

Chapter 11 Suspension, and steering

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Specifications

Front suspension

Type	Independent - coil spring
Dampers	Telescopic hydraulic

Castor angle:

Mk 1 models ...	...	...	...	...	...	...	...	...	$\frac{1}{2}^{\circ} - 1^{\circ}$ negative
All other models	...	...	...	...	...	...	...	...	$0^{\circ} - \frac{1}{2}^{\circ}$

Camber angle:

Mk 1 models ...	...	...	...	...	...	...	...	...	$\frac{1}{2}^{\circ} - 1^{\circ}$ positive
All other models	...	...	...	...	...	...	...	...	$\frac{1}{2}^{\circ} \pm \frac{1}{2}^{\circ}$ positive

Swivel inclination:

Mk 1 models ...	...	...	...	...	...	...	...	...	$6\frac{1}{2}^{\circ}$
All other models	...	...	...	...	...	...	...	...	$3\frac{1}{2}^{\circ}$

Coil springs:

Number of coils (approx) ...	...	...	...	...	...	...	...	...	6 $\frac{1}{2}$
Diameter of bar - 2.4 litre and 240	...	...	...	...	...	...	...	...	0.630 in. (16 mm)
- All other models	0.635 in. (16.13 mm)

Rear suspension

Type	Semi-elliptical cantilever
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Spring data:

Number of leaves	5
Width of leaves	2.25 in. (57 mm)
Thickness of leaves - bottom three	0.281 in. (7 mm)
- top two	...	...	...	...	...	...	...	...	0.25 in. (6.3 mm)
Diameter of spring eye ...	...	...	...	...	...	...	...	...	1 in. (25.4 mm)
Free camber ...	...	...	...	...	...	...	...	...	3.45 in. to 3.7 in. (87.5 to 94 mm)

Steering (standard)

Type ...	...	...	...	...	...	...	...	...	Recirculating ball
Steering wheel turns lock to lock:	...	...	...	...	...	...	...	...
Mk 1 models	...	...	...	...	...	...	...	...	4
All other models	...	...	...	...	...	...	...	...	4 $\frac{1}{4}$

Toe-in:

Mk 1 models and 2.4 litre Mk 2	...	...	...	...	...	...	...	...	Parallel to 1/16 in. toe-in
All other models	...	...	...	...	...	...	...	...	Parallel to 1/8 in. toe-in

Steering (power assisted)**Earlier type steering unit**

Make ...	...	...	...	...	...	...	...	...	Burman
Type ...	...	...	...	...	...	...	...	...	Hydraulically assisted worm and recirculating ball

Steering gear ratio at centre of travel	...	...	...	...	21.4 : 1
Number of turns lock to lock	...	...	...	...	4.9
Turning circle	...	...	...	...	33 ft 6 ins (10.21 m)
Oil pump:					
Make	...	...	...	...	Hobourn-Eaton
Type	...	...	...	...	Eccentric motor
Location	...	...	...	...	Rear of generator
Operating pressure	...	...	...	...	800–850 lb per sq in (56.24–59.76 kg/cm ²)
Later type					
Make	...	...	...	...	Adwest Engineering Co. Ltd.
Type	...	...	...	...	Marles Varamatic-Hour glass roller with hydraulic servo cylinder
Steering gear ratio at centre	...	...	...	...	21.6 : 1
Steering gear ratio at full lock	...	...	...	...	13 : 1
Number of turns lock to lock	...	...	...	...	2¾ Turning circle 33ft 6 ins (10.21 m)

1 General description

The front suspension assemblies fitted to all models are of similar construction and differ only in respect of the coil springs.

A sectioned view of the front suspension assembly as fitted to cars equipped with drum type brakes is given and except for the hub fittings this is identical with the exploded view of the whole suspension assembly with disc brakes.

Attached to a fabricated pressed steel crossmember are the wishbones, the stub axle carriers, the coil springs and the hydraulic dampers. The coil springs, which are housed in turrets at each end of the suspension crossmember and which are retained at their lower ends by seat pans bolted to the lower wishbone, are controlled by telescopic hydraulic dampers, one being mounted in the centre of each spring. The top of the damper is attached to the crossmember turret and the bottom is bolted to a mounting bracket which is attached to the coil spring seat pan.

The forged steel upper wishbones (earlier models were pressed steel) are mounted at the fulcrum shaft end on rubber/steel bonded bushes whilst the outer ends are bolted to the upper wishbone ball joint which, in turn, is attached to the stub axle carrier.

The inner end of the lower wishbones is also mounted on rubber/steel bonded bushes and the outer end is attached to the lower ball joint at the stub axle carrier.

Two tapered roller bearings carry the wheel hub. The inner races of the bearings fit on a shaft located in a tapered hole in the stub axle carrier.

Fitted between the two lower wishbones is an anti-roll bar which is attached to the chassis by rubber insulated brackets.

The whole front suspension assembly is attached to the chassis at four points; two rubber mountings at the rear and two at the front.

A general arrangement of the rear suspension is shown. It consists of semi-elliptic cantilever springs having rubber inserts between the ends of the spring leaves. An eye is formed at the rear of the spring into which fits a rubber/steel bonded bush bolting to a bracket on the rear axle tube. Fitted at the front end of the spring is a circular rubber pad which bears on an inclined plate attached to the chassis side member whilst the centre of the spring, also fitted with rubber pads top and bottom, is clamped between plates in the box section at the rear of the chassis side member.

Torque arms with large rubber/steel bonded bushes at both ends are fitted between brackets on the top of the rear axle and to a body crossmember at the back of the rear seat panel. Lateral location of the suspension is controlled by means of a rubber mounted panhard rod which fits between brackets on the rear axle and the right hand chassis member. Damping of the suspension is controlled by two telescopic hydraulic dampers located between brackets on the rear axle and the front of the luggage compartment floor. The dampers incorporate bump and

rebound stops which limit the movement of the rear suspension.

The standard steering unit is of the recirculating ball type in which motion is transmitted from the inner column worm to the rocker shaft by means of a nut running on a continual train of steel balls.

The worm is supported at each end by a ball race which can be adjusted by means of shims under the end plates at the top and bottom of the steering box. The rocker shaft is supported in a bush pressed into the steering box and end float of the shaft is controlled by an adjusting screw mounted on the top plate of the box. The drop arm, which is taper splined to the rocker shaft, is connected to an idler by an adjustable track rod and extensions of the track rod ends are attached to the inner ball joints of the two steering tie rods. The outer ball joints of the tie rods are connected to the steering arms bolted to the stub axle carriers.

A layout of the standard steering is given. A description of the power assisted steering system as fitted to 3.4 and 3.8 litre and 340 models, as an optional extra, is given in Section 42. The layout of the steering components is however, similar.

2 Front suspension assembly - removal and refitting

Two methods can be employed. The first entails supporting the body on stands and drawing out the assembly, less road wheels, on a jack. The second method can be used with the car on a lift, or on the floor, and in this method the car is lifted by means of tackle attached to a cross-bar placed under the chassis side members. This means removal of the radiator. We feel that the extra work involved does not justify using the second method so we have confined ourselves to describing only the first method.

1 Place a jack under the front suspension cross member and raise the car to remove the road wheels.

2 Place substantial blocks not less than 16" (40 cm) in height on the chassis adjacent to the front jacking sockets. We suggest that you do not place the blocks directly under the sockets, the logical place, because these may have deteriorated due to age and rust and may not be capable of supporting the weight of the car.

3 Lower the car so that its weight is taken on the blocks but leave the jack in position under the crossmember.

4 Hold the hexagon of the flexible brake hose pipe with a spanner and undo the union nut of the rigid pipe, allow the fluid to drain into a container and then blank off the end of the rigid pipe.

5 Still holding the hexagon of the flexible pipe, remove the locknut and withdraw the flexible pipe from the bracket. Blank off the end of the pipe.

6 Repeat the foregoing for the other brake hose pipe.

7 Remove the nut securing the anti-roll bar at each lower wishbone. Remove the two set bolts securing the brackets holding the anti-roll bar to the underframe members and remove the bar.

8 Remove the clamping bolt securing the steering column universal joint to the steering box shaft.

9 Remove the two bolts at each side securing the suspension rear mountings to the chassis side members.

10 Remove the four nuts and bolts securing the front mountings to the brackets at the front ends of the chassis side members.

11 Lower the jack until the front suspension assembly is clear and can be drawn forward, it will be necessary during this operation to ease the steering column universal joint off the splines of the steering box shaft.

12 Refitting is the reverse of the above but before starting the work, carefully examine the mounting rubbers for deterioration especially the front mounting rubbers (a "clonking" sound whilst the car is being driven indicates that the front mounting rubbers, or a rubber, have failed and that the centre bolt is being brought into contact with the chassis frame). Look carefully also at the rubbers of the anti-roll bar mounting bracket as these are prone to failure after high mileage.

13 When offering the assembly up to the car, make sure that the wheel discs (brake hubs) are in the dead ahead position and that the steering wheel spokes are in the three and nine o'clock positions with the horn ring at the bottom.

14 Finally bleed the brake system as described Chapter 9.

3 Hydraulic damper (front) - removal and refitting

1 Jack up the car to remove the road wheel and then support the car on a firmly based axle stand.

2 You will find it easier to remove the damper if the wishbone levers are kept approximately horizontal either by placing a support under the lower wishbone and partly lowering the car to compress the spring or by placing a packing piece made out of hard wood (see Fig 11.6) between the upper wishbone levers and the crossmember turret as shown in Fig.11.7.

3 Undo the locknut and the nut at the top mounting of the damper to withdraw the outer washer, the rubber buffer and the inner washer noting the difference between the two washers. Look for the distance piece fitted to the top mounting hole and if it is loose make sure that it is not lost.

4 Knock back the tabs to the four set bolts securing the damper mounting bracket to the coil spring seat. Remove the bolts and withdraw the damper.

5 Refitting is the reverse procedure but make sure that the distance piece (Fig.11.8) is in position.

4 Coil springs - removal and refitting

Warning: These are extremely heavy springs of about 14" free length. We strongly recommend that you do not attempt to remove them unless you are fully competent to do so and have

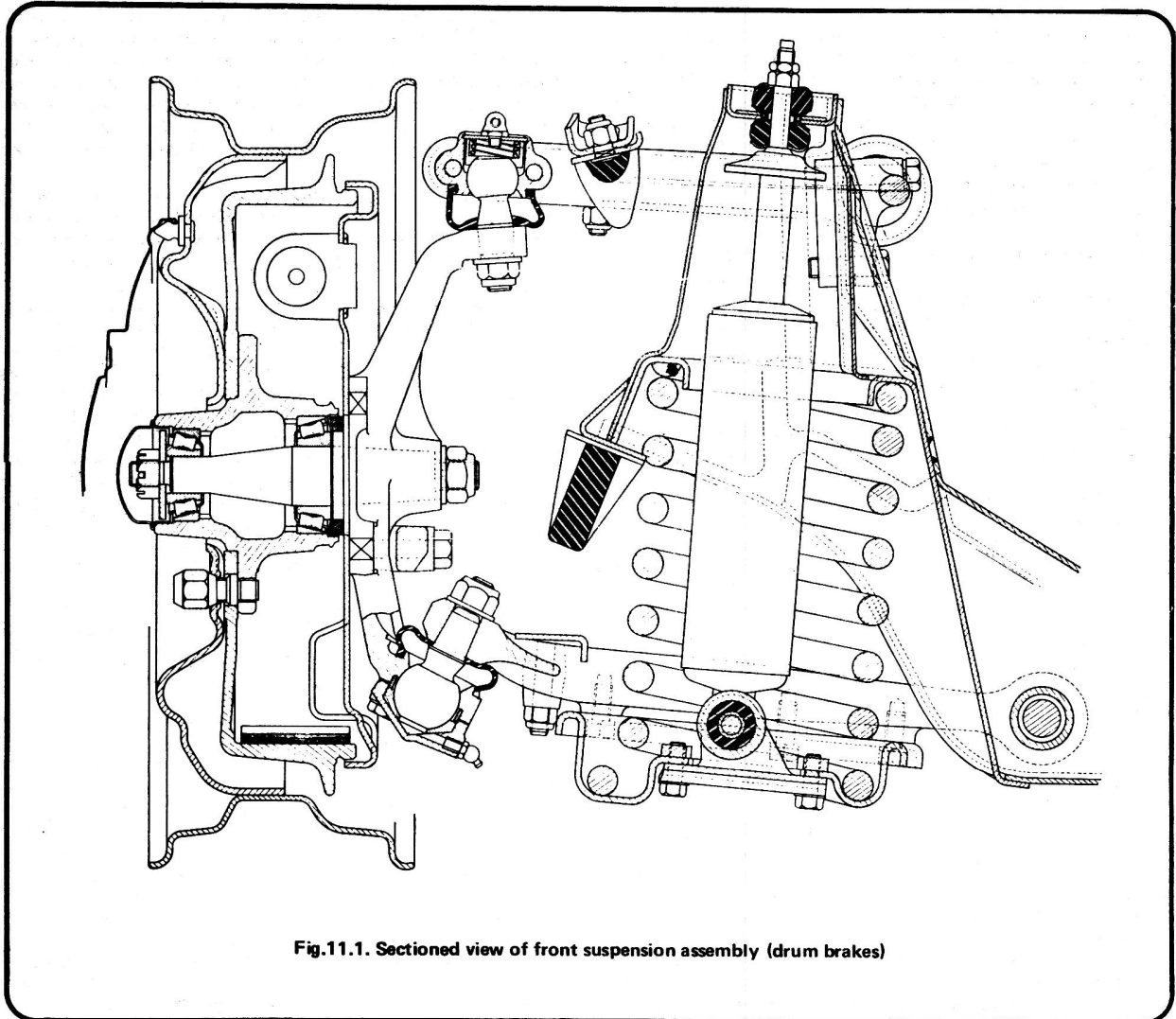


Fig.11.1. Sectioned view of front suspension assembly (drum brakes)

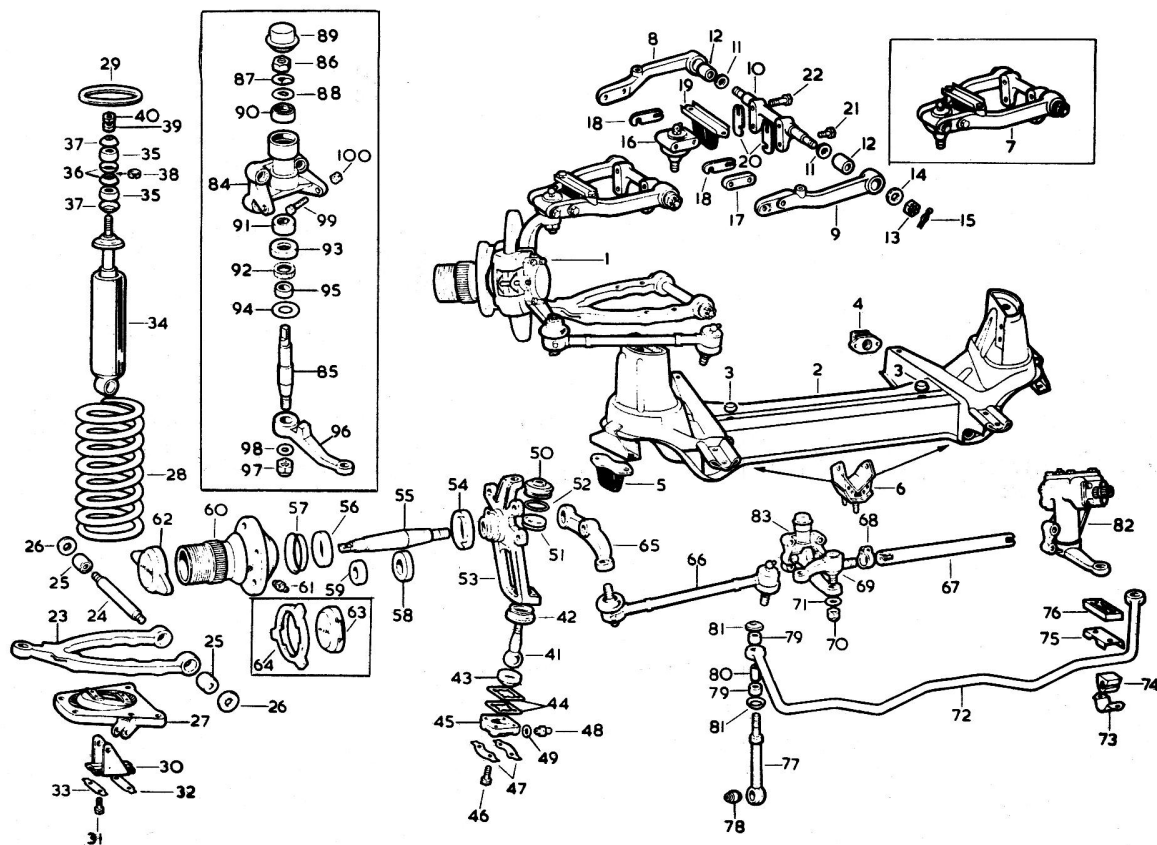


FIG.11.2. FRONT SUSPENSION ASSEMBLY

- | | | | |
|----------------------------------|--------------------------|---------------------------------------|---------------------|
| 1 L.H. front suspension assembly | 25 Bush | 51 Plastic insert | 75 Keeper plate |
| 2 Front suspension cross-member | 26 Special washer | 52 Ring | 76 Packing block |
| 3 Rubber plug | 27 L.H. seat assembly | 53 Stub axle carrier | 77 Link |
| 4 Rubber mounting | 28 Front suspension coil | 54 Water deflector | 78 Rubber bush |
| 5 Bump stop | 29 Packing ring | 55 Stub axle shaft | 79 Rubber pad |
| 6 Rubber mounting | 30 Bracket | 56 Oil seal | 80 Distance tube |
| 7 Upper wishbone | 31 Setscrew | 57 Water deflector | 81 Retaining washer |
| 8 Upper wishbone lever | 32 Tab washer | 58 Inner bearing | 82 Steering box |
| 9 Upper wishbone lever | 33 Tab washer | 59 Outer bearing | 83 Steering idler |
| 10 Fulcrum shaft | 34 Front shock absorber | 60 L.H. front hub | 84 Bracket |
| 11 Distance washer | 35 Rubber buffer | 61 Grease nipple | 85 Idler spindle |
| 12 Rubber bush | 36 Inner washer | 62 L.H. hub cap | 86 Nut |
| 13 Slotted nut | 37 Outer washer | 63 L.H. hub cap | 87 Tab washer |
| 14 Special washer | 38 Spacing collar | 64 Tool for removing/fitting hub caps | 88 'D' washer |
| 15 Split pin | 39 Nut | 65 L.H. tie rod lever | 89 End cap |
| 16 Ball joint | 40 Locknut | 66 L.H. outer tie rod | 90 Bearing |
| 17 Distance piece | 41 Ball pin | 67 Tie rod tube | 91 Bearing |
| 18 Shim | 42 Spigot | 68 Clamp | 92 Felt seal |
| 19 Rebound stop | 43 Railko socket | 69 End assembly | 93 Retainer |
| 20 Shim (camber angle) | 44 Shim | 70 Nut | 94 Abutment washer |
| 21 Bolt (short) | 45 Cap | 71 Special washer | 95 Abutment ring |
| 22 Bolt (long) | 46 Bolt | 72 Anti-roll bar (heavy duty) | 96 Idler lever |
| 23 Lower wishbone lever | 47 Tab washer | 73 Bracket | 97 Nut |
| 24 Fulcrum shaft | 48 Grease nipple | 74 Rubber bush | 98 Washer |
| | 49 Washer | | 99 Setscrew |
| | 50 Rubber gaiter | | 100 Nut |

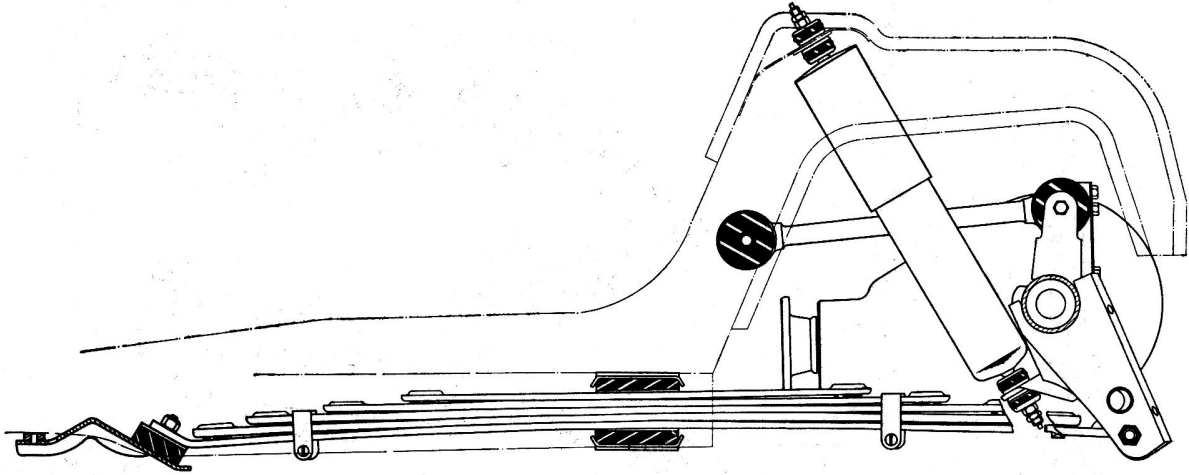


Fig.11.3. Rear suspension arrangement

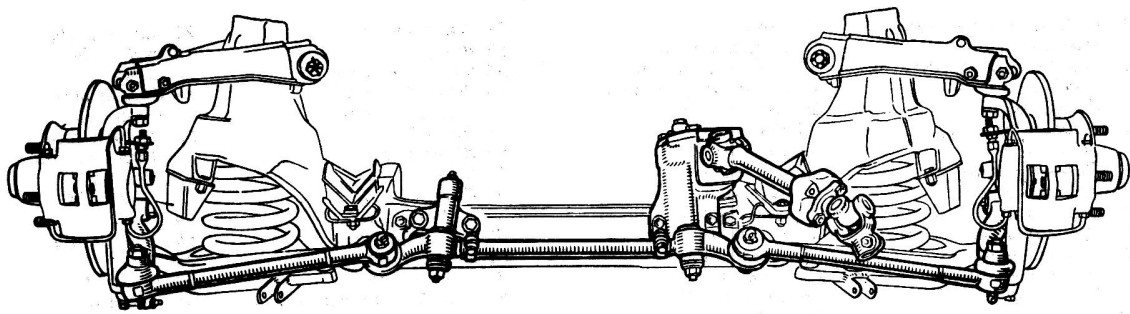


Fig.11.4. Steering layout

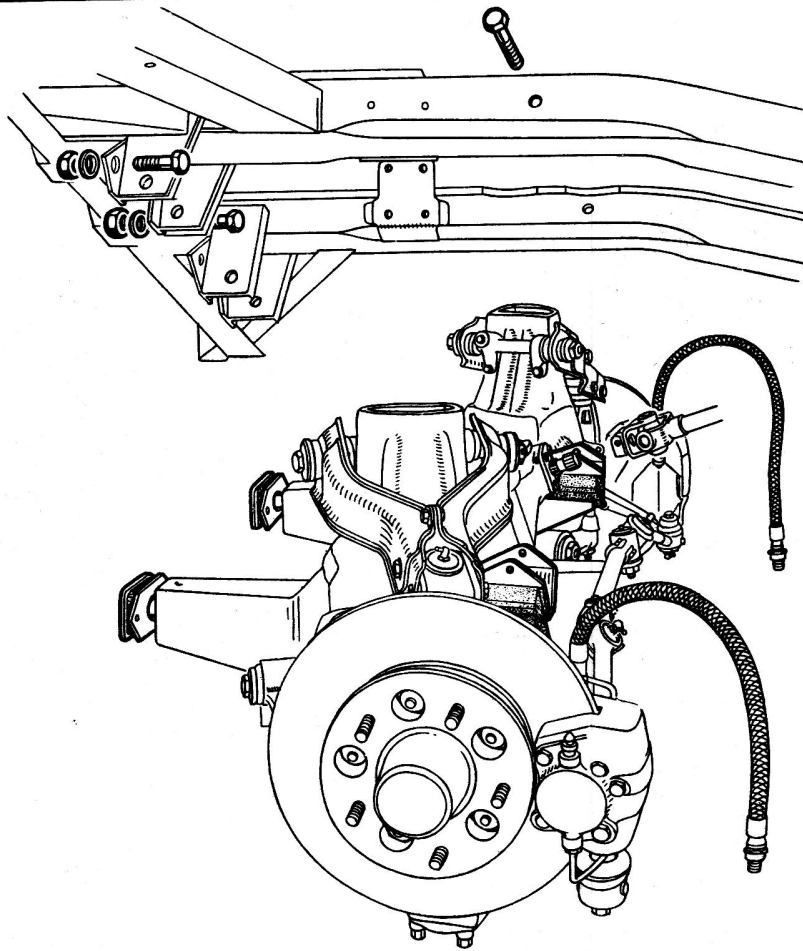


Fig.11.5. Removing the front suspension assembly

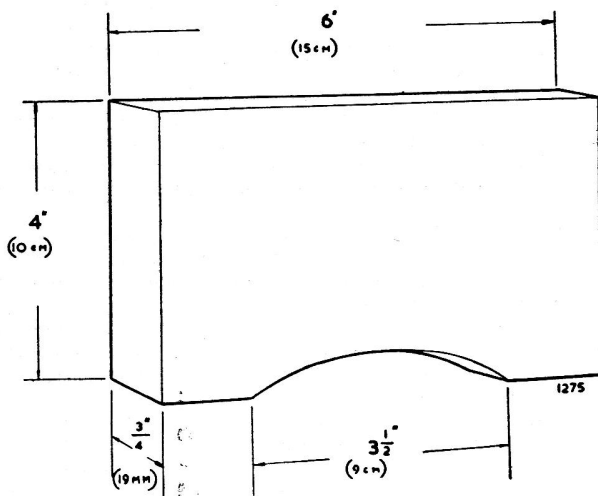


Fig.11.6. Packing piece to support wish-bone levers

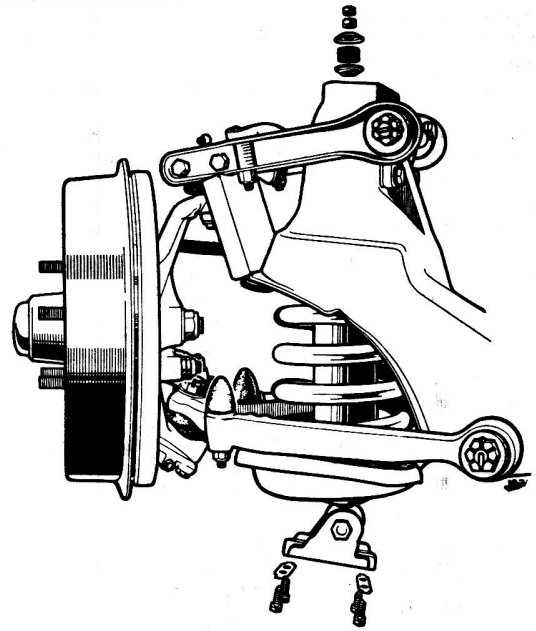


Fig.11.7. Removal of damper. Packing piece in position

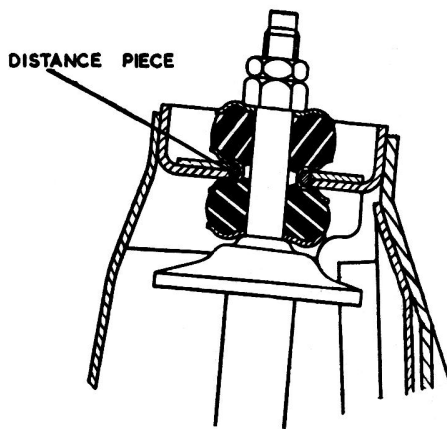


Fig.11.8. Location of distance piece on damper

all the necessary equipment. Any attempt to remove, or replace, these springs using unsuitable equipment could result in a serious accident.

Springs are marked with coloured paint to denote those of the same static load (this will probably be gone with age) it is essential, that springs fitted to a car are of the same colour coding. Packing pieces may be fitted above the coil springs of some cars to accommodate variations in the length so when ordering new springs, enquire also about packing pieces and their thickness for your particular model.

- 1 Remove the hydraulic damper as described in Section 3.
- 2 Detach the anti-roll bar link arm from the bracket at the rear edge of the spring pan.
- 3 Insert a suitable, and serviceable, coil spring compressor through the centre of the spring and compress the spring to relieve the load on the seat pan screws (Fig.11.9).
- 4 Remove the six setscrews with their spring washers securing the seat pan to the lower wishbone.
- 5 Unscrew the compressor until the load on the spring is relieved completely. The coil spring and the seat pan now can be removed.
- 6 Refitting is the reverse procedure but alignment of the seat pan holes with their counterparts in the lower wishbone will be made easier if pilot studs 8" (20 cm) in length with one end threaded 3/8" UNF are fitted as shown in Fig.11.10. Take note of the necessity for fitting similar coded springs and, possibly, packing pieces.

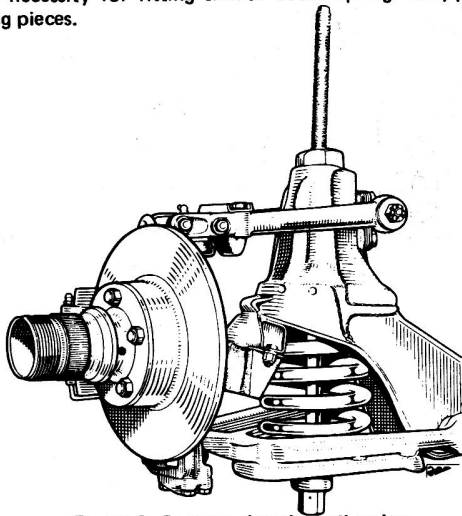


Fig.11.9. Compressing the coil spring

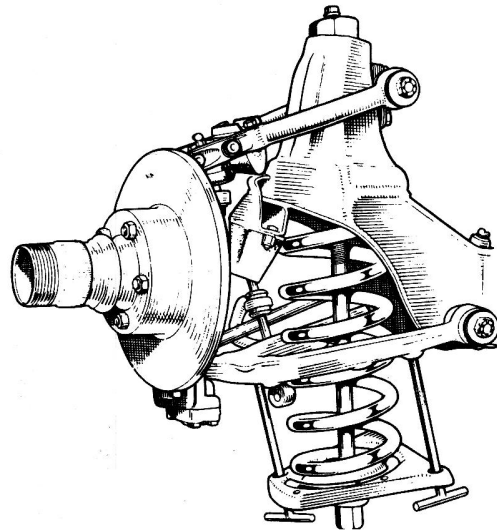


Fig.11.10. Aligning the seat pan holes

5 Front wheel hub - removal, dismantling and refitting

- 1 Jack up the car to remove the front road wheel. Support the car on firmly based axle stand.
- 2 Refer to Chapter 9 and remove the brake caliper from the front stub axle carrier.
- 3 Take out the split pin locking the hub nut. On cars with disc brakes it will first be necessary to prise off the end cap in order to get at the split pin and the retaining nut. The split pin is accessible through a hole in the hub of cars with wire wheels.
- 4 Remove the slotted nut, and the plain washer behind it, from the end of the stub axle shaft.
- 5 Withdraw the hub from the stub axle shaft by hand.
- 6 To dismantle the hub, first extract the grease seal and then withdraw the taper roller bearings. If new bearings are to be fitted the old ones can be drifted out using the grooves provided in the abutment shoulders in the hub.
- 7 Refitting is the reverse of the removal procedure.
- 8 First repack the bearing with high melting point grease, do not pack the hub with grease but apply a coating to the inside of the hub between the outer races of the bearings and apply a light coating of grease to the stub axle shaft. Do not fill the end cap with grease. Later cars are fitted with a front hub grease nipple so the foregoing can be done after assembly if desired but care should be taken not to overlubricate the hubs as this may cause the seal to "blow". Stop pumping in grease when it starts to come out of the bleed hole in the end of the dust cap.
- 9 The end float of the wheel bearings must be checked after assembly and before the split pin is fitted to the hub securing nut.
- 10 The correct end float of the bearing is 0.003" to 0.005" (0.07 to 0.13 mm). On cars fitted with disc brakes it is most important that it does not exceed 0.005" otherwise the brakes may tend to drag and not function properly.
- 11 The end float can be checked with a Dial Test Indicator mounted with its plunger against the hub. Tighten the nut until lateral movement of the hub is within limits and then lock the nut with a new split pin.
- 12 An alternative method of adjusting the end float is to tighten down on the nut until slight restriction to rotation of the hub is felt. Now slacken the nut between one and two flats (depending on alignment of the split pin hole with a slot in the nut) and check that the hub is now free. It is advisable to fit the wheel and make sure that it spins freely. If satisfactory, remove the wheel and fit a new split pin.
- 13 When refitting the brake caliper do not overlook the necessity for checking its clearance with the disc (see Chapter 9).
- 14 Bleed the brake system when reassembly is completed.

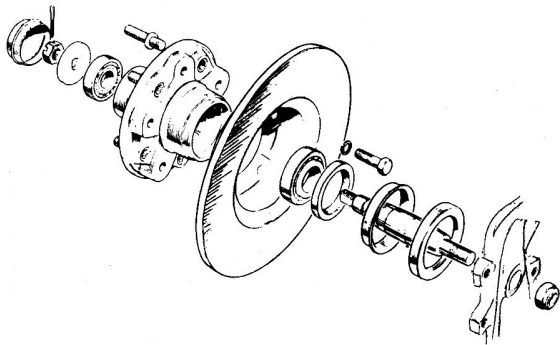


Fig.11.11. Exploded view of the front wheel hub

6 Stub axle carrier and lower wishbone ball joint - removal, adjustment and refitting

- 1 Take the weight of the car under the lower wishbone lever and remove the road wheel. As a safety measure, place a stout block at any convenient point on the chassis to support the car in the event of the jack slipping.
- 2 Remove the front wheel hub as described in Section 5.
- 3 Refer to Fig.11.12.
- 4 Undo and remove the self locking nuts and plain washer which secures the upper ball joint to the stub axle carrier.
- 5 Remove the nut securing the lower ball joint to the wishbone.
- 6 The stub axle carrier is now held in position by the grip on the taper of the ball joints. To release them, strike the stub axle carrier several sharp blows with a hammer adjacent to the upper ball joint and follow this by striking the lower wishbone as close as possible to the ball joint. If the ball joints are not released by that action you will have to resort to drifting out the joints.
- 7 The stub axle carrier will come away complete with the lower ball joint. To separate them, first release the wire clip holding the rubber gaiter in place and then remove the gaiter and the plastic insert below it.
- 8 Knock back the tabs of the locking plates and take out the four bolts securing the ball pin cap to the stub axle carrier, note the shims under the cap. Lift off the cap complete with the Railko socket inside it, the ball pin and the spigot.
- 9 Reassembly of the ball joint to the stub axle carrier is the reverse of the removal procedure but the ball joint, if a new item is being fitted, must be shimmed to give clearance of 0.004" to 0.006" (0.10 to 0.15 mm). It is not permissible to remove the shims to take up wear in the ball pin and socket. If wear is present in these items they should be replaced.
- 10 Shims for adjusting the ball joint are available in 0.002" (0.05 mm) and 0.004" (0.10 mm) thicknesses. To adjust the clearance, assemble the ball pin to the stub axle carrier together with shims so that when the ball cap is fully tightened, the ball pin is tight in its socket. Now fit additional shims to a value of between 0.004" to 0.006" (0.10 to 0.15 mm) and this should allow the shank of the pin to be moved by hand without any perceptible play.
- 11 Use new locking plates to secure the ball pin cap bolts and knock up the tabs to lock the bolts.
- 12 Refit the stub axle carrier in the reverse order to that in which it was removed not forgetting to check the end float of the wheel hub and the clearance of the brake calipers.
- 13 Using a grease gun, pump grease into both ball joints.
- 14 Finally bleed the brake system and refit the road wheel.

7 Lower wishbone - removal, replacement of bushes and refitting

- 1 Remove the coil spring in the manner described in Section 4

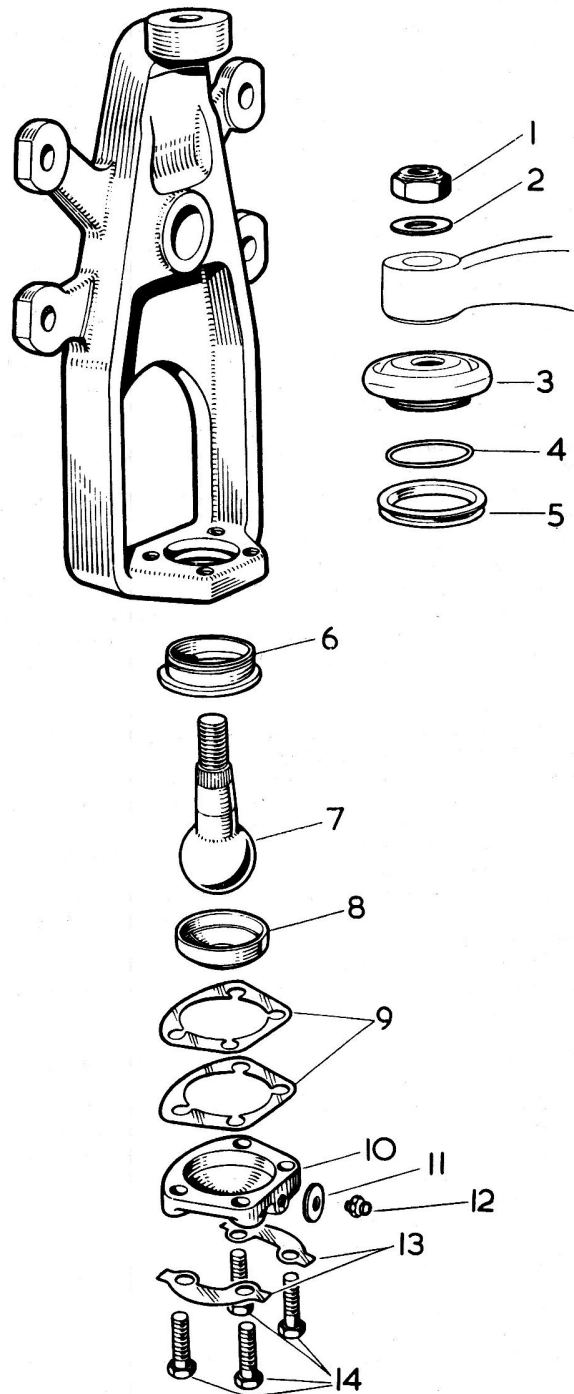


FIG.11.12. THE STUB AXLE CARRIER & LOWER WISHBONE BALL JOINT

- | | |
|--------------------|-------------------|
| 1 Self locking nut | 8 Railko socket |
| 2 Washer | 9 Shims |
| 3 Rubber gaiter | 10 Cap |
| 4 Securing ring | 11 Washer |
| 5 Plastic insert | 12 Grease nipple |
| 6 Spigot | 13 Tab washer |
| 7 Ball pin | 14 Securing bolts |

but your attention is first drawn to the warning at the beginning of that Section.

2 Remove the nut and washer securing the ball joint to the wishbone and tap the wishbone smartly with a hammer to break the grip of the taper at the ball joint. Now try to lift the wishbone off the lower ball joint. If you cannot get enough movement on the stub axle carrier to allow the wishbone to swivel clear, completely remove the stub axle carrier.

3 Take out the split pin and remove the slotted nut from one end of the fulcrum shaft. Take off, and retain, the special washer which will be found under the nut.

4 Replace the nut and screw about halfway onto the shaft, now drive the shaft out from that end unscrewing the nut as necessary to allow the shaft to move. Finally, use a punch to drift the shaft right out but be careful not to damage the thread. Remove the wishbone.

5 The old bushes can be drifted out, or preferably pressed out, from the wishbone eyes but when doing this, support the wishbone on the eye from which the bush is being removed.

6 Lubricate the new bush with soapy water (a 12:1 solution is adequate) and press it into the eye until it projects from each side an equal amount.

7 Refitting is the reverse of the above but for the time being leave the slotted fulcrum nut finger tight.

8 After refitting the roadwheel, lower the car until full weight is taken on the wheel. Move the car to position the front wheels to give access to the fulcrum nut, fully tighten it and fit and open a new split pin. Tightening of the fulcrum nut when the car is not in the normal riding position will result in undue torsional loading of the rubber bushes and will probably lead to premature failure.

8 Upper wishbone and upper wishbone ball joint - removal, replacement of bushes and refitting

1 Take the weight of the car under the lower wishbone lever and remove the roadwheel. As a safety measure, place a stout block at any convenient point under the chassis to support the car in the event of the jack slipping.

2 Tie up the stub axle carrier to the subframe because, when the ball joint is disconnected, it will rotate outwards and damage to the flexible hose may result.

3 Refer to Fig.11.13. Remove the nuts from the two bolts securing the ball joint to the upper wishbone lever and remove the bolts, taking extreme care to collect the shims and distance piece from each side of the ball joint. The shims from each side must be kept together and replaced in their original positions because they control the caster angle.

4 If the upper ball joint only is to be removed, undo the nut securing it to the stub axle carrier and strike the carrier several sharp blows with a hammer to break the grip of the ball joint taper. Lift out the ball joint. If wear is present in the joint a new assembly will have to be fitted.

5 The upper wishbone ball joint can be left in position if it is the wishbone which has to be removed.

6 Remove the four set bolts securing the wishbone fulcrum shaft to the suspension cross member turret. The wishbone assembly can now be removed but take careful note of the relative positions of the shims between the turret and the fulcrum shaft brackets as these control the camber angle and must be replaced in the position from which they were removed (Fig.11.14).

7 Remove the nuts, bolts and the distance pieces securing the rebound stop brackets to the wishbone levers.

8 Take out the split pins and remove the slotted nuts which secure the levers to the fulcrum shaft. Work the levers off the shaft.

9 Drift out, or preferably press out, the bush from the eye of the wishbone lever.

10 Lubricate the new bush with soapy water (a 12:1 solution is adequate) and press it into the eye of the lever until it projects from each side an equal amount.

11 Reassemble the wishbone levers in the reverse manner to

their dismantling but leave the slotted nuts securing the levers to the fulcrum shaft finger tight at this stage.

12 Refit the upper wishbone assembly and the upper wishbone ball joint, if applicable, in the reverse manner to the dismantling procedure but do ensure that the shims are refitted correctly otherwise, as already mentioned, the caster and camber angles will be upset.

13 After refitting the roadwheel, move the car to turn the wheels to a convenient position to give access to the slotted nuts of the upper wishbone fulcrum shaft. Tighten the nuts and fit, and open, a new split pin. Tightening of the fulcrum nuts when the car is not in the normal riding position will place undue torsional loading on the rubber bushes and may lead to their premature failure.

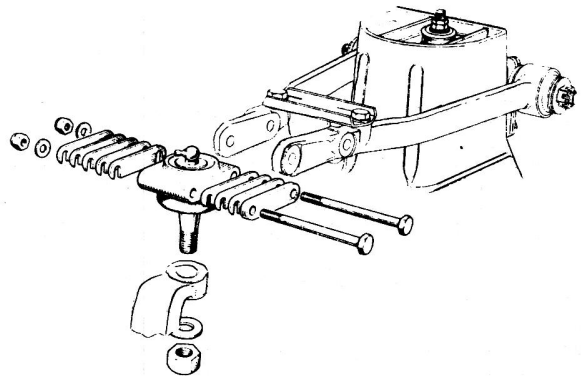


Fig.11.13. Removing the upper wishbone lever ball joint

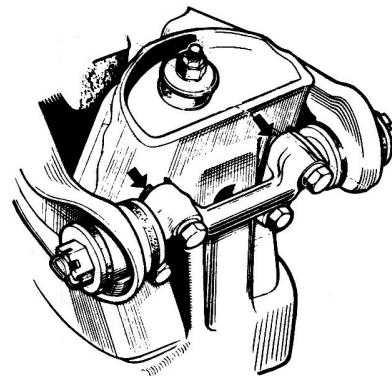


Fig.11.14. Location of shims controlling the camber angle

9 Anti-roll bar - removal, refitting and replacement of rubber bushes (Fig.11.15)

1 Place the car over a pit or raise it, making sure that it is adequately supported, to give access to the anti-roll bar.

2 Remove the self locking nut and drift out of the bolt attaching the link arms to the right and left hand coil spring seat.

3 Remove the two bolts securing each support bracket to the chassis side member and remove the anti-roll bar.

4 The only faults likely to arise with the anti-roll bar components are deterioration of the rubbers and, as experience has shown, wear on the centre hole of the lower rubber pad retaining washer allowing it to work down over the shoulder on the link arm. In extreme cases the shoulder on the link arm may also be worn.

5 You will find it possible to replace individual rubbers without removing the whole assembly.

6 To replace the bracket rubbers (item 4 in Fig.11.15). Raise the front of the car and support it firmly. Remove the two bolts securing each bracket, remove the brackets and pull down on the

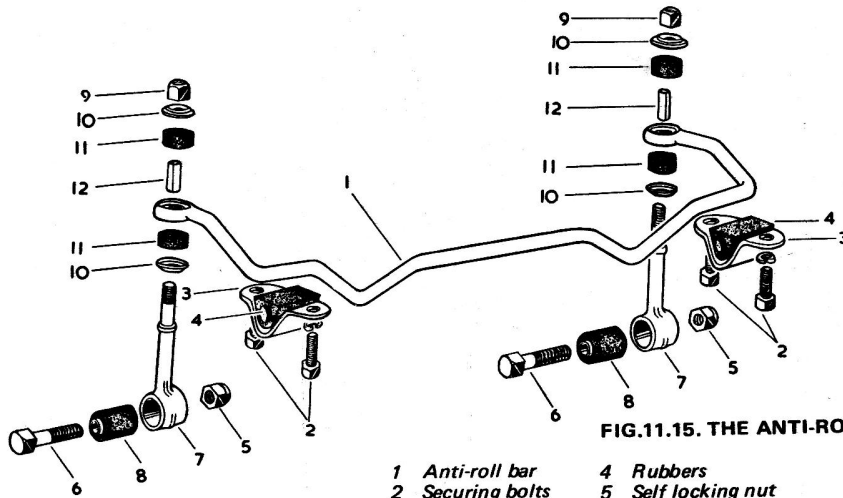


FIG.11.15. THE ANTI-ROLL BAR ASSEMBLY

- | | | | |
|--------------------|--------------------|---------------|----------------|
| 1 Anti-roll bar | 4 Rubbers | 7 Link arm | 10 Cup washers |
| 2 Securing bolts | 5 Self locking nut | 8 Rubber bush | 11 Rubbers |
| 3 Support brackets | 6 Bolt | 9 Nut | 12 Spacer |

bar and remove the rubbers by springing them over the bar. Fit the new rubbers and replace the brackets with the bolts finger tight. Lower the car to take the full weight on the wheels and then tighten up on the bracket bolts.

7 To replace the upper and lower cup washers and rubbers (items 10 and 11 in Fig.11.15) first remove the self locking nut at the top of each link arm and then push upwards on the bar to clear the link arm. If you cannot get sufficient movement of the bar to clear the link arm, slacken the bolts to the brackets on the chassis side members. The cup washers and rubbers can be lifted off when the bar is clear of the link arm new items can be fitted but do not overlook replacement of the spacer and the necessity for the full weight of the car to be taken on the wheels before tightening the bracket bolts.

8 To replace the link arm bush, first take off the self locking nut at the top of the link arm then remove the self locking nut

from the bolt attaching the link arm to the coil spring seat. Drift out the bolt and remove the link arm. Drift, or preferably press, out the bush from the link arm eye, lubricate the new bush with a soap and water solution and press it into position in the eye so that it projects an equal amount on each side. Refit the link arm in the reverse order to the above.

9 Refitment of the whole assembly is the reverse of the removal procedure but the support bracket bolts on the chassis side members must not be fully tightened until the full weight of the car is taken on the wheels.

10 Accidental damage to front suspension components

The dimensioned drawings at Figs.11.16, 17,18 and 19 are provided to enable you to assess the dimensional serviceability of front suspension components following accidental damage to your car. Be sure to check, in addition for fractures and deterioration.

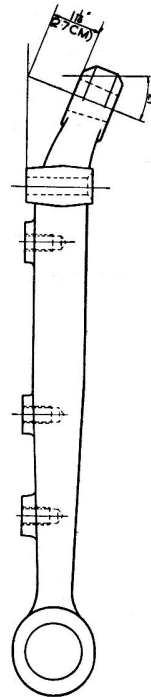
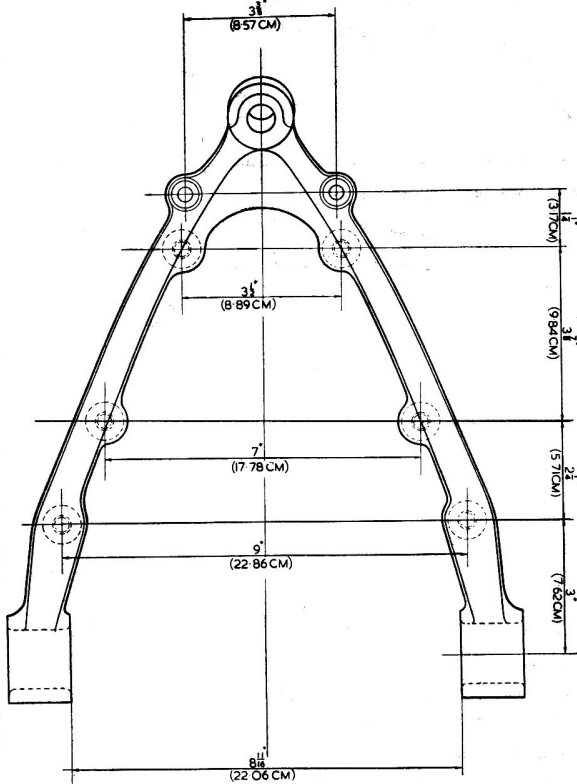


Fig.11.16. Lower wishbone

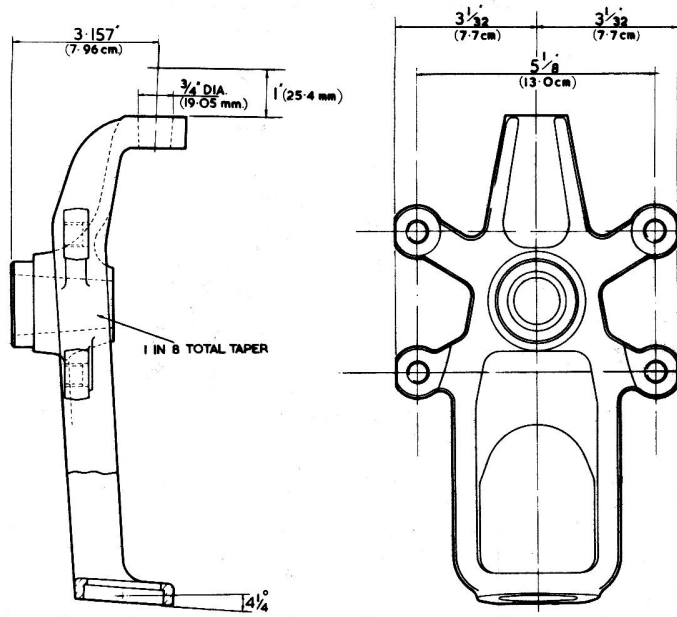


Fig.11.17. Stub axle carrier

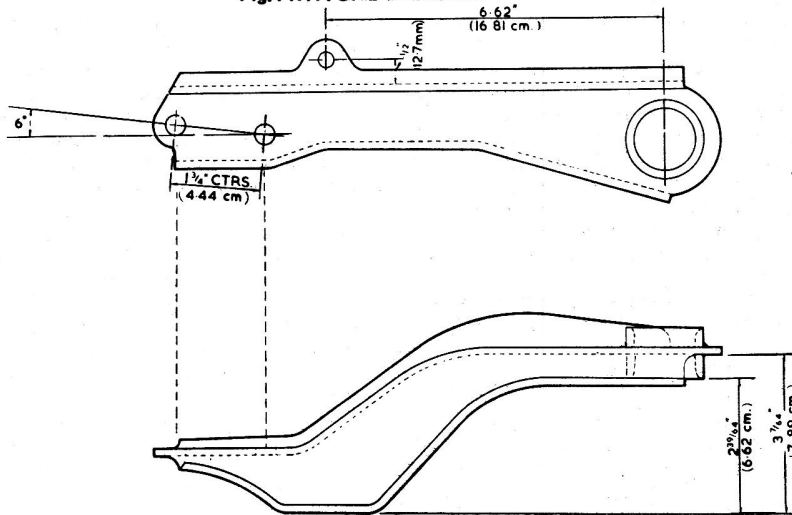


Fig.11.18. Upper wishbone lever (pressed steel type)

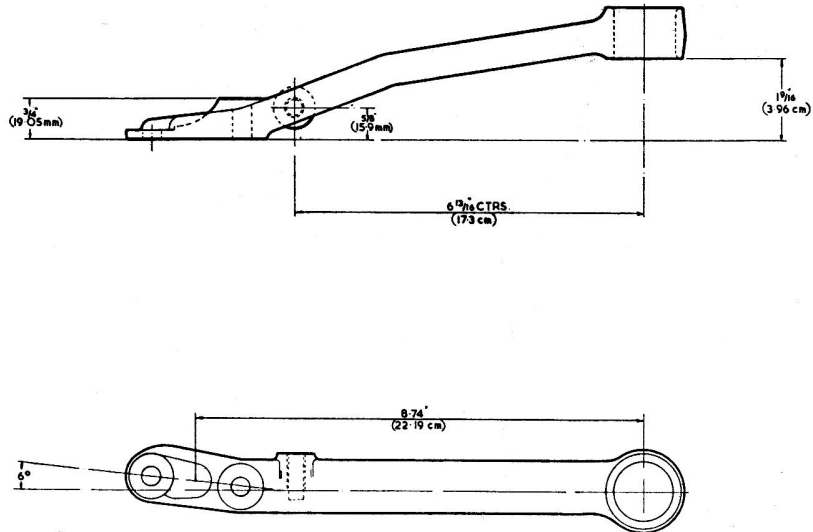


Fig.11.19. Upper wishbone lever (forged type)

11 Rear road springs - general

An exploded view of the rear suspension assembly is given at Fig.11.20 to which reference should be made when carrying out work described in the following Sections.

Should a spring have weakened considerably or failed and a new one has to be fitted, they must be renewed in pairs as the remaining spring will have taken a "set" and unless the springs have the same performance and characteristics, road holding and ride can be affected adversely.

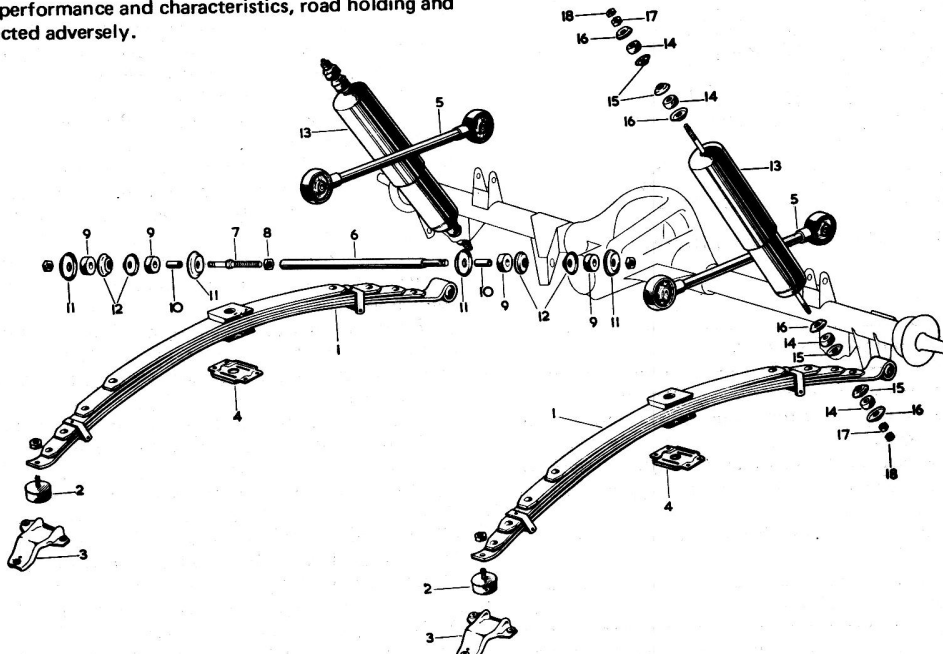


FIG.11.20. EXPLODED VIEW OF THE REAR SUSPENSION

- | | | | |
|-------------------------|--------------------|---------------------|------------------|
| 1 Rear road spring | 6 Panhard rod | 11 -Outer washer | 16 -Outer washer |
| 2 Front mounting pad | 7 -Adjusting piece | 12 -Inner washer | 17 -Securing nut |
| 3 Front mounting plate | 8 -Locknut | 13 Hydraulic damper | 18 -Locknut |
| 4 Centre clamping plate | 9 -Rubber buffer | 14 -Rubber buffer | |
| 5 Torque arm | 10 -Distance tube | 15 -Inner washer | |

12 Rear road spring - removal and refitment

- Jack up the car under the rear axle and place a stand under the chassis member just forward of the front mounting point of the spring. Place a wooden block between the stand and the body to distribute the load and then lower the car onto the stand.
- Remove the road wheel to improve access to the spring.
- Place a jack under the eye of the spring and raise it to relieve pressure on the centre mounting clamp plate.
- Remove the four nuts and bolts securing the centre mounting clamp plate and remove the plate.
- Unscrew the nut from the spring eye bolt and drift out the bolt taking care not to damage the thread.
- Lower the jack and the spring can now be withdrawn from the front mounting plate.
- Refitting the spring to the car is the reverse of the above but do not tighten the spring eye bolt until the weight of the car is taken on the wheel otherwise undue torsional loading of the rubber bush will result and may lead to premature failure.

13 Centre mounting rubber and replacement

- The centre mounting rubbers are bonded to plates which are

attached to the top and bottom of the spring by the centre bolt. (Fig.11.21).

- Remove the rear spring as described in Section 12.
- Place the spring in a vice and hold it as close to the centre mounting rubbers as possible.
- Undo the nut from the centre bolt, drift out the bolt from the spring leaves and collect the spacing washer from the recess in the main leaf. The two mounting rubbers can now be detached.
- Place the new rubbers in position on the spring with the spacing washer between the main leaf and the lower mounting.
- Refit the centre bolt with its plain washer and tighten down securely on the nut.
- Remove the spring from the vice and refit to the car in the manner described in Section 12.

14 Front mounting rubbers - removal and refitting

- Remove the rear spring as described in Section 12.
- Unscrew the self locking nut securing the rubber mounting to the main leaf and remove the rubber mounting.
- Refitting is the reverse of the above.
- Replace the rear road spring as described in Section 12.

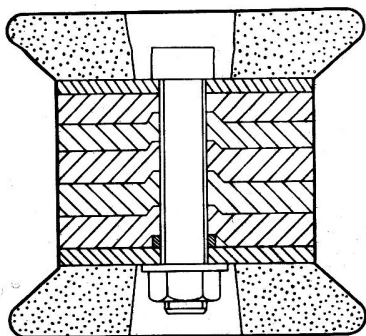


Fig.11.21. Section through spring centre bolt

15 Spring eye bush - removal and refitting

- 1 Remove the rear road spring as described in Section 12.
- 2 Drift, or preferably press, out the rubber steel bonded bush from the eye of the spring.
- 3 Lubricate the new bush with a soapy water solution and press it into position in the eye so that it projects an equal amount each side of the spring.
- 4 Refit the spring to the car as described in Section 12.

16 Torque arm - removal and refitting

- 1 Place the car over a pit or raise the rear of the car to give access to the torque arm. Make sure that the car is adequately supported before doing any work underneath it.
- 2 Remove the self locking nuts of the bolts securing the torque arm to the bracket on the rear axle and on the body.
- 3 Drift out the bolts making sure that you do not damage the thread and remove the torque arm.
- 4 Refitting is the reverse of the above.

17 Hydraulic dampers (rear) - removal and refitting

- 1 Remove the floor of the luggage compartment. The nuts securing the top of the dampers will be soon at the right and left hand side of the compartment.
- 2 Remove the two nuts and the rubber buffer and washers from the top of the damper.
- 3 Place the car over a pit or raise the rear of the car to give access to the dampers. Make sure that the car is adequately supported before doing any work underneath it.
- 4 Remove the two nuts and the inner and outer washers and the rubber buffer from the damper attachment bracket on the rear axle.
- 5 Compress the damper until it can be removed from the mounting and collect the remaining washers and rubber buffers.
- 6 There is no provision for adjustment or "topping up" of the damper so if it is faulty a new item must be fitted.
- 7 Before fitting a new damper, hold the damper in its normal vertical position with the shroud uppermost and make several short strokes (not more than halfway) until there is no lost motion and then extend the damper to its full extent once or twice. This will bleed any air from the pressure chamber that may have accumulated due to the damper having been stored in a horizontal position.
- 8 After completing the operation at paragraph 7, refit to the car in the reverse order to the removal sequence.

18 Panhard rod - removal, refitting and adjustment

- 1 Place the car over a pit or raise the rear of the car to give access to the panhard rod. Make sure that the car is adequately supported before doing any work underneath it.
- 2 Remove the nut at each end of the rod and take off the rubber buffer and washers.
- 3 Loosen the locknut and screw it along to the end of the thread.
- 4 Screw the adjusting piece into the panhard rod tube, by means of a spanner on the flats, until the rod can be disconnected from the mounting brackets.
- 5 When refitting the rod, first screw the adjusting piece into the rod tube and then fit one rubber buffer with a distance piece and inner and outer washers at each end of the rod.
- 6 Offer the rod to the mounting brackets and screw out the adjusting piece until the rod is retained in the brackets.
- 7 The car must now be lowered so that its full weight is on the wheels.
- 8 Fit the inner washer, the rubber buffer and the outer washer to the bracket at the rear axle and fit the nut but do not tighten fully as yet.
- 9 Fit the inner washer, the rubber buffer and the outer washer at the body bracket end of the rod. Hold the adjusting piece with a spanner on the flats and fit and tighten down on the securing nut.
- 10 Now refer to Fig.11.22 for adjustment of the panhard rod.
- 11 Both rear tyres must be of the same type and of the same pressure.
- 12 Place a straightedge across one rear tyre and measure the distance from the straightedge to the flange of the chassis side member between the two bolts on the member as shown at "A" in Fig.11.22. Repeat for the other side of the car.
- 13 Dimensions "A" must be the same in each case. If they are not, adjust the length of the rod until they equalise.
- 14 Now fully tighten the securing nut at the rear axle bracket and recheck the adjustment. If dimensions are still equal screw up the locking nut to lock the adjusting piece to the panhard rod tube.

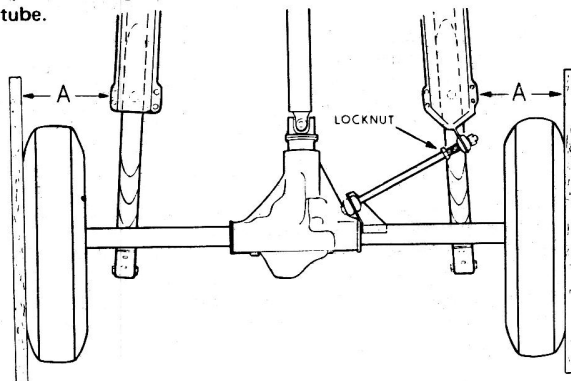


Fig.11.22. Adjustment of the panhard rod

19 Steering wheel - removal and refitting

- 1 Disconnect the battery.
- 2 Paragraphs 3 - 13 (inclusive) refer to Mk 1 cars.
- 3 Remove the four grub screws from the steering wheel hub.
- 4 Withdraw the horn push assembly and remove the eyelet from the horn wire contact.
- 5 Bend back the tab washer locking the steering wheel securing nut. Hold the steering wheel to stop it turning and remove the nut securing it to the inner column.
- 6 Pull upwards on the steering wheel to remove it from the splines on the inner column shaft. Before removal, note its position in relation to the road wheels.
- 7 Remove the two cup washers and the telescopic dust cover which are located on the inner shaft under the steering wheel.
- 8 Remove the two halves of the split cone from the inner shaft.

9 To refit the steering wheel, first place the two halves of the split cone in position making sure that the narrowest part of the cone is towards the top of the column.

10 Fit the lower cup washer followed by the telescopic dust cover and the upper cup washer. Whilst holding those items in position, slide the steering wheel onto the splines in the same position as before removal. The wheel should slide onto the splines quite easily, do not force it if it does not immediately enter the splines.

11 Fit the plain washer and a new tab washer over the inner column thread and fit the nut. Tighten down on the nut at the same time holding the steering wheel from turning. Turn over the tab to lock the nut.

12 Refit the eyelet to the horn wire contact and refit the horn push assembly.

13 Reconnect the battery and test the horn for correct operation.

14 The following paragraphs refer to Mk 2 and later cars.

15 Unscrew the four setscrews securing the horn ring cover to the steering wheel and remove the horn ring assembly.

16 On later cars, the horn ring cover attaches to the horn ring by spring loaded studs and on this type the cover is removed by an upward pull. The horn ring is attached to three studs on the steering wheel by nuts. Remove the nuts and lift off the horn ring but be careful not to lose the small washers under the nuts and the springs and washers over the studs under the horn ring.

17 Remove the eyelet from the horn wire.

18 Undo the locknut and the nut securing the steering wheel to the inner column and remove them.

19 Take note of the position of the steering wheel in relation to the road wheels and remove it from the inner column by a sharp upward pull.

20 Collect the two halves of the split cone from the inner column.

21 When refitting the steering wheel, first place the two halves of the split cone in position so that the narrowest part of the cone is towards the top of the column.

22 Whilst holding the split cone in position, slide the steering wheel onto the splines of the inner column in the same position as before removal. The wheel should slide onto the splines quite easily, do not force it if it does not immediately enter the splines.

23 Fit the plain washer to the inner column followed by the securing nut. Tighten down on the nut at the same time holding the wheel from turning. Fit the locknut.

24 Refit the eyelet to the horn wire and refit the horn ring and its cover.

25 Reconnect the battery and test the horn for correct operation.

20 Steering box (standard) - removal

1 Remove the nut and take out the pinch bolt which locks the lower steering column to the upper column.

2 Remove the screws securing the two halves of the switch covers at the centre of the steering wheel and separate them to clear the indicator and the transmission selector lever (if applicable) (photo 27.5).

3 On those cars with automatic transmission, remove the four drive screws and washers securing the piece of dash casing just above the steering column to gain access to the gear selector adjustment rod. Lift out the ball joint on the crank lever.

4 Carefully pull up on the steering wheel to move the inner column just a sufficient amount for the splines to clear the universal joint (photo 27.10).

5 If the car is not already over a pit, raise the front to gain access to the steering unit. Make sure that the car is well supported before doing any work underneath it.

6 If desired, the lower steering column may now be removed from the steering box. Turn the wheels to bring the pinch bolt into a favourable position, unscrew the nut and remove the pinch bolt and then pull the lower steering column off the

splines of the steering box.

7 Take off the self locking nut and the plain washer securing the track rod end to the drop arm.

8 Strike the drop arm smartly several times with a hammer, at the same time levering up on the track rod, to release the taper holding the track end to the drop arm (photo).

9 Knock back the tabs locking the four steering unit bolts which attach it to the front suspension. Remove the bolts and lift off the steering unit.



20.7. Track rod end released

21 Steering box (standard) - dismantling

1 First thoroughly clean the exterior of the steering box.

2 Refer to the exploded view of the steering box at Fig.11.23.

3 Remove the drain plug and drain the oil from the box. Do not confuse the drain plug with the rocker shaft adjustment screw (photo).

4 Remove the four set bolts and the spring washers securing the rocker shaft cover plate and remove the plate (photo). Take care not to lose the spring from the rocker shaft adjustment screw.

5 Remove the roller from the top of the main nut.

6 Take off the nut securing the drop arm to the rocker shaft.

7 Refer to Fig. 11.24 and take careful note of the position of the alignment marks so that the arm is fitted in the correct position on reassembly.

8 Using a suitable extractor, remove the drop arm from the spline on the rocker shaft (photo). Under no circumstances must the drop arm be hammered off as this will cause damage, through indentation to the balls.

9 Withdraw the rocker shaft from the top of the box (photo).

10 Take out the "O" ring from the bottom of the box.

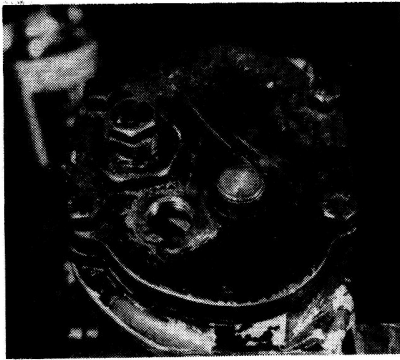
11 Remove the four set bolts and the washers securing the upper end plate to the steering box. Remove the plate and note the gasket and the shims underneath it (photo).

12 Push the worm shaft outwards and withdraw the outer race of the upper bearing (photo). The ten balls of the race will come out at the same time; take care not to lose them.

13 Unscrew the worm from the worm nut and take it out of the unit (photo).

14 Take out the four set bolts attaching the end plate to the bottom of the box noting the shims, gasket and distance piece underneath it. Withdraw the outer race of the lower bearing and collect the ten balls being careful not to lose them.

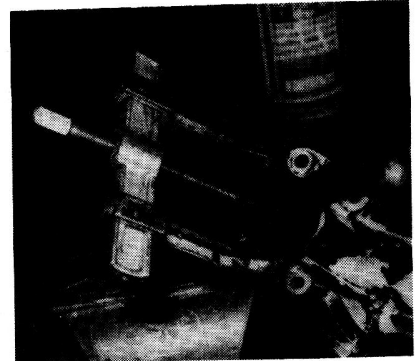
15 Knock back the tabs locking the two setscrews securing the transfer tube to the main nut, remove the screws and take off the tube with the thirty one balls if these have not already run out.



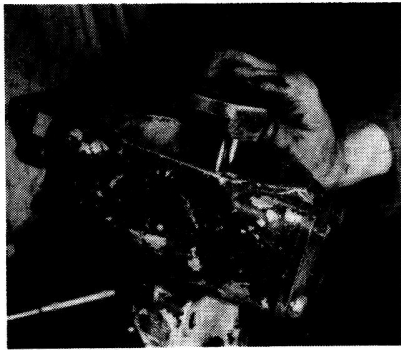
21.3. Filler/level plug



21.4. Removing the cover plate



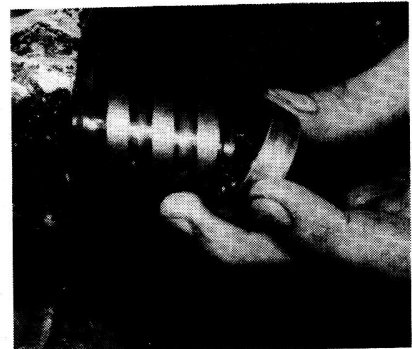
21.8. Removing the drop arm



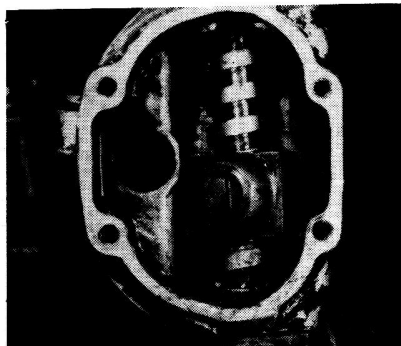
21.9. Removing the rocker shaft



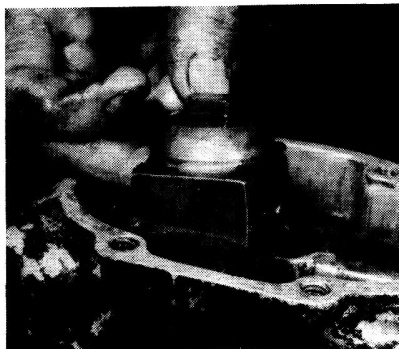
21.11. The end plate and shims



21.12. Withdrawing the upper bearing



21.13a. The worm and nut



21.13b. Removing the nut

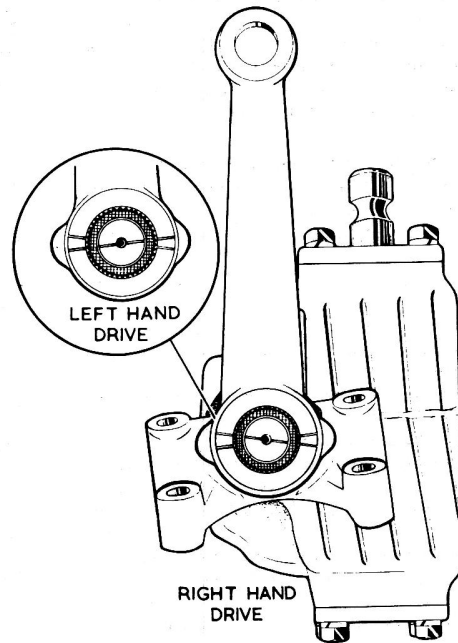


Fig.11.24. Alignment marks on rocker shaft and drop arm

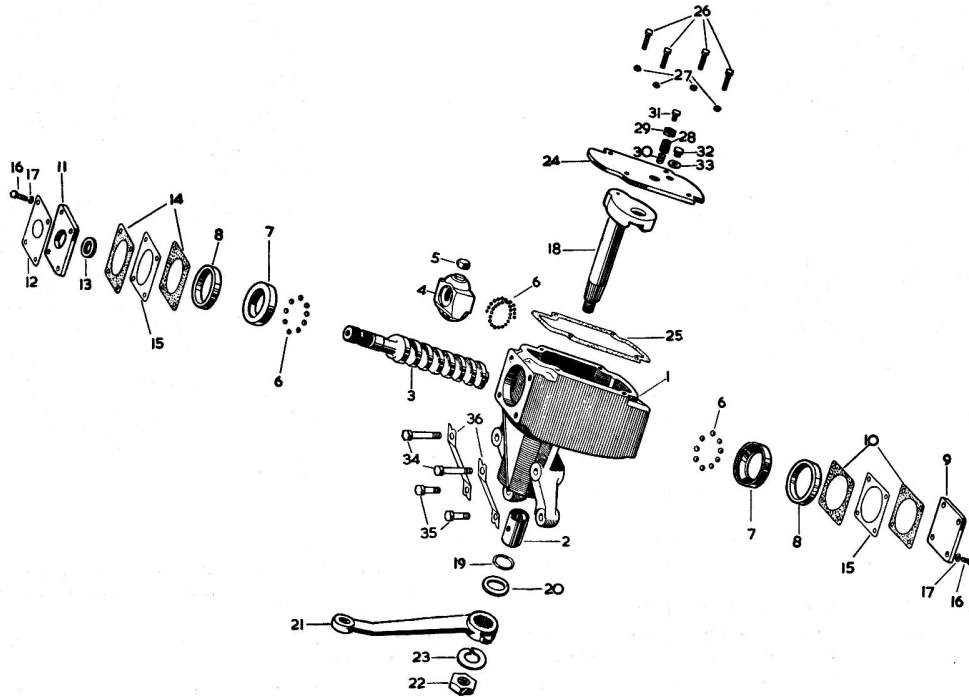


FIG.11.23. THE STANDARD STEERING BOX

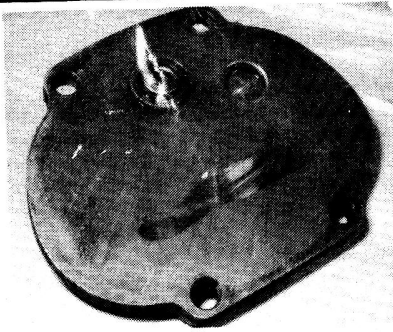
- | | | | |
|----------------------|----------------------------|----------------------------------|------------------------|
| 1 Steering box | 11 End plate (top) | 21 Drop arm | 30 Spring |
| 2 Trunnion bush | 12 Oil seal retainer plate | 22 Nut | 31 Spring tension bolt |
| 3 Inner column worm | 13 Oil seal | 23 Spring washer | 32 Oil filler plug |
| 4 Main nut | 14 Gaskets | 24 Cover plate | 33 Washer |
| 5 Roller | 15 Shims | 25 Gasket | 34 Bolt (long) |
| 6 Steel balls | 16 Setscrew | 26 Setscrews | 35 Bolt (short) |
| 7 Ball race | 17 Spring washer | 27 Spring washer | 36 Tab washer |
| 8 Distance piece | 18 Rocker shaft | 28 Rocker shaft adjustment screw | |
| 9 End plate (bottom) | 19 'O' ring | 29 Locking nut | |
| 10 Gasket | 20 Washer | | |

22 Steering box (standard) - examination

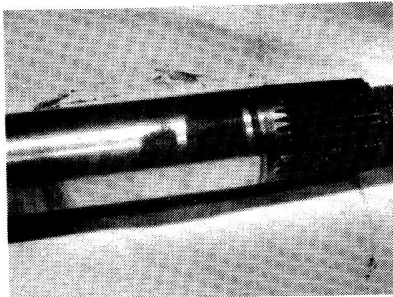
- 1 Clean all parts and visually examine them for wear. Two examples of possible faults are shown in photographs 22.1. The first illustrates wear on the top cover resulting from gouging from the roller on the top of the main nut and the other shows general wear on the rocker shaft.
- 2 Assemble the rocker shaft to the box and check for wear in the trunnion bush.
- 3 Assemble the main nut to the inner column worm and check for longitudinal play.
- 4 Examine the balls for indentations which will show up as minute flats.
- 5 Although individual parts can be obtained, as wear will be fairly general it is advisable, if trouble does arise, to fit a replacement unit.

23 Steering box (standard) - reassembly

- 1 If the transfer tube was removed, refit it with its clip to the main nut. Tighten down on the setscrews and lock them by knocking up one corner of the clip.
- 2 Fit the thirtyone recirculating balls into the tube after liberally coating them and the tube with light grease to keep them in position.
- 3 Coat the bottom ball race and the ten balls with light grease and assemble to the bottom of the steering box together with the distance piece.
- 4 Fit the gasket, the shims as removed and the end plate to the bottom of the steering box and fit, and tighten down, the four securing bolts.
- 5 Insert the worm nut in the box and then carefully screw in the shaft watching through the top cover aperture that the balls

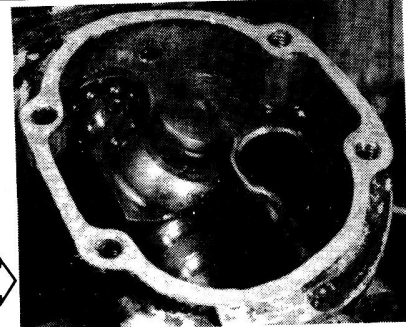


22.1a. Damage to top cover

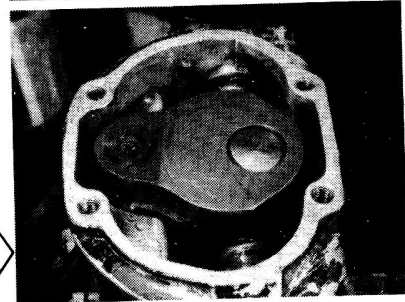


22.1b. Wear on rocker shaft

23.5. Assembly of worm and nut



23.10. Final assembly of components



- in the bottom race remain in position (photo). Feed the shaft until the nut is halfway along it.
- 6 Coat the top race and the balls with light grease and assemble to the top of the box together with the shims as removed with a gasket at each side of them.
 - 7 Slide the "O" ring oil seal over the end of the shaft and press it into position. It is a good tip to cover the splines of the shaft with adhesive tape to prevent damage to the seals by the splines.
 - 8 Offer the end plate to the box and secure it in position with the four bolts.
 - 9 Assemble the rocker shaft and engage the slotted extension with the main nut.
 - 10 Fit the roller to the top of the main nut to give the assembly shown (photo).
 - 11 Fit the cover plate gasket, fit the cover plate and secure with the four bolts.
 - 12 Fit the drop arm to the rocker shaft making sure that the splines mate correctly and that the scribed line on the rocker shaft matches the correct line on the drop arm (see Fig.11.24).

24 Steering box (standard) - adjustment of wormshaft end float

- 1 The wormshaft bearings should be adjusted to a preload of 0.002" to 0.003" (0.05 to 0.08 mm) by adding or subtracting shims as necessary at each end of the box. The shims are 0.005" (0.13 mm) in thickness and the gaskets are 0.003" (0.08 mm) thick.
- 2 Remove the bolt (31 in Fig.11.23) and the spring underneath it and unscrew the rocker shaft adjustment screw (28 in Fig.11.23) until it is fully clear of the rocker shaft.
- 3 Eliminate all feel of play in the worm shaft by removing shims or gaskets, if more than two at each end are fitted, as may be necessary, always maintain one gasket at each side of the pack of shims.
- 4 Now check that the worm shaft turns freely by fitting the lower steering column and rotating the shaft. If there is any tightness fit another gasket, make sure there is no undue end float of the wormshaft and try once again for freedom in rotation.

25 Steering box (standard) - adjustment rocker shaft end float

- 1 This work can be done when the steering box is in position on the car but access to the locking nut and to the spring tension

bolt is rather restricted.

- 2 If the work is being done with the box in position on the car, make sure that the wheels are in the straight ahead position. If you have the box on the bench, halve the number of turns the wormshaft makes from lock to lock to obtain the centre position of the nut.
- 3 Unscrew the spring tension bolt (item 31 in Fig.11.23) and take out the spring.
- 4 Slacken the locknut (item 29 in Fig.11.23) and screw down on the adjuster screw by hand until it contacts the rocker shaft.
- 5 Hold the adjuster screw from turning and screw down on the locknut.
- 6 Now test for freedom of movement of the wormshaft, if there is any tightness at the centre of travel the rocker shaft end float will have to be readjusted.
- 7 Refit the spring followed by the retaining bolt.

26 Steering box (standard) - refitment

Refitting the steering box to the car is the reverse of the removal procedure but when reassembling the upper steering column to the lower column make sure that the position of the steering wheel in relation to the road wheels is the same as before removal. Before tightening the top socket pinch bolt of the lower steering column, fully depress the upper half of the universal joint and then raise it by ¼" (6 mm) and tighten in that position.

27 Steering column - removal

- 1 Disconnect the battery.
- 2 Unscrew the bezels which hold the speedometer trip and the clock cables to the dash casing.
- 3 Remove the four screws and washers securing the dash casing.
- 4 Disconnect the wires to the flashing indicator and the headlamp flasher, at the snap connectors. Detach the horn wire from the connector lower down the steering column and, if overdrive is fitted, disconnect the wires from the overdrive switch snap connector at the top part of the column.
- 5 Remove the screws and washers which secure the two halves of the switch covers below the steering wheel and place them clear of the flashing indicator lever and the transmission selector lever if the car is an automatic model (photo).
- 6 If the car is fitted with automatic transmission, unscrew the ratchet on the adjustment rod and lift out the ball from the joint

on the crank lever.

- 7 Now open the bonnet and move the car to bring the wheels to a favourable position for removal of the lower steering column pinch bolt and nut. Remove the nut and the pinch bolt securing the lower steering column to the upper column.
- 8 On later cars, a jubilee clip secures the upper steering column to a flange where the column passes through the body. Undo the jubilee clip. (photo).
- 9 Support the steering column and remove the two set bolts which attach it to the bracket on the dash.
- 10 Lift upwards on the steering column to disconnect it from the splines of the lower column (photo). It may be helpful at this point to have an assistant lightly tap the lower column with a hammer to help in separating it but this is not usually necessary.
- 11 Lift out the steering column and collect the rubber cup from the bottom end of the column.

28 Steering column - dismantling

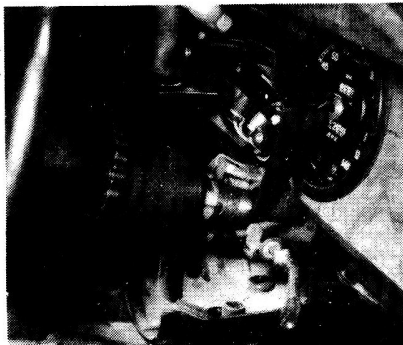
- 1 Steering columns of early and later model cars differ slightly but the procedure for dismantling is very similar.
- 2 Refer to Fig.11.25 which gives an exploded view of a typical steering column assembly.
- 3 Remove the steering wheel in the manner described in Section 19.
- 4 Withdraw the inner column from the outer column.
- 5 Take out the two screws with their serrated and plain washers which hold the flashing indicator striker in position.
- 6 Take off the circlip from the end of the horn wire contact nipple and remove the washer, spring and rubber.
- 7 Remove the split collet (item 23 in Fig.11.25).
- 8 Unscrew and remove the centre button which retains the inner column shaft. Remove the shaft.
- 9 Carefully prise up the horn pick-up ring serrations and slide the ring off the rubber rotor (items 37 and 38 in Fig.11.25).
- 10 Separate the two halves of the rotor at the same time disengaging the horn wire from the top half of the rotor.
- 11 Withdraw the horn wire.
- 12 Remove the two screws which secure the flashing indicator switch to the outer column.
- 13 If overdrive is fitted, remove the two nuts and bolts securing the overdrive switch to the outer column.
- 14 For those cars with automatic transmission, undo the circlip and slide it with the washer along the upper control rod.
- 15 Slacken the nut securing the upper control rod to the lower rod.
- 16 Remove the two nuts, bolts and the spacers which secure the

quadrant selector to the outer column bracket.

- 17 Remove the bolt, the plain and serrated washers securing the quadrant selector pointer to the bracket.
- 18 Pinch together one of the ends of the starter/reverse inhibitor switch control rod and withdraw the washer and the control rod.
- 19 Take out the upper and lower automatic transmission control rods from their bushes. On left hand drive cars, slide the lower cranked control rod off the outer column with its support bracket, after slackening the jubilee clip, and then separate the lower control rod from the support bracket.
- 20 Remove the bolt which holds the starter/reverse inhibitor switch.
- 21 Take out the nuts and bolt holding the earth contact.
- 22 Remove the nut and the bolt securing the two rubber contact holders, the fibre insulation strip and the contact.
- 23 Remove the felt bearings in the top and the bottom of the outer column by removing the spring clips and the washers. Some models may have nylon bushes instead of felt bearings, the bushes have studs which locate in holes in the outer column and are removed by pressing down on the studs, at the same time pulling outwards on the bush.

29 Steering column - reassembling

- 1 Figures in brackets refer to the items depicted in Fig.11.25.
- 2 Replace the two retaining washers (17) the felt washers (15 and 16) and the spring clips (18) in the top and bottom of the outer column.
- 3 Refit the two rubber contact holders (40) in the bracket at the lower end of the column.
- 4 Pass the bolt (42) through the contact (41), which should face towards the top of the column, through the fibre insulating strip (45) and secure with the nut.
- 5 Replace the earth contact (32) and secure it with its nut and bolt.
- 6 The following paragraphs refer to cars fitted with automatic transmission.
- 7 Slide the lower control rod through the lower bush. On left hand drive cars thread the rod through the hole in the steering column bottom support bracket.
- 8 Refit the support bracket and the jubilee clip and pass the lower control rod through the supporting bush on the side of the outer column.
- 9 Refit the selector quadrant securing it to the bracket by the two nuts and bolts, fit the spacers between the selector quadrant and the bracket.
- 10 Pass the upper control rod through the top bush on the outer column and now slide the plain washer and the circlip over the



27.5. Separate the switch covers



27.7. Jubilee clip securing steering column



27.10. Separating the upper and lower steering columns

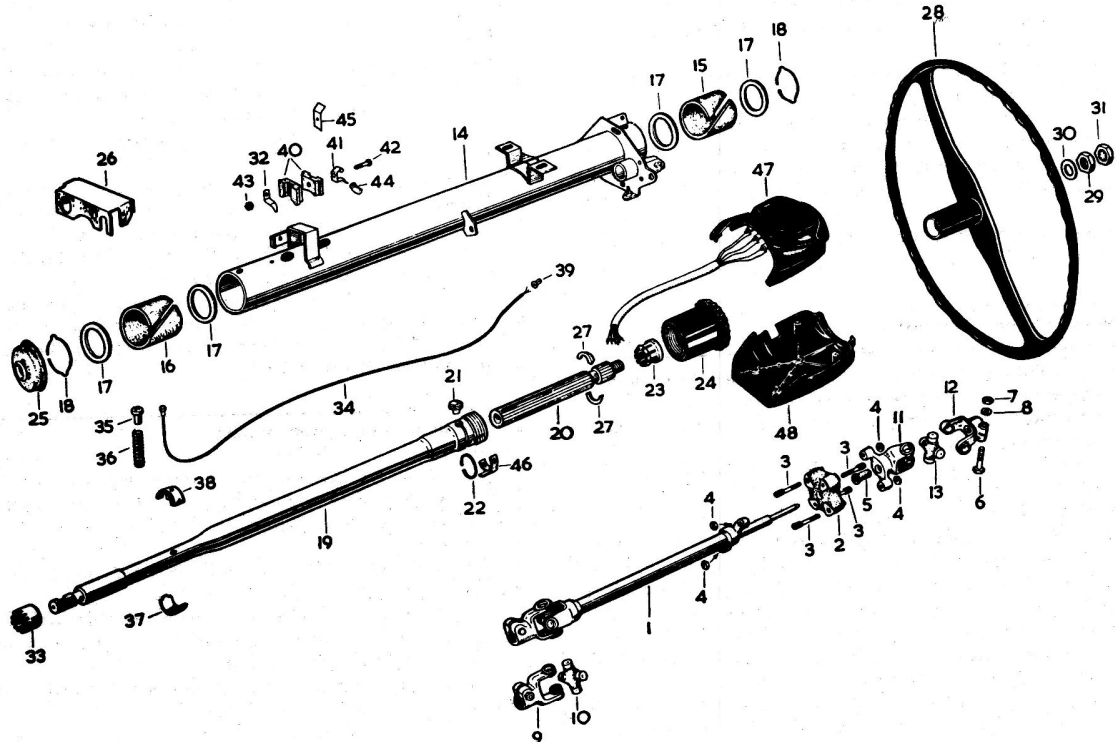


FIG.11.25. TYPICAL STEERING COLUMN ASSEMBLY

- | | | | |
|-------------------------------------|-------------------------------------|-------------------|--------------------------------|
| 1 Lower column sub-assembly | 12 Universal joint end yoke | 24 Locknut | 37 Bottom half of rubber rotor |
| 2 Rubber coupling | 13 Universal joint journal assembly | 25 Rubber seal | 38 Top half of rubber rotor |
| 3 Bolt | 14 Outer tube | 26 Stone guard | 39 Eyelet |
| 4 Locking nut | 15 Felt bearing | 27 Split cone | 40 Contact holder |
| 5 Rubber bush | 16 Felt bearing | 28 Steering wheel | 41 Contact |
| 6 Bolt | 17 Retaining washer | 29 Nut | 42 Bolt |
| 7 Nut | 18 Spring clip | 30 Washer | 43 Nut |
| 8 Spring washer | 19 Inner column | 31 Locking nut | 44 Rubber sleeve |
| 9 Universal joint end yoke | 20 Shaft | 32 Earth contact | 45 Fibre insulating strip |
| 10 Universal joint journal assembly | 21 Stop button | 33 Slip ring | 46 Striker peg |
| 11 Flange yoke | 22 Spring clip | 34 Cable | 47 Upper switch cover |
| | 23 Split collet | 35 Contact | 48 Lower switch cover |
| | | 36 Spring | |

rod.

11 Refer to Fig.11.26 and align the flat on the end of the upper control rod with the hole for the securing screw in the end of the lower control rod.

12 Join the upper and the lower control rods, fit the plain washer and secure the upper rod with the circlip.

13 Check that the upper and lower control rods are aligned and then tighten down on the bolt.

14 Assemble the quadrant selector pointer to its bracket and tighten down finger tight on its nut and bolt.

15 Refit the starter/reverse inhibitor switch finger tight to its bracket on the outer column.

16 Fit the rubber grommet to the crank lever on the lower control rod, pass the starter/reverse inhibitor wire through the grommet, fit the washer and open the ends of the control rod.

17 The following paragraphs again refer to all cars.

18 Refit the flashing indicator switch to the outer column.

19 If overdrive is fitted, refit the overdrive switch to the bracket on the outer column and secure with the two nuts, bolts and serrated washers.

20 Thread the horn wire (39) through the inner column by passing it through the upper rotor (38) and fit the upper half of the rotor with the groove towards the bottom of the column.

21 Fit the lower half of the rotor (37) and whilst holding them in position, slide on the horn pick-up ring with its serrations towards the bottom of the column. Knock or press down the serrations into the groove until the pick-up ring is secure.

22 Pass the inner shaft (20) over the horn wire into the inner column (19) so that the slot in the shaft splines aligns with the hole in the inner column. Screw in the centre button (21) until the inner shaft binds on the button and then slacken off until the inner shaft moves freely.

23 The indicator striker ring (46) should now be fitted with the

peg pointing towards the bottom of the column. Turn the inner column until the striker retaining bolts are in the vertical position and now set the striker peg so that it is just below the horizontal axis. Fit the two screws with the serrated and plain washers to secure the ring in position.

24 Slide the split collet (23) onto the inner shaft with the serrations towards the bottom of the column.

25 Carefully slide the inner column into the outer column, making sure that the peg of the indicator striker ring does not foul the contacts on the indicator lever.

26 Slide the rubber grommet, with the flange towards the top of the column, over the horn wire and the spring with the larger coils first, and the washer. Fit the circlip over the nipple.

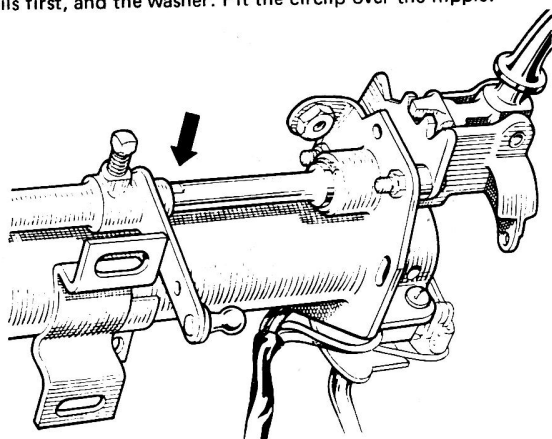


Fig.11.26. Alignment of flat on upper control rod (automatic transmission)

30 Steering column - refitting

- 1 Ensure that the front wheels are in the same position as before removal of the column.
- 2 Fit the rubber cup (25) over the end of the steering column.
- 3 Ensure that the striker peg (46) is between the two cancelling arms on the flashing indicator lever.
- 4 Pass the steering column through the hole in the floor of the body and engage it with the splines on the lower steering column universal joint, restrain the inner column from being pushed up whilst engaging the splines.
- 5 On left hand drive cars fitted with automatic transmission, secure the bottom support bracket on the column to the body by means of the four bolts.
- 6 Offer the top mounting bracket to the studs on the body and secure with the two nuts and washers.
- 7 Refit the jubilee clip to the flange on the body at the bottom of the column and tighten up.
- 8 Refit the pinch bolt to secure the inner column to the lower column, fit the nut and tighten down.
- 9 On right hand automatic drive cars refit the ratchet adjustment onto the ball joint on the crank lever. Now, for right and left hand drive, move the hand control to the "D" position on the quadrant, match up the upper switch cover and move the pointer along the elongated slot in the outer column bracket until the pointer coincides with the "D" on the switch cover.
- 10 To ensure correct operation of the reverse light and starter cut-out inhibitor switch on automatic drive models, slacken the starter/reverse light inhibitor switch securing bolt. Move the gear selector lever to the "D" position. Move the starter/reverse light inhibitor switch until the hole in the lever is in line with the hole in the switch base plate. Maintain the holes in alignment by passing a piece of wire through them (Fig.11.27). Tighten the nut securing the switch to the upper column. Remove the wire.
- 11 Refit the upper and lower switch covers and secure with their screws.
- 12 Reconnect the wires to the overdrive switch, the flashing indicator/headlamp flashing switch and the horn.

13 Refit the dash casing and secure with the four screws.

14 Secure the speedometer trip and the clock remote control cables to the casing with their bezels.

15 Screw the steering wheel position locknut (24) onto the inner column.

16 Refit the steering wheel as described in Section 19.

17 Check for correct cancelling of the flashing indicators and adjust as necessary by slackening the two securing screws and then rotating the striker ring as necessary.

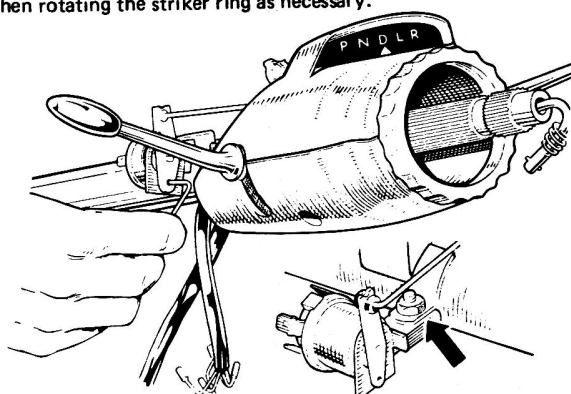


Fig.11.27. Setting the starter/reverse light inhibitor switch

31 Lower steering column - removal, dismantling and refitting

- 1 To remove and refit the lower steering column, follow the instructions given in Section 20 paragraphs 1 - 4 and those given in Section 26.
- 2 To dismantle the column, remove the four locknuts and then unscrew the four Allen screws which attach the jaw and the lower column to the rubber coupling.
- 3 There is a later type lower steering column to that illustrated in Fig.11.25 but it is used on standard steering only. It has a different flange yoke assembly, end yoke and journal assembly. The journal assembly takes two replaceable nylon rollers and to remove these, take off their securing circlips and slide off the rollers. There is no difference on the removal and refitting of this later type column.

32 Steering idler assembly - removal

- 1 Place the car over a pit or raise it at the front to give access to the idler assembly. If the car is raised make sure that it is well supported before doing any work underneath it.
- 2 Remove the self locking nut and the washer securing the track rod end to the idler lever.
- 3 Place a support against one side of the lever and then strike the other side several sharp blows with a hammer to break the hold of the taper joint of the track rod end.
- 4 Remove the four bolts and spring washers which attach the steering idler bracket to the front suspension crossmember and lift off the steering idler assembly.

33 Steering idler assembly - dismantling and reassembly

- 1 An exploded view of the steering idler assembly as fitted to early cars is given in Fig.11.28. Later cars are fitted with a steering idler having tapered roller bearings of a very similar type to that used with power assisted steering and this type is described in Section 61 to which reference should be made for the dismantling and reassembly procedure. The new type idler can be used in place of the previous type with plain bush, as illustrated, when total replacement is necessary.
- 2 Take off the self locking nut and the washer which attach the idler lever to the fulcrum pin.
- 3 Using a suitable extractor, withdraw the idler lever from the fulcrum pin.



Fig.11.28. Exploded view of the steering idler assembly (early type)

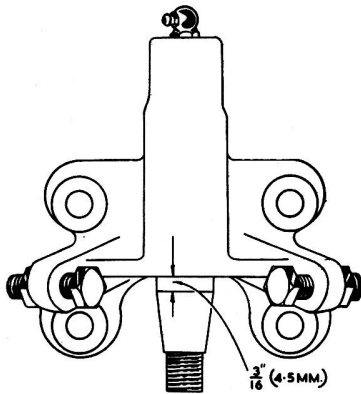


Fig.11.29. Setting dimension for the steering idler fulcrum pin

- 4 Unscrew the fulcrum pin from the housing to remove it and then take out the "O" ring which will be found at the bottom of the housing.
- 5 To reassemble, first fit a new "O" ring in the groove at the bottom of the pin housing.
- 6 Now screw the fulcrum pin into the housing until the top of the taper is 3/16" (4.5 mm) from the bottom face of the idler housing as illustrated in Fig.11.29.
- 7 Offer the idler lever to the taper of the fulcrum pin and lightly tap it into position to grip on the taper but make sure that it is kept square.
- 8 Fit the washer and the self locking nut and tighten down, but make certain whilst tightening, that the fulcrum pin does not turn.

34 Steering idler assembly - refitting

Refitting is the reverse of the removal procedure but be sure that the idler lever and the drop arm are in the straight ahead position before fitting the track rod end to the lever. Using a grease gun, lubricate the assembly with the recommended grease.

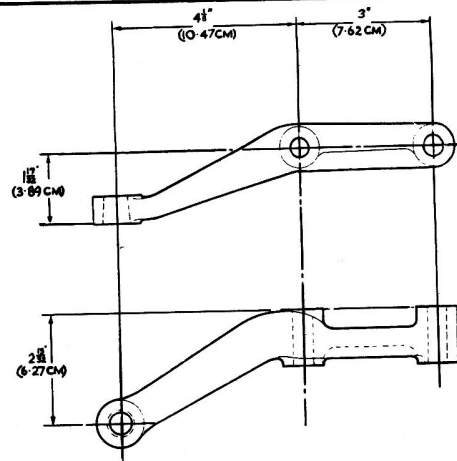


Fig.11.30. Steering arm - Mk 1 cars

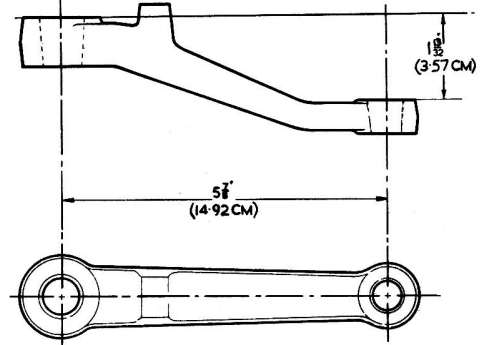


Fig.11.31. Steering idler lever - Mk 1 cars

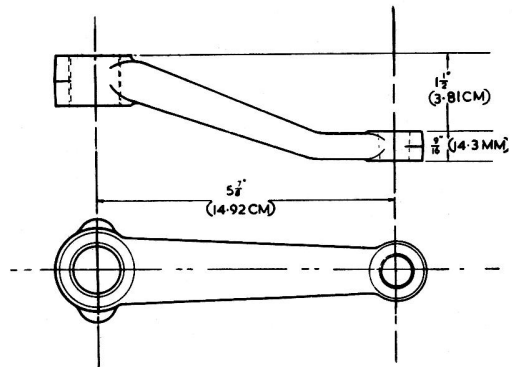


Fig.11.32. Steering drop arm - Mk 1 cars

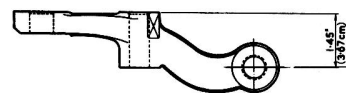
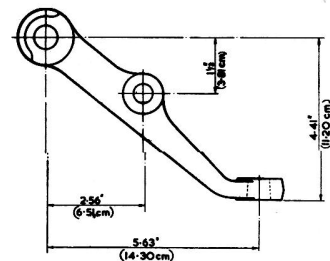


Fig.11.33. Steering arm - later type

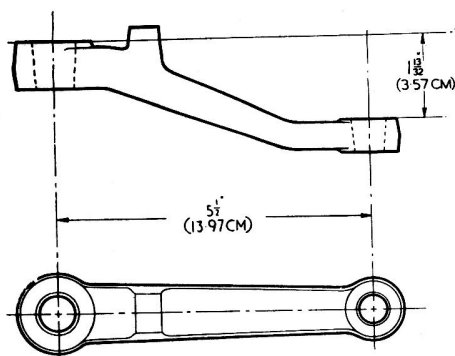


Fig. 11.34. Steering idler lever - later type

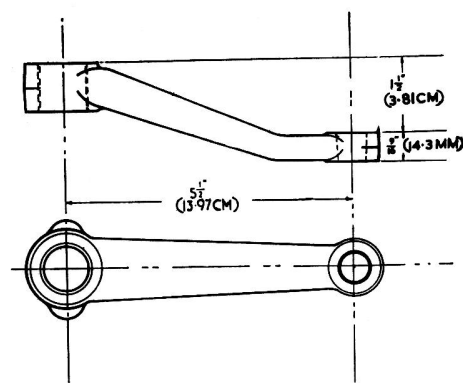


Fig. 11.35. Steering drop arm - later type

35 Tie rod lever, left hand and right hand - removal and refitting

- 1 Raise the car to remove the appropriate front wheel. Support the car on a firmly based axle stand.
- 2 Take off the self locking nut and the plain washer securing the tie rod to the tie rod lever.
- 3 Support one side of the lever and then strike the other side several smart blows with a hammer to separate the tie rod ball pin from the taper of the lever.
- 4 Unscrew the self locking nut securing the stub axle shaft and the tie rod lever to the stub axle carrier.
- 5 Break the locking wire to the bolt attaching the end of the lever to the stub axle carrier and remove the bolt and the lever.
- 6 Refitting is the reverse of the removal procedure. Use soft iron locking wire to secure the wired bolt.

36 Tie-rod - removal and refitting

- 1 Place the car over a pit or raise the front of the car for access to the tie rod. Make sure that the car is well supported before working underneath it.
- 2 Take off the self locking nuts and the plain washers which secure the tie rod on the tie rod lever and the track rod end.
- 3 Support one side of the tie rod lever and then strike the other side several sharp blows with a hammer to break the taper joint. Repeat at the track rod end and remove the tie rod.
- 4 The tie rod ball joints cannot be dismantled so if they are worn a new assembly must be fitted.
- 5 Refitting is the reverse of the above procedure.

37 Track rod - removal

- 1 Remove the self locking nuts and the plain washers from the inner ball joint of each tie rod.
- 2 Support one side of the track rod end and strike the other side several smart blows with a hammer to separate the ball joint.
- 3 Remove the self locking nuts and the plain washers securing the track rod ends to the drop arm and the idler lever and separate the track rod ends in the manner already described.
- 4 Remove the track rod.

38 Track rod - dismantling and reassembling

- 1 Slacken the clamp at each end of the centre tube and unscrew the track rod ends noting that one has a left hand and the other a right hand thread. Note the number of turns required to separate each end so that they can be reassembled in approximately the same position.
- 2 If there is wear in the rubber/steel bonded bush at the track rod end, the assembly will have to be replaced.
- 3 Reassemble by screwing in the track rod ends to the tube the same number of turns as when removed (the final setting of the track rod length must be carried out after refitting to the car and as this requires special wheel alignment equipment it is a job which will have to be left to your Jaguar agent or any well equipped garage). For the time being, tighten down on the clamp bolts. The car will be driveable with care, with the track rod roughly adjusted in this manner but some wander in the steering must be anticipated and some scuffing and uneven wear of the tyres if driven for long distances.

39 Track rod - refitting

- 1 Refitting is the reverse of the removal procedure but it is essential that the steering drop arm and the idler lever are turned to the straight ahead position before fitting the track rod. Also the pins should be tapped into the drop arm and idler lever to prevent them turning when tightening the nuts. If those precautions are not observed, undue torsional loading of the rubber bushes will result and will give a tendency to steering wander and premature failure of the bushes.

40 Lock stop adjustment (standard steering)

- 1 Fig. 11.29 shows the position of the lock stop bolts. The bolts which are screwed into the idler bracket and retained by locknuts, are set at the factory to allow 38° travel of the drop arm and the idler lever each side of the straight ahead position.
- 2 Adjustment is not normally necessary but if the setting of the bolts is upset for any reason, adjust their position as follows.
- 3 Slacken the locknuts and screw in the bolts as far as possible.
- 4 Turn the steering until it is at the end of its travel on that particular lock. Now screw out the bolt until the head contacts the idler lever and then centre the steering. Unscrew the bolt a further two turns and tighten down on the locknut.
- 5 Repeat the operations at paragraph 4 for the other lock.

41 Accidental damage to standard steering components

The dimensioned drawings at Figs. 11.30, 31 and 32 in respect of Mk 1 cars and at Figs. 11.33, 34 and 35 in respect of later models of cars fitted with standard steering, are provided to enable you to access the dimensional serviceability of steering components following damage to your car. Check also for fractures and deterioration. It must be noted that for Mk 1 models, the 5 7/8" (14.92 mm) dimension of the steering idler and the drop arm is reduced to 5 1/2" (13.97 mm) with effect from the following chassis numbers:-

	RH Drive	LH Drive
2.4 litre	914564	943496
3.4 litre	976917	991866

42 Power assisted steering - general description

Power assisted steering is supplied as an optional extra for 3.4, 3.8 litre and 340 models only. Early cars were fitted with the Burman recirculating ball worm and nut type of steering box but this was replaced by the Adwest steering box which operates on the "hour glass" cam and roller principle. Apart from this, both systems have a similar layout and use the same type of pump.

The layout of the power assisted steering system (Burman box depicted) is given in Fig.11.36, it consists of an oil reservoir, an eccentric rotor type pump which is driven off the rear of the dynamo shaft a hydraulically assisted steering box. These items are connected by flexible hoses as follows:-

- Reservoir to inlet side of the pump.
- Outlet side of the pump to the inlet pipe connection attached to the steering box.
- Outlet at the top of the steering box to the reservoir.

The pump supplies a continuous flow of oil through the system whilst the engine is running and the steering is in the straight ahead position. As soon as the steering column is rotated a valve is opened to allow oil to enter the appropriate pressure chamber.

A section view of the Burman type steering box is given in Fig.11.37. Hydraulic assistance is applied to a piston which forms part of the nut (G), the piston works within a cast iron cylinder and hydraulic pressure is admitted to one side or the

other of it depending on which steering lock is applied. Admission of oil to the appropriate pressure chamber is controlled by a selector valve (M) which is mounted within the hollow rear end of the wormshaft (P) and to which the lower steering column is attached in the same manner as for standard steering. Rotary movement of the valve relative to the wormshaft opens and closes ports in the wormshaft and this directs oil to the side of the piston for the steering lock required.

A sectional view of the Adwest steering box is given in Fig.11.38. A hydraulic control valve, which is connected to the lower steering column in the same manner as the standard steering box, is embodied in the input shaft of the "hour glass" cam. The hydraulic assistance is supplied by a servo piston from which a rack projects, the teeth of which mesh with a sector of a spur gear which is machined on projection from the sector shaft. The track of the "hour glass" cam is machined with a varying helix so that the pitch is non-constant. A roller carried in the sector shaft meshes with this track and this is responsible for provision of the variable steering ratio.

Operation of the control valve is shown in Figs.11.39 and 11.40. This is a rotary type valve made up in two parts. The valve rotor, which is also the input shaft to the steering gear, has six grooves machined in it and these lie between six grooves in the valve sleeve when no load is applied to the steering wheel, the rotor being centred in the sleeve by the torsion bar. When the steering wheel is turned, effort is transmitted to the rotor which, in turn, transmits the effort to the hour glass cam by means of the torsion bar. The torsion bar is designed to twist under this effort thus allowing the rotor to rotate within the sleeve. The relative movement of the grooves in the rotor to the grooves in the sleeve causes a build up of hydraulic pressure on one side or the other of the servo piston, to assist turning the steering.

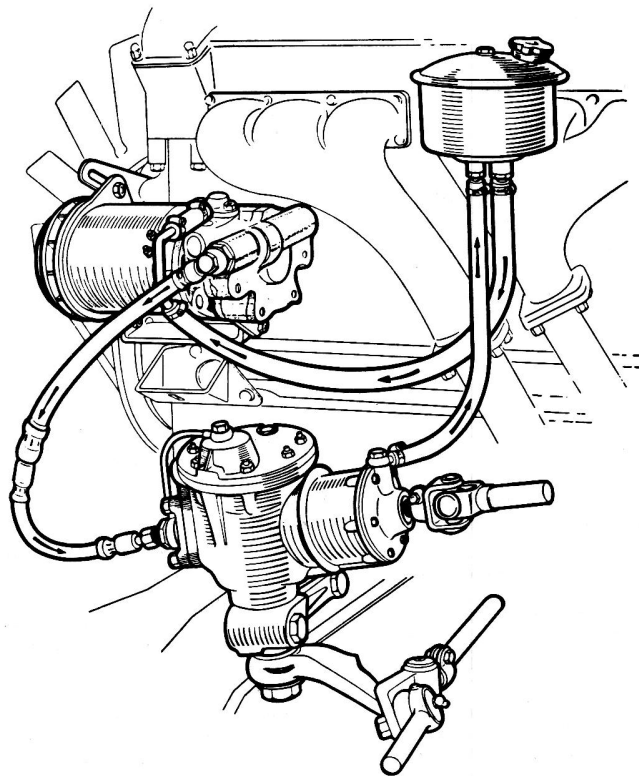


Fig.11.36. Layout of power assisted steering system

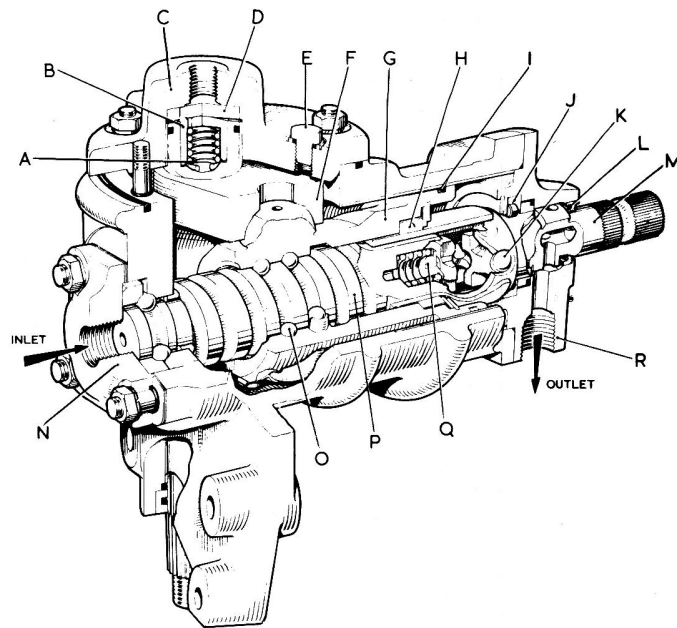


FIG.11.37. SECTIONED VIEW OF THE BURMAN POWER ASSISTED STEERING BOX

- | | | | | | | | |
|---|---------------------------------|---|----------------|---|-------------------|---|-------------------------------|
| A | Rocker shaft plunger
springs | E | Bleed plug | J | Roller race | O | Re-circulating balls |
| B | Rocker shaft plunger | F | Rocker shaft | K | Interlock ball | P | Worm shaft or inner
column |
| C | Rocker shaft cover plate | G | Main nut | L | Twin lip oil seal | Q | Valve spring and plunger |
| D | Thrust pad | H | Sealing sleeve | M | Selector valve | R | Top end plate |
| | | I | Piston rings | N | Bottom end plate | | |

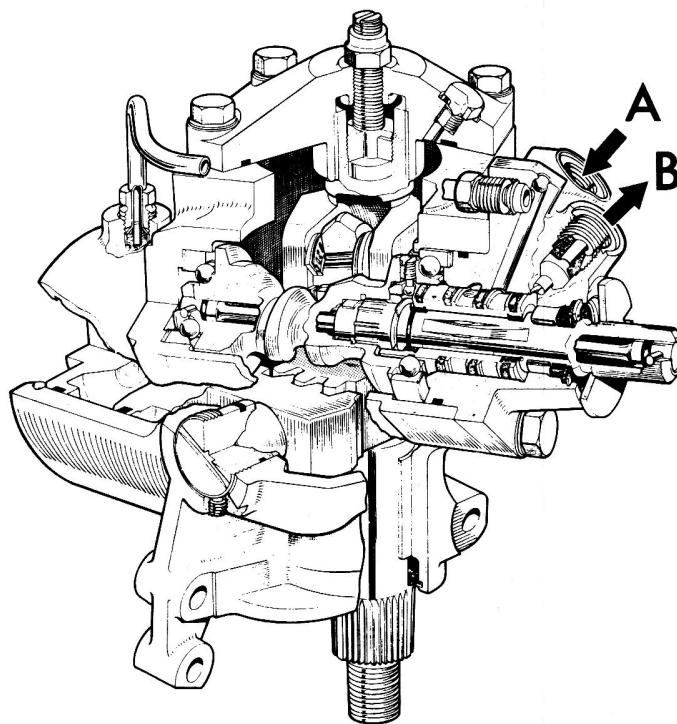


Fig.11.38. Sectioned view of the Adwest power assisted steering box. 'A' high pressure and 'B' low pressure connections

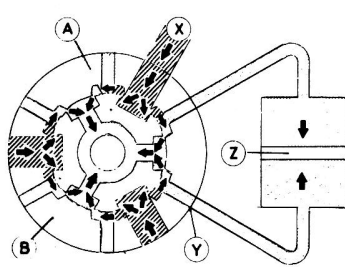


FIG.11.39. OPERATING DIAGRAM OF THE ROTOR VALVE (STRAIGHT AHEAD)

A Rotor
B Sleeve
X Pump pressure
Y Reservoir pressure
Z Equilibrium

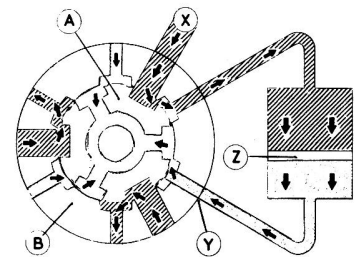


FIG.11.40. OPERATING DIAGRAM OF THE ROTOR VALVE (STEERING TURNED)

A Rotor
B Sleeve
X Pump pressure
Y Reservoir pressure
Z Pressure displacement

43 Steering box, power assisted steering - removal

- 1 Place the car over a pit or on a ramp. If neither of those facilities are available, raise the front of the car to give access to the steering box but make sure that the car is well supported before doing any work underneath it.
- 2 Disconnect the high and low pressure unions from the box and hold a container beneath them to catch the oil which will escape. Blank off the pipes and the unions at the box to prevent the ingress of dirt.
- 3 Now refer to Section 20 and carry on in the manner described for removal of the standard type box.

44 Steering box, Burman, power assisted - dismantling

Always make sure that there is good reason for dismantling this steering box. Parts may not be available easily - it may be more efficient to purchase another steering box complete. Always check part availability.

- 1 An exploded view of the Burman type steering box is given at Fig.11.41 to which reference should be made during the following operations.
- 2 Remove the tab washer and nut securing the drop arm (34). Withdraw the drop arm from the rocker shaft.
- 3 Hold the steering box in a padded vice by the mounting boss. Place a container beneath the box to catch the oil which will escape as dismantling proceeds.
- 4 Remove the feed pipe assembly from the lower end cover and the rocker shaft cover.
- 5 Remove the rocker shaft cover to the steering box. Remove the set screw and recover the "O" ring.
- 6 Push up on the rocker shaft and remove the cover.
- 7 Take out the plunger (40) and the coil spring (41) and collect the thrust pad (39) from the counterbore in the cover.
- 8 Allow the oil to drain from the box into the container.
- 9 Remove the bottom cover (11) and take off the cover and the outer ball race.
- 10 Take off the top cover.
- 11 Lift up on the rocker shaft to disengage the ball on the nut assembly from the socket in the rocker arm and then withdraw the worm and nut assembly.
- 12 Lift out the rocker shaft.
- 13 Remove the end cover (29).
- 14 Take out the wormshaft and the main nut. Unscrew the nut from the wormshaft and collect the forty-four recirculating balls. Note that twenty-two of the balls are black in colour, these are smaller than the others by 0.007" (0.017 mm). It is essential that they are assembled alternatively with the larger one on reassembly of the box.

- 15 Take off the spring circlip and the sealing sleeve from the lower end of the worm.

- 16 Remove the circlip and the washer (28) and (27) from the upper end cover roller race assembly, and collect the twenty-four loose rollers.

- 17 Tap the cover against a block of wood to remove the race (25) followed by the packing piece, the "O" ring and the seal. If the race cannot be dislodged by tapping against the wooden block, immerse the end cover in boiling water for a few minutes and try again.

- 18 Remove the piston rings from the main nut assembly by lifting out one end and then working them round with the fingers. Do not stretch them too far as they are very brittle and are easily broken.

- 19 Remove the internal circlip, washer and sealing sleeve from the nut.

45 Steering box, Burman, power assisted - reassembly

Owing to the high working pressure of this unit (800 -850 psi) we always replace all "O" rings and seals with new items on reassembly of the steering box.

- 1 Press the lower inner ball race into the bottom end of the box.
- 2 Fit the lower sealing sleeve inside the inner ball race and check for freedom of rotation.
- 3 Fit the lower sealing sleeve and the spring circlip onto the lower end of the valve assembly.
- 4 Fit the sealing sleeve over the tube pressed onto the worm and check for freedom of rotation.
- 5 Fit the top cover sealing sleeve onto the worm and check for freedom of rotation.
- 6 Assemble the sealing sleeve, the retaining washer and the circlip in the main nut.
- 7 Fit the piston rings to their grooves in the main nut.
- 8 Assemble the forty-four balls in the main nut making sure that the black and the bright balls are assembled alternatively. Now screw the worm and valve assembly into the nut taking care that none of the balls are dislodged from the nut. It will assist in keeping the balls in place if they, and the nut, are coated with light grease.
- 9 Press the oil seal into the recess in the end cover with the spring showing towards the inside of the box.
- 10 Fit the "O" ring and the sealing sleeve to the top end cover and then push in the roller race. Coat the race with light grease and then insert the twenty-four rollers. Secure with the washer and circlip.
- 11 Turn the piston rings so that the slots are opposed at 180° and then compress them with a small ring clamp of a size which will fit into the recess in the end of the box. Carefully insert the

- 1 Steering box
- 2 Stud
- 3 Stud
- 4 'O' ring
- 5 Dowel
- 6 Stud
- 7 'O' ring
- 8 Inner adjustable ball race
- 9 Outer adjustable ball race
- 10 Balls
- 11 Bottom end plate
- 12 Shim
- 13 Main nut
- 14 Piston ring
- 15 Balls (small)
- 16 Balls (large)
- 17 Sleeve
- 18 Washer
- 19 Circlip
- 20 Sleeve
- 21 Sleeve
- 22 Inner column assembly
- 23 Packing piece
- 24 'O' ring
- 25 Roller race
- 26 Rollers
- 27 Washer
- 28 Circlip
- 29 Top end plate
- 30 Seal
- 31 'O' ring
- 32 Rocker shaft
- 33 'O' ring
- 34 Drop arm

- 35 Nut
- 36 Washer
- 37 'O' ring
- 38 Cover plate
- 39 Thrust pad
- 40 Plunger
- 41 Spring
- 42 Bolt
- 43 Washer
- 44 'O' ring
- 45 Feed pipe
- 46 Connection for feed pipe
- 47 Copper washer
- 48 Banjo bolt
- 49 Copper washer

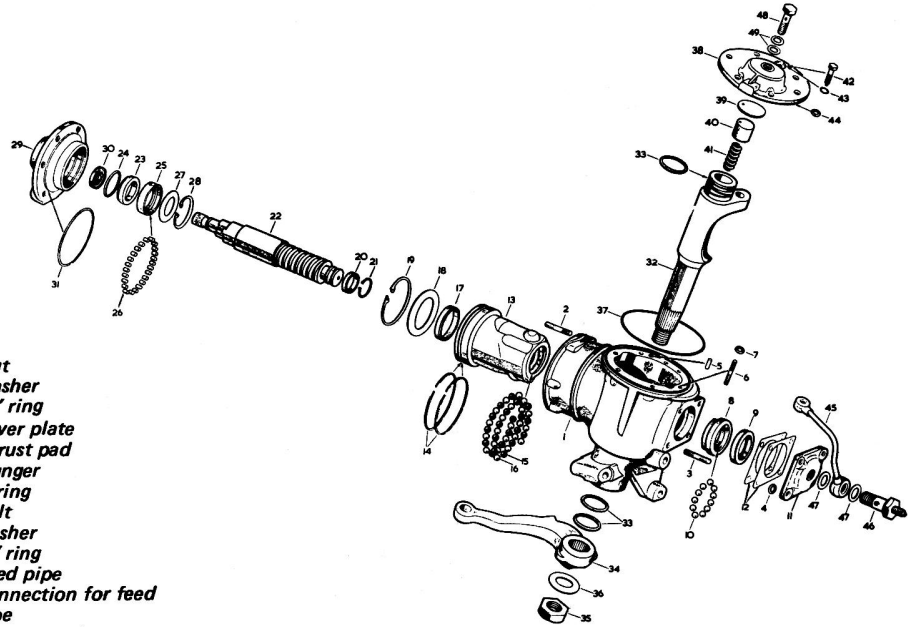


FIG.11.41. THE BURMAN POWER ASSISTED STEERING BOX

main nut into the box to assemble together with the rocker shaft. It will be necessary to turn the rocker shaft onto the far lock and to lift the rocker arm so that the ball on the nut will fit into the socket on the rocker arm.

12 Now coat the lower ball race with light grease and fit the eleven balls. Fit the outer ball race followed by the end plate with shims between the plate and the box so that the worm assembly just rotates freely without end float with the end plate tightened down. Now remove a 0.0025" (0.063 mm) shim to obtain the correct axial preload on the worm assembly.

13 Cover the serrations on the valve with tape to prevent damage to the "O" ring when sliding it onto the spigot. Fit the "O" ring and the end cover with the oil outlet facing downwards for right hand drive, and facing upwards for left hand drive, cars. Remove the protective tape and tighten down evenly on the cover.

14 The end float of the rocker shaft must be checked, and adjusted as may be necessary, when refitting the top cover. The design of the box provides for a certain amount of end movement of the rocker shaft when on full lock and, as the shaft rises and falls slightly in travelling from lock to lock, adjustment for end float should be carried out at the highest point of the rocker arm travel.

15 Assemble the original thrust pad (39) and plunger (40), less spring, into the top cover and fit the top cover to the box but do not fit the "O" rings at this stage. Fit the cover securing bolts and tighten down evenly.

16 Rotate the input shaft by hand to check for tightness as the rocker passes over the highest point on each lock. If no tightness is felt, take off the top cover and replace the thrust pad by one 0.005" thicker (pads are available ranging in thickness from 0.155" to 0.185" in steps of 0.005"). Carry on checking and fitting thicker pads until restriction to movement is felt and then remove the pad and fit one 0.005" thinner.

17 Assemble the "O" rings to the top cover face and to the top of the rocker shaft checking fit on the latter within the top cover bush. Insert the spring and the plunger in the rocker shaft, fit the thrust pad followed by the top cover. Fit the bolts to the cover and tighten down evenly or the top bush may be damaged.

18 Fit the drop arm making sure that the splines mate correctly and that the lines on the arm and on the rocker shaft coincide. 19 Fit the pipe between the bottom cover and the rocker shaft cover and use new copper washers on each side of the banjo connections.

46 Steering box, Adwest, power assisted - dismantling

Always make sure that there is good reason for dismantling this steering box. Parts may not be available easily it may be more efficient to purchase another steering box complete. Always check the part availability.

1 An exploded view of the Adwest steering box is given in Fig.11.42 to which reference should be made during the following operations.

2 Remove the nut (34) which secures the drop arm (33) to the sector shaft (24).

3 Mark the location of the drop arm in relation to the shaft for reassembly purposes and then, withdraw the drop arm from the splines of the shaft.

4 Remove the plug you fitted to the inlet orifice when disconnecting the pipe, invert the box and allow the oil to drain out.

5 Set the input shaft to the straight ahead position. Slacken the screw (22) and remove the rack adjusting plug with the seal (21) and the thrust pad (23).

6 Remove the top cover (25), and the sector shaft and worm follower assembly (24) from the box by tapping on the bottom of the shaft with a hide faced hammer (Fig.11.43).

7 Separate the top cover from the sector shaft assembly by undoing the locknut and then screwing off the cover.

8 Remove the circlip and take the seals and washers (items 29,30,31 and 32) out of the box.

9 Remove the alignment washer (11) and tap the valve housing (7) with a hide faced hammer to remove it. Collect the shims (12) which are located between the housing and the bearing outer race.

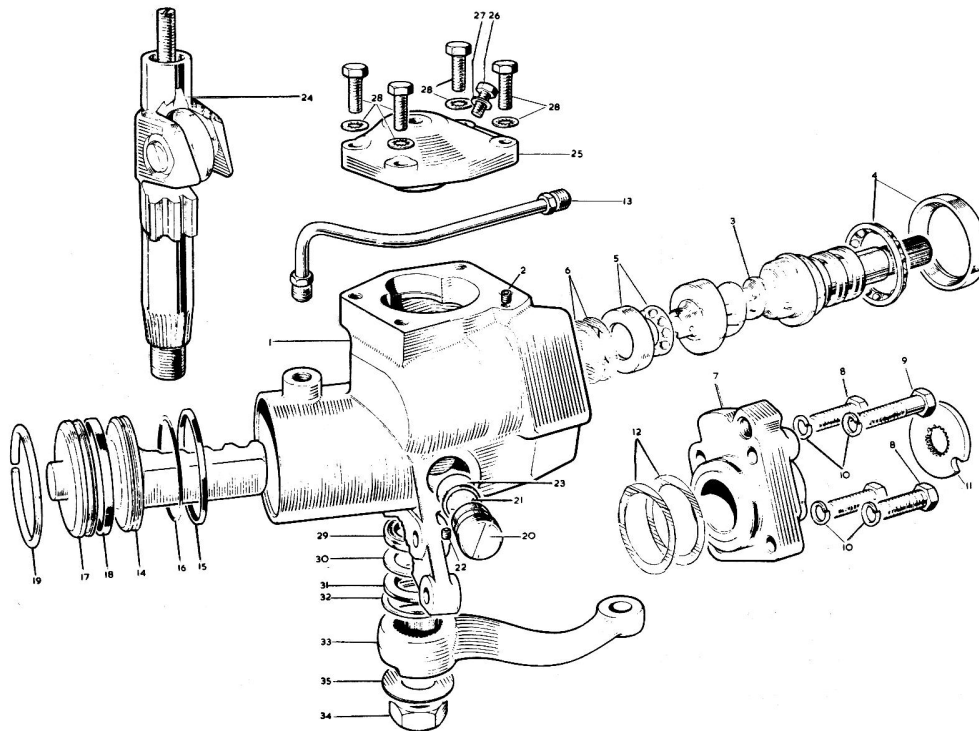


FIG.11.42. THE ADWEST POWER ASSISTED STEERING BOX

- | | | | |
|------------------|-------------------------|-----------------------------------|---------------|
| 1 Steering box | 11 Centralising washer | 21 Seal | 29 Seal |
| 2 Screw | 12 Shims | 22 Screw | 30 Washer |
| 3 Valve and worm | 13 Feed pipe assembly | 23 Thrust pad | 31 Seal |
| 4 Ball bearing | 14 Piston and rack | 24 Sector shaft | 32 Circlip |
| 5 Ball bearing | 15 Teflon sealing rings | 24 Sector shaft and worm follower | 33 Drop arm |
| 6 Shims | 16 'O' rings | 25 Top cover | 34 Nut |
| 7 Valve housing | 17 Cylinder cover | 26 Bleed screw | 35 Tab washer |
| 8 Bolt | 18 Seal | 27 Washer | |
| 9 Bolt | 19 Clip | 28 Screw and lock washer | |
| 10 Washer | 20 Plug | | |

10 Remove the valve and worm assembly (3) complete with the bearing (4) (Fig.11.44). If the bearing is to be replaced, withdraw the outer race. It is essential that none of the shims behind the outer race are mislaid.

11 DO NOT remove the trim screw shown in Fig.11.45 from the worm and valve assembly.

12 Remove the cylinder cover retaining clip (19) by forcing one end out of its groove using a short 3/16" (4.5 mm) steel punch. The clip can be eased clear with a screwdriver (Fig.11.46).

13 Remove the cylinder cover (17) complete with its seal by pulling on the centre boss.

14 Screw a long 1/2 inch UNC bolt into the tapped hole in the centre of the piston and rack (14) and withdraw the assembly through the open end of the cylinder (Fig.11.47).

47 Steering box, Adwest, power assisted - examination

1 Sector shaft assembly: Check for preload on the thrust bearing which should be free to rotate but should be slightly stiff with no side play. Examine the three sector teeth for signs of excessive wear. Look at the bearing areas on the top and bottom

of the shaft and make sure that wear is not excessive. Examine the seal area at the bottom of the shaft for wear, damage or grooving. Any fault found in the sector shaft assembly will entail replacement of the complete assembly.

2 Cover assembly: Examine the sector shaft bush for wear which, if excessive, will mean replacement of the cover. Discard the cover sealing ring.

3 Housing assembly: Examine the sector shaft bush for wear and the cylinder bore for damage, wear or scoring, any of these faults will entail replacement of the housing. Discard the sector shaft seal. Check the condition of the pipe seats in the housing and cover assemblies. If the seats are damaged in any way they can be replaced by tapping a suitable thread in the internal bore of the seat and then fitting a screw with an attached nut and plain washer; tighten the nut down against the housing case and withdraw the seat. Fit the new seal by inserting in the housing and tapping it home square with a soft punch.

4 Valve and worm assembly: Check the three teflon rings on the sleeve for damage, they should be a loose fit in their grooves and should be free from cuts, scratches and other blemishes. Examine the valve and worm ball bearing tracks for wear or

damage. Check that there is no relative movement at the trim pin between the valve sleeve and the worm. Check for wear in the torsion bar assembly pins by ensuring there is no free movement between the input shaft and the worm. Look for damage or wear at the needle bearing area towards the outer end of the shaft and look also, for wear in the area of the seal. Any faults other than in the teflon rings will entail replacement of the valve and worm assembly.

5 **Piston and rack:** Discard the teflon piston ring and the rubber "O" ring beneath it. Examine the rack teeth for signs of wear and the back face of the rack for wear caused by the rack adjuster pad.

6 **Valve housing:** Examine the bore for signs of wear or damage particularly in the area where the teflon rings have been rubbing. Look for damage in the needle roller bearing. Discard the seal.

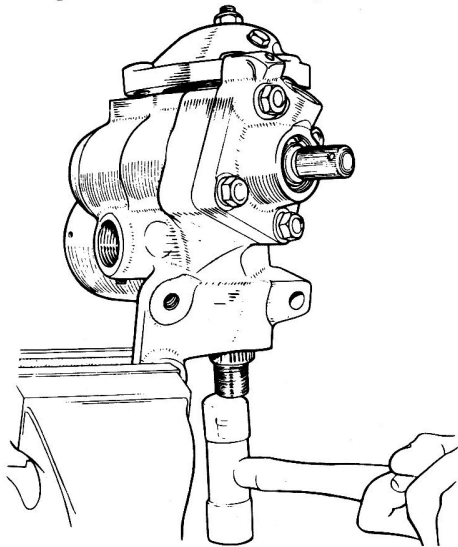


Fig.11.43. Removing the sector shaft worm follower assembly and the top cover

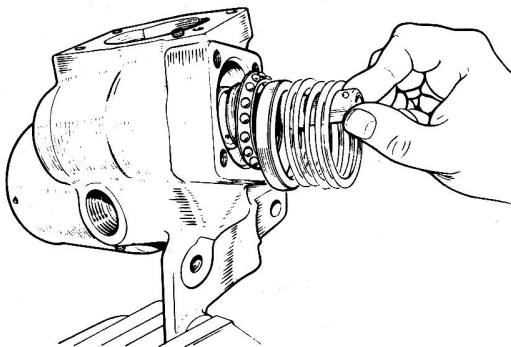


Fig.11.44. Removing the valve and worm assembly

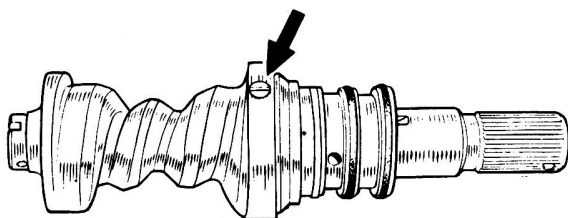


Fig.11.45. Location of the trim screw

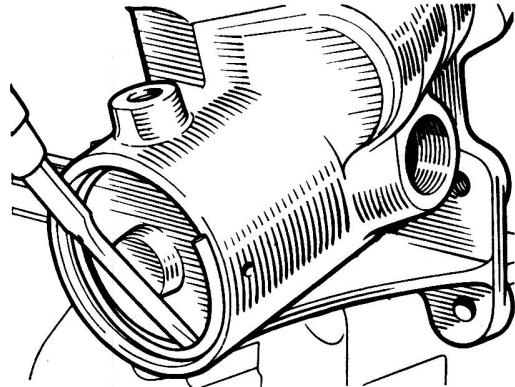


Fig.11.46. Removing the cylinder cover retaining clip

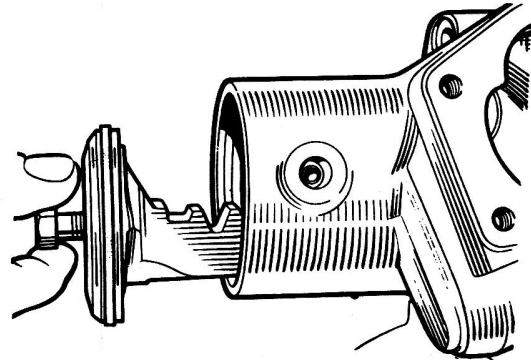


Fig.11.47. Using a bolt to withdraw the piston and rack assembly

48 Steering box, Adwest, power assisted - replacement of internal seals

- 1 If your examination of the teflon rings on the valve or worm shows that they have to be replaced, cut the old rings through with a sharp knife and remove from the groove.
- 2 Two special tools are used for fitting the rings, a Valve Seal Expander (Tool No. J 32) and a Valve Seal Compressor (Tool No. J 33), (Figs.11.48 and 11.44) you may be able to borrow these to do the job but if you are unable to do so, we suggest that you have the rings fitted in a workshop holding the necessary equipment as, without them, some difficulty may be experienced in expanding the rings to fit them without damage.
- 3 To fit a ring into a particular groove, slide the ring onto the expander and work it up to the large end. Now slide the expander over the sleeve and position the end cover over the groove to which the ring is to be fitted.
- 4 Push the ring over the end of the expander and into the groove.
- 5 It must be noted that the expander will not fit over the sleeve when rings are already fitted in the grooves so it may happen that you will have to discard serviceable rings in order to replace faulty ones.
- 6 Having expanded a ring and fitted it to the groove, it is now necessary to compress it into the groove and this is done by working the sleeve into the seal compressor or starting at the end of the tool having the shallow taper and finishing at the other end with the steep taper.
- 7 Check, when the compressor is withdrawn, that the ring is fitting snugly in the groove, is not damaged and is free to rotate.

49 Steering box, Adwest, power assisted - reassembling

- 1 It is advisable to replace all "O" ring seals at reassembly of

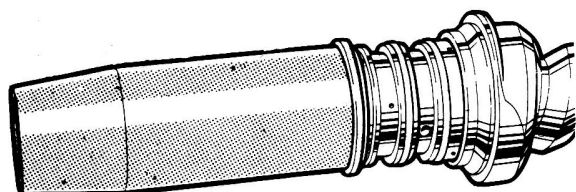


Fig.11.48. Fitting a teflon ring using the valve seal expander

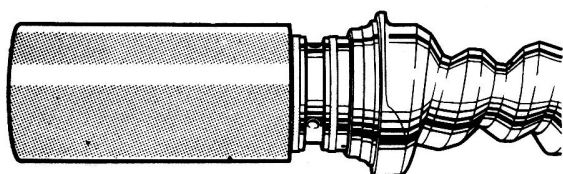


Fig.11.49. The valve seal compressor

the box irrespective of their visual condition.

- 2 It is important that the worm is centred in the gear housing to ensure the correct relationship between the ratio curve, the preload peak and the central position of the steering gear. Look at the worm and you will see a figure etched on it and another figure will be found stamped on the valve housing (Fig.11.50) these figures indicate the amount, in thousandths of an inch, that the worm is short and that the box is deep over design limits. Add the two datum errors together to give the thickness of shims which must be placed in the bottom of the recess in the race housing. Shims are available in thicknesses of 0.002", 0.003" and 0.010".
- 3 Assemble the required pack of shims into the recess in the race housing.
- 4 Press the outer race of the small bearing into the recess on top of the shims.
- 5 Fit the ball bearing assembly and the large cage over the top of the worm.
- 6 Remove the large square sectioned "O" ring from the spigot of the valve housing assembly.
- 7 Fit the valve housing over the valve rotor taking care not to cause damage to the seal by the splines of the rotor.
- 8 Now check the input shaft for end float. Add shims between the valve housing and the gear housing to provide a 0.0015" (0.04 mm) gap, this should be measured whilst applying reasonable hand pressure to the valve housing (Fig.11.51).
- 9 Assemble the four bolts and washers to the valve housing and tighten down evenly.
- 10 Fit a new piston ring, and "O" ring beneath it, in the groove of the piston.
- 11 Screw a long 1/2" UNC bolt into the tapped hole in the centre of the piston and press the piston into its bore with the teeth in the rack facing the sector shaft centre line. Take off the end plate and enter the piston until its end is 1.675" (42.5 mm) from the mouth of the cylinder (Fig.11.52). Refit the end plate. Align the piston in the bore so that the back face of the rack is hard up against the gear casing adjacent to the rack adjuster plug bore.
- 12 Assemble the top cover to the sector shaft assembly by screwing it on as far as it will go. Ensure that the square section "O" ring is fully home in its recess.
- 13 Protect the splined end of the sector shaft and assemble the shaft to the housing with the roller positioned towards the middle of the worm.
- 14 Work the sector to engage the teeth of the rack and move the input shaft to and fro to engage the worm and then push the sector shaft fully home.
- 15 Fit the four screws and washers and tighten down evenly to

secure the top cover at the same time making sure that the spigot is hard up against its recess in the casing aperture.

16 Assemble the thrust pad, the seal and the rack adjusting plug. In order to make sure that the pad remains in position it is advisable to fit these items with the box on its side with the adjuster plug uppermost. Fit the plug loosely and fit the locking screw finger tight.

17 Fit the seal to the cylinder cover, press the cover into the bore and then secure it with the retaining clip.

18 It is now necessary to adjust the sector shaft and the rack.

19 To adjust the sector shaft first make sure that the rack adjusting plug is slack, turn the input shaft from lock to lock using a torque wrench or just by "feel" noting the position at which the arm of the wrench turns through centre. Now note the torque felt one full turn from centre in either position.

20 Using a screwdriver, turn the adjusting bolt in a clockwise direction a little at a time at the same time turning the input shaft through the centre position until an increase of 4 lbf in over the torque previously noted is obtained at the centre position.

21 Lock the bolt with the locknut and recheck the adjustment by turning from lock to lock and if the adjustment is correct there will be an increase in torque of 4 lb f in over that of a turn from centre in either direction. It is important to avoid excessive preloading of the sector shaft assembly into the worm as this will result in possible poor return - efficiency.

22 The rack is adjusted in a very similar manner to adjustment of the sector shaft. First centre the gear as described in paragraph 19 and note the torque reading over the centre of the gear.

23 Now screw in the rack adjusting plug firmly to ensure proper seating and then slacken off by about a quarter of a turn.

24 Screw in the plug gradually and at the same time turn the input shaft through centre until an increase of 4 lb f in over the original reading is obtained.

25 Rotate the shaft from lock to lock and check that this adjustment has not produced an increase of torque in excess of 4 lb f in at any other point. If it has, reduce the torque at centre until that maximum limit is reached.

26 Finally lock the rack adjusting plug by means of the small socket screw.

27 Complete the assembly of the steering box by replacing the feed pipe and then fit the drop arm to the sector shaft with the location mark made at dismantling correctly aligned.

28 Fit the washer and the nut to secure the drop arm and tighten the nut to a torque of 130 lb f ft.

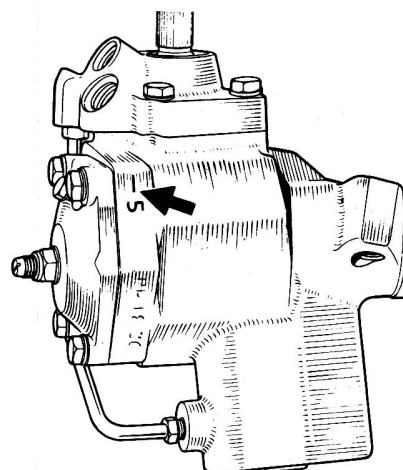


Fig.11.50. Location of depth marking on valve housing

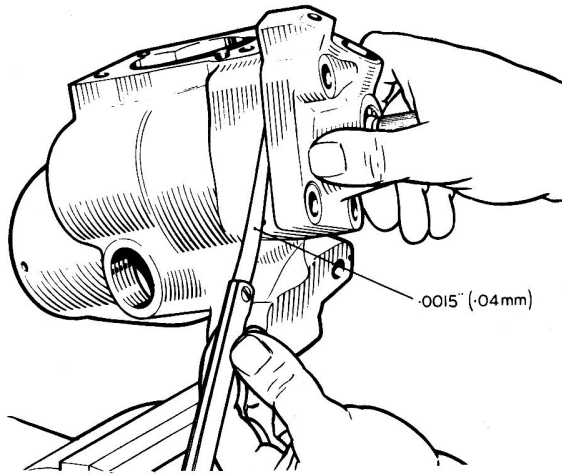


Fig.11.51. Checking the gap between the valve and gear housings

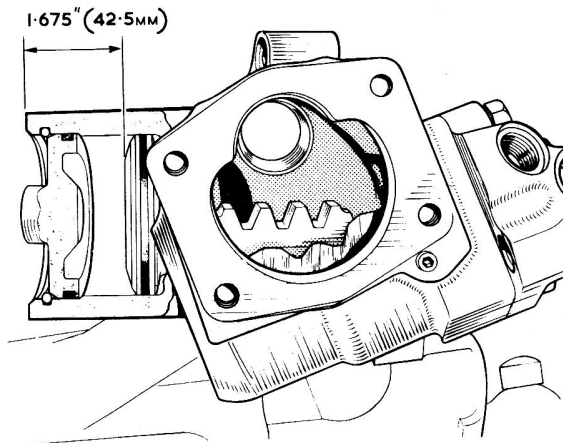


Fig.11.52. Assembly of the rack and piston

50 Steering box, power assisted - refitting

- 1 The steering box is refitted to the car in the manner described in Section 26 covering the standard box.
- 2 Ensure that the hydraulic connections are perfectly clean and then refit the high and low pressure hoses to the box.
- 3 Fill the reservoir to the full mark with the recommended grade of automatic transmission fluid and then bleed the system as described in Section 51.

51 Power assisted steering - bleeding the system

- 1 The system will only require bleeding when any hydraulic union has been disconnected or where, due to a leak, an excessive quantity of oil has been lost.
- 2 Make sure that the reservoir is full of oil.
- 3 Start the engine and allow it to idle, recheck the level of oil in the reservoir and top up as necessary.
- 4 Check all unions for leaks.
- 5 On early model cars not provided with a bleed screw in the top cover of the box, increase the engine speed to about 1000 rpm and turn the wheels in each direction five or six times.
- 6 On those cars fitted with a bleed screw (item 26 in Fig.11.42) slacken the screw whilst the engine is running and retighten securely when all air has been expelled. Turn the steering, with engine running, from lock to lock a few times and check for lumpiness.
- 7 Finally, for both models, recheck for leaks and top up the reservoir.

52 Power steering pump - general

There are two types of oil pump which supply hydraulic pressure in the power assisted steering system. Early cars were fitted with a pump of the eccentric rotor type but this was superseded by a Hobourn-Eaton unit of the roller type on later cars. Both pumps incorporate a combined flow and relief valve and both are attached to the rear of the dynamo and are driven by a rubber coupling from the dynamo shaft. An exploded view of the early and later model pumps is given in Figs.11.53 and 11.54 respectively.

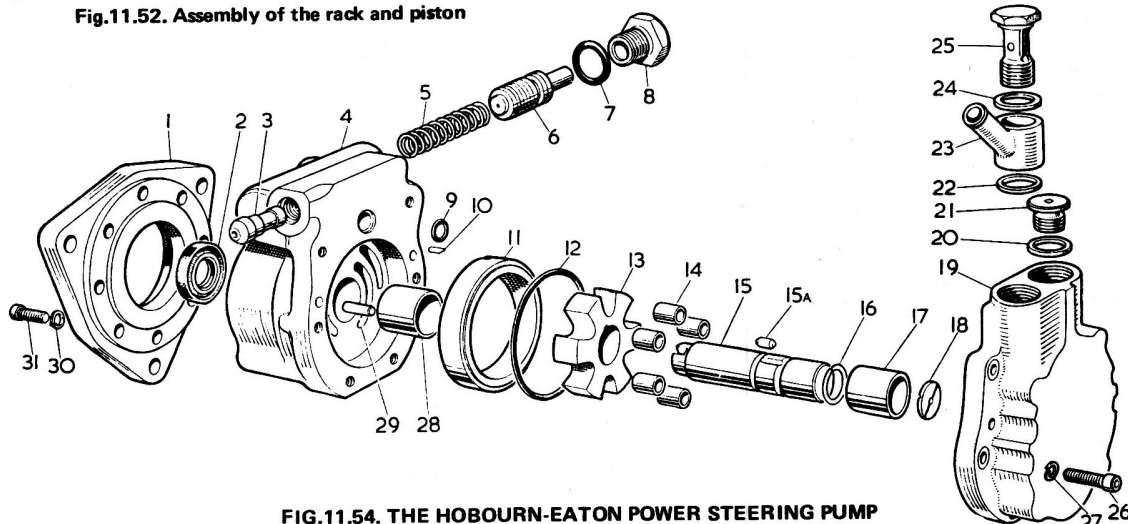


FIG.11.54. THE HOBOURN-EATON POWER STEERING PUMP

- | | | | |
|-----------------------|--------------------|---------------------|----------------------|
| 1 End plate | 9 Sealing ring | 16 Snap ring | 24 Fibre washer |
| 2 Oil seal | 10 Cam locking peg | 17 Drive shaft bush | 25 Adaptor screw |
| 3 Orifice tube | 11 Cam | 18 Thrust washer | 26 Cover screw |
| 4 Pump body | 12 Sealing ring | 19 Pump cover | 27 Spring washer |
| 5 Flow control spring | 13 Roller carrier | 20 Plug seal | 28 Drive shaft bush |
| 6 Flow control valve | 14 Rollers | 21 Plug | 29 Dowel pin (2-off) |
| 7 Valve seal | 15 Drive shaft | 22 Gasket | 30 Spring washer |
| 8 Valve cap | 15a Drive pin | 23 Adaptor | 31 End plate screw |

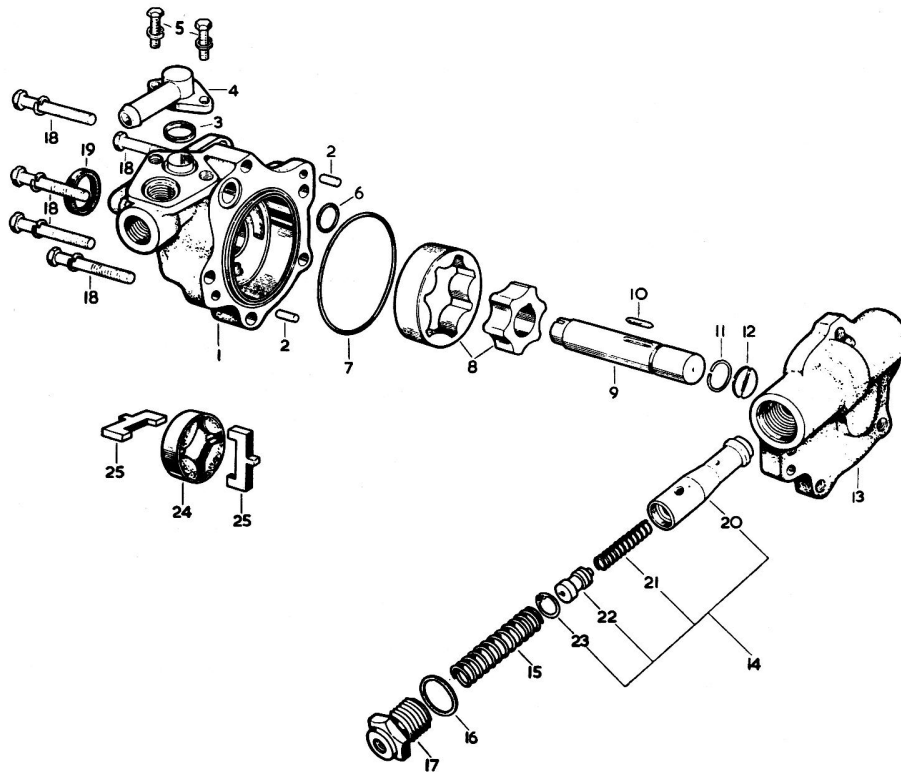


FIG.11.53. EXPLODED VIEW OF THE POWER STEERING PUMP (EARLY TYPE)

- | | | | |
|--------------------------|-------------------|--------------------------------|-----------------------|
| 1 Oil pump body assembly | 7 Large 'O' ring | 14 Flow control valve assembly | 20 Flow control valve |
| 2 Dowel | 8 Rotor assembly | 15 Return spring | 21 Spring |
| 3 Sealing ring | 9 Shaft | 16 'O' ring | 22 Relief valve |
| 4 Inlet pipe adaptor | 10 Drive pin | 17 Adaptor | 23 Circlip |
| 5 Screw and lockwasher | 11 Circlip | 18 Bolt and lockwasher | 24 Coupling assembly |
| 6 Small 'O' ring | 12 Thrust button | 19 Oil seal | 25 Driving dog |
| | 13 Cover assembly | | |

53 Power steering pump - removal

- 1 Disconnect the hoses at the pump unions and secure the hose ends in a raised position to prevent the oil syphoning out or alternatively drain the oil into a container.
- 2 Blank off the hose union and plug the orifices of the pump to prevent the ingress of dirt.
- 3 Remove the nuts and lock washers securing the pump to the dynamo and remove the pump. If the flexible coupling comes away with the pump, withdraw it from the slot in the pump shaft.

54 Power steering pump, early type - dismantling

- 1 Thoroughly clean the exterior of the pump and take care that dirt does not enter the inlet or outlet orifices.
- 2 Refer to Fig.11.53.
- 3 Remove the two setscrews (5) holding the inlet adaptor (4) and take off the sealing ring (3).
- 4 Remove the five screws holding the cover assembly (13) to the body (1) and separate the cover from the body.
- 5 Take out the large and small sealing rings (6 and 7) from the grooves in the body housing.
- 6 Remove the thrust button (12) from the bearing hole in the cover.
- 7 Withdraw the drive shaft and the rotor assembly (9 and 8) and take care not to reverse the inner rotor in the outer rotor.
- 8 Remove the circlip (11) from the drive shaft.
- 9 Use a punch to drive out the bearing oil seal (19).
- 10 Remove the valve cap adaptor (17) and the seal (16) from the

pump cover. Take out the flow control valve spring (15) and the flow control valve assembly (20).

11 Remove the circlip (23) from the flow control valve and take out the relief valve (22) and the spring (21).

55 Power steering pump, Hobourn-Eaton type - dismantling

- 1 Thoroughly clean the exterior of the pump and make sure that dirt does not enter the inlet or outlet orifices. Maintain absolute cleanliness when dismantling the pump.
- 2 Refer to Fig.11.54.
- 3 Remove the adaptor screw (25) followed by the fibre washer (24) the adaptor (23) and the gasket (22).
- 4 Remove the six screws securing the cover (19) to the pump body (4).
- 5 Turn the pump so that the cover is uppermost and then lift off the cover.
- 6 Take out the sealing rings (9 and 12) from the grooves in the pump body.
- 7 Remove the thrust washer (18) from the bearing hole in the cover.
- 8 Take the snap ring (16) off the drive shaft (15) and withdraw the six rollers (14) and the roller carrier (13).
- 9 Remove the drive pin (15a) and withdraw the drive shaft from the body.
- 10 Remove the cam (11) from the cam locking peg (10).
- 11 Drift out the oil seal (2) but take care not to damage the drive shaft bush.
- 12 Unscrew the valve cap (8) and take out the valve seal (7), flow control valve (6) and the flow control valve spring (5).

56 Power steering pump, early type - examination and re-assembly

- 1 It is advisable to replace all seals and gaskets on reassembly of the pump.
- 2 Wash all parts and dry them on a clean non-fluffy rag.
- 3 Check the cover and body for signs of wear and replace if scored or worn.
- 4 Lubricate the seal (2) with transmission fluid and assemble it to the body with the lip pointing towards the rotor. It is advisable to use a press for this task with a 1.7/32" (30.95 mm) piece of bar as a piloting tool. Press the seal in to its fullest extent but do not squash it.
- 5 Assemble the shaft through the oil seal end of the body and gently rotate it whilst passing it through the seal.
- 6 Examine the drive and the driven rotors and if they are worn or scored replace them (the rotors are supplied in matched sets).
- 7 Place the rotors over the shaft in the pump body and check the clearance between them at all points. The rotors should be replaced if the clearance exceeds 0.006" (0.15 mm).
- 8 Place a straight edge across the pump body and, using feeler gauges, check the end clearance of the rotors in the pump body. The end clearance should not exceed 0.0025" (0.06 mm), replace the pump body if this dimension is exceeded.
- 9 Now check the clearance between the driven rotor and the bushing in the pump body. Replace the body if the clearance exceeds 0.008" (0.20 mm).
- 10 Fit the drive pin in the slot of the shaft and drive rotor.
- 11 Carefully check that the relief valve is not sticking in the flow control valve, use a fine oil stone to remove any burrs as may be causing trouble.
- 12 Insert the relief valve spring, followed by the relief valve, in the flow control valve and fit the circlip to hold them in place.
- 13 Assemble the flow control valve and the spring in the pump cover. Fit the valve cap adaptor with a new seal and screw down securely.
- 14 Fit new "O" ring seals to the grooves in the body of the pump. Fit the pump body and the cover together and secure with the five screws tightened down evenly. Check that the shaft is not binding.
- 15 Fit a new seal at the inlet pipe adaptor and refit the adaptor.

57 Power steering pump, Hobourn-Eaton type - examination and reassembly

- 1 It is advisable to replace all seals and gaskets on reassembly of the pump.
- 2 Wash all parts and dry them on a non-fluffy cloth.
- 3 Check the pump body and the cover for wear and replace if the faces or bushes are scored or worn.
- 4 Fit a new oil seal in the same manner as described in paragraph 4 of Section 56.
- 5 Refit the cam locking peg. Examine the cam for wear and if it appears satisfactory refit it with the slot over the locking peg and make sure that it is seated correctly.
- 6 Make sure there are no sharp edges on the drive shaft as may damage the seal and then insert the shaft from the seal side of the body.
- 7 Fit the drive pin to the shaft, examine the roller carrier and if there are no signs of wear fit it into position as shown in Fig.11.55. Be sure that the correct face of the carrier slots are driving the rollers. Fit the snap ring to hold the carrier in position.
- 8 Examine the rollers, replace them if they are scored, damaged or if there is any degree of ovality. Fit them to the carrier if they appear satisfactory.
- 9 Place a straight edge across cam surface and, using feeler gauges, check the end float of the carrier and rollers in the pump body. The end float should not exceed 0.002" (0.051 mm) and if this dimension is exceeded the rollers and carrier must be replaced.

- 10 Make up a rig for checking the tension of the valve spring. A piece of bar, over which the spring will pass, held in a vice will be satisfactory to support the spring and all that is needed is weights to pass over the bar onto the spring. The tension of the spring should be between 8 - 9 lb (3.63 - 4.08 kg) when compressed to a length of 0.02" (20.8 mm).
- 11 Fit the spring to the body followed by the valve with the ball bearing end entering last. Check that the valve is not sticking.
- 12 Refit the cap with a new sealing ring and tighten to a torque of 30 - 35 lb f ft (4.15 - 4.84 kg f m).
- 13 Fit new sealing rings to the pump body joint face.
- 14 Fit the thrust washer to the cover and refit the pump cover to the body. Secure the cover and the body with the six screws and tighten down evenly to a torque of 18 lb f ft (2.49 kg f m). Check the drive shaft for freedom in rotation.
- 15 Fit a new rubber gasket to the adaptor on the cover and refit the adaptor bolt.
- 16 If the plug in the top of the cover has been removed, make sure that an air tight seal is obtained when it is replaced.

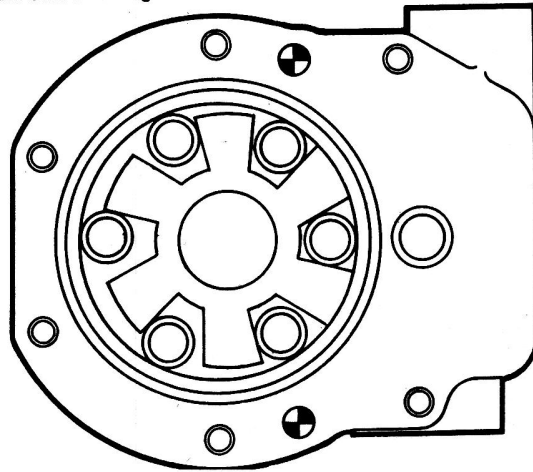


Fig.11.55. Assembly of the roller carrier

58 Power steering pump - refitting

- 1 Place the flexible coupling assembly in the slot in the dynamo shaft and align the slot in the pump driving shaft with the driving tongue on the flexible coupling.
- 2 Place the pump on its mounting studs and after a final check that the coupling drive is correctly aligned, push the pump home and secure with the nuts and spring washers.
- 3 Reconnect the inlet and outlet hose to the pump.
- 4 Bleed the system as described in Section 51.

59 Power steering oil reservoir - dismantling, examination and reassembling

- 1 Remove the pump inlet hose from beneath the reservoir and allow the oil to drain into a container.
- 2 The procedures which follow can be carried out with the reservoir installed in the car but if it is desired to remove the reservoir this can be done by first removing the other hydraulic pipe. Now undo the two pipe adaptors which hold the reservoir on the mounting bracket noting that the feed and return adaptors have different sized threads. Collect the "O" rings located between the adaptors and the bracket. Lift off the reservoir and collect the "O" rings between it and the bracket.
- 3 Thoroughly clean the exterior of the reservoir.
- 4 Remove the screw securing the cover and take off the "O" ring beneath it. Lift off the cover with its gasket.
- 5 Take out the filter (Purolator MFH.117) (HE.1307).
- 6 Clean out any residue which may have collected in the bottom of the reservoir.

7 Reassembly is the reverse of the above procedure. It is advisable to fit new gaskets and "O" rings at reassembly. The filter should be changed every 25,000 miles.

8 When replacing the cover, make sure that it is replaced flush with the reservoir body.

9 Finally refill the reservoir with automatic transmission fluid of the recommended type.

60 Power steering idler assembly - removal

The power steering idler assembly is removed from the car in the same manner as the idler assembly for standard steering as described in Section 32 except that, owing to the different configuration of the lock stop bolts for power steering (see Fig.11.57), one lock stop bolt acts as a securing bolt and must be removed.

61 Power steering idler assembly - dismantling and reassembly

The following procedures also cover the later type idler assembly fitted to cars equipped with standard steering.

1 An exploded view of the steering idler assembly is given in Fig.11.56.

2 Take off the self locking nut and plain washer which secure the lever to the shaft. Apply a suitable extractor to the lever and withdraw it from the shaft. However, there is no need to remove the lever unless it is required.

3 Prise out the dust cap from the top of the idler bracket.

4 Knock back the tab locking the nut at the top of the shaft and unscrew it from the idler shaft. Take out the tab washer and the "D" washer underneath it.

5 The shaft can now be withdrawn. Collect the abutment washer and its ring (located between the lever and the body of the assembly), the felt seal and its retaining ring.

6 Remove the upper and lower taper roller bearings.

7 Thoroughly cleanout the races and the idler housing.

8 Repack the housing and the bearing with the recommended greases.

9 Refit components to the housing in the reverse order in which they were removed. It is advisable to fit a new felt seal.

10 Tighten the nut at the top of the shaft to a torque of 5 lb f ft or, alternatively, tighten the nut until movement of the shaft feels restricted and then slacken the nut one flat. Lock the nut with a new tab washer and refit the dust cap.

62 Power steering idler assembly - refitting

The power steering idler assembly is refitted to the car in the same manner as that for standard steering as described in Section 34 except that, as the position of the lock stop has been upset, it will be necessary to adjust the lock stop, as described in Section 63.

63 Power steering - lock stop adjustment

The position of the lock stops fitted to models with power steering is shown in Fig.11.57. The lockstops are adjusted in the manner described in Section 40 except that the bolts are screwed out four turns from their contact position on full lock and not two turns as for standard steering.

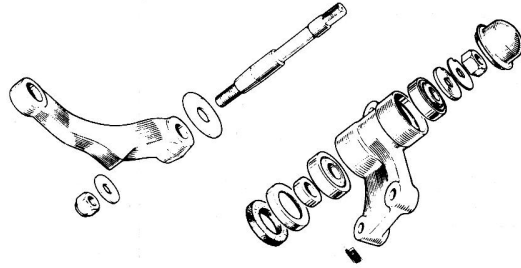


Fig.11.56. Steering idler, power assisted steering

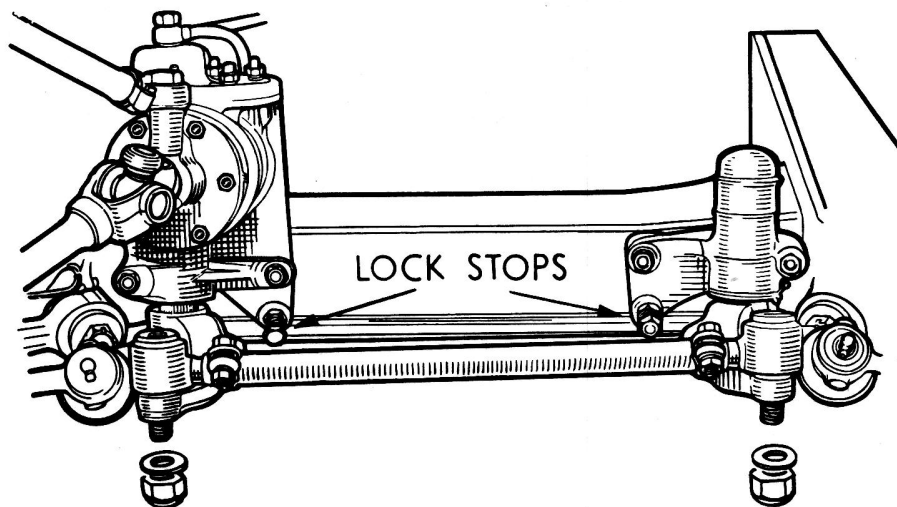


Fig.11.57. Location of lock stop bolts, power assisted steering

64 Power steering - adjustment and check of gear when installed in car

a) Sector shaft adjustment, Adwest steering box: Lost motion in the steering box will probably be due to wear between the hour glass cam and roller. To check, centralise the steering by positioning the cut-away on the centralising washer (item 11 in Fig.11.42) over the hole in the steering box and then insert a piece of $\frac{1}{4}$ " (6.4 mm) rod to make sure that the position is correct. Disconnect the tie rod from the drop arm (see Section 20) and rock the drop arm to both sides of the centre line to feel for excessive backlash which, if present, may be rectified by slackening the locknut on the top of the box and then screwing down on the adjuster screw until only slight backlash is felt. Retighten the locknut and refit the tie rod and road test the car. If lost motion is still present, the box will have to be removed and overhauled.

b) Steering pulling to one side: First check tyre pressures and change tyres from one side to the other and if the pull changes direction the fault lies in the tyres. If the pull remains, check the steering linkage for wear and, if this is satisfactory, have the alignment of the front wheels checked. If there is still no improvement the fault must lie in the trimming of the valve in the steering box. To check, insert a 2,000 lb/sq in pressure gauge in the pressure line, start the engine and allow it to idle. Now turn the steering to the left and then to the right and check that the pressures recorded on moving to each side are equal. If the pressure rise is not balanced, the steering box will have to be removed from the car for replacement of the worm and valve assembly.

c) Checking the hydraulic system: Install a pressure gauge, which is fitted with a tap so that pressure to the steering box can be shut off, in the pressure line between the pump and the steering box. Check the fluid in the reservoir for correct level and freedom from froth. Make sure that the tap is open to the box and then start the engine and run at idle speed, now turn the steering to full lock and increase the effort until the pressure shown on the gauge ceases to increase. The pressure recorded should be between 950 and 1000 lb/sq in (65 to 70 kg/sq cm) and it should not increase with engine speed. If the pressure is below that figure but rises to it with increased engine speed then the trouble is probably due to, either a faulty control valve in the pump, or to internal leakage in the steering box. To find out where the fault lies, close the tap for a maximum of five seconds with the steering still at full lock, if the pressure rises to the correct figure the fault is in the steering box which will have to be removed and overhauled, if the pressure is still low the fault is in the pump.

65 Accidental damage to power steering components

The dimensional drawings at Figs.11.58 and 11.59 are provided to enable you to assess the dimensional serviceability of power steering components following accidental damage to your car. Always check for fractures and deterioration as well.

66 Front wheel alignment

The correct alignment for the front wheels is :-

Mk.1 models and 2.4 litre Mk.2	- parallel to $\frac{1}{16}$ " (1.59 mm) toe-in
All other models	- parallel to $\frac{1}{8}$ " (3.2 mm) toe-in

The alignment must be checked when the car is full of petrol, oil and water and is standing on a level surface with all tyre pressures correct. In addition, for those cars fitted with power steering, the steering must be centralised (see Section 64 paragraph (a)).

The adjustment is effected by loosening the clamps at each end of the track rod and then rotating the tube until the adjustment is correct.

Accurate alignment of the front wheels is essential otherwise the steering will be vague with wear on the tyres will be heavy and uneven. Accurate alignment requires the use of special equipment so this is a task which is best left to your Jaguar agent or another fully equipped garage.

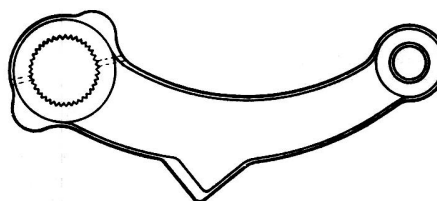
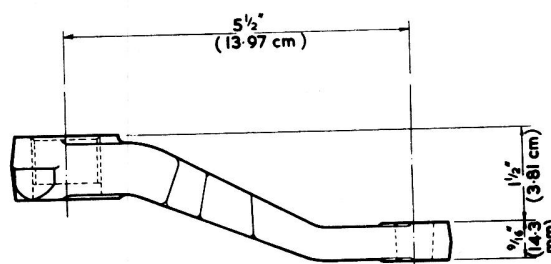


Fig.11.58. Drop arm, power assisted steering

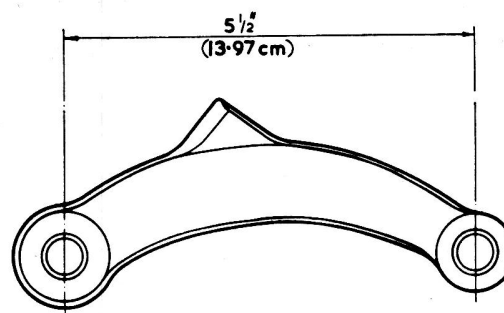
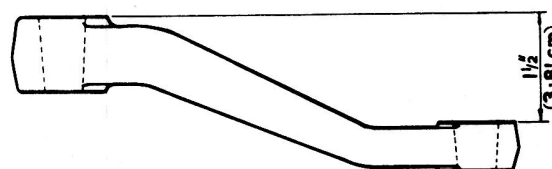


Fig.11.59. Power assisted steering idler lever

67 Fault diagnosis

Symptom	Reason/s	Remedy
(Standard Steering)		
STEERING FEELS VAGUE, CAR WANDERS AND FLOATS AT SPEED		
General wear or damage	Tyre pressures uneven Shock absorbers worn Steering gear ball joints badly worn Suspension geometry incorrect Steering mechanism free play excessive Front suspension and rear suspension pick-up points out of alignment or badly worn Front suspension lacking grease	Check pressures and adjust as necessary. Test, and replace if worn. Fit new ball joints. Check and rectify. Adjust or overhaul steering mechanism. Normally caused by poor repair work after a serious accident. Extensive rebuilding necessary. Check condition and grease or replace worn parts and re-grease.
STIFF AND HEAVY STEERING		
Lack of maintenance or accident damage	Tyre pressures too low No oil in steering box No grease in steering ball joints Front wheel toe-in incorrect Suspension geometry incorrect Steering gear incorrectly adjusted too tightly Steering column badly misaligned	Check pressures and inflate tyres. Top up steering box. Replace. Check and reset toe-in. Check and rectify. Check and re-adjust steering gear. Determine cause and rectify (usually due to bad repair after severe accident damage and difficult to correct).
WHEEL WOBBLE AND VIBRATION		
General wear or damage	Wheel nuts loose Front wheels and tyres out of balance Steering ball joints badly worn Hub bearings badly worn Steering gear free play excessive	Check and tighten as necessary. Balance wheels and tyres and add weights as necessary. Replace steering gear ball joints. Remove and fit new hub bearings. Adjust and overhaul steering gear.
(Power Steering)		
IMPORTANT: Check that the fluid reservoir is filled to the correct level before investigating any steering fault.		
Steering pulling to one side	Imbalanced front tyres. Damaged tyres. Incorrect tyre pressures Steering gear out of trim	Balance front wheels. Replace tyres. Correct pressures Replace worm and shaft if out of trim.
Steering feels different to 'left' and 'right', but does not actually pull	Incorrectly centred worm and valve. The worm and valve assembly will be on the wrong part of the ratio curve when driving straight ahead	Centralise. It may be necessary to re-align the steering wheel after operation.
Heavy steering when driving	Low tyre pressures. Tightness or stiffness in the steering column and/or steering and suspension joints Steering gear adjusted too tightly	Inflate. Grease or replace. Re-adjust steering box as necessary.
Heavy steering when parking	Loose pump belt (accompanied by squealing). Insufficient pressure from pump due to restricted hoses or defective control valve. Insufficient pressure due to leaks in steering gear	Check belt and replace if necessary. Remove restriction or check control valve. Check for correct blow-off pressure. Confirm internal leaks by carrying out leak tests. If proved, remove gear and replace seals.
Steering effort too light	Worn torsion bar pins or torsion bar broken	Remove steering box; remove worm and valve assembly; check that valve rotor has no free play relative to valve sleeve. Replace worm and valve assembly as necessary.
Imbalance of steering effort varying irregularly	Worn or loose trim screw Rotor sticking in valve sleeve	Replace worm and valve assembly. Remove steering box; remove worm and valve assembly. Hold worm in hand and rotate rotor to and fro feeling for sticking. Replace worm and valve assembly if necessary.