SECTION H

THE REAR AXLE

GENERAL DESCRIPTION

The rear axle is of the three-quarter floating type. It is of unit construction and no repairs or adjustments, apart from those connected with the half-shafts and rear wheel bearings, brake-drums and shoe mechanism, can be carried out without removing the complete axle unit from the car.

The axle shafts are upset at their outer ends to form the attachment for the brake-drums and wheels. Each shaft is carried in a ball bearing located on the axle casing secured by a nut and locking washer.

Hypoid-type final reduction gears are used and the axle housing is divided close to its centre for assembly purposes, the pinion assembly being mounted in the right-hand half.

The bearings of the differential and crown wheel assembly are carried in recesses machined in the axle casing and cover. No inspection apertures are provided, **all adjustments are carried out by pre-measurement with special gauges.**

Adjustment of the position of both the crown wheel and the pinion in the axle is by distance-pieces, which are selected on initial assembly : there is no other provision for adjustment. The crown wheel and pinions are only supplied in pairs.

Section H.1

REMOVING A HALF-SHAFT

Jack up the axle and take off the hub cover and wheel.

Unscrew the two countersunk screws securing the drum to the hub ; pull off the drum.

Unscrew the countersunk screw securing the axle shaft flange to the hub ; tap the studs and withdraw the axle shaft. If tapping the studs lightly does not free the axle shaft, grip or prise the flange from the hub, taking care not to damage the gasket between axle flange and hub.

Section H.2

REMOVING A HUB

Remove the axle shaft as detailed in Section H.1.

Tap up the locking tab and unscrew the hub nut ; pull the hub and bearing assembly from the end of the axle tube with the special tool (see Section Q), 3 bolts and an axle plug which are available.

When reassembling, fit a new gasket between the axle driving flange and the hub if the old one was damaged in removal.

Section H.3

REMOVING A BACK-PLATE

Remove the half-shaft and hub as detailed in Sections H.1 and H.2. Detach the hand brake rod at the expander unit on the back-plate, and disconnect the hydraulic brake pipe union.

Fig. H.1.
A rear hub and back-plate.

Unscrew the nuts from the four bolts securing the back-plate to the axle tube flange and remove the back-plate complete with brake-shoe assembly.

Reassemble by reversing this sequence of operations.

Bleed the system and readjust the brake-shoes.

Section H.4

REMOVING AND REPLACING THE AXLE

Using jacks under the axle, raise the car and support it with blocks under the chassis side-members. Mark the two halves of the universal joint and disconnect : **do not remove the jacks until this has been done.**

Extract the split pins and clevis pins from the brake cables at the back-plates.

Unscrew the bolt and nut and set screw securing each end of the axle to the radius arm.

Remove the split pin and unscrew the anti-sway bar nut at the right-hand side ; move the axle to the right and withdraw the anti-sway bar.

Lift the axle and remove it rearwards from the ends of the radius arms.

Reassembly procedure is the reverse of the above.

Bleed the brakes after reassembling the axle.

Section H.5

IMPORTANT POINTS CONCERNING AXLE SERVICE

Dismantling the axle and the replacement of parts other than those dealt with above is not advised unless this is absolutely necessary, and unless the necessary checking gauges and a full range of distance-pieces and spacers from which to select the required new sizes are available. The fitting of a replacement axle, when possible, is advised.

Dismantling for examination and cleaning is permissible provided care is taken to refit the distance-pieces and spacers in exactly the same locations.

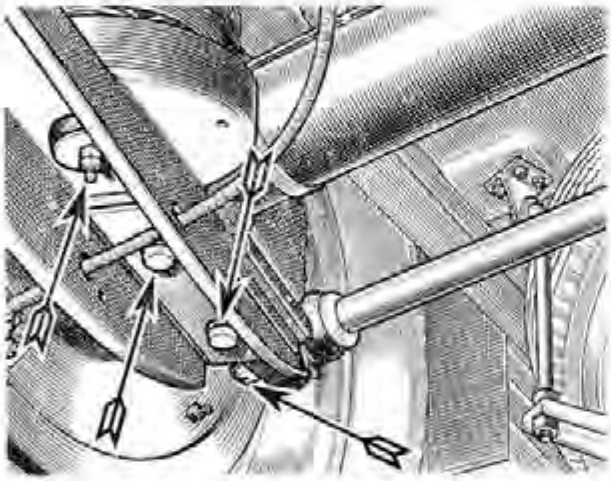


Fig. H.2

Arrows indicate (from L. to R.) the lower damper mounting; two axle securing bolts; and the anti-sway bar nut.

No adjustment is provided in the accepted sense. The crown wheel and pinion are set in their correct relation to each other by means of distance-pieces and spacers selected to provide the correct location of the components on initial assembly. Should the components be dismantled, their relative positions should be carefully observed and each part marked suitably so that it can be reassembled correctly in its original position.

Various components can be replaced by correctly combining the markings on the original components with those on the new parts in the manner detailed in subsequent sections.

It is important that the repairer be quite clear on this point before he undertakes the dismantling of the axle.

Spacers between the outer races of the differential bearings and the faces of the recesses machined in the axle casing and cover, control the position of the crown wheel in relation to the centre line of the pinion.

Adjustment of the pinion position is made by varying the thickness of the pinion washer, and that of the crown wheel by the varying thickness of the differential bearings spacers.

The following operations are possible without the use of special tools :—

(*a*) To replace a crown wheel and pinion with a pair carrying markings which are identical to those of the originals.

(*b*) To replace a crown wheel bearing alone, since these are of the controlled-width type, provided genuine **Riley** replacements are used.

(*c*) To replace an axle cover which carries markings identical to those of the original.

The following replacements are possible by calculations alone :—

(*d*) To replace the differential cage by one carrying a differential marking from that of the original.

(*e*) To replace an axle cover carrying different markings from those of the original.

The following replacements can be carried out by calculation and the use of special tools :—

(*f*) To replace an axle case carrying different markings from those of the original.

(*g*) To replace a crown wheel and pinion carrying different markings from those of the originals.

(*h*) To replace pinion shaft bearings.

Operations (*a*), (*b*) and (*c*) merely call for the fitting of the new parts in the positions occupied by the old. The remaining operations entail special precautions and are detailed subsequently.

The axle or half-shafts, rear hub bearings, brake-drums and shoe mechanism can all be dismantled and replaced with the axle in position on the car.

Section H.6

DISMANTLING THE AXLE AND REMOVING THE DIFFERENTIAL ASSEMBLY

Remove the axle from the car as detailed in Section H.4.

To dismantle the axle, first remove the hub and brake plate assemblies as in Sections H.1, H.2 and H.3.

Remove the series of bolts joining the axle casing and cover together and carefully part them, taking care to see that both halves of the axle are suitably supported to avoid damage to the differential assembly.

The withdrawal of the axle cover from the casing releases the differential and crown wheel assembly, which can now be withdrawn.

Note that spacers are fitted between the differential bearings and the bearing housings and that they are important as they control the position of the differential assembly in the axle.

Fig. H.3.
The differential and crown wheel assembly with the ball races in position on the differential cage. The bolt locking the shaft for the differential pinions is clearly seen at the lower right-hand corner of the cage.

It is essential that they be replaced in their original locations on assembly, so make a note of the positions from which they are removed.

Note.—*All original spacers are marked o/s and n/s.*

It must also be noted that the axle casing and cover are marked on the surface of one of the outside webs, or tubes with one of the following figures :—Zero, 1, 2, 3, 4, 5, 6, all being positive.

Section H.7

DISMANTLING THE DIFFERENTIAL AND CROWN WHEEL ASSEMBLY

When the differential assembly has been removed from the axle casing, as detailed in Section H.6, it is dismantled by bending back the locking washer tab of the bolt locating the differential pinion shaft, withdrawing the bolt and removing the shaft.

The differential pinions can now be removed from the differential cage by swinging them round with their dished thrust plates until they register with the openings in the differential cage, through which they can be removed together with their distance-piece.

The differential cage gears can then be withdrawn from inside the differential through the openings, together with their thrust washers.

The crown wheel is attached to the differential cage by bolts locked by lock plates. Bending back the tabs of the lock plates and removing the bolts releases the crown wheel from the differential cage.

Note.—*All crown wheels are marked on the back face with one of the following figures : +2, +1, Zero (or no marking), −1, −2.*

Section H.8

EXAMINING PARTS FOR WEAR

Before examination all parts should be cleaned thoroughly.

The crown wheel bearings are of the ball type and should be renewed if necessary. They are controlled dimensionally and must be replaced only by **genuine Riley parts.** Failure to observe this instruction will only lead to complications later.

The pinion shaft bearings are of the taper roller type and should be renewed, as a set, complete with distance-piece, if they do not run smoothly on their rollers.

The crown wheel and pinion are lapped in together and **it is essential, therefore, that crown wheels and pinions be stored and used in pairs as originally supplied, otherwise satisfactory results cannot be obtained.**

If the inner races of the roller bearings are loose on the pinion, check with a new set of bearings, and if these are also loose on the pinion shaft it is an indication that the shaft has worn : a new crown wheel and pinion should be fitted.

Fractures in the teeth, hollows or any roughness on the surface of the teeth will render both crown wheel and pinion unserviceable.

The axle casing or axle cover (or both) should be renewed if new replacement bearings are not a light drive fit in the bores machined in their housings.

Any looseness of the bearings should be overcome by renewing the bearing, the axle cover or the axle casing.

The cage should be replaced if there is excessive wear in the bores in which the differential gears revolve.

The oil seals should be renewed if they are not a press fit in the pinion housing or wheel bearing housing, or if their central portion is loose in the outer metal casing, or if the spring is fractured or broken.

The differential gears, pinions and pins should be renewed if there is any doubt about their condition, although more latitude in wear is permissible in these parts without detrimental effects than is the case with the crown wheel and pinion.

Section H.9

TO REPLACE A DIFFERENTIAL CAGE

Selecting an axle casing spacer

All differential cages are stamped with two letters—"C" and "D"—together with a figure. The prefix "C" indicates the dimension over the differential bearings, and the dimensional range is from 0 in. to ·012 in. "D" indicates the dimension from the crown wheel back face to the outside face of the right-hand bearing outer race, and the range is from 0 in. to +·006 in.

Differential cages can be interchanged by applying the following procedure :—

Balance the "D" dimensions of the two cages and from the result select differential bearing spacers which will produce the same final location of the crown wheel on assembly.

Fig. H.4.
The marking of the differential cage to indicate its assembly dimensions is clearly shown in this illustration, which bears a "C" dimension of ·007 and a "D" dimension of ·003.

Example (1) If the "D" dimension of the old cage was ·005 in. and the "D" dimension on the new cage is ·002 in., giving a difference of +·003 in., then this difference must be **added** to the old spacer thickness.

That is to say, if the old spacer is marked ·503 in. the new spacer must be ·506 in. thick.

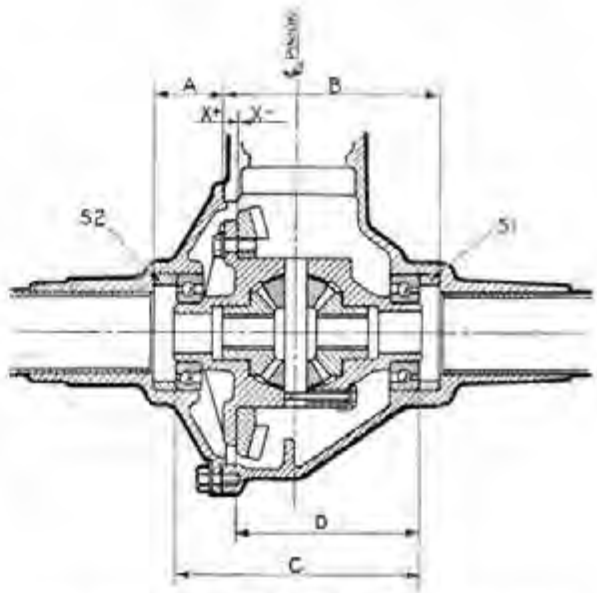
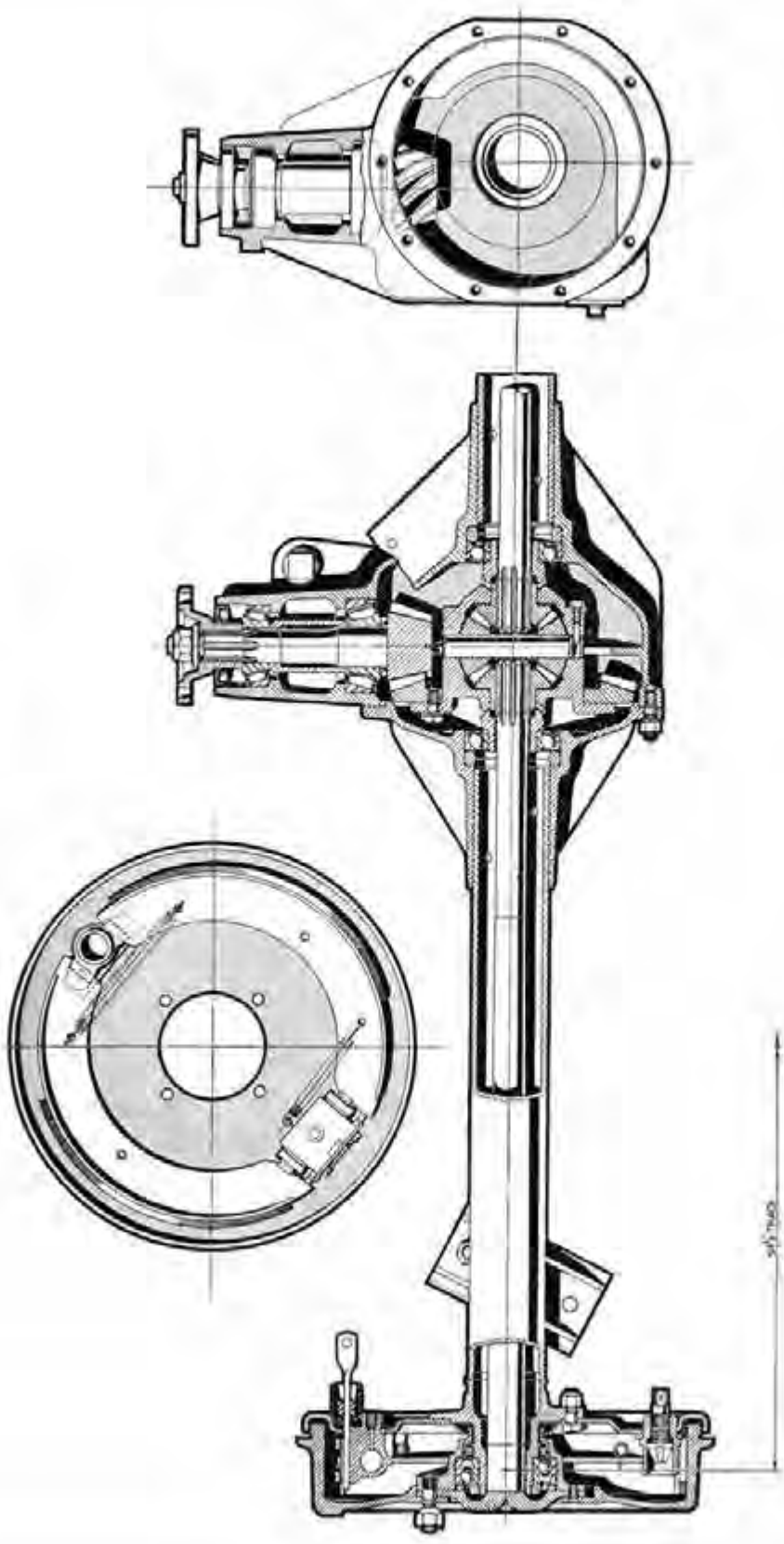


Fig. H.5.
This diagram indicates the significance of the "A," "B," "C" and "D" dimensions.

THE REAR AXLE



Example (2) If the "D" dimension of the old cage was ·001 in. and the "D" dimension on the new cage is ·005 in., giving a difference of —·004 in., then this difference must be **subtracted** from the original spacer thickness.
That is to say, if the old spacer was ·509 in. thick, then the new spacer must be ·505 in. thick.

Selecting an axle cover spacer

In this case subtract the "D" dimension from the "C" dimension on both the old and new differential cages.

If the resultant of the dimensions on the new cage is greater than that on the old cage, the new spacer for the axle cover is less than the old one by the difference and vice versa.

Example (1) Old : "C" ·006 in.—"D" ·005 in. = ·001 in.
New : "C" ·007 in.—"D" ·002 in. = ·005 in.
The resultant with the new cage is the greater by ·004 in., therefore the new spacer should be ·004 in. **less** in thickness than the old one.

Example (2) Old : "C" ·022 in.—"D" ·001 in. = ·001 in.
New : "C" ·001 in.—"D" ·005 in. = —·004 in.
The old resultant is here the greater by ·005 in., therefore the new spacer must be ·005 in. thicker than the old one.

Section H.10

ASSEMBLING DIFFERENTIAL AND CROWN WHEEL

The differential is assembled by first inserting the differential gears inside the differential cage with their thrust washers in position.

Note.—*When new washers are fitted it is necessary to see that they are properly bedded in or it may be difficult to insert the pinions.*

The differential pinions are next inserted through the opening of the cage with their distance-pieces and thrust washers. The pinions are then rotated in the cage until they register with the holes in the cage for the shaft.

The pinion spindle, which should be a light push-fit in the cage, is then inserted, taking care to line up the locking bolt holes.

Note.—*The slot in the shaft can be used as a guide.*

Fit the locking bolt and turn up the tab of its locking washer.

Fit the crown wheel to the differential cage after making sure that the mating surfaces are perfectly clean and the edges free from burrs.

Check the crown wheel for truth by spinning the assembly on a roller fixture with a dial gauge registering against the outer edge of the crown wheel. The maximum permissible error of alignment is ·001 in. (·025 mm.), and if the figure registered is in excess of this the crown wheel should be removed from the differential cage and the flange of the cage checked for truth. If necessary, fit a replacement cage.

Provided the flange is true within the permissible error, clean all parts carefully and reassemble the crown wheel to the cage in a different position to that in which it was first assembled and checked, then re-check. This process should be repeated several times before finally deciding to discard the crown wheel and pinion.

The differential ball races can now be pressed on.

Section H.11

TO REPLACE A PINION

(*a*) The old pinion in a new axle casing.
(*b*) New pinion and new matched set of bearings and distance-piece in an old casing.
(*c*) New pinion and old bearings and distance-piece in an old casing.
(*d*) Old pinion and new matched set of bearings and distance-piece in an old casing.

In all cases the pinion must be set accurately in the axle casing, remembering that the roller races and their distance-pieces are supplied in sets giving the correct amount of pre-load on assembly. They can, therefore, only be replaced as "sets" and not individually.

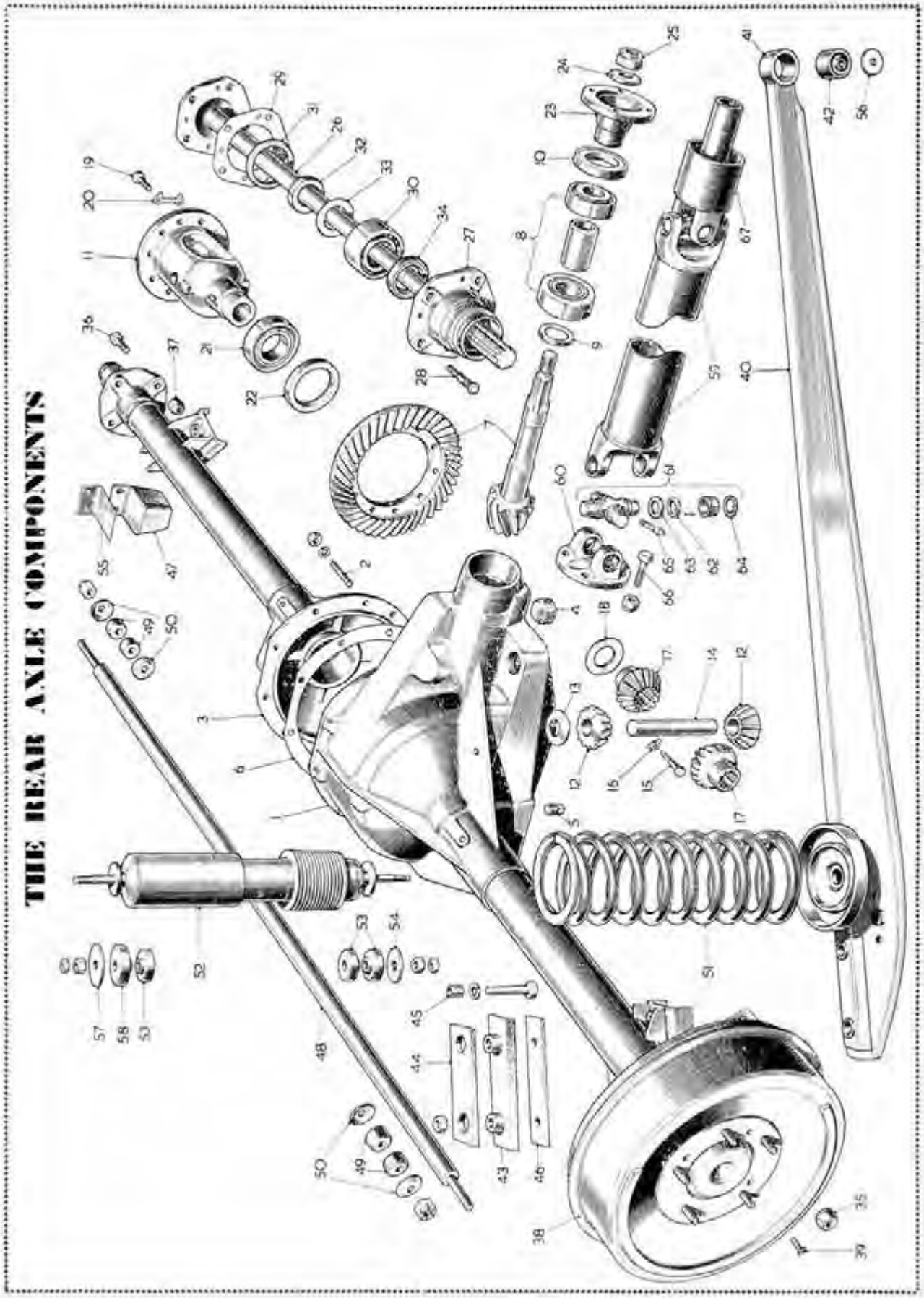
The pinions may be marked on their heads with one of the following figures :—

A ringed figure +2, +1, Zero (or no marking), —1, —2, and possibly an unringed figure —1 or —2.

The pinion washer controls the position of the pinion in relation to the axis of the crown wheel, and it is fitted between the head of the pinion and its rear bearing.

Adjustment of the pinion position is made by varying the thickness of the pinion washer. These are available in a range of thickness varying by ·001 in. (·025 mm.) and are marked on spares replacements only.

THE REAR AXLE COMPONENTS



KEY TO THE REAR AXLE COMPONENTS

No.	Description
1.	Tube and centre case assembly—rear axle—R/H.
2.	Stud—axle case to cover.
3.	Tube and cover assembly—rear axle—L/H.
4.	Plug—oil filler.
5.	Plug—drain.
6.	Joint (gasket)—axle case and cover.
7.	Crown wheel and pinion.
8.	Bearing assembly—pinion.
9.	Washer—distance—pinion rear.
10.	Seal—oil—pinion front.
11.	Cage—differential.
12.	Pinion—differential.
13.	Washer—differential pinion.
14.	Pin—differential pinion.
15.	Bolt—locking—differential pinion pin.
16.	Tab washer—differential pinion pin locking bolt.
17.	Gear—differential.
18.	Washer—differential gear.
19.	Bolt—crown wheel.
20.	Tab—locking—crown wheel bolt.
21.	Bearing—differential.
22.	Collar—distance—differential.
23.	Flange—universal joint.
24.	Washer—pinion nut.
25.	Nut—pinion.
26.	Shaft—rear axle.
27.	Hub assembly—rear.
28.	Stud—wheel.
29.	Joint—gasket—shaft to hub.
30.	Bearing—hub.
31.	Distance-piece—hub bearing.
32.	Nut—hub bearing.
33.	Washer—locking hub bearing.
34.	Seal—oil—hub.
35.	Nut—wheel.
36.	Bolt—brake backplate to axle tube.
37.	Nut—brake backplate to axle tube.
38.	Drum—brake.
39.	Screw—brake-drum and axle shaft.
40.	Arm—radius assembly—R/H.
41.	Housing—radius arm bearing.
42.	Bush—radius arm pivot.
43.	Rubber—bottom.
44.	Rubber—top.
45.	Distance-piece.
46.	Plate clamping.
47.	Buffer—rear.
48.	Rod assembly—anti-sway bar.
49.	Bush—anti-sway bar.
50.	Washer—cup—anti-sway bar.
51.	Spring—rear.
52.	Shock absorber—rear.
53.	Bush—stem fixing.
54.	Washer—shock absorber bottom.
55.	Packing—rubber buffer.
56.	Washer—radius arm pivot.
57.	Washer—top—shock absorber.
58.	Bush—top—shock absorber.
59.	Tubular shaft.
60.	Flange—yoke.
61.	Journal and needle kit assembly.
62.	Gasket—journal.
63.	Retainer—journal gasket.
64.	Circlip—journal.
65.	Grease nipple.
66.	Bolt—propeller shaft.
67.	Sleeve yoke—assembly.

The pinion is fitted to the axle in the following way :—

Fit the pinion bearing outer races in the pinion housing, then assemble the rear pinion bearing inner race to the special dummy pinion spindle (special tool No. 68892), and place in position in the housing, inserting it through the cover opening in the axle casing.

Fit the front bearing inner race.*

Fit the spindle nut and tighten it up to give the correct pre-load torsional resistance of 14 to 16 lb./in. (·161 to ·184 kg./m.) to the bearings.

Fig. H.6.
The marking of the pinion to show its dimension for fitting is indicated by the arrow.

Rotate the spindle eight or ten times to seat the bearings.

Fit the checking fixture (special tool No. 68892) in the axle cover opening and make sure that the locating arm makes firm contact with the side of the dummy spindle head. (See Fig. H.11.)

This leaves a gap between the dummy pinion head and the checking anvil of the fixture, and this is the actual thickness of the pinion washer required for a standard pinion or one that has no marking.

Select a washer which will just slide between these faces and fit it behind the pinion head when re-assembling.

To assist manufacturing conditions it is occasionally necessary that a pinion be assembled away from the standard position. If this is so the variation is marked on the pinion head in a ring such as (+2), the sign + meaning that the centres are increased by ·002 in. Correction has to be made for this, and when the figure is + (plus) the amount must be **taken from** the washer thickness, and if the figure is — (minus), then the amount has to be **added** to the washer thickness.

Example (*a*) A washer fitting the gap of the dummy pinion with a marking of ·127 must be replaced by a washer having the marking ·129 when refitting a pinion with the marking —2 or —·002.

Example (*b*) A washer fitting the gap of the dummy pinion bearing the marking ·127 must be replaced by a washer marked ·125 when the pinion is marked +2 or +·002 on its head.

A plain or unringed figure may be marked on the pinion head in addition to a ringed figure, but this is only an indication of the variation of the pinion head thickness from standard and is always minus. It has no bearing on the pinion setting.

When the correct spacing washer has been decided upon, the actual pinion assembly can take place, **but the importance of making the measurements correctly must be appreciated, since it is impossible to check the adjustment when the axle is assembled.**

The actual pinion assembly is carried out by threading the selected pinion washer on to the pinion shaft, bevelled side against the pinion, and pressing on the rear roller bearing inner race with its largest diameter against the washer. This sub-assembly is then inserted into the casing through the axle cover opening and located in position in the pinion housing of the axle casing.

The distance-piece and forward roller bearing inner race are next passed on to the pinion shaft, with the largest diameter of the inner race facing forward. These components are followed by the pinion flange with its retaining washer and nut. Tighten up the nut firmly.

Rotate the pinion to ascertain that the correct degree of pre-load is present. The pinion should present the same resistance to rotation as was evident when using the special dummy spindle.

If the pre-load is correct, undo the nut and remove the washer and flange ; fit the oil seal (sharp edge of the bore towards the bearing), replace the pinion flange, retaining washer and nut.

Finally tighten up the nut and fit the split pin.

*NOTE.—The bearing spacer is omitted, because the correct pre-load can only be obtained with the bearing spacer in position if the universal joint flange is locked up tight. This is due to the calculated compression of the bearing spacer under this locking load.

Section H.12

TO FIT A NEW AXLE CASING

When a new axle case is being fitted it is necessary to refit the pinion as detailed in Section H.11, and to select a new distance collar for the differential bearing in the manner here indicated.

Compensation for variations in the depth of the differential bearing bores is made by taking note of the markings on the old and new axle casings. For example :—

If the old casing is +·002 in. and the new one +·004 in., the positive difference ·002 in. is added to the existing differential bearing distance collar. That

Fig. H.7.
The pinion and pinion spacing washer. Note that the bevelled side of the washer bore should be against the pinion.

Fig. H.8.
Inserting the special dummy pinion shaft into the axle casing pinion housing.

Fig. H.9.
The dummy pinion shaft in position in the housing. The ground head of the dummy shaft forms the datum for establishing the correct thickness for the spacing washer.

is to say, if the old distance collar is marked ·505 in., then the required new distance collar is ·507 in.

Similarly, if the old casing is +·005 in. and the new one +·001 in., the resulting difference is negative

Fig. H.10.

(Above.) When the locating tongue of the special checking fixture is in contact with the head of the dummy pinion spindle the space between the head of the spindle and the anvil of the checking fixture determines the thickness of the pinion spacing washer.

Fig. H.11.

(Right.) The special checking fixture for determining the correct spacing washer thickness in position in the axle casing. Note that its locating tongue is making contact with the head of the dummy pinion spindle.

—·004 in. and must be subtracted from the bearing distance collar, i.e. if the old distance collar is ·509 in., the required new distance collar is ·505 in.

The distance collars are manufactured in steps of ·001 in., and measurements should therefore be made to the nearest thousandth of an inch.

Section H.13

TO FIT A NEW AXLE HOUSING COVER

When a new axle cover is being fitted it is not necessary to make any adjustment to the pinion.

Compensation must, however, be made for variations in the depth of the differential bearing housing in the same manner as that outlined for the axle casing in Section H.10, and the same calculations for the selection of the required new distance collar for the differential bearings involved.

Section H.14

TO REPLACE A CROWN WHEEL AND PINION HAVING MARKINGS DIFFERENT FROM THE ORIGINAL

Note.—The crown wheels and pinions are manufactured in matched pairs and are not replaceable individually but only in pairs. The necessity for replacing either a pinion or crown wheel therefore necessitates the fitting of a new pair of components, and the operations of fitting a new pinion and a new crown wheel are involved.

A crown wheel is marked on its back face with one of the following markings: +2, +1, Zero (or no marking), —1 and —2.

Read off the marking from the back face of the old crown wheel and note the difference between this and the marking on the new crown wheel.

For example If the old one is marked −1 (−·001 in.) and the new one +2 (·002 in.), the dimensional difference is +·003 in. To reassemble correctly it is thus necessary to fit a new distance collar in the axle casing which is ·003 in. **thicker** than the old one, and a new one ·003 in. **thinner** than the old one in the axle cover.

Note that the **combined** thicknesses of these distance collars must remain the same.

The setting of the pinion is carried out as indicated in Section H.11.

that a genuine Riley replacement is used. (Thickness of gasket ·005 in. (·125 mm.) when compressed.)

The differential assembly should be assembled in the axle casing, making sure that its bearing in the axle casing is right home in its housing and that a gasket is in position on the joint surface. The axle cover is then placed in position over the axle casing and carefully pushed home till the joint faces are in contact.

The ten nuts fastening the halves of the axle housing together are then screwed lightly in position and finally tightened up a quarter of a turn at a time in

Fig. H.12.
The location of the pinion bearing spacer in the axle casing is indicated by the arrow.

Section H.15

REASSEMBLING THE AXLE

Provided that no replacement parts are fitted, the assembly of the axle is quite straightforward if proper note is taken of the positions of various distance-pieces, washers and spacers on dismantling, and they are replaced in exactly their original locations.

Assembly of the differential and crown wheel is described in detail in Section H.10.

Assembly of the pinion housing is given in detail in Section H.11.

The assembly of the axle cover to the axle casing is carried out with a gasket between their joint surfaces. The calculations made for adjustment provide for the thickness of the gasket, but it is important

a diagonal sequence to ensure even tightening and absence of distortion.

Reassemble and replace the half-shaft, hub and brake back-plate assemblies as detailed in Sections H.1, H.2 and H.3.

Make sure that the pinion differential and axle half-shafts are free from undue restriction before replacing the axle in the car.

Section H.16

REFITTING THE AXLE TO THE CAR

Replacing the assembled axle in position on the car is a direct reversal of the removal procedure detailed in Section H.4.

Bleed the brakes as detailed in Section M.3.