Chapter 2 R.P. EQUIPMENT

LIST OF CONTENTS

DESCRIPTION

General

1. Provision is made for fitting two Mk. 8 rocket projectors on the underside of each wing, between the fuselage and the stub boom. Each projector consists of a front and a rear strut with an interposed guide rail and is capable of carrying two tier-mounted rocket projectiles. The rockets are fired electrically and details of the electrical installation are contained in Sect. 5, Chap. 1. The electrical visual safety break located on the outboard diaphragm of each main wheel well is described in Sect. 5, Chap. 1. A full description of the Mk. 8 installation is given in A.P.2802A.

Front and rear mounting struts (*fig. 1*)

2. The front and rear mounting struts each comprise a strut fitted with, respectively, a front carrier and a rear carrier. The mounting struts are fabricated from streamline section tube and each has a plate welded to the top for attaching the strut to the wing. Incorporated within each front strut is a mounting block to which the front carrier is secured by a pin, and a base block. A similar internal mounting block is riveted to the lower end of each rear strut to which the rear carrier is bolted.

Guide rails

3. The purpose of the guide rails is to prevent the tails of the upper rockets, when they are fired, fouling the front mounting struts. Each guide rail consists of a light-alloy tube to which is secured the flanged guide-rail runner. Attachment for the rear end of the guide rail is provided by an internal socket which engages with the spigot at the forward end of the rear carrier guide. At the forward end, the guide rail is secured by a U-section bracket to the front carrier attachment pin.

Installation

4. The inner and outer front mounting struts are secured by bolts which engage with anchor nuts on the main plane structure. Both rear mounting struts are attached to the No. 1 fuel tank door; the electrical connections are accessible only when the struts have been removed from the door. The installation is rigged with the guide rails parallel to the centre-line of the aircraft in azimuth $\pm \frac{1}{4}$ deg. and at 1 deg. negative to the wing datum; no adjustment for alignment of the projectors is provided.

◀ **Note . . .**

If the front mounting struts are not fitted, it is essential to replace *the correct rear mounting bolts* (*fig.* 1), *as they are also H.T.S. main spar structural attachment bolts. The* inboard *rear bolts are Pt. No.* 12.W.4023, *and the* outboard *rear bolts are Pt. No.* AS.1242–12G. *These part numbers are stencilled on the main plane close to the mounting strut, but instances have occurred of the wrong bolts being fitted.* ▶

Loading

5. Instructions for loading the projectile are given in A.P.2802A, Vol. 1.

SERVICING

General

6. Servicing instructions for the Mk. 8 rocket projector installation are given in A.P.2802A, Vol. 2, Part 3.

REMOVAL AND ASSEMBLY

General

7. Removal and assembly instructions for the Mk. 8 installation are given in A.P.2802A, Vol. 2, Part 3.

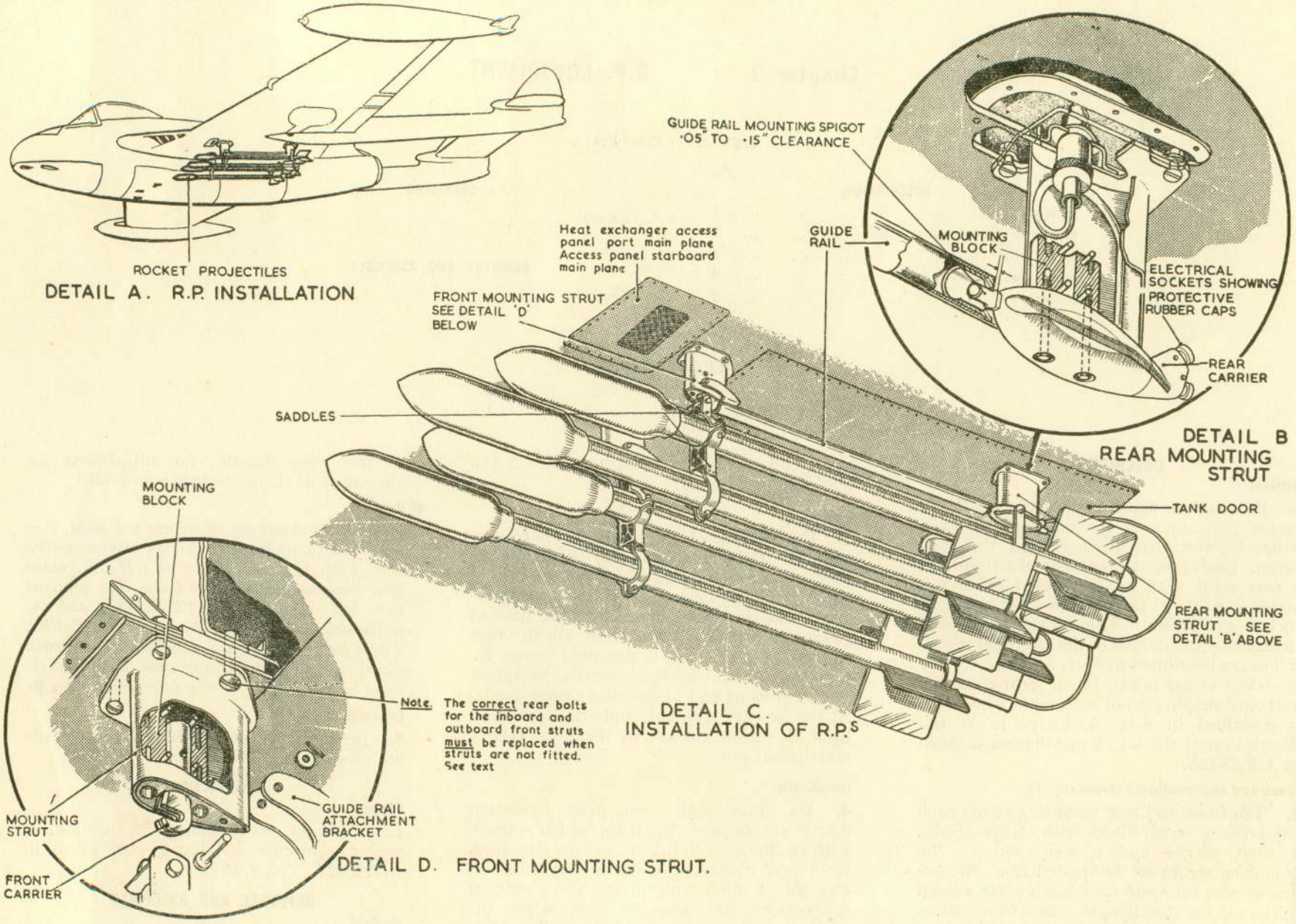

Fig. 1. R.P. installation

Chapter 3 GUNS

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LIST OF ILLUSTRATIONS

DESCRIPTION

Introduction

1. This chapter covers the installation of the four Hispano 20 mm. Mk. 5, No. 2 guns and belt feed mechanisms, L.H. and R.H., Mk. 5, together with instructions for harmonizing, arming, re-arming and butt testing. Descriptive and servicing details for the guns and belt feed mechanisms are contained in A.P.1641F and for the firing gear in A.P.1641E. The guns are mounted in pairs on the underside of the fuselage in a heated bay, the outboard guns being positioned approximately 9 in. aft of the inboard guns.

Front mountings (*fig. 1*)

2. The four front mountings are of the ball and socket type comprising an inner and outer eccentric, which provide lateral and vertical alignment for the guns. The outer ball eccentric has 24 equally spaced V-shaped grooves around the periphery in a fore-and-aft direction in relation to the gun. The outer eccentric is locked to the ball housing, when the gun is in correct alignment, by a locking screw which engages in one of the V-shaped grooves. The inner eccentric piston sleeve, which has a similar number of equally spaced grooves, is locked to the outer eccentric by a spring-loaded locking tab. The procedure for aligning the guns is described in para. 18.

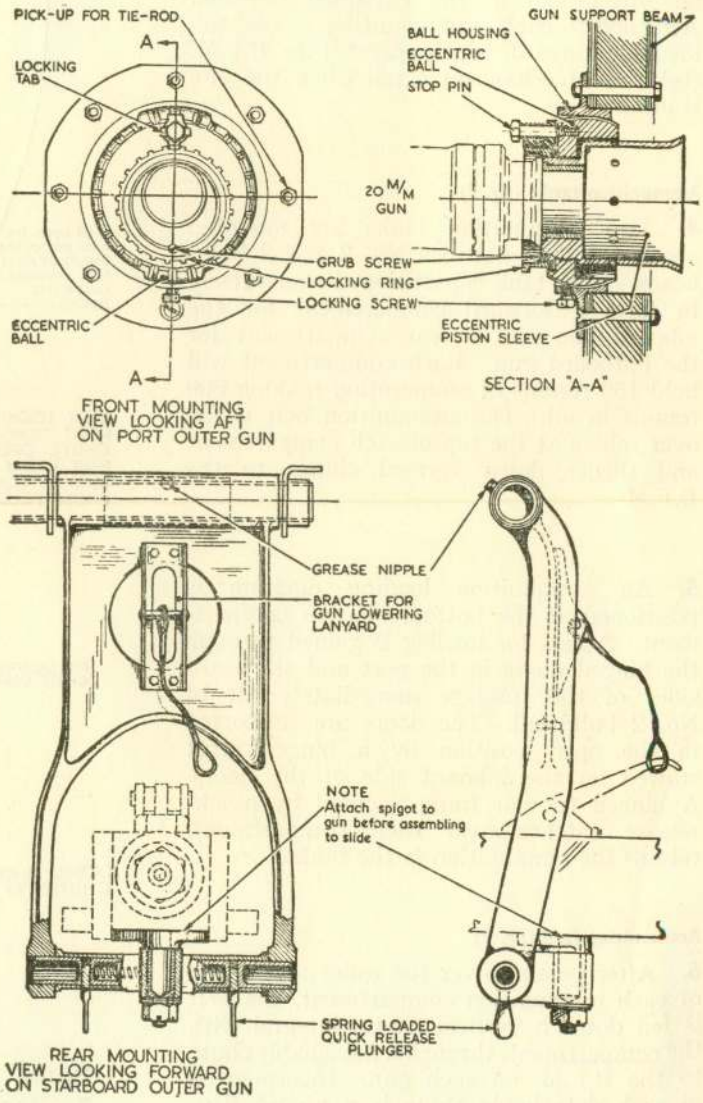


Fig. 1. Gun mountings

Rear mountings (*fig. 1*)

3. Each rear mounting consists simply of an inverted 'U' shaped bracket, which is hinged from a fitting on the roof of the gun bay. The mounting is capable of free reciprocal movement when recoil takes place. When the gun is installed in the mounting, the spring-loaded quick-release plungers must be wire-locked in the extended position. Attached to each rear mounting is the gun lowering lanyard, which operates the B.F.M. (belt feed mechanism) catch when the gun is lowered.

Ammunition tanks (*fig. 2*)

4. Two ammunition tanks are mounted above the guns between No. 2 and 3 bulkheads. Each tank is partitioned transversely to form a forward compartment for the inboard gun and a rear compartment for the outboard gun. Each compartment will hold 150 rounds of ammunition making 600 rounds in all. The ammunition belt is fed over rollers at the top of each compartment and thence down vertical chutes to the B.F.Ms.

5. An ammunition loading diagram is positioned at the bottom of each compartment. Access for loading is gained through the hinged doors in the port and starboard sides of the fuselage immediately aft of No. 2 bulkhead. The doors are supported in the open position by a hinged strut stowed on the inboard side of the doors. A hinged tubular frame secured by quick-release catches over each compartment, retains the ammunition in the tanks.

Ammunition feed (*fig. 2*)

6. After passing over the roller at the top of each ammunition compartment, the belt is fed down a vertical chute, integral with the compartment, through a detachable chute to the B.F.M. on each gun. Incorporated in each detachable chute is a hinged flap, which allows the belt to be made or broken as required during re-arming.

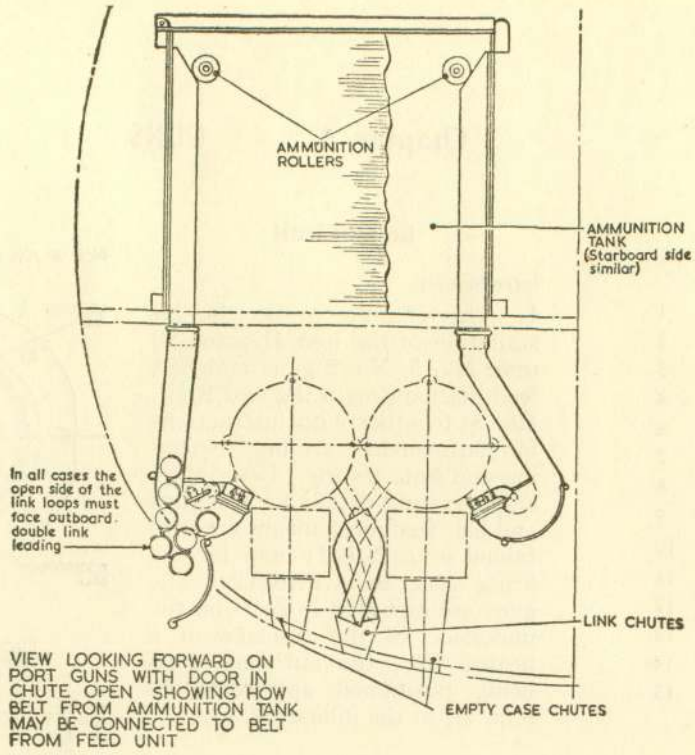


Fig. 2. Ammunition tanks and feed

Ejection

7. The gun bay doors (*fig.* 4) incorporate empty case chutes which are aligned with the ejection openings on the guns. Separate ejector chutes, also built into the gun bay doors and adjacent to the empty case chutes, are aligned with the empty link chutes from the B.F.Ms.

Firing mechanism

8. The guns are fired electrically by a trigger-type switch mounted on the control column handle (*Sect.* 1, *Chap.* 1). A safety catch mechanically locks the firing switch in the SAFE position and also operates an electrical fire-and-safe switch. The firing switch permits salvo firing of the guns only; no provision is made for independent firing of the inner or outer guns. The Maxiflux firing unit is screwed and wire-locked to each gun. Full details of the gun firing circuits are given in Sect. 5, Chap. 1.

Cocking

9. The guns are cocked with a No. 11 hand cocking unit. Details of its application are given in A.P.1641F. A hand cocking unit is not carried in the aircraft.

Blast tubes

10. The Martin Baker telescopic-type blast tubes are fitted over the gun barrels between the front mountings and the spout fairings. The tubes are secured to the front mountings by worm-drive clips, the forward telescopic portions being held against the spout fairings by springs (*fig.* 7).

Magazine carrier tie-rods

11. The purpose of the magazine carrier tie-rods is to maintain the B.F.Ms. in a rigid position during the recoil of the guns. One tie-rod is fitted to each gun and is attached

at its forward end to a fork end on the gun beam, and at its rear end to the magazine carrier. In each instance, the tie-rod is mounted on the outboard side of the gun and has a $\frac{3}{8}$ in. adjustment. The magazine carrier tie-rods should be adjusted to obtain the correct clearance between the rack operating-lever and the rack. The forward attachment fork end bolt of each tie-rod passes through the gun beam and constitutes one of the front mounting attachment (*fig.* 1 *and* 7).

Gun sight

12. The Mk. 4E gyro gun sight is positioned on the upper instrument panel and mounted on the bracket secured to the windscreen casting. The mounting surface of the gun sight bracket is parallel to the aircraft datum and the gun centre-lines, and also laterally level within the permitted tolerance of $\pm\frac{1}{2}$ deg. in each instance. The gun sight range control is operated by Bowden cables from the twist grip on the throttle lever. It is important that the torque at the twist grip does not exceed 4 lb. in. at any position. The gun sight installation is illustrated in Sect. 5, Chap. 3. A full description of the Mk. 4E sight together with servicing instructions, including the method of adjusting the range control cables, is given in A.P.1275E, Vol. 1.

Gun sight recorder

13. A mounting bracket is provided on the gyro gun sight for mounting a recorder camera. A description of the camera is given in A.P.1355D, Vol. 1, Sect. 3, Chap. 1. A stowage is provided in the cabin for the recorder and connecting plug when not in use (*Sect.* 1, *Chap.* 1).

Cine camera

14. The G.45B cine camera is mounted on a platform immediately above the nose wheel on a Type 39 mounting. The camera and mounting are easily accessible with the top nose fairing panel removed. The camera is electrically operated, and may be operated independently, or when the guns are fired. A test switch, mounted on the lower port instrument panel, allows the camera circuit to be tested independently of the gun circuit and the nose wheel leg micro switch. The cine camera installation is illustrated in Sect. 5, Chap. 3 and the camera and its associated components are fully described in A.P.1355D, Vol. 1. The method of harmonizing the camera with the guns and gun sight is given in para. 18.

Gun heating (*fig.* 3)

15. The gun bay is heated with warm air supplied from the engine diffuser casing. From a tapping on the front starboard side of the casing, the air is directed through a duct on the starboard side of the gun bay to the distributors to the guns. The heating duct is mounted to the airframe and in no way interferes with the removal or replacement of the gun installation.

Warning

There is no fire-and-safe mechanism for the guns, other than the firing button safety catch and the nose wheel micro switch, The only master switch is the GROUND/FLIGHT *switch which controls the entire aircraft electrical installation. It is essential, therefore, to disconnect the electrical lead plugs from the Maxiflux firing units before interfering with the armament installation in any way. The plugs to the Maxiflux firing units should be connected only when the aircraft is " at readiness."*

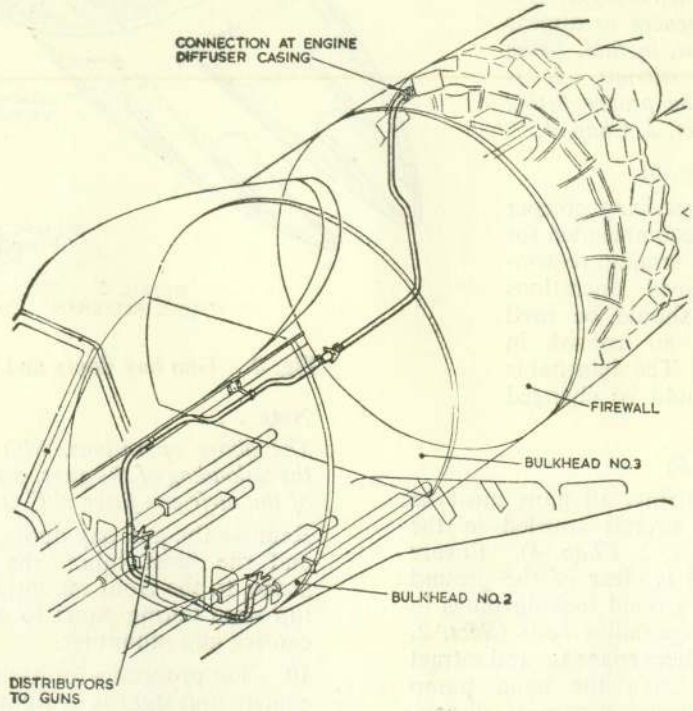


Fig. 3. Gun heating

Access to guns (*fig.* 4)

16. Access to the guns is gained from the underside of the aircraft by opening the two gun bay doors. Each door is hinged at its outboard edge by three hooks which engage with hinge brackets secured to the fuselage. The doors are secured by three de Havilland type toggle fasteners mounted on the starboard door, which engage with corresponding stirrups on the port door. The method of adjusting the fasteners is given in A.P.1464B, Vol. 1, Part 2, Sect. 6. The nose fairing panels, which incorporate the forward part of the blast tubes, are also detachable and give access to the gun muzzles and front mounting units.

Note . . .

Instances have occurred of the gun bay doors becoming detached in flight. It is possible for the fasteners to appear *to be secured without, in fact, being engaged over the stirrups. It is essential to follow the proper fitting sequence given in Sect.* 2, *Chap.* 4.

Servicing creeper (*fig.* 5)

17. The use of a servicing creeper (*Sect.* 2, *Chap.* 4) is recommended for gun servicing. The arming, re-arming and gun removal operations where the creeper should be used are annotated with an asterisk in para. 21, 23 and 26. The detachable head rest cover should be changed at frequent intervals.

Harmonization (*fig.* 6)

18. Before harmonizing, all guns must be unloaded and the aircraft trestled in the rigging position (*Sect.* 2, *Chap.* 4). Ensure that the nose wheel is clear of the ground and then insert the ground locking plugs in the main undercarriage radius rods (*Sect.* 2, *Chap.* 1). Select undercarriage UP and retract the nosewheel by using the hand pump (if the aircraft electrical system is disconnected, the solenoid-operated selection lever stop may be operated by hand).

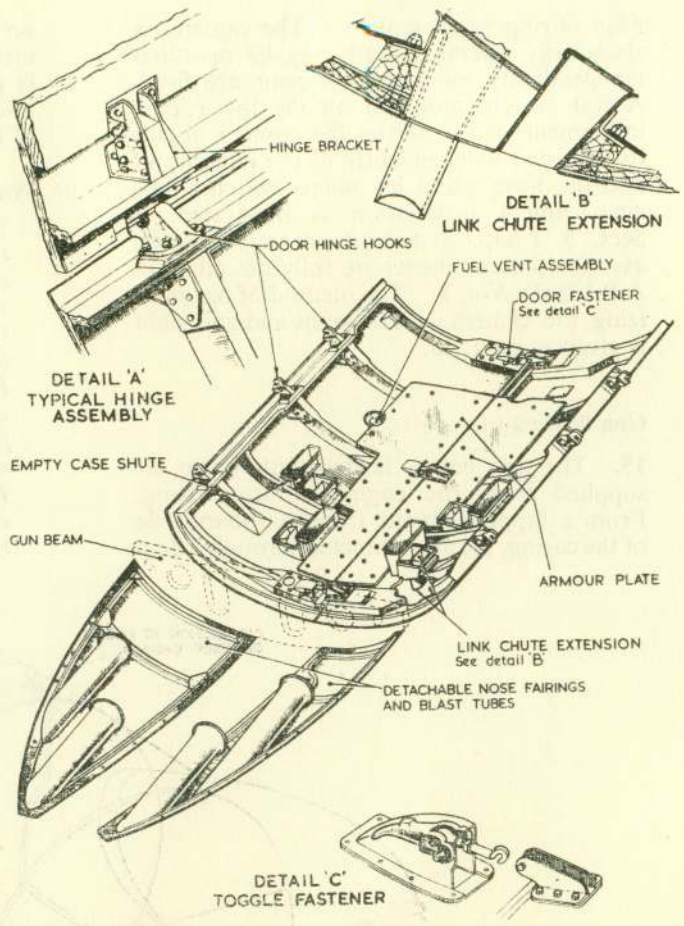


Fig. 4. Gun bay doors and nose fairings

Note . . .

The above operations, with the exception of the unloading of the guns, are the responsibility of the airframe fitter N.C.O.

Remove the gun bay doors, the nose fairings and the blast tubes, the latter providing access to the front mountings. Remove the top nose fairing panel to gain access to the camera gun mounting.

19. The procedure for harmonizing the guns, camera and sight is as follows:—

(1) Trestle the aircraft in the rigging position as given in Sect. 2, Chap. 4.

(2) Drop plumb lines from the leading edge of the port main plane at the mark immediately above the air-intake and from the mark on the port side of the tail plane leading edge. The skin is drilled at each point and indicates the exact position 48·0 in. from the aircraft centre-line.

(3) Position the harmonization stand 50 yards ahead squarely in front of the aircraft and sight the plumb lines to coincide with the outer vertical line on the stand.

(4) Place the adjustable spirit lever (*Ref. No.* 1B/4235), on the top of the breech block of the master gun and level the gun. Either of the outboard guns may be used as the master gun.

Note . . .

Levelling the gun is effected by unlocking the front mounting eccentrics and rotating them separately, using the special Y-spanners (*Sect.* 2, *Chap.* 4).

(5) Insert the gun aligning instrument, Type C (*Ref. No.* 1E/5157), fitted with an adapter for 20 mm. guns (*Ref. No.* 1E/5206), in the master gun barrel and sight on the harmonization stand.

(6) Adjust the stand cross bar until the gun aligning instrument is aligned on the stand horizontal sighting line. Secure the cross bar in this position after ensuring that the sighting line is level. The harmonization stand is now in the correct position relative to the aircraft.

(7) Adjust the master gun until it is correctly aligned on its respective mark on the stand by rotating the front mounting eccentrics, then relock the eccentrics.

(8) Align each gun in turn on its respective mark on the harmonization stand and lock the front mounting eccentrics. Recheck the alignment of the gun when the eccentrics are locked.

(9) Align the gyro gun sight on its mounting, until the central dot of the moving graticule and the cross of the fixed graticule, coincide with the respective marks on the harmonization stand. The procedure for adjusting the sight is given in A.P.1275E, Vol. 1. Ensure that all adjustments are securely locked and recheck the sight harmonization.

(10) Align the ciné camera on its mounting, using the sighting unit, to the sight mark on the harmonization stand. The method of using the sighting unit and the procedure for adjusting the mounting are described in A.P.1355D, Vol. 1. Lock all adjustments securely and recheck the camera harmonization.

(11) Refit the blast tubes and gun spout fairings, and replace the top nose fairing panel.

(12) Place the undercarriage lever in the DOWN position and lower the nose wheel. Return the undercarriage emergency retraction switch to OFF, *then* remove the ground locking plugs from the undercarriage radius rods. Lower the aircraft and remove the trestles.

Note . . .

The operations contained in sub-para. 12 are the responsibility of the airframe fitter N.C.O.

Arming

20. Instructions for filling the B.F.Ms. and loading the guns are given in A.P.1641F, Vol. 1, Part 1, Chap. 8. The following equipment and personnel are required :—

Equipment

4 B.F.Ms. (2 L.H. and 2 R.H.) fitted with appropriate feed and link chute extensions, loaded with 16 rounds and tensioned to 300 in. lb.

Sufficient boxed ammunition in belts of 25 rounds.
1 servicing creeper (*para.* 17).
1 low platform or steps.
1 No. 11 cocking unit.
Cleaning equipment for chamber and barrel.
Tools, breech stoppage, No. 2, Mk. 1 (Stores Ref. 8D/2917).
Feeler gauges.
Screwdriver.

Personnel

Two armourers.
One assistant to act as " safety man " and to assist in arming.

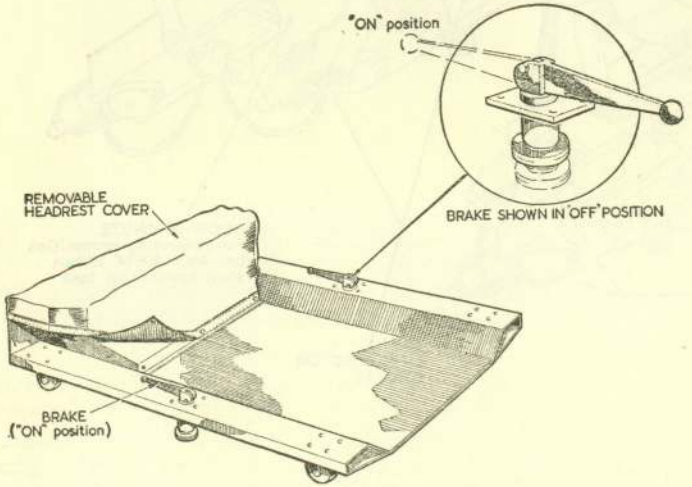
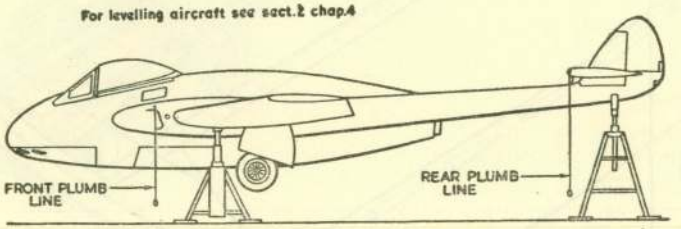
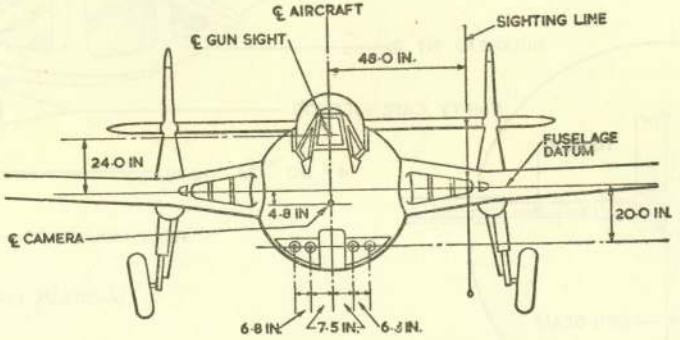


Fig. 5. Servicing creeper





℄ of guns with adjustment in mid position parallel to aircraft datum ± 1/4 deg. all round. Adjustment of ± 1/2 deg. all round provided by front mounting eccentrics in addition to above.

℄ of camera parallel to aircraft datum

Gun sight mounting bracket parallel to aircraft datum ± 1/2 deg. and laterally level ± 1/2 deg.

Fig. 6. Harmonization

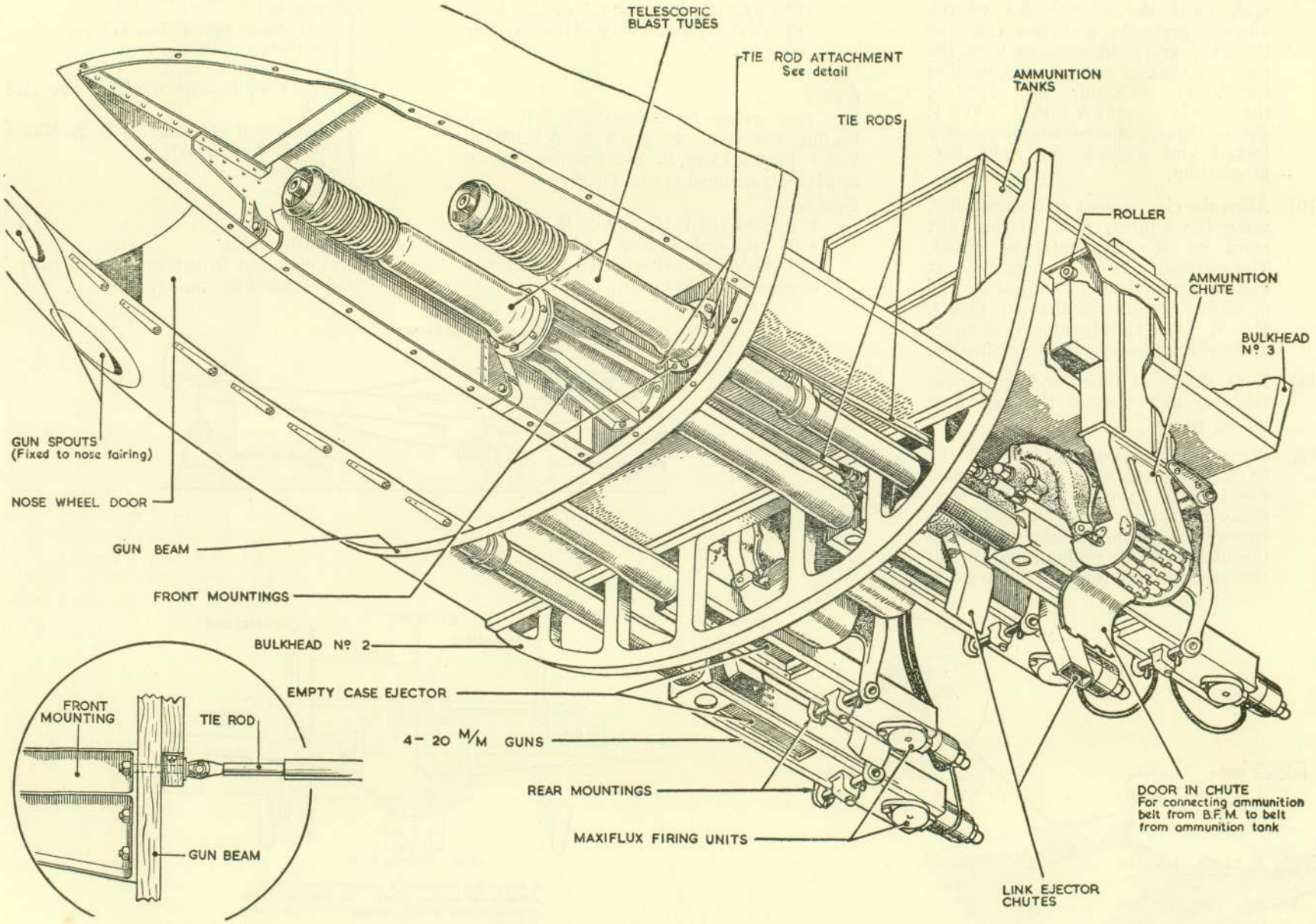


Fig. 7. Gun installation

21. The procedure for arming is as follows:—

(1) Set the gun firing safety catch to SAFE.

(2) Open and remove the gun bay doors by releasing the three toggle fasteners and unhooking the doors from the hinge bracket.

*(3) Remove the plugs from the Maxiflux firing units.

*(4) Commencing with the outer guns and following with the inner guns, remove the detachable feed chutes.

*(5) Lower the guns on their lowering lanyards.

(6) Open the ammunition tank access doors and remove the ammunition retaining frames. Fill the tanks as described on the ammunition loading diagram at the bottom of each compartment.

*(7) Commencing with the inner guns and following with the outer guns, mount the filled B.F.M. on the gun as described in A.P.1641F, Vol. 1, Part 1, Chap. 8.

*(8) Lift the gun and lock it into position. Ensure that the quick-release locking plungers are fully engaged in the rear mounting stirrups.

*(9) Replace the detachable feed chutes, feeding the rounds from the B.F.M. through the open flaps.

*(10) Join the belt from the ammunition tank to the belt from the B.F.M. as described in A.P.1641F, Vol. 1, Part 1, Chap. 8.

*(11) Replace the plugs in the Maxiflux firing units *if the aircraft is "at readiness."*

(12) Replace the ammunition tank retaining frames, close and secure the ammunition tank access doors.

(13) Remove the servicing creeper.

(14) Refit and secure the gun bay doors.

(15) Fit frangible gun muzzle covers.

Re-arming

22. Instructions for unloading the guns, filling the B.F.Ms. and loading the guns are given in A.P.1641F, Vol. 1, Part 1, Chap. 8. The following equipment and personnel are required :—

Equipment
As for arming (*para.* 20).

Personnel
As for Arming (*para.* 20).

23. The procedure for re-arming is as follows :—

(1) Set the gun firing safety catch to SAFE.

*(2) Open and remove the gun bay doors by releasing the three toggle fasteners and unhooking the doors from the hinge brackets.

*(3) Remove the plugs from the Maxiflux firing units.

*(4) Fit the breech stoppage tool (*para.* 20) to each gun as described in A.P.1641F, Vol. 1, Part 1, Chap. 8, following the instructions carefully, and referring to Part 3, Chap. 2, if stoppages have occurred.

(5) Open the ammunition tank access doors and remove the ammunition retaining frames.

*(6) Open the flap in each detachable feed chute and break the belt if the ammunition is not expended. Pull the remaining ammunition back into the tanks.

*(7) Commencing with the outer guns and following with the inner guns, remove the detachable feed chutes.

*(8) Lower the guns on their lowering lanyards and remove the B.F.Ms.

Note . . .
The "safety man" can now report that the guns are unloaded.

(9) Remove any unexpended ammunition from the ammunition tanks.

*(10) Carry out the "between flight servicing."

*(11) Re-load the guns as detailed for Arming (*para.* 21, *sub-para.* (6) *to* (15)).

Butt tests

24. When butt testing the guns, it is essential that the nose wheel is retracted (*para.* 18) and the blast tubes and gun spout fairings are securely fitted. Failure to comply with this instruction will cause extensive damage to the forward structure of the fuselage.

REMOVAL AND ASSEMBLY

WARNING

Ground locking plugs must be inserted in the main undercarriage radius rods (Sect. 2, Chap. 1) before commencing work beneath the fuselage. All guns must be unloaded before any work is started, and a "safety man" detailed to enforce the necessary precautions until all guns are cleared. The frangible muzzle covers, referred to in para. 26, must be fitted at all times except when actually servicing the guns.

Sear release units

25. The sear release units may be removed from the guns when the latter are installed. The procedure for each gun is as follows :—

(1) Ensure that the breech block is in the fired position.

(2) Release the gun back block catch and ease up the back block about $\frac{3}{16}$ in.

(3) Support the weight of the sear release unit, and unscrew the knurled-headed screw on the underside until the unit has free vertical movement.

(4) Slide the sear release unit to the rear and downwards, out of engagement with the sear.

26. After completion of the gun unloading operations (*para.* 23), all the guns will be cocked and suspended by their lowering lanyards. Commencing with the port outer gun, proceed as follows :—

(1) Remove the blast tube by unscrewing the worm drive clip, which secures the blast tube to the front mounting.

(2) Fit the frangible muzzle covers.

(3) Remove the gun front mounting unit using the special ratchet spanner (*Sect.* 2, *Chap.* 4).

*(4) Disconnect the magazine carrier tie-rod by removing the nut and bolt between the tie-rod and the extension.

*(5) Support the gun, unhook the lowering lanyard from the release catch and withdraw the gun to the rear.

Repeat the foregoing procedure for the starboard outer gun and then for the two inner guns. The procedure for installing the guns is the reverse of that given for their removal.

◀ *Gun recoil check*

27. On each gun :—

(1) Unscrew the front mountings until it is possible to simulate gun recoil by hand.

(2) Disconnect the magazine carrier tie rod.

(3) Adjust the front eccentric mounting until it is in its aft position.

(4) Slide the front mounting components forward on the gun barrel clear of the eccentric and pull the gun barrel to the forward position. Mark the barrel so that it is possible to measure the simulated recoil over the required distance.

(a) Clearance around the gun and rear stirrup and the surrounding structure and equipment must allow for a minimum recoil of 35 mm. This check must be made on the port and starboard guns separately with the appropriate gun bay door *closed*.

(b) For non-rigid equipment, i.e., pipes, cables, etc., a clearance to allow for a 45 mm. recoil must exist around the gun and rear mounting stirrup.

(5) After re-assembly, the guns must be harmonized (*para.* 18).▶

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