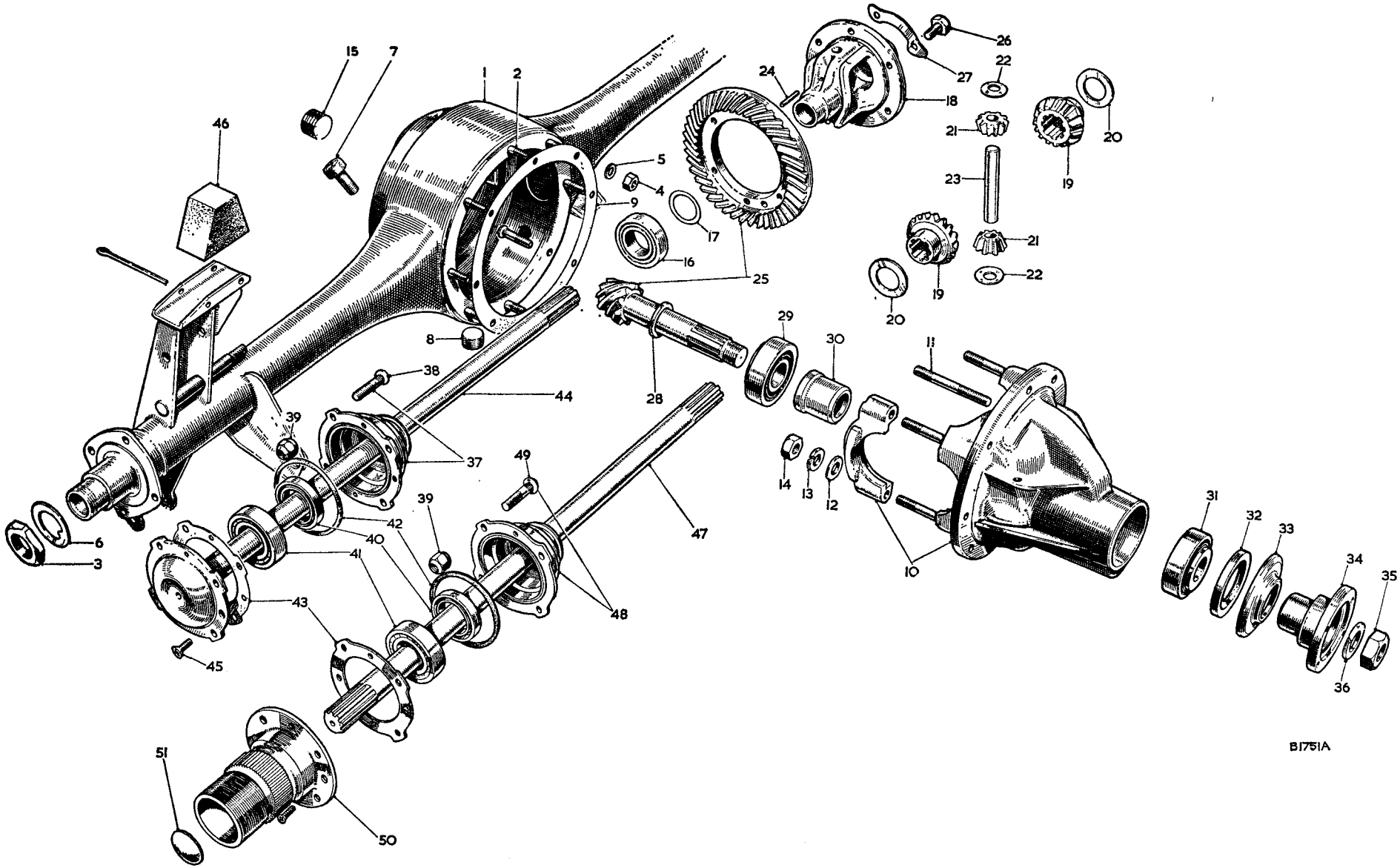
SECTION H

THE REAR AXLE AND REAR SUSPENSION

THE REAR AXLE COMPONENTS



KEY TO THE REAR AXLE COMPONENTS

No.	Description
1.	Case assembly.
2.	Gear carrier stud.
3.	Bearing retaining nut.
4.	Gear carrier to axle case nut.
5.	Spring washer.
6.	Washer.
7.	Breather assembly.
8.	Drain plug.
9.	Gear carrier joint.
10.	Carrier assembly.
11.	Bearing cap stud.
12.	Plain washer.
13.	Spring washer.
14.	Nut.
15.	Filler plug.
16.	Differential bearing.
17.	Bearing packing washer.
18.	Differential cage.
19.	Differential wheel.
20.	Thrust washer.
21.	Differential pinion.
22.	Thrust washer.
23.	Pinion pin.
24.	Pinion peg.
25.	Crown wheel and pinion.
26.	Bolt.
27.	Lock washer.
28.	Pinion thrust washer.
29.	Inner pinion bearing.
30.	Bearing spacer.
31.	Pinion outer bearing.
32.	Oil seal.
33.	Dust cover.
34.	Universal joint flange.
35.	Pinion nut.
36.	Spring washer.
37.	Hub assembly.
38.	Wheel stud.
39.	Nut.
40.	Oil seal.
41.	Hub bearing.
42.	Oil seal ring.
43.	Hub shaft joint.
44.	Axle shaft.
45.	Screw.
46.	Bump rubber.
47.	Axle shaft.
48.	Hub assembly.
49.	Wheel stud.
50.	Hub extension.
51.	Welch plug.

Nos. 47–51: Wire wheels only.

GENERAL DESCRIPTION

The rear axle is of the three-quarter-floating type incorporating hypoid final drive reduction gears. The axle shafts, pinion, and differential assemblies can be withdrawn without removing the axle from the vehicle. The rear wheel bearing outer races are located in the hubs, and the inner races are mounted on the axle tube and secured by nuts and lock washers. Wheel studs in the hubs pass through the brake-drums and axle shaft driving flanges. Brake-drums are located on the hub flanges by two countersunk screws in each.

The differential and pinion shaft bearings are preloaded, the amount of preload being adjustable. The position of the pinion in relation to the crown wheel when being adjusted must be kept within the maker's figure limits. The backlash between the gears is adjustable by shims. Suspension is by rubber-mounted quarter-elliptic leaf springs and the shackles are fitted with rubber bushes of the flexing type.

Section H.1

LUBRICATION

The combined filler and level plug situated on the rear axle casing is reached from beneath the rear of the car. The oil must be level with the bottom of the filler hole. The drain plug is situated on the bottom of the rear axle casing.

Section H.2

AXLE UNIT

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. Remove the wheels.

The down pipe, silencer, and exhaust pipe should be withdrawn from the car as described in Section A.

Keeping the jack in position, release each check strap by unscrewing the nut and bolt at its body connection.

Release each damper arm from its connecting linkage.

Disconnect each suspension upper link from the rear axle bracket by unscrewing the nut and bolt and tapping the bolt from its housing.

Disconnect the brake cable at the cable adjustment.

Working beneath the car, unscrew the self-locking nuts and remove the bolts securing the propeller shaft flange to the axle pinion flange.

Disconnect the hydraulic brake pipe at the main union just forward of the differential housing.

After ascertaining that the weight of the axle is fully on the jack, unscrew and remove the shackle pins.

Lower the axle and withdraw it from the car.

Refitting

The refitting of the rear axle is a reversal of the removal procedure, with attention to the following. If for any reason it has been necessary to remove the suspension upper link and at the same time the rear axle has been withdrawn from the car, do not tighten the shackle pins until the upper link is mounted in position.

Section H.3

AXLE SHAFTS

Removing

Raise the vehicle by placing a jack under the differential housing. Place supports under the rear springs and remove the wheels.

Release the handbrake and back off the brake shoes adjusters.

Disc wheels

Remove the brake drum locating screws and tap the drums off the hubs.

Remove the axle shaft retaining screw and withdraw the shaft from the hub assembly. Should the paper washer be damaged, it must be renewed when reassembling.

Wire wheels

Remove the nuts securing the drum to the hub and tap the drums off the hub. Remove the retaining screws securing the hub extension flanges to the hubs. Withdraw the hubs extensions and axle shaft. Should the paper washer or 'O' ring be damaged, it must be renewed when reassembling.

Refitting

Reverse the removal procedure when refitting.

Section H.4

HUBS

Removing (See Editor's note at end of Section Ha.)

(1) Remove the brake drum and axle shaft as described in Section H.3.

(2) Using tool 18G 152 remove the nut and lock washer.

(3) Withdraw the hub complete with bearing and seal using tool 18G 146, or 18G 304 (Z) with adaptors 18G 304 F and 18G 304 H.

Refitting

Before refitting, repack the hub bearings with grease.

The hub bearing is non-adjustable and is replaced in one operation by pressing it into position.

It is essential when fitting the differential shaft that the paper joint washer between its flange and the hub is compressed before the abutment shoulder of the shaft pulls up against the bearing races. If in an emergency a paper joint washer is hand-made, ensure that it is about ·010 in. (·2 mm.) thick. An oil leak will invariably result if the washer is too thin.

It is advisable to use joint washers supplied by BMC Service Ltd. to ensure correct assembly.

If the seal has been removed, drift it into position with the bearing (lip towards the bearing) using tool 18G 134 with adaptor 18G 134 Q.

The hub is then drifted onto the axle casing with Service tools 18G 134 and 18G 134 Q. Continue to assemble to the reverse of the removal procedure.

Section H.5

RENEWING THE PINION OIL SEAL

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.

Unscrew the nut in the centre of the driving flange, using Service tool 18G 34 A to prevent the flange from turning. Remove the nut and washer and withdraw the flange and pressed end cover from the pinion shaft.

Extract the oil seal from the casing.

Press a new seal into the casing with the edge of the sealing ring facing inwards.

Replace the driving flange and end cover, taking care not to damage the edge of the oil seal, and tighten the nut with a torque wrench (Service tool 18G 372) to a reading of 140 lb. ft. (19·4 kg. m.).

Reconnect the propeller shaft, taking care to fit the two flanges with the locating marks in alignment.

Section H.6

DIFFERENTIAL ASSEMBLY

Removing

Drain the rear axle.

Remove the axle shafts as detailed in Section H.3.

Mark the propeller shaft and pinion shaft driving flanges to ensure correct assembly. Remove the self-locking nuts and disconnect the joint.

Remove the nuts securing the differential assembly to the axle banjo and withdraw the complete unit.

Dismantling (See Editor's note at end of Section Ha.)

Check to ensure that the differential housing caps are marked to ensure correct replacement, then remove the bearing cap securing nuts and spring washers. Remove the bearing caps and withdraw the differential cage.

Remove the differential bearings from the cage, using Service tool 18G 47 C together with 18G 47 M. Note that the thrust face of each bearing is marked with the word 'THRUST', and that shims are fitted between the inner ring of each bearing and differential cage.

Knock back the tabs of the locking washers, unscrew the bolts securing the crown wheel to the differential, and remove the crown wheel from the differential cage.

Tap out the dowel pin locating the differential pinion shaft. The diameter of the pin is $\frac{1}{8}$ in. (3·18 mm.) and it must be tapped out from the crown wheel side of the differential cage as the hole into which it fits has a smaller diameter at the crown wheel end to prevent the pin

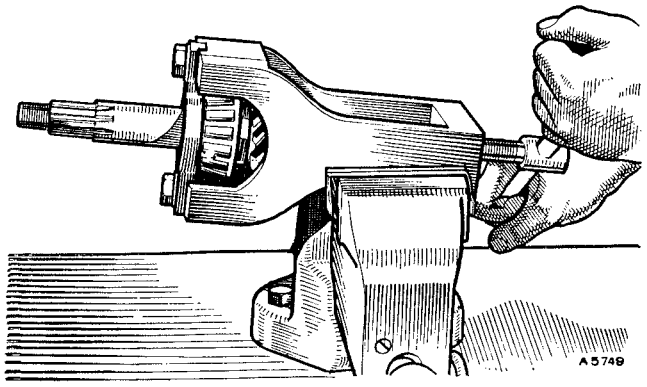


Fig. H.1

Refitting the inner race of the pinion rear bearing, using tool 18G 285. *This tool is also used to remove the race*

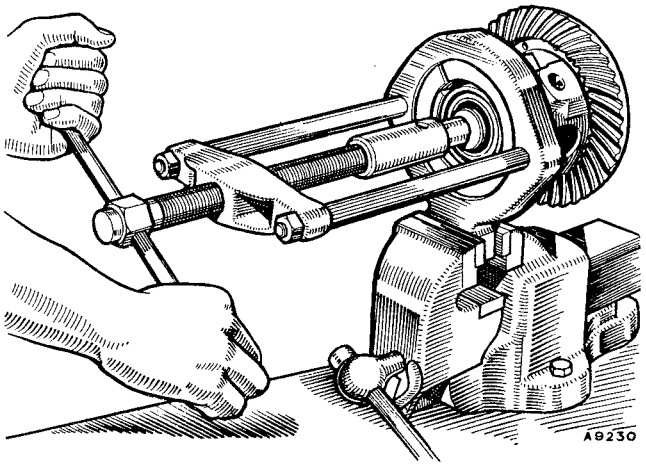


Fig. H.2

Remove the differential bearings, using remover 18G 47 *C with adaptor* 18G 47 *M*

passing right through. It may be necessary to clean out the metal peened over the entry hole with a $\frac{1}{8}$ in. drill in order to facilitate removal of the dowel pin. Drive out the differential pinion shaft and remove the pinions and thrust washers from the differential cage.

Remove the pinion nut, driving flange, and pressed end cover.

Drive the pinion shaft towards the rear through the carrier; 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.

Tap out the inner race of the front bearing and the oil seal. The outer races should be withdrawn with Service tool 18G 264 with adaptors 18G 264 D and 18G 264 E.

Slide off the pinion sleeve and the shims; withdraw the rear bearing inner race from the pinion shaft with Service tool 18G 285, noting the spacing washer against the pinion head. Withdraw the rear bearing outer race with Service tool 18G 264 and adaptor 18G 264 E.

Reassembling

Where it is only necessary to fit a replacement oil seal the axle may be reassembled in the reverse order of dismantling, assuming that the original shim thicknesses are retained. Where any part is renewed, such as a crown wheel and pinion, pinion bearings, etc., the setting of the pinion (i.e. its position relative to the crown wheel) must be checked. This work should be carried out with the aid of Service tools 18G 191 and 18G 191 A.

Examine the crown wheel teeth. If a new crown wheel is needed **a mated pair—pinion and crown wheel—must be fitted.**

1. SETTING THE PINION POSITION

Fit the bearing outer races to the gear carrier, using Service tools 18G 134 and 18G 134 Q.

Smooth off the pinion head with an oil-stone, but do not erase any markings that may be etched on the pinion head.

Assemble the pinion and rear bearing with a washer of known thickness behind the pinion head.

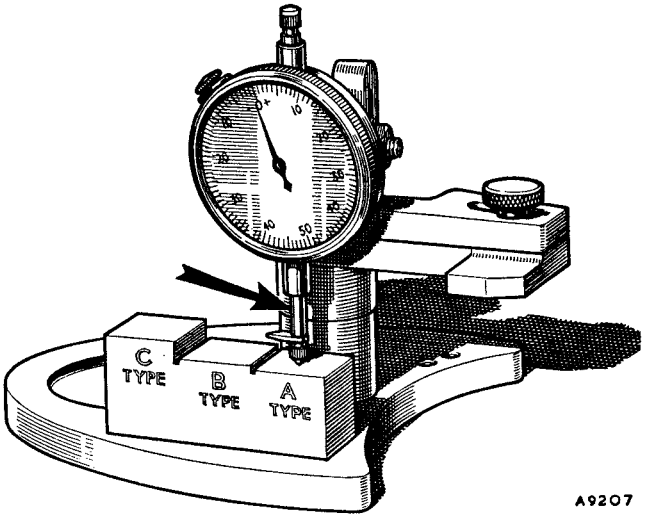


Fig. H.3

Setting the dial gauge to zero on the gauge block pinion position setting. The arrow indicates the extension foot

Position the pinion in the gear carrier without the bearing spacer and oil seal.

Fit the inner ring of the front bearing and the driving flange and tighten the nut gradually until a bearing preload of 8 to 10 lb. in. (·09 to ·12 kg. m.) is obtained.

Remove the keep disc from the base of the magnet. Adjust the dial indicator to zero on the machined step 'A' of the setting block.

Clean the pinion head and place the magnet and dial indicator in position. 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 zero setting. Repeat the check in the opposite bearing bore. Add the two variations together and divide by two to obtain a mean reading.

Take into consideration any variation in pinion head thickness. This will be shown as an unbracketed figure etched on the pinion head and will always be minus (—). If no unbracketed figure is shown, the pinion head is of nominal thickness.

Using the mean clock gauge reading obtained and the unbracketed pinion head figure (if any), the following calculation can be made.

(*a*) **If the clock reading is minus** add the clock reading to the pinion head marking, the resulting sum being minus. **Reduce** the washer thickness by this amount.

Example

Clock reading	—·002 in.
Pinion marking	—·005 in.
Variation from nominal	—·007 in.

Reduce the washer thickness by this amount.

(*b*) **If the clock reading is plus and numerically less** than the pinion marking **reduce** the washer thickness by the difference.

Example

Pinion marking	—·005 in.
Clock reading	+·003 in.
Variation from nominal	—·002 in.

Reduce the washer thickness by this amount.

(*c*) **If the clock reading is plus and numerically greater** than the pinion marking **increase** the washer thickness by the difference.

Example

Clock reading	+·008 in.
Pinion marking	—·003 in.
Variation from nominal ..	+·005 in.

Increase the washer thickness by this amount.

The only cases where no alterations are required to the washer thickness are when the clock reading is **plus** and **numerically equal** to the unbracketed pinion marking, or the clock reading is zero and there is no unbracketed marking on the pinion head.

Allowance should then finally be made as follows for the mounting distance marked on the pinion head in a rectangular bracket.

If the marking is a **plus** figure **reduce** the washer thickness by an equal amount.

If the marking is a **minus** figure **increase** the washer thickness by an equal amount.

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

2. PINION BEARING PRELOAD

A washer of the thickness indicated by the use of the tool and calculations should now be fitted under the pinion head and the pinion assembled with bearings, pinion bearing distance piece, oil seal, universal joint flange, and nut. (See Editor's note at end of Section Ha.)

NOTE.—The pinion bearing distance piece is of the collapsible type. That is to say, when the pinion nut is tightened to the correct torque spanner reading of 135 to 140 lb. ft. (18·69 to 19·4 kg. m.) the distance piece collapses to give the correct bearing preload of 11 to 13 lb. in. (·126 to ·149 kg. m.). It will only perform this function

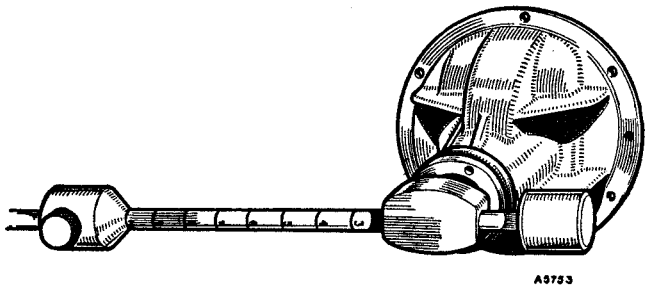


Fig. H.4

Checking the bevel pinion bearing preload (Service tool 18G 207)

once. Thus, when the pinion is reassembled a new distance piece must be fitted.

Prevent the universal joint flange from turning and tighten the pinion nut gradually to a torque spanner reading of 140 lb. ft. (19·4 kg. m.). Checks should be made during the tightening, using Service tool 18G 207, to ensure the pinion bearing preload does not exceed 13 lb. in. (·15 kg. m.). When the nut is correctly tightened it should provide a pinion bearing preload of 11 to 13 lb. in. (·13 to ·15 kg. m.). When the correct preload is obtained no further attention is needed so far as the pinion is concerned.

3. SETTING THE CROWN WHEEL POSITION

The method of setting the position of the crown wheel assembly depends upon the markings given on the differential gear carrier and differential gear cage.

To assist in the calculation of the thickness of shims to be fitted behind each differential cage bearing variations are indicated by stamped numbers on the carrier adjacent to the bearing bores. The dimensions to be considered are shown in Fig. H.6. (A) being the distance from the centre-line to the bearing register of the carrier on the left-hand side and (B) the distance from the centre-line to the bearing register of the carrier on the right-hand side. The (C) dimension is from the bearing register on one side of the cage to the register on the other side, while the (D) dimension is from the rear face of the crown wheel to the bearing register on the opposite side. Any variation on the (A) dimension will be found stamped on the carrier adjacent to the bearing bore, and similarly with the (B) dimension. Variations on the (C) and (D) dimensions are stamped on the machined face of the differential cage.

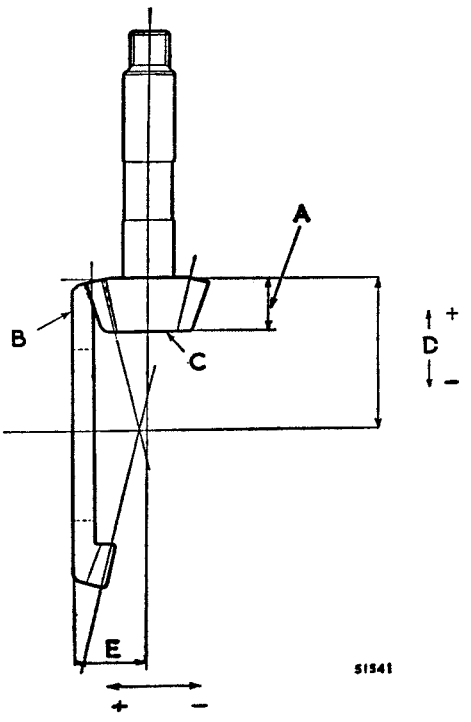


Fig. H.5

Crown wheel and pinion markings

A. Pinion head thickness. Max. −·007 in. (−·178 mm.).
B. Crown wheel marked here.
C. Pinion marked here.
D. Pinion mounting distance. Max. ±·004 in. (±·102 mm.).
E. Crown wheel mounting distance. Max. ±·005 in. (±·127 mm.).

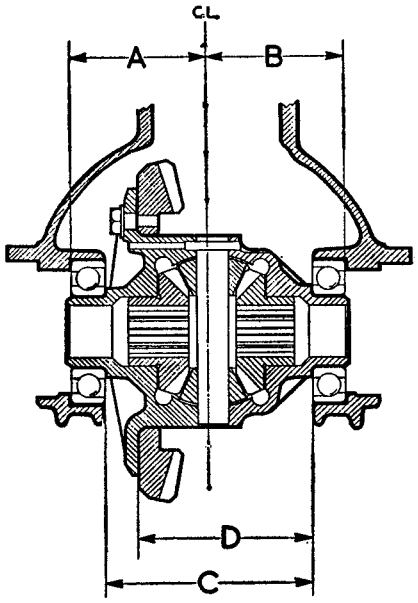


Fig. H.6

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

It is possible to calculate the shim thickness required on the left-hand side by the use of the following formula:

A+D−C+·002 in.

Substituting the actual variations shown, this formula gives the shim thickness required to compensate for the variations in machining plus the extra ·002 in. (·05 mm.) to give the necessary bearing pinch. In addition, allowance must be made for variations in bearing thickness in the following manner.

Rest the bearing, with the inner race over the recess and outer ring thrust face downwards, on the small surface plate of Service tool 18G 191 A. Drop the magnet on the surface plate and zero the clock gauge to the small gauge block on its step marked 'A'. (This is the thickness of the standard bearing.) Swing over the indicator until it rests on the plain surface of the inner race, and, holding the inner race down against the balls, take a reading (Fig. H.7). Normally the bearing will be standard to −·003 in., though in some cases tolerances may be from standard to −·005 in. A negative variation shown by this test indicates the additional thickness of shimming to be added to that side of the differential.

The formula for the right-hand side is:

B−D+·006 in.

and here again final allowance must be made for variation in bearing thickness.

When a framed number is marked on the back of the crown wheel, e.g. +2, it must be taken into account before assembling the shims and bearings to the differential cage. This mark assists in relating the crown wheel with the pinion.

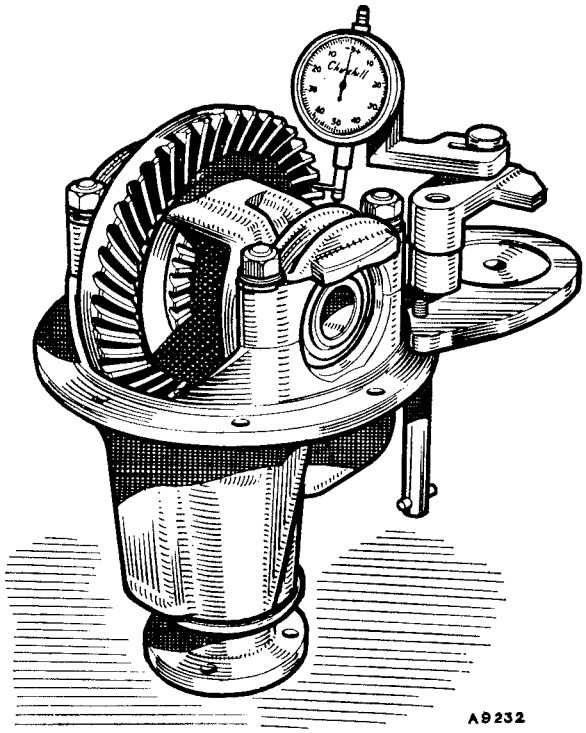


Fig. H.7

Checking crown wheel to pinion backlash (Service tools 18G 191 and 18G 191 A)

If, for example, the mark is +2, then shims to the value of ·002 in. (·05 mm.) must be transferred from the left-hand side (the crown wheel side) to the right-hand side. If the marking is −2, then shims to the value of ·002 in. (·05 mm.) must be moved from the right-hand side to the left-hand side.

4. ADJUSTING THE BACKLASH

Assemble the bearings (thrust faces outwards) and shims as calculated to the differential cage.

Bolt the crown wheel to the differential cage but do not knock over the locking tabs. Tighten the bolts to a torque wrench reading of 60 lb. ft. (8·30 kg. m.).

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. The maximum permissible run-out is ·002 in. (·05 mm.) and any greater irregularity must be corrected. If there is excessive run-out detach the crown wheel and examine the joint faces on the flange of the differential cage and on the crown wheel for any particles of dirt.

When the parts are thoroughly cleaned it is unlikely that the crown wheel will not run true.

Tighten the bolts to the correct torque wrench reading and knock over the locking washers.

Fit the differential to the gear carrier. Replace the bearing caps and tighten the nuts to a torque wrench reading of 65 lb. ft. (8·99 kg. m.). Bolt the special tool surface plate to the gear carrier flange and mount the clock gauge on the magnet bracket in such a way that an accurate backlash figure may be obtained (see Fig. H.8).

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.

A movement of ·002 in. (·05 mm.) shim thickness from one side of the differential cage to the other will produce a variation in backlash of approximately ·002 in. (·05 mm.).

Great care must be taken to ensure absolute cleanliness during the above operations, as any discrepancies resulting from dirty assembly would affect the setting of the crown wheel or pinion.

Refitting is a reversal of the removal procedure.

Section H.7

SPRINGS

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. After ascertaining that the weight of the axle is fully on the jack and that the springs are in the fully unloaded position remove the shackle pins.

The spring can now be removed simply by extracting the bolts which pass upwards at the forward end of the spring into the spring attachment plate. The 'U' bolt must also be removed when the spring can be pulled out of its mounting.

Refitting

Reverse the removal procedure when refitting the spring assemblies.

NOTE.—Tighten the spring bolts when the normal working load has been applied to the springs.

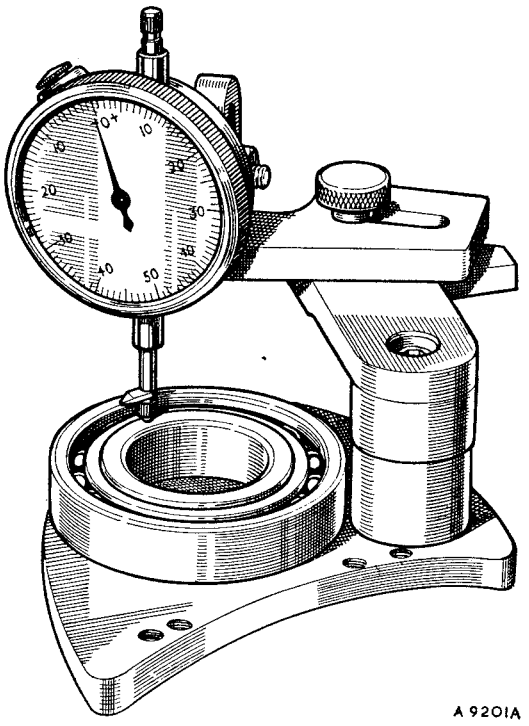


Fig. H.8

Checking differential bearing width with Service tools 18G 191 and 18G 191 A

SECTION Ha

THE REAR AXLE AND REAR SUSPENSION

The information given in this Section refers specifically to the Sprite (Mk. III and IV) and Midget (Mk. II and III) and must be used in conjunction with Section H

GENERAL DESCRIPTION

The rear axle is the same as that used on earlier cars. Suspension is by rubber-mounted semi-elliptic leaf springs and the shackles are fitted with rubber bushes of the flexing type.

Section Ha.1

AXLE UNIT

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. Remove the wheels.

Remove the down pipe, silencer, and exhaust pipe (see Section A).

Keeping the jack in this position, release each check strap at its axle location.

Release each damper arm from its connecting linkage. Disconnect the brake cable at the cable adjuster. Unscrew the nuts and remove the bolts securing the propeller shaft flange to the axle pinion flange (see Section G). Disconnect the hydraulic brake pipe at the main union just forward of the differential housing. Remove the 'U' bolt securing nuts. Ascertain that the weight of the axle is fully on the jack, unscrew and remove the rear shackle pins.

Refitting

Reverse the removal procedure.

NOTE.—Before tightening the spring bolts it is essential that the normal working load be applied to the springs so that the flexing rubber bushes are deflected to an equal extent in both directions during service. Failure to take this precaution will inevitably lead to early deterioration of the bushes.

Section Ha.2

SPRINGS

Removing

Raise the vehicle by placing a jack under the differential housing and support the body. Ascertain that the weight of the axle is fully on the jack and that the springs are in the fully unloaded position. Remove the wheels. From within the car remove the set screws securing the front anchor bracket to the rear of the body foot-well.

From beneath the car remove the two front bracket securing set screws. Remove the four 'U' bolt securing nuts and the damper anchorage plate. Remove the rear shackle nuts, pins, and plates and lift out the spring assembly.

Refitting

Remove the axle check strap to assist fitting the 'U' bolts. Tighten the spring bolt when the normal working load has been applied to the spring.

Reverse the removal procedure.

EDITOR'S NOTES

H. The Rear Axle and Rear Suspension

Hubs

Appropriate hub and gear pullers may be substituted if the suggested service tools are not available. The object is to remove or install the part in question without damaging it.

Careful use of a soft-faced hammer and appropriate drifts can be very often substituted for suggested driving tools.

Differential assembly, dismantling

Any disassembly of the differential unit involving the replacement of parts will require that the necessary clearances be reset. This job requires very specialized tools and the ability to use them in the manner indicated. Unless the proper equipment is available, it is advisable to leave this work to a properly equipped shop. An improperly set differential assembly will be noisy and will wear quickly.

An arbor press and suitable adaptors may be used in place of the recommended bearing removal and installation tools.

Pinion bearing preload

An inch-pound torque wrench may be used in place of Service tool 18G207 for measuring the pinion bearing preload.