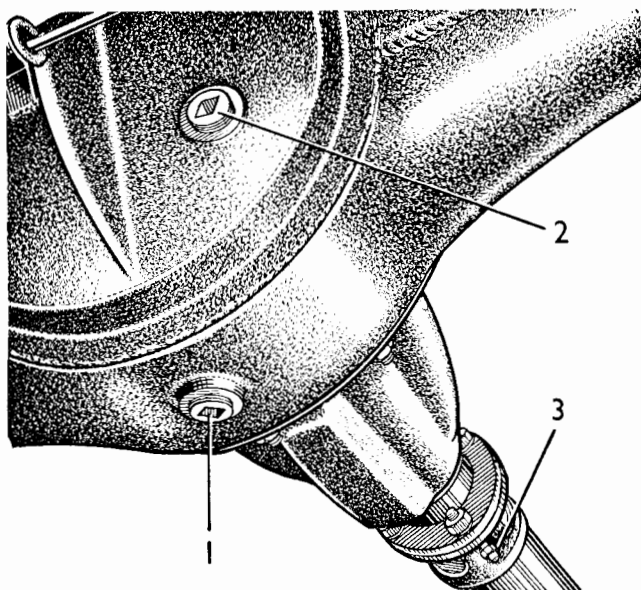


## Section J.1

### LUBRICATION

For the lubrication of the hypoid axle use lubricants only from approved sources, as tabulated in Section Q. Do not, in any circumstances mix brands of hypoid lubricant. If there is any doubt as to the oil previously used, drain and flush the axle before finally filling up with new hypoid oil. Do not use paraffin as a flushing medium.

The filler plug is situated on the rear side of the axle, and the drain plug in the bottom of the banjo casing.



B. 153. A.

*Fig. J.1. Rear axle.*

1. Drain plug. 2. Filler plug. 3. Propeller shaft universal nipple

## Section J.2

### AXLE UNIT

#### To Remove and Replace

- (1) Loosen the wheel nuts or hub caps, then jack-up the car and place supports under frame members just forward of the rear springs front anchorage. Take off both wheels after removing the wheel nuts or hub caps.
- (2) Working from under the car, unscrew the four self-locking nuts and remove the bolts (U.N.F.) securing the propeller shaft flange to axle pinion flange.
- (3) Disconnect the handbrake cable from the axle. This is accomplished by unscrewing it from its link to the brake balance lever, and unscrewing the nut holding its outer casing to the axle.

- (4) The hydraulic brake pipe at the rear axle is detached from the flexible pipe at the union just forward of the right hand shock absorber.
- (5) Unscrew the nuts securing the shock absorber links to the axle mounting brackets. Do not attempt to remove the links as this operation will prove much easier when freeing the axle.
- (6) Remove the self-locking nuts from the spring clips ("U" bolts) which secure the axle to the springs. Observe that a fibre pad is situated between the axle and spring.
- (7) Disconnect the tiebar at its axle anchorage by unscrewing its securing nuts.
- (8) With the axle free, the connecting links from the shock absorbers should be detached.
- (9) Remove the rubber block fixed between the axle and the left hand chassis frame. It is not necessary to detach the corresponding block on the right hand chassis frame.
- (10) The complete axle should be removed from the right-hand side of the car. Take care not to damage other components, particularly the petrol pump.
- (11) Installing the axle is the reverse of the above operations.

On re-assembling, it is advisable to jack-up the springs to meet the axle thus locating the spring centre bolt properly. Remember to fit the fibre pad.

When assembly is complete adjust the handbrake if required and bleed the hydraulic brake system all round.

## Section J.3

### AXLE SHAFTS

#### To Remove and Replace

- (1) Loosen the wheel nuts or hub cap of the wheel concerned before jacking-up the car.
  - (2) Remove the wheels after further unscrewing the wheel nuts or hub caps.
  - (3) Take out the two drum locating screws, using a screwdriver.
- Note.**—If wire wheels are fitted it will be necessary to remove the five self-locking nuts, which secure the rear hub extension, to gain access to the two drum locating screws.
- (4) The drum can be tapped off the hub and brake linings, provided the handbrake is released and the brake shoes are not adjusted so closely as to bind on the drum.

Should the brake linings hold the drum when the handbrake is released, it will be found necessary to slacken the brake shoe adjuster a few notches.

- (5) Remove the axle shaft retaining screw and draw out the axle shaft by gripping the flange outside the hub. It should slide easily but if it is tight on the studs it may need gently prising with a screwdriver inserted between the flange and the hub. Should the paper washer be damaged it must be renewed when re-assembling.
- (6) Replacement is a reversal of the above operations. Make sure that the bearing spacer is in position.

- (5) Fit a new oil seal using Service Tool 18G 134 and adaptor 18G 134AQ.
- (6) The bearing is not adjustable and is replaced in one straightforward operation.

When re-assembling it is essential that the outer face of the bearing spacer should protrude from .001 in. (.025 mm.) to .004 in. (.1 mm.) beyond the outer face of the hub and the paper washer, when the bearing is pressed into position. This ensures that the bearing is gripped between the abutment shoulder in the hub and the driving flange of the axle shaft.

### Section J.4

#### HUBS

##### To Remove and Replace

- (1) Remove the drum, axle shaft and bearing spacer.
- (2) Knock back the tab of the locking washer and unscrew the nut with Service Tool 18G 258.
- (3) Tilt the lock washer to disengage the key from the slot in the threaded portion of the axle casing; remove the washer.
- (4) The hub can then be withdrawn with a suitable extractor such as Service Tool 18G 220 with adaptors 'A', 'D' and 'E'. The bearing and oil seal will be withdrawn with the hub.

### Section J.5

#### REMOVING AND REPLACING THE PINION OIL SEAL AND THE DIFFERENTIAL PINIONS

##### Pinion Oil Seal

##### Removal

- (1) Mark the propeller shaft and pinion shaft driving flanges so that they can be replaced in the same relative positions, and disconnect the propeller shaft, carefully supporting it.

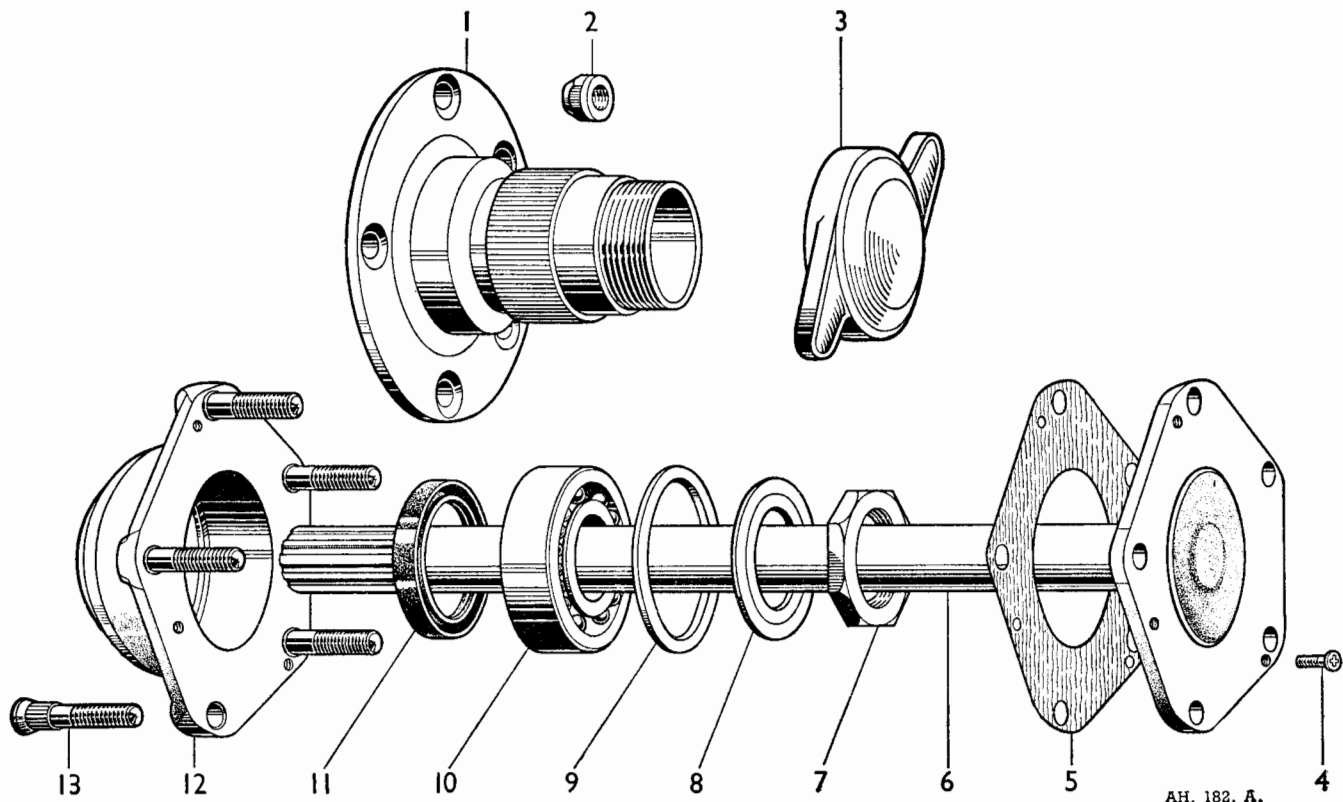


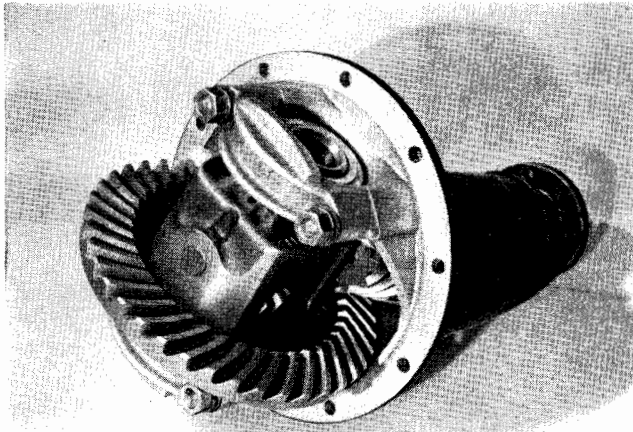
Fig. J.2. Rear axle hub assembly (with wire wheel hub extension).

- |                   |                         |                    |                  |
|-------------------|-------------------------|--------------------|------------------|
| 1. Hub extension. | 4. Securing screw.      | 7. Hub locknut.    | 10. Hub bearing. |
| 2. Securing nut.  | 5. Joint washer         | 8. Hub lockwasher. | 11. Oil seal.    |
| 3. Hub cap.       | 6. Half shaft.          | 9. Bearing spacer. | 12. Hub casing.  |
|                   | 13. Hub extension stud. |                    |                  |

- (5) Replace the driving flange end cover, taking care not to damage the edge of the oil seal. Tighten the nut with a torque wrench to a reading of 1.680 lb. in. (19.36 kg. m.).
- (6) Reconnect the propeller shaft, taking care to fit the two flanges with the locating marks in alignment.

### Removing the Differential

- (1) Drain the oil from the axle casing, and remove the axle shafts.
- (2) Mark the propeller shaft and pinion shaft driving flanges so that they may be replaced in the same relative positions; unscrew the nuts and bolts and separate the joint.
- (3) Unscrew the twelve nuts securing the bevel pinion and gear carrier casing to the axle banjo; withdraw the casing complete with the pinion shaft and differential assembly.
- (4) Make sure that the differential bearing housing caps are marked so that they can be replaced in their original positions, then remove the four nuts and spring washers. Withdraw the bearing caps and differential assembly.



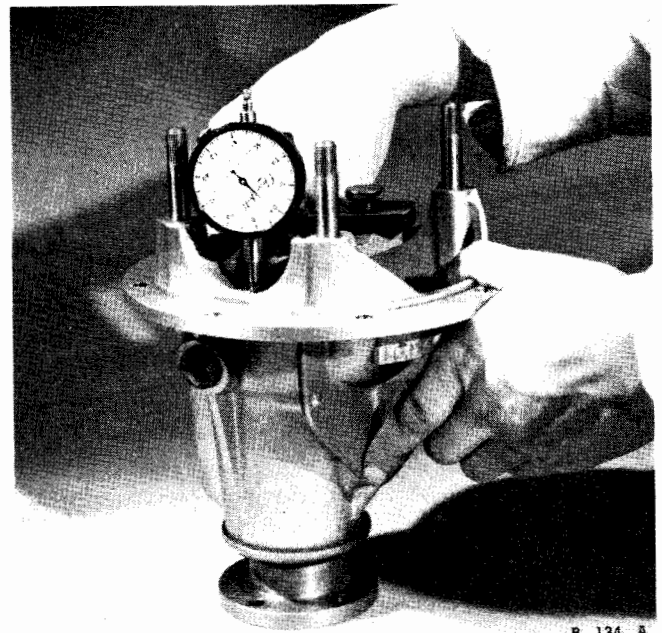
B. 139. A.

*Fig. J.3. The differential carrier.*

- (5) Remove the differential bearings from the differential case. Note that the word "Thrust" is stamped on the thrust face of each bearing and that shims are fitted between the inner ring of each bearing and the differential case.
- (6) Knock back the tabs of the locking washers, unscrew the nuts from the bolts securing the crown wheel to the differential, and remove the crown wheel.
- (7) Tap out the dowel pin locating the differential pinion shaft. The diameter of the pin is  $\frac{3}{16}$  in. (4.8 mm.). The pinions and thrust washers can then be removed from the case.

### Examination and Assembly

- (1) Examine the pinions and thrust washers and renew as required.
- (2) Examine the crown wheel teeth. If a new crown wheel is needed, a mated pair—pinion and crown wheel—must be fitted (see Section J.6).
- (3) Replace the pinions, thrust washers and pinion shaft in the differential casing and insert the dowel pin. Peen over the entry holes.
- (4) Bolt the crown wheel to the differential case, but do not knock over the locating tabs. Tighten the nuts to a torque wrench reading of 540 lb. ft. (6.2 kg. m.).
- (5) Mount the assembly on two "V" blocks and check the amount of run out of the crown wheel as it is rotated, by means of a suitably mounted dial indicator.



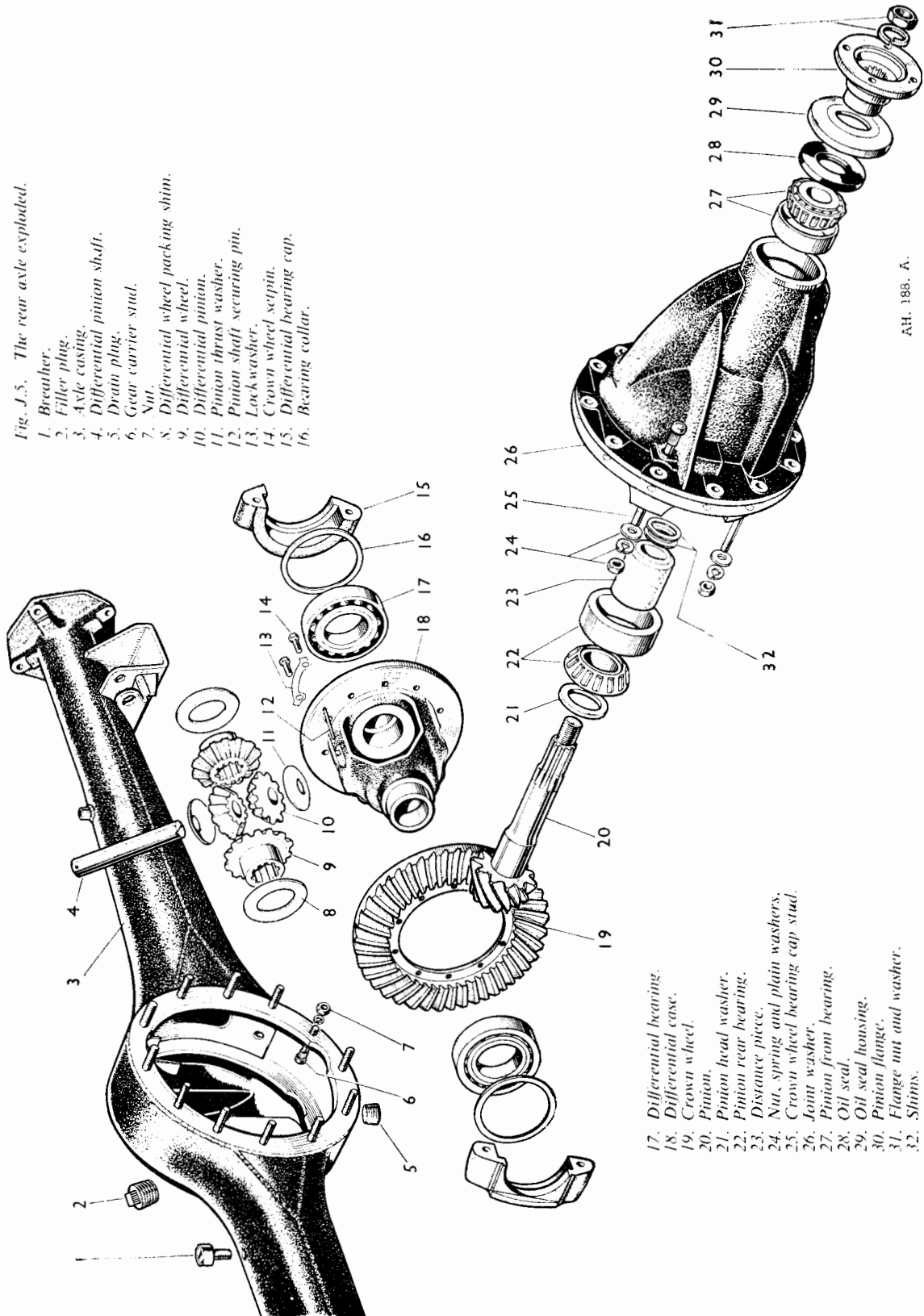
B. 134. A.

*Fig. J.4. Gauging the depth of the differential bearing housings.*

- (6) The maximum permissible run out is .002 in. (.05 mm.) and any greater irregularity must be corrected. Detach the crown wheel and examine the joint faces on the flange of the differential case and crown wheel for any particles of dirt.
- (7) When the parts are thoroughly cleaned it is unlikely that the crown wheel will not run true.
- (8) Tighten the bolts to the correct torque wrench reading and knock over the locking tabs.
- (9) Fit the differential bearings with the thrust faces outwards.

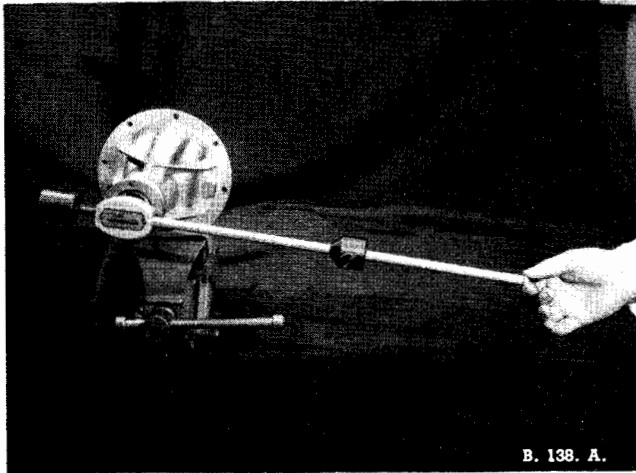
Fig. J.5. The rear axle exploded.

1. Breather.
2. Filler plug.
3. Axle casing.
4. Differential pinion shaft.
5. Drain plug.
6. Gear carrier stud.
7. Nut.
8. Differential wheel packing shim.
9. Differential wheel.
10. Differential pinion.
11. Pinion thrust washer.
12. Pinion shaft securing pin.
13. Lockwasher.
14. Crown wheel scripuit.
15. Differential bearing cap.
16. Bearing collar.



AH. 185. A.

17. Differential bearing.
18. Differential case.
19. Crown wheel.
20. Pinion.
21. Pinion head washer.
22. Pinion rear bearing.
23. Distance piece.
24. Nut, spring and plain washers.
25. Crown wheel bearing cap stud.
26. Joint washer.
27. Pinion front bearing.
28. Oil seal.
29. Oil seal housing.
30. Pinion flange.
31. Flange nut and washer.
32. Shim.



B. 138. A.

Fig. J.6. Checking the bevel pinion bearing pre-load (Service Tool No. 18G 207).

## The Pinion Shaft

- (1) Remove the differential assembly. Unscrew the nut ; remove the spring washer, the driving flange and the pressed end cover.
- (2) Drive the pinion shaft towards the rear ; it will carry with it the inner race and the rollers of the rear bearing, leaving the outer race and the complete front bearing in position.
- (3) The inner race of the front bearing may be removed with the fingers after removal of the oil seal, and the outer race may be withdrawn with Service Tool No. 18G 264 with adaptors 'D' and 'H'.
- (4) Slide off the pinion sleeve and shims ; withdraw the rear bearing inner race from the pinion shaft, noting the spacing washer against the pinion head.

## Section J.6

### CROWN WHEEL AND PINION

#### Replacing Crown Wheel and Pinion

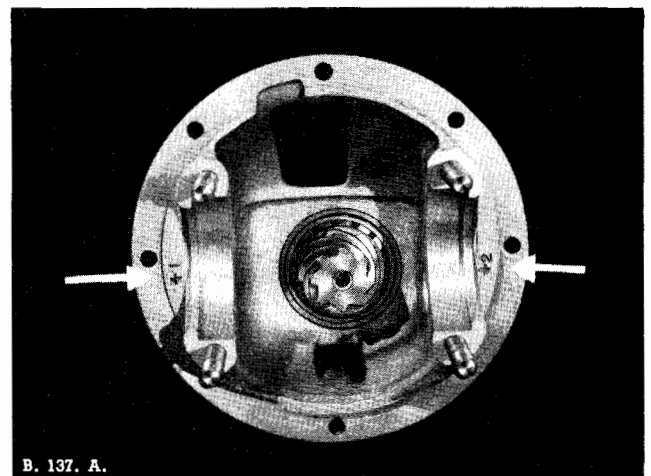
Fitting a new crown wheel and pinion involves four distinct operations :—

- (1) Setting the position of the pinion.
- (2) Adjusting the pinion bearing pre-load.
- (3) Adjusting the differential bearing pre-load.
- (4) Adjusting the backlash between the gears.

To carry out these operations correctly, three special tools are required: the bevel pinion setting gauge, Service Tool No. 18G 191, the pinion bearing outer race remover and replacer, Service Tool No. 18G 264 and the pre-load checking tool, Service Tool No. 18G 207.

#### Setting the Pinion Position

- (1) Fit the bearing outer races to the gear carrier.
  - (2) Smooth off the pinion head with an oil stone, but do not erase the variation in pinion head thickness that is etched on the pinion head.
  - (3) Refit the pinion head washer; if the original washer is damaged or not available, select a washer from the middle of the range of thicknesses: say, .214 in. or .216 in.
  - (4) Fit the inner race of the rear bearing to the pinion shaft and position the pinion in the gear carrier without the shims, distance tube and oil seal. Fit the inner race of the front bearing.
  - (5) Refit the universal joint driving flange and tighten the nut gradually until a pre-load figure of 16 to 18 in. lb. (1.84 to 2.07 kg. m.) is obtained.
  - (6) Adjust the dial indicator to zero on the machined step "C" of the setting block (Service Tool No. 18G 191).
  - (7) Remove the keep disc from the base of the magnet; clean the pinion head and place the magnet and dial indicator in position (fig. J.4). Move the indicator arm until the foot of the gauge rests on the centre of the differential bearing bore at one side and tighten the knurled locking screw. Obtain the maximum depth reading and note any variation from the zero setting.
- Repeat the check in the opposite bearing bore. Add the two variations together and divide by two to obtain a mean reading.



B. 137. A.

Fig. J.7. Illustrating the machining tolerances for the differential bearing housings as marked by the factory inspector.

- (8) *With a standard pinion head (no variation marked).*

If the mean reading is within  $+001$  in. ( $.025$  mm.) of the zero setting, the washer thickness is correct.

A positive mean reading indicates that the washer is not thick enough, and a negative mean reading indicates that it is too thick.

*Example:* Thickness of washer fitted ...  $.214$  in.  
 Mean reading ...  $+003$  in.  
 Thickness of washer required ...  **$.217$  in.**

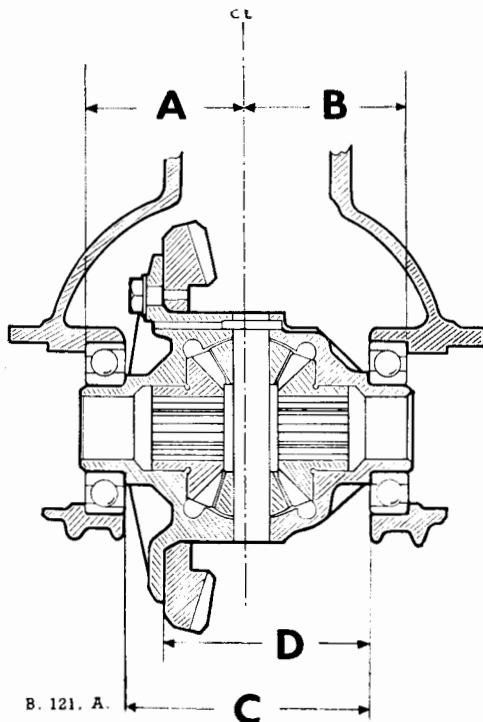
- (9) *With a non-standard pinion head (variation marked).*

In addition to the procedure detailed above, allowance must also be made for the variation in thickness of the pinion head: a positive ( $-$ ) dimension must be subtracted from the thickness obtained above, and a negative ( $-$ ) dimension added.

Using the same example and assuming a pinion head of non-standard thickness :

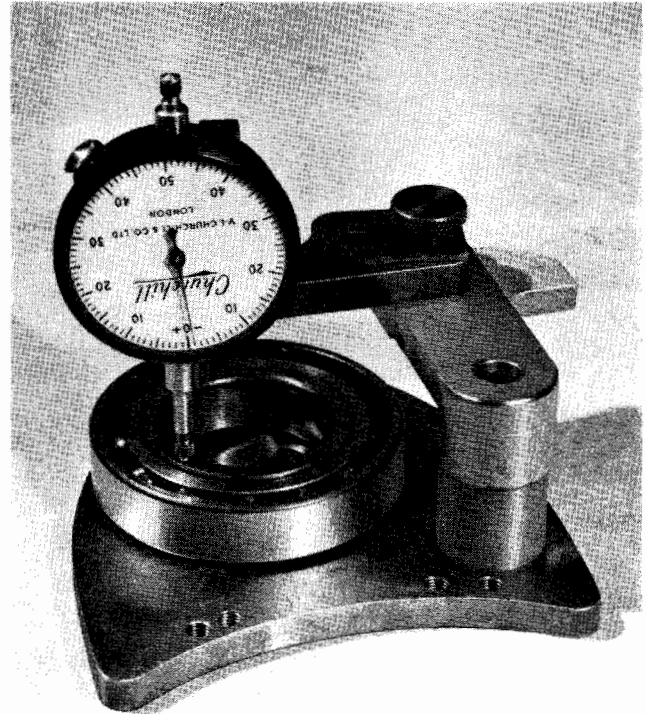
*Example:* Thickness of washer fitted ...  $.214$  in.  
 Mean reading ...  $-003$  in.  
 Total ...  **$.217$  in.**  
 Marked variation pinion head thickness ...  $-002$  in.  
 Thickness of washer required ...  **$.215$  in.**

A tolerance of  $.001$  in. is allowed in the thickness of the washer finally fitted.



B. 121. A.

*Fig. J.8. Illustrates the points from which the calculations must be made to determine the shim thickness for the bearings on each side of the carrier.*



B. 135. A.

*Fig. J.9. Checking differential bearing width with Service Tool No. 18G 191B.*

### Adjusting Pinion Bearing Pre-load

- (1) Assemble the pinion shaft bearings, distance tube, and shims to the gear carrier: fit the oil seal and driving flange.
- (2) Tighten the flange nut gradually to a torque wrench reading of  $1,680$  lb. in. ( $19.4$  kg.m.), checking the pre-load at intervals to ensure that it does not exceed  $21$  lb. in., *i.e.*  $3$  lb. in. greater than the previous figure as the oil seal is now fitted.
- (3) If the pre-load is too great more shims must be added, and if too small the thickness of the shimming must be decreased.

### Adjusting the Differential Bearing Pre-load

**Units marked with tolerances:** The differential bearings must be pre-loaded and this is done by "pinching" them to the extent of  $.002$  in. on each bearing, the "pinch" being obtained by varying the thickness of the bearing distance collar fitted between each bearing outer ring and the register in the axle housing. The collar thickness is calculated as shown below.

In making the necessary calculations, machining tolerances and variations in bearing width must be taken into account. Machining tolerances are stamped on the component: bearing width variations must be measured.

The dimensions involved in pre-loading the differential bearings are illustrated in fig. J.8, and it is



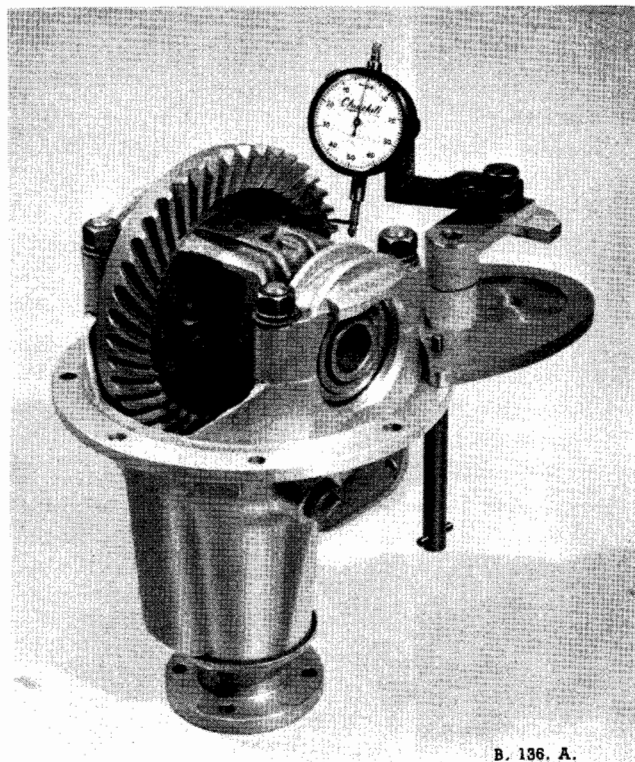


Fig. J.10. Checking crown wheel to pinion backlash (Service Tool No. 18G 191B).

emphasised that it is the tolerance on each dimension which is important and referred to in the formula used.

The dimensions are :—

- (1) From the centre line of the differential to the bearing register on the left-hand side of the gear carrier.  
Tolerance: stamped on the carrier.
- (2) From the centre line of the differential to the bearing register on the right-hand side of the carrier.  
Tolerance: stamped on the carrier.
- (3) From the bearing register on one side of the differential cage to the register on the opposite side.  
Tolerance: stamped on the cage.
- (4) From the rear face of the crown wheel to the bearing register on the opposite side.  
Tolerance: stamped on the cage.

To calculate the collar thickness :—

*Left-hand side:*

$$\text{Formula: } A + D - C + \cdot 1815 \text{ in. (4.610 mm.)}$$

Substitute the dimensional tolerances for the letters in the formula. The result is the thickness of the collar required at the left-hand side to compensate for machining tolerances and to give the necessary pinch, with bearings of standard width. The width of the bearing must now be checked and any variation from

standard added to or subtracted from the collar thickness. If the bearing width is under standard, that amount must be added to the collar thickness, and *vice versa*.

### Table of Washer and Shim Thickness

Pinion head washer thicknesses	... .. .	·208 in. to ·222 in. in steps of ·002 in.
Pinion bearing shims	pre-load ... .. .	·004 in. to ·012 in. in steps of ·002 in., plus ·020 in. and ·030 in.
Crown wheel bearing collars	...	·175 in. to ·185 in. in steps of ·002 in.
Pinion bearing pre-load	...	16 to 18 lb. in. without oil seal ; 19 to 21 lb. in. with oil seal.
Crown wheel bearing pinch...	...	·002 in. each side.

### To Check Bearing Width

- (1) Rest the bearing on the small surface plate of Tool No. 18G 191B with the inner race over the recess and the thrust face downwards.
- (2) Place the magnet on the surface plate and set the dial indicator to zero on the step marked "C" of the small gauge block ; this is the width of a standard bearing. Transfer the indicator to the plain surface of the bearing inner race and, holding the race down against the balls, note the reading on the dial. A **negative** reading shows the additional thickness to be **added** to the collar at this side ; a **positive** reading, the thickness to be **subtracted**.

*Right-hand side:*

$$\text{Formula: } B - D + \cdot 1825 \text{ in. (4.634 mm.)}$$

The procedure is the same as that for the left-hand side.

**Units not marked with tolerances :** Some early models are fitted with differentials bearing no markings except the correct backlash for that particular pair of gears. The differential in such a case can be set as follows:—

- (1) Fit the differential to the carrier with a distance collar at each side.  
By trial and error select collars of thicknesses

such that the differential with bearings and collars just fits into the carrier without slack and without pinching the bearings.

- (2) Remove the unit and add .002 in. to the thickness of the collar at each side to give the required pre-load.
- (3) Fit the unit to the carrier and bolt up.
- (4) Check and adjust the backlash as detailed below.

#### Adjusting Backlash

- (1) Assemble the bearings to the differential cage and refit the differential to the gear carrier with the collars of calculated thickness.
- (2) Mount the dial indicator on the magnet bracket so that an accurate measurement of the backlash can be taken. The recommended backlash is etched on the crown wheel.
- (3) Vary the backlash by decreasing the thickness of the collar at one side and increasing the thickness of the collar at one side and increasing the thickness of the collar at the other side by the same amount, thus moving the crown wheel into or out of mesh as required. The total thickness of the two collars must not be changed.
- (4) A tolerance of  $-.002$  in. ( $-.05$  mm.) to  $-.001$  in. ( $-.025$  mm.) on the recommended backlash is allowable so long as this does not bring it below a minimum of  $.006$  in. ( $.152$  mm.) or above a maximum of  $.012$  in. ( $.306$  mm.).

## Section J.7

### REAR SPRINGS

#### Description

The road springs are of the semi-elliptical type. The rear ends pivot in shackles to allow for variation in the effective lengths of the springs as they are flexed on load or rebound. The front ends of the springs are mounted in rigid brackets on the chassis longitudinal members. Driving and braking forces are transmitted from the axles to the chassis by this end of the springs.

Two rubber buffers attached to the axle limit any excessive upward or bump movement of the axle.

The rear spring dampers are of the lever, hydraulic type and are mounted to brackets on the chassis longitudinal members. The levers are attached to brackets on the axle. A filler plug is located in the top plate of each rear damper.

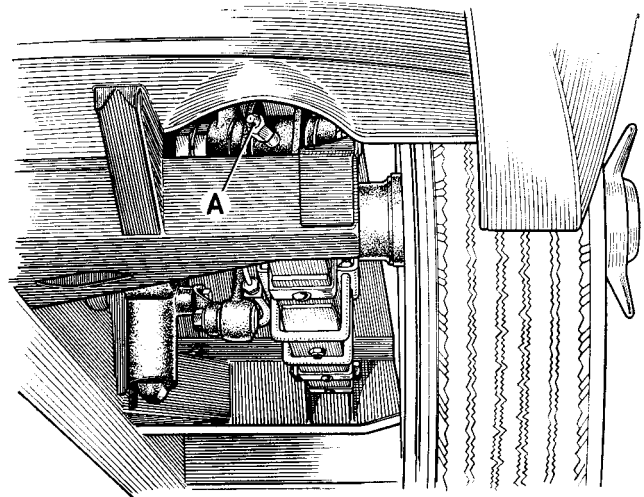
#### Maintenance

- (1) Examine and tighten, if necessary the spring "U" bolts.
- (2) Examine the oil level in the rear spring dampers and top up if necessary.
- (3) Clean the springs and wipe them with an oily rag.

- (4) Examine the springs for fractures and the bushes for wear.

#### To Remove

- (1) Jack up the car on that side from which the spring is to be removed.
- (2) Pack up the chassis rear cross member with suitable supports, placing the supports as near to the spring rear anchorage as possible.
- (3) Place a screw jack under the centre of the spring to relieve the tension.
- (4) Remove the respective wheel.
- (5) Using a box spanner release the four self-locking nuts from the "U" bolts which secure the spring to the axle tube.
- (6) Detach the nut and spring washer on the inside of the upper rear shackle, and the locknut, spring washer and nut on the inside of the lower rear shackle.



AH. 39. A.

Fig. J.11. This illustration shows the position of the rear spring lubricator beneath the luggage compartment.

- (7) Remove the shackle inside connecting link and extract the top and bottom shackle pins, together with the outside link.
- (8) At the forward end of the spring detach the anchor pin by removing the nut and spring washer on the inside of the pin and drive the pin clear.
- (9) Remove the supporting jack from under the spring to withdraw the latter from the car.

#### To Dismantle

- (1) Grip the spring in a vice jaws against the top and bottom leaves, adjacent to the centre bolt.
- (2) Unscrew the clips.

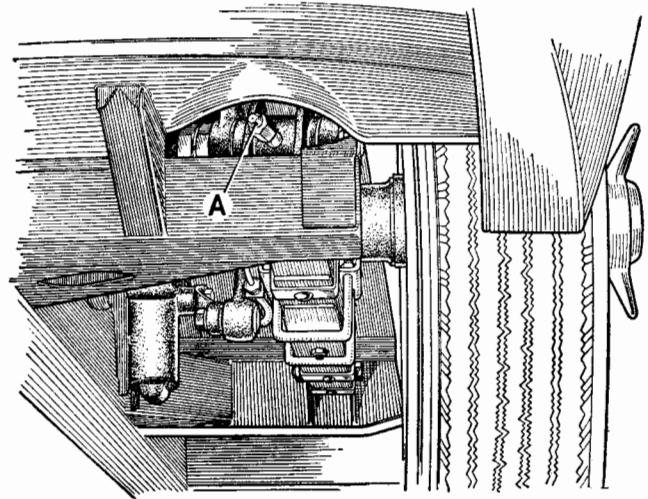


- (4) The maximum permissible run out is .002 in. (.05 mm.) and any greater irregularity must be corrected. Detach the crown wheel and examine the joint faces on the flange of the differential case and crown wheel for any particles of dirt.
- (5) When the parts are thoroughly cleaned it is unlikely that the crown wheel will not run true.
- (6) Tighten the bolts to the correct torque wrench reading and knock over the locking tabs.
- (7) Refit the differential to the gear carrier with the collars of calculated thickness. Tighten the bearing caps to a torque wrench reading of 65 lb. ft. (8.99 kg. m.).
- (8) Mount the dial indicator on the magnet bracket so that an accurate measurement of the backlash can be taken. The correct figure for the backlash to be used with any particular crown wheel and pinion is etched on the rear face of the crown wheel concerned and must be adhered to strictly.
- (9) Vary the backlash by decreasing the thickness of the collar at one side and increasing the thickness of the collar at one side and increasing the thickness of the collar at the other side by the same amount, thus moving the crown wheel into or out of mesh as required. The total thickness of the two collars must not be changed.
- (10) The minimum backlash allowed in any circumstances is .005 in. (.12 mm.) and the maximum is .011 in. (.18 mm.).

- (3) Clean the springs and wipe them with an oily rag.
- (4) Examine the springs for fractures and the bushes for wear.

### To Remove

- (1) Jack up the car on that side from which the spring is to be removed.



AH. 39. A.

*Fig. J.11. This illustration shows the position of the rear spring lubricator beneath the luggage compartment.*

## Section J.8

### REAR SPRINGS

#### Description

The road springs are of the semi-elliptical type. The rear ends pivot in shackles to allow for variation in the effective lengths of the springs as they are flexed on load or rebound. The front ends of the springs are mounted in rigid brackets on the chassis longitudinal members. Driving and braking forces are transmitted from the axles to the chassis by this end of the springs.

Two rubber buffers attached to the axle limit any excessive upward or bump movement of the axle.

The rear spring dampers are of the lever, hydraulic type and are mounted to brackets on the chassis longitudinal members. The levers are attached to brackets on the axle. A filler plug is located in the top plate of each rear damper.

#### Maintenance

- (1) Examine and tighten, if necessary the spring "U" bolts.
- (2) Examine the oil level in the rear spring dampers and top up if necessary.

- (2) Pack up the chassis rear cross member with suitable supports, placing the supports as near to the spring rear anchorage as possible.
- (3) Place a screw jack under the centre of the spring to relieve the tension.
- (4) Remove the respective wheel.
- (5) Using a box spanner release the four self-locking nuts from the "U" bolts which secure the spring to the axle tube.
- (6) Detach the nut and spring washer on the inside of the upper rear shackle, and the locknut, spring washer and nut on the inside of the lower rear shackle.
- (7) Remove the shackle inside connecting link and extract the top and bottom shackle pins, together with the outside link.
- (8) At the forward end of the spring detach the anchor pin by removing the nut and spring washer on the inside of the pin and drive the pin clear.
- (9) Remove the supporting jack from under the spring to withdraw the latter from the car.