

# FINAL DRIVE

## CHAPTER X

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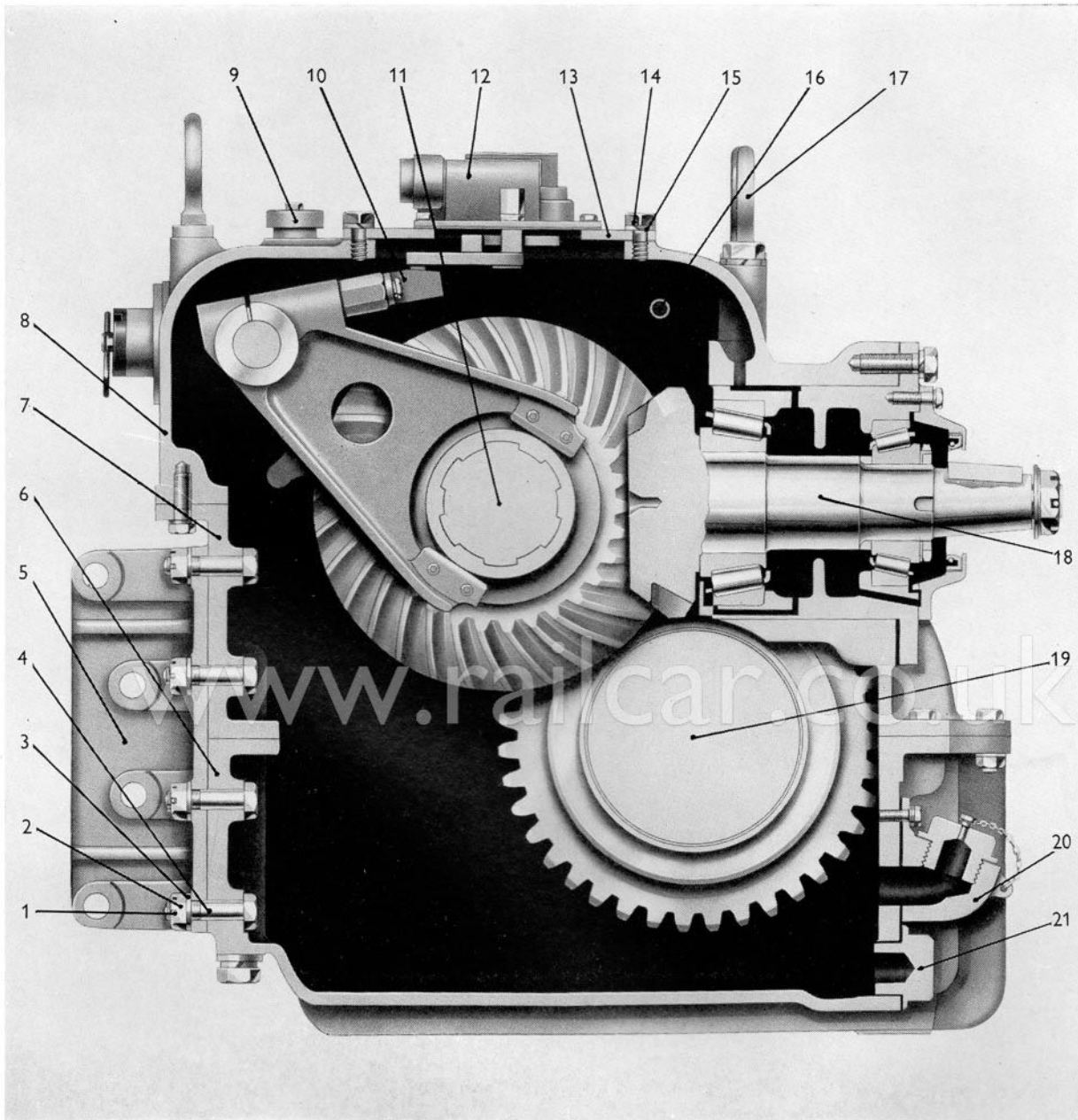


Fig. 1. Vertical Section along Axis of Input Shaft.

1. SPLIT PIN
2. SLOTTED NUT
3. PLAIN WASHER
4. BOLT
5. TORQUE ARM BRACKET
6. GEARCASE (BOTTOM PORTION)
7. GEARCASE (INTERMEDIATE PORTION)

8. GEARCASE (TOP PORTION)
9. BREATHER BODY
10. SWITCH OPERATING BRACKET
11. ASSEMBLY OF TOP SHAFT
12. INDICATOR SWITCH
13. INSPECTION COVER
14. BOLT

15. SPRING WASHER
16. OIL DISTRIBUTION PIPE
17. EYEBOLT
18. ASSEMBLY OF INPUT BEVEL
19. ASSEMBLY OF AXLE
20. FILLER SPOUT
21. DRAIN PLUG

**Sect. X1.****FINAL DRIVE - DATA**

(TYPE R.F.28).

<b>Type:</b>	Railcar Reverse and Final Drive Unit
<b>Max. Input Torque:</b>	3,000 ft. lbs.
<b>Ratio:</b>	2.97 : 1
<b>Lubrication:</b>	One Hobourn-Eaton Bi-directional Type pump.
<b>Operation:</b>	By Air Pressure 65 lb./sq. in. $\pm$ 2½ lbs.
<b>Weight:</b>	10 cwt. less axle.
<b>Oil Capacity:</b>	5 gallons.

**Sect. X2.****FINAL DRIVE - GENERAL DESCRIPTION**

This unit is specially designed for heavy duty rail traction purposes, and provides full reverse, enabling the vehicle to be driven in either direction at all speeds provided by the gearbox.

The casing is a steel casting made in three portions which are suitably dowelled to maintain accurate alignment. The forward and reverse gearing consists of a spiral bevel pinion (made integral with input shaft) meshed with two bevel wheels which are mounted on the top shaft and is carried in the top portion of the unit. The bevel wheels are free on the top shaft, the centre portion of which is splined

carrying a sliding dog. This is engaged with either one or the other of the bevel wheels, depending upon the direction of drive required. A direction detector switch is incorporated to give positive indication that the sliding dog is fully engaged.

The bevel wheels are carried on adequately proportioned bearings which ensure accurate positioning. The top shaft pinion is keyed on the top shaft and is in constant mesh with a driving spur gear mounted on the axle. Taper and roller bearings are provided throughout the unit.

**Sect. X3.****SELECTOR MECHANISM***(See fig. 5).*

The selector mechanism consists of a fork which fits into a groove in the sliding dog. The top end of the fork is fastened by means of set bolts (14) to a selector bar (15), which is moved to the required positions by air pressure moving one of the two pistons (20) at each end of the selector bar (15). The bar is held in position by air pressure on the piston (20).

**A neutral detent is provided in the selector bar (15)**

**which should always be engaged by means of the manually operated neutral lock if the vehicle is being towed.**

Should the main air supply fail at any time when forward or reverse is engaged, remove the top cover of the unit and with a suitable lever move the selector bar (15) into the neutral position, ensuring that the locking plunger (9) in the neutral lock mechanism is positively engaged before moving the vehicle.

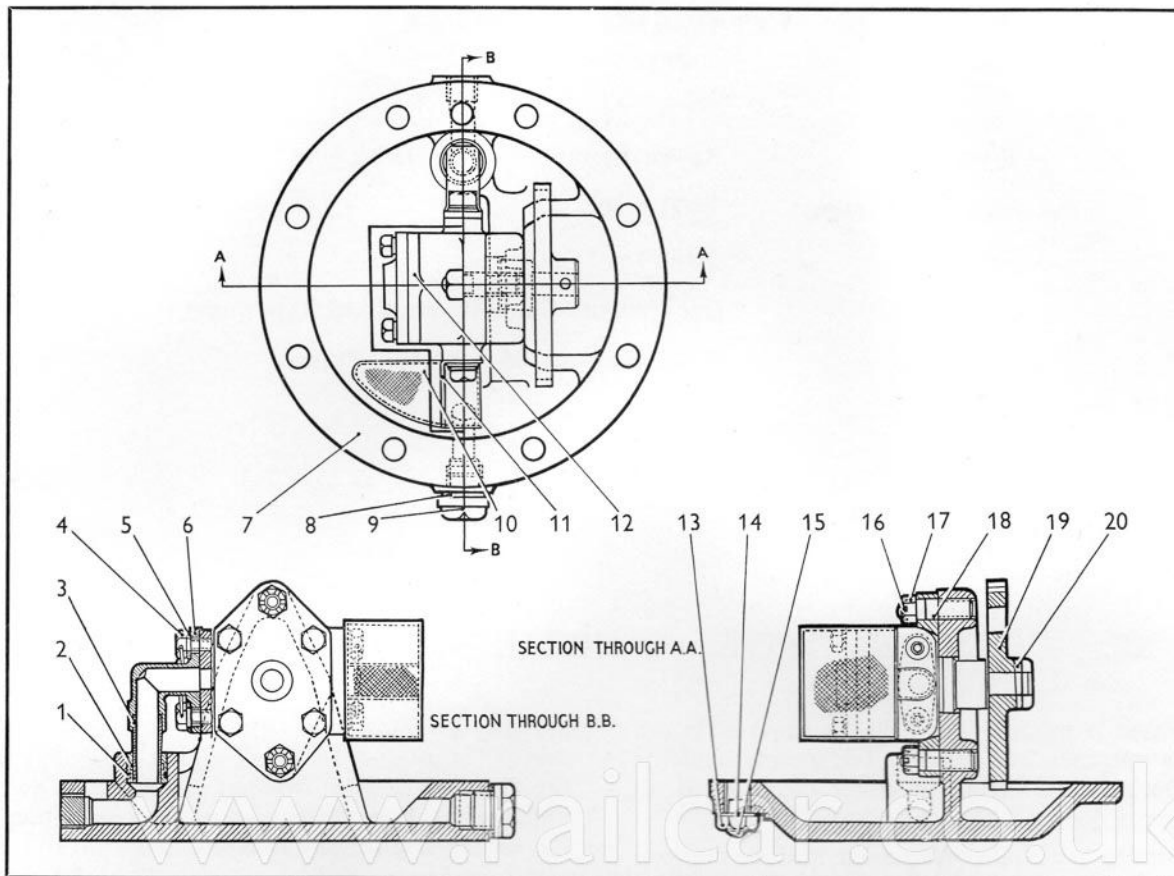


Fig. 2. Oil Pump Assembly.

1. 'O' RING FOR BUSH
2. BUSH
3. OIL DELIVERY PIPE
4. BOLT
5. WASHER
6. OIL PUMP ELBOW
7. OIL PUMP BRACKET
8. DRAIN PLUG WASHER
9. DRAIN PLUG
10. OIL FILTER
11. MOUNTING PLATE
12. OIL PUMP
13. NUT
14. WASHER
15. STUD
16. SPLIT PIN
17. SLOTTED NUT
18. STUD
19. PUMP GEAR
20. TAPER PIN

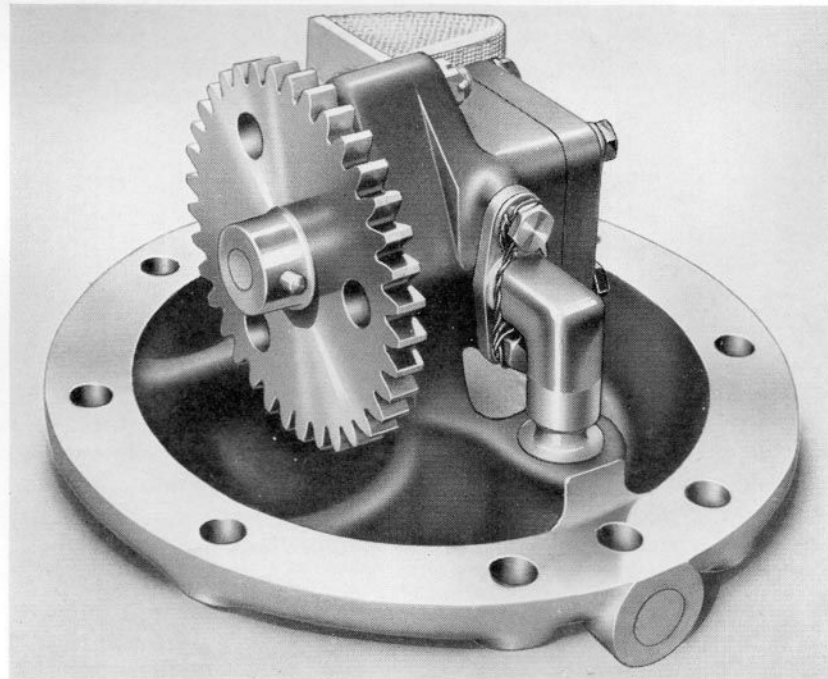


Fig. 3. View of Oil Pump and Base Plate.

## Sect. X4. FINAL DRIVE - MAINTENANCE

The following points require attention at intervals quoted in Railway Standing Instructions.

1. Top-up or drain and re-fill final drive with fresh oil (See section X5).
2. Check for air leaks (See instructions in this section).
3. Clean the breather on the final drive casing.
4. Examine all casings, covers, driving flanges and input shaft joints for leakage and rectify if necessary.
5. Check the air piston seals (See instructions in this section).

### To Check for Air Leaks.

To check for air leaks apply a solution of soap and water to the suspected joints and watch for bubbles.

Check the air pipe connections to the air cylinders for leaks and tighten the unions or renew the washers as necessary.

Leaks on operating pistons can be detected by placing hand over gearbox breather when appropriate direction is selected.

### To Renew the Piston Seals (See fig. 5).

#### Important.

**Piston assemblies are selectively adjusted to ensure end float in operating mechanism.**

**Pistons and cylinders must therefore be kept to their respective sides.**

**If this instruction is not observed unnecessary wear between selector fork and sliding dog can be caused.**

**When new piston seals are being fitted or the pistons are removed for examination, cylinder liners, seals and pistons should be oiled before being replaced preferably with "OILDAG" colloidal graphite. If the final drive has been standing without use for some time, the pistons should be withdrawn and the parts oiled as described above.**

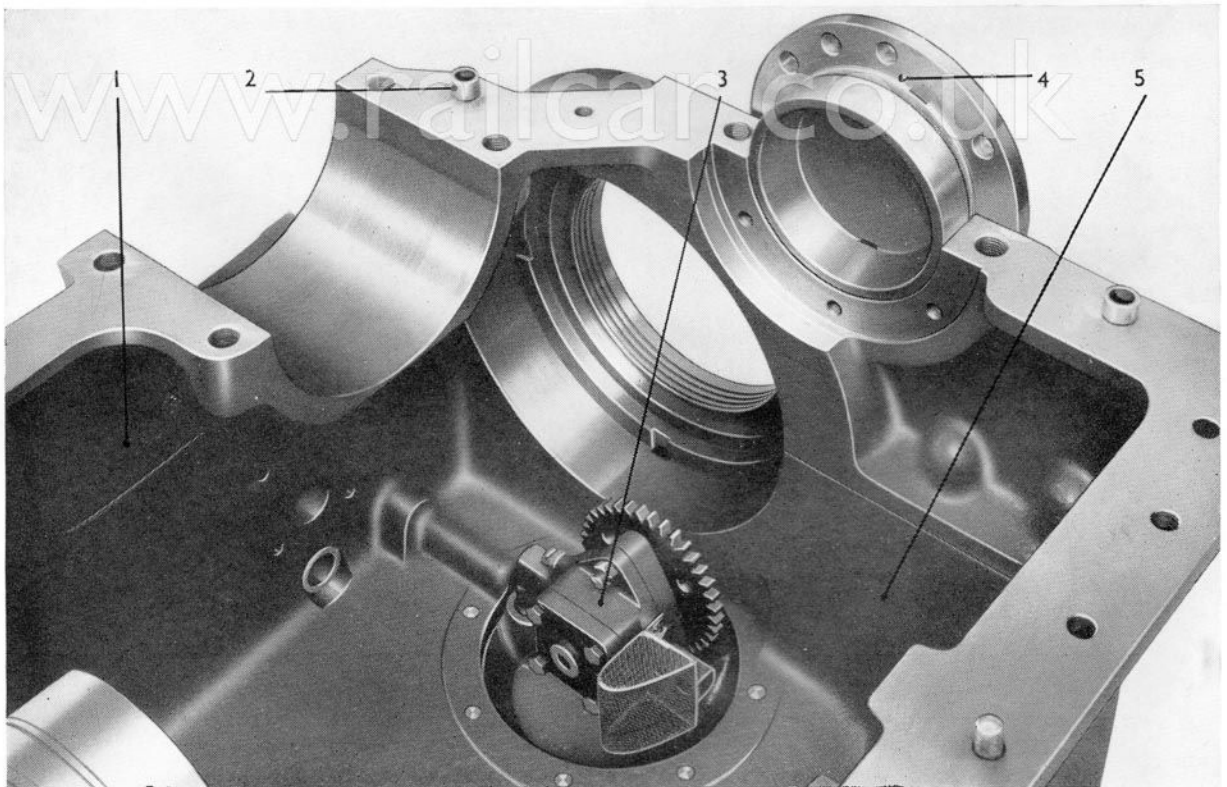


Fig. 4. View of Oil Pump located in bottom portion of Gearcase.

1. INTERMEDIATE PORTION OF GEARCASE  
2. HOLLOW DOWEL

3. OIL PUMP  
4. END COVER

5. BOTTOM PORTION OF GEARCASE

**Sect. X5.****FINAL DRIVE - LUBRICATION**

(See figs. 2 and 6).

The lubrication of the whole of the unit is carried out by a rotary type bi-directional pump situated in the bottom portion of the case. The pump is driven by means of a gear (Fig. 2, Item 19) which engages with a driving gear on the axle (Fig 6, Item 34). The oil is pumped from the sump and is fed into an oil distribution pipe situated in the top portion of the

casing. The oil distribution pipe has drilled holes so placed as to deliver oil jets on to the bevel gears, at the same time lubricating the bearings by means of oil ways in the casings and covers.

The oil specification relating to the Final Drive is quoted in Railway Standing Instructions.

**The Oil capacity of the unit is 5 galls.**

**Sect. X6.****FINAL DRIVE - OIL PUMP**

(See fig. 2).

The oil pump is of the rotary type and because of its simple and robust construction it can be depended on to give trouble free service. Only if difficulty is experienced with maintaining the oil pressure should the pump be dismantled, and the parts inspected for excessive wear and damage. Parts of the reversible pump are not interchangeable, and therefore should the pump fail an entirely new replacement pump should be fitted.

**Removal of Oil Pump** (See fig. 2).

Drain the oil from the sump. Remove the nuts (13), spring washers (14), and withdraw oil pump assembly from the gearcase. Tap clear the tapered pin (20) and withdraw the pump gear (19). Remove

pump elbow (6), oil filter (10), split pin (16), and slotted nuts (17). Remove the oil pump (12) from oil pump bracket (7).

**Replacement of Oil Pump** (See fig. 2).

Fit the new oil pump (12) in position on the oil pump bracket (7), secure with slotted nuts (17) and split pins (16). Using bolts (4), secure in position the oil filter (10), and pump elbow (6), locking the bolts (4) with a suitable wire. Press home the pump gear (19), and secure with tapered pin (20). Replace the pump assembly into the bottom portion of the gearcase securing with spring washers (14) and nuts (13).

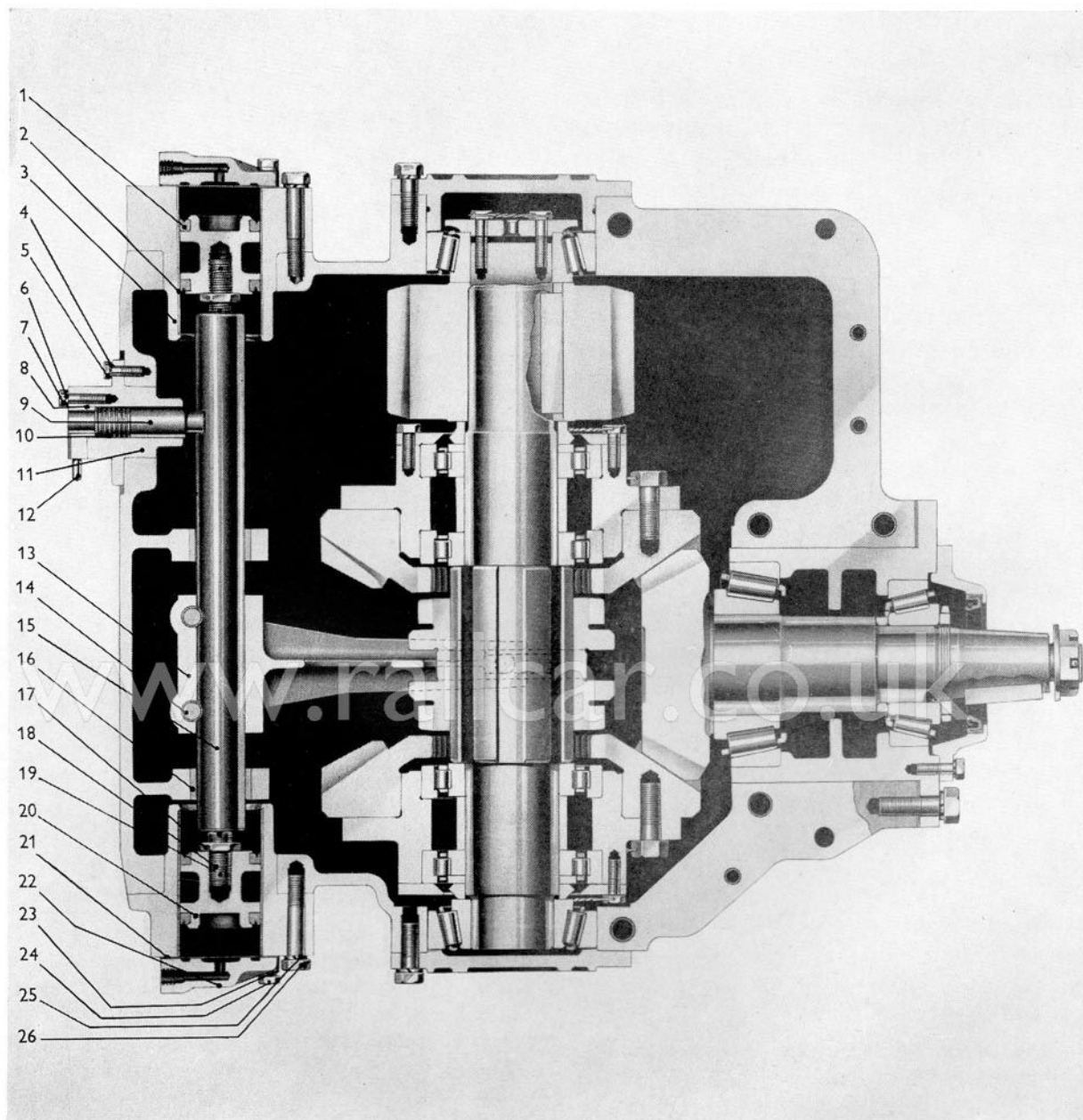


Fig. 5. Selector Mechanism

- 1. PISTON SEAL
- 2. AIR CYLINDER LINER
- 3. AIR CYLINDER
- 4. SPRING WASHER
- 5. BOLT
- 6. SPRING WASHER
- 7. BOLT
- 8. LOCKING PLUNGER GUIDE
- 9. LOCKING PLUNGER

- 10. LOCKING PLUNGER SPRING
- 11. NEUTRAL LOCK SLEEVE
- 12. LOCKING PLUNGER HANDLE
- 13. DOG SHIFTING FORK
- 14. BOLT
- 15. SELECTOR BAR
- 16. SELECTOR BAR BUSH
- 17. LOCKNUT
- 18. ADJUSTER SCREW

- 19. SPLIT PIN
- 20. PISTON
- 21. GASKET
- 22. CYLINDER CAP
- 23. SPRING WASHER
- 24. BOLT
- 25. SPRING WASHER
- 26. BOLT

## Sect. X7. FINAL DRIVE - TO REMOVE AND DISMANTLE

### To Remove.

Isolate the car batteries by means of the isolating switch. Drain the oil from the final drive casing by removing drain plug (Item 12, Fig. 10).

To disconnect the leads from the direction indicator switch remove the locking pin and unscrew the plug from the socket.

Disconnect the universal joint coupling flange from the driving shaft coupling flange.

Disconnect the supply pipes from the air cylinders.

Remove the pivot pin and disconnect the torque arm from the torque reaction bracket.

Place a lifting jack or wood blocks under the final drive unit to support the bottom portion of the casing, whilst lifting off the top and intermediate casings.

Place a suitable lifting tripod in position and attach the lifting chain or sling through the eye-bolts and take up the slack.

Remove the nuts and bolts securing the intermediate casing to bottom casing and lift off the top half which contains the working parts and place on a suitable bench for dismantling.

Lower the bottom half of the casing to the ground, leaving the driven spur gear, support bearings, oil thrower and end covers on the axle shaft.

### To Fit.

Reverse the procedure for removal noting the following points :—

Wash all parts in clean paraffin and ensure all oilways and channels are clear.

Examine the support bearings on the axle shaft and renew if necessary.

Ensure that the oil seal surfaces on the axle shaft are not scored or damaged.

Remove all traces of jointing compound from all joint faces.

Renew all joints and fit with non-hardening jointing compound.

Ensure that the air pipe connections are secure, that the marks on the unions correspond with the marks on the cylinder and that the original number of washers are fitted with each union.

### To Dismantle.

#### Important.

When dismantling ensure that all bearing outer races are kept paired up with their inner races, as these parts are selectively assembled and are therefore not interchangeable.

#### Removing Inspection Cover (See fig. 1).

Remove bolts (14) and spring washer (15), and lift away the inspection cover (13).

#### Selector Mechanism (See fig. 5).

Remove the bolts (7), spring washers (6), and withdraw the locking plunger handle (12), spring (10), plunger guide (8) and the locking plunger (9).

Remove bolts (26), spring washers (25), and withdraw the air cylinder (3) with cylinder caps (22), gaskets (21), pistons (20), together with the adjuster screws (18), locknuts (17), split pins (19) and seals (1). Ensure that the air cylinders and unions are marked and retained with their washers so that they can be fitted to their original cylinders when re-filling. Release the locking wire, remove bolts and withdraw the switch operating bracket (Fig. 1, Item 10). Release the locking wire and remove the bolts (14) from dog shifting fork assembly (13) and withdraw the selector bar (15) from the top portion of gearcase.

#### Gearcase Top Portion (See figs. 1, 5, and 6).

Remove all the bolts securing the top portion (Fig. 1, Item 8) to intermediate portion of gearcase (Fig. 1, Item 7). Remove the bolts (Fig. 6, Items 14 and 24) and spring washers from the top shaft end covers (Fig. 6, Items 22 and 45), and input bevel housing (Fig. 6, Item 1). Three bolts should be left in the bottom of the top shaft end covers, secured in position to retain the shims and outer races, whilst the top portion of gearcase (Fig. 1, Item 8) complete with the oil distribution pipe is lifted away. Remove the dog shifting fork assembly (Fig. 5, Item 13), top shaft (Fig. 6, Item 21), and input bevel housing assembly (Fig. 6, Item 1). Remove the remaining bolts from the end covers (Fig. 6, Items 22 and 45), keeping shims and outer races together. It is not advisable to dismantle these assemblies as they have been carefully adjusted to give correct clearances for the bearings and bevels.



1. INPUT BEVEL HOUSING
2. INPUT BEVEL PINION
3. OIL SEAL HOUSING
4. OIL SEAL
5. WASHER — LOCKING RING
6. WASHER — NUT
7. SPLIT PIN
8. NUT
9. KEY
10. LOCKING RING
11. BEARING
12. BOLT
13. SPRING WASHER
14. BOLT
15. SPRING WASHER
16. SHIMS
17. DISTANCE PIECE
18. BEARING
19. BOLT
20. BOLT
21. TOP SHAFT
22. END COVER
23. OIL THROWER
24. BOLT
25. SPRING WASHER
26. BEARING
27. BEARING
28. DISTANCE PIECE
29. BEARING
30. THRUST PLATE
31. HALF SHIM
32. BEARING
33. SPACING PIECE
34. PUMP DRIVING GEAR
35. SLIDING DOG
36. SLEEVE
37. AXLE
38. GEAR
39. OIL THROWER
40. SPRING WASHER
41. BOLT
42. OIL COLLECTOR RING
43. OIL THROWER
44. SHIMS
45. END COVER
46. BEARING RETAINING PLATE
47. BOLT
48. KEY
49. DRIVING PINION
50. BEVEL HUB
51. BEVEL WHEEL

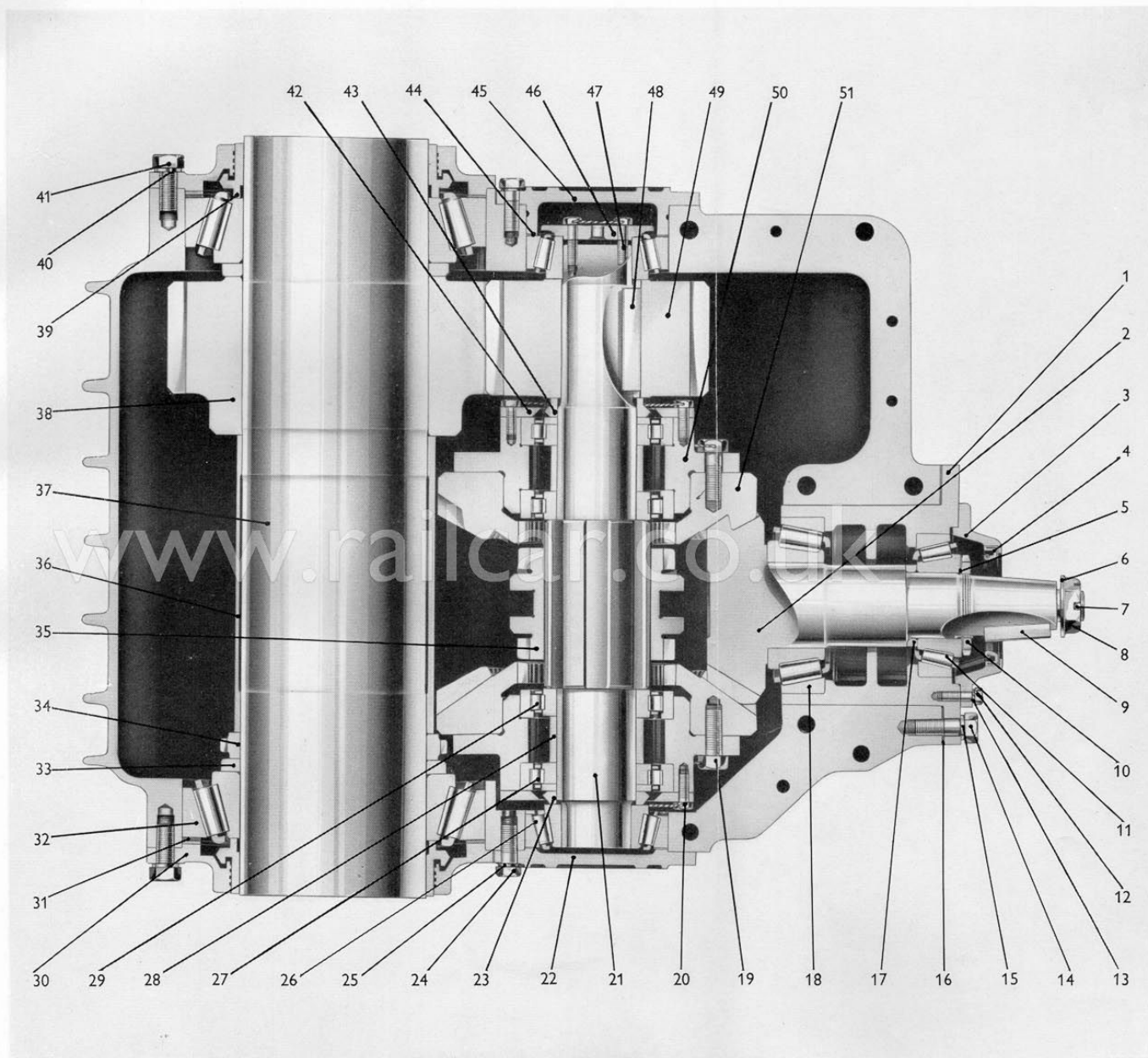


Fig. 6. Sectional Elevation through Final Drive

**Gearcase Intermediate Portion** (See *figs. 1 and 6*).

The torque arm bracket (Fig. 1, Item 5) can be withdrawn by removing split pin (Fig. 1, Item 1), slotted nut (Fig. 1, Item 2), and washers (Fig. 1, Item 3). The bolts (Fig. 1, Item 4) are a drive fit and should not be removed. Remove the nuts and spring washers from oil pump assembly and withdraw it from the bottom portion of the gearcase.

Withdraw all the bolts securing the intermediate portion (Fig. 1, Item 7) to bottom portion (Fig. 1, Item 6) of the gearcase. Remove bolts (Fig. 6, Item 41) and spring washers (Fig. 6, Item 40) from the

bearing thrust plates (Fig. 6, Item 30). Two bolts should be kept lightly secured in position on the bottom of each thrust plate to retain the shims (Fig. 6, Item 31) and outer races (Fig. 6, Item 32) in position, whilst the intermediate portion of casing is lifted away.

**Gearcase Bottom Portion** (See *fig. 6*).

Take the weight of the axle assembly (37) and completely remove thrust plates (30), keeping axle half shims (31) and outer races (32) together. The axle (37) can now be lifted away from the bottom portion of the gearcase (See Fig. 7).

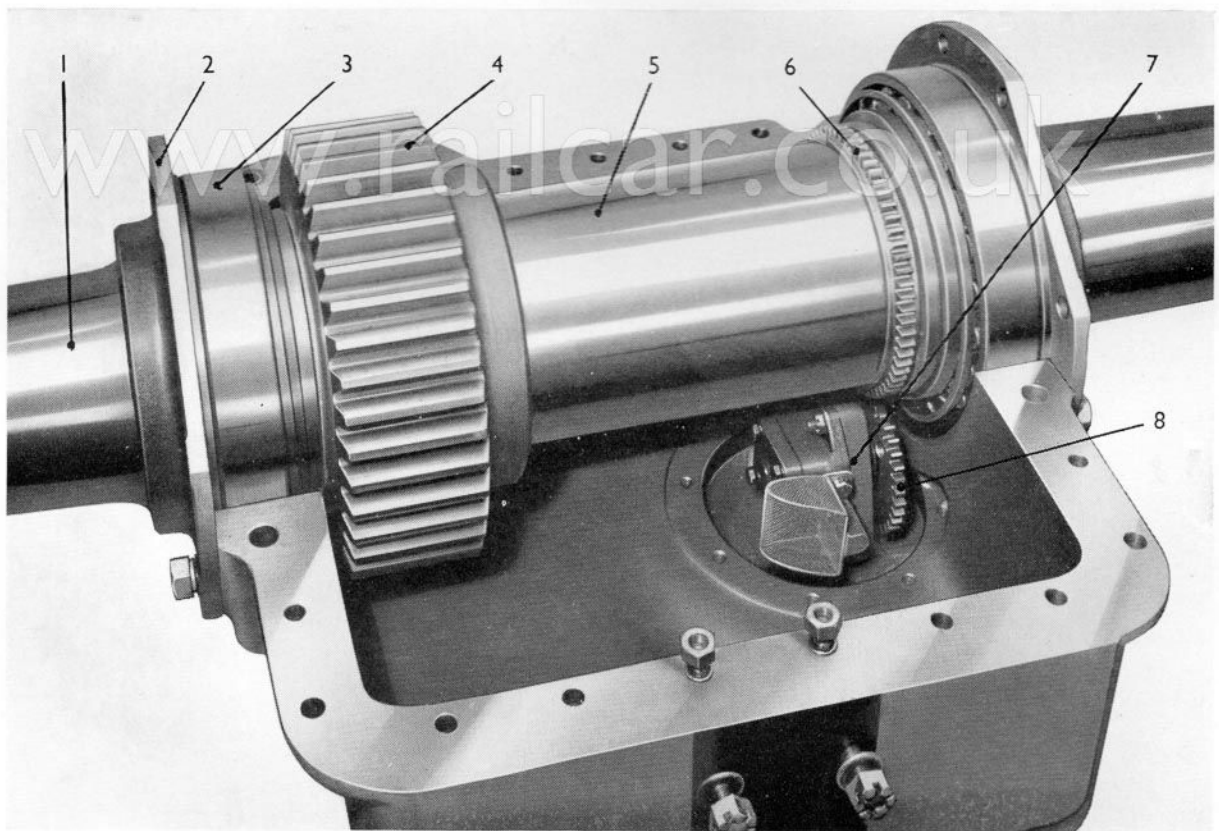
**Sect. X8. FINAL DRIVE - TO ASSEMBLE AND FIT**

To assemble reverse the procedure for dismantling.

**Gearcase Bottom Portion** (See *fig. 6*).

Replace the axle assembly (37) into the bottom

portion of case (See Fig. 7). Re-fix bearing thrust plates (30) on to the bottom portion of gearcase, and so retaining in position axle roller bearings (32).

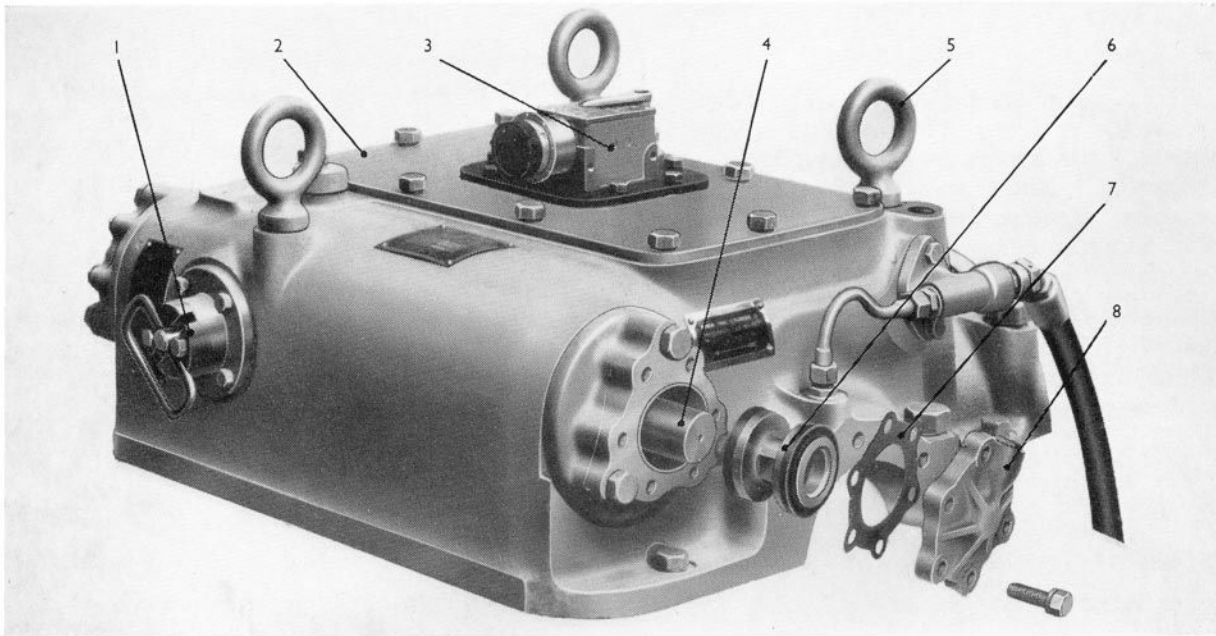


**Fig. 7. View of Axle Mounted in Bottom Portion of Gearcase.**

1. AXLE  
2. THRUST PLATE  
3. BEARING

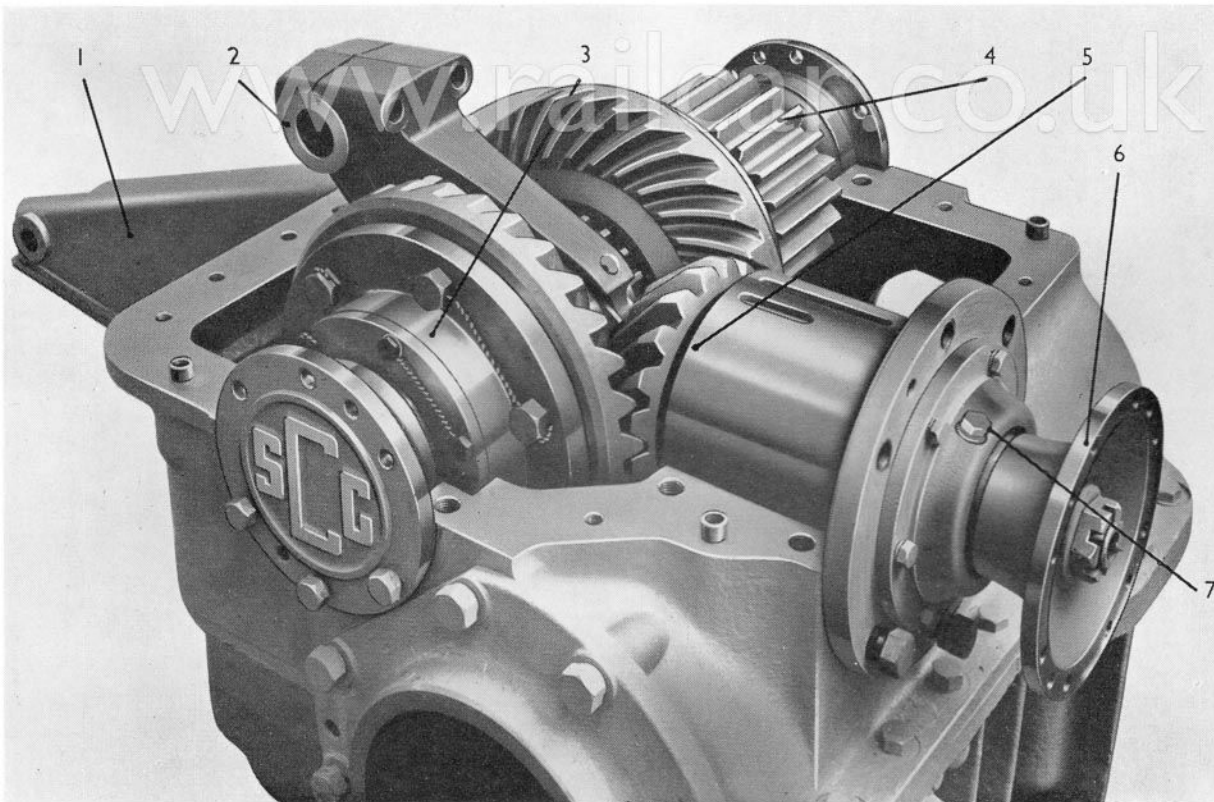
4. AXLE GEAR  
5. AXLE SLEEVE  
6. PUMP GEAR DRIVER

7. OIL PUMP  
8. PUMP GEAR DRIVEN



**Fig. 8. View of Top Portion of Case and Piston.**

- |                               |                 |                 |
|-------------------------------|-----------------|-----------------|
| 1. NEUTRAL LOCK               | 4. SELECTOR BAR | 7. GASKET       |
| 2. INSPECTION COVER           | 5. EYEBOLT      | 8. CYLINDER CAP |
| 3. DIRECTION INDICATOR SWITCH | 6. PISTON       |                 |



**Fig. 9. View of Input Bevel and Top Shaft showing location of Dog Shifting Fork.**

- |                       |                         |                   |
|-----------------------|-------------------------|-------------------|
| 1. TORQUE ARM         | 4. DRIVING PINION       | 6. INPUT COUPLING |
| 2. DOG SHIFTING FORK  | 5. INPUT BEVEL ASSEMBLY | 7. PLUG           |
| 3. TOP SHAFT ASSEMBLY |                         |                   |

**Gearcase Intermediate Portion** (See figs 1, 2 and 6).

Re-fit the intermediate portion of the gearcase (Fig. 1, Item 7) on to the bottom portion, locating with the hollow dowels. The axle half shims (Fig. 6, Item 31) can now be replaced, and the bearing thrust plates (Fig. 6, Item 30) secured in position. Check axle end float (See running Gear Assembly Dimensions). Re-fit the oil pump assembly (See Fig. 2) into the bottom portion of the gearcase and secure in position, ensuring that there is backlash between the pump driving gear (Fig. 6, Item 34) and the pump gear (Fig. 2, Item 19).

Replace the torque arm bracket (Fig. 1, Item 5) ensuring that it is perfectly square in relation to the machined surface of the intermediate portion of the gearcase. The top shaft assembly end cover (Fig. 6, Item 22) and (Fig. 6, Item 45) can now be replaced on to the intermediate portion of gearcase, and lightly secured in position with three bolts (Fig. 6, Item 24).

The top shaft and input bevel assemblies can now be replaced in the casing.

The end float on the top shaft and input bevel assemblies must now be checked.

(See running Gear Assembly Dimensions).

Bearing End Float			Gauge Dimensions		Backlash
INPUT SHAFT	TOP SHAFT	AXLE	BEVEL PINION TO SLIDING DOG	OVER BEVEL WHEELS	BEVELS
.0025" .003"	.003" .004"	.003" .004"	.888" ± .0015"	9.876" ± .001"	.010" .014"

**Running Gear Assembly Dimensions**

**Gearcase Top Portion** (See figs. 1, 5 and 6).

Replace the top portion of gearcase (Fig. 1, Item 8) ensuring that the dog shifting fork assembly (Fig. 5, Item 13) is in its approximate working position, with

the dog shifting fork pads which are located in the grooves, in the sliding dog (Fig. 6, Item 35) on the top shaft assembly. Locate top portion with the hollow dowels, replace bolts and secure in position. Finally secure into position the top shaft end covers and input bevel housing and note that the letters S.C.G. on all end covers are kept in an upright position, as this ensures that the lubrication ports in the cases and covers are in alignment.

**Selector Mechanism** (See fig. 5).

Slide the selector bar (15) into position in the top portion of the gearcase, and secure it to the dog shifting fork assembly (13) with the bolts (14). Locking the bolts with a suitable wire, replace the switch operating bracket (Fig. 1, Item 10) on to the dog shifting fork bolts, securing with bolts and spring washer, and locking bolts with a suitable wire.

Replace the air cylinders (3) with cylinder caps (22) gaskets (21), pistons (20) together with the adjuster screws (18), locknuts (17), split pins (19), and seals (1), securing in position with bolts (26) spring washers (25). Replace the locking plunger (9), locking plunger handle (12), spring (10), and plunger guide (8), securing with bolts (7) and spring washers (6).

**To Replace Top Cover** (See fig. 1).

Replace the inspection cover (13) complete with indicator switch (12) on to the top portion of the gearcase, ensuring that the arm on the indicator switch is correctly located in the switch operating bracket (10). Secure with bolts (14), and spring washer (15).

Replace the external oil pipes and fill up the unit with the correct grade of oil ensuring that the drain plug (21) has been replaced.

The sump will be at correct capacity when oil overflows from the filler spout (20).

Note. (See fig. 9).

It is important that the input bevel assembly (5) is primed with 1 pint of oil prior to installation of the final drive in the railcar. A plug (7) is provided in the oil seal housing to facilitate this. Failure to do

this will result in overheating of the input bearings on initial test run. The oil pump will adequately lubricate this assembly after a few revolutions of the running gear.

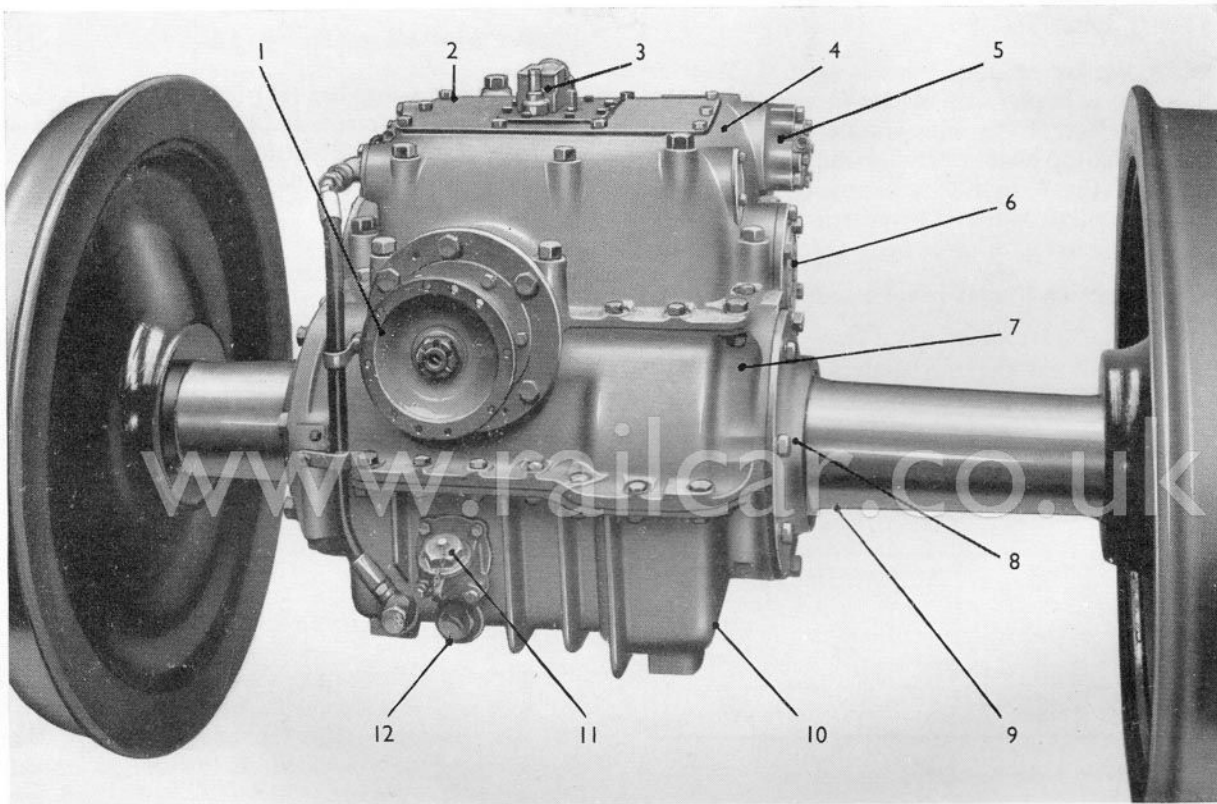


Fig. 10. View of Complete Unit Mounted on Axle.

1. INPUT COUPLING
2. INSPECTION COVER
3. INDICATOR SWITCH
4. TOP PORTION OF GEARCASE

5. AIR CYLINDER
6. END COVERS
7. INTERMEDIATE PORTION GEARCASE
8. THRUST PLATE

9. AXLE
10. BOTTOM PORTION OF GEARCASE
11. FILLER SPOUT
12. DRAIN PLUG