

# Section D—PROPELLER SHAFTS—ALL MODELS

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### Propeller shaft (front and rear axle drives)

Wear on the thrust faces of the bearings can be located by testing the lift in the joint, either by hand or with the aid of a length of wood suitably pivoted. Any circumferential movement of the shaft relative to the flange yokes indicates wear in the roller bearings or the splined joint.

Lubricant may seep from the bearings after a lengthy period of service, owing to failure of the bearing seals.

If a leak is severe, or is neglected, failure of the needle roller bearings may result.

If any of these defects are apparent, the complete shaft should be removed from the vehicle and rectified as described.

### To remove

1. Disconnect the propeller shaft from the differential input flange.
2. Disconnect the propeller shaft from the transfer box output flange.

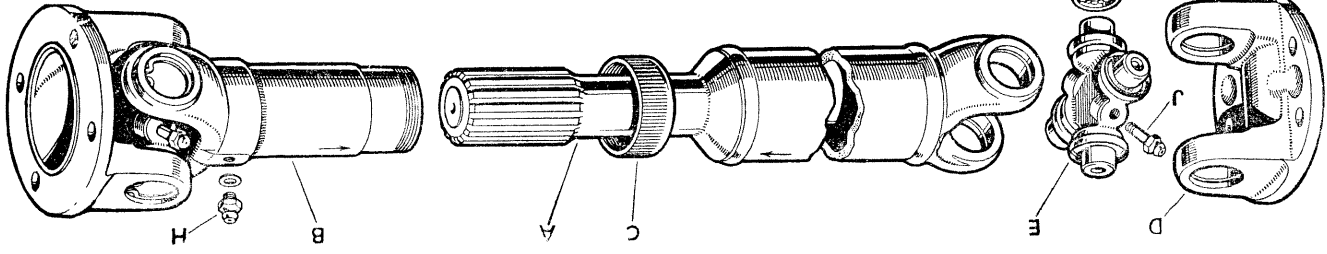


Fig. D-1—Construction of propeller shaft

- A—Splined shaft
- B—Splined sleeve
- C—Dust cap
- D—Flange yoke
- E—Journal spider
- F—Needle roller bearing assembly
- G—Circlip securing bearing
- H—Lubrication nipple for splined joint
- J—Oil nipple for universal joint

The top bearing should then begin to emerge from the yoke. (Fig. D-2.)

1. If fitted, unscrew the two hose clips and slide the rubber grommet up the shaft.
2. Unscrew the dust cap and withdraw the sliding joint from the splined shaft.
3. Clean the enamel and dirt from the four circlips and the tops of the bearing races.
4. Remove the circlips.
5. Hold the joint in the left hand with one of the splined sleeve (or shaft) yoke lugs uppermost and tap the radius of the yoke lightly with a soft-nosed hammer.

3. Withdraw the propeller shaft complete.
- Propeller shaft (rear power take-off drive)**  
 To remove  
 See Section T.  
 Operation D/4
- Operation D/6 To strip**

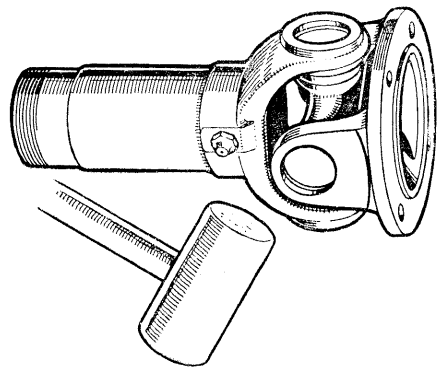


Fig. D-2—Removing a yoke bearing. Stage 1

6. Turn the joint over and withdraw the bearing. (Fig. D-3.)

Always remove a bearing downwards, to avoid dropping the needle rollers. It may be necessary to tap the bearing race from the inside with a small drift; in such cases, care should be taken to prevent damage to the bearing race.

7. Repeat these operations for the opposite bearing.

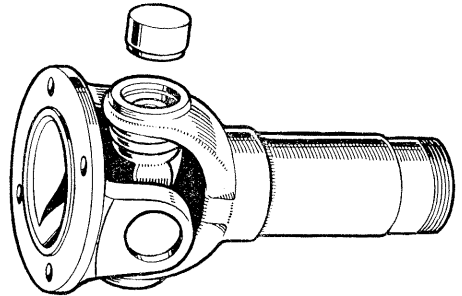


Fig. D-3—Removing a yoke bearing. Stage 2

8. The splined sleeve (or shaft) yoke can now be removed. (Fig. D-4.)

9. Rest the flange yoke on a short piece of tubing of suitable diameter (slightly larger than the bearing race) and drive out the two remaining bearings, using a brass drift. (Fig. D-5.)

10. Wash all the parts and lay them out for inspection.

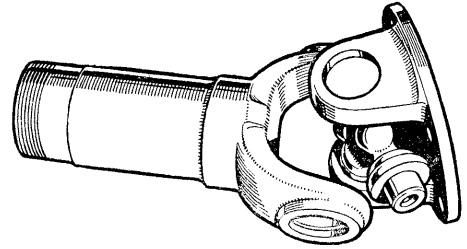


Fig. D-4—Removing the splined sleeve or shaft

The other parts likely to show signs of wear are the splined sleeve yoke and splined shaft. A total of .004 in. (0,1 mm) circumferential movement, measured on the outside diameter of the splines, should not be exceeded. If wear beyond this limit has taken place, a new propeller shaft complete must be fitted.

The parts most likely to show signs of wear after long use are the bearing races and the spider journals. Should looseness in the fit of these parts, load markings or distortion be observed, they must be renewed complete, as oversize journals or bearing races are not supplied. Replacement journal assemblies comprise a spider complete with cork oil seals and four bearings.

To assemble

Operation D/8

1. Assemble the needle rollers in the bearing races, if necessary using a smear of vaseline to retain them in place. About half fill the races with a recommended grease.

2. Insert the journal in the flange yoke holes and, using a brass drift slightly smaller in diameter than the hole in the yoke, lightly tap the first bearing into position.

It is essential that the bearing races be a *light drive fit* in the yoke trunnions. In the event of wear taking place in any of the eight yoke cross holes, rendering them oval, a new propeller shaft complete must be fitted.

3. Repeat the operation for the other three bearings comprising the universal joint, and assemble the other joint similarly.

4. Replace the circlips and ensure that they are firmly located in their grooves. If the joint appears to bind, tap the ears slightly with a soft-nosed hammer.

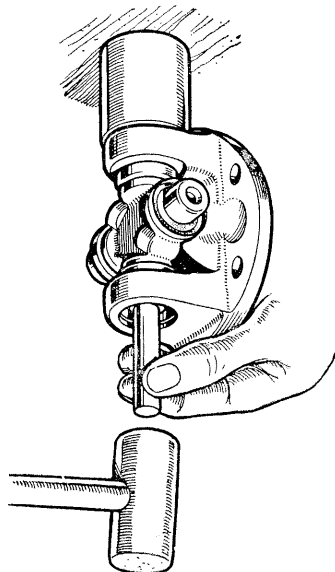


Fig. D-5—Removing the flange yoke

2. Insert the bolts securing the front and rear propeller shafts together, in the rear flange, before fitting the flange on the splined shaft.
3. The centre ball bearing must be a *light fit* on the shaft; if a new bearing is loose on the shaft, the complete shaft must be renewed.
4. The centre ball bearing must be a *press fit* in the housing; if a new bearing is loose in the housing, the complete housing must be renewed.

**Propeller shaft (front and rear axle drives)  
To refit  
Operation D/14**

1. Wipe the faces of the transfer box and differential flanges clean.

2. Replace the propeller shaft and ensure that the register engages and that the joint faces bed down correctly all round.

3. Secure the propeller shaft, sleeve end, to the transfer box output flange. Tighten the nuts evenly.

4. Secure the propeller shaft to the differential input flange (with the nuts behind the input flange). Tighten the nuts evenly.

**Propeller shaft (rear power take-off drive)  
To refit  
Operation D/16**

1. See Section T.

5. Slide the rubber grommet and hose clips on to the shaft; liberally smear the splines of the sliding joint and splined shaft with grease and replace the joint on the shaft, making sure that the arrows marked on the splined sleeve yoke and shaft are in line (Fig. D-1).
6. Screw up the dust cap as far as possible by hand.
7. Place rubber grommet in position and secure hose clips at 180° to each other to maintain balance.

**Centre bearing assembly (rear power take-off drive—109 only)  
To strip  
Operation D/10**

1. Remove the rear driving flange from the front shaft.

2. Drift off the flange from the splined shaft.
3. Hold the centre bearing housing firmly in a vice and drift the shaft, complete with the bearing and dust plate, from the housing. Remove the two Woodruff keys from the shaft.

4. Press the centre ball bearing and dust plate off the shaft.

5. Wash all the parts and lay them out for inspection.

**To assemble  
Operation D/12**

1. Reverse the stripping procedure.

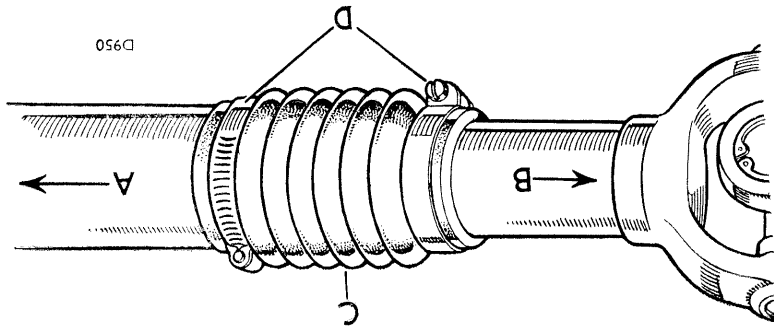


Fig. D-6—Rubber grommet in position on shaft

- A—To output shaft housing.
- B—To front axle.
- C—Rubber grommet.
- D—Hose clips at 180° to each other.

DEFECT LOCATION

(Symptom, Cause and Remedy)

B—UNIVERSAL JOINTS NOISY

1. Lack of lubrication—*Lubricate or renew bearings.*
2. Securing nuts loose—*Tighten.*
3. Worn bearings or worn spline—*Renew.*

A—VIBRATING PROPELLER SHAFT

1. Worn needle roller bearings—
2. Balance marks out of alignment—*Check alignment of balance marks on the splined sleeve yoke and shaft.*
3. Worn splines—*Renew.*
4. Shaft out of balance—*Tighten the securing nuts; renew the shaft if still out of balance.*

GENERAL DATA

<p>109 in.</p> <p>Type: Hardy Spicer needle bearing</p> <p>Tubular shaft—</p> <p>diameter ..... 2 in. (50,8 mm)</p> <p>wall thickness ..... <math>\frac{3}{8}</math> in. (2,4 mm)</p> <p>Overall length (face to face in neutral position)—</p> <p>Front axle drive ..... 23.812 in. (654 mm)</p> <p>Rear axle drive ..... 42.812 in. (1,087 mm)</p> <p>Lubricant ..... Grease</p>	<p>88 in.</p> <p>Type: Hardy Spicer needle bearing</p> <p>Tubular shaft—</p> <p>diameter ..... 2 in. (50,8 mm)</p> <p>wall thickness ..... <math>\frac{3}{8}</math> in. (2,4 mm)</p> <p>Overall length (face to face in neutral position)—</p> <p>Front axle drive ..... 23.812 in. (654 mm)</p> <p>Rear axle drive ..... 21.812 in. (554 mm)</p> <p>Lubricant ..... Grease</p>
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# Section E - REAR AXLE - ALL MODELS

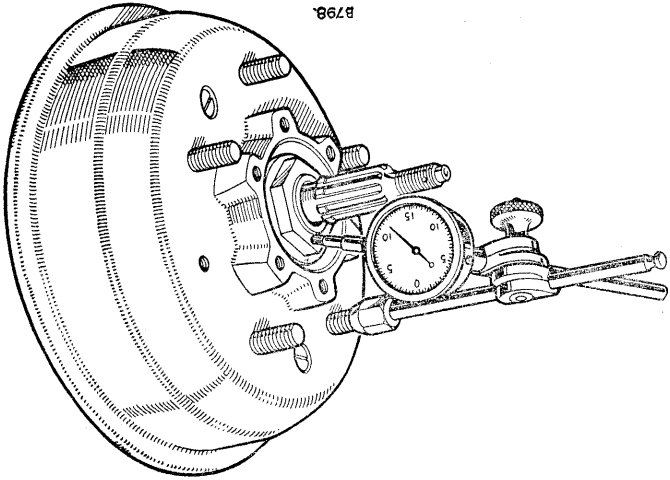
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E-3	Fig. E-3	Layout of rear axle
Data, details and illustrations concerning the differential assembly will be found in Section F.		

4. Depress the brake pedal fully, and wedge it in that position, detach the brake pipes at the wheel brake unit.
5. Remove the brake components. (Section H).
6. Withdraw the shaft and hub assembly, complete with anchor plate, from the flange, by removing the six securing bolts, spring washers and nuts.



1. Adjust the end-float of the hub bearing by adjusting the inner hub nut by hand until it can be felt that the end-float has been taken up, and at the same time revolving the hub slowly to allow the rollers to settle down in their bearings. Tighten the locknut and check the end-float by means of a dial test indicator mounted on to one of the wheel studs (see Fig. E-1). Take the reading by pushing the hub as far as possible towards the axle centre, note the indicator reading, pull the hub outwards and again take the indicator reading, the total hub movement so measured should be .004 in. to .006 in. (.010 mm to .015 mm). When the correct end-float has been obtained, bend over two tabs of the locking washer. As a safeguard, the end-float should be checked once more after locking the nuts.

### To adjust Operation E/2 Rear hub assembly

### To remove Operation E/4

1. Jack up the rear of the vehicle under the chassis frame.
2. Drain off the rear axle oil.
3. Remove the road wheel and brake drum.

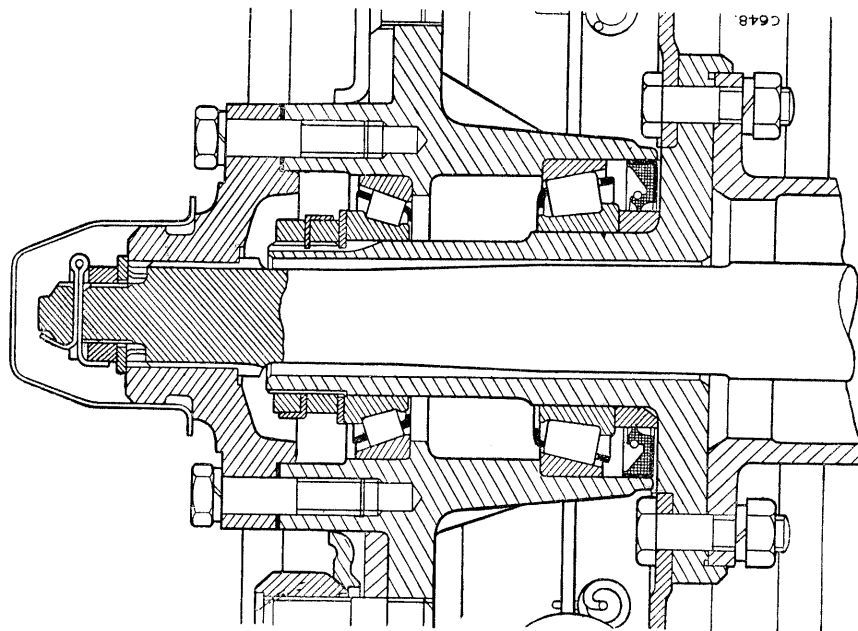


Fig. E-2—Cross-section of rear hub

4. Examine the oil seal and renew as necessary; press the seal into the hub with the knife edge towards the inner bearing until the oil seal face is flush with the rear face of the hub. If the seal is pressed too far in, the element will fall to register on the rear hub bearing sleeve distance piece, so allowing oil to leak past and on to the brake linings.

**To assemble complete unit Operation E/10**

1. Bolt the rear hub bearing sleeve to the axle casing.

2. Place brake anchor plate into position and then slide the complete hub on to the rear hub bearing sleeve.

3. Fit the thrust key washer, adjusting nut, lock washer and locknut. Adjust the hub end-float, Operation E/2.

4. Slide the axle shaft through the rear hub bearing sleeve until it locates in the splines of the differential unit. Place a joint washer on to the driving member, then slide the member on to the spline at the end of the axle shaft, securing it to the hub with the six set bolts and washers.

5. Replace oil seal and secure the axle shaft to the driving member by using the slotted nut, plain washer and split pin. Take care not to over-tighten. Tap the hub cap into place.

6. Fill the hub with one-third of a pint (0,190 litres) of oil, through the oil filler plug in the driving member, using a dispenser with a pipe extension, so that the oil is discharged adjacent to the outer bearing. Replace the filler plug and joint washer.

**To strip Operation E/6**

1. Remove the hub cap (*press fit*) on the driving member.

2. Remove the driving member and joint washer from the axle shaft and the hub. Remove oil seal.

3. Prise up the locking tabs and remove the locknut, lock washer and adjusting nut from the rear bearing sleeve, remove the thrust key.

4. Remove the hub complete with the inner and outer roller bearings and oil seal. Remove brake anchor plate. Withdraw the oil seal and bearings from the hub if necessary.

**To assemble hub Operation E/8**

1. Before assembling the hub, examine the outside diameter of the inner bearing distance piece, on which the oil seal runs, for signs of damage or roughness. Renew as necessary. The distance piece should be a *press fit* on the rear hub bearing sleeve. Any clearance between these two parts will allow oil to leak past on to the brake linings.

2. Examine the two hub bearings and renew them as necessary. Both bearings should be an easy fit on the rear hub bearing sleeve and a *press fit* in the hub. If new bearings are slack in the hub, the hub itself should be renewed.

3. Lightly smear the bearings with grease and press them into the hub. Do not disturb the coating of oil, which is present on new bearings.

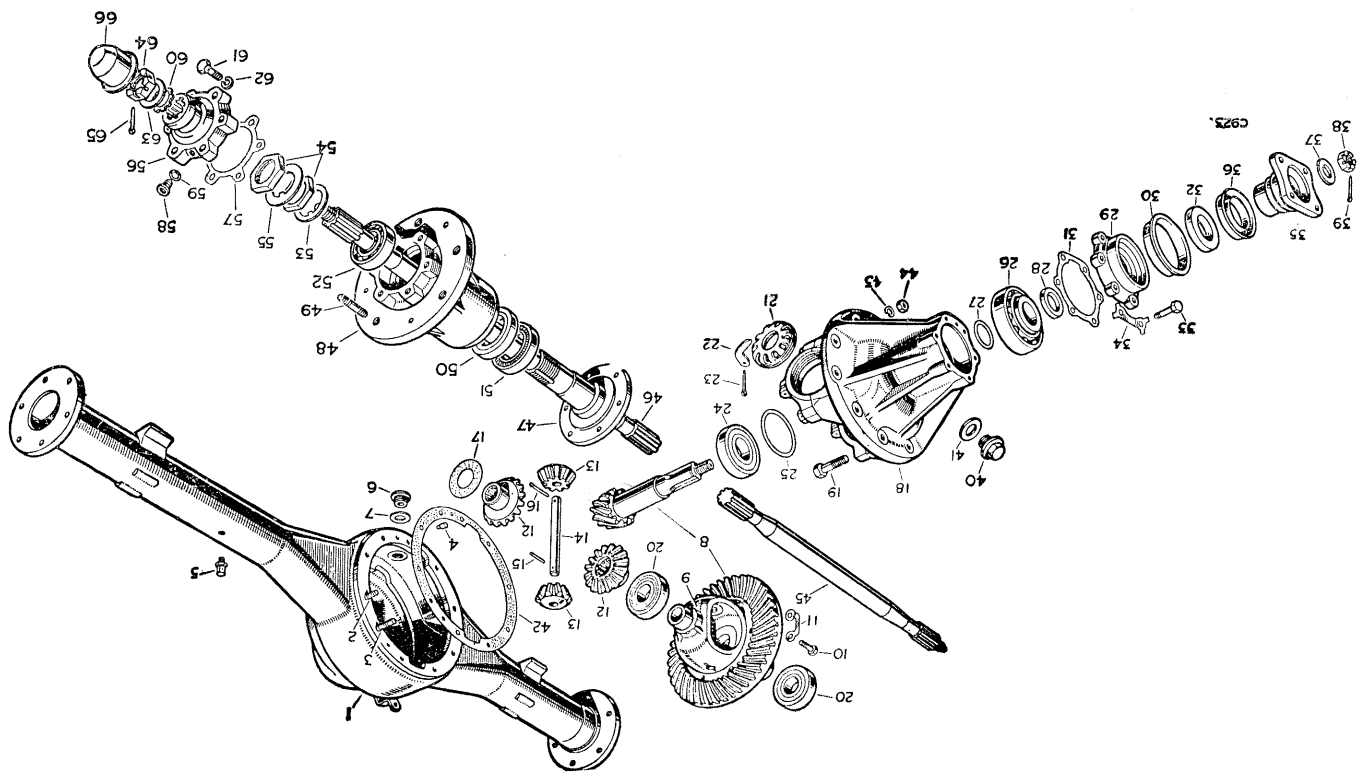


Fig. E-3—Layout of rear axle

- |       |  |       |                                      |
|-------|--|-------|--------------------------------------|
| 1     | Rear axle casing                         | 31    | Joint washer for retainer            |
| 2-3   | Bolts fixing differential                | 32    | Oil seal for pinion                  |
| 4     | Dowel locating differential              | 33-34 | Fixings for retainer                 |
| 5     | Breather                                 | 35    | Driving flange                       |
| 6-7   | Oil drain plug                           | 36    | Dust shield for driving flange       |
| 8     | Crownwheel and bevel pinion              | 37-39 | Fixings for driving flange           |
| 9     | Differential casing                      | 40-41 | Oil filler plug and washer           |
| 10-11 | Fixings for crownwheel                   | 42    | Joint washer for differential        |
| 12    | Differential wheel                       | 43-44 | Fixings for differential             |
| 13    | Differential pinion                      | 45    | Axle shaft, R.H.                     |
| 14    | Spindle for pinions                      | 46    | Axle shaft, L.H.                     |
| 15-16 | Fixings for spindle                      | 47    | Rear hub bearing sleeve              |
| 17    | Thrust washer for differential           | 48    | Rear hub assembly                    |
| 18    | Bevel pinion housing                     | 49    | Stud for road wheel                  |
| 19    | Bolt fixing bearing cap                  | 50    | Hub bearing, inner                   |
| 20    | Roller bearings for differential         | 51    | Oil seal for inner bearing           |
| 21    | Serrated nut                             | 52    | Hub bearing, outer                   |
| 22    | Lock tab                                 | 53-55 | Fixings—for hub bearing              |
| 23    | Split pin                                | 56    | Driving member for rear hub          |
| 24    | Bearing for bevel pinion, pinion end     | 57    | Joint washer for driving member      |
| 25    | Shims for bearing adjustment, pinion end | 58    | Filler plug for hub driving member   |
| 26    | Bearing for bevel pinion, flange end     | 59    | Joint washer for filler plug         |
| 27    | Shims for bearing adjustment, flange end | 60    | Oil seal for rear axle shaft         |
| 28    | Washer for bearing                       | 61-62 | Fixings—driving member to rear hub   |
| 29    | Retainer for oil seal                    | 63-65 | Fixings—axle shaft to driving member |
| 30    | Mudshield for retainer                   | 66    | Hub cap, rear                        |

7. Refill the rear axle with 3 pints (1,75 litres) of oil.
8. Replace brake components and reconnect the brake pipes, bleed and adjust the brakes (Section H).

#### Differential pinion oil seal

**To renew**  
 Operation E/12  
 Proceed as detailed under Section F, Operation F/2.

1. Jack up the rear of the vehicle.
2. Drain off the axle oil.
3. Remove the road wheels and brake drums.
4. Depress the brake pedal and wedge it in that position; detach the brake pipes at the wheel brake units.
5. Remove the wheel brake components. Section H.
6. Withdraw the shafts complete with driving member about 6 in. (150 mm) from the axle casing.
7. Disconnect the propeller shaft at the differential input flange.
8. Remove the differential assembly from the axle casing.

*Note*:—If any difficulty is anticipated when adjusting the differential, it is recommended that the unit be replaced by a new assembly (obtainable from our Spares Department) and the old one returned for reconditioning.

#### To strip, examine and assemble

Proceed as detailed under Section F, Operations F/6, F/8 and F/10. For data see "Data", Section F.

#### To refit

Operation E/18

1. Fit the differential assembly in the axle casing.
2. Connect the propeller shaft to the input flange.
3. Push the axle shafts into the splines of the differential, and secure in position.
4. Replace the wheel brake components. Section H.

5. Replace the brake drums and road wheels.
6. Connect the brake pipes to the wheel brake units and bleed the brake system. Section H.
7. Lower the vehicle to the ground.
8. Refill the axle with oil, 3 pints (1,75 litres).

#### Axle complete

#### To remove, Method I

Operation E/20

1. Jack up the rear of the vehicle.
2. Remove both road wheels.
3. Depress the brake pedal and wedge it in that position. Disconnect the flexible brake pipe at the Tee-piece on the differential casing.
4. Disconnect the propeller shaft at the differential input flange. Disconnect one extremity of each check strap.
5. Remove the axle U-bolts.
6. Remove the self-locking nuts from the rear shackle pins. Slacken the shackle pins at the front end of the springs. Place a jack under the axle casing, raise the axle slightly and withdraw the shackle pins to allow the rear ends of the springs to rest on the ground.
7. Lower and remove the jack and axle complete towards the rear.

#### To remove, Method II

Operation E/22

An alternative method for removal eliminates removal of the shackle pins; proceed as follows:—

1. Jack up the rear of the vehicle.
2. Drain off the axle oil.
3. Remove the road wheels and brake drums.
4. Depress the brake pedal and wedge it in that position; detach the brake pipes at the wheel brake units.
5. Remove the wheel brake components. Section H.
6. Withdraw the shaft and hub assemblies complete from the axle casing.
7. Disconnect the flexible brake pipe at the Tee-piece on the differential casing.
8. Disconnect the propeller shaft at the differential input flange.
9. Remove the differential assembly from the axle casing.



- To refit**      **Operation E/24**
1. Replace the axle assembly by reversing the removal procedure (Method I or II).
  2. Bleed the brake system. Section H.
  3. Refill the differential with oil, 3 pints (1,75 litres) and lower the vehicle off the jacking stands.
10. Remove the axle U-bolts and allow the road spring bottom plates to hang on the shock absorbers.
  11. Remove the axle casing by manoeuvring it past the road springs and check straps.

**GENERAL DATA**

**Type:** ..... Fully floating  
**Oil capacity** ..... 3 pints (1,75 litres)  
**Hub bearing lubrication** 1/3rd pint (0,190 litres)  
**Final drive** ..... Spiral bevel  
**Ratio** ..... 4.7 to 1

**DETAIL DATA**

**Rear hub assembly:**  
 Rear hub end-float ..... 0.004 to .006 in. (0,10 to 0,16 mm)  
**Clearance of hub bearing in rear hub bearing sleeve** ..... .0002 to .0013 in. (0,005 to 0,033 mm)  
**Fit of hub bearing in hub** ..... .001 to .003 in. (0,025 to 0,075 mm) interference



# Section F - FRONT AXLE - ALL MODELS

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## Operation F/2

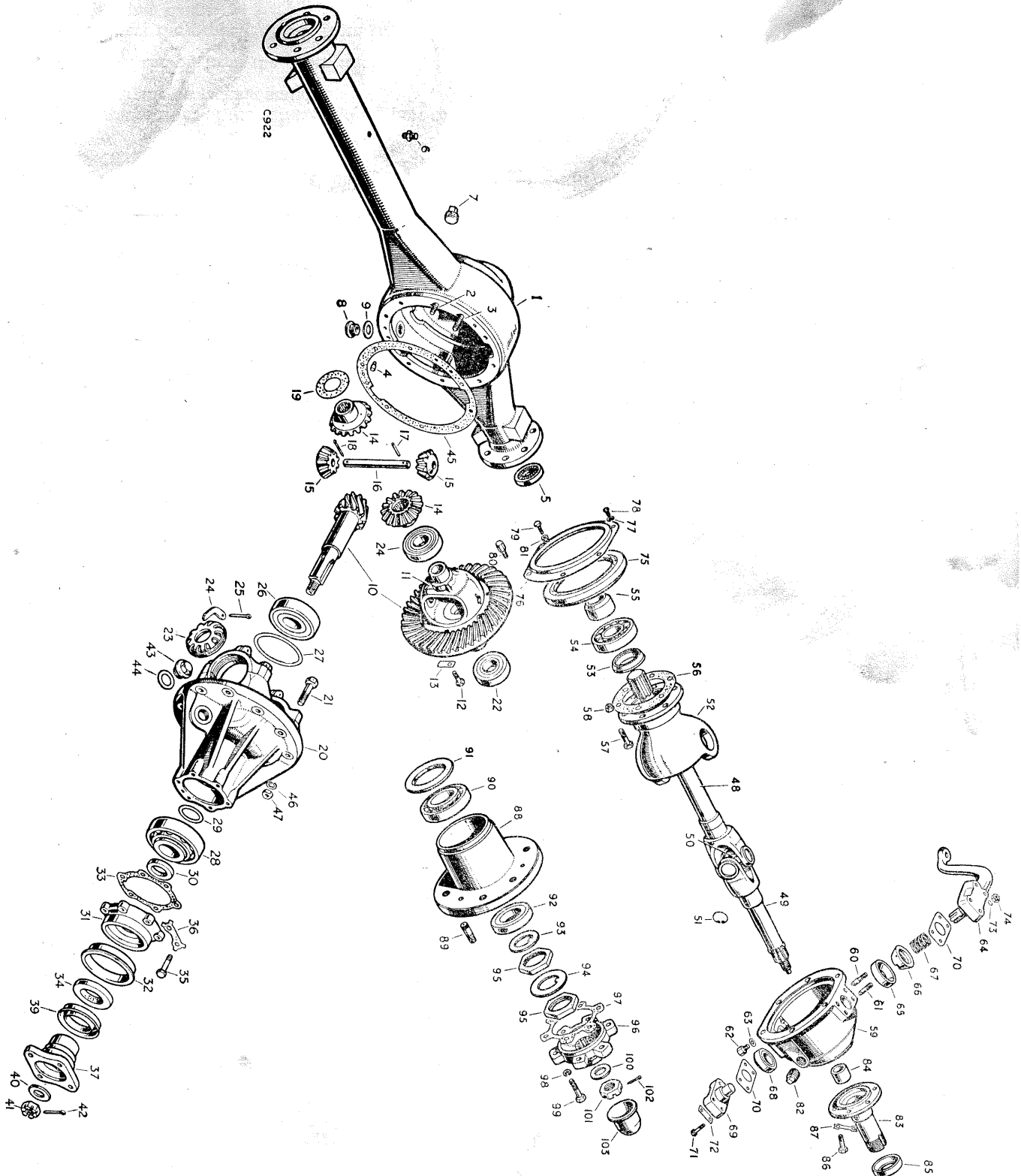
## To renew

### Differential pinion oil seal

1. Jack up the front of the vehicle and support the chassis frame on jacking stands.
2. Drain off the oil from the differential.
3. Disconnect the propeller shaft from the differential input flange.
4. Remove the differential pinion driving flange.
5. Remove the oil seal retainer and seal together with a joint washer. Care should be taken not

6. Remove the oil seal from the retainer and fit the new seal with the lip towards the axle casing. The retainer must be warmed and the outer diameter of the new oil seal, smeared with jointing compound before assembly.
7. Replace a new joint washer and the oil seal retainer.
8. Examine the input flange outer diameter for roughness or damage which may have caused failure of the original seal and rectify or replace as necessary.

Fig. F-1—Layout of front axle



Key to Fig. F-1

- |       |   |       |  |
|-------|---|-------|--|
| 1     | Axle casing complete                        | 52    | Housing for swivel pin bearing                             |
| 2-3   | Fixings—differential housing to axle casing | 53    | Distance piece for bearing                                 |
| 4     | Dowel, locating housing                     | 54    | Bearing for half shaft                                     |
| 5     | Oil seal, in casing                         | 55    | Retaining collar for bearing                               |
| 6     | Breather                                    | 56    | Joint washer for housing                                   |
| 7     | Oil filler plug                             | 57-58 | Fixings—housing to front axle casing                       |
| 8-9   | Drain plug and joint washer                 | 59    | Housing assembly for swivel pin                            |
| 10    | Crownwheel and bevel pinion                 | 60    | Special stud for steering lever and bracket                |
| 11    | Differential casing                         | 61    | Stud for steering lever                                    |
| 12    | Set bolt                                    | 62-63 | Drain plug and joint washer                                |
| 13    | Locker (double type)                        | 64    | Swivel pin and steering lever                              |
| 14    | Differential wheel                          | 65    | Cone seat for swivel pin, top                              |
| 15    | Differential pinion                         | 66    | Cone bearing for swivel pin, top                           |
| 16    | Spindle for pinion                          | 67    | Spring for cone bearing                                    |
| 17    | Plain pin } For                             | 68    | Bearing for swivel pin, bottom                             |
| 18    | Split pin } spindle                         | 69    | Swivel pin and bracket                                     |
| 19    | Thrust washer                               | 70    | Shim, for swivel pin bearing                               |
| 20    | Bevel pinion housing                        | 71-74 | Fixings—swivel pin to swivel pin housings                  |
| 21    | Special bolt, fixing bearing cap            | 75    | Oil seal for swivel pin bearing housing                    |
| 22    | Taper roller bearing for differential       | 76    | Retainer for oil seal                                      |
| 23-24 | Bearing adjustment                          | 77-81 | Fixings—retainer and lock stop plate to swivel pin housing |
| 25    | Split pin, fixing lock tab                  | 82    | Oil filler plug for swivel pin housing                     |
| 26    | Bearing for bevel pinion, pinion end        | 83    | Stub axle assembly   |
| 27    | Shim, bearing adjustment, pinion end        | 84    | Bush for driving shaft                                     |
| 28    | Bearing for bevel pinion, flange end        | 85    | Distance piece for inner bearing                           |
| 29    | Shim, bearing adjustment, flange end        | 86-87 | Fixings—stub axle to swivel pin housing                    |
| 30    | Washer for pinion bearing                   | 88    | Front hub assembly   |
| 31    | Retainer for oil seal                       | 89    | Stud for road wheel  |
| 32    | Mudshield for retainer                      | 90    | Bearing for front hub, inner                               |
| 33    | Joint washer for oil seal retainer          | 91    | Oil seal for inner bearing                                 |
| 34    | Oil seal for pinion                         | 92    | Bearing for front hub                                      |
| 35-36 | Fixings—oil seal retainer                   | 93    | Keywasher  |
| 37    | Driving flange                              | 94    | Locker   |
| 39    | Mudshield for driving flange                | 95    | Special nut } bearing                                      |
| 40-42 | Fixings for flange                          | 96    | Driving member for front hub                               |
| 43-44 | Oil filler plug and joint washer            | 98-99 | Joint washer for driving member                            |
| 45    | Joint washer, differential to axle casing   | 100   | Fixings—driving member to front hub                        |
| 46-47 | Fixings—differential to axle casing         | 101   | Plain washer } Fixing                                      |
| 48    | Half shaft                                  | 102   | Slotted nut } driving member                               |
| 49    | Stub shaft                                  | 103   | Split pin } to driving shaft                               |
| 50    | Journal assembly                            |       | Hub cap, front   |
| 51    | Circlip for journal                         |       |  |

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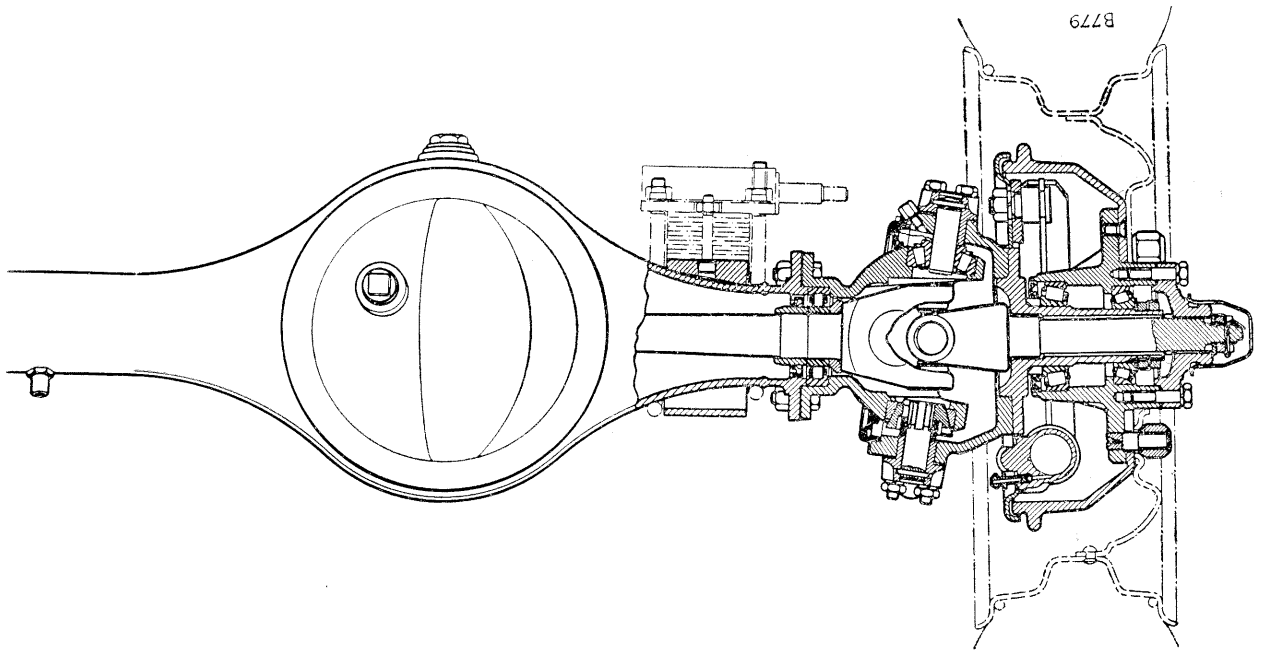


Fig. F-2—Cross-section of axle (differential)

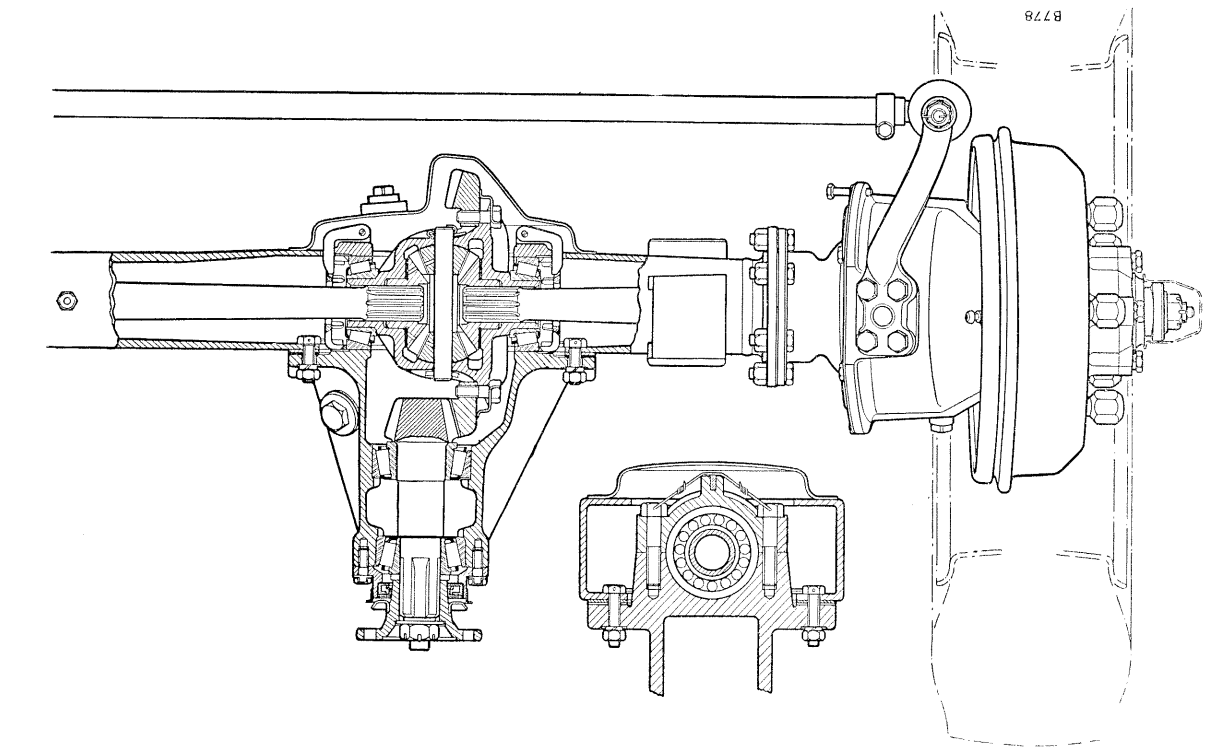


Fig. F-3—Cross-section of axle (universal joint and hub)

9. Retighten the castle nut to 85 lb./ft. (11.75 mKg) on a torque spanner. Fit the split pin.
10. Reconnect the propeller shaft.
11. Lower the vehicle from the jacking stands and refill the differential with oil, 3 pints (1.75 litres).

**Differential assembly**

**To remove**

1. Jack up the front of the vehicle and place jacking stands under the chassis frame.
2. Remove the road wheels.
3. Drain off the axle and universal joint housing oil; (drain and filler plugs to be removed).
4. Depress the brake pedal and wedge it in that position; detach the flexible brake pipes at the wheel brake units.
5. Disconnect the drag link and track rod from the steering arm.
6. Withdraw each universal joint housing assembly from the axle casing, taking care not to damage the axle casing oil seals.
7. Disconnect the propeller shaft at the differential input flange.
8. Remove the differential assembly.

*Note:*—If any difficulty is anticipated when adjusting the differential it is recommended that the unit be replaced by a new assembly (obtainable from our Spares Department) and the old one returned for reconditioning.

**To strip**

**Operation F/6**

1. Remove the differential bearing caps.
2. Remove the serrated nuts.
3. Remove the differential complete with races.
4. Remove the crownwheel from the differential case.
5. Remove the split pin and tap out the differential wheel spindle.
6. Remove the two differential wheels.
7. Remove the two differential pinions, together with the fibre thrust washer fitted between each wheel and the differential casing.
8. Draw off the two differential thrust bearings.
9. Remove the differential pinion input flange.
10. Remove the oil seal retainer and washer from the pinion housing.
11. Withdraw the pinion, remove the flange end bearing washer and the flange end bearing inner member.

12. Remove the shims for flange end bearing of adjustment and press off the inner member of the pinion end bearing.
13. Press out both bearing outer members and remove the pinion bearing shims. Use the special extractor Part No. 262757 to remove the pinion end bearing outer race.
14. Press out the oil seal from the retainer.

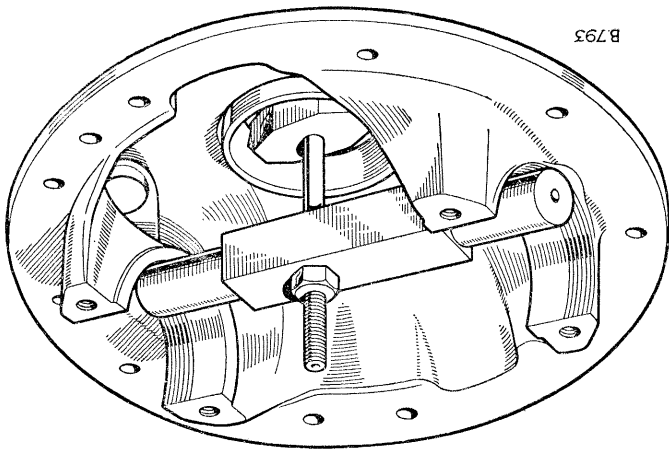


Fig. F-4—Pressing out pinion end bearing outer race

**To examine**

Wash all the component parts and renew them as necessary.

The more important examination details are listed below:—

1. Flange end pinion bearing. This bearing is of single row taper roller pattern; it should be renewed if it does not roll smoothly or if excessively worn. The pinion housing should be checked and renewed if worn in the bore. The bearing should be a *light press fit* in the housing and a *light push fit* on the pinion shaft.
2. Pinion end pinion bearing. This bearing should also be renewed if it does not run smoothly, or if excessively worn. It should be a *drive fit* on the bevel pinion shaft and a *light press fit* in the pinion housing.
3. Differential thrust bearings. These taper roller bearings must be renewed if any doubt exists about their condition. They should be a *light press fit* on the differential casing spigots.
4. Pinion oil seal. Renew as necessary. The retainer must be warmed and the outer diameter of the seal smeared with jointing compound before assembly. The lip of the seal must be set towards the axle casing.
5. Crownwheel and pinion. The crownwheel and pinion are lapped and supplied in pairs with corresponding engraved markings on each component. It is absolutely essential that they are retained and fitted in pairs, otherwise it will be impossible to obtain the correct tooth bearing on assembly. Should any imperfections such as

4. Fit the flange end bearing inner member into position on the pinion shaft.

5. Fit the flange end bearing washer and the driving flange on to the pinion shaft and retain with the nut and plain washer. The nut should be tightened to 85 lb./ft. (11,75 mKg) on a torque spanner.

6. The loading on the bearings should be sufficient to give a reading of 6 to 10 in./lb. (0,07 to 0,11 mKg) when rotating the shaft. If the loading is incorrect, then the assembly must be dismantled sufficiently to allow shims to be either placed or removed from the front of the flange end bearing until the correct value is obtained. The required number of shims can only be found by trial and error. When the correct poundage is obtained, note the thickness of each shim used. The shims are available .003 in. (0,076 mm), .005 in. (0,127 mm), .010 in. (0,254 mm) and .020 in. (0,50 mm) thick.

cracks or roughness be found on the teeth of either component, they must be discarded and a new factory-mated pair fitted.

If new pinion bearings are loose on the pinion shaft (see above), both the crownwheel and pinion must be renewed.

6. **Pinion housing.** The pinion housing is supplied complete with differential caps and securing bolts; the caps are not available as separate items and must always be retained with the correct pinion housing.

If a new pinion bearing outer member is loose in the pinion housing, the housing must be renewed complete.

7. **Differential casing.** If new differential thrust bearings are loose on the differential casing spigots, the casing must be renewed.

A larger amount of wear is permissible on the remaining differential components, but parts whose serviceability is in doubt should be renewed.

**To assemble**

**Operation F/10**

1. Press the outer member of the pinion end bearing into the pinion casing together with the shims removed on stripping (at least .020 in. (0,50 mm) should be used), using press block (Part No. 262758). Press the outer member of the flange end bearing into the pinion casing.

2. Press the inner member of the pinion end bearing on to the pinion shaft.

3. Fit the pinion shaft into the pinion case together with the shims removed on stripping (at least .020 in. (0,50 mm) should be used).

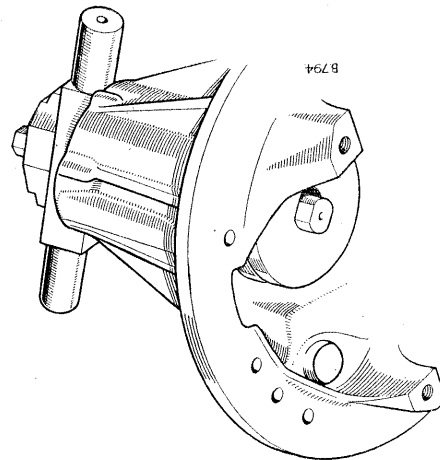


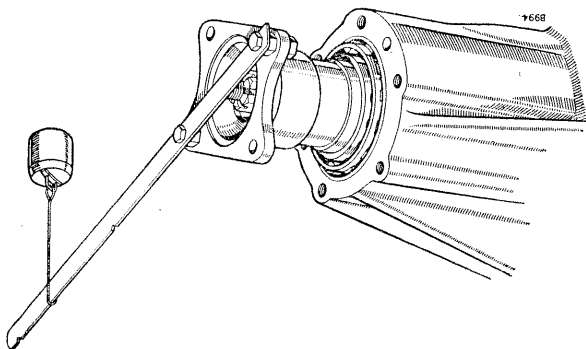
Fig. F-5—Pressing pinion end bearing outer member into pinion casing

7. Check the dimension from the axis of the crownwheel to the pinion face, using special gauge, Part No. 262761 (Fig. F-7). This dimension should be 3.00 to 3.002 in. (76,2 mm to 76,7 mm).

8. Measure the clearance between the bar end and face of the pinion with a set of feeler gauges. Adjust the position of the pinion, as necessary, by placing shims of the same value behind the pinion end bearing; these shims are available .003 in. (0,076 mm), .005 in. (0,127 mm) and .020 in. (0,50 mm) thick.

9. Note the total thickness of the shims added to those already placed behind the pinion end bearing, and add a similar amount in front of the flange end bearing in addition to those already fitted to load the bearings.

Fig. F-6—Measuring pinion bearing pre-load



Set the pinion as follows:



14. Replace the two differential pinions.

15. Replace the differential wheel spindle and secure with a split pin.

16. Fit the crownwheel to the differential with eight standard bolts, .375 in. (9,5 mm) dia., and two special bolts, .390 in. (10 mm) dia., and five double lockers.

17. The special bolts can be fitted in any hole in the differential casing; selective fitting to line up with the crownwheel holes may be necessary, but they must be as nearly diametrically opposite each other as possible. Tighten the bolts evenly by diagonal selection.

The double lockers must be fitted as shown in Fig. F-10.

18. Press on the inner members of the two differential thrust bearings.

19. Place the differential in the housing, together with the thrust bearing outer races and serrated locking nuts. Replace the bearing caps ensuring that the markings coincide and secure each with two set bolts, which must not be tightened at this stage.

20. Tighten the locking nut on the crownwheel side of the differential casing as much as possible; slacken the locking nut, then tighten once more until it just rests against the bearing. Proceed in a similar manner for the other locking nut; this ensures that all end-float has been taken up and that the bearings are not pre-loaded at this stage. The special spanner, Part No. 262759 (Fig. F-9) will facilitate this operation.

21. Slacken the locking nut on the crownwheel side of the differential casing by two serrations and tighten the opposite locking nut by the same amount. This should ensure an initial backlash of .008-.010 in. (0,20-0,25 mm) on the crownwheel.

22. Check the backlash on the crownwheel by using a dial test indicator mounted on the crownwheel teeth. The indicator should be mounted so that the indicator plunger can be brought to bear on the securing flange of the pinion housing.

Hold the pinion shaft securely and rotate the crownwheel through its available backlash; the total movement indicated should be .008 in. to .010 in. (0,20 to 0,25 mm) at the tightest position.

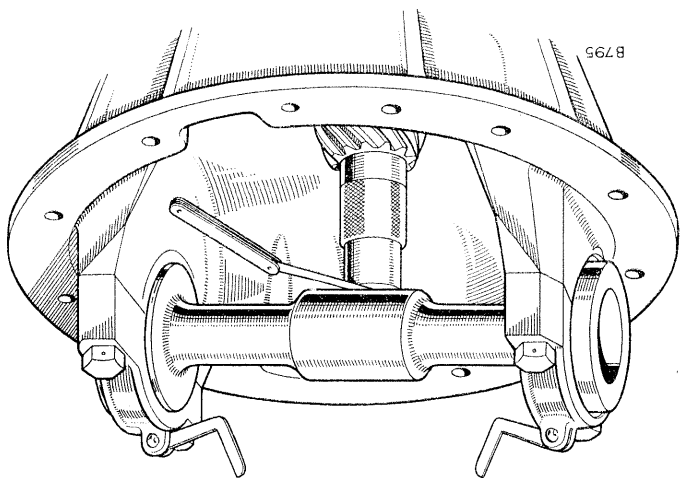


Fig. F-7—Pinion setting

10. Smear the pinion oil seal with Molydne 'C' Compound, then place the oil seal retainer and joint washer in position on the pinion shaft, but do not fit the retainer fixing bolts at this stage.

11. Recheck the torque on the pinion shaft and adjust as necessary.

12. Position the oil seal retainer and joint washer (oil hole at the bottom) and secure to the pinion housing.

13. Replace the two differential wheels, together with the fibre thrust washers, which are supplied .040 in. (1,015 mm), .045 in. (1,142 mm) and .050 in. (1,270 mm) thick; they should be selected to give minimum but definite backlash between the differential wheels and pinions.

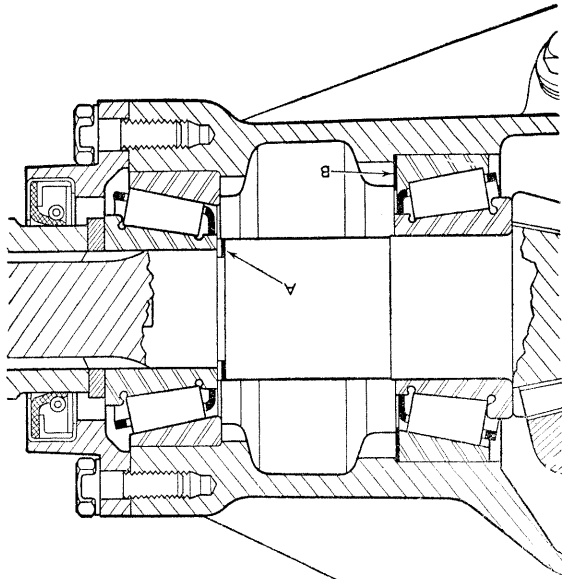


Fig. F-8—Bevel pinion adjustment shims  
A—Shims adjusting bearing preload  
B—Shims adjusting pinion position

Adjust the backlash as necessary by turning the thrust bearings, both in the same direction, as no tolerance is permitted and as one serration on the adjusting nut alters the backlash by approximately .005 in. (0,12 mm), it may be necessary to effect a re-location of the locking tabs to obtain the correct figure at the tightest point.

When the pinion and backlash are adjusted to these requirements the tooth bearing should also be correct.

23. Tighten both locking nuts by half a serration, so putting the necessary .005 in. (0,12 mm) pre-load on the bearings.

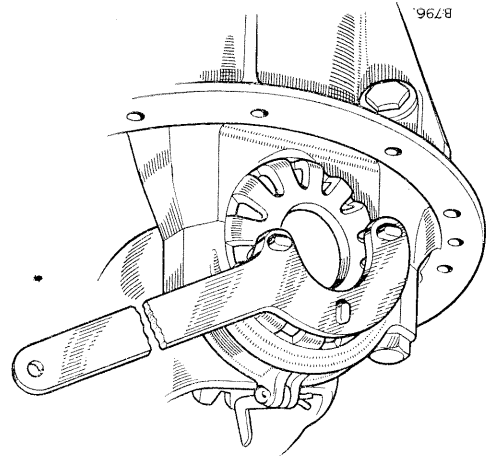


Fig. F-9—Adjusting crownwheel backlash

24. Lock the serrated nuts with the locking tabs; tighten the set bolts securing the thrust bearing caps, and lock the tabs and bolts with locking wire. Split pin the castle nut securing the driving flange.

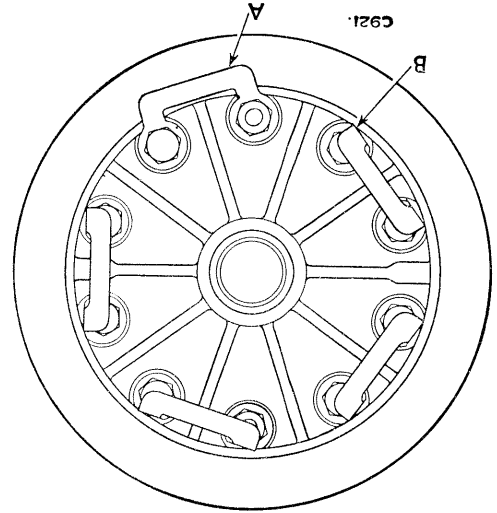


Fig. F-10—Fitting crownwheel double lockers  
A—Lockers before bending  
B—Locker bent in position

1. Secure the differential assembly, together with joint washer, to the axle casing.

2. Connect the propeller shaft to the differential input flange (nuts behind the input flange).

3. If necessary, renew the oil seals in the ends of the axle casing by prising out the oil seal from the end of the axle casing. The new oil seal must be fitted with the knife edge inwards. For further details see Operation F/14.

4. Place the joint washer on the axle casing joint face.

5. Replace the universal joint housing assemblies, taking care not to damage the axle casing oil seals.

6. Replace the drag link and track rod. If the ball joints have been disturbed, the lengths of the drag link and track rod must be adjusted.

Section G.

7. Connect the flexible brake pipes to the wheel brake units and bleed the brake system. Section H.

8. Replace the road wheels.

9. Lower the vehicle to the ground.

10. Replace the axle and universal joint housing drain plugs and refill with oil, 3 pints (1,75 litres) in the axle and 1 pint (0,5 litre) in each universal joint housing.

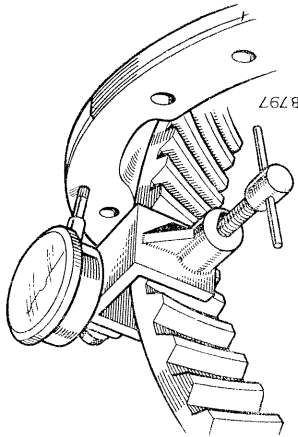


Fig. F-11—  
Checking crownwheel  
backlash

**Axle casing oil seal**

- To renew**
1. Remove the universal joint housing assembly from the axle casing. Operation F/4.

2. Prise out the oil seal from the end of the axle casing and fit the new seal, with the knife edge inwards.
3. Examine the retaining collar on the half shaft, on which the oil seal runs, for signs of damage or roughness which may have caused failure of the original seal; renew as necessary. Operations F/38 and F/40.

4. Replace the universal joint housing assembly by reversing the stripping procedure, taking care not to damage the seal.

5. Bled the brake system. Section H.

6. Refill the axle and the universal joint housings with oil, 1 pint (0,5 litre).

**Front hub****To adjust**

1. Jack up the front of the vehicle and remove the road wheel.

2. Remove the driving member and joint washer from the stub shaft and hub. Operation F/18.

3. Mount a dial test indicator on one of the road wheel studs using the bracket, illustrated at Fig. F-12. The total hub movement should be .004-.006 in. (0,10-0,15 mm).

4. Should the end-float prove to be correct, re-assemble by reversing the stripping procedure.

5. If the end-float is not correct, prise up the locking tabs and unscrew the outer locknut.

8. Check oil level in universal joint housing.

**To strip**

1. Jack up the front of the vehicle and remove the road wheel and brake drum.

2. Drain off the oil from the universal joint housing (remove both drain and filler plugs).

3. Remove the hub cap (*press fit* on the driving member).

4. Place a drip tray below the hub and remove the driving member and joint washer from the stub shaft and the hub.

5. Prise up the locking tabs and remove the locknut, lock washer and adjusting nut from the stub axle. Remove the thrust key washer.

6. Remove the hub complete with the inner and outer roller bearings and oil seal. Withdraw the oil seal and bearings from the hub, if necessary.

**To assemble**

1. Before assembling the hub, examine the outside diameter of the inner bearing distance piece, on which the oil seal runs, for signs of damage or roughness. Renew as necessary. The distance piece should be a *press fit* on the stub axle. Any clearance between these two parts will allow oil to leak past on to the brake linings.

2. Examine the two hub bearings and renew them as necessary. Both bearings should be an *easy fit* on the stub axle and a *press fit* in the hub. If new bearings are slack in the hub, the hub itself should be renewed.

3. Lightly smear the bearings with grease and press them into the hub. Do not disturb the coating of oil, which is present on new bearings.

4. Examine the oil seal and renew as necessary; smear the operating surfaces with a suitable

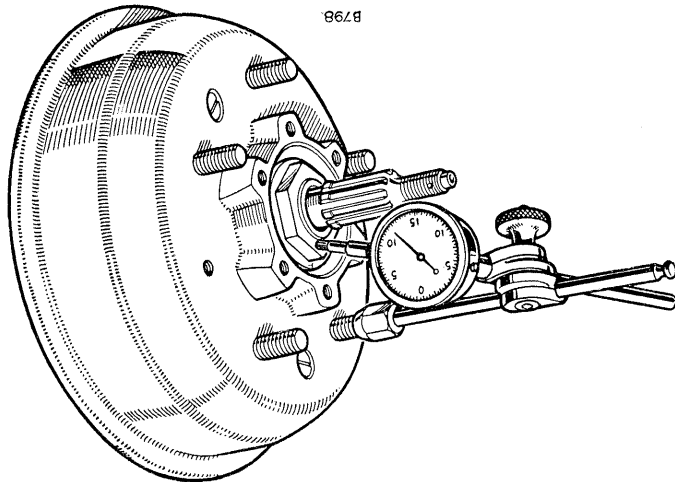


Fig. F-12—Checking hub end-float

**Universal joint housing assembly**

*Note:* The half shaft, universal joint and stub shaft assembly can be withdrawn without disturbing the universal joint housing assembly.

**Swivel pin housing oil seal**

**To renew** Operation F/24

1. Jack up the front of the vehicle and remove the road wheel.
2. Depress the brake pedal and wedge it in that position; detach the flexible brake pipe at the wheel brake unit.
3. Drain off the axle and universal joint housing oil.
4. Disconnect the track rod and drag link (if applicable), from the steering arm.
5. Remove the universal joint housing assembly from the axle casing, taking care not to damage the axle casing oil seal.
6. Remove the swivel pin housing oil seal retainer, complete with seal. Discard the seal.
7. Examine the surface of the swivel pin bearing housing for signs of corrosion or damage, and renew if necessary. Operation F/44.
8. Pack the new oil seal with heavy grease and replace the retainer and the seal with the knife edge towards the surface of the swivel pin bearing housing over its full range of travel. If not, adjust the position of the oil seal by slackening off the retainer bolts and resetting the seal as necessary.
9. For further details see Operation F/34.
9. Set the adjustable lock stop bolt so that the head of the bolt protrudes  $\frac{3}{8}$  in. (12,7 mm) from face of oil seal retainer. See Fig. F-26.
10. Complete the assembly by reversing the stripping procedure.
11. Bleed the brake system. Section H.
12. Refill the universal joint housing and axle with oil, 3 pints (1,75 litres) in the axle and 1 pint (0,5 litre) in each universal joint housing.

**Stub shaft**

**To renew** Operation F/26

1. Withdraw the stub shaft, universal joint and half shaft assembly. Operation F/36.
2. Disconnect the stub shaft from the spider journals. Operation F/28. Discard the shaft.
3. Connect the new stub shaft to the spider journals, Operation F/28, and complete the assembly, Operation F/42.
4. Complete the assembly. Operation F/20.
5. Ensure that the joint face of the brake anchor plate is clean and secure it and the stub axle to the housing.
6. Ensure that the joint faces of the stub axle and swivel pin housing are clean and replace the stub axle with the keyway to the top.
7. Ensure that the joint face of the stub axle and swivel pin housing are clean and replace the stub axle before withdrawing a faulty stud.
8. Renew the bush if necessary and ream to 1.250 in. (31,75 mm). The road wheel studs should be .020 to .028 in. (0,50 to 0,70 mm). The clearance of the shaft in the bush should be .020 to .028 in. (0,50 to 0,70 mm).
9. Examine the stub shaft bush at the inner end of the axle. The clearance of the shaft in the bush should be .020 to .028 in. (0,50 to 0,70 mm).
10. If the original stub axle is to be replaced, examine the stub shaft bush at the inner end of the axle. The clearance of the shaft in the bush should be .020 to .028 in. (0,50 to 0,70 mm).
11. Remove the brake anchor plate and stub axle from the swivel pin housing; swing the anchor plate back to rest on the road spring, thus obviating bleeding the brakes on reassembly.
12. Remove the stub axle and discard if unserviceable.

**Stub axle**

**To renew** Operation F/22

1. Remove the front hub components. Operation F/18.
2. Remove the brake anchor plate and stub axle from the swivel pin housing; swing the anchor plate back to rest on the road spring, thus obviating bleeding the brakes on reassembly.
3. Remove the stub axle and discard if unserviceable.
4. If the original stub axle is to be replaced, examine the stub shaft bush at the inner end of the axle. The clearance of the shaft in the bush should be .020 to .028 in. (0,50 to 0,70 mm).
5. Renew the bush if necessary and ream to 1.250 in. (31,75 mm). The road wheel studs should be .020 to .028 in. (0,50 to 0,70 mm).
6. Ensure that the joint face of the stub axle and swivel pin housing are clean and replace the stub axle before withdrawing a faulty stud.
7. Examine the surface of the swivel pin bearing housing for signs of corrosion or damage, and renew if necessary. Operation F/44.
8. Pack the new oil seal with heavy grease and replace the retainer and the seal with the knife edge towards the surface of the swivel pin bearing housing over its full range of travel. If not, adjust the position of the oil seal by slackening off the retainer bolts and resetting the seal as necessary.
9. For further details see Operation F/34.
9. Set the adjustable lock stop bolt so that the head of the bolt protrudes  $\frac{3}{8}$  in. (12,7 mm) from face of oil seal retainer. See Fig. F-26.
10. Complete the assembly by reversing the stripping procedure.
11. Bleed the brake system. Section H.
12. Refill the universal joint housing and axle with oil, 3 pints (1,75 litres) in the axle and 1 pint (0,5 litre) in each universal joint housing.

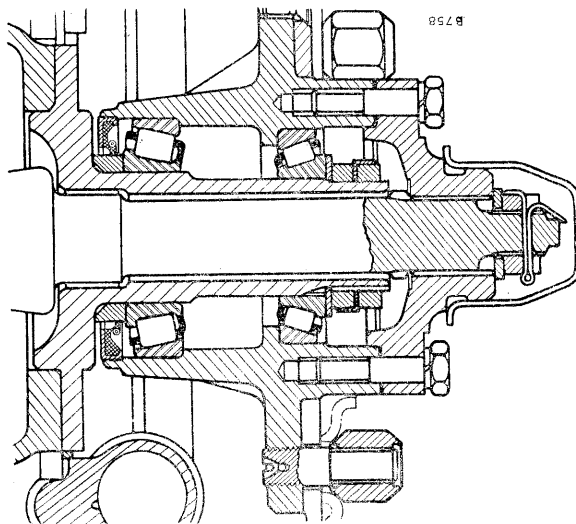


Fig. F-13—Cross-section of hub

Universal joint

- To renew**  
**Operation F/28**
1. Withdraw the stub shaft, universal joint and half shaft assembly. Operation F/36.
  2. Dismantle the universal joint as follows:—
  3. Remove the circlip.

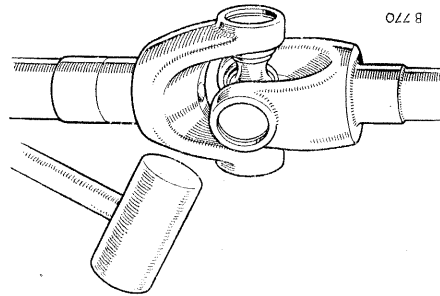


Fig. F-14—Removing a yoke bearing. Stage 1

4. With one of the stub shaft yoke lugs uppermost tap the radius of the yoke lightly with a soft-nosed hammer.
5. The top bearing should then begin to emerge from the yoke.
6. Turn the joint over and withdraw the bearing.

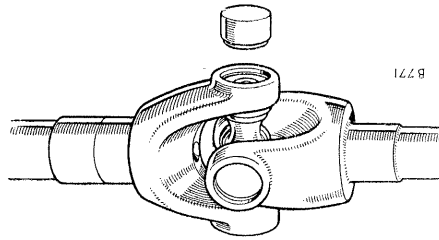


Fig. F-15—Removing a yoke bearing. Stage 2

- Always remove a bearing downwards, to avoid dropping the needle rollers.
6. Repeat these operations for the opposite bearing.
  7. Part the stub shaft from the spider journals.
  8. Repeat Items 4 to 7 for the half shaft bearings.

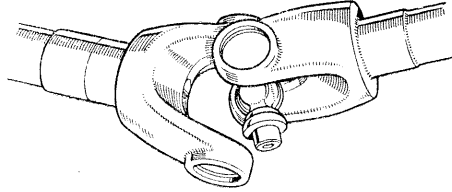


Fig. F-16—Removing the stub shaft

9. Wash all parts and renew as necessary.
10. The parts most likely to show signs of wear after long usage are the bearing races and the spider journals. Should looseness in the fit of these

parts, load markings or distortion be observed, they must be renewed complete, as oversize journals or bearing races are not supplied separately.

The bearing races should be a *light drive fit* in the yoke trunnions.

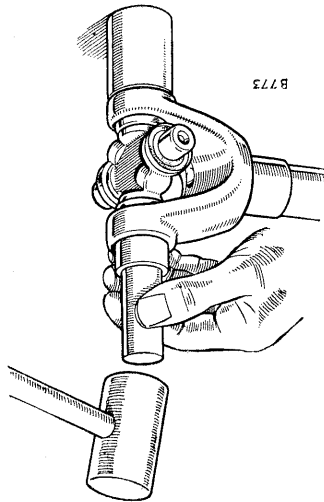


Fig. F-17—  
Replacing a yoke bearing

- In the event of wear taking place in any of the four yoke cross holes, rendering them oval, a new stub shaft or half shaft must be fitted.
11. Assemble the needle rollers in the bearing races, if necessary using a smear of vaseline to retain them in place.
  12. Insert the journal in the stub shaft yoke holes, and using a brass drift slightly smaller in diameter than the hole in the yoke, lightly tap the first bearing into position.
  13. Repeat the operations for the other three bearings.
  14. Replace the circlips and ensure that they are firmly located in their grooves. If the joint appears to bind, tap the ears slightly with a soft-nosed hammer.
  15. Complete the assembly. Operation F/42.

Swivel pins

**To renew**  
**Operation F/30**

1. Remove the swivel pins. Operation F/32.
2. Thoroughly clean the boss of the steering lever or bracket with paraffin and a wire brush.
3. Drill out the grooved pin by means of a 1/8 in. (3,17 mm) drill.
4. Place the steering lever or bracket upon a solid base, i.e., between the jaws of a vice, and drive out the swivel pin from the lever or bracket boss by means of a brass drift.
5. **Top swivel pin only.** Fit the new pin, by positioning its splines in relation to the track rod

lever as shown at Fig. F-18, that is with a splined groove placed in line with the longitudinal axis of the track rod lever. This is very important as it ensures that the cone is located correctly.

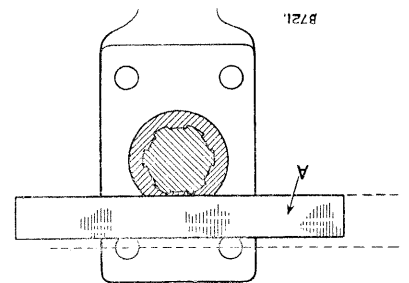


Fig. F-18—  
Setting the top  
swivel pin  
A—Straight edge

6. Press the pin squarely into the lever or bracket.
7. Drill the lever or bracket boss and swivel pin with a 5/32 in. (3,96 mm) drill and insert a 5/32 in. grooved pin.

8. Examine the cone bearing and cone seat for wear and roughness and renew as necessary. Operation F/34.
9. Examine the bottom taper roller race for wear and renew as necessary. Operation F/34.
10. Reassemble the universal joint housing assembly. Operation F/34.

**Swivel pins and bearings**

**Operation F/32**

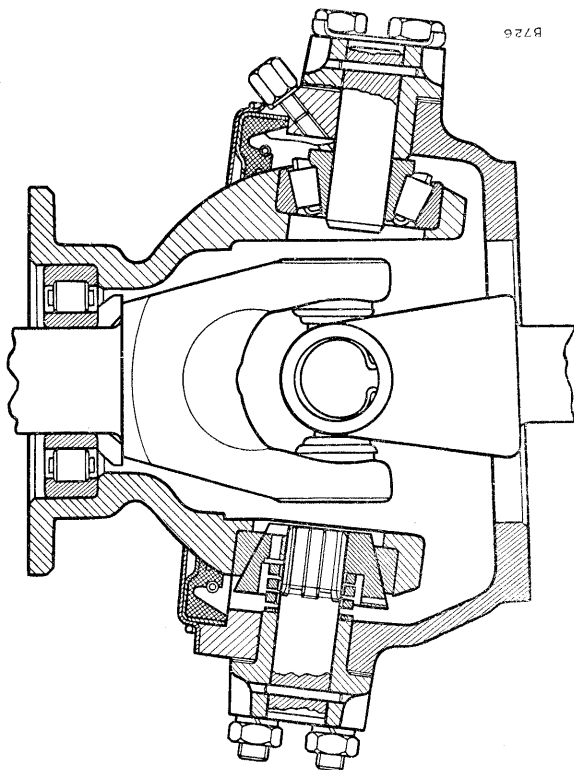
1. Remove the front hub components. Operation F/18.

2. Remove the brake anchor plate and stub axle from the swivel pin housing and swing the anchor plate back to rest on the road spring, thus obviating bleeding the brakes on re-assembly.
3. Disconnect the track rod and drag link (if applicable) from the steering arm.
4. Withdraw the stub shaft complete with universal joint and half shaft, taking care not to damage the oil seal in the end of the casing.

5. Remove the universal joint housing assembly complete with joint washer, half shaft roller outer member and race from the axle casing. Remove the half shaft roller race outer member and race from the swivel pin bearing housing.
6. Remove the swivel pin and steering lever assembly from the top of the swivel pin housing together with the shims, which should be preserved. Remove the cone bearing spring.
7. Remove the swivel pin and bracket assembly from the bottom of the swivel pin housing together with the shims which should be preserved.

8. Examine the swivel pin and bracket assembly from the top of the swivel pin housing together with the shims, which should be preserved. Remove the cone bearing spring.
9. Remove the swivel pin and steering lever assembly from the top of the swivel pin housing together with the shims, which should be preserved. Remove the cone bearing spring.
10. Remove the swivel pin and bracket assembly from the bottom of the swivel pin housing together with the shims which should be preserved.

Cross-section of universal joint housing assembly



8. Part the swivel pin and swivel pin bearing housings and remove the roller race inner member and the cone bearing.
9. Drive out the race outer member and the cone seat from the swivel pin bearing housing.

**To assemble**

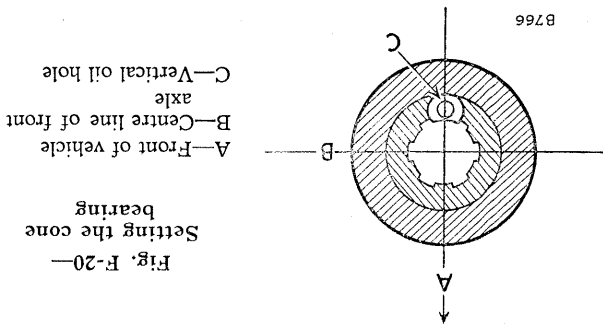
**Operation F/34**

1. Examine the bottom taper roller race and swivel pin for wear and renew as necessary. The bearing should be a *light press fit* in the housing and a *light push fit* on the swivel pin. If a new bearing race is slack in the housing, the housing must be renewed; if it is slack on the swivel pin, the swivel pin assembly must be renewed. Operation F/30.
2. Examine the upper cone seat and swivel pin for wear and roughness and rectify as necessary. The cone seat should be a *light press fit* in the housing; if a new cone seat is slack in the housing, the housing must be renewed.
3. Examine the cone bearing for wear or roughness and rectify or renew as necessary.
4. Check the cone spring: free length 1.150 in. (2,92 mm) and renew as necessary.
5. Examine the surface of the swivel pin bearing housing for signs of corrosion or damage, and renew it if necessary.
6. Press the roller race outer member and cone seat squarely into the swivel pin housing as far as possible.

7. If necessary, renew the axle casing oil seal, by prising out the seal from the end of the axle casing. The new seal must be fitted with the knife edge inwards. For further details see Operation F/14.

8. Place the swivel pin housing oil seal and retainer over the axle casing flange, and fit the joint washer in position on the joint face of the flange.

9. Fit the half shaft roller race outer member and fit the housing to the axle casing flange.



10. Insert the cone bearing after smearing with oil, with the vertical oil hole in the bearing towards the rear of the vehicle (Fig. F-20).

11. Insert the race inner member, and holding it in position, offer the swivel pin housing to the bearing housing.

12. Replace the swivel pin and bracket assembly at the bottom of the swivel pin housing, together with the shims removed on stripping, to the value of .040 in. (1.0 mm), and tighten down. Sharply tap the assembly to ensure positive seating and again check the tightness of the securing nuts.

13. Insert the cone spring in the top bearing.

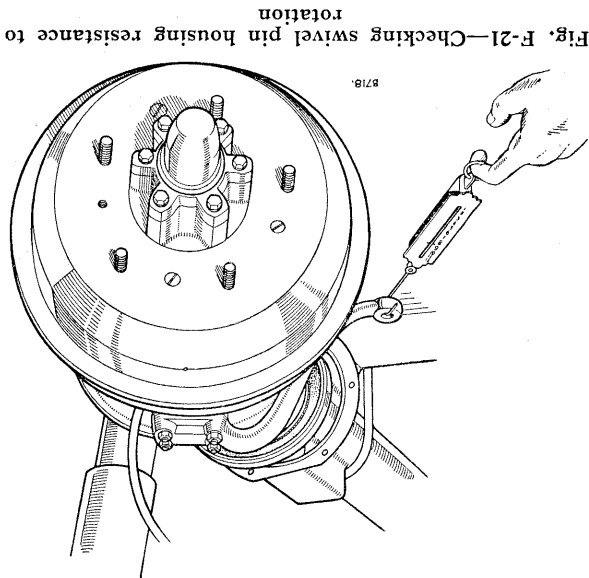


Fig. F-21—Checking swivel pin housing resistance to rotation

14. Fit the swivel pin and steering lever assembly at the top of the swivel pin housing, fitting the shims removed on stripping to the value of .040 in. (1.0 mm).

Note that the double steering lever is fitted to the L.H. assembly on R.H.D. models and to the R.H. assembly on L.H.D. vehicles.

15. Pull down the top swivel pin securing nuts in rotation until tight, then check the resistance to rotation of the steering lever.

16. Using a suitable spring balance as shown at Fig. F-21, add or subtract shims at the top only until a figure of 14-16 lb. (6.25-7.25 kg) is obtained.

17. Pack the swivel pin housing oil seal with heavy grease, and fit the seal and its retainer to the swivel pin housing.

Check that the oil seal wipes the full surface of the bearing housing and adjust the position, if necessary, by slackening off the retainer bolts and resetting the seal.

18. Check that there is a .050 in. (1.2 mm) clearance between the stub and half shaft yoke lugs and the swivel pin end faces. If the clearance is insufficient, increase the chamfer on the radius of the yokes.

19. Set the lock stop bolts, so that the head of the bolt protrudes  $\frac{1}{8}$  in. (12.7 mm) from face of oil seal retainer. See Fig. F-26.

20. Replace the half shaft, universal joint and stub shaft assembly, taking care not to damage the oil seal in the end of the casing.

21. Replace the stub axle and brake anchor plate. Operation F/22.

22. Reconnect the track rod and drag link (if applicable).

23. Replace the front hub components. Operation F/20.

24. Refill the universal joint housing with oil, 1 pint (0.5 litres).

**Half shaft**

**To remove**  
Operation F/36  
1. Remove the front hub components. Operation F/26.

2. Remove the stub axle. Operation F/22.  
3. Withdraw the stub shaft, universal joint and half shaft assembly from the universal joint housing assembly.

Note: There are two methods of stripping and assembling the half shafts.

**Method A—Using hydraulic press**

**To strip**  
Operation F/38

1. Stand the half shaft on its splined end and press down squarely on the conical distance piece, using press blocks, A, D, J and K (Part No. 245178) (Fig. F-22).

2. Remove the collar together with the roller race inner member and the conical distance piece. Discard the retaining collar.

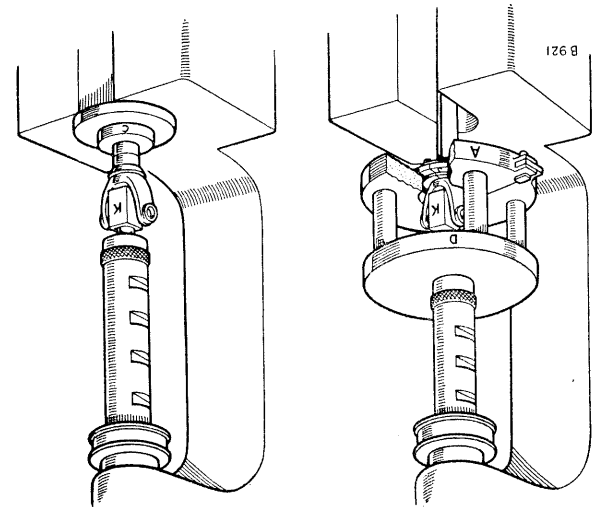


Fig. F-22—Stripping the half shaft  
Fig. F-23—Assembling the half shaft

**Method A—Using hydraulic press**

To assemble

1. Examine the bearing for excessive wear. The bearing is a *light press fit* on the shaft and a *push fit* in the housing. Examine the external surface of the swivel pin bearing housing for signs of corrosion or damage. Renew the bearing or housing as necessary.
2. Fit the conical distance piece over the half shaft with the internal chamfer to the radius on the shaft.
3. Place the roller race inner member and a new retaining collar over the half shaft with the chamfer towards the splined end; stand the shaft on end and press the race inner member and collar on to the shaft until the race inner member abuts the conical distance piece. The necessary press blocks C and K, Part No. 245178, are illustrated at Fig. F-23.
4. Connect the half shaft to the spider journals. Operation F/28.

**Method B—Using extractor**

To strip

1. Clamp the extractor firmly in the vice.
2. Position the appropriate adaptor on the end of the axle shaft and insert into the extractor.
3. Secure the shaft to the extractor, using adaptor No. 5.
4. The shaft may now be forced out of the collar by screwing in the ram.

**Method B—Using extractor**

To assemble

1. Examine the bearing for excessive wear. The bearing is a *light press fit* on the shaft.

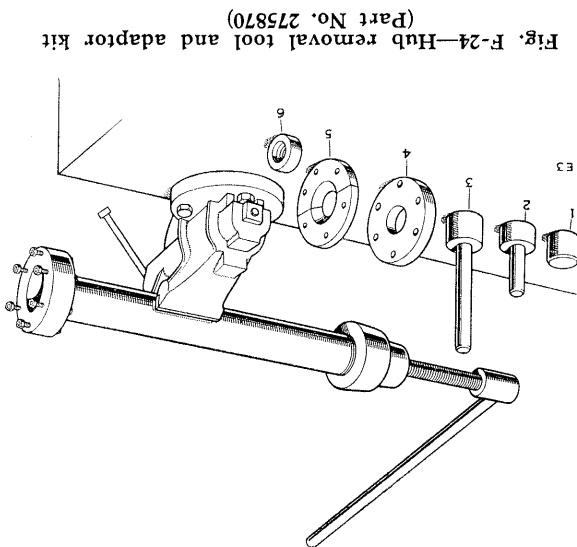


Fig. F-24—Hub removal tool and adaptor kit (Part No. 275870)

2. Fit the conical distance piece over the half shaft with the internal chamfer to the radius on the shaft.

3. Place the roller race inner member and a new retaining collar over the half shaft with the chamfer towards the splined end; stand the shaft on end on a block of hard wood.
4. Bolt adaptor No. 4 to the tool with the recess towards the collar.
5. The weight of the extractor is such that it may now be used as a ram to drive the collar on to the shaft.

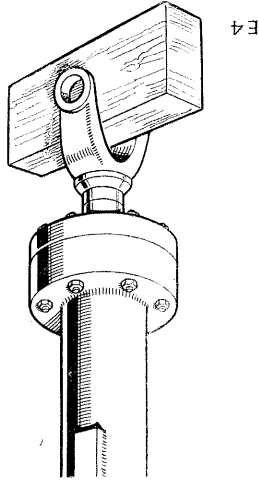


Fig. F-25—Extractor used as a ram to drive collar on to axle shaft

To refit

1. If necessary, renew the axle casing oil seal, by prising out the seal from the end of the axle casing. The new seal must be fitted with the knife edge inwards. For further details see Operation F/14.

Operation F/42



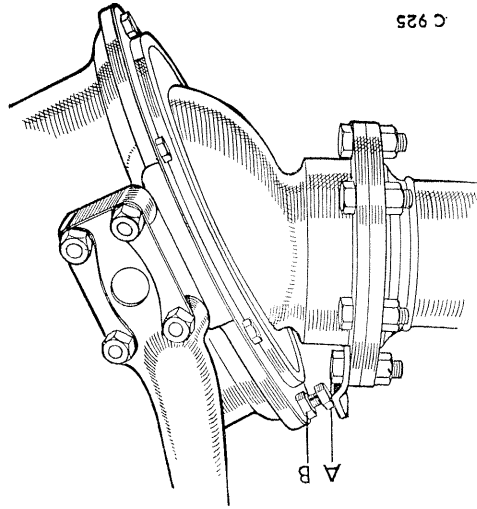
2. Replace the half shaft, universal joint and stub shaft assembly, taking care not to damage the axle casing oil seal.
3. Check that there is a .050 in. (1,27 mm) clearance between the stub and half shaft yoke lugs and the swivel pin end faces. If the clearance is insufficient, increase the chamfer on the radius of the yokes.
4. Replace the stub axle and brake anchor plate. Operation F/22.
5. Complete the assembly. Operation F/20.

### Swivel pin bearing housing

- To renew**  
Operation F/44
1. Remove and strip the universal joint housing assembly. Operation F/32.
  2. Discard the housing.
  3. Reassemble the universal joint housing and complete the assembly. Operation F/34.

### Lock stop

- To adjust**  
Operation F/46
1. Slacken the stop bolt locknut(s).



2. Adjust the stop bolt so that the distance from the head of the bolt to the face of the oil seal retainer is correct.
3. Tighten the locknut.

### Axle complete

#### To remove, method 1

- Operation F/48
1. Jack up the front of the vehicle and place jacking stands under the chassis side member.
  2. Remove both road wheels.

3. Depress the brake pedal and wedge it in that position; disconnect the flexible brake pipes at the wheel brake units.
4. Disconnect the drag link from the lower relay lever.
5. Disconnect the propeller shaft at the differential input flange.
6. Support the axle on a jack placed under the centre of the casing.
7. Remove the axle U-bolts; slacken the shock absorber fixing nuts and swing the spring bottom plates to the rear to allow full downwards movement of the springs.
8. Slacken the shackle pins at the rear end of the front springs. Remove the self-locking nuts from the front shackle pins, and withdraw the shackle pins.
9. Remove the jack with the complete axle towards the front.

#### To remove, method 2

- Operation F/50
- An alternative method for removal eliminates removal of the shackle pins; proceed as follows:—
1. Jack up the front of the vehicle and place jacking stands under the chassis side members.
  2. Remove the road wheels.
  3. Drain off the universal joint housing and the axle oil.
  4. Depress the brake pedal and wedge it in that position; detach the flexible brake pipes at the wheel brake units.
  5. Disconnect the drag link and track rod from the steering arms and lower relay lever.
  6. Withdraw each half shaft complete with joint washer, universal joint housing, hub and brake gear from the axle casing, taking care not to damage the axle casing oil seal.
  7. Disconnect the propeller shaft at the differential input flange.
  8. Remove the differential assembly. Operation F/4.
  9. Remove the U-bolts and allow the road spring bottom plates to hang on the shock absorbers.
  10. Remove the axle casing by manoeuvring it past the road springs.

#### To refit

- Operation F/52
1. Replace the axle assembly by reversing the removal procedure (Method 1 or 2).
  2. Bleed the brake system. Section H.
  3. Lower the vehicle off the jacking stands and refill the differential (3 pints, 1,75 litres) and universal joint housing (1 pint, 0,5 litres) with oil.

#### Operation F/52

## DEFECT LOCATION

(Symptom, Cause and Remedy)

- A—VEHICLE PULLS TO ONE SIDE**
1. Incorrect camber—Check for worn bushes, settled road springs or damage to front axle unit.
  2. Incorrect or unequal castor and swivel pin inclination—Check front wheel alignment. Check for damage to front axle unit and settled road springs.
  3. Uneven tyre pressures or worn tyres—Renew tyres if necessary and check pressures. Section S.
  4. Dragging brake—Adjust. Section H.
  5. Swivel pin tight—Rectify or renew.
  6. Tight or dry front wheel bearings—Inspect the wheel bearings for damage; adjust and check oil level.
  7. Incorrect toe-in on front wheels—Adjust.
- B—VEHICLE WANDERS**
1. Incorrect castor—Check for worn bushes and damage to front suspension and axle unit; check for settled road springs.
  2. Incorrect toe-in—Adjust.
  3. Worn swivel pins and bearings—Renew.
  4. Worn front wheel bearings—Renew.
  5. Tight steering assembly—Adjust. Section G.
  6. Bent or broken frame—Examine frame for damage. Section K.
  7. Loose axle "U" bolts—Tighten.
  8. Unequal tyre pressures—Section S.
  9. Unequal tyre wear—Section S.
- C—WHEEL SHIMMY**
1. Excessive castor—Check for worn bushes and damage to the front axle or suspension; check for settled road springs.
  2. Worn ball joints—Renew.
  3. Insufficient damping at relay unit—Section G.
  4. Worn or loose front wheel bearings—Adjust or renew.
  5. Steering column loose on dash—Section G.
  6. Out-of-balance wheels—Check, balance. Section S.
- F—OIL LEAKS**
1. Loose drain plug—Tighten.
  2. Worn oil seals—Replace.
  3. Damaged joint washer—Replace.
- E—FRONT END NOISY**
1. Looseness in front suspension—Retighten and check all mountings for wear; renew as necessary. Check the front wheel alignment.
  2. Front hydraulic damper noisy—Check damper mounting bushes for wear. If the damper itself is noisy, renew. Section J.
  3. Worn bushes—Renew.
- D—EXCESSIVE TYRE WEAR**
1. Incorrect camber—Check for worn bushes, settled road springs or damage to front axle unit.
  2. Incorrect toe-in—Adjust.
  3. Incorrect tyre inflation—Section S.
  4. Fast cornering—In the hands of the operator.
  5. Wheel wobble—Renew wheel and tyre assembly as necessary.
  6. Worn swivel pins—Renew.
  7. Harsh or unequal brakes—Section H.
  8. Sustained high speed driving—In the hands of the operator.
  9. Failure to rotate tyres—Change position of tyres, including spare—Section S.

**GENERAL DATA**

Type: Fully floating ..... Final drive ..... Spiral bevel ..... Angularity of universal joint on full lock ..... 26°

Differential oil capacity 3 Imperial pints (1,75 litres)

Universal joint housing oil capacity ..... 1 Imperial pint (0,5 litre)

**DETAIL DATA**

**Swivel pin setting:** Resistance of 14-16 lb. (6,25-7,25 kg) at steering lever eye ..... Clearance between stub and half shaft yoke and lugs and swivel pin end faces ..... .050 in. (1,27 mm)

**Cone spring:** Number of working coils ..... Three

Free length ..... 1.150 in. ± .010 (29,2 mm ± 0,25)

Length in position ..... .687 in. (17,4 mm)

Rate ..... 660 lb/in. (7,5 mKg)

Fit of retaining collar on shaft ..... .001 in. (0,025 mm) interference (selective assembly)

**Differential assembly:** Pinion teeth ..... 10

Crownwheel teeth ..... 47

Ratio ..... 4.7 to 1

Backlash: crownwheel to pinion ..... .008 to .010 in. (0,20 to 0,25 mm) at the tightest point

Backlash: differential wheels to differential pinions ..... Minimum but definite backlash

**Front hub and stub axle assembly:** Front hub end-float ..... .004 to .006 in. (0,10 to 0,15 mm)

Clearance between stub shaft and stub axle bush ..... .020 to .028 in. (0,50 to 0,70 mm)

Stub axle bush bore ..... 1.250 in. + .004 (31,75 mm + 0,10)

Pinion thrust bearing pre-load ..... Adjust to give a torque of 6 to 10 in./lb. (0,069 to 0,115 mKg) on the pinion shaft

Crownwheel bearing pre-load ..... .005 in. (0,13 mm)

Distance from crownwheel axis to pinion face ..... 3.000 to 3.002 in.

Pinion thrust bearing pre-load ..... Standard .375 in. (9,5 mm) bolts 35 lb./ft. Special .390 in. (10 mm) bolts 45 lb./ft.

Differential pinion input flange: tightening torque ..... 85 lb./ft. (11,75 mKg)

Crownwheel fixing bolts, tightening torque ..... Standard .375 in. (9,5 mm) bolts 35 lb./ft. Special .390 in. (10 mm) bolts 45 lb./ft.

Pinion thrust bearing pre-load ..... Adjust to give a torque of 6 to 10 in./lb. (0,069 to 0,115 mKg) on the pinion shaft

Crownwheel bearing pre-load ..... .005 in. (0,13 mm)

Distance from crownwheel axis to pinion face ..... 3.000 to 3.002 in.

Front hub and stub axle assembly: Front hub end-float ..... .004 to .006 in. (0,10 to 0,15 mm)

Clearance between stub shaft and stub axle bush ..... .020 to .028 in. (0,50 to 0,70 mm)

Stub axle bush bore ..... 1.250 in. + .004 (31,75 mm + 0,10)

