

# **SEMI-AUTOMATIC GEARBOX**

**TYPE RV 28**

## **SERVICE MANUAL**

**1st EDITION**

**RVM 28/1000/54**



**SELF-CHANGING GEARS LTD**







DIRECT AIR OPERATED

# SEMI-AUTOMATIC GEARBOX

TYPE RV28

List No. 5586 — with Hill-holder

List No. 5648 — without Hill-holder

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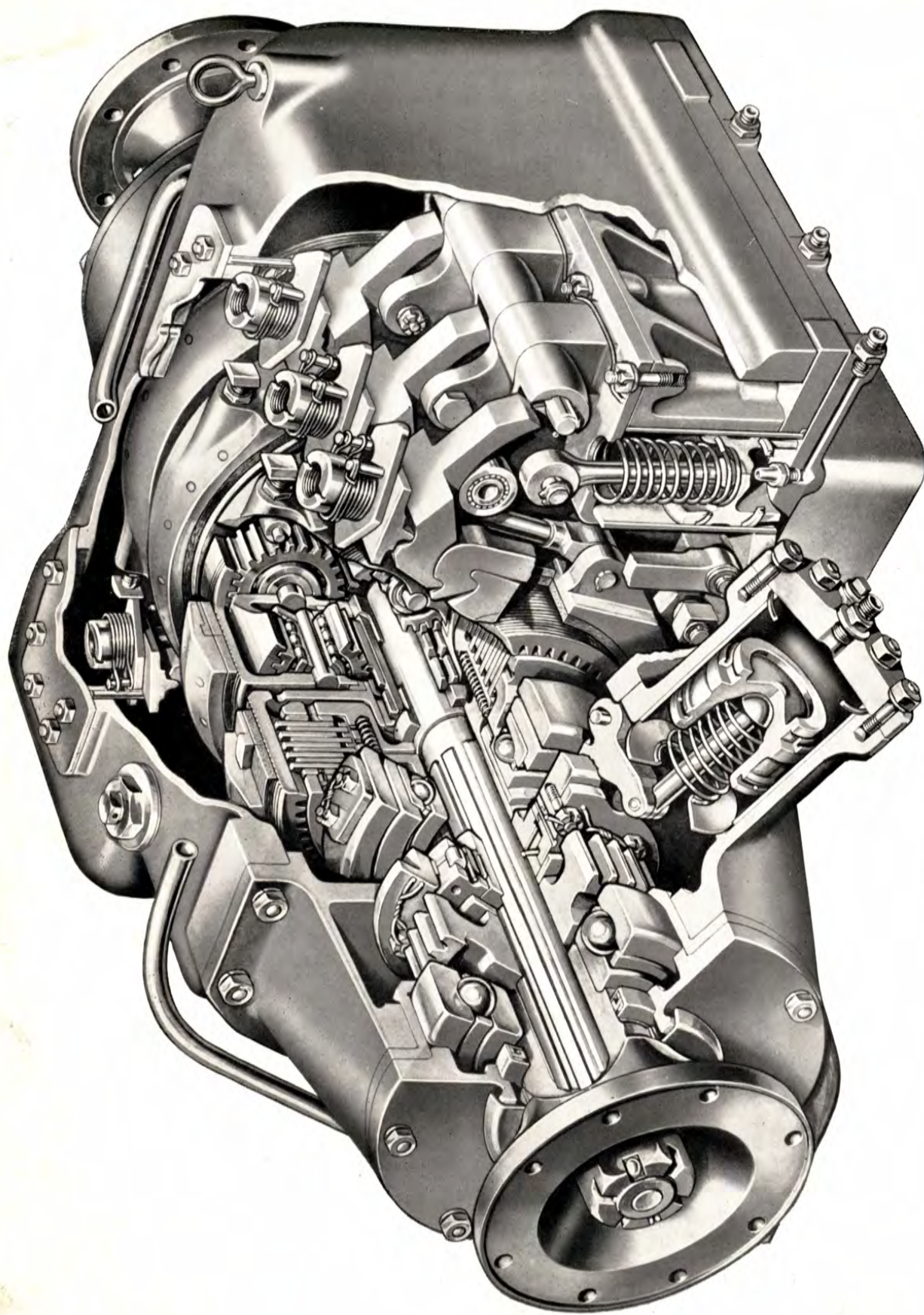


FIG. 1 CUT-AWAY VIEW OF THE GEARBOX



## THE GEARBOX

### DATA

**Type** ... .. Epicyclic gearbox, 4 forward speeds and reverse.

#### Gear Ratios

4th speed ... .. 1 to 1.

3rd speed ... .. 1.59 to 1.

2nd speed ... .. 2.43 to 1.

1st speed ... .. 4.28 to 1.

Reverse ... .. 5.97 to 1.

#### Bearings

Input shaft bearing ... .. British Std. No. B.R.H. 070.  
Ball journal 180 mm.o/d.  $\times$  70 mm. i/d.  $\times$  42 mm. wide.

Output shaft bearing ... .. British Std. No. B.R.L. 3.  
Ball journal  $5\frac{3}{4}$  in. o/d.  $\times$  3 in. i/d.  $\times$   $1\frac{1}{16}$  in. wide.

Output shaft intermediate bearing ... .. British Std. No. R.R.X.  $3\frac{1}{2}$ .  
Roller bearing 5 in. o/d.  $\times$   $3\frac{1}{2}$  in. i/d.  $\times$   $\frac{3}{4}$  in. wide.

Top speed clutch bearing ... .. British Std. No. A.C.M. 070.  
Ball bearing 150 mm. o/d.  $\times$  70 mm. i/d.  $\times$  35 mm. wide

#### Oil Seals

Input and output shafts ... .. Perfect No. D.A. 475316.

Speedometer housing ... .. Perfect No. 11216.







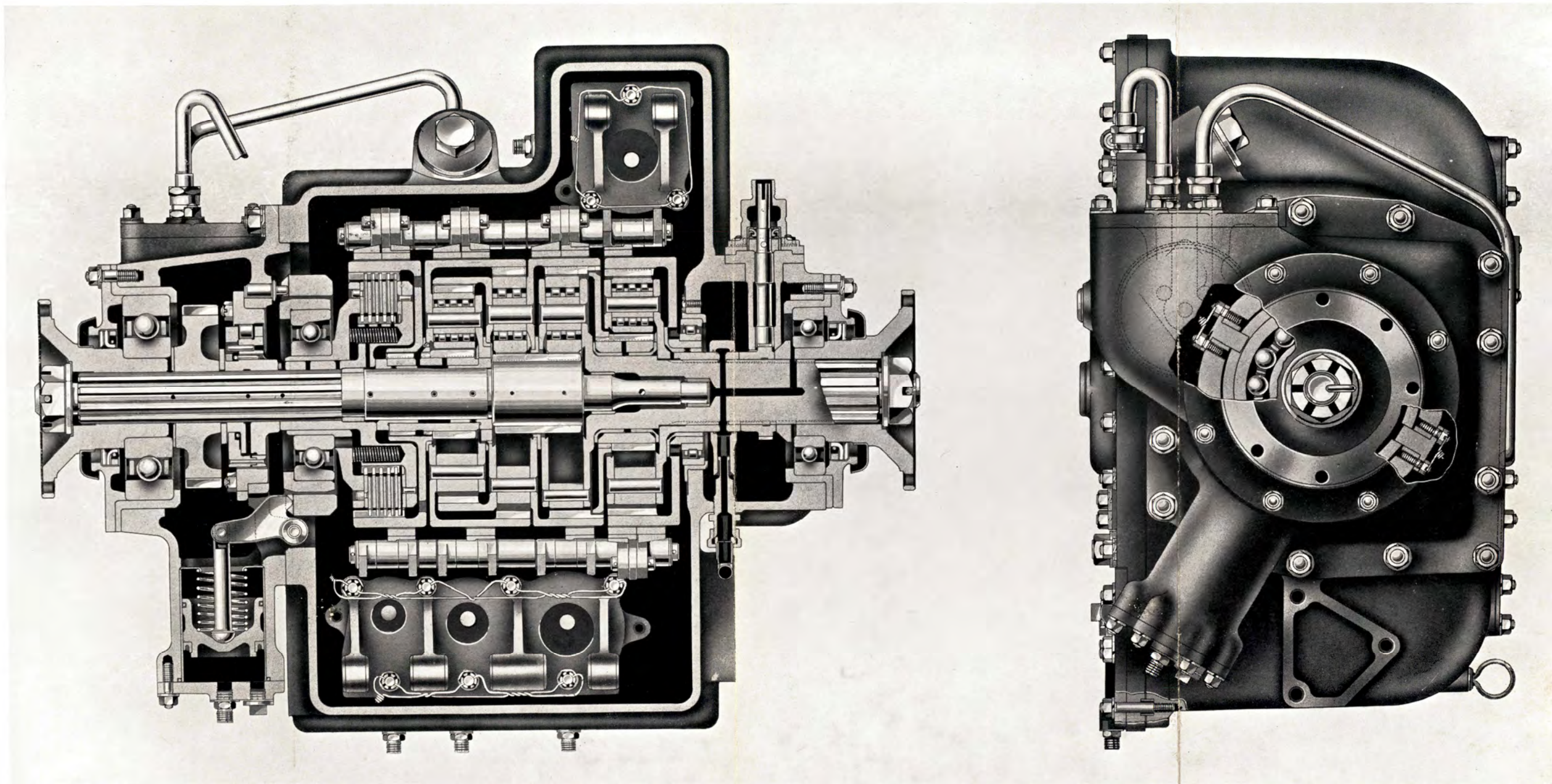


FIG. 2. SECTION THROUGH THE GEARBOX AND PART CUT-AWAY END VIEW







## GENERAL DESCRIPTION

The gearbox can be supplied with or without the hill-holding device which is described and illustrated in this Chapter. When this device is not fitted it is replaced by a sleeve.

The gearbox is of the epicyclic type having four forward speeds and reverse, of which three forward gears and reverse are provided by epicyclic gear trains. The direct drive top gear is provided by means of a multiplate clutch.

All five gears are air-operated, each being provided with a separate air cylinder. For the indirect gears the air pistons, working in cylinders mounted on the bottom cover, are used to apply the 1st, 2nd, 3rd and reverse speed brakes.

Air flow to and from the operating cylinders is restricted by the restrictor valves fitted in the outer adapters situated in the cover plates of the 1st, 2nd, 3rd and reverse speed pistons, so as to release one band while progressively applying the band of the gear to be engaged.

The top gear clutch is operated by a piston acting in an external cylinder cast integral with the front cover, Fig. 2.

The function of the clutch is to couple together the gear trains which comprise the direct gears and, by preventing rotation of the trains relative to each other, provide a direct drive from input to output shafts.

Air is admitted to the cylinder (Fig. 2) and forces up the piston and with it the piston rod which is linked to a lever which pivots about a pin, acting on the trunnion ring the lever converts the pressure of the piston into thrust parallel to the input shaft and thus applies the plate clutch.

The trunnion ring is mounted on the sliding panel and is so pivoted as to allow the assembly to take up its own alignment as the clutch is applied.

Admission of air to all cylinders is controlled by an air valve situated in the driver's compartment.

The combination of this gearbox with a fluid flywheel provides a highly efficient transmission, combining flexibility with ease of control.

The fluid coupling provides a smooth take-up of drive when starting from rest. When the engine is idling and the vehicle is stationary with the wheel brakes applied, the coupling gives 100 per cent slip. The first gear can, therefore, be engaged without stalling the engine. By releasing the vehicle brakes and increasing the engine speed the drive is taken up smoothly and positively with a minimum of skill and effort.

A longitudinal section through the gearbox is shown in Fig. 2. The epicyclic gear trains and their brake bands, the top gear clutch with its operating cylinders and piston are shown. The operating cylinder is not vertical as shown, but lies at an angle of  $30^\circ$  below the horizontal centreline of the gearbox.

A ball bearing of the angular-contact type is fitted between the clutch sliding member and the trunnion ring to take the thrust load in top gear. A ball bearing housed in the front cover locates the input shaft and take the journal load and clutch reaction, its inner race being mounted on the input coupling. Fitted between these two bearings is the oil pump driving gear and the freewheel mechanism.

At the rear end of the gearbox, the reverse gear train carrier is splined to the output shaft and the brake drum for this gear is carried by a roller bearing. The output coupling is supported by a ball bearing which takes the thrust and journal loads. The two bushes in the output shaft provide location and support for the rear end of the input shaft.



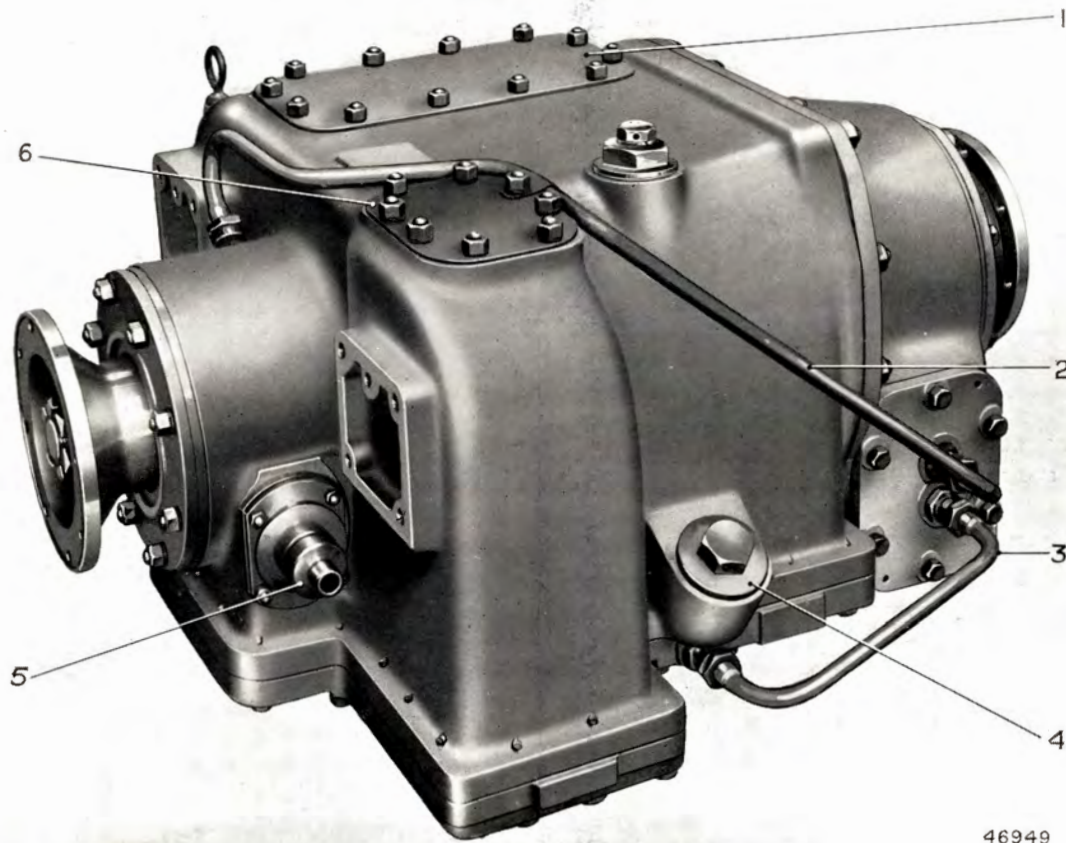


FIG. 3. RIGHT-HAND VIEW OF THE GEARBOX

- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| 1. Inspection cover (forward speeds). | 4. Filler plug.                      |
| 2. Outlet pipe (oil pump).            | 5. Speedometer housing.              |
| 3. Inlet pipe (oil pump).             | 6. Inspection cover (reverse speed). |

Incorporated in the gearbox is a hill-holding device, designed on the freewheel principle, which ensures that when any forward gear is engaged it is impossible for the vehicle to run backwards on a gradient, even with the brakes off, the engine idling and the fluid flywheel inoperative.

When a driver stops on a steep gradient he can, after engaging forward gear, release the brakes knowing that the vehicle cannot move backwards and will move away as the accelerator is depressed.

Lubrication is provided by a gear-type pump mounted on the front casing, Fig. 3 and 4, the flow of oil passes through an external pipe which is connected to an oil muff, Fig. 2, fitted on the output shaft and thence to the gear trains and bearings.

A speedometer drive unit is fitted, Fig. 3.

A section through the 1st speed brake in the **off** position, as seen from the input end, is shown in Fig. 6.



FIG. 4. THE OIL PUMP

- |                         |                        |
|-------------------------|------------------------|
| 1. Outlet pipe adapter. | 2. Inlet pipe adapter. |
|-------------------------|------------------------|



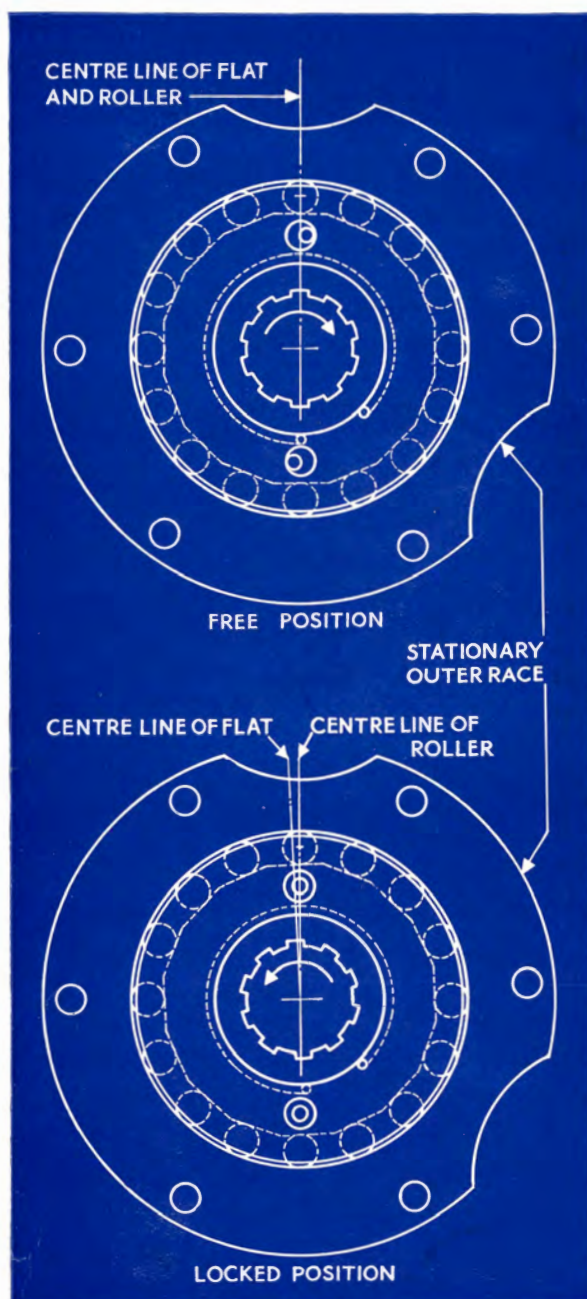


FIG. 5. PRINCIPLE OF THE HILL-HOLDING DEVICE

The brake actuating mechanism is the same for all the indirect gears except for the size of the cylinder and piston. The 1st speed and reverse brakes have the largest diameter cylinders because the greatest torque reaction occurs in these gears.

All four brakes are automatically adjusted for wear, and they are also centralised concentric with the drums in such a manner as to prevent them rubbing when in the **off** position.

A section through the 1st speed brake, but with the brake engaged is shown in Fig. 7. The amount of movement of the mechanism which takes place when air is admitted to the cylinder is clearly shown.

### BRAKE OPERATION

The brake mechanisms are used to bring into operation the indirect gears, one brake being provided for each gear.

When a gear is engaged, the appropriate brake grips the brake drum, bringing it to rest, thus providing a reaction so that power is transmitted to the gearbox output shaft.

The importance of correct setting of the brakes cannot be over emphasised, for incorrect settings will result either in excessive loadings in every part of the transmission from engine to road wheels, or in rapid deterioration and wear of the brake linings.

If the instructions are followed carefully, however, accurate brake settings can be made which will ensure that the gearbox can give its most efficient service.

A brake band consists of two concentric bands whose friction linings are situated side by side, Fig. 25. The outer band, when constricted by the brake mechanism, closes the inner band, both linings thus being brought into contact with the brake drum.

By using suitable anchorages for the inner and outer bands, the brake is balanced, so preventing the shafts and bearings from being subjected to any load arising from the application of the brakes.

The brakes are centralised about the drums in such a manner as to prevent them rubbing when in the **off** position.

The brake linings are made of a material which is extremely hard wearing and is suitable for working in oil. It is inevitable, however, that some wear will occur in time, and this is corrected by the automatic adjuster mechanism which keeps the brake constantly at its initial setting.



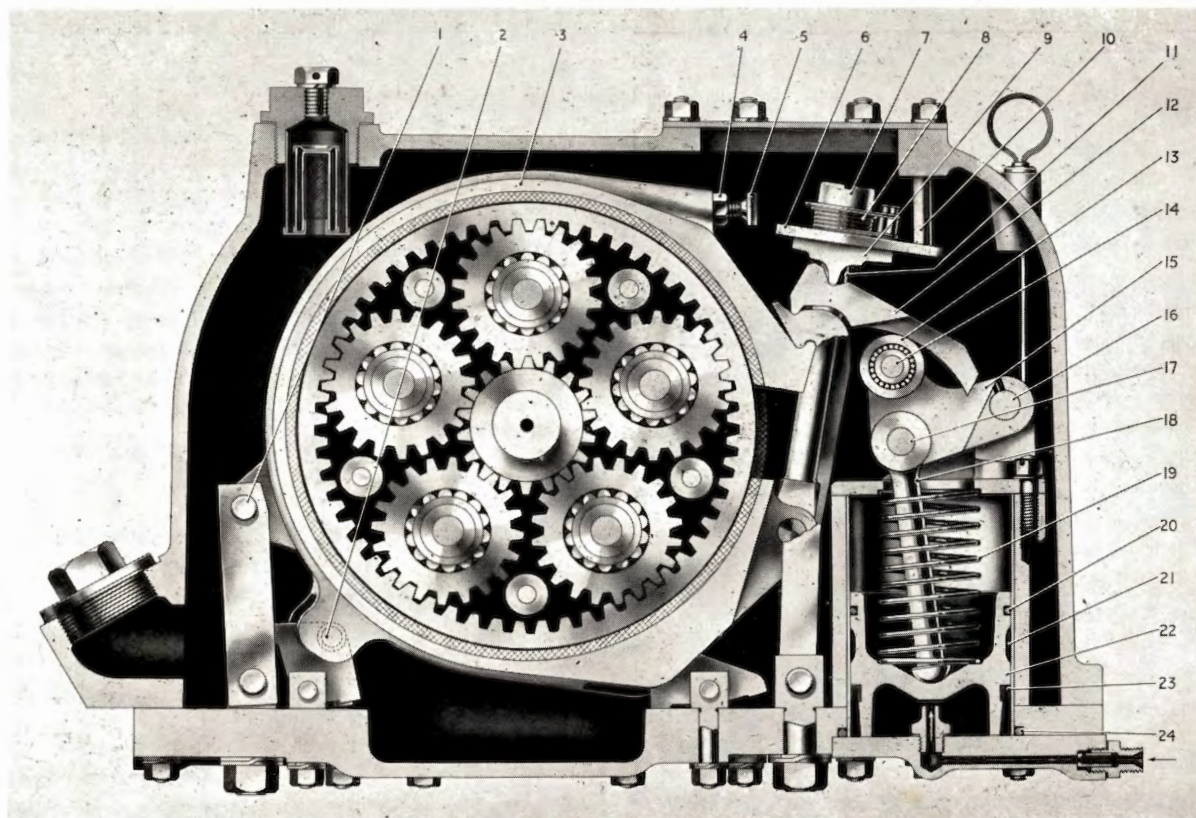


FIG. 6. SECTION THROUGH THE 1st SPEED BRAKE BAND (BRAKE OFF)

- |                         |                               |                                  |                       |
|-------------------------|-------------------------------|----------------------------------|-----------------------|
| 1. Link pin.            | 7. Automatic adjuster nut.    | 13. Cam roller race.             | 19. Piston spring.    |
| 2. Centraliser spring.  | 8. Automatic adjuster spring. | 14. Cam roller pin.              | 20. "O" ring.         |
| 3. Brake band assembly. | 9. Adjuster table.            | 15. Operating lever.             | 21. Cylinder liner.   |
| 4. Locknut.             | 10. Tail pin.                 | 16. Shaft (long).                | 22. Piston.           |
| 5. Adjuster screw.      | 11. Pull rod.                 | 17. Bearing pin, dowel, circlip. | 23. Distributor seal. |
| 6. Adjuster ring.       | 12. Thrust pad.               | 18. Piston rod.                  | 24. "O" ring.         |

When the gear change lever is moved into position, air is admitted to the cylinder, forcing the piston upwards, Fig. 7. This movement applies an upward force to the thrust pad which pivots about its knife edge on the hooks, thereby raising the adjuster mechanism and the pull rod. Since the pull rod is attached to the lower end of the outer band (the upper end of which is anchored by the hooks) this action constricts the brake band.

It will be seen that in rising, the pull rod and adjuster mechanism move towards the brake band and that the adjuster ring is brought into contact with the adjuster screw in the brake band.

#### THE AUTOMATIC ADJUSTER

The height to which the thrust pad is allowed to swing is the factor which determines the grip of the brake, and the travel of the thrust pad is governed by the automatic adjuster nut, note carefully that screwing the

nut **anti-clockwise** gives more movement and increased brake grip to the limit of movement of the adjuster mechanism.

Assuming that the brakes are correctly set, the automatic adjuster ring will, when the brake is in the **on** position, just touch the adjuster screw in the brake band, Fig. 7.

Wear on the brake linings will allow the thrust pad to move higher. When this occurs the automatic adjuster ring, Fig. 8, striking the adjuster screw will be rotated **anti-clockwise**. The adjuster ring is pinned to the spring in such a manner that this action loosens the spring from contact with the adjuster nut. As the brake approaches the **off** position, the rear portion of the adjuster ring strikes the tail pin. The adjuster ring now rotates in the **clockwise** direction, taking with it the adjuster nut which is thereby screwed down. This reduces the effective length of the pull rod and takes up the extra movement caused by the wear of the brake linings.



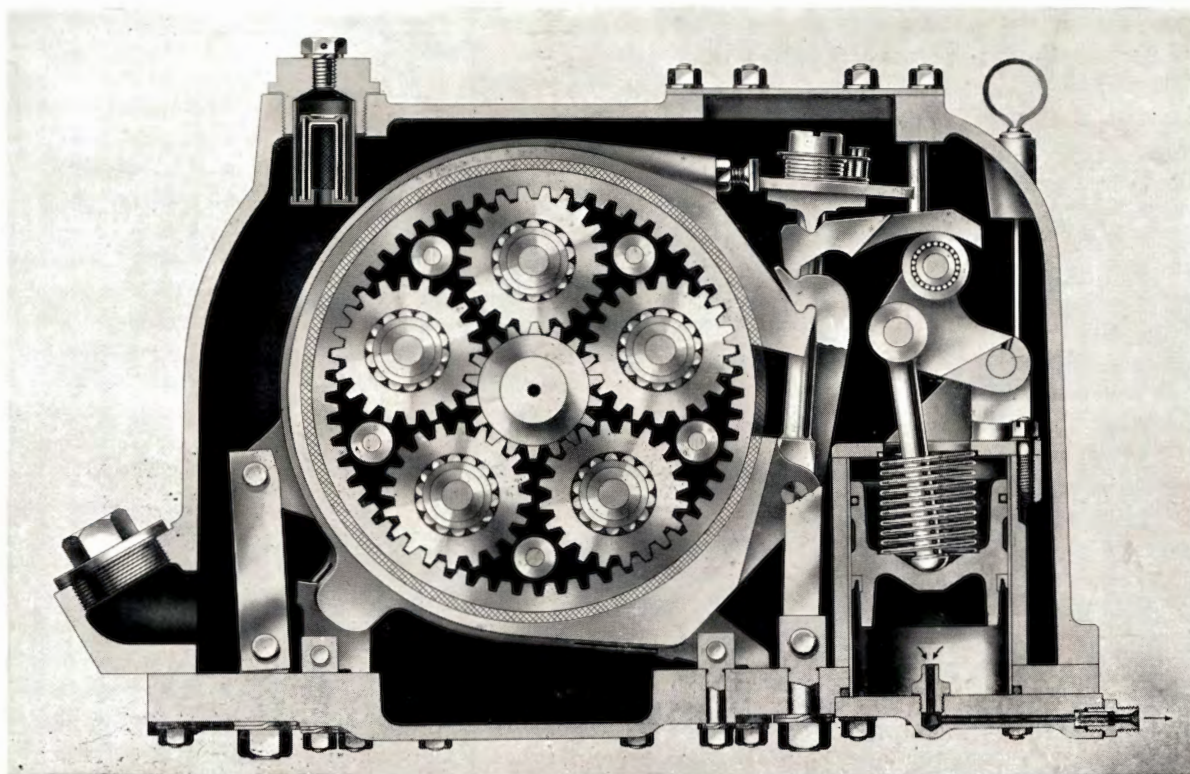


FIG. 7. SECTION THROUGH THE 1st SPEED BRAKE BAND (BRAKE ON)

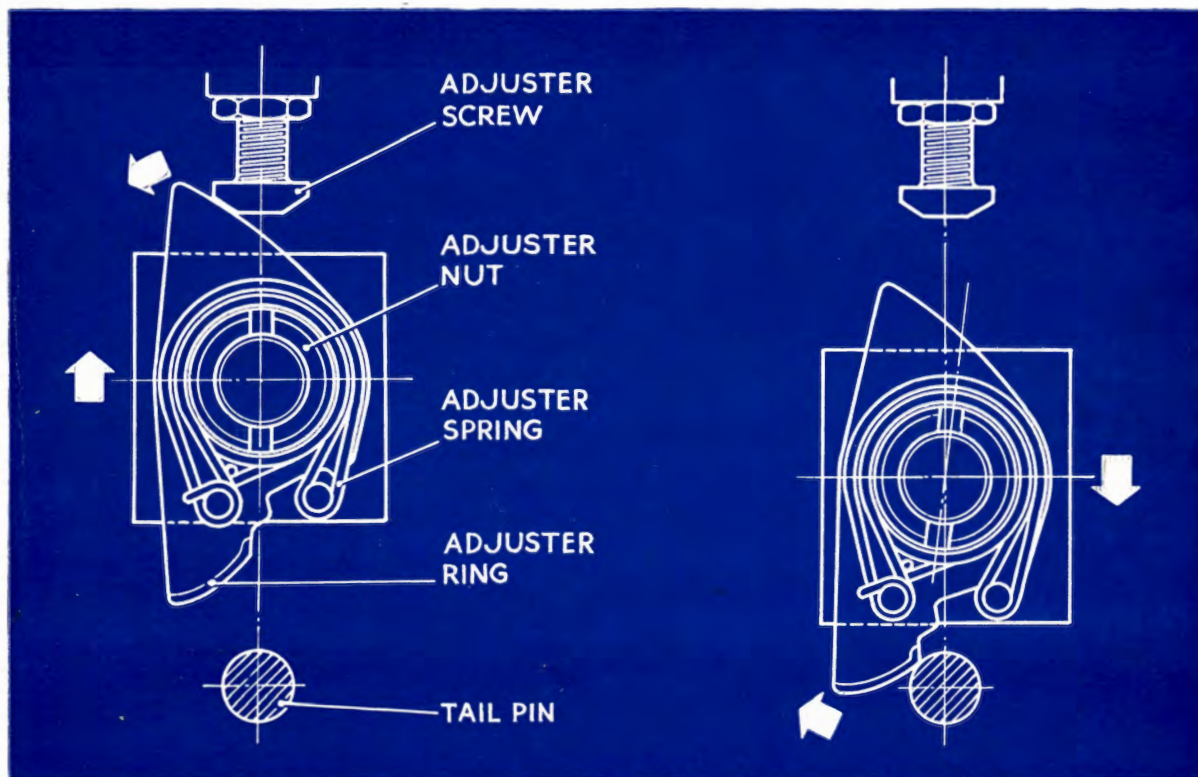
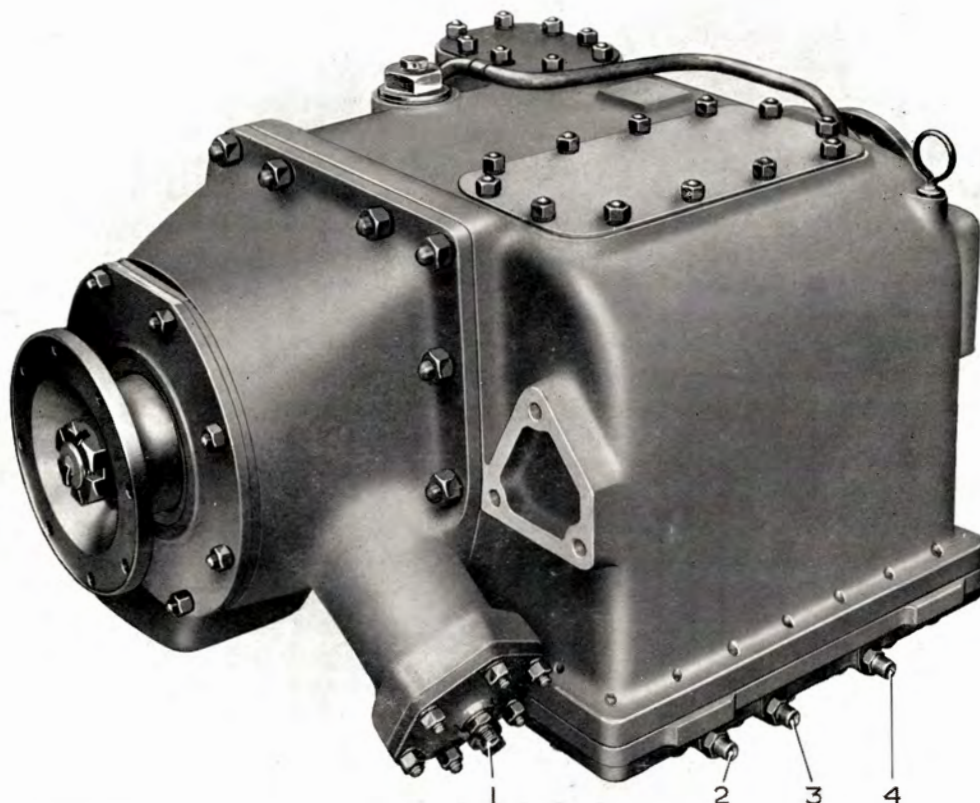


FIG. 8. THE AUTOMATIC ADJUSTER



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FIG. 9. LEFT-HAND VIEW OF THE GEARBOX

- |                       |                       |
|-----------------------|-----------------------|
| 1. Top speed adapter. | 3. 2nd speed adapter. |
| 2. 3rd speed adapter. | 4. 1st speed adapter. |

## HINTS ON DRIVING

To obtain the best service from the gearbox and to keep maintenance to a minimum, these driving instructions should be followed :

Ensure at all times that sufficient air pressure for operation is available.

### To Start from Rest

1. With vehicle brakes applied, move control lever to the first gear position.
2. Release vehicle brakes and open the throttle.
3. When the appropriate road speed is reached, move the control lever into the next gear position without closing the throttle.

4. Repeat until top gear is reached.

### To Change Down on Level

1. Close the throttle.
2. Move the control lever to the next lower gear position.

### To Change Down Ascending a Hill

1. Keep the throttle open.
2. Move the control lever to the next lower gear position.

### To Change Up Ascending a Hill

1. Keep the throttle open.



2. Move the control lever to the next higher position.
3. Open the throttle.

### To Move Off on a Hill

1. Engage first gear.
2. Fully release vehicle brakes.

**Never coast in neutral gear**, this may result in damage through over-speeding of the planet train gears.

## LUBRICATION

The oil level should be checked weekly by the dipstick and topped up as required.

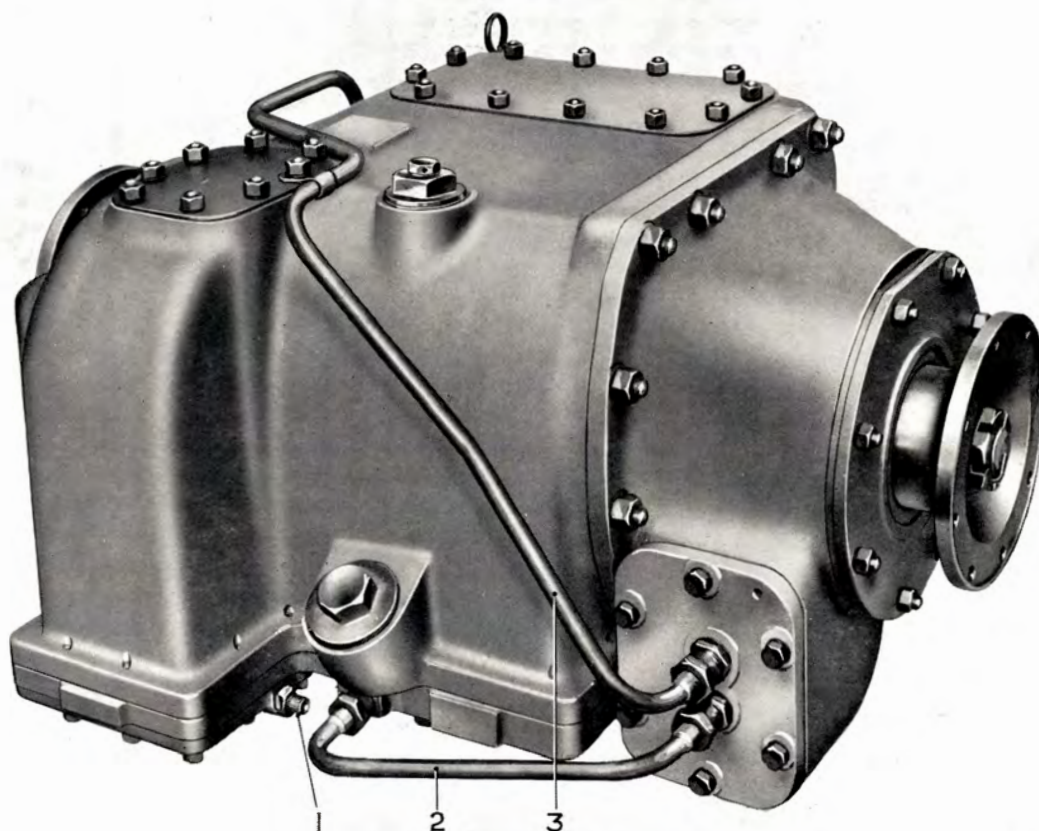
The oil capacity of the gearbox is approximately 1½ gallons (6.8 litres).

When a new or reconditioned box is put into service the sump should be drained and flushed after 500 miles running. Use a special flushing oil or thin machine oil for this purpose.

It is very important that the correct lubricating oil should be used in this gearbox—**Shell Donax T3** and **Wakefield Perfecto PSG** are the recommended lubricants. The mileage for flushing and refilling when these oils are used is 50,000 miles.

Should these oils not be available, a high grade straight mineral engine oil to specification SAE30 may be used, but the sump must then be drained every 10,000 miles.

When changing the brand of oil in the gearbox, the old oil must be cleaned from the box entirely.



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FIG. 10. RIGHT-HAND VIEW OF THE GEARBOX

1. Reverse speed adapter.
2. Inlet pipe.
3. Outlet pipe.

1. Oil pump casing.	125. Input coupling flange.	187. Centraliser spring.
2. Stud.	126. Output coupling flange.	188. Piston rod.
3. Stud.	127. Washer.	189. Bearing pin.
4. Cover, oil pump.	128. Nut and split pin.	190. Circlip.
5. Ring dowel.	129. Seal ring, rubber.	191. Thrust pad.
6. Pump gear and driving shaft.	130. Oil seal.	192. Operating lever, thrust pad.
7. Shaft, for driven gear.	131. Output bearing housing.	193. Automatic adjuster spring.
8. Bush, oil pump cover.	132. Output oil seal housing.	194. Nut.
9. Bush, oil pump case.	133. Distance washer.	195. Piston return spring, 1st and reverse.
10. Pump drive gear.	134. Speedometer drive worm wheel.	196. Piston return spring, 2nd speed.
11. Circlip.	135. Fourth speed cylinder cover.	197. Piston return spring, 3rd speed.
12. Key.	136. Fourth speed piston.	198. Piston, 1st and reverse.
13. Pump gear, driven.	137. Fourth speed cylinder liner.	199. Piston, 2nd speed.
14. Freewheel body.	138. Plate, 4th speed.	200. Piston, 3rd speed.
15. Freewheel cage.	139. Return spring, 4th speed.	201. Cylinder liner, 1st and reverse.
16. Stop pin.	140. "O" ring, 4th speed.	202. Cylinder liner, 2nd speed.
17. Roller retainer.	141. "O" ring, 4th speed piston.	203. Cylinder liner, 3rd speed.
18. Spring.	142. External distributor seal.	204. "O" ring, 1st and reverse.
19. Roller.	143. Pivot pin.	205. "O" ring, 2nd speed.
20. Rivet.	144. Joint.	206. "O" ring, 3rd speed.
21. Drive shaft, speedometer.	145. Joint.	207. Distributor seal, external, 1st and reverse piston.
22. Thrust ring, speedometer drive.	146. Inspection cover.	208. "O" ring, 1st and reverse piston.
23. Casing, speedometer drive.	147. Inspection cover.	209. Distributor seal, external, 2nd speed piston.
24. Grooved pin.	148. Cover plate.	210. "O" ring, 2nd speed piston.
25. Planet pinion, 1st and 2nd.	149. Cover plate.	211. Distributor seal, external, 3rd speed piston.
26. Planet pinion, inner race.	150. Joint.	212. "O" ring, 3rd speed piston.
27. Planet rollers.	151. Hollow dowel.	213. Cylinder block, 1st, 2nd, and 3rd speeds.
28. Spacing collar.	152. Drain plug.	214. Stud.
29. Output shaft.	153. Adapter.	215. Stud.
30. Plate.	154. Washer.	216. Stud.
31. Distance piece.	155. Breather plug and washer.	217. Cylinder block, reverse speed.
32. Rivet.	156. Drain plug.	218. Stud.
33. Planet pinion, 1st and 2nd.	157. Adapter, outer.	219. Stud.
34. Planet pinion, inner race.	158. Adapter, inner.	220. Stud.
35. Planet rollers.	159. Restrictor valve, 1st and reverse.	221. Bottom cover and sump.
36. Spacing collar.	160. Restrictor valve, 2nd and 3rd.	222. Cover, cylinder block.
37. Third speed annulus.	161. Washer.	223. Cover, reverse cylinder block.
38. First speed annulus.	162. Name plate.	224. Link, internal band.
39. Distance piece.	163. Plug and washer.	225. Eyebolt.
40. Rivet.	164. Magnetic plug and washer.	226. Eyebolt.
41. Rivet.	165. External brake band.	227. Centraliser, L.H.
42. Planet pinion, 3rd and reverse.	166. External brake liner.	228. Centraliser, R.H.
43. Planet pinion, inner race.	167. Rivet.	229. Centraliser rod, long.
44. Planet rollers.	168. Internal brake band.	230. Centraliser rod, short.
45. Spacing collar.	169. Internal brake liner.	231. Distance piece.
46. Second speed annulus.	170. Rivet.	232. Hook, rear.
47. Plate.	171. Adjuster ring.	233. Hook, front.
48. Rivet.	172. Pin.	234. Fulcrum rod.
49. Distance piece.	173. Adjuster table.	235. Distance piece.
50. Rivet.	174. Pin.	236. Distance piece.
51. Planet pinion, 3rd and reverse.	175. Outer race.	237. Distance piece.
52. Planet pinion, inner race.	176. Inner race.	238. Distance piece.
53. Planet rollers.	177. Needle rollers.	239. Ring dowel.
54. Spacing carrier.	178. Dowel.	
55. Reverse carrier.	179. Cam roller pin.	
56. Plate.	180. Adjuster screw.	
57. Distance piece.	181. Tail pin.	
58. Rivet.	182. Operating lever shaft, short.	
59. Inner plate, front.	183. Operating lever shaft, long.	
60. Peg.	184. Link pin, internal band.	
61. Inner member.	185. Pull rod.	
62. Clutch plate, rear.	186. Pin.	
63. Rivet.		

KEY TO FIG. 11



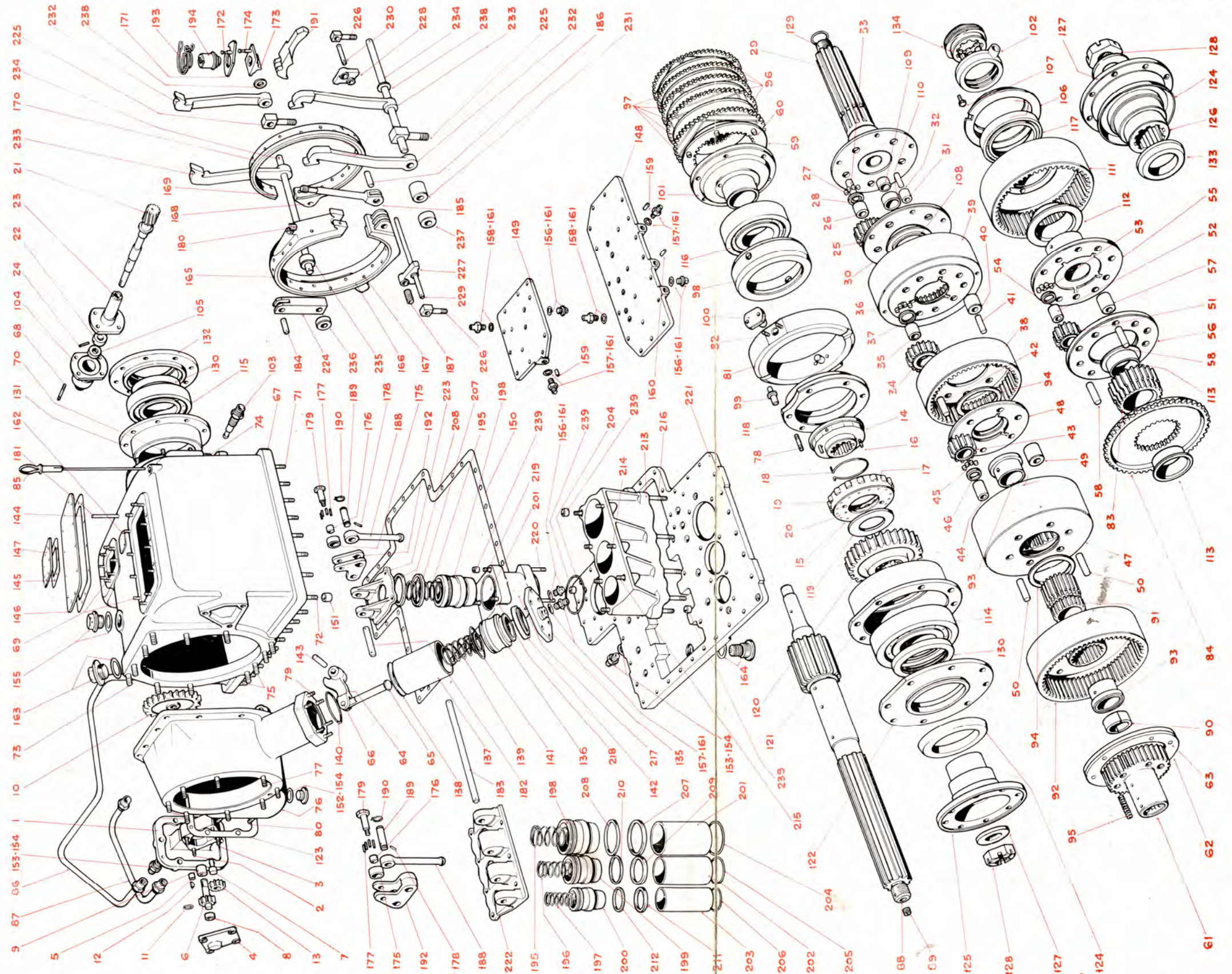


FIG. 11 EXPLODED VIEW OF THE GEARBOX



112 02 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



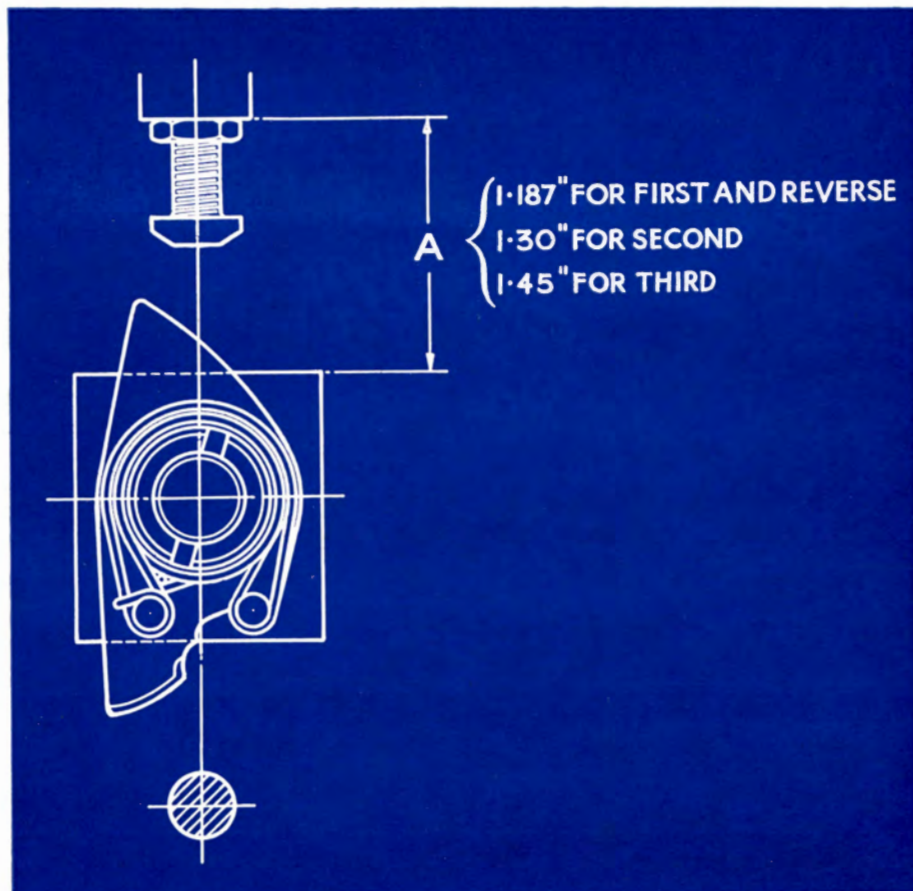


FIG. 12. SETTING DIMENSIONS FOR THE AUTOMATIC ADJUSTERS

## MAINTENANCE AND ADJUSTMENT

### AIR PRESSURE

The air pressure at which the gearbox should operate is governed by the torque of the engine to which it is coupled. If the box is used at its full rated capacity of 550 lb. ft. the air pressure required is 75/80 lb. sq. in. For engines of smaller output a lower pressure may be used and the advice of the manufacturer should be sought before using the gearbox.

Fierce engagement of all the gears can be caused by having the air pressure too high. If this occurs, the air-pressure should be adjusted to the correct value.

If the air pressure is low, slip may occur in the gearbox, particularly in the lower gears, and the air pressure must be adjusted to the correct value.

Should brake slip be experienced with adequate

pressure available, the external air pipe connections to the gearbox should be checked for leaks.

### CONSTANT SUPPLY OF AIR

It is essential that when the brakes are being set the air pressure should be kept constant at the operating pressure and this may be carried out as follows :

1. Use an independent air line taken through a reducing valve from the main supply.
2. Employ a portable compressor, set to give the correct pressure.

If no independent supply is available the reservoir must be re-charged by running the engine with the gearbox in the neutral position. (To prevent oil being

flung out of the gearbox, replace temporarily the inspection covers.)

Throughout the setting operation a continuous watch must be kept on the pressure gauge to ensure that the correct pressure is maintained, otherwise the final result will be unsatisfactory.

If the pressure is maintained and the sequence of operation relative to **Setting the Brakes** adhered to, the brakes should normally need no attention between overhauls.

## BRAKES

Normally the automatic adjusters will keep the brakes fully effective and no maintenance should be required for these units.

If their functioning is not correct, however, full information on adjustment is given in **Brake Operation and Adjustment**.

The dimensions of the gauges referred to in **Setting the Brakes** are :

- 1.187 in. for 1st and reverse speeds.
- 1.30 in. for 2nd speed.
- 1.45 in. for 3rd speed.

## To Release the Brakes

Before removing the running gear it is necessary to release each brake by screwing the adjuster nut **anti-clockwise** several turns. If this is not done, incorrect centralising of the brake bands may cause rapid and uneven wear of the linings when the box is again in service. The adjuster spring is first released by engaging the gear concerned and removing the two eyes from the pin fixed to the adjuster ring and the loop from the table pin. It is not necessary to remove the spring.

## Slipping Brakes

When brake slip is detected the cause should be corrected immediately or rapid deterioration of the brake linings will occur.

The cause of brake slip and the means of correction are as follows :

### 1. Low Air Pressure

Normal air pressure for operation is given in the **Air Pressure** section.

### 2. Leakage in the Air System

The air system should be checked by applying a solution of soap and water to the joints in the piping.

### 3. Leaking Piston Seals

Air leaking past the piston seals can be detected by air escaping from the breather or by a burbling sound from within the gearbox. Examine the seals for wear, hardening, cracked lips, etc., and the cylinder bore for scoring, see **Piston Seals** for method of removal.

### 4. Incorrect Setting of the Adjuster Mechanism

Check the gap between the adjuster table and the boss on the brake band see **Setting the Brakes**.

### 5. Adjuster Mechanism not Operating

If slipping persists when these instructions have been followed see **Failure of Adjuster Mechanism**.

## Fierce Engagement of Brakes

Fierceness of all gears is usually caused by excessive air pressure. This should be adjusted to the correct limits, and the brakes then reset from (9) in **Setting the Brakes**.

Fierceness of one gear only may be due to :

### 1. Incorrect Adjuster Setting

Apply the brake and check the gap with gauge, if the gap is only a little too small, carry out the instructions given in **Final Adjustment**.

### 2. Adjuster Mechanism not Operating

Apply the brake and check the gap with gauge, if the adjuster has failed the gap will be much too small, see **Failure of Adjuster Mechanism**.

## Failure of Adjuster Mechanism

The first effect of failure of the adjuster mechanism is usually fierceness of the brake concerned, which will increase as the linings wear until the linkage reaches the limit of its travel.

Slip will then occur and will become rapidly worse, giving exactly the same effect as clutch slip in other forms of transmission.



Some possible causes of failure being :

**1. Tightness of the Adjuster Nut**

Remove the spring, adjuster nut, adjuster ring, table and thrust pad, clean these parts and try the adjuster nut on the pull-rod thread, the nut should screw down by hand until the pull-rod protrudes through the top. If tightness persists, examine the threads for damage and correct if necessary. Re-assemble and re-set the brake.

**2. Trapped Adjuster Ring**

With the spring removed, the adjuster ring should turn freely about the adjuster nut and a degree of vertical play be discernable. File the adjuster ring on the underside until these conditions are obtained, then re-assemble and re-set the brake.

**3. Weak or Broken Spring**

Renew this component and check the working of the new spring when adjusting the brake as described in **Setting the Brakes.**

**Fitting the Adjuster Spring**

The spring is fitted over the adjuster nut with the wide coils lying uppermost. The two eyelets and the loop which lies between them are placed on the adjuster ring pin and the remaining loop over the table pin, Fig. 1.

**Setting the Automatic Adjuster**

When a gear is engaged it will be seen that the adjuster mechanism travels inwards towards the brake band when moving from the **off** to the **on** position, Figs. 6 and 7.

By measuring between the brake band and the adjuster mechanism with the brake in the **on** position, it is possible to obtain the setting required for each brake.

The surfaces convenient for measuring are the face of the boss on the brake band, on which the locknut rests, and the face of the adjuster table, Fig. 12.

The gearbox must not be hot or the measurement will be incorrect.

**PISTON SEALS**

Periodically the seals should be inspected for wear or deterioration, any seals which have hardened in service, or show worn or cracked lips, should be replaced.

**To Remove the 1st, 2nd, and 3rd Speed Pistons**

1. Remove the nuts which secure the bottom plate to the gearbox bottom cover, and allow the bottom plate to come away under the pressure of the piston return springs.
2. Remove the pistons and springs.
3. Fit new seals by stretching them over the flanges on the pistons, the groove in the seals to be facing outwards when in position.
4. Thoroughly lubricate any new seals fitted.

**To Remove the Reverse Piston**

This is a separate cylinder mounted on the opposite side of the base plate to the main bank of cylinders.

The piston is removed in a similar manner as described previously.

**To Replace the Pistons**

1. Ensure that the piston seals are fitted correctly.
2. Place the springs in the bore of the piston, and lead the spring and piston into its cylinder (guiding the leading seal into the cylinder with a small steel feeler), compress the spring slightly and tilt the piston to retain it until the other pistons are fitted.
3. Replace the "O" rings and bottom plates and tighten the nuts.

**TOP SPEED CLUTCH**

The clutch will require no adjustment, as wear on the clutch plates is compensated by increased travel of the operating piston.

**To Remove the Piston (Top Speed Clutch)**

1. Remove the cover and the piston will emerge under pressure of the clutch springs and the piston return spring.

**To Replace the Piston**

No special instructions are required, after replacing the piston refit the cover with the "O" ring in position.

## SETTING THE BRAKES

**Note :** This operation should be carried out when the gearbox is cold. It is also important that each time the brake is applied it should be left in the **on** position for at least five seconds. This will allow the full pressure to be reached in the cylinder.

1. Release the adjuster spring, see **Releasing the Brakes**.
2. Loosen the locknut on the adjuster screw in the brake band, and screw the adjuster screw right in.
3. Apply the brake and try gauge between the face of the adjuster table and the boss on the brake band, Fig. 12. The correct setting is that which just allows the gauge to enter.
4. If the gauge will not enter, release brake and screw the adjuster nut **clockwise**, apply the brake and check with the gauge until the correct setting is obtained.
5. If the gauge has too much clearance, the adjuster nut must be screwed **anti-clockwise** to obtain the correct setting.
6. When the correct setting has been obtained, release the brake, hold the adjuster ring against the tail pin and replace the spring.
7. Apply and release the brake, moving the adjuster screw out at each release, until the adjuster ring just touches the screw in the **on** position.
8. Lock the adjuster screw, with the face which contacts the adjuster ring vertical, Fig. 8.
9. Release the spring, then screw the adjuster nut **anti-clockwise** half a turn and replace the spring.
10. Apply and release the brake several times and note if the adjuster nut has turned. (This may be seen by laying a straight edge across the inspection aperture parallel to the slots in the nut when the

brake is in the **off** position, and then sighting the slots at each release).

If the adjuster nut has turned, apply and release the brake repeatedly until the nut stops turning. When the nut appears to have stopped turning, another six applications should be made to ensure that no further movement takes place.

11. If the adjuster nut has not turned, move the adjuster screw out half a turn at a time until the nut commences to turn, apply and release the brake until the nut has ceased to turn, and check the gap with the gauge.

## Final Adjustment

1. If the gauge will not enter, release the brake and move the adjuster screw half a turn outwards and re-lock.
2. Apply and release the brake until the adjuster nut stops turning.
3. Check the gap.

Repeat these operations 1 to 3 if required.

1. If the gauge has too much clearance, move the adjuster screw half a turn inwards and re-lock.
2. Release the adjuster spring and screw the adjuster nut half a turn in the anti-clockwise direction.
3. Replace the adjuster spring, apply and release the brake until the adjuster nut stops turning.
4. Check the gap.

Repeat these operations 1 to 4 if required.

**Note :** Should the mechanism fail to respond to this setting sequence (especially failure of adjuster nut to turn when the adjuster spring is considerably deflected) see **Failure of Adjuster Mechanism**.



## OVERHAUL

**Note:** The sequence of operations for the relining of the brake bands is described in **To Reline the Brake Bands.**

### TO REMOVE THE GEARBOX

1. Drain the oil from the gearbox by removing the two plugs fitted in the bottom cover and the front cover, Fig. 13.

**Note:** The drain plug in the bottom cover is of the magnetic type and should be cleaned prior to replacement.

2. Disconnect the propeller shaft couplings from the front and rear of the gearbox.

3. Release the five air connections at the gearbox.

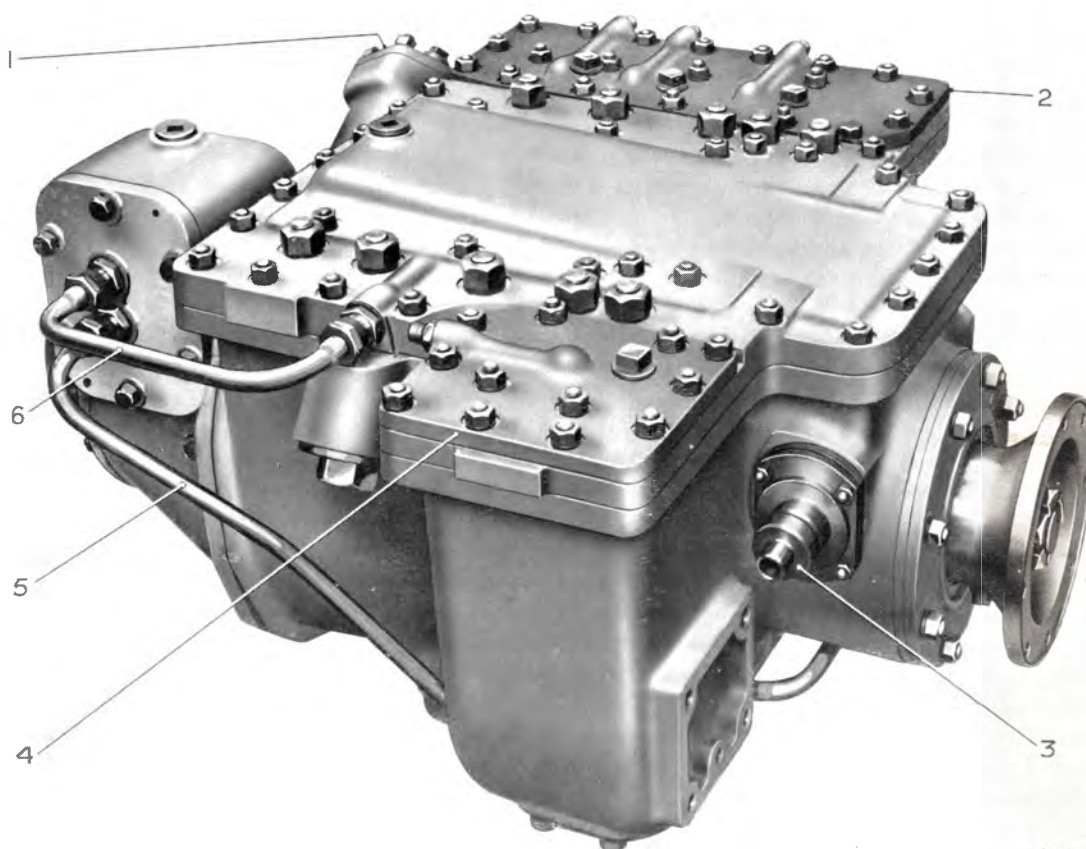
4. Disconnect the speedometer cable from the gearbox.

5. Pack up the gearbox and remove the mounting bolts.

6. Remove the gearbox from the chassis and transfer to a suitable stand for dismantling.

### TO REPLACE THE GEARBOX

In general, the replacement is a direct reversal of the procedure for removal.



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FIG. 13. VIEW OF THE GEARBOX SHOWING BOTTOM COVER

1. Top speed cylinder.
2. Cover plate (1st, 2nd and 3rd speeds).
3. Speedometer housing.

4. Cover plate (reverse speed).
5. Oil pump, outlet pipe.
6. Oil pump, inlet pipe.

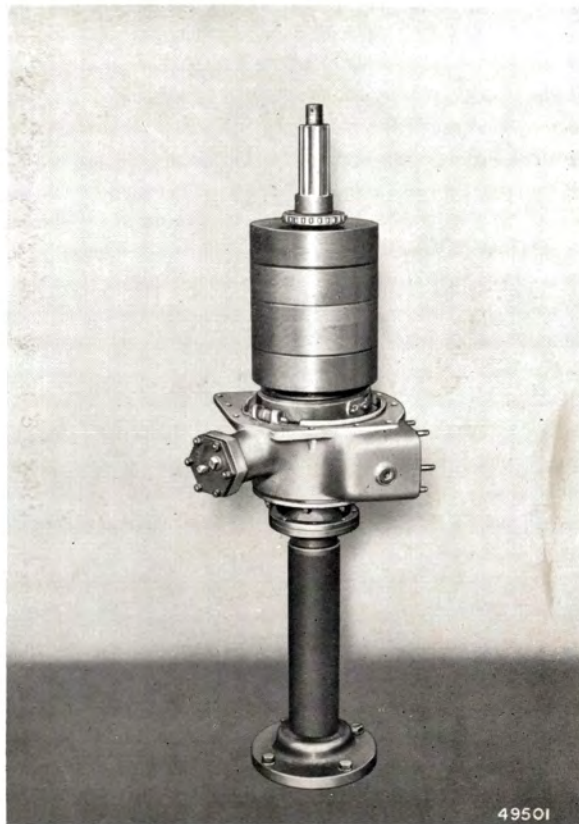
# **TO DISMANTLE AND RE-ASSEMBLE THE GEARBOX**

**Note:** Refer to Figs. 11 and 16 when dismantling and re-assembling the gearbox.

1. Place the gearbox in the horizontal position, uncouple the inlet and outlet pipes and remove the oil pump, Fig. 4.
2. Remove the two inspection covers situated on the top of the gearbox to gain access to the automatic brake adjusters.
3. Remove the securing nuts and withdraw the speedometer housing complete.
4. Remove the union (41) from the gearbox casing to the oil muff.
5. Tighten the reverse and 3rd speed brake bands, remove the split pins and nuts (30) and (71) from ends of the input and output shafts remove the seal ring (29).
6. Place the gearbox in the vertical position using the stand and flange adapter, Fig. 14.
7. Remove the nuts which secure the oil seal and the bearing housings at the rear of the gearbox casing.



**FIG. 14. ASSEMBLY STAND AND ADAPTERS**



**FIG. 15. RUNNING GEAR AND FRONT COVER ASSEMBLY**

8. Withdraw the housings (34) and (35) complete with the oil seal (27), bearing (26) and the coupling flange (28).
9. Remove the distance washer (36), speedometer worm wheel (37) and the oil muff (38).
10. Slacken off the four brake adjusters.
11. Remove the two eyes of each adjuster spring from the ring pin and the loop from the table pin to release the adjuster nut, then unscrew the adjuster nut a few turns in an anti-clockwise direction.
12. Remove the nuts which secure the front cover (82) to the gearcase (17).
13. Withdraw the gearcase, leaving the running gear and front cover assembly attached to the stand. Fig. 15.



1. Split ring.
2. Bearing.
3. Bearing housing.
4. Trunnion ring.
5. Sliding panel.
6. Bush.
7. Inner plate (sub-assembly).
8. Clutch spring.
9. Plate, inner.
10. Plate, outer.
11. Third speed brake drum.
12. Adapter, outer.
13. Third speed gear train.
14. Third speed sunwheel.
15. Second speed gear train.
16. Adjusting washer.
17. Gearbox casing.
18. Reverse speed driving member.
19. Reverse speed gear train.
20. Reverse annulus.
21. Speedometer pinion complete.
22. Bush.
23. Oil seal housing.
24. Oil seal.
25. Bush.
26. Bearing.
27. Oil seal.
28. Coupling flange.
29. Seal ring.
30. Nut.
31. Washer.
32. Output shaft.
33. Mud flinger.
34. Oil seal housing.
35. Bearing housing.
36. Distance washer.
37. Speedometer worm wheel.
38. Oil muff.
39. Intermediate bearing housing.
40. Intermediate bearing.
41. Union.
42. Bush.
43. Bush.
44. Reverse speed sunwheel.
45. First speed gear train.
46. First speed annulus.
47. Bush.
48. Adapter, outer.
49. Second speed annulus.
50. Adapter, outer.
51. Adapter, outer.
52. Seal.
53. Ring.
54. Plug and washer.
55. Adapter, outer.
56. Piston, fourth speed.
57. Cylinder cover.
58. Cylinder liner.
59. Spring.
60. Piston rod, fourth speed.
61. Pivot pin.
62. Ring.
63. Operating lever.
64. Plate.
65. Pin.
66. Freewheel housing.
67. Oil pump drive gear.
68. Mud flinger.
69. Coupling flange.
70. Input shaft.
71. Nut.
72. Washer.
73. Oil seal.
74. Oil seal housing.
75. Bearing.
76. Bearing housing.
77. Spacing washer.
78. Freewheel (sub-assembly).
79. Oil pump (sub-assembly).
80. Inner member (sub-assembly).
81. Pivot pin.
82. Front end cover.

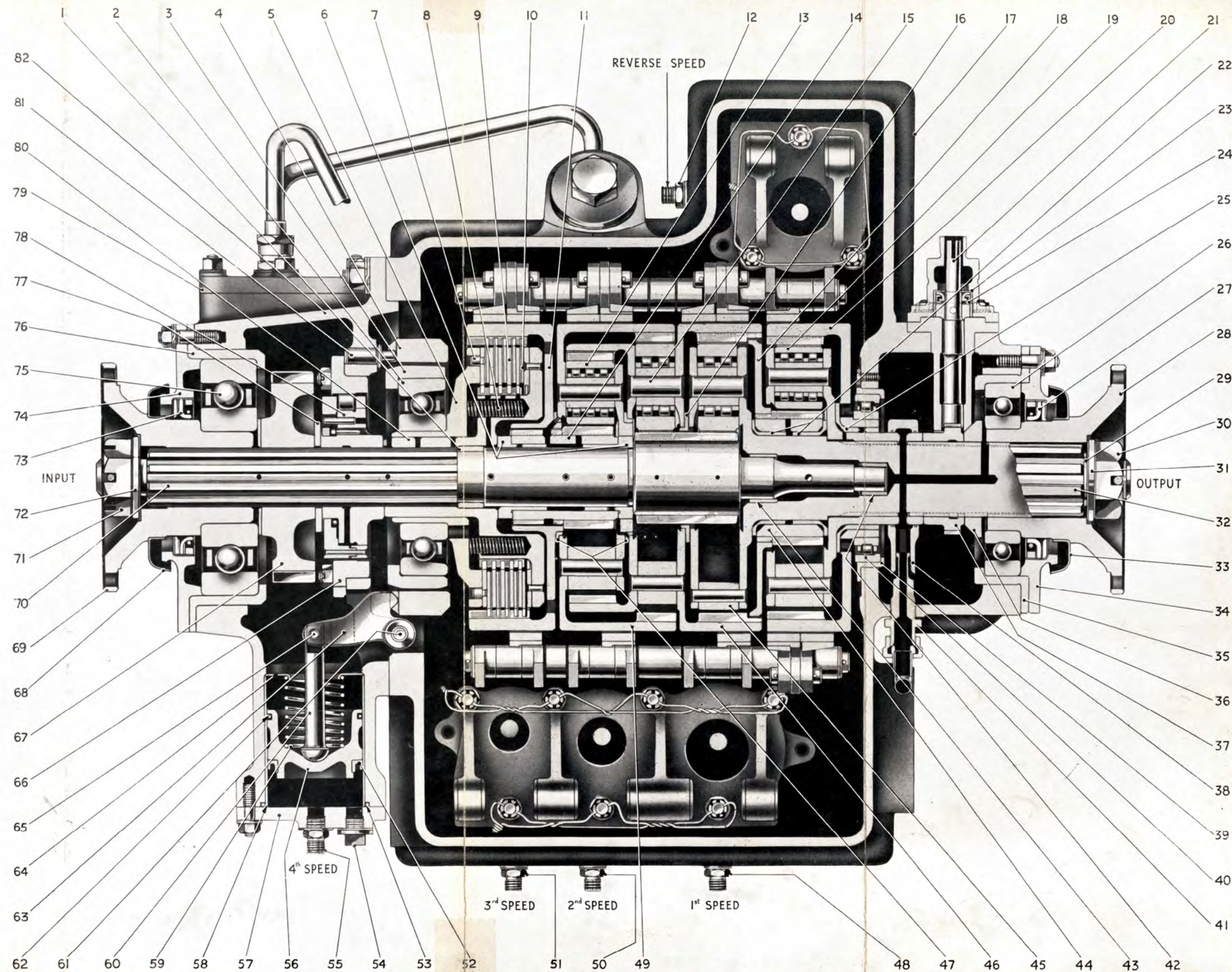


FIG. 16. SECTION THROUGH THE GEARBOX







# **To Dismantle the Running Gear and Front Cover Assembly**

1. Remove the intermediate bearing (40).
2. Remove the reverse speed annulus (20) and the bush (25).
3. Remove the reverse speed gear train (19), reverse speed sunwheel (44), reverse speed driving member (18), and the bushes (22).
4. Remove the adjusting washer (16), the sub-assembly of the 1st and 3rd speed annuli (46), and the 2nd speed gear train (15).
5. Reverse the input shaft (70), and front end cover (82) in the stand by using the lifting device, Fig. 17.
6. Remove the nuts which secure the oil seal and bearing housings (74) and (76) to the front end cover.
7. Withdraw the front coupling flange (69) complete with the oil seal and bearing housings.

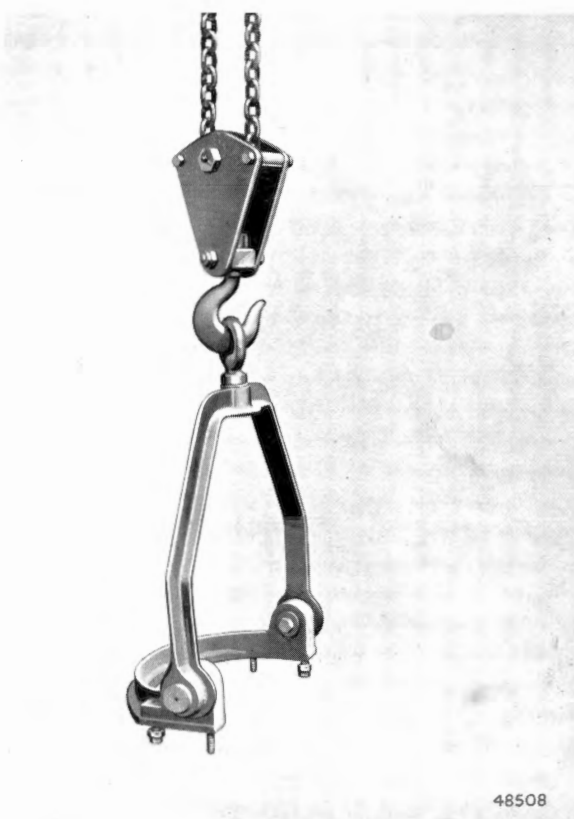


FIG. 17. LIFTING DEVICE FOR FRONT COVER ASSEMBLY

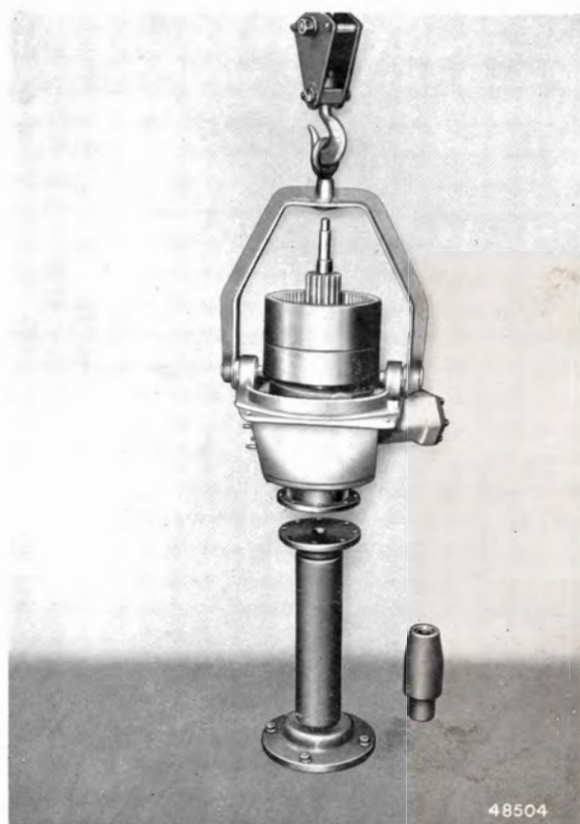


FIG. 18. LOWERING THE FRONT COVER ASSEMBLY TO STAND

8. Remove the oil pump driving gear (67) and the spacing washer (77).
9. Remove the front end cover with the 4th speed piston complete.
10. Remove from the front end cover the free-wheel assembly (78) leaving in position the free-wheel housing (66).
11. Remove the trunnion ring assembly (4) and the clutch sliding panel (5).
12. Remove the clutch inner plate (7) and the inner and outer clutch plates (9) and (10).
13. Remove the clutch springs (8) and the clutch inner member (80).
14. Remove the split ring (1) and bush (6).
15. Remove the 3rd speed brake drum (11), the 3rd speed sunwheel (14) complete and the bush (6).

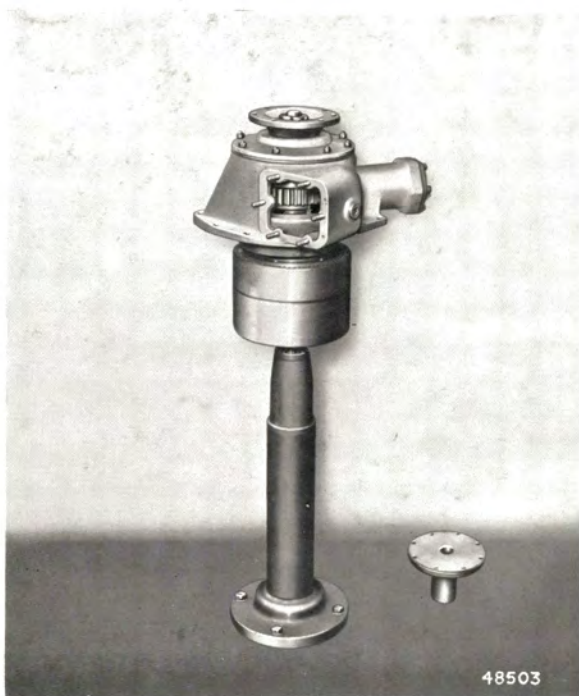


FIG. 19. FRONT COVER ASSEMBLY IN STAND

16. Remove the sub-assembly of the 2nd speed anulus (49) and 3rd speed gear train and the bush (47).

#### To Remove the Gearcase from the Bottom Cover

1. Remove the nuts which secure the cover to the gearcase, Fig. 16.
2. Remove the gearcase, leaving the bottom cover complete with the brakes, brake actuating mechanism and the air cylinders, Fig. 25.

#### To Remove the Brake Bands

1. Remove the adjuster springs (193) and unscrew the adjuster nut (194) from each adjuster mechanism, Fig. 11.
2. Support the adjuster ring (171), table (173) and the thrust pad (191) as the adjuster nut leaves the thread of the pull rod (185).

**Note:** It is essential to keep these parts in sets for re-assembly to the respective brake bands.

3. Press down the top of each brake band to remove the hooks (232) and (233).

4. Remove the split pins from the internal band link pins (184) and extract the pins.
5. Lift the bands away, ensuring that precaution has been taken to prevent the centraliser springs (187), Fig. 11, from flying out.

#### To Reline the Brake Bands

The necessity for relining the brakes is usually shown by the pull rod protruding from the top of the adjuster nut.

To separate the internal band from the external band, simply prise the free end of the band inwards and upwards with a screwdriver.

After relining, the lug on the internal band is led through its slot in the external band, the free end again pushed towards the centre, when the band will slip easily into position.

The linings are then skimmed up as shown in Fig. 24, and the bands replaced, see **To Replace the Brake Bands**.

#### To Replace the Brake Bands

**Note:** Ensure that the adjuster nuts are an easy fit on the pull rod threads.

1. Insert the springs (187) in the centralisers (227) and (228), compress each spring in turn and pass the ears of the bands over them.
2. Secure each external band with the pin (184) and fit the split pins.
3. Compress each external band and engage the brake hooks (232) and (233).
4. Fit the pull rods (185), thrust pads (191), adjuster tables (173) and the adjuster rings (171). Secure them with the adjuster nuts (194) screwed down enough to keep them in position.
5. The adjuster springs can be fitted later, after the running gear has been re-assembled.

#### To Replace the Gearcase

1. Smear the faces of the gearcase and bottom cover with jointing compound.





FIG. 20. ASSEMBLY STAND FOR BOTTOM COVER



FIG. 22. FITTING THE AUTOMATIC ADJUSTERS



FIG. 21. BOTTOM COVER FITTED TO STAND

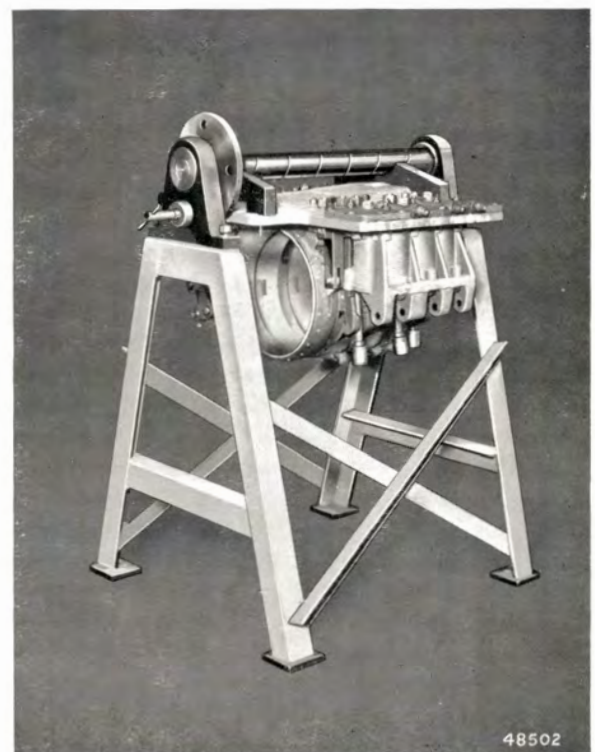


FIG. 23. BOTTOM COVER REVERSED IN STAND

2. Place the gearcase on the bottom cover, Fig. 27, and replace the nuts and washers which secure the gearcase to the bottom cover.

### To Re-assemble the Running Gear

Refer to Fig. 16 during the assembly operation.

1. Place the input shaft (70) in the assembly stand, using the adapter as shown in Fig. 35.
2. Fit the bush (6).
3. Fit the sub-assembly of the 2nd speed annulus and 3rd speed gear train (49) and (13) and bush (47).
4. Fit the sub-assembly of the 3rd speed brake drum and 3rd speed sunwheel (11) and (14).
5. Fit the bush (6).
6. Fit the clutch inner member assembly (80), place in position the clutch plates (10) and (9) alternately, it is advisable to smear a light oil on the faces to prevent initial sticking.

7. Fit the clutch inner plate (7), place in position the clutch springs (8) and fit the split ring (1).

8. Smear light oil on the shaft and fit the sub-assembly of the clutch sliding panel and the trunnion ring (5), ensure that the pegs are located correctly.

**Note:** The bearing (2) on the clutch sliding panel is of the angular contact type, and if the bearing has been removed it must be re-assembled in the position shown.

9. Fit the front end cover (82) to which the 4th speed piston (56), freewheel housing (66), and the clutch pivot pin (81), are previously assembled.
10. Fit the freewheel sub-assembly (78) on the input shaft and locate correctly in the housing.
11. Fit the spacing washer (77) and the oil pump drive gear (67).

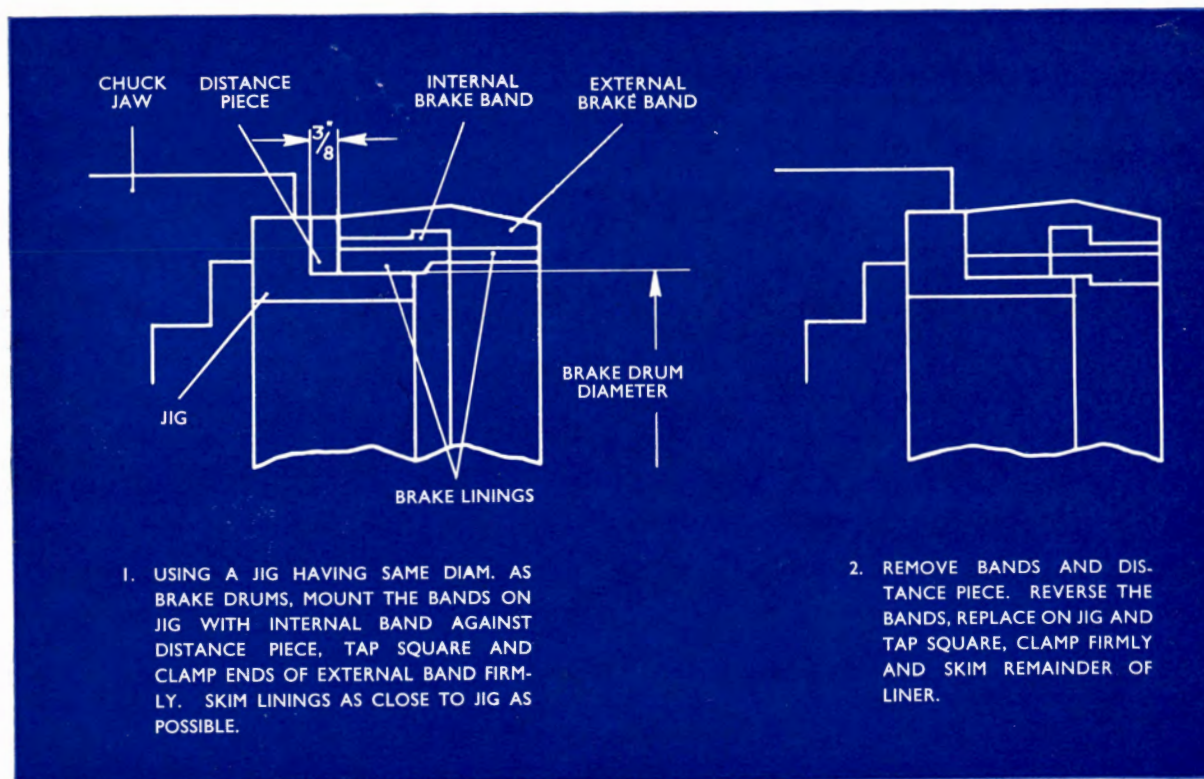


FIG. 24. METHOD OF SKIMMING THE BRAKE LININGS



12. Smear the face of the end cover with jointing compound the sub-assembly of the input flange (69), mud flinger (68), oil seal (73), housing (74), bearing (75), housing (76), can now be fitted to the front end cover.
13. Fit the washer (72), nut (71), but do not tighten.
14. Reverse the assembly in the stand by using the lifting device, Fig. 17, having previously placed the flange adapter, Fig. 18, in position.
15. Fit the bush (47).
16. Fit the sub-assembly of the 2nd speed gear train (15), which includes the 3rd speed annulus and the 1st speed annulus.
17. Fit the adjusting washer (16).
18. Fit the sub-assembly of the 1st speed gear train (45) and the output shaft (32).
19. Fit the bush (22), reverse speed driving member (18), and the reverse speed sunwheel (44).
20. Fit the bush (22) and the reverse speed gear train (19).
21. Fit the reverse speed annulus bush (25) and the reverse speed annulus (20).
22. Fit the intermediate bearing (40), the bearing housing (39) has been fitted previously to the gearbox casing (17).
23. The assembly of the running gear, Fig. 15, is now ready for the fitment of the assembly of the bottom cover and gearbox casing, Fig. 39.



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FIG. 25. THE BOTTOM COVER AND BRAKE BAND ASSEMBLY

- |  |  |
|--|--|
| 1. Automatic brake adjuster (reverse).   | 3. Automatic brake adjuster (2nd speed). |
| 2. Automatic brake adjuster (3rd speed). | 4. Automatic brake adjuster (1st speed). |

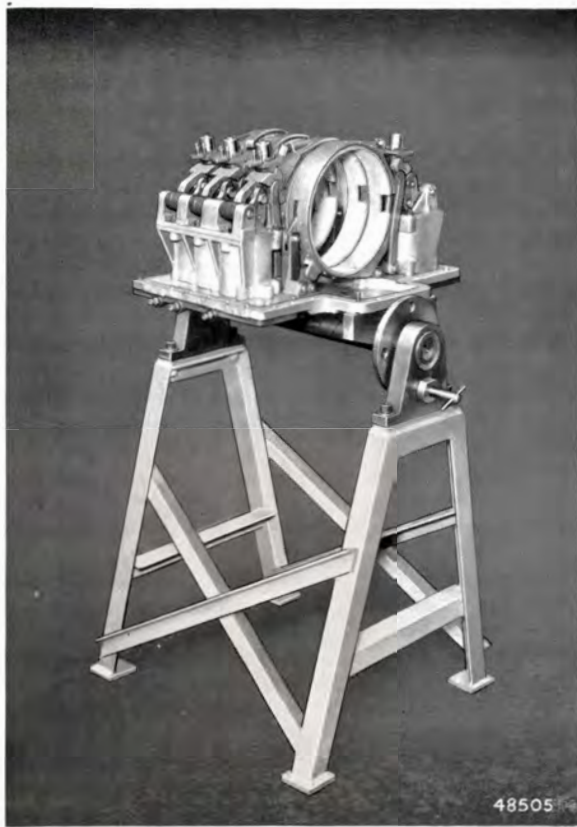


FIG. 26. BOTTOM COVER AND BRAKE BAND ASSEMBLY

24. Lift the assembly of the bottom cover and gearbox casing, paint the mating faces of the front end cover and the gearbox casing with jointing compound and lower the assembly over the running gear, Figs. 40 and 41.
25. Ensure that the intermediate bearing and the studs are located correctly.
26. Tighten the nuts which secure the front end cover to the gearbox casing.
27. Fit the oil muff (38), speedometer worm wheel (37), and the distance washer (36).
28. Paint the face of the gearbox casing with jointing compound and fit the sub-assembly of the bearing (26), housing (35), oil seal (27), housing (34), mud flinger (33), and the output coupling flange (28), tighten the nuts which secure the sub-assembly to the gearbox casing.

29. Fit the rubber seal ring (29), washer (31), and nut (30), but do not tighten.
30. Fit the speedometer pinion complete (21), oil seal (24), and the casing for the speedometer drive.
31. Fit the union (41) to the oil muff (38).
32. Fit the oil pump assembly, Fig. 4, to the front end cover, ensure that the joint is in position.
33. Couple the inlet pipe to the oil pump and the outlet pipe from the oil pump to the union fitted to the oil muff.
34. Place the gearbox in a horizontal position, fit the adjuster springs, Fig. 42, ensure that the wide coils of the springs lie uppermost, the two eyelets and one loop slide over the ring pin whilst the remaining loop fits on the table pin.
35. Lock the reverse and 3rd speed brake bands to enable the nuts which secure the flanges to be tightened by using a torsion spanner set to 350 lb./ft.



FIG. 27. FITTING THE GEAR CASE TO THE BOTTOM COVER ASSEMBLY



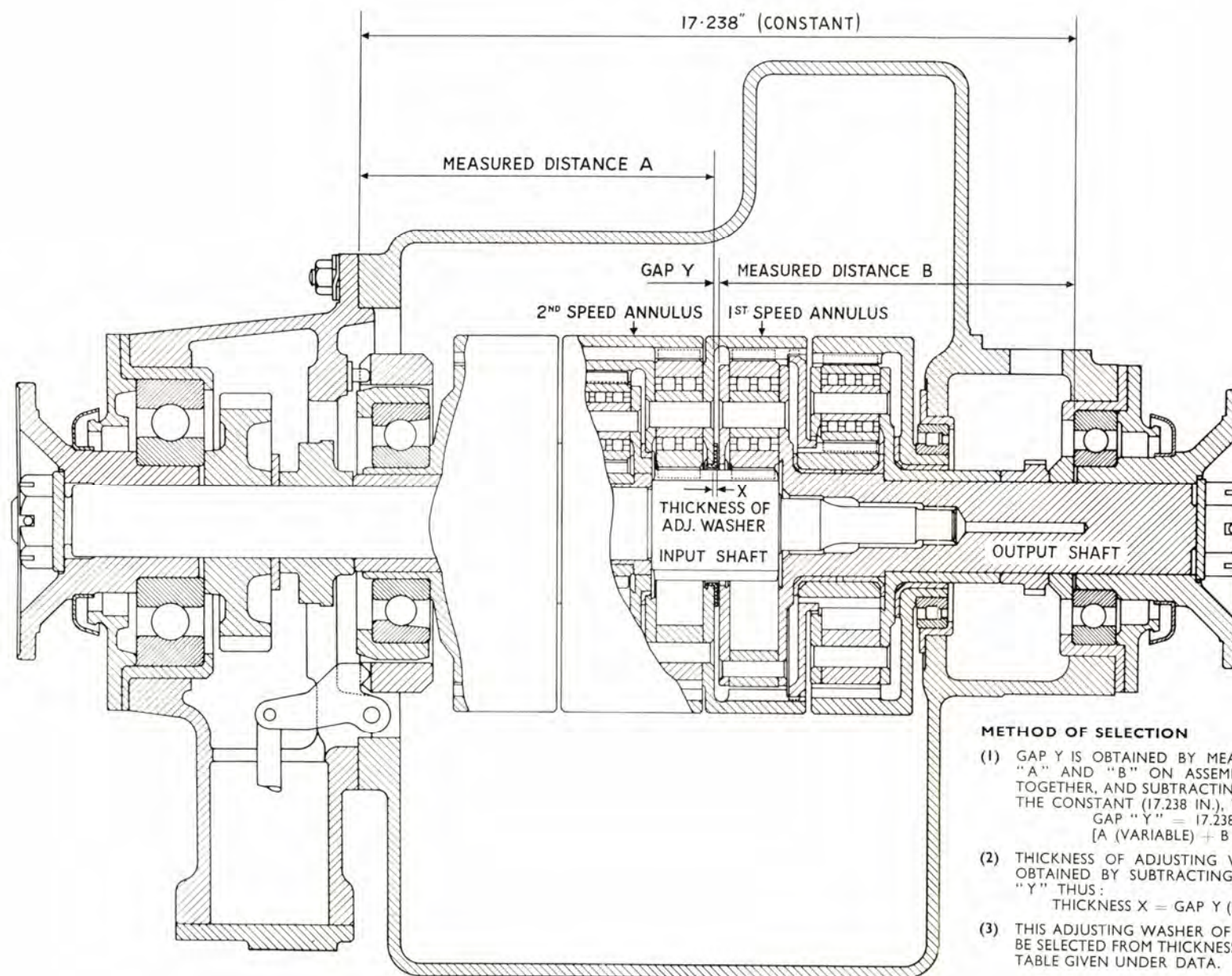
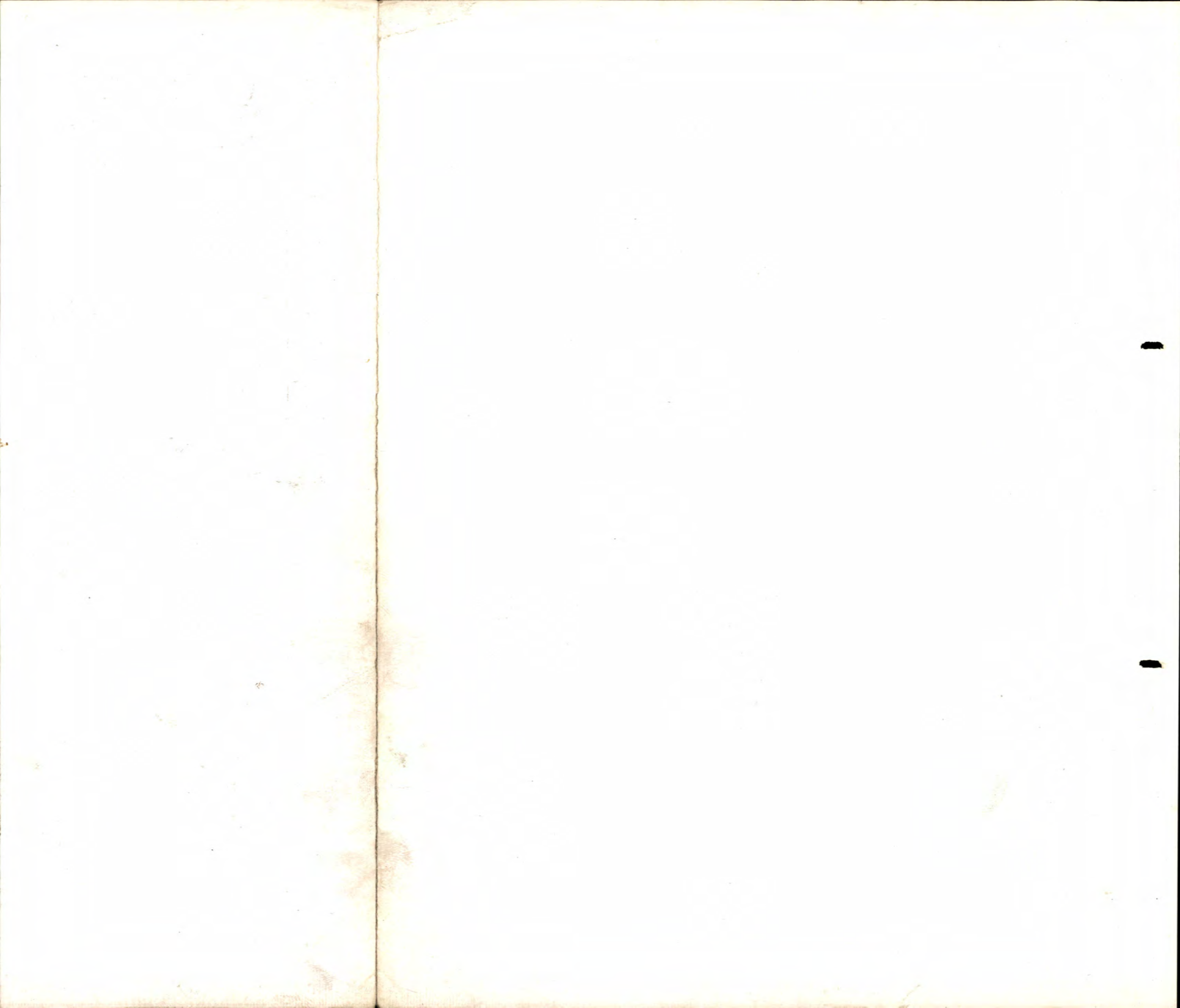


FIG. 28. METHOD OF SETTING THE END FLOAT BETWEEN 1st AND 2nd SPEED GEAR TRAINS



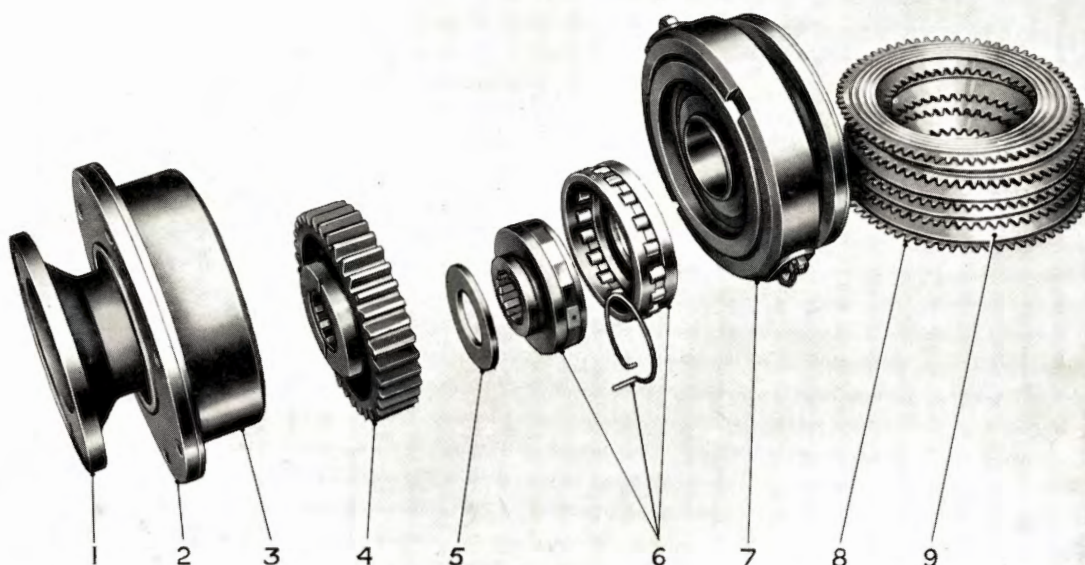




47210

FIG. 29. DETAILS OF THE RUNNING GEAR

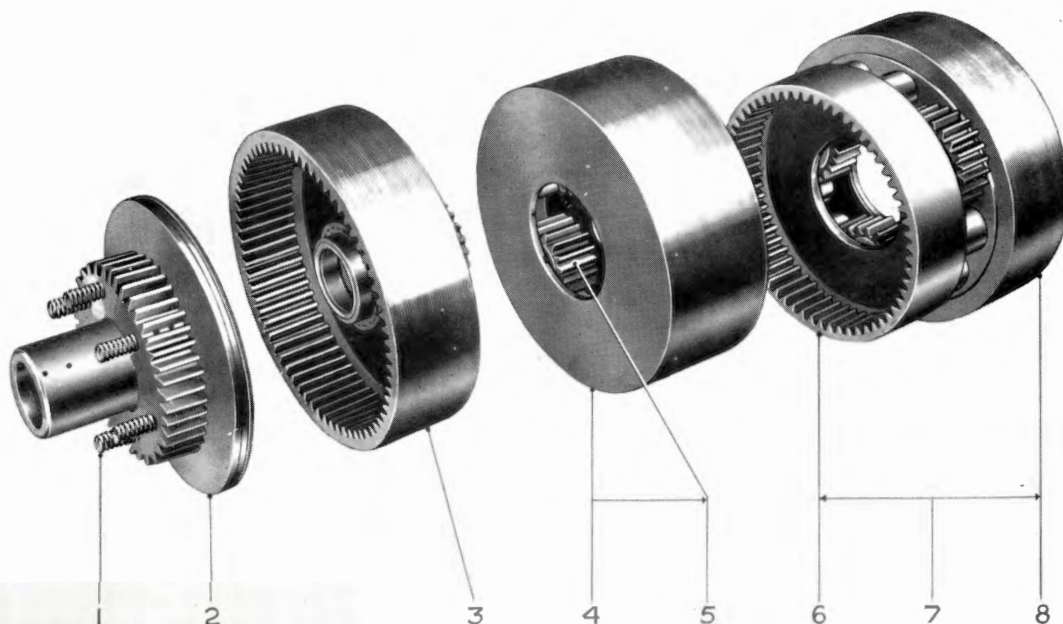
- |                                  |                              |
|----------------------------------|------------------------------|
| 1. Input shaft.                  | 3. Bush, input shaft, rear.  |
| 2. Bush, reverse speed sunwheel. | 4. Bush, input shaft, front. |



47209

FIG. 30. DETAILS OF THE RUNNING GEAR

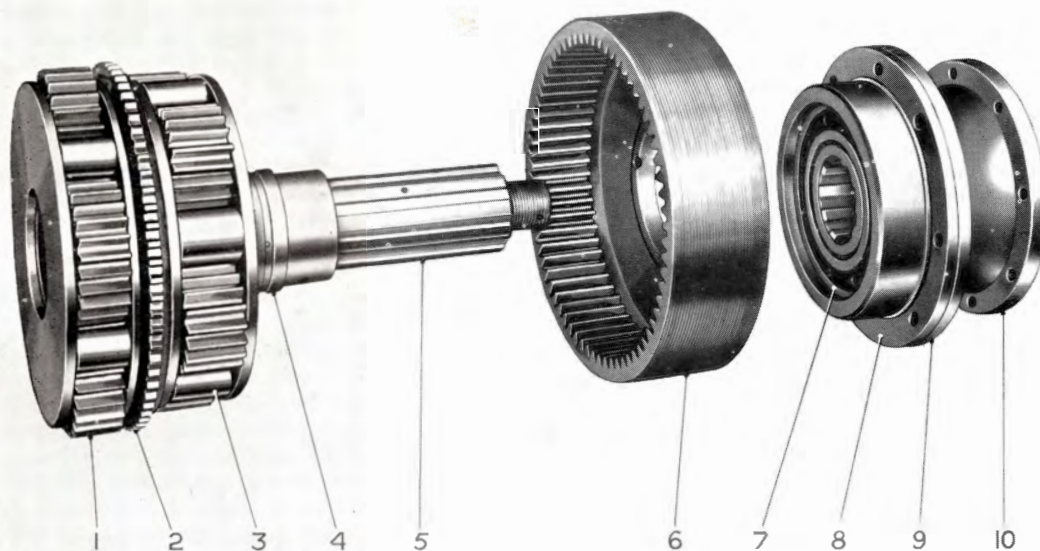
- |                            |                         |                        |
|----------------------------|-------------------------|------------------------|
| 1. Input coupling flange.  | 4. Oil pump drive gear. | 7. Trunnion ring.      |
| 2. Input oil seal housing. | 5. Spacing washer.      | 8. Outer clutch plate. |
| 3. Input bearing housing.  | 6. Freewheel.           | 9. Inner clutch plate. |



47206

FIG. 31. DETAILS OF THE RUNNING GEAR

- |                            |                            |
|----------------------------|----------------------------|
| 1. Clutch spring.          | 5. Gear train (3rd speed). |
| 2. Clutch inner member.    | 6. Annulus (3rd speed).    |
| 3. Brake drum (3rd speed). | 7. Gear train (2nd speed). |
| 4. Annulus (2nd speed).    | 8. Annulus (1st speed).    |



47207

FIG. 32. DETAILS OF THE RUNNING GEAR

- |                                  |                             |
|----------------------------------|-----------------------------|
| 1. 1st speed gear train.         | 6. Reverse speed annulus.   |
| 2. Reverse speed driving member. | 7. Output bearing.          |
| 3. Reverse speed gear train.     | 8. Output bearing housing.  |
| 4. Bush, reverse speed sunwheel. | 9. Output oil seal housing. |
| 5. Output shaft.                 | 10. Output coupling flange. |



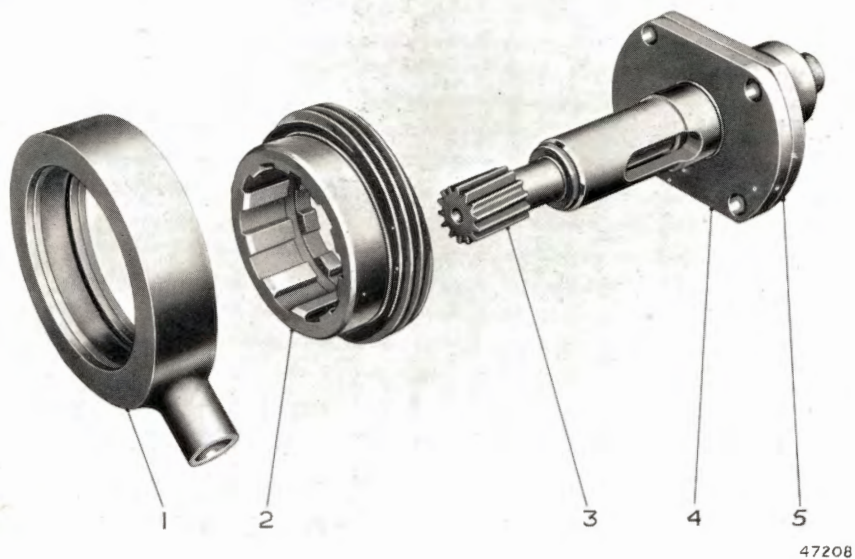


FIG. 33. DETAILS OF THE RUNNING GEAR

- |                             |                                  |
|-----------------------------|----------------------------------|
| 1. Oil muff.                | 4. Speedometer drive casing.     |
| 2. Speedometer worm wheel.  | 5. Speedometer oil seal housing. |
| 3. Speedometer drive shaft. |                                  |

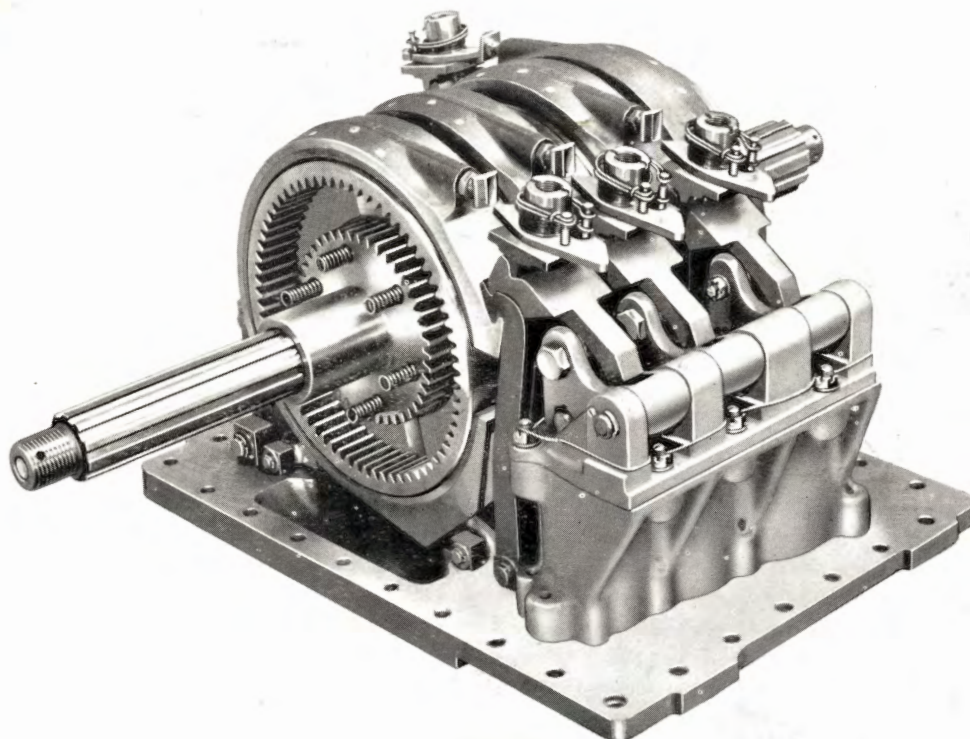


FIG. 34. VIEW TO SHOW RUNNING GEAR AND BRAKE BANDS



FIG. 35. THE INPUT SHAFT IN STAND



FIG. 37. FITTING THE TOP SPEED CLUTCH PLATES



FIG. 36. FITTING THE 3rd SPEED BRAKE DRUM



FIG. 38. FITTING THE FRONT COVER ASSEMBLY



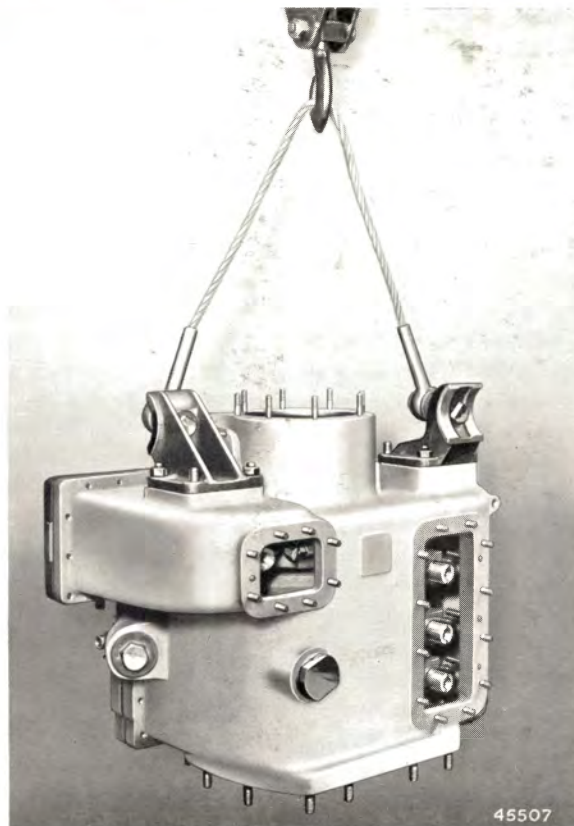


FIG. 39. LIFTING THE GEAR CASE ASSEMBLY



FIG. 40. FITTING GEAR CASE TO RUNNING GEAR

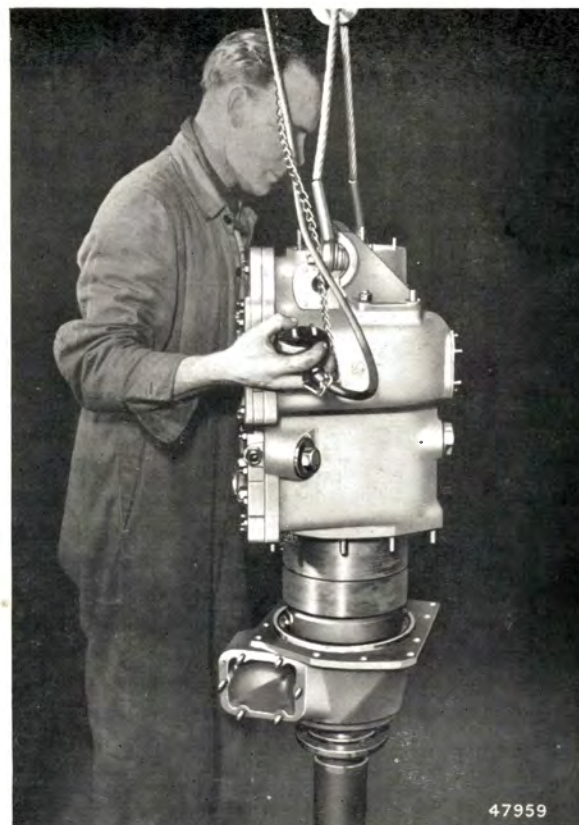
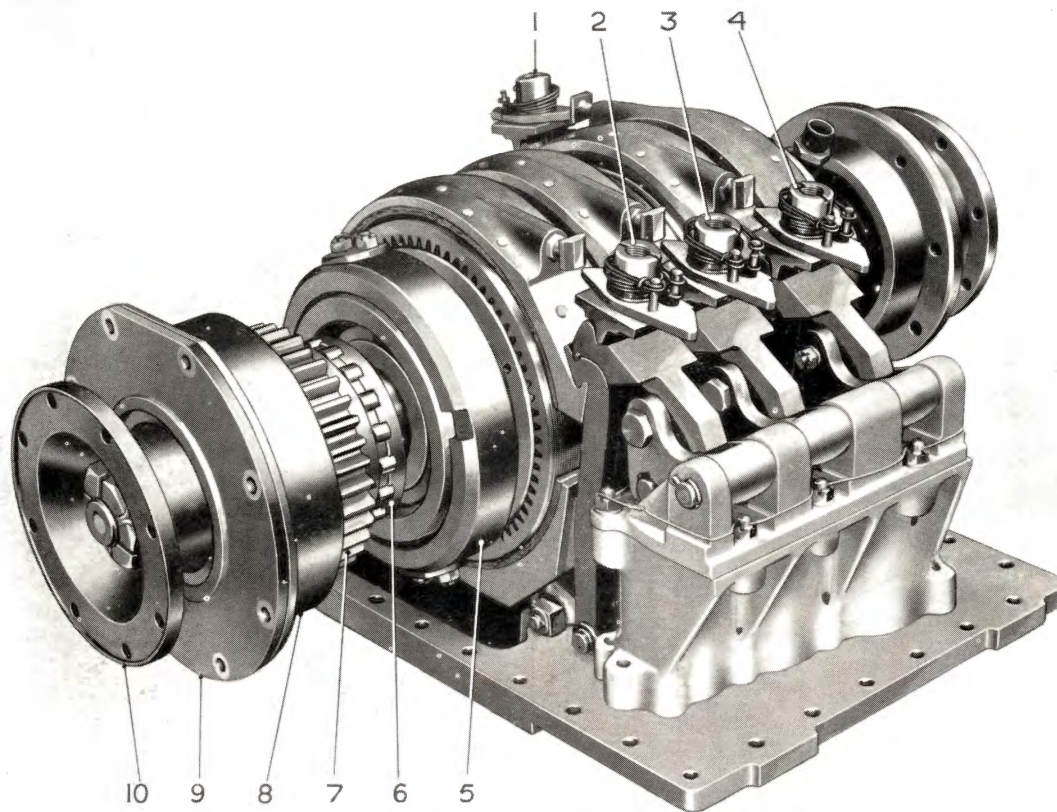


FIG. 41. FITTING GEAR CASE TO RUNNING GEAR

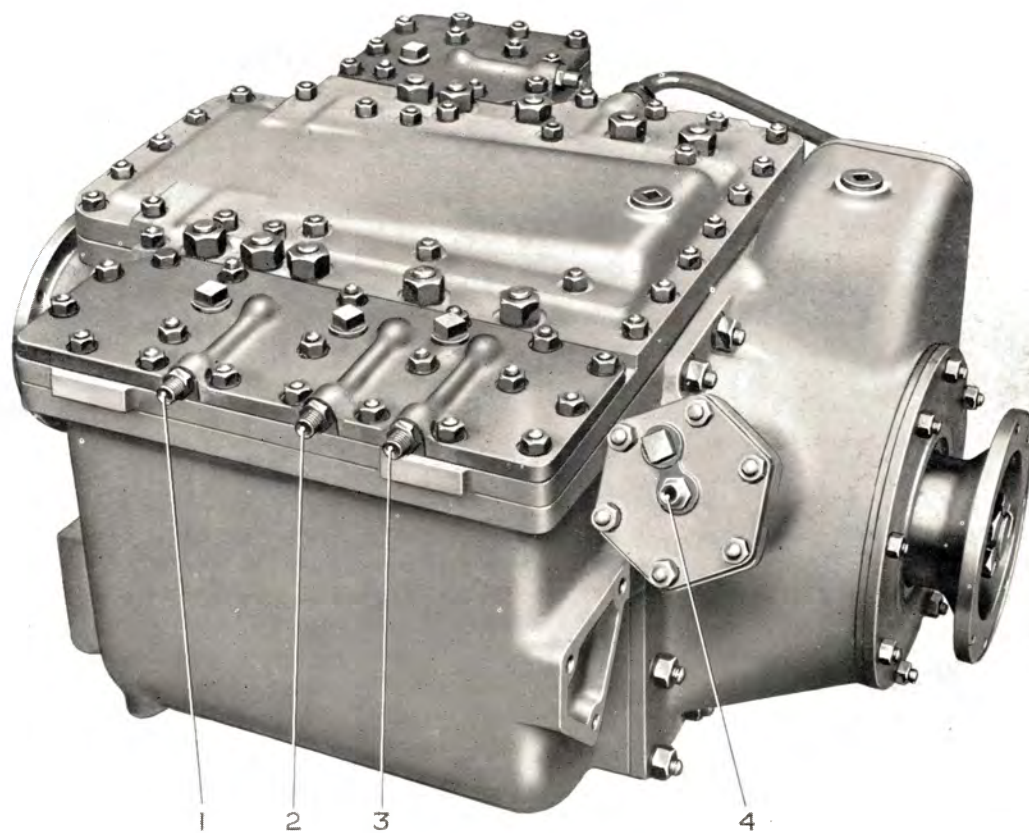


46714

FIG. 42. VIEW TO SHOW RUNNING GEAR AND BRAKE BANDS COMPLETE

1. Automatic adjuster (reverse speed).
2. Automatic adjuster (3rd speed).
3. Automatic adjuster (2nd speed).
4. Automatic adjuster (1st speed).
5. Trunnion ring.
6. Freewheel.
7. Oil pump and power take-off driving gear.
8. Input bearing housing.
9. Input oil seal housing.
10. Input coupling flange.





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FIG. 43. VIEW OF GEARBOX SHOWING BOTTOM COVER

1. 1st speed adapter.
2. 2nd speed adapter.
3. 3rd speed adapter.
4. 4th speed adapter.





# **Parts List for the** **Semi-Automatic** **Gearbox**

(Arrangement No. 508962)

## **TYPE RV 28**

Part No.	Description	Illustration Ref. No.	No. Req'd. Per Gearbox
<b>RUNNING GEAR GROUP</b>			
508980	Oil pump, complete ... ..		1
509171	Oil pump casing, complete ... ..		1
500136	Casing ... ..	1	1
509110	Stud, $\frac{5}{16}$ " dia. $\times$ 1.25" long, UNF ... ..	2	2
509111	Stud, $\frac{5}{16}$ " dia. $\times$ 1.55" long ... ..	3	2
500027	Cover, oil pump ... ..	4	1
505618	Ring dowel, pump cover to casing ... ..	5	2
500039	Pump gear and driving shaft ... ..	6	1
500026	Shaft, for driven gear ... ..	7	1
500035	Bush, oil pump cover ... ..	8	1
500028	Bush, oil pump case ... ..	9	1
500033	Pump, drive gear ... ..	10	1
238560	Circlip (.50" external) ... ..	11	2
507191	Woodruff key, No. 20 ... ..	12	1
500037	Pump gear, driven ... ..	13	1
UFN405	Nut, $\frac{5}{16}$ " dia., UNF, slotted ... ..	} Casing to cover	4
X75919	Washer, $\frac{5}{16}$ " dia., plain ... ..		4
508979	Free-wheel, complete ... ..	} List No. 5586 only	1
509495	Free-wheel body ... ..		14
509497	Free-wheel cage ... ..		15
505579	Stop pin ... ..		16
509496	Roller retainer ... ..		17
500040	Spring ... ..		18
505766	Roller, .50" $\times$ .50" ... ..		19
500034	Rivet, for cage ... ..		20
522313	Sleeve, List No. 5648 only ... ..		1
508978	Speedometer, pinion complete ... ..		1
505558	Drive shaft, speedometer ... ..	21	1
505559	Thrust ring, speedometer drive ... ..	22	1
505560	Casing, speedometer drive ... ..	23	1
505562	Grooved pin ... ..	24	1
508232	First speed gear train, complete ... ..		1
508973	Planet pinion and bearings complete, 1st and 2nd ... ..		5
500069	Planet pinion, 1st and 2nd ... ..	25	5
500068	Planet pinion, inner race ... ..	26	5
270222	Planet rollers, $\frac{5}{16}$ " $\times$ $\frac{5}{16}$ " ... ..	27	140
500065	Spacing collar ... ..	28	15



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
500141	Output shaft ... ..	29	1
500052	Plate ... ..	30	1
500045	Distance piece ... ..	31	5
500061	Rivet, $\frac{3}{8}$ " dia. ... ..	32	5
500060	Rivet, $\frac{5}{8}$ " dia. ... ..	33	5
508233	Second speed gear train, complete ... ..		1
508973	Planet pinion and bearings complete, 1st and 2nd ... ..		3
500069	Planet pinion, 1st and 2nd ... ..	34	3
500068	Planet pinion, inner race ... ..	35	3
270222	Planet rollers, $\frac{5}{16}$ " $\times$ $\frac{5}{16}$ " ... ..	36	84
500065	Spacing collar ... ..	37	9
500125	Third speed annulus ... ..	38	1
500132	First speed annulus... ..	39	1
501198	Distance piece ... ..	40	6
501199	Rivet, $\frac{1}{2}$ " dia. ... ..	41	6
500060	Rivet, $\frac{3}{8}$ " dia. ... ..	42	3
508234	Third speed gear train, complete ... ..		1
508974	Planet pinion and bearings complete, 3rd and reverse ... ..		3
500064	Planet pinion, 3rd and reverse ... ..	43	3
500048	Planet pinion, inner race ... ..	44	3
245210	Planet rollers, $\frac{1}{4}$ " $\times$ $\frac{1}{4}$ " ... ..	45	126
500056	Spacing collar ... ..	46	12
500130	Second speed annulus ... ..	47	1
500058	Plate ... ..	48	1
500047	Distance piece ... ..	49	3
500055	Rivet, $\frac{1}{2}$ " dia. ... ..	50	6
508235	Reverse speed gear train, complete ... ..		1
508974	Planet pinion and bearing complete, 3rd and reverse ... ..		5
500064	Planet pinion, 3rd and reverse ... ..	51	5
500048	Planet pinion, inner race ... ..	52	5
245210	Planet rollers, $\frac{1}{4}$ " $\times$ $\frac{1}{4}$ " ... ..	53	210
500056	Spacing collar ... ..	54	20
500126	Reverse carrier ... ..	55	1
500057	Plate ... ..	56	1
500047	Distance piece ... ..	57	5
500055	Rivet, $\frac{1}{2}$ " dia. ... ..	58	10
508983	Clutch, inner plate, complete ... ..		1
500051	Inner plate, front ... ..	59	1
500079	Peg ... ..	60	6
518783	Clutch inner member, complete ... ..		1
518754	Inner member ... ..	61	1
500044	Clutch plate, rear ... ..	62	1
507190	Rivet ... ..	63	6



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
508985	Clutch operating lever, complete ... ..		1
505760	Operating lever ... ..	64	1
506664	Piston rod, 4th speed ... ..	65	1
506646	Pin ... ..	66	1
508977	Gear casing, complete ... ..		1
506622	Gear case ... ..	67	1
509112	Stud, $\frac{1}{2}$ " dia. $\times$ 1.5" long, UNF, speedometer facing ... ..	68	4
509113	Stud, $\frac{1}{2}$ " dia. $\times$ 1.25" long, UNF, inspection cover facings ... ..	69	20
509114	Stud, $\frac{1}{2}$ " dia. $\times$ 1.75" long, UNF, output facing ... ..	70	8
299989	Stud, $\frac{1}{2}$ " dia. $\times$ 2.2" long, UNF, bottom cover ... ..	71	30
299991	Stud, $\frac{1}{2}$ " dia. $\times$ 2.4" long, UNF, bottom cover ... ..	72	2
509115	Stud, $\frac{1}{2}$ " dia. $\times$ 1.85" long, UNF, front cover ... ..	73	10
509114	Stud, $\frac{1}{2}$ " dia. $\times$ 1.75" long, UNF, bottom cover ... ..	74	5
513490	Stud, $\frac{1}{2}$ " dia. $\times$ 2.25" long, UNF, front cover ... ..	75	2
508976	Front cover, complete ... ..		1
500143	Front end cover ... ..	76	1
509118	Stud, $\frac{3}{8}$ " dia. $\times$ 1.65" long, UNF, input bearing housing ... ..	77	8
509119	Stud, $\frac{3}{8}$ " dia. $\times$ 1.40" long, UNF, free-wheel housing ... ..	78	6
298809	Stud, $\frac{3}{8}$ " dia. $\times$ 1.50" long, UNF, 4th speed cylinder ... ..	79	6
509114	Stud, $\frac{3}{8}$ " dia. $\times$ 1.75" long, UNF, oil pump facing ... ..	80	6
508975	Trunnion ring, complete ... ..		1
500134	Trunnion ring ... ..	81	1
509122	Stud, $\frac{5}{16}$ " dia. $\times$ 1.00" long, UNF ... ..	82	4
517512	Reverse speed sunwheel, complete ... ..		1
500053	Reverse speed, sunwheel ... ..	83	1
500128	Reverse speed driving member ... ..	84	1
507310	Dipstick ... ..	85	1
508972	Oil outlet pipe, complete ... ..	86	1
508971	Oil inlet pipe, complete ... ..	87	1
500142	Input shaft ... ..	88	1
508186	Screw plug, for input shaft ... ..	89	Length as reqd.
518315	Split ring ... ..	90	1 pair
500066	Third speed sunwheel ... ..	91	1
500131	Third speed brake drum ... ..	92	1
500067	Bush for sunwheel ... ..	93	2
500046	Bush, 2nd and 3rd speed annulus ... ..	94	2
500118	Spring, for clutch ... ..	95	6
500049	Inner clutch plate ... ..	96	4
500050	Outer clutch plate ... ..	97	5
500133	Clutch bearing housing ... ..	98	1
500029	Clutch pivot pin ... ..	99	1
500030	Clutch actuating pin ... ..	100	2
500062	Clutch sliding panel ... ..	101	1
506656	Oil muff ... ..	102	1
506657	Union, casing muff ... ..	103	1
505561	Speedometer oil seal housing ... ..	104	1
511437	Oil seal, speedometer, Perfect No. 11216 ... ..	105	1
505581	Intermediate bearing housing ... ..	106	1
UFS104/5	Setscrew, intermediate bearing housing ... ..	107	1



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
518525/10	Adjuster washer, .10"/.105" thick ...	108	as reqd.
518525/12	Adjuster washer, .120"/.125" thick ...		as reqd.
518525/14	Adjuster washer, .140"/.145" thick ...		as reqd.
518525/16	Adjuster washer, .160"/.165" thick ...		as reqd.
518525/18	Adjuster washer, .180"/.185" thick ...		as reqd.
518525/20	Adjuster washer, .20"/.205" thick ...		as reqd.
518525/22	Adjuster washer, .220"/.225" thick ...	109	as reqd.
518525/24	Adjuster washer, .240"/.245" thick ...		as reqd.
500063	Bush, input shaft, rear ...	110	1
500078	Bush, input shaft, front ...	111	1
500127	Reverse shaft annulus ...	112	1
500043	Bush, reverse speed annulus ...	113	2
500054	Bush, reverse speed sunwheel ...	114	1
505762	Input bearing, B.R.H. .070 ...	115	1
505763	Output bearing, B.R.L. 3 ...	116	1
505764	Angular contact bearing, A.C.M. .070 ...	117	1
505765	Intermediate bearing, R.R.X. 3½, single lip outer race ...	118	1
500135	Free-wheel housing ...	119	1
508172	Spacing washer ...	120	1
50041	Pump driving gear and power take-off ...	121	1
500140	Input bearing housing ...	122	1
500138	Input oil seal housing ...	123	1
513491	Joint, oil pump ...	124	2
511650	Mud flinger ...	125	1
505584	Input coupling flange ...	126	1
505587	Output coupling flange ...	127	1
505582	Washer ...		2
505577	Nut ...		2
K5735	Split pin, 7/32" dia. × 3" long ...	128	2
517521	Seal ring, rubber ...	129	1
511438	Oil seal, input and output, Perfect DA.475316 ...	130	2
505586	Output bearing housing ...	131	1
505585	Output oil seal housing ...	132	1
505583	Distance washer ...	133	1
505557	Speedometer driving worm wheel ...	134	1
506659	Fourth speed cylinder cover ...	135	1
506663	Fourth speed piston. Original type ...	136	1
521108	Fourth speed piston. Revised piston where two external dist. seals are fitted ...	137	1
506640	Fourth speed cylinder liner ...		1
506662	Plate, 4th speed ...	138	1
506661	Return spring, 4th speed ...	139	1
506633	"O" ring, 4th speed ...	140	1
506632	"O" ring, 4th speed piston. Original piston only ...	141	1
506648	External distributor seal ...	142	1
506658	Pivot pin, clutch operating lever ...	143	1
513492	Joint, inspection cover, forward speeds ...	144	1
513493	Joint, inspection cover, reverse speeds ...	145	1
506666	Inspection cover, forward speeds ...	146	1
506665	Inspection cover, reverse ...	147	1
506621	Cover plate, 1st, 2nd and 3rd speeds ...	148	1
506641	Cover plate, reverse ...	149	1
508544	Joint, bottom cover to gear case ...	150	1



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
506654	Hollow dowel, cover to gear case ... ..	151	2
505619	Dowel, $\frac{1}{4}$ " dia., oil pump to front cover ... ..		2
13834	Drain plug, $\frac{1}{2}$ " B.S.P., front cover ... ..	152	1
240919	Adapter, oil pipes to sump and oil pump ... ..	153	3
X42629	Washer, drain plugs and oil pipes adapters ... ..	154	5
509107	Breather plug ... ..	} 155	1
509108	Washer, breather plug ... ..		1
9545	Drain plug, $\frac{1}{4}$ " B.S.P., drain plug } ... ..	156	5
508483	Adapter, outer ... ..	157	5
508057	Adapter, inner ... ..	158	4
508481	Restrictor valve, 1st and reverse } Cylinder cover plates	159	2
508482	Restrictor valve, 2nd and 3rd ... ..	160	2
232470	Washer ... ..	161	14
516734	Name plate, gearbox serial No., etc. ... ..	162	1
516738	Hammer drive screw ... ..		4
50938	Plug, oil filler ... ..	} 163	1
232018	Washer, for plug ... ..		1
511570	Magnetic plug, for drain ... ..	} 164	1
511365	Washer, for plug ... ..		1
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Inspection covers to gear case	20
X75949	Washer, $\frac{3}{8}$ " dia., Kolok ... ..		20
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Input bearing housing to front cover	6
X75949	Washer, $\frac{3}{8}$ " dia., Kolok ... ..		6
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Oil pump to front cover	6
X75962	Washer, $\frac{3}{8}$ " dia., Thackeray ... ..		6
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Output bearing housing to gear case	8
X75962	Washer, $\frac{3}{8}$ " dia., Thackeray ... ..		8
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Bottom cover to gear case	18
X75962	Washer, $\frac{3}{8}$ " dia., Thackeray ... ..		18
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Cylinder cover plates to bottom cover	32
X75949	Washer, $\frac{3}{8}$ " dia., Kolok ... ..		32
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... ..	} Fourth speed cylinder cover	6
X75949	Washer, $\frac{3}{8}$ " dia., Kolok ... ..		6
UFN108	Nut, $\frac{1}{2}$ " dia., UNF ... ..	} Front cover to gear case	10
X75964	Washer, $\frac{1}{2}$ " dia., Thackeray ... ..		10
UFN104	Nut, $\frac{1}{4}$ " dia., UNF ... ..	} Speedometer housing to gear casing	4
X75960	Washer, $\frac{1}{4}$ " dia., Thackeray ... ..		4
UFN405	Slotted nut, $\frac{5}{16}$ " dia., UNF, clutch actuating pin to trunnion ... ..		4
UFN406	Slotted nut, $\frac{3}{8}$ " dia., UNF, free-wheel housing to front cover ... ..		6
299444	Stud, bottom cover to cylinder cover ... ..		1
UFN408	Slotted nut, $\frac{1}{2}$ " dia., UNF ... ..	} Front cover to gear case	2
X75922	Washer, $\frac{1}{2}$ " dia., plain ... ..		2



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
<b>BRAKE GEAR GROUP</b>			
508968	Brake band and liners, complete ... ..		4
508969	External brake band, complete ... ..		4
500144	External brake band ... ..	165	4
505460	External brake liner ... ..	166	4
500082	Rivet ... ..	167	56
505457	Rivet ... ..		12
505458	Rivet ... ..		8
508970	Internal brake band, complete ... ..		4
500664	Internal brake band ... ..	168	4
505459	Internal brake liner ... ..	169	4
505456	Rivet ... ..	170	104
508987	Automatic adjusting ring, complete ... ..		4
500086	Adjuster ring ... ..	171	4
500075	Pin for ring ... ..	172	4
508986	Automatic adjuster table, complete ... ..		4
500073	Adjuster table ... ..	173	4
500074	Pin, for table ... ..	174	4
508078	Cam roller race, complete ... ..		4
500070	Outer race ... ..	175	4
500071	Inner race ... ..	176	4
231732	Needle rollers ... ..	177	88
500092	Dowel, $\frac{1}{8}$ " dia., piston rod bearing pin ... ..	178	4
500090	Cam roller pin ... ..	179	4
500077	Adjusting screw, external brake band ... ..	180	4
500097	Tail pin, $\frac{3}{8}$ " dia. ... ..	181	4
500109	Operating lever shaft, short ... ..	182	1
500108	Operating lever shaft, long ... ..	183	1
500114	Link pin, internal band ... ..	184	4
500103	Pull rod ... ..	185	4
500072	Pin, for pull rod ... ..	186	4
500080	Centralizer spring ... ..	187	8
500087	Piston rod ... ..	188	4
500084	Bearing pin, piston rod ... ..	189	4
282038	Circlip, $\frac{5}{8}$ " ext./dia. ... ..	190	8
500124	Thrust pad ... ..	191	4
500083	Thrust pad, operating lever ... ..	192	4
500081	Automatic adjuster spring ... ..	193	4
500076	Nut, automatic adjuster ... ..	194	4
500085	Piston return spring, 1st and reverse ... ..	195	2
500089	Piston return spring, 2nd speed ... ..	196	1
500088	Piston return spring, 3rd speed ... ..	197	1
500104	Piston, 1st and reverse ... ..	198	2
500105	Piston, 2nd speed ... ..	199	1
500106	Piston, 3rd speed ... ..	200	1



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
521105	Piston, 1st and reverse	Revised pistons where two external dist. seals are fitted	
521106	Piston, 2nd gear ...		
521107	Piston, 3rd speed ...		
506637	Cylinder liner, 1st and reverse ... ..	201	2
506638	Cylinder liner, 2nd speed ... ..	202	1
506639	Cylinder liner, 3rd speed ... ..	203	1
506634	"O" ring, 1st and reverse	Bottom cover	2
506632	"O" ring, 2nd speed		
506631	"O" ring, 3rd speed ...		
506629	Distributor seal, external	First and reverse speed piston, original piston only	2
506636	"O" ring ... ..		
506629	Distributor seal, external, revised piston ... ..	207	4
506628	Distributor seal, external	Second speed piston, original piston only	1
506631	"O" ring ... ..		
506628	Distributor seal, external, revised piston ... ..	209	2
506630	Distributor seal, external	Third speed piston, original piston only	1
506635	"O" ring ... ..		
506630	Distributor seal, external, revised piston ... ..	211	2
UFN106	Nut, $\frac{3}{8}$ " dia., UNF, external band adjusting screw ... ..		4
K5667	Split pin, $\frac{5}{64}$ " dia. $\times$ 1" long, internal band link pin ... ..		8
K5681	Split pin, $\frac{1}{8}$ " dia. $\times$ $1\frac{1}{8}$ " long, operating lever shaft ... ..		4
UFN405	Slotted nut, $\frac{5}{16}$ " dia., UNF	Cam roller pin	4
X75919	Washer, $\frac{5}{16}$ " dia., plain		
K5659	Split pin, $\frac{1}{16}$ " dia. $\times$ $\frac{3}{4}$ " long		
BOTTOM COVER GROUP			
508981	Speed cylinder, 1st, 2nd and 3rd speed, complete ... ..	213	1
500123	Cylinder block, 1st, 2nd and 3rd speed ... ..		
509119	Stud, $\frac{3}{8}$ " dia. $\times$ 1.4" long, UNF	Cylinder block to cover	5
501921	Stud, $\frac{9}{16}$ " dia. $\times$ 1.65" long, UNF		
299989	Stud, $\frac{3}{8}$ " dia. $\times$ 2.2" long, UNF, bottom cover ... ..	216	8
508982	Cylinder block, reverse speed, complete ... ..	217	1
500122	Cylinder block ... ..		
509119	Stud, $\frac{3}{8}$ " dia. $\times$ 1.4" long, UNF	Cylinder block to cover	1
509121	Stud, $\frac{9}{16}$ " dia. $\times$ 1.65" long, UNF		
299989	Stud, $\frac{3}{8}$ " dia. $\times$ 2.2" long, UNF, bottom cover ... ..	220	4
506623	Bottom cover and sump ... ..	221	1
500121	Cover, cylinder block ... ..	222	1



Part No.	Description	Illustration Ref. No.	No. Reqd. Per Gearbox
500107	Cover, reverse cylinder block ... ..	223	1
505461	Link, internal band ... ..	224	4
500095	Eyebolt, for link ... ..	225	10
500116	Eyebolt, for centralizer ... ..	226	10
500094	Centralizer, left hand... ..	227	4
500102	Centralizer, right hand ... ..	228	4
500100	Centralizer rod, long ... ..	229	2
500101	Centralizer rod, short ... ..	230	2
500112	Distance piece, 1.358" long ... ..	231	1
500098	Hook, rear ... ..	232	4
500099	Hook, front ... ..	233	4
500096	Fulcrum rod ... ..	234	2
506685	Distance piece, .793" long	235	2
500113	Distance piece, .462" long	236	2
506684	Distance piece, .685" long	237	1
506649	Distance piece, .104" long	238	4
506654	Ring dowel, $\frac{9}{16}$ " o/dia.	239	8
508992	Bolt, $\frac{3}{8}$ " dia., UNF ... }		4
X75920	Washer, $\frac{3}{8}$ " dia., plain... }		8
K5661	Split pin, $\frac{1}{16}$ " dia. $\times$ 1.0" long }		8
K5673	Split pin, $\frac{3}{32}$ " dia. $\times$ $1\frac{1}{8}$ " long, fulcrum rods ... ..		4
UFN110	Nut, $\frac{5}{8}$ " dia., UNF ... }		10
X75966	Washer, $\frac{5}{8}$ " dia., Thackeray ... }		10
UFN106	Nut, $\frac{3}{8}$ " dia., UNF ... }		10
X75962	Washer, $\frac{3}{8}$ " dia., Thackeray ... }		10
UFN406	Slotted nut, $\frac{3}{8}$ " dia., UNF ... }		10
X75920	Washer, $\frac{3}{8}$ " dia., plain ... }		10



# Semi-Automatic Gearbox

