Chapter 2

MAIN PLANE

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LIST OF ILLUSTRATIONS

Introduction

1. A brief description of the outer wing structure is given in this chapter, together with illustrations showing the general structure assembly and rib positions. Descriptive and other details of the centre section, which is integral with the fuselage, have been included in Section 3, Chapter 1 of this book since the description of the main plane portion of the centre section structure cannot conveniently be separated from that of the fuselage portion.

DESCRIPTION

General

2. Each outer wing is a two-spar cantilever structure and is manufactured in three main sections, viz., inner portion outer portion and wing tip. In plan view each wing has a sweepback of approximately 50 degrees on the leading edge, the two wings combining with the centre section to give a delta planform. In front elevation each wing is kinked at points about one half and three quarters of its length from the root end.

3. Basically, the structure consists of a two-cell torsion box made up of cranked front and rear spars braced by inter-spar ribs and skinning, to which are attached the leading and trailing edge, and extends on each side from the outer wing root to the wing tip. The main-wheel units are housed in the inboard portion of each outer wing between the inboard elevon hinge rib and the transport rib.

FRONT SPAR

4. The front spar is built up from upper and lower booms of machined, extruded, stepped T-section aluminium alloy with a plate web between. At the junction of the inner and outer wing sections the spar booms are joined together by high tensile steel joint shackles and the webs by 14 s.w.g. light-alloy joint plates. The continuity of the spar booms in the inner section of the wing is broken at station 576·186, the booms being cranked from here to the joint at the outer section. The boom joints in the inner section at station 576·186 are made with steel joint shackles.

5. The plate web is built up from seven sections of aluminium-alloy sheet

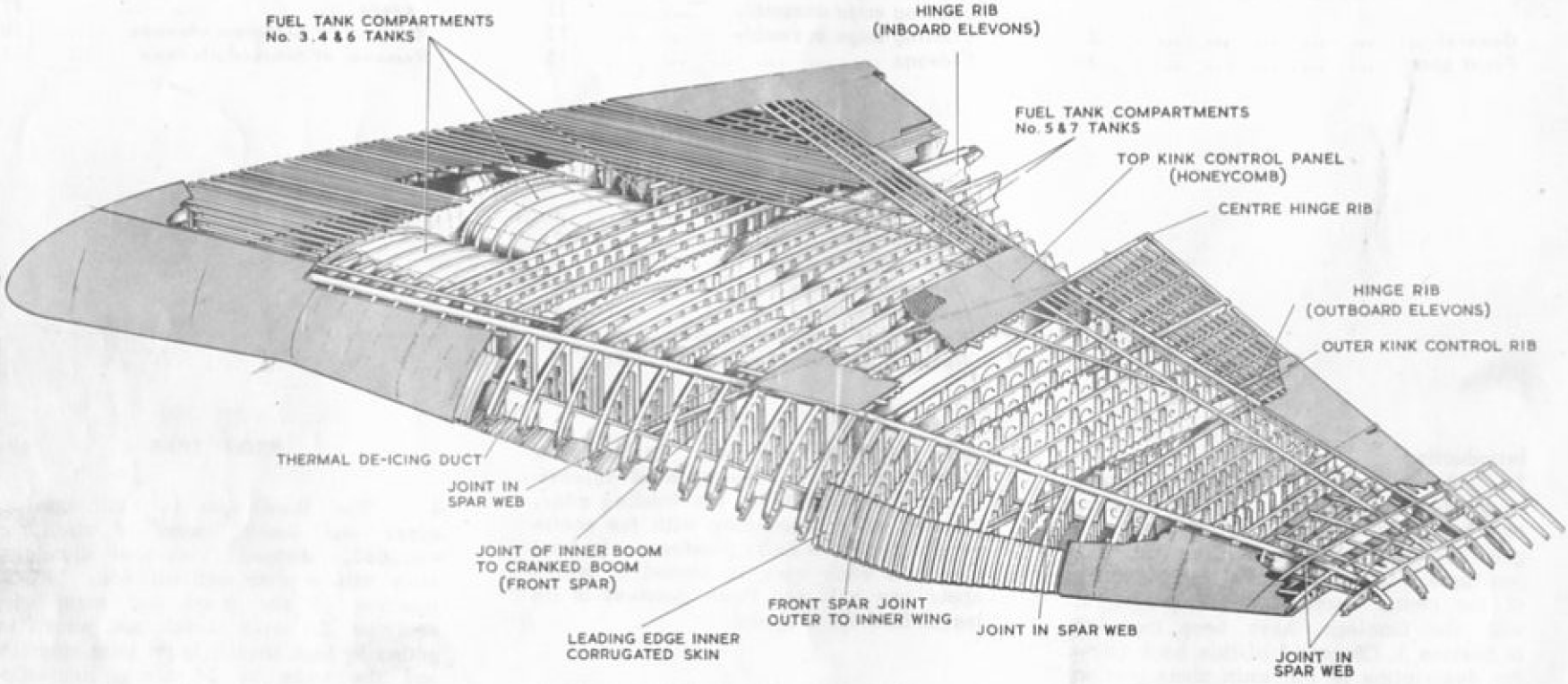
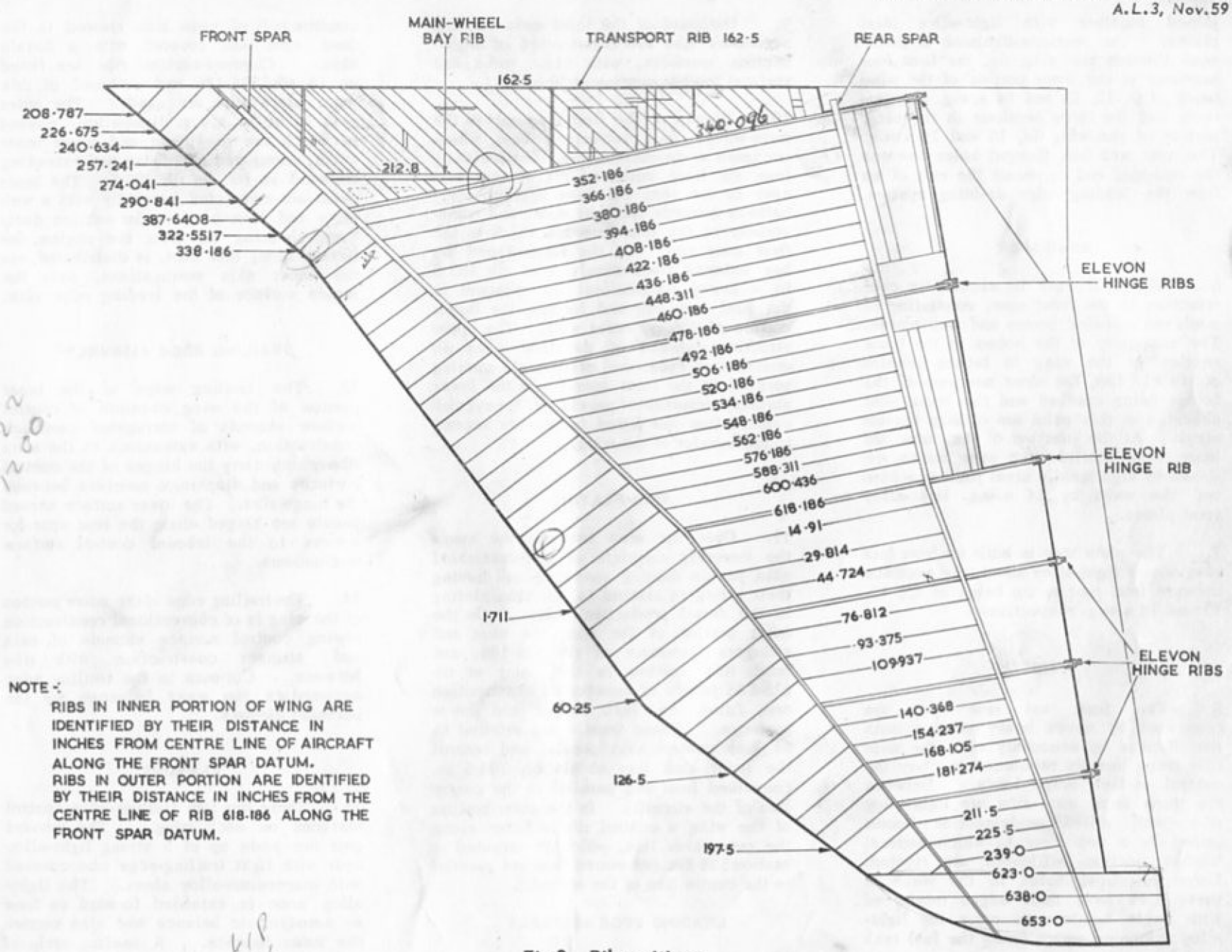


Fig.1 Outer wing structure



NOTE :-

RIBS IN INNER PORTION OF WING ARE IDENTIFIED BY THEIR DISTANCE IN INCHES FROM CENTRE LINE OF AIRCRAFT ALONG THE FRONT SPAR DATUM.
RIBS IN OUTER PORTION ARE IDENTIFIED BY THEIR DISTANCE IN INCHES FROM THE CENTRE LINE OF RIB 618·186 ALONG THE FRONT SPAR DATUM.

Fig.2 Rib positions

joined together with light-alloy joint plates. The sections diminish in thickness towards the wing tip, the first four sections in the inner portion of the wing being of 9, 13, 13 and 14 s.w.g. respectively and the three sections in the outer portion of the wing 14, 16 and 16 s.w.g. The spar web has flanged holes towards the outboard end to permit the exit of air from the leading edge de-icing system.

REAR SPAR

6. The rear spar is similar in construction to the front spar, consisting of machined extruded booms and web plates. The continuity of the booms in the inner section of the wing is broken inboard of rib 618·186, the short sections of the booms being cranked and the boom joint shackles at this point are of high tensile steel. At the junction of the outer and inner wing sections the spar booms are joined by high tensile steel joint shackles and the webs by 14 s.w.g. light-alloy joint plates.

7. The plate web is built up from four sections of light-alloy sheet, the sections outward from root to tip being of 12, 12, 12 and 14 s.w.g. respectively.

RIBS

8. The front and rear spars are connected by seven heavy section main ribs flanked by secondary ribs, the main ribs being heavily reinforced to carry the control surface hinge loads. Between the three inner main ribs are light-alloy ribs with rolled angle-section booms joined by a web plate to which vertical top-hat section stiffeners are riveted. Large elliptical holes in the webs of these ribs have their edges reinforced with angle members to carry the light-alloy skinning which forms the fuel tank tunnels.

9. Outboard of the third main rib, the secondary ribs are constructed of angle-section members, with plate webs and vertical top-hat section stiffeners.

10. Inboard of the first main rib is the main-wheel unit retraction bay, which occupies a space extending longitudinally from its front bulkhead aft of the front spar to its rear bulkhead approximately halfway towards the rear spar, and transversely at the rear from rib 162·5 to the first main rib. At the forward end the bay extends transversely from rib 162·5 to a heavy longitudinal rib adjacent to the first main rib and forming the larger portion of the bay outer wall. The upper structure inboard of the first main rib consists of spanwise intercostals running parallel to the front spar. On the lower surface, removable panels of honeycomb construction are fitted to provide access to the interior of the wing.

SKIN PLATING

11. Over the area between the spars the covering consists of sub-assembled skin panels running spanwise and having their stringers riveted to the skin plating in the detail production stage. On the inner portion of the wing the skin and stringers terminate at rib 576·186, and from this station to the joint at rib 618·186 panels of honeycomb construction are fitted on both upper and lower surfaces. These panels are referred to as kink control skin panels, and control the inner kink line at station 398·5 in. (measured from and parallel to the centre line of the aircraft). In the outer portion of the wing a control rib is fitted along the outer kink line, which is situated at station 528·8in. (measured from and parallel to the centre line of the aircraft).

LEADING EDGE ASSEMBLY

12. The leading edge assembly is constructed of nose ribs riveted to the front spar and covered with a double skin. Channel-section ribs are fitted up to rib 338·186 and outboard of this point plate ribs are used. The outer skin is of 14 s.w.g. light-alloy, riveted to which are the upper and lower inner skins, corrugated chordwise and extending outboard as far as rib 225·5. The inner skins are connected internally with a web plate and form a triangular-section duct. Warm de-icing air from the engine, delivered along this duct, is distributed, via the inner skin corrugations, over the inside surface of the leading edge skin.

TRAILING EDGE ASSEMBLY

13. The trailing edge of the inner portion of the wing consists of control surface shrouds of corrugated sandwich construction, with extensions to the main ribs which carry the hinges of the control surfaces and diaphragm members between the hinge ribs. The lower surface shroud panels are hinged along the rear spar for access to the inboard control surface mechanisms.

14. The trailing edge of the outer portion of the wing is of conventional construction having control surface shrouds of skin and stringer construction with ribs between. Cut-outs in the trailing edge accomodate the mass balances for the outboard elevons.

ELEVONS

15. There are four trailing-edge control surfaces on each wing. The inboard pair are made up of a strong light-alloy spar with light trailing-edge ribs covered with magnesium-alloy sheet. The light-alloy nose is extended forward to form an aerodynamic balance and also carries the mass balance. A sealing strip of rubberised fabric is attached between the

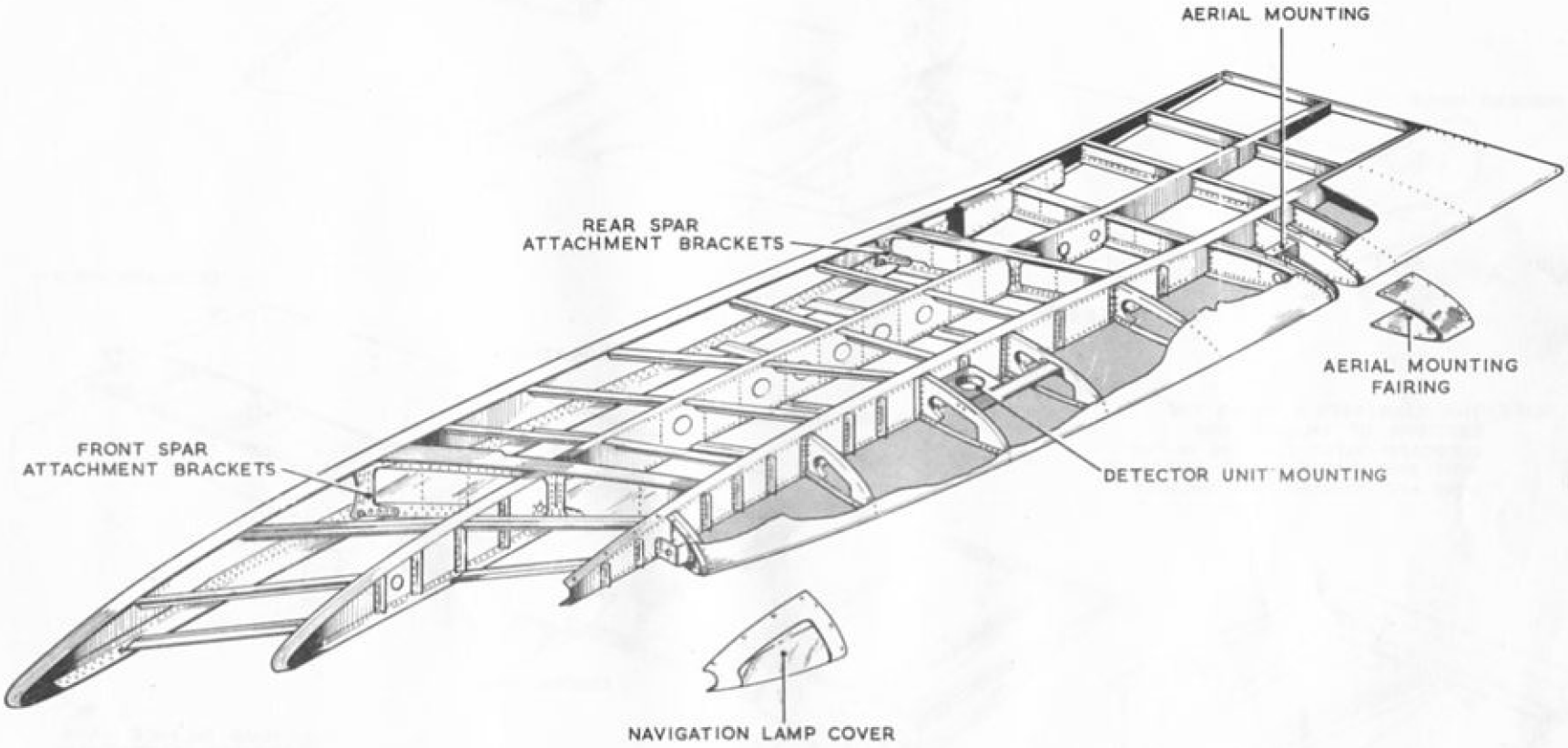


Fig.3 Wing tip (port side)

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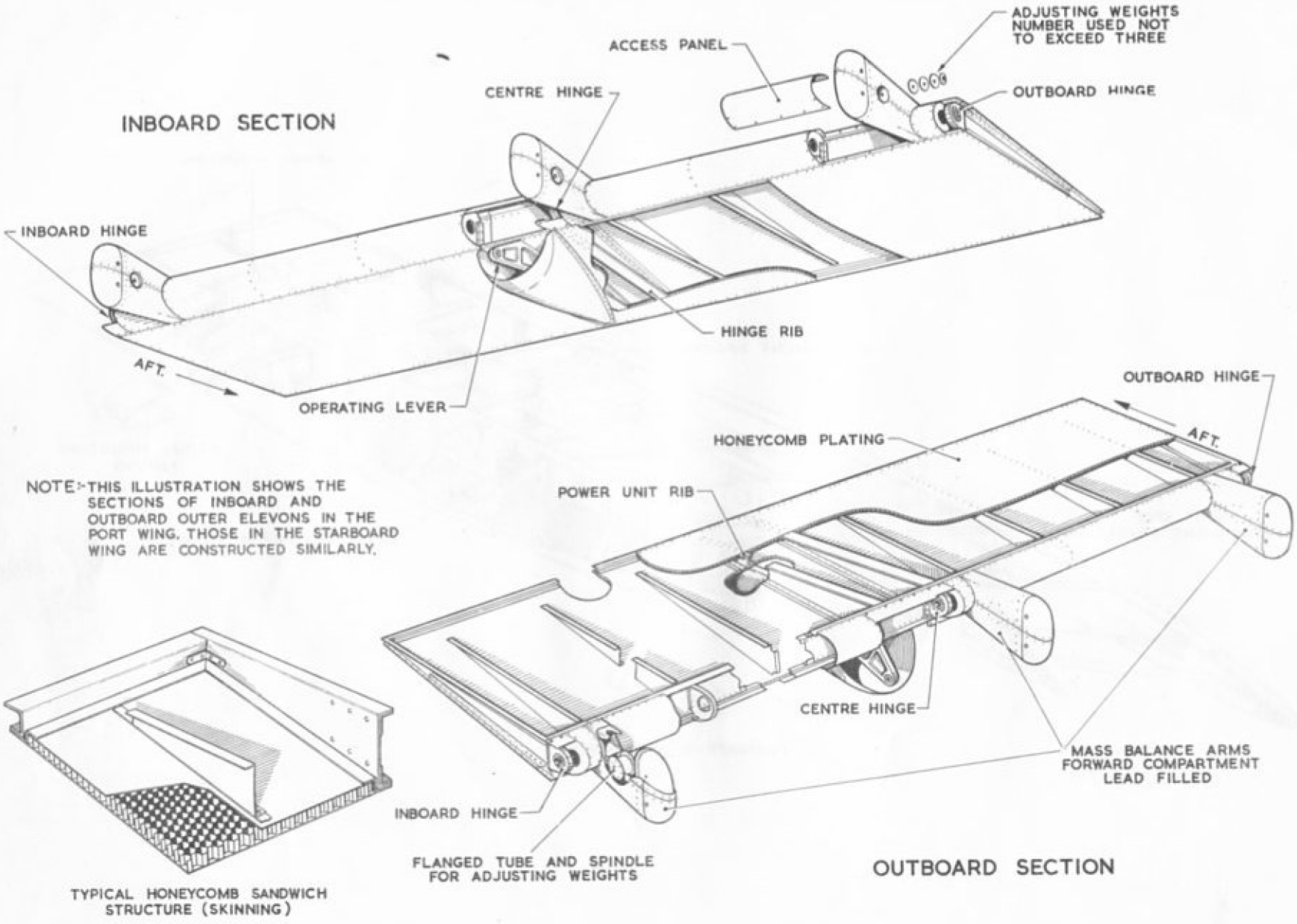

Fig.4 Outboard elevons

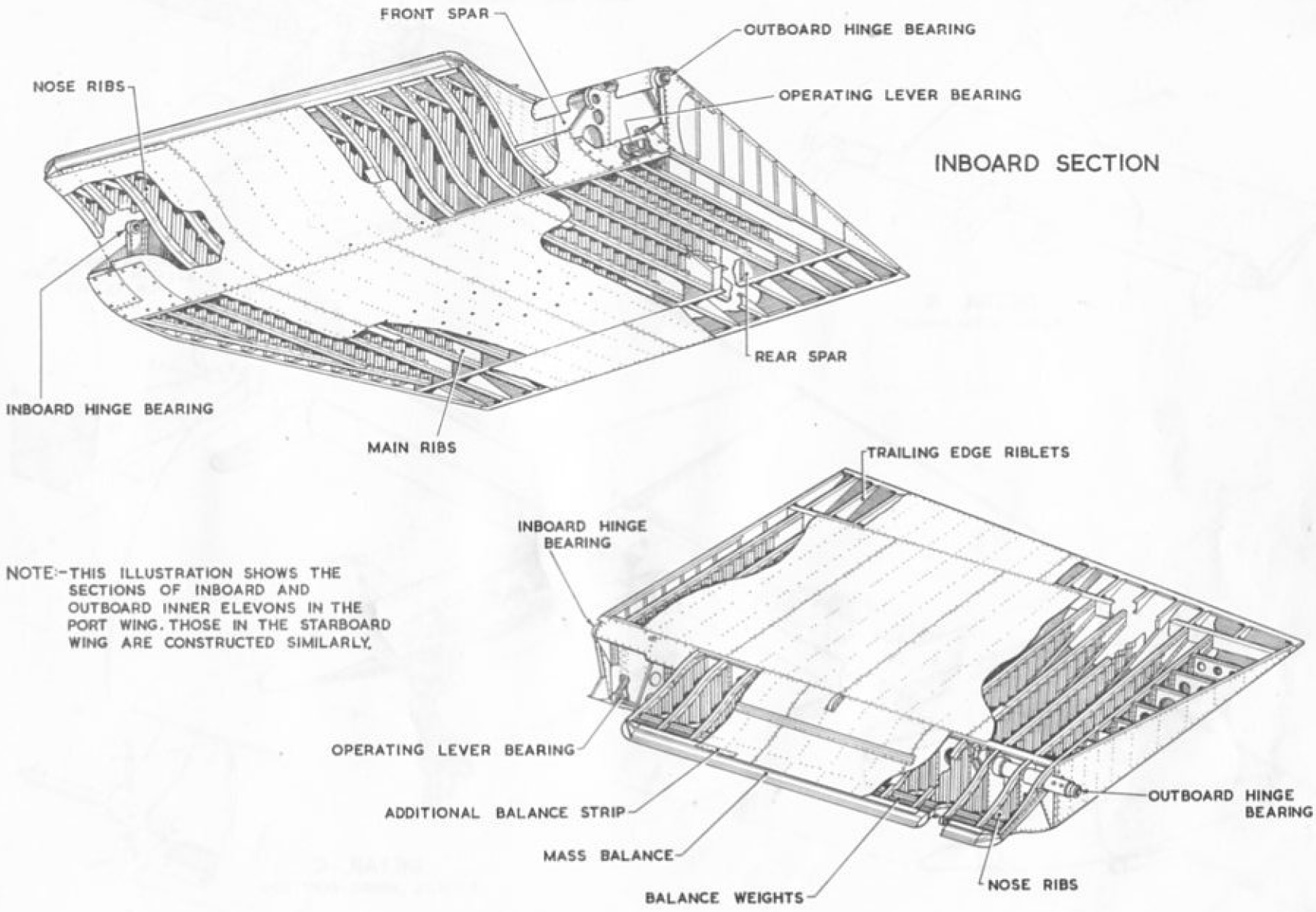

Fig.5 Inboard elevons

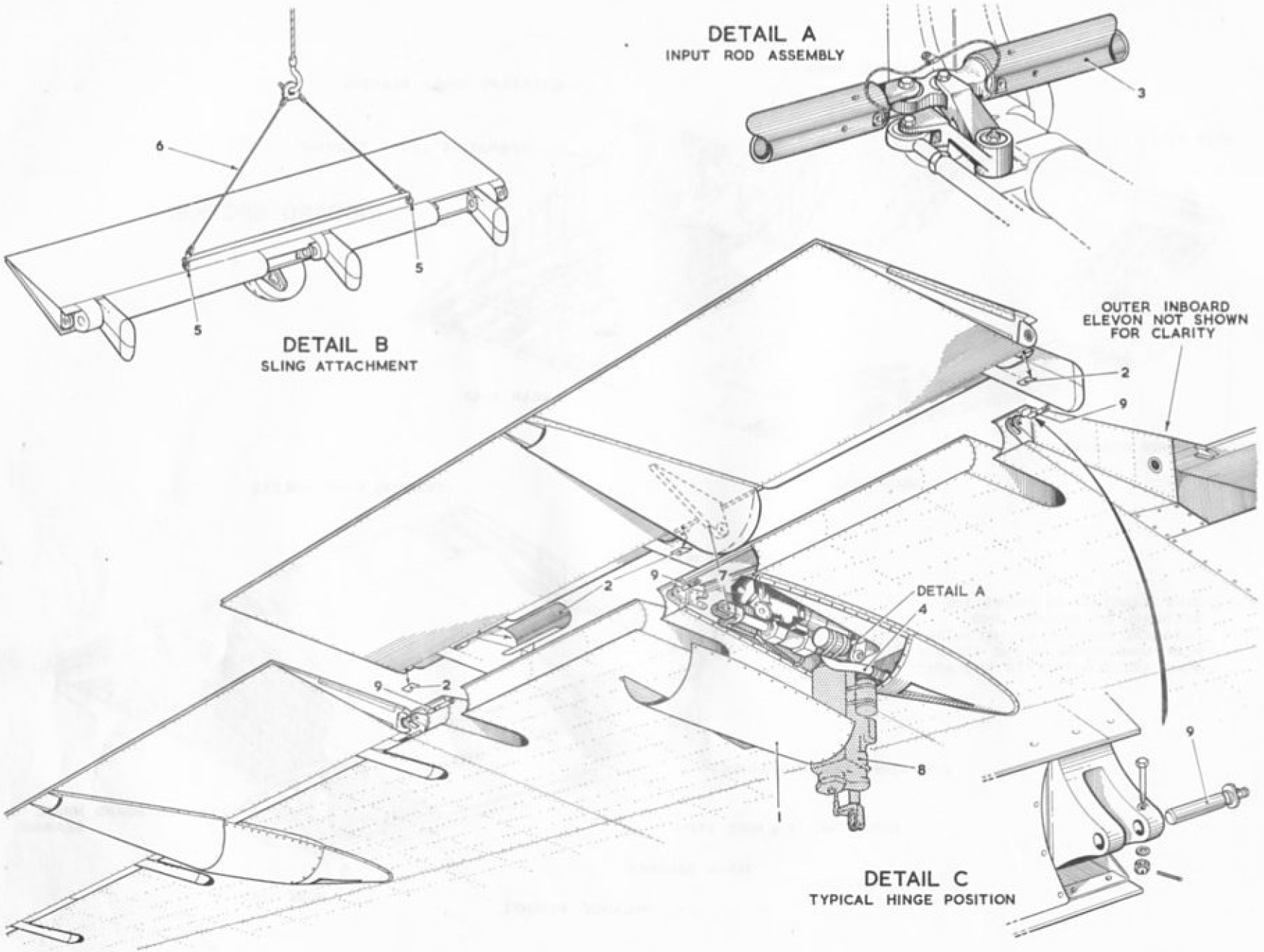

Fig.6 Removal of outboard elevons

forward edge of the latter and the shroud skin.

16. The type of structure used for the outboard set of elevons differs from that used on the inboard set in that the skin covering consists of light-alloy honeycomb sandwich panels which are attached to an internal rib structure and front and rear webs. The centre hinge rib and the adjacent rib, which carries the power control operating lever, are forged in light-alloy. The end ribs, which carry the hinges, and the light intermediate ribs, which serve to stabilise the skin panelling, are built up from light-alloy rolled section. The Irving-type balance surface, as used on the inboard set of elevons, is not used on the outboard set. Mass balance arms are situated near each hinge.

REMOVAL AND ASSEMBLY

General

17. For information on the removal of the outer wing, reference should be made to A.P.4505A, Vol.6. The recommended procedure for the removal of elevons is given in para. 20 and 21 and illustrated in fig. 6 and 7 of this chapter. Care must be excercised during the removal operations to avoid damage to components and removed aerofoils must not be placed on any surface which could scratch or otherwise damage the skin covering.

18. The re-assembly procedure for elevons is a reversal of the removal process. After assembly, elevons must be checked for correct movement and full and free travel.

19. Power units should be checked and serviced in accordance with instructions given in the relevant publications: A.P.4603C, Sect.4 for the two outboard power units and A.P.4603D, Sect.5 for the two inboard units.

Removal of outboard elevons

20. To remove an outboard elevon refer to fig. 6 and proceed as follows:-

Numerals in brackets indicate components shown on illustration.

1. Remove the power unit fairing (1).
2. Remove the elevon detachable nose fairing and small access panels (2).
3. Disconnect electrical leads.
4. Disconnect main input rod (3) at power unit lever assembly (detail A).
5. Remove cooling duct (4) from the power unit generator.
6. Remove screwed plugs in elevon top surface and insert eye-bolts (5) of sling (6), Ref.No.26DC/95187 for inner outboard elevon or Ref.No.26DC/95188 for outer outboard elevon, and attach sling to suitable hoist or crane (detail B).
7. Disconnect power unit from elevon (7).
8. Lower power unit (8) to servicing position.
9. With the sling cable just in tension, remove the securing bolts (detail C) and withdraw the hinge pins (9). Ensure that the pin at the double hinge is only withdrawn sufficiently to allow the removal of the required elevon.
10. Remove the elevon.

Removal of inboard elevons

21. The procedure for the removal of the inboard elevon is similar to that used on the outboard elevon and fig.7 illustrates the operation. The recommended method is as follows:-

1. Lower the power unit access door (1).
2. Lower the bottom hinged shroud panels (2).
3. Disconnect the electrical leads.
4. Remove the small access panels (3) at the inner and outer hinge points.
5. Disconnect the main input rod (4) at the power unit lever assembly.
6. Remove the coupling lever (5). This passes through the web of the centre hinge rib.
7. Disconnect the generator cooling duct at the supporting bracket (6) (detail A).
8. Disconnect the sealing strip (7).
9. Disconnect the transmitter lever (8) from the elevon front spar.

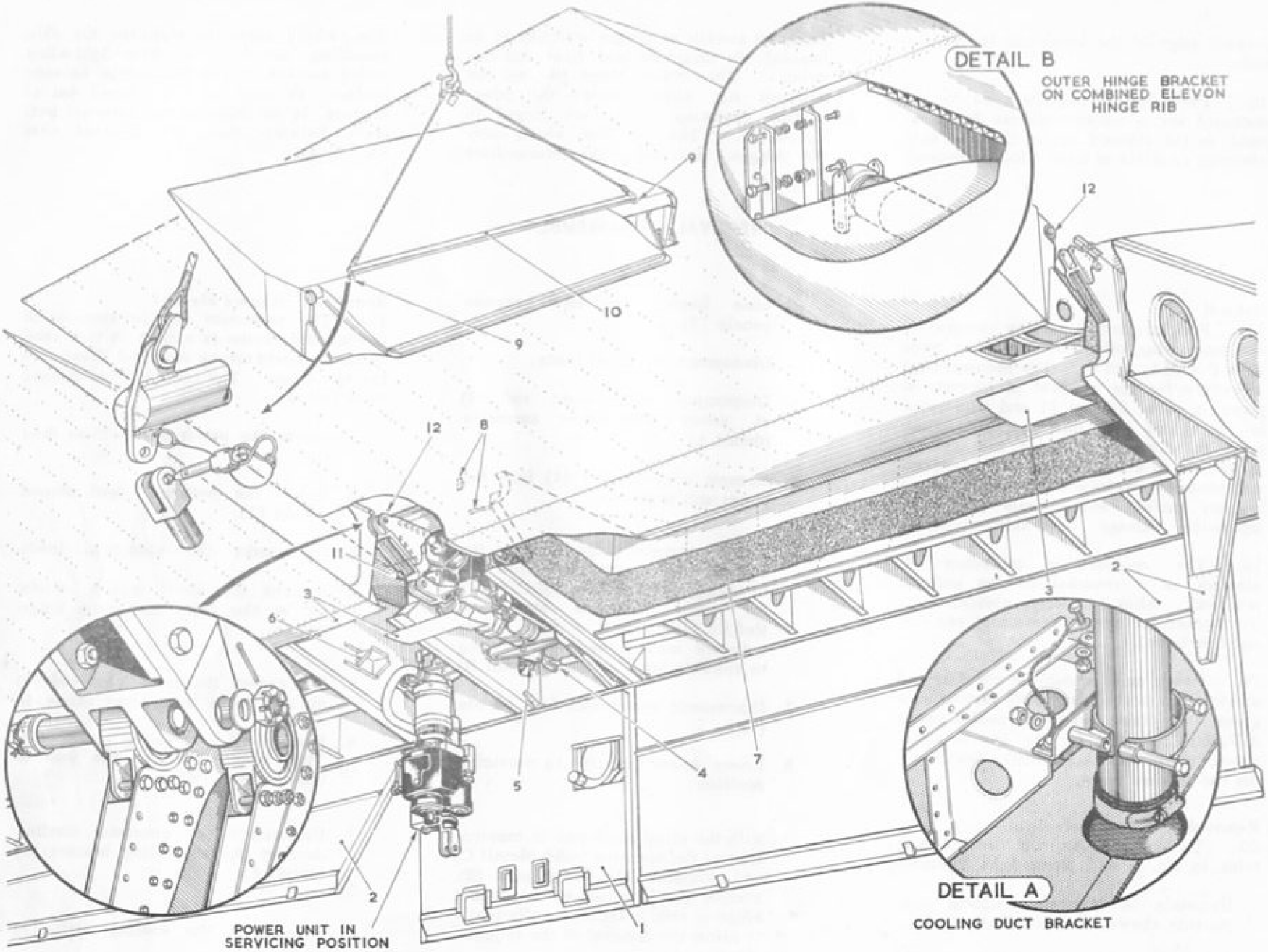

Fig.7 Removal of inboard elevons

10. Remove the screwed plugs in the top surface of the elevon and fit sling eyebolts (9).

11. Fit elevon sling (10), Ref.No. 26DC/95185 for inner inboard elevon and Ref.No.26DC/95186 for outer inboard elevon, and attach to a suitable hoist or crane.

12. Disconnect elevon from power unit (11) and lower the power unit to its servicing position.

13. With the sling cable just in tension, remove the split pins, nuts and washers from the inner and outer hinge bolts (12) and withdraw the bolts. Ensure that the elevon remaining in the main plane is adequately supported at the double-hinge point when the hinge pin is withdrawn.

14. Remove the elevon.

15. The bearing bracket (detail B) may be withdrawn when an outer inboard elevon is removed.