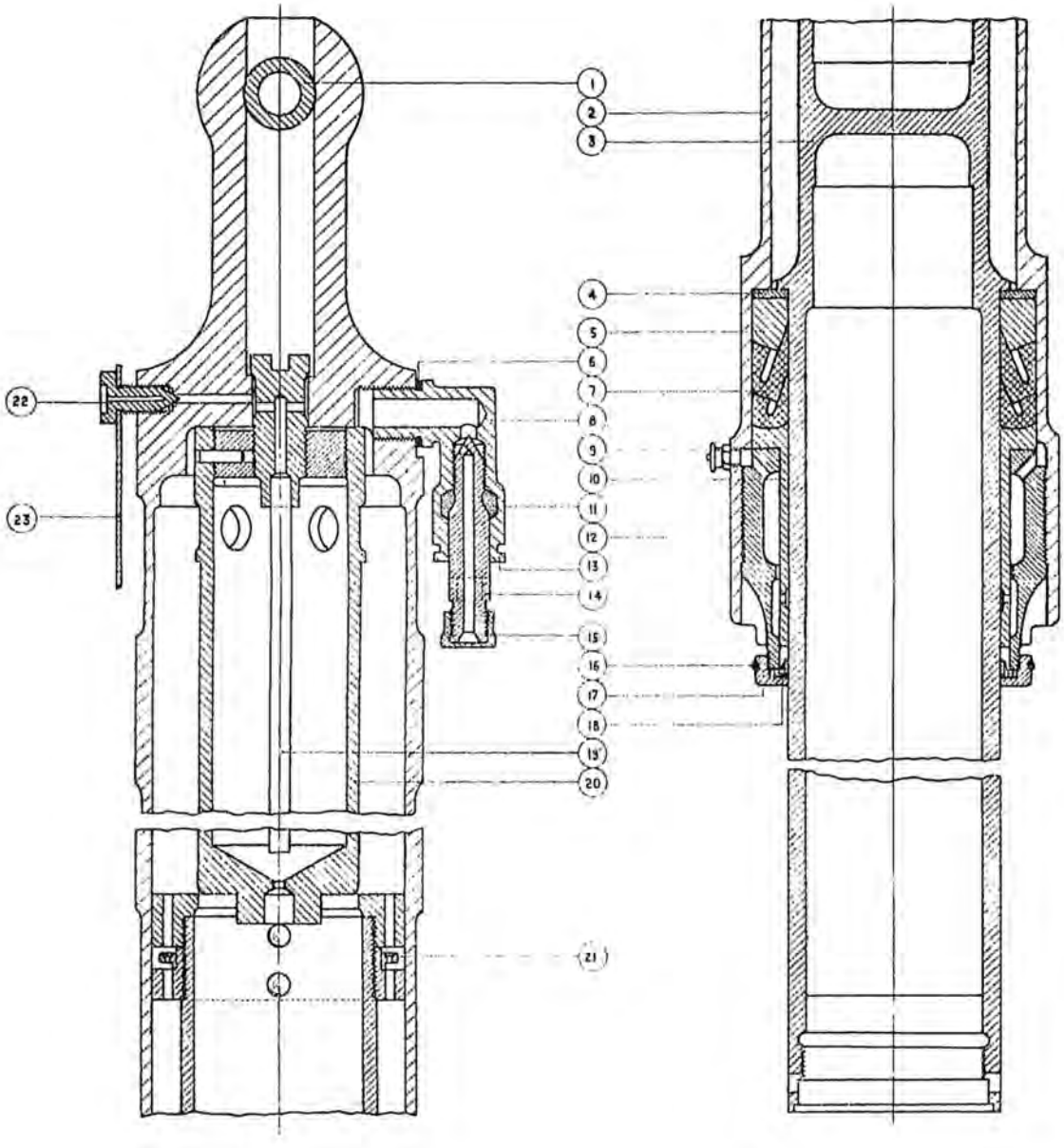
(a) UNDERCARRIAGE EXTENDED, ABOUT TO BE RETRACTED.
PISTON ROD 3 RETRACTS INTO JACK BODY THEREBY PULLING ITS END FROM 1 (i.e., NORMAL POSITION WITH UNDERCARRIAGE DOWN) ALONG SLOT TO 2
THIS MOVEMENT LIFTS LATCH 4 FROM BOTTOM CATCH 5 BY LINK 8 THROUGH LEVER 7 TURNED BY TORQUE SHAFT 6 SEE ALSO DIAGRAM B

(b) UNDERCARRIAGE RETRACTED.
LATCH HELD RIGID THROUGH ATTENDANT LINKAGE BY PULL OF PISTON ROD UNTIL DRAWN INTO POSITION AT TOP CATCH 9
TO EXTEND U'CARRIAGE 2 MOVES TO 1 AND ALL OPERATIONS REVERSED.



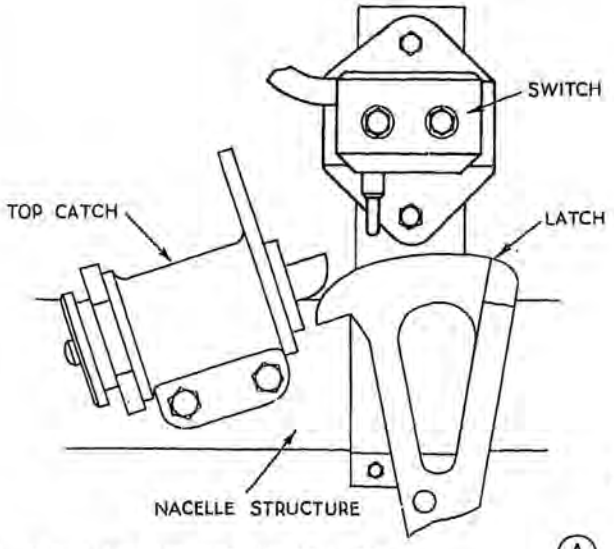
(F) JACKING PAD

2 **UNDERCARRIAGE DETAILS** 2

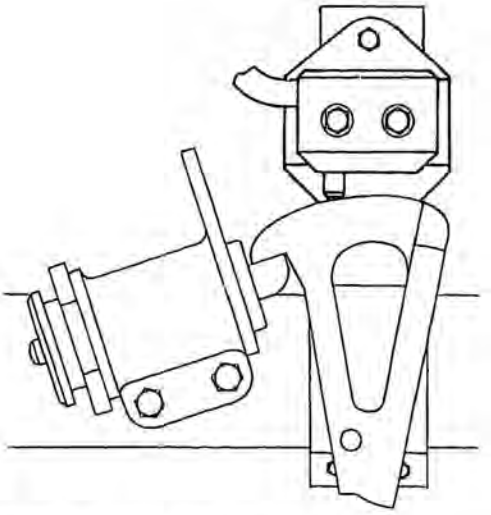


1	BUSH	12	GLAND NUT
2	CYLINDER	13	PACKING NUT
3	SUSTAINING RAM	14	VALVE
4	GLAND PACKING BUFFER RING	15	VALVE CAP
5	SUPPORT RING	16	CIRCLIP
6	JOINT WASHER	17	OIL SEAL CAP
7	GLAND PACKING RING	18	OIL RETAINING RING
8	AIR VALVE BODY	19	OIL LEVEL TUBE
9	LUBRICATION NIPPLE	20	PLUNGER
10	GLAND NUT SLEEVE	21	RETURN VALVE PLATE
11	GREASE PACKING	22	OIL LEVEL PLUG
		23	SAFETY STRAP

3 UNDERCARRIAGE SHOCK ABSORBER UNIT 3

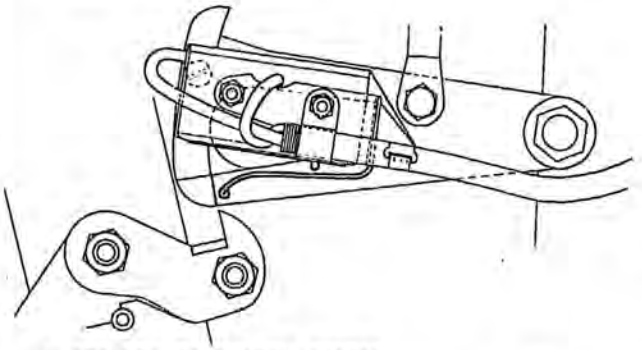


1. CATCH AND UNDERCARRIAGE LATCH ABOUT TO ENGAGE.

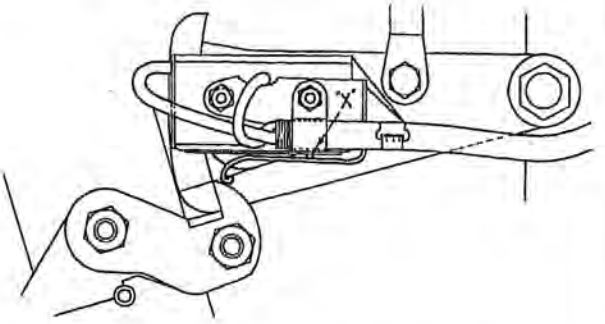


2. UNDERCARRIAGE LATCH FULLY ENGAGED OPERATING PLUNGER ON SWITCH.

(A) TOP SWITCH

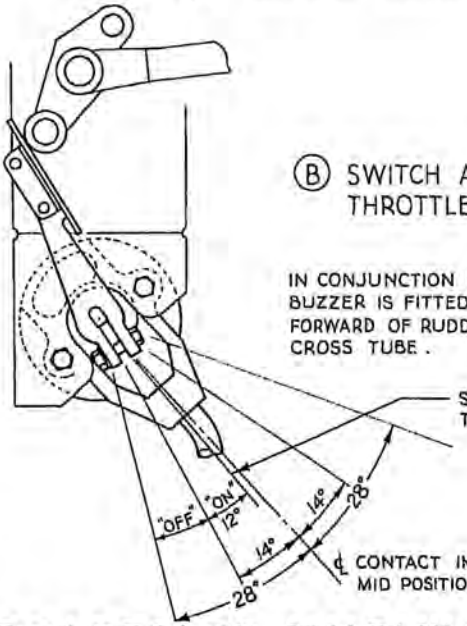


1. POSITION OF SWITCH BEFORE MAKING CONTACT WITH U/C CATCH.



2. SWITCH SPRING PRESSED UP BY CATCH THEREBY ACTUATING SWITCH AT "X".

(C) BOTTOM SWITCH



(B) SWITCH AT ENGINE THROTTLE CONTROL

14° (APPROX.) ON EACH SIDE OF ℄ IS TRAVEL OF "MOVING CONTACT" WHILE MAKING CONTACT.

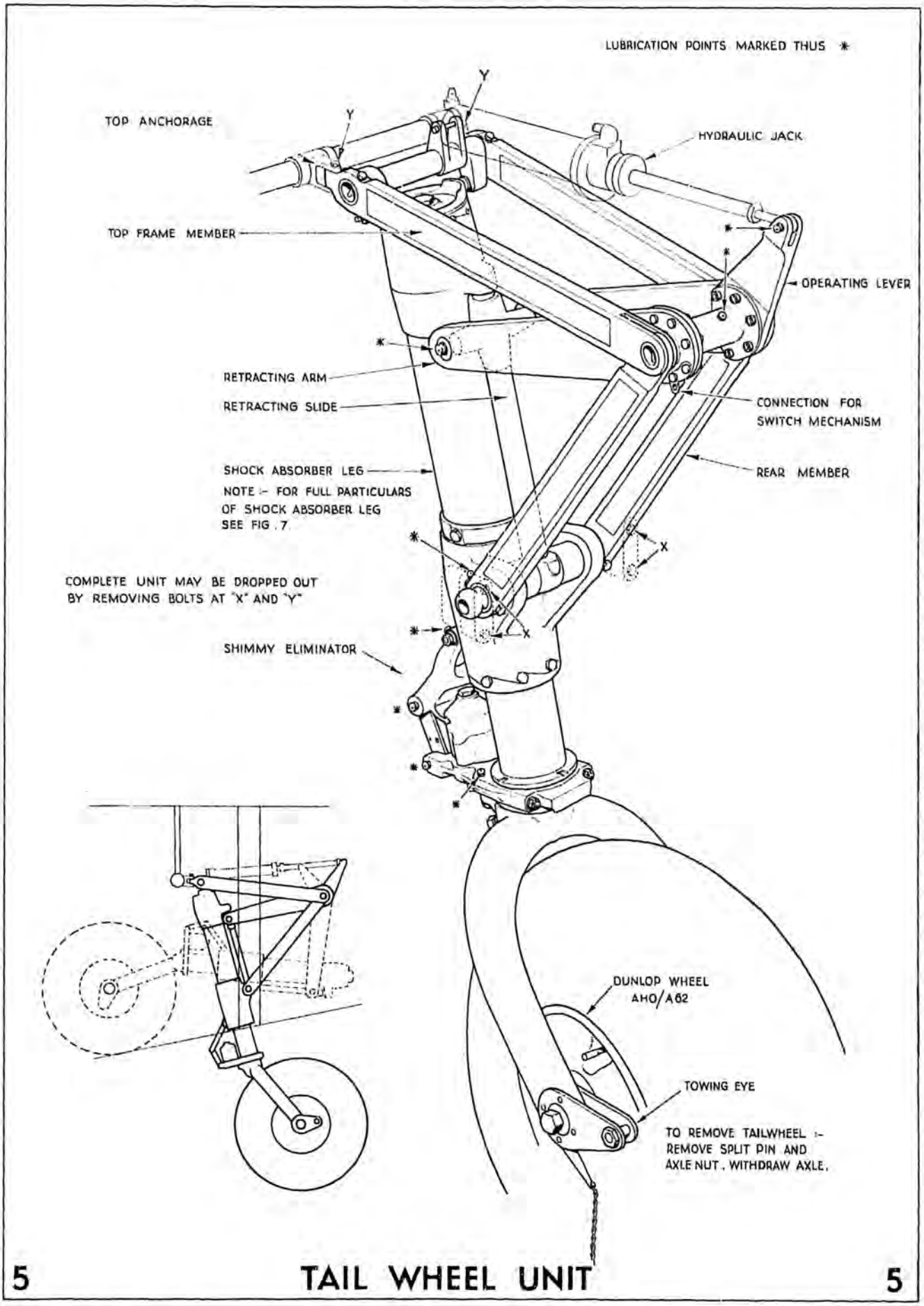
28° (APPROX.) ON EACH SIDE OF ℄ IS TRAVEL OF "MOVING CONTACT" TO SWITCH STOPS.

12° (APPROX.) REPRESENTS "ON" PERIOD.

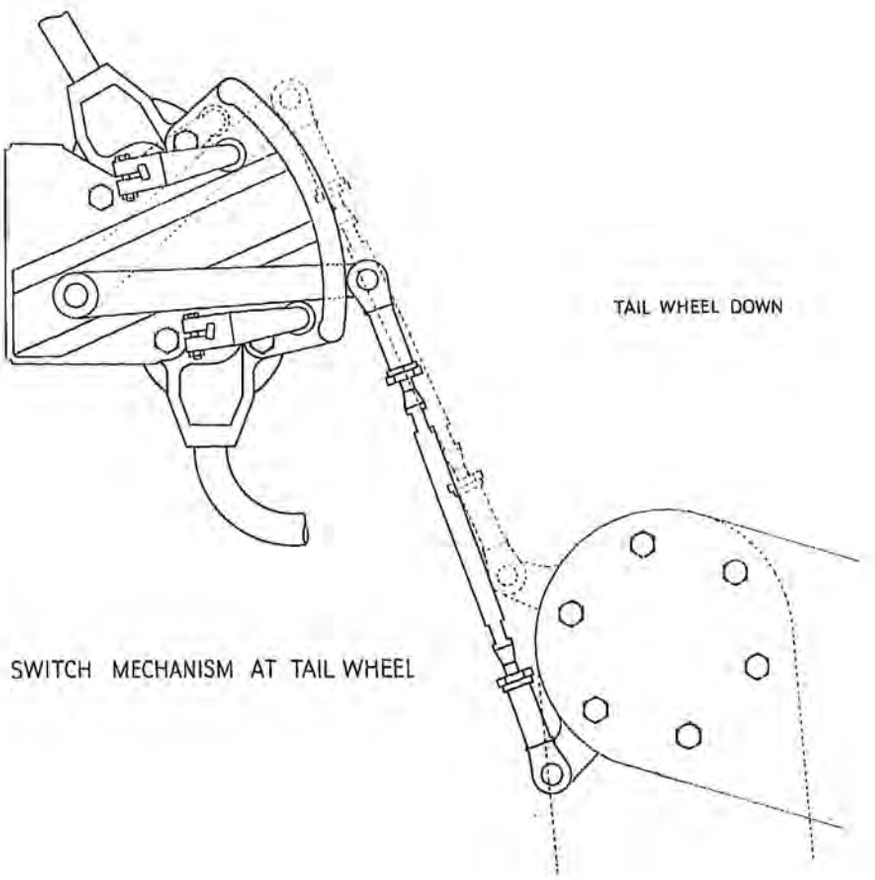
IN CONJUNCTION WITH THIS SWITCH A WARNING BUZZER IS FITTED ON STRUCTURE MEMBER JUST FORWARD OF RUDDER STIRRUPS SUPPORTING CROSS TUBE.

SWITCH LEVER DRAWN IN THROTTLE CLOSED POSITION.

SEE ALSO FIG. 6.

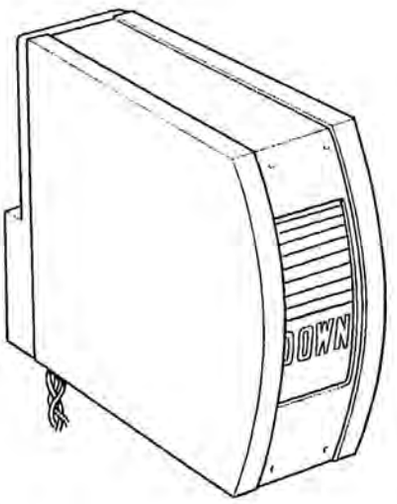


5 TAIL WHEEL UNIT 5



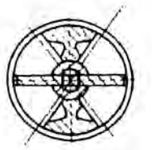
TAIL WHEEL DOWN

(A) SWITCH MECHANISM AT TAIL WHEEL



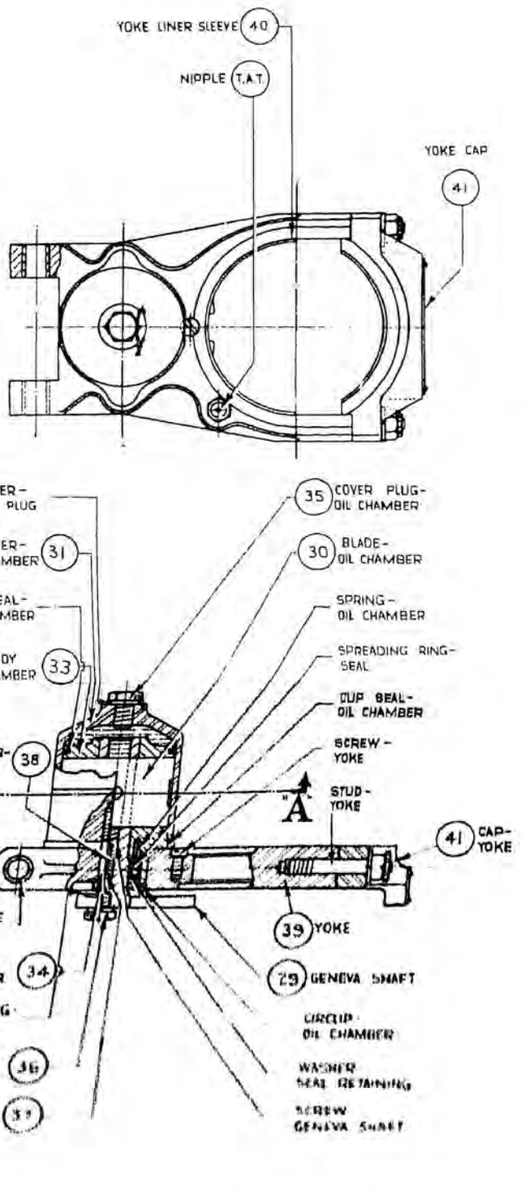
(B) VISUAL WARNING DEVICE

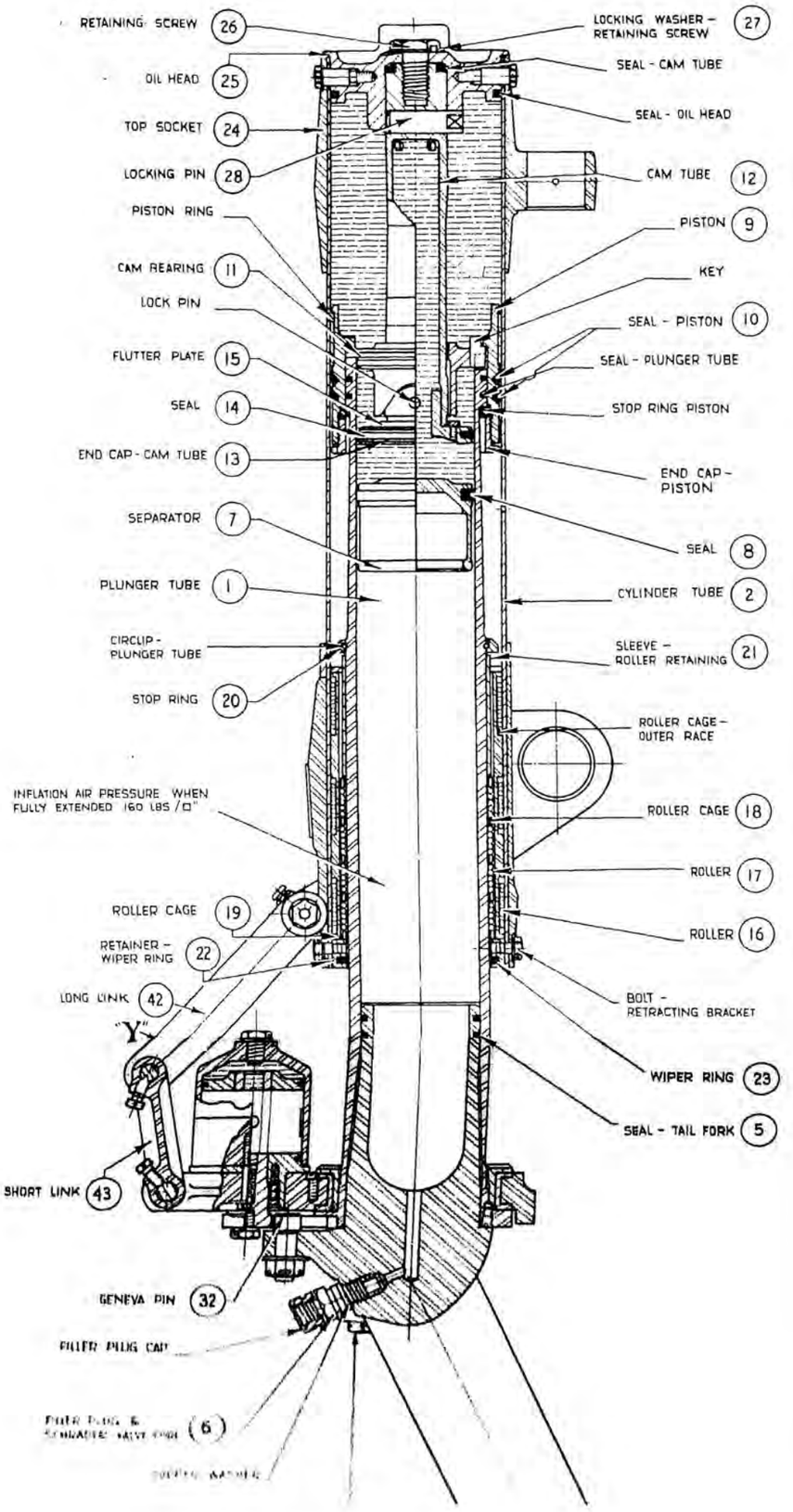
THIS DEVICE IS WORKED ON THE SOLENOID PRINCIPLE.
ONE EACH FOR UNDERCARRIAGES AND TAIL WHEEL GROUPED ON THE PORT SIDE OF COCKPIT.

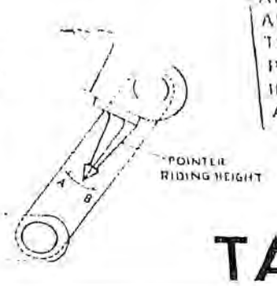


SECTION A-A

NOTE :-
STRUT TO BE CHARGED WITH ANTI-FREEZING OIL DTD 44D

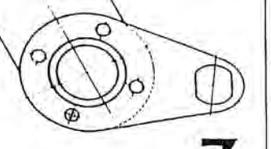






AIR CHARGING INSTRUCTIONS
ADJUST AIR PRESSURE SO THAT INDICATOR TAKES A POSITION BETWEEN A & B, INDICATOR TO APPROACH A AT TAKE OFF LOADS

THE WHITE DISC (8)



TAIL WHEEL STRUT

7 7

SECTION 7 — CHAPTER 4.

Tail Unit

CONTENTS.

Tail Unit

General:

1. The tail unit comprises a cantilever tail plane and fin, elevator, and rudder. The tail plane has a pronounced dihedral. All-metal construction is employed for the tail plane and fin, whereas the elevators and rudder have metal framework and fabric covering. The rudder and elevators have inset trim tabs, and each elevator has a balance tab. Tail plane attachment fittings, extending to the upper surface of the tail plane, also serve as fin attachment points. The tail plane and fin are faired at their junction with the stern frame, by fillets secured by woodscrews to wooden fairing strips on the fin and stern frame.

Tail Plane:

2. The tail plane is built in three sections, a small-span centre panel, and two other panels. The outer panels are riveted to the centre panel. Two alclad channel-section spars, with extruded light-alloy booms riveted on as reinforcements for the flanges, flanged alclad sheet ribs, and alclad skin covering, form the tail plane structure. Between the spars, the skin is stiffened by transverse stringers, and aft of the rear spar, inboard of the cutaways for the elevator balance portions, a false spar is fitted. On either side of the tail plane centre-line, a steel inter-spar tube between the tail plane and the fuselage attachment fittings reinforces the structure. An inspection panel is provided in the upper surface. The elevator hinge bearings are carried on two brackets, one secured to the rear spar and false spar on the tail plane centre-line, and one on each outer panel, inboard of the elevator cutaway. The tail plane tip edge is of wood, secured by woodscrews to the skin overlap.

3. The two attachment fittings, riveted on the rear spar, are bolted direct to formers 330 and 332; the two fittings on the front spar are connected to formers 308.25 and 310.5 by link plates which can be set to accommodate small variations in the attachment centres. At the top of the attachment fittings, the forward attachments are additionally secured by link plates to a fork fitting, at the top of a diaphragm extension on the forward face of former 308.25.

Elevators:

4. The elevators are fabric covered and are built in separate halves, each having a tubular spar, alclad ribs and nosing, and a trailing edge of oval-section tube. A trim tab (see Para. 7) controllable from the pilot's cockpit, is inset in the trailing edge and operated by a rod, one end of which is attached to the balance lever, and the other end to a fixed lever on the elevator bearing bracket.

5. The steel tube spar has a sleeve and a liner at the outboard hinge point, and a flanged plate extension bolted on at the tip. The ribs are of flanged alclad plate with flanged lightening holes and are secured to the spar, by collars riveted to the ribs and secured to the spar by Chobert rivets. Eyelets for the fabric attachment are incorporated in the flanges. An oval-section steel tube forms the trailing edge outboard of the trim tab. From the inboard end to the balance portion, the nosing is of alclad sheet bent around and riveted to the nose of the ribs. The balance portion is covered with alclad sheet, and has a wooden nose fillet secured to the sheet by woodscrews; mass-balance weights are secured to the nose. A fairing of aluminium-manganese alloy sheet is fitted at the inboard end of each elevator, aft of the alclad nosing. Fabric covering extends right around the balance portion and the nosing.

6. The elevator control lever is bolted to a socket on the inboard end of the spar; the pin for the final connecting tube from the elevator control passes through both the port and starboard levers and, together with a bolt and distance piece and two packing blocks between the levers, interconnects both elevators. A spigot at the inboard end of each spar

engages in a ball-bearing on the tail plane bracket and forms the centre hinge; the outboard has two split bearings in which the spar rotates.

Elevator Trim Tabs:

7. A tubular light alloy spar, alclad ribs and covering, and oval tube trailing edge form the construction of both trim tabs. The tabs are capable of quick detachment, and are fitted with mild steel hinge pins in slots at the spindle ends (see Sect. 7, Chap. 5, Fig. 8).

Fin:

8. The fin has front and rear posts and a rear member of channel-section. Alclad is used for the above, also for the ribs and covering. The nosing is of aluminium-manganese alloy sheet. The front and rear posts are reinforced at their lower ends, to form box-sections to which the fin attachment lugs are bolted. The attachment lugs are of light alloy with steel bushes. The front lugs are bolted direct to the fittings on the tail plane front spar (see Para. 3), while the rear lugs are connected through links to the rear tail fittings. A rearward extension of the second rib from the fin base is bolted to the rear post.

9. A removable panel, secured by setscrews, covers the gap between the bottom rear channel members and the sternpost on each side. A mahogany filling piece is fitted inside the top rear channel member; a spruce strip, for the attachment of the fairing fillets, is secured by woodscrews to the flanges of the bottom rib on each side. The steel aerial attachment bracket is riveted to the apex of the fin.

Rudder:

10. The rudder is similar in construction. An inset trim tab is controllable from the pilot's cockpit (see Para. 13).

11. The spar is a light alloy tube with a flattened extension near the tip. The ribs and their attachments are similar to the elevators (see Para. 5). Above the trim tab and to the top of the foremost point of the balance portion, the trailing edge is of mild steel tube, and below the trim tab it is of light alloy tube. The nosing and balance portions are similar to those on the elevator; mass-balance weights are bolted to the balance portion underneath the nose fillets. A fairing of aluminium-manganese alloy is secured to the bottom of the rudder by Chobert rivets. Inset in the trailing edge is a tail lamp, the cables for which are led in conduits along a rib, and through a door in the nosing. The fabric covering extends right around the nosing and the balance portions. Inspection doors are provided on the port side at the mass-balance weights and over the trim tab actuator, and on the starboard side at the rudder lever.

12. The rudder is hinged to the fuselage at two points by means of double split bearings bolted to the sternpost. The operating lever is in separate halves bolted to a socket on the spar above the bottom hinge.

Rudder Trim Tab:

13. This is of the same construction as the elevator trim tab and is mounted in the same manner. The operating lever is fitted on the starboard side at the bottom end, and is linked to the actuator in the rudder.

SECTION 7 — CHAPTER 5.

Flying Controls

CONTENTS.

ILLUSTRATIONS.

Flying Controls

General:

1. The pendulum type rudder pedals and the spectacle type control column are connected to their respective control surfaces by chains and cables. A ground-adjusted trim tab is fitted to the port aileron. For directional, longitudinal, and lateral trimming, tabs controllable by the pilot are inset in the trailing edges of the rudder, elevators, and starboard aileron. All sprockets, pulleys, and levers for the chains and cables in the flying control system are carried on ball bearings. Locking gear is provided for the main flying controls (see Sect. 4, Chap. 1). The split trailing edge flaps are hydraulically operated.

Control Column:

2. The control column (see Fig. 6) is pivoted on a box bracket secured to the control frame, and consists of a duralumin tube to the top of which is bolted the control column head. The control column head is in two halves and has a ball bearing for the spindle of the spectacle type aileron control handwheel. At the centre of the handwheel, the undercarriage brake lever and parking lock are fitted, and at the top right-hand corner is the firing button for the guns. A sprocket is fitted on the handwheel spindle, from which a chain extends downwards inside the control column and over two pulleys, mounted on ball bearings, on a spindle fitted to the mounting bracket, aft of the pivot point of the column. A socket bolted to the control column at the bottom is secured to spigots pivoted on ball bearings in the mounting bracket. The lever for the elevator control is riveted to the socket and spigots, and extends down below the mounting bracket. Adjustable stops, restricting the movement of the lever, are provided at the forward and aft ends of the bracket.

Rudder Pedals:

3. The rudder pedals (see Fig. 3) are pivoted at the top, on the transverse support tube mounted between the sides of the fuselage, and are of stirrup form with leather toe-straps. Each pedal, at approx. mid-length, is connected by a link tube to a lever which rotates a vertical counter-shaft, and at the bottom of the counter-shaft is an outboard pointing lever. To provide adjustment for leg reach, the two levers at the top of the counter-shaft are rigidly fixed to a trunnion sliding within an adjusting box (see Fig. 4) pinned to the countershaft. The trunnion can be moved backwards or forwards, to give a 3 in. adjustment to the pedals on either side of the normal position, by means of a threaded rod which is connected by a universal joint and a tube to a crank handle below the instrument panel.

Elevator Control:

4. The run of the elevator control, and the details at various points are illustrated in Figs. 1 and 2. From the lever at the bottom of the control column, one cable passes forward and around a pulley on the rudder and elevator torque tube, and another passes aft to a pulley assembly mounted on the control frame and then to a pulley assembly on the front keel member forward of the front spar. From the rudder and elevator torque tube and the pulley assembly, the cables extend along the inboard side of the port keel member over pulleys aft of the crate in the rear fuselage, to a vertical double counter-shaft in the stern frame on the centre line of the aeroplane. For adjustment of the cables, turnbuckles are provided at the rear entry and exit hatch. The counter-shaft carrying the elevator levers, is mounted on ball bearings outside the counter-shaft for the rudder control. From this counter-shaft, the elevator control movement is transmitted by an adjustable connecting tube to a horizontal counter-shaft and thence to the elevators by a final adjustable connecting tube, to which the operating levers for the port and starboard elevators are secured by a special bolt.

Rudder Control:

5. The rudder control system and constructional details are illustrated in Figs. 3 and 4. From the lever at the bottom of the rudder pedal vertical counter-shaft, the movement is transmitted by a connecting tube to the rudder and elevator torque tube, and thence by a cable run similarly to the elevator control to the counter-shaft in the stern frame (see Para. 4). From the top of this counter-shaft, cables, with turnbuckles at the counter-shaft lever ends, lead over pulleys to the rudder operating levers.

Aileron Control:

6. The run of the aileron control and the details at various points are illustrated in Figs. 5 and 6. From the control column, the aileron control chains pass around a sprocket at the foot of the relay post mounted on the aft end of the control frame just forward of the front spar. From the four quadrants on the relay post, chains and cables extend outboard over jockey sprockets and pulleys on the front face of the front spar, port and starboard, to a point between ribs 11 and 12 where their direction is altered rearwards towards the ailerons. Turnbuckles for adjusting the chains and cables are fitted between the control column and the relay post, and also just outboard of the outer and centre plane joints. A telescopic conduit encloses the chains and cables from the front spar to the rear spar. The final chain passes over the idler sprocket mounted behind the rear spar, and then around a sprocket on the differential gear.

7. Two special tail ribs behind the rear spar at rib 12, support the aileron differential gear. The differential gear consists of a sprocket, mounted on the inboard tail rib, and having an integral differential lever which is connected by a link to the aileron operating lever. A lever on the outboard tail rib also supports the connecting link. The top pivot point of the connecting link, in the neutral position of the aileron, is above the horizontal line through the centre of the sprocket; so that, for the same angle of rotation of the sprocket on either side of the neutral position, the amount of vertical movement of the pivot, and therefore the angular movement of the aileron, is greater when the aileron is being raised than when it is being lowered.

Trim Tab Controls:

8. The trim tabs, inset in the trailing edges of the elevators and of the rudder, are controlled from the starboard of the pilot's cockpit by means of cables and chains connected to actuating units at the stern frame. The aileron trim tab on the port aileron can be adjusted only when the aeroplane is on the ground, but the tab on the starboard aileron is controllable by the pilot.

Elevator Tabs:

9. The elevator tab control wheel is mounted on top of a column on the starboard side of the pilot's cockpit (see Sect. 1) and operates, by a chain, a drum at the bottom of the column from which cables extend along the starboard keel member to a point just forward of the tail wheel unit (see Figs. 7 and 8). At this point, the cables are connected by turnbuckles to chains which operate a drive unit mounted in the tail plane behind the rear spar. From the drive unit, flexible drives are connected to a screw jack, or actuator, mounted at the inboard end of each elevator and coupled directly to the tab operating lever by an adjustable rod. An indicator is mounted partly on the starboard shelf and partly on the aft side of the column supporting the hand-wheel. The operation of the tabs is described in Sect. 1. Each elevator is also fitted with a tab which gives a servo action.

Rudder Tab:

10. The rudder tab control handle and indicator is mounted on the starboard shelf in the pilot's cockpit, and is connected by bevel wheels and a torque shaft to a drum. From the drum, cables and chains connect to a drive unit in the stern frame below the elevator tab drive unit (see Figs. 9 and 10) by a run similar to that for the elevator tab control (see Para. 9). From the drive unit, a flexible drive operates a screw jack, or actuator, mounted approximately mid-way along rib 10 of the rudder and coupled directly to the tab operating lever by an adjustable rod. The operation of the tab is described in Section 1.

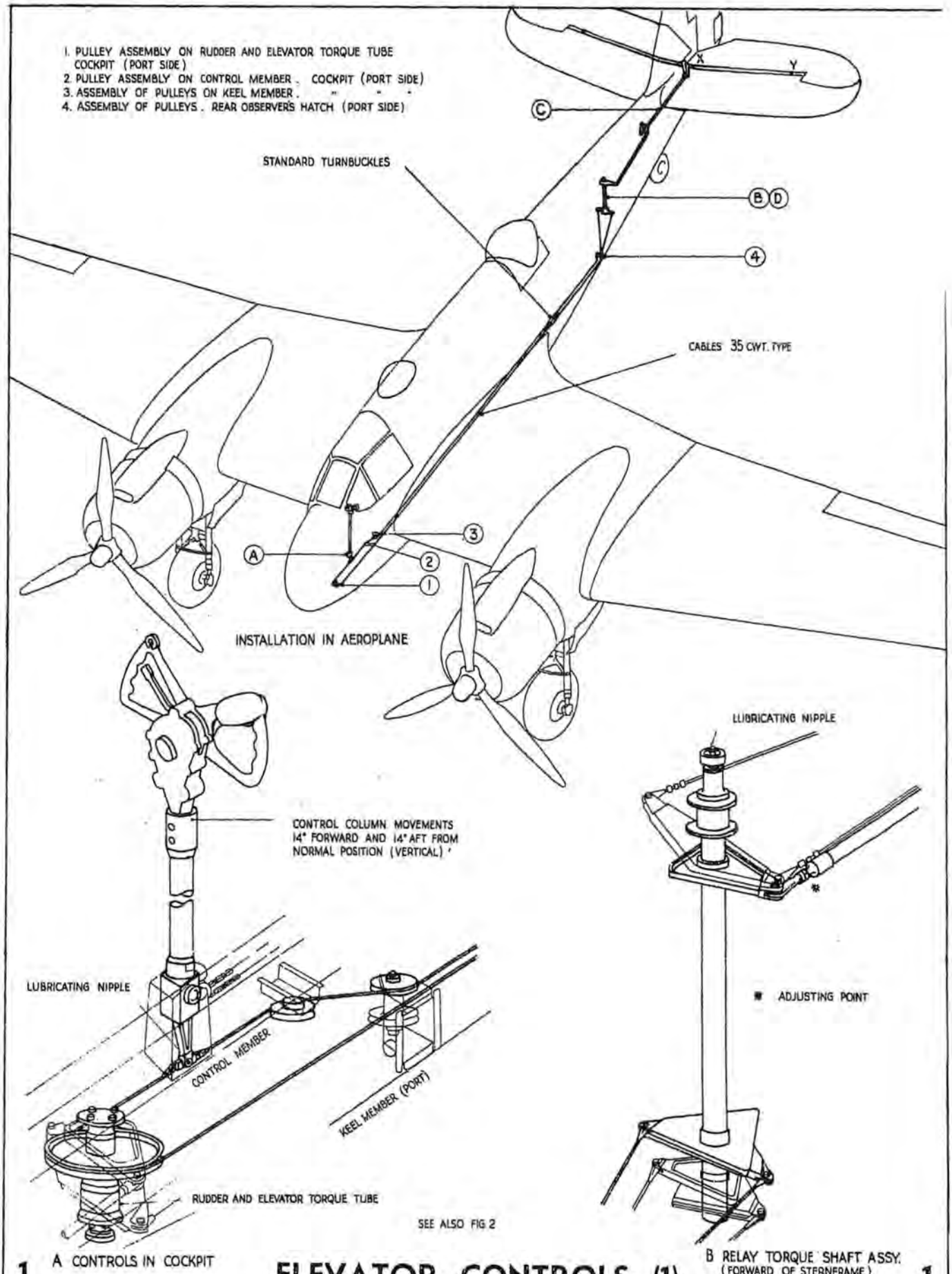
Aileron Tab Control, Starboard:

11. The aileron tab control handle and indicator is mounted on the starboard shelf in the pilot's cockpit in line with the back of the seat, and is connected by a cable to a pulley and sprocket assembly on the rear face of the rear spar, starboard side (see Fig. 11). Cables and chains couple up this pulley and sprocket assembly to a screw jack, or actuator, mounted behind the aileron spar and coupled directly to the tab operating lever by an adjustable rod.

Flap Operating Gear:

12. The two flaps on each side of the main plane are operated by a hydraulic jack pivoted on the rear face of the rear spar, inboard of the centre to outer plane joint. The piston rod of the jack is coupled to the bottom of a quadrant pulley mounted on a support frame extending behind the rear spar, and two links pivoted at the top of the pulley are connected to the operating levers of the centre and outer flaps (see Figs. 12 and 13). A cable around the quadrant pulley is connected by a chain to a small sprocket on a relay shaft, chains and cables extend across the centre plane behind the rear spar, to another relay shaft on the other side of the centre plane, and inter-connect the flaps on each side so that they are raised and lowered simultaneously.

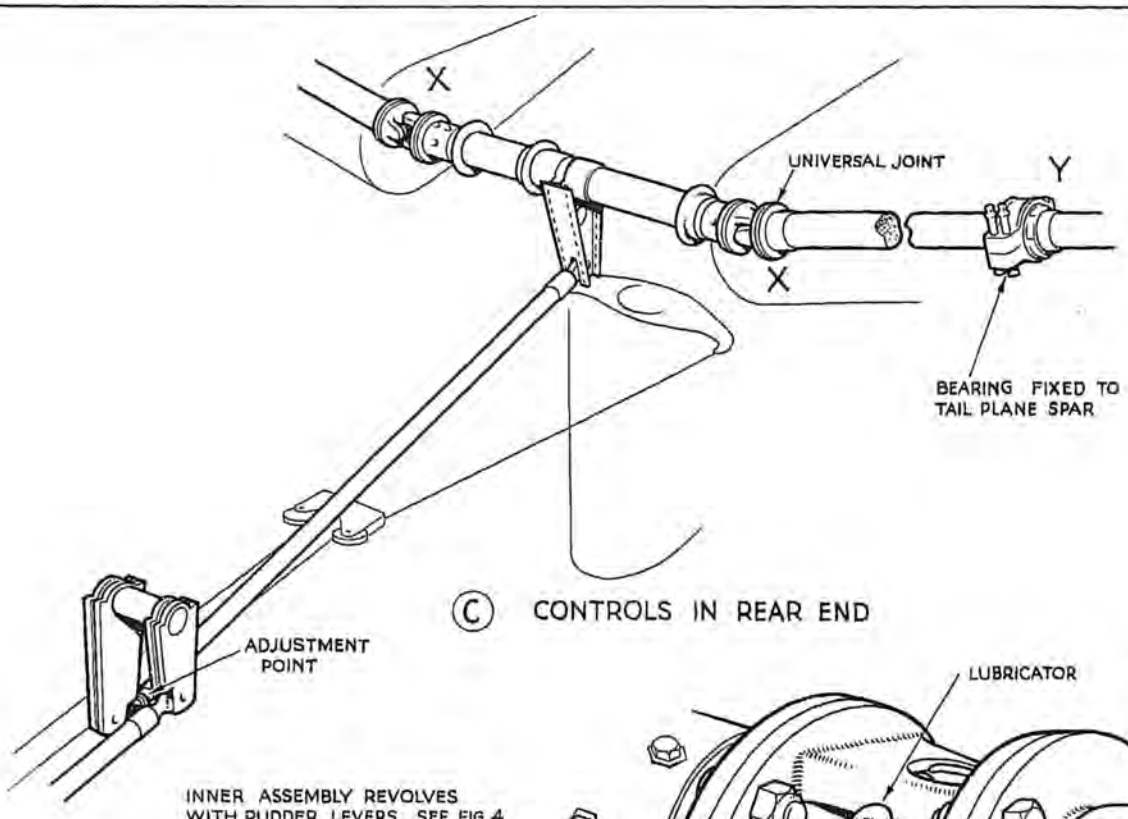
13. The lever for the flap control is situated on the port side below the pilot's instrument panel. An indicator beside the control lever shows the position of the flaps, and is connected by M.R. (Teleflex) controls to a lever on the flap hinge at the port side of the fuselage (see Figs. 12 and 13). Instructions for operating the flaps are given in Sect. 1.



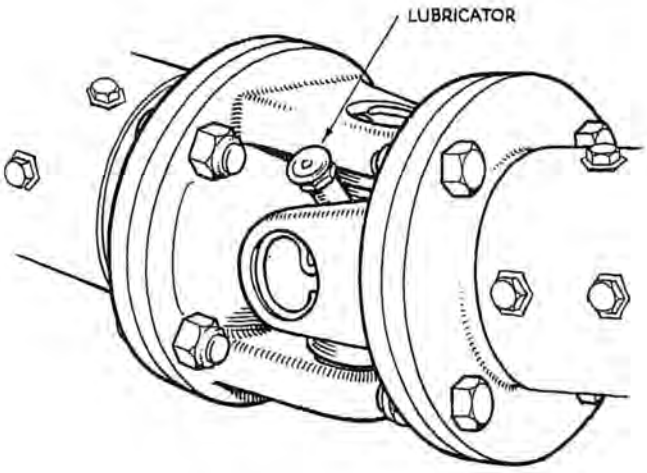
1 A CONTROLS IN COCKPIT

ELEVATOR CONTROLS (1)

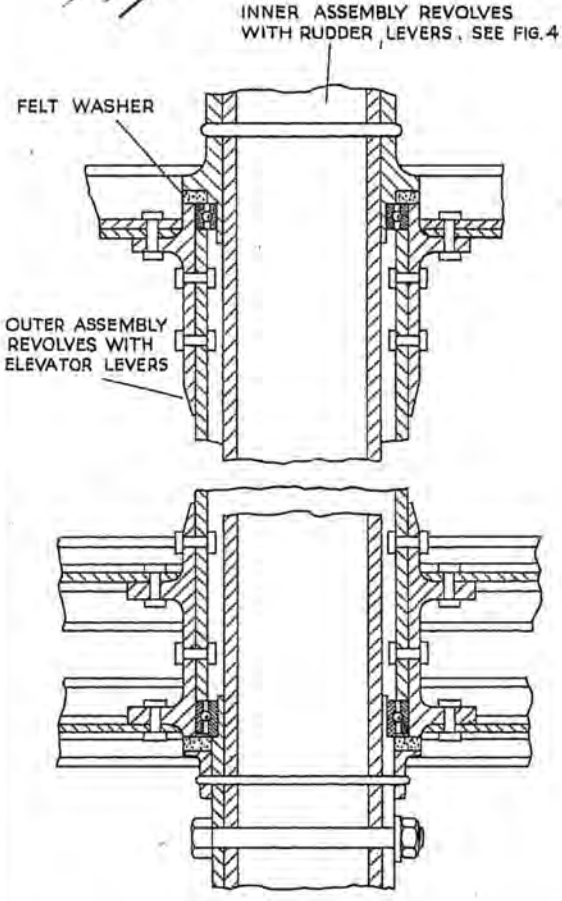
B RELAY TORQUE SHAFT ASSY. (FORWARD OF STERNFRAME) 1



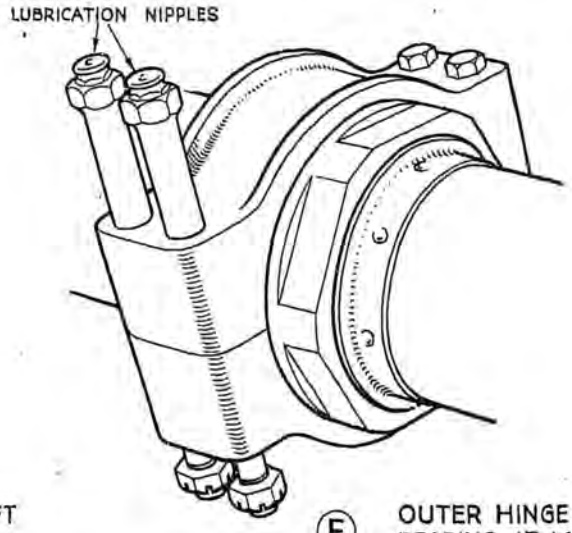
(C) CONTROLS IN REAR END



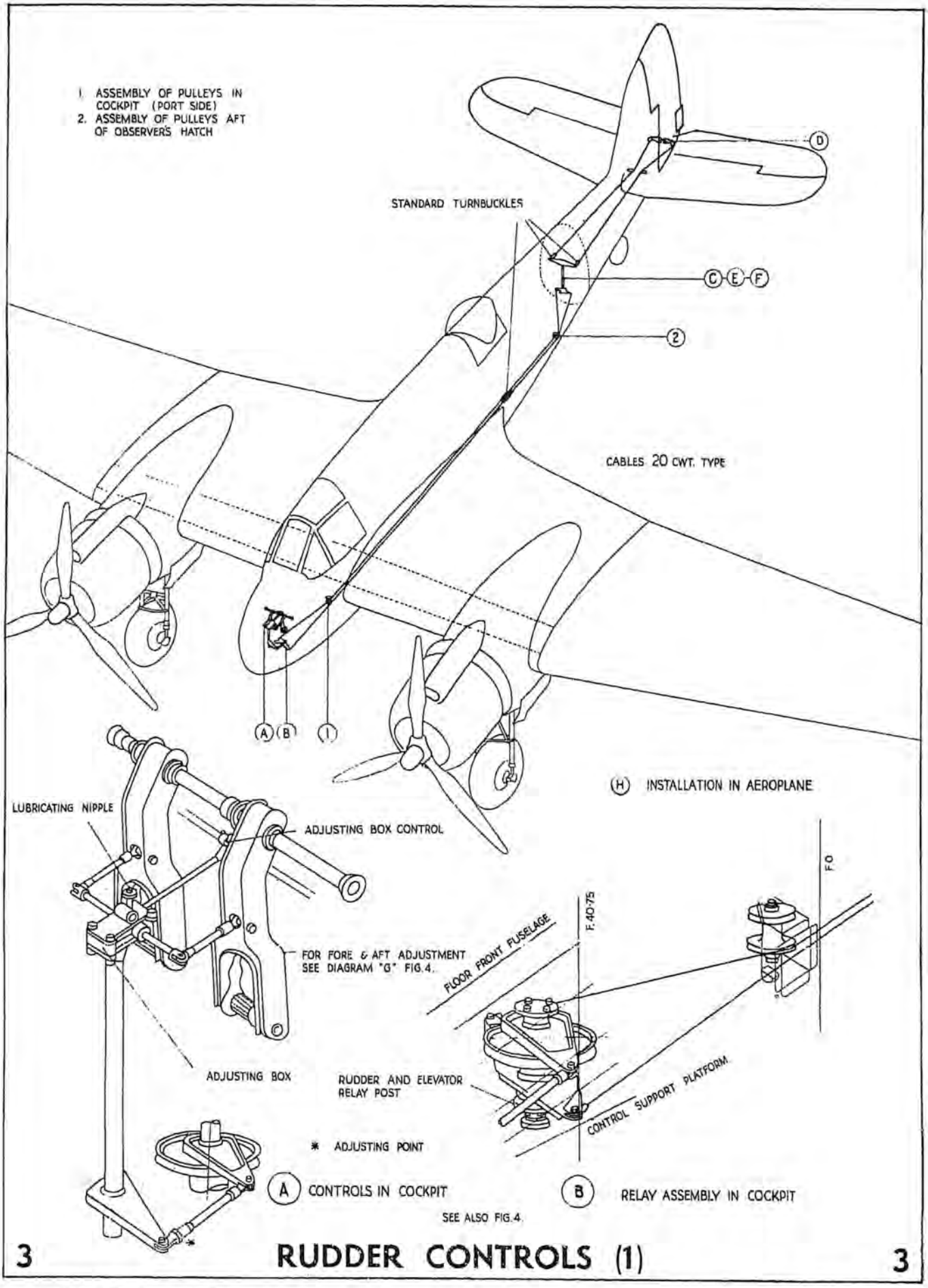
(E) UNIVERSAL JOINT AT X



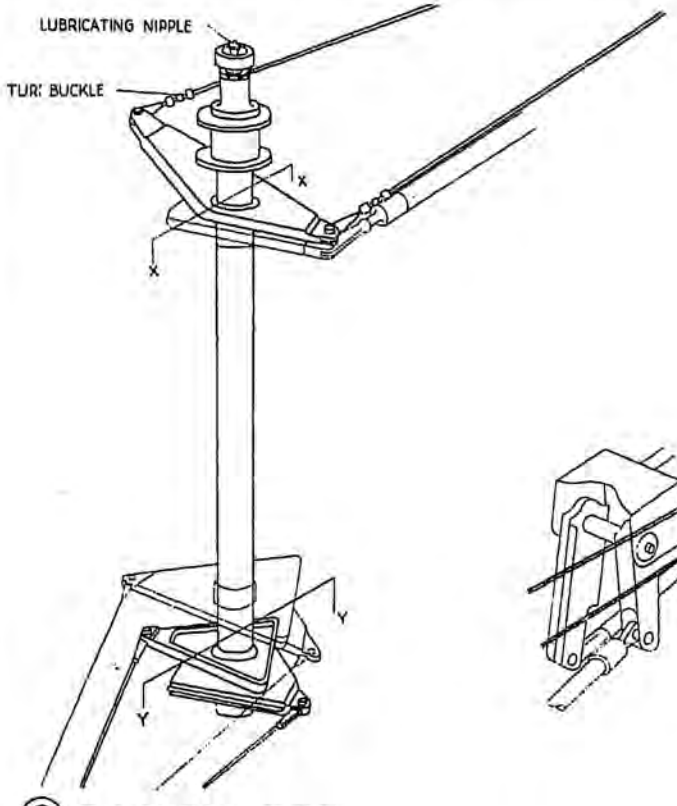
(D) SECTION THROUGH RELAY TORQUE SHAFT



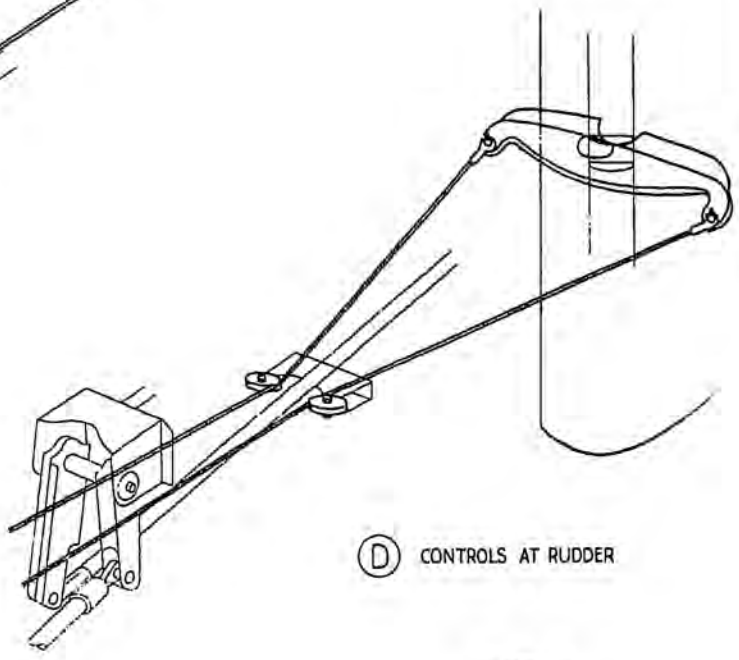
(F) OUTER HINGE BEARING AT Y



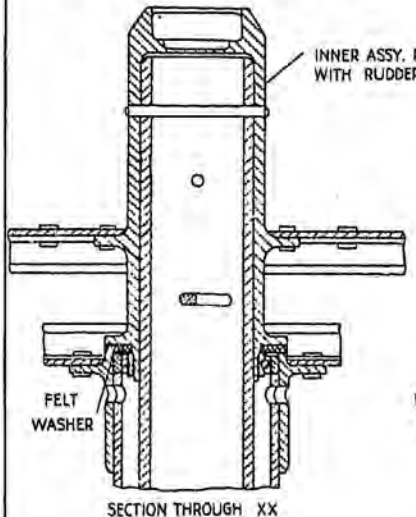
3 **RUDDER CONTROLS (1)** 3



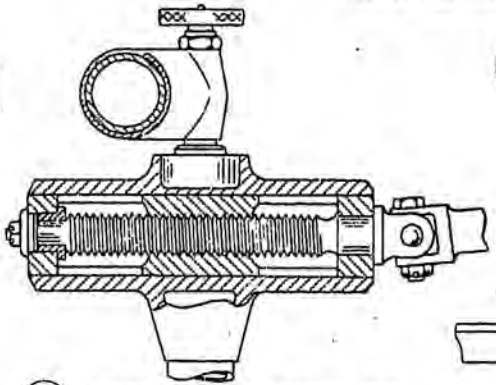
(C) RELAY TORQUE SHAFT ASSY.



(D) CONTROLS AT RUDDER

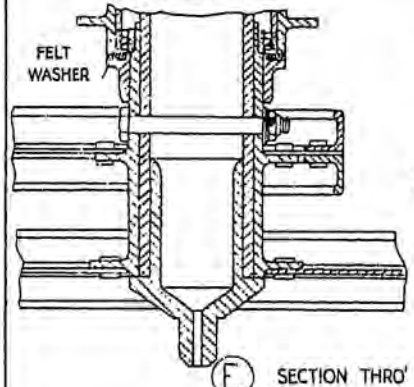


SECTION THROUGH XX

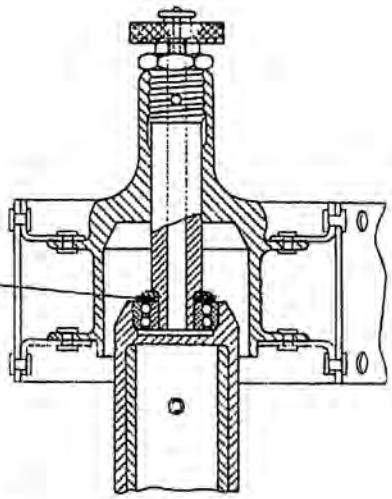


(G) SECTION THROUGH ADJUSTING BOX. BOX PROVIDES APPROX. 3" FORWARD OR 3" AFT ADJUSTMENT.

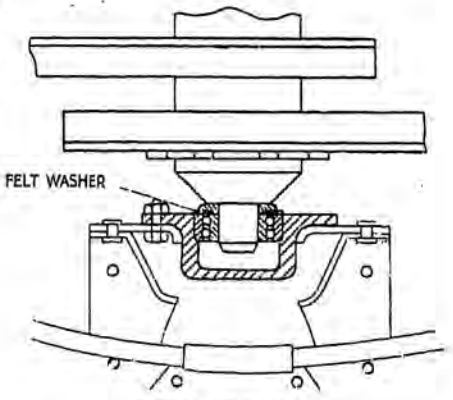
OUTER ASSEMBLY REVOLVES WITH ELEVATOR LEVERS



(E) SECTION THRO' RELAY TORQUE SHAFT AT YY



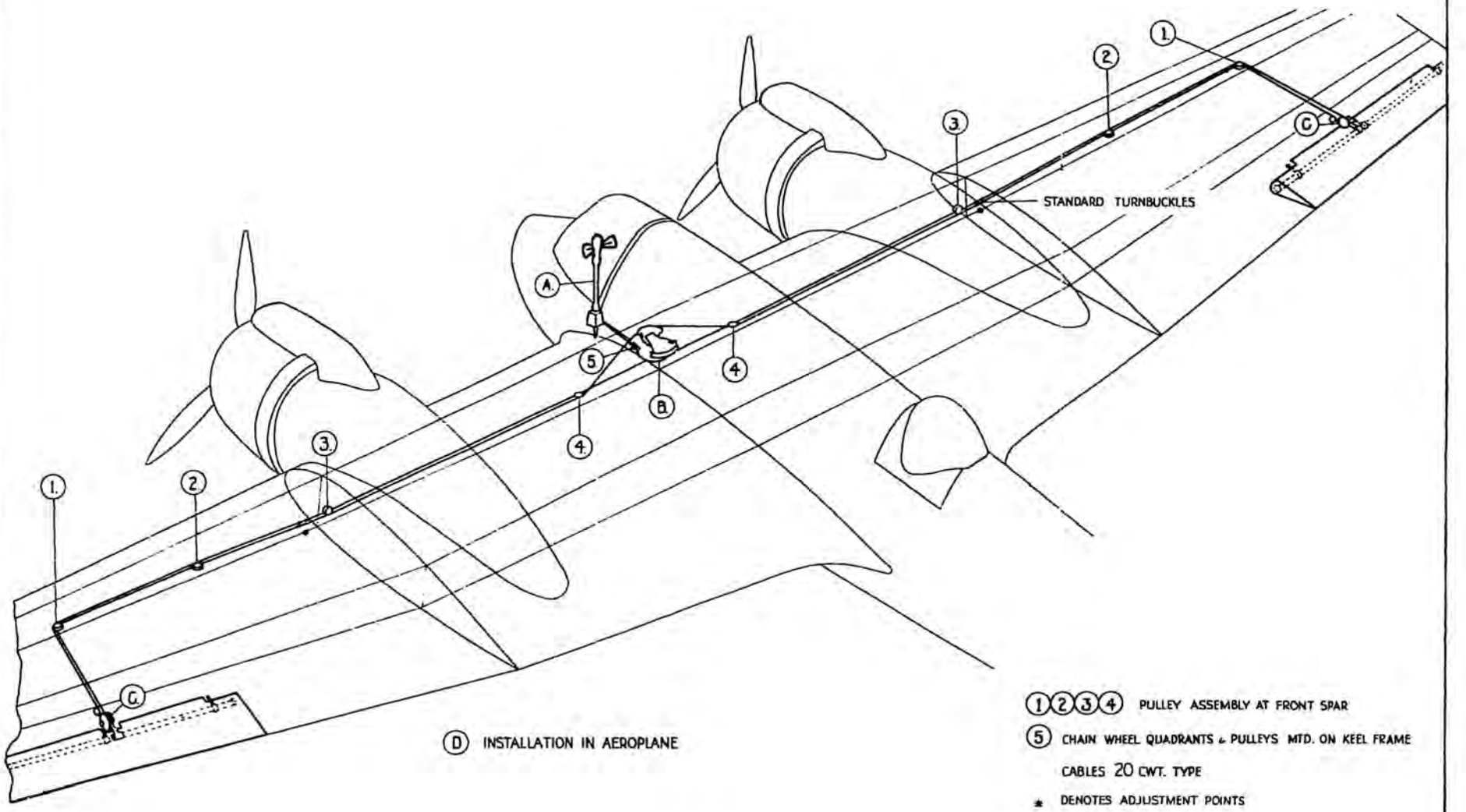
TOP ATTACHMENT



BOTTOM ATTACHMENT

(F) LOCATION OF TORQUE SHAFT

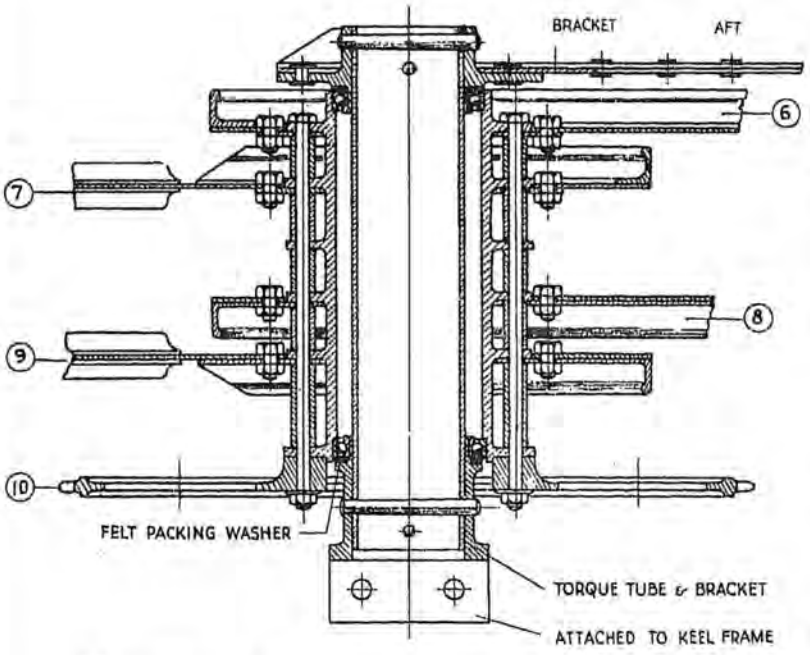
SEE ALSO FIG.3



SEE ALSO FIG 6

AILERON CONTROLS (1)

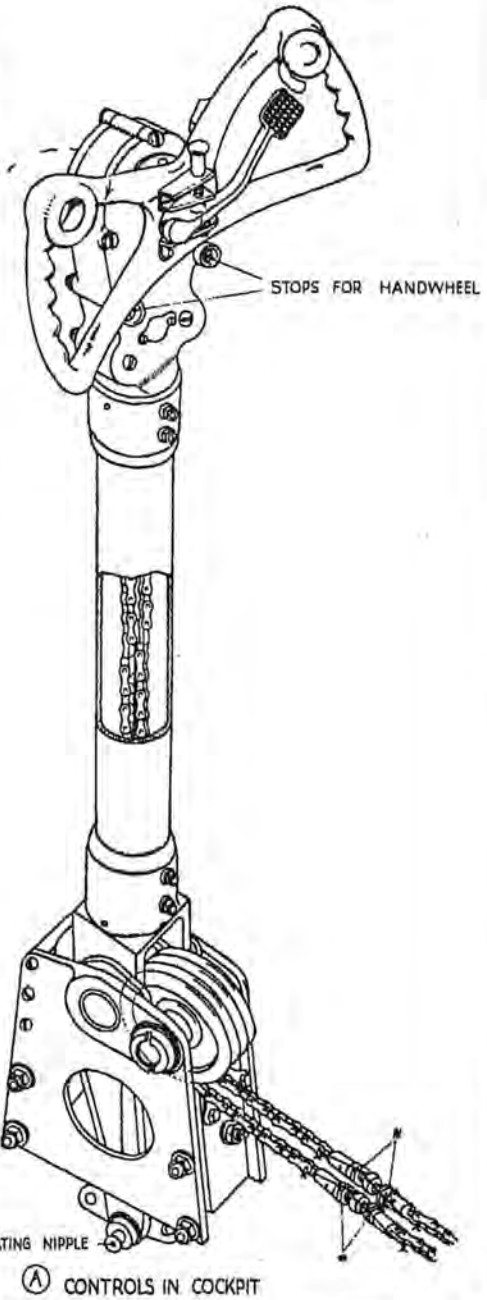
5 5



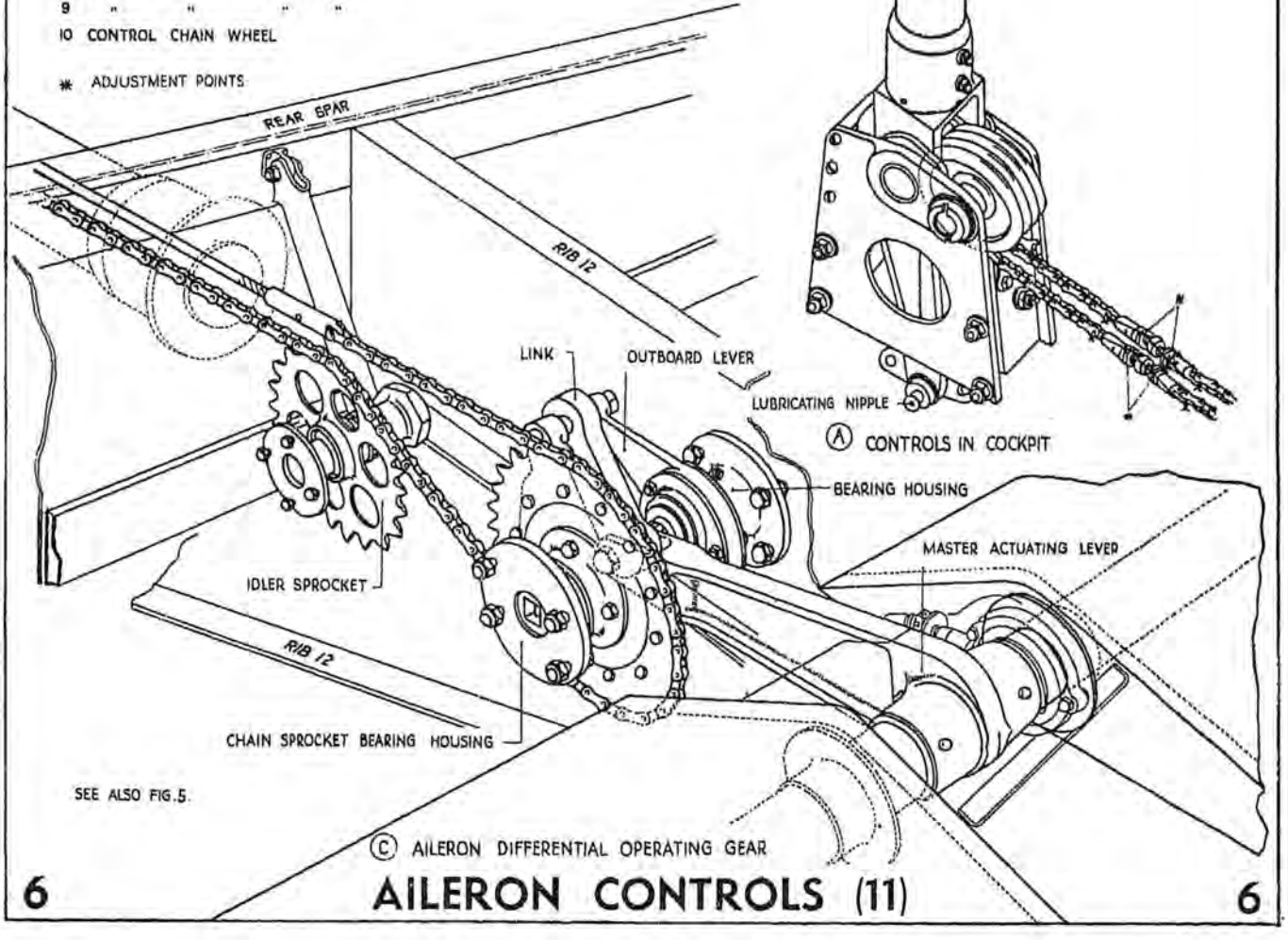
(B) SECTION THROUGH RELAY QUADRANT ASSY. AT FRONT SPAR

6 CABLE QUADRANT (STARBOARD AILERON)
7 " " " "
8 CABLE QUADRANT (PORT AILERON)
9 " " " "
10 CONTROL CHAIN WHEEL

* ADJUSTMENT POINTS



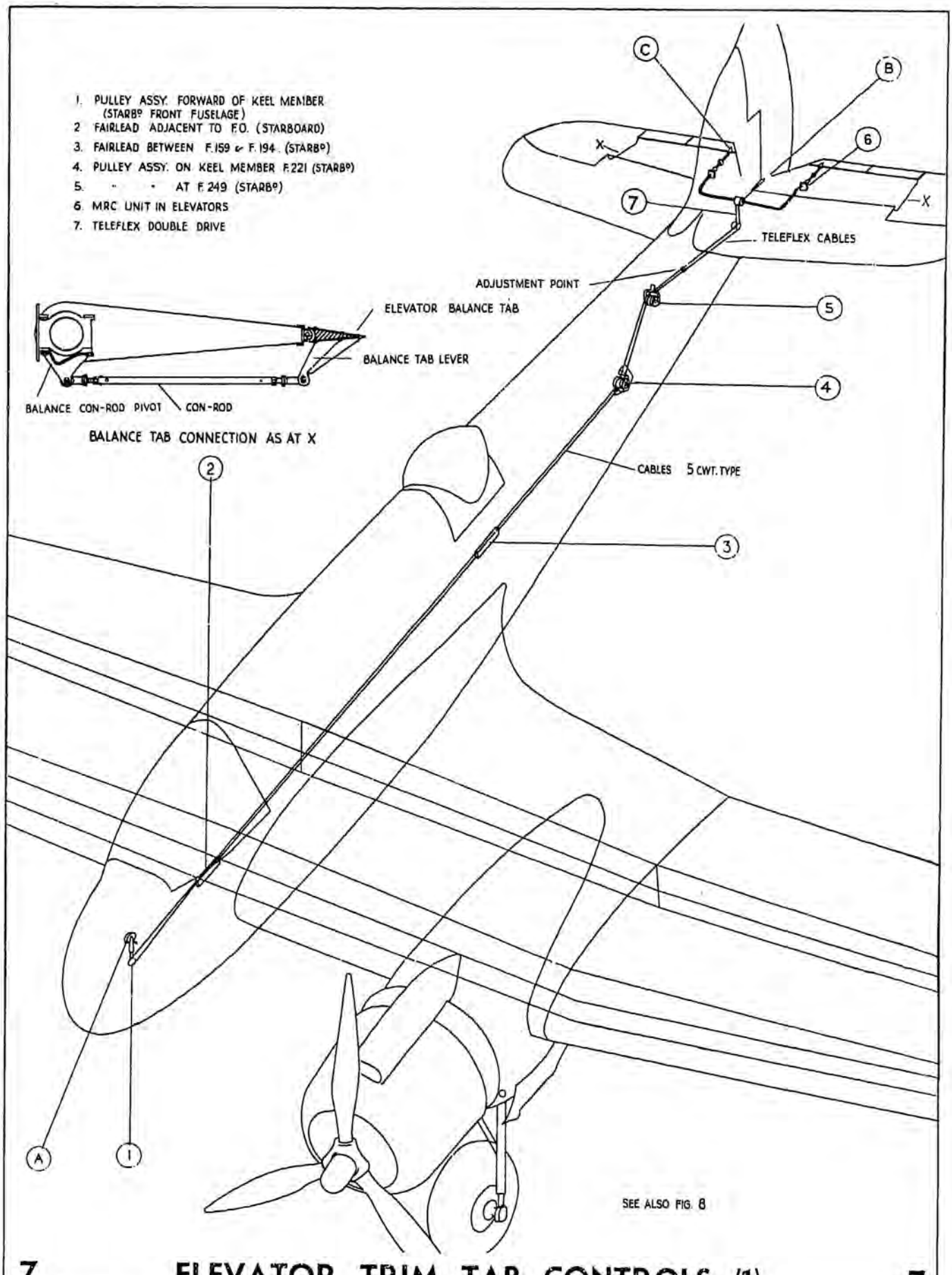
(A) CONTROLS IN COCKPIT



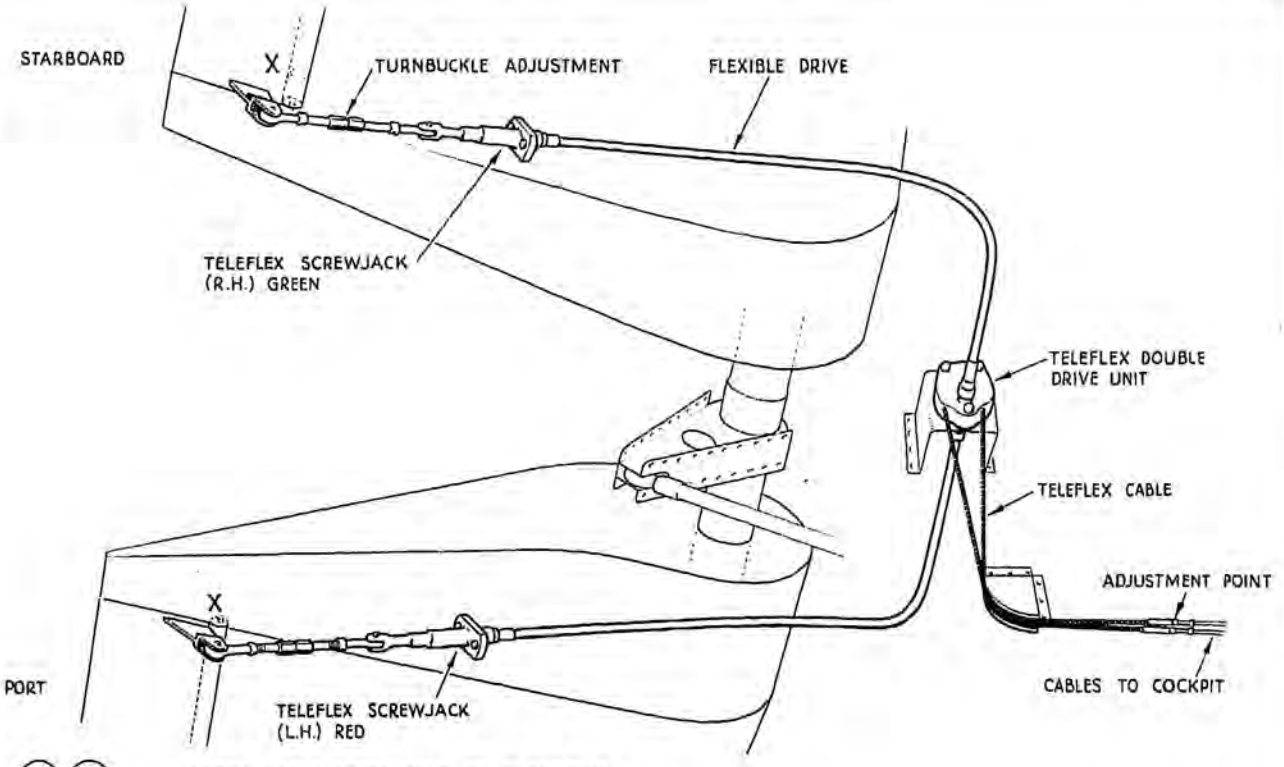
SEE ALSO FIG.5.

(C) AILERON DIFFERENTIAL OPERATING GEAR

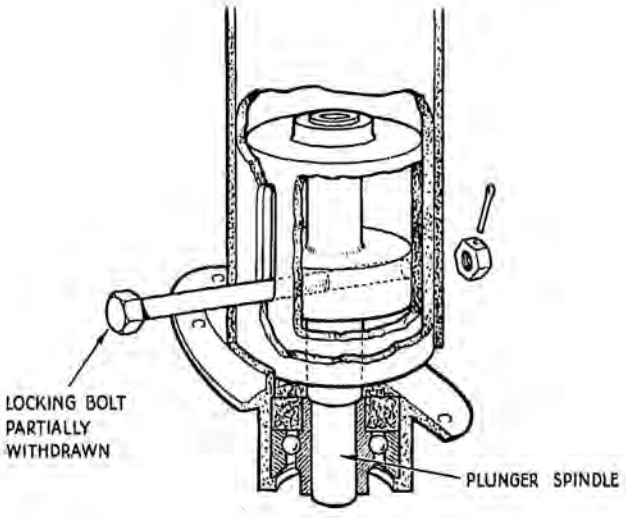
6 **AILERON CONTROLS (11)** 6



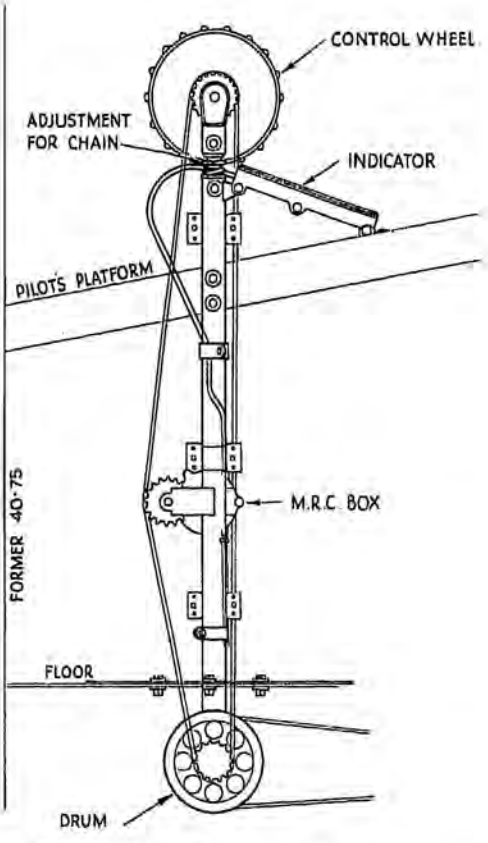
7 ELEVATOR TRIM TAB CONTROLS (1) 7



(B) (C) VIEW FROM UNDERSIDE OF ELEVATOR

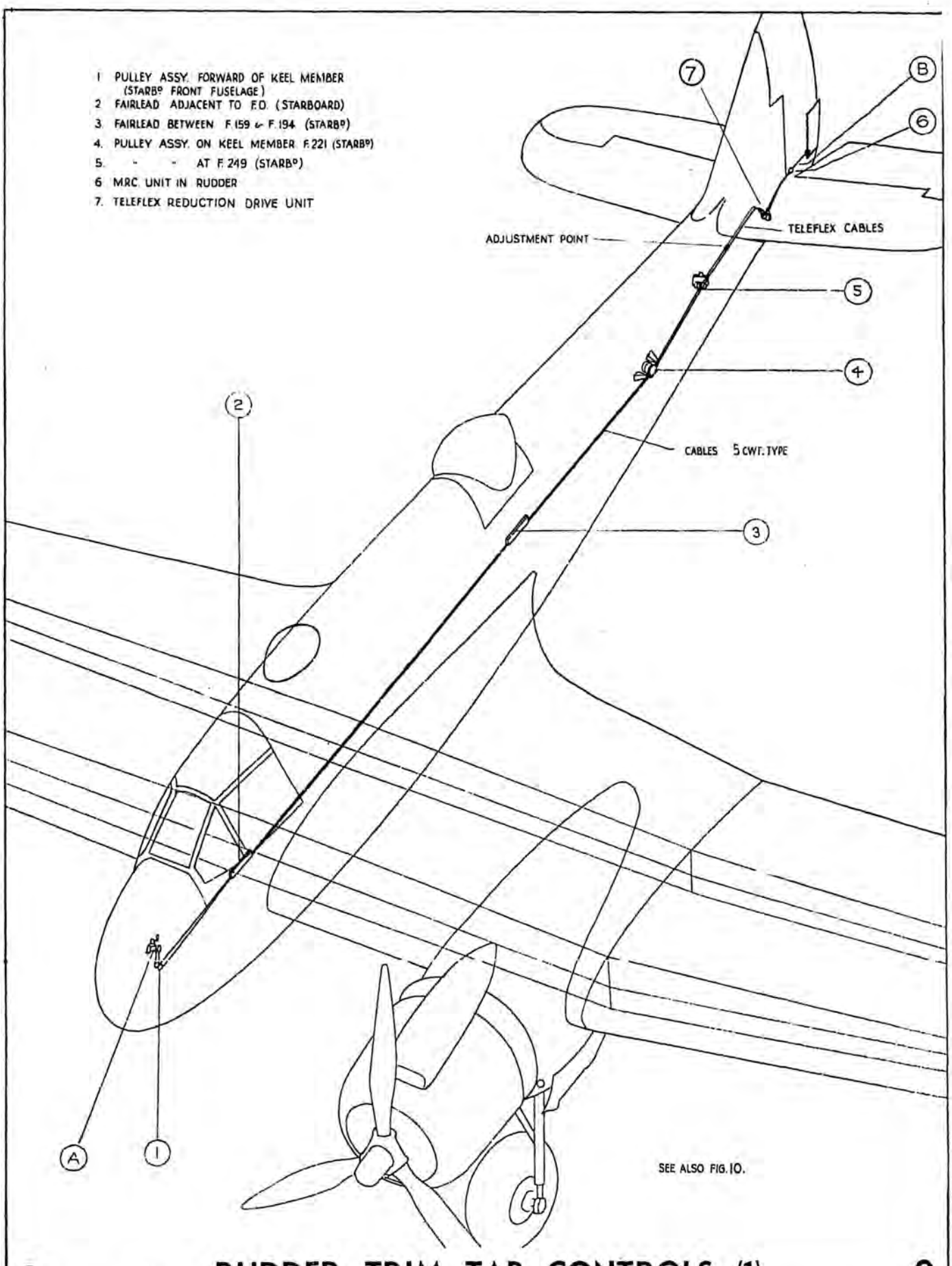


(D) ATTACHMENT OF TRIM TAB TO ELEVATOR AT X
CUT-AWAY VIEW

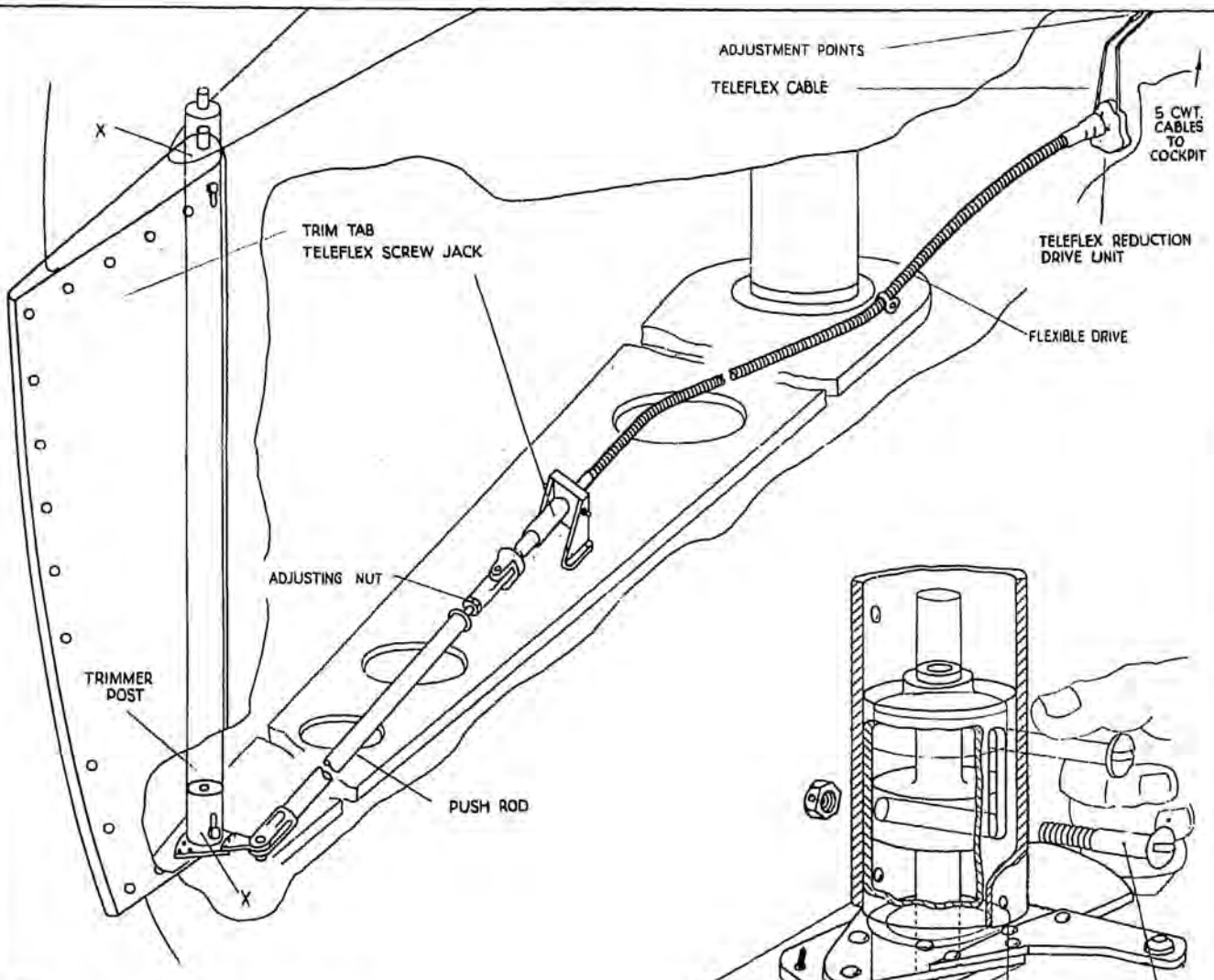


(A) CONTROL WHEEL AND DRUM
IN COCKPIT

8 ELEVATOR TRIM TAB CONTROLS (11) 8

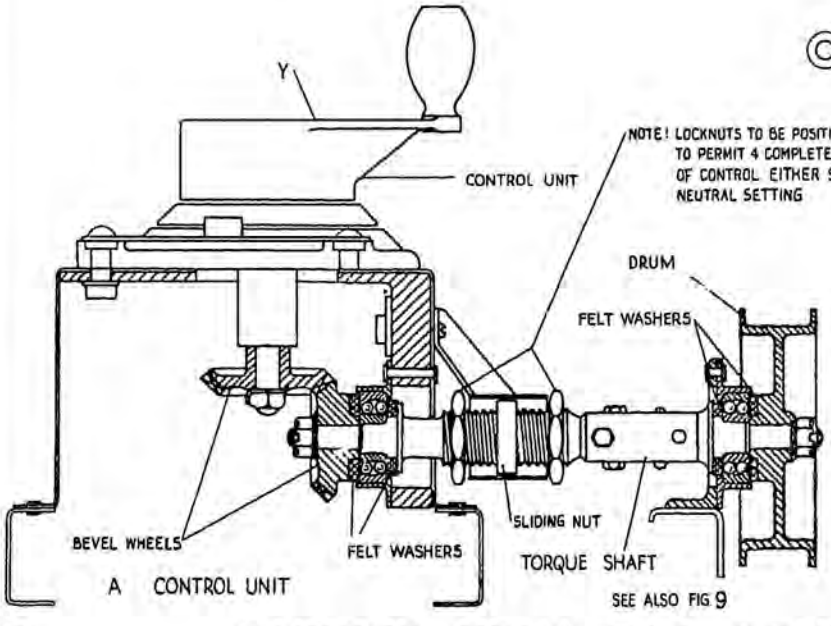


9 RUDDER TRIM TAB CONTROLS (1) 9



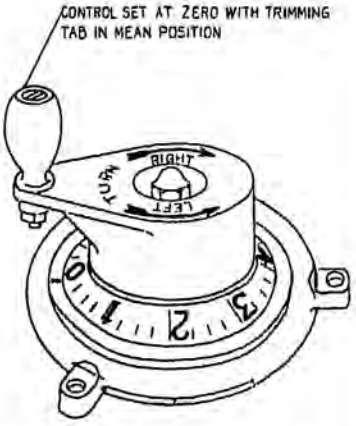
(B) ASSEMBLY OF CONTROLS AT RUDDER

(C) VIEW AT 'X' SHEWING METHOD OF LOCATING TRIMMER POST

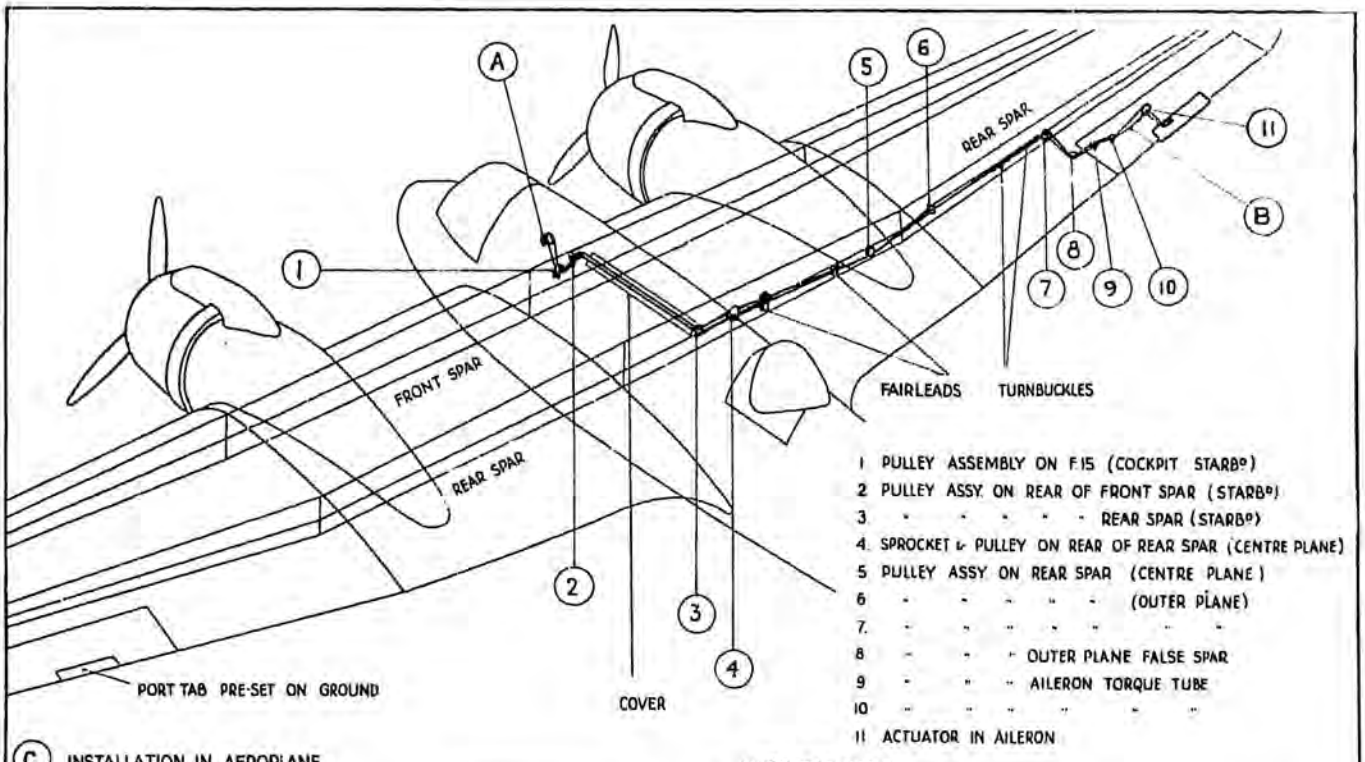


A CONTROL UNIT

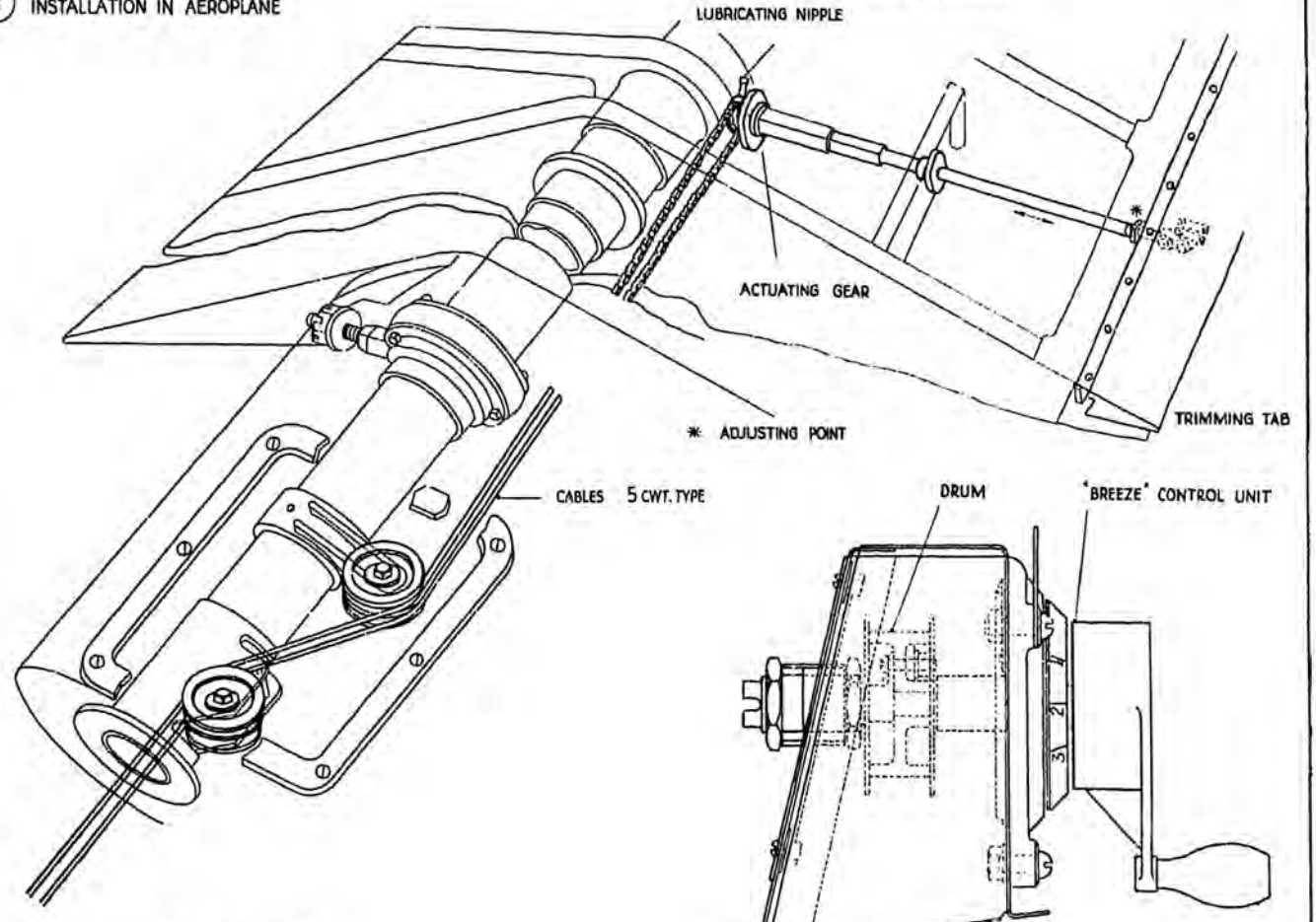
SEE ALSO FIG 9



D VIEW AT 'Y' SETTING OF CONTROL UNIT



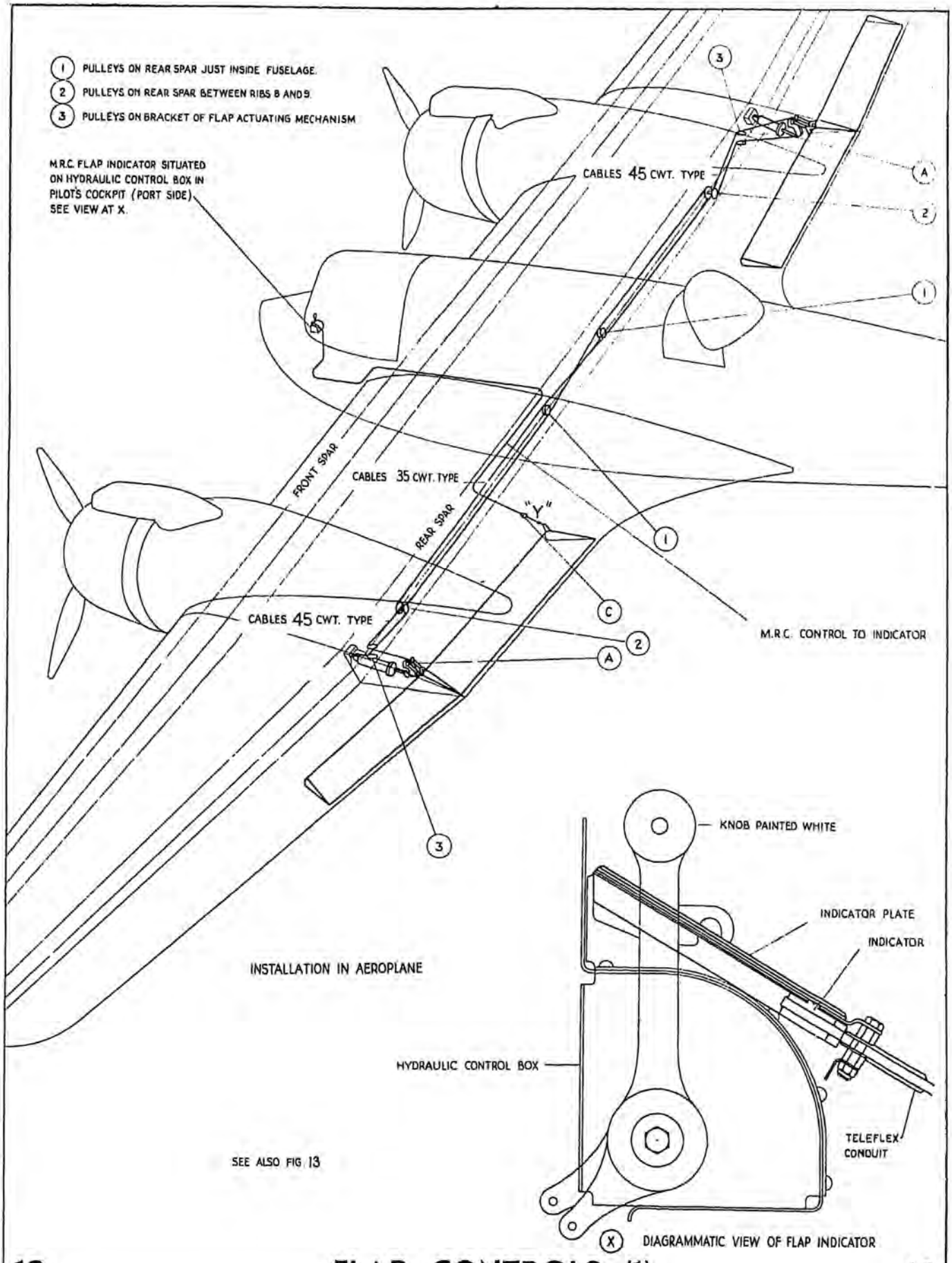
(C) INSTALLATION IN AEROPLANE



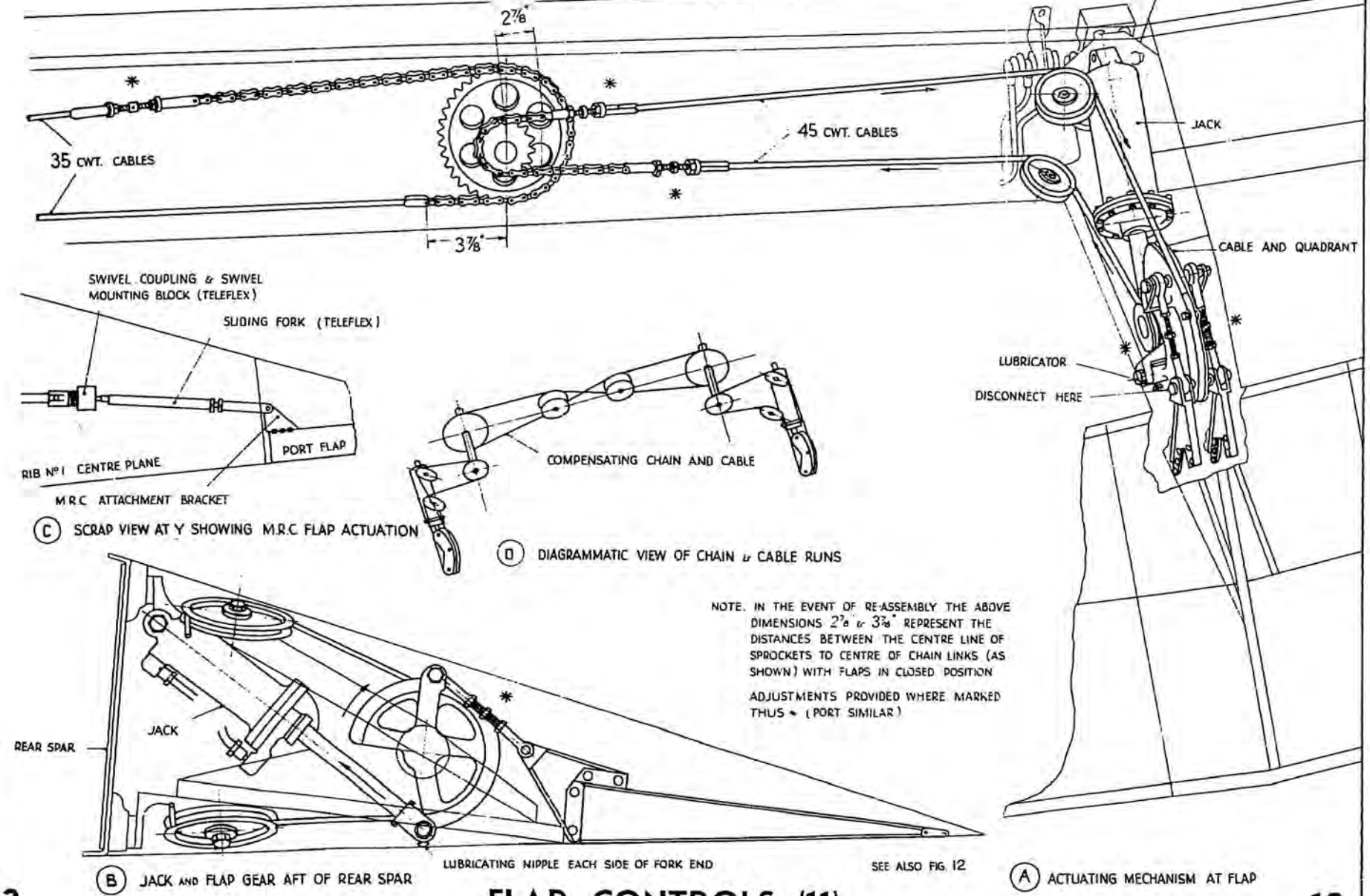
(B) CONTROLS IN OUTERPLANE

(A) "BREEZE" CONTROL UNIT IN COCKPIT

11 AILERON TRIM TAB CONTROLS 11



FLAP CONTROLS (1)



(C) SCRAP VIEW AT Y SHOWING M.R.C. FLAP ACTUATION

(D) DIAGRAMMATIC VIEW OF CHAIN & CABLE RUNS

NOTE. IN THE EVENT OF RE-ASSEMBLY THE ABOVE DIMENSIONS 2⅞ & 3⅞" REPRESENT THE DISTANCES BETWEEN THE CENTRE LINE OF SPROCKETS TO CENTRE OF CHAIN LINKS (AS SHOWN) WITH FLAPS IN CLOSED POSITION

ADJUSTMENTS PROVIDED WHERE MARKED THUS * (PORT SIMILAR)

(B) JACK AND FLAP GEAR AFT OF REAR SPAR

(A) ACTUATING MECHANISM AT FLAP

FLAP CONTROLS (11)

THE

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

R.A.A.F. Publication No. 615.

SECTION 8.

ENGINE INSTALLATION.

SECTION 8.

Engine Installation

CONTENTS.

ILLUSTRATIONS.

Engine Installation

GENERAL.

1. The two engines are each installed in a nacelle, one near each outboard end of the centre plane, and are fitted with constant-speed full feathering hydromatic propellers. The engine cowling includes, at the leading edge, the exhaust collector ring and, at the trailing edge, controllable gills which govern the flow of cooling air. The fuel tanks are carried between the spars of the centre and outer planes on each side, and the fuel is delivered to the carburettors by engine-driven pumps. Each engine has a separate oil tank mounted on the top of the centre plane and a separate oil cooler mounted in the outer plane. The engines are fitted with electrical starters, and hand turning gear is provided for maintenance work.

PROPELLERS.

2. The propellers are de Havilland hydromatic variable pitch type 55/14, and are constant-speed operated by means of a governor unit mounted on each engine (see Air Publication 1538D).

ENGINES.

3. The Hercules XVIII engines are of the air-cooled sleeve-valve double bank radial type (see Air Publication 1728E).

Engine Mounting:

4. Each engine mounting is a welded steel tube structure attached to the main structure near the outboard ends of the centre plane at five points; three on the front spar and two on the nacelle structures. The tubes, at the rear attachment joints, are split, wrapped around and welded to a steel bush, and a steel wrapper plate is welded over the joint. At the forward end, the engine ring is bolted to four points on the engine mountings; the joints on the mounting being formed by a steel barrel to which the tubes are secured by welding, and steel wrapper plates and gussets. The engine ring is a steel tube of rectangular section, with steel side plates for attachment to the engine mounting. Bushes are welded into the ring to take the seven engine crankcase attachment studs.

FUEL SYSTEM.

Description:

5. A diagram of the fuel system is given in Fig. 2, the fuel system installation is illustrated in Fig. 1 and a diagram of the fuel cock control is given in Fig. 4. Fuel is carried in eight tanks, two in the centre plane, one in each nacelle, and two in each outer plane. The fuel can be jettisoned from all tanks, except the two nacelle tanks (see Sect. 9, Para. 37). Fuel contents gauges, one for each tank, are mounted in two groups of four on the control panel, port side just forward of the pilot. Fuel pressure gauges are mounted on the left hand corner of the instrument flying panel. Boost gauges are centrally situated on the instrument flying panel.

6. The fuel supply to the carburettors is maintained by engine-driven pumps. The system is similar on each side of the aeroplane, but is not symmetrical owing to the engine rear cover assemblies being identical and not handed. A suction balance pipe, fitted with pilot-controlled cocks and connecting the starboard and port systems, enables fuel to be drawn from any selected tank, or tanks, to either engine.

Operation:

7. The fuel is drawn from the centre-plane tank, or the other tanks, through a pilot-controlled three-way selector cock situated in each engine nacelle. From this cock the fuel passes to a filter, mounted on the forward face of the firewall. Connection of the suction balance pipe, which is led along the leading edge of the centre plane to the other side of the aeroplane, is made at the engine-side

of the pilot-controlled cock. Pilot-controlled cocks, in the balance line, are located in each nacelle and adjacent to the selector cocks. They are operated by a single control situated in the cockpit. When in operation, the cocks are either both open or both closed. If a part of the balance line gets damaged or shot away during flight, by shutting off the cocks, fuel can only be drawn from the tanks for the engine on the side the tanks are located. The engine pump draws fuel from the filter and delivers it through a pressure regulator to the carburettor. A connection for the fuel pressure gauge is made at the carburettor connection. An induction system priming pump is situated in the cockpit, and connected to the balance line. To prime the engines, for starting, both balance line cocks must be open. Situated in the nacelle, and connected between the filter and the engine-driven pump, is an electric auxiliary pump. The pump delivers fuel, through the by-pass valve of the engine-driven pump, to the carburettor. A non-return valve, located in the suction line of the engine-driven pump, prevents the fuel from the auxiliary pump returning to the filter. This pump may be used for the following purposes:—

(i) For emergency use if the engine-driven pump fails.

(ii) To ensure fuel supply for take off in the event of failure of the engine-driven pump. For this purpose the auxiliary pump should be switched on for take off, and switched off when altitude is reached.

(iii) For priming carburettor before starting engine; when used for this purpose the auxiliary pump should be switched on for 5 seconds only, otherwise flooding may occur.

It should be noted that priming of the carburettor is necessary only when the aircraft has been standing idle for a considerable period or when the carburettor or fuel lines have been disconnected for servicing or adjustment.

Fuel Tanks:

8. Welded aluminium construction is employed for the fuel tanks. Transverse and fore-and-aft bulkheads, with flanged holes in the webs, are fitted inside the tank. The transverse bulkheads, and also an intermediate fore-and-aft bulkhead on the outer plane tank, have T-section flanges and the edges of the main shell panels are butt-welded to the edges of the horizontal part of the T-sections. The fore-and-aft bulkheads have angle section flanges on both sides of the webs and are riveted to the webs of the transverse bulkheads, but no attachment of these bulkheads is made to the shell. The edges of the tank ends are welded to the shell and also to a special strip on the middle transverse bulkhead. Filler caps, vent adaptors, inspection doors, fuel contents gauges, attachments and sumps for water drainage and foreign matters, are fitted on the tanks. The tanks are protected by a self-sealing covering.

9. The main outer and centre plane tanks are strapped to bearers riveted to detachable panels on the under-surface of the plane, and bolted to brackets at the front and rear spars. The nacelle tank is strapped to brackets fitted under the top skin of the wing.

Fuel Pressure Regulators:

10. The fuel pressure regulator (see Fig. 3) is mounted on the starboard side of each engine. Its purpose is to regulate the pressure of the fuel supply to the carburettor at a predetermined figure, irrespective of the delivery pressure, and functions in the following manner:—

11. When the system is empty, the diaphragm (O), under the influence of the control spring (D), is pressed down so that the diaphragm washer (J) rests on the raised arms of the valve seat (U). The hexagon head of the diaphragm screw (F) presses on the conical valve (V) as indicated in Fig. 3.

12. Fuel from the pump enters the end marked INLET and flows through the regulator, passing through the radial holes in the valve seat and past the conical valve (V). As soon as the pressure of the inflow exceeds the defined outlet pressure, this excess pressure influences the diaphragm (O) on the underside and raises it; so allowing the conical valve (V), and with it the piston valve (X), to move in the cut-off direction under the influence

of the piston valve spring (Y). The valves then float in such position as to maintain a flow equal to the demand at the pre-determined pressure. This pressure is determined by the control spring (D) working against the combined pressure of the spring and the fuel on the diaphragm.

13. The balanced piston valve (X), sliding in the valve seating (U), gradually cuts off the passage-way through the radial holes, and as it moves to the cut-off position, it pushes the conical valve on to its seat, and so a fuel-tight seal is made. However, should by chance the piston valve stick open, the conical valve (V) would slide up the pin under the influence of its own spring (W), and so make a seal until it was pressed down again by the diaphragm.

14. The piston valve (X) is maintained in balance under pressure by the provision of the two communicating holes between the top face and the spring recess.

Fuel Jettison:

15. A jettison valve is fitted to the side of the two main tanks, port and starboard, and is operated pneumatically (see Sect. 9, Para. 37) by means of a lever on the fuel control panel. The fuel is jettisoned through an outlet pipe attached to the underside of the nacelle. Fuel can be jettisoned from all fuel tanks, except the nacelle tanks (No. 1 outer).

OIL SYSTEM.

Operation:

16. The oil system for each engine is similar, but entirely separate. An installation and pipe-line diagram is given in Fig. 5.

17. The feed pipe-line for the engine leads from the tank sump direct to the pressure pump on the engine. The inlet end of this feed pipe is located above the bottom of the tank so that one gallon of oil will always be in reserve for propeller emergency feathering. The return oil from the engine passes through an oil cooler mounted span-wise on tubular struts at the inboard end of the outer plane leading edge. From the outboard end of the cooler, the oil returns to the top of the tank. Centrifuger oil cleaners are incorporated in the engine.

18. A thermometer connection is provided on the feed pipe and a pressure gauge connection is made on the oil pump. A cock for draining the oil system is fitted in the main feed pipe, aft of the firewall.

Oil Cooler:

19. The oil cooler is of the two-element 12" diameter, R.A.E. drum type. Each element of the cooler has a separate relief valve which by-passes the oil around a jacket outside the cooling tubes if the pressure exceeds a certain figure; each relief valve has a different setting, which is clearly marked on it. The cooling air is collected by an opening, forward of the cooler in the cooler fairing, and is exhausted through the top surface of the centre plane, just forward of the front spar. The air outlet opening is adjustable on the ground.

Oil Tanks:

20. Each oil tank is constructed of welded aluminium and is strapped to the top of the centre plane under the engine nacelle top panel. Inside the tank are two transverse bulkheads in line with the straps; they are not attached to the shell but are tightly fitted. Vertical fore-and-aft bulkheads are fitted between the transverse bulkheads. The filter, in the sump of the tank, may be withdrawn through the cover on the top of the tank. The filler cap is situated in such a position that the tank cannot be filled beyond its correct level and also ensures the correct air space. The total oil capacity of each tank is 20 gallons, i.e., 19 gallons for the engine, and one gallon for emergency feathering. The air space is 2 gallons. A dipstick is provided adjacent to the filler cap.

ENGINE CONTROLS.

21. The throttle, mixture, propeller speed, two-speed supercharger and air-intake controls, are mounted on a shelf on the port side of the pilot's cockpit. The carburettor cut-out controls are mounted on the top of the front spar, on the port side of the cockpit, under a spring-loaded cover. The cowling

gills' switches are mounted on a sloping panel between the engine control shelf and the carburettor cut-out box. The controls are illustrated in Figs. 6 to 10.

22. The throttle and mixture levers are connected to the layshaft and operating rods in the engine nacelles, by push-pull rods, and by torque tubes, in oilite and ball bearings, along the nose of the centre plane.

NOTE:—*With Hercules Mk. XVIII engines fitted the mixture lever is fixed with a stop plate, and is inoperative.*

The carburettor cut-out knobs, and the air-intake, propeller speed, and super-charger control levers, are connected to the respective engine levers by Teleflex controls, details of which are illustrated in Sect. 4, Chap. 2, Fig. 9. The cowling gills' switches operate an electric motor mounted on the starboard side of each engine.

AUXILIARY GEAR BOX.

23. An auxiliary gear-box, type G.B.I.C., is mounted on the firewall in each engine nacelle and is driven from the engine by a flexibly jointed carden shaft. It is so constructed that the generator drive face is positioned vertically. The accessories driven by the gear-boxes are:—

(i) G.B.I.C. (port engine):—
- Rotax generator G5U/190 (top face).
- Pesco B. 3 vacuum pump (inboard face).
- Hydraulic system pump, mark IV (outboard face).

(ii) G.B.I.C. (starboard engine):—
- Rotax generator G5U/190 (top face).
- Air compressor (rear face).
- Pesco B. 3 vacuum pump (outboard face).
- Hydraulic system pump, mark IV (inboard face).

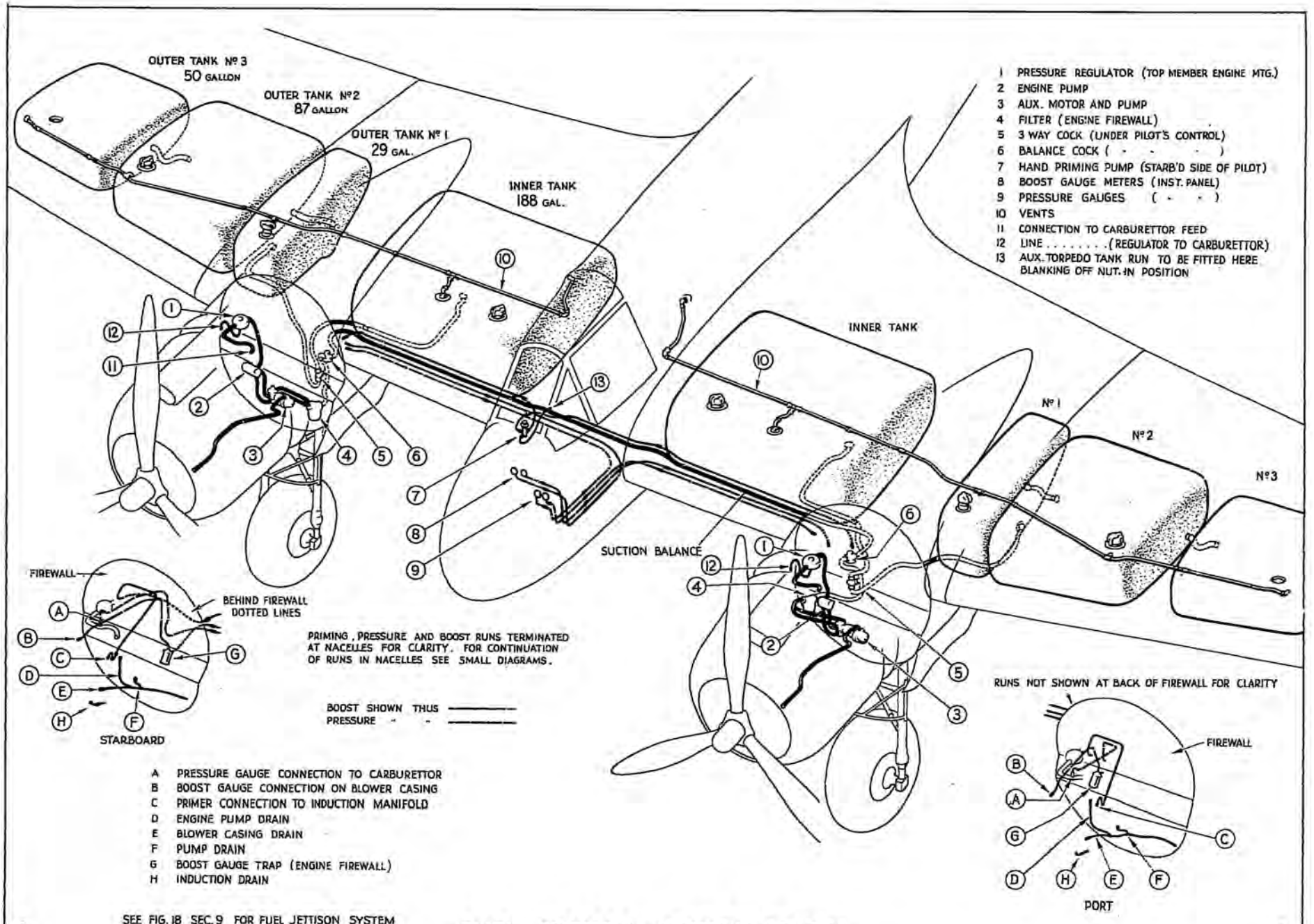
IGNITION SYSTEM.

24. The two magnetos on each engine are individually controlled by separate switches, the four being combined in one unit, mounted adjacent to the instrument-flying panel, on the starboard side. The four switch knobs are prevented from being moved to the "ON" position, when the switch for the alighting gear position indicators is "OFF", by an extension bar on the indicator switch. The disposition of the components of one system is shown in Fig. 11 and the wiring diagram is given in Sect. 6.

25. A booster coil is mounted on each bulkhead forward of the firewall; one is connected to the inboard magneto of the port engine, and the other to the outboard magneto of the starboard engine. The booster coils supplying current for starting the engines are operated by two push switches, one for each engine. Located in the high tension cables, connecting the booster coils to the engine magnetos, are isolating spark gaps which isolate the booster coil windings when the engines are running normally.

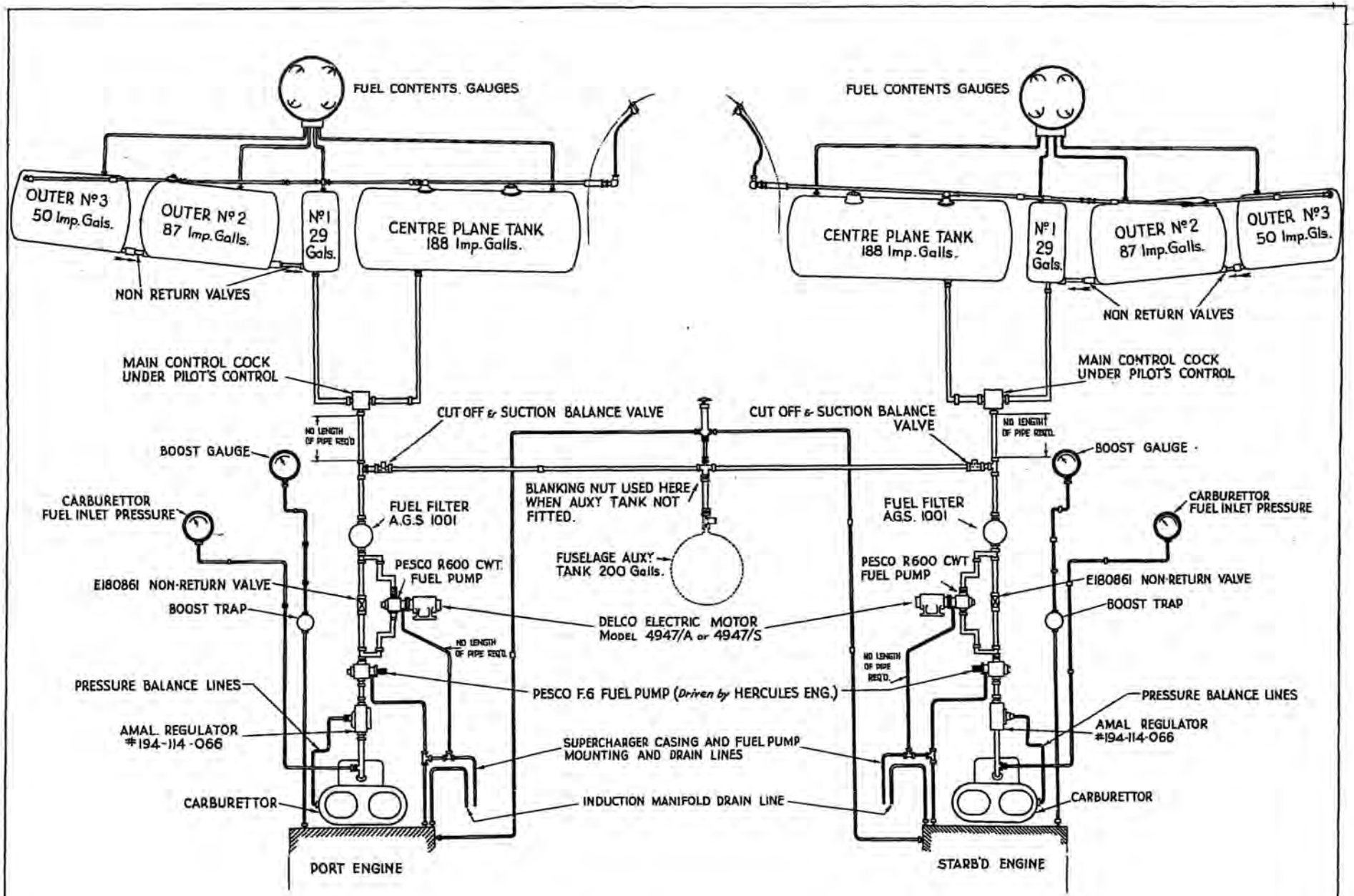
CYLINDER, AND AIR, TEMPERATURE INDICATORS.

26. Two Western temperature indicators are mounted on the pilot's instrument panel. The left-hand indicator of the two is connected through a selector switch to a thermo-couple unit on No. 14 cylinder of the port and starboard engines. The right-hand indicator is connected through a 4 way selector switch to three resistance units situated to show alternatively, the outside air temperature, port engine carburettor air temperature and starboard engine carburettor air temperature. The positions of the indicators and switches are shown in Sect. 1, Fig. 2. The cables for these follow the same run as the oil temperature, oil pressure, and the boost pipe lines.



SEE FIG. 18 SEC. 9 FOR FUEL JETTISON SYSTEM

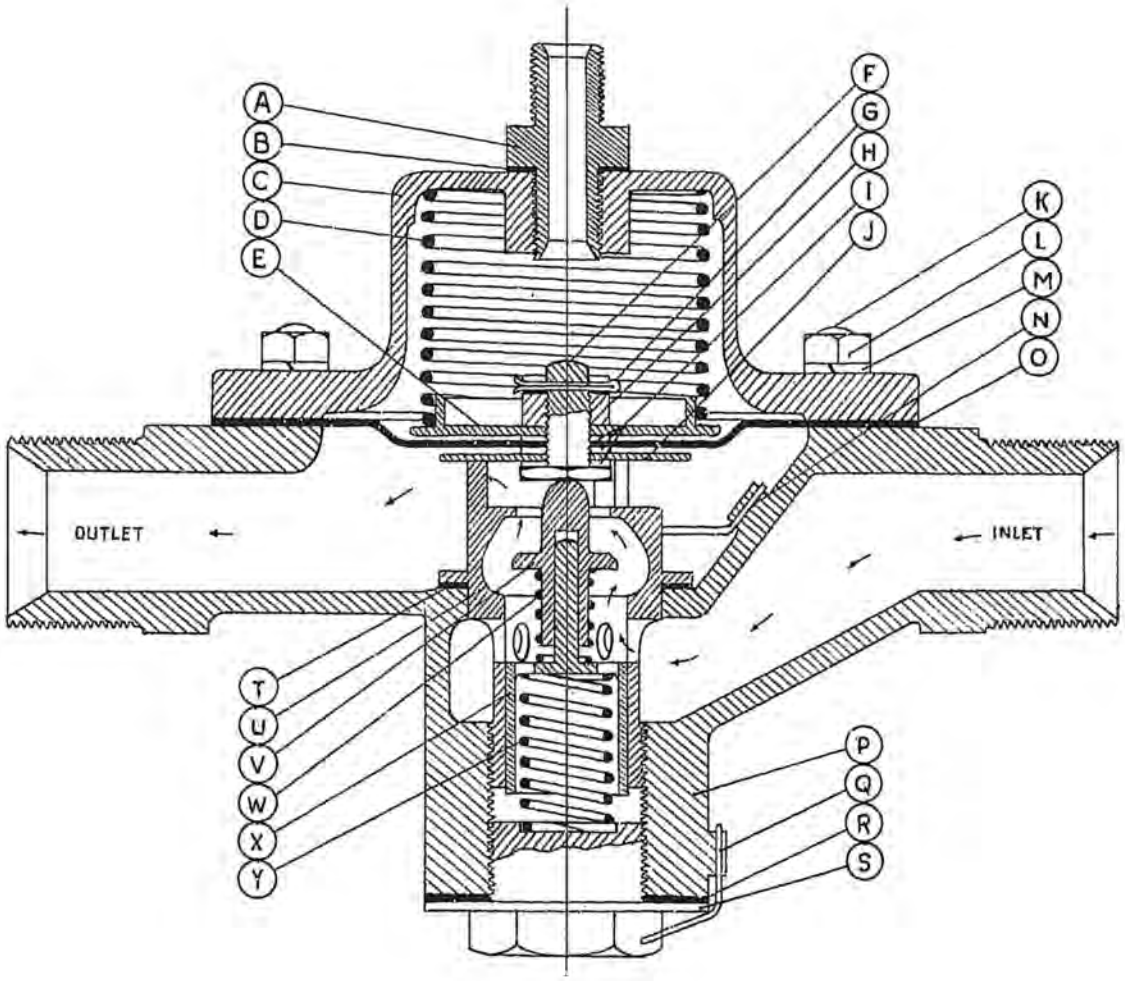
FUEL SYSTEM INSTALLATION



FUEL SYSTEM DIAGRAM

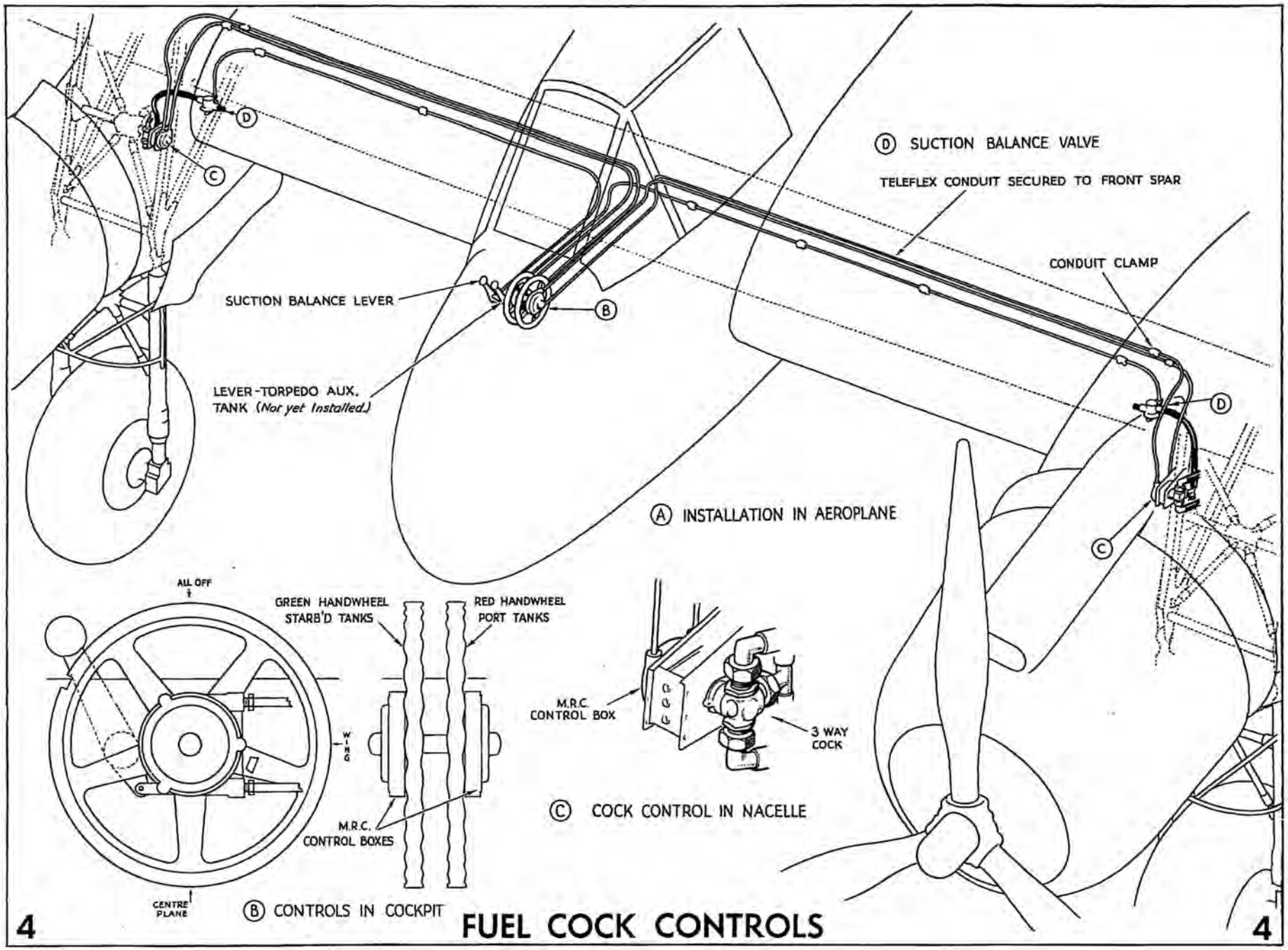
2

NOTE ATTACHMENT WEBS OMITTED FROM SECTION FOR CLARITY



A UNION BODY
B UNION WASHER
C TOP COVER
D CONTROL SPRING
E SPRING CAP
F DIAPHRAGM SCREW
G SPLIT PIN
H DIAPHRAGM SCREW NUT
I FIBRE WASHER
J DIAPHRAGM WASHER
K STUD
L TOP COVER NUT
M SPRING WASHER
N EYELET
O DIAPHRAGM
P BODY
Q EYELET
R PLUG WASHER
S PLUG
T PISTON VALVE WASHER
U VALVE SEAT
V CONICAL VALVE
W CONICAL VALVE SPRING
X PISTON VALVE
Y PISTON VALVE SPRING

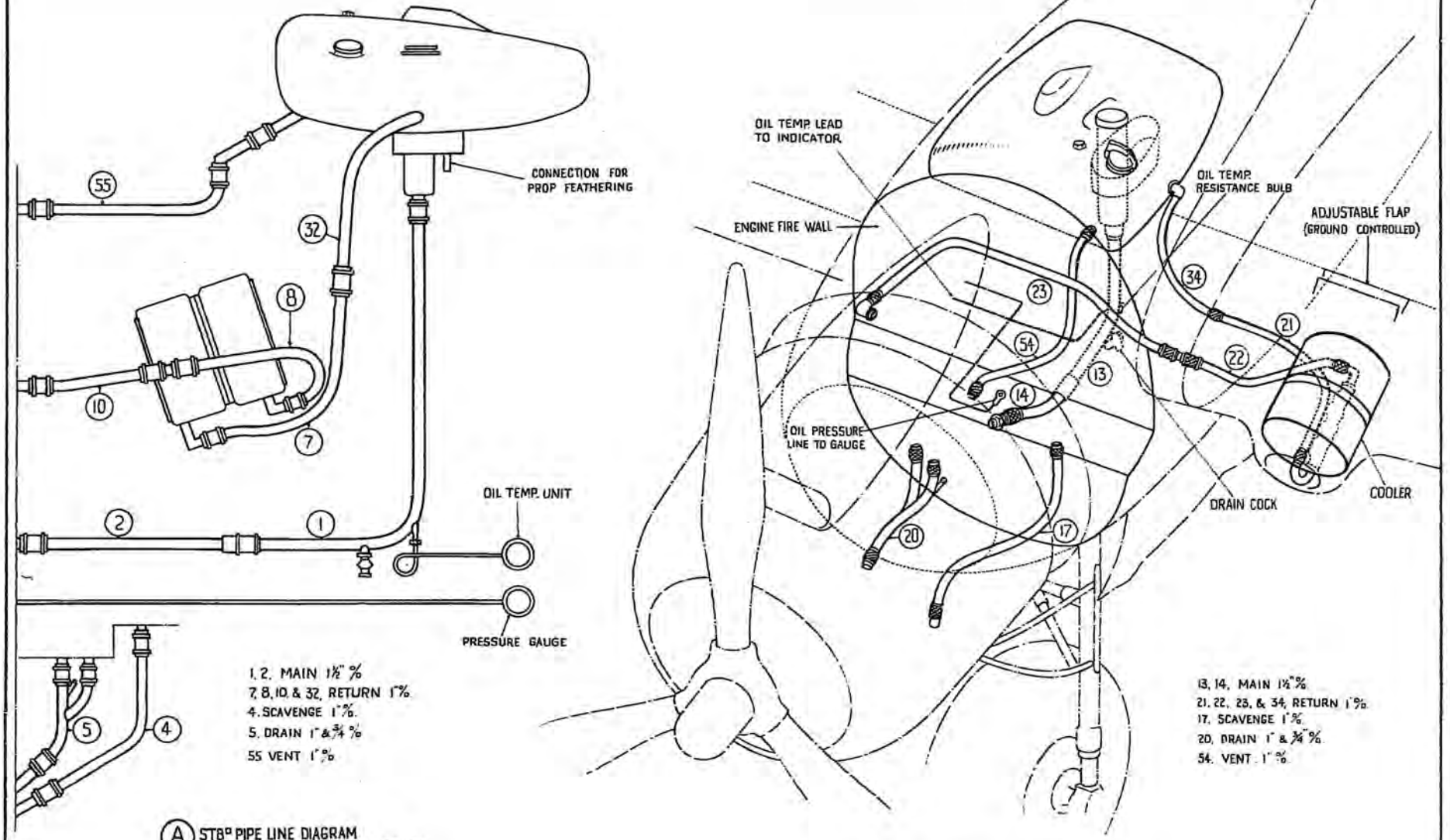
3 FUEL PRESSURE REGULATOR 3



4

FUEL COCK CONTROLS

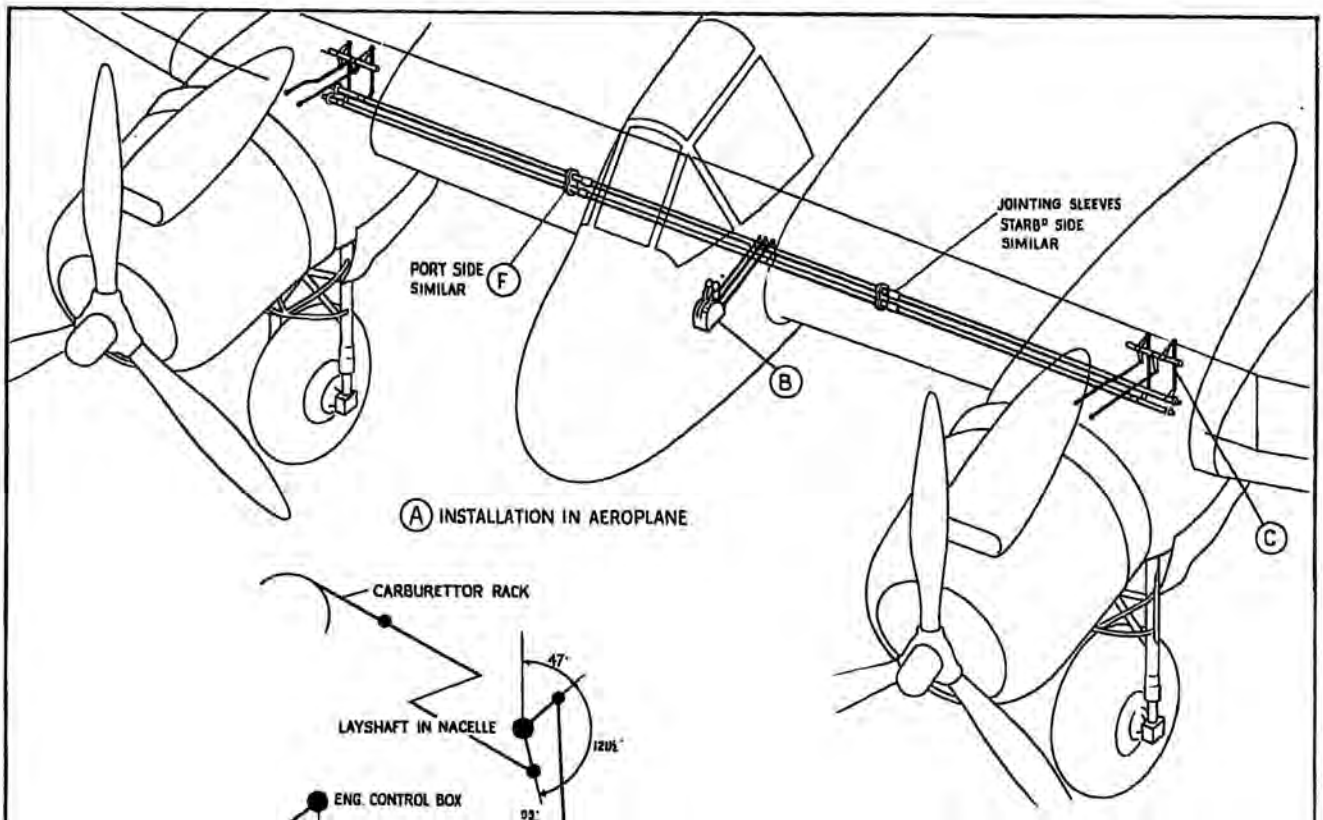
4



(A) STB^{D} PIPE LINE DIAGRAM
PORT SIMILAR EXCEPT FOR NUMBERS

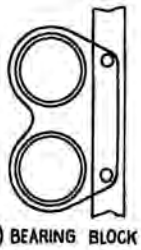
(B) INSTALLATION IN AEROPLANE (PORT)

5 OIL SYSTEM 5

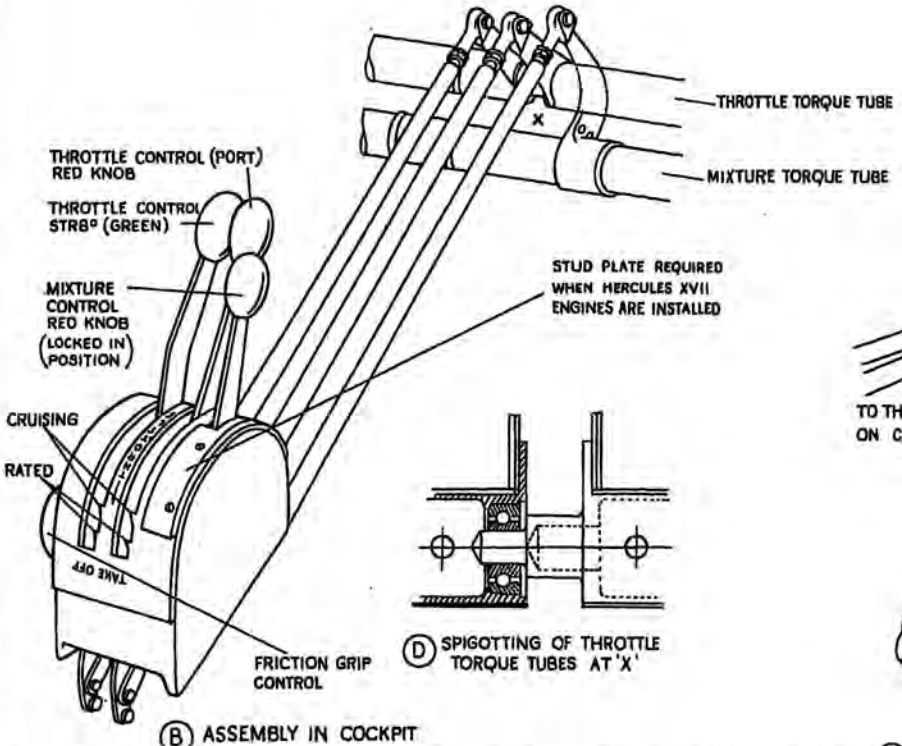


A INSTALLATION IN AEROPLANE

E ANGULAR SETTINGS OF THROTTLE CONTROLS AT "SHUT" POSITION

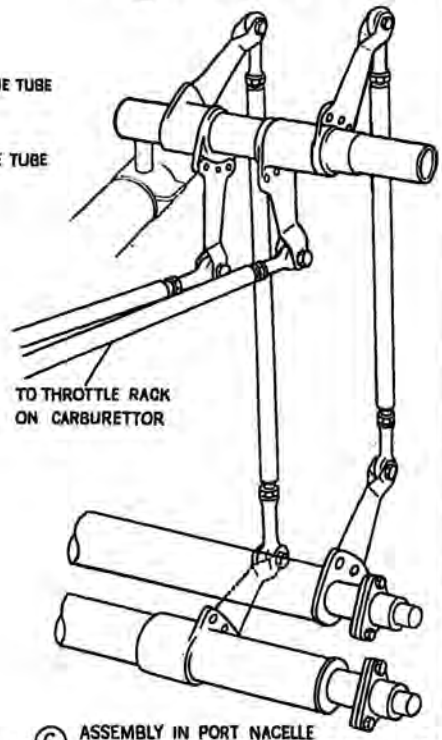


F BEARING BLOCK



B ASSEMBLY IN COCKPIT

D SPIGOTTING OF THROTTLE TORQUE TUBES AT 'X'

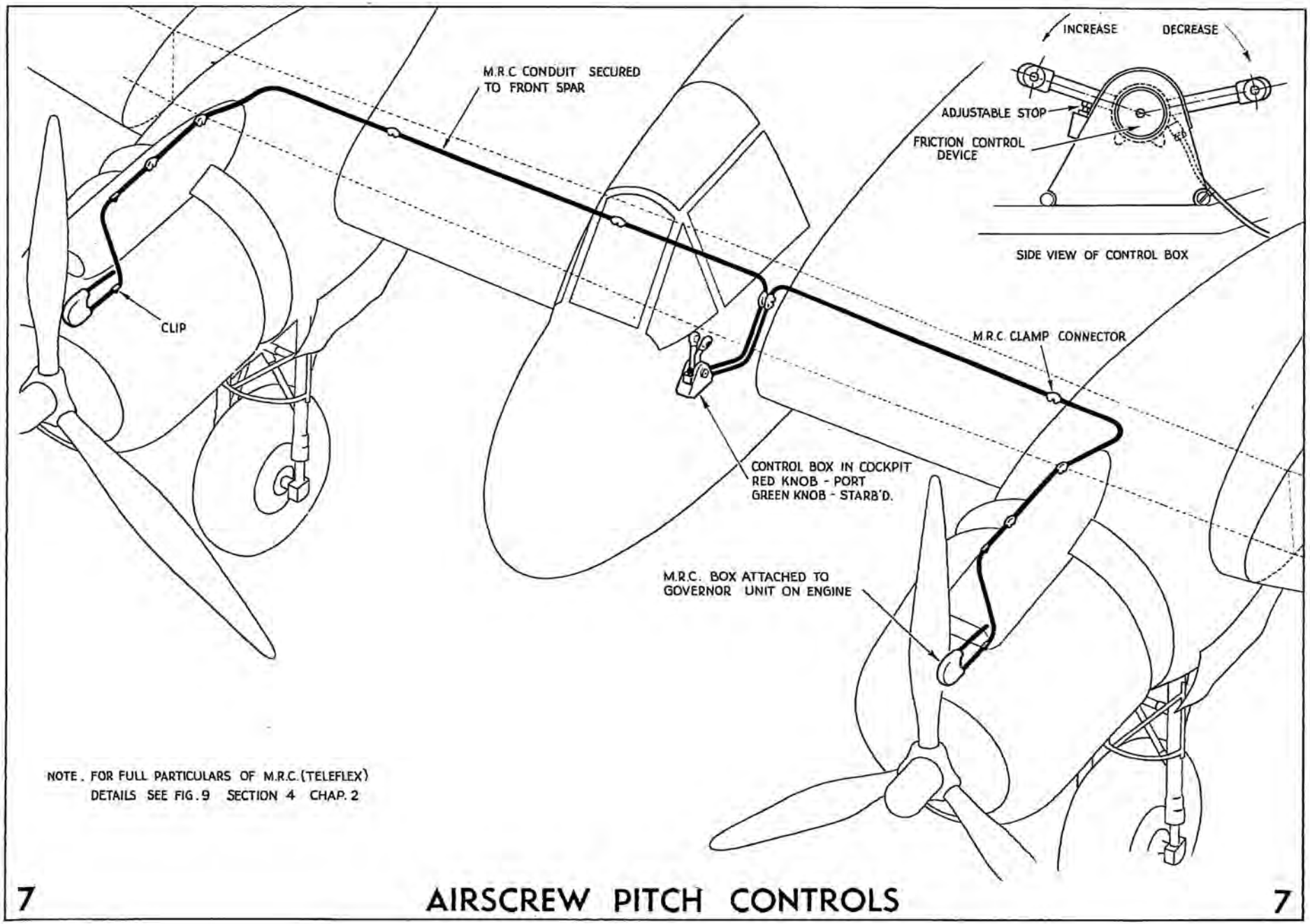


C ASSEMBLY IN PORT NACELLE STBº NACELLE CONTROLS SIMILAR

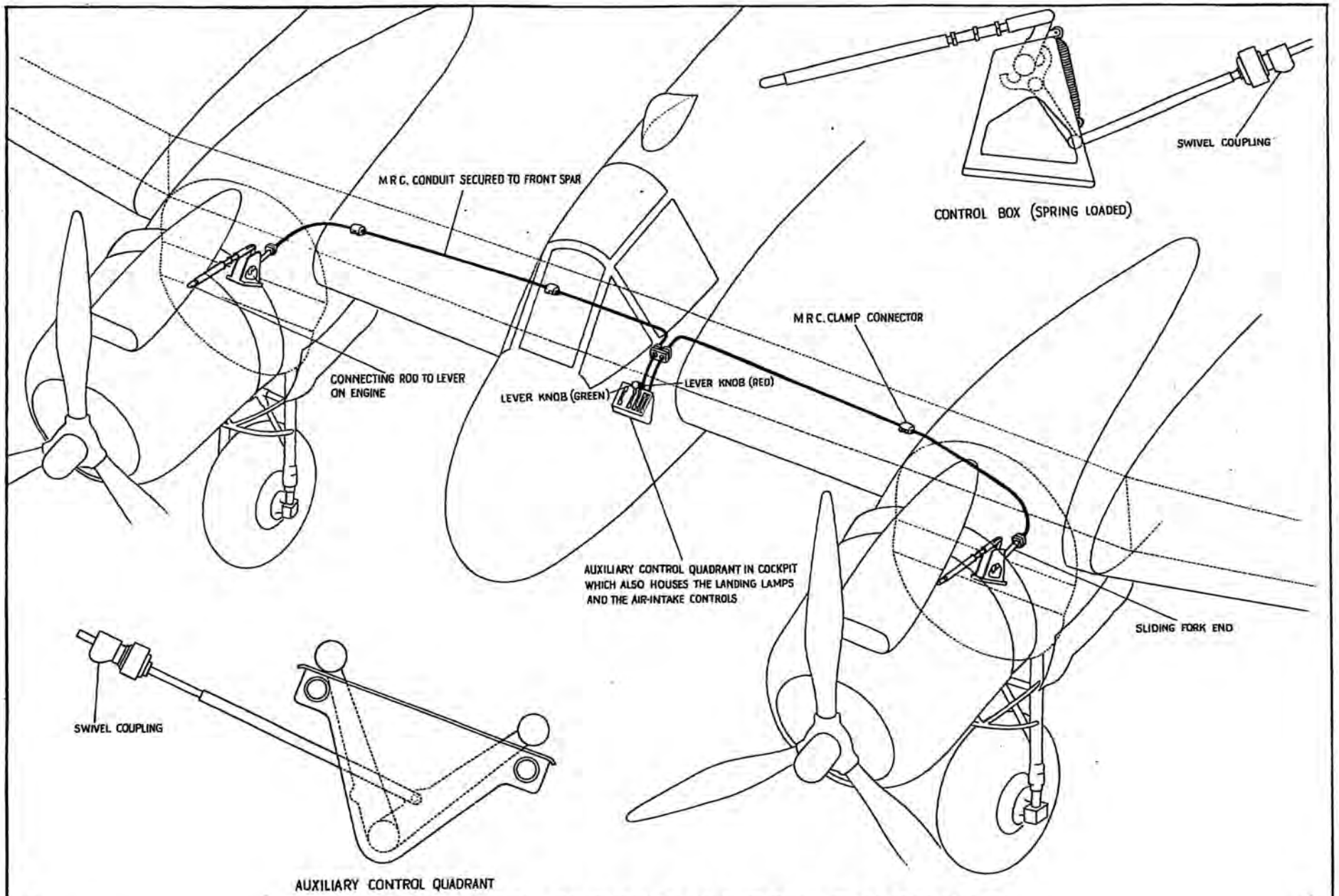
6

ENGINE CONTROLS

6



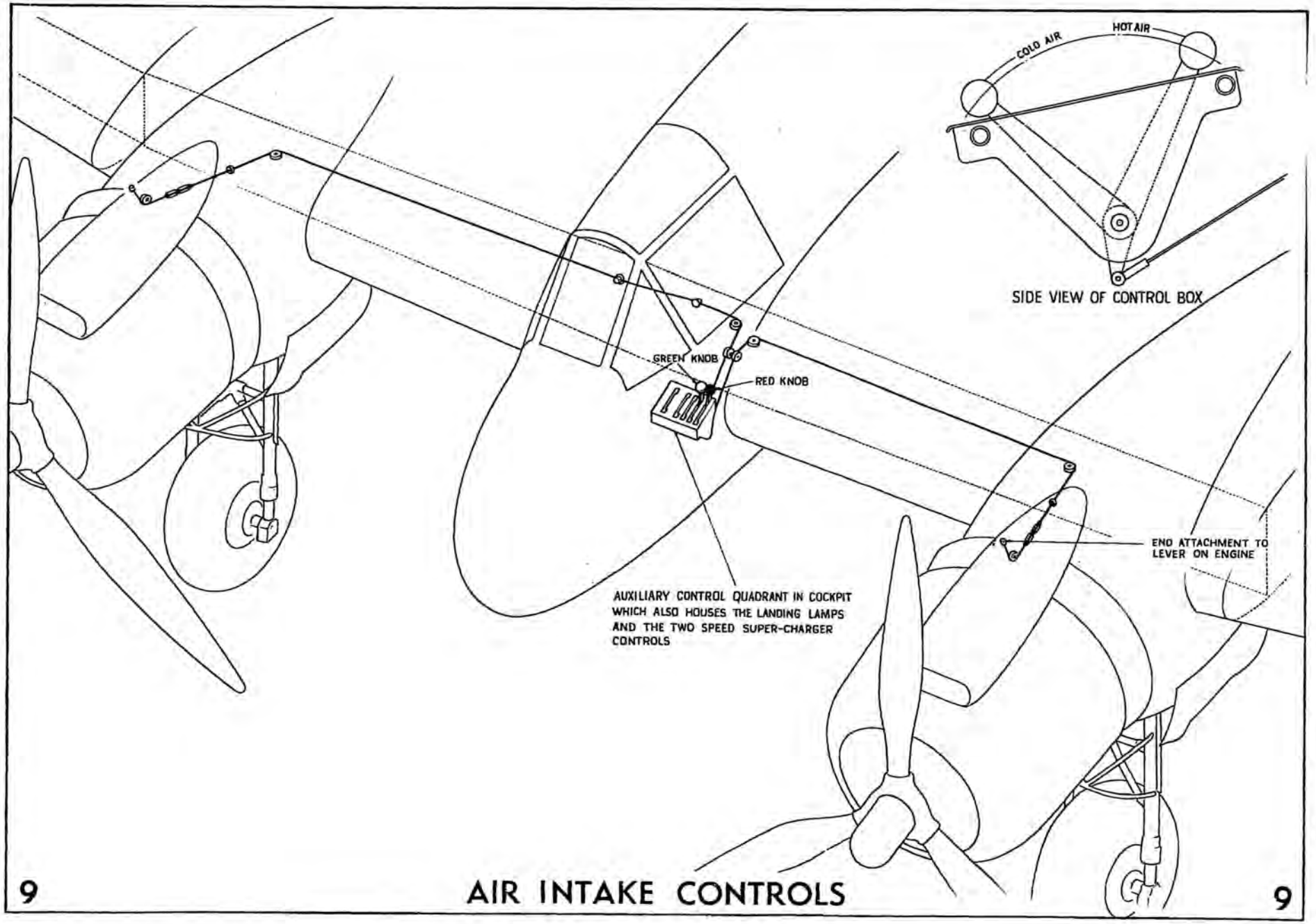
7 AIRSCREW PITCH CONTROLS 7



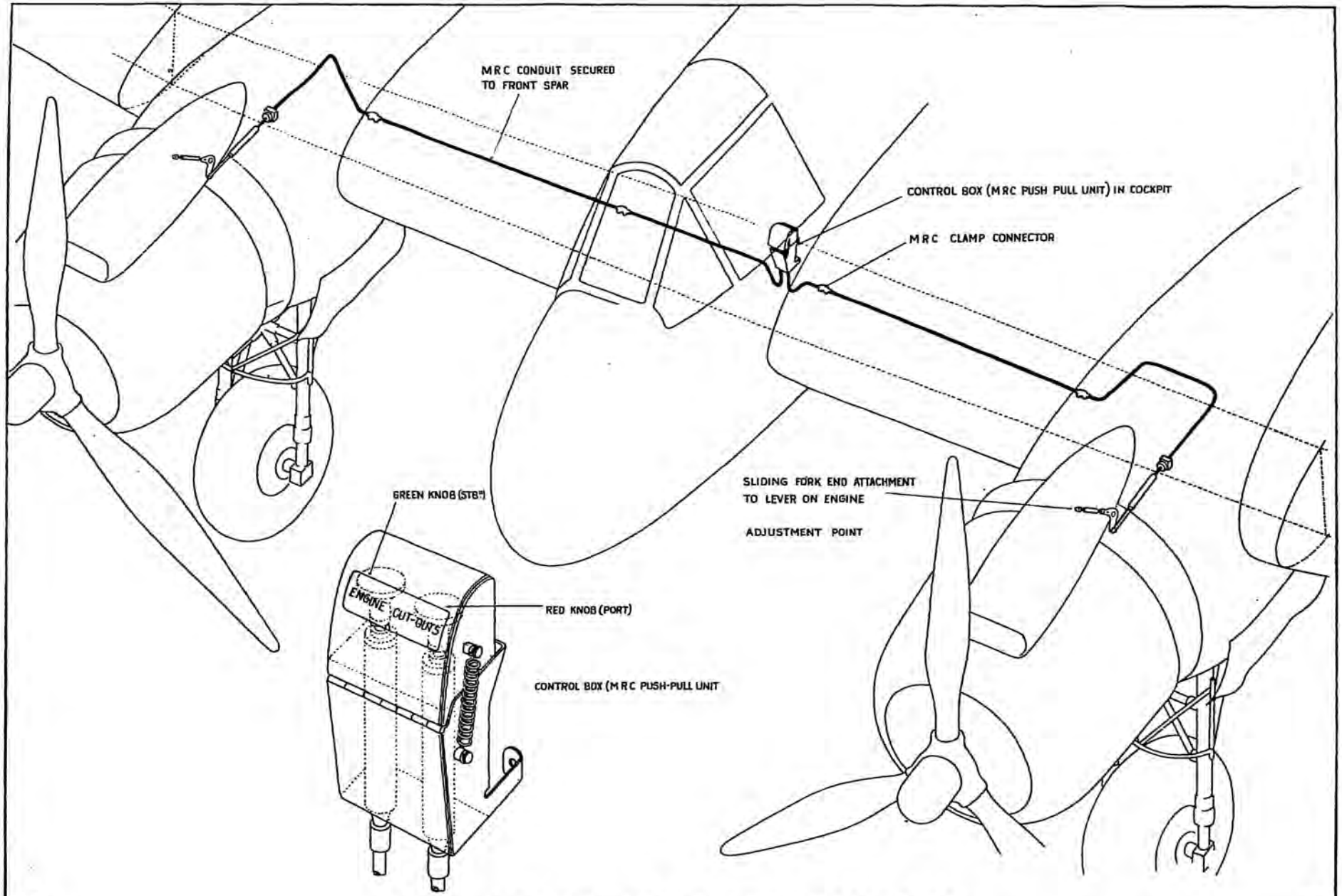
8

TWO SPEED SUPERCHARGER CONTROLS

8



9 AIR INTAKE CONTROLS 9

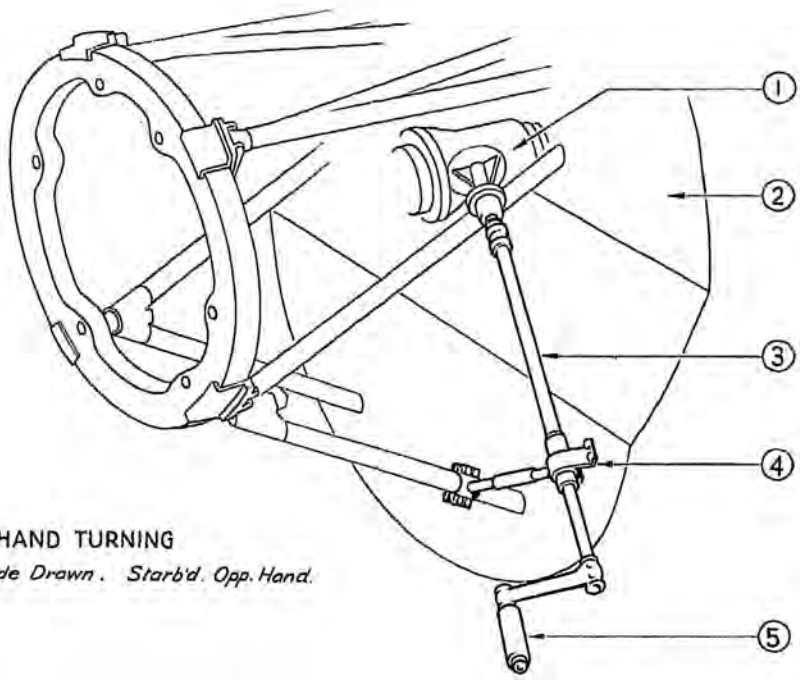


10

CARBURETTOR CUT-OUT CONTROLS

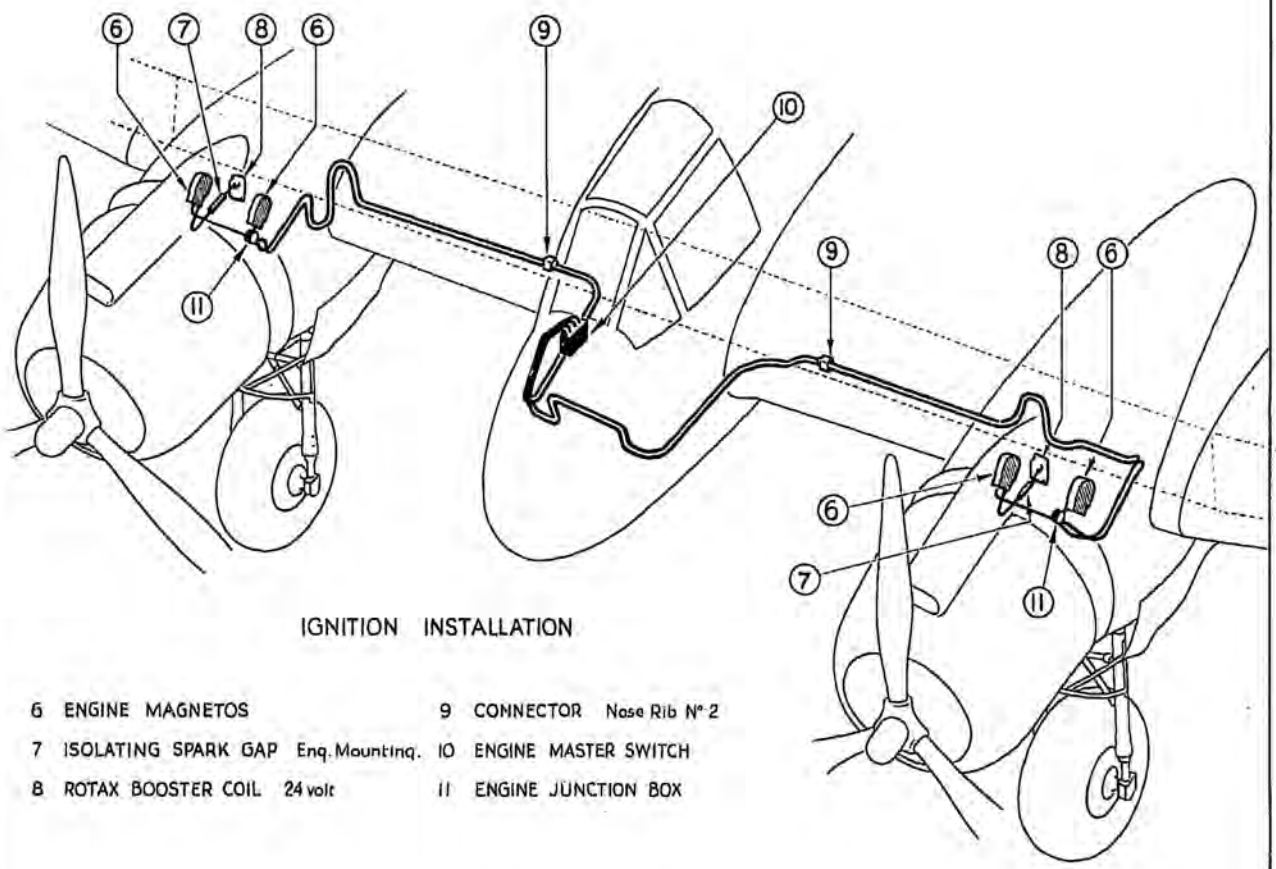
10

1 STARTER
2 ENGINE FIREWALL
3 EXTENSION SHAFT
4 BEARING BRACKET
5 CRANK HANDLE



HAND TURNING

Port Side Drawn. Starb'd. Opp. Hand.



IGNITION INSTALLATION

6 ENGINE MAGNETOS
7 ISOLATING SPARK GAP Enq. Mounting.
8 ROTAX BOOSTER COIL 24 volt
9 CONNECTOR Nose Rib N° 2
10 ENGINE MASTER SWITCH
11 ENGINE JUNCTION BOX

THE

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

R.A.A.F. Publication No. 615.

SECTION 9.

HYDRAULIC AND PNEUMATIC SYSTEMS.

AUSTRALIAN BEAUFIGHTER DESCRIPTIVE MANUAL

SECTION 9.

Hydraulic and Pneumatic Systems

CONTENTS.

ILLUSTRATIONS.

Hydraulic and Pneumatic Systems

General:

1. The hydraulic system operates the flaps, and the undercarriage and tail wheel retracting gear. Installation and system diagrams are given in Figs. 1 and 2, and the components are illustrated in Figs. 3 to 15.

2. Power is supplied by two gear-type pumps, one mounted on each engine auxiliary gear-box, circulating fluid at a maximum pressure of 1,200 lb./sq. in., to one common pipe line. If either pump fails, the output from the remaining pump is maintained at maximum pressure, and the faulty pump becomes isolated from the circuit.

3. In addition, a hand pump is provided for servicing the system when the engine-driven pumps are not being run, and also for emergency operation in flight in the event of failure of the main supply. The delivery of the hand pump is taken through an emergency control valve, which directs the fluid either to the normal circuit, or to an emergency circuit for lowering the flaps, undercarriage and tail wheel. A reserve supply of fluid for the hand pump is maintained in the fluid reservoir below that of the normal level, and is available if the service fluid is lost, should any of the system's pipe lines be shot away or damaged.

4. For servicing and test operations carried out with the aircraft on the ground, two standpipe connections are provided on each firewall for connecting an external pump.

Operation:

5. Broadly, the system operates as follows:—

Fluid pressure is generated by two engine-driven pumps, and passes through the double non-return valve, and the relief and non-return valve, to the main control valve. During the operation of any selected service, fluid pressure is directed by the individual control valve to the required operating jack, and the displaced fluid at the other end of the jack returns to the main control valve. From the main control valve, the return pipe-line passes through the relief valve and the filter, thence back to the supply side of the engine-driven pumps and the fluid reservoir.

6. A small shunt circuit, which consists of a relief valve and a by-pass valve, and operates only when the aircraft is on the ground, provides a maximum pressure of 600 lb./sq. in. for flap operation at take off (see Paras. 19 to 21).

7. A hand pump, the delivery from which is directed through an emergency selector valve either to the main pressure lines or to an emergency circuit, provides pressure for servicing, or in the event of failure of the engine driven pumps or damage to the main pressure lines. When the emergency circuit is selected, fluid is directed to the undercarriage, tail wheel and flap jacks for LOWERING these components, and transfer valves automatically isolate the main pressure lines.

Fluid Reservoir:

8. The fluid reservoir is mounted in the roof of the rear fuselage above the rear spar. The service level is up to the filler spout, giving a capacity of approx. 1¾ gallons of fluid with an air space of ½ gallon. The service fluid level is sufficient for all conditions of operation, and also allows for small leakages and the displacement of the jack piston rods. A standpipe for the main system allows a reserve of approx. 1 gallon to be maintained for use of the hand pump. The reservoir has an air vent in the top, a gauze filter in the filler spout, and also two pipe connections; main feed and return, and the emergency system feed. The main feed is split into two and connected at two points to the pump supply pipes, to provide fluid flow balance and counteract any difference in the fluid resistances of the pipes to each pump.

Engine-Driven Pumps:

9. A three-stage gear pump, type B.H. Mk. IV (see Fig. 3), is mounted on the starboard side of each engine auxiliary gear-box forward of the firewall. Each pump delivers 2¾ gallons of fluid per minute at the normal pump speed of 2,240 r.p.m. When neither of the services is selected, the fluid is circulated through a by-pass in the main control valve. The pump has three chambers for raising the fluid pressure from atmospheric to maximum pressure; each chamber raises the pressure from the preceding one.

10. A drain pipe to the atmosphere is fitted to the gland end of the pump and conveys fluid leakage away from the auxiliary gear-box.

Control Valve:

11. The control valve (see Fig. 4) is mounted on the floor below the engine controls on the port side of the cockpit, and consists of three rotary type valves in one block, each operated by a selector lever; one selector for each control, i.e., undercarriage and tail wheel, flaps, and main by-pass. The main by-pass valve is left open when pressure is not required for operating the system, thus relieving the load on the engine-driven pumps. Use of the pilot's control levers is described in Sect. 1, Paras. 7, 16 and 21.

Hand Pump:

12. The hand pump (see Fig. 5) is mounted on the floor near the pilot's seat on the starboard side, and the method of operating it is described in Sect. 1. The hand pump supplies pressure for servicing the system as a whole when the engine-driven pumps are not being run, or alternatively supplies pressure through the emergency system direct to the undercarriage, tail wheel, and flap operating jacks for emergency lowering. Either of these services is selected on the emergency control valve (see Paras. 15 and 16, and also Sect. 1, Para. 21).

13. The maximum pressure available from the hand pump during servicing is 1,250 to 1,300 lb./sq. in. During emergency operation, the output from the hand pump is isolated from the main system by a transfer valve, fitted adjacent to each undercarriage jack, and a single transfer valve for the flaps adjacent to the choke valve.

Emergency Control Valve:

14. The emergency control valve (see Fig. 6) is mounted on the floor, forward of the main control valve and below the engine controls, on the port side of the cockpit. The valve is for use in conjunction with the hand pump.

15. During normal operation of the main system, with the engine-driven pumps supplying the pressure or with the hand pump for service use, the valve selector lever should be in the "OFF" position. To isolate the main system and bring the emergency system into operation, the valve selector lever should be placed in the "ON" position (see Sect. 1, Para. 21).

16. The emergency control valve has four pipe connections. In the service ("OFF") position, the hand pump feed connects to the inlet of the main control valve, and the hand pump emergency circuit is connected to the hand pump supply pipe from the reservoir; the latter connection prevents a closed fluid column which might expand and tend to close the shuttle valve in the transfer valve (see Para. 23). In the emergency ("ON") position, the hand pump feed connects direct to the transfer valves, and the connections from the emergency valve to the main control valve and to the hand pump supply pipe are closed.

Double Non-Return Valve:

17. The double non-return valve (see Fig. 7) is mounted on the forward face of the front spar in the port centre plane just outboard of the fuselage. It consists of two spring-loaded poppet type valves. The functions of the valves are to balance out the pressure of both engine-driven pumps, to give a common feed to the system, and to prevent pressure from one pump acting on the other. In the event of one pump failing, the output from the remaining pump is available for use and the faulty pump is isolated from the circuit.

Relief and Non-return Valve:

18. The relief and non-return valve (see Fig. 8) is mounted on the floor in the cockpit, just aft of the main control valve. The valve body houses two relief valves and one non-return valve. The main relief valve which governs the main feed from the engine-driven pumps, is of the poppet type and is spring-loaded to relieve at a pressure of 1,200 lb./sq. in.; fluid pressure above this figure is automatically by-passed to the return side of the system. Normal pressure (up to 1,200 lb./sq. in.) feeds through the ball type non-return valve to the main system. The non-return valve prevents pressure from the hand pump, when in use, from passing to the engine-driven pump delivery pipe-line. The secondary ball type relief valve governs the hand pump pressure to a maximum of 1,250 to 1,300 lb./sq. in.

Relief Valve:

19. The relief valve (see Fig. 9) is mounted on a cross bracing member in the port nacelle, situated just above the top of the undercarriage shock-absorber unit. The valve is of the spring-loaded poppet type and is set to relieve at a pressure of 600 lb./sq. in. It is arranged in circuit with the by-pass valve to operate a relief shunt circuit while the aeroplane is on the ground (see Paras. 20 and 21).

By-pass Valve:

20. The by-pass valve (see Fig. 10) is mounted outboard of the relief valve on the same cross bracing member (see Para. 19); it is of the ball type, and is normally sealed by the engine-driven pump pressure. The valve is operated by a plunger in contact with mechanism fitted to the port outboard shock-absorber leg (see Sect. 7, Chap. 3, Fig. 2, Dia. G).

21. When the aircraft is on the ground with the engines running, the by-pass valve is automatically opened by the compression of the shock-absorber legs. This allows the output from the engine-driven pumps at low R.P.M. to circulate through a small relief shunt circuit (see Para. 19) at a maximum pressure of 600 lb./sq. in (sufficient for flap operation at take-off), and eliminates the high fluid temperature which would occur if the pump output was circulated through the whole system at low R.P.M. The by-pass valve closes immediately when the weight is released from the shock-absorber legs.

Choke Valve:

22. A choke valve (see Fig. 11), mounted on the starboard side of the fuselage slightly above and aft of the rear spar, is fitted in the pipe-line to control the flap operating jacks. The valve is of the ball type and allows the ball to seat itself in one direction only; in this condition, the fluid return from the flap jacks, when the flaps are being raised, is directed through a length of small bore pipe which acts as a choke for slowing the upward movement of the flaps. In the reverse flow of fluid, the ball is lifted from its seat, allowing the full bore of the main and small bore pipe-lines to be available for giving maximum speed of movement in lowering the flaps.

Transfer Valves:

23. Transfer valves, two for the undercarriage and one for the tail wheel situated adjacent to their respective jacks, and one for the flaps adjacent to the choke valve, are automatic in action. The valves (see Fig. 12) are identical in construction except for pipe connections, and consist of a main shuttle valve, spring-loaded in the normal position, to close the hand pump emergency circuit. For hand pump emergency operation, the shuttle valve automatically transfers to the main feed end and closes the circuit from the engine-driven pump line. The ball valve has slots cut in the seat to allow any air, that might be trapped between the ball valve and the shuttle valve, to escape to atmosphere through the reservoir; the ball valve is thus rendered inoperative, but the ball has been retained in order to render it unnecessary to lengthen the shuttle valve.

Operating Jacks:

24. The jacks (see Figs. 13, 14 and 15) each consist of a light alloy cylinder, a piston with sealing cup rings, and a steel tube piston rod which passes through a packing gland at

the lower end of the jack. An adjustable eye-bolt, screwed into the piston rod of the under-carriage and tail wheel jacks, picks up with the operating mechanism. The gland (or end cap) and the cylinder flange are attached by bolts, and a Will's high pressure joint ring is fitted between the cap and the flange.

Filter:

25. The filter is mounted on a cross bracing member, in the port nacelle, situated above the relief and by-pass valves. Fitted inside the container are two cylindrical sheets of gauze of different mesh, which can be removed in one piece for cleaning purposes.

Piping:

26. The pipe-lines are of $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in. outside diameter tubing of 22 S.W.G. except where otherwise shown on the system diagram (see Fig. 2). Flexible pipes are fitted to the connections on the engine-driven pumps and the tail wheel jack. Swivel joints are provided in the pipe-lines to the undercarriage and flap jacks, to accommodate the swing of the jack cylinders during operation.

27. The unions, and similar fittings generally, consist of a union nut that embraces a loose collar with an internal conical face. The union fittings are of conical form, the pipe end being flared over the union, and gripped between the collar and the conical end when the union nut is tightened.

Standpipe Connections:

28. Two standpipe connections, situated at the top of the forward face of each firewall, are provided for refilling the system with fluid when the engines are not being run, and for servicing and test operations whilst the aircraft is on the ground. Normally the connections are blanked off (see Section 4, Chap. 2).

PNEUMATIC SYSTEM.

General:

29. The pneumatic system supplies pressure for operating the 20 mm. and .5-in. wing gun firing, the fuel jettison valves, and the wheel brake units. The system mainly comprises the following:—

ITEM.	POSITION IN AIRCRAFT.
Air compressor	On engine auxiliary gear-box, rear face starboard firewall.
Oil and water trap	In rear fuselage, opposite air cylinders.
Auto regulator	On starboard nacelle structure.
Air cylinders (2)	On air cylinder structure aft of observer's wireless crate.
Pressure gauges	One to each cylinder, adjacent to air cylinders.
Charging connections	On starboard nacelle structure.
Air Filter	Aft of wireless crate, fuselage wall, port.
Reduction valve (for gun firing)..	Opposite observer's seat, fuselage wall, starboard.
Reduction valve, (for brake and fuel jettison services).	Slightly aft of reduction valve for gun firing services.
Fuel jettison valves (4)	One on underside of each outer and inner tank.
Isolating valves (2)	On control structure to right of pilot.

ITEM.	POSITION IN AIRCRAFT.
Cut-off Valve	On tubular member below aileron trim tab control, starboard.
Relay control valve..	On cross tube of rudder adjusting box, forward of pilot's instrument panel, port.
Triple pressure gauge	On pilot's control structure, stbd. side, aft of rudder trim tab control.
Gun firing trigger and cocking button	Control column handwheel (stbd.)
Brake operating lever	Control column handwheel.
Wheel brake units..	Undercarriage wheels.

30. A diagram of the complete system is shown on Fig. 20, and the jettison and brake systems are illustrated in Figs. 18 and 19. Further information on the brake system and gun-firing system is given in A.P.'s 1464B and 1641E respectively.

Air Compressor:

31. The compressor, which has an oil inlet taken off the starboard vacuum pump, is driven by the starboard engine and supplies pressure via the oil and water trap to the air cylinders. Each air cylinder has a cubic capacity of 620 cubic inches.

Auto Regulator:

32. The auto regulator, which incorporates both a safety valve and an adjusting valve, is fitted on the inlet side of the air cylinders, and assists in maintaining a pressure of 450 lb./sq. in. from the air cylinders to the reduction valve adjacent to the filter. Between the air cylinders and the reduction valve, an air cylinder pressure gauge and an air filter for cleaning the air before it passes to the various services, are provided.

Oil and Water Trap:

33. The oil and water trap is fitted to collect oil and water which is present in the system, due to condensation, etc., and is to be drained periodically according to the amount of oil and water found in the system. It is essential that there should be no leakage at the drain plug.

Air Filter:

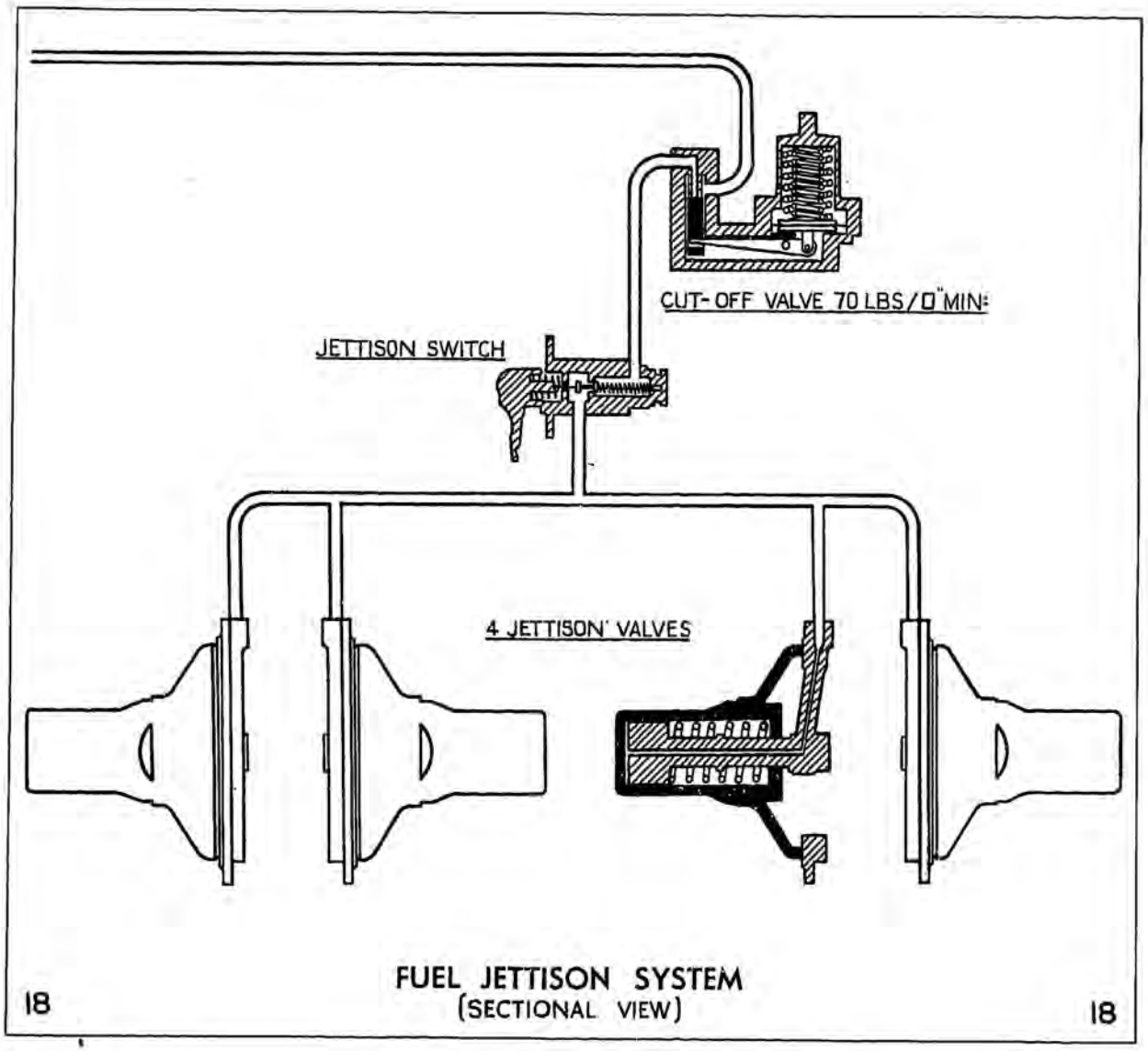
34. The air filter is fitted between the air cylinder and the reduction valve on the brake portion of the system, which cleans the air from the first cylinder, allowing only clean air to enter the second cylinder and the delivery side of the system. The drain plug should be removed periodically and the felt cleaned when necessary. If oil is present it is an indication that there is oil in one or both of the cylinders, and they must be removed and cleaned.

Reduction Valves:

35. The reduction valves adjacent to the air filter reduce the air pressure from 450 lb./sq. in. to 220 lb./sq. in., which is the maximum required for operating each service. The MINIMUM pressure required for operating each service is approximately 80 lb./sq. in., with the exception of the gun firing (20 mm. type), which requires 150 lb./sq. in. A safety valve is incorporated in the reduction valve.

Non-Return Valve:

36. A non-return valve isolates the two cylinder delivery pipe-lines from each other.



18 FUEL JETTISON SYSTEM (SECTIONAL VIEW) 18

Fuel Jettison:

37. The fuel jettison service is illustrated in Fig. 18 and supplies air pressure to the jettison valves. The valves are controlled by the lever fitted on the face of the isolating valves in the cockpit (see Sect. 1, Para. 7). A sectional view of the isolating valve is shown in Fig. 16. If the air pressure in this part of the system falls to 70 lb./sq. in., the cut-off valve automatically closes off the fuel jettison service. This leaves the remaining pressure for operating the wheel brake services.

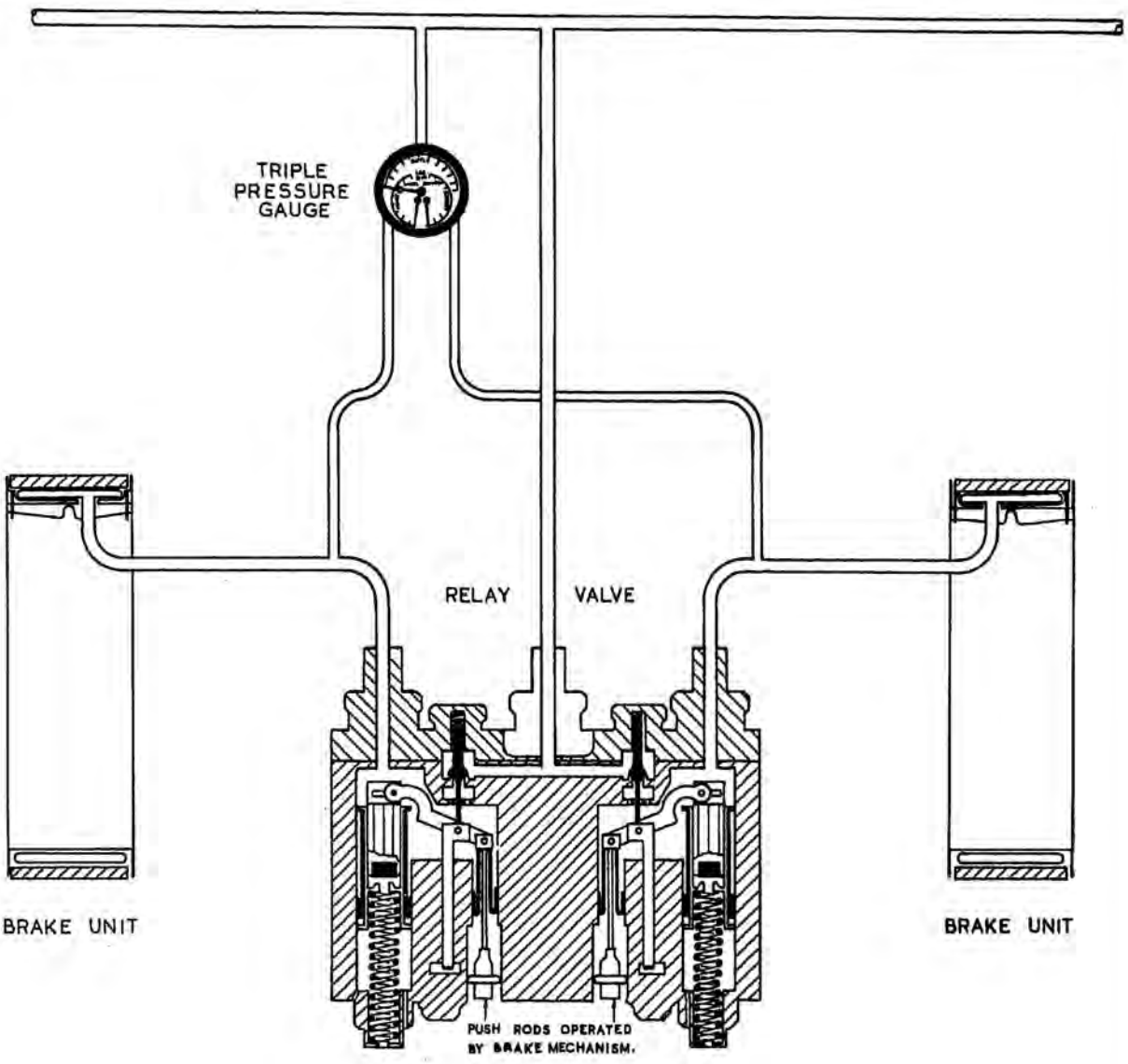
Fuel Jettison Valve:

38. In principle, the jettison valve is an inverted cup type assembly held in position on a seat by the weight of fuel, and a coil spring bearing on the valve cup and on a central stem attached to the seat. Each jettison valve (see Fig. 17) consists of a seat (D) carried by a spider attached to the underside of the tank, and a cup-shaped valve element (C) carried by a stem (F) secured to the spider. The upper portion of the valve element forms a cylinder (A) which can slide on a piston (H)

integral with the stem. Spring (G), assembled between the piston and a nut (B) screwed into the valve element, forces the element on to the seat; the action of the springs is supplemented by the weight of the fuel in the tank. One arm of the spider is provided with a pipe connection (E) for coupling the pneumatic jettison control pipe-line; the pipe connection communicates, through a longitudinal hole in the arm and an axial hole in the stem, with the space above the piston. When air pressure is applied to the valve, the valve element is lifted off its seat to allow fuel to escape from the tank, and emerge into the airstream, through a funnel leading to the undersurface of the plane.

Charging Connection:

39. The charging connection is provided for charging the cylinders from an outside source. Test the charging connection valve for leakage in soapy water. If leaking, clean core or replace valve if damaged.



19 **BRAKE SYSTEM** (SECTIONAL VIEW) 19

Wheel Brakes:

40. The wheel brake service is illustrated in Fig. 19. The air supply is taken to the relay control valve and thence to each undercarriage wheel brake unit (the brake lever is operated by Bowden Cable). A triple pressure gauge with a branch pipe from each wheel brake and main supply pipe-line indicates the available pressure in that part of the system forward of the reduction valve adjacent to the air filter, and also the pressure at each of the wheel brake units; (see also Para. 43).

Relay Control Valve.

41. This instrument reduces the air pressure from the reduction valve, to the pressure required by the pilot to apply the brakes for straight or differential braking. If the relay valve does not function properly, this will be indicated on the triple pressure gauge. The pressure at the reduction valves is continually shown on this gauge, the pressure at the individual brakes being indicated during operation.

Differential operation of the brakes is obtained by the connection of the brake control to the rudder bar of the aeroplane. With rudder control set in the "DEAD AHEAD" position, the braking effect is equal on each wheel. As the rudder is moved to steer the aeroplane, the retarding force is steadily increased on the inside, and decreased on the outside wheel until at full rudder the inside wheel will be fully braked, and the outside wheel free. Any degree of braking desired by the pilot is obtained by varying the movement of the brake lever. (See illustration preceding page).

Brake Lever:

42. The brake lever operates a Bowden Cable connected to the relay control valve. The pressure is determined by, and is strictly in proportion to, the movement of the brake lever on the control column, and the position of the linkage system connecting the control dual relay valve with the rudder pedal mechanism.

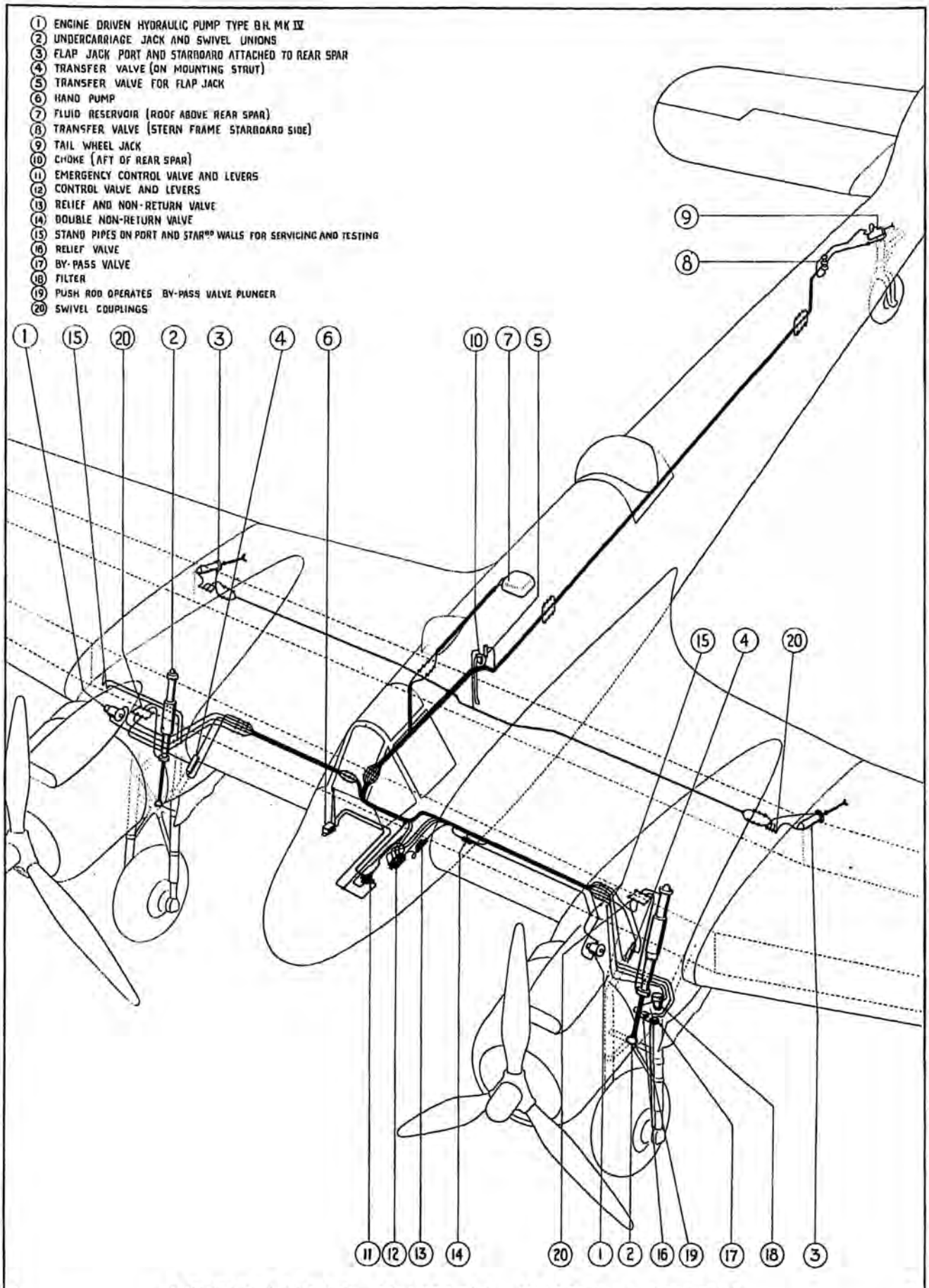
Cut Off Valve:

43. If the air pressure in the brake system falls to 70 lbs. per sq. in., the cut-off valve automatically closes and cuts off the fuel jettison service. This leaves the remaining pressure for operating the wheel brakes.

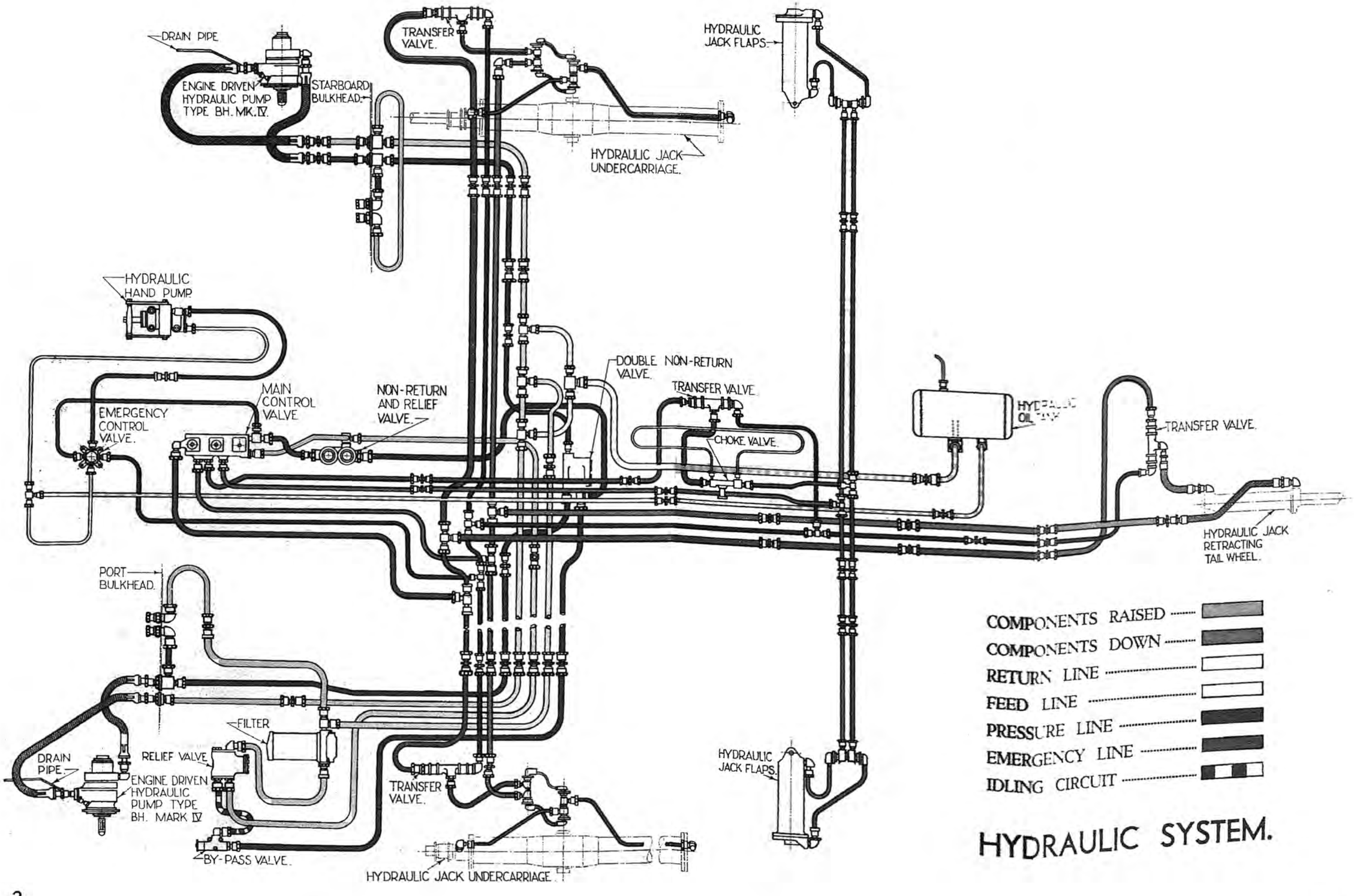
Piping:

44. Briefly the particulars of the pipe-lines are as follows:—The inlet to the compressor, the supply lines from the compressor to the relay control and gun firing unit and part of the supply lines to the cocking units and the wheel brake units are all $\frac{1}{4}$" outside diameter tubing of 22 S.W.G. The remaining pipe-lines are of 3/16" outside diameter by 22 S.W.G. Rubber hose is fitted to the wheel brake units, and the firewall connection in the compressor drain. Flexible hose is used for the oil inlet from the engine vacuum pump, and armoured hose for the connecting pipe to the cocking and firing units.

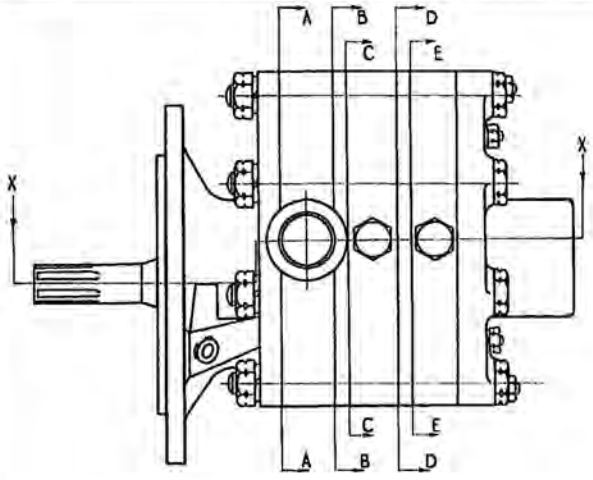
45. The pipe joints in the line from the compressor to the reduction valve adjacent to the filter, are of the high pressure type and consist of olives, sleeves, collars and pipe to pipe connections. From the reduction valves and throughout the various services the pipe joints are of the low pressure type, and consist of rubber seals, outer sleeves and pipe to pipe connections.

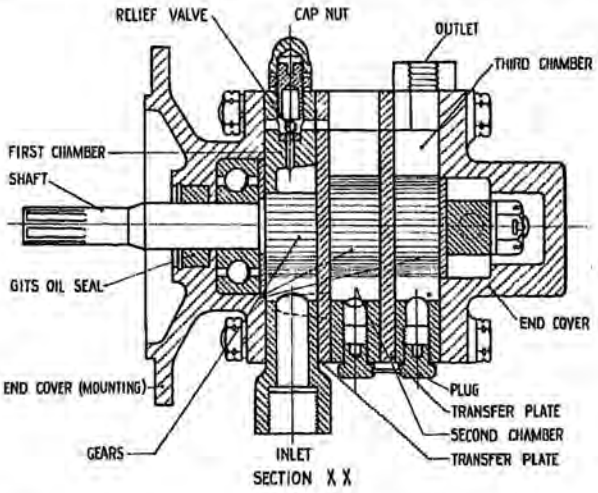


1 HYDRAULIC SYSTEM INSTALLATION 1

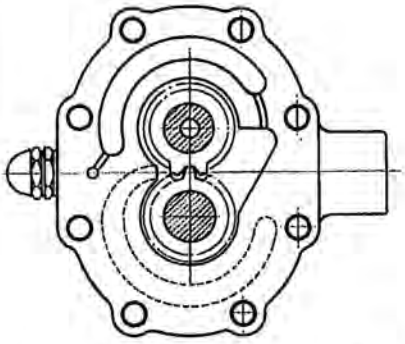


HYDRAULIC SYSTEM.

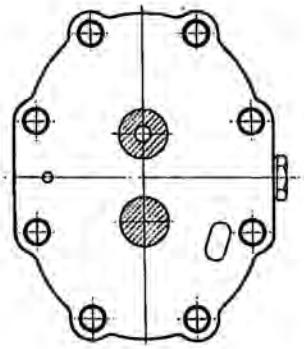




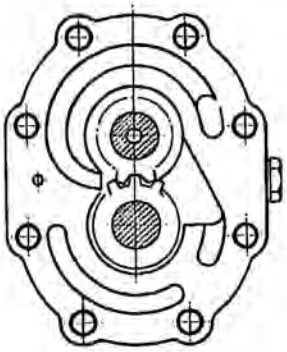
SECTION X X



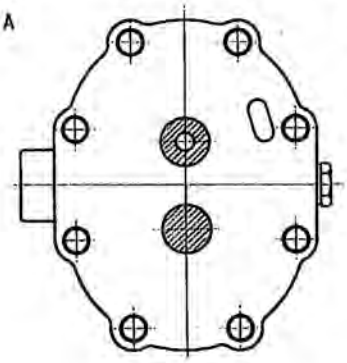
SECTION A A



SECTION B B

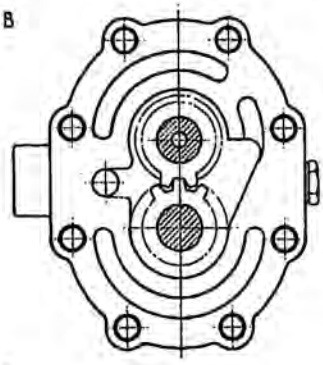


SECTION C C

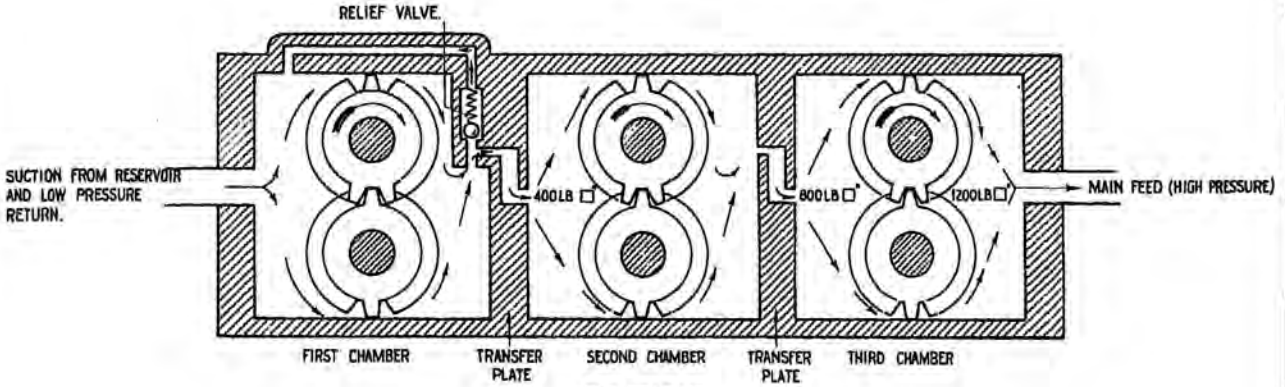


SECTION D D

DETAILS

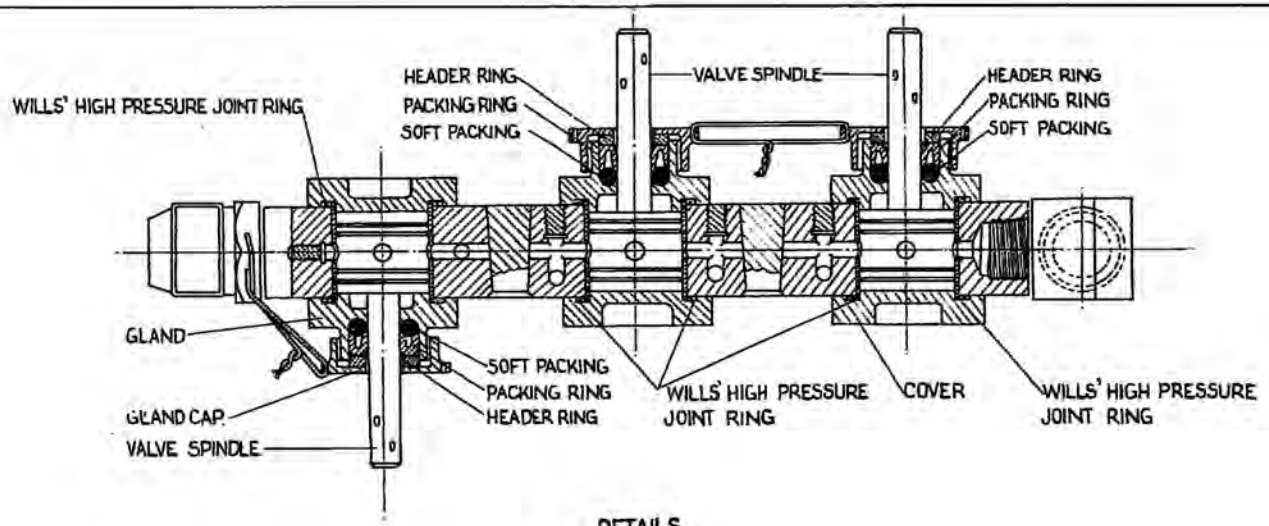


SECTION E E

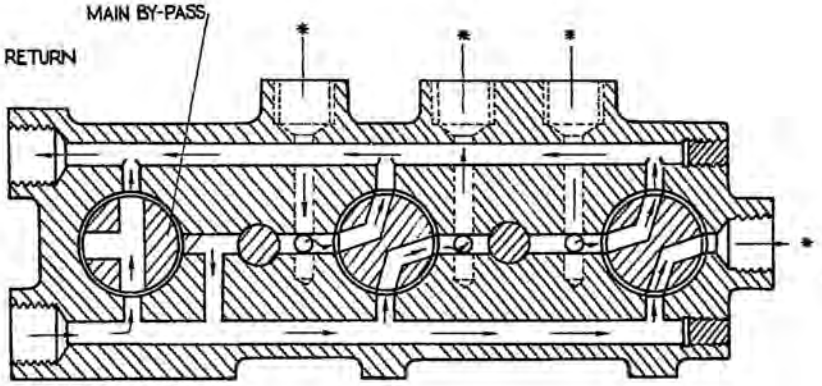


FUNCTIONS

3 ENGINE DRIVEN PUMP 3

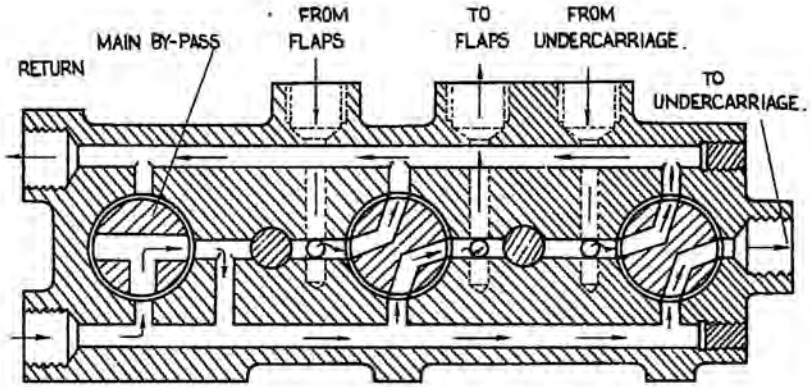


DETAILS



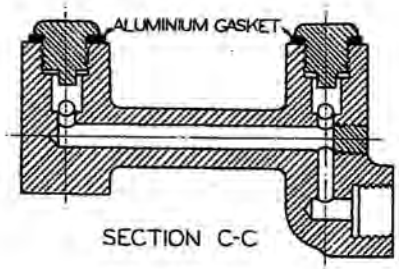
* THESE PIPES UNDER LOW PRESSURE UNTIL UNIT REQUIRED IS SELECTED.

SECTIONAL VIEW SHOWING NORMAL POSITIONS OF VALVES AND CIRCUIT BY-PASSED.

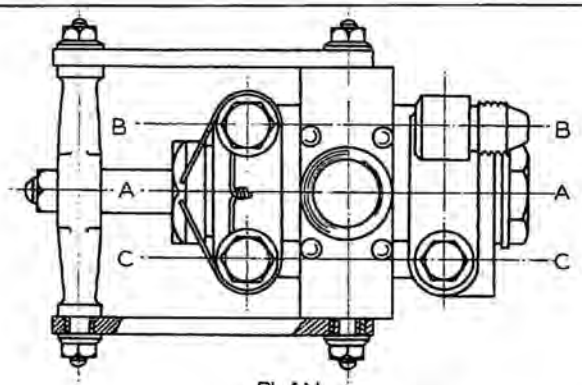


VIEW SHOWING FLOW OF FLUID IN SELECTING UNDERCARRIAGE AND FLAPS.
FOR REVERSE MOVEMENT JACK VALVES ARE MOVED BACK THROUGH 90°
WHEN AFTER SELECTING FLAPS THEY HAVE TO BE HELD IN ANY REQUIRED
POSITION THE CONTROL LEVER IS ENGAGED IN A SPECIAL GATE (ON HYDRAULIC PANEL)
CLOSING THE FLAP CONTROL VALVE.

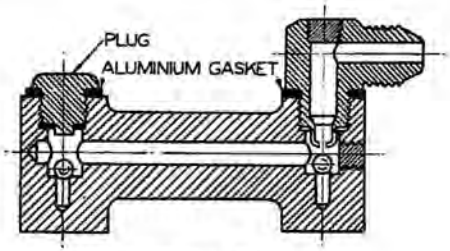
FUNCTIONS



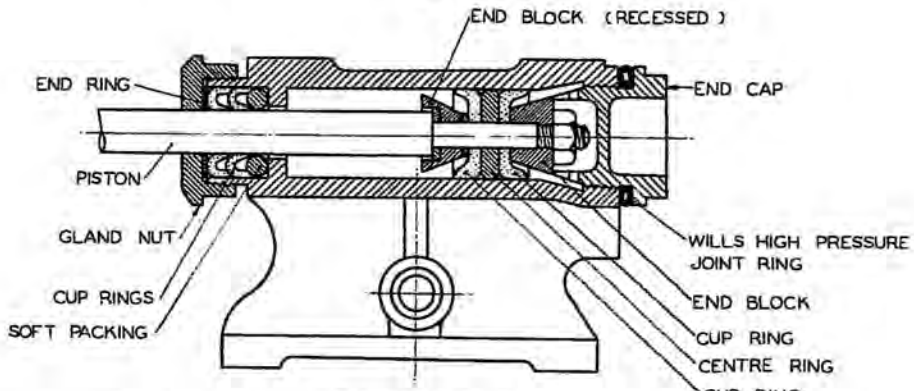
SECTION C-C



PLAN

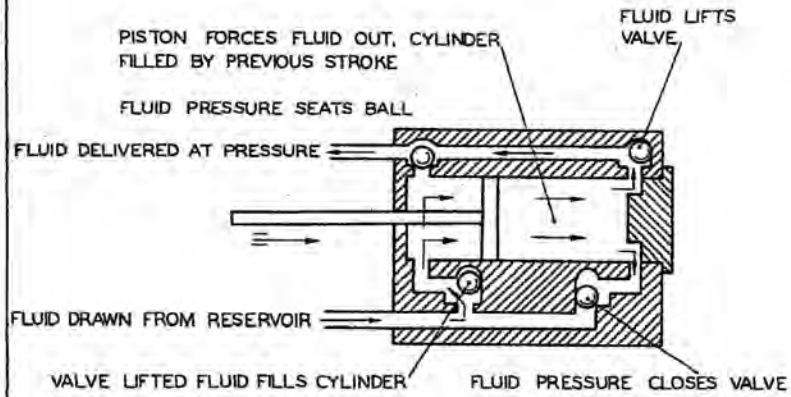


SECTION B-B

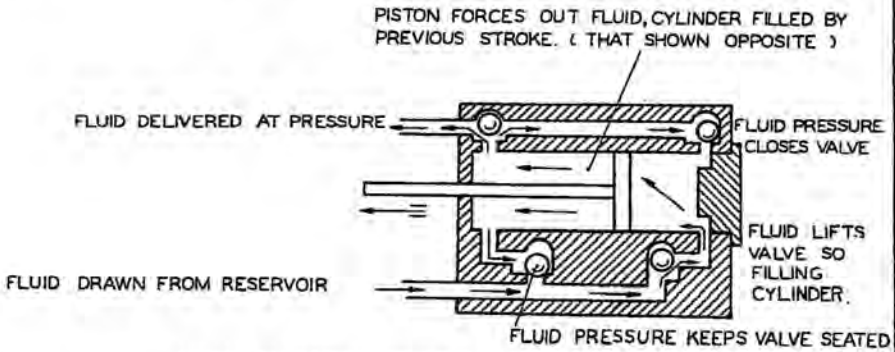


SECTION A-A

DETAILS



VIEW SHOWING DISPLACEMENT OF VALVES BY FLUID PRESSURE BEING EXERTED BY PISTON



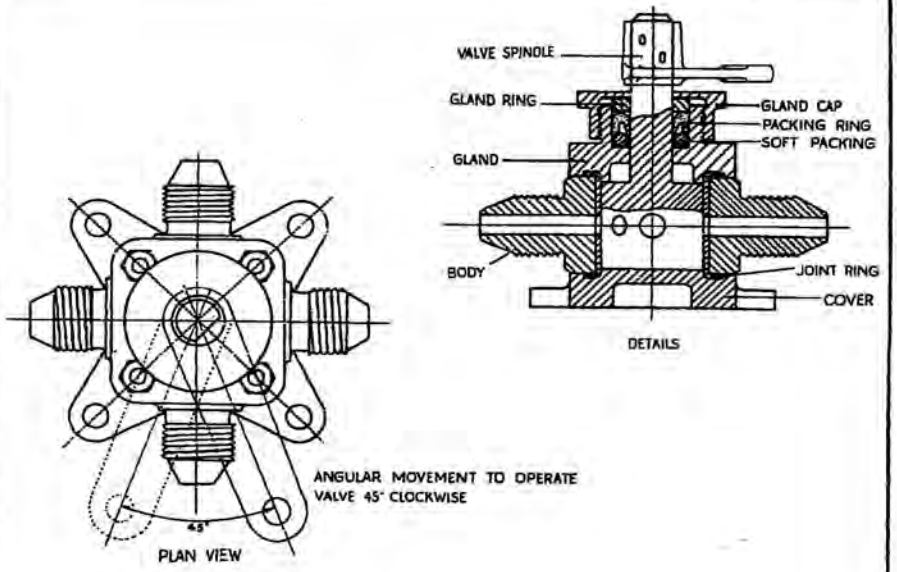
VIEW SHOWING POSITIONS OF VALVES DURING FOLLOWING STROKE TO THAT SHOWN OPPOSITE. ARRANGEMENT OF PUMP GIVES CONTINUOUS DELIVERY

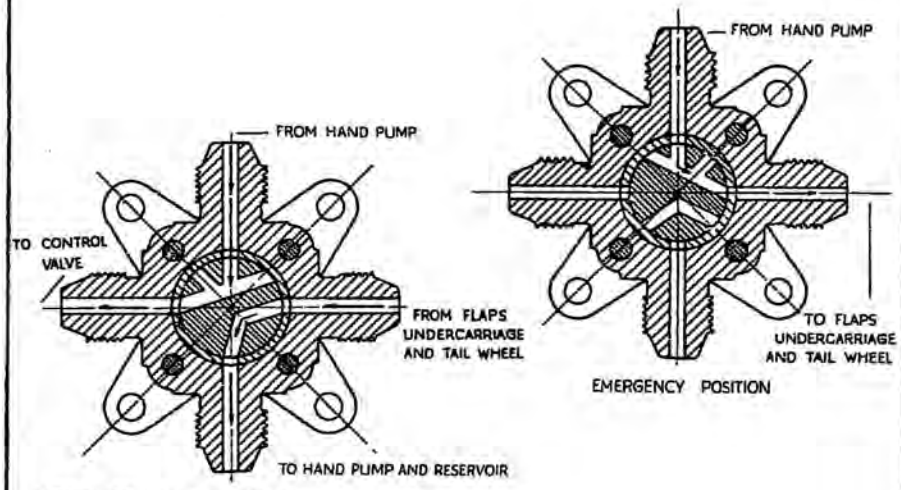
5

FUNCTIONS

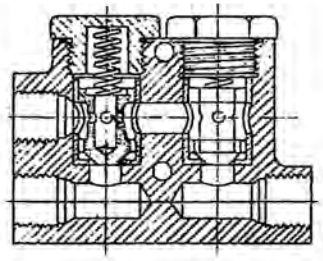
HAND PUMP

5

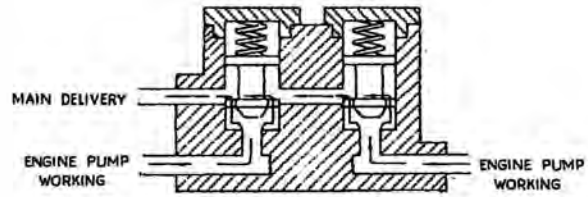




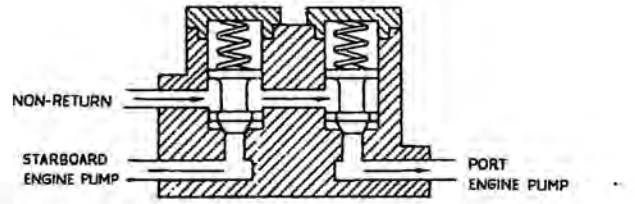
6 **EMERGENCY CONTROL VALVE** 6



DETAILS



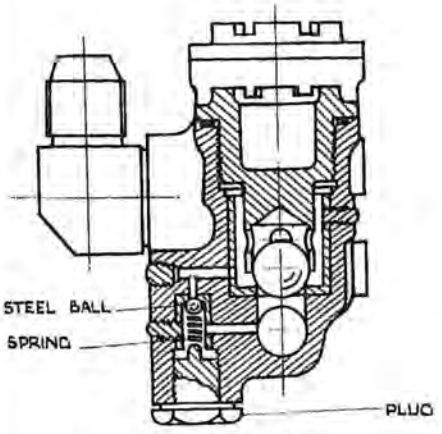
POSITION OF NON-RETURN VALVES LIFTED FROM THEIR SEATINGS BY PRESSURE OF FLUID PUMPS PERMITTING FLOW OF FLUID TO MAIN DELIVERY. NOTE I EACH VALVE ACTS INDEPENDENTLY.



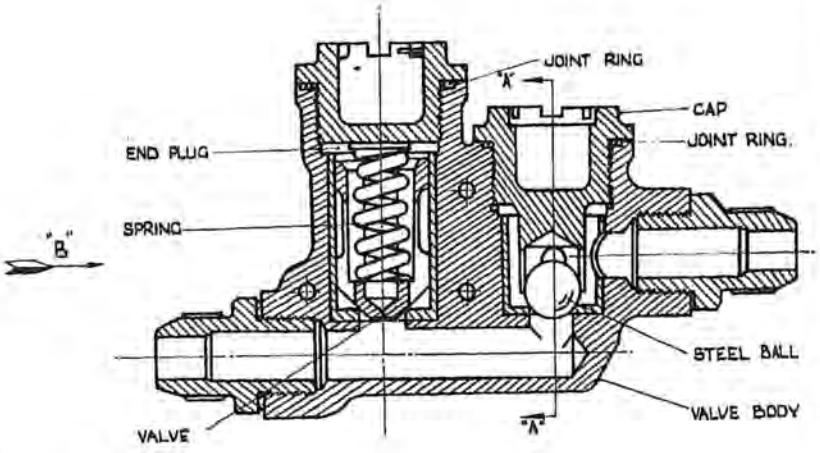
NORMAL POSITION OF NON-RETURN VALVES SHOWING COMPRESSION SPRINGS HOLDING VALVES DOWN ON THEIR SEATINGS THIS OCCURS WHEN ENGINE PUMPS ARE NOT WORKING

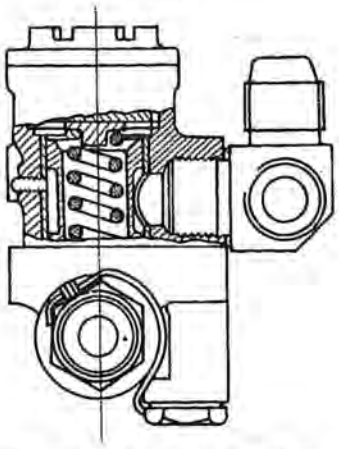
FUNCTIONS

7 **DOUBLE NON-RETURN VALVE** 7



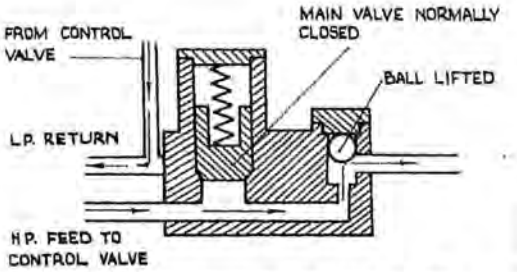
SECTION ON 'AA'





END VIEW IN DIRECTION OF ARROW B

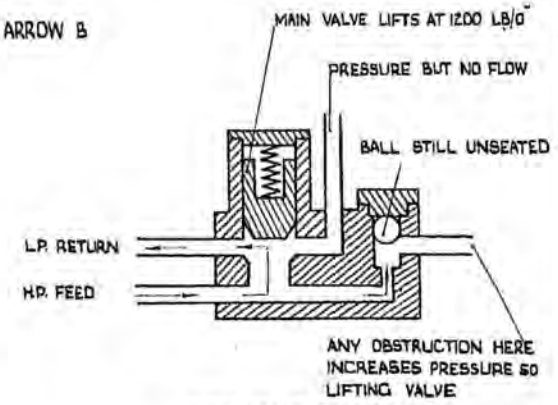
DETAILS



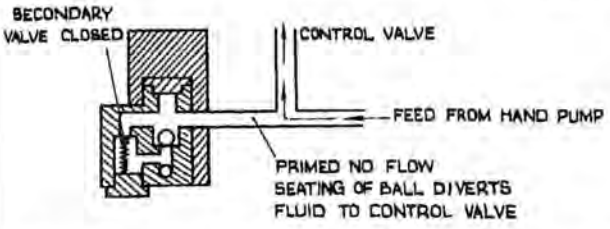
NORMAL POSITION OF MAIN VALVE

MAIN VALVE SET 1200 LB/□" SECONDARY VALVE 1250 - 1300 LB/□"

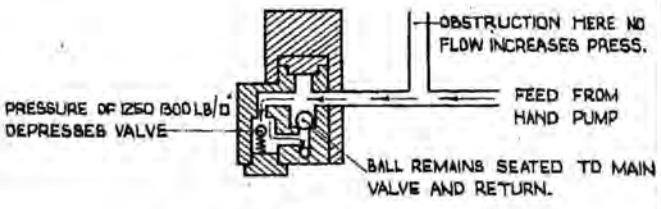
LABEL ON VALVE



MAIN VALVE AT BY-PASS



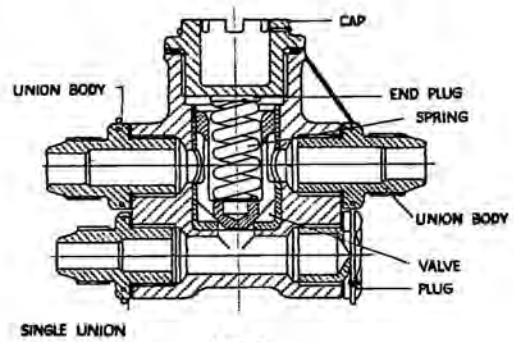
END VIEW SHOWING NORMAL POSITION OF SECONDARY VALVE



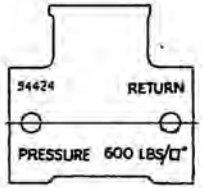
SECONDARY VALVE AT BY-PASS

FUNCTIONS

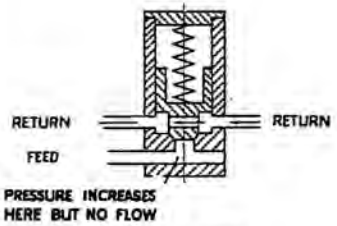
8 RELIEF AND NON RETURN VALVE 8



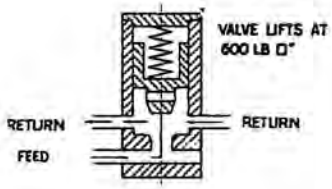
DETAILS



LABEL ON VALVE



NORMAL POSITIONS

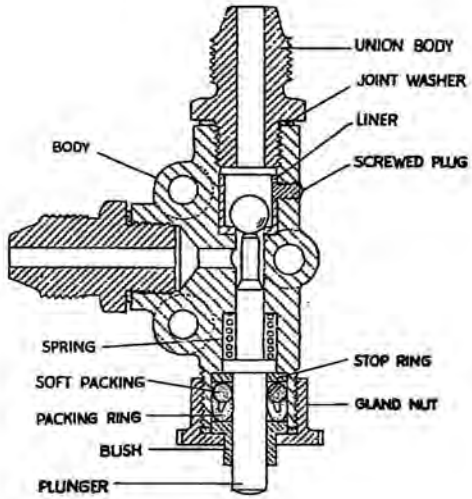


BY-PASS

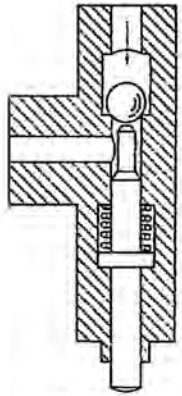
FUNCTIONS

THIS VALVE IS USED AS A PROTECTION RELIEF VALVE FOR ENGINE-DRIVEN PUMP PRESSURE FROM THE PUMP BEING RELIEVED AT 600 LB □" OPERATIVE ONLY WHEN AEROPLANE IS NOT IN FLIGHT

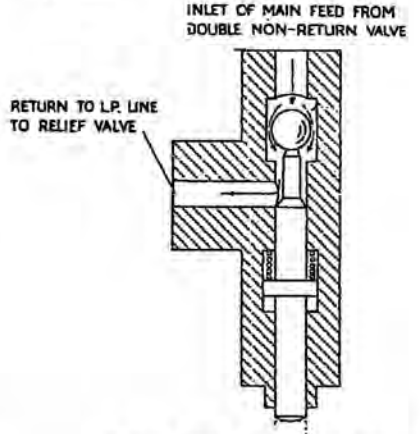
9 **RELIEF VALVE** 9



DETAILS



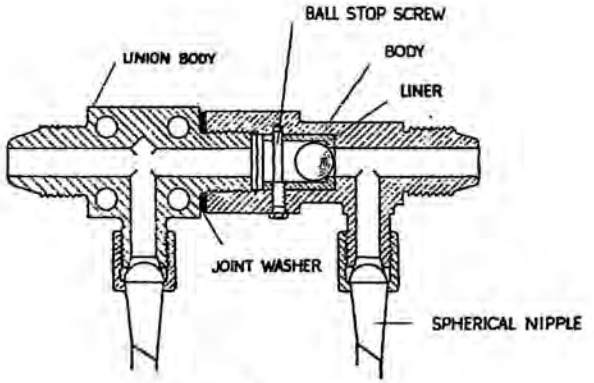
NORMAL POSITION



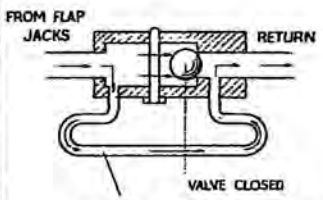
STOP ON SHOCK ABSORBER LEG OPERATES PLUNGER WHEN AEROPLANE LANDS

FUNCTIONS

10 **BY-PASS VALVE** 10

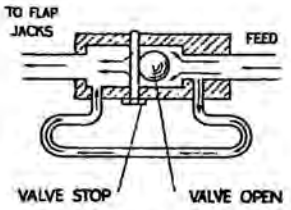


DETAILS



SMALL BORE RESTRICTS FLOW OF RETURN FLUID WHEN FLAPS ARE BEING RAISED SLOWS DOWN MOVEMENT

CHOKE IN OPERATION

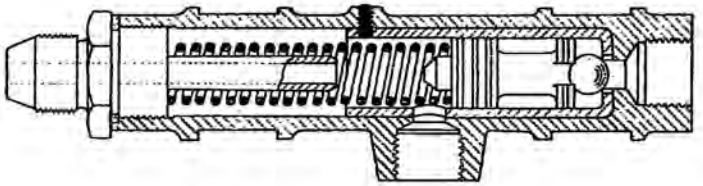


UNRESTRICTED FEED ALLOWS FLAPS TO OPEN NORMALLY

CHOKE OPEN

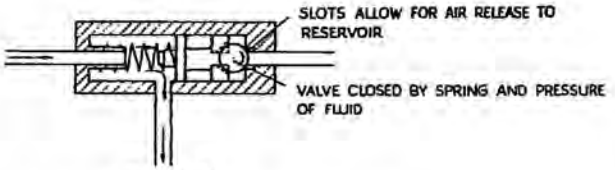
FUNCTIONS

11 **CHOKE VALVE** 11

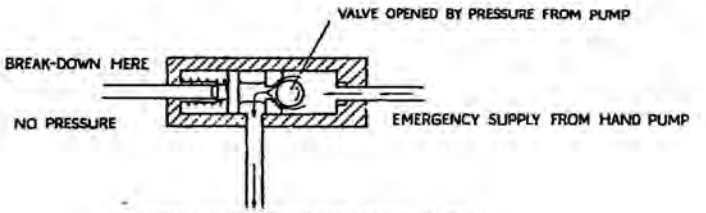


DETAILS

VALVE ALLOWS USE OF EMERGENCY SYSTEM TO UNDERCARRIAGE, TAIL WHEEL AND FLAP JACKS



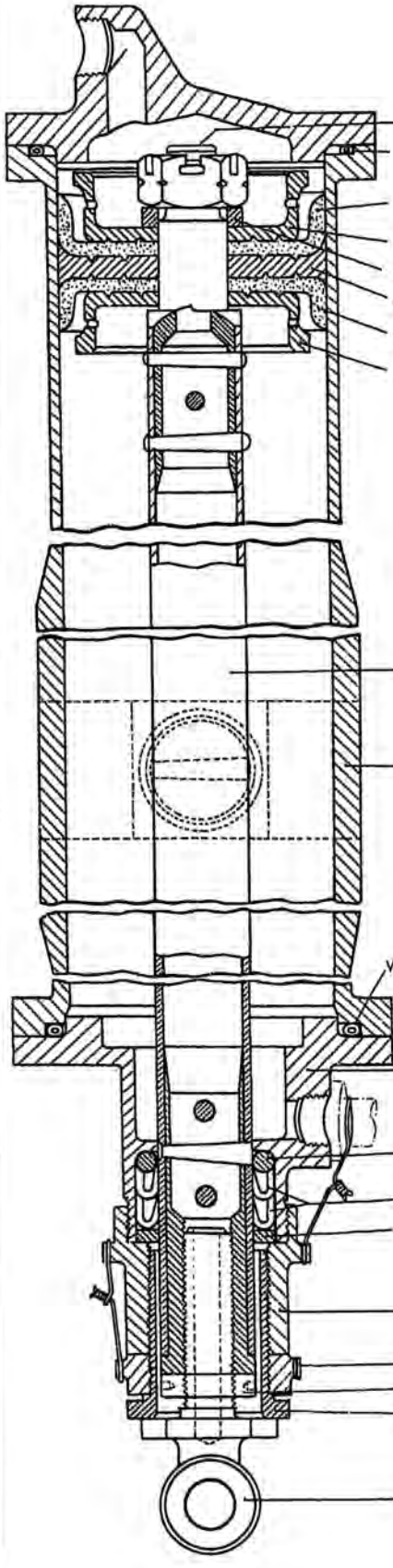
NORMAL SUPPLY FROM ENGINE-DRIVEN PUMP



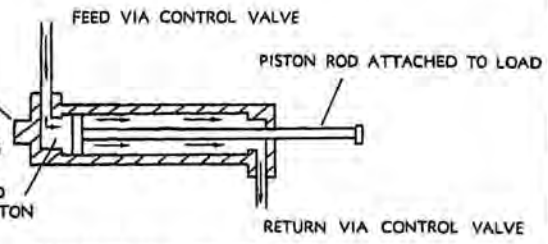
EMERGENCY SUPPLY FROM HAND PUMP TO JACK

FUNCTIONS

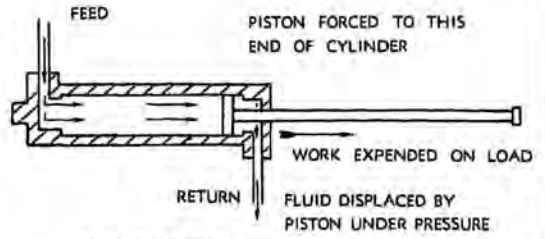
12 **TRANSFER VALVE** 12



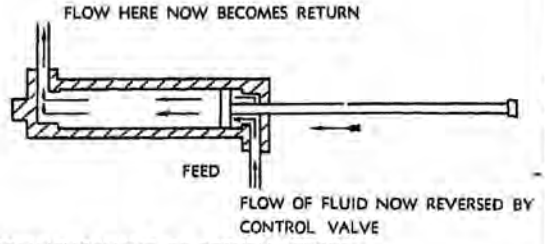
DETAILS



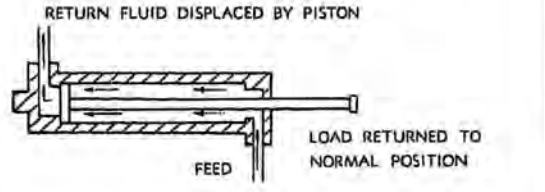
COMMENCEMENT OF STROKE



END OF STROKE



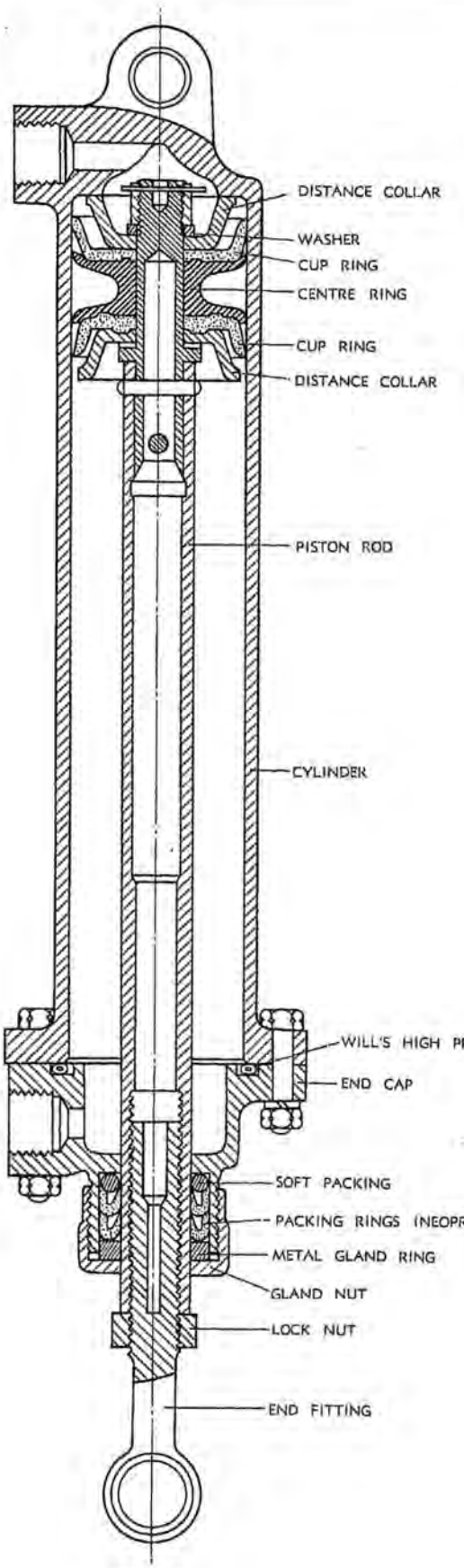
COMMENCEMENT OF RETURN STROKE



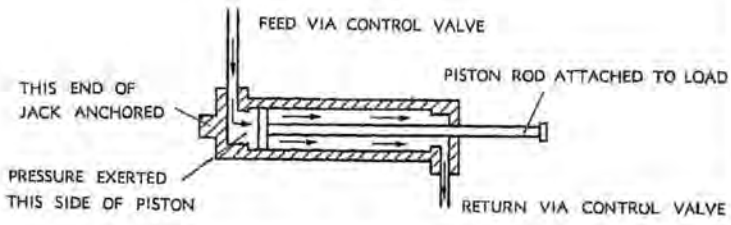
END OF RETURN STROKE

CONDITIONS NOW REVERT TO COMMENCEMENT OF STROKE

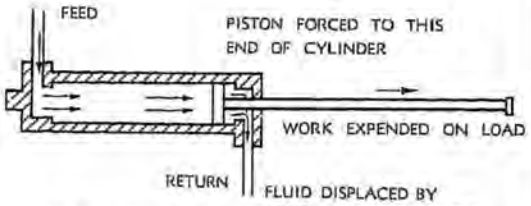
FUNCTIONS



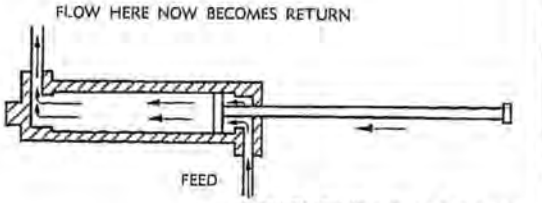
DETAILS



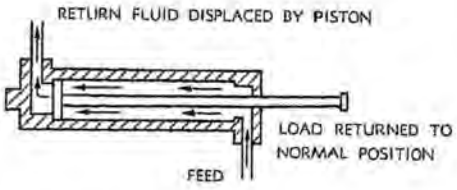
COMMENCEMENT OF STROKE



END OF STROKE



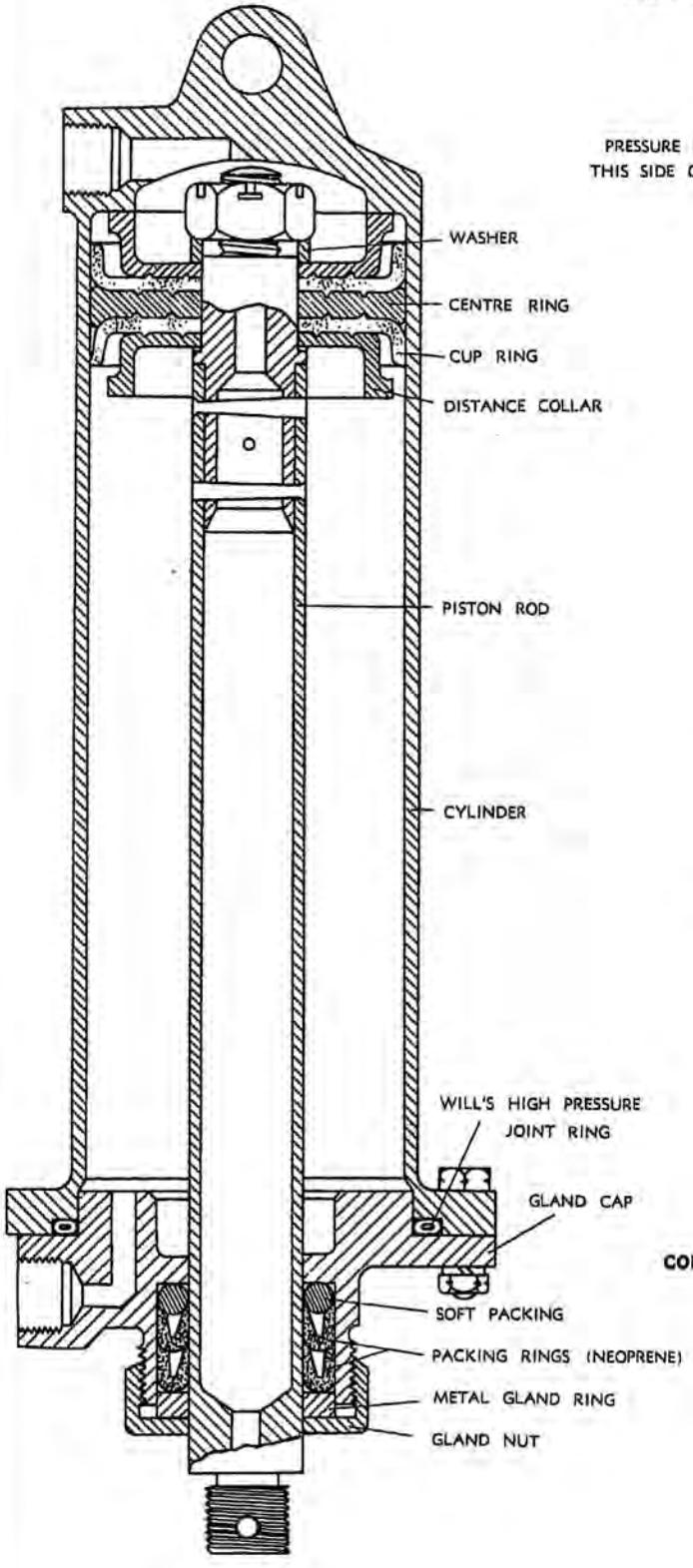
COMMENCEMENT OF RETURN STROKE



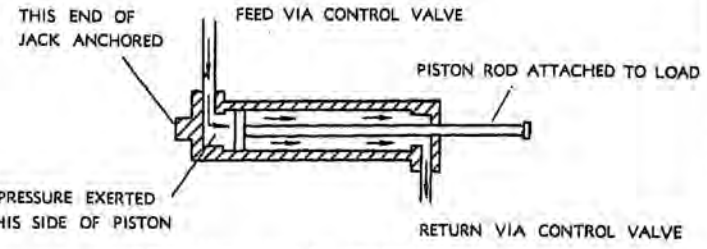
END OF RETURN STROKE

CONDITIONS NOW REVERT TO COMMENCEMENT OF STROKE

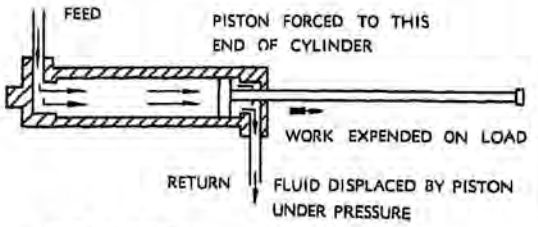
FUNCTIONS



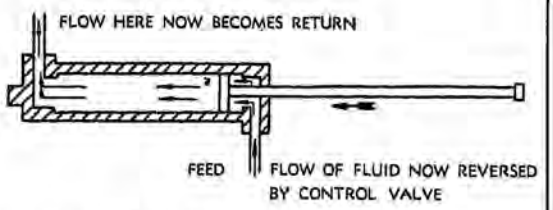
DETAILS



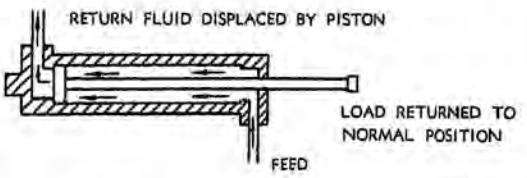
COMMENCEMENT OF STROKE



END OF STROKE



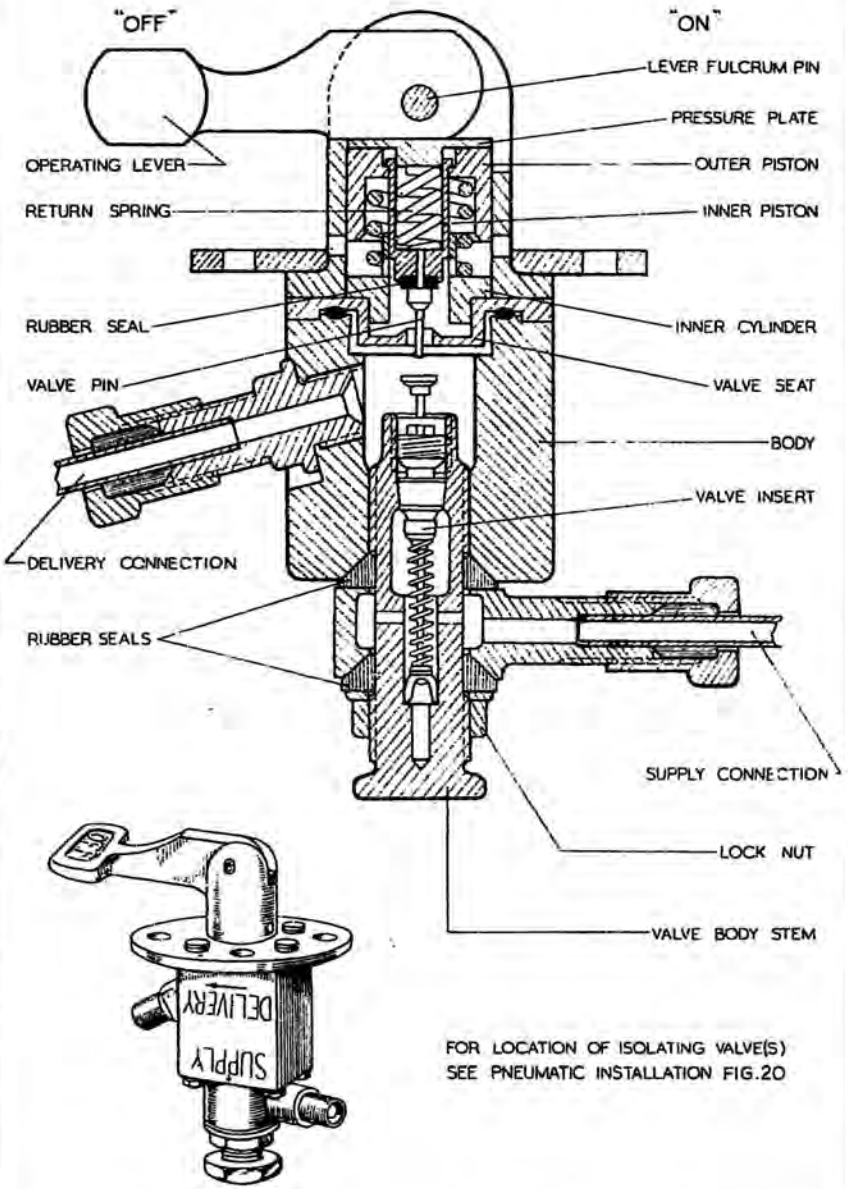
COMMENCEMENT OF RETURN STROKE



END OF RETURN STROKE

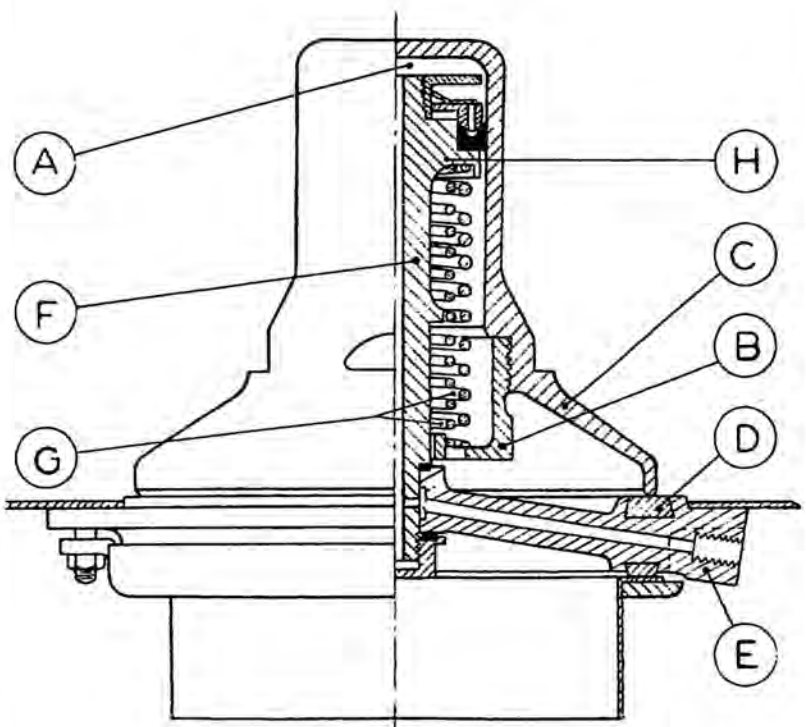
CONDITIONS NOW REVERT TO COMMENCEMENT OF STROKE

FUNCTIONS

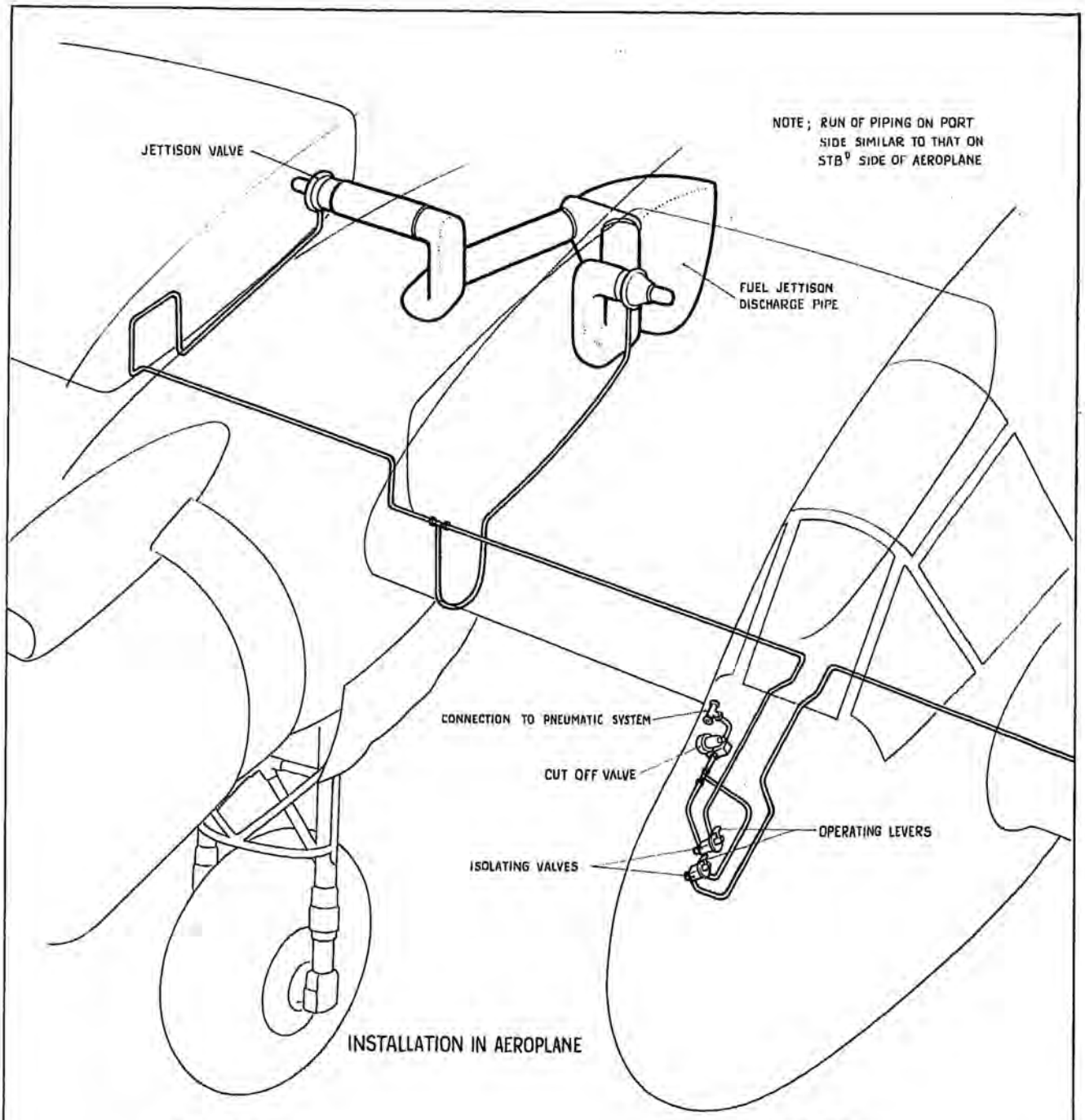


FOR LOCATION OF ISOLATING VALVE(S)
SEE PNEUMATIC INSTALLATION FIG.20

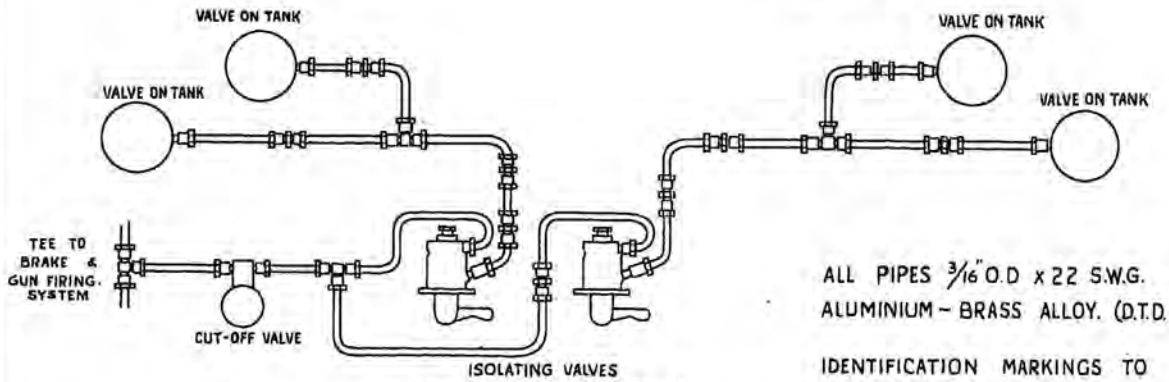
16 ISOLATING VALVE 16



17 FUEL JETTISON VALVE 17



INSTALLATION IN AEROPLANE

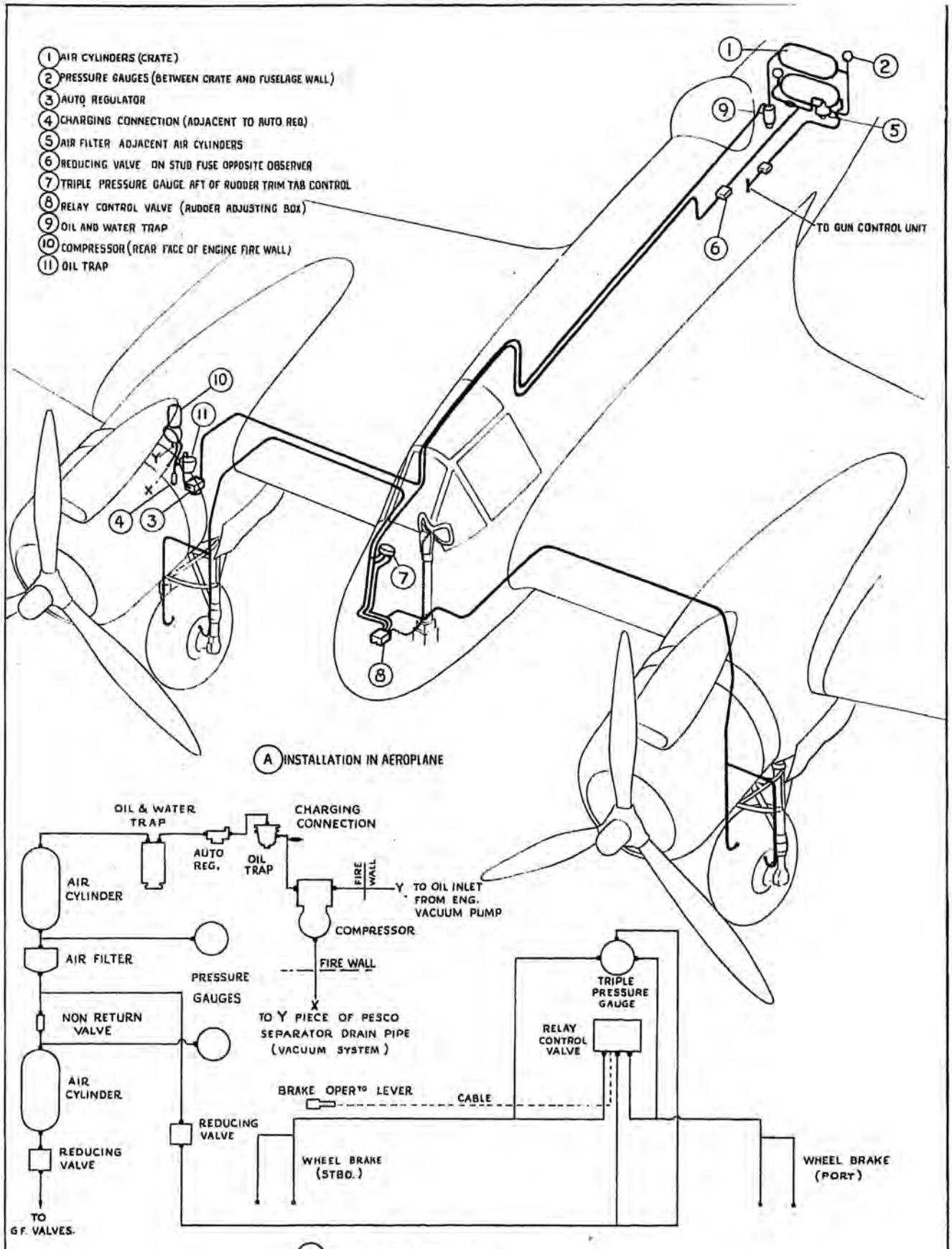


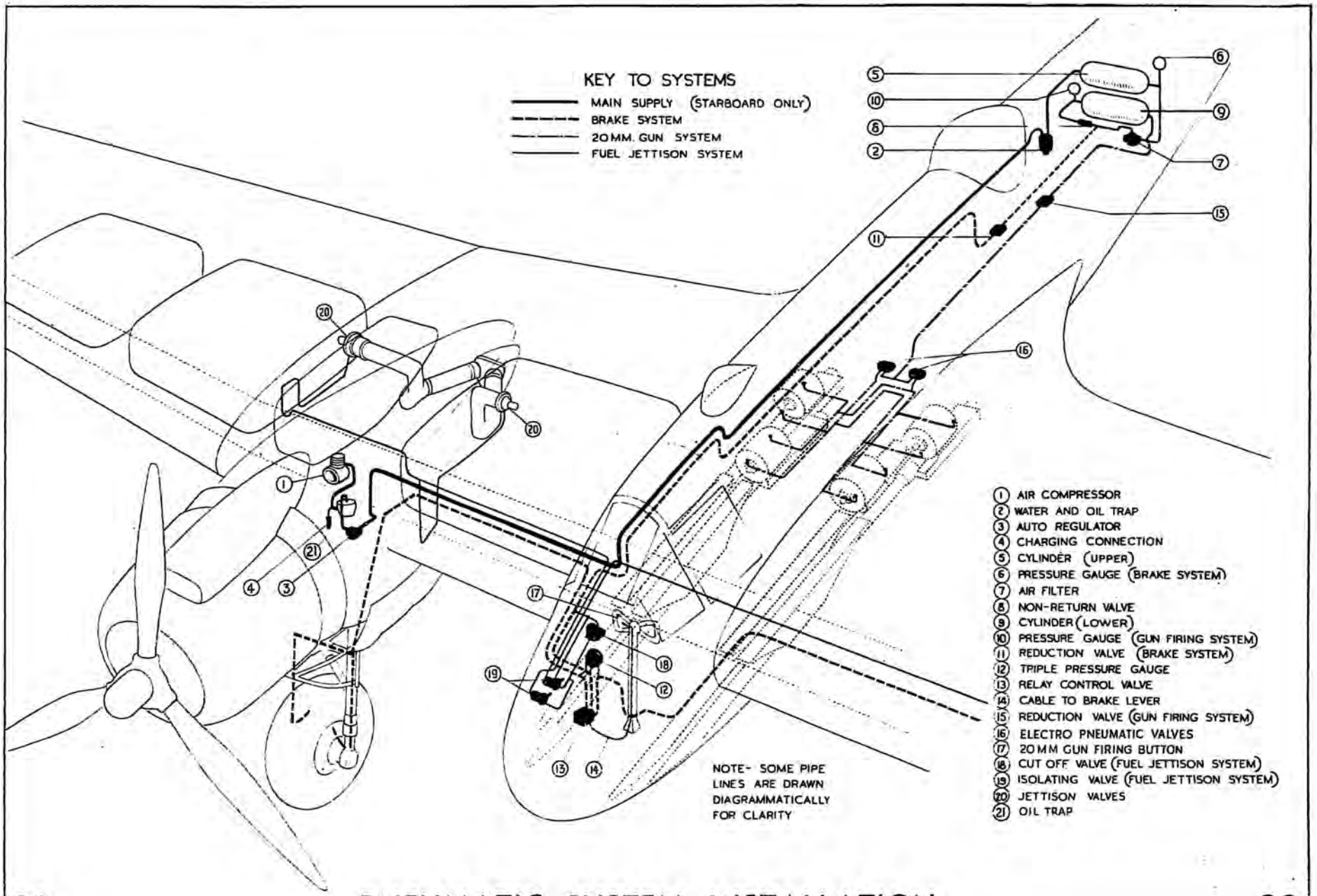
PIPE LINE DIAGRAM

ALL PIPES 3/16" O.D x 22 S.W.G.
ALUMINIUM – BRASS ALLOY. (D.T.D. 253 A)

IDENTIFICATION MARKINGS TO SPEC. B.S. 3130

FUEL JETTISON SYSTEM


1 AIR CYLINDERS (CRATE)
2 PRESSURE GAUGES (BETWEEN CRATE AND FUSELAGE WALL)
3 AUTO REGULATOR
4 CHARGING CONNECTION (ADJACENT TO AUTO REG)
5 AIR FILTER ADJACENT AIR CYLINDERS
6 REDUCING VALVE ON STUD FUSE OPPOSITE OBSERVER
7 TRIPLE PRESSURE GAUGE AFT OF RUDDER TRIM TAB CONTROL
8 RELAY CONTROL VALVE (RUDDER ADJUSTING BOX)
9 OIL AND WATER TRAP
10 COMPRESSOR (REAR FACE OF ENGINE FIRE WALL)
11 OIL TRAP
TO GUN CONTROL UNIT
A INSTALLATION IN AEROPLANE
OIL & WATER TRAP
CHARGING CONNECTION
AUTO REG.
OIL TRAP
FIRE WALL
Y TO OIL INLET FROM ENG. VACUUM PUMP
AIR CYLINDER
COMPRESSOR
AIR FILTER
FIRE WALL
PRESSURE GAUGES
TRIPLE PRESSURE GAUGE
NON RETURN VALVE
X TO Y PIECE OF PESCO SEPARATOR DRAIN PIPE (VACUUM SYSTEM)
RELAY CONTROL VALVE
AIR CYLINDER
BRAKE OPERTG LEVER
CABLE
REDUCING VALVE
REDUCING VALVE
WHEEL BRAKE (STBD.)
WHEEL BRAKE (PORT)
TO G.F. VALVES.
B PIPE LINE CIRCUIT



20 PNEUMATIC SYSTEM INSTALLATION 20

ALPHABETICAL INDEX.

ALPHABETICAL INDEX—(*continued*).

ALPHABETICAL INDEX—(*continued*).

ALPHABETICAL INDEX—(*continued*)

ALPHABETICAL INDEX—(*continued*).

ALPHABETICAL INDEX—(*continued*).

ALPHABETICAL INDEX—(*continued*).

ALPHABETICAL INDEX—(*continued*).