Chapter 14 FLAP GEARBOX

(Completely revised)

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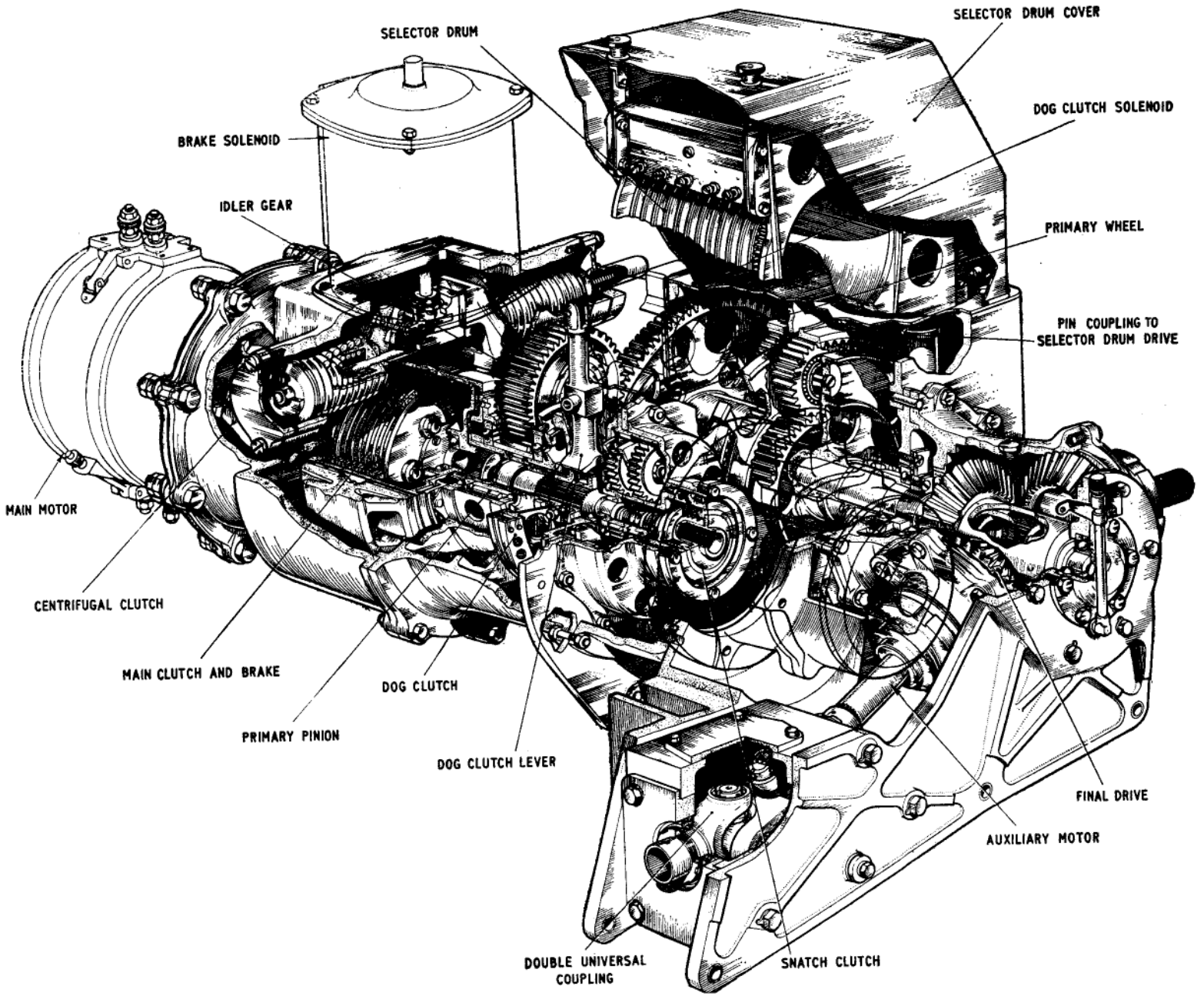


Fig. 1. Flap gearbox

DESCRIPTION

1. The flap gearbox (*fig.* 1) transmits the power of the operating motor to the flap mechanism through a train of epicyclic gears. It also rotates a drum assembly on which cam-operated microswitches are set to shut off the motor and apply a brake when the flap has reached the end of its selected travel.

2. There are two methods of operation, each having its own driving motor. One, the main, is controlled from a lever on the right-hand side of the pilot's control pedestal; the other, the auxiliary, is controlled from a switch on the left-hand side of the pedestal. The auxiliary drive is provided to operate the flaps in the event of a breakdown of the main motor. For wiring instructions and details of the gearbox electrical components see Sect. 5, Chap. 2, Group 4.

3. The unit casing (*fig.* 19) is in four sections; the central casing, the diaphragm plate, the end casing, and the cover plate. The selector drum assembly is mounted on top of the gearbox, under a light-alloy cover.

4. The main drive shaft rotates the primary drive through a clutch and brake mechanism. The primary drive is assembled on the main shaft and drives a two-stage epicyclic gear, the final stage of which is splined to the shaft. A train of gears, operating from a pinion wheel keyed to the output stage, rotates the selector drum.

5. The auxiliary drive engages the primary drive through a snatch clutch, two stages of epicyclic gearing and a flexible dog clutch, and is put into operation by a solenoid-operated lever which controls the engagement of the dog clutch.

MAIN DRIVE UNIT

6. The main drive unit comprises the main driving motor, the centrifugal clutch, the main clutch, and the brake. The motor and the brake operating solenoid are bolted to a housing which encloses both clutches and is itself bolted to the gearbox central casing.

Motor

7. For a description of the motor and details of its servicing see A.P.4343.

Centrifugal clutch

8. The centrifugal clutch is interposed between the main motor and the main clutch. It is bolted to the driving shaft of the motor and is contained in, and acts against, a drum which incorporates a serrated spindle that transfers the drive to the main clutch.

9. The clutch consists of a driving boss, on the pins of which are mounted four bonded-asbestos lined shoe quadrants. The quadrants are retained in position by four coil springs which act as return springs when the motor power has been cut off.

Main clutch

10. The main clutch consists of a drum encasing a plate assembly. The outer surface of the drum forms a bearing surface for the brake shoes and the bore is slotted axially to take the eight outer clutch plates. A serrated spigot is machined at one end of the drum to mesh with the primary assembly.

11. The driving spindle rotates in two ball bearings, one housed in the drum and the other in the cover plate which closes the end of the drum. The spindle is splined to form a mounting for the inner and end clutch plates which are held in position by retaining plates screwed to the spindle. The spindle bore is serrated to take the drive from the centrifugal clutch shaft.

12. The plates are held in contact by the compression of six coil springs. The springs, encased in collars, pass through the plates; a bolt through the centre of each spring can be used to vary the compression in the springs, thereby adjusting the torque.

Brake

13. When applied, the two bonded-asbestos lined brake shoes stop the rotation of the main clutch and, in turn, the primary drive pinion, by contacting the drum which forms the outer casing of the clutch. The shoes are pivoted about a single pin and a hinge block bolted to the clutch housing, and are linked by double coil springs which hold them in the "on" position.

14. The spring assemblies are supported by a screwed rod through the upper end of each brake which passes through both sets of springs and shoe. The inboard ends of the springs are capped by sockets which bear on thrust rings fitted in recesses in the shoes; the outboard ends of the springs fit into caps, one of which houses the stem of the spring compression adjusting nut.

15. Normally, the shoes bear on the outer surface of the drum and are withdrawn from contact by the action of the solenoid-operated roller block acting against track plates in the shoes. The solenoid plunger is connected to the roller block by an adjuster.

Primary pinion

16. This unit is housed in the central casing and forms the connection between the main and auxiliary drives and their means of operating the primary drive.

17. The centre piece, or driving sleeve, consists of a short shaft serrated internally to

receive the main clutch driving spigot and externally to take the primary pinion and the dog clutch inner plate. A self-lubricating bush is located in the bore to house the end of the auxiliary output planet carrier.

18. The sleeve rotates in two ball bearings retained in a housing bolted to the gearbox casing. A flange on the dog clutch inner plate restricts axial movement of one of the bearings while the other is held by a retaining plate, which is screwed to the housing, and a spacer ring that abuts a flange on the end of the sleeve. The retaining ring incorporates a synthetic rubber seal.

Idler gear

19. The drive from the primary pinion is transferred to the primary wheel through an idler gear which is mounted in the gearbox casing and rotates in two ball bearings.

Primary drive

20. The primary drive assembly incorporates both the primary wheel and the driving sun wheel for the main input planet carrier. The assembly rotates around the main shaft on two ball bearings. These are separated by a spacer and are secured axially, at one end by a seal abutting the output drive, and at the other by two circlips and another spacer.

Planet assemblies

21. Each assembly carries three planet wheels rotating on needle rollers. The input stage is driven by the primary sun wheel and meshes with the output stage. The latter rotates the main shaft through serrations in the bore of the planet carrier which engage with serrations on the shaft. The planets of both assemblies mesh with a fixed epicyclic drum which is bolted to the diaphragm plate.

SELECTOR DRUM

22. The selector drum assembly is bolted to the gear casing and when the drum is rotated it controls the current to the two driving motors and the brake solenoid. The assembly comprises: — a cylinder or drum mounted horizontally between two supports, the micro switches controlling flap selection, the switch operating rocker arms, and a local indicator. The two supports, or end mountings, are connected at the base by tie-rods and at the top by the rocker support brackets. The microswitches are supported by the rods which pass through them, the end mountings, the switch spacers and a brace bracket bolted to the rocker support brackets. Designation plates, marked to identify individual switches, span the end mountings.

23. In addition to the lettering on the designation plates, each station is marked by a coloured spot which, in conjunction with the coloured washers used in securing the cams, facilitates identification when making adjustments.

24. A gear ring mounted at one end of the drum, is driven by a spiral gear on the main shaft. Parallel grooves are machined around the outer surface of the drum to house the cams which contact the appropriate rocker arms and, through them, the microswitches. Each cam is curved to the contour of the groove and is secured by a stud passing into the cylinder through a slot in the groove. Slot lengths vary for individual cams to permit adjustment of the settings.

25. The support bracket at the gear ring end of the drum incorporates the driving mechanism for the selector drum and the local indicator. The spiral gear driving wheel is keyed to the output stage of the main epicyclic gear train. This, in turn, drives a wheel supported by its attachment to the gearbox cover plate. A coupling driven by the wheel is connected by a short shaft to a similar coupling at the base of the selector drum assembly. The latter, when rotated, turns a pinion that is meshed with the worm drive to the drum and the drive for the local indicator. The indicator comprises a cam which is rotated to operate against a pivoted lever. The lever aligns with a scale marked off in degrees to represent the travel range of the flaps. A coil spring returns the lever on reversal of flap movement.

AUXILIARY DRIVE

26. The auxiliary drive is provided for use in the event of failure of the main drive. It engages the primary drive through a snatch clutch, epicyclic gearing and a solenoid-operated dog clutch.

Motor

27. For a description of the motor and details of its servicing see A.P.4343.

Snatch clutch

28. This component, a plate type clutch, is fitted in a housing which is bolted to the diaphragm plate. The housing is in two sections; the outer forms the casing and the inner, which rotates in roller bearings, transfers the drive to the input stage of the auxiliary epicyclic gear. A groove is machined around the latter to form a pulley for an endless band which passes through the outer casing and around another pulley situated below the main shaft. The band is formed from a coil spring and its purpose, when rotated, is to circulate the lubricant.

29. The centre piece of the clutch is a hollow spindle internally serrated to take the auxiliary motor drive shaft and externally splined to locate the inner plates of the clutch. The outer plates are interposed between the inner plates and are tongued to mesh with keyways in the bore of the clutch housing. A thrust ring, which contacts the flange on the driving spindle, and a pressure plate sleeved on the spindle, "sandwich" the clutch plates; these are held in contact by a coil spring, the compression of which is adjusted by locknuts.

30. A stop is introduced in the spindle bore to position the motor drive shaft, and the end of the spindle locates in the shaft of the epicyclic output stage.

Planet assemblies

31. There are two assemblies—input and output. Each assembly carries three planet wheels rotating on needle rollers.

32. The planets of the input stage are driven by a sun wheel on the snatch-clutch housing and the input sun wheel drives the output planets. Both stages rotate in a fixed epicyclic drum bolted between the diaphragm plate and the support casing.

33. The output planet carrier rotates in a ball bearing housed in a support casing which is secured to the plate diaphragm by peripheral bolts. Externally the carrier is serrated to provide driving contact with the flexible dog clutch.

Dog clutch

34. This clutch transfers the auxiliary drive to the primary drive when the main motor is out of action. The shift mechanism is solenoid operated and selection is achieved by a switch on the left-hand side of the pilots' control pedestal.

35. The bore of the clutch hub is serrated for connection with the output stage of the epicyclic gear and the hub is machined externally to accommodate the clutch lever. Slots are cut in the periphery of the hub to form driving lugs which engage similar lugs in the thrust ring. Double coil springs are interposed between the lugs to take the transfer load.

36. The thrust ring is backed by a retaining ring and faced by the outer clutch plate. The three items are bolted together, enclosing the operating portion of the hub. The outer clutch plate is slotted to correspond with the number of dogs on the inner clutch plate of the primary pinion assembly.

37. To prevent damage to the emergency motor in the event of the dog clutch sticking in the engaged position, two hold-off microswitches, operated by the clutch lever, are included in the electrical circuit of the main motor and prevent it operating until the dog clutch disengages. The microswitches are attached to the stop bracket (1) in fig. 20.

FINAL DRIVE UNIT

38. The final drive unit consists of a bevel wheel which is rotated by the gearbox main shaft and drives diametrically opposed shafts that connect with the flap operating torque tubes. The assembly is contained in a casing that is bolted to the gearbox main casing.

39. Where the flap driving shafts pass out of the bevel box they are supported in ball and roller bearings contained in a housing bolted to the casing. Each shaft is held in

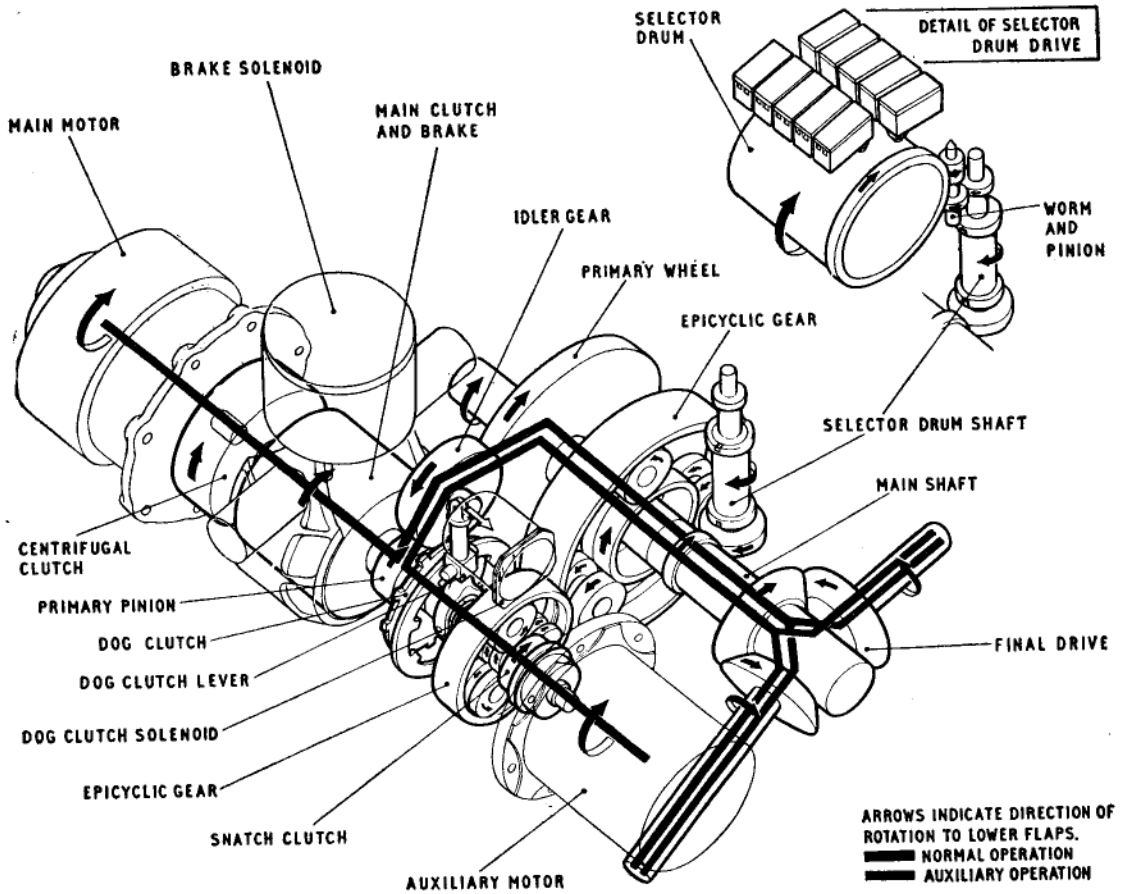


Fig. 2. Flap gearbox—functional diagram

position by a nut which screws on to the threaded portion of the shaft and locates the two bearings. A cap incorporating a sealing ring screws on to the bearing housing where it is locked by a circlip. The connection to the starboard torque tube is through a double universal joint carried between an extension of the bearing cover and a support plate on the auxiliary motor mounting.

40. The bore of the main bevel wheel is serrated to engage a quill shaft, the bore of which is serrated to locate with the gearbox main shaft drive. The main drive is supported in two ball bearings; one in the bevel gearbox casing and the other in the casing end cover.

41. Plugs are fitted in the body casing for filling and draining the lubricant.

OPERATION (*fig.* 2)

42. The main electric motor drives, through a centrifugal clutch and a brake-controlled plate clutch, a train of epicyclic gears designed to give an output shaft speed suitable for direct operation of the flaps. The gearbox is mounted fore-and-aft in the fuselage and, at the forward end of the main shaft, a bevel gearbox provides left and right-hand shafts to connect with flap operating torque shafts in the main plane.

43. An auxiliary drive, comprising an electric motor, a snatch clutch, a two-stage epicyclic gear train, and a dog clutch, is incorporated to drive the main shaft in the event of a breakdown in the main drive unit.

44. A pinion, keyed to the output stage of the main epicyclic gear train, drives a rotating drum on which are set a number of cams arranged to contact, through pivoted rocker arms, a series of microswitches controlling current to the two motors and the brake.

45. Electrical control of the gearbox is through a rotary switch housed in the pilots' control pedestal in the cockpit. The switch is operated by a three-position (DOWN, OFF, UP) hand lever on the right-hand side of the pedestal. If the lever is moved to DOWN or UP and held there, the flaps will move in the selected direction; when the limit of travel has been reached, a cam contact on the selector drum will switch off the motor and apply the brake.

46. When making the selection it is necessary for the pilot to hold the lever until the flap has taken up the desired position. This enables the pilot to make intermediate selections as shown by the indicator on the instrument panel. When the lever is released it it will automatically return to the centre position and, by doing so, switch off the motor and apply the brake.

47. Emergency operation is by an independent switch on the control pedestal. This, in addition to switching on the auxiliary motor, energizes a solenoid which operates the dog clutch shift lever. Movement of the shift lever engages the slots in the clutch outer plate with mating dogs on the primary pinion clutch inner plate; the coil springs in the clutch ensure a smooth transfer of load.

48. To obviate the possibility of the emergency drive having to operate against the friction of a seized main motor, a centrifugal clutch is mounted between the main clutch and the main motor. In normal operation, motor rotation of the centrifugal clutch shaft causes the outflung shoes to contact the drum and so provide a friction drive for the main clutch, through its connection with the serrations on the drum shaft. When the main motor is dead the clutch springs withdraw the shoes from their contact with the drum and so free the gearbox from the motor drive.

TABLE 1

Functional data

Overall ratio of main gear train	36 : 1
Overall ratio of auxiliary gear train	828 : 1
Movement of flap when main driven	0 to 58 deg.
Movement of flap when auxiliary driven	0 to 45 deg. (60 deg. on extreme limit overrun)
Duration of main operation	40 seconds
Duration of auxiliary operation	10 minutes
Maximum torque	8,150 lb. in. (4,075 each side)

SERVICING

Lubrication

49. For details of lubrication see Table 5 in conjunction with the particulars given on the back of the Contents marker card.

Brake serviceability

50. An indication of brake liner serviceability can be obtained by checking the clearance between the roller block and the shoes (*fig.* 12). This is done, in service, by the tell-tale indicator in the head of the solenoid, which can be lifted an amount corresponding to the lift of the roller block adjuster. The brakes can be reset to take up wear as described in para. 60, provided that the indicated figure does not fall below 0·05 in., or that the roller block does not bind on the adjuster rod, in which case the liners must be renewed.

Faults and their remedies

51. Two specific faults in the operation of the flaps (that can be attributed to the mechanical side of the gearbox), and their remedies, are given in the following paragraphs. For electrical faults, such as seizure of the motor, flaps overrunning their normal limits, or switch failures, etc., see Sect. 5, Chap. 2, Group 4.

52. For effective brake operation, it is essential to keep the brake linings free from oil. To this end a $\frac{1}{8}$ in. hole has been drilled in the lower part of the brake and clutch housing for the purpose of revealing oil leaks in the main clutch. If any oil is leaking from this hole the brake must be inspected immediately and the clutch checked for oil leakage.

The faults

53. *Flaps hunting.*—This is defined as an oscillating movement of the flaps during lowering or raising.

54. *Flaps lose motion.*—The flaps operate sluggishly or not at all.

The remedies

55. The source of both faults will be found in the brake and/or the clutches, which must be inspected and dealt with as follows: —

(1) Remove the main and centrifugal clutches.

(2) Check the brake for nominal torque as described in para. 60. If this figure cannot be obtained and inspection shows the brake parts to be undamaged, check the vertical motion on the roller block against the requirements of para. 50 and the brake shoes for glazing. Glazing can be removed by washing in petrol and, after drying, scraping the surface of the brake liners as described in para. 90.

(3) Check the main clutch torque (*para.* 58). If the required figure cannot be obtained drain the oil from the clutch and measure the quantity. Provided that no leakage has occurred and that the oil is free from sludge, the clutch can be flushed through with oil OX-14, filled as specified (*Table* 5) and the clutch torque readjusted.

(4) If appreciable leakage has occurred or the oil is charged with sludge, the clutch must be stripped, the plates checked for wear and condition (*para.* 82), and the general condition of the shaft and oil seal checked. The seal must be undamaged and its sealing edge intact. That portion of the shaft forming the oil seal must be completely free from marks or scores (*para.* 86).

(5) Inspect the centrifugal-clutch shoes for glazing and wear. Worn liners call for renewal of the shoes and glazing can be dealt with as in operation (2).

(6) Check the snatch clutch torque (*para.* 59). If the required figure cannot be obtained, the spring adjustment must be checked and the plates checked for wear and condition (*para.* 82). If dismantled for checking, the outer plates must be soaked in warm oil for at least 24 hours and allowed to cool in the oil (*Table* 5).

Note . . .

Plates removed from the shaft must be replaced in the same order and position.

Selector drum cam setting (*fig.* 3 *and* 4)

56. New gearboxes are issued with the cams set on the selector drum in the correct positions for shutting off the motors and operating the brake when the flap angle limits have been reached. Final setting of the cams, on assembly after overhaul, is effected by turning the main shaft or the primary drive sleeve. Turning the latter provides fine adjustment.

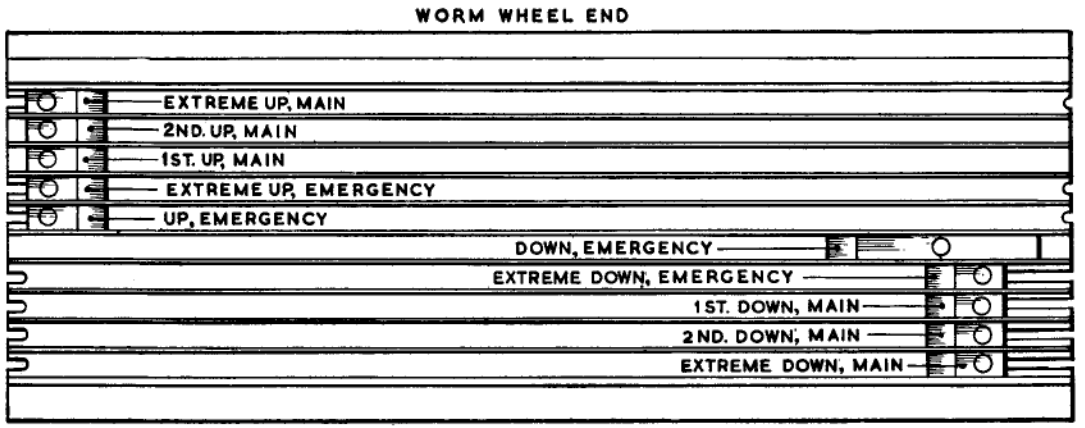


Fig. 3. Development of selector drum

TABLE 2

Colour sequence—selector drum cams

Cam	*Microswitch*	*Colour sequence*
1	Extreme up main	Red
2	Second normal up main	Green
3	First normal up main	Blue
4	Extreme up emergency	Yellow
5	Normal up emergency	Red
6	Normal down emergency	Green
7	Extreme down emergency	Blue
8	First normal down main	Yellow
9	Second normal down main	Red
10	Extreme down main	Green

57. The cams, whose attachment washers are coloured to assist identification (*Table* 2), should be adjusted in the order given in Table 3 until they trip their respective microswitches.

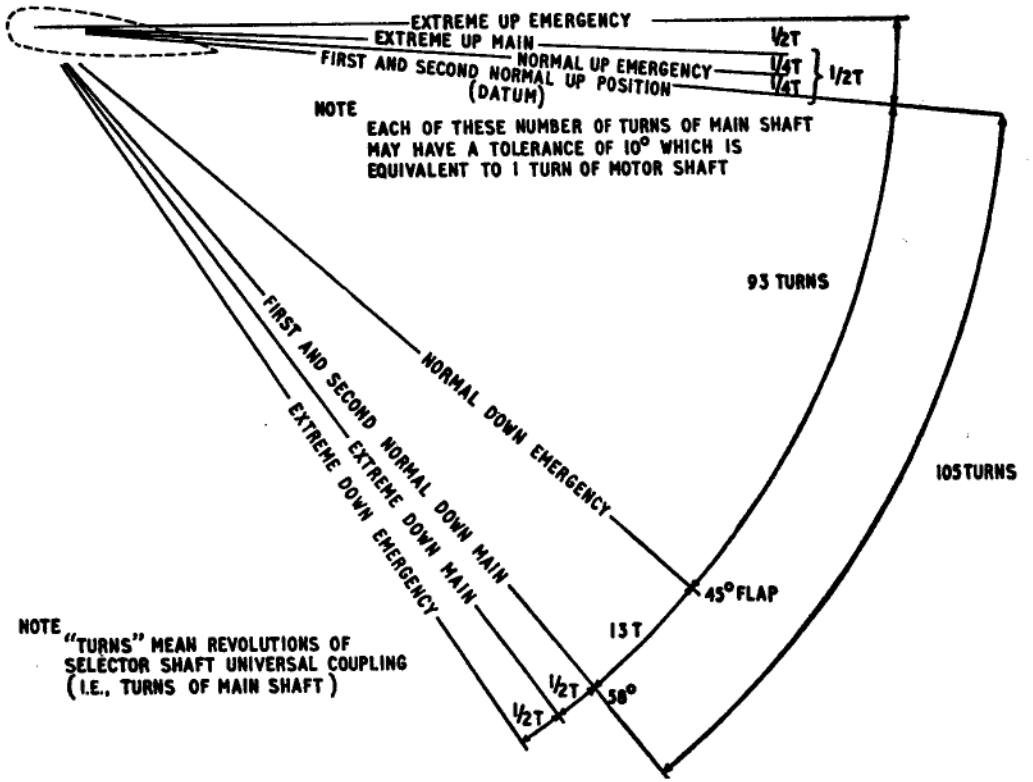


Fig. 4. Cam setting diagram

Main clutch adjustment (*fig.* 10)

58. To check and adjust the main clutch torque: —

(1) Remove the main drive unit from the gearbox and, after removing the motor and centrifugal clutch drum, and releasing the brakes, withdraw the main clutch.

(2) Remove the clutch drum cover plate (47), taking care not to damage the seal (51), and drain the oil from the clutch. If the seal is damaged it must be renewed.

(3) Support the clutch drum on the vice-adapter (*Table* 4/19) and check the

TABLE 3

Selector drum cam setting

Operation	*Direction of turn*	*No. of turns*	*Cam to set*
1	Clockwise	Until switches trip	First and second up main
2	Clockwise	$\frac{1}{4}$	Up emergency
3	Clockwise	$\frac{1}{4}$	Extreme up main
4	Clockwise	$\frac{1}{2}$	Extreme up emergency
5	Counter-clockwise	93	Down emergency
6	Counter-clockwise	13	First and second down main
7	Counter-clockwise	$\frac{1}{2}$	Extreme down main
8	Counter-clockwise	$\frac{1}{2}$	Extreme down emergency

A cam is set when the switch trips. The point at which a microswitch trips must be determined by means of an Avometer

torque, using a torque spanner in conjunction with the adapter (*Table* 4/2). The clutch should slip within the dynamic slip envelope shown in fig. 4A.

(4) If the torque requires adjusting turn each of the spring adjusters by an equal amount.

(5) Replenish with oil (*Table* 5).

(6) Replace the cover plate, taking care not to damage the sharp sealing edge of the seal, bolt up and wire lock. On assembly of the main clutch, it is of the utmost importance to ensure that the gasket (23) is intact and coated on both sides with Wellseal, and that the bolts are tightened evenly. Each time the bolts are removed the gasket must be annealed.

Snatch clutch adjustment (*fig.* 15)

59. To check and adjust the snatch clutch torque: —

(1) Withdraw the auxiliary motor and draw the clutch from its housing.

(2) Locate the clutch in the vice-adapter (*Table* 4/6).

(3) Insert the clutch torque spanner adapter (Table 4/5) and check the torque with a torque spanner. The torque at which the clutch should slip is 15·5/16·5 lb. in.

(4) If the torque requires adjusting, unscrew the lock nut (5) and tighten or slacken the spring (6). Re-lock the adjusting nut with the locknut.

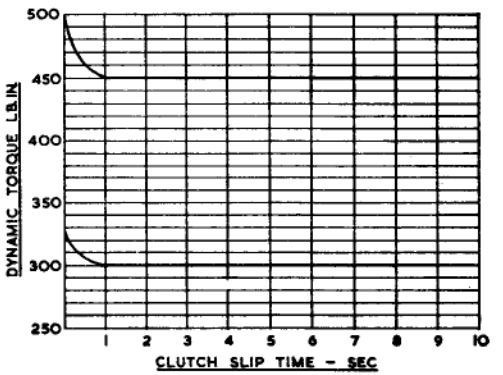


Fig. 4A. Characteristic curve of main clutch

Brake adjustment (*fig.* 10)

60. To check and adjust the brake torque proceed as follows: —

(1) Drain the gearbox.

(2) Remove the main drive unit from the gearbox.

(3) Locate the splined end of the clutch-drum (37) in the clutch torque spanner adapter (*Table* 4/2) and turn the drum, using a torque spanner, to determine the static torque of the brakes, which should be 600 lb in. min.

(4) If the static torque is low, remove the cover plate (18) and adjust the brake springs by the adjusting nut (21). After adjusting the springs check to ensure that the solenoid will hold the brake off.

61. If the above condition cannot be obtained the brake shoe liners must be renewed.

62. In addition to removing and refitting the complete gearbox, instructions are given in the following paragraphs to enable the two motors and the two solenoids to be changed, with the gearbox in situ.

Main motor

63. To remove the main motor proceed as follows: —

(1) Disconnect the electrical cables to the motor.

(2) Unbolt the motor from the drive unit and withdraw it complete with centrifugal clutch, less drum.

(3) Disconnect the clutch by removing the bolt, tab washer, and retainer securing the clutch to the motor shaft (*fig.* 13).

Note . . .
The replacement sequence is the reverse of that for removal.

Auxiliary motor

64. To remove the auxiliary motor proceed as follows: —

(1) Disconnect the electrical cables to the motor.

(2) Break the locking wire, remove the securing bolts, and withdraw the motor from the serrations in the bore of the snatch clutch spindle.

Note . . .
The replacement sequence is the reverse of that for removal.

Dog-clutch solenoid

65. To remove the dog-clutch solenoid proceed as follows: —

(1) Remove the selector gear cover.

(2) Disconnect the electrical cables to the solenoid.

(3) Disconnect the clutch lever connecting link from the solenoid plunger.

(4) Unbolt the solenoid from the cover plate.

Note . . .
The replacement sequence is the reverse of that for removal. To fit a new solenoid see para. 83.

Brake solenoid

66. To remove the brake solenoid proceed as follows: —

(1) Disconnect the electrical cables to the main motor and to the brake solenoid.

(2) Unbolt the main drive unit from the gearbox casing and withdraw it from the primary pinion assembly.

(3) Unbolt the solenoid from the unit casing and slide the adjuster out of the roller block. Withdraw the solenoid from the casing and remove the adjuster and its locknut.

Note . . .
The replacement sequence is the reverse of that for removal. Readjustment of the brake setting and the fitting of a serviceable solenoid are dealt with in para. 90 (10).

Flap gearbox (*fig.* 5 *and* 6)

67. The following instructions detail the procedure to be adopted for removing the flap gearbox; replacing the gearbox is a reversal of these operations.

Note . . .
When removing or refitting the gearbox to the aircraft, care must be taken to avoid tilting the gearbox, which could cause flooding of the emergency motor; if tilting is unavoidable, ensure that the emergency motor is kept 'high'. Preferably, the gearbox should be drained of oil before removal and not refilled until after replacement.

(1) Remove the hatch cover leading to the bomb bay and fit the sling (5) and take the weight.

(2) Remove the bolts (2) from the torque tube and universal joint at the starboard wing root.

(3) Remove the bolt (3) from the universal joint at the gearbox and slide the torque tube clear of the gearbox.

(4) Withdraw the tube (4) from the wing root universal joint complete with the double splined coupling.

(5) Remove the bolts (5) from the torque tube and the universal joint at the port wing root.

(6) Remove the retaining bolt (6) from the universal joint at the bomb hoist structure and slide the torque tube clear.

(7) Remove the bolt (7) from the spline at the gearbox.

(8) Remove the four securing bolts from the bearing housing (8) and withdraw the bearing and stub shaft assembly.

(9) Remove the bolts (9) securing the gearbox to its mounting, hoist the gearbox, pull the sling along the hoist rail and lower the gearbox through the access hole.

Notes . . .

(1) *When re-installing the unit, ensure that the selector drum and flaps are at the datum position before coupling the unit to the torque tubes.*

(2) *When fitting the cross bolt (7) in the torque tube, ensure that the bolt is free to slide in the slot when the split pin is fitted.*

(3) *After installation, the oil level in the gearbox casing and final drive must be rechecked.*

◀(4) *Whenever the bearing retaining nuts on the forks of the double universal coupling, mounted on the gearbox, are disturbed every effort must be made when replacing the locking ring to pick up the existing hole in the fork. If this is not possible one further hole may be drilled in the fork provided that it is at 90 deg. to the existing hole. To facilitate this it is permissible to fit shims up to a thickness of 0·020 in. max. under the bearing nut, or to reduce the face of the nut by a similar amount.*▶

DISMANTLING

Equipment

68. The special tools required for dismantling, reconditioning and reassembling the gearbox, with their application, are given in Table 4. A set of suitable torque spanners to cover the torques 0/20, 300/500 and 600 lb. in. will be required with each set of special tools.

TABLE 4 **Special tools**

Item	Ref. No.	Part No.	Description
1	26SR/95171	67479 Sht. 851	Flap gearbox sling
2	26SR/95087	94160-1	Torque spanner adapter, main clutch
3	26SR/95036	92911-7	Torque spanner adapter, snatch clutch
4	26SR/95035	92911-9	Vice adapter, auxiliary clutch
5	26SR/95092	94160-11	Adapter, main shaft hand turning
6	26SR/95099	94160-25	Vice adapter, bevel shaft
7	26SR/95093	94160-13	Main shaft synchronizing jig
8	26SR/95094	94160-15	Special bolt, attachment of main shaft synchronizing jig to gearbox (3 off)
9	26SR/95121	94160-29	Selector drum winding handle
10	26SR/95091	94160-9	Brake shoe and torque setting tool support jig
11	26SR/95095	94160-17	Bevel shaft synchronizing jig
12	26SR/95089	94160-5	Brake shoe and torque setting tool
13	26SR/95247	94160-31	Brake shoe resurfacing tool wrench, double-ended
14	26SR/95090	94160-7	Brake shoe resurfacing tool
15	26SR/95097	94160-21	Spanner, bevel shaft bearing nut and dog clutch nut
16	26SR/95098	94160-23	Spanner, main and bevel shaft nuts
17	26SR/95096	94160-19	Setting tool, brake solenoid
18	26SR/95044	92911-27	Setting tool, dog clutch solenoid
19	26SR/95099	94160-3	Vice adapter, main clutch and primary pinion checking
20	—	94160-33	Double universal shaft synchronizing jig
21	—	Local manufacture	Bench support, main drive unit (fig. 23)

Lubrication

69. Table 5 specifies the lubricants to be used during servicing and assembly operations, and their application.

Note . . .

It is **important** *that the brake shoes are kept free of grease and oil during these operations, using trichlorethylene (Ref. No. 33C/547 or 836) as the cleaning medium.*

The gearbox

70. Except where indicated otherwise, the following operations refer to items annotated on fig. 19.

(1) Disconnect the electrical cables at the plugs on the cover plate and drain the main and final drive casings.

(2) Remove the main drive unit (1), unbolting it from the main casing and

withdrawing it from the serrations in the driving sleeve bore (fig. 14, item 2).

(3) Unbolt and remove the auxiliary motor (32), withdrawing it from the serrations in the snatch clutch spindle.

(4) Remove the double universal joint by unscrewing the bolts attaching it to the cover and support plate, then withdraw the unit from the final drive shaft.

(5) Unbolt the final drive assembly (23) from the cover plate (21) and withdraw it from the serrations on the main shaft.

(6) Remove the selector drum cover.

(7) Remove the selector drum assembly (fig. 9), unbolting it from the gear casing cover plate and withdrawing the selector driving shaft from engagement with the pin coupling.

(8) Remove the dog-clutch solenoid (fig. 1 and 20), disconnecting the plunger from the clutch lever connecting link and removing the bolts securing the solenoid to the gear casing cover plate.

(9) Remove the eight bolts securing the cover plate (fig. 21) and detach the plate from the dog-clutch lever.

(10) Unbolt the clutch lever bracket from the diaphragm plate, disengage the lever slippers from the dog-clutch, and remove the lever assembly.

(11) Withdraw the snatch clutch (38) from its housing.

(12) Release the lubricator band (30) from the pulley (29).

(13) Unlock and remove the main shaft nut (25).

(14) Remove the two screws securing the cover plate (21) and remove the plate complete with the selector drive assembly (20). The bearing (27) can, if necessary, be removed from the cover plate after first removing the screws securing the bearing retainer (26).

(15) Unbolt and remove the end casing (35).

(16) Remove the selector drum driving wheel (22).

(17) Withdraw the main output planet carrier (19) from the shaft and the main input planet carrier (18) from the epicyclic drum.

(18) Unbolt and remove the auxiliary snatch clutch housing support (37) complete with clutch housing from the diaphragm plate (17).

(19) Remove the diaphragm plate (17), complete with the main and auxiliary epicyclic drums (31, 41), the latter complete with its input and output planet carriers (39) and (40).

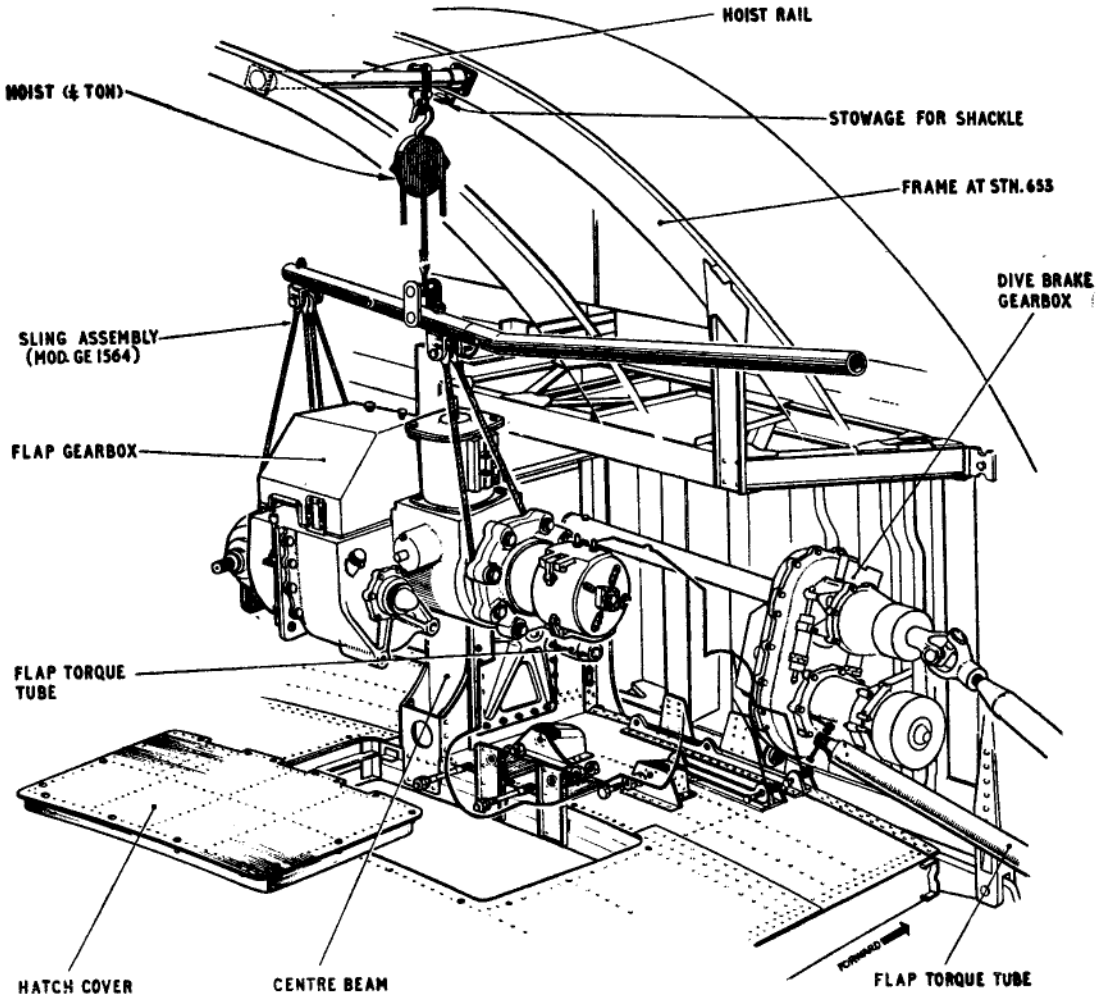


Fig. 5. Gearbox removal—slinging

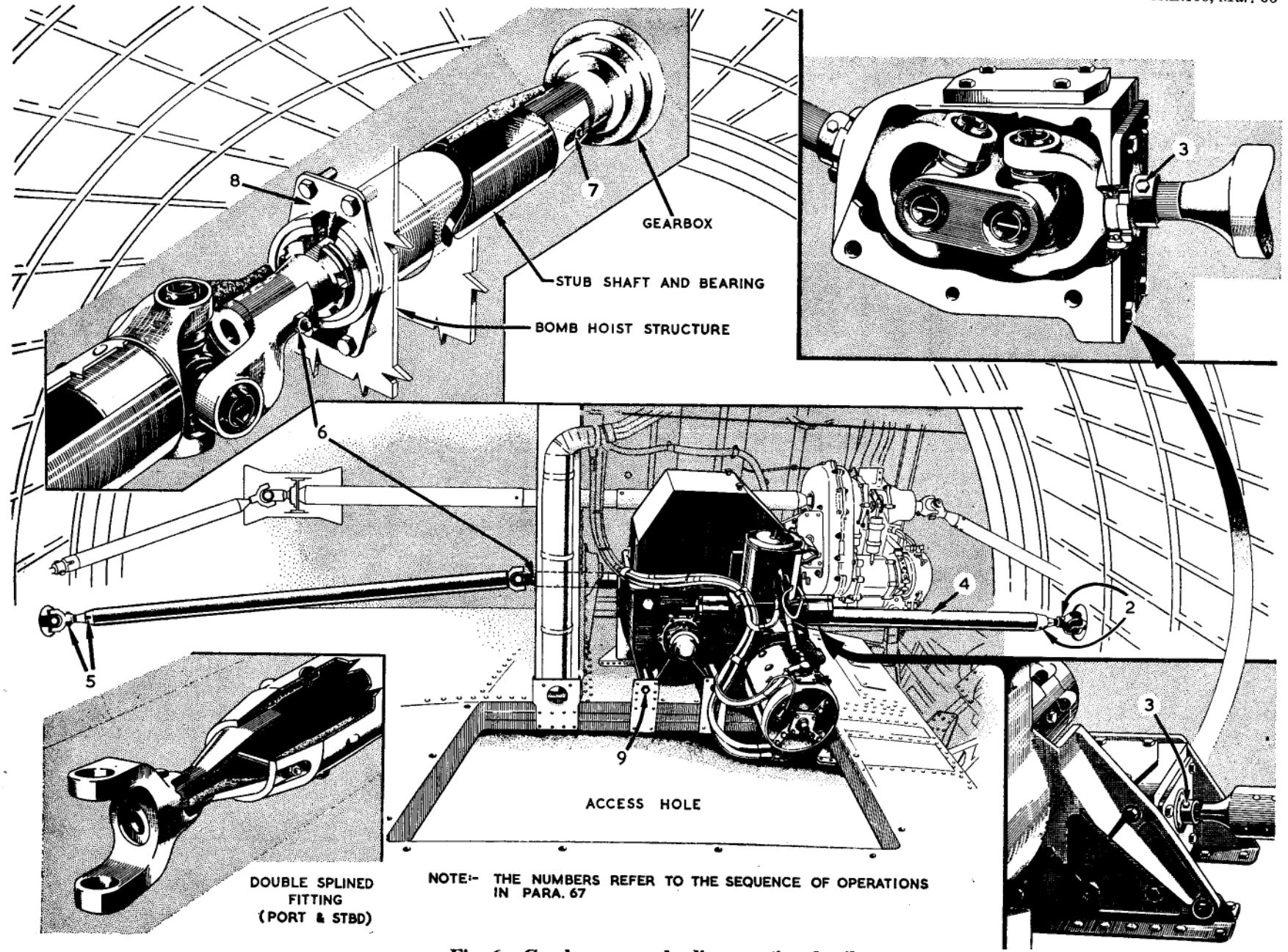


Fig. 6. Gearbox removal—disconnection details

(20) Withdraw the dog-clutch (43).

(21) Remove the bolts (45) and ring nut (44) securing the primary pinion assembly to the casing and withdraw the assembly.

(22) Unscrew and remove the cap nut (5), complete with the cap (9).

(23) Unbolt and remove the locator cap (4) complete with seal (7).

(24) Withdraw the primary wheel (12) complete with bearings (11, 14), spacer (13) and seal (16) and the spacer (10) from the shaft (6).

(25) Withdraw the shaft (6) complete with shaft locator (3) and ball bearing (8) from the central casing (15).

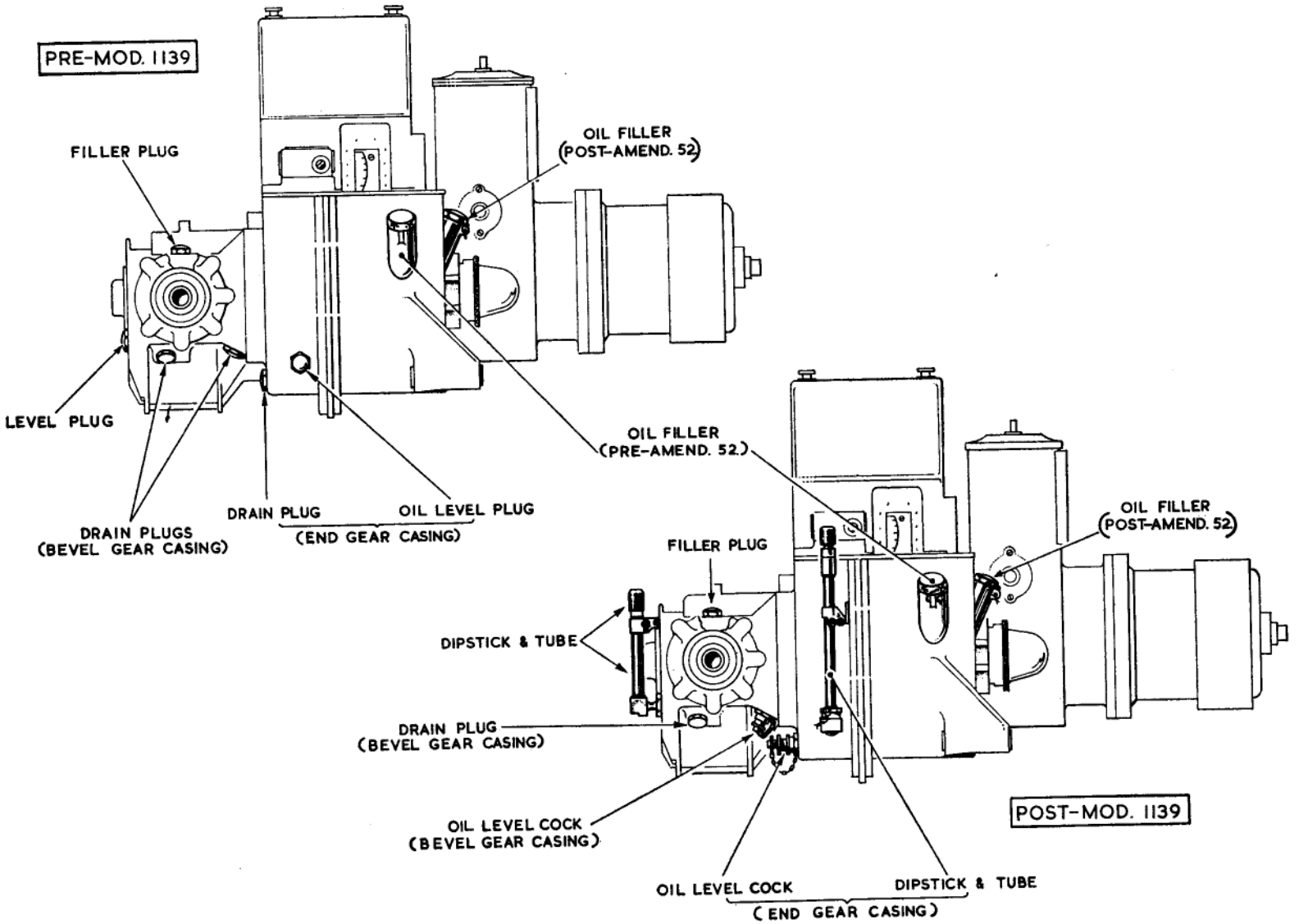


Fig. 7. Draining and replenishing

Main and auxiliary motors

71. Dismantling, reconditioning, repair, and reassembly of the main and auxiliary motors are covered in A.P.4343.

Main drive unit (*fig.* 10)

72. To dismantle the main drive unit proceed as follows: —

(1) Unbolt and remove the main motor from the unit casing, withdrawing it complete with centrifugal clutch (2), less drum.

(2) Untab and remove the bolt and retainer (*Items* 8, 9, 10 *in fig.* 13) securing the centrifugal clutch to the motor shaft.

(3) Untab and remove the bolt (3) securing the centrifugal clutch drum (4) to the main clutch spindle (24) and withdraw the drum.

(4) Unscrew and remove the brake spring cover plates (18, 63) and gaskets (17, 62).

(5) Unlock the brake adjusting nut (21), release the spring tension and remove the nut.

(6) Withdraw the adjuster rod (22) and spring assemblies from the housing.

(7) Withdraw the plate clutch from its bearing (7) in the housing (53).

(8) Unbolt and remove the solenoid complete with the brake roller block (12) and its adjuster (11).

(9) Remove the brake shoes (28) and (43), breaking the locking wire and withdrawing the hinge pin (39).

Centrifugal clutch

73. To dismantle the centrifugal clutch refer to fig. 13 which is self-explanatory.

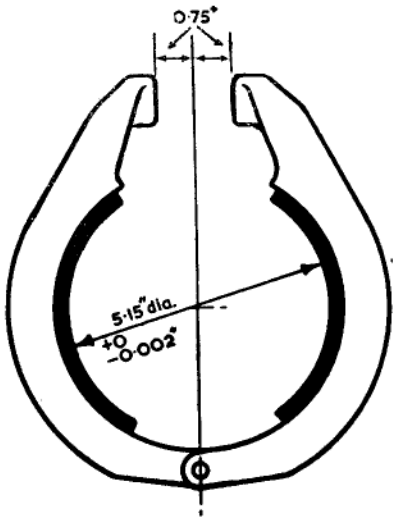


Fig. 8. Brake liner dimensions

Main clutch (*fig.* 10)

74. To dismantle the main clutch proceed as follows: —

(1) Break the locking wire and remove the clutch drum cover plate securing bolt (52). Hold the clutch upright and, carefully, so as not to damage the sharp edge of the seal (51), remove the clutch cover plate (47) and gasket (23).

(2) Drain the clutch.

(3) Withdraw the clutch plate assembly from the drum (37) and dismantle it by removing the spring adjuster bolts (34), collars (26), springs (25) and clutch plate retainers (38) and (46). The inner and outer clutch plates can then be withdrawn from the spindle. The plates must be marked as they are withdrawn to ensure that they are replaced in the same relative positions.

(4) Remove the seal (51) from the neck of the clutch cover plate and the circlips (35, 50) securing the two ball bearings.

Primary drive (*fig.* 14)

75. To dismantle the primary drive proceed as follows: —

(1) Untab and remove the nut (11) using the vice-adapter (*Table* 4/19) and spanner (*Table* 4/15) and withdraw the inner dog clutch plate (10) from the splines on the driving sleeve (2).

(2) Withdraw the driving sleeve from the opposite end of the bearing housing (1).

(3) Remove the screws securing the bearing retainer (23) from the housing and remove it complete with spacer (4) and seal (5). Separate these parts, taking care to avoid damaging the sealing edge of the seal.

(4) Dismantle the remainder by withdrawing the two bearings (6, 21), bearing seal plate (7), and primary pinion (3).

Dog clutch and lever

76. To dismantle the dog clutch (*fig.* 14) reverse the assembly instructions detailed in para. 95.

Snatch clutch and housing (*fig.* 15)

77. *Clutch.*—Remove the locknuts (5) and slide the parts off the driving spindle (10).

Housing.—Unbolt and remove the bearing clamp ring (15). Remove the locking screw (17). Push out the clutch housing (3), complete with outer races (2) and (16) and bearing spacer (1).

Selector drum (*fig.* 9)

78. To dismantle this unit, reverse the assembly instructions detailed in para. 89.

Final drive (*fig.* 16)

79. To dismantle the final drive proceed as follows: —

(1) Remove the bolts securing the double universal joint to the support plate and cover plate and withdraw the unit from the final drive shaft. This frees the support plate.

(2) Carefully remove the bearing cap seals (2, 24) after first binding the serrated shaft ends with cellophane tape to prevent damage to the sharp sealing edges.

(3) Remove the circlips (1, 23), unscrew and remove the bearing caps (3, 22) and the bevel shaft nuts (4, 21).

(4) Unbolt and remove the bearing housings (10, 18) from the casing and dismantle the bevel shaft assemblies. To facilitate meshing of the gears on reassembly each shim (9, 27) must be stored with its own shaft.

(5) Unbolt and remove the bevel wheel bearing cap (33) and remove the bolt (32) and the bearing retainer (29).

(6) Unbolt and remove the cover plate (28).

(7) Remove the circlip (12) and withdraw the bevel wheel (40), keeping the shims (38), with it.

(8) Dismantle the double universal coupling by removing the locking ring (45) and unscrewing the bearing nut (44) from each shaft; remove the bolts securing the bearing mounting plate (46) and withdraw the plate and shim (47). The universal joint assembly can then be withdrawn from the mounting box (50).

RECONDITIONING

Inspection

80. At the reconditioning period specified in the servicing schedule the gearbox must be removed from the aircraft and thoroughly examined for signs of external oil leakage; it is then to be stripped down, checking at each sub-assembly for signs of oil seepage, especially into the brake compartment. The mechanical parts are to be washed in a trichlorethylene bath and a thorough check made. Corrosion may be cleaned off and the part accepted provided that pitting is not excessive (*para.* 87).

81. Threads of bolts, studs, and setscrews must be examined for signs of damage and the studs tested for security. Inspect the ball bearings to A.P.1464B, Vol. 1. Where cracks are suspected in the casing, gears, or other parts, detection tests (A.P.880C, *Vol.* 1) must be made.

82. If the metal clutch plates are scored, or the bonded-asbestos plates worn to less than three-quarters of their original thickness of $0{\cdot}125\ ^{+0}_{-0{\cdot}003}$ in., main clutch and $0{\cdot}11\ ^{+0}_{-0{\cdot}002}$ in., snatch clutch, or are burnt dark brown, a new pack of bedded and tested plates must be fitted. It is not permissible to renew individual plates.

Brake shoes

83. When the brake shoe liners are worn they can be removed from the shoes, using a sharp knife or chisel and finally scraping the shoe surface, and replaced by new liners which are Reduxed to the shoes. When the liners are secured the shoes must be set as in fig. 8, and the braking surface bored to $5{\cdot}15\ ^{+0}_{-0{\cdot}002}$ in.

Centrifugal clutch shoes

84. Worn liners on the centrifugal clutch shoes can be removed and new liners fitted as described in para. 83.

Dog-clutch solenoid

85. Should it become necessary to renew the dog-clutch operating solenoid the new solenoid must be located, in relation to the clutch lever, in the following manner (*fig.* 20): —

(1) Assemble the clutch lever stop bracket (1) and adjusting screw (2) to the cover plate (5).

(2) Slide the clutch until both sets of dogs butt endwise (if the dogs slip into engagement, correct by turning the primary pinion).

(3) Hold the clutch lever in the butted position and turn the adjusting screw until there is a gap of 0·02 in. between screw and lever.

(4) Assemble the link and link pin (6) on the plunger eye of the solenoid and position the solenoid on the two back fixing bolts. Couple the link to the clutch lever eye, using the assembly tool (*Table* 4/18) in place of the pin (7), then press the solenoid towards the clutch lever until the lever is touching the stop and the assembly tool can just slide in the link. Note whether the two bolt holes in the front feet of the solenoid correspond with the anchored nuts on the underside of the cover plate. If they do not, draw the bolt holes in the solenoid to suit.

(5) Bolt the solenoid down securely, remove the assembly tool and couple the link to the lever eye by the pin (7) and split pin. The solenoid spring then has an initial compression of 0·06 in.

(6) Adjust the operating pins (10) on the microswitches so that both switches are made when the clearance between the clutch lever and screw (2) is 0·007 in., and are 'open' when the clearance is 0·0075 in. to 0·010 in. Lock the pins when this setting is obtained.

Main clutch spindle

86. Marks or scores on the portion of the spindle that forms the oil seal seating may be honed out to a 4 micro. in. finish, provided that the spindle is not reduced from its original dimension (0·75 in. class Y fit) by more than 0·0005 in.

Corrosion

87. Where the protective coating has been removed from the casing, or where corrosion occurs, the area must be treated in accordance with the instructions contained in Spec. D.T.D.911B.

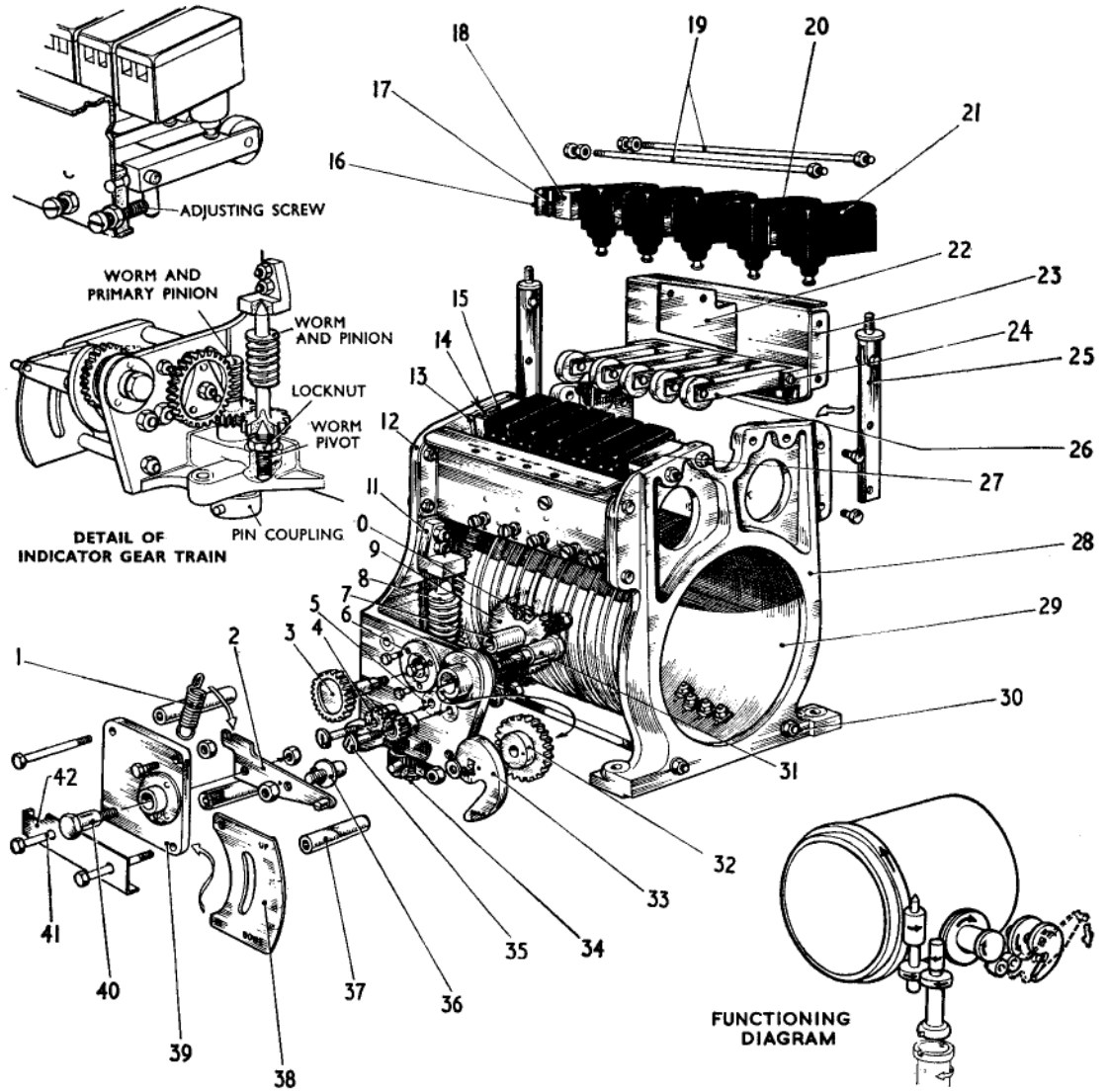
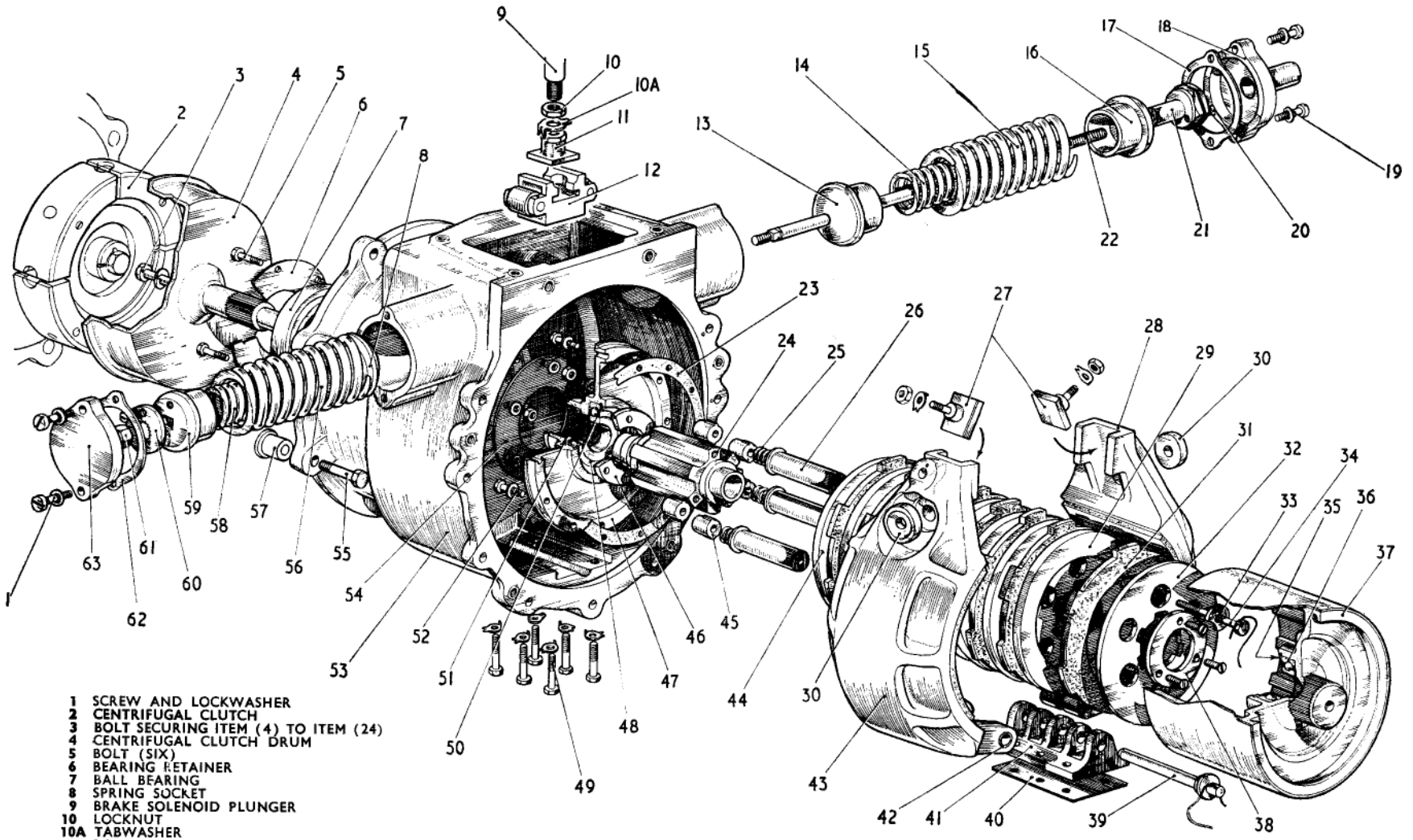


Fig. 9. Selector drum assembly

KEY TO FIG. 9

(SELECTOR DRUM ASSEMBLY)

1 RETURN SPRING
2 INDICATOR LEVER
3 PINION
4 IDLER GEARS
5 IDLER BUSH (TWO)
6 PINION BUSH
7 SPINDLE
8 WORM AND PINION
9 WORM WHEEL
10 SHIM
11 WORM PIVOT BLOCK
12 SELECTOR DRUM SUPPORT (FRONT)
13 BACKING PLATE
14 LAMINATED STRIP
15 SWITCH SPACER
16 BACKING PLATE
17 LAMINATED STRIP
18 SWITCH SPACER
19 SWITCH STAY RODS
20 SWITCH SPACER
21 MICROSWITCHES (TEN)
22 MICROSWITCH BRACKET
23 ROCKER ARM SUPPORT BRACKET
24 HINGE PIN
25 COVER SUPPORT STRIP
26 ROCKER ARM
27 SWITCH SPACER
28 SELECTOR DRUM SUPPORT (REAR)
29 SELECTOR DRUM
30 TIE ROD
31 BEARING PIN
32 CAM DRIVER
33 CAM
34 PIN COUPLING ON WORM AND PRIMARY PINION
35 IDLER GEAR PINS
36 CAM FOLLOWER
37 SPACER
38 INDICATOR PLATE
39 INDICATOR BEARING PLATE
40 INDICATOR LEVER HINGE PIN
41 BOLTS
42 GUARD PLATE



1 SCREW AND LOCKWASHER
2 CENTRIFUGAL CLUTCH
3 BOLT SECURING ITEM (4) TO ITEM (24)
4 CENTRIFUGAL CLUTCH DRUM
5 BOLT (SIX)
6 BEARING RETAINER
7 BALL BEARING
8 SPRING SOCKET
9 BRAKE SOLENOID PLUNGER
10 LOCKNUT
10A TABWASHER
11 ROLLER BLOCK ADJUSTER
12 ROLLER BLOCK ASSEMBLY
13 SPRING SOCKET
14 INNER SPRING
15 OUTER SPRING
16 SPRING CAP
17 COVER PLATE GASKET
18 COVER PLATE
19 SCREW AND LOCKWASHER
20 LOCKSCREW
21 BRAKE ADJUSTER NUT
22 ADJUSTER ROD
23 GASKET
24 CLUTCH SPINDLE
25 CLUTCH SPRING (SIX)
26 SPRING COLLAR (SIX)
27 ROLLER TRACK PLATE
28 BRAKE SHOE
29 CLUTCH PLATE (INNER)
30 THRUST RING
31 CLUTCH PLATE (OUTER)
32 CLUTCH PLATE (END)
33 WASHER
34 SPRING ADJUSTER BOLT (SIX)
35 CIRCLIP
36 BALL BEARING
37 CLUTCH DRUM
38 PLATE RETAINER
39 HINGE PIN
40 LAMINATED SHIM
41 HINGE BLOCK
42 HINGE BUSH
43 BRAKE SHOE
44 CLUTCH PLATE (END)
45 SPRING ADJUSTER NUT (SIX)
46 PLATE RETAINER
47 CLUTCH COVER PLATE
48 BALL BEARING
49 BOLT (SIX) (SECURING 40 AND 41 TO 53)
50 CIRCLIP
51 SEAL
52 BOLT (TWELVE)
53 BRAKE AND CLUTCH HOUSING
54 BEARING RETAINER
55 BOLT (EIGHT)
56 OUTER SPRING
57 BUSH FOR ITEM 55
58 INNER SPRING
59 SPRING CAP
60 LOCKING PLATE
61 LOCKNUT
62 GASKET
63 COVER PLATE

Fig. 10. Main drive unit

ASSEMBLY

88. The gearbox has been dealt with, first by assembling the separate sub-assemblies and finally by assembling the unit as a whole. The sub-assemblies comprise the following: —

(1) Selector drum

(2) Main drive unit

(3) Centrifugal clutch

(4) Main clutch

(5) Primary pinion

(6) Snatch clutch

(7) Dog clutch

(8) Final drive.

Before starting the assembly operation, refer to Table 5 for lubricating instructions. When making oil-proof joints, use Wellseal as the sealing medium.

Selector drum (*fig.* 9)

89. To assemble the selector drum and local indicator proceed as follows: —

(1) Fit the cams in the grooves of the selector drum (29), locating them as shown in fig. 3, and securing them with the nuts and washers of the same colour as the cam stations (*Table* 2). For final setting of the cams see para. 56.

(2) Fit the supports (12, 28) over the ends of the drum and assemble the support tie-rods (30), microswitches (21), switch brackets (22), switch stay rods (19), switch spacers (15, 18, 20, 27), laminated strips (14, 17) and backing plates (13, 16). Adjust the tie-rods and strips to give free rotation of the drum with a maximum end play of 0·005 in. and a minimum of 0·002 in. Secure the worm pivot block (11) to the drum support by the two fitted bolts. Engage the worm (8) with the drum worm wheel, insert the worm pivot from the underside of the support base, screwing it through its previously-positioned locknut. Adjust the pivot until there is free rotation of the worm, without end play, then tighten the locknut.

(3) Assemble the rocker arms (26) on their support brackets (23), securing them with the hinge pins (24) and locking the ends of the latter with split pins. Remove both switch inner stay rods and slacken the nuts on the outer rods to allow the complete support brackets and cover support studs to be secured in position. Replace the inner stay rods, retighten all nuts and adjust each microswitch by turning the adjusting screw clockwise until the switch trips, then turn back half-a-turn and lock.

Note . . .
It is important that the tie-rods do not project through their nuts at the worm end by more than 0·03 *in., any necessary adjustment being made at the other end.*

(4) Insert the worm and primary pinion into its bearing bush in the support base and fit the pin coupling (34) on its serrations. Secure in position with the screw and tabwasher, ensuring free rotation without end play, but do not lock at this stage.

(5) Set the selector drum to just trip the 1st and 2nd UP-MAIN microswitches. Assemble idler bushes (5), idler gears (4), and idler pins (35). Attach the worm wheel (9) and the shim (10) to the pinion spindle (7) by three screws and lockwashers and place loosely in position through the hole in the support. Thread the pinion bush (6) over the spindle from the outer side, securing it by the three bolts. Pass the spigot on the pinion (3) through the pinion spindle, meshing the pinion teeth with the idler, and secure by nut and washer.

(6) Insert the cam bearing pin (31) through its bearing bush in the drum support. Mount the cam driver (32) to which is pinned the cam (33), meshing its teeth with those of the idler pinion when a line joining the engraved UP and DOWN marks on the cam is truly vertical. Fit the washer and nut and securely tighten.

(7) Fit the cam follower (36) to the indicator lever (2). Attach the lever to the indicator bearing plate (39), using the hinge pin (40), and fit the return spring (1) to the lever. Bolt the bearing plate (39), indicator plate (38) and guard plate (42) to the drum support (12), using the spacers (37) and the bolts (41), aligning the indicator with the UP mark on the plate. When fitting the left-hand lower spacer, insert it through the loop of the return spring (1).

Main drive unit (*fig.* 10)

90. To assemble the main drive unit proceed as follows: —

(1) Fit the ball bearing (7) in the housing (53). Pack the bearing half full with

grease (*Table* 5) and secure it in position by fitting the two retainers (6, 54).

Note . . .

When fitting new bolts, they must be cut to length so that 0·02 *in. protrudes through the nut.*

(2) Fit the hinge block (41) and its packing shim (40) into the housing, screwing the bolts (49) into the tapped holes in the block.

(3) Press a thrust ring (30) and a roller track plate (27) into each brake shoe (28, 43), and secure the plates by nut and tabwasher.

(4) Position the brake shoes, and insert the hinge pin (39), wire-locking it to the drilled screw in the shoe (28).

(5) Fit the spring cap (59) on the squared end of the adjuster rod (22), securing it with the nut (61) and the locking plate (60).

(6) Position the brake springs (56, 58), complete with spring seat (8) on the spring cap (59) and pass the screwed end of the adjuster rod through the brake shoes towards the left, when viewed from the motor end of the housing. Complete the assembly by fitting the spring socket (13), springs (14, 15), spring cap (16), adjuster nut (21) and lock screw (20).

(7) Insert the brake setting tool (*Table* 4, *item* 12 *and fig.* 11) between the brake shoes, supporting the shaft end in the clutch shaft ball bearing (7) and the opposite end in the support jig (*Table* 4, *item* 10).

(8) Rotate the adjuster nut (21) until each spring is compressed by approximately 0·25 in., then using a feeler gauge, test to see that the shoes are concentric with the tool. If not, remove strips from the laminated shim (40) until concentricity is obtained.

(9) Release the spring tension, remove the setting tool, replace it by the brake resurfacing tool (*Table* 4, *item* 14 *and fig.* 11) and compress the springs until 1·12 in. of the threaded end of the adjuster rod protrudes through the adjuster nut. Bed the shoes by rotating the surfacing tool until 100 per cent. contact is obtained.

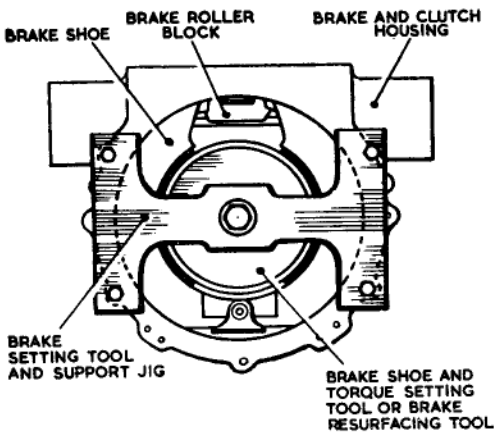


Fig. 11. Brake setting/resurfacing tool and support jig

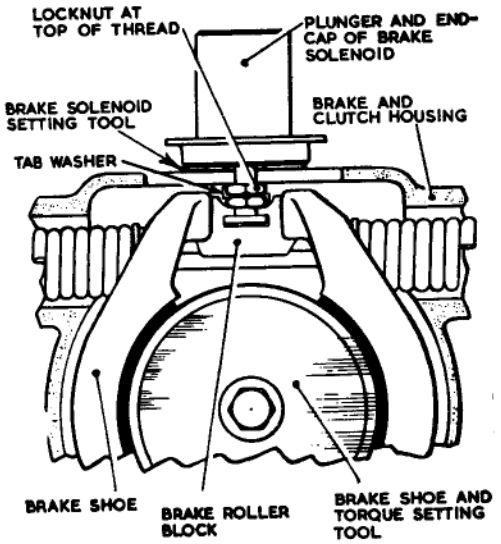


Fig. 12. Brake setting

(10) Adjust the brake setting in the following manner: —

(a) Remove the solenoid lower end cap and plunger and set the locknut (10) and roller block adjuster (11) on the solenoid plunger (9) so that the end of the plunger is about 0·15 in. under flush with the lower face of the adjuster and the locknut is at the top end of the thread.

(b) Insert the brake roller block (12) between the horns of the brake shoes, ensuring that the rollers run on the track plates (27).

(c) With the solenoid setting tool (*Table* 4, *item* 17 *and fig.* 12) interposed between the top face of the housing and the solenoid lower end

cap, engage the roller block adjuster with the "T" slot in the roller block.

Note . . .

Between the brake rollers and the track plates there should now be a small gap which must be eliminated by turning the solenoid plunger clockwise, while lightly pressing downwards. This action draws the rollers into contact with the track plates. When end play has been just eliminated, cease turning and remove the plunger and the solenoid setting tool. Tighten the locknut on to the roller block adjuster, taking care that the latter does not move on the connecting rod. Lock by turning up the single tab on the tabwasher (10A).

(d) Replace the solenoid plunger and end cap in the solenoid body, lock the retaining screws and position and secure the solenoid after re-engaging the adjuster with the "T" slot in the carrier.

(e) Release the spring load and remove the surfacing tool.

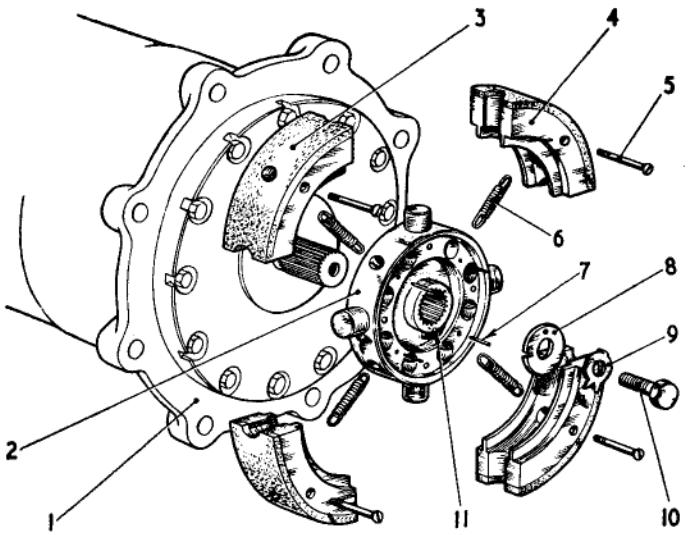
(11) Assemble the main clutch (*para.* 92) in position, supporting the serrated end in the brake tool support jig (*fig.* 11) which must remain in position until the main drive unit is assembled to the gearbox.

(12) Engage the centrifugal clutch drum shaft (4) with the main clutch driving spindle (24), packing the central space between shaft and spindle with grease (*Table* 5) and secure by the central bolt (3) and spring washer.

(13) Mount the centrifugal clutch assembly (*fig.* 13) on the main motor shaft, securing it by the clutch retainer, bolt and tabwasher.

(14) Insert the bolt bushes (57) into the fixing holes and bolt the motor to the brake housing (53), using bolts (55), washers, nuts and locknuts.

(15) Compress the brake springs until the adjuster rod protrudes 1·12 in. beyond the adjuster nut to give a nominal 600 lb. in. static torque. Lock firmly in this position and fit the cover plates (18, 63) with their gaskets (17, 62).



1. MAIN MOTOR
2. DRIVING BOSS
3. CLUTCH LINER
4. CLUTCH SHOE
5. SCREW (FOUR)
6. CLUTCH SPRING
7. PIANO WIRE PIN
8. CLUTCH RETAINER
9. TABWASHER
10. 5/16in.B.S.F. BOLT
11. PEG

Fig. 13. Centrifugal clutch

Centrifugal clutch

91. To assemble the centrifugal clutch refer to fig. 13, which is self-explanatory.

Main clutch (*fig.* 10)

92. To assemble the main drive plate clutch proceed as follows: —

Note . . .

Before fitting the clutch in the main drive unit (*para.* 90, *operation* 11) *it must be tested for leaks by immersion in water, with air at* 28-30 *lb/in² applied through the clutch cover plate* (47). *The air can be introduced through a length of rubber tube fitted over the neck of the cover plate and secured by a standard pipe clip.*

(1) Fit the ball bearing (36) into the clutch drum (37) and the ball bearing (48) into the clutch cover plate (47), securing them with the circlips(35, 50). Enter the end of the clutch spindle (24) into the drum bearing and fit the clutch cover and sealing gasket (23). Bolt the drum and cover together temporarily and try the spindle for free rotation. There should be not less than 0·005 in. end play.

(2) Remove the cover and spindle from the drum and secure by three screws the clutch plate retainer (38) to one end of the spindle splines.

(3) Position one of the two end clutch plates (32, 44) on the spindle, with its plated side facing inwards. Assemble

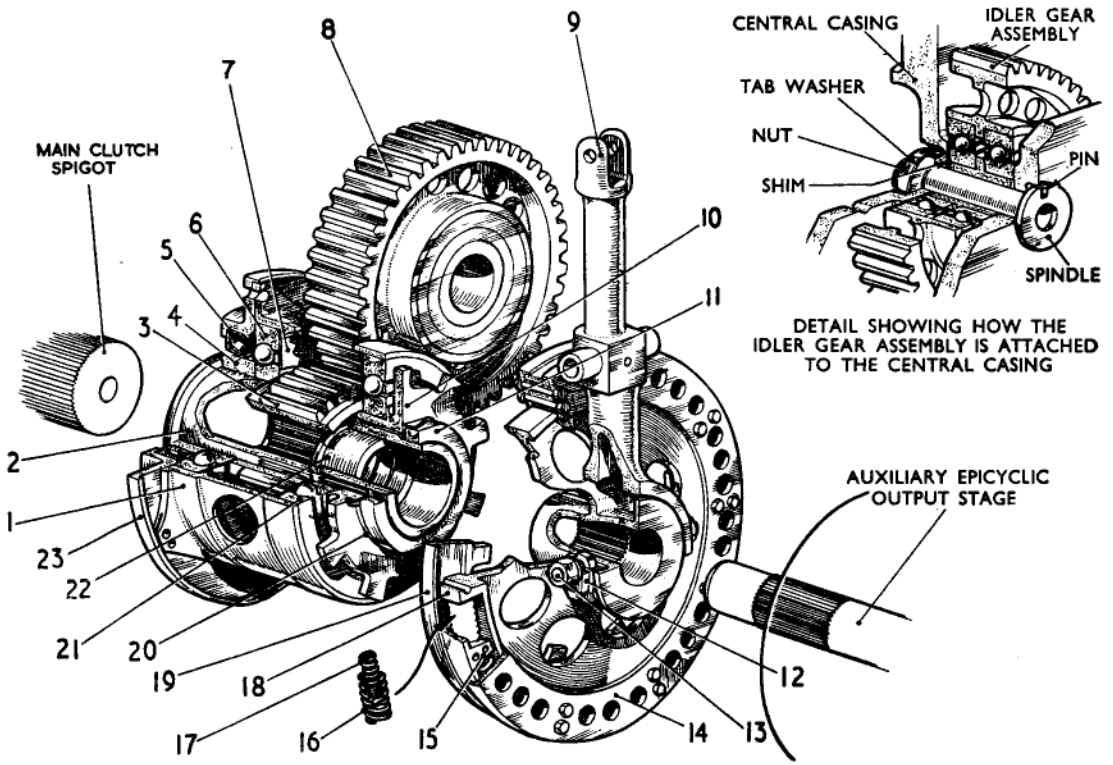


Fig. 14. Primary drive and dog clutch

the outer (31) and inner (29) clutch plates alternately on the spindle and finally fit the second end plate and the clutch plate retainer (46).

Note . . .

Before assembly, the bonded-asbestos outer clutch plates must be soaked in warm oil as specified in Table 5. The plates must be dripping wet from the oil bath when assembling.

(4) Assemble the spring sleeves (26), springs (25), adjuster nuts (45), washers (33) and spring adjuster bolts (34) and pass this partial assembly into the drum as a preliminary to final adjustment.

(5) Final adjustment. — Tighten each spring adjuster bolt until the springs are solid, then turn back each bolt by an equal amount until the clutch slips within the dynamic clutch slip envelope (*fig.* 4A). Wire lock the adjusters after setting. For the method of torque checking see para. 58.

(6) Pour in oil as specified in Table 5.

(7) Press the seal (51) into the clutch cover, taking care not to damage the sharp inner edge of the seal and replace gasket and cover. Check that the gasket is intact and coated on both sides with Wellseal, tighten the cover bolts evenly and wire-lock the heads. Each time the cover bolts are removed the gasket must be annealed.

Primary pinion (*fig.* 14)

93. To assemble the primary pinion proceed as follows: —

(1) Pack the bearings (6) and (21) with grease (*Table* 5). Assemble both bearings (with the primary pinion (3) between them and the bearing seal plate (7), groove inwards) against the bearing (6), into the housing (1).

(2) Fit the bush (22) into the driving sleeve (2) and fit the bearing spacer (4), with its chamfered edge towards the flange on the sleeve.

(3) Pass the driving sleeve into the assembly, meshing its splines with those of the primary pinion, until the bearing spacer abuts the bearing (6).

(4) Fit the dog clutch plate (10) over the splines on the driving sleeve. Fit the lockwasher (20) and the nut (11) and tighten, using the vice-adapter and spanner (*Table* 4/15) until the flange on the dog clutch plate and the bearing spacer abut their respective bearings.

(5) Carefully, so as to preserve the sealing edge, fit the seal (5). Fit the bearing retainer (23), screwing it to the housing (1) and locking the screws by centre punching.

Snatch clutch and housing (*fig.* 15)

94. Assemble the parts of the clutch on the driving spindle (10), and the housing assembly in its casing (4), adjusting the nuts (5) so that the clutch slips at 15·5/16·5 lb. in. torque. Before assembly, the outer clutch plates (8) must be soaked in warm oil (*Table* 5) and assembled wet.

Dog clutch (*fig.* 14)

95. To assemble the dog clutch and its operating lever proceed as follows: —

(1) Bolt the parts, (18), (19), (15) and (14) in their correctly assembled positions —aligning the red line on the outer edge of (19), (15), and (14)—and check the hub (18) for free rotation.

Note . . .

The assembly bolts, which are locked by shakeproof washers, must not project more than 0·03 *in. beyond the nut face.*

(2) Dismantle the assembly and position the springs (16) and (17) in pairs, between the lugs of the clutch hub (18) and the thrust ring (15).

(3) Reassemble as in operation (1).

(4) Fit the slippers (12) to the lever (9), securing them with the pins (13). Fit each pin so that the slot in its barrel aligns with the pin hole in the slipper. Drive a 0·57 in. × 18 s.w.g. steel pin through the hole to lock the pin in position. Lock the pin by centre punching.

(5) Slide the lever into position on the clutch hub.

Final drive unit (*fig.* 16)

96. To assemble the final drive unit proceed as follows: —

(1) Fit the ball bearing (41) on the bevel wheel (40) and secure it with the circlip (12).

(2) Fit the shim (38) and cover plate (28), into which the bearing (37) has been fitted, and secure by the retainer (29) and bolt (32). Fit the bearing cap (33), using two bolts only at this stage.

Note . . .

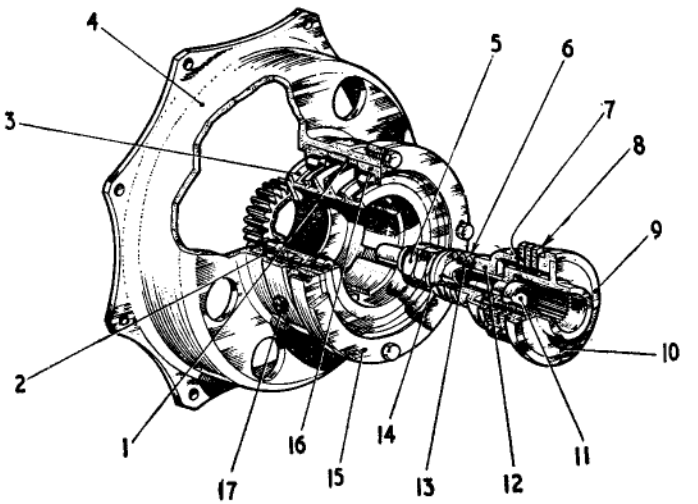
Do not lock the tabwashers until the final gear adjustments are completed.

(3) Insert this assembly into the bevel gearbox body (13), securing the cover plate (28) by two bolts only at this stage.

(4) Insert the outer race of the roller bearing (26) into the shaft bearing housing (18). Fit the shim (27) and the inner race and rollers of the bearing on the bevel shaft (17), and pass the shaft into the bearing cover. Insert the spacers (19, 25) and the ball bearing (20). Secure the assembly in place with the shaft nut (21) but do not lock at this stage. Fit the bearing cap (22), omitting the oil seal (24) and the circlip (23) at this stage.

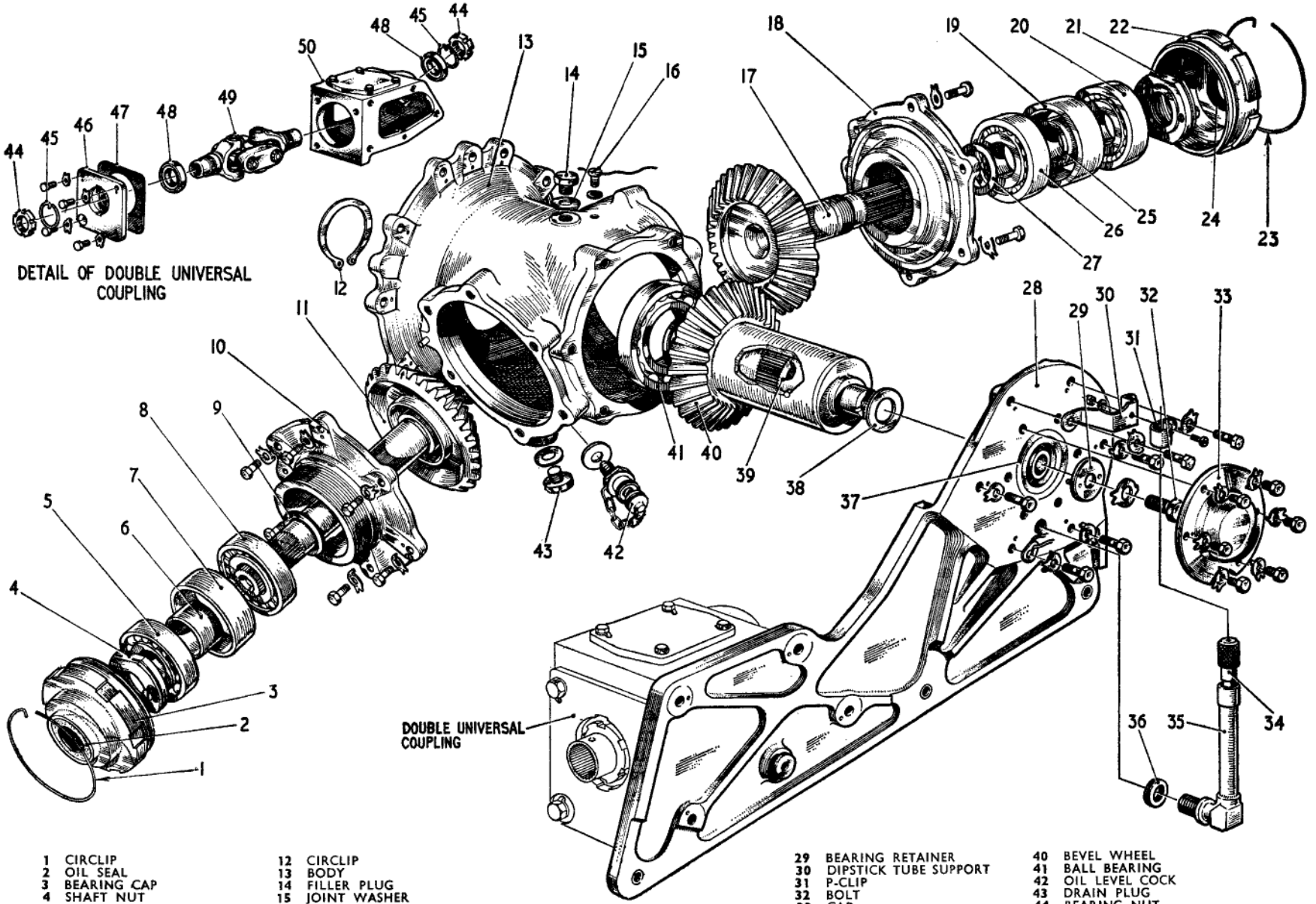
(5) Turn the bevel wheel (40) until the red arrow on the tooth is seen through the left-hand inspection hole (*fig.* 17) in the casing and the red arrow in the gap is seen through the right-hand inspection hole when viewed from the fixing flange end.

(6) Hold the bevel wheel in this position and mesh its marked tooth with the marked gap on the bevel shaft (17),



1 BEARING SPACER
2 ROLLER BEARING OUTER RACE
3 CLUTCH HOUSING
4 CLUTCH HOUSING CASING
5 ADJUSTER NUT AND LOCKNUT
6 LOADING SPRING
7 CLUTCH PLATE (INNER)
8 CLUTCH PLATE (OUTER)
9 THRUST RING
10 CLUTCH DRIVING SPINDLE
11 SPINDLE STOP
12 PRESSURE PLATE
13 SLEEVE
14 DISTANCE PIECE
15 BEARING CLAMP RING
16 ROLLER BEARING OUTER RACE
17 LOCKING SCREW

Fig. 15. Auxiliary snatch clutch and housing



1 CIRCLIP
2 OIL SEAL
3 BEARING CAP
4 SHAFT NUT
5 BALL BEARING
6 SPACER
7 SPACER
8 ROLLER BEARING
9 SHIM
10 BEARING HOUSING
11 BEVEL SHAFT (STBD.)
12 CIRCLIP
13 BODY
14 FILLER PLUG
15 JOINT WASHER
16 LOCKSCREW
17 BEVEL SHAFT (PORT)
18 BEARING HOUSING
19 SPACER
20 BALL BEARING
21 SHAFT NUT
22 BEARING CAP
23 CIRCLIP
24 OIL SEAL
25 SPACER
26 ROLLER BEARING
27 SHIM
28 COVER PLATE
29 BEARING RETAINER
30 DIPSTICK TUBE SUPPORT
31 P-CLIP
32 BOLT
33 CAP
34 DIPSTICK
35 DIPSTICK TUBE
36 JOINT WASHER
37 BALL BEARING
38 SHIM
39 QUILL SHAFT
40 BEVEL WHEEL
41 BALL BEARING
42 OIL LEVEL COCK
43 DRAIN PLUG
44 BEARING NUT
45 LOCKING RING
46 BEARING MOUNTING PLATE
47 SHIM
48 BALL BEARINGS
49 UNIVERSAL JOINT
50 MOUNTING BOX

Fig. 16. Final drive unit

securing the bearing housing (18) to the body by the two vertically pitched bolts only.

(7) Adjust the bevel wheel (40) by the shaft shims (38) to give correct meshing of both gears. This is obtained when the back cone faces, as seen through the left-hand inspection hole, are flush, taking care that a nominal backlash of 0·005 in. remains.

(8) Assemble the synchronizing jig (*fig.* 17) over the end of the bevel shaft (17) and secure it to the casing by four jig bolts. Secure the shaft to the jig with the attached pin, thus ensuring that the marked teeth are coincident with the inspection holes.

(9) Assemble the bevel shaft (11) in the same manner as for (17), meshing its marked tooth with the marked gap in the bevel wheel and adjust on the shim (9).

(10) When all of the adjustments are completed, pack all bearings with grease (*Table* 5).

(11) Finally lock the shaft nuts (4, 21) and the bearing caps (22, 3). After binding the serrated shaft ends with cellophane tape to prevent damage to the sharp sealing edge, assemble the seals for the two bearing caps.

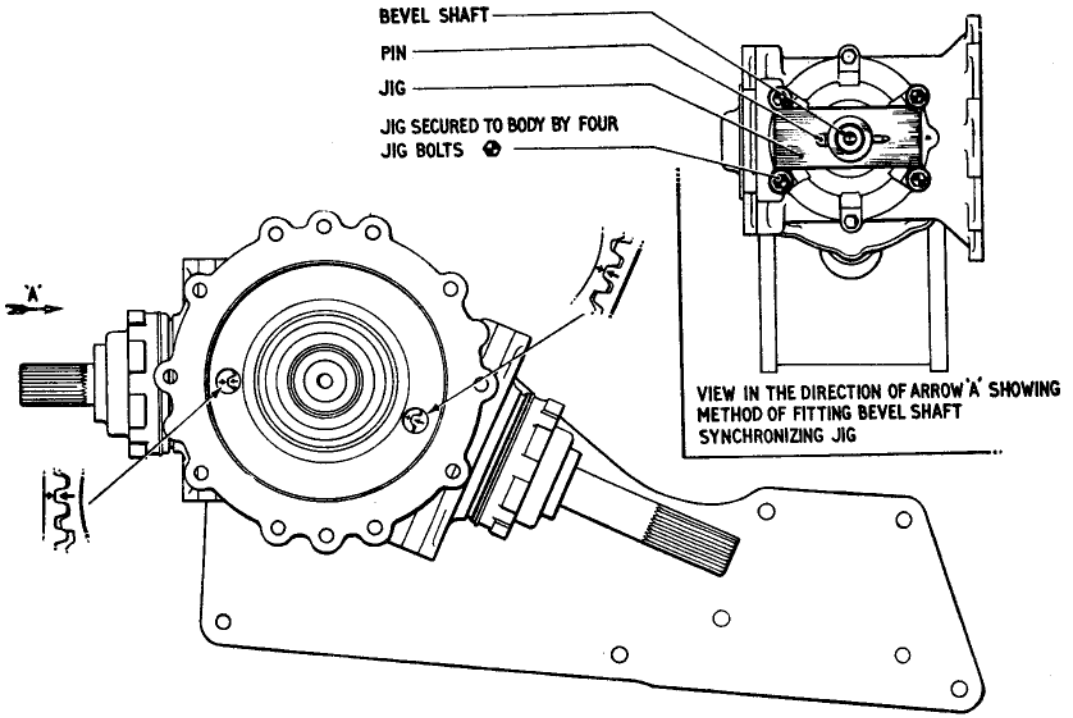


Fig. 17. Gear teeth alignment—final drive

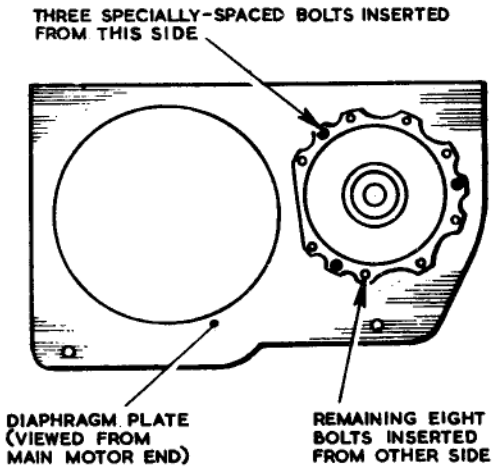


Fig. 18. Auxiliary epicyclic drum assembly detail

(12) Fit the dipstick tube (35) and joint washer (36) to the cover plate (28), removing laminations from the washer, as required, to obtain an oil-tight joint when the dipstick tube is vertical.

(13) Bolt the dipstick tube support (30) to the cover plate (28) and lock the bolts. Secure the dipstick tube (35) to its support (30).

(14) Assemble and lock all bolts by the tabwashers, except at the synchronizing jig, which must be left in position until the final drive unit is assembled to the main gearbox.

Main assembly

97. Except where otherwise stated, all an-

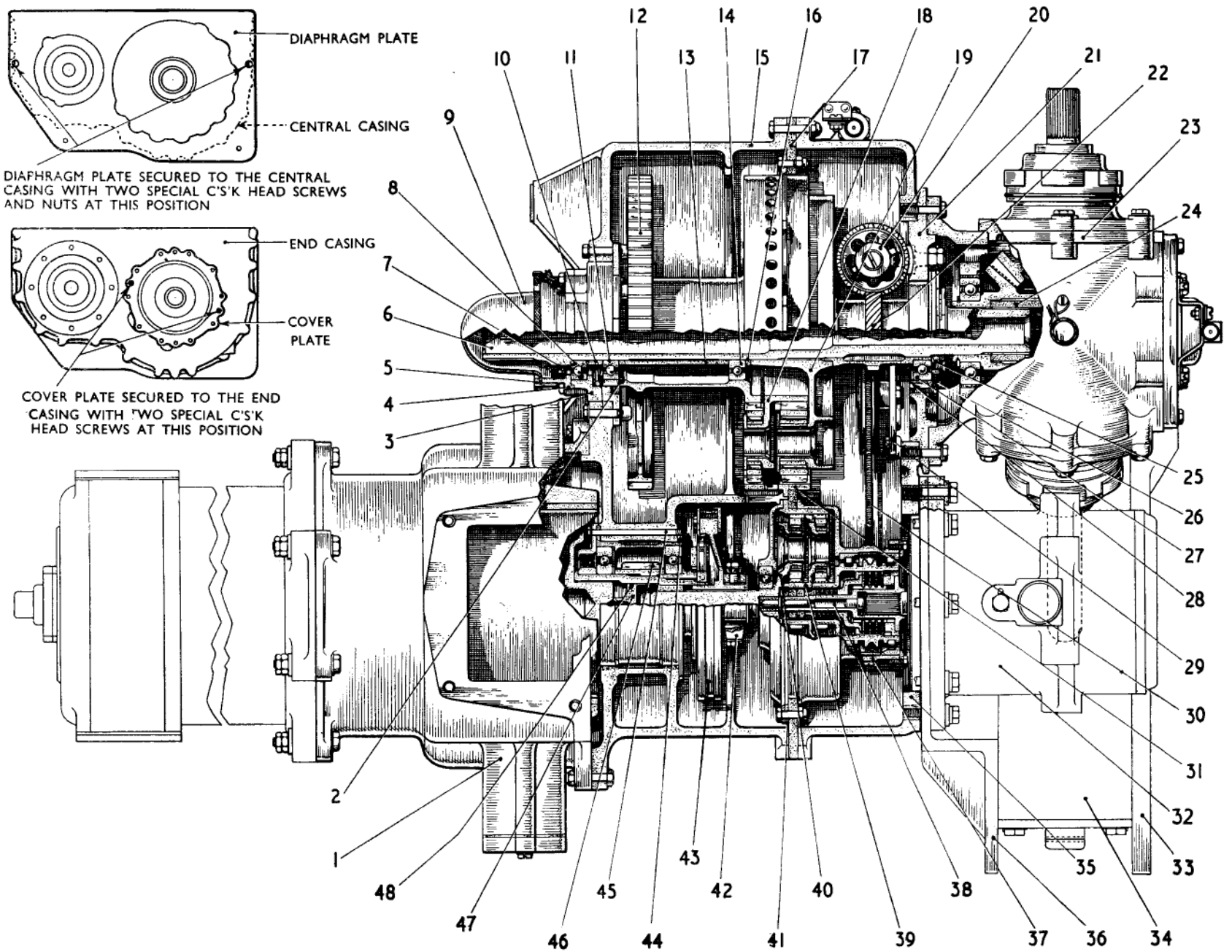


Fig. 19. Flap gearbox—main assembly

KEY TO FIG. 19

1 MAIN DRIVE UNIT
2 CIRCLIPS
3 MAIN SHAFT LOCATOR
4 MAIN SHAFT LOCATOR CAP
5 CAP NUT
6 MAIN SHAFT
7 SEAL
8 BALL BEARING
9 SHAFT PROTECTION CAP
10 BEARING SPACER
11 BALL BEARING
12 PRIMARY WHEEL AND SUN
13 BEARING SPACER
14 BALL BEARING
15 CENTRAL CASING
16 BEARING SEAL
17 DIAPHRAGM PLATE
18 MAIN INPUT PLANET CARRIER
19 MAIN OUTPUT PLANET CARRIER
20 SELECTOR DRUM DRIVE
21 COVER PLATE
22 SELECTOR DRUM DRIVING WHEEL
23 FINAL DRIVE UNIT
24 QUILL SHAFT
25 MAIN SHAFT NUT
26 BEARING RETAINER
27 BALL BEARING
28 SHAFT BEARING PLATE LINER
29 LUBRICATOR ASSEMBLY
30 LUBRICATOR BAND
31 MAIN EPICYCLIC DRUM
32 AUXILIARY MOTOR
33 COVER PLATE
34 DOUBLE UNIVERSAL JOINT
35 END CASING
36 SUPPORT PLATE
37 SNATCH CLUTCH HOUSING SUPPORT
38 SNATCH CLUTCH
39 AUXILIARY INPUT PLANET CARRIER
40 AUXILIARY OUTPUT PLANET CARRIER
41 AUXILIARY EPICYCLIC DRUM
42 DOG CLUTCH LEVER
43 DOG CLUTCH
44 RING NUT
45 BOLTS
46 PRIMARY PINION
47 GREASE RETAINING CUP
48 SEAL

notations refer to fig. 19. To assemble the gearbox proceed as follows: —

(1) Fit the grease retaining cup (47) complete with seal (48), in the bore of the primary pinion assembly (46). Fit the assembly in the central gear casing (15), securing it with the housing bolts (45), tabwashers, and nut ring (44).

(2) Fit the idler assembly (*fig.* 14), meshing the gear wheel with the primary pinion.

(3) Mount the auxiliary epicyclic drum (41) and the auxiliary output planet carrier (40) on the case diaphragm plate (17), using three bolts (*fig.* 18). Slide the auxiliary epicyclic input planet carrier (39) into mesh with the drum and the output planets. Slide the snatch clutch housing assembly (37) onto the drum (41), meshing its sun pinion with the input planets and bolt it to the diaphragm plate. Tighten all nuts. Slide the dog clutch (43) on to the serrated shaft of the auxiliary output stage, making sure that it moves freely.

(4) Fit the ball bearing (8) to butt against the shoulder on the main shaft. Assemble the main shaft locator (3) on the bearing, securing it by the locator cap (4), nuts and tabwashers. Secure the ball bearing (11) in the hub of the primary wheel and sun (12) with the circlips (2), slide the bearing spacer (10) over the shaft (6) and follow with the primary wheel and sun. Pass the bearing spacer (13) over the shaft, pack the hub of the wheel and sun with grease (*Table* 5) and fit the bearing (14).

(5) Mount this partial assembly in the central casing (15) and bolt the locator (3) to the casing, *taking great care that the shaft ball bearing is not subjected to wracking loads (caused by movement of the unsupported end of the shaft) during this or subsequent assembly operations.*

(6) Bolt the main epicyclic drum (31) to the diaphragm plate (17) and secure the latter to the central casing by the two countersunk-head screws shown in detail on fig. 19. Mesh the main input planet carrier (18) with the epicyclic drum (31) and the primary sun. Slide the bearing seal (16) over the main shaft and follow with the main output planet carrier (19), meshing with the epicyclic drum and the input sun. Fit the selector drive wheel (22), engaging it with the recess in the bore of the output planet carrier.

(7) Bolt the lubricator assembly (29) to the end casing (35) and bolt the latter to the assembled diaphragm plate and central casing.

(8) Fit the ball bearing (27) in the bearing plate liner (28) and insert the liner into the cover plate (21), after first fitting the selector drive (20). Position the bearing retainer (26) and secure the assembly with countersunk-head screws.

Note . . .

When fitting (20) *ensure that it rotates freely, but without end play.*

(9) Pass the assembled cover plate (21) over the main shaft, carefully meshing the spiral gears, and secure the assembly to the end casing (35) by the two special countersunk-head screws as shown in detail on fig. 19.

(10) Fit, tighten and lock the main shaft nut (25) (*Table* 4/16).

(11) Stretch the lubricator band (30) and fit it on the grooved wheel.

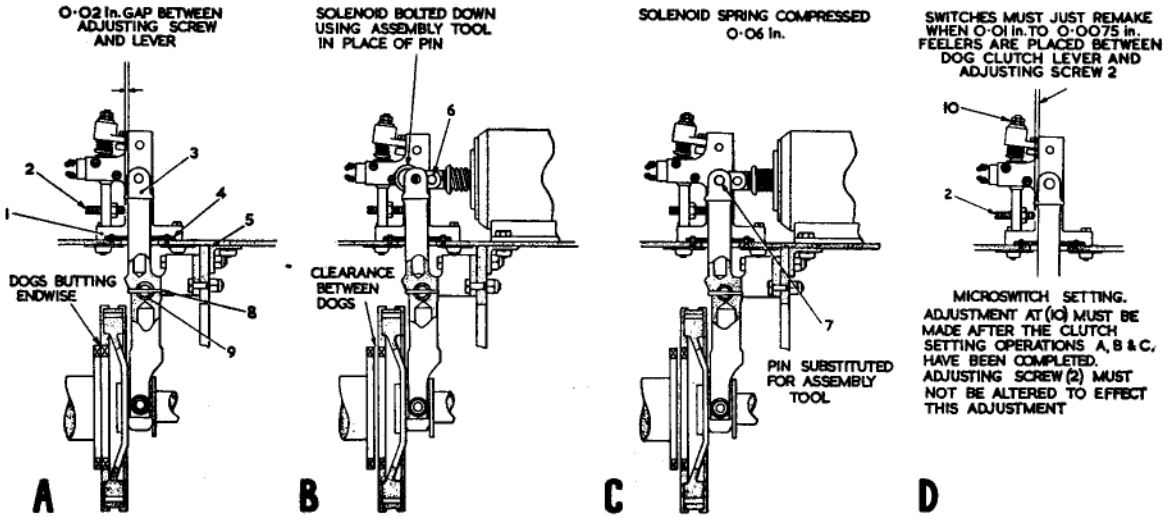


Fig. 20. Dog clutch setting

(12) Press the seal (7) into the shaft locator cap (4), taking care not to damage the sealing edge.

(13) *Fig.* 20. Fit the hinge pin (9) securing the clutch lever (3) in its supporting bracket. Lock the pin with taper pin (8). Engage the lever slippers with the thrust flanges of the dog clutch and bolt the lever bracket to the diaphragm plate.

(14) *Fig.* 20. Pass the rubber seal (4) on the casing cover plate (5) over the clutch lever, and bolt the plate to the gearcase by the eight bolts and tab-washers as shown in fig. 21.

(15) *Fig.* 20. Position the dog-clutch solenoid.

(a) Assemble the clutch lever stop bracket (1) and adjusting screw (2) and bolt them to the cover plate (5).

(b) Slide the clutch until both sets of dogs butt endwise. If the dogs pass into engagement, correct by turning the primary pinion.

(c) Hold the clutch lever in the butted position and turn the adjusting screw until there is a gap of 0·02 in. between screw and lever. Lock the screw at this setting.

(d) Assemble the link and link pin (6) on the plunger eye of the solenoid and place the solenoid on the two rear fixing studs.

(e) Couple the link to the clutch lever eye, using the assembly tool (*Table* 4, *item* 18) in place of the link pin, and press the solenoid forward against the clutch lever until the lever is touching the stop and the assembly tool will just slide in the link. Bolt the solenoid down in this position. Withdraw the assembly tool from the link, fit the link pin (7) and secure it with a split pin. This operation gives the solenoid spring an initial compression of 0·060 in.

(f) Adjust the operating pins (10) on the microswitches so that both are 'made' when the clearance between the clutch lever and screw (2) is 0·007 in., and are 'open' when the clearance is between 0·0075 and 0·010 in. Lock the pins when this setting is obtained.

(16) Fit the selector gear: —

(a) Pass the main shaft synchronizing jig over the driving end of the main shaft and bolt it to the casing (*fig.* 22). Rotate the gears by hand until the synchronizer pin can be inserted through the $\frac{3}{16}$ in. dia. hole in the main shaft.

(b) Rotate the selector drum until the 1st and 2nd UP-MAIN limit switches trip.

(c) Place the selector shaft on its lower universal joint pins. Note the position of the pin slots in the top end of the shaft and set the pin coupling block (*fig.* 9, *item* 34) on its serrations, while keeping the drum stationary, so that the two driving pins will engage the slots in the shaft when the drum assembly is mounted in position. After this adjustment has

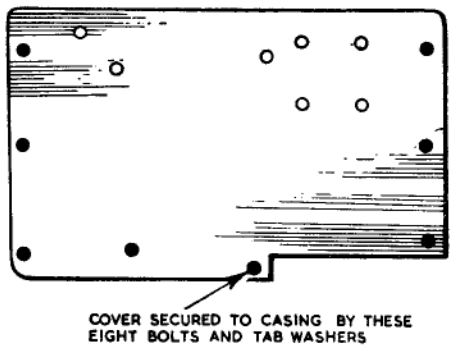


Fig. 21. Cover plate assembly detail

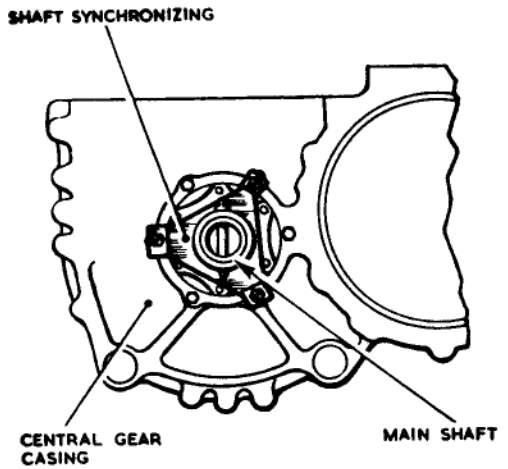


Fig. 22. Main shaft synchronizing jig assembly

been made, lock the coupling block on its spindle by the special screw and tabwasher.

(d) Bolt the drum assembly (*fig.* 9) in position on the casing cover.

(17) Engage the final drive quill shaft (24) with the end of the main shaft and bolt the final drive unit (23) to the gearbox casing.

(18) Remove the synchronizing jigs from the main shaft and bevel shaft and replace and lock the bolts.

(19) Bolt the main drive unit (1) to the central gear casing.

(20) Enter the snatch clutch (38) into its housing, engaging the outer plate splines with those in the clutch housing. Fit the support plate (36) for the double universal joint (34), then mount the auxiliary motor (32) on the end casing after inserting the stud bushes in the motor flange fixing holes. Secure by nuts and locknuts.

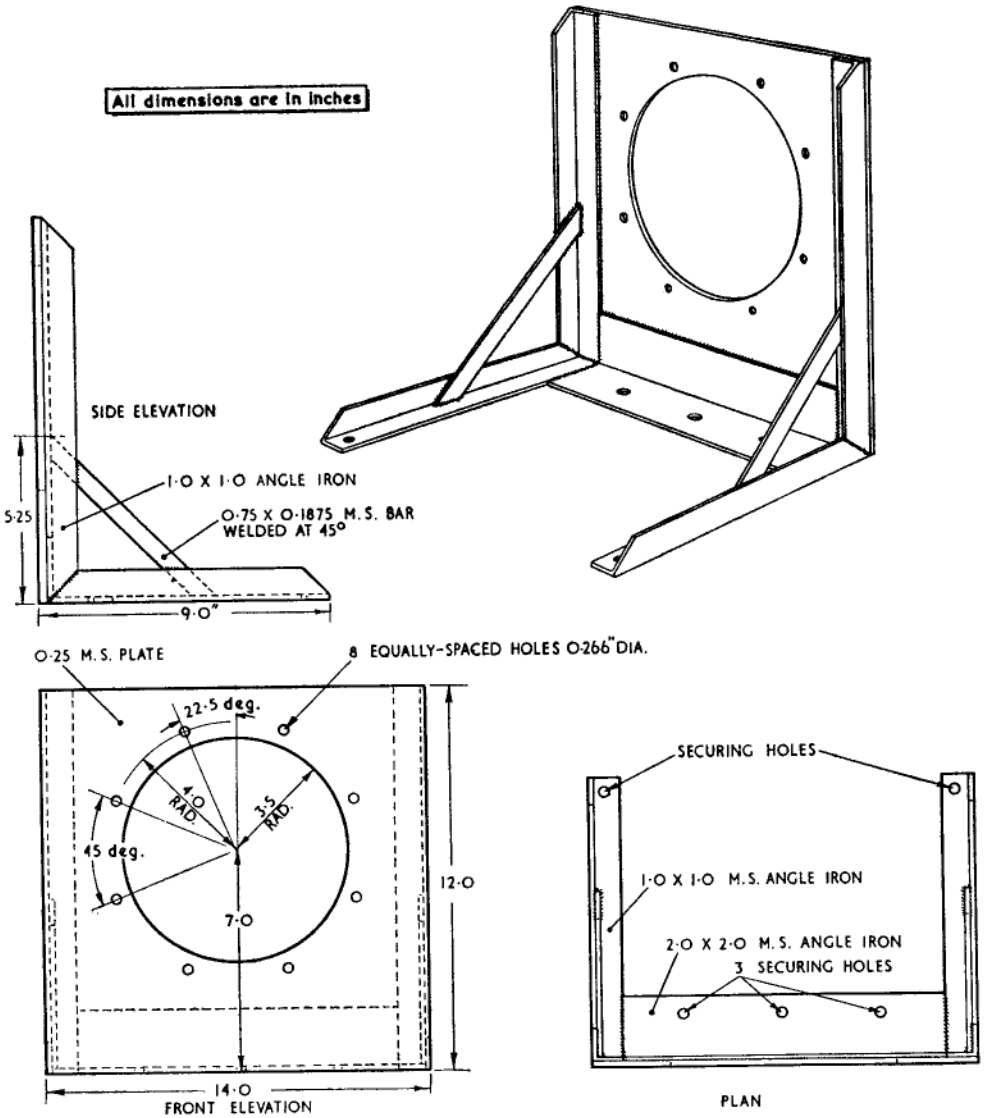


Fig. 23. Bench support for main drive unit (local manufacture)

(21) Assemble the synchronizing jig (*Table* 4/20) on the double universal mounting box and secure by two bolts. Rotate the double universal coupling by hand until the jig pin can be inserted horizontally through the jig and coupling.

(22) Locate the bevel shaft in its jig by the jig pin.

(23) Slide the double universal mounting box (34) between the support plate (36) and the cover plate (33), engage the bevel shaft with the double universal coupling and secure the mounting box to the support and cover plates.

(24) Remove the two synchronizing jigs and fit the remainder of the bolts and tabwashers to secure the bearing mounting plate and the bearing housing to the double universal mounting box and the bevel box body, respectively.

(25) Bolt the cable plug bracket on the top cover and mount the cable sockets.

(26) Tighten all nuts, locknuts, screws, wires, tabwashers, etc.

(27) Fit the selector gear cover.

(28) When the gearbox is released for installing in the aircraft it must be set in a position where the 1st and 2nd UP-MAIN switches have just tripped, i.e., the datum position.

(29) Fill the main and final drive casings with lubricant as specified in Table 5.

TABLE 5 Lubrication details

Ref. No.	*Specification*	*N.A.T.O. Code No.*	*Description*	*Where used*	*Application*
34B/9423150	OX-23	O-158	Oil	Gearbox casing	Fill through the filler orifice until the oil reaches the required level as shown on dipstick The filler, dipstick and drain plugs are shown in fig. 7
				Final drive	Fill through plug in top of box to required level on front-cover dipstick The filler, dipstick and drain plugs are shown in fig. 16
				Main clutch	Pour in 300 c.c. (pre-Mod. 2248) or 350 c.c. (post-Mod. 2248)
				Main and snatch clutch outer plates	Soak in warm oil for at least 24 hours before assembly and leave to cool in the oil
				The external surface of the selector drum and cams	Smear
				Selector drum bearings and the driving worm pivot bearings	Light application
34B/9100512	XG-275	G-350	Grease	Primary wheel and sun	Pack on assembly
				Main clutch bearing in main drive housing	Pack half-full on assembly
				Bevel shaft-housing and bearings	Pack two-thirds full on assembly
				Primary pinion	Pack drive end bearing two-thirds full on assembly
				Main clutch and brake bearing, fig. 10 item (7)	Pack half-full on assembly
				Gear teeth on selector drum and local indicator drive	Smear
				Between centrifugal and main clutch spindles	Pack on assembly

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