SECTION 6

REAR AXLE AND REAR SUSPENSION

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SERVICE BULLETIN

RECORD SHEET

No.	Subject	Date	Signature
1	"Newton and Bennett" shock absorbers.	27. 4. 54.	Embodied
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REAR AXLE AND REAR SUSPENSION

REAR AXLE

DESCRIPTION

The rear axle is a semi-floating type with spiral bevel drive, the axle casing being of "banjo" construction. A drain plug is located at the bottom of the casing and a breather assembly is fitted to the top to the left of the banjo. Both ends of the casing have an integral flange to which the brake backplates and the hub bearing housings are spigoted and bolted.

The rear cover is welded to the casing and locations for the suspension arms are welded inboard of the wheel assemblies. An oil filler and level plug is screwed into the cover.

A single-row ball race and a spring-lip type oil seal are located within each bearing housing, the assembly being secured against the inside of the half shaft flange by a tabwashered nut. The half shafts are splined on their inner ends, the outer ends having integral flanges to accept the brake drums and road wheels.

The differential gearbox assembly is secured to the front of the axle casing.

Suspension is controlled by transverse radius arms and stabilised by the triangular attachment unit pivotted laterally to the top of the chassis frame rear cross member, see Fig.1. Springing is by means of longitudinal torsion bars, damping being effected by hydraulic shock absorbers.

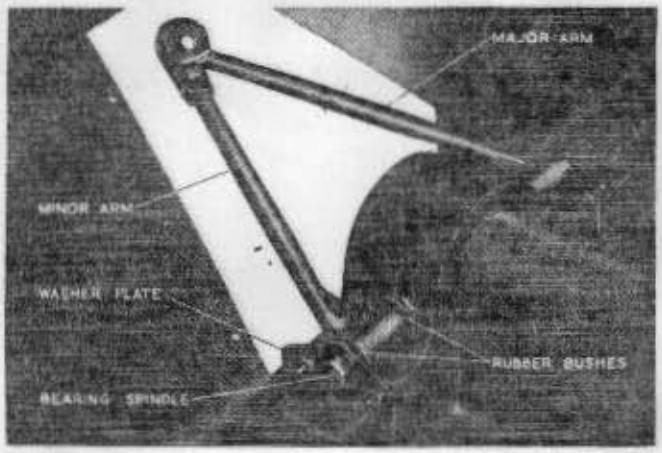

Fig.1. Attachment Unit.

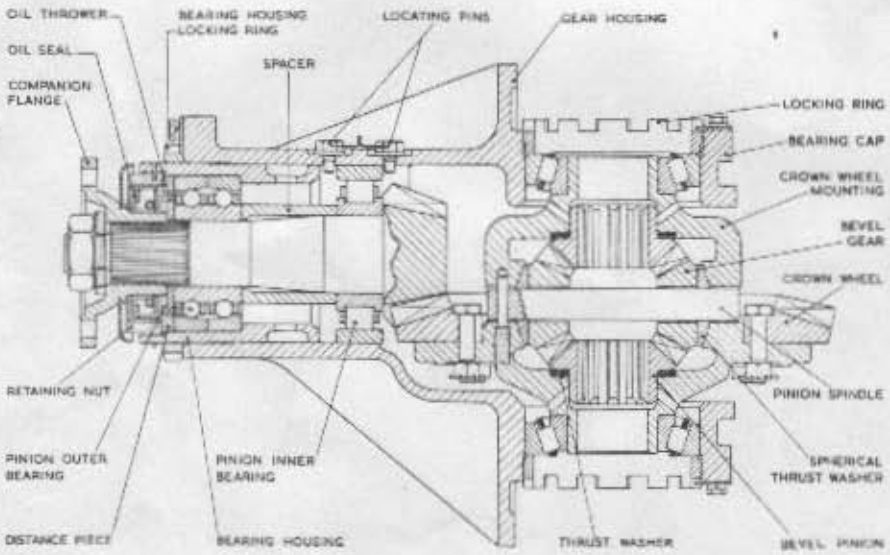

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Fig. 2. Sectioned view of Differential Gearbox (with screwed pinion adjustment).

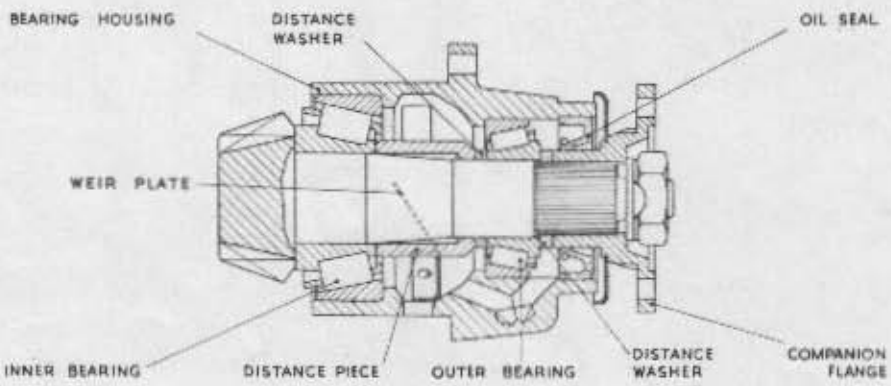


Fig. 3. Sectioned view of Driving Pinion Group (shimmed pinion adjustment)

Two types of differential gearbox have been manufactured; they differ only in the method of mounting and adjusting the driving pinion. Fig.2 illustrates the screwed adjustment type which is fitted to all type 400 and 402 cars and to approximately the first 150 type 401 cars. It will be noted that the driving pinion inner bearing outer face is located in the gear housing by screwed locating pins. The inner race and the roller and cage assembly of this bearing together with the spacer, outer bearing, oil thrower and companion flange assembly are secured to the pinion by a special washer and tabwashered nut. The whole pinion assembly is retained in an adjustable bearing housing by a retaining nut which is locked by a circlip. The retaining nut also houses an oil seal which embraces the spigot of the companion flange. The bearing housing assembly is screwed into the gear housing where it is retained by a locking ring.

The crown wheel is secured to the crown wheel mounting by twelve bolts, nuts and split pins. Apertures in the mounting provide for insertion or removal of the differential pinions and gears. A bronze thrust washer for each gear is located in a recess in the mounting, while semi-spherical bronze washers take the thrust of the pinions which are freely mounted on the pinion spindle. The spindle is drilled at one end to receive a locking pin which is screwed into the crown wheel mounting and locked with a split pin.

The differential assembly is supported by a taper roller bearing located in a split housing on either side of the differential gear housing, side adjustment being provided by locking rings, which are locked by locking plates secured in position by bolts and spring washers.

The later type of differential gearbox assembly has a re-designed gear housing and bearing housing. The differential gear assembly is identical to the

earlier type but the pinion assembly is carried in a flanged bearing housing secured to the gear housing by studs, nuts and washers, see Fig.3. The pinion is mounted in two taper roller bearings which, together with the distance piece, distance washers and companion flange are secured with a tabwashered nut. An oil seal closes the outer end of the bearing housing. Pinion adjustment is achieved by means of a laminated adjusting washer fitted at the joint face of the gear and bearing housings.

GENERAL DATA

Type...	Spiral bevel, semi-floating.
Axle casing..	Banjo type.
Differential	Two-star bevel.
Crown wheel..	39 teeth.
Pinion	10 teeth. Integral with shaft.
Ratio..	3.90
Bearings	
Crown wheel mounting..	Two- - taper roller.
Pinion - outer..	Taper roller)) adjusted by shims.
Pinion - inner..	Taper roller)
Pinion - outer..	Double-row semi-) thrust ball) Screwed pinion) adjustment.
Pinion - inner..	Single-row roller)
Hubs	Single-row ball.
Pre-loading..	Differential bearings - one castellation on locking ring (4inch pounds) Driving pinion bearings - later type (8 to 10 inch pounds).
Backlash (crown wheel and pinion)	0.006in.

End-float of differential bevel gear	Nil.
End-float of differential bevel pinion	Nil.
End-float of driving pinion	Nil.
Crown wheel "run out"	0.002in. maximum.
Oil seals	
Hubs	Spring-loaded lip-type.
Pinion	Spring-loaded lip-type.
Oil capacity	4 pints initial filling; 3 pints for drain and refill.
Filler plug location	Rear cover.
Drain plug location	Bottom of axle casing.

REMOVING AND REFITTING HALF SHAFTS

1. Remove the relevant road wheel and brake drum, see Section 10.

2. From behind the brake backplate, release the tabwashers and remove the six special 5/16in. B.S.F. bolts. The brake rod spring anchor plate is secured by one of the bolts; it is important to note its position so that it is refitted correctly. Refit one of the bolts temporarily to secure the backplate.

   Note :- This anchor plate is not fitted to type 401 cars of later manufacture.

3. Withdraw the half shaft complete with the bearing housing.

To refit the shafts, proceed as follows :-

1. Check that the gasket is in good condition and is in position on the backplate. Remove the bolt fitted temporarily to secure the backplate.

2. Refit the shaft and secure the bearing housing to the brake backplate, using new tabwashers. Make sure that the brake rod anchor plate (if fitted) is refitted to its previous position.

3. Refit the brake drum and wheel, see Section 10.

REPLACING HALF SHAFT BEARINGS OR SEALS

1. Remove the relevant half shaft as described previously.

2. Bend back the lock washer fitted to the recess of the bearing housing and remove the bearing retaining nut with the spanner TFN.5022, see Fig.5.

Note :- The nut fitted to the left-hand shaft has a left-hand thread.

3. Withdraw the bearing assembly from the shaft.

Note :- The remains of a broken half shaft cannot be pushed out from the other side of the axle casing since the differential pinion spindle crosses over the axle centre line.

4. Remove the external wire lock ring from the bearing housing, unscrew and remove the retaining ring with the spanner TFN. 5023 and withdraw the oil seal; if necessary, press it from the retaining ring. It is advisable to discard the seal.

Note :- The left-hand retaining ring has a left-hand thread.

5. If necessary, press the ball race from the bearing housing.

The following is the sequence of operations for re-assembling the bearing housing :-

1. Inspect the bearing location shoulder in the housing and, if necessary, remove any burrs then press the bearing right home in the housing. During the operation, take care to avoid damage to the bearing.

2. It is advisable to fit a new oil seal to the retaining ring. Press the seal into the retaining ring, taking great care to keep it square with the bore. Never apply the load to the rear

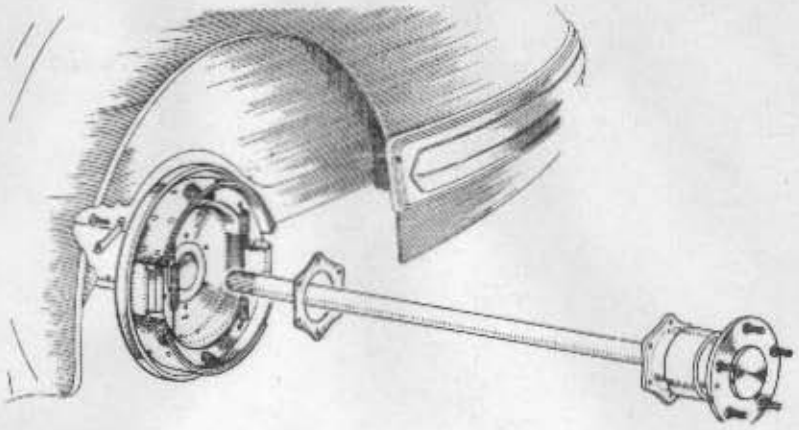


Fig. 4. Withdrawing Half Shaft.

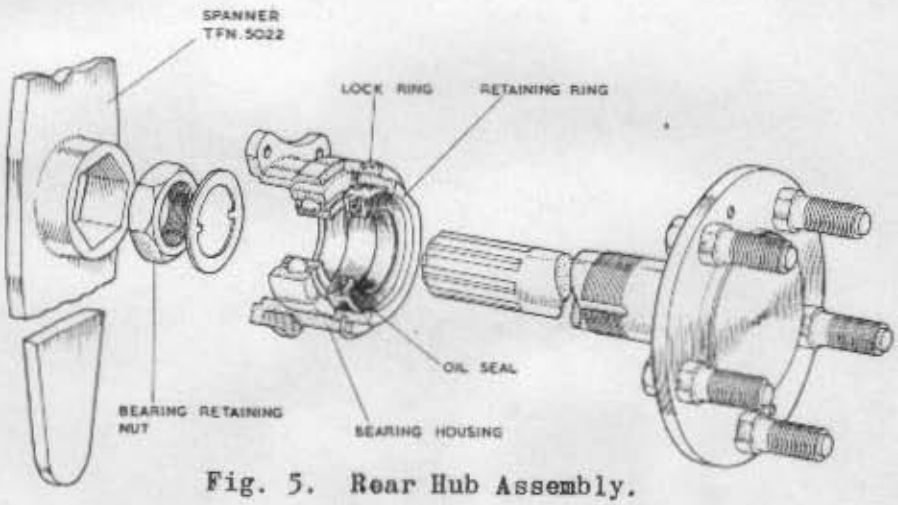


Fig. 5. Rear Hub Assembly.

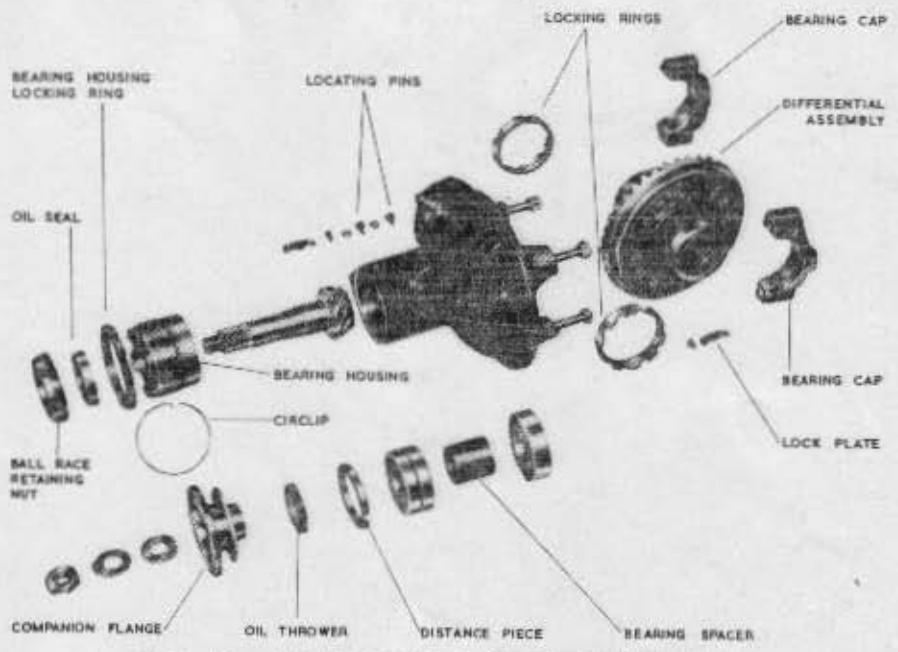


Fig. 6. Differential Gearbox Assembly (Screwed adjustment type).

face or "dishing" may occur. Screw the assembled seal and retaining ring into the housing; tighten with the special spanner TFN.5023. Replace the wire lock ring. If the holes in the housing and retaining ring do not register, drill a new hole half-way into the retaining ring.

3. Fit the housing assembly to the half shaft, ensuring that the bearing face is tight against the shoulder of the shaft.

4. Fit the retaining nut lock washer over the shaft and screw up and tighten the retaining nut. Bend up two sides of the lock washer using the tool TFN.5024.

5. Fit the half shaft to the axle as described previously.

REPLACING DRIVING PINION OIL SEAL
Screwed adjustment type

If the oil seal becomes faulty proceed as follows :-

1. From below the car, disconnect the rear universal joint at the companion flange.

2. Bend up the tab of the locking washer and remove the companion flange retaining nut, the tabwasher, the special washer and withdraw the companion flange.

Note :- Before the companion flange is removed, check for any up and down movement in the pinion shaft. If any play is present, remove the differential unit and dismantle it with a view to examination of the driving pinion bearings and replacement, if necessary, see page 14.

3. Remove the wire circlip from in front of the adjustable housing locking ring.

4. Unscrew and remove the ball race retaining nut.

5. Remove the oil seal from inside the ball race retaining nut and press in a new oil seal, lip upwards.

6. Re-assemble all components, ensuring finally that the tongue of the circlip is entered in its locating hole.

Shimmed adjustment type

To replace a pinion oil seal on this type of differential gear, proceed as follows :-

1. From below the car, disconnect the rear universal joint at the companion flange. Check for any up and down movement in the shaft. If any play is present, remove the differential unit and dismantle it with a view to examination of the driving pinion bearings and replacement, if necessary, see page 20.

2. If the foregoing check is satisfactory, bend up the tab of the locking washer and remove the companion flange retaining nut, the tabwasher, the special washer and withdraw the companion flange.

3. Remove the oil seal from the bore of the pinion housing and refit a new one, lip inwards.

4. Re-assemble all components.

REMOVING AND REFITTING DIFFERENTIAL GEARBOX

The differential gearbox must be withdrawn from the front of the axle casing and necessitates the partial withdrawal of both half shafts. The sequence of operations is as follows :-

1. Drain the rear axle, jack-up the car and provide support under the chassis frame. Take care to avoid damage to the petrol and hydraulic system pipes. Remove both rear road wheels.

2. Withdraw the half shafts with their respective bearing assemblies as described previously.

3. Retain the brake backplates and the main flange joints by re-fitting two diametrally opposite bolts in each axle casing flange and temporarily fit 5/16in. B.S.F. nuts.

4. Place a jack beneath the pinion bearing housing of the differential and raise the axle slightly. Release the tabwasher and remove the nut securing the attachment unit to the ball joint assembly; manipulate the jack until the axle position allows the attachment unit to be pushed clear of the ball joint.

5. Disconnect the universal joint and push the propeller shaft forward towards the gearbox.

6. Release the tabwashers, remove the nuts securing the differential gearbox assembly to the axle casing and draw it forward from the axle.

Adopt the following sequence to refit the differential gearbox assembly to the axle.

1. Clean the joint faces on the axle casing and the gear housing.

2. Fit a new gasket, using jointing compound on both faces.

3. Refit the assembly to the axle casing, replace the tabwashers and nuts, tighten evenly, and lock.

4. Connect the attachment unit to the ball joint on top of the differential gearbox.

5. Reconnect the universal joint.

6. Remove the temporary retaining nuts from the brake backplate flanges and refit the half shafts, brake drums and road wheels as described previously.

DISMANTLING AND RE-ASSEMBLING DIFFERENTIAL GEARBOX
Screwed adjustment type

With the differential gearbox removed from the rear axle casing, the dismantling sequence is as follows :-

1. If not already marked, identify each bearing cap and locking ring with position markings, then remove the lock plates from each crown wheel mounting bearing locking ring.

2. Remove the locking wire from the bearing cap nuts.

3. Remove the bearing cap nuts from each side and withdraw each bearing cap, taking care that the locking rings and outer races of the bearings are not dropped in the process.

4. Identify both bearing outer races by means of labels.

5. Withdraw the differential assembly.

To dismantle the pinion group, continue as follows :-

1. Remove the lock plate from the bearing housing locking ring and loosen the ring.

2. Unscrew the bearing housing until clear of the threads in the gear housing and withdraw the complete pinion assembly.

   Note :- The outer race of the inner bearing will remain in the gear housing.

3. Hold the companion flange in a suitable fixture with pins or bolts through the holes, bend down the tabwasher and remove the companion flange nut.

4. Extract the companion flange together with the tabwasher and the special washer behind it.

5. Remove the wire circlip from the threaded part of the bearing housing and unscrew the locking ring.

6. Unscrew and remove the ball bearing retaining nut together with the oil seal; press the oil seal from the nut.

7. Remove the oil thrower and the distance piece which surrounds it.

8. Press the pinion from the double-row ball bearing, which will also release the bearing spacer.

   Note :- Some bearings have a split outer race.

9. Remove the inner race and roller assembly from the pinion.

10. Extract the locking wire and remove the two hexagon-headed locating pins from the gear housing.

    Note :- These pins are located one on each side of the roller bearing outer race.

11. Press the roller bearing outer race from the gear housing.

12. Press the double-row bearing from the adjustable bearing housing.

Dismantle the differential assembly as follows :-

1. Remove the split pins from the nuts securing the crown wheel to the crown wheel mounting, then loosen each nut evenly, a little at a time, and finally remove them.

2. Remove the bolts and separate the crown wheel and mounting.

3. Remove the split pin retaining the pinion spindle lock pin and unscrew the pin. Drift out the pinion spindle.

4. Manoeuvre each pinion until opposite the large apertures in the mounting and withdraw them together with their respective spherical thrust washers. Label the pinions and thrust washers to record their correct relative positions.

5. Push each bevel gear in turn to the centre of the casing and remove through the larger aperture.

Note :- The bronze thrust washer behind each bevel gear is pressed into its recess and therefore, should not be displaced unless necessary. If due to wear they must be replaced; they can be driven out by inserting a small punch in the holes provided behind the washers for this purpose.

6. If the taper roller bearings are unserviceable, remove them from the crown wheel mounting.

Make sure that all components are scrupulously clean and that all oil passages are unobstructed. It is preferable to use petrol to clean these components finally, since this will facilitate the subsequent assembly checks. Commence re-assembly of the differential group in the following sequence.

1. Insert both bevel gears into position.

2. Manoeuvre both bevel pinions (with their respective spherical thrust washers) into position and insert the pinion spindle. Make sure that the spindle is the correct way round, i.e. with the hole to register with the lock pin location.

3. Ensure that all bevels are free in their respective bearings, and that there is no end-float between each pinion and gear and the respective thrust washers. All the bevels must be in "tight

mesh" so that it should just be possible to rotate them by inserting one half shaft and turning it with a bar giving a 6inch radius. If the pinions are too free, replacement thrust washers must be fitted by selective assembly. A selection of washers is available in the following thicknesses :-

Thrust washers

0.102in., 0.104in., 0.105in., 0.107in., 0.110in., 0.112in., 0.114in., and 0.116in.

Spherical thrust washers

0.219in., 0.221in., 0.228in., 0.231in., and 0.234in.

When fitting thrust washers, it is essential to make sure that the gears or pinions on both sides require the same degree of effort to rotate them.

4. Fit the pinion spindle lock pin and lock with a split pin (1/16in. x $\frac{1}{2}$in. long).

5. Press the outer race of the pinion roller bearing into the gear housing and fit the two locating pins, ensuring that the fibre washers are in good condition; lock the pins with wire.

6. Check the serial numbers of the crown wheel and pinion to ensure that the numbers correspond.

7. Assemble the crown wheel to the crown wheel mounting and bolt up securely. The bolt heads must be inside the wheel.

8. Spin the assembly and check for run out with a dial indicator located on the back of the gear. The run out should not exceed the figure quoted in the General Data; when correct, fit the split pins to the crown wheel nuts.

9. If the taper roller bearings have been rejected, label the outer races of the new bearings, then press the inner races and roller assemblies on the bosses on either side of the crown wheel mounting. The smaller diameter of each bearing must face outwards.

10. Fit the correct outer races to the bearings then place the assembly in position in the differential gearbox, enter the locking rings into engagement with the threads and position the crown wheel mounting slightly towards the left side (this is to clear the pinion when assembled).

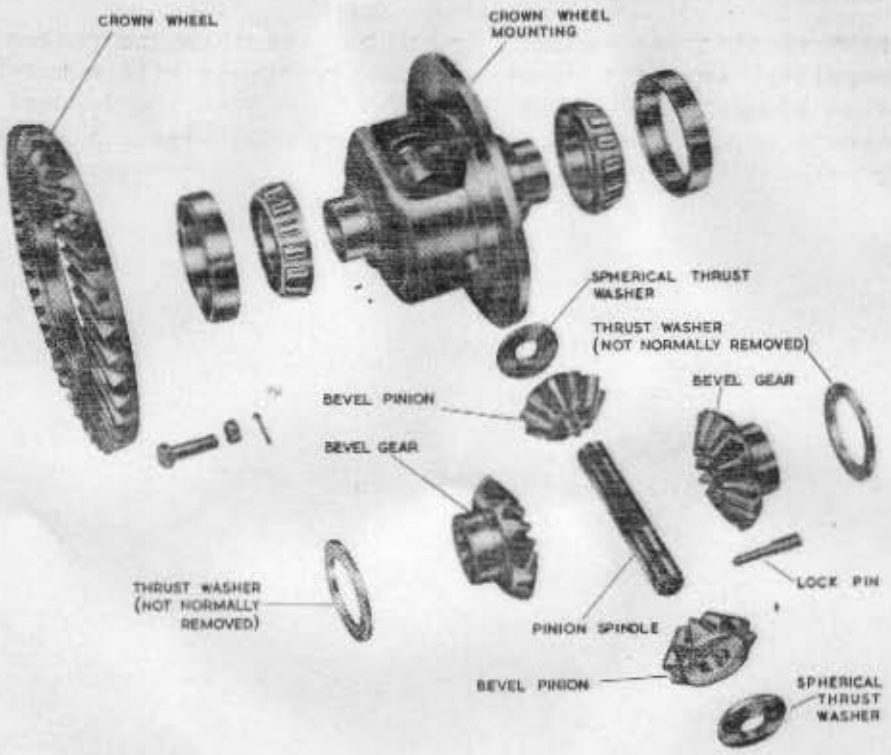


Fig. 7. Differential Assembly.

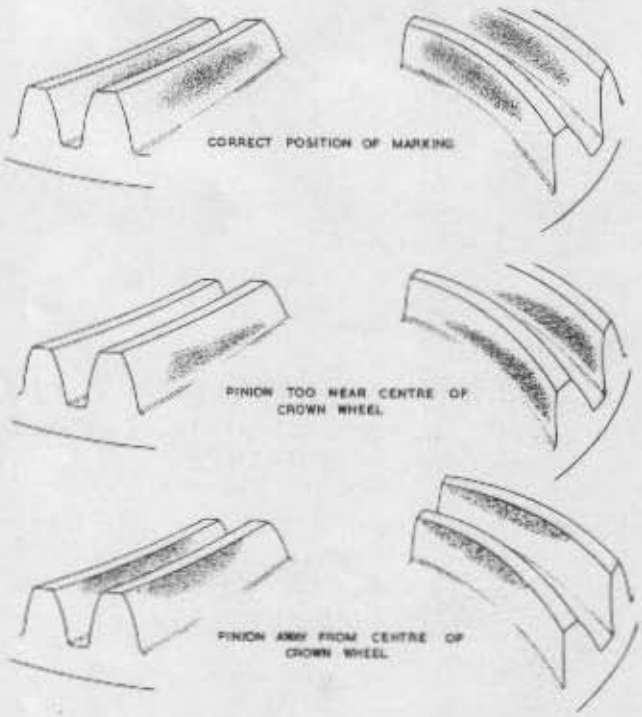


Fig. 8. Diagram of tooth contact.

11. Assemble the bearing caps taking care that the locking rings move freely in the threads. Screw up the bearing cap nuts until just nipped.

12. Adjust the locking rings until a preload of 4 inch pounds is imposed on the bearings with the bearing cap nuts thoroughly tight.

Note :- The preload can be achieved by first setting the locking rings to "nip" the bearings so that the assembly is free to rotate without side play, then tightening each locking ring one notch further.

Continue with the pinion group as follows, taking care to avoid any damage to the bearings.

1. Press the roller bearing inner race and roller assembly on the pinion, ensuring that it abuts the shoulder of the pinion.

2. Thread the bearing spacer over the pinion spindle against the roller bearing and place the pinion to one side.

3. Press the double-row ball bearing into the bearing housing against the internal shoulder.

Note :- When a bearing with a one-piece outer race is fitted, the filling slot must face outwards.

4. Insert the pinion, together with the roller bearing inner race assembly and spacer, into the bearing housing. Support the ball bearing and press in the pinion until the spacer abuts the ball bearing inside the bearing housing.

5. Screw the locking ring on to the bearing housing until the locating hole for the wire circlip is exposed.

6. Fit the oil thrower against the ball race, with its recess outwards, and fit the distance piece which surrounds it.

7. Press the oil seal into the bearing retaining nut; the lipped side must face the threaded end of the nut.

8. Screw home and tighten the bearing retaining nut securely, then fit the circlip. If the hole in the nut does not co-incide with the hole in the bearing housing drill a fresh hole in the nut with a No.43 drill (0.089in.dia.).

9. Press home the companion flange, fit the special washer, a locking tabwasher and the nut; tighten the nut securely before bending over two tabs of the lock washer.

Before fitting the pinion group and bearing housing to the gear housing, make sure that the pinion is dry.

Note :- In order to facilitate correct crown wheel and pinion engagement checks, both must be absolutely dry. It is recommended to wash them in clean petrol and dry with compressed air.

Proceed as follows :-

1. Screw the pinion group and bearing housing into the gear housing until the inner end of the pinion is approximately in line with the inner edge of the crown wheel teeth.

2. Adjust the crown wheel as necessary to obtain the desired backlash by moving the two locking rings in the bearing caps by equal increments; this will ensure that the preload setting is maintained. The correct backlash is 0.006in. measured on the outside of the crown wheel with a dial indicator.

3. Check the tooth contact by lightly smearing the pinion teeth with marking compound, and rotate the crown wheel and pinion together, noting the contact on the crown wheel teeth (see Fig.8).

4. Correct as necessary as detailed in Fig.8; adjust by means of the bearing housing and re-adjust the backlash as described above.

5. Finally fit the lock plates and locking wire to the cap nuts.

Note :- In order to ensure silent operation of the rear axle, it is most important to obtain correct tooth engagement as described above.

Shimmed adjustment type

The differential group is identical with the earlier type; therefore the sequence of operations is as given on page 14.

The method of dismantling the pinion assembly is as follows :-

1. Release the tabwashers and remove the five nuts securing the pinion assembly to the differential gearbox.

2. Gently press out the pinion assembly and carefully remove the shim gasket.

3. Bend up the tab of the washer locking the companion flange nut.

4. Secure the companion flange in a suitable fixture with pins to enter the bolt holes and remove the nut and both washers.

5. Withdraw the companion flange.

6. Press the pinion from the bearing housing and remove the distance washer, distance piece and the inner bearing inner race, cage and rollers from the pinion.

7. Hook the oil seal from the bearing housing, lift out the distance washer followed by the outer bearing inner race, cage and rollers. Press the two outer races from the housing.

8. Press the outer bearing inner race from the pinion.

Note :- On the earlier design of this assembly, the inner of the two distance washers (i.e. that nearer the pinion head) comprised two rings. It is advisable to discard the two rings when stripping and rebuilding this design and replace them by the single piece distance washer of later design. These are available in thicknesses varying from 0.200in. to 0.220in. inclusive, in steps of 0.002in.

When re-assembling, commence with the differential group. The sequence of operations is given on page 16, omitting para.5.

Caution :- Do not distort the oil deflector riveted to the inside of the differential gearbox, nor the weir plate in the bearing housing.

Make sure that all components are scrupulously clean and that all oil passages are unobstructed. It is preferable to use petrol to clean these components finally, since this will facilitate the subsequent assembly checks.

Continue with the pinion group in the following sequence :-

1. Referring to Fig.3, press the two outer races of the roller bearings into the bearing housing (the larger diameters facing outwards) until they abut their respective shoulders. Do not fit the oil seal at this stage.

2. Press the larger bearing inner race and roller assembly on to the pinion until it abuts the pinion head. The smaller diameter faces towards the serrated end of the shaft.

3. Fit the distance piece against the bearing followed by the thinner of the two distance washers, (see note after foregoing paras.). The total length of these components should equal approximately 0.205in.

4. Insert the assembly into the bearing housing, ensuring that the weir plate is not distorted.

5. Support the pinion head on a press and press the outer bearing inner race and roller assembly on the pinion until hard against the distance washer.

6. Fit the remaining distance washer.

7. Press on the companion flange, (omitting the oil seal) and fit the special washer and retaining nut. Tighten the nut, holding the companion flange in the fixture referred to on page 15, and using a dial indicator, check the end-float in the bearings; rotate the bearings in the process to bed the rollers to their correct seatings.

8. Note accurately any end-float; if there is end-float, withdraw the pinion assembly and extract the distance washer fitted between the outer race and the distance piece. Measure the washer. To select a washer of the correct thickness, the sum of the end-float and the 0.0015in. compression figure must be deducted from the thickness of the existing washer.

   Note :- Distance washers are supplied in eleven different thicknesses varying by 0.002in. (from 0.200in. to 0.220in. inclusive).

9. When finally assembled, the correct thickness of washer will ensure a preload of 8 to 10 inch pounds on the pinion bearings.

10. Rebuild the assembly complete with oil seal. Tighten the nut firmly and tab lock.

Before inserting the pinion group into the gear housing, make sure that the pinion is absolutely dry. Proceed as follows :-

1. Fit the shim gasket, adjusted to 0.025in. by peeling off the necessary number of shims (0.002in. each).

   Note :- There is unequal spacing between the studs to ensure correct mating of the oil feed and drain holes.

2. Ensure that there is backlash between the crown wheel and pinion, and tighten the five securing nuts evenly.

3. Now obtain backlash quoted in the General Data by moving the two locking rings in the bearing caps by equal increments; this will ensure that the preload setting is maintained. The backlash is measured on the outside of the crown wheel with a dial indicator.

4. Check the tooth contact by lightly smearing the pinion teeth with marking compound and rotate the crown wheel and pinion together, noting the contact on the crown wheel teeth as shown in Fig.8.

5. Correct as necessary as detailed in Fig.8 by adjusting the thickness of the shim fitted to the bearing housing flange and re-adjust the backlash as described above.

6. When adjusted correctly, withdraw the pinion assembly, apply jointing compound to both sides of the shim, then re-assemble. Finally fit the lock plates and locking wire to the cap nuts.

   Note :- In order to obtain silent operation of the rear axle, it is most important to make sure of correct tooth engagement as described above.

REMOVING AND REFITTING REAR AXLE

1. Jack up and support the car on the chassis frame side members well towards the rear wheels, taking care to avoid damage to the petrol and brake fluid pipes.

2. Remove both rear wheels.

3. Jack up the axle clear of the snubber straps and detach the rearmost anchorage of each snubber strap by removing the two ½in. B.S.F. bolts, shake-proof washers, washer plate, packing washer and nuts.

4. Manipulate the jack until the axle is in its neutral position i.e. with no stress on the torsion bars.

5. Detach the attachment unit from the ball and socket joint on top of the differential gearbox (see page 28) and push the unit out of the way.

6. Disconnect the rear universal joint.

7. Disconnect the brake fluid pipe from its union at the axle centre, and the handbrake operating cable from the brake operating lever.

8. Bend up the lock tab, unscrew the nut and break the taper joint of each suspension arm shaft with the special extractor TFN.8039 (see Fig.15).

   Warning :- Do not disturb the position of the squared end of the suspension arm shaft.

9. Draw the axle backwards until the suspension arms are clear of the shock absorber arms. Lower the axle and remove from beneath the car.

To refit the axle, proceed as follows :-

1. Manoeuvre the axle below its location on the car and raise it until the shock absorber arms are in line with the suspension arms.

2. Enter both suspension arm shafts into their respective arms, push home each taper joint and tighten each nut securely. Do not lock by bending over the tabwasher until an alignment check has been made.

   Warning :- Do not disturb the position of the squared end of the suspension arm shaft.

3. Connect the attachment unit to the ball and socket joint above the differential gearbox and secure the nut with the tabwasher. Re-connect the rear universal joint.

4. Refit the brake fluid pipe to its central union, and the hand-brake cable to the brake operating lever.

5. Jack up the axle and refit the snubber strap fixtures.

6. Bleed the braking system as instructed in Section 8.

7. Refit the rear wheels and lower the car.

Whenever the rear axle has been removed, it is necessary to check the alignment after refitment and if necessary, to adjust as described below.

ALIGNMENT CHECK AND ADJUSTMENT

Whenever the rear axle mounting is disturbed in any way, the alignment must be checked and rectified, if necessary. Adjustment for this purpose is provided for in the ball and socket joint attachment of the suspension arm shaft to the suspension arm (see Fig.11).

The procedure for checking and rectifying the alignment is as follows :-

1. Remove both rear wheel "snap-on" caps.

2. Set the adjustment of the trammel TFN.5033 to correspond to the distance from the centre point of one rear hub to the centre of the front spring spigot bolts, see Fig.10.

3. Retain the trammel setting and check the same points on the other side of the car. The two measurements should agree within $\pm$ 1/16in. If the difference in measurement is more or less than 1/16in., adjustment is necessary.

To make the adjustment, proceed as follows :-

1. Remove the rearmost fixture of the relevant snubber strap.

2. Jack up the car by the chassis side member well towards the rear wheel, taking care to avoid damage to the brake fluid and fuel pipes. Raise the side of the car until the torsion bar is relieved of all strain.

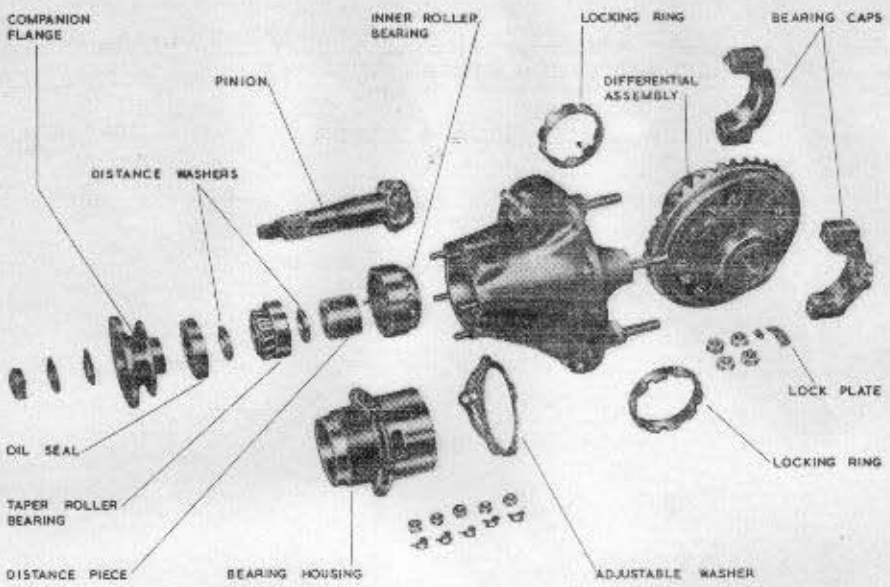


Fig. 9. Differential Gearbox Assembly (Shimmed adjustment type).

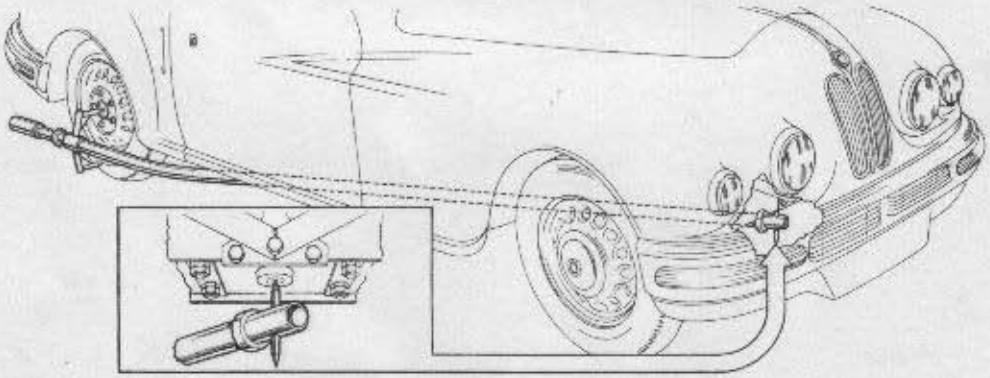


Fig.10. Checking Rear Axle alignment.

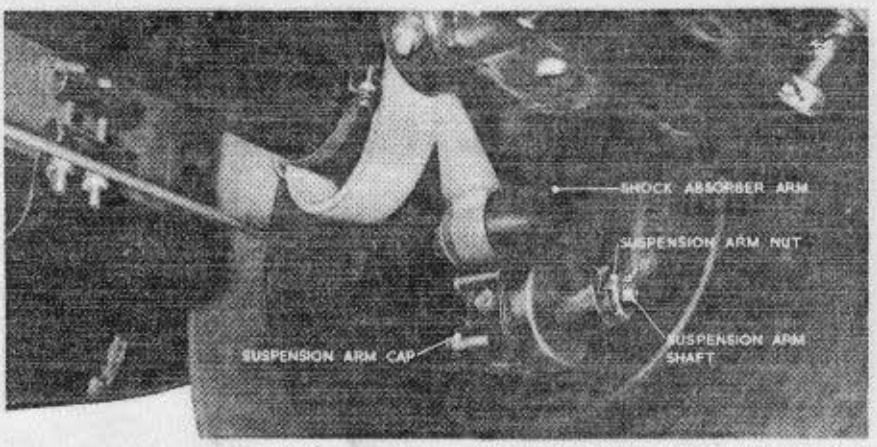


Fig.11. Alignment adjustment.

3. Bend back each tab of the lock washer and remove the nut securing the suspension arm shaft to the shock absorber arm.

4. Use the extractor TFN.8039 to break the taper joint of the suspension arm, see Fig.15.

5. Using a spanner on the flats provided (see Fig.11), turn the end of the suspension arm shaft in the appropriate direction.

Note :- Turning the suspension arm shafts clockwise will draw the adjacent rear wheel forward (i.e. decreases the trammel measurement) and vice versa.

On no account must the following adjustment be exceeded :-

Clockwise.. ... Maximum permissible = $\frac{1}{2}$ turn.

Anti-clockwise... Maximum permissible = 1 turn.

If the foregoing adjustments are outside the range quoted, continue as follows :-

1. Repeat the process of paras.1 to 4 above on the other side of the car.

2. Remove the domed cap from each suspension arm by bending back the tabs of the four lock washers and removing the four nuts. Do not damage or mislay the shims (see Fig.14).

3. Re-set each suspension arm shaft by turning it with a spanner on the flats provided at the end of the taper, until the end of the threaded part (exposed by the removal of the cap) is flush with the face of the ball sleeve (see Fig.14).

4. Replace each cap, making sure that all the shims and a gasket are replaced correctly under their respective caps.

5. Refit the suspension arm shaft to each shock absorber arm and tighten each nut.

6. Re-check the axle alignment.

7. Re-adjust, if necessary, by the method given in paras. 1 to 5 above, until the measurement is within the limits stated.

8. Refit the suspension arm shaft to each shock absorber arm, tighten the nuts, and bend up the tabs of the lock washers.

9. Refit the snubber strap fixtures and the road wheels and lower the car.

ATTACHMENT UNIT

Description

The attachment unit is illustrated in Fig.1 of this Section. Its purpose is to transmit reaction of the axle (both driving and braking). The apex of the unit is attached to a ball and socket joint fitted to the top of the differential gearbox. The two arms of the unit (the major and the minor arms) extend forward to rubber-bushed pivots astride the propeller shaft tunnel on top of No.4 cross member of the chassis frame. The ball and socket seating is integral with the major arm.

All type 400 and 402 cars and some of the earlier type 401 cars are fitted with adjustable cross-bracing, but this has not been fitted to later cars.

Removing and refitting

1. Jack up and support the car by the frame (well towards the rear wheels) so that the axle rests in the snubber straps. Take care not to damage the hydraulic fluid or fuel pipes.

2. Place a jack centrally beneath the pinion bearing housing of the differential and raise the axle slightly.

3. Remove the rear seat and detach the differential cover from the car floor by removing the mushroom-headed screws.

4. Unscrew and remove the ½in. B.S.F. nuts and shake-proof washers from the bearing spindle on either side of the propeller shaft tunnel.

5. Unscrew and remove the two 5/16in. B.S.F. bolts, nuts and shake-proof washers and the triangular washer plate from each side.

6. When fitted, remove the cross bracing member from the minor arm by removing the 5/16in. nut, bolt and shake-proof washer.

7. Release the tab and remove the 9/16in. B.S.F. nut from the ball joint assembly on the differential gearbox.

8. Manipulate the central jack until the attachment unit can be pulled upwards to disengage it from the ball joint assembly quite freely.

9. Remove the nut, bolt and washer connecting the major and minor arms.

10. Detach both arms from the mounting spindles and remove the rubber bushes.

To refit, proceed as follows :- (see Fig.1).

1. Coat each rubber bush (inside and out) with Dag colloidal graphite anti-freeze lubricant.

2. Fit a bush into each side of the bores of the major and minor arms.

3. Fit the arms (complete with the rubber bushes) on to their respective spindles on either side of the propeller shaft tunnel. The major arm is fitted to the left-hand spindle. Mate the fork joint of the two arms, and fit the bolt, shake-proof washer and tighten the nut.

4. Fit each triangular plate washer to its respective tunnel spindle. Insert the bolts, washers and nuts and tighten the nuts.

5. Fit the spindle nut and washer to each spindle. Hold the arms parallel to the ground and tighten the nuts.

6. Manipulate the central jack beneath the differential pinion housing until the arms can be engaged with the ball joint assembly quite freely. Fit and tighten the nut and tab lock it.

7. When a cross-bracing member is fitted, adjust the length (if necessary) so that the bolt can be inserted without force through the eye of the member and the lug on the minor arm.

Note :- In order to adjust the length of the cross-bracing member, (if fitted) it is necessary to remove the bolt from the major arm, loosen the adjusting nut on the cross-member and turn the eyebolt as necessary. Tighten the lock-nut and refit the bolt.

8. Lower the car to the ground.

9. Replace the differential cover and fit and tighten the mushroom-headed screws.

10. Replace the rear seat.

REAR BALL JOINT ASSEMBLY

Description

The ball and socket joint between the attachment unit and the differential gearbox consists basically of two parts :- a ball bolt and a socket bearing, see Fig.12. The ball bolt is fitted to the differential gearbox by a taper shank and locked by a nut and tabwasher inside the gear housing. The socket bearing housing consists of an inner and outer housing; the outer housing has a threaded extension at the top to receive the rear end of the major arm of the attachment unit.

Lubrication is carried out by oil from the differential passing through a hole drilled in the taper of the ball bolt. A further passage is drilled from the centre of the ball to meet that of the taper. Oil can thus flow to the head of the ball itself. Surplus oil is drained back to the differential via a drilling in the neck of the ball and a groove along the taper which emerges from a further groove along the machined face beneath the retaining nut.

Due to excessive lubrication of the ball joint assembly, a modification was introduced which provided for the oil to enter the threaded end of the ball bolt, (see Fig.13) but this proved unsatisfactory and the side feed was re-introduced.

Since the ball bolts with the side feed are the only type now available, it is most important when renewing a ball bolt to make sure that the mating hole is

drilled in the differential casing. If the casing is not drilled, this must be done to the dimension given in Fig.13 together with a groove cut across the seating for the tabwasher and nut as illustrated.

Removing and refitting ball bolt

In order to remove the ball joint assembly, the differential gearbox must first be removed from the axle casing as described on page 13. Remove the crown wheel and differential assembly as described on page 14, but first mark the relative positions of the locking rings and lock plates to facilitate assembly. Remove the ball joint as follows :-

1. From inside the differential gearbox, release the tabwasher and remove the nut securing the ball bolt.
2. With a suitable soft-metal drift and a heavy hammer, knock out the ball assembly.

To refit the ball joint, reverse the foregoing procedure. Make sure that the oil passage in the side of the taper of the ball bolt coincides with the oil passage in the differential gearbox.

1. Fit the angle tabwasher from inside the differential gearbox but make sure that the tabs do not obstruct the oil feed passage or the oil return groove.
2. Fit the nut to the ball bolt, tighten fully and tab-lock the nut.

Refit the crown wheel and differential assembly as described on page 14. Refit the differential assembly to the rear axle as described on page 20 or 23.

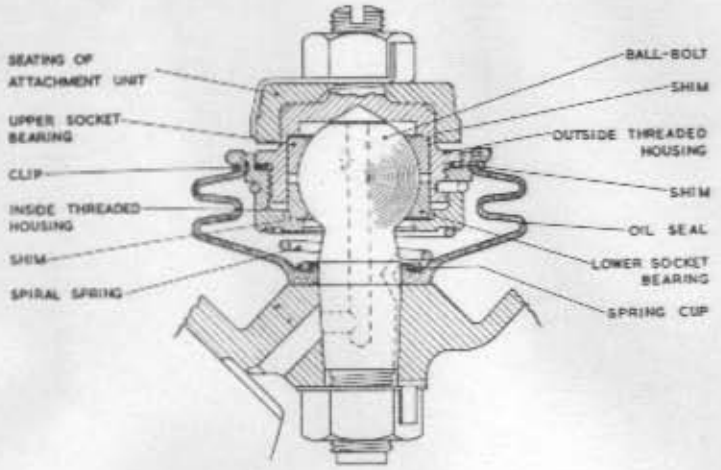


Fig.12. Sectioned view of Ball Joint Assembly.

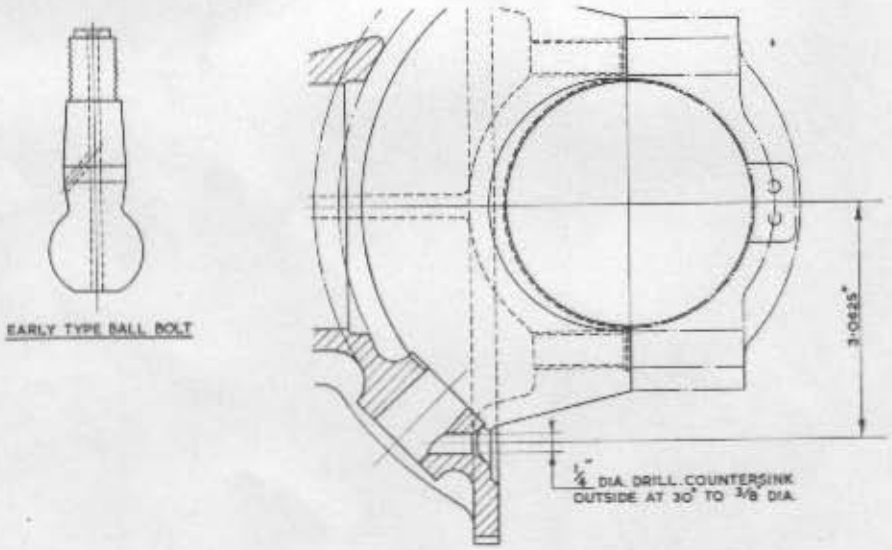


Fig.13. Oil Hole and Groove in Differential Casing for Ball Bolt lubrication.

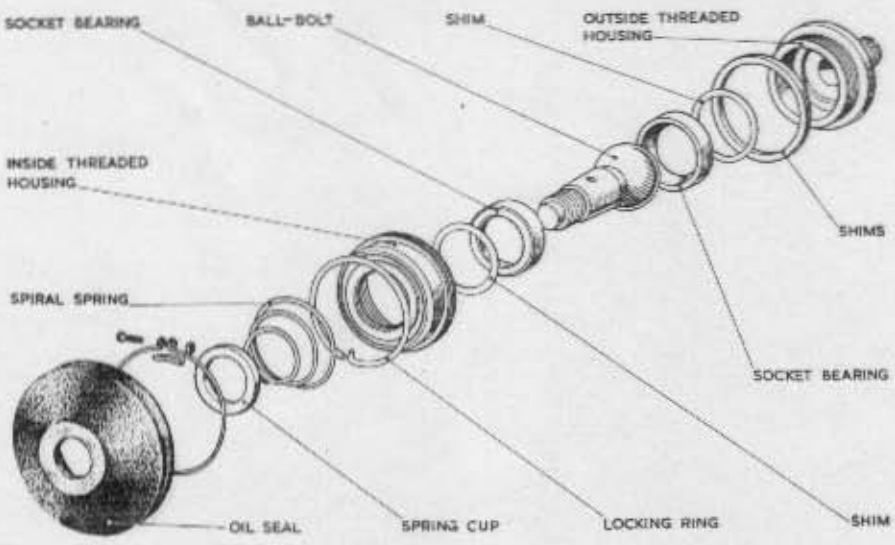


Fig. 14 Ball Joint Components.

Dismantling and re-assembling

To dismantle the ball joint assembly, it should first be removed from the differential gearbox as described previously. Then proceed as follows, referring to Figs.12 and 14.

1. Remove the clip (or clips) around the rubber oil seal. The early type has two clips and the later type one.

2. Withdraw the rubber oil seal over the taper of the ball bolt followed by the spiral spring. On the early type, a dished cover is fitted over the end of the seal; on later types, it is omitted, but a spring cup is fitted inside to take the loading of the spring against the oil seal on the taper side of the ball bolt.

3. Remove the wire locking ring from around the housing, first disengaging the tongue from its hole.

4. Unscrew the two halves of the housing and remove the outside threaded housing. Do not lose the shims.

   Warning :- Inside each housing is a circular socket bearing which is shimmed against its respective seating in the housing. Do not mix these parts, but label or otherwise identify them for position.

5. Remove the ball bolt from the inside threaded housing, taking care not to lose the shim beneath the socket bearing inside.

To re-assemble, proceed as follows :-

1. Smear the ball end of the ball bolt with oil and insert it into the lower socket bearing (marked for position on dismantling).

2. Fit the correct shim into the recess of the inside threaded housing and fit it over the socket bearing on the ball bolt.

3. Fit the correct shim into the recess of the outside threaded housing followed by the remaining socket bearing.

4. Fit the larger diameter shim or shims over the threaded portion of the housing and screw home (over the ball) into the inside threaded housing.

Note :- Shims are fitted by selective assembly and so adjusted that when the two housings are screwed tightly together, the ball bolt and the complete socket housing can just be' swivelled manually with some stiffness.

5. When adjusted correctly, check that the two holes for the locking ring are aligned. If they are not, use the outer hole as a pilot and drill sufficiently deep with a No.44 (0.086in.dia.) drill to accept the tongue of the locking clip.

6. Fit the spiral spring (large end first) over the ball bolt into the recess in the socket housing.

7. Fit the spring cup (when fitted) over the ball bolt to seat over the end of the spring.

8. Fit the rubber oil seal (large diameter first) over the ball bolt until the large diameter fits over the recess midway along the socket bearing housing, and secure it with the wire clip. Do not forget the saddle piece beneath the joint of the clip.

9. Fit the complete assembly to the differential gearbox as described on page 29.

10. Fit the differential gearbox to the axle case as described on page 13.

Replacements

Any grooving or scoring of the ball bolt and socket bearings render both the ball bolt and the socket bearings unserviceable. These parts are selected carefully and mated during manufacture and should not be intermixed. The ball bolt and its mating socket bearings should thus be ordered together.

Faults

If any "bumping" is audible when accelerating or braking, the joints of the attachment unit should be checked. This is most easily done by removing the back seat, detaching the differential cover from the floor and, with the car in second gear, rock the car backward and forward; during the process, note any slackness in the attachment bracket joints or the ball joint on the differential.

SUSPENSION ARM UNIT

Description

The suspension arm units provide the swivel links between the rear shock absorber arms and the axle casing. They are not handed and consequently will fit either side of the car.

The unit is illustrated in Fig.15 and comprises two major parts, i.e. the suspension arm and the suspension arm shaft. The suspension arm is screwed into a threaded recess inside the bushed housing in the axle casing, its accurately-ground journal locating in the bush. The arm is free to swivel in the bush. A bushed ball sleeve, together with the ball sleeve housing, is located in the outer end of the suspension arm where they are secured by a shimmed cap. The suspension arm shaft is screwed into the threaded bore of the ball sleeve, its outer end being tapered to receive the shock absorber arm, which is secured by a tab-washered nut. The extreme outer end of the shaft is squared to provide a means of turning the shaft for adjustment purposes.

Lubrication is achieved automatically through suitably-drilled passages in the suspension arm and a communicating passage in the axle casing, oil from the axle casing being fed to all working surfaces. Suitable oil seals and dirt-excluding seals are fitted to prevent loss of oil and ingress of foreign matter, see Fig.14.

Removing and refitting

To remove a suspension unit from the car proceed as follows :-

1. Raise the car on a lift or use other suitable means to allow for operation from below the car.

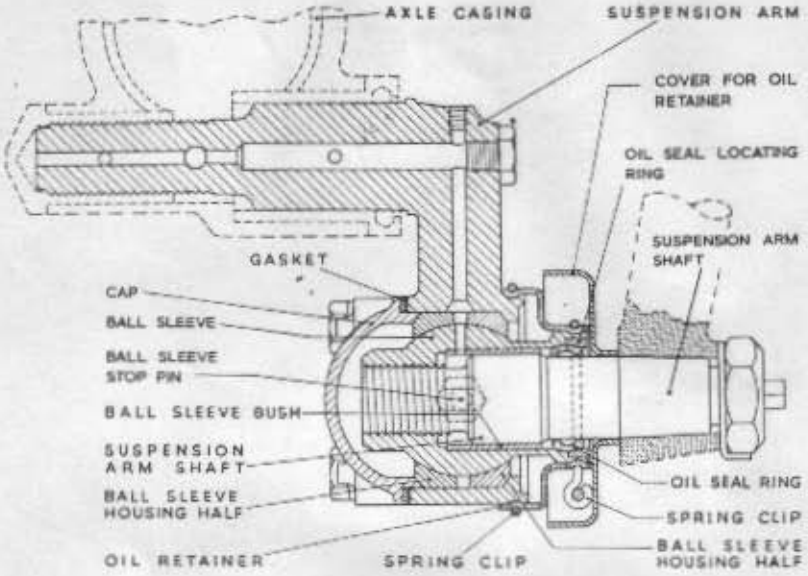


Fig.15. Suspension Arm Unit.

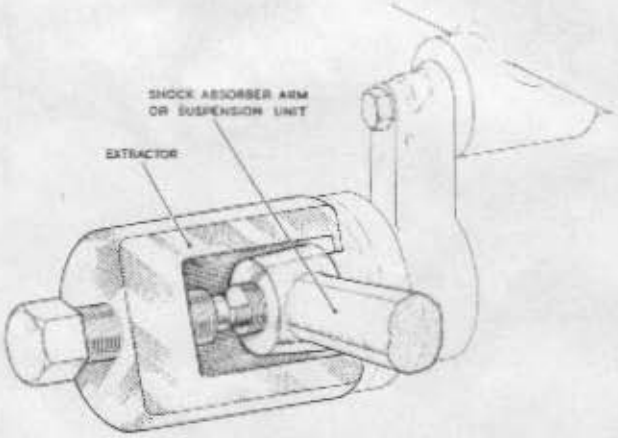


Fig.16. Suspension Arm Shaft Extractor.

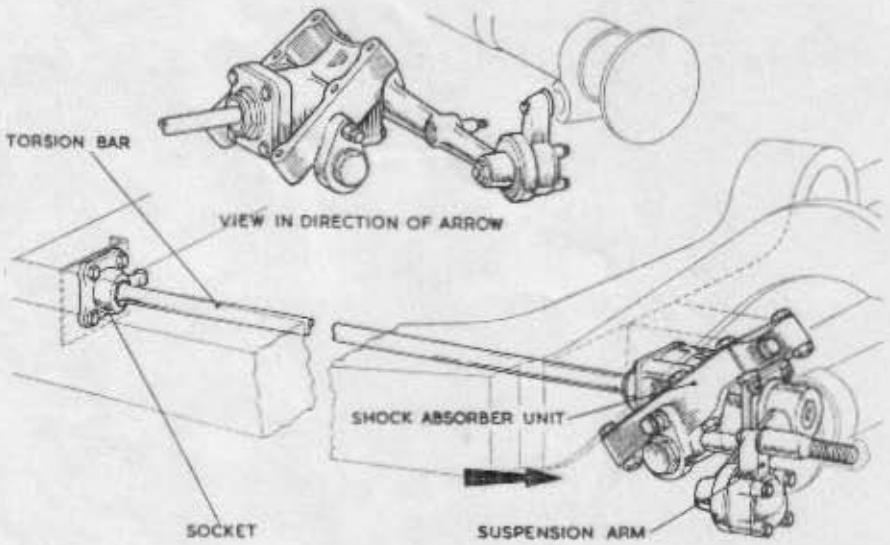


Fig.17. Diagram of Rear Suspension.

2. Remove the rearmost fixtures of the snubber straps.

3. Place a jack beneath each side of the chassis frame well towards the rear wheels, ensuring that no damage is sustained by the brake fluid or fuel pipes. Raise the car evenly until the torsion bars are relieved of all strain.

4. Bend up the lock tab, unscrew and remove the nut from the relevant suspension arm shaft.

5. Use the extractor TFN.8039 and break the taper from the shock absorber arm.

6. Roll the relevant side of the axle back until the suspension arm is clear of the shock absorber arm.

7. Release the tabwashers and remove the four bolts and the cap at the forward end of the suspension arm shaft. Do not damage or mislay the shims.

8. Jack up and support the relevant side of the axle, remove the rear wheel, brake drum, and withdraw the half shaft, then detach the brake backplate.

9. Unscrew the suspension arm (anti-clockwise) from the axle casing.

To refit the unit, proceed as follows :-

1. Enter the screwed portion of the suspension arm into the bushed housing in the rear axle casing, and screw home. Then turn it back so that there is a minimum of 1/16in. between the end of the bush and the machined lip of the suspension arm when the arm is in its correct position (i.e., the unit is hanging downwards). Make sure that there is sufficient lateral movement before the threaded end bottoms in the axle housing. If necessary, carefully grind the end of the thread. If the clearance is less than 1/16in., it must be unscrewed one turn.

2. Refit the brake assembly and half shaft as described on page 9.

3. Fit the suspension arm shaft to the shock absorber arm and fit the tabwasher and nut. Tighten the nut, but do not tab lock.

4. Refit the snubber strap fixtures.

5. Lower the car to level ground and check the axle alignment as described on page 25; when satisfactory tab lock the suspension arm shaft nut.

Dismantling and re-assembling

1. Withdraw the oil retainer cover from the suspension arm shaft.

2. Remove both clips from around the rubber oil retainer and remove the oil retainer and the oil seal locating ring. Take care not to lose the saddle pieces of the clips.

3. Untab and remove the four nuts and remove the shaft cap. Take care not to lose or damage the shims.

4. Break the locking wire and remove the two ball sleeve stop pins.

5. Push out the suspension arm shaft (together with the ball sleeve and its housing) from the taper end towards the capped end, taking care not to drop the housing halves. Label the housing halves for positioning purposes, if they are to be refitted.

6. Carefully unscrew the suspension arm shaft from the ball sleeve, bringing with it the oil seal ring.

Adopt the following procedure to re-assemble :-

1. Fit the outer half housing into the suspension arm, with the spherical bearing surface facing the threaded end of the journal.

2. Lightly oil the ball sleeve and insert it (bushed end first) into the spherical housing. Make sure that the oil feed hole coincides with the countersunk drilling in the shank of the housing.

3. Fit the ball sleeve stop pins, ensuring that they both enter their respective slots in the ball sleeve. Lock both stop pins together with wire.

4. Screw the suspension arm shaft into the ball sleeve.

5. Insert the remaining half housing over the ball sleeve, and adjust the suspension arm shaft until the threaded end is flush with the end face of the ball sleeve. Do not disturb this setting as it is most important to the alignment of the car, and cannot be seen once the cap is fitted.

6. Fit a gasket and shims to the shaft cap and fit it to the assembly.

7. Fit the four tabwashers and nuts. Tighten the nuts evenly and check the fit of the ball joint. The ball joint must not be locked. Some difficulty may be experienced in judging the

correct "feel" of the ball joint, since the sockets are sufficiently well mated to require a distinct jerk to free the surfaces initially. The joint however, should be capable of movement by a fair amount of manual force only. Any necessary adjustment is effected by altering the shims beneath the cap. These are available in 0.001 in., 0.002 in. and 0.003 in. thicknesses.

8. When adjusted correctly, lock the cap nuts.

9. Fit the oil seal ring over the suspension arm shaft and push it against the ball sleeve, followed by the oil seal locating ring.

10. Fit the flexible oil retainer and secure it with both clips. Do not forget to fit the saddle pieces at the clip gaps.

11. Fit the oil retainer cover. This cover is finally retained in position by the shock absorber arms.

Replacing oil seal ring

To replace the oil seal ring in the ball sleeve assembly, it is not necessary to remove the suspension unit from the car. Detach the axle fixtures as described on page 35, but ensure that the suspension arm shaft adjustment is not disturbed. Proceed as follows :-

1. Detach the oil retainer cover.

2. Hook out the oil seal locating ring followed by the oil seal. If necessary, remove the flexible oil retainer for replacement at this stage.

3. Fit the new oil seal ring followed by the oil seal retaining ring and, if necessary, fit a new flexible oil retainer, securing it with the two clips. Ensure that the clips bed into their respective grooves.

4. Fit the oil retainer cover.

5. Refit the axle fixtures as described on page 37.

Replacing ball sleeve and housing and/or ball sleeve bush

The ball sleeve and the two halves of its housing are lapped and mated. They are therefore only supplied as a mated assembly wired together in their correct relative positions. The half housings must not be mixed.

To replace an unserviceable ball sleeve and housing and/or ball sleeve bush, proceed as follows :-

1. Break the taper of the suspension arm shaft/shock absorber arm and withdraw the suspension arm shaft clear of the shock absorber arm as described on page 37, para.2 to 6 inclusive.

2. Remove and dismantle the ball sleeve assembly together with its suspension arm shaft as described on page 37, para. 7 to 9 inclusive, and page 38.

3. If the ball sleeve bush is to be replaced, remove it from the ball sleeve housing. Clean out any score marks and carefully press in the new bush. Drill the oil passage by using the oil hole in the ball sleeve as a pilot. Carefully ream the bush to size ensuring that the reamed surface is concentric to the threaded portion of the ball sleeve.

4. Assemble the unit as described on page 38.

5. Refit the suspension arm shaft to the shock absorber arm, and check the axle alignment as described on page 25; when correct, tab-lock the suspension arm shaft nut.

Replacing axle casing bush

To fit a new bush in the axle casing, remove the relevant suspension unit from the car as described in this Section, and withdraw the bush with a "Stillson" wrench. Clean out the bush housing and press in the new bush, which must be pressed right home. If freezing facilities are available, freeze the bush before insertion.

Carefully ream the bush with a 1.1875 in. parallel reamer (1.3/16in.). Fit a new oil seal into the recess of the bush and assemble all parts as described previously.

REAR SUSPENSION

Description

The rear suspension employs torsion bars in conjunction with shock absorbers; the shock absorbers are dealt with subsequently in this Section. One torsion bar is used for each side of the car, being located longitudinally along the inside of the left and right-hand of the chassis frame respectively, see Fig.17. The left and right are not interchangeable and are therefore marked "L" and "R" respectively on the rear ends of the bars.

Each bar is serrated at both ends, the front end being held rigid in a female serrated mounting on No.2 chassis cross-member, approximately below the front edge of the front seats. The rear end engages serrations in the shock absorber arm of a "Bristol" shock absorber or a suspension unit secured to No.4. chassis cross-member (immediately forward of the rear axle). The outer end of the shock absorber arm or suspension unit engages a suspension arm unit fitted to the rear axle. It must be noted that on type 401 cars of later production the shock absorbers are replaced by suspension units which provide bearing units for the rear end of the torsion bars. In these cases, "Newton and Bennett"shock absorbers are incorporated in the system as described later in this Section.

Two types of torsion bars have been fitted, and speaking generally, 20 m.m. bars were fitted to type 400 cars and 22 m.m. bars to type 401 and 402 cars.

Both bars have 25 serrations at the front end and 27 at the rear in order to provide a vernier adjustment for setting and they are completely interchangeable in any Bristol car.

The rear end of each bar is drilled and tapped 5/16in. B.S.F. to accommodate an extractor, while half-way along the length of the rear serrations is a half-round annular groove to accommodate the cotter bolt which secures the shaft to the shock absorber or suspension unit arm.

It is essential to note that 20 m.m. bars are pre-loaded but that 22 m.m. bars are not pre-loaded. It is therefore necessary to make sure which bars are fitted by checking the diameter of the unmachined part of the bars. It should be noted that 20 m.m. = 0.787 in. and 22 m.m. = 0.866 in. approximately. Ensure also that the bars on any one car are not mixed. They must be fitted left and right as marked "L" and "R" on their faces.

Removing torsion bars

To remove torsion bars from type 401 and 402 cars, it is necessary also to remove the "Bristol" shock absorbers or the alternative suspension units. Proceed as follows :-

1. Lift the car bodily on a lift, or use other suitable means to allow for operation from below the car with the rear wheels "on the ground".

2. Remove the rearmost fixture of the snubber straps.

3. Place a jack beneath each side of the chassis frame well towards the rear wheels, ensuring that no damage is sustained by the brake fluid or fuel pipes. Raise the car evenly until the torsion bars are relieved of all strain.

4. On type 400 cars with the deep boot, remove at this stage the nut, shake-proof washer and cotter bolt from the absorber arm,

also the relevant circular caps in the front and rear face of the boot, to enable the torsion bar to pass out through the boot. Use the torsion bar extractor TFN.5026 (see Fig.18) to withdraw the torsion bar clear of its serrations; remove the extractor and withdraw the torsion bar through the boot.

5. On type 401 and 402 cars, bend up the tab and remove the nut from the relevant suspension arm shaft and by means of the extractor TFN.8039 (see Fig.15), free the suspension arm shaft from its shock absorber arm.

6. Roll the relevant side of the axle back until the suspension arm shaft is clear of the shock absorber arm.

7. Remove the nut, shake-proof washer and withdraw the cotter bolt from the shock absorber arm.

8. By means of the extractor TFN.5026 (see Fig.18) withdraw the torsion bar clear of its serrations.

Caution :- Ensure that the centre bolt of the extractor is right home in the torsion bar.

9. If "Newton and Bennett" shock absorbers are fitted, detach the lower fixture from the shock absorber arm, and then bend up the tabs and remove the six 7/16 in. B.S.F. nuts, tabwashers and bolts securing the suspension unit to the chassis.

10. Withdraw and remove the suspension unit together with the torsion bar.

11. Repeat the foregoing process on the other side of the car, if necessary.

Refitting 22 m.m. torsion bars

Refit and set one bar at a time. In the case of type 400 cars with the deep boot, insert the bar through the openings in the front and rear faces of the boot, with the "Bristol" type shock absorber in position on the chassis. Manipulate the torsion bar into engagement with its front serrations only, then proceed as from para.6 on page 44.

In the case of type 401 and 402 cars, the suspension unit must already be detached from the chassis. Proceed as follows :-

If the car is fitted with torsion bar screw adjusters on the front fixture, ensure that the socket in the movable arm is hard against the adjuster bolt and that the measurement between the top face of the trunnion and the end of the thread is 0.300 in. Re-adjust to this figure if necessary, (see Fig.23).

1. Insert the small end (front) of the torsion bar into the shock absorber or suspension unit main shaft from the rear of the unit.

2. Offer up the assembly to its location on the chassis and secure the "Bristol" shock absorber or suspension unit to the chassis by the six 7/16 in. B.S.F. bolts, tabwashers and nuts. Tighten the nuts and tab-lock them. If a "Newton and Bennett" shock absorber is fitted, secure its lower fixture as described on page 62.

3. Manipulate the torsion bar into engagement with its front serrations only.

4. Manoeuvre the axle or the height of the car so that the suspension arm shaft will enter the taper hole in the relevant shock absorber arm; take care not to disturb the suspension arm shaft adjustment.

5. Fit the tabwasher and nut. Tighten the nut but do not tab-lock it at this stage, in case adjustment is required finally.

6. Fit the jig TFN.5040 to the end of each torsion bar by means of the spigoted discs and centre bolts provided with the jig (shown in Fig.19 in stowed position).

7. Adjust the jack below the chassis on the side operated on until the centre of the suspension arm shaft (square end) can be sighted centrally through the 41° hole in the jig (see Fig.18).

8. Withdraw the torsion bar clear of front serrations, then rotate the bar and find by trial the "neutral" position, i.e. where the bar can be pushed forward to engage both front and rear serrations. If the car is fitted with an adjuster on the front socket, this will facilitate insertion of the bars. Tap the bar right home. In the case of "deep boot" coachwork, the torsion bar drift TFN.5027 is inserted through the apertures in the boot.

9. Remove the jig.

10. Refit the cotter bolt and secure it with the shake-proof washer and nut. Replace the boot aperture covers where applicable, sealing the joints against ingress of water.

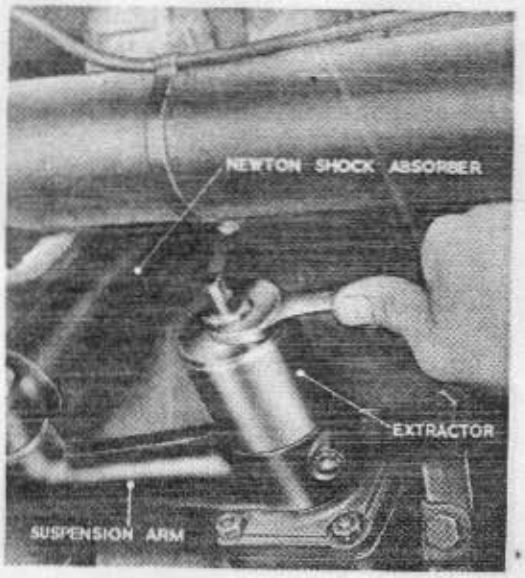


Fig.18. Torsion Bar Extractor.

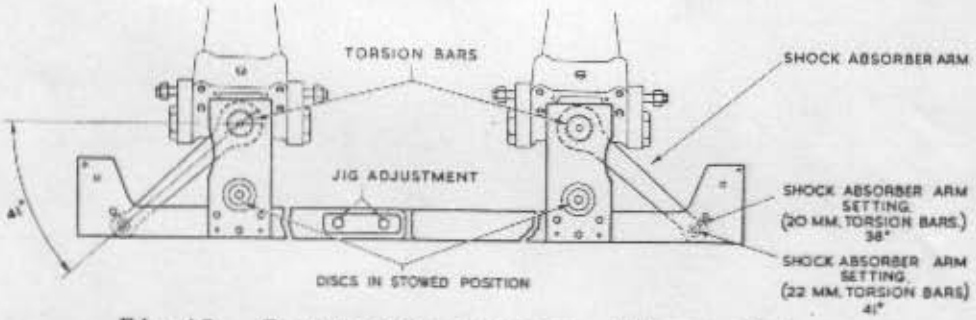


Fig.19. Torsion Bar Setting - 22 m.m. Bar.

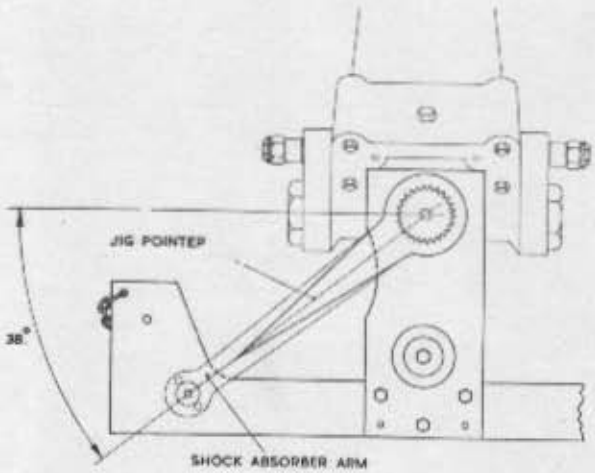


Fig.20. First stage zero setting.

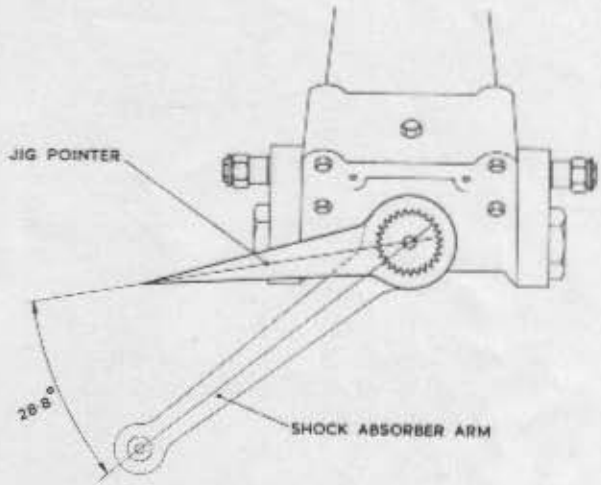


Fig.21. Second stage - 28.8° setting.

11. Lower the car by the jacks and refit the snubber strap fixtures.

12. Lower the car to level ground and check the axle alignment as described on page 25. When satisfactory, tab-lock the securing nuts on the suspension arm shafts.

Refitting 20 m.m. torsion bars

The initial stage of fitting the 20 m.m. bar is similar to the procedure adopted for the refitting of 22 m.m. torsion bars, as described on page 44 in the relevant opening paragraphs up to and including para.6, then proceed as follows :-

1. Adjust the jack below the chassis on the side operated on until the centre of the suspension arm shaft (square end) can be sighted centrally through the 38° hole in the jig (see Fig.19).

2. Withdraw the torsion bar clear of the front serrations, then rotate the bar and find by trial the neutral position, i.e. where the bar can be pushed forward to engage both front and rear serrations. If the car is fitted with an adjuster on the front socket, this will facilitate insertion of the bars.

3. Remove the jig.

4. Fit a jig pointer on the end of the relevant torsion bar to lie along the centre line of the shock absorber arm (zero position, see Fig.20).

5. Withdraw the bar sufficiently to disengage the front serrations: turn the bar together with the pointer upwards by two front serrations and re-engage the front serrations only. The pointer will now be 28.8° above the zero position (see Fig.21).

6. Detach the pointer carefully from the torsion bar and set it three serrations lower. The pointer will now be 39.9° below the previous setting, or 11.1° below the zero line (see Fig.22).

7. Engage the torsion bar lever TFN.8036 with the protruding rear end of the torsion bar and twist the bar until the pointer is returned to line up with the centre line of the shock absorber arm, (i.e. the original zero position). Holding the bar thus, tap it into engagement with its rear serrations).

8. Remove the serrated spanner and the pointer and tap the bar fully home, using a soft metal drift. In the case of "deep boot" coachwork, the torsion bar drift TFN.5027 is inserted through the apertures in the boot.

9. Fit the cotter bolt and secure it with the shake-proof washer and nut. Replace the boot aperture covers where applicable, sealing the joints against ingress of water.

10. Lower the car by the jacks and refit the snubber strap fixture.

11. Lower the car to level ground, and check the axle alignment as described on page 25. When satisfactory, tab-lock the securing nuts on the suspension arm shafts.

With reference to the preloading sequence of operations, it will be noted that the preloading twist (i.e. causing a downward pressure of the shock absorber arm) is through an arc of 11.1° below the zero line which cannot be obtained by movement of one end of the bar only, since one serration at the front will give an arc of 14.4°, and one serration at the rear will give an arc of 13.3°.

In order to obtain the required 11.1° with this combination so that the serrations mate exactly at each end of the bar on this setting. it is necessary to turn the <u>whole bar upwards</u> (as indicated by the pointer) by two front serrations, i.e. $2 \times 14.4^{\circ} = 28.8^{\circ}$. Then, with the bar remaining in this position, the <u>pointer only</u> is re-set at three rear serrations down which is $3 \times 13.3^{\circ} = 39.9^{\circ}$; the pointer thus lies 11.1° below the zero line (39.9° less 28.8°).

By having the front serrations engaged and twisting the bar until the pointer is back to the zero line, the bar is twisted the correct amount, which means that a given load will set the shock absorber arms at pre-determined and equal positions.

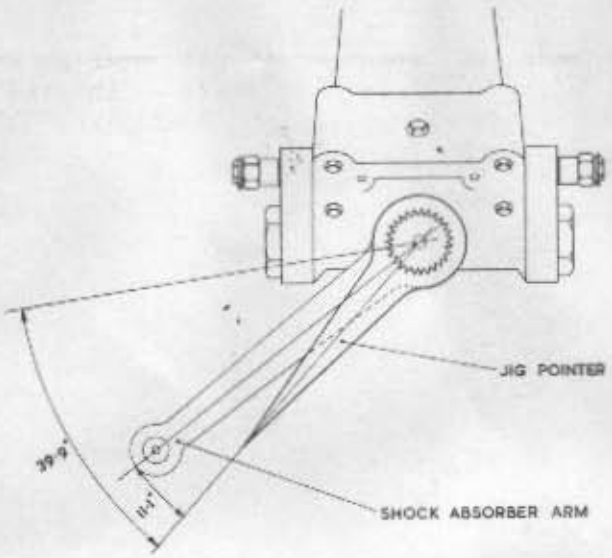


Fig.22. Third stage - 39.9° lower setting.

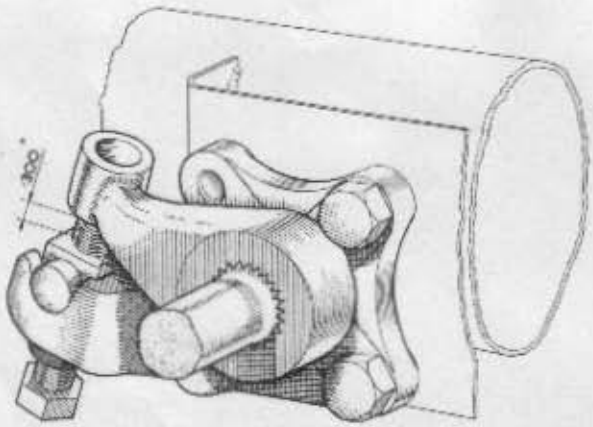


Fig.23. Torsion Bar adjuster.

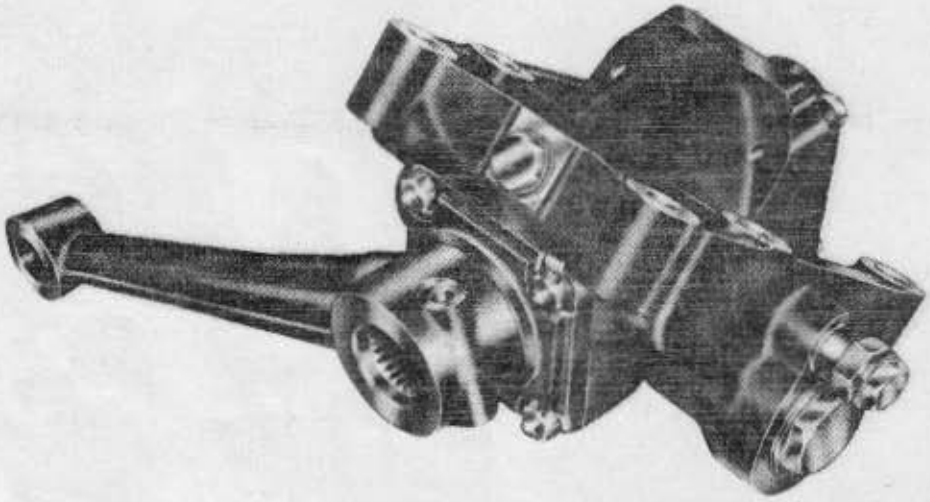


Fig.24. Bristol Rear Shock Absorber.

Torsion bar adjusters

Torsion bar adjusters are fitted to all type 401 cars from chassis No.1016 onwards.

The adjustment is incorporated in each torsion bar front mounting and enables a fine setting to be accomplished in service without the need of withdrawing the bars, and facilitates an accurate setting on installation, see Fig 23.

A base plate is bolted in place of each fixed front serrated mounting, and has a forked extension facing inboard. Accommodated in the fork is a trunnion nut through which a special adjusting bolt is screwed from beneath and locked in position with a lock-nut. A short rocker arm with an internally serrated boss mates with the torsion bar front serrations, and is spigoted into a central hole in the base plate. The outer end of the rocker arm is cupped to receive the rounded end of the adjusting bolt, on to which it is held by the weight of the car. The two members cannot come apart inadvertently since the "no load" position of the axle is below the check point of the snubber straps around the axle.

Initial setting

Screw the adjustment bolt in until a measurement of 0.300 in. is obtained from the top face of the trunnion nut and the end of the bolt thread, then lock in position with the lock nut.

Service adjustment

If, for any reason, adjustment is considered necessary, the following check should first be made.

Remove all luggage and extraneous articles from the car. Clean off all heavy mud from the under parts and drain the fuel tank. This is to bring the rear end of the car to a kerb side weight of 1,320 lb. Set the car on a dead level surface. Take the measurement from the centre of the rear end of a torsion bar to the ground. Take the measurement from the centre of the suspension arm shaft to the ground. The difference between the two readings should be 3 in. ($\pm \frac{1}{8}$ in.). Carry out this check on the other side of the car.

If the above measurements are outside the limits quoted, adjust the torsion bar adjuster as necessary until the measurements are correct.

SHOCK ABSORBERS

Introduction

Rear shock absorbers fitted to Bristol cars are in two categories :-

1. The "Bristol" type.
2. "Newton and Bennett" shock absorbers while utilising a suspension unit for the torsion bars.

"Bristol" type shock absorbers are fitted to the majority of type 400 cars; "Newton and Bennett" telescopic shock absorbers are fitted to some later type 400 cars and to all type 401 and 402 cars.

"Bristol" type - Description

The "Bristol" shock absorber is a double-acting hydraulic cylinder type which serves to support the rear end of the car as well as to dampen the spring action. It is illustrated in Figs.24 and 25. Adjustment is provided to give a "soft" or "hard" setting on the shock absorber units.

The shock absorber arm is an integral part of a hollow mainshaft, the two forming approximately a right angle. The mainshaft is supported in the body by a ball race and needle roller race at each end respectively, the body being bolted to the rear extensions of the chassis frame. A piston actuating arm is keyed to a tapered portion in the centre of the mainshaft. Spacers are fitted between the bearings and the actuating arm, the assembly being retained in the body by a special sealing nut at the opposite end to the shock absorber arm. An oil seal ring is fitted at each end of the body.

The piston actuating arm fits into the centre slot of a double-headed piston and operates on two shock pads, one being spring-loaded. The cylinder in which the piston slides is integral with the body and is at a right angle to the mainshaft housing. Any movement of the shock absorber arm thus moves the piston in the cylinder, which is filled with special oil.

For the purpose of describing the action, it is assumed that the upper illustration in Fig.25 represents the left-hand unit as viewed from the rear. The shock absorber arm will thus be to the left.

When the rear wheel, and therefore the shock absorber arm are moved upward, it results in the piston moving to the left-hand end of the cylinder. To permit displacement of the oil, the low pressure valve is lifted from its seating, the pressure required (and thus the resistance offered) being regulated by the adjustment of the valve spring. The low pressure valve is linked by a passage (not shown in the illustration) to the chamber formed around the central part of the piston and the mainshaft. A spring-loaded non-return disc valve in the right-hand piston head communicates with the right-hand end of the cylinder to permit displacement of oil from the chamber. On rebound of the road wheel, a reverse

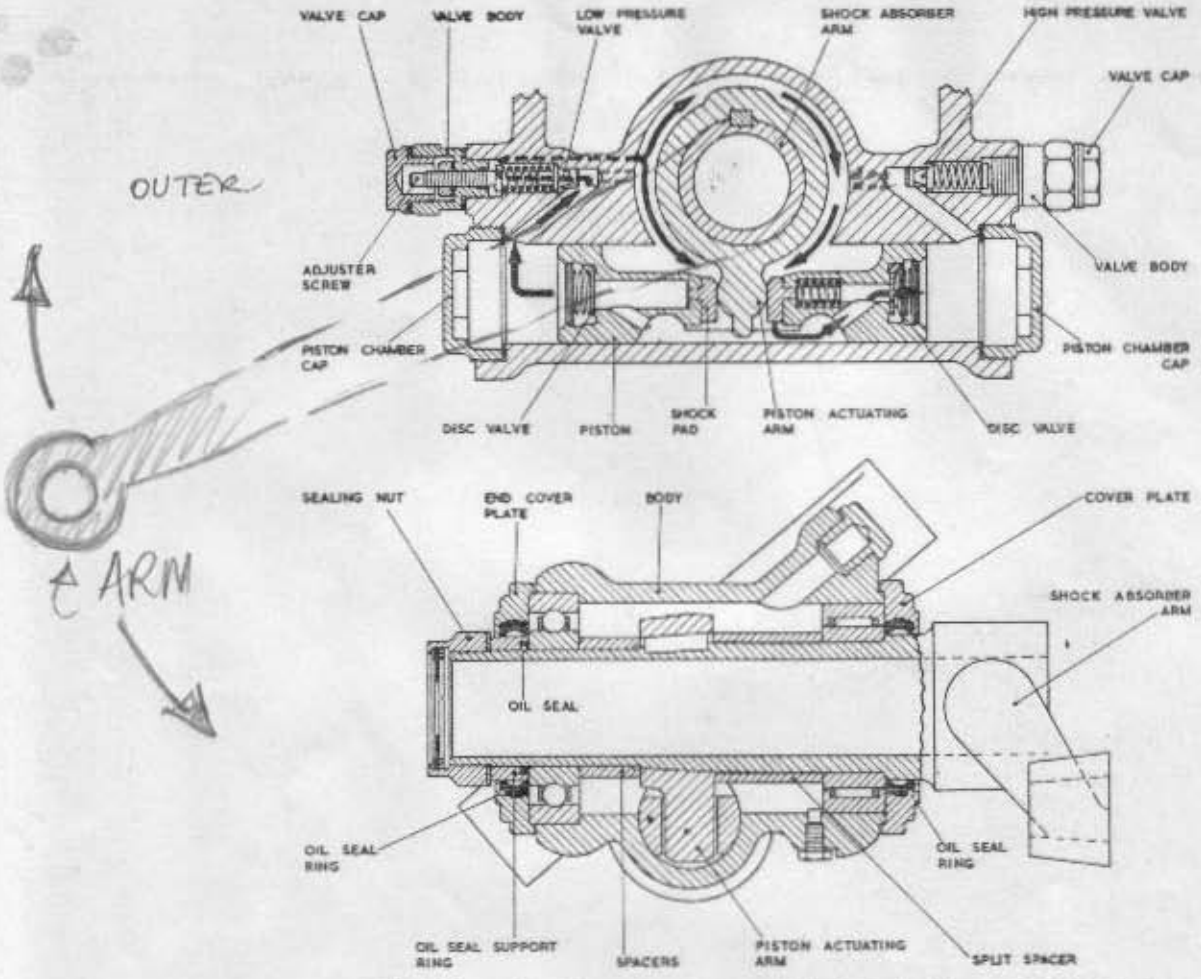


Fig.25. Sectioned view of Bristol Shock Absorber.

TFN 8034

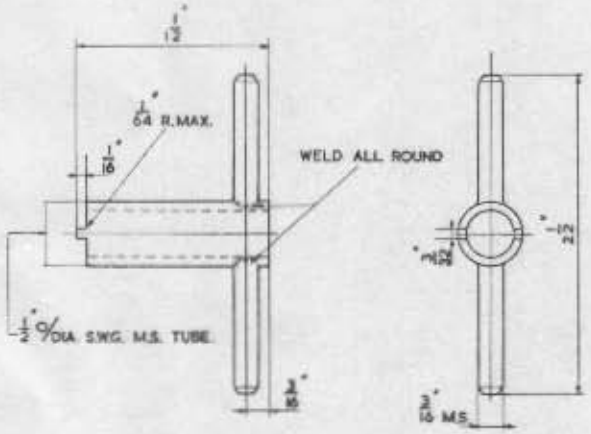


Fig.26. Valve adjusting lock nut key.

TFN 8033

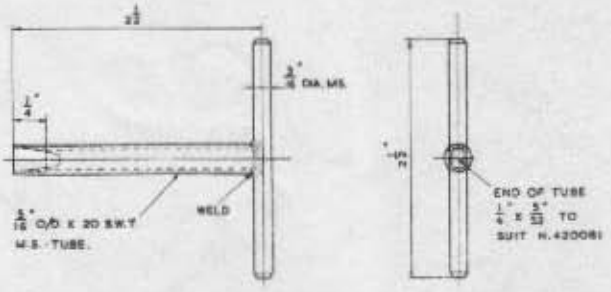


Fig.27. Valve adjusting spindle key.

action takes place when oil is forced out of the right-hand cylinder and through the high pressure valve.

A higher pressure of greater resistance than that created by the loading action is due to a smaller bleed slot in the solid type high pressure valve as well as adjustment of the spring. In later type valves, the bleed is adjusted and set by the makers by means of a screw in the end of the valve adjacent to the spring.

The slight bleed past wach valve is designed to allow for smooth action when up and down road wheel movement is relatively slow, thus permitting a soft ride on reasonably good surfaces.

Maintenance

Normal servicing consists only of checking the oil level at intervals of 3,000 miles (5,000 k.m.), and if necessary, replenishing with the correct type of oil. The procedure is as follows :-

1. Jack up and support the car by the chassis well towards the rear wheels, taking care to avoid damage to the fuel or hydraulic pipe lines.
2. Remove the rear wheels.
3. Clean off the area around the filler plug and remove the plug from each shock absorber.

   Warning :- It is vital that no foreign matter is allowed to enter these units.

4. Fill completely each unit with clean oil of the correct type.
5. Pump the shock absorber arms to ensure the expulsion of air. A "quick-lift" jack beneath the axle case will achieve the necessary pumping action.
6. If necessary, repeat the process of paras. 4 and 5 until the oil level is maintained and all air is expelled.

7. Remove approximately 2 c.c. (about 1⅓ teaspoons) of oil with a clean syringe from each shock absorber and replace the filter plug securely, ensuring that the fibre washer is in good condition.

Warning :- It is most important that a small air space is left above the oil to allow for expansion, otherwise pressure is built up with the consequent risk of bursting oil seals and joints. The correct level is just perceptibly below the level of the lower end of the filler neck.

8. Refit the rear wheels and lower the car.

Removing and refitting

On type 400 cars, withdraw the torsion bar as described on page 42. Then release the lock tabs and remove the six 7/16 in. B.S.F. nuts and bolts securing the shock absorbers to the chassis, and remove the shock absorbers.

When refitting, first secure the shock absorber to the chassis by the six 7/16 in. B.S.F. bolts, tabwashers and nuts. Tighten the nuts and tab-lock them. Then fit and set the torsion bars as described on page 43 or 46. Take note of the torsion bar diameter as noted on page 42.

On type 401 and 402 cars, withdraw the torsion bar and remove the shock absorber, and when refitting, follow the instructions given previously.

Dismantling

Remove the filler plug and drain all fluid. Referring to Fig.25, proceed as follows :-

1. Release the tabwasher and remove the sealing nut from the shock absorber arm mainshaft. Remove the tabwasher.

2. Release the tabwasher on each of the four nuts securing the end cover plate. Remove the nuts, washers, cover plate and oil seal support ring.

3. Remove the oil seals from the cover and support ring.

4. Release the tabwasher beneath each of the four nuts and remove the nuts securing the cover plate adjacent to the shock absorber arm.

5. Unscrew and remove both piston chamber caps and their respective washers.

6. Unscrew and remove both valve caps and valve bodies and withdraw each valve and its respective spring. There is normally no need to disturb the adjuster screw and lock nut.

   Warning :- The valve assemblies, together with their respective springs, must be labelled or otherwise identified for re-assembly to their original positions. This is most important.

7. Suitably support the shock absorber on a press, with the shock absorber arm free underneath. Place a suitable protection pad on the hollow mainshaft and press the shaft until the piston actuating arm is parted (a sharp bump will denote this). Remove the assembly from the press.

8. Tap alternate ends of the mainshaft with a hide-faced hammer until the mainshaft is "worked clear", complete with the roller bearing inner race, split spacer and the cover plate. (This process is to safeguard against the piston actuating arm rocking over and biting into the mainshaft). Ensure that the cover plate and seal assembly comes away squarely to avoid damage to the four holes.

9. Remove the key in the taper and withdraw the needle roller bearing inner race from the mainshaft (if necessary), remove the cover plate and from it, the oil seal. Mark the cover plate for position. The piston actuating arm and the shorter spacer, together with the ball race and the outer race of the roller bearing and the piston assembly, are now left in the body.

10. Tap out the ball race by inserting a soft metal bar into the body through the centre of the piston actuating arm, and tap out the outer race and needle assembly of the roller bearing in the same manner from the opposite end, and remove the roller race stop pin.

11. Withdraw the remaining spacer.

12. Remove the piston actuating arm.

13. Withdraw the piston assembly from the piston chamber.

14. Remove the shock pads and spring from the centre portion of the piston.

15. Remove the circlip, spring and disc-valve from each end of the piston.

Re-assembling

Before re-assembling, all parts must be absolutely clean and free from all dust and grit; this cannot be emphasized too strongly since any particles of foreign matter lodged in one of the valves will disturb seriously the effective damping action of the unit. It is recommended that all parts are laid out on a clean sheet of paper after cleaning, preparatory to re-assembly.

Since the pressures developed during action of the unit are very high, it is recommended to check that all seals, gaskets or washers are in good condition. If any are in doubtful condition, fit new ones on re-assembly. The assembly procedure is as follows :-

1. Fit the key to the tapered portion of the mainshaft. Ensure that it is a good tight fit in the shaft and in the piston actuating arm keyway, then dismantle and place aside pending final assembly. If the key is damaged fit a new one.

2. Fit the roller race stop pin. Press in the outer race assembly of the roller bearing until it is flush with the end of the body.

3. Fit the shock pads and spring into their respective positions in the piston. The spring will fit correctly in one side only. Very early shock absorbers will be found to have shock pads with a stem which fits into the piston, these being replaced on later types with pads of a spherical self-aligning type. If the early type pads are fitted, they must be checked in position minus the spring to ensure that no slackness is present. Should the pads be slack in the piston, it is recommended that a new piston and spherical type shock pads are fitted. No early type shock pads and pistons are available. All spherical type shock pads are a selective fit in four sizes, and the final condition, which should be checked without the spring in position, should be a good rolling fit in the piston with no slackness in the actuating arm.

4. Fit the disc valve, spring and circlip to each end of the piston. If new valves have been fitted, make sure that each has a minimum lift of 1/32in. when assembled. If necessary, shorten the three legs of each valve by equal amounts to obtain the required lift. Check that the spring is seating correctly and that the valve will seat satisfactorily.

5. Fit the piston into the piston chamber.

6. Place the piston actuating arm in position with the larger diameter of the taper bore facing the shock absorber arm end of the unit. Make sure that the piston operating lug engages correctly between the shock pads of the piston.

7. Fit a new oil seal into the cover plate, first coating the recess with jointing compound. This cover plate should be marked as being adjacent to the filler plug or the needle roller race.

8. Just fill the circular recess of the oil seal with Dag colloidal graphite anti-freezing rubber lubricant. Do not overfill or the lubricant will be expelled when the seal is fitted.

9. Thread the cover plate and seal assembly over the mainshaft, followed by the inner race of the roller bearing.

10. Fit the key to the mainshaft then fit the split spacer over the shaft to abut the roller bearing inner race.

11. Coat both sides of a new cover plate gasket with jointing compound and fit in position at the filler plug end of the body.

12. Insert the mainshaft assembly carefully into the body at the filler plug end, ensuring correct entry of the key into the piston actuating arm.

13. Support the actuating arm under a press and press the shaft into the key and taper of the piston actuating arm. Ensure at the same time that the roller bearing and the cover plate enter their respective locations correctly. Remove the assembly from the press.

14. Fit the tabwashers and nuts to the four studs of the cover plate. Tighten the nuts and bend up the tabs.

15. Insert the remaining spacer over the open end of the mainshaft and push it in to abut the piston actuating arm.

16. Fit the ball race over the mainshaft and press it right home.

Note :- Support the assembly on the boss of the mainshaft and use a circular plate over the ball race, to distribute the load evenly. Do not use excessive pressure.

17. Coat the recess of the end cover plate with jointing compound.

18. Just fill the recess of a new seal with Dag colloidal graphite anti-freezing rubber lubricant. Do not overfill.

19. Enter the plain side of the oil seal support ring half-way into the oil seal then enter the oil seal (together with the support ring) into the recess of the cover plate, and press into position in the plate with the fingers until all faces are approximately flush.

20. Fit a new small oil seal ring over the mainshaft and push it against the ball race.

21. Coat both sides of a new cover plate gasket with jointing compound, and fit it into position on the face of the body.

22. Fit the cover plate together with the oil seal assembly.

23. Fit the tabwashers and nuts, tighten the nuts and bend up the tabs of the washers.

24. Fit the tabwasher and sealing nut to the end of the mainshaft. Tighten the nut and bend up the tab of the washer.

Note :- Take care not to shear the inner tongues of the washer when tightening the nut.

25. Refit both piston chamber end caps, using new washers. Tighten fully.

26. Refit the high and low pressure valve assemblies into their correct locations respectively (as marked on dismantling) followed by the valve caps.

27. Fill the shock absorber with the recommended oil, working the shock absorber arm during the process to clear trapped air. Replace the filler plug when it is full. Topping up should again be carried out after refitting to the car, see page 53.

Resetting

This is greatly facilitated by the use of the two special keys TFN.8033 and TFN.8034, which can be made up from the drawings in Fig.26 and 27.

Reset each valve as follows :-

1. Remove both valve caps from each shock absorber.
2. Insert the key TFN.8034 into a valve housing, engage the lock-nut and slacken it.
3. Hold the lock-nut key steady and insert key TFN.8033 into the hollow shank of the first, engage the valve adjuster spindle and screw it IN to its full extent. Then turn it back as indicated below.

   Low pressure (facing outwards).. 6 turns.

   High pressure (facing inboard).. 4 turns.

4. Hold the valve adjusting spindle key steady and tighten the lock-nut.
5. Refit the valve cap.

With the absorbers fitted to the car, their action can be checked roughly by bouncing the car up and down; it should move quite easily but on letting go, the bouncing action should cease almost immediately. Further checking may be carried out on a road of known reaction to suspension generally.

To stiffen the action of the shock absorber, the valve adjusters are screwed IN and to soften, screwed OUT. On no account must any valve adjusting screw be less than two complete turns out from the "fully-in" position or there is a serious risk of hydraulic locking.

Faults and remedies

Soft riding with uncontrolled bouncing.

1. Units need refilling (see page 53).
2. Valve adjustment is ineffective; valves are faulty and require replacement.
3. External leakage. Fit new gaskets, washers, oil seals or tighten the joints.
   Note:- To check for leak location, thoroughly clean the unit with a degreasing agent and dry completely. Apply french chalk around all joints. Move the axle up and down or bounce the car, when leakages will be visible on the chalk.

Rattle at low speeds, when freewheeling over cobbles or rippled surfaces.

This is caused by the piston disc-valves and may be cured by replacing the valves with those with "Tufnol" facings.
Proceed as follows :-

1. Clean off all dirt from around the hexagonal piston chamber caps and the filler plug.
2. Remove the piston chamber caps using the spanner TFN.5035 and allow the oil to drain.
3. Remove the circlip, valve spring and disc-valve from each end of the piston.
4. Re-assemble with "Tufnol" faced disc-valves Part No. N.420551.
   Note:- Ensure that each valve has a minimum of 1/32in. lift when assembled. If necessary, shorten the three legs of the valve by equal amounts. Ensure that the spring seats correctly inside the three legs and that the valve will seat correctly on its seating.
5. Refit and tighten the piston chamber caps, ensuring that the washers are in good condition.
6. Refill the shock absorber as described on page 53.

Knocking at all speeds.	This is most probably due to the piston turning in the cylinder, i.e. a screw action. The cure is to remove the shock absorber, and then stripping.
Miscellaneous rattles.	1. Loose attachment bolts and nuts. 2. Loose dust cover over suspension arm. 3. Dust cover on suspension arm preventing the taper joint of the suspension arm shaft seating correctly in the shock absorber arm.

SUSPENSION UNITS

Each suspension unit is basically the "Bristol" shock absorber with all valves, pistons and their respective working parts removed. The mainshaft and shock absorber arm, together with the two bearings and the oil sealing assemblies are retained. A single piece spacer separates the bearings, see Fig.28, and the unit is filled with lubricating oil.

The shock absorber arm has an additional integral stub extending rearwards to accommodate the lower eye of the "Newton and Bennett" shock absorber.

"NEWTON AND BENNETT" SHOCK ABSORBERS

There are three types of "Newton and Bennett" shock absorbers fitted to "Bristol" cars and <u>they are not interchangeable with each other</u>. One type is fitted to type 400 cars; all type 401 cars up to Chassis No. 1155 have a second type, and from Chassis No.1156 onwards a larger type is fitted. <u>It is therefore essential when an absorber is removed, that another of identical type is fitted.</u>

Servicing

No attention or adjustment is required by these units during the normal working period between major car overhauls. They are carefully set and adjusted in the first instance and should trouble occur, the offending unit should be exchanged.

Removing and refitting

To remove the "Newton and Bennett" telescopic shock absorber, it is unnecessary to disturb the axle fixtures. Proceed as follows :-

1. Jack up and support the car by the rear axle.
2. Remove the relevant rear wheel.
3. Remove the lock-nut and nut from the top vertical fixture. On type 400 cars, this will be found beneath the wing in the wheel arch, and on type 401 and 402 cars, in the forward corners inside the boot.
4. Remove the split pin and the castellated nut from the lower horizontal fixture.
5. Withdraw the complete unit, together with the rubber bushes (two in each fixture).

The refitting procedure is as follows. If the car is not already jacked up, ensure that it is supported by the axle and that the axle is parallel to the car laterally. This is necessary to ensure no torsional stress in the rubber bush fixtures at the normal position.

1. Remove the relevant rear wheel.
2. Fit a rubber mounting bush into each side of the lower eye of the shock absorber.
3. Fit the lower eye of the shock absorber over the lug on the suspension unit arm, followed by a steel washer. Fit the nut finger-tight only.

4. Fit a step-type rubber bush over the top fixture stud (small diameter upward) and insert the stud and bush into the top mounting bracket. On type 400 cars, this will be found beneath the wing in the wheel arch; on type 401 and 402 cars, in the forward corners inside the boot.

5. Fit a step-type rubber bush over the stud (the small diameter downward) to enter the recess formed by the hole in the bracket and the lower bush.

6. Fit a steel washer, a nut and lock-nut.

7. Tighten both upper and lower fixture nuts sufficient only to grip the rubber bushes firmly, and secure the lower fixture with a split pin. Refit the road wheel and lower the car.

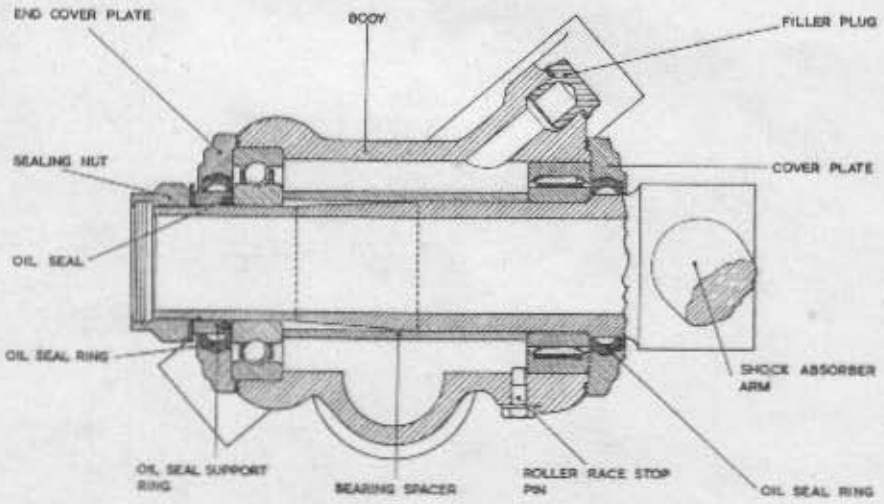
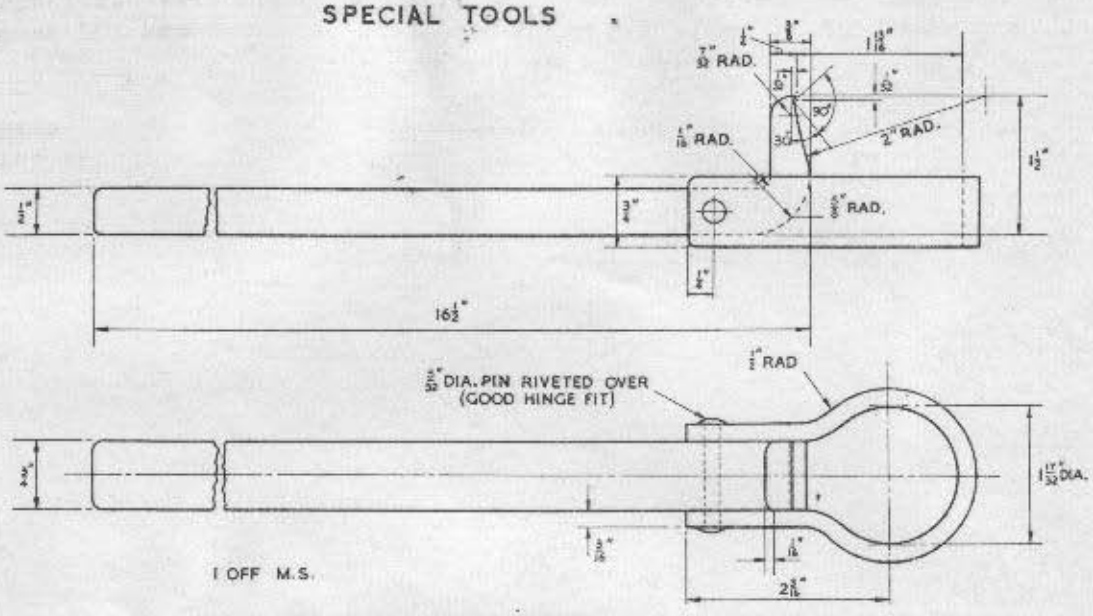
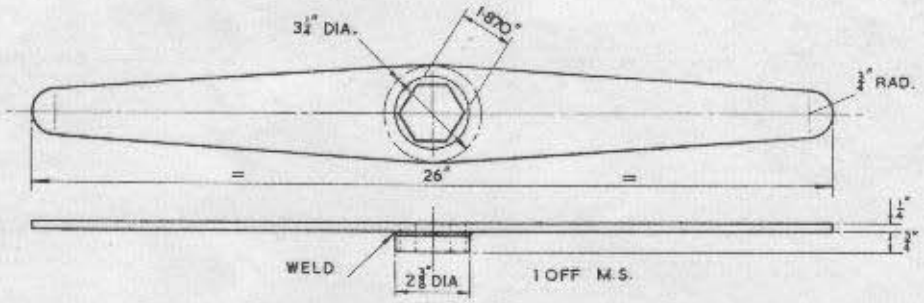


Fig.28. Suspension Unit.

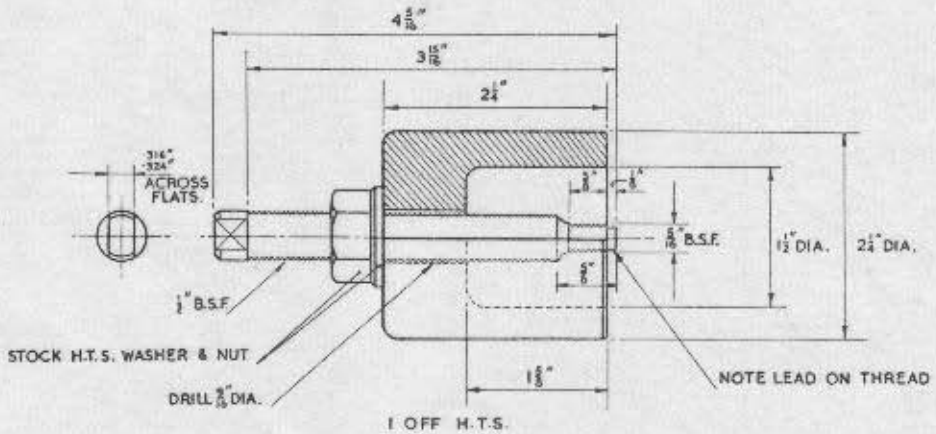
SPECIAL TOOLS



TURN UP TOOL FOR TABWASHERS T.F.N. 5024.

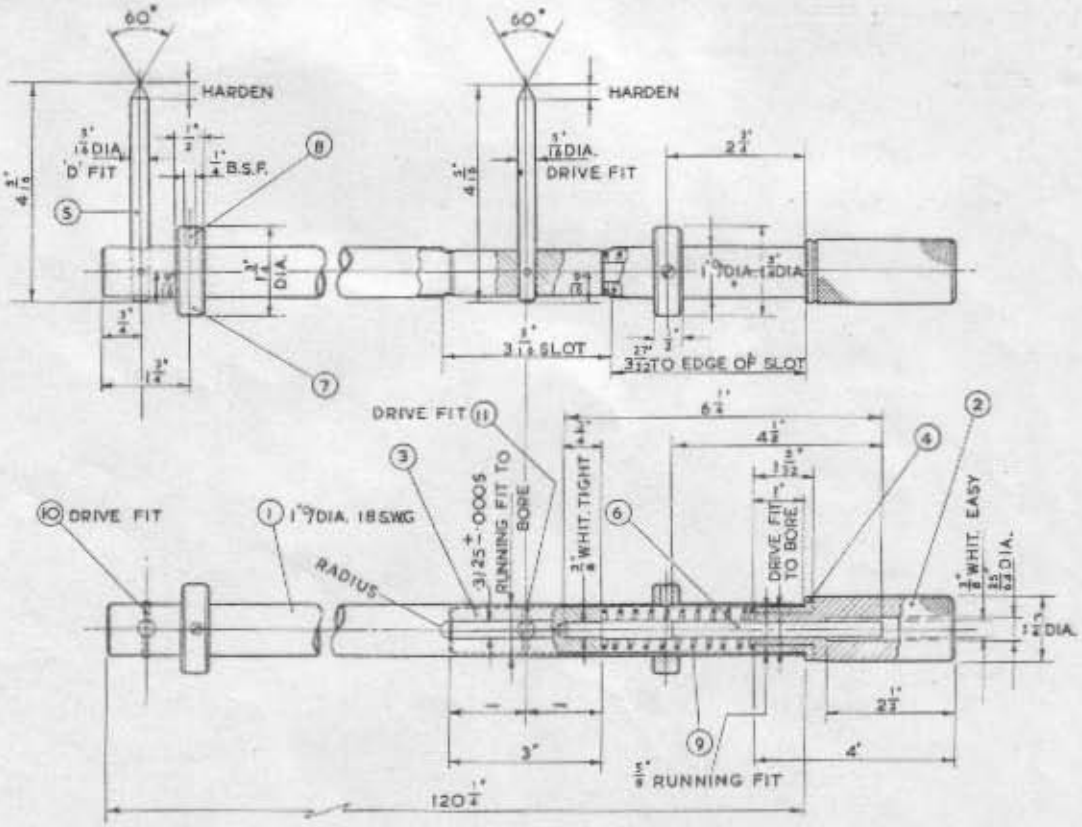


SPANNER FOR RETAINING RINGS T.F.N. 5022.



TORSION BAR EXTRACTOR T.F.N. 5026

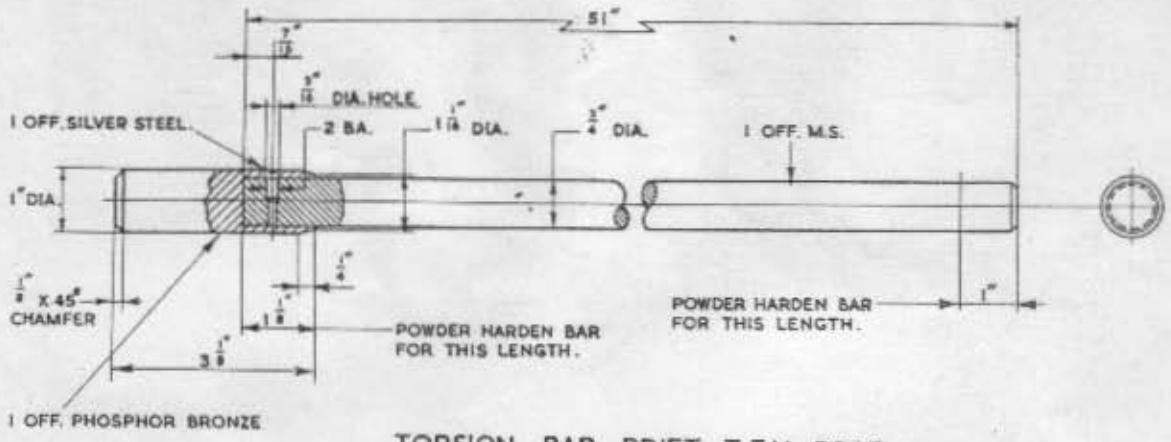
SPECIAL TOOLS



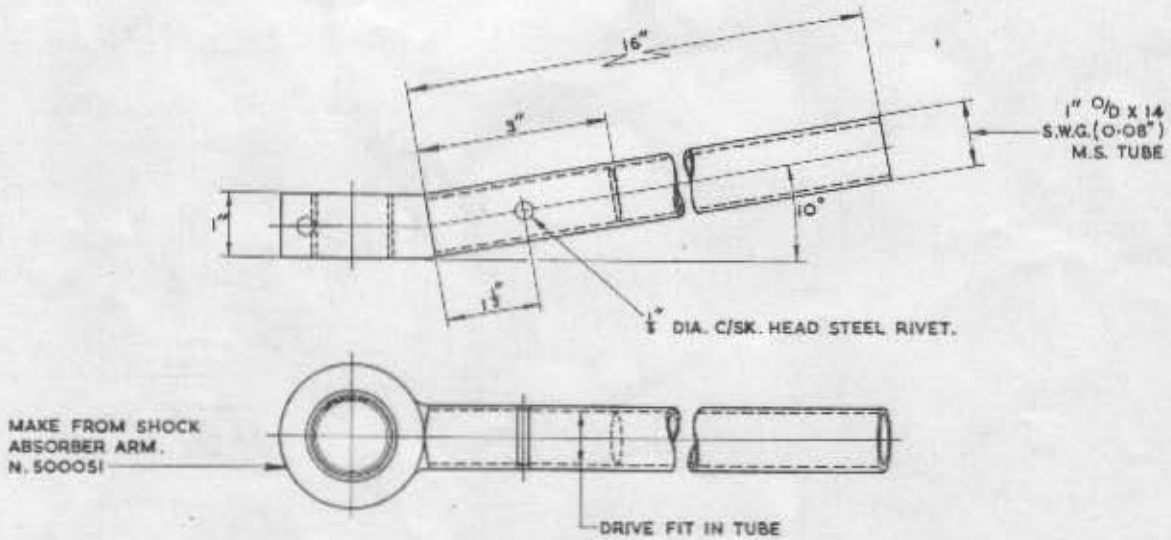
ITEM	DESCRIPTION	NO. OFF	MATERIALS	ITEM	DESCRIPTION	NO. OFF	MATERIALS
1	TUBE	1	MILD STEEL	7	COLLAR	2	MILD STEEL
2	KNURLED SCREW	1	DURAL	8	GRUB SCREW	2	1/4" B.S.F.M.STEEL
3	TRAVERSING SLEEVE	1	DURAL	9	SPRING	1	TO SUIT
4	BUSH	1	MILD STEEL	10	PIN 1/8" DIA.	1	S.STEEL
5	ARM -FIXED	1	" "	11	PIN 1/8" DIA.	1	S.STEEL
6	SPINDLE.	1	" "				

TRAMMELS T.F.N. 5033

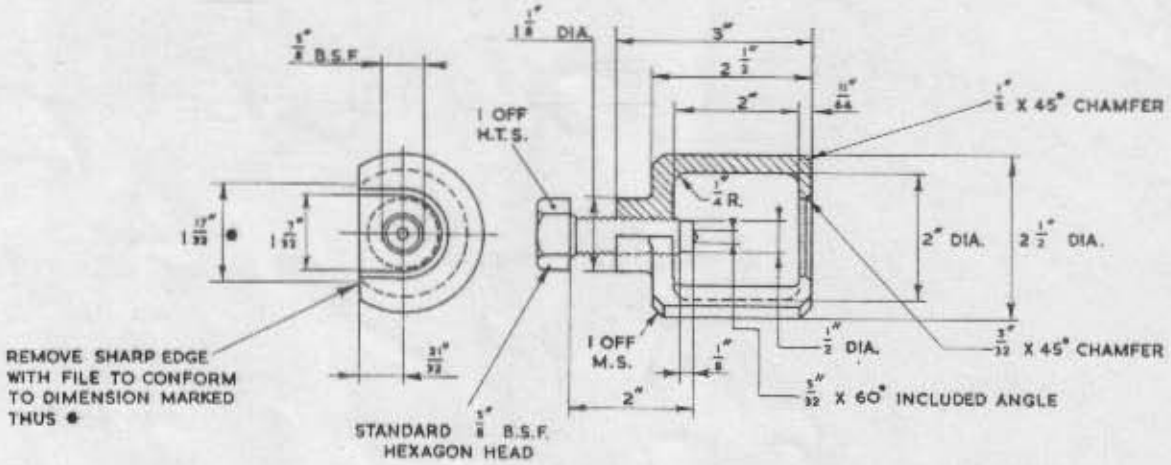
SPECIAL TOOLS



TORSION BAR DRIFT T.F.N. 5027.

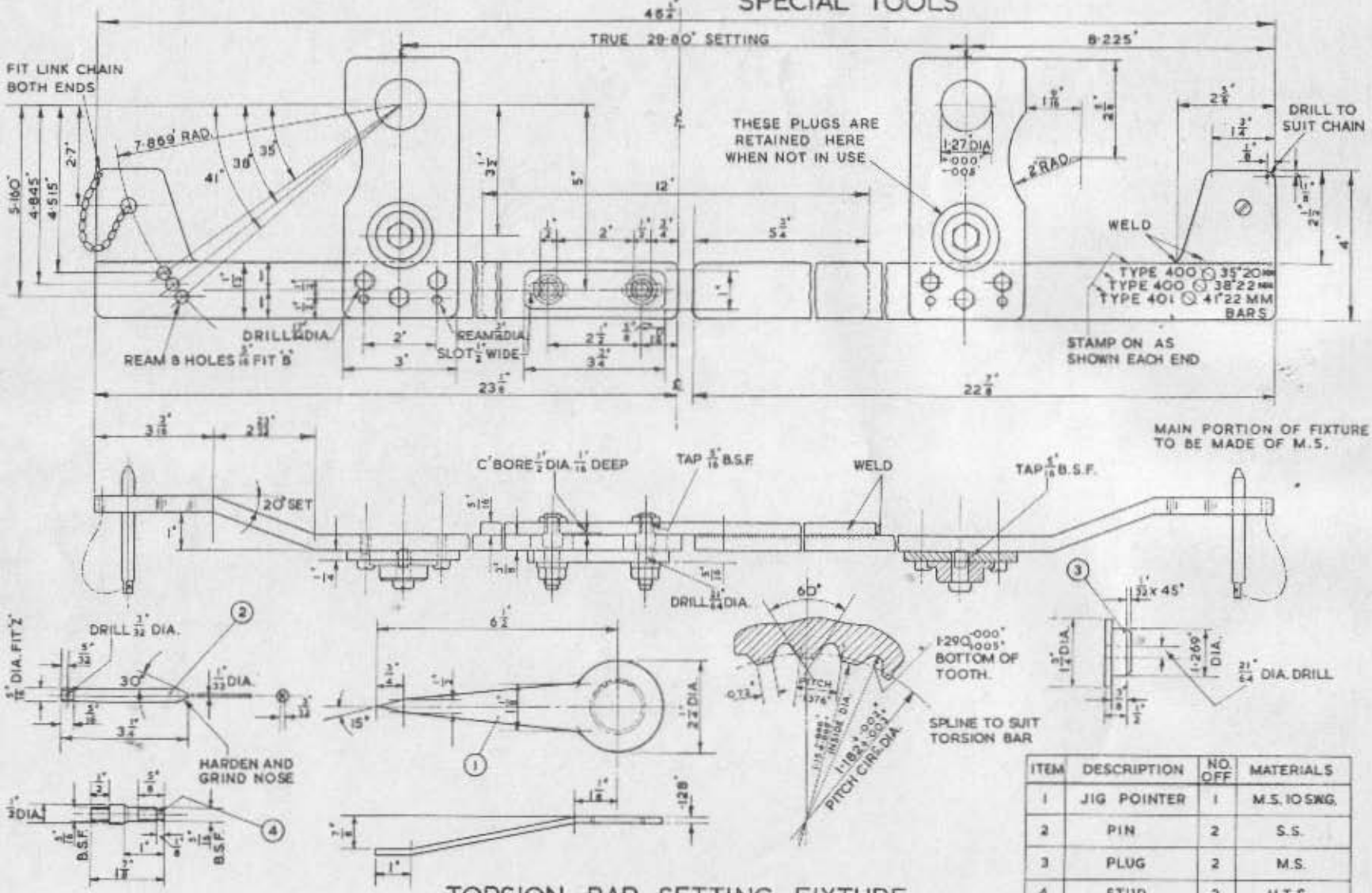


TORSION BAR LEVER T.F.N. 8036.



REAR SUSPENSION ARM EXTRACTOR T.F.N. 8039.

SPECIAL TOOLS



TORSION BAR SETTING FIXTURE

ITEM	DESCRIPTION	NO. OFF	MATERIALS
1	JIG POINTER	1	M.S. 10 SWG.
2	PIN	2	S.S.
3	PLUG	2	M.S.
4	STUD	2	H.T.S.

WORKSHOP MANUAL

Section:- 6 **Bulletin No:-** 1

ISSUE NO.2.

AUG. 1955.

Subject:-

INSTALLING "NEWTON AND BENNETT" TELESCOPIC SHOCK ABSORBERS TO THE REAR OF TYPE 400 CARS

SEE ALSO BULLETIN NO.2

1. The installation of "Newton and Bennett" telescopic shock absorbers to the rear suspension of the type 400 car necessitates changing the present "Bristol" shock absorbers to suspension units whereby they will act only as a link between the axle casing and the torsion bar. At the same time, upper and lower fixtures have to be fitted to the wheel arches and the brake back plates.

The "Bristol" shock absorber may be adapted in one of two ways, thus :-

Procedure A

By removing the disc valves from each end of the shock absorber piston, which can be done without disturbing either the shock absorber unit or its torsion bar.

Procedure B

By removing all the shock absorber working parts and fitting a distance piece between the bearings, as shown on page 63, Fig.28. This process necessitates the removal and dismantling of the unit as well as the removal of the torsion bar with the consequent need for resetting on assembly.

With regard to Procedure A, there is the risk that sooner or later undue noise may develop in the piston and actuating assembly. Much will depend, of course, on the degree of wear already suffered as to whether noise becomes unacceptable.

Both procedures are given in detail in this Bulletin, but where a procedure coincides with that already given in the Workshop Manual, reference is made thereto. A list of the parts required appears at the end of this Bulletin as well as a general arrangement drawing of the necessary installation.

PREPARATION

2. It is advisable first to wash thoroughly beneath the rear wings and wheel arches, behind the brake assemblies and around each shock absorber.

PROCEDURE A

3. (1) Remove the fuel tank to allow access to the wheel arches as described in Section 3, page 10.

(2) From each side of the "Bristol" shock absorber, unscrew the piston chamber cap, remove and discard the disc valves and their respective springs from the piston heads. Check the condition of the piston chamber cap washers; renew any that are in doubtful condition. Refit the caps and screw home securely. Fill up the unit with an approved engine oil, and check for oil leaks.

Continue as from paragraph 5 of this Bulletin.

PROCEDURE B

4. (1) Remove the fuel tank to allow access to the wheel arches as described in Section 3, page 10.

(2) Place a jack beneath each side of the chassis frame well towards the rear wheels, taking care not to damage the brake fluid or fuel pipes. Raise the car evenly until the wheels are just clear of the ground, then lift the axle evenly to relieve all strain on the torsion bars. Remove the wheels. Remove the torsion bars as described in page 42 of this Section.

(3) Remove the "Bristol" shock absorbers by detaching the six 7/16in. nuts and bolts securing them to the chassis. Thoroughly clean and dry each unit as it is removed, remove the filler plug and drain the hydraulic fluid.

(4) Dismantle the shock absorbers as described in page 54 of this Section. The warning given in para.6 on page 55 is superfluous in this case, since the valves are to be discarded.

(5) Reassemble the unit as illustrated in Fig.28, page 63. Fit new oil seals if necessary.

(6) Fit a washer (item 1) over the blanking plug (item 2) and then screw home into the valve assembly location in the shock absorber body.

(7) Coat the recess of the rear cover plate with jointing compound and fit the oil seal into the recess.

(8) Just fill the circular recess of the oil seal with "Dag" colloidal graphite anti-freezing rubber lubricant. Do not overfill or the lubricant will be expelled on assembly.

(9) Thread the cover plate over the mainshaft, followed by the inner race of the roller bearing.

(10) Coat both sides of the cover plate gasket with jointing compound and fit it in position at the filler plug end of the suspension unit body (as this shock absorber now becomes).

Note:- It is important that a good quality jointing compound be applied to both sides of the end plate gaskets and the faces forming the small gap between the plate and the body. Take care that no compound is allowed to exude into the bearings on assembly.

(11) Insert the mainshaft assembly into the same end of the unit and push right home, ensuring that the bearing race and the cover plate enter their respective locations correctly.

(12) Fit the tabwashers and nuts to the four studs of the cover plate. Tighten and tab lock the nuts.

(13) Insert a distance piece (item 3) over the open end of the mainshaft and push it home to abut the roller bearing inner race.

Continue as from page 57, para.16 to para.25 inclusive.

(14) Fill the unit to the correct level with a recommended brand of engine lubricating oil. The correct level is just below the bottom of the filler "neck".

(15) Refit both suspension units to the chassis as described on page 54, followed by the torsion bars as described on page 43 or 46, according to the diameter of the torsion bars, see page 42.

INSTALLATION OF "NEWTON AND BENNETT"

SHOCK ABSORBER FIXTURES

Fitting shock absorber lugs

5. (1) Remove the rear brake drums and brake shoes as described in Section 8, page 20, paragraphs 1 and 2 (Removing and refitting).

Warning:- Ensure that the brake operating pistons do not come out of the cylinders.

(2) Mark off and drill (letter 'O' 0·316in.) the middle hole of the lower attachment lug to the dimensions 2 1/32in. and 1 29/32in. as shown in Fig.1.

(3) Bolt the lugs (items 4 and 5) into position as shown in Fig.1 with a bolt, shake proof washer and nut, (Items 6, 7 and 8).

(4) Position the lug to conform to the 2 1/32in. (plus ⅛in.) dimension at the top hole and mark off both the remaining holes. Remove the lugs and drill the holes (letter 'O' 0·316in. dia.). Refit the lugs and tighten the bolts and the setscrew (item 9) in the lower position.

(5) Refit the brake shoes, taking care to locate the "Micram" adjuster in the slot in the leading shoe with the mask in position as shown in Fig.6 of Section 8, page 12 and fit the pull off and tension springs in their correct positions.

(6) Connect the steady springs to the brackets on the back plate, ensuring that the shank of the hook is on the inside of the bracket.

(7) Refit each brake drum.

Fitting the wheel arch stiffening plates and shock absorber brackets

6. For the detailed layout, see Fig. 1.

(1) First make sure that all foreign matter (and any rust) is removed from the central part of the wheel arch and, using the rear face of the chassis member as a datum, mark off a vertical line on the wheel arch.

(2) Scribe a vertical centre line on the stiffening plate (item 10 or 11) to bisect the aperture in the centre.

(3) Offer up the stiffening plate to the wheel arch so that the scribed centre lines coincide (as seen through the central aperture), and note any existing rivets etc. which impede close contact between the wheel arch and the stiffening plate. Remove any such rivets.

Note:- (1) At the rear lower corner of the stiffening plate when in position, is a small plate either riveted or spot welded on the bodywork; this plate must be broken loose along its top, front and lower edges and pulled away to allow the stiffening plate to be slipped beneath it. The stiffening plate will thus be "sandwiched" between the bodywork and the plate, which are all riveted together on final assembly.

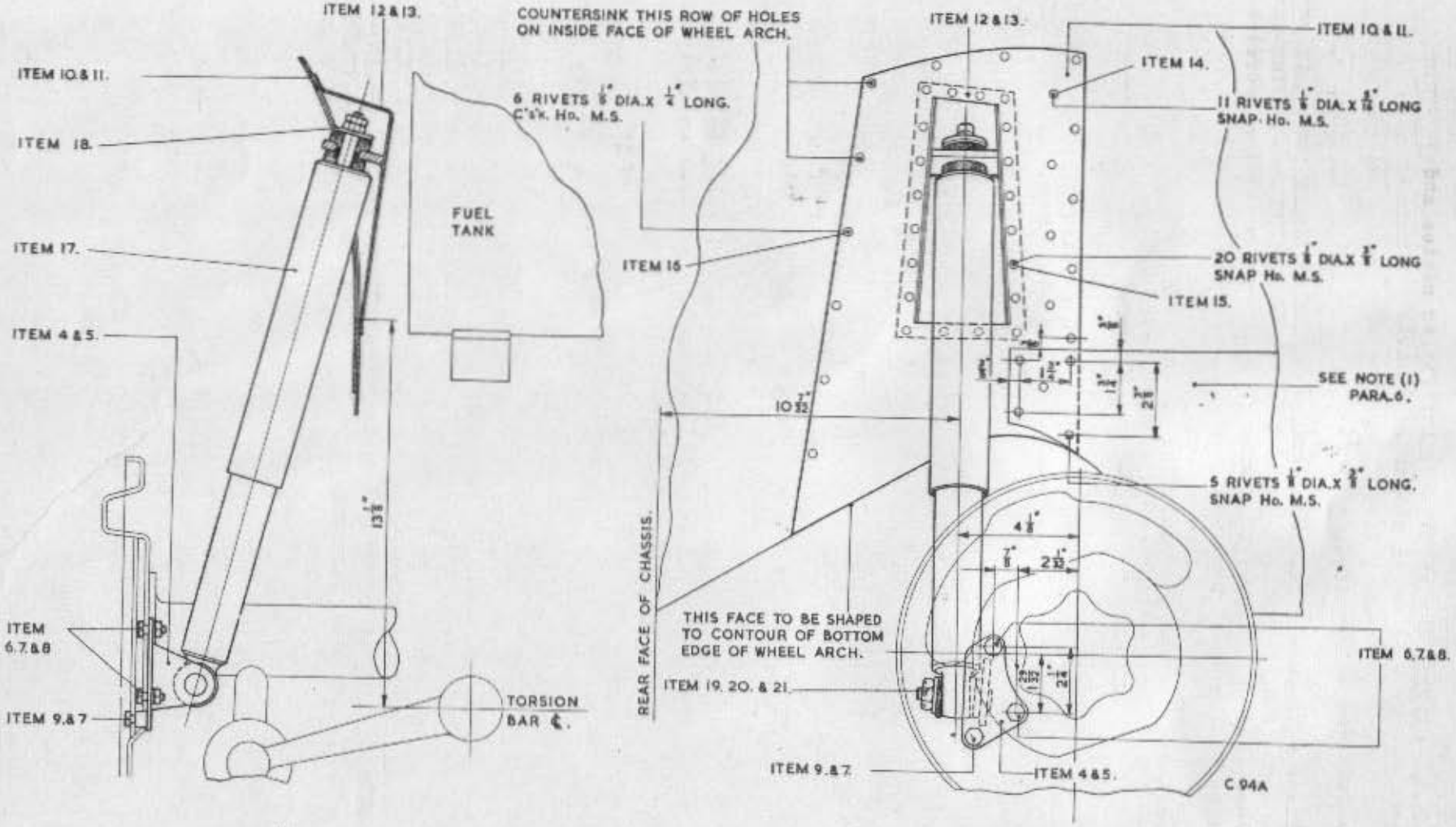
(2) Running aft from approximately the same location as in (1) above are two "ribs"; these must carefully be beaten flat as required.

(4) Mark off the lower edge of the stiffening plate to the same contour as the lower edge of the wheel arch, then remove the stiffening plate and trim the lower edge as marked.

(5) Apply a protective coat of paint to that area of the wheel arch which is to be covered, and when dry, reposition the stiffening plate, then mark off and drill the necessary rivet holes as shown in Fig. 1. It is suggested that bolts and nuts are fitted to alternate holes as they are drilled to give positive positioning of the plate while work progresses, which is more easily done when starting from the bottom and working upwards. The plate and the wheel arch contour are thus pulled tightly together. From inside the car, countersink the holes in the forward facing row.

(6) Starting from the bottom and working alternate sides, fit and secure the <u>correct</u> rivets in the vacant holes then remove one nut and bolt at a time and fit and secure the remaining rivets.

(7) Cut out an aperture from the wheel arch to coincide with the aperture in the centre of the stiffening plate, then drill the rivet holes.



NOTE:- ALL HOLES 1/8" DRILL IN CONJUNCTION WITH ITEM No. 10 OR 11. ALL RIVETS IN WAY OF STIFFENING PLATES ITEM No. 10 OR 11 ARE TO BE DRILLED OUT AND REPLACED THROUGH STIFFENING PLATE AS WELL.

NOTE:- 1 COAT OF PROTECTION PAINT BETWEEN METAL PARTS BEFORE RIVETING.

FIG. 1.

(8) Offer up the bracket (item 12 or 13) from inside the car and temporarily bolt it in position. This bracket protrudes inside the car. If it should foul the bulkhead (behind the rear squab site) carefully cut away the bulkhead sufficiently to leave the minimum clearance, and in such a manner that the bracket can be welded to the bulkhead.

(9) Remove one nut and bolt and replace it with a rivet as shown in Fig. 1; continue this process until the riveting is complete.

(10) Apply a coat of protective paint to all rivet heads or any naked metal.

REPLACING COMPONENTS REMOVED

7. (1) It is advisable now to replace the fuel tank, all interior fittings, spare wheel etc. before fitting the telescopic shock absorbers in order that there shall be as little distortion as possible in the rubber bushes of the lower shock absorber mounting when the car is standing with the "normal" suspension deflection, i.e. the rubber bushes should be at or very near their "neutral" state. Proceed therefore as follows :-

(2) Refit the fuel tank and rear seating arrangement as described in Section 3, page 11, and fit the spare wheel if it has been removed.

FITTING SHOCK ABSORBERS

8. (1) Support the rear of the car by the axle, making sure that the axle is laterally parallel to the car and that the ground is level. Fit each telescopic shock absorber (item 17) as shown in Fig. 1, and secure the top fixture by fitting a steel washer (item 18) against the rubber bush, followed by the plain nut; fit the lower fixture by fitting a steel washer (item 20) followed by the slotted nut (item 19). Tighten both fixtures sufficient only to grip securely their respective rubber bushes. Fit a locknut to the upper fixture, and a split pin (item 21) to the lower.

(2) Fit the rear wheels and lower the car.

PARTS REQUIRED FOR FITTING TELESCOPIC SHOCK ABSORBERS, AND ALTERING "BRISTOL" SHOCK ABSORBERS ON TYPE 400 CAR

Item No.	Part	Part No.	No. supplied
1.	Washer, for use with item 2	N.420541	4
2.	Blanking plug, for replacing HP. and LP. valves in Bristol shock absorber.	N.500630	4
3.	Distance piece, for replacing parts removed from Bristol shock absorber.	N.500620	2
4.	Lug L.H.) Bottom fixture for item 17.	N.502461	1
5.	Lug R.H.)	N.502471	1
6.	Bolt, 5/16in. B.S.F. x $\frac{3}{4}$in. for uppermost fixture of items 4 and 5 to brake backplate.	FB.502361	4
7.	Shakeproof washer, 5/16in. for use with items 6 and 9.	-	6
8.	Nut, 5/16in. B.S.F. for use with items 6 and 9.	FN.105/K	4
9.	Setscrew, 5/16in. B.S.F. x $\frac{3}{4}$in. for lower fixture of items 4 and 5.	FB.105/6D	2
10.	Stiffening plate L.H.) For stiffening wheel arch	N.647321A	1
11.	Stiffening plate R.H.)	N.647321B	1
12.	Bracket L.H.) Top fixture for item 17	N.647311A	1
13.	Bracket R.H.)	N.647311B	1
14.	Rivet, snaphead, 5/16in. x $\frac{1}{4}$in. dia.	-	72
15.	Rivet, snaphead, $\frac{5}{8}$in. x $\frac{1}{4}$in. dia.	-	72
16.	Rivet, c'sk head $\frac{3}{4}$in. x $\frac{1}{4}$in. dia.	-	36
17.	"Newton and Bennett" telescopic shock absorber, S.14490. Setting WE.4C3	-	2
18.	Washer. Supplied with shock absorber	-	2

Item No.	Part	Part No.	No. supplied
19.	Nut, ½in. B.S.F. slotted, for securing lowermost fixture of item 17 to item 4 or 5.	FN.408/K	2
20.	Washer. For use in lower fixture of item 17.	N.502351	2
21.	Split pin, 1¼in. x 3/32in. dia. for use with item 19.	-	2

WORKSHOP MANUAL

Section:- 6 **Bulletin No:-** 2

August 1955.

Subject:-

MODIFICATION OF "NEWTON AND BENNETT" TELESCOPIC SHOCK ABSORBER FITTED TO THE REAR OF TYPE 400 CARS

The "Newton and Bennett" telescopic shock absorber type S.12490, which has previously been fitted to the rear of type 400 cars can no longer be supplied as a new unit and has been replaced by the telescopic shock absorber, type S.14490 setting WE4C3. The new shock absorber is not interchangeable with the old unit, therefore, in the event of failure of a S.12490 unit the following action can be taken.

1. Obtain a reconditioned type S.12490 unit or, alternatively, have the unserviceable unit reconditioned.

2. Fit a pair of new type S.14490 units which will necessitate the replacement of the old bottom lugs, Part Nos. N.502331A (left-hand) or N.502331B (right-hand) by new bottom lugs, Part Nos. N.502461 (left-hand) or N.502471 (right-hand).

In the event of the second course being taken it is important that both rear shock absorbers should be renewed to maintain an even damping action. Furthermore, it is essential that the new type lugs are fitted as the dimensions of the shock absorber locations are completely different to those on the old lugs.

To fit the new lugs, refer to the procedure given in Bulletin 1, Issue No.2.