Chapter 5

ALIGHTING GEAR

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

DESCRIPTION

Introduction

1. This chapter describes the alighting gear, the servicing necessary to maintain the installation in an airworthy condition and the recommended procedures for the removal and assembly of the components. Where no specific instructions are given for the servicing, dismantling or assembly of a component, reference must be made to A.P.1803E for the nose-wheel unit, A.P.1803V for the main-wheel unit, and A.P.2337 for wheel and tyres. A description of the hydraulic system which is provided to operate the components, will be found in Sect.3, Chap.6 of this Book. Since the operation of the units is initiated electrically, reference must be made to Vol.1, Book 2, Sect.5, Chap.1, Graph 7 of this publication for circuit details.

General

2. The alighting gear comprises two main-wheel units, retracting forward and upward into the main plane and a single nose-wheel unit retracting rearward and upward into the fuselage aft of the crew's compartment. The units, operated by hydraulic jacks, are controlled electrically by push switches mounted on the pilots' centre instrument panel, electrical position indicator lamps for both the up and down positions of all three units are also provided on this panel.

3. When fully extended, all wheel units are secured in the down position by hydraulically-operated downlock units. To enclose the units in their wheel bays, fairing doors are provided, also operated by hydraulic jacks, and a hinged fairing attached to the rear of both main-wheel units. Micro switches harmonise movement of the door jacks with that of the alighting gear units, to make, or break, the electrical circuits to the control valves in the hydraulic system which operate the alighting gear installation.

4. Each main-wheel unit is fitted with a four-wheeled, eight-tyred bogie and hydraulically-operated brakes incorporating Maxaret (anti-skid) units. The nose-wheel unit has two wheels secured to a common axle to eliminate shimmy, and a hydraulically-powered steering system. Hydraulic operation of the brake system and steering system is described in Sect.3, Chap.6 of this Book.

MAIN-WHEEL UNITS

General

5. Each main-wheel unit consists basically, of four major sub-assemblies, i.e., the main fitting assembly incorporating a sliding tube and bogie trim jack; a liquid-spring shock-absorber, a retracting strut assembly and a bogie frame with axle and wheel brake fittings. Brief details of the assemblies comprising a unit are given in the following paragraphs but reference must be made to A.P.1803E for detailed description and servicing information.

6. It must be noted that the port and starboard units are not interchangeable due to the handing of the hydraulic retracting jack attachment lever. Part numbers of the components together with the specifications of the fluids and oils used in the units are given in the Leading Particulars.

Main fitting assembly

7. The main fitting assembly is a hollow triangular casting with two arms at its upper end transversely bored to accommodate the main pivot by which the unit is attached to the main plane structure. An arm, integral with one of the main attachment arms, provides the attachment for the jack. A down-lock and its associated operating jack are attached to the top of the main fitting.

8. Within the main fitting is a sliding tube assembly and an air inflated bogie trim jack. Screwed on to the end of the sliding tube is a lugged axle fitting which also carries the torque link attachment lug. Torque links connect the main fitting to the sliding tube to ensure lateral rigidity.

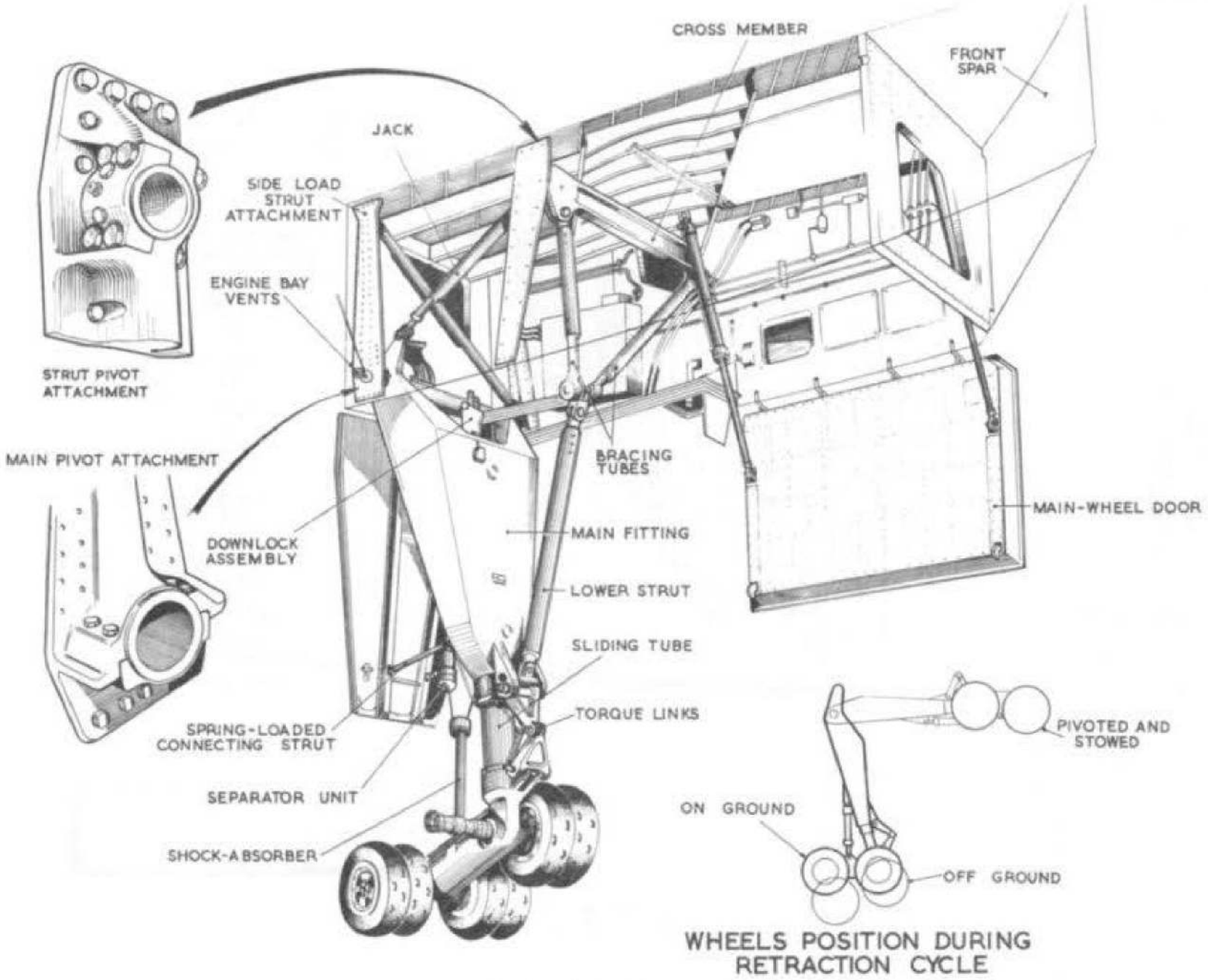
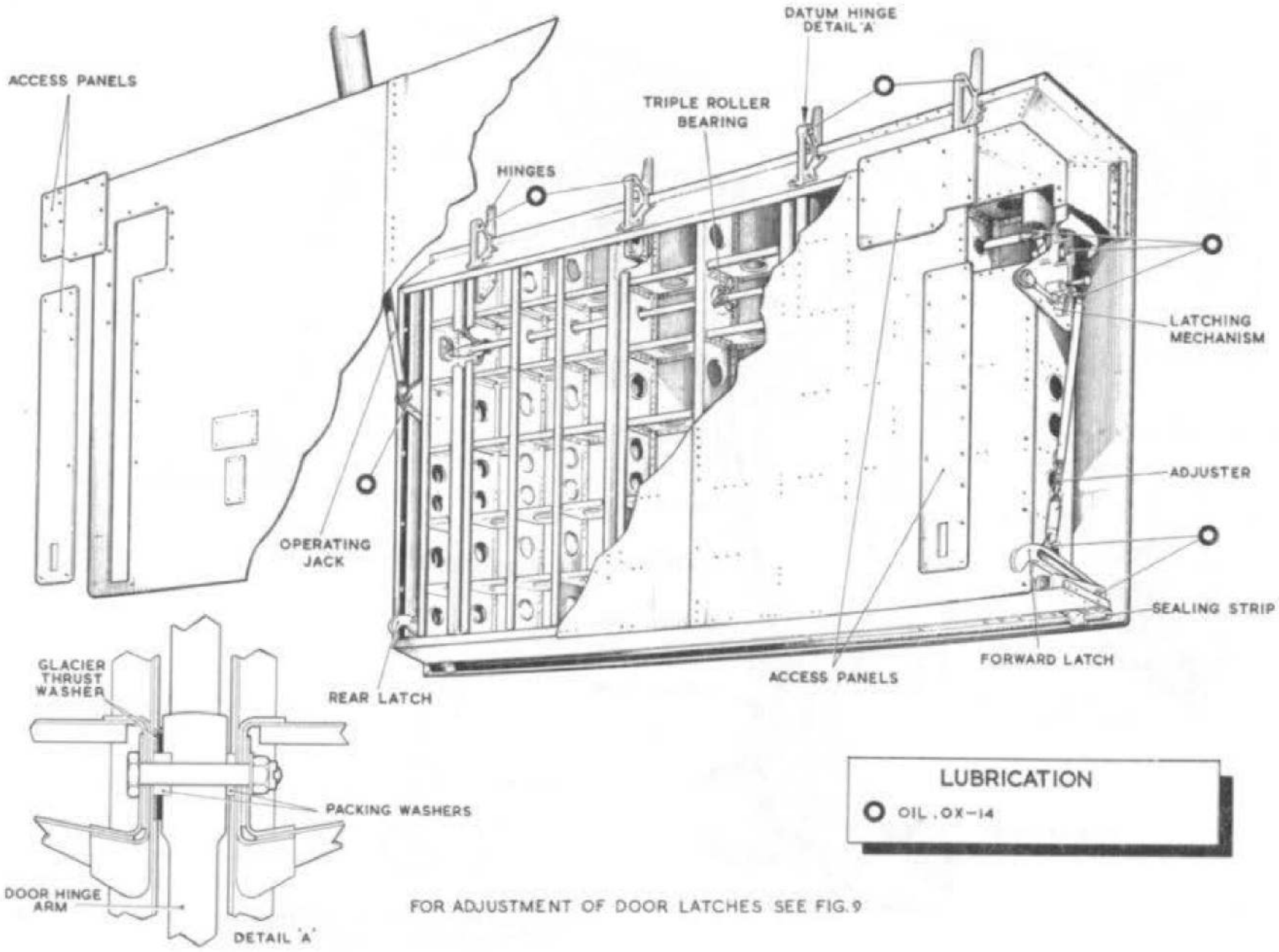


Fig.1. Main-wheel unit



FOR ADJUSTMENT OF DOOR LATCHES SEE FIG. 9

Fig. 2. Main-wheel door and operating mechanism
(◄ *Mod. 1907* ►)

RESTRICTED

9. Two micro switches are mounted at the lower end of the main fitting. One, bolted to a mounting ring and operated by a striker on a bracket on the sliding tube end fitting, is connected in series with a micro switch operated by the main unit pivot, to energise the door close valve when the unit is fully retracted and bogie trimmed properly. The other, bolted to the mounting ring and operated by a striker on the upper torque link hinge pin, has an electrical circuit so arranged that normal up selection cannot be made until the weight of the aircraft is off its wheels. On aircraft with Mod.1280 embodied the latter micro switch is mounted on the sliding tube end fitting and is operated by an arm actuated by one of the brake torque rods.

Bogie assembly

10. To provide wheel mountings, a bogie frame is secured to the main fitting. Two lugs at each end of the bogie frame are fitted with bushes through which the axles pass. The front axle passes through the two lugs and through the axle fitting on the sliding tube to form the attachment to the main fitting.

Strut assembly

11. This assembly forms a Y shape of two diagonal bracing tubes connected by a universal joint to a lower strut which, in turn, is connected to the main fitting by a shear pin and a trunnion fitting.

12. A cross member, provided at one end with a lug for the attachment of the retracting jack, is secured by two further lugs, one at each end, to the diagonal bracing tubes. Fitted in transverse borings at each end of the cross member are pivot pins by which the assembly is attached to the main plane structure.

Main jack

13. The main jack is the normal type comprising a cylinder assembly and a piston assembly and is mounted between a lug on the main fitting and a further lug on the strut assembly cross member. Hydraulic pressure to the jack is supplied through swivel pipe assemblies, the close line connects to the jack through a shuttle valve which is provided for emergency air operation of the jack.

Shock-absorber and separator

14. The shock-absorber (filled with fluid to the specification given in the Leading Particulars) is a liquid-spring unit in which the recoil movement is damped by regulating the flow of fluid from one side of the piston to the other. It is connected between the middle of the bogie and lugs on the main fitting. A separator is connected by a short pipe assembly to a recuperator valve on the shock absorber.

Doors and operating mechanism

15. Each main-wheel unit compartment is partially sealed by a rectangular fairing door secured by four hinge arms to the outer wall of each compartment. Approximately two-thirds of the way up each end of the door, is a pair of slotted brackets to which is connected the door latch operating linkage and the door operating hydraulic jack.

16. The sealing of the compartment is completed by a rectangular fairing attached by two adjustable spring-loaded connecting struts to the main-wheel fitting, and two arm type hinges to the lower edge of the compartment's rear bulkhead.

Attachment to airframe

General

17. Attachment bearings for the inboard pivots of the main unit and the strut are secured to the outer engine bay outboard rib. The outboard bearing for the main unit pivot, which passes through the outboard side of the compartment, is secured to the first wing rib. The strut outboard bearing is attached to the compartment outboard wall. The bearings are carried at the ends of tapered, T-section, attachment members which transfer the bearing loads over the complete depth of the ribs to which the members are bolted. Certain of these bolts are tightened to specific torque loadings.

Bearing bushes

18. Bearing bushes are carried in split type housings of which the half caps carry a lubrication nipple and two wire locked stud bolts. The stud bolts locate the bearing bushes in the half caps. The outboard main pivot bearing bush differs in that it is of the double flange split type, the upper half being dowel located in the main bearing.

Side load strut

19. A diagonal side load strut is mounted between a lug on the outer main unit pivot bearing housing, and a lug at the upper end of the inboard bearing member. This caters for side loads, particularly when the aircraft is being turned on the ground.

Operation

General

20. Three hydraulic jacks are operated to extend or retract each main-wheel unit, they are the downlock jack, the main unit jack, and the bogie trim jack. Operation of these jacks and their effect are dealt with in the following paragraphs.

Retraction

21. On selecting alighting gear UP, the selector valves on the compartment wall and on the main-wheel unit are energised and hydraulic pressure is applied to the downlock jack. Operation of the downlock jack breaks the joint of the centre and rear links of the downlock unit which operates a micro switch to indicate that the lock is broken. The arrangement of the lock units is such that the centre and front links move sufficiently to move the centre link roller clear of the lock strut end.

22. Simultaneously, under hydraulic pressure, the main-unit jack is extended causing the main-wheel unit to rotate forward about the main pivots. The strut assembly folds at the centre during this movement, towards the rising leg and the lock strut is pushed aft through the down-lock assembly.

23. Whilst the main-wheel unit is being retracted the bogie trim jack is shortened, the sliding tube is consequently raised causing the bogie to pivot about the lower end of the shock-absorber until it is in line with the main unit. This places the bogie assembly in the correct attitude for stowage in the wing compartment.

24. At the end of the sliding tube travel, into the main fitting, a striker on the axle fitting operates a micro switch connected in series with a further micro switch mounted above the main pivot tube. The second micro switch operates at the moment of retraction, the electrical circuit is such that the fairing doors cannot close until the two micro switches have been operated, i.e., until the main units have been properly trimmed and fully retracted. The shock-absorber remains fully extended, the correct pressure being maintained by the recuperator valve and separator.

Lowering

25. When undercarriage DOWN is selected the fairing door selector valve is energised and hydraulic pressure is applied to extend the door jacks. On reaching the fully open position the door operates a micro switch to energise the main-wheel selector valve which supplies hydraulic pressure to the main-wheel jack to lower the main unit.

26. Whilst being powered, oil is expelled from the bogie trim jack, through a relief valve and the main-unit selector valve to the normal return line. This release of oil allows the compressed air on the other side of the jack to extend the jack and the main-unit sliding tube, to lower the bogie to the landing position, i.e., the rear axle lower than the front owing to the shock-absorber being fully extended. On aircraft with Mod.1280 embodied, the hydraulic pressure holding the recuperator valve open is relieved to the main return through the main-unit selector, allowing the recuperator valve to close under its spring loading.

27. The operation of the micro switch to energise the main-unit jack selector also energises the downlock jack selector allowing hydraulic pressure to operate the downlock jack. When the undercarriage is fully down the lock jack extends to straighten the centre and rear links, the ends of their connecting pin seating in the two half bushes mounted on the lock unit side plates, to form a rigid joint. The roller, on the pin connecting the front and centre links, engages the groove on the end of the lock strut, thus preventing any movement of the strut through the lock unit and maintaining the rigidity of the knuckle joint of the strut. An arm on the rear link operates a micro switch to give visual indication that the unit is locked down.

28. On landing, the rear wheels of the bogie contact the ground first. This causes the shock-absorber to compress until the front wheels of the bogie are also in contact with the ground. Thereafter, the movement of the bogie as a whole is taken by the shock-absorber.

Emergency lowering

29. In the event of hydraulic or electrical faults which prevent the alighting gear being lowered in the normal manner an emergency air system is provided. Reference must be made to Sect.3, Chap.6 of this book for details of the system.

Micro switches

30. Fourteen micro switches, seven on the port and seven on the starboard are employed in the control and indication of the main-wheel units and main-wheel unit compartment doors. The three micro switches on each main-wheel unit are microseal Type DN.1241Z, Mk.1 whilst the four fitted on the aircraft for each main-wheel unit are Dowmic Type C.1831Y pre Mod.1906 or Honeywell Type 402EN.N3 post Mod.1906. These micro switches are described in A.P.4343C, Vol.1, Sect.2. Details of these switches, their markings, function and location are as follows:-

P.B.T. - Port bogie trim

This switch is located on the outboard face at the bottom of the port main leg. This switch is operated, and connected in series with micro switch P.U. ↑ , to energise the door close valve solenoid when the main-wheel unit is properly trimmed and fully retracted.

S.B.T. - Starboard bogie trim

As for the port bogie trim switch.

P.B. - Port bogie

This switch is located on the rear of the end fitting on the sliding tube. The switch is operated by an arm actuated by the brake torque rods when the weight of the aircraft is off the wheels and the shock-absorber extended. This isolates the safety lock solenoid from the electrical supply allowing the alighting gear UP switch to be selected.

S.B. - Starboard bogie

As for the port bogie switch.

P.U. ↓ - Port unit down switch

This switch is located on the port main-wheel unit downlock assembly and is operated when the port main-wheel unit is locked down, thus operating the pilots' alighting gear indicator.

S.U. ↓ - Starboard unit down switch

As for the port main-wheel unit down switch.

P.U.↑ - Port main-wheel unit switch

This switch is located above the pivot tube of the port main-wheel unit and is operated by a cam mounted on the pivot tube. This switch is operated as the main-wheel unit approaches the fully retracted position to provide an electrical supply to energise the door close valve solenoid.

S.U. ↑ - starboard main-wheel unit switch

As for the port main-wheel unit switch.

P.D. ↑ - Port main-wheel unit door switches

These two switches are located one at each door catch on the inboard wall of the port main-wheel unit compartment and are operated when the door is fully closed to operate the pilots' alighting gear indicator.

S.D. ↑ - Starboard main-wheel unit door switches

As for the port main-wheel unit door switches

P.D. ↓ - Port main-wheel unit down switch

This switch is located near the compartment door forward hinge bracket and is operated when the door is fully open to energise the main-wheel unit down selector valve solenoid.

S.D. ↓ - Starboard main-wheel unit down switch

As for the port main-wheel unit down switch.

Bogie action

31. The weight of the aircraft, when on the wheels, is transferred through the shock-absorber strut and the centre of the bogie to the wheels and tyres. When the bogie trim jack is extended, the air pressure within it is at a relatively low pressure compared with the pressure in the shock-absorber. Therefore, any resistance to movement of the bogie on rough ground is negligible.

Shock-absorber recuperation

32. A recuperator valve, incorporating a spring-loaded poppet valve and a floating piston, is screwed into the attachment fitting at the top of the shock-absorber. Two pipes are connected to the recuperator, one from the separator and the other from the feed pipe to the bogie trim jack. The function of the valve is to make good any loss of fluid in the shock-absorber prior to shock-absorber operation.

33. The separator contains a floating piston which is maintained at a suitable level by the fluid beneath it and a constant pressure of 1,500 p.s.i. maintained on the upper side by oil from the hydraulic system.

34. When the shock-absorber is fully extended, i.e., the aircraft weight is off the wheels, any drop in pressure in the shock-absorber is made good by fluid forced in by the action of the hydraulic oil pressure applied to the separator floating piston. Fluid is able to pass through the recuperator valve to reach the shock-absorber as, under the stated conditions, a certain rate of leakage past the recuperator valve piston is possible. If the leakage is inadequate the poppet valve in the recuperator lifts and the rate of flow into the shock-absorber is increased. When the pressure equalises, the return spring reseats the poppet valve.

35. When U/C UP is selected, the hydraulic pressure, tapped from the line to the trimmer jack, acts on the recuperator valve floating piston which lifts the poppet off its seat against its spring loading. This gives an unrestricted connection between the shock-absorber and the recuperator which ensures that the shock-absorber is not over-recuperated due to varying temperature conditions encountered in flight. When U/C DOWN is selected the hydraulic pressure on the floating piston is relieved allowing the poppet valve to reseat under its spring loading.

36. Should a rapid build up of pressure occur in the shock-absorber, due to a landing or static load, the poppet valve is forced on to its seat. Thus the shock-absorber is sealed off to prevent fluid returning to the separator during landing operations, or when the aircraft weight is on the wheels.

Door release mechanism

37. When each door closes, the two door latches automatically engage with their respective roller catches attached to the engine outboard rib. As soon as the door jacks begin to extend they each push the bolt, by which they are connected to the door latch operating mechanism, along the slot in the attachment brackets, to withdraw the door latches from the door catches. When the attachment bolts reach the end of the slots, the door latches are clear of the roller catches. Further jack extension then opens the door and a spring returns each jack attachment bolt to the "hooks engaged" end of the attachment bracket slots.

NOSE-WHEEL UNIT

General

38. The nose-wheel unit is a rearward retracting lever-suspension unit incorporating, a liquid-spring shock-absorber, a powered steering system providing for 47 deg. 15 min. movement to either port or starboard, a centring jack and a retracting strut assembly. It retracts into the fuselage aft of the crew's compartment.

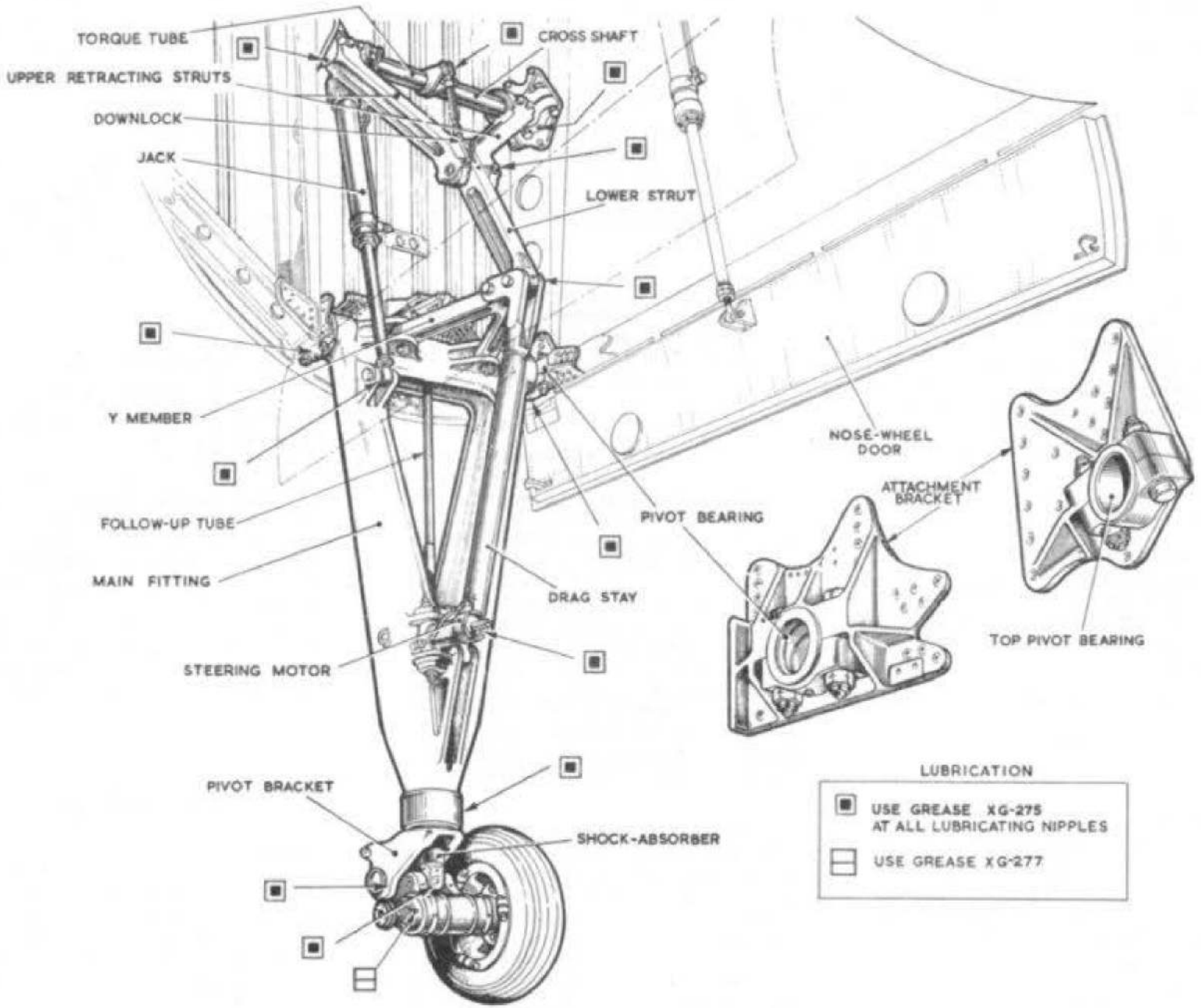


Fig. 3. Nose-wheel unit
(◄ *Lubrication symbol amended* ►)

RESTRICTED

Brief descriptive details of the unit are given in subsequent paragraphs but reference must be made to A.P.1803E, Vol.1, Sect.6, Chap.7 for full descriptive and bay servicing details.

39. Basically the unit consists of a main fitting, accommodating a shock-absorber, the ram end of which is connected to a lever arm and axle assembly. Installed within the main fitting is, the follow-up tube of the steering mechanism and the steering system hydraulic components. At the rear of the unit is a steering motor connected to a steering lever within the unit which, in turn, is attached to a wheel pivot bracket carried in an upper and lower bearing within the lower part of the main fitting. An inter-communication plug, covered by a spring-loaded flap, is provided in the fork of the main fitting, for ground communication until immediately before take-off.

40. Completing the assembly is an operating mechanism consisting of:-

1. Port and starboard upper struts connected at their upper ends to a torque tube/cross shaft.

2. A lower strut hinged on a pin joining the lower ends of the two upper struts and pivoted about a pin bolt, at its lower end attachment, to a drag stay.

3. The drag stay is attached, at its lower end, to a fork on the aft face of the main fitting. The upper end of the drag stay is bolted to a Y member, of which, the two arms are secured to two forks, one on each side of the top of the main fitting.

4. A latch tube extending from a lever at the centre of the strut cross shaft to the downlock mechanism.

The strut joint is on the hinge pin at the position where the upper struts link up with the lower strut, the downlock is also located at this point. The operating jack is connected to a lever on the port side of the strut cross-shaft and the ram end of the jack is connected to a bracket on the port side of the rear face of the main fitting.

Operation

Retraction

41. When alighting gear UP is selected, the nose-wheel unit selector valve is energised, allowing hydraulic pressure to be supplied to the jack causing it to close. The initial movement of the jack, acting on the jack attachment lever, rotates the strut torque tube which imparts a pull on the downlock latch tube. This pull disengages the downlock latch from the downlock roller.

42. When the downlock is disengaged, the bottom of the slot, in the jack attachment lever, bears against the cross-shaft lever pin transferring the movement from the torque tube to the cross-shaft. The continuing movement of the jack, rotates the strut cross-shaft, breaks the strut joint and raises the complete nose-wheel unit into the compartment. On the unit reaching the fully retracted position, it operates a micro switch which energises the door close selector valve, which supplies hydraulic pressure to the door jacks to close the compartment doors.

Lowering

43. On selecting alighting gear DOWN, the door selector valve is energised to open the doors which, when fully down, contact micro switches to energise the nose-wheel unit selector valve which in turn supplies hydraulic pressure to extend the jack and lower the nose-wheel unit. The final movement of the jack rotates the torque tube to engage the downlock catch and brings the cross shaft lever pin against the top of the jack attachment lever slot.

Emergency lowering

44. In the event of hydraulic or electrical faults, which prevent the alighting gear being lowered in the normal manner, an emergency air system is provided. Reference must be made to Sect.3, Chap.6 of this Book for details of the system.

Doors and operating mechanism

45. The two nose-wheel unit compartment doors are attached to the compartment aperture side members by five hinges. The door operating hydraulic jacks are attached to two slotted brackets on each door by bolts which also pick up the door latch operating mechanism actuating levers. When the doors are closed, the door latches, one at the forward end and one at the rear end of each door, engage with catch plate rollers attached to the compartment front and rear bulkheads. Springs, at the door latch ends of the operating mechanism retain the door latches in the locked position.

Micro switches

46. Nine micro switches are employed in the control and indication of the nose-wheel unit and the nose-wheel unit compartment doors. The two micro switches on the nose-wheel unit are Microseal Type DN.1241Z Mk.1 and the seven fitted on the aircraft are Dowmic Type C.1831Y pre-Mod.1906 or Honeywell Type 402EN.N3 post-Mod.1906. These micro switches are described in A.P. 4343C, Vol.1, Sect.2. Details of these switches, their marking, function and location are as follows:-

N.S.A. - Nose-wheel unit shock-absorber

This switch, located on the lower forward face of the nose-wheel unit is

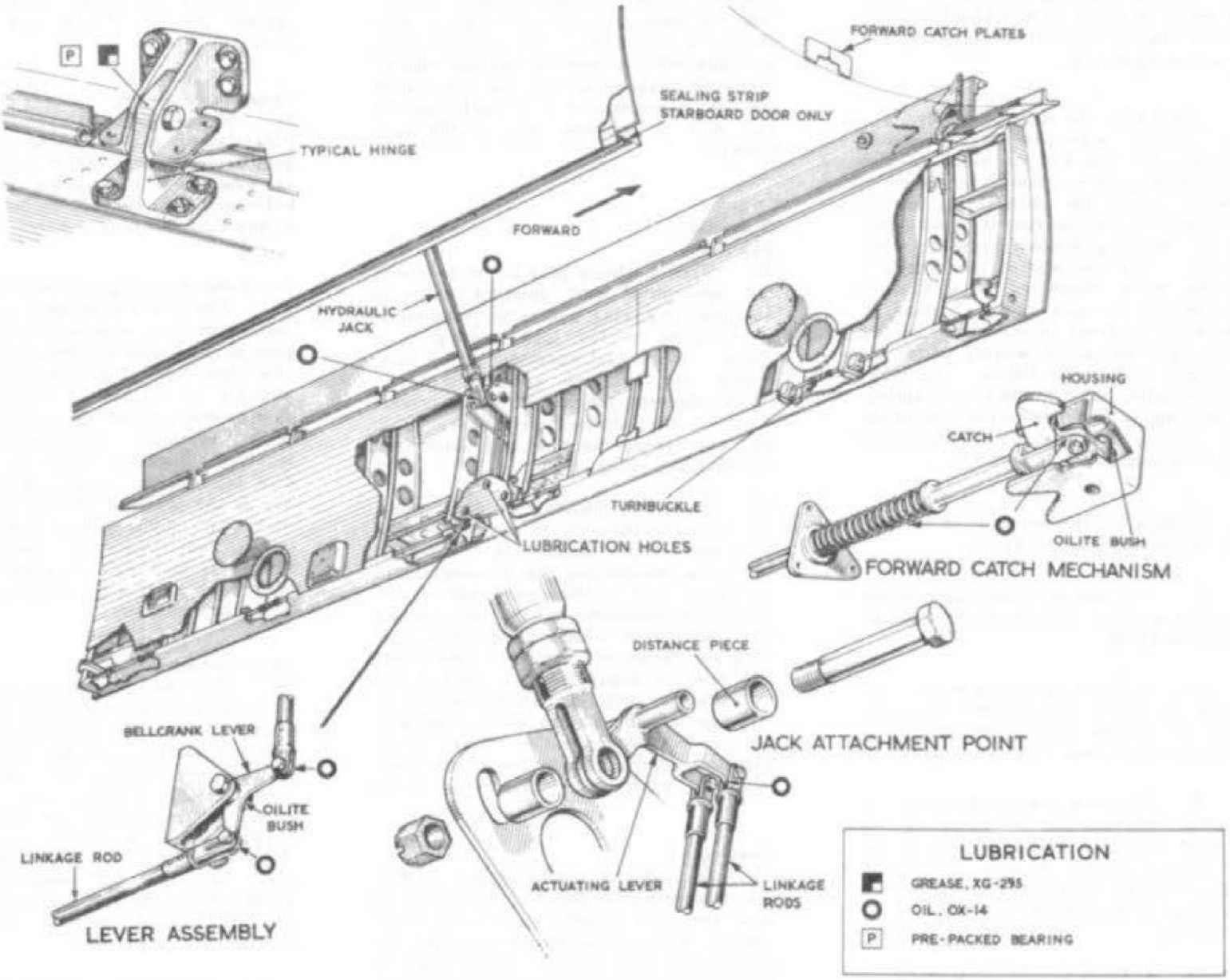


Fig. 4. Nose-wheel door and operating mechanism

(Lubrication holes added)

RESTRICTED

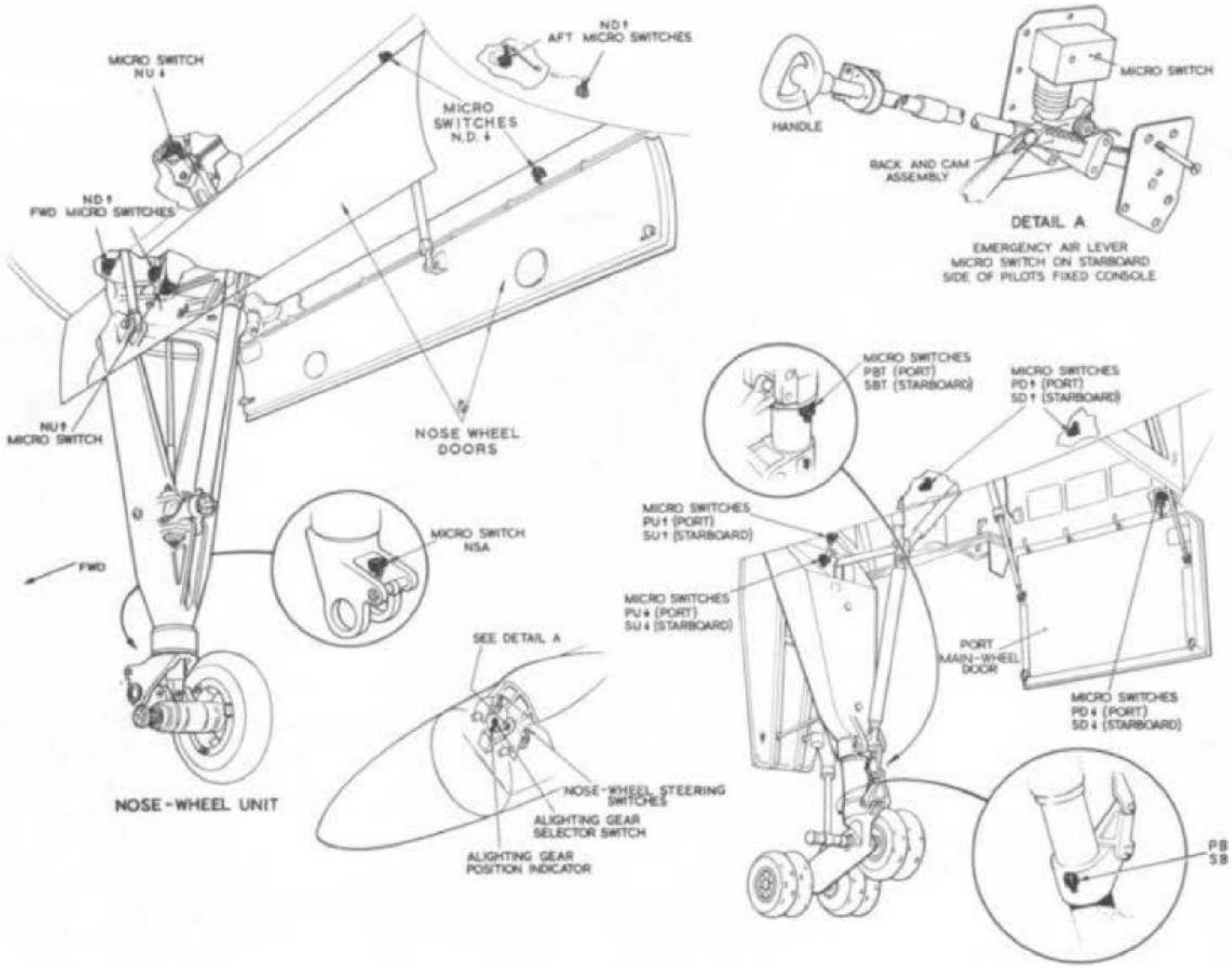


Fig.5. Micro switch location
(◀ Mod. No. 1280 ▶)

RESTRICTED

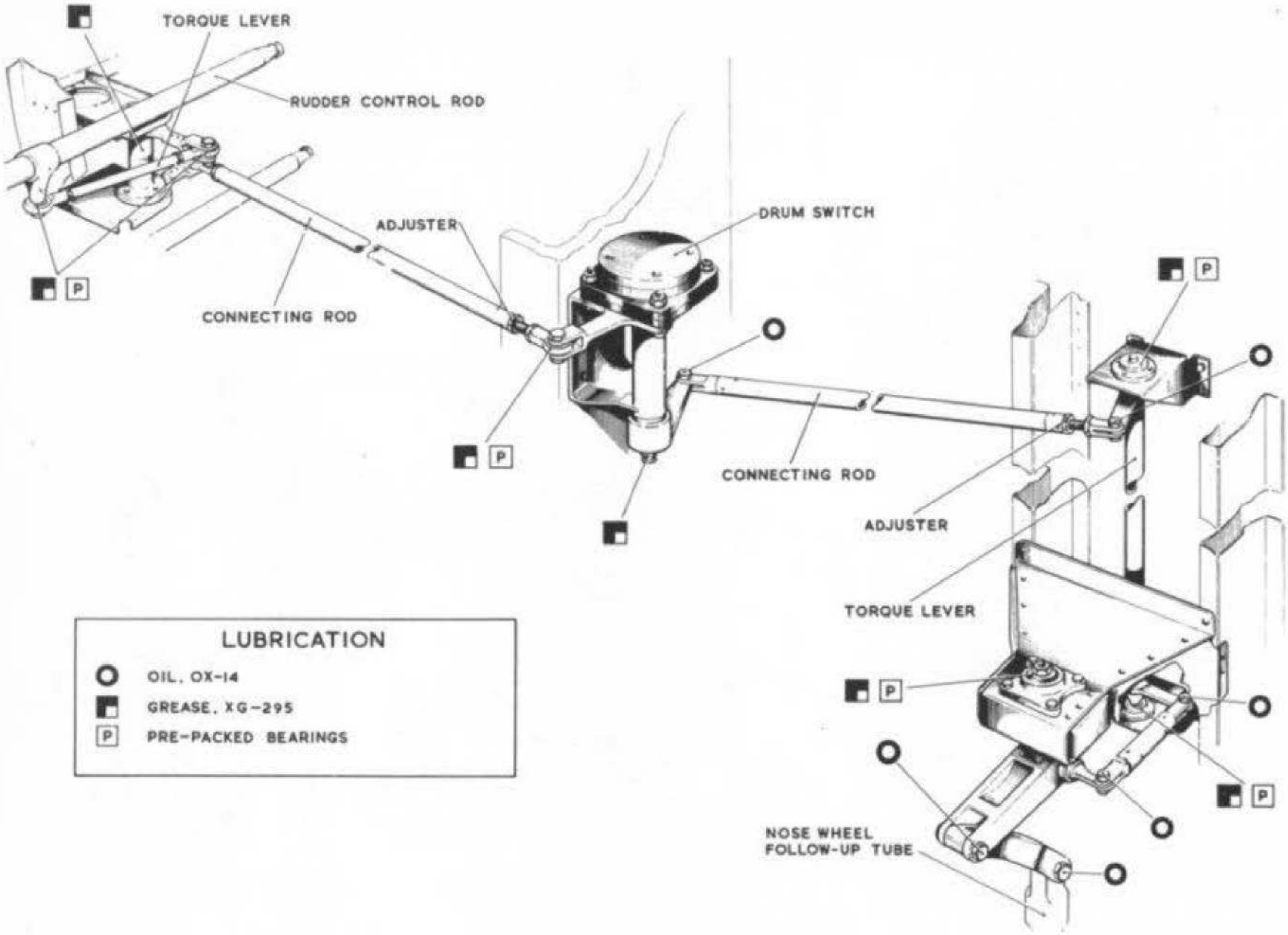


Fig. 6. Nose-wheel steering system

operated when the weight of the aircraft is off the wheels and the shock-absorber is extended. The operation of the switch isolates the nose-wheel steering valve solenoid.

N.U.↓ - Nose-wheel unit down switch

This switch, located on the nose-wheel unit down-lock, operates the pilots' alighting gear indicator when the unit is locked down.

N.U.↑ - Nose-wheel unit up switch

This switch, located on the aft face of the rear pressure bulkhead in the nose-wheel unit compartment, is operated by the nose-wheel unit when it is fully retracted. When the switch is operated it isolates the nose-wheel unit doors open valve solenoid and energises the doors close valve solenoid.

N.D.↑ - Nose-wheel unit doors up switches

These four switches are located in pairs in the nose-wheel compartment. One pair is located adjacent to the N.U.↑ switch, the other pair are mounted on the nose-wheel compartment rear bulkhead. All four switches are operated when the nose-wheel compartment doors are closed, and they control the pilots' alighting gear indicator.

P.N.D.↓ - Nose-wheel unit port door down switch

This switch is located by the door second hinge counting from the rear hinge. It is operated when the door is fully open to energise the nose-wheel unit selector valve down solenoid.

S.N.D.↓ - Nose-wheel unit starboard door down switch

As for the nose-wheel unit port door down switch.

Nose-wheel steering system

General

47. The controlling device in the steering system is a stepped drum switch, Dowty Part No.C1220-Y Mk.107. This is a follow up device by which pre-determined positions of the nose-wheel can be selected by operation of the rudder pedals.

48. Movement of the rudder pedals is transferred by a push-pull rod assembly to the upper side of the drum switch, which is attached by a bracket to the pressure bulkhead at the forward end of the nose-wheel compartment. A further lever, attached to the lower side of the switch, passes to a torque link assembly, to which is attached a follow up tube, which projects through the top of the nose-wheel unit main fitting.

Operation

49. When the engage switch, on either of the pilots' control handgrips, is depressed the solenoid of a steering stop valve in the hydraulic system is energised open, allowing a flow of hydraulic pressure to a steering control valve.

50. Movement of the rudder pedals is transmitted by the push-pull rod assembly to the upper rotating half of the drum switch, which in turn supplies an electrical feed to the steering control valve. The control valve is opened and hydraulic pressure is supplied to the selected side of the steering motor and the nose-wheel turn to the selected position.

51. The follow up tube transmits the nose-wheel movement through the torque linkage causing the lower half of the drum switch to rotate, until the upper and lower halves of the drum switch are again in alignment. Thus the electrical feed to the steering control valve is broken and movement of the nose-wheel ceases until a further selection is made.

52. The purpose of the drum switch and follow up linkage is to ensure that the wheels are turned through an arc corresponding with the movement of the rudder pedals since, without these components movement of the pedals would merely control the speed of the steering motor and, the rudder pedals would have to be centralised when the required angle of steering was reached.

WHEELS AND BRAKES

General

53. Dunlop wheels, tyres and tubes are fitted to the alighting gear. In addition, the main-wheel unit wheels are equipped with Dunlop hydraulically operated brake units controlled by foot motors on the pilots' rudder pedals. Maxaret anti-skid units are fitted on the brake units.

Wheels

54. Reference should be made to A.P.2337, Vol.1, for descriptive and bay servicing details of the wheels.

Brakes

55. Full descriptive and servicing details for the wheel brake units are given in A.P.2337, Vol.1, Book 2, Chap.2. It is essential to check the adjustment of the Maxaret units whenever a wheel or brake unit has been disturbed.

56. Details of the hydraulic control of the wheel brakes are given in Sect.3, Chap.6 of this book.

Maxaret automatic brake control valve

57. Maxaret units are fitted in the hydraulic lines to the brake units so that the oil must pass through the Maxarets in

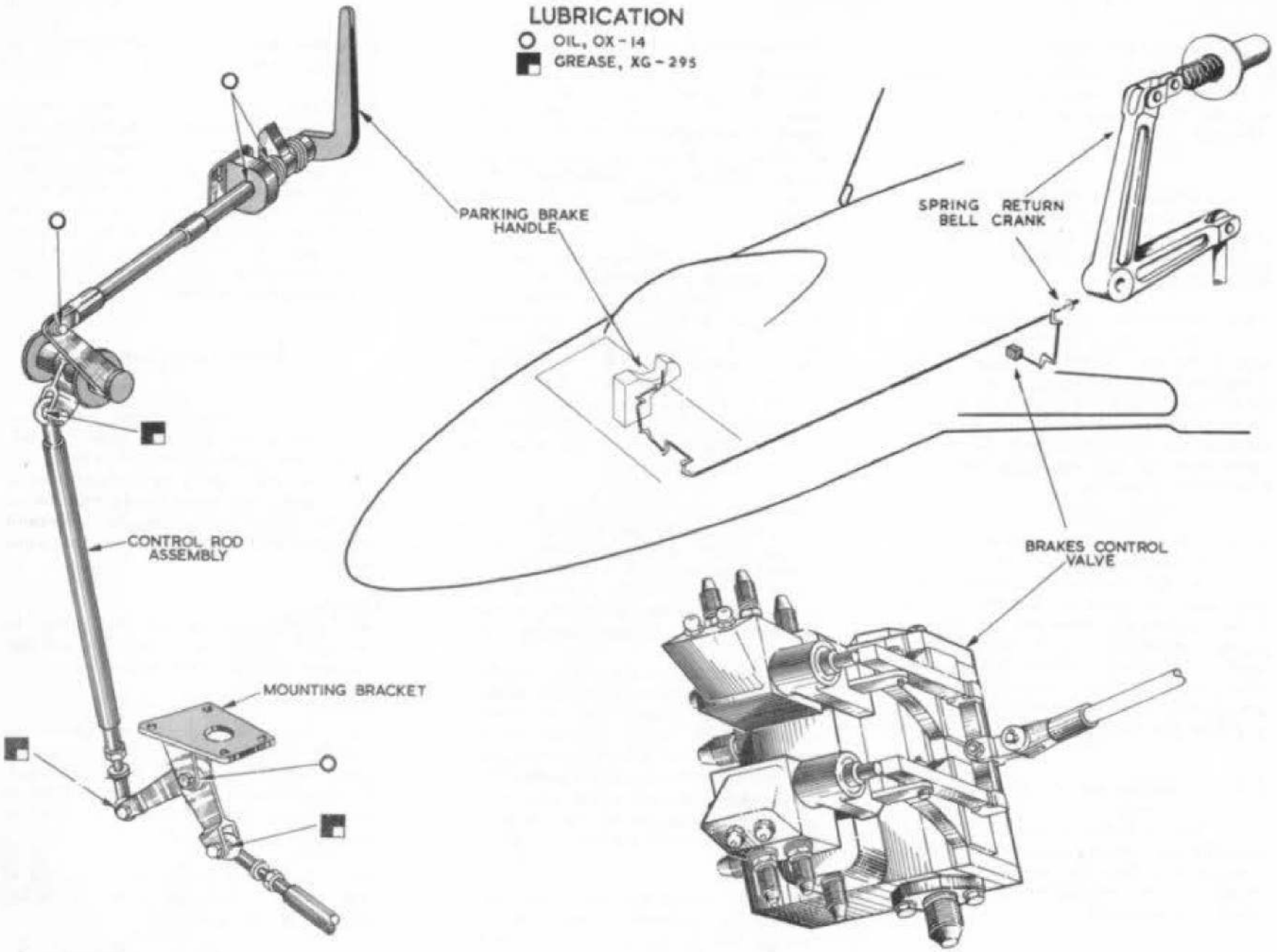


Fig. 7. Parking brake mechanism

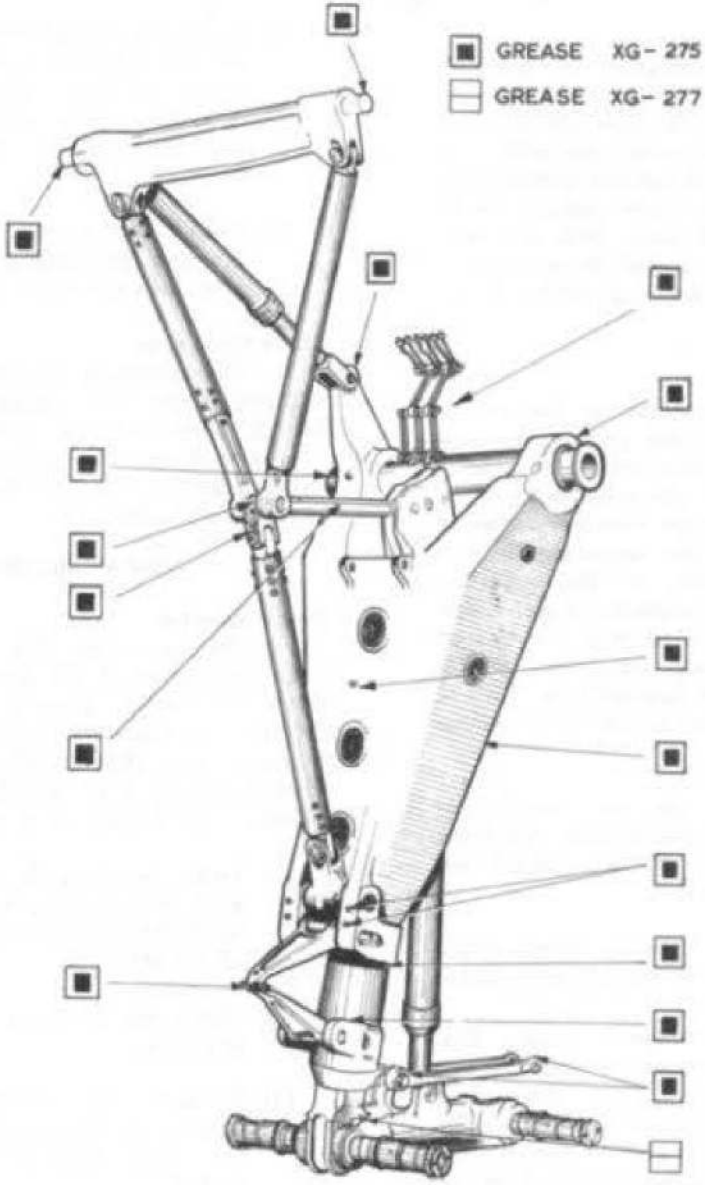


Fig.8. Main-wheel unit lubrication
(◀ Lock strut lubrication added ▶)

order to operate the brakes. When the wheels tend to lock as the brakes are applied on landing, the Maxaret unit by-passes the hydraulic oil from the pressure line to the return, the pressure is reduced and wheel rotation continues. Reference must be made to A.P.1803S, Vol.1, Book 2, Sect.8, Chap.5 for full descriptive details of the unit.

58. The units, handed for installation, are identified by markings on a plate attached to the bracket mounting. The markings are as follows:-

Units marked R.A.M.
- R right-hand installation
- A anti-clockwise rotation
- M mineral hydraulic oil

Units marked L.C.M.
- L left-hand installation
- C clockwise rotation
- M mineral hydraulic oil

Operation

59. The brakes control valve, described in Sect.3, Chap.6 of this book, is governed by foot operated power transmitters consisting of a piston assembly and a static column of oil. When the pistons are depressed, a force, proportional to the applied pressure, is transmitted to operate the brake control valve which, in turn, allows hydraulic oil pressure to the selected wheel brake units. The arrangement of the system is shown in Sect.3, Chap.6, Fig.10 of this book.

Parking brakes

60. Parking brake control is provided by a handle, mounted on the port side of the pilots' centre console, connected to the brake control valve by a series of push-pull rods and levers. By pulling and turning the pilots' control handle to lock it in the ON position, linkage on the control valve, operated by the push-pull rods, depresses two plungers in the control valve allowing hydraulic pressure to pass to the wheel brake units.

General

61. Before attempting to adjust the alighting gear, the aircraft must be jacked and trestled with the wheels clear of the ground as described in Sect.2, Chap.4 of this Book.

62. When operating the alighting gear, ensure that the area in the vicinity of the units is free from obstruction and that no personnel are working in the area affected.

63. Should it be found necessary to remove any part of the system, pipe ends and unions must be blanked off using the approved blanking caps. Before replacement, parts should be given a thorough examination to ensure absolute cleanliness.

Priming and bleeding

64. Whenever a component has been removed or a pipe disconnected for any reason, the system must be primed and bled after replacement or reconnection to release any air trapped in the system. The method of priming and bleeding the system is given in Sect.3, Chap.6 of this book.

Lubrication

65. Grease nipples and points requiring suitable minimum quantities of oil are indicated on the illustrations throughout this chapter. Grease XG-277, XG-275, XG-295 and oil OX-14 are to be used as indicated. The main undercarriage swivel pipe coupling unit joints must be liberally smeared with grease XG-275.

MAIN-WHEEL UNIT

Shock-absorbers

66. A certain amount of loss of oil from the shock-absorbers is rectified by the separator units. Instructions for filling, charging and testing the shock-absorbers are given in A.P.1803V, Vol.1, Sect.3, Chap.5.

67. If a shock-absorber has been replaced the shock-absorber on the opposite undercarriage must be checked for over-recuperation. This shock-absorber must be depressurised through the bleeder plug and both separator units charged to the correct level. Finally both shock-absorbers must be charged in accordance with the instructions in A.P.1803V, Vol.1, Sect.3, Chap.5.

Separator units

68. The fluid content of the shock-absorber and the lower half of the separator unit may be regarded as the fluid of the shock-absorber with a reserve supply. Loss of fluid from the shock-absorber is replenished from the separator with a consequent lowering of the separator fluid level. The separator must, therefore, be topped up when, with the aircraft weight on its wheels, the filling line on the piston rod is in line with the base of the cut away portion of the level indicator.

69. Instructions on the method of topping up the unit, are printed on a plate secured to the body of the separator and are amplified below:-

(1) Open the service bleed screw situated at the top of the cylinder body.

(2) Using an adapter (Dowty Part No. ST.2034) and a charging gun (Part No. GB.2761) pump fluid OX-16 through the charging valve at the bottom end of the cylinder body until the indicator rod moves.

(3) Open the bleed screw at the top of the indicator rod and continue charging until a stream of fluid free from air bubbles emerges.

(4) Close the bleed screw at the top of the indicator rod and continue charging until the filling line marked on the indicator rod and the mark on the level indicator coincide.

(5) Close the service bleed screw. Remove the charging equipment and wire lock the bleed screws.

Bogie trim jacks

70. The procedure for checking the air inflated bogie trim jacks is given in Sect.2, Chap.2 of this Book. Servicing of the unit is described in A.P.1803V, Vol.1, Sect.3, Chap.5 and A.P.1803D, Vol.1, Book 4, Sect.10.

NOSE-WHEEL UNIT

Shock-absorber

71. The procedure for checking the static deflection of the shock-absorber is given in Sect.2, Chap.2, the fluid is OX-16. To replenish the unit, in situ, a charging gun (Ref.No.1B/4467) and an adapter (Dowty Part No.D4385Y) and required. The method is as follows:-

(1) Jack the aircraft in accordance with Sect.2, Chap.4 of this book, until the nose-wheel unit is clear of the ground.

(2) Check the pressure in the shock-absorber.

(3) Connect the charging gun and adapter to the charging valve at the lower end of the shock-absorber.

(4) Pump in fluid as required until a pressure of 1,500 ± 50 p.s.i. is

attained, remove the charging equipment, replace the charging valve cap and lock.

For servicing and complete filling the shock-absorber requires removing from the nose-wheel unit. Details of servicing and filling are given in A.P.1803E, Vol.1, Sect.6, Chap.7.

BRAKES

Master cylinder

72. Periodic replenishment of oil in the master cylinders attached to the rudder bar pedals is the only servicing normally required. To replenish, remove the screwed filter cap assembly from the reservoir and add oil OM-15 as necessary. Full servicing details of the unit is given in A.P.1803S, Vol.1, Sect.3, Chap.3.

Parking brake

73. Lubrication of the parking brake mechanism is shown in fig.7 of this chapter.

ADJUSTMENTS

General

74. Faulty operation of the alighting gear may be caused by hydraulic, electrical or mechanical defects. A fault finding table of hydraulic defects is given in Sect.3, Chap.6 of this book and electrical faults are dealt with in Vol.1, Book 2, Chap.1 of this publication. Mechanical defects which may result in faulty operation are as follows:-

(1) Lack of lubrication at bearings, hinges, etc., the lubrication points are given on the illustrations throughout this chapter.

(2) Mechanical interference or the presence of obstructions between moving parts.

(3) Side loads on jack pistons due to malalignment or incorrect adjustment.

(4) Incorrect setting of micro switches.

75. The following paragraphs give the methods of setting and/or adjustment of the hydraulic jacks, door catch mechanism and micro switches. When setting or adjusting the hydraulic operating jacks, a hydraulic servicing trolley is to be connected to the aircraft ground servicing points in the port main-wheel unit bay. A ground electrical supply is also required.

Main-wheel unit

Jack

76. Should the length of stroke of the jack be suspect, or after any servicing operation which may have affected its travel, adjust as follows:-

(1) Adjust the fuel load to approximately 40 per cent then jack and trestle the aircraft in accordance with the instructions given in Sect.2, Chap.4 of this Book. Connect a ground electrical supply to the aircraft.

(2) Prior to fitting the operating jack check that, with the jack fully extended, the distance between the attachment pin hole centres is set at a nominal 75·5 in. Adjust, if necessary, as laid down in item (7).

(3) With the main-wheel unit fully down and locked (cockpit indicator showing green), the jack closed and disconnected at its point of attachment to the main-wheel unit, check the alignment of the holes in the fork-end to the hole in the main attachment arm.

(4) Should adjustment be necessary, release the fork-end locknut using two C spanners (Dowty Part No.ST2355) and rotate the fork-end until the attachment pin can be freely inserted to attach the jack to the main unit. Tighten and wire-lock the locknut and connect the jack to the main unit.

(5) Disconnect the door jacks at their attachments to the main-wheel door and the two spring struts attaching the fairing door to the main-wheel unit.

(6) Retract the main-wheel unit, close the main-wheel door by hand and check that a clearance of approximately 3 in. exists between the door and the nearest tyre.

(7) If adjustment is required to obtain the above clearance, lower the main-wheel unit and relieve the pressure in the jack. Release the adjusting sleeve locknut using a C spanner (Dowty Part No.ST2140) and adjust the adjusting sleeve, as necessary, using a C spanner (Dowty Part No.ST1562).

(8) Retract the main-wheel unit and check the tyre to door clearance. Repeat op.(7) until the clearance is obtained, ensuring that a dimension of 1·610 in. between the end faces of the cylinder and adjusting sleeve is not exceeded and keeping the measurement between the attachment pin hole centres of the extended jack to 75·5 ± 0·5 in.

NOTE...
It is important that the jack retracted adjustment is carried out before the jack extended adjustment.

(9) On completion of adjustments lower the main-wheel unit, tighten the adjusting sleeve locknut and wire-lock.

(10) Connect the door jacks and the fairing door spring struts.

(11) Carry out a retraction test checking for correct operation, sequence and indication.

Door jacks

◀77. Two jacks are employed to operate each main undercarriage door, they are similar in construction but of different lengths. The closed pin hole centres of the forward jacks are set to 32 ± 0·10 in. and the rear jacks closed pin hole centres are set to 38·875 ± 0·10 in. All jacks have 24·75 ± 0·07 in. travel. These are manufacturers settings and should not normally require alteration. Should adjustment be necessary due to servicing operations which may have affected the setting, or when new jacks are fitted, proceed as follows:-

(1) Adjust the fuel load to approximately 40 per cent, then jack and trestle the aircraft in accordance with the instructions in Sect. 2., Chap.4 of this Book.

NOTE . . .
Ensure that the wing steady trestles are positioned in a 'no load' condition.

(2) Connect a hydraulic servicing trolley and the miscellaneous test console, (Ref.No.26DC/95216) to the aircraft.

(3) With the alighting gear down and locked, disconnect the jacks at their attachments to the door.

(4) Using the hydraulic servicing trolley and the test console, fully retract the door jacks.

(5) Close the door by hand until the door latches fully engage with the catch plate rollers. Ensure that the door fits flush with the undersurface of the main plain, adjust, if necessary, on the shims under the door stops. Check the correct location of the door in the wheel bay, the gap between the door outer skin and aircraft structure must be within the dimensions given in fig.10A.

(6) Maintain pressure in the jacks and with the door flush with the undersurface, adjust the jacks, as necessary to suit the attachment brackets on the doors, by releasing the locknuts and turning the eye-ends. Ensure that the attachment bolts are at the top of the slots in the door attachment brackets and that the measurement between the jack pin hole centres is within the laid down tolerance. One turn of the eye-end alters the pin centre length 0·050 in.

NOTE . . .
If the pin centre lengths are outside the permitted tolerance, with the jacks connected to the door and the door against the stops, it may be due to distortion of the jack attachment structure or adverse tolerance on the stroke of the jack. Further investigation and a possible jack change may be necessary. If no faults are found a tolerance of 0·050 in. inside or outside skin line is permitted on the door.

(7) When the setting is satisfactory, leave the jacks connected to the door and open the door using the hand pump on the hydraulic servicing trolley.

(8) When the door is fully open, disconnect one jack from the door.

(9) With the hydraulic servicing trolley delivering 4,000 p.s.i. and door OPEN selected on the test console, check the alignment of the disconnected eye-end with the inboard end of the slot in the door attachment. It must be possible, using manual pressure only, to insert the attachment bolt. If the jack is too long, shorten by adjusting the eye-end, noting that one turn alters the length by 0·050 in.

NOTE . . .
During this operation do not exert pressure to alter the door position.

(10) If the disconnected jack length is too short do not lengthen the jack but disconnect and shorten the other jack to suit.

(11) When the alignment is correct, connect the jacks to the door.

(12) Close, then open the door using the hand pump on the hydraulic servicing trolley. During this opening operation ensure that the door latches are correctly disengaging from the rollers

(13) Close the door using the test console and the hydraulic servicing trolley. With 4,000 p.s.i. pressure on the jacks check that the jack pin centre lengths are within the tolerance. If adjustment is necessary both jack eye-ends must be adjusted the same amount in the same direction. The door can be 0·050 in. inside or outside the undersurface skin line with the door stops adjusted to suit.

(14) Check the clearance between the door latches and the roller latches as illustrated in fig.9, adjust, if necessary in accordance with para. 79

(15) Open the door, disconnect the test ▶

console, restore the aircraft electrical circuit and connect a ground electrical supply to the aircraft.

(16) Carry out a full retraction test, check for correct operation and indication. If a requirement exists for longer striker bolts for micro switches P.D. and S.D., bolts Ref.No.26DC/13716 must be fitted.

(17) On completion of adjustments positively lock all adjustment points. Restore the aircraft to normal fit ground locks, remove trestles and lower the aircraft.

Door latching mechanism

78. Adjustment, to either the forward or rear door latches, is by the operating mechanism adjusting turnbuckles when the screwed panels, on the inner face of the doors, are removed. Adjustment must be made with the door jack attachment bolt at the top of the attachment bracket slot.

79. When fitting a replacement door, or when the latching mechanism setting is suspect, adjustment is carried out as follows with reference to fig.9.

(1) Adjust the fuel load to approximately 40 per cent, then jack and trestle the aircraft in accordance with the instructions given in Sect.2, Chap.4 of this Book.

NOTE...
It is important that the wing steady trestles are positioned in a 'no load' condition.

(2) Connect a hydraulic servicing trolley and the miscellaneous test console (Ref.No. 26DC/95216) to the aircraft.

(3) Ensure that the door jacks have been adjusted in accordance with the instructions given in para.77,

(4) Remove the panels from the door to gain access to the door latch operating mechanism.

(5) Remove the locking wire, loosen the locknuts on the adjusting turnbuckles and adjust the turnbuckles as far as possible to shorten the linkage rods.

(6) Close the door using the hydraulic servicing trolley and the test console

(7) Maintain the 4,000 p.s.i. pressure on the door jacks, adjust the turnbuckles so that the door latches assume the locked position over the catch-plate rollers and the dimension between the door latches and the skin face of rib 162·5 is established. The correct dimensions are, the forward door latch 0·34 in. and the rear door latch 0·62 in. as illustrated in fig.9.

NOTE...
It is important that these dimensions are strictly adhered to, also that the bolts in the telescopic links attached to the door latches are at the ends of the slots furthest from the door latches.

(8) Tighten the turnbuckle locknuts.

(9) Check the clearance between the door latches and the roller latches as illustrated in fig.9. This clearance is governed by the aircraft fuel loading as follows:-

Fuel load %	Clearance (in. ± 0·005 in.) Front	Rear
Residual	0·070	0·070
10	0·070	0·070
20	0·065	0·065
30	0·065	0·065
40	0·060	0·060
50	0·060	0·060
60	0·055	0·055
70	0·055	0·050
80	0·050	0·050
90	0·050	0·045
100	0·045	0·045

Adjustment to obtain this clearance is made on the laminated shims between the catch bracket and the roller catch assembly.

(10) Open the door using the hand pump on the hydraulic servicing trolley. Check that the door latches move simultaneously with the jack attachment points, and that when the jack attachment bolts reach the bottom of the slots, in the jack attachment brackets, the door latches are clear of the catch plate rollers.

(11) Disconnect the test console, restore the aircraft electrical circuit, connect a ground electrical supply and carry out an operational check on the door.

(12) Wire-lock the adjusting tumbuckles and replace the access panels.

(13) Disconnect the hydraulic servicing trolley, fit the ground locks, remove the trestles and lower the aircraft.

Micro switch setting

80. The main undercarriage micro switches must be set to give correct operation and sequence of the main-wheel units and doors under the following conditions. The aircraft must contain a fuel load of approximately 40 per cent and be jacked and trestled in accordance with the instructions in Sect.2, Chap.4 of this Book. A hydraulic servicing trolley must be connected to the aircraft and the test console (Ref.No.26DC/95216), together with the necessary ground electrical supplies, must be available for using during the tests. After adjustment ensure that each striker is secure and correctly locked.

81. The setting sequence is identical for both port and starboard sides of the alighting gear. Port only is given. In conjunction with an electrical tradesman proceed:-

(1) Ensure that the main-wheel unit is locked DOWN and that the door is fully OPEN with its operating jack fully pressurised.

(2) Locate the P.D. ↓ (port door open) micro switch and adjust the striker to provide a 0·15 in. override from the point of operation of the switch.

(3) Locate the P.U. ↓ (port unit down) micro switch and adjust the striker to provide a 0·10 in. override from the point of operation of the switch.

(4) Locate the P.B. (port bogie) micro switch, remove the cover, adjust the striker to provide an override of 0·060 in. from the point of operation of the switch.

(5) Locate the P.B.T. (port bogie trim) micro switch striker pin and adjust so that the pin protrudes 0·470 in. above the attachment bracket.

(6) Locate the P.U. ↑ (port unit up) micro switch and striker. This switch must be adjusted, or checked for correct adjustment, during retraction of the main-wheel unit. Operation of the switch must be such that door operation does not commence until the tread of the rear wheel tyres is level with the undersurface of the main plane, ensuring at the same time that the bogie is fully trimmed and that contact between the door and tyres does not occur. To adjust the micro switch proceed as follows:-

(a) With the main-wheel unit operating jack adjusted in accordance with the instructions in para.76, remove the hinged fairing from the rear of the main-wheel unit.

(b) Adjust on the striker pin to give adequate clearance between the striker pin and the micro switch plunger to ensure that the switch does not operate with the undercarriage in the down position.

(c) Release the air from the bogie trim jack.

(d) Remove the cam centre attachment bolt, loosen the two end attachment bolts and move the cam so that the cam ramp is at its maximum distance from the lever roller.

(e) Using the hydraulic servicing trolley and the test console, retract the undercarriage until the tread of the rear wheel tyres are approximately level with the undersurface of the main plane. Switch off the servicing trolley and, using the hand pump on the servicing trolley, position the undercarriage with the tread of the rear wheels level with the undersurface of the main plane, at the same time ensuring that the bogie is fully trimmed.

(f) Move the cam round the undercarriage pivot tube until the micro switch is just operated and tighten the two end bolts, ensuring that, when the bolts are fully tightened, the switch remains operated.

(g) Check the alignment of the cam centre attachment hole with the hole in the undercarriage pivot tube. If alignment is correct, fit the securing bolt. If alignment is incorrect, fit a new cam in accordance with para.81A.

NOTE...

During the subsequent retraction test (op.(12)) it may be necessary to adjust the micro switch striker to ensure that door closing occurs correctly. To retard door operation screw the striker pin in.

(7) Using the console select main-wheel unit DOWN.

(8) When the main-wheel unit is locked down, select door CLOSE on the test console and ensure that the door latching mechanism is adjusted in accordance with the instructions given in para. 79 and fig.9.

(9) Locate the two P.D. ↑ (port door up) micro switch strikers and adjust to provide an override of 0·30 in. from the operating point of the switches. A minimum override of 0·20 in. is acceptable if 0·30 in. cannot be obtained.

(10) Using the console, select door OPEN.

(11) Disconnect the test console, restore the aircraft electrical circuit and connect an external electrical supply to the aircraft.

(12) Using a hydraulic servicing and the external electrical supply, carry out a retraction test, adjusting, if necessary, on the P.U. ↑ micro switch striker to ensure that door closing occurs correctly and that no foul occurs between the door and the tyres during the final stages of retraction.

NOTE...
(1) With the undercarriage fully up, the position of the roller on the cam ramp is not critical provided the undercarriage and door operation sequence is correct. It is probable the the roller will not reach the top of the ramp.

◀ *(2) With the undercarriage locked in the down position the clearance between the striker pin and the micro switch plunger should be 0·025 to 0·060 in.*

(13) Fit the rear fairing to the rear of the main-wheel unit and carry out a normal retraction test. Check that the undercarriage and door operate correctly and that the appropriate indication is given on the cockpit indicator.

(14) Charge the bogie trim jack to the correct pressure (Sect.2, Chap.2).

(15) Carry out a further retraction test and check all operations as in ▶ op.(13).

Cam replacement
81A. To fit a replacement operating cam for the P.U. ↑ and S.U. ↑ micro switches proceed as follows:-

(1) With the main-wheel unit operating jack adjusted in accordance with the instructions in para.76, connect a test console, (Ref.No. 26DC/95216), and a hydraulic servicing trolley to the aircraft.

(2) Position the cam on the undercarriage pivot tube with the ramp at the front at its maximum possible distance from the lever roller. Secure the cam using the attachment bolts in the front and rear slots in the cam.

NOTE...
The cams are handed, port (Ref. No. 26DC/2649) and starboard (Ref.No. 26DC/2650), and must not be confused with the restrictor valve operating cams which are located adjacent to the micro switch cams but have longer ramps.

◀ (3) Adjust on the micro switch striker pin to give a clearance between the striker pin and the micro switch plunger as in para.81 (6)(b). ▶

(4) Using the test console, the hydraulic servicing trolley and the hand pump on the servicing trolley position the undercarriage as in para.81 op.(6)(d)

(5) Move the cam round the undercarriage pivot tube until the micro switch is just operated and tighten the two end bolts. Lower the undercarriage.

(6) Establish the position of the centre attachment bolt hole on the cam. Remove the cam and drill the hole using a 4·9 mm. drill.

(7) Fit the cam to the pivot tube using the three attachment bolts and lock the bolts using 22 s.w.g. locking wire, (Ref.No. 30A/3339).

(8) Carry out a retraction test, check for correct operation and adjust, as necessary, as given in para.81.

Nose-wheel unit
Jack
82. The extended attachment pin hole centres of the nose-wheel unit jack are normally set to 47·02 ± 0·13 in. This is a manufacturers setting and should not normally require alteration. Should the length of stroke of the jack be suspect, or after any servicing operation which may have affected its travel, adjust, as necessary, as follows:-

(1) Adjust the fuel load to approximately 40 per cent then jack and trestle the aircraft in accordance with the instructions given in Sect.2, Chap.4 of this Book.

(2) With the nose-wheel unit fully down and locked (cockpit indicator showing green) disconnect the jack from its point of attachment to the nose-wheel unit.

(3) Using a hydraulic servicing trolley, fully extend the jack by pressing on the rubber-capped solenoid of the control valve. This valve is the centre valve on the hydraulic components panel on the port side of the nose-wheel unit compartment.

(4) Using the spanner (Dowty Part No. ST2141) adjust the end of the jack until the attachment bolt can be freely inserted through the holes in the eye-end and the attachment lugs on the body of the nose-wheel unit. Ensure that the retracting strut cross-shaft lever pin is at the

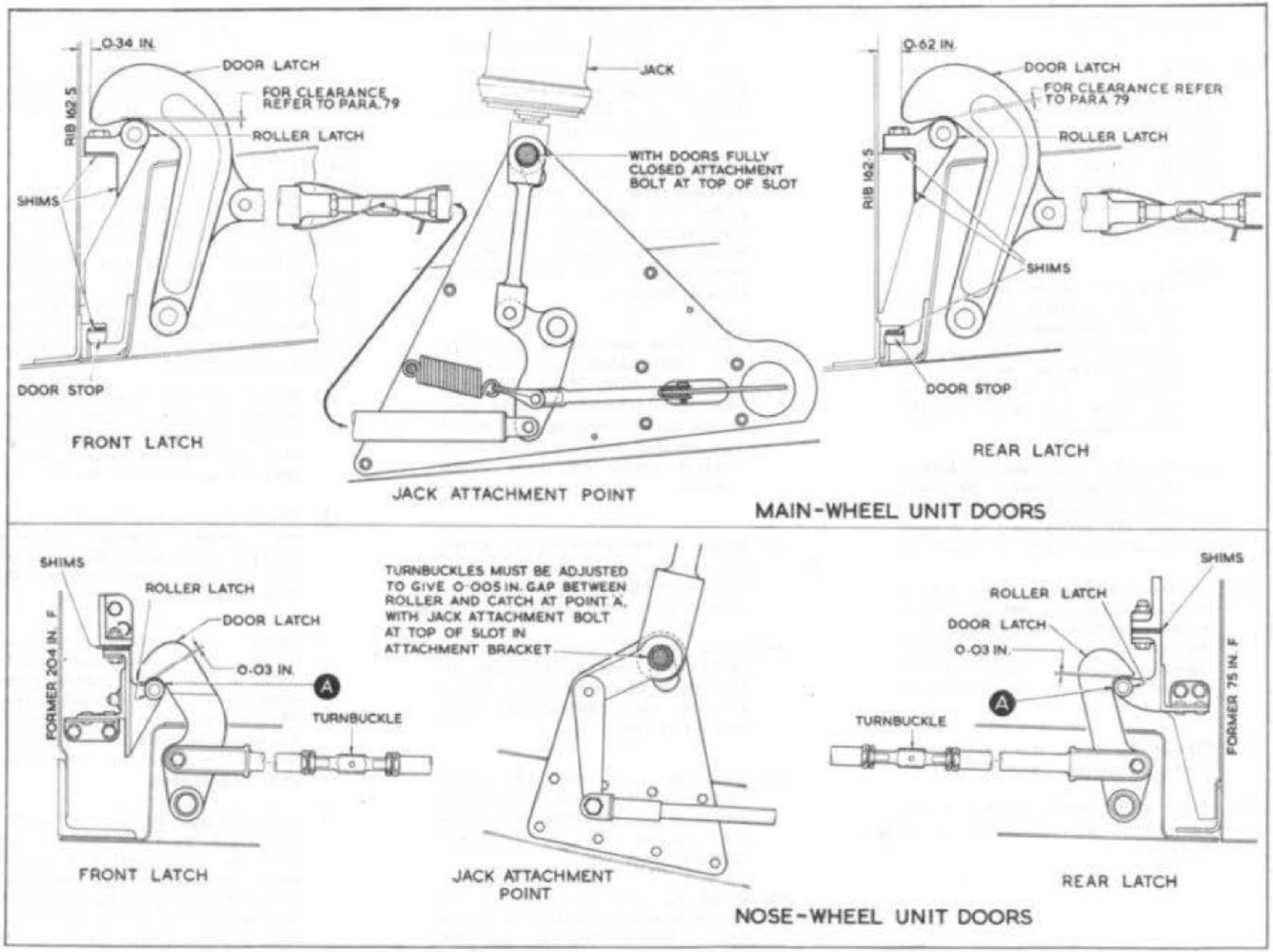


Fig. 9. Door latching mechanism settings

bottom of the jack attachment lever slot when carrying out adjustments to the eye-end.

(5) Remove the eye-end attachment pin and adjust the eye-end to give 0·05 to 0·06 in. override. Measure the distance between the attachment pin hole centres.

(6) Positively wire-lock the eye-end locknut and spanner-grip. Note that the locking wire must not interfere with the jury strut stop faces.

(7) Fully retract the jack using the hydraulic service trolley and by pressing the solenoid on the selector valve.

(8) Measure the distance between the attachment pin hole centres, subtract this measurement from the measurement obtained in sub-para.(5), this will give the jack travel which should be 19·5 ± 0·2 in. Adjust if necessary, on the jack gland nut using C spanners (Dowty Part No. ST1512) and (Dowty Part No. ST1701) to obtain the correct jack travel.

(9) Extend the jack until the attachment bolt to the nose-wheel unit can be inserted.

(10) Disconnect the compartment door operating jacks from the doors.

(11) Fully retract the nose-wheel unit and the door operating jacks.

(12) Close one of the doors by hand, check that the nose-wheel unit wheels are clear of the door. Open the door and repeat on the other door.

(13) Lower the nose-wheel unit, extend and connect the door jacks. Lock all attachment points and adjusting points. Ensure that when being extended, the door jacks do not foul on the surrounding structure.

Door jacks

83. Should the setting of the door jacks be suspect, or, after any servicing operation which may have affected the settings, the jacks can be adjusted as follows:-

(1) Adjust the fuel load to approximately 40 per cent then jack and trestle the aircraft in accordance

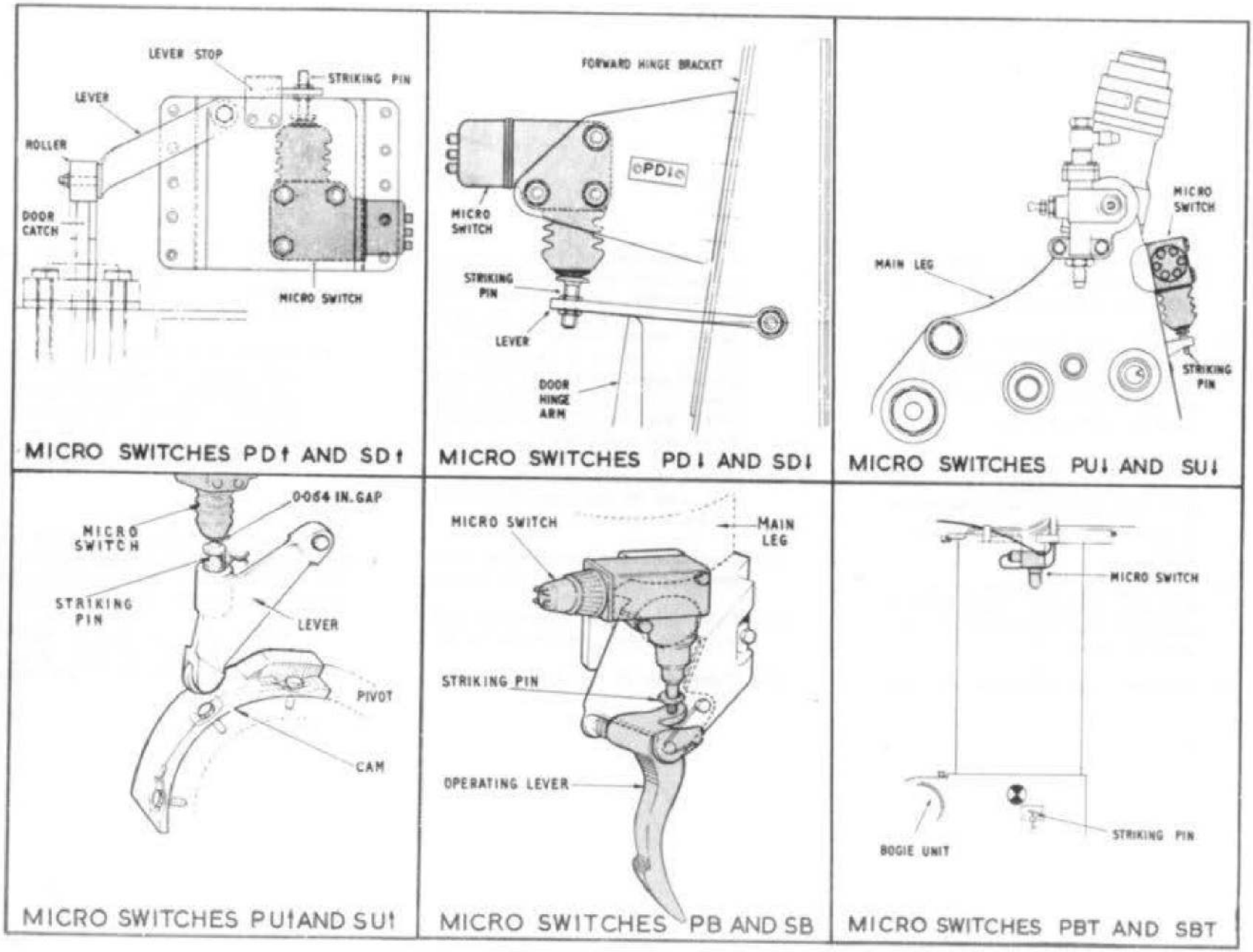


Fig. 10. Micro switch setting–main unit

RESTRICTED

with the instructions given in Sect.2, Chap.4 of this Book.

(2) Disconnect both door jacks from their points of attachment to the doors.

(3) With a hydraulic servicing trolley connected to the aircraft retract the nose-wheel unit by pressing on the rubber-capped solenoid of the control valve. This valve is the centre valve of the three valves on the nose-wheel compartment bulkhead.

(4) Retract the door jacks by pressing the door control valve solenoid. This valve is the starboard valve of the three valves on the nose-wheel compartment bulkhead.

(5) Close either one of the doors by hand so that the door latches engage with the catch plate rollers. When the door is fully closed, i.e., fitting flush with the surrounding structure, a clearance of 0·03 in. must exist between the door latches and the top of the catch plate rollers. Adjustment can be made on the shims between the catch plate and the top attachment angle to obtain 0·03 in. clearance.

(6) Adjust the fork-end of the jack so

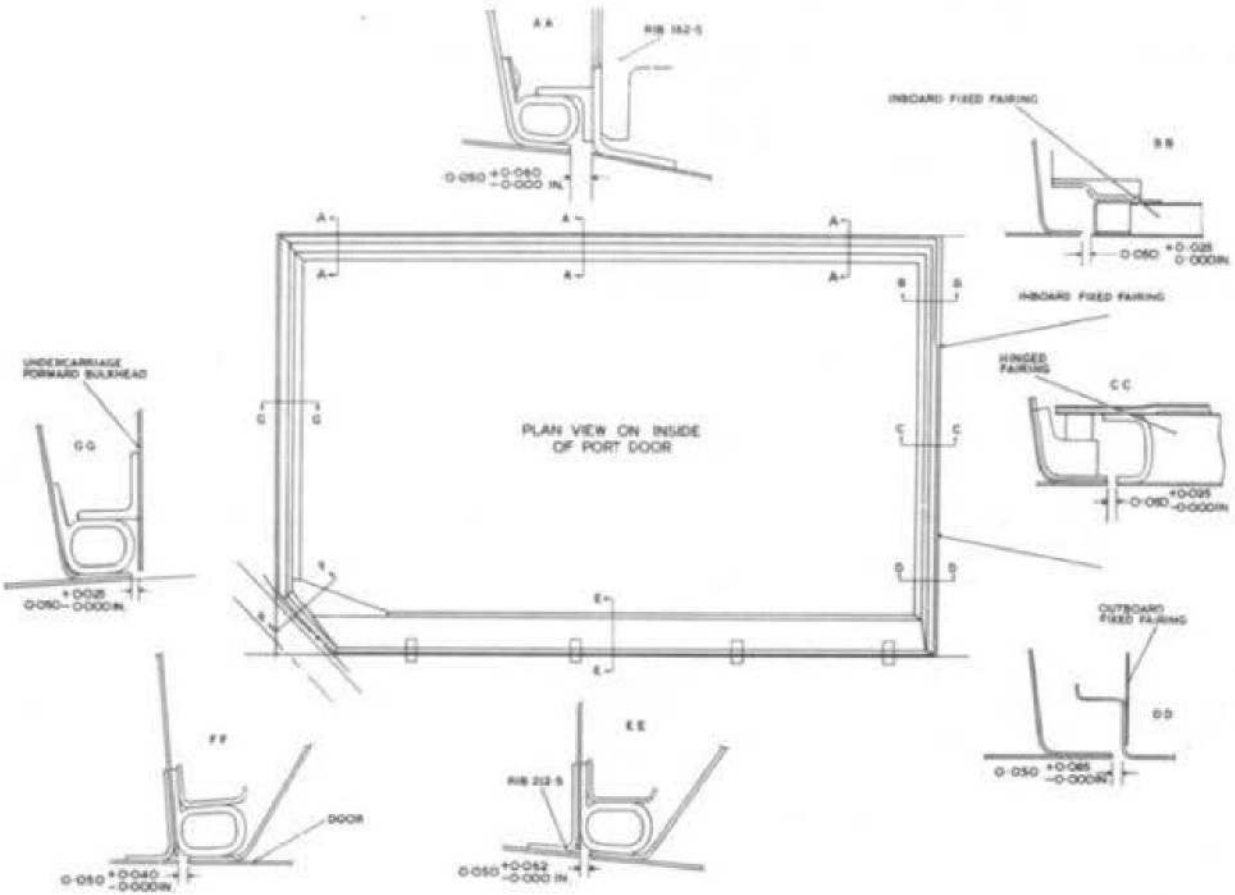


Fig.10A. Gap setting - main-wheel doors.

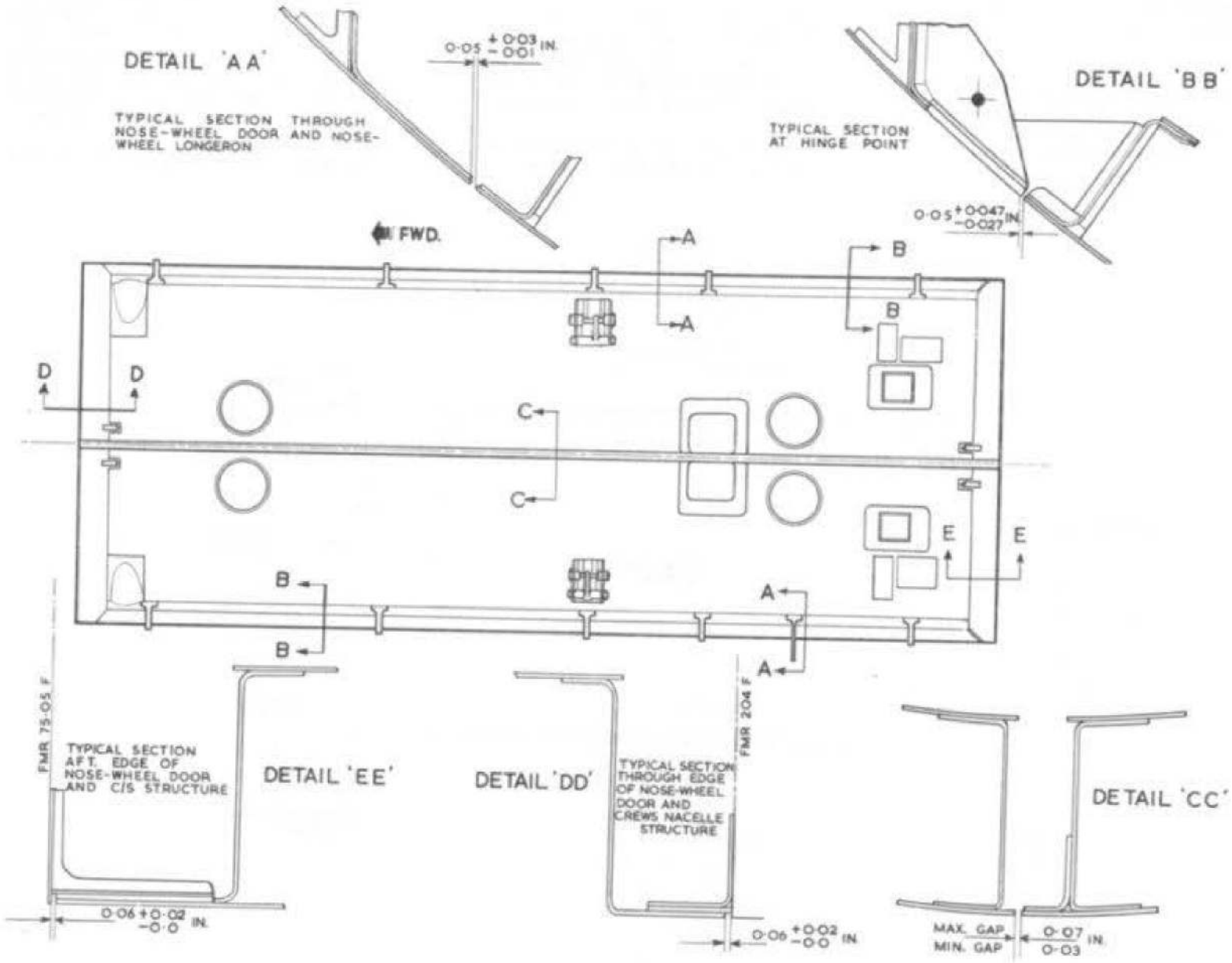


Fig.108 Gap setting- nose-wheel doors

RESTRICTED

that, when the jack is attached to the door, the attachment bolt is at the top of the slot in the door attachment point. Do not connect the jack to the door at this stage. After adjustment of the jack positively wire-lock the fork-end, the the locknut and the spanner-grip.

(7) Open the door by hand. Repeat op.(5) and (6) on the remaining door and open the door by hand.

(8) Extend the door jacks by operating the control valve. Ensure that, when extending, the jacks do not foul the surrounding structure. Connect the jacks to their respective doors.

(9) Lower the nose-wheel unit by operating the control valve solenoid.

(10) Carry out a retraction test on the nose-wheel unit and check the doors for correct closing.

Door latching mechanisms

84. Adjustment to the nose-wheel door latching mechanism can be made on the linkage rod turnbuckles with the circular access panels on both doors removed.

85. When fitting a replacement door, or, when the latching mechanism setting is suspect, adjustment is carried out as follows with reference to fig.9.

(1) Adjust the fuel load to approximately 40 per cent then jack and trestle the aircraft in accordance with the instructions given in Sect.2, Chap.4 of this Book.

(2) Disconnect the door hydraulic jacks from their attachment points on the doors. Refit the attachment bolts and distance pieces to the door attachment points.

(3) With a hydraulic servicing trolley connected to the aircraft, retract the nose-wheel unit and the nose-wheel door operating jacks.

(4) Remove the circular access panels from both doors to gain access to the latching mechanism adjusting turnbuckles.

(5) Remove the locking wire and slacken the locknuts on the adjusting turnbuckles

(6) Adjust the turnbuckles as far as possible to shorten the linkage rods.

(7) Close one of the doors by hand, ensure that no fouling occurs and that the gaps between the door outer skin and the fuselage outer skin are as shown on fig.10B. Retain the door in the fully closed position.

(8) Adjust on the turnbuckle so that the door latches assume the locked position over the catch plate rollers, leaving a gap of 0·005 in. between the door catches and the catch plate rollers as illustrated on fig.9.

(9) Tighten the turnbuckle locknuts.

(10) Manually operate the latching mechanism at the jack attachment point. It is important that the door latches move simultaneously with the jack attachment point, and that when the jack attachment bolt reaches the bottom of the slot in the jack attachment brackets the door latches are clear of the catch plate rollers.

(11) Lower the door by hand.

(12) Repeat op.(7) to (11) on the remaining door.

(13) Check the door jack settings as laid down in para.83 of this chapter.

(14) With both doors open extend the door jacks, ensure that they clear the surrounding structure, and connect them to the doors.

(15) Lower the nose-wheel unit.

(16) Carry out a retraction test on the nose-wheel unit, check the doors for correct operation and check that the gap between the doors is as shown on fig.10B.

(17) Wire-lock the latching mechanism adjusting turnbuckles and replace the circular access panels.

Micro switch setting

86. The nose undercarriage micro switches must be set to give correct operation of the nose-wheel unit and the nose-wheel doors under the following conditions. The aircraft must contain a fuel load of approximately 40 per cent and be jacked and trestled in accordance with the instructions given in Sect.2, Chap.4 of this Book. A hydraulic servicing trolley must be connected to the aircraft and the test console (Ref.No.26DC/95216), together with the necessary ground electrical supplies, must be available for use during the tests. After adjustment ensure that each striker assembly is secure and correctly locked.

(1) Ensure that the nose-wheel unit is locked DOWN, the doors are fully OPEN and that their operating jacks are fully pressurised.

(2) Locate the two N.D. ♦ (nose door open) micro switches and adjust their strikers to provide an over-

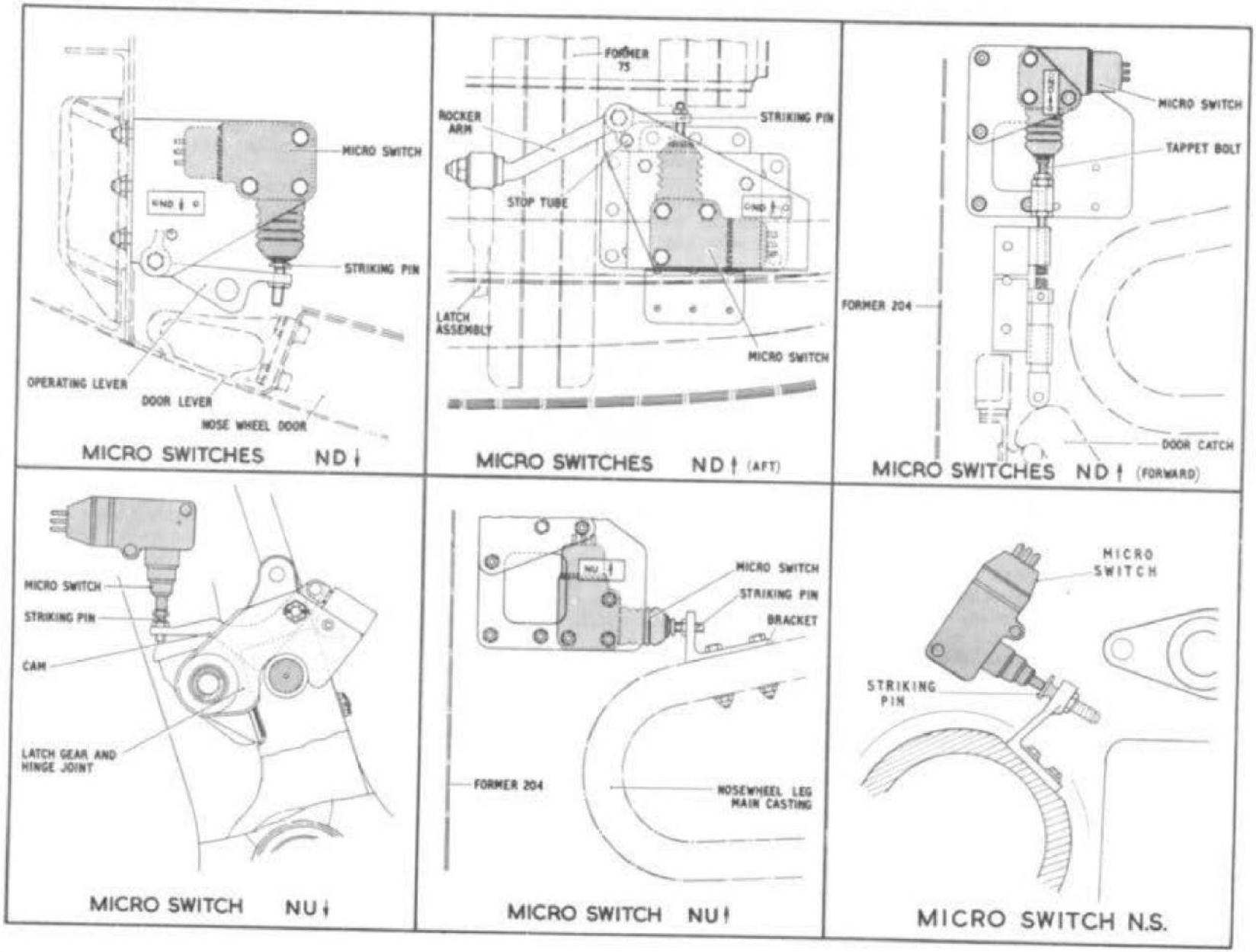


Fig.11. Micro switch setting—nose unit

RESTRICTED

ride of up to 0·20 in. maximum from the point of operation of the switches.

(3) Locate the N.U.↓ (nose unit down) micro switch and adjust the striker to provide an override of 0·15 in. from the point of operation of the switch.

(4) Locate the two forward N.D.↑(nose door up) micro switches and adjust their strikers to provide a gap clearance (between striker and switch) of 0·005 to 0·010 in.

◀ (5) Locate the N.S.A. (nose-wheel unit shock-absorber) micro switch and adjust the striker to provide an override of 0·15 in. from the point of operation of the switch.

NOTE . . .

The N.S.A. micro switch is only adjustable on aircraft with Mod.1638 embodied. ▶

WARNING . . .

Care must be exercised, when using the test console for nose-wheel unit tests, to ensure that unit and doors are not operated simultaneously. Reference must be made to the test console operating notes for the correct sequence of selection.

(6) Using the test console, retract the nose-wheel unit to the fully locked position.

(7) Locate the N.U.↑ (nose unit up) micro switch and adjust the striker to provide an override of 0·15 in. from the point of operation of the switch.

NOTE . . .

This is a nominal setting which may require slight variation to suit individual aircraft should contact occur between doors and unit.

(8) Disconnect the operating jack from one of the nose-wheel doors. Secure the jack to prevent damage being caused when the door system is operated.

(9) Using the test console, select nose-wheel doors CLOSE.

(10) Locate the aft N.D.↑ (nose door close) micro switch operated by the closed door and adjust its striker to provide an override of 0·20 in. from the point of operation of the switch. ▶

(11) Using the test console, select doors OPEN, ensure that the disconnected jack does not foul the aircraft structure.

(12) Connect the disconnected jack and disconnect the operating jack from the other door.

(13) Repeat op. (8) to (10).

(14) Connect the disconnected door operating jack.

(15) Using the test console, select nose-wheel unit DOWN.

(16) Disconnect the test console, restore the nose-wheel unit electrical system and connect a ground electrical supply to the aircraft.

(17) Carry out a normal retraction test using the hydraulic servicing trolley. Check that the nose-wheel unit and doors operate correctly and that the appropriate indication is given in the cockpit.

MAIN UNDERCARRIAGE REMOVAL

General

87. The method and sequence of removing a complete main undercarriage is given in the following paragraphs. The aircraft must be jacked and trestled in accordance with Sect.2, Chap.4 of this book. To remove the wheels only, the main-wheel unit can be jacked using a jacking bracket forward (Ref.No.26DC/95064), jacking bracket rear (Ref.No.26DC/95065), adapter heads Mk.104 (Ref.No.4Q/2663) and 15 ton pillar jacks (Ref.No.4Q/2657) as shown on fig.12. It is necessary to remove the stone guard from the bogie prior to fitting the forward jacking bracket.

REMOVAL AND ASSEMBLY

Wheels

88. To remove the main undercarriage wheels proceed as follows:-

(1) Release the brakes in the cockpit and lock the brake plates by tightening the piston rods using the special spanner (Ref.No. 27G/5457) and bar (Ref.No.27G/5458).

(2) Remove the axle nut securing bolt, washer and locking bar.

(3) Using the key spanner (Ref.No. 27Q/14258) and extension bar (Ref.No.27Q/11093) release and remove the axle nut and locking ring.

(4) Record the wheel positions. Slide the wheels off the axles.

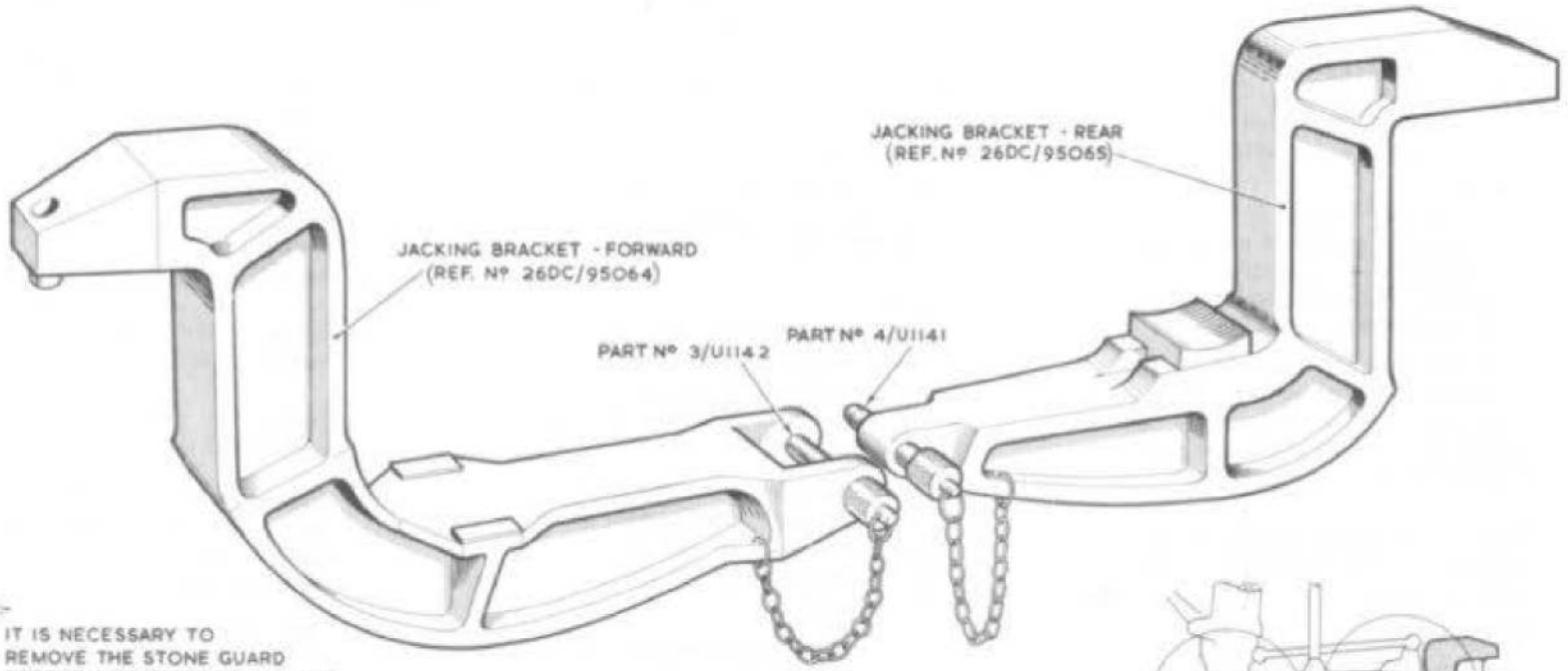
Main-wheel brakes

89. To remove the main-wheel brake units proceed as follows:-

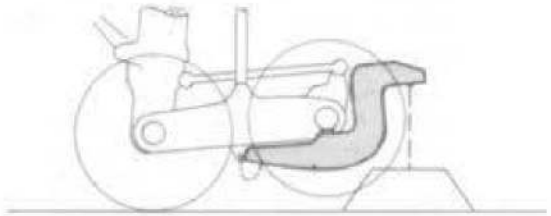
(1) Remove the inner wheel bearing bushes and pins.

(2) Ensure that the brake control in the cockpit is off and disconnect the brake pipes from the Maxaret units. Blank off all disconnected pipes.

(3) Disconnect the brake torque rods from the rear brake units by un-

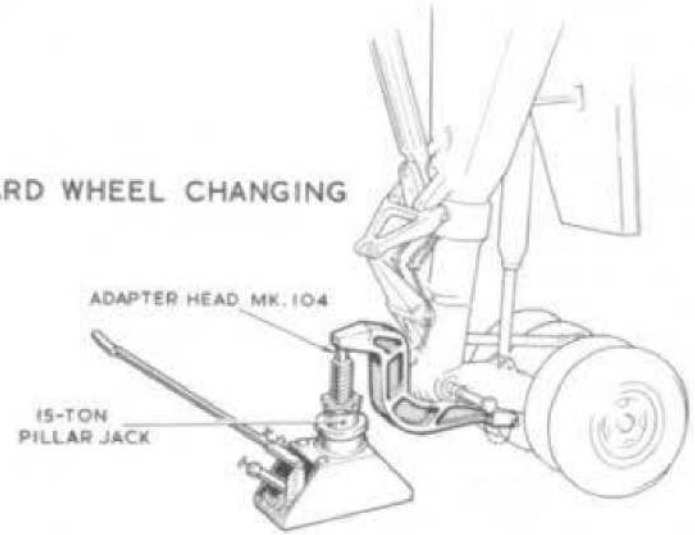


NOTE:-
IT IS NECESSARY TO REMOVE THE STONE GUARD BEFORE THE FORWARD JACKING BRACKET CAN BE PLACED IN POSITION.



REAR WHEEL CHANGING

FORWARD WHEEL CHANGING



WARNING:-
WHEN CHANGING WHEELS, ONLY ONE PAIR OF WHEELS IS TO BE JACKED AT A TIME. FRONT AND REAR WHEELS MUST NOT BE JACKED SIMULTANEOUSLY

Fig. 12. Jacking for main-wheel changing

RESTRICTED

screwing the torque rod pin retaining bolts, removing the brake pipe trunnions and the torque rod pins.

(4) Lift the torque rods clear of the rear brake units and remove the units from the axles.

(5) Disconnect the torque rod forward attachment points by removing the retaining bolt locking pins and removing the retaining bolts and nuts.

(6) Remove the forward brake units and torque rods from the axles.

(7) Refit the axle nuts, locking bars and securing bolts to the axles.

Main-wheel unit

90. To remove the main-wheel unit and strut proceed as follows with reference to fig.17. It is pointed out that the bracketed items only are illustrated on fig.16.

(1) Remove the panels to gain access to the main pivot bearings (Sect.2, Chap.4, Fig.1, Item 21).

(2) Disconnect the hinged fairing door spring – loaded struts from the fairing door.

(3) Remove the hinged fairing door hinge bolts and remove the door from the aircraft.

(4) Disconnect the electrical services multi-pin plug from the socket mounted on the main pivot shaft.

(5) Disconnect the six pipe unions of the swivel coupling unit on the undercarriage bay rear bulkhead. Blank off all connections and fold the pipes down.

(6) Remove the pin securing the jack to the main unit casting.

(7) Disconnect the hydraulic and emergency air pipes to the jack. Blank off all disconnected unions.

(8) Disconnect the jack from the strut cross member and remove the jack from the aircraft.

(9) Remove the slide bearing retaining pins from the down lock unit and withdraw the slide bearings. Retain the shims on their respective pins.

10 Disengage the engine bay vent operating arms situated on the outboard face of Nos.1 and 4 engine bay outboard ribs, this is effected by pulling out and rotating them through 90 degrees.

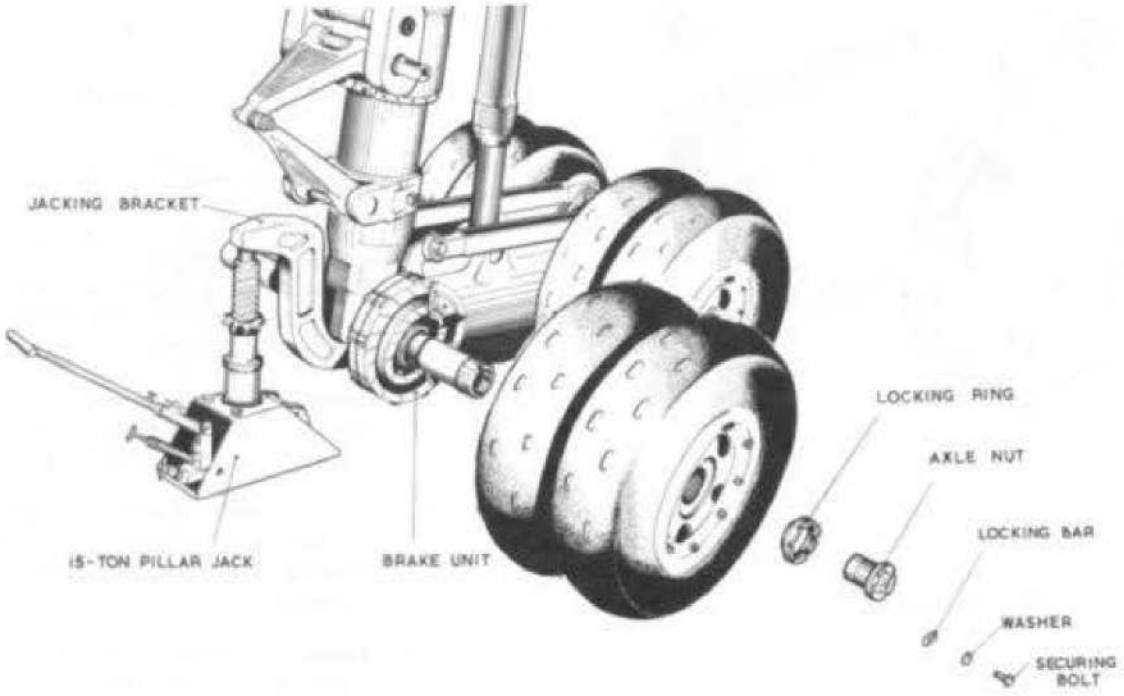


Fig.13. Main-wheel changing

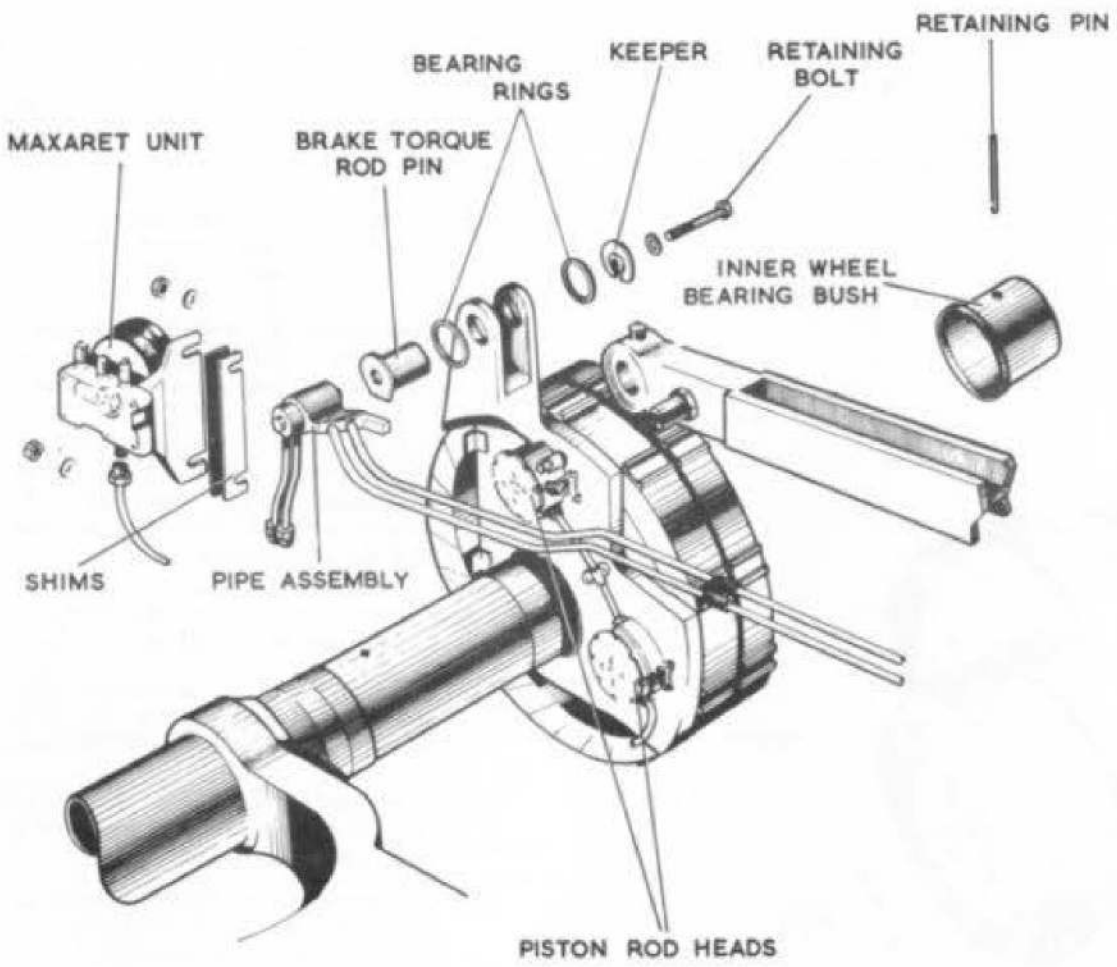


Fig.14. Removal of brake units

NOTE...
This is not applicable on aircraft with Mod.338 embodied.

(11) Suitably supporting the main unit remove the attachment pin securing the strut to the main unit.

12 Lift the strut clear of the main unit ensuring that the locking strut is clear of the down-lock unit. Secure the strut to the under-carriage bay jury strut.

13 Position the handling trolley 26DC/95149 fitted with the main-wheel unit support frame 26DC/95016 to the rear of the main unit and secure the front axle to the frame clamping blocks.

14 Pump up the support frame so that it takes the unit's weight.

(15) Remove the split pins and nuts retaining the outboard main pivot bearing half cap, remove the half cap complete with the lower half of the split bearing.

(16) Remove the wire-locked stud bolts locating the inboard main pivot bearing bush in the half cap.

(17) Remove the split pins and nuts retaining the inboard main pivot bearing half cap. Remove the half cap.

18 Lower the support frame slowly and move the trolley forward as the unit clears the pivot bearings.

19 Move the trolley clear of the aircraft.

20 Disconnect the pipes to the under-

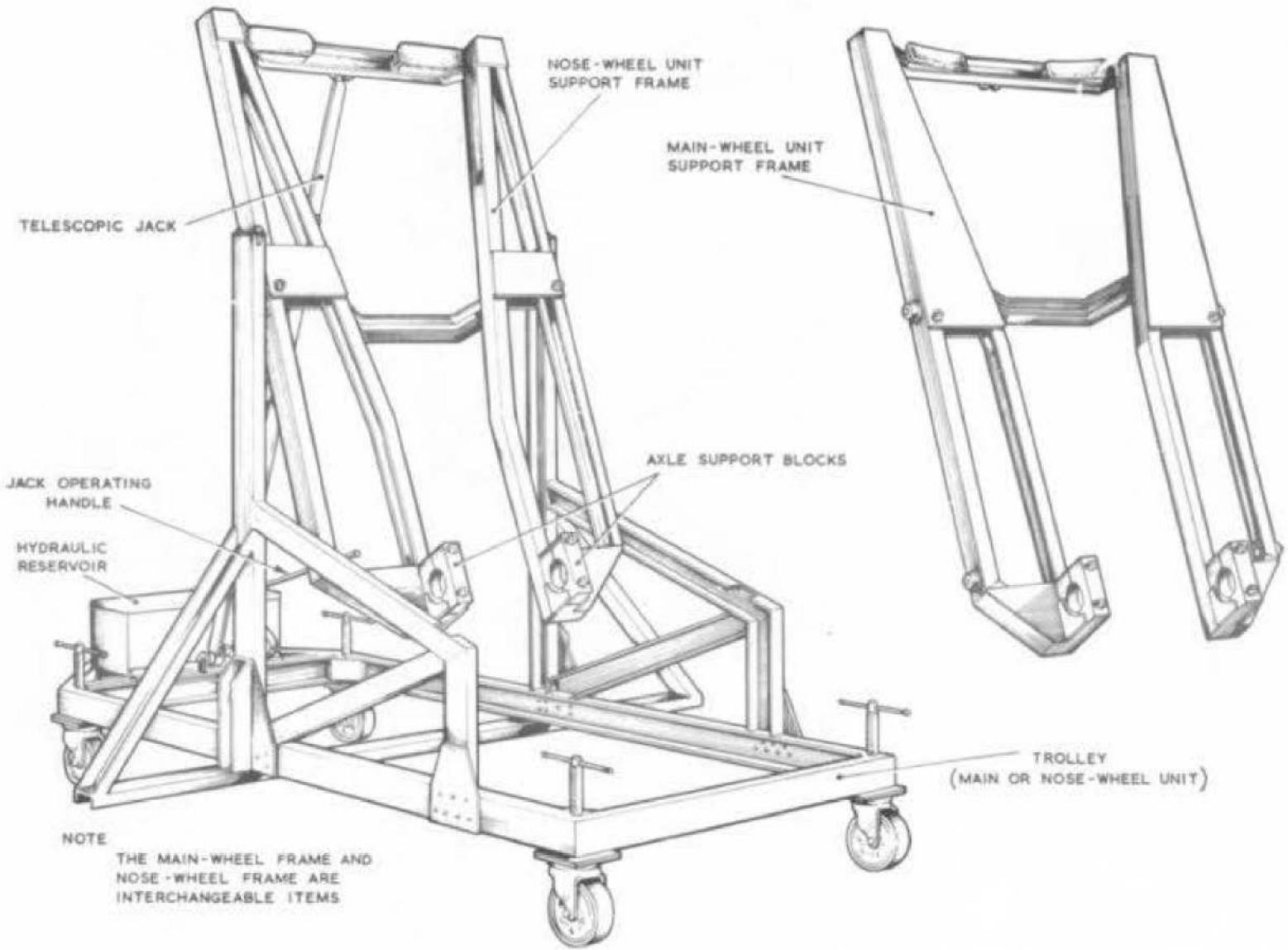


Fig. 15. Alighting gear trolley

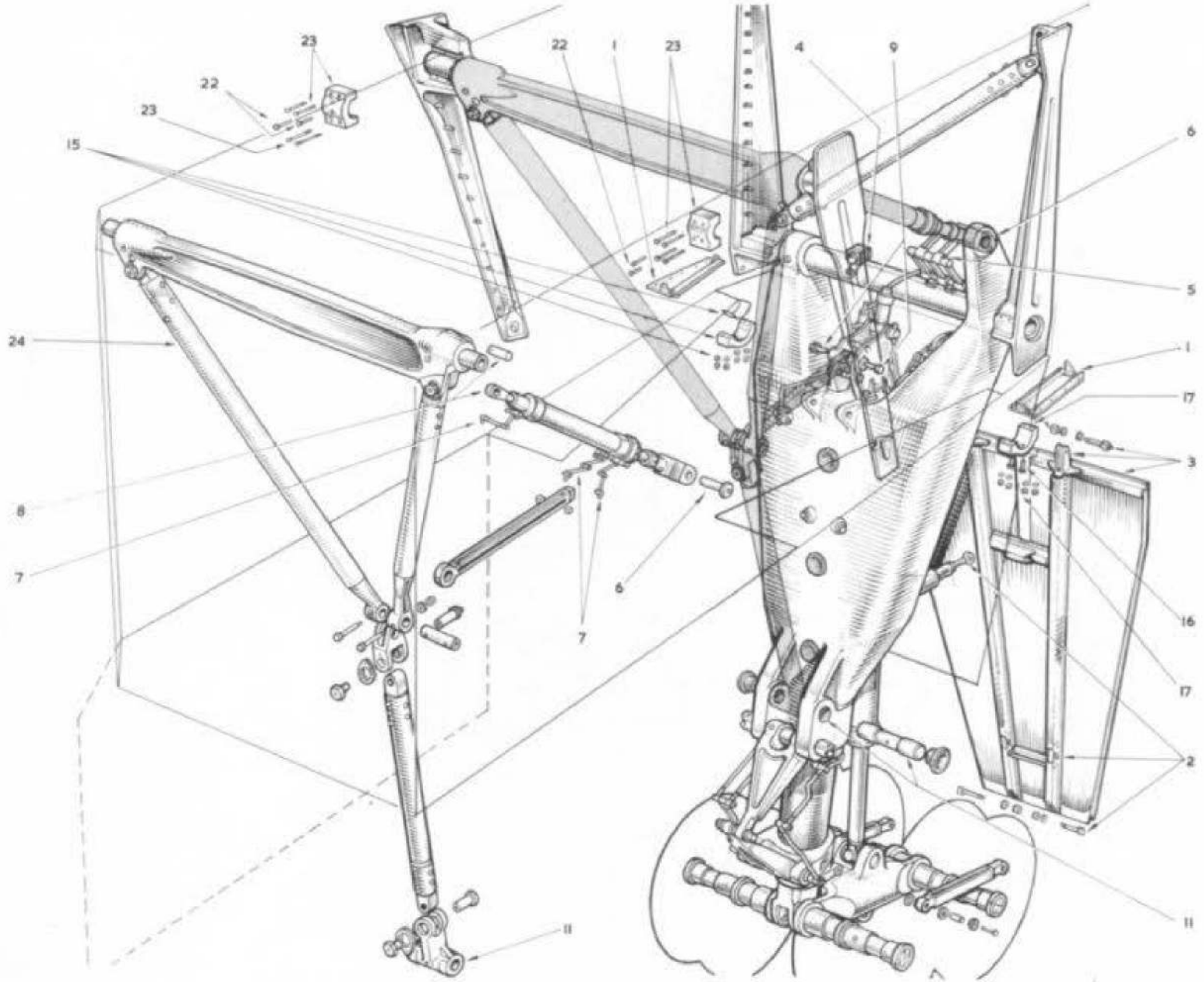


Fig. 16. Main-wheel unit removal

carriage bay door rear operating jack. Blank off the disconnected unions.

21 Disconnect and remove the door jack from the aircraft.

(22) Remove the wire-locked stud bolts from the retracting strut cross member pivot bearing half caps.

(23) Remove the split pins, nuts and bolts securing the retracting strut cross member pivot bearing half caps. Remove the half caps.

(24) Lower the strut and remove it from the aircraft.

NOTE...
In order to prevent damage to the main unit inboard bush, and the strut cross member pivot bearing bushes, it is imperative that the wire-locked stud bolts are removed prior to the loosening and subsequent removal of the half cap retaining nuts and bolts and the half caps.

MAIN UNDERCARRIAGE ASSEMBLY

Main-wheel unit

91. The assembly of the main-wheel unit and strut to the aircraft is a reversal of the operations given in para.90. The half cap securing bolts are to be treated with Celloseel (Ref. No. 33H/113) and torque loaded as follows:-

Main unit pivot bearing outboard	83 - 101 lb.ft.
Main unit pivot bearing inboard	52 - 64 lb.ft.
Strut cross member outboard bearing	35 - 43 lb.ft.
Strut cross member inboard bearing	52 - 64 lb.ft.

92. When engaging the lock strut in the down-lock unit proceed as follows:-

(1) Screw the lock pins, fitted with with laminated shims under the heads, tightly into the side plates of the down-lock unit and check the dimension between the end faces of the pins. Adjust, if necessary, the laminated shims to obtain a dimension of 0·415 to 0·42 in. The laminations of the shim are 0·002 to 0·003 in. thick. Check the dimension from the inner face of each side plate to the end face of the lock pins, this must be equal to within 0·002 in.

(2) Remove the lock pins, complete with shims. Fit the slide bearings in the grooves of the lock strut and engage the lock strut in the down-lock unit.

(3) Screw the lock pins, complete with shims, into the down-lock unit side plates, at the same time engaging the ends of the lock pins in the slide bearings. Tighten the lock pins and wire-lock the heads to the adjacent spacer securing bolts.

93. On completion of assembly, including brakes and wheels, carry out the following in accordance with Sect.3, Chap.6.

(1) Check the bogie trim jack.

(2) Bleed the hydraulic system.

(3) Bleed the brake system.

(4) Carry out an undercarriage retraction test.

NOTE...
Both main-wheel unit shock-absorbers must be checked after replacement of one main-wheel unit to ensure that both shock-absorbers are pressurised to 1,300 ±50 p.s.i.

Main-wheel brakes

94. To fit the brake units to the main-wheel unit proceed as follows:-

(1) Remove the securing bolt, washer, locking bar, axle nut and locking ring from the axles.

(2) Slide the front brake units on to the axles, and fit the inner wheel bearing bushes and retaining pins.

(3) Assemble the brake units and torque rods to the main-unit fittings using the torque pins and the retaining nuts and bolts.

(4) Torque load the retaining nuts and bolts to 200 lb. in. and lock.

(5) Connect the brake pipes to the Maxaret units.

(6) Fit the rear brake units on to the axles, and fit the inner wheel bearing bushes and retaining pins.

(7) Assemble the torque rods, torque rod pins, pipe assembly trunnions, and the retaining bolts and washers to the brake units.

(8) Connect the brake pipes to the Maxaret units.

Wheels

95. To fit the wheels to the main unit proceed as follows:-

(1) Lightly lubricate the axle using grease XG-277.

(2) Using the spanner, (Dunlop Part No.AC.10185 or AC.101086) slacken the brake unit piston rods sufficiently to enable the friction plates to be moved manually.

(3) Using the brake alignment fixture, (Ref.No. 27G/5590), align the brake plate tenons and tighten the brake unit piston rods. Remove the brake alignment fixture.

(4) Fit the wheels on to the axles, ensuring that no damage occurs when engaging the brake plate tenons with the wheels.

(5) Fit the locking ring to the axle, the minimum permissible engagement between the axle and the locking ring is 0·05 in.

(6) Release the brakes by unscrewing the brake unit piston rods, fit the axle nut and tighten using the key spanner, (Ref.No.27Q/14258) and extension bar, (Ref.No.27Q/11093).

(7) The axle nut must be turned back 30 to 60 deg., from the fully tight position to allow the locking bar to be fitted in the slots in the axle nut and locking ring. Check that the wheel rotates freely.

(8) Secure the locking bar with the securing bolt and washer. Wire-lock the securing bolt to the locking bar.

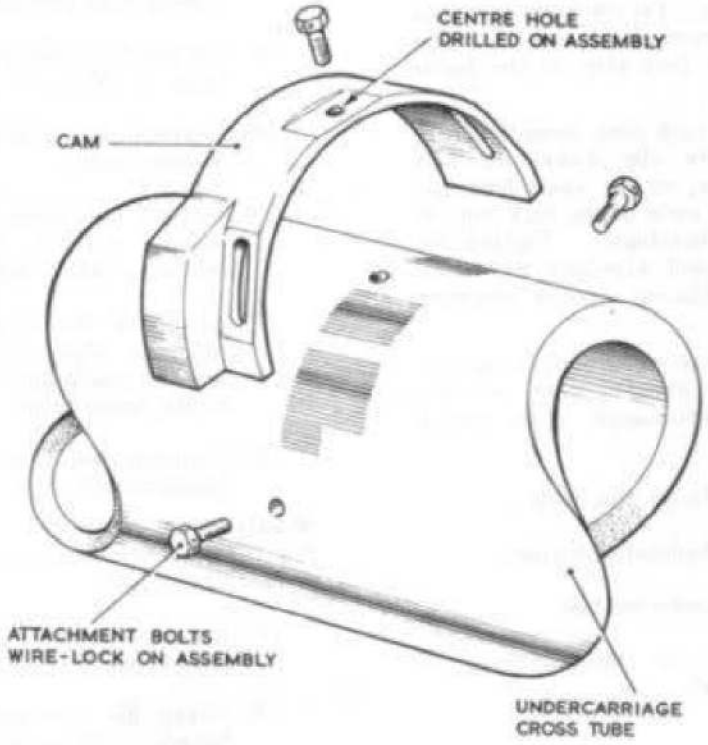


Fig.17. Main-wheel unit micro-switch cam.

(9) Tighten the brake unit piston rods then unscrew them nine complete slots (1⅛ turns) or to the next slot if necessary.

(10) Check that the Maxaret unit tyres 'flat' contact with the main unit is 0.875 ± 0.125 in. Add or remove shims from under the Maxaret unit mounting, as necessary, to obtain the correct measurement.

(11) Ensure that the main wheel and the Maxaret unit wheel rotate freely.

Doors

96. The main-wheel unit compartment door position is governed by the datum hinge, (fig.2, detail A). On post Mod.1907 aircraft the two Glacier thrust washers at the front of the hinge must be fitted with the P.T.F.E. faces to the outside. The packing washer at the rear of the hinge may be filed, if necessary, to ensure that, after tightening the hinge bolt, the hinge moves freely with no fore-and-aft movement and with no tightening up on the two thrust washers.

NOSE UNDERCARRIAGE REMOVAL

General

97. The procedure and sequence for the removal of the complete nose-wheel undercarriage is given in the following paragraphs. The aircraft must be jacked and trestled in accordance with Sect.2, Chap.4 of this Book. It must be noted that where the wheels only have to be removed the nose-wheel unit can be jacked utilising a pillar jack, (Ref.No.4Q/1309) and an adapter head Mk.104 (Ref.No.4Q/2663).

Wheels

98. The sequence of operations for nose wheel removal is as follows:-

(1) Remove the locking bolts and washers securing the axle nuts.

(2) Unscrew the axle nuts using the key spanner, (Ref.No.27Q/17044), and the extension bar, (Ref.No. 27Q/11093).

(3) Record the wheel positions. Remove the wheels from the splined axles.

(4) Fit the axle nuts and locking bolts to the axles.

Nose-wheel unit

99. To remove the nose-wheel unit and strut from the aircraft proceed as follows:-

(1) Disconnect the jacks from the nose undercarriage bay doors.

(2) Remove the door hinge attachment bolts and remove the doors from the aircraft.

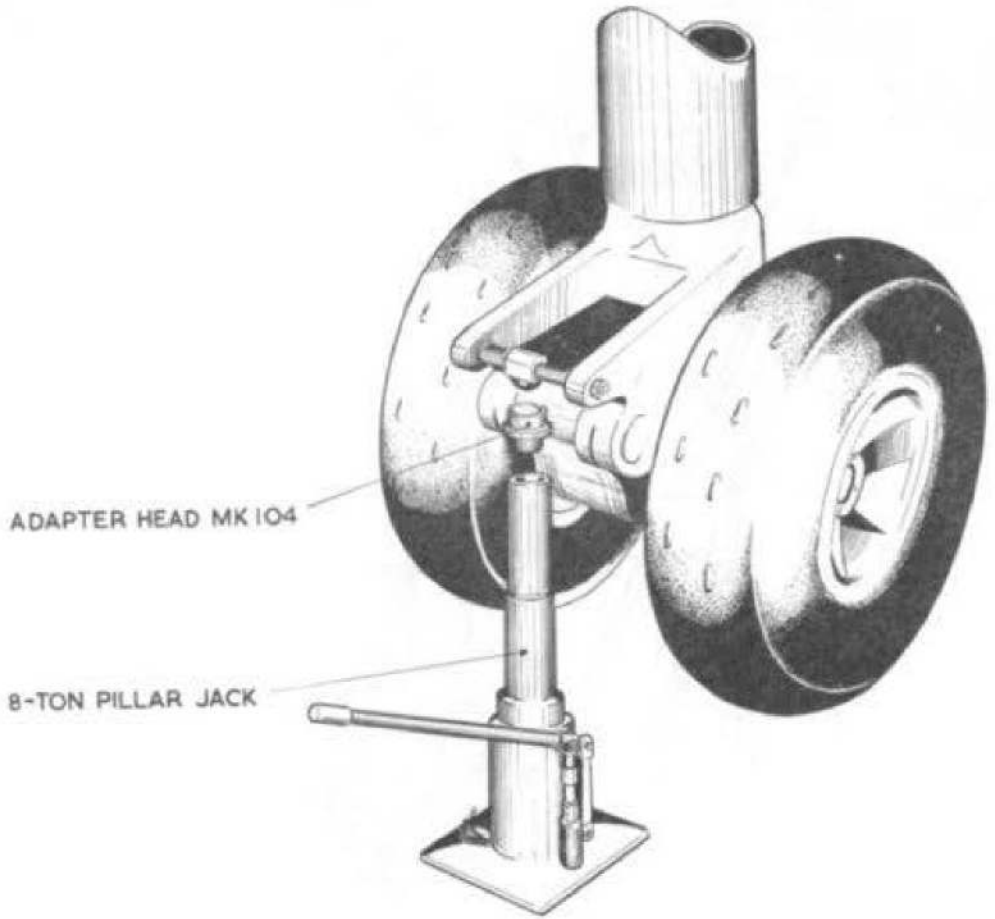


Fig.18. Jacking for nose-wheel changing

(3) Remove the panels to gain access to the nose-wheel unit pivot bearings (Sect.2, Chap.4, Fig.1, Item 4).

(4) Disconnect the cable from the intercom. plug, withdraw the cable from the conduit and coil and secure the cable clear of the unit.

(5) Release the screws and remove the conduit from the unit.

(6) Disconnect the down-lock micro switch electrical cable at panel 13P on the port side forward in the nose-wheel bay. Coil the cable and secure it to the unit.

(7) Remove the split pin and washer from the pin securing the jack to the nose-wheel unit and remove the pin.

(8) Disconnect the jack hydraulic and emergency air swivel pipes from the nose-wheel bay roof and the pressure bulkhead. Blank off the disconnected unions.

(9) Remove the split pin and nut from the pin securing the jack to the retracting strut. Remove the securing pin and remove the jack from the aircraft.

(10) Disconnect the pneumatic by-pass valve operating rod from the strut cross member.

(11) Remove the split pin, nut and pin securing the strut to the drag stay. Secure the strut clear of the nose-wheel unit.

(12) Remove the split pin, nut and taper pin securing the torque linkage to the nose-wheel steering follow-up tube.

(13) Disconnect the hydraulic swivel

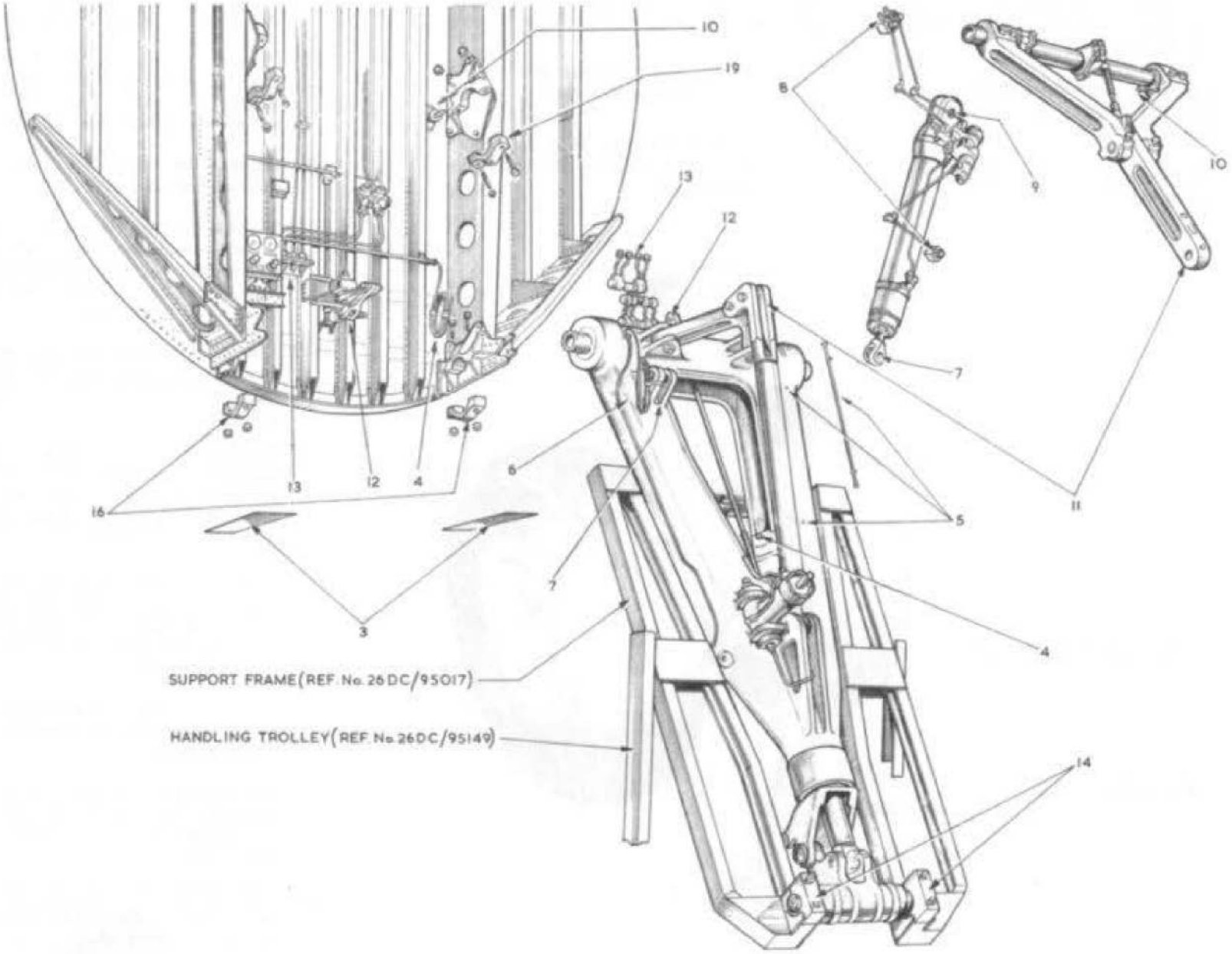


Fig. 19. Nose-wheel unit removal

pipe couplings on the pressure bulkhead. Blank off all disconnected unions and fold the swivel pipes down.

(14) Position the handling trolley (Ref.No.26DC/95149) fitted with the nose-wheel unit support frame (Ref.No.26DC/95017) and secure the nose-wheel unit axle to the support frame clamping blocks.

(15) Pump the support frame into position to take the weight of the unit.

(16) Remove the split pins, nuts and bolts securing the main pivot bearing half caps. Remove the half caps.

(17) Lower the support frame slowly, move the trolley rearward as the unit clears the pivot bearings.

(18) Move the trolley complete with the unit clear of the aircraft.

(19) Remove the split pins, nuts, bolts and studs securing the strut cross member pivot bearing half caps. Remove the half caps.

NOTE . . .
On aircraft with Mod.690 embodied, studs replace the forward retaining bolts of the retracting strut pivot bearing half caps.

(20) Lower and remove the retracting strut from the aircraft.

NOSE UNDERCARRIAGE ASSEMBLY

Nose-wheel unit

100. Assembly of the nose-wheel unit to the aircraft is a reversal of the sequence given in para.99. During assembly the following operations must be carried out.

(1) The main unit bearing half cap retaining bolts must be coated with Celloseel (Ref. No. 33H/113) and fitted with a special washer (Ref. No. 26DC/17359) fitted under the head with the chamfer towards the head. The bolts must be torque loaded to 270 to 330 lb.ft. and locked with split pins.

(2) The retracting strut pivot bearing retaining bolts and studs must be coated with Celloseel and torque loaded to 180 to 220 lb.ft. and locked with split pins. To torque load the retaining studs, hold the top nut, which is locked with a split taper pin, and tighten the lower nut. To torque load the bolts, it is permissible to hold the nut and tighten on the bolt head. If, due to inaccessibility it is found impossible to carry out the torque loading, it is permissible to tighten the bolts and studs using conventional spanners. Care must be taken to ensure that the studs and bolts are uniformly tightened, overtightening is avoided and damage to the half caps and forgings does not occur.

(3) Prior to attaching the jack to the nose-wheel unit, bleed the hydraulic system and check the jack override in accordance with para.82 of this chapter.

(4) After assembly of the wheels to the unit, carry out a retraction test and check for correct operation and sequence.

(5) Check the nose-wheel steering for correct functioning and full movement.

Wheels

101. To assemble the wheels to the nose-wheel unit proceed as follows:-

(1) Remove the locking bolts, washers and axle nuts from the axles.

(2) Lightly lubricate the axles using grease XG-277.

(3) Fit the wheels to the splined axles.

(4) Fit the axle nuts and tighten as far as possible using the key spanner, (Ref.No.27Q/17044) and the extension bar (Ref.No.27Q/11093), until one of the four tapped holes lines up with the slot on the axle.

(5) Fit the locking bolts and washers and wire-lock the bolts to the axle nuts.