

The



GRANTURA

Mk.I, II & IIa

WORKSHOP
MANUAL

*Compiled and Edited
by*

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for the*

TVR
CAR CLUB

SCOPE OF THIS MANUAL

This manual has been compiled to meet the increased demand for detailed information on the maintenance and repair of the early T.V.R. models, namely the Grantura Mk.1, II & IIIA, where specialist knowledge and techniques peculiar to the marque are not commonly known. We have therefore concentrated on these points and made no attempt to provide information where this is common to other makes of car, information about which can be found in the relevant manual for the make of car in question. The main example of this being the engine and gearbox unit.

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SECTION A IDENTIFICATION

1. Introduction.

During 1954 Trevor Wilkinson built a two seater fixed head coupe using A40 Devon 1250cc components in a multitubular chassis using a solid rear axle, and was fitted with an R.G.S. special body. This was his personal car and although it was the second car that he had built it was the first to be called TVR from his own name. During 1956 a further 4 were built using Rochdale special bodies of the 'Conaught' and 'Ferrari' styles. These cars are often referred to as the 'Pre Mark 1'.

During 1957 the prototype of the Mark 1 was built using trailing arm suspension and independent rear suspension using a specially mounted BMC 'B' series differential, with a fibreglass open 2 seater body of his own make. During 1957 about 4 were made with 1098cc Climax engines and between 1957 and 1959 about 12 rolling chassis were sold to America to this specification, one having a supercharged 1500cc Coventry Climax engine. However in 1957 2 of the open prototypes had been fitted with hard tops bonded in position, paving the way to the Mark 1 GT body style which was produced in 1958 and was fitted with 1008 Ford Supercharged engines. About 12 of these were made, mostly left hand drive cars for America. 1959 saw a growing demand on the home market when David Duxton became the first Dealer covering the Midlands area. V.J.Last followed covering East Anglia. At this time about 3 to 4 cars per week were being built mostly with the MGA 1588cc engine. Several were L.H. drive cars for American servicemen at bases in this country. Production continued at this rate till June 1960 when at the chassis No 200 the Mk 11 was introduced.

A new body was used, a logical development of the Mk 1 style with many detailed improvements but using the same bonnet mould. Approximately 200 of these cars were built. Later in 1961 the Mk 11A was introduced. This embodied many detailed improvements and continued in production till April 1962 when the Mk 111 was introduced. This was the end of the trailing arm suspension cars. The Mk 111 adopted a more conventional suspension layout which has been developed continually up to the present time. The body of the Mk 111 was basically that of the Mk 11 but with a revised bonnet.

Unfortunately the TVR marque has been involved in many financial troubles which has led to changes of ownership and the change of the company's name. The company called Devon Sportscars Ltd was

formed in 1958 and in 1962 its name was changed to TVR Cars Ltd. Meanwhile Grantura Engineering Ltd was formed in 1961 (it was necessary to have 2 companies to sell kit cars to satisfy the purchase tax regulations). When TVR Cars Ltd was dissolved at the end of 1962 Grantura Engineering Ltd continued production in conjunction with Grantura (Plastics) Ltd, which was formed in 1963 to make the fibreglass bodies.

2. Description.

The TVR Grantura Mk1 and 11 have a tubular backbone chassis using small diameter tubes. Suspension is by transverse laminated torsion bars and trailing arms both front and rear, based on the Volkswagen suspension. Steering is by worm and peg using a Ford steering box (L.H. Drive 101E fitted upside down).

A wide variety of engines was fitted throughout the production of the car from 100E Ford Anglia, Ford Anglia 997cc 105E; 1340cc Ford Classic 109E; MGA 1489, 1588 and 1622cc; Coventry Climax 1098 and 1220cc units. All of these were used with the normal production gearboxes (the Coventry Climax engines using the MG box), the MG gearboxes were also available with close ratio gears. Some of the MG engines were fitted with the HRG Derrington aluminium cross flow head with twin Weber carburettors as a factory fitted option.

Power is transmitted by a conventional propeller shaft with 2 universal joints to a chassis mounted differential unit. This is a BMC 'B' series unit in a special TVR alloy case. Drive is then taken to the rear wheels by short drive shafts having 2 universal joints with a sliding spline joint in the centre to allow for the change of length in the shaft as the suspension moves up and down.

The rear king post is of TVR manufacture in alloy carrying the bearing assemblies and 11" brake drums (of Austin Healey 3000 origin) and is mounted to the trailing arms by 2 metalastic bushes and an 11/16" BSP set pin top and bottom. Camber angles can be adjusted by inserting shims (or washers) between the inner metalastic bushes and the trailing arms. The track and toe-in of the rear wheels is controlled by track rods with conventional ball jointed ends and left and right hand threads. Adjustment is made by the right and left hand threads which take the wheel out of line on the flexibility of the rubber bushes. It should be noted here that even when the metalastic bushes are new and the rear suspension and track rods are

In new condition the rear wheels still have a small flexibility due to the thickness of the rubber bushes used. This does not cause alarm amongst RAC scrutineers and Police officers when trying to find mechanical fault with this particular Marque.

The front wheel assemblies are again TVR manufacture using a king post made up of a curved aluminium bar fastened to brass top and bottom eyes which take the mounting pins onto the trailing arms, as at the rear. The suspension works by the king posts pivoting on the mounting pins using the torsional flexibility of the metalastic bushes. The brake assemblies are again 11" drums or 11" discs on the Mk 11A version (from A-H 3000). The king pin is TVR but the bushes and the stub axle are Austin A55/60.

The body is of glassfibre reinforced plastic bonded directly onto the chassis. The design was modified slightly at the rear in the Mk 11 version to give small fins incorporating the rear light clusters. The windscreen is Ford Consul/Zephyr Series 1 and is available in both laminated and toughened glass. (The same as on the current TVR models). The rear screen is a perspex one. 48 spoke wire 4½ J section wheels were standard. A cross flow radiator was standard with a remote header tank mounted between the engine and the scuttle. An electric fan was offered as an option. (this was normally fitted to avoid boiling in traffic). The car was generally supplied in component form to avoid purchase tax in the UK, but the export cars and a few home market cars were finished at the factory.

Lightweight Cars

The factory produced a few lightweight cars for competition work. These were of three types. Lightweight chassis using thinner tubes for the chassis and all gussets drilled. Lightweight body - using minimum of fibreglass thickness and perspex windows in doors with no winding mechanism. The third - a combination of the two - (only supplied on rare occasions for out and out racing).

3. Individual Characteristics.

Mark 1. Commenced manufacture in 1959. Had original spider TVR emblem on bonnet, special bumpers were available and extra grilles on bonnet. Doors had opening quarter lights mounted in chrome on brass window frames. Rear very rounded and short, spare wheel mounted between rear of car and petrol tank in upright position.

Engines available: Climax 1220cc P.W.E.
1098cc P.V.A.
Ford 100E (1172cc)
105E (997cc)
MGA 1588cc

Mark 11. Commenced manufacture in June 1960. Rear of body incorporated small fins and rear light clusters, but using same bonnet as Mk 1 without special bumpers.

Engines available: Climax 1220cc P.W.E. (1 only 1500cc P.V.B.)
Ford 105E (997cc)
109E (1340cc)
MGA 1588cc

Mk 11A. Commenced manufacture 1961. Body as Mk 11; prep. tunnel cover deeper, 11" disc brakes on front. No opening quarter light.

Engines available: Climax 1220cc P.V.E.
Ford 1340cc 109E
MGA 1622cc (a few 1588cc)

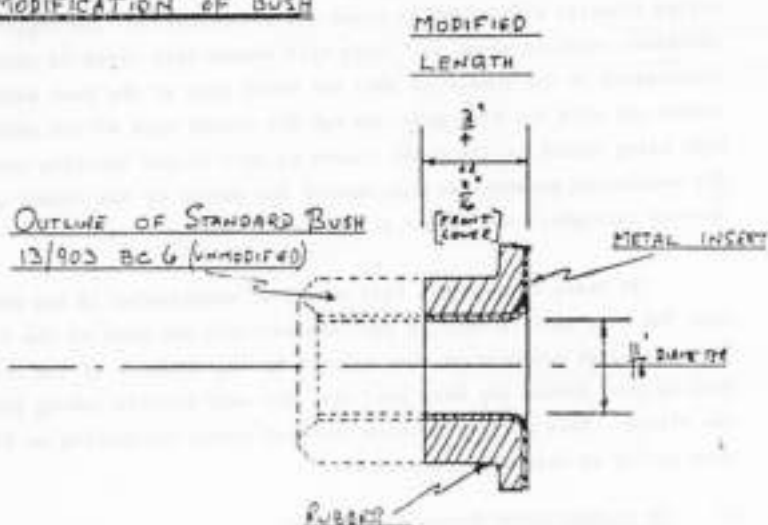
Production ceased end of April 1962 when Mk 111 was introduced.

During the changeover of production from one model to the new one there were often combinations of the specifications.

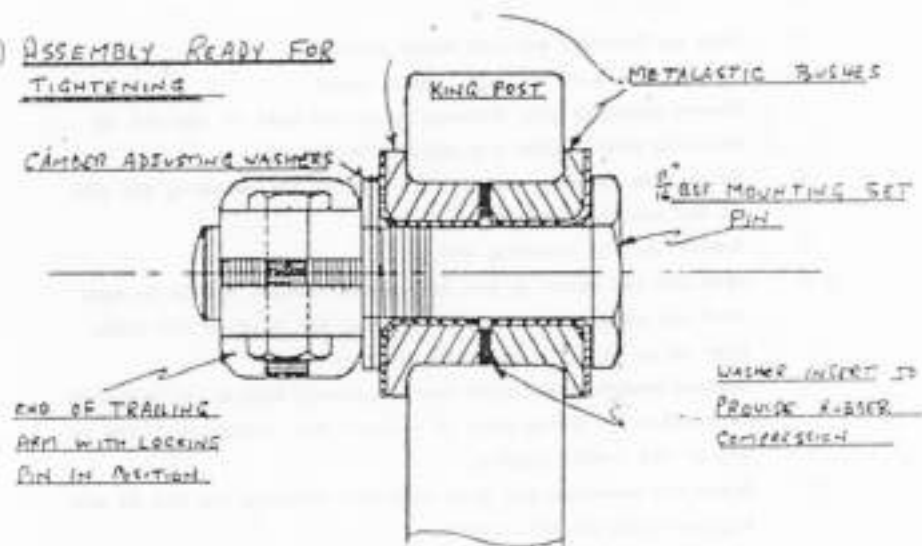
1. Metalastic Rubber Bushes.

The metalastic bushes used to mount the king posts onto the trailing arms are part number 13/9038C6 (as used in the Bover part number X4478). These are then cut down in length to $\frac{3}{4}$ " with the exception of the front lever ones which should be $\frac{11}{16}$ " long.

(a) MODIFICATION OF BUSH



(b) ASSEMBLY READY FOR TIGHTENING



In theory these bushes are compressed in their length so their diameter expands so as to grip inside the eye of the king post. In order that this can occur the rubber must protrude beyond the metal insert as in the unmodified bush. When these bushes are shortened by turning in a lathe the rubber gives a little and provides this effect, to a small extent. However to ensure that there is sufficient rubber to compress to give the required increase in diameter before the metal inserts come together it is convenient to insert a washer of uncompressible material between the two bushes which has an inside diameter sufficient to clear the metal insert. The suggested thickness would be about $\frac{1}{4}$ ". This will ensure that there is adequate compression in the rubber so that the outer edge of the bush becomes almost one with the king post eye and the inside edge of the rubber bush being bonded to the metal insert is part of the trailing arm. The suspension movement is then catered for purely by the rubber in torsion throughout the length of the rubber bush.

If there is not this full amount of compression in the rubber then the king post is only in full contact with the bush at the flanges. The suspension movement is then allowed by the tendency of the rubber bush to move inside the king post eye, the only torsion taking place at the flange. This gradually tears the bush apart, by chafing on the king post giving an extremely short life.

2. (a) To replace Front Suspension Bushes

1. Jack up front of car and mount on stands.
2. Taking each side in turn, remove wheel.
3. Remove mounting pin, locking bolts and nuts in the end of trailing arms. (One top and one bottom).
4. Using thin spanner unscrew the $\frac{11}{16}$ " DSF mounting set pin at the top trailing arm.
5. Remove the top mounting set pin.
6. When the top mounting pin is removed caution should be made that the weight of the assembly does not hang on the brake pipe so as to avoid possible fracture.
7. Replace mounting pin with new metalastic bushes (as prepared in section 1) being sure to replace the washers or shims to adjust the camber angles.
8. Screw the mounting pin back into the trailing arm but do not tighten fully at this stage.
9. Using the thin spanner once again, unscrew the bottom mounting pin.

- or a) The mounting pin may be removed by turning the king post through 90° , this forces the splash plate against the disc-drum and enables the pin to be removed freely.
- or b) Should this not be possible then the king post must be dismantled by removing the four nuts holding the curved aluminium bar between the two king post eyes. Remove the aluminium bar (difficulty may be experienced here since the aluminium tends to corrode in contact with the steel studs, when reassembling it is advisable to use an anti-seize grease). The bottom king post eye may now be removed from the king pin.
10. a) Replace the mounting pin with new bushes as in 6, turn king post back into normal position ensure that splash back is free from disc-drum.
- or b) Replace the mounting pin with new bushes as in 6, replace the bottom king post eye onto the king pin, replace curved aluminium bar, replace four securing nuts and tighten.
11. Screw the mounting pin back into the trailing arm, but do not tighten at this stage.
12. By using the car jack load the suspension by jacking under the bottom trailing arm, with the jack nearly taking the weight of the car tighten the two mounting pins fully. Remove jack.
13. Repeat the above for the other side of the car.
14. Lower car from the stands after refitting wheels.
15. After some fifty miles of road use check all four mounting pins for tightness with the suspension in the loaded state. Check the comber angles and toe-in. When all is satisfactory replace the four mounting pin locking pins.

2. (b) To replace Rear Suspension Bushes

1. Jack up rear of car and mount on stands.
2. Taking each side in turn, remove wheel.
3. Remove mounting pin, locking bolts and nuts in the end of trailing arms. (One top and one bottom).
4. Remove four bolts and nuts on drive shaft flange at hub leaving drive shaft to one side.
5. Remove brake drums.
6. Clean down back of back plate and hub flange.
7. Slacken off four nuts mounting back plate to hub flange.

8. Using thin spanner unscrew 11/16" BSP mounting set pin at the top trailing arm.
9. Remove the top mounting set pin by taking advantage of the loose back plate.
- N.B. When the top mounting pin is moved caution should be made that the weight of the assembly does not hang on the brake pipe so as to avoid possible fracture.
10. Replace mounting pin with new metalastic bushes (as prepared in section 1) being sure to replace the washers or shims to adjust the camber angles.
11. Screw the mounting pin back into the trailing arm but do not tighten fully at this stage.
12. Repeat 7,8,9, & 10 for bottom mounting.
13. Refit drive shaft to hub flange (four nuts and bolts).
14. After ensuring there is no dirt trapped between the back plate and mounting flange retighten the four mounting nuts.
15. Replace wheel.
16. Repeat 2 - 15 for the other side of car.
17. Remove stands and lower car.
18. After some fifty miles of road use check all four mounting pins for tightness with the suspension in the loaded state. Check the camber angles and toe-in. When all is satisfactory replace the four mounting pin locking pins.

3. (a) To overhaul Front Suspension

1. Position car in garage to give room to remove torsion bars. Jack up front of car and mount on stands.
 2. Taking each side in turn, remove wheel.
 3. Remove mounting pin, locking bolts and nuts in the end of trailing arms. (One top and one bottom).
 4. Using thin spanner unscrew 11/16" BSP mounting set pins top and bottom. Either support the hub assembly to take the weight off the brake pipe at the same time being in such a position so as not to be in the way for remaining work. If this is not practical, or if further work has to be carried out on the hub, the track rod and brake pipe should be disconnected and the hub assembly removed.
- If the metalastic bushes are in first class condition and are not to be replaced the mounting set pin complete with bushes can be taped together to the king post eye.

5. Remove shock absorber.
6. Remove the trailing arms by undoing the allen pin and lock nut which clamp onto the end of the torsion bar.
7. Withdraw trailing arms taking note that the lower arm has the shock absorber mounting.
8. Repeat 2 - 7 for the other side.
9. Remove clamping allen screw, nut and plate in centre of torsion bar tubes.
10. Remove torsion bars, taking note difference between top and bottom.
11. Remove grease nipples from torsion tubes.
12. Remove trailing arm bushes by tapping out with a bar of fairly small diameter from the opposite side of the car. There are two bushes at each end of each torsion bar - eight bushes in all.
13. Clean all parts thoroughly.
14. Examine all parts thoroughly for wear and faults. The following points in particular:-
 1. Torsion bar tubes for cracks - weld or braze if found.
 2. Torsion bars for broken laminations - a lamination can be replaced but it is advisable to replace whole torsion bar.
 3. Trailing arms for excessive wear which appears as a helical ridge in line with the oil groove of the bush. If the diameter of the new bush will allow, the trailing arm can be reground but beware of any cracks in the arms themselves as these are made up of a tube flash welded onto a forged arm - a fault such as this may not be apparent until after regrinding has taken place. If in doubt replace. They may have been reground before or in the case of excessive wear the regrind may remove too much material thereby reducing the thickness of the tube making the unit dangerously weak.

Re-assembly

15. Taking each end of each torsion tube in turn insert new bushes into their respective position. These must then be reamed in size to take the trailing arm. (Use an expanding reamer with a bar or tube on the end to locate in the central square of the torsion bar clamp to ensure that they are reamed true.)

16. Replace torsion bars locating the countersink in the centre in line with the centre clamp and the countersinks on each end upwards.
17. Replace centre clamp allen set pin and tighten fully.
- N.B. Care should be taken not to cross the thread in the central clamp as this location is brass and cannot be replaced.
18. Replace trailing arms, clamping set pins tight and tightening locking nuts.
19. Replace grease nipples.
20. Replace hub assemblies (if new bushes are required see appropriate section) but do not tighten fully.
21. With the suspension fully down fit new torsion bar clamping plates (top and bottom), the maximum length of which will fit under the retaining brackets. These plates provide the correct suspension height. To improve the static height, the torsion bars can be preloaded slightly by placing an allen key into the central clamp allen pin, then using this as a lever longer clamping plates can be used. Fit locking nuts and tighten fully.
22. Replace shock absorber.
23. By using the car jack load the suspension by jacking under the bottom trailing arm, with the jack nearly taking the weight of the car tighten the two mounting pins fully. Remove jack.
24. Refit track rod to hub.
25. Refit brake pipe and biced brakes.
26. Lower car from the stands after refitting wheels.
27. Check camber angles and toe-in.
28. After some fifty miles of road use check all four mounting pins for tightness with the suspension in the loaded state. Check the camber angles and toe-in. When all is satisfactory replace the four mounting pin locking pins.

3. (b) To overhaul Rear Suspension

1. Position car in garage to give room to remove torsion bars. Jack up rear of car and mount on stands.
2. Taking each side in turn, remove wheel.
3. Remove mounting pin, locking bolts and nuts in the end of trailing arms. (One top and one bottom).
4. Remove four bolts and nuts on drive shaft flange at hub leaving drive shaft to one side.

5. Remove track rod from hub.
6. Using thin spanner unscrew 11/16" BSF mounting set pins top and bottom. Either support the hub assembly to take the weight off the brake pipe at the same time being in such a position so as not to be in the way for remaining work. If this is not practical or further work has to be carried out on the hub, the brake pipe should be disconnected and the hub assembly removed.
If the metallic bushes are in first class condition and are not to be replaced the mounting set pin complete with bushes can be taped together to the king post eye.
7. Remove the shock absorber.
8. Remove the trailing arms by undoing the allen pin and lock nut which clamp onto the end of the torsion bar.
9. Withdraw trailing arms taking note that the lever arm has the shock absorber mounting.
10. Repeat 2 - 9 for the other side.
11. Remove clamping allen screw and plate in centre of torsion bar tubes. (Upper one accessible through floor from inside of car).
12. Remove torsion bars, taking note difference between top and bottom.
13. Remove grease nipples from torsion tubes.
14. Remove trailing arm bushes by tapping out with a bar of fairly small diameter from the opposite side of the car. There are two bushes at each end of each torsion bar - eight bushes in all.
15. Clean all parts thoroughly.
16. Examine all parts thoroughly for wear and faults.
The following points in particular:-
 1. Torsion bar tubes for cracks - weld or brace if found.
 2. Torsion bars for broken laminations - a lamination can be replaced but it is advisable to replace whole torsion bar.
 3. Trailing arms for excessive wear which appears as a helical ridge in line with the oil groove of the bush. If the diameter of the new bush will allow, the trailing arms can be reground but beware for any cracks in the arms themselves as these are made up of a tube flash welded onto a forged arm - a fault such as this may not be apparent until after regrinding has taken

place. If in doubt replace. They may have been re-ground before or in the case of excessive wear the regrind may remove too much material thereby reducing the thickness of the tube making the unit dangerously weak.

Re-assembly

17. Taking each end of each torsion tube in turn insert new bushes into their respective position. These must then be reamed to size to take the trailing arm. (Use an expanding reamer with a bar or tube on the end to locate in the central square of the torsion bar clamp to ensure that they are reamed true).
18. Replace torsion bars locating the countersink in the centre in line with the centre clamp and the countersinks on each end upwards.
19. Replace centre clamp allen set pin and tighten fully.
- N.B. Care should be taken not to cross the thread in the central clamp as this location is brass and cannot be replaced.
20. Replace trailing arms, clamping set pins tight and tightening locking nuts.
21. Replace grease nipples.
22. Replace hub assemblies (if new bushes are required see appropriate section), but do not tighten fully.
23. With the suspension fully down fit new torsion bar clamping plates (top and bottom), the maximum length of which will fit under the retaining brackets. These plates provide the correct suspension height, to improve the static height, the torsion bars can be preloaded slightly by placing an allen key into the central clamp allen pin, then using this as a lever longer clamping plates can be used. Fit locking nuts and tighten fully.
24. Replace shock absorber.
25. By using the car jack load the suspension by jacking under the bottom trailing arm, with the jack nearly taking the weight of the car tighten the two mounting pins fully. Remove jack.
26. Refit track rod to hub.
27. Refit drive shaft to hub flange (four nuts and bolts).
28. Refit brake pipe and bleed brakes.
29. Lower car from the stands after refilling wheels.

30. Check camber angles and toe-in.
31. After some fifty miles of road use check all four mounting pins for tightness with the suspension in the loaded state. Check the camber angle and toe-in. When all is satisfactory replace the four mounting pin locking pins.

4. To adjust the height of Suspension (Front or Rear)

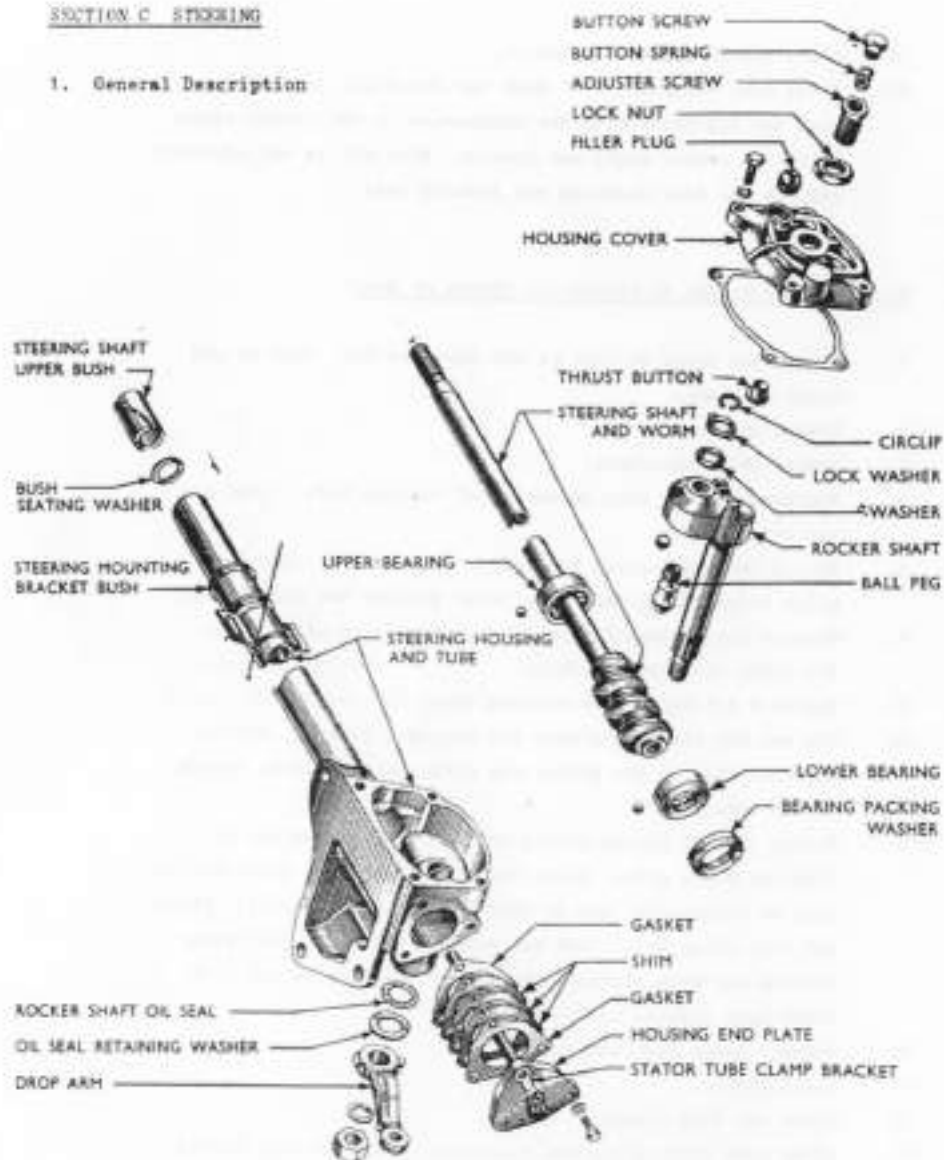
1. Taking the front or rear as the case may be. Jack up and mount on stands.
2. Remove wheels.
3. Remove shock absorbers.
4. Slacken clamping nuts in centre of torsion bars. (One top and one bottom).
5. Taking the top torsion tube place allen key in clamping allen screw, using this as a lever preload the torsion bar.
6. Measure the maximum length of clamping plate which would fit under retaining brackets.
7. Repeat 5 & 6 for bottom torsion tube.
8. Cut two new clamping plates the required length. (It is possible that if the plates are reversed sufficient length may be obtained.)
9. Taking top and bottom plates in turn place allen key in clamping allen screw. place clamping plate over allen key to rest on allen screw and to rest in retaining bracket. Place nut over allen key. With one hand on allen key preloading torsion bar drop clamping plate over allen screw and with other hand tighten fully with spanner.
10. Replace shock absorbers.
11. Refit wheels.
12. Lower car from stands.
13. After some fifty miles the tightness of the central clamps and shock absorber mountings should be checked. The camber angles and toe-in should also be checked, this is most important if the suspension has been raised considerably.

N.B.

If the car is still too low. Then the torsion bars are suspect - having fatigued or may have broken laminations; When a full overhaul is advised as in section 3.

SECTION C STEERING

1. General Description



The steering box is of worm and ball peg design made by Burman Gear for the Ford 101E Anglia (is the left hand drive version of the 100E Anglia). The worm is an integral part of the steering shaft and is carried on ball bearings at each end. The ball peg which engages in the worm fits into the upper end of the rocker shaft and is secured by a locking washer and circlip. Ball bearings in the top of the rocker shaft permit the ball peg to rotate. The column is shortened

and the unit is mounted upside down with a grease nipple in the place of the oil filler plug. On left hand drive TVRs the 10GE version was used in a similar manner. The drop arm is a TVR flame cut piece of steel, machined to fit the splined steering box output shaft and to take the taper of the track rod ends. The track rods (a short one to the offside wheel and a long one to the nearside wheel) are made up using conventional parts having left and right hand threads for track adjustment. The steering shaft is located in the outer case at the top by a felt bush.

The steering wheel is mounted to the top of the column on a spline and a taper with a right hand thread nut. The steering shaft is hollow to take a stator tube which carries the wiring for the horn and indicators. This is clamped to the steering box at the foot of the column to prevent it turning with the shaft. The horn and indicator assembly is located in the stator tube (to prevent it turning) and is held in position by the indicator cancelling mechanism disc which is retained in the hub of the steering wheel by three conical nose grub screws.

Provision is made for wear in the steering box to be taken up by removing shims to reduce steering shaft end float and an adjuster screw to eliminate rocker shaft end float. The ball peg may be replaced if necessary.

2. (a) To centralise Indicator Cancelling Mechanism

1. Jack up front of car.
2. By turning the steering wheel back from full lock position with indicator switch operated note position that cancellation occurs. Repeat on other lock. Set steering wheel in a position midway between these points.
3. Slacken fully the three small grub screws mounted in the steering wheel hub.
4. Centralise the steering wheel.
5. Re-tighten the three grub screws.
6. Repeat (2) to check cancellation for centre.

2. (b) To adjust the Rocker Shaft End Float

1. Jack up front of car.
2. Check that there is no excess play in the steering shaft end float (otherwise this will affect the rocker shaft end float adjustment).

3. Disconnect the steering drop arm.
4. Remove the button screw and button spring.
5. Place steering in the dead ahead position.
6. Undo adjuster screw locknut and turn adjuster screw until a light resistance is felt at the dead ahead position as the steering is moved from lock to lock, (take care not to overtighten this adjustment as this will cause undue resistance on the steering mechanism which could prove dangerous).
7. Re-tighten adjuster screw locknut.
8. Check again that only a very light resistance is felt when moving the steering from lock to lock.
9. Re-fit the button spring and screw.
10. Re-fit drop arm.

2. (c) To adjust the Steering Shaft End Float

1. Jack up front of car.
2. Remove steering drop arm.
3. Slacken stator tube clamp bracket.
4. Remove top of steering box complete with button screw, by undoing four bolts.
5. Tap the drop arm end of the rocker shaft so as to lift the ball peg clear of the worm.
6. Carefully remove end plate and shims by undoing three bolts, holding the lower bearing of the worm to prevent the balls falling out.
7. Remove one shim by cutting it with scissors to clear the indicator wires. Note that nearest the lower bearing is a thick packing washer, this should not be confused with the shims and must not be lost.
8. Check the adjustment by replacing the steering box end plate with the three screws and tighten fully.
9. Check the steering wheel end float. If still excessive repeat 6, 7 and 8.
10. When all end float is removed yet there is no tendency of the steering shaft to bind adjustment is complete.
11. Press the rocker shaft down to engage fully in the worm. Re-fit the steering box cover and gasket with the adjuster screw fully unscrewed using the four bolts and spring washers.

12. Adjust rocker shaft end float as in 2(b).
13. Re-fit drop arm.
14. Ensure that stator tube is on centre and tighten clamp.
15. Check indicator cancelling mechanism.
16. Re-charge steering box with grease checking that there is no leak.

3. (a) To replace Ball Peg.

1. Remove drop arm.
2. Remove gearbox top.
3. Remove rocker shaft assembly.
4. Check rocker shaft oil seal and renew if necessary.
5. Remove circlip from end of ball peg.
6. Remove lock washer and flat washer and extract ball peg complete with eight ball bearings.
7. Check ball peg bearing for pitting and position the eight balls ($\frac{1}{8}$ " diameter) in the bearing housing. Hold them in place with the ball peg.
8. Holding the assembly together turn over and fit flat washer, locking washer and circlip (the tabs of the locking washer should point away from the rocker shaft).
9. Place steering wheel in dead ahead position. Place rocker shaft assembly in the steering box case so that the upper end of the rocker shaft is at right angles to the steering wheel.
11. Adjust rocker shaft end float as in 2 (b).
12. Re-fit drop arm.

3. (b) To replace Steering Shaft Top Bush.

1. To remove steering wheel:
 - a) Slacken the three grub screws in steering wheel boss.
 - b) Slacken the stator tube clamp.
 - c) Disconnect battery and disconnect horn/indicator wires at foot of column.
 - d) Pull horn/indicator assembly out of steering wheel hub.
 - e) Pull the horn/indicator assembly from stator tube, withdraw wires from stator tube and remove horn/indicator assembly.
 - f) Remove steering wheel nut.
 - g) Remove steering wheel (a puller may be required).

2. Remove felt bush from top of column.
3. Soak new felt bush in hot heavy grease until it is fully impregnated.
4. Place new felt bush over steering shaft and locate in outer casing.
5. Replace steering wheel, taking care to place it on the spline in line with the steering, replace the nut and tighten securely.
6. Pull the stator tube clear of the steering wheel hub and thread horn/indicator wires through tube locating the horn/indicator assembly in the top of the stator tube.
7. Position horn/indicator assembly in steering wheel hub, hold in place by tightening three grub screws.
8. Reconnect horn/indicator wires at foot of steering column and reconnect battery.
9. Locate stator tube clamp on stator tube and tighten clamp.
10. Centralize indicator mechanism as in 2(a).

SUPPLEMENT TO Nos 1, 2, 2A WORKSHOP MANUAL

by PAUL HOWARD

D: DIFFERENTIAL

Removal from Car

Disconnect driveshafts (4 bolts each) and propshaft (4 bolts). Remove two bolts from front bracket. Remove two bolts from main casing (1 top, 1 bottom). Withdraw unit rearwards and downwards.

To Remove Nosepiece from Casing

Undo six nuts from each side plate (bearing housing). Withdraw shaft (complete with companion flange, side plate, bearing and oil seal) from casing. Undo nuts holding nosepiece to casing (approx 10 no.). Withdraw nosepiece from casing.

To Dismantle Nosepiece

See BMC Workshop Manual MGA, early MGB, Austin Cambridge etc.

Alternative axle ratios: 4.55:1 Austin Cambridge etc, 4.3:1 MGA 1500, 4.1:1 MGA 1600, 3.9:1 early MGB (later MGBs have tubed axle and are different).

To Remove Front Bracket from Nosepiece

Undo large nut. Remove companion flange. Undo two countersunk screws, remove bracket. See torque figures in BMC workshop manual for reassembly.

To Remove Bearing and Oil Seal from Inner Drive Shaft

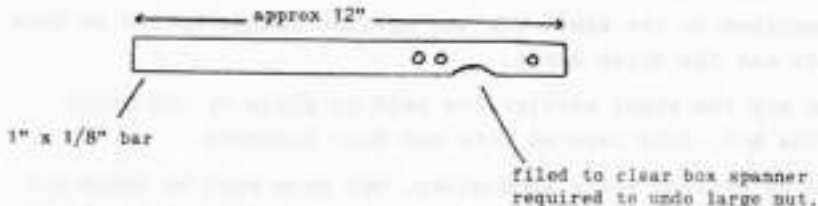
(This may be possible with axle still in car)

Disconnect driveshaft (Hardy Spicer, 4 bolts). Remove split pin. Undo large nut. Remove companion flange. Undo six nuts. Remove side plate. This contains oil seal which may now be removed. Withdraw inner drive shaft and bearing. Remove bearing from shaft.

Additional Notes

If a replacement BMC diff is to be fitted, two holes need to be drilled to fit front bracket. These are approximately 5/16" ϕ . Also companion flange is fitted with a cover to the oil seal which needs modifying to clear bracket. Alternatively original companion flange may be fitted. Inner drive shaft splines are square section. Later diffs may contain star wheels with vee-shaped splines. Therefore star wheels may need changing. See BMC workshop manual for procedure. (It is a fairly easy job to change star wheels)

A special tool to assist with removing companion flanges may be useful:-



The tool is bolted to the companion flange whilst undoing the large nut. Alternative holes are for front flange (close spacing) and side flanges (large spacing).

E: BRAKES & HUBS

To Adjust Front Wheel Bearing

Remove wheel. Withdraw grease cap. Remove split pin from stub axle nut (inside splined hub). Tighten nut gently until play in bearing has disappeared. Undo nut to align split pin hole with castellated nut. Replace split pin. (There are two holes at right angles for the split pin giving adjustment of 1/12th turn of the nut)

To Remove Hub (Front)

Undo two bolts holding brake caliper to suspension upright (brake pipes may need disconnecting). Withdraw grease cap. Remove split pin, castellated nut, washer and outer bearing race. Remove hub complete with brake disc.

To Remove Wheel Bearings (Front) (Taper Roller).

Outer bearing race already removed. Withdraw grease seal. Remove inner bearing race. Tap out bearing cups from opposite side of hub, i.e. outer bearing cup tapped out from inside of hub.

To Remove Brake Disc (Front)(Mk 2A only)

Remove hub from car as above. Undo five (?) nuts. Remove disc from hub. Brake disc is Austin Healey 3000 but I am not certain which model or year. Brake pads also Austin Healey

SECTION E BRAKES AND HUBS

Description - Rear Hubs

The rear hubs of the Mk. IIA are a combination of both standard Healey 3000 and TVR parts. The aluminium king posts are supported via the metalistic bushes, shackles pins, and radius arms by the torsion bars.

Through the king post is machined a 2½" dia. hole, and bolted onto the posts' outer face is the brake drum backing plate and the outer bearing carrier. The double row outer bearing supports the hub and is a press fit on the carrier, it is held in place by a tab washer and retaining nut. The shaft passes through the carrier to be supported at its splined end by the single row inner bearing, this bearing being a press fit in the king post and held between a shoulder and a circlip on the shaft.

Drive is transmitted to the shaft via the splined flange bolted to both the hubs' shaft and the drive shaft.

The brake drum and the wheel carrier are held in place by the studs pressed into the hub, four tapered nuts and four locknuts.

The hub should be greased every 5000 miles, but care must be taken not to overfill the hub as this could cause grease to contaminate the brake shoes rendering them useless.

Dismantling the rear hub

1. Raise the rear of the car and support on axle stands under the lower torsion tube.
2. Remove the chrome wheel nut and the road wheel.
3. Undo the four locknuts and four tapered nuts enabling the removal of the wheel carrier.
4. Slacken the brake adjuster by turning it in an anti-clockwise direction until enough clearance has been achieved to allow the brake drum to be removed.
5. Remove the brake shoes, first at the adjuster side, then off the cylinder side noting the correct fitment for re-assembly.
6. Remove the outer ball joint from its taper using either the special clamp available from most accessory shops, or by the use of wedges, or as a last resort by hitting the side of the supporting bracket whilst simultaneously levering the joint apart.
7. Mark the drive shaft flange to enable correct re-assembly, incorrect assembly of these flanges can cause considerable damage due to the shaft being out of balance.

8. Undo the four bolts and separate the two flanges allowing the drive shaft to hang down.
9. Remove the split pin from the flange securing nut. Undo nut and remove flange from the shaft.
10. Undo the four bolts and remove the inner seal and bracket.
11. Using either straight circlip pliers or long nose pliers remove the circlip from the splined end of the drive shaft.
12. Undo the countersunk screw from the drive shaft flange and using a copper or soft mallet on the splined end of the drive shaft, knock outwards from the hub.
13. Knock back the tab washer and remove the retaining nut.
14. Using a suitable puller withdraw the hub from the bearing carrier bringing with it the double row outer bearing.
15. Tap out the inner bearing with a copper drift on the outer race.
16. Remove the four securing nuts and remove the backing plate being careful not to place any strain on the flexible brake pipe.
17. Remove the outer bearing carrier from the four studs.
18. At this point all the parts should be cleaned off and any worn or suspect components replaced.

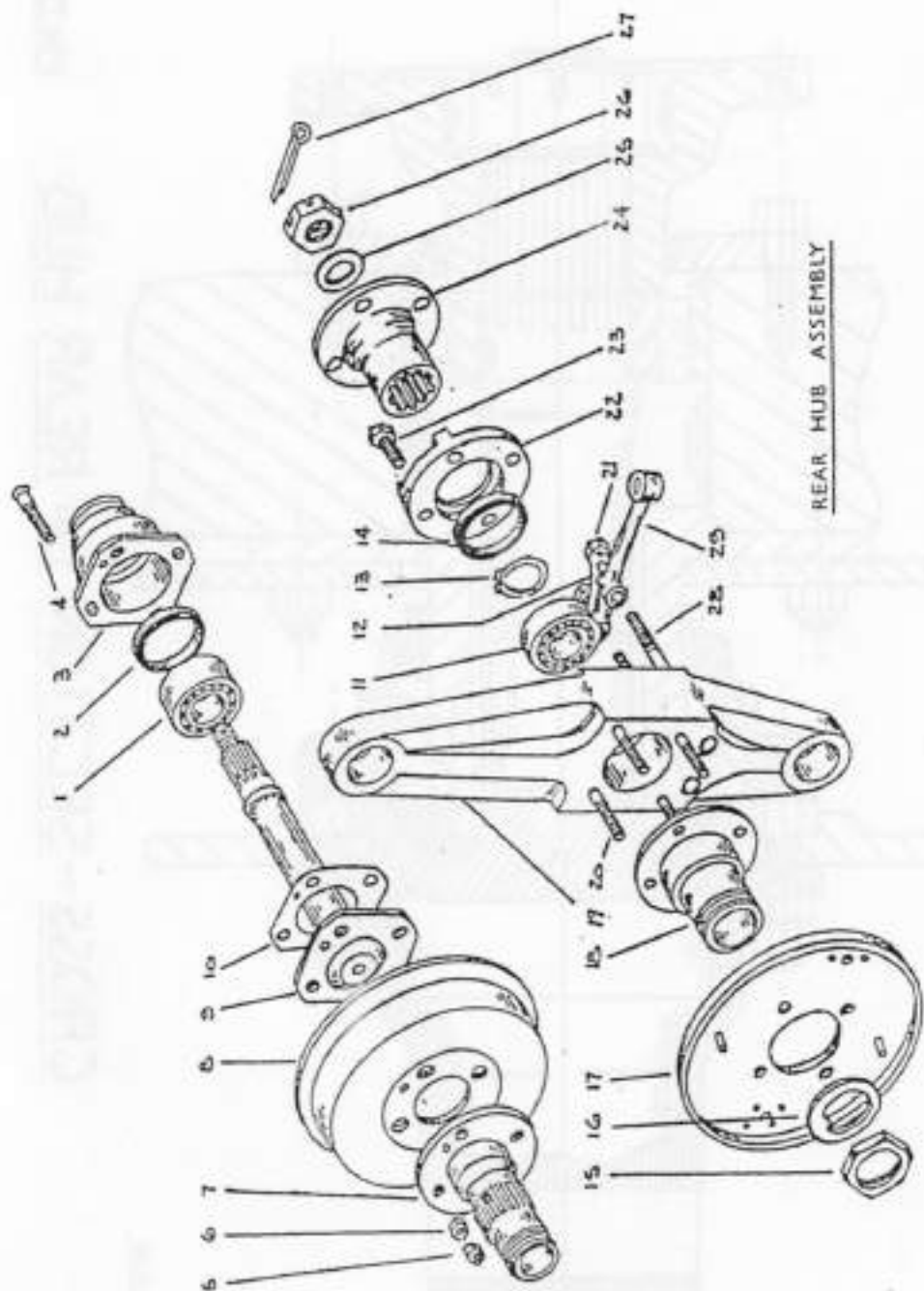
Re-assembly

1. Having checked that all the hub components are in a serviceable condition, including the metalistic bushes at the top and bottom of the king post, replace the outer bearing carrier onto the four studs, followed by the brake drum backing plate.
2. Refit the securing nuts.
3. Replace the inner single row bearing from the rear of the king post tapping it gently on its outer race with a brass drift until approximately $\frac{1}{4}$ " of the bore is visible.
4. Refit the outer bearing onto the bearing carrier, tapping the inner race to avoid damage, then replace the tab washer and retaining nut. Bend the tab onto the flats of the nut.
5. Insert the drive through the bearing carrier and replace the screw in its flange.
6. Fit the circlip over the drive shaft spline.
7. Refit the inner seal and bracket, replacing the four small bolts.

8. Slide the drive flange onto the shaft's splines, fitting the washer and nut. Fit a new split pin through the nut bending back its ends.
9. Lift up the drive shaft and re-aligning the marks replace the four flange bolts, tightening to a torque of approximately 45 lbs.
10. Refit the tie bar ball joint, re-newing if necessary the 'nylock' locking nut.
11. Brush clean the brake shoes, (DO NOT USE AN AIR LINE), avoiding inhaling the asbestos dust and refit them as noted during dismantling.
12. Replace the brake drum and take up any play by tightening the adjuster until the drum locks then backing off until the drum releases.
13. Replace the wheel carrier, fitting the four conical nuts with the taper towards the hub, and then the locknuts.
14. Finally fit road wheel, with new grease on its splines, followed by the chrome wing nut. Lower the car and hammer the wing nut home with a copper mallet.

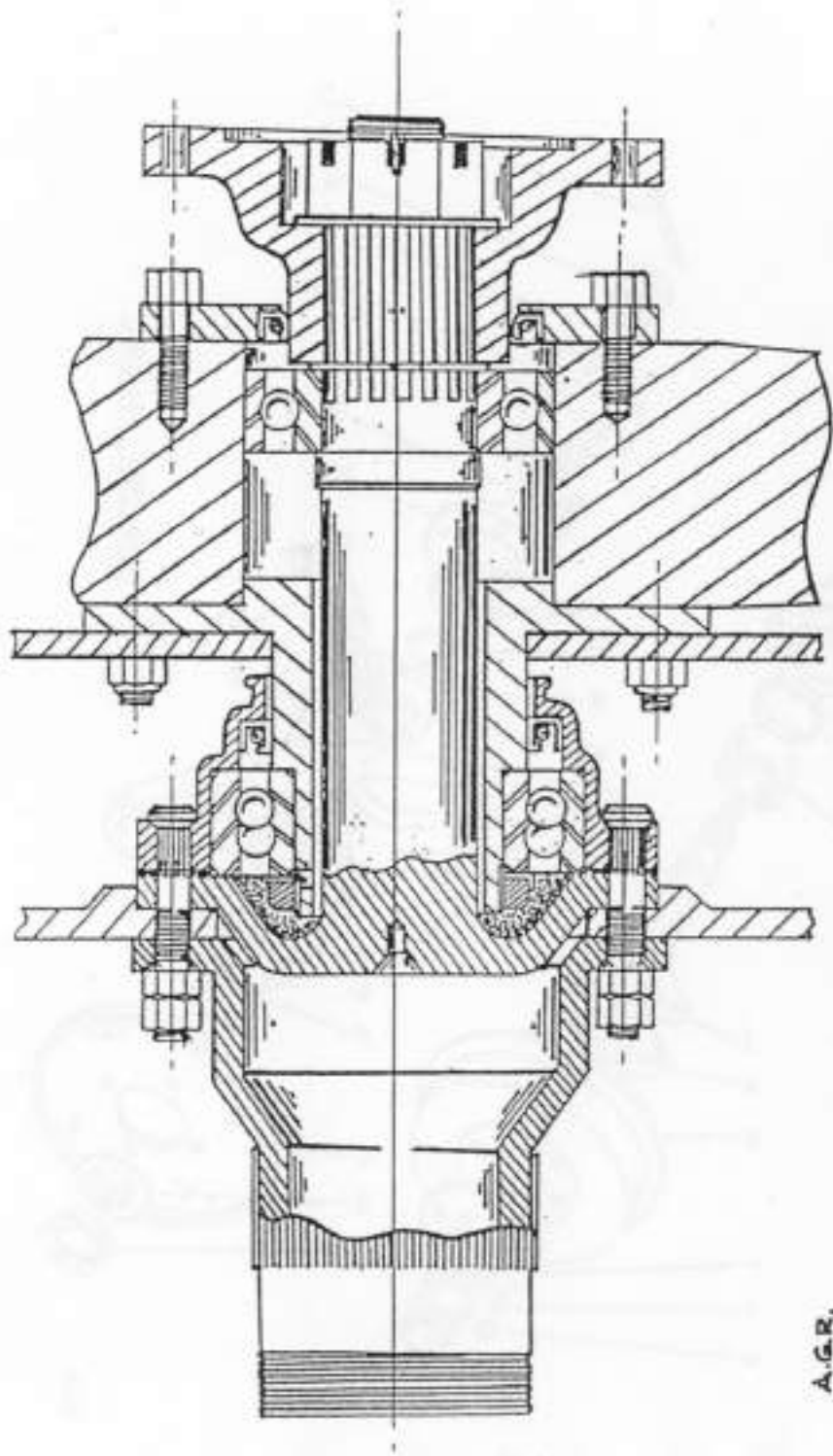
Key to exploded view of the rear hub

- | | |
|----------------------------|--------------------------------|
| 1. Wheel bearing (bearing) | 16. Tab washer |
| 2. Oil seal (hub) | 17. Brake drum backing plate |
| 3. Hub | 18. Bearing carrier |
| 4. Wheel stud | 19. King post |
| 5. Locknut | 20. Stud |
| 6. Tapered nut | 21. Nut |
| 7. Wheel carrier | 22. Flange seal bracket |
| 8. Brake drum | 23. Bolt |
| 9. Drive shaft | 24. Drive flange |
| 10. Gasket | 25. Washer |
| 11. Bearing (inner) | 26. Locknut |
| 12. Locking tab | 27. Split pin |
| 13. Circlip | 28. Stud |
| 14. Oil seal (flange) | 29. Tie bar supporting bracket |
| 15. Retaining nut | |



REAR HUB ASSEMBLY

AGR



A.G.R.

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CROSS-SECTION OF REAR HUB

MK IIA

Description - Front Hubs

The front hubs, unlike the rear, are almost entirely B.M.C. (A.60 and Austin-Healey 3000) parts. The king pin is supported via the brass castings (top and bottom), metalastic bushes, shackle pins, and radius arms by the torsion bars. An Aluminium bridge piece holds the top and bottom brass castings in line. The wheel hub pivots on the king pin which is angled inwards at the top thus achieving an increased camber angle on cornering. Washers placed between the radius arms and the metalastic bushes on the shackle pins increase and decrease the camber angle.

The wheel carrier is supported by small outer and larger inner, angular contact roller bearings, this arrangement allows a small amount of adjustment to be made for wear.

The brake calliper is supported on the hub by an auxiliary bracket as is the track rod end. The rear of the brake disc is protected from water by a splash guard.

The hubs should be repacked with grease every 6000 miles.

Dismantling the front hub

1. Raise the front of the car and support on axle stands under the lower torsion tube.
2. Remove the chrome wheel nut and the road wheel.
3. Clamp the flexible pipe with a suitable clamp i.e. cloth cover sole-grips or the Lockhead brake pipe clamp.
4. Uncouple the flexible pipe from the rear of the wheel hub.
5. Remove the two spring clips and disc pad retaining pins, and withdraw the disc pads.
6. Undo the two calliper mounting bolts and remove the calliper.
7. Remove the dust cover from inside the hub by gripping the bolt or peg attached to it and drawing it out.
8. With long nose pliers straighten and remove the split

pin from the castellated nut, (if this proves too difficult it is possible to drive a socket over the nut and undo it shearing the pin - this is not recommended but the pin is made only of mild steel and the hardened nut and shaft should not be damaged). Undo and remove the castellated nut and washer.

9. Draw off the brake disc/hub assy, if this proves difficult and a suitable hub puller is not available, more leverage can sometimes be created by replacing the wheel and chrome nut.
10. Care must be taken not to drop the inner ring of the outer bearing or either of the roller cages, these items be placed somewhere clean and dry.
11. Remove the five nuts and spring washers holding the brake disc to the hub, (again if difficulty is found slide the hub into the wheel for improved leverage).
DO NOT HOLD BRAKE DISC IN A VICE.
12. Remove oil seal. (It is almost impossible to remove the seal without damage occurring and a new seal should be purchased prior to removal).
13. Drift out using a copper drift the outer rings of both bearing, the outer from the back and the inner from the front.
14. The inner ring of the inner bearing can be removed from the stub axle with a $\frac{1}{2}$ " diameter dowel from the rear of the hub carrier.
15. To remove the backplate and brake carrier the two large and two small diameter bolts must be removed from the hub carrier during which operation heat may have to be applied to the casting.
16. When carrying out the removal of the above, note on which bolt and in which order the spacer, brake pipe bracket and track rod carrier are fitted.
17. To fit new king pin and bushes the shackle pins, the

- aluminium bridge piece and the top and bottom brass castings must be removed from the trailing arm and hub.
18. The bushes can now be removed by slitting them along their axis and driving them out with a suitable drift.
 19. New bushes must be driven in with a mandrel press and reamed out with a stepped reamer to ensure line-up.
(When driving new bushes into place ensure that the grease hole in the bush lines up with grease nipple in the hub carrier.)
 20. Clean and inspect thoroughly all parts replacing where necessary.

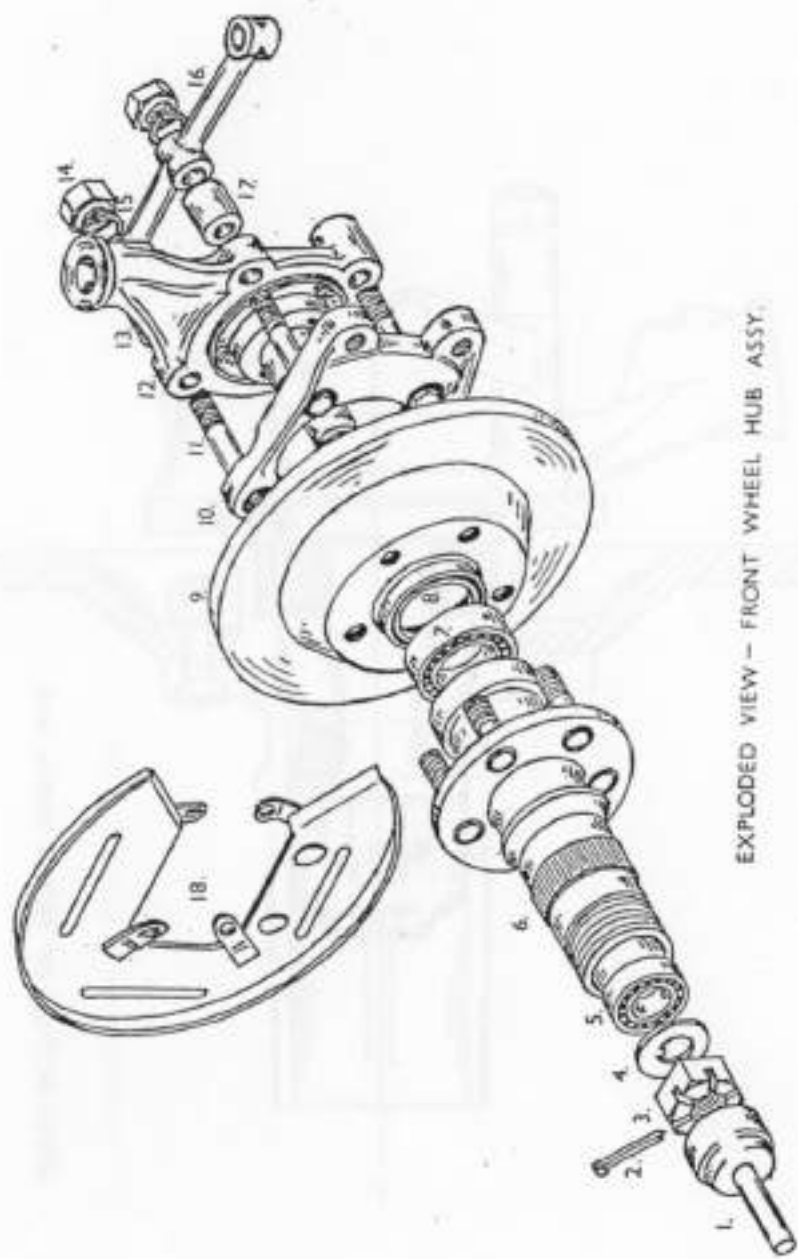
Re-assembly of front hub

Re-assembly is a reversal of the dismantling with the following points noted.

1. The holes in the king pin must be made to line up with the inner studs of the brass castings.
2. Excess clearance between brass castings and the hub carrier must be corrected by fitting a thrust washer of the correct size between the top of the hub carrier and the top brass casting.
3. The castellated nut split pin, fitted to the stub axle, is fitted via the hole in the hub.
4. The brake calliper must be bled after recoupling and if sponginess is still apparent in the brake pedal all the system must be bled. (The clamp must not be removed until the bleeding operation is about to start.)
5. Regrease the hub spline before refitting road wheel and nut.

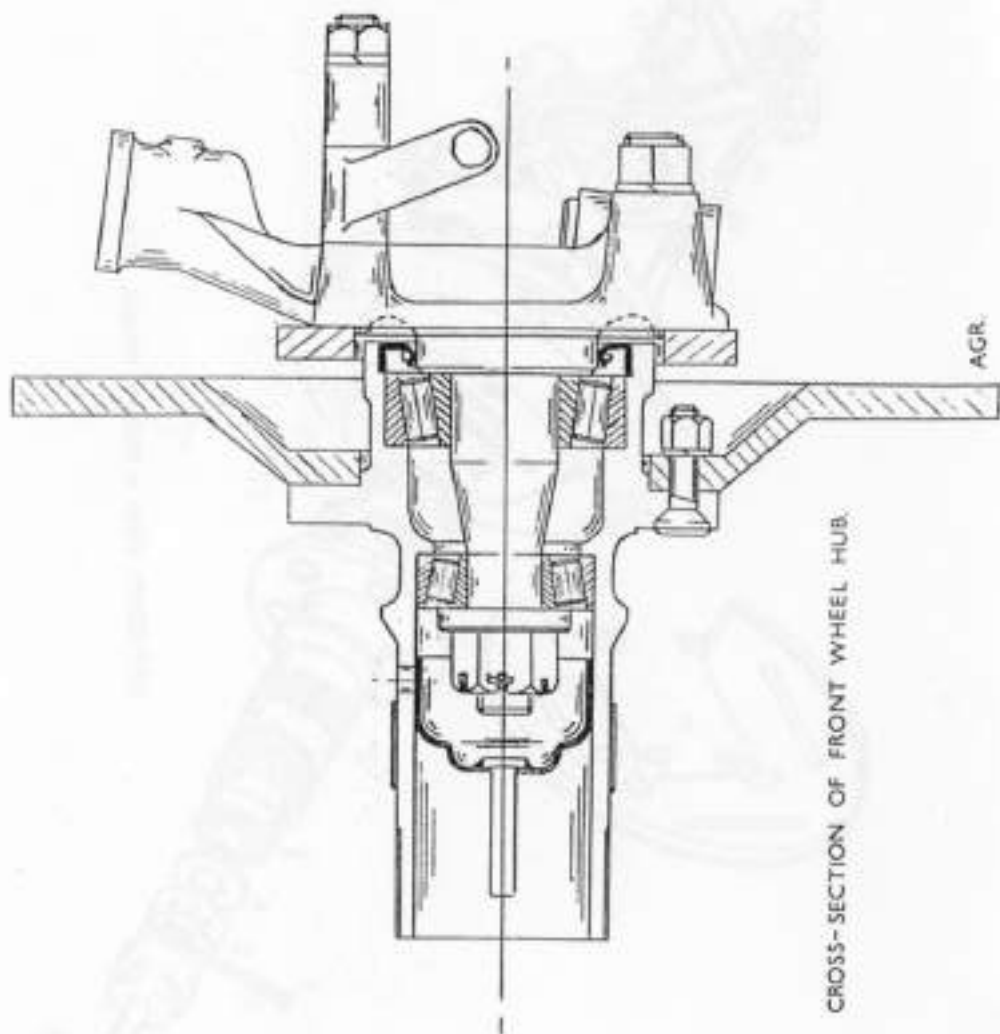
Key to exploded view of the front hub

- | | |
|--------------------|------------------------|
| 1. Dust cover | 10. Brake carrier |
| 2. Split pin | 11. Studs |
| 3. Castellated nut | 12. Hub carrier |
| 4. Clamping washer | 13. Brake pipe bracket |
| 5. Outer bearing | 14. Nut |
| 6. Hub | 15. Spring washer |
| 7. Inner bearing | 16. Track rod carrier |
| 8. Oil seal | 17. Spacer |
| 9. Brake disc | 18. Splash guard |

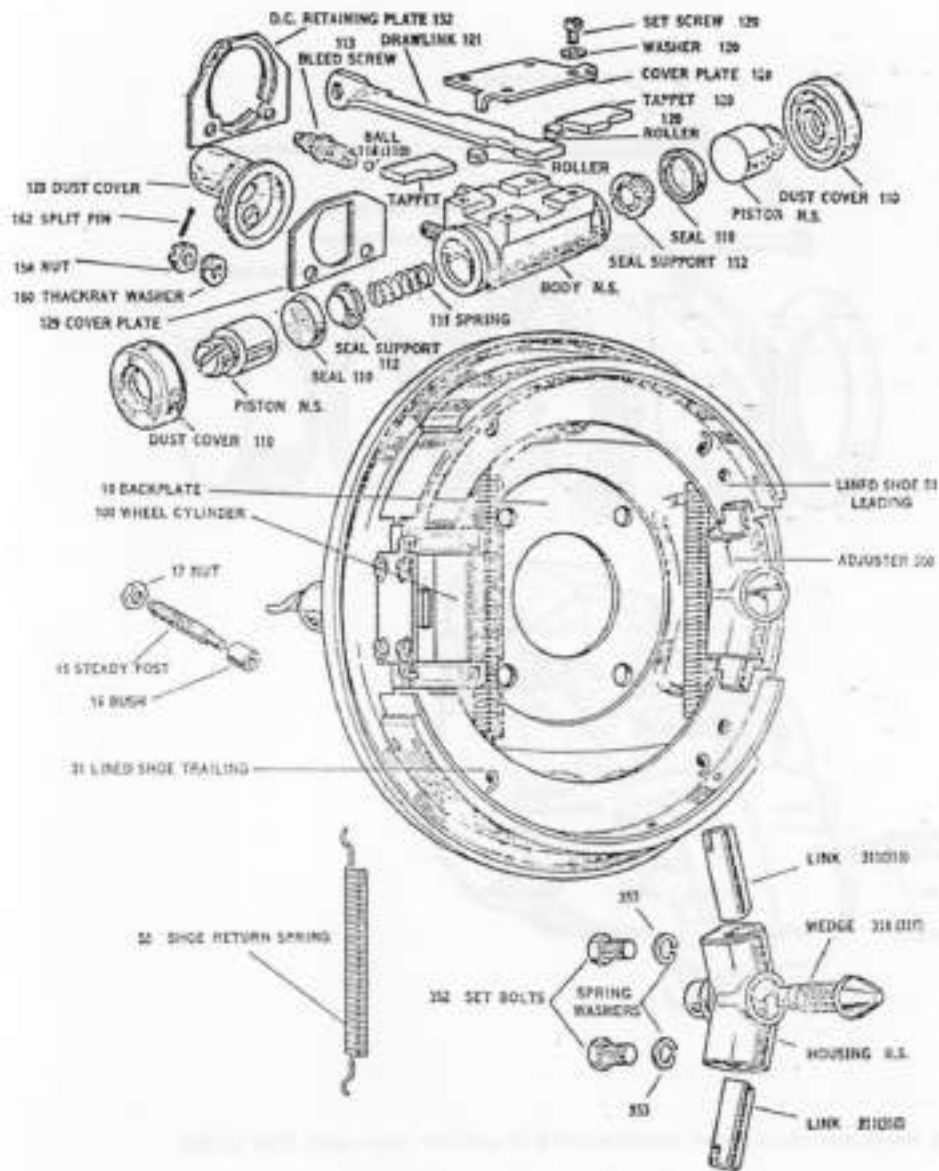


EXPLODED VIEW - FRONT WHEEL HUB ASSY.

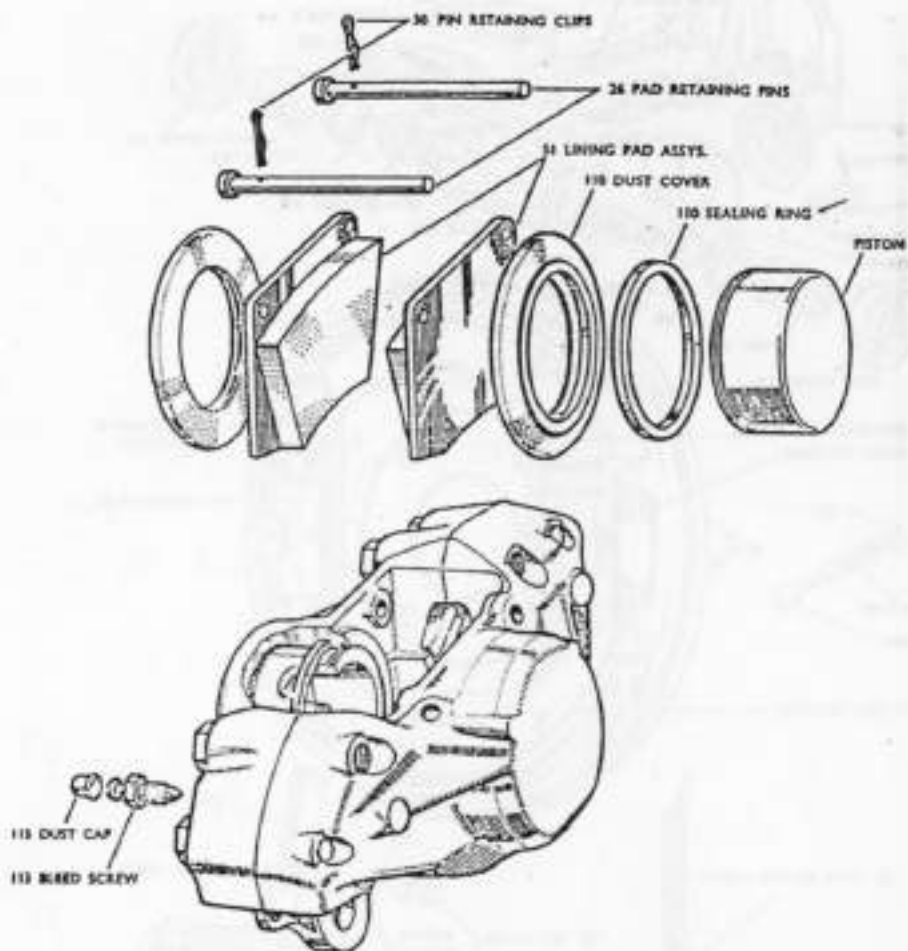
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TYPE HW HYDRAULIC WEDGE

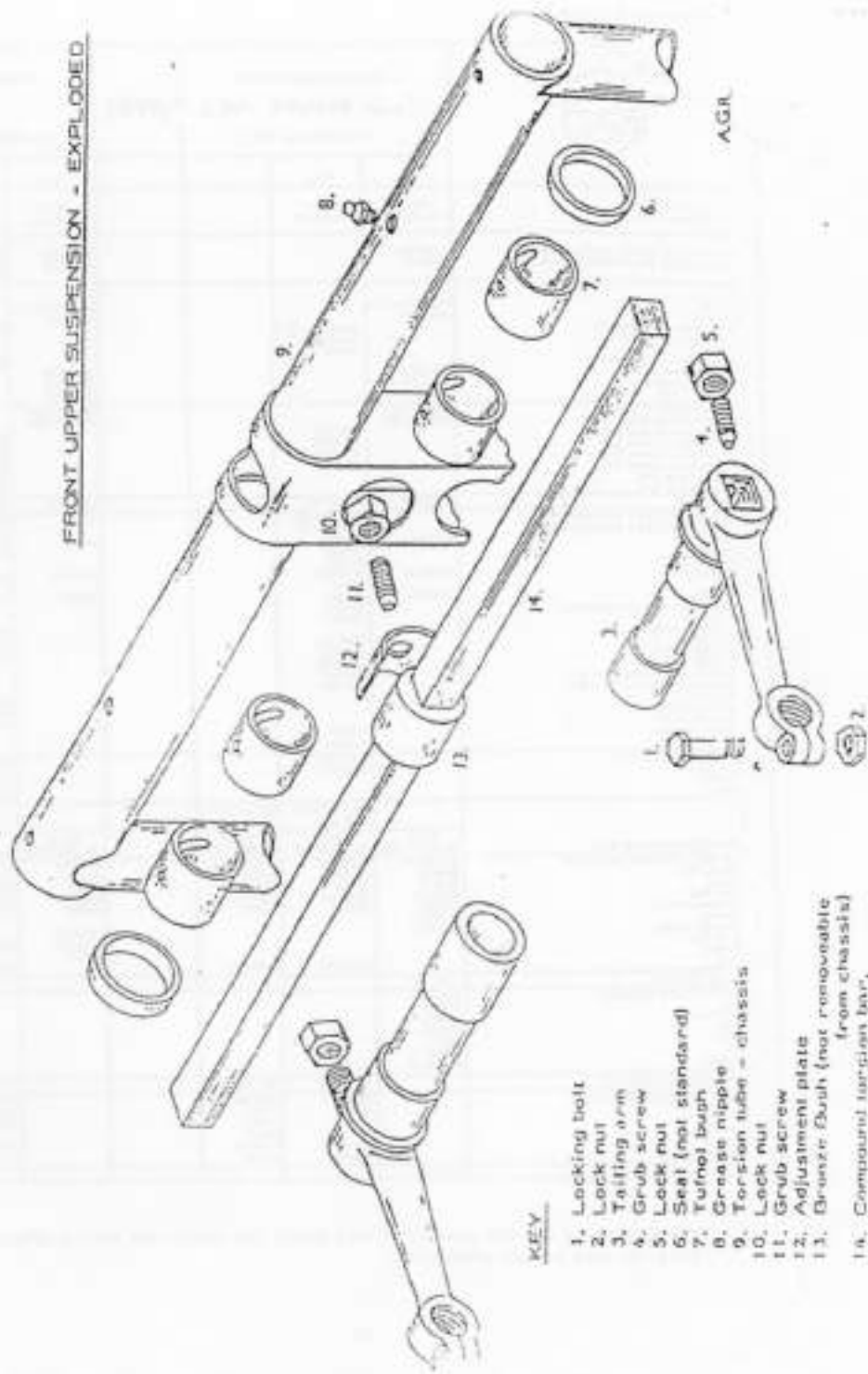


TYPICAL TYPE OF CALIPER USED



Ring seals and dust cover are included in caliper seal unit (SP 2504)

FRONT UPPER SUSPENSION - EXPLODED



KEY

1. Locking bolt
2. Lock nut
3. Tailing arm
4. Grub screw
5. Lock nut
6. Seat (not standard)
7. Tufted bush
8. Grease nipple
9. Torsion tube - chassis
10. Lock nut
11. Grub screw
12. Adjustment plate
13. Bush (not removable from chassis)
14. Compound torsion bar.

