Chapter 2 MAIN PLANES

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LIST OF ILLUSTRATIONS

Introduction

1. This chapter contains a general description of the main plane structure, together with the lubrication and servicing information necessary to maintain it in a serviceable condition. Illustrations showing the method of slinging and dismantling the structure into its major components, are also included.

DESCRIPTION

General

2. The main plane is built in three sections, the stub wing, which is integral with the centre fuselage and the port and starboard outer wings. The outer wings are of swept-back design with slight negative dihedral and carry the wing fuel tanks, pylons and the main undercarriages. The wings incorporate conventional ailerons and split trailing edge flaps, the ailerons being provided with hydro-boosters to facilitate their operation at high speed. The stub wing structure is described in Sect. 3, Chap. 1.

Outer wings (fig. 1)

3. Each outer wing is an all metal stressed skin cantilever structure consisting of leading edge, front and rear spars, undercarriage girder, nose ribs, inter-spar ribs and tail ribs, it is covered with a heavy-gauge light-alloy skin which is additionally strengthened by stringers and stiffeners. An extension is fitted on to the outboard portion of the leading edge extending from ribs H-J to rib R consisting of nosing ribs and heavy gauge skins, this extension is riveted to the nosing of the main structure. A detachable wing tip which extends from the leading edge to aft of the rear spar completes the structure. Ribs A, G, M and R are of heavier construction than the remaining ribs and with the front spar, undercarriage girder and rear spar form the major framework of the outer wing. The wing fuel tanks are carried forward of the front spar in compartments formed between nose ribs A and G; the leading edge of the wing over this portion is removable for access to the tanks. Inboard pylons when fitted are bolted to the underside of the wing outboard of the fuel tank compartments and outboard pylons just inboard of the wing tip.

Spars and undercarriage girder

4. Both spars are fabricated in three portions, but are continuous when assembled, both inboard ends of the inner portions carry high-tensile wing attachment fittings which pick up with the fittings on the fuselage stub wing frames. The undercarriage girder is attached to the inboard end of the rear spar and extends outward and forward to the inter-spar rib G, thus forming a box-like structure between the two spars in which the main undercarriage is housed when retracted. The undercarriage pivot block is accommodated at the outboard end of this structure being attached to the front spar, inter-spar rib G and the undercarriage girder.

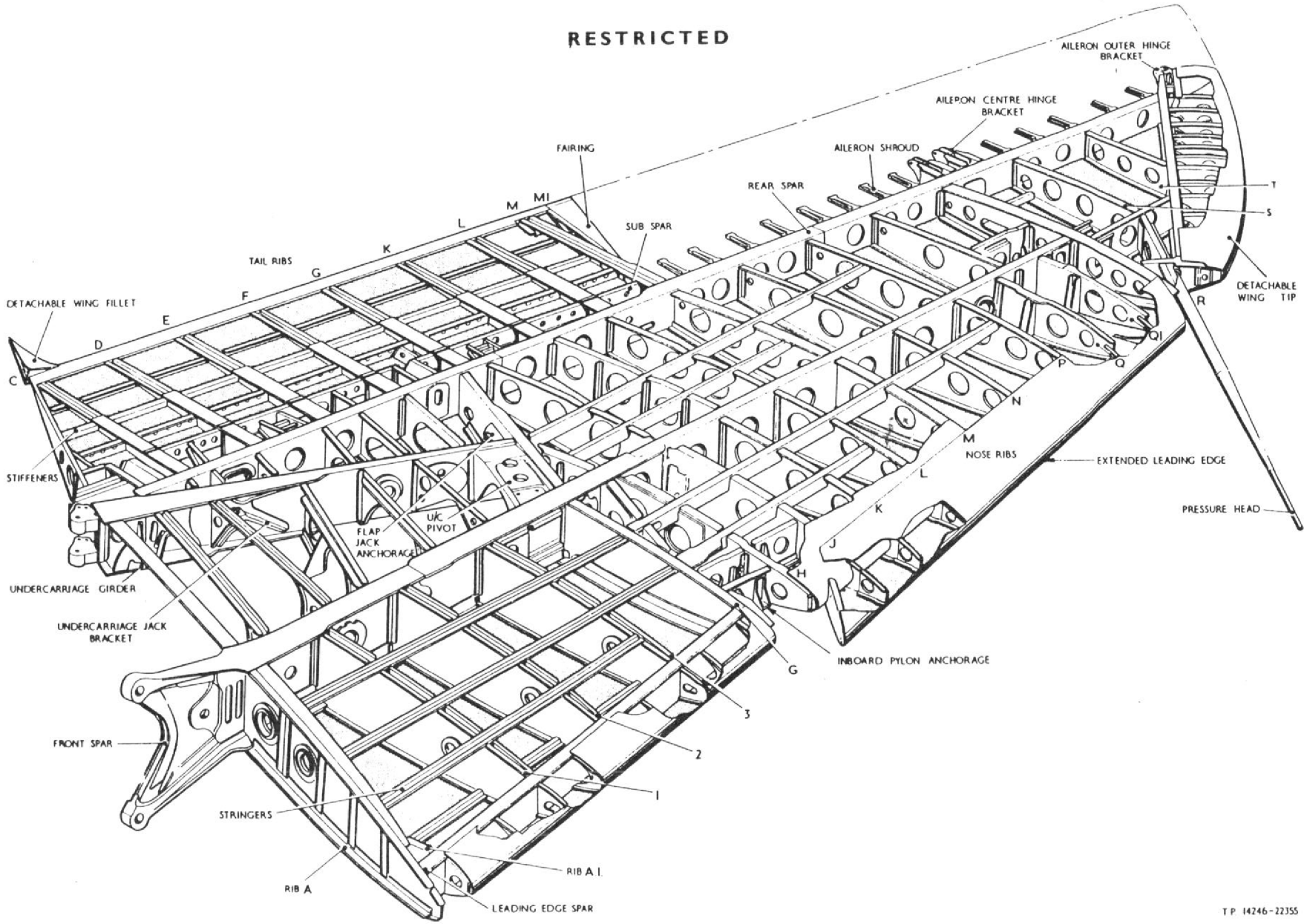

Fig. 1 Outer wing

Trailing edge and aileron shroud

5. The trailing edge structure, aft of the rear spar, consists of a number of tail ribs extending from the wing root to the aileron shroud. These ribs are recessed to form the flap housing. The flap is mounted on four bearing brackets located as follows:—Between tail ribs A and C, at rib E, between tail ribs F and G and at rib L. The aileron shroud structure extends from tail rib M to the outer rib and is attached to the rear spar. Rib M carries the aileron inner hinge, the outer rib carries the outer hinge and the centre hinges are mounted on the shroud structure.

Leading edge extension

6. The leading edge extension is a fixed portion of structure consisting of ribs and heavy gauge skins riveted to the outboard portion of the leading edge of the main wing structure between ribs H-J to rib R. The chord line of this extension is angled downwards in relation to the chord line for the main portion of the wing, thus minimising "pitch up" effects in flight.

Fuel tank compartments

7. The flexible-bag type fuel tanks in each outer wing are contained in four compartments formed between the leading edge spar and front spar in the region of ribs A to G. These compartments are sealed from the remaining structure and each other by moulded packing attached to the ribs and spars, and are provided with internal skinning to support the tanks. The leading edge forward of these compartments is detachable to provide access to the tanks, it consists of a curved light-alloy shell stiffened by a number of dished nose ribs. The nosing is attached to the top and bottom booms of the leading edge spar and to the nose ribs extending forward from this spar.

Pylon attachments

8. Two pylons may be fitted to each wing. The inboard pylon is bolted to the undersurface of the outer wing, forward of the front spar, in the region of nose ribs G to J, in which region the structure is strengthened by spanwise ribs located just aft of the nosing and by reinforcing plates on the lower wing skin between the nose ribs. Eleven machined stampings in the form of mounting brackets with nut plates attached are riveted to the spanwise ribs and nose ribs H and J. The inboard pylon is bolted to these mounting brackets by special bolts extending through the top member of the pylon and wing skin to engage with the nut plates on the mountings. Access panels and cover plates are provided to give access to the fuel and electrical connections between the wing and pylon. A diaphragm, joining interspar ribs Q and R between the front and rear spars, and an additional nose rib also between ribs Q and R, provide the necessary strengthening of the structure for the accommodation of the outboard pylon on each wing, the attachments being similar to those for the inboard pylons.

Inboard pylons

9. The structure of the inboard pylons consists of a top member of light alloy channel between two extruded angles connected by a cover plate. A light alloy bottom member completes the main structure. The top and bottom members are connected at intervals by vertical angles between which are steel bridge pieces. The whole is covered with a metal skin to form a structure which, when bolted to the underside of the wing *(para. 8)*, houses the release mechanism and electrical cables, etc., together with the fuel pipes and valves necessary when a drop fuel tank is fitted.

Outboard pylons

10. The outboard pylons are of similar construction to the inboard pylons *(described in para. 9)*, but the electrical fittings differ.

By-pass valve

11. When a pylon is not fitted, the disconnected air and fuel pipes are interconnected by means of a by-pass valve which takes the form of a ducted plate. A blanking plate is provided to fit over the by-pass valve in place of the fuel and air pipes in the pylon, thus completing the inter-connection. *The plate must be fitted at all times when the pylon is not assembled to the wing.*

R.P. attachments

12. Provision is made for fitting rocket projectiles under each wing, the rails are located as follows:—

Rail A — outboard of rib R and across rib S.

Rail B — between nose rib Q and rib R *(across main spar)*.

Rail C — between nose rib N and interspar rib Q *(across the juncture of nose rib P and interspar rib P with main spar)*.

Rail D — between nose rib L and interspar rib N *(across juncture of rib M with stringer)*.

Rail B on each wing is an alternative installation to that of the outboard pylons which must be removed before the complete installation of R.P. can be effected. A description of the R.P. equipment together with removal and assembly instructions are given in Sect. 7, Chap. 2.

Aileron operating gear

13. The aileron hydrobooster and operating gear is housed between ribs R and S in a bay formed by these two ribs, a diaphragm and the rear spar. The gear consists of the booster jack, control tubes and levers, all of which are carried on two sets of bearing blocks attached to the outboard face of rib R. For further information on this installation, refer to Sect. 3, Chap. 4.

Wing tip

14. The detachable wing tip consists of a light-alloy shell stiffened by a number of ribs, it is attached to the wing outer rib. A housing with a transparent window, containing the navigation lamp, is incorporated at its leading edge. The pressure head, which is mounted to a rib extending diagonally from the forward end of rib R to rib S, projects forward from the leading edge of the port wing tip.

Flaps

15. The flaps are of conventional design, each consisting of a single spar with a number of ribs covered on the undersurface only with a light-alloy skin. A reinforcing plate is incorporated along the upper surface of the trailing edge. Each flap is hinged at four points (*para. 5*) and extends from the wing root to just inboard of the ailerons.

Ailerons

16. Each aileron consists of a main spar with a number of ribs and stiffeners covered with a light-alloy skin. They are hinged at three points, the centre point having a double hinge *(para. 5)*. The port aileron incorporates a small electrically-operated trim-tab in its inboard trailing edge. The ailerons are provided with hydro-boosters to facilitate operation at high speed.

SERVICING

General

17. Little servicing is necessary to the main plane apart from the various systems incorporated therein; these are described in the various chapters of this volume dealing with the systems concerned. The instructions given in this chapter will, therefore, only include items not covered in other chapters. The drain holes in the bottom surface should be examined periodically to ensure that they are not blocked.

18. After servicing, it is necessary to check that all access panels and doors are securely locked and flush with the surrounding structure; this is very important as any alteration in contour will give rise to a shock-wave, resulting in a vast increase in drag and consequently a loss in performance as well as the possibility of the panels becoming detached, in flight. Extreme care must, therefore, always be taken, during removal or fitment of the access panels, to ensure that they are not damaged or distorted in any way.

Undercarriage pivot fittings

18A. These should be examined frequently (by NDT technique CSDE/HUNTER/EDD/4) for cracks around the circumference of the machined faces into which the bearing-cap retaining studs are screwed. Fittings found cracked must be changed.

Skin, outboard top, forward of rear spar, examination for cracking (SI/Hunter/121)

18B. Cases have occurred where cracks have developed in the outboard top skin, forward of the rear spar, between the forward line of rivets attaching the skin to the rear spar between ribs S and T, on both port and starboard main planes. Periodically at the periods detailed in the servicing schedule examine the outboard top skin forward of the rear spar as follows:

(1) On each mainplane, remove the paint from the skin at the forward line of rivets attaching the skin to the rear spar between ribs S and T (fig.1).

(2) Visually examine, with the aid of a magnifying glass, for cracks developing between the rivets on the forward line of rivets attaching the skin to the rear spar, between ribs S and T.

Note . . .

Where there is doubt about the presence of cracks on mainplane skins, following visual examination, examine further for cracking using a dye penetrant method.

(3) Where no cracking is evident, restore the surface finish.

(4) Where a crack is evident but does not exceed 4.50 inches in length, the mainplane is considered satisfactory for a further period of unrestricted flying subject to re-examination at each subsequent Primary Servicing. Restore the surface finish.

(5) Where a crack exceeds 4.50 inches length, replace the skin, Port, Pt.No. D.206924/9 or Starboard, Pt.No. D.206924/18 as applicable.

Lubrication

19. The principal lubrication points for the main plane are given in Sect.3, Chap.4. The remaining points are dealt with in this chapter and are given on fig. 16, 17 and 18 with a key to the lubricants on fig.15.

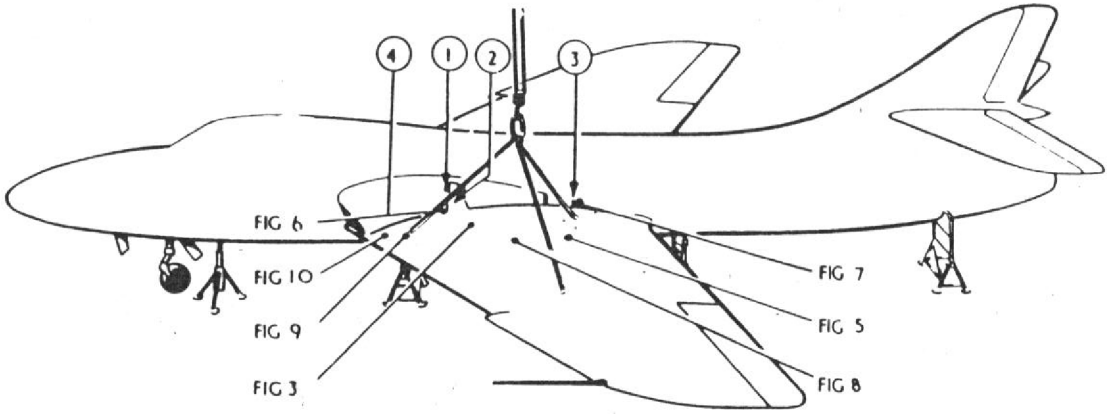

Fig. 2 Removing wing

REMOVAL AND ASSEMBLY

General

20. The separation of the outer wings from the stub wing and the removal of the various major components, together with the method of slinging during removal, is shown in the illustrations contained in this chapter. In general, the assembly of the units is a reversal of the removal, but where there is any special assembly feature it is covered in the key to the illustration.

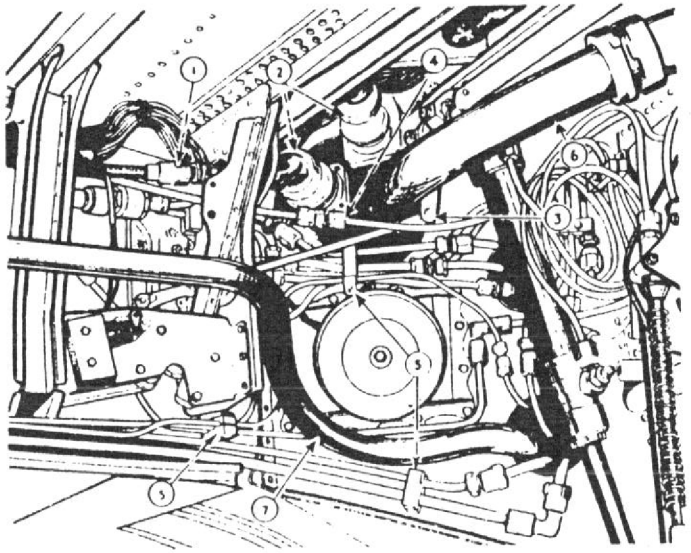

Fig. 3 Connections at front spar (port)

KEY TO FIGS. 2 TO 10 (Removal of wings)

Jack and trestle the aircraft (*Sect. 2, Chap. 4*), and place two additional trestles beneath the centre fuselage (*Sect. 3, Chap. 1*).

Render the aircraft electrically safe (*Sect. 5, Chap. 1*).

Dissipate the hydraulic fluid pressure (*Sect. 3, Chap. 6*).

Remove the access panels over the front and rear spar joints (*fig. 2, items 1, 2 and 3 and the panels forward of the front spar for the refuelling pressure relief valve, item 4*).

Remove the pressure head from the port wing as described later in this chapter.

Drain the wing fuel tanks (*Sect. 2, Chap. 2*). If fitted, remove the wing drop tanks or external stores from the pylons (*Sect. 2, Chap. 2*). Should it be required to remove the pylons, reference should be made to fig. 20 and 21 of this Chapter.

From inside the wheel well, disconnect all the services between the fuselage and the wing.

For disconnecting the port wing (*front spar*) refer to fig. 3. Disconnect the aerial lead (1) and the electrical supply leads (2). Detach the wheel door lock controls from the lever (3). Disconnect the Teleflex control tube at (4) and at the connection to the swivel block on the bracket attached to the fuselage, leave loose. Unscrew the locknut and the Teleflex cable at the end connected to the link on the wheel door and also at the leg fairing lock. Withdraw the cable at this lock, coil up and attach it securely to the wing structure.

Referring again to fig. 3 dismantle the clamps (5) and remove the short lengths of pipes by disconnecting the unions at both ends of the pipe. Remove the fuel pipe (6) by disconnecting unions at both ends of the pipe.

Remove the vent pipe (7) by disconnecting the clamp fitting, similar to (8) at fig. 4, of the tank connection and at the union forward of the front spar.

For the starboard wing (*front spar*) refer to fig. 4. Dismantle the clamp (1). Remove the short lengths of pipe by disconnecting the unions at both ends. Disconnect the electrical supply lead (2) and the compass lead (*Pre-mod. 256*). Detach the wheel door lock controls from lever (3). Disconnect Teleflex control (4). Remove the short lengths of pipe (5) and the fuel pipe (6) by disconnecting the unions at both ends of the pipes. Remove the vent pipes (7) by disconnecting the clamp fitting, (8) detail A, at the tank connection and at the union forward of the front spar. Refer to fig. 5 for either port or starboard wing. Disconnect the pipes (1) and the lever (2).

Note . . .

There are three hydraulic pipes at this point for the port wing and five for the starboard wing.

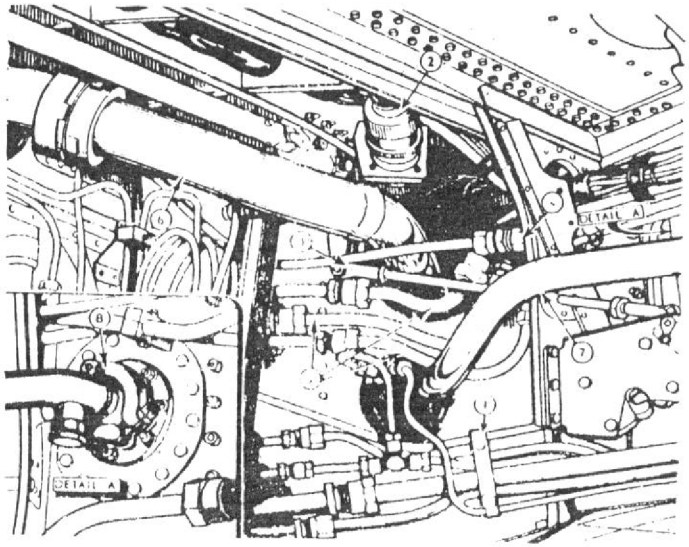

Fig. 4 Connections at front spar (Starboard)

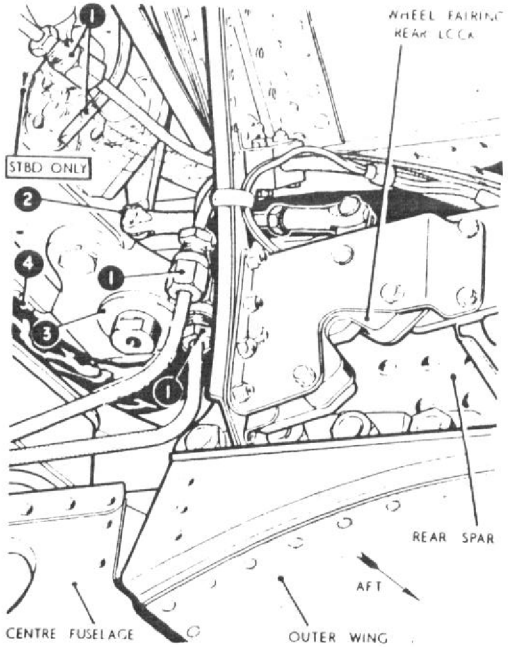

Fig. 5 Connections at rear spar (port)

Disconnect and stow away the electrical supply cable A.4, (4), the plug and socket is located between the drag members on the side of the fuselage.

Through the access hole (*port and starboard*) in the bottom surface of the stub wing forward of the front spar, first remove the pressure relief valve fig. 6 (1) by taking out the screws securing the valve to the mounting brackets and disconnecting the outer sleeve on the pipe (3).

Detach the mounting brackets (2) and remove the pipe (3).

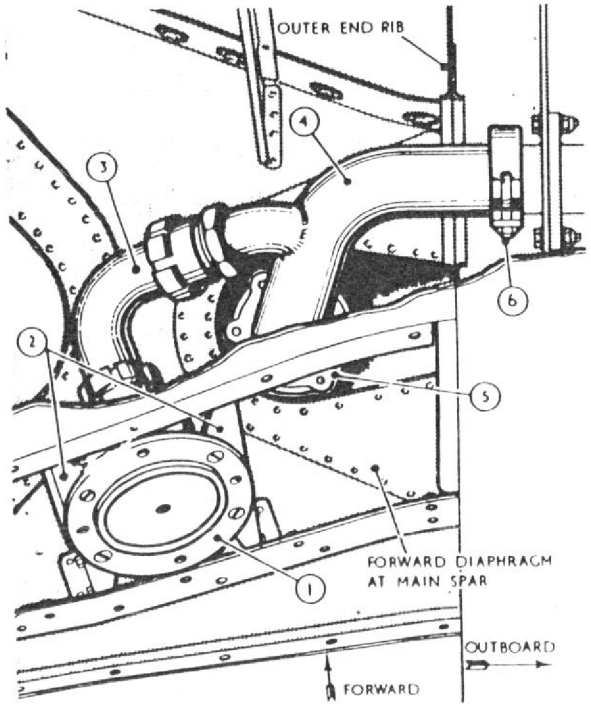

Fig. 6 Fuel pipe connections forward of front spar

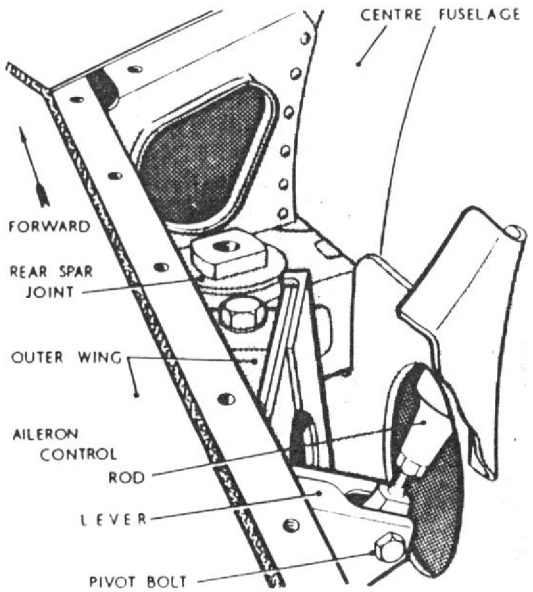

Fig. 7 Details of rear spar joint

Unscrew the bolts at (5) and the clamp fixing at (6) and remove the pipe (4), taking care not to lose the rubber sealing rings at each joint.

Remove the pipe from the main spar connection to the fuselage, by disconnecting the pipe connector at the fuselage joint.

Disconnect the aileron control rod (*fig. 7*) by removing the pivot bolt. While at this access hole disconnect the three rear pipes. The two pipes running forward should not be disturbed.

Blank off all exposed pipe connections.

Remove the undercarriage wheel and the small access panel over the wheel axle in the leg fairing.

Procure an undercarriage up-lock tool (*Ref. 26FX/95080*) refer to fig. 8 and proceed as follows:—

Insert the hook portion of the tool over the spigot mounting as shown and allow the screwed rod portion to hang down minus its retaining plate, washer and nut.

Connect a hydraulic ground rig direct to the main undercarriage jack via the pipes which have been disconnected from the stub wing.

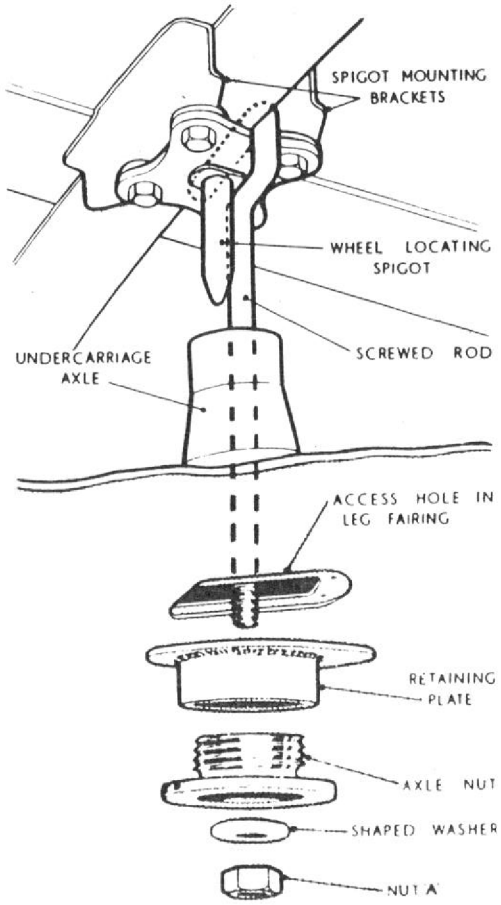

Fig. 8 Undercarriage up-lock tool