

17 Valve and tappet guide - removal

The valve and tappet guides are shrunk into the cylinder head and although their removal is a fairly simple task it is not recommended that you do this because their replacement is too difficult to do accurately. It is far better to leave this task to a Jaguar garage.

18 Sump, piston, connecting rod and big end bearing - removal

The sump, pistons and connecting rods can be removed with the engine still in the car or with the engine on the bench. Proceed with the appropriate methods in either case for removing the cylinder head and for removing the front suspension. The pistons and connecting rods are drawn up out of the top of the cylinder bores.

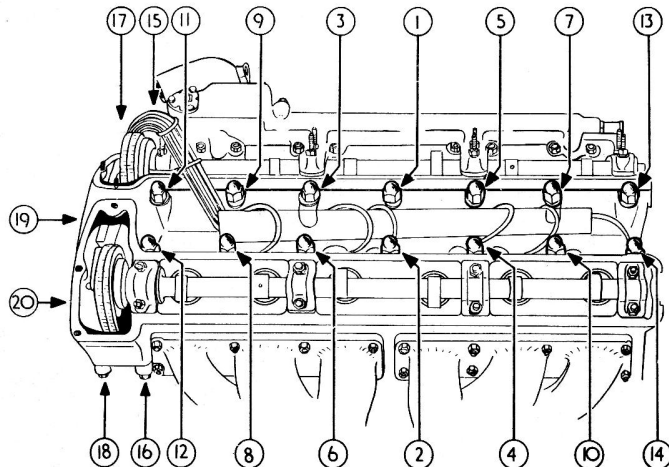


Fig. 1.8. Tightening sequence of cylinder head studs

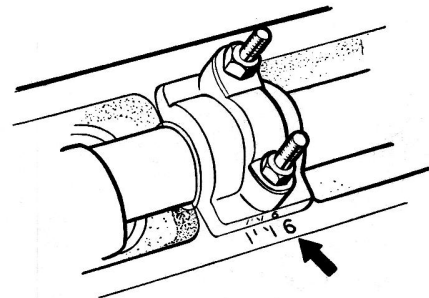


Fig. 1.9. Corresponding numbers on cylinder head and camshaft bearing cap

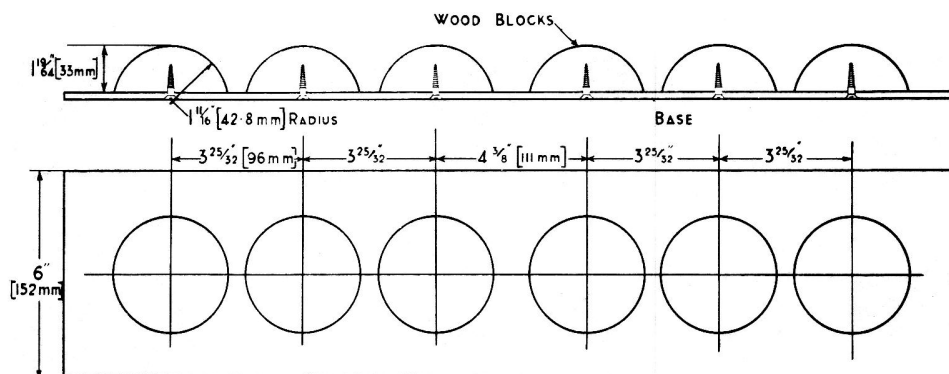


Fig. 1.10. Wooden block to support valves

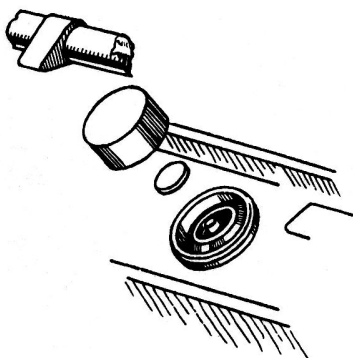
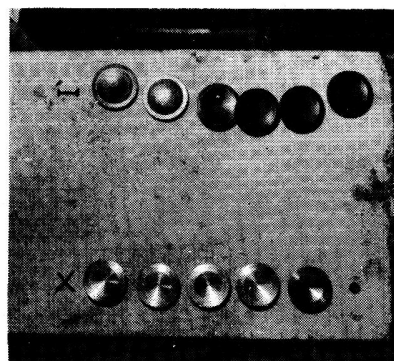
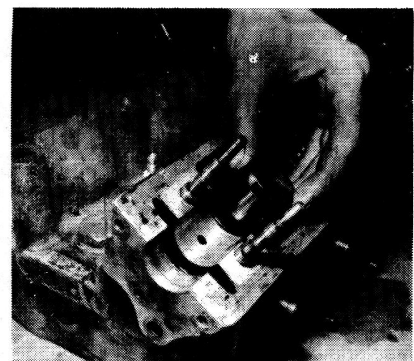


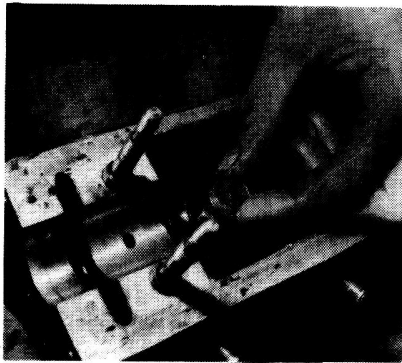
Fig. 1.11. Valve tappet and adjusting pad



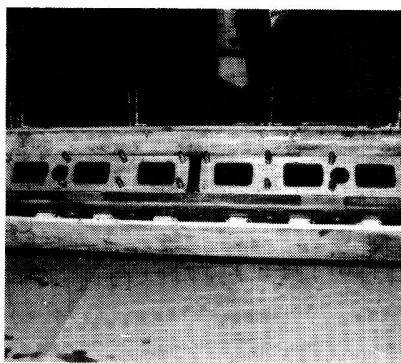
16.1. Board to hold valves



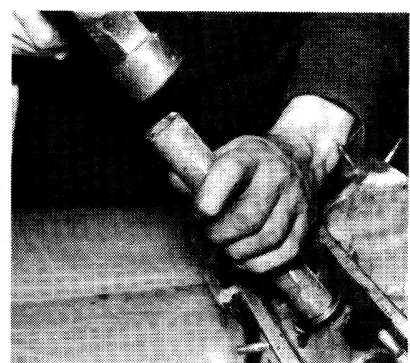
16.3. Remove tappets



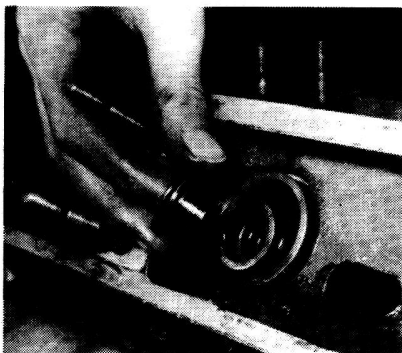
16.4. Remove valve adjusting pad



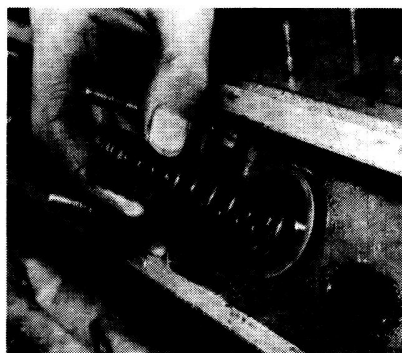
16.5. Place wooden support block beneath cylinder head



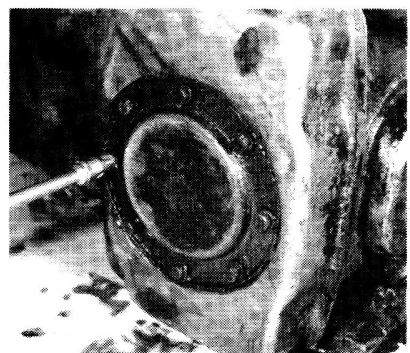
16.6. Removing valve springs



16.7a. Remove valve collar



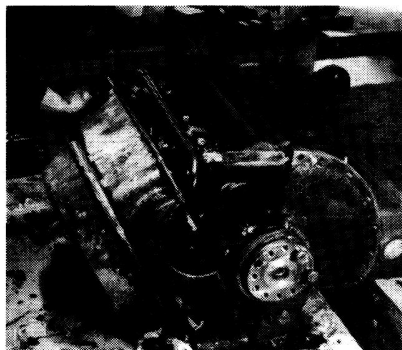
16.7b. Remove valve springs



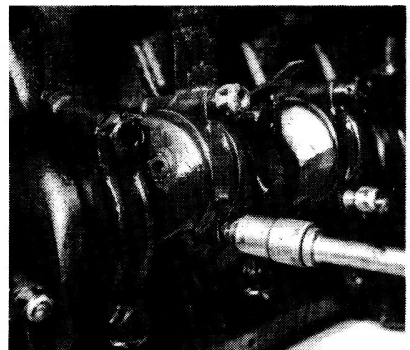
18.2a. Removing filter assembly



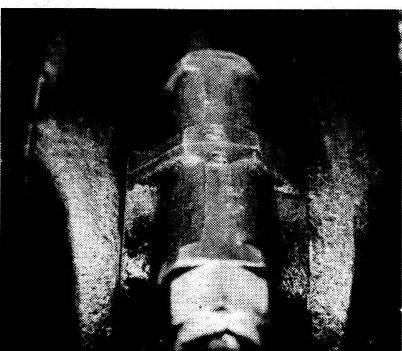
18.2b. The oil sump filter



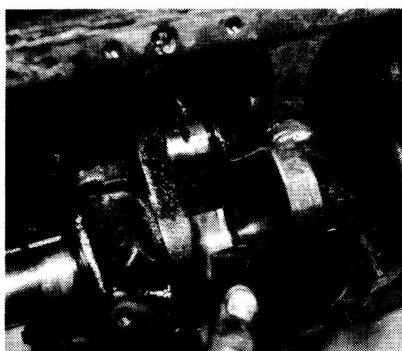
18.2c. Remove the sump



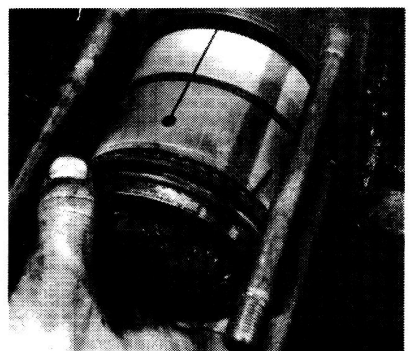
18.3. Remove big-end cap nuts



18.4a. Marking of connecting rod and bearing cap



18.4b. Remove big-end bearing cap



18.6. Withdraw piston and connecting rod

- 1 Turn the engine on its side, if on the bench.
- 2 Remove the sump by unscrewing the twenty six set screws securing the sump to the crankcase and, if the engine is installed in the car, the four nuts securing it to the timing cover. Note that a short set screw is fitted at the right hand front corner of the sump. It may be found that the oil suction pipe fouls the filter gauze in the sump and prevents removal of the sump. In that event the gauze assembly will have to be removed by removing the retaining bolts (your car may not be fitted with the type depicted).
- 3 Undo the split pins and remove the nuts to the big-end bearing caps, self locking nuts are used in later models.
- 4 Remove the big-end bearings caps and shell bearings. Note that the big-end bearing cap and the connecting rods are marked with the number of the cylinder to which they belong and that the numbers on the rod and cap are together. If they are not so marked, or if there is any doubt, stamp them or mark them in some way for correct reassembly.
- 5 If the bearings are not to be changed, keep them with their respective caps and connecting rods.
- 6 Withdraw the pistons and connecting rods upwards and lay them out in their correct order for replacement in the same bore. Refit the caps and bearings to the connecting rods and replace the nuts finger tight to keep them in position.

19 Timing gear - removal

- 1 Remove the front timing cover by undoing the set bolts. Note that the cover is located by two dowels, ensure that these

are a tight fit in the cylinder block. Remove them if they are loose, to prevent loss.

2 Remove the bottom timing chain tensioner by knocking up the tab washer and undoing the hexagon plug from the end of the body. Next insert an Allen key (0.125 A/F) into the hole until it registers in the end of the restraint cylinder, turn the key clockwise until the restraint cylinder can be felt to be fully retracted within the body. The adjuster head will now be free of the chain.

3 Open the tab washers to the two bolts securing the chain tensioner to the cylinder block, withdraw the bolts and remove the tensioner together with the backing plate and shim. Note the conical gauze filter fitted in the tensioner oil feed hole in the cylinder block, this should be removed for subsequent cleaning.

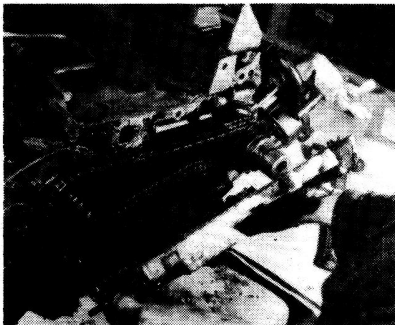
4 Remove the bolt holding the serrated adjuster plate. Remove the plate and the spring loaded plunger.

5 Unscrew the four set bolts securing the front mounting bracket of the timing gear to the cylinder block. Release the tabs of the tab washers and remove the two screwdriver slotted set screws from the rear mounting bracket; on the 3.4, 3.8 litre and 340 models these screws also secure the intermediate timing chain damper bracket.

6 Lift out the left and right hand upper chain damper assembly and distance pieces and the vibration damper for the lower chain which have now been released by removal of the mounting bolts.

7 Disconnect the bottom chain and lift the timing gear assembly away from the cylinder block.

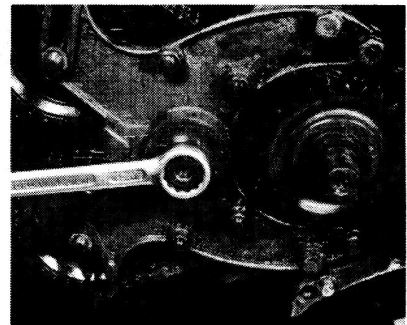
8 Remove crankshaft timing gear sprocket. Note the Woodruff key.



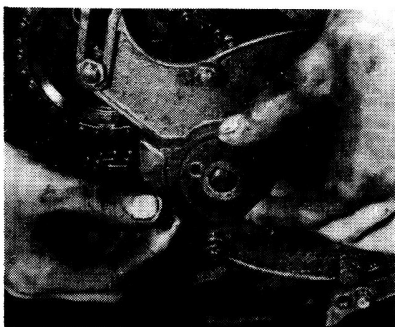
19.1. Remove front timing cover



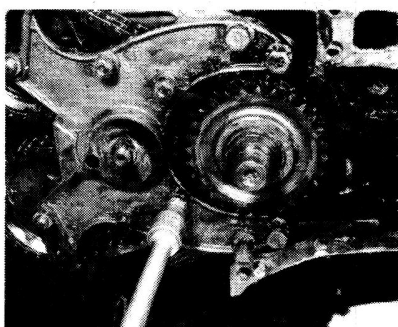
19.2. The bottom timing chain tensioner



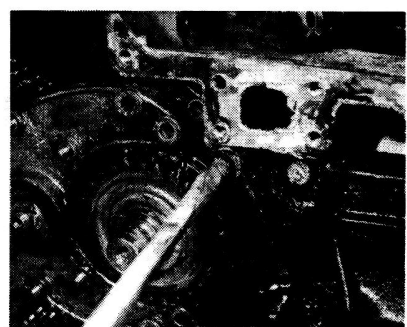
19.4a. Bolt holding serrated adjuster plate



19.4b. Removing serrated plate and spring loaded plunger



19.5a. Removing front mounting bolts



19.5b. Removing screwdriver slotted setscrews

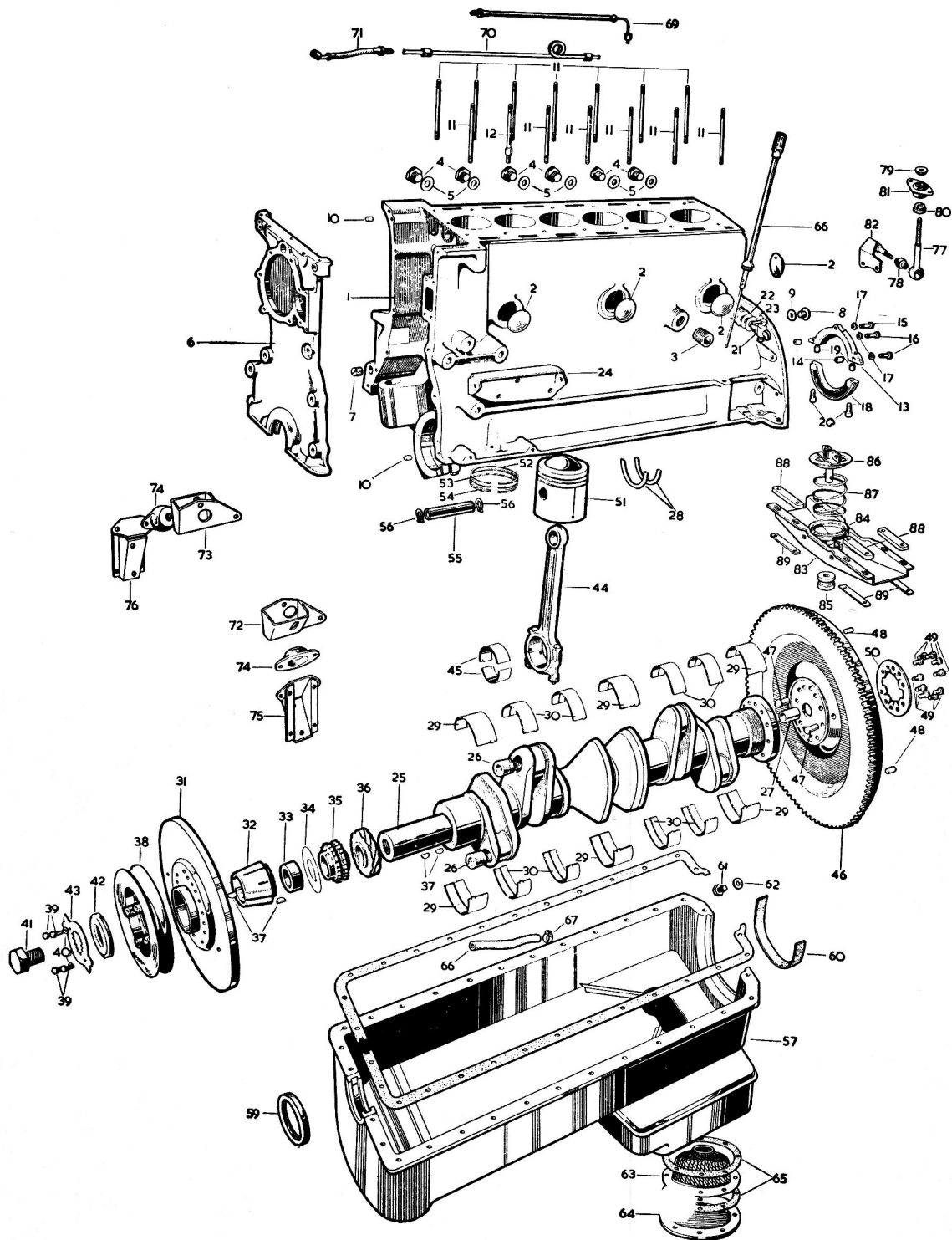
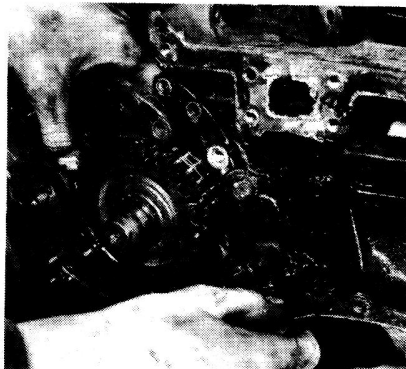


FIG.1.12. EXPLODED VIEW OF THE CYLINDER BLOCK

- | | | | |
|--|--|---|--|
|  <ol style="list-style-type: none"> 1 Cylinder block 2 Core plug 3 Plug 4 Plug 5 Copper washer 6 Front timing cover 7 Plug 8 Plug 9 Copper washer 10 Dowel 11 Stud 12 Dowel stud 13 Cover 14 Ring dowel 15 Bolt 16 Bolt 17 Spring washer 18 Sealing ring 19 Ring dowel 20 Cap screw 21 Water drain tap 22 Copper washer 23 Fibre washer 24 Dynamo mounting bracket 25 Crankshaft | <ol style="list-style-type: none"> 26 Screwed plug 27 Bush 28 Thrust washer 29 Main bearing (front, centre and rear) 30 Main bearing (intermediate) 31 Crankshaft damper 32 Cone 33 Distance piece 34 Oil thrower 35 Timing chain gear 36 Oil pump drive gear 37 Key 38 Pulley 39 Bolt 40 Shakeproof washer 41 Bolt 42 Washer 43 Tab washer 44 Connecting rod 45 Big end bearing 46 Flywheel 47 Dowel 48 Dowel 49 Setscrew | <ol style="list-style-type: none"> 50 Locking plate 51 Piston 52 Pressure ring (upper) 53 Pressure ring (lower) 54 Scraper ring 55 Gudgeon pin 56 Circlip 57 Oil sump 58 Gasket 59 Seal 60 Cork rubber seal 61 Drain plug 62 Copper washer 63 Oil sump filter basket 64 Cover 65 Gasket 66 Hose 67 Clip 68 Dipstick 69 Flexible oil pipe from oil filter 70 Copper oil pipe to pressure gauge 71 Flexible oil pipe from copper oil pipe to pressure gauge | <ol style="list-style-type: none"> 72 Front engine mounting bracket (left hand) 73 Front engine mounting bracket (right hand) 74 Front engine mounting 75 Flange support bracket (left hand) 76 Flange support bracket (right hand) 77 Stabilizing link 78 Bush 79 Stepped washer 80 Stepped bush 81 Stabilizer rubber mounting 82 Stabilizer mounting bracket on clutch housing 83 Channel support 84 Rubber spring seat 85 Rubber centre bush 86 Spring retainer 87 Coil spring 88 Packing block 89 Stiffening plate |
|--|--|---|--|



19.7a. Disconnect bottom chain



19.7b. Lift away timing gear



19.8. Crankshaft timing gear sprocket

20 Gudgeon pin - removal

- 1 The fully floating gudgeon pins are a finger push fit in the piston at normal room temperature and are retained by a circlip at each end.
- 2 Remove the circlips, using a pair of circlip pliers, and discard them.
- 3 Apply finger pressure to the gudgeon pin, if it does not move try from the other end.
- 4 If the gudgeon pin cannot be moved, immerse the piston in a

bath of hot oil. After a few minutes it will be found that the pin will move quite easily.

- 5 Push out the pin far enough to clear the small end of the connecting rod. Separate the piston and connecting rod. Do not push the gudgeon pin right out of the piston unless absolutely necessary, if it does come clear of the piston make sure that it is replaced in its original position.

- 6 The piston should be marked with the number of the cylinder to which they belong. If they are not marked ensure that they are correctly identified because it is important that they are reassembled to the bore from which they were removed.

21 Piston ring - removal

1 To remove the piston rings, slide them over the top of the piston taking care not to scratch the surface of the piston and not to distort the rings. Never slide them off the bottom of the piston skirt. Piston rings are very brittle and are easily broken if they are pulled off roughly. It is helpful to use an old feeler gauge blade to facilitate their removal.

2 Lift one end of the piston ring to be removed out of its groove and insert the end of the feeler gauge under it.

3 Turn the feeler gauge slowly round the piston and as the ring comes out of its groove it rests on the land above. It can then be eased off the piston with the feeler gauge stopping it from entering an empty groove if it is any but the top ring that is being removed.

22 Oil pump assembly - removal

1 Remove the nut and bolt securing the oil pump inlet pipe clip to the bracket on the main bearing cap.

2 Tap back the tab washers and unscrew the two set bolts securing the oil feed pipe flange to the bottom of the crankcase.

3 Open the tab washers from the three bolt heads securing the oil pump to the front main bearing cap, remove the bolts.

4 The oil pump can now be withdrawn.

23 Distributor drive - removal

1 Tap back the tab washer securing the distributor drive gear nut and remove the nut and washer.

2 Tap the squared end of the distributor drive shaft through the gear; note that the gear is keyed to the shaft.

3 Remove the gear and thrust washer and withdraw the shaft.

4 Remove the distributor/oil pump helical drive gear. Remove the key locking it to the shaft.

24 Crankshaft - removal

1 Knock back the tab washers securing the fourteen main bearing cap bolts.

2 Note the corresponding numbers stamped on the caps and the bottom face of the crankcase. The caps must be correctly identified if they are not marked.

3 Undo the bolts and remove the main bearing caps. If the main bearing shell does not come away with the cap, remove it from the crankshaft and keep it with its cap.

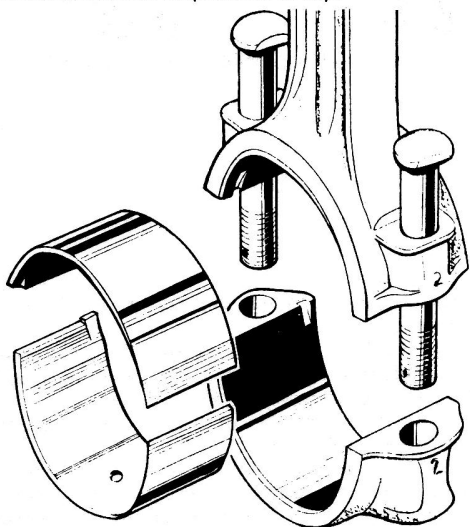


Fig.1.13. Connecting rod and cap stamped with cylinder number

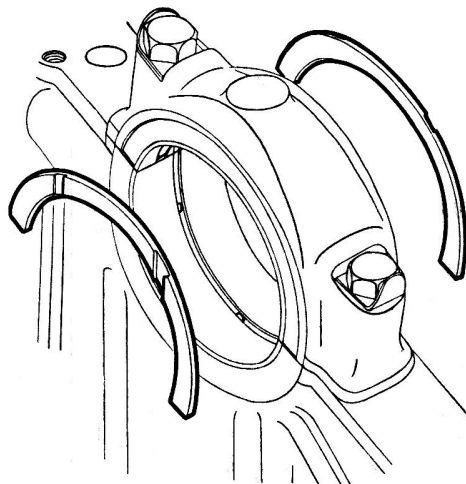


Fig.1.14. The crankshaft thrust washers

4 Note the thrust washers fitted in the recesses in the centre main bearing cap.

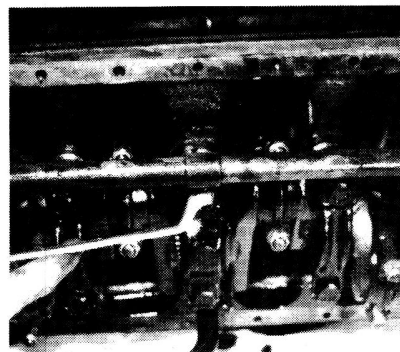
5 Detach the bottom of the oil return thread cover from the top half by removing the two Allen securing screws. Note that the two halves are located by hollow dowels.

6 The crankshaft can now be lifted away from the crankcase.

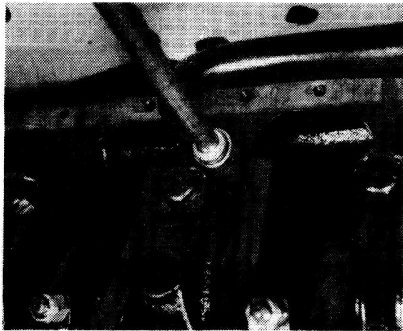
7 Collect the remaining halves of the main bearing shells and, if they are to be refitted, identify them with the position from which they were removed.

25 Lubrication system - description

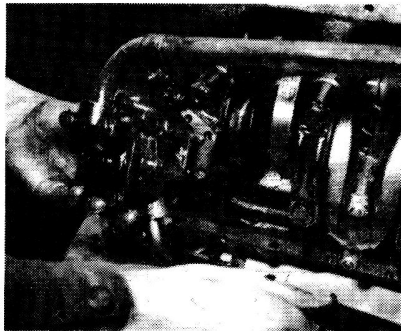
A force feed system of lubrication is employed with oil being circulated round the engine from the sump below the cylinder block. The level of the oil in the sump is indicated by the dipstick which is fitted on the left hand side of the engine. High and low level of oil is indicated by marks on the dipstick; ideally the level of oil should not be above the high mark and should never be allowed to fall below the low mark. Oil is replenished via the filler cap in the left hand camshaft cover. The oil is circulated round the engine by an eccentric rotor type oil pump which consists of five main parts: the body, the driving spindle with the inner rotor pinned to it, the outer rotor and the cover which is secured to the main body by four bolts. The pump is illustrated in Fig 1.28. Oil is drawn from the sump and is then passed under pressure by the pump to the filter on the right hand exterior of the crankcase and thence through drillings to the big end, main and camshaft bearings. A longitudinal drilling through the connecting rod feeds the small end and gudgeon pin with oil and



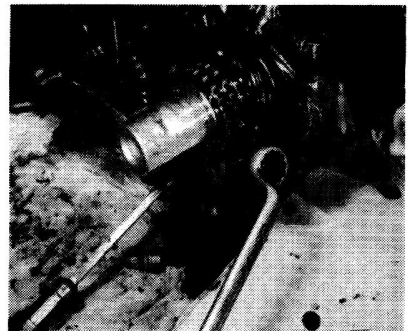
22.1. Remove oil pipe clip



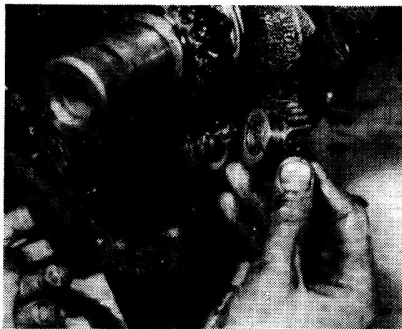
22.2. Undo oil feed pipe flange



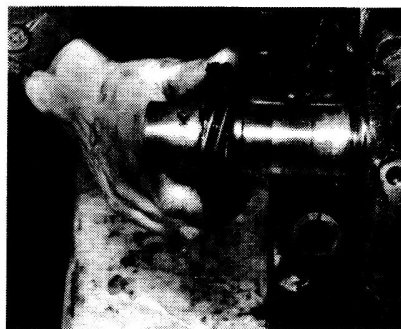
22.4. Withdraw oil pump



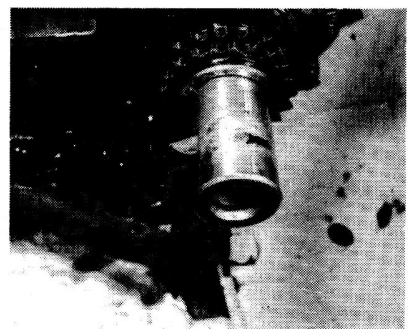
23.1. Remove distributor drive gear nut



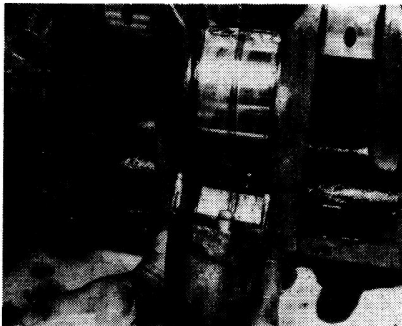
23.3. Remove distributor drive gear and thrust washer



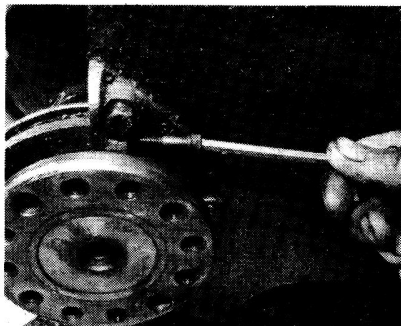
23.4a. The helical gear, oil pump drive



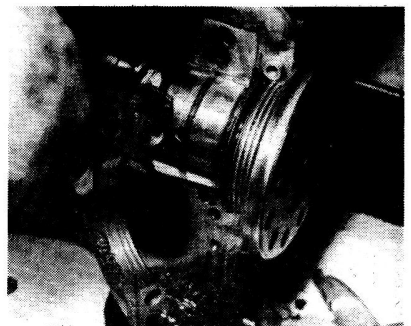
23.4b. Woodruff key on crankshaft (typical)



24.3. Remove main bearing caps



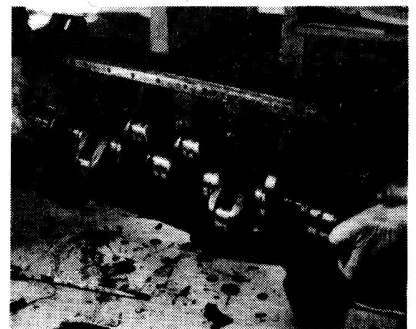
24.5a. Undo oil thread cover Allen screws



24.5b. Detach bottom half of oil thread cover

a small hole in each connecting rod throws a small jet of oil to the cylinder wall with each revolution. The camshafts are fed through an exterior pipe at the rear of the engine, the oil then passes along a longitudinal drilling in each camshaft and is fed to the bearings through drillings in each cam.

The external oil filter is of the full flow type with a replaceable element. There are two patterns of filter, the first an upward pointing type which is fitted to early models and the second a downward pointing type fitted to later model cars, typical examples of each illustrated in Figs 1.50 and 1.16 respectively. The two types of filter assembly are not interchangeable and the filter elements differ, it is essential, therefore, to quote the engine number when ordering a new filter element. The head of the filter assembly incorporates a removable oil pressure relief valve and a balance valve which provides a safeguard against the possibility of the filter element becoming so choked as to prevent oil reaching the bearings.

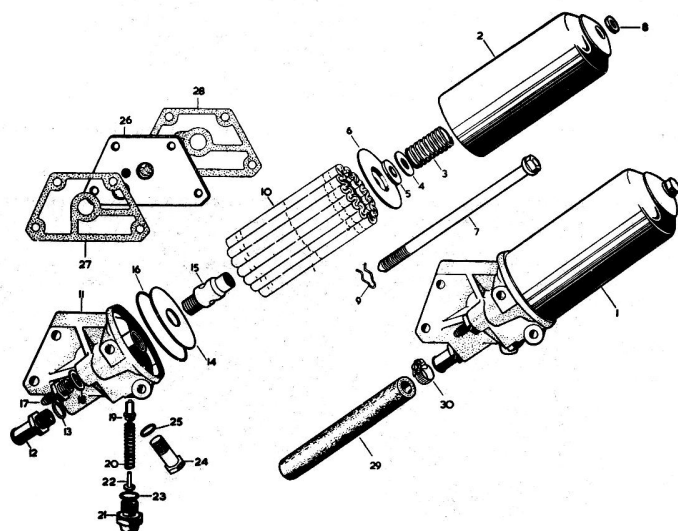


24.6. Lift out crankshaft

26 Oil filter - removal and replacement

1 The external oil filter is of the disposable cartridge type and is located on the right hand side of the engine. It is most important to renew the filter element at the recommended periods (5000 mile servicing) as at this mileage it is becoming choked with impurities.

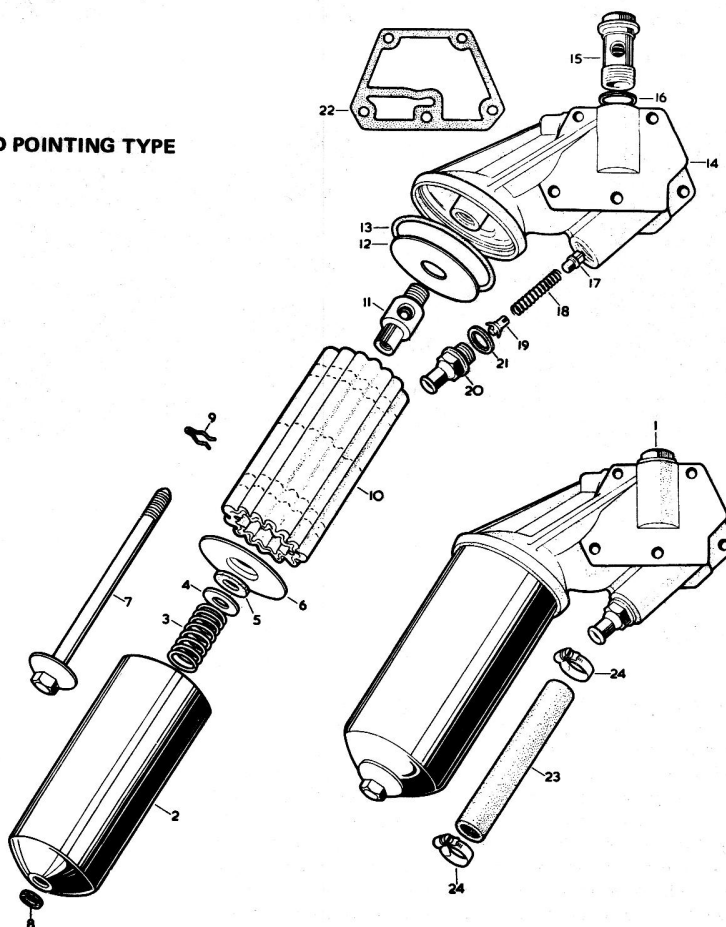
- 2 Place a tray on the floor beneath the oil filter.
- 3 Drain the upward pointing type by removing the drain plug from the bottom of the head. Replace the plug after draining.
- 4 Remove the central bolt securing the canister to the head and remove the canister complete with the filter element. The canister of the downward pointing type will be full of oil at this stage so it must be kept upright until placed to drain.
- 5 Remove the rubber sealing ring from the head of the oil

**FIG.1.15. OIL FILTER – UPWARD POINTING TYPE**

- | | |
|-----------------------|-------------------|
| 1 Oil filter assembly | 16 Sealing ring |
| 2 Canister | 17 Union screw |
| 3 Spring | 18 Copper washer |
| 4 Plain washer | 19 Relief valve |
| 5 Felt washer | 20 Spring |
| 6 Pressure plate | 21 Dome nut |
| 7 Bolt | 22 Stop pin |
| 8 Rubber washer | 23 Washer |
| 9 Spring clip | 24 Drain plug |
| 10 Element | 25 Sealing washer |
| 11 Filter head | 26 Blanking plate |
| 12 Outlet adaptor | 27 Gasket |
| 13 Sealing washer | 28 Gasket |
| 14 Clamping plate | 29 Hose |
| 15 Anchor insert | 30 Clip |

FIG.1.16. OIL FILTER – DOWNWARD POINTING TYPE

- 1 Oil cleaner
- 2 Canister
- 3 Spring
- 4 Plain washer
- 5 Felt washer
- 7 Bolt
- 8 Rubber washer
- 9 Spring clip
- 10 Element
- 11 Anchor insert
- 12 Clamping plate
- 13 Sealing ring
- 14 Filter head
- 15 Balance valve
- 16 Seal
- 17 Relief valve
- 18 Spring
- 19 Spider and pin
- 20 Adaptor
- 21 Seal
- 22 Gasket
- 23 Hose
- 24 Clip



filter.

6 Remove and discard the old element.

7 Withdraw the canister retaining bolt and note the order of assembly of the spring clip, the pressure plate (and which way up it faces), the felt washer, the plain washer and spring.

8 Thoroughly clean all parts, especially the interior of the canister where it will be found that sediment has collected in the base and this will probably have to be removed using paraffin and a brush.

9 Reassemble the filter in the reverse order to the above but fitting a new element, rubber sealing ring in the head and a new felt and rubber washer on the canister securing bolt.

27 Engine - examination and renovation - general

With the engine stripped and all parts thoroughly cleaned, every component should be examined for wear. The following items should be checked and, where necessary, renewed or renovated as described later.

28 Crankshaft - examination and renovation

1 Examine the crankpin and main journal surfaces for signs of scoring or scratches and, where bearings are thought to have failed, for white metal adhering to them. White metal contamination can be removed by very light rubbing with fine crocus paper. If the journals are scored the crankshaft should be re-ground or a factory reconditioned item fitted as can be obtained on an exchange basis provided the old shaft is fit for reconditioning.

2 Clean the journals and crankpins and measure the diameter at different positions with a micrometer. Regrinding is generally recommended when wear or ovality in excess of 0.003" (0.08mm) is found. Details of the basic diameter of the journals and crankpins will be found under the specification at the beginning of this Chapter.

3 Ensure that the oil passages are clear.

4 If the original crankshaft is to be refitted, remove the Allen headed plugs in the webs and thoroughly clean out any accumulated sludge using a high pressure jet followed by blowing out with compressed air.

5 Replace the plugs and secure in position by staking with a centre punch or a blunt chisel.

29 Crankshaft pulley and damper - examination and renovation

1 The rubber portion of the damper should be examined for deterioration. If the rubber appears to have perished it should be replaced.

2 The drive on the pulley should be taken on the "V". Check that the fan belt does not bottom. If it does, recheck with a new fan belt; if this does not bottom, renew the fan belt. If the new belt bottoms, renew the pulley.

3 Note that the damper and pulley are balanced as an assembly at production and if they are to be separated they should be marked for correct reassembly.

30 Big end and main bearings - examination and renovation

1 Big end bearing failure is usually accompanied by a noisy knocking from the crankcase and a drop in oil pressure. Main bearing failure give rise to vibration which can be quite severe as the engine speed increases and reduces, a drop in oil pressure will also be noticed. However, if engine vibration is experienced do not immediately jump to the conclusion that the main bearings have failed because there are a number of other factors which can cause this.

2 Inspect the big ends, main bearings and thrust washers for signs of general wear, scoring, pitting and scratches. The bearings should be a matt grey in colour. Should a trace of copper be noticed in lead indium bearings, the bearings are badly worn for the lead bearing has worn away to expose the indium underlay. Renew the bearings if they are in this condition or if there is any sign of pitting or scoring.

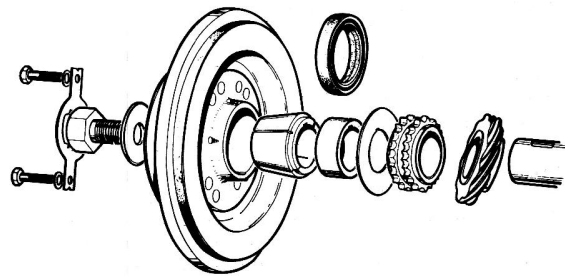
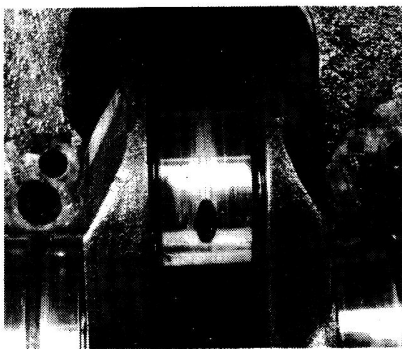
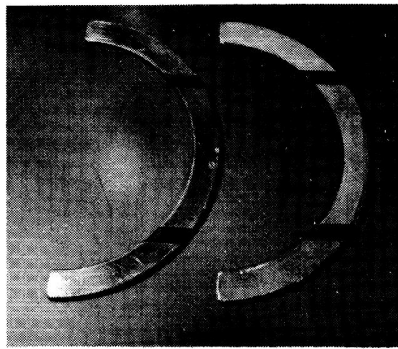


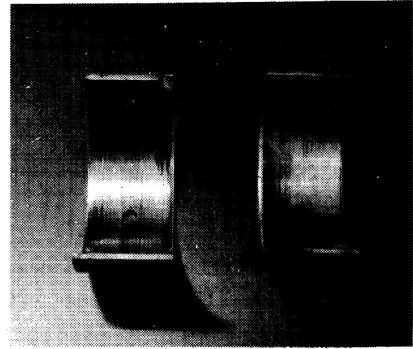
Fig.1.17. Crankshaft damper and pulley assembly



28.1. Scored crankpin journal



30.2a. Unserviceable crankshaft thrust washers



30.2b. Scored big-end bearing shells

3 The undersizes available are designed to correspond with regrind sizes in steps of $-0.010''$. The bearings are in fact slightly larger than the stated undersize as running clearances have been allowed for during their manufacture.

4 Bearing shells must be changed in pairs. It is no use fitting a new half bearing to one that has been in use.

5 Very long engine life can sometimes be achieved by changing big-end bearings at 30,000 and main bearings at 50,000 miles respectively, irrespective of the visual condition of the bearings. Normally, crankshaft wear is infinitesimal and regular changes of bearings may ensure mileages of between 100,000 and 120,000 miles before regrinding becomes necessary. Crankshaft wear and scoring is usually the result of bearing failure.

6 Despite the foregoing, it is recommended that whenever the engine is dismantled new bearing throughout should be fitted on reassembly.

31 Flywheel - examination and renovation

1 Examine the starter teeth for wear or damage which, if found will necessitate replacement of the flywheel.

2 The new flywheel and clutch must be balanced as an assembly. (See Fig 1.6).

3 Mount the assembled flywheel and clutch on a mandrel and set up on parallel knife edges.

4 Find the balance point and mark the relative position of the clutch and the flywheel.

5 If necessary to obtain balance, remove the clutch and drill $0.375''$ (9.5 mm) holes not more than $\frac{1}{8}''$ (12.7 mm) deep at a distance of $0.375''$ (9.5 mm) from the edge of the flywheel.

6 However it will be appreciated that this is a task best left to a Jaguar garage having the necessary equipment and experience.

32 Cylinder block - examination and renovation

1 Thoroughly clean the top face of the cylinder block and check it for truth with a straight-edge.

2 Examine the top face of the block for damage. Pay particular attention to the condition of the face between the webs of the cylinder bores, look for burning or cracks.

3 Examine the cylinder bores for taper, ovality, scratches and scores. Start by carefully examining the top of the bores, if they are worn fractionally a very slight ridge will be felt on the thrust side. This marks the top of the piston travel. You will have a good indication of the condition of the bores before dismantling the engine, or removing the cylinder head as excessive oil consumption accompanied by blue smoke from the exhaust is a sure sign of excess wear.

4 Measure the diameter of the bore just under the ridge with an internal micrometer or vernier and compare it with the diameter at the bottom of the bore which is not subject to the same amount of wear. If the difference between the two measurements is greater than $0.006''$ (0.1524 mm) it will be necessary to fit a "ring set" or to rebores and fit oversize pistons and rings. If you do not have a micrometer, remove the rings from a piston and place it in each bore in turn about $\frac{3}{4}''$ from the top of the bore. If a $0.010''$ (0.254 mm) feeler gauge can be entered between the piston and the cylinder wall on the thrust side of the bore then remedial action must be taken. Refer to the specifications at the beginning of this Chapter for rebores sizes. The present size of the bore (ie $+0.10, +0.20$ etc) should be found marked on the cylinder block face alongside each bore.

5 Oversize pistons are available in the following sizes:-
 $+0.010$ inch (0.254 mm) $+0.030$ inch (0.76 mm)
 $+0.020$ inch (0.51 mm)

There are no selective grades in oversize pistons, (see Section 33).

6 The maximum limit for reboring $+0.030''$ (0.762 mm). Liners and standard size pistons should be fitted when bores will not clean up at that limit.

7 If the bores are slightly worn but not so badly as to justify

reboring them, special oil control rings can be fitted to the existing pistons which will restore compression and stop the engine burning oil. Several different types are available and the manufacturer's instructions concerning their fitting must be followed closely. However, fitting special rings is a comparatively short term remedy; if the engine is out of the car and completely stripped it seems false economy not to return the engine to an "as new" condition by reboring.

8 Remove the six brass blanking plugs in the main oil gallery and thoroughly clean out the cylinder block oilways and the interior of the crankcase.

33 Pistons and piston rings - general

The pistons of the 2.4 and 3.4 Mk 1 models have two compression and one oil control ring, the top compression ring being hard chrome plated; tapered periphery compression rings are fitted on the 3.4 litre car.

The pistons of the 2.4 litre Mk.2 and the 240 model, have four rings each, three compression and one oil control. The top compression ring only is chromium plated and the other two have a tapered periphery.

In the case of the 3.4 Mk.2 and the 3.8 litre and the 340 engines, the pistons have three rings each, two compression and one oil control. The top compression ring is chromium plated and both the top and second compression rings have a tapered periphery. "Maxiflex" type oil control rings are fitted to later engines and if desired may be fitted to those engines which do not incorporate them. 2.4 litre pistons will require modification to accept these rings. The modification consists of drilling a $0.125''$ diameter hole in the centre of the oil control ring groove in line with the gudgeon pin bore, as shown in Fig 1.20, to accept the ends of the equaliser.

The pistons fitted to an engine should not vary in weight one with another by more than 3.5 grammes; replacements are, therefore, supplied in sets.

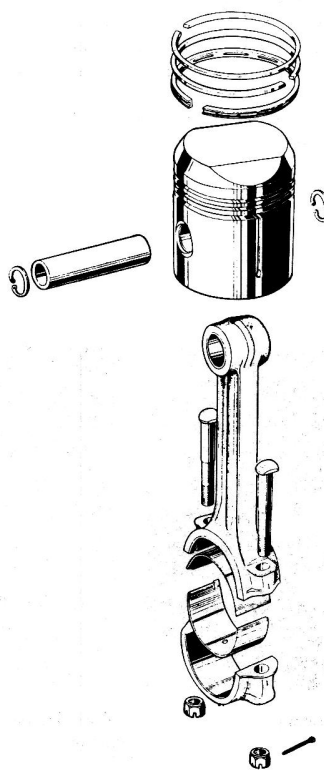


Fig.1.18. Exploded view of the connecting rod and piston assembly

Five selective grades of piston are available in standard sizes only. If you have to order a set of standard pistons you will have to quote the identification letter of the selective grade either F, G, H, J or K. This identification letter is stamped on the crown of the piston and is stamped also on the top face of the cylinder block adjacent to the bores.

Oversize pistons are available in the following sizes:-

+ 0.010 inch (0.25 mm) 0.030 inch (0.76 mm)

+ 0.020 inch (0.51 mm)

There are no selective grades in oversize pistons.

The various types of piston for the various compression ratios are shown in Fig 1.21 from which it will be seen that although the 2.4 and the 3.4 litre engine pistons are of similar diameter, they are not interchangeable.

It must be noted that 240 engines are produced with an 8:1 compression ratio only and the 340 model is available with a compression ratio of 8:1 as standard and 9:1 as an optional.

34 Pistons, piston ring and gudgeon pin - examination and renovation

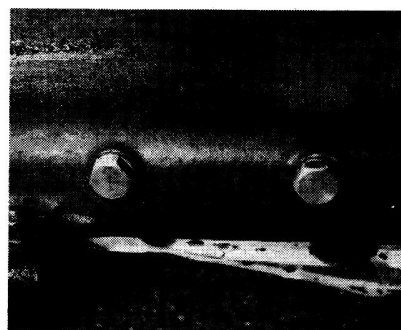
- 1 The method of removing the gudgeon pin and the piston rings has already been described in Section 19 and 20 respectively.
- 2 Remove the piston rings.
- 3 Clean carbon from the head of the piston using worn emery cloth and paraffin. Do not use a scraper or any tool that may score the head.
- 4 Do not use an abrasive to clean the outside of the piston, despite the discolouration that may be present; a wipe with a cloth and paraffin will suffice.
- 5 Examine the lands for burrs and these may prevent freedom of movement of the ring, rectify as necessary using fine emery cloth.
- 6 Clean all dirt out of the grooves especially in the corners. A broken piston ring is a handy tool for this job but be careful not to dig in or remove metal.
- 7 Examine the skirt for fractures at the extremity of the split.
- 8 When a new piston ring is brought into use its gap, when sprung out in the cylinder bore, must be measured. If the gap is too small seizure will result when the ring expands; if the gap is too great compression pressure will be lost.
- 9 Push the new ring down the bore as far as possible using a piston for this to ensure that the ring is square in the bore.
- 10 Refer to Fig 1.22 and measure the gap using a feeler gauge. The correct gaps are:-
 Compression rings 0.015 to 0.020" (0.38 to 0.51 mm)
 Oil control rings 0.011 to 0.016" (0.28 to 0.41 mm)
 Oil control rings Maxiflex 0.015 to 0.038" (0.38 to 0.83 mm)
 Adjust with a fine file if the gap is too small.
- 11 Check the side clearance of the ring in its groove, this should be 0.001 to 0.003" (0.025 to 0.076 mm).
- 12 All engines are fitted with taper periphery rings in at least one position and it is essential that these are fitted the correct way up. The narrowest part of the ring must be fitted uppermost and this can be identified by the letter "T" or TOP stamped on the face (See Fig.1.23).
- 13 Apply pressure longitudinally to the gudgeon pin through the connecting rod. Watch for movement of the pin in the piston and if movement is noted the piston and pin must be replaced.

35 Connecting rods - examination and renovation

- 1 If the connecting rods have been in use for a very high mileage or if bearing failure has been experienced it is advisable to renew the affected rods owing to the possibility of fatigue failure.
- 2 The alignment should be checked and corrected as necessary on an approved connecting rod alignment jig. Arrangements should be made for this to be done at your local Jaguar garage.
- 3 Check that the big end caps have not been filed. If they have,



32.2. Cracked and burnt cylinder block



32.8. Two of the six brass plugs to the main oil gallery

there is no alternative but to replace the connecting rod complete.

- 4 Check "rock" of the connecting rods on the gudgeon pin. If movement is observed and it can be established that this is due to wear at the small end, a new small end bush must be fitted.
- 5 Remove the gudgeon pin in the manner described in Section 19, discard the circlips, new items must be fitted on reassembly.
- 6 The small end bush is a press fit in the connecting rod. Force it out using a vice or press and fit a new item. Ream the new bush after fitting to a diameter of 0.875" to 0.8752" (22.225 to 22.223 mm)

36 Camshaft and camshaft bearings - examination and renovation

The camshaft and bearings normally give a very long life but there are always exceptions to the rule. The photograph adjacent shows a camshaft which has failed due to a breakdown in the

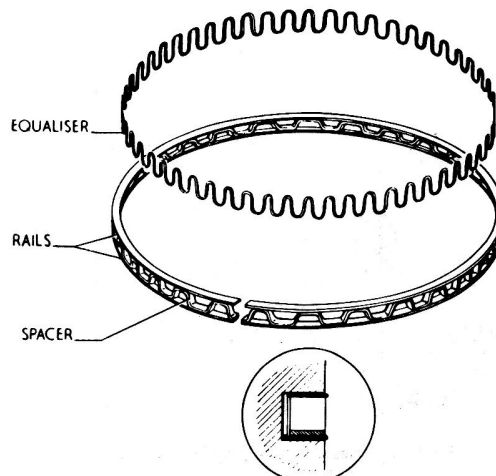


Fig.1.19. "Maxiflex" oil control ring

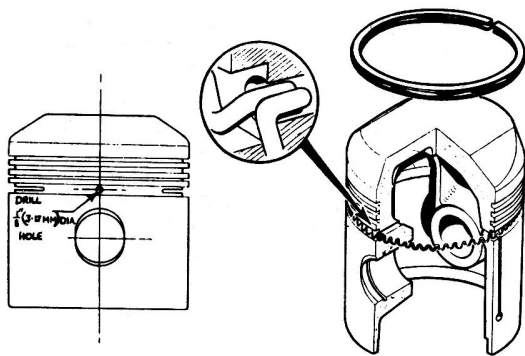
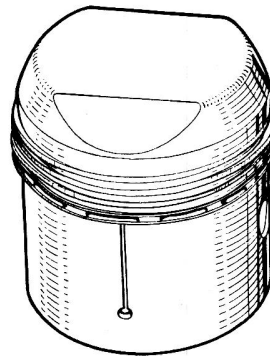
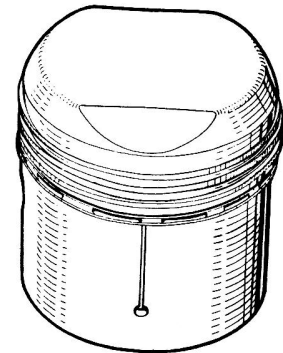


Fig.1.20. Method of modifying 2.4 litre piston

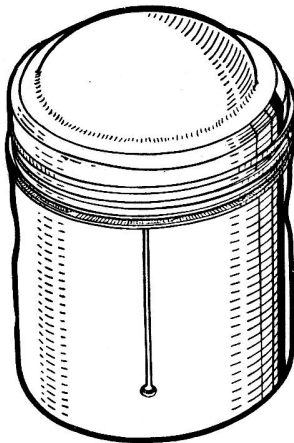


8:1 COMP:RATIO

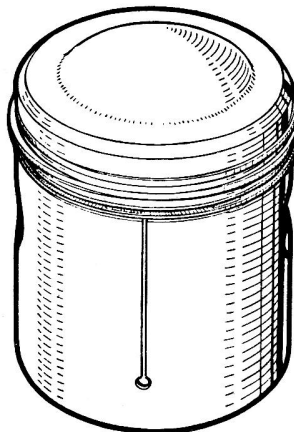


7:1 COMP:RATIO

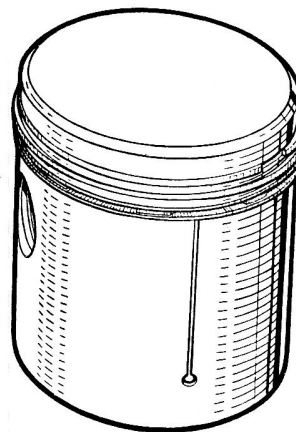
Fig. 1.21A Types of piston 2.4 litre



9:1 COMP:RATIO



8:1 COMP:RATIO



7:1 COMP:RATIO

Fig. 1.21B Types of piston 3.4 litre

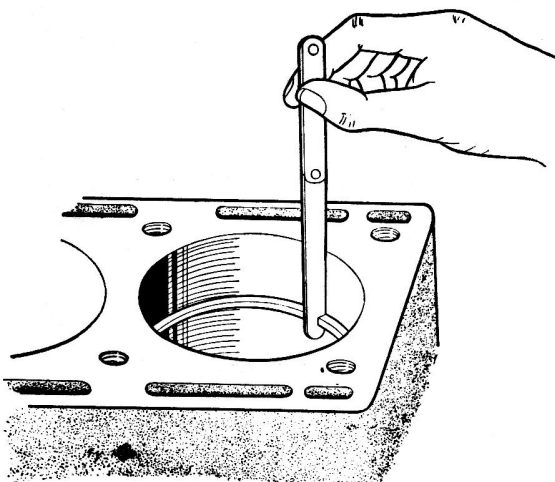


Fig.1.22. Checking the piston ring gap

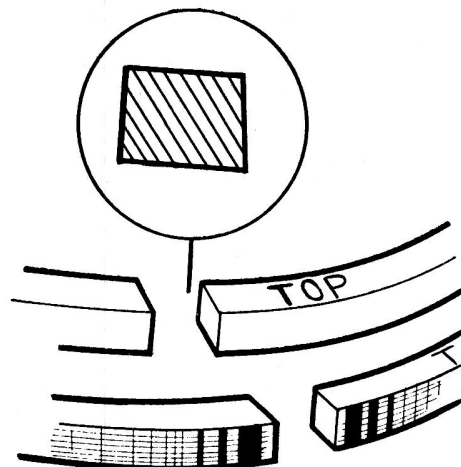


Fig.1.23. Identification marks on tapered periphery compression rings

case hardening of a cam, it is estimated that the engine from which this shaft was removed had done well over 100,000 miles. This type of fault is not as common as wear on the lobes. Preferably make a comparison with a new shaft although a good idea of their condition can be obtained by comparing one lobe with another and with those on the other camshaft.

Scoring on the bearing surfaces is a more likely fault to be found; it may be possible to remove slight score marks by gently rubbing down with very fine emery cloth or an oilstone, but this must not be overdone as undersize bearings are not supplied. Thus, if the scoring cannot be rectified, or if wear on the lobes is found, the shaft should be scrapped.

Examine the shell bearings for scoring, pitting and general signs of wear. It is advisable to fit new bearings if there is any doubt as to their condition.

Remember that the camshafts are not interchangeable, the inlet shaft has a dog drive at the rear for the revolution counter generator whereas the exhaust shaft is plugged at this end. Be careful to ensure, when checking valve clearances, that the correct camshaft for that particular bank of valves is indeed being used.

37 Valves and seats - examination and renovation

1 Examine the heads of the valves for pitting and burning, especially the exhaust valves.

2 If the valves appear fit to re-use after grinding to their seats in the cylinder head, scrape all carbon away and carefully clean the stem of the valve. Clean the valve guide in the cylinder head and fit the valve to its guide.

3 With the valve about three quarters of its way in the guide check it for sideways movement. If movement appears to be excessive, remove the valve and measure the diameter of the stem, this should not be less than 0.309". If the stem diameter is satisfactory it means that the valve guide is worn, note the condition when servicing the cylinder head. If no wear is present check the valve stem for truth by moving the valve up and down in its guide and at the same time rotating the valve, no restriction should be felt.

4 Valve grinding is easily carried out. Place the cylinder head upside down on a bench with a block of wood at each end to give clearance for the valve stems.

5 Smear a trace of coarse carborundum paste on the seat face and apply a suction grinding tool to the head of the valve. With a semirotary action, grind the valve to its seat, lifting the valve occasionally to redistribute the paste. When a dull matt even finish is produced on both the valve seat and the valve, then wipe off the paste and repeat the process with a fine paste, lifting and turning the valve as before. A light spring placed under the head of the valve will assist in the lifting operation. When a smooth unbroken ring or light grey matt is produced on both valve and valve seat faces, the grinding operation is complete. Be very careful during the grinding operation not to get the abrasive paste on the stem of the valve, do not handle the valve stem once you have started to use the abrasive because it will be transferred to the stem from the fingers and the result will be rapid wear of the valve guide. Trouble is often experienced with the suction tool not gripping the valve head, this can be overcome if the valve head and the tool are kept free of oil and grease at all times.

6 Do not overdo the grinding; if it becomes apparent that the valve will not bed down without excessive grinding the valve should be changed for a new one or the valve seat may require to be re-cut as explained later.

7 Thoroughly clean both the valve and the cylinder head when grinding is complete to remove any trace of carborundum, this can cause quite a bit of damage after first start up of the engine.

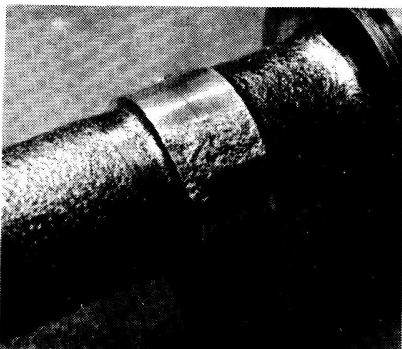
38 Inlet valve oil seals - general

To reduce the amount of oil being drawn down the inlet valve guides, "O" ring oil seals were introduced for late production Mk.2 models. These rings can be fitted to the whole range of 2.4, 3.4 and 3.8 litre cars if desired.

From the introduction of the 240 and 340 models, oil seals were fitted to the inlet valve guides as shown in Fig.1.24. These guides may be fitted to existing cylinder heads but a complete set of parts as follows is required:-

Inlet guide	6 off
Valve collar	6 off
Cotters	12 off
Spring seat	6 off
Circlip	6 off

When fitting the seals it is essential to ensure that the seal is seated in the groove machined in the top of the valve guide.



36.1. Unserviceable camshaft



37.2. Clean valves



37.5a. Valve grinding equipment

39 Valve springs - examination and test

After a considerable mileage some deterioration in the valve springs and consequent reduction in engine efficiency, must be expected. It is considered advisable, therefore, to test the springs when they are removed from the cylinder head to ensure that they are fit for use. It is felt that to measure the free length of a spring or to compare it with a new item is no test of its capacity. To avoid the need for special test equipment, the following method of test will meet requirements:-

- 1 Obtain a new inner and outer valve spring.
- 2 Place the new spring and the one to be tested end to end between the jaws of a vice or under a press with a flat metal plate interposed between the two springs.
- 3 Apply a load partly to compress the springs and measure their lengths whilst under load. If the old spring is obviously shorter than the new one it is a sign that deterioration has set in.

40 Tappets and valve adjusting pads - examination and renovation

Examine the bearing surface of the tappets which run on the camshaft. Any indentation on this surface or any cracks indicate serious wear and the tappet must be renewed. Thoroughly clean them out, removing all traces of sludge. It is unlikely that the sides of the tappets will be worn, but if they can be rocked in their guide in the cylinder head it should be established by measurement which item is at fault; details of dimensions are given in the Specifications at the beginning of this Chapter. The tappet should also be checked that it moves freely in the guide, the most likely cause of restriction is dirt but rectify as necessary.

Clean and examine the valve adjusting pads. After considerable mileage it is most probable that the pads will be indented, if this is found they should be replaced. Adjusting pads are available rising in 0.001" (0.03 mm) increments from 0.85" to 0.110" 2.16 to 2.79 mm) and are etched on the surface with the letter A to Z each letter indicating an increase in size of 0.001".

41 Cylinder head and bore - decarbonisation, examination and renovation

1 This operation can be carried out with the engine either in or out of the car. With the cylinder head off, carefully remove with a wire brush and blunt, plastic scraper, all traces of carbon deposits from the combustion spaces and the ports. Wash the combustion spaces clean with paraffin and scrape the cylinder head surface free of any foreign matter. Take care not to scratch or damage the face of the cylinder head in any way. Do this work with the spark plugs, or an old set of plugs, fitted to the head to prevent hard carbon getting into the plug threads. If this happens and the carbon is not cleaned out there is risk of damaging the soft threads in the head when the plugs are screwed in.

2 Examine the face of the cylinder head for damage such as score marks, indentations or burning as depicted in the photograph adjacent. Damage of this type will prevent the head seating properly and will result in failure of the cylinder head gasket and burning of the head as shown or in water leak to the cylinders.

3 Examine the valve seat inserts, firstly for burning and pitting to the extent of preventing seating of the valves by grinding and secondly check the insert for security.

4 Burned or badly pitted valve seat inserts can be reclaimed by re-facing. Your local garage can probably do this work for you.

Valve seat angles are:-

Inlet	2.4 litre Mk.1.	30°
	All other models	45°
Exhaust	All models	45°

5 The valve seat insert, valve guide and tappet guide are shrunk into the cylinder head and if either of these items are loose or damaged as to need replacement it is advisable to leave the job to a Jaguar agent having the necessary equipment and experience.

6 If a spark plug thread has been damaged to the extent of preventing correct fitment of the plug it is possible to reclaim the head by fitting an insert in the following manner:-

a) Refer to Fig.1.25.

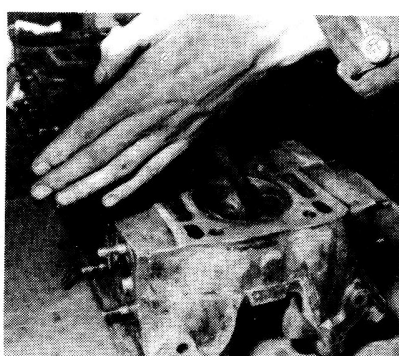
b) Bore out the damaged thread to 0.75" (19.05 mm) diameter and tap ½" BSP.

c) Counterbore 57/64" (22.62 mm) diameter to accommodate the larger diameter of the insert.

d) Fit the screwed insert ensuring that it sits firmly at the bottom of the thread.



37.5b. Smear of carborundum paste on valve



37.5c. Grinding the valve to its seat

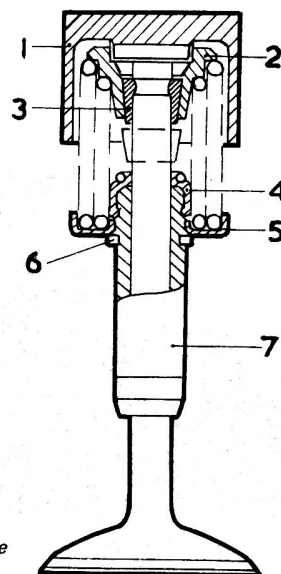


FIG.1.24. INLET VALVE OIL SEAL

- 1 Tappet
- 2 Valve collar
- 3 Cotter
- 4 Oil seal

- 5 Spring seat
- 6 Circlip
- 7 Inlet valve guide

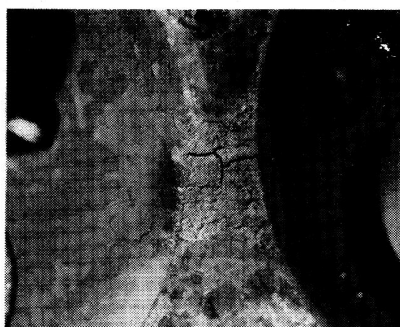
e) Drill and ream a 1/8" (3.17 mm) diameter hole 3/16" (4.76 mm) deep between the side of the insert and the cylinder head. Drive in the locking pin and peen over the insert and locking pin.

7 Clean the pistons and the top of the cylinder bores. If the pistons are still in the bores then it is essential that great care is taken to ensure that no carbon gets into the bore for this will scratch the cylinder walls or cause damage to the pistons and rings. To stop it happening, first turn the crankshaft so that two of the pistons are at TDC. Place a clean non-fluffy rag into the other bores or seal them off with paper and masking tape. Seal off all other openings in the cylinder head and to the sump.

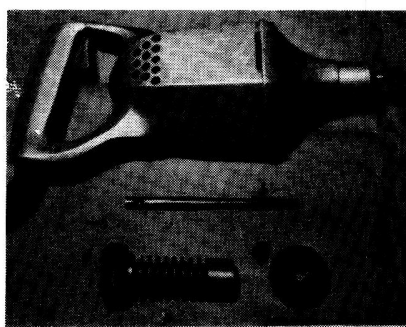
8 It is a matter of opinion as to how much carbon ought to be removed from the piston union. Some consider that a ring of carbon should be left around the edge of the pinion and on the

cylinder bore walls as an aid to keep oil consumption low. We feel that this is probably true for engines with worn bores, but with an engine in good condition the tendency should be to remove all trace of carbon.

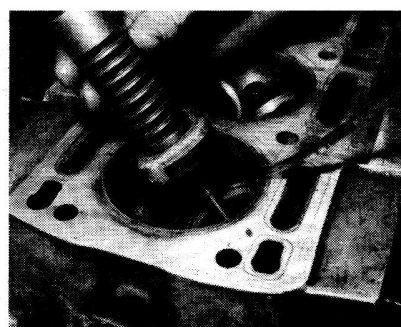
9 If all traces of carbon are to be removed, press a little grease into the gap between the cylinder walls and the pistons that are to be worked on. With a blunt scraper carefully scrape away all carbon from the piston crown, taking care not to scratch the surface. Also scrape away carbon from the surrounding lip of the cylinder wall. When all carbon has been removed, scrape away the grease which will now be contaminated with carbon particles taking care not to press any into the bores. To retard carbon build up the piston crown can be polished with metal polish but be careful that the polish is not allowed to run into the bore.



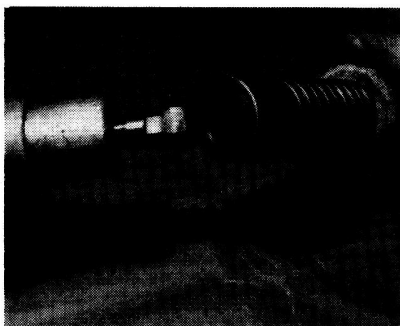
41.2. Burning and cracking of cylinder head



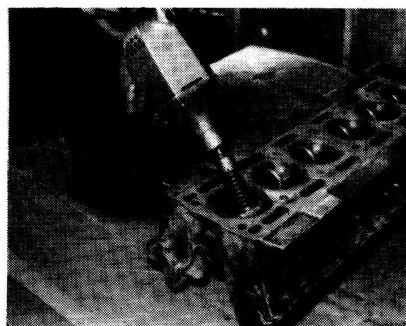
41.4a. Valve seat refacing equipment



41.4b. Valve seat refacing stone



41.4c. Drive for refacing stone



41.4d. Refacing the valve seat



47.1. Engine stabiliser - perished rubber

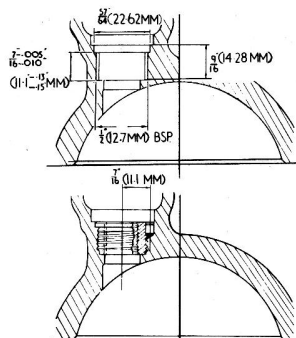


Fig.1.25. Fitting dimensions for spark plug inserts

e) Drill and ream a 1/8" (3.17 mm) diameter hole 3/16" (4.76 mm) deep between the side of the insert and the cylinder head. Drive in the locking pin and peen over the insert and locking pin.

7 Clean the pistons and the top of the cylinder bores. If the pistons are still in the bores then it is essential that great care is taken to ensure that no carbon gets into the bore for this will scratch the cylinder walls or cause damage to the pistons and rings. To stop it happening, first turn the crankshaft so that two of the pistons are at TDC. Place a clean non-fluffy rag into the other bores or seal them off with paper and masking tape. Seal off all other openings in the cylinder head and to the sump.

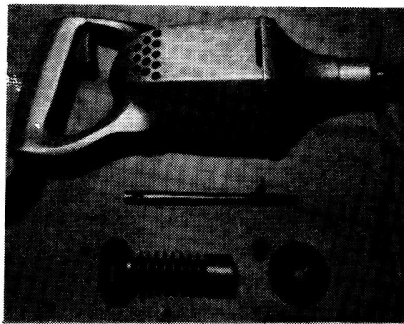
8 It is a matter of opinion as to how much carbon ought to be removed from the piston union. Some consider that a ring of carbon should be left around the edge of the pinion and on the

cylinder bore walls as an aid to keep oil consumption low. We feel that this is probably true for engines with worn bores, but with an engine in good condition the tendency should be to remove all trace of carbon.

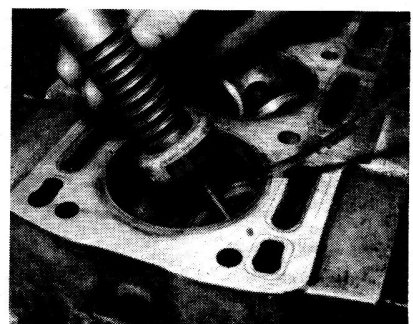
9 If all traces of carbon are to be removed, press a little grease into the gap between the cylinder walls and the pistons that are to be worked on. With a blunt scraper carefully scrape away all carbon from the piston crown, taking care not to scratch the surface. Also scrape away carbon from the surrounding lip of the cylinder wall. When all carbon has been removed, scrape away the grease which will now be contaminated with carbon particles taking care not to press any into the bores. To retard carbon build up the piston crown can be polished with metal polish but be careful that the polish is not allowed to run into the bore.



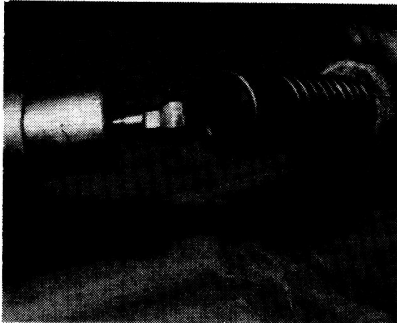
41.2. Burning and cracking of cylinder head



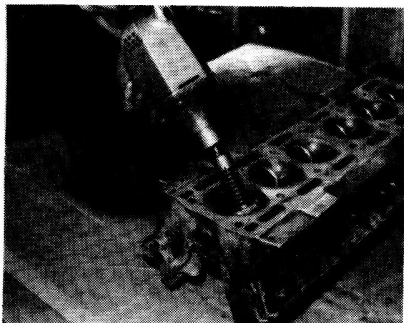
41.4a. Valve seat refacing equipment



41.4b. Valve seat refacing stone



41.4c. Drive for refacing stone



41.4d. Refacing the valve seat



47.1. Engine stabiliser - perished rubber

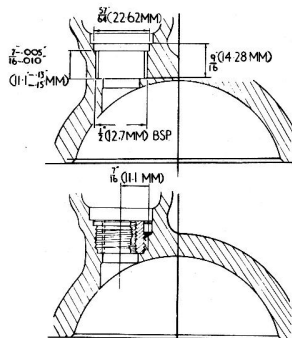


Fig.1.25. Fitting dimensions for spark plug inserts

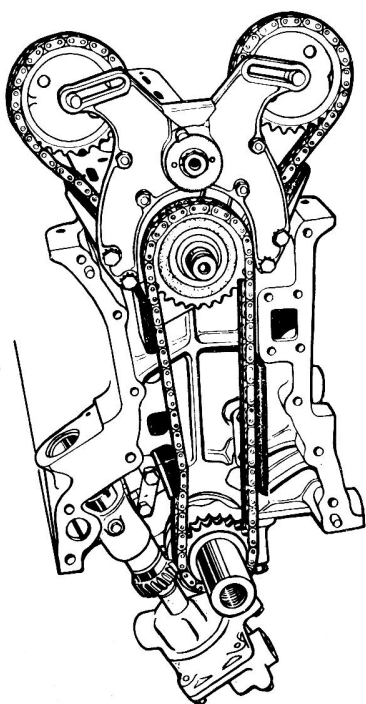


Fig.1.26. Arrangement of timing gear

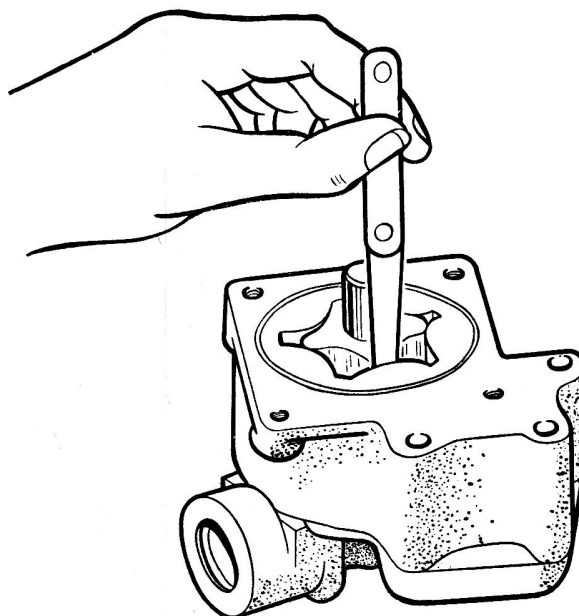
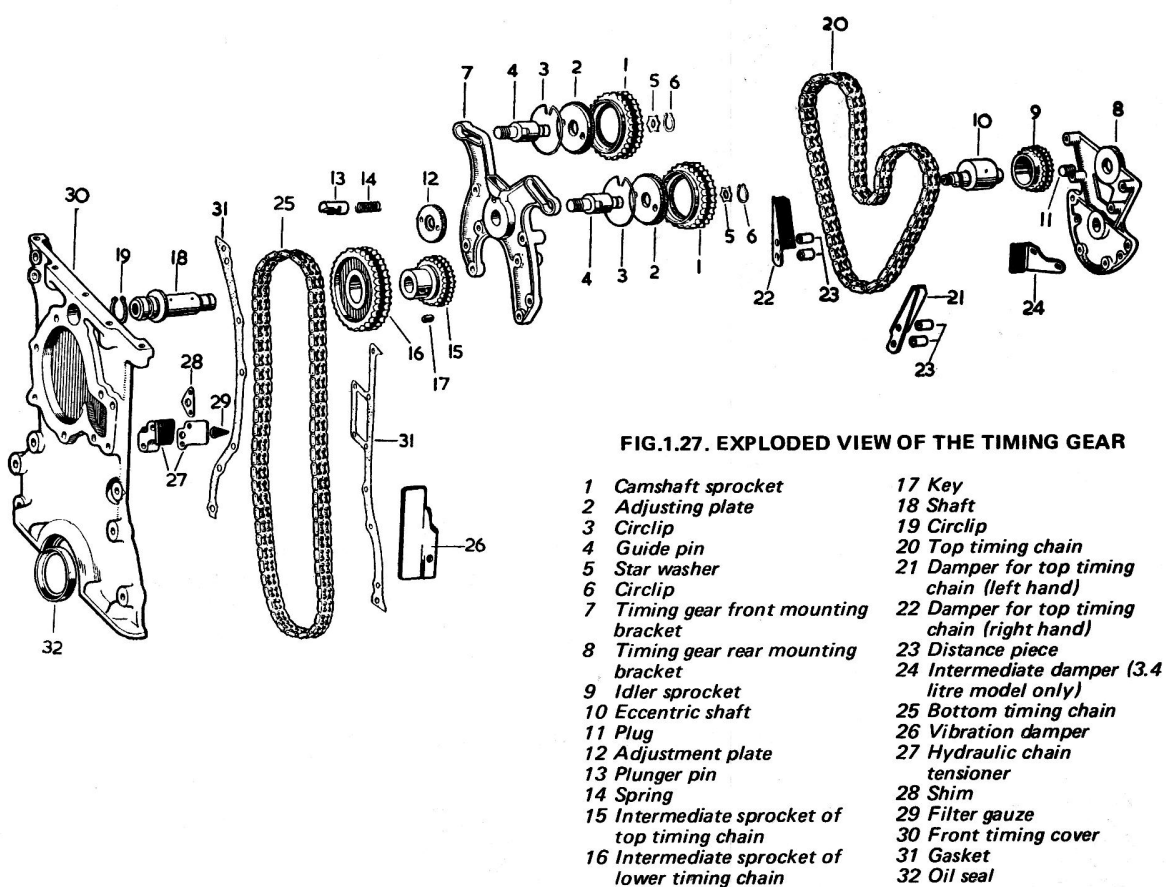


Fig.1.29. Measuring the clearance between the inner and outer rotors



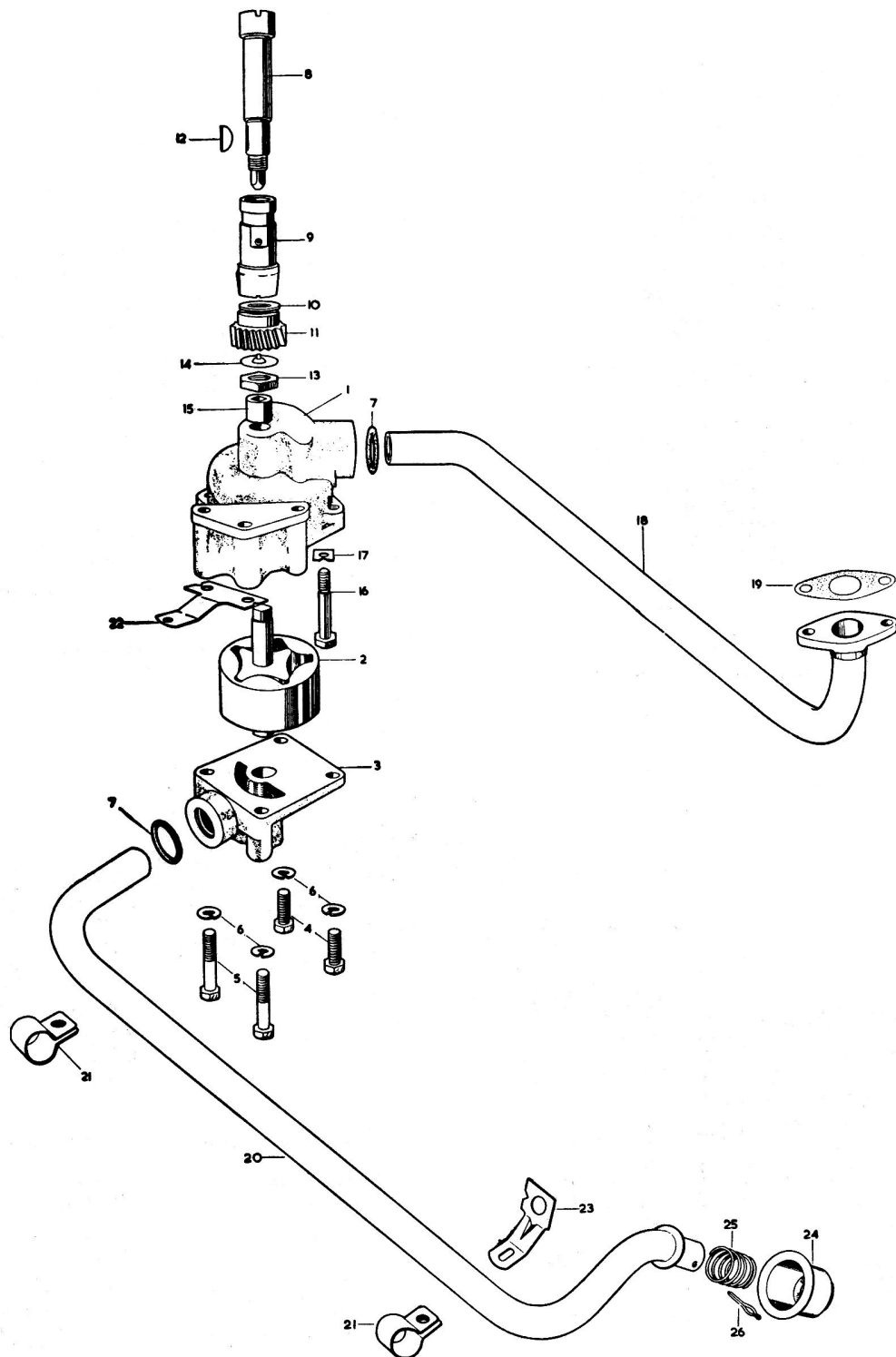


FIG.1.28. EXPLODED VIEW OF THE OIL PUMP

- 1 Body
- 2 Rotor assembly
- 3 Cover
- 4 Setscrew
- 5 Setscrew
- 6 Spring washer
- 7 'O' ring

- 8 Drive shaft
- 9 Bush
- 10 Washer
- 11 Helical gear
- 12 Key
- 13 Nut
- 14 Locking washer

- 15 Shaft
- 16 Dowel bolt
- 17 Tab washer
- 18 Oil delivery pipe
- 19 Gasket
- 20 Oil suction pipe
- 21 Clip

- 22 Suction pipe supporting strut
- 23 Suction pipe supporting strut
- 24 Hood
- 25 Spring
- 26 Split pin

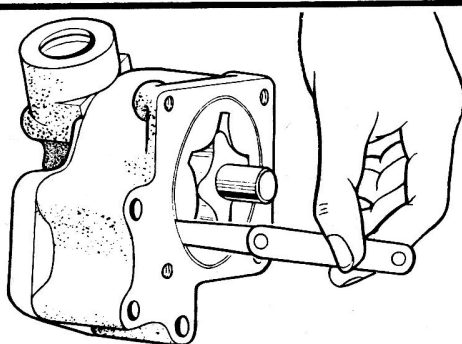


Fig.1.30. Measuring the clearance between the outer rotor and the pump body

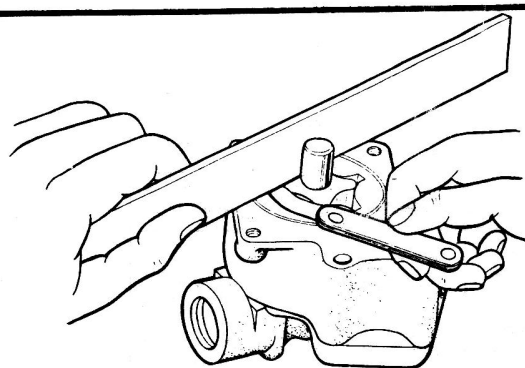


Fig.1.31. Checking endfloat of the rotors

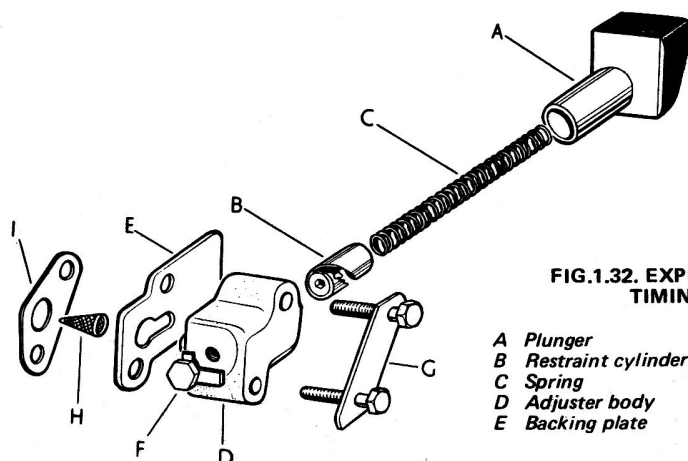


FIG.1.32. EXPLODED VIEW OF THE BOTTOM TIMING CHAIN TENSIONER

A Plunger
B Restraint cylinder
C Spring
D Adjuster body
E Backing plate

F End plug and tab washer
G Body securing bolts and tab washer
H Gauze filter
I Shim

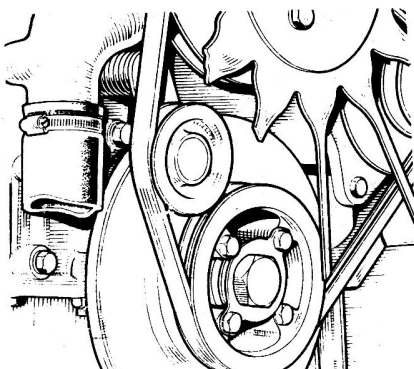


Fig.1.33. Automatic fan belt tensioner

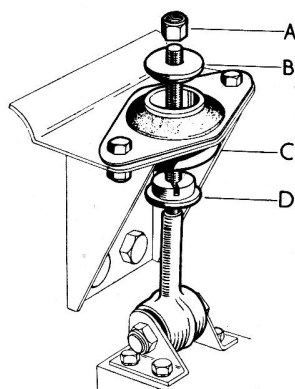


Fig.1.34. The engine stabiliser

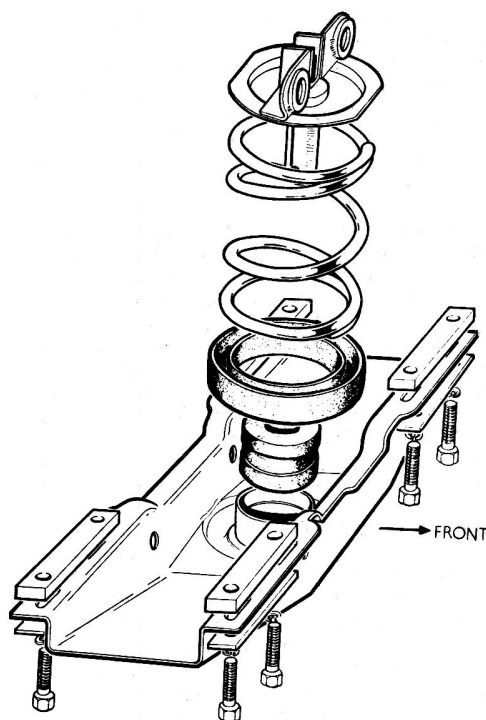


Fig.1.35. Exploded view of the rear engine mounting

are fitted with air cleaners of the oil bath type as are early 3.4 and 3.8 litre models. Later production cars are fitted with paper element air cleaner.

51 Air cleaners - maintenance

The air cleaners should be serviced at overhaul of the engine irrespective of the mileage since the last routine servicing of the car.

Oil bath type:-

Unscrew the wing nut and remove the top cover, lift out the filter element and oil base. Wash the element by swishing up and down in a bowl of clean paraffin and allow to drain thoroughly. Empty the oil from the oil base and clean out the accumulated sludge. Fill the base with engine oil to the level indicated by the arrow, it is not necessary to re-oil the filter element as this is done automatically when the engine is run. Ensure that the top cover gasket is in good condition and reassemble the filter.

Paper element type:-

The only maintenance necessary is to replace the element and ensure that the air cleaner assembly in general is clean.

52 Engine reassembly - general

1 To ensure maximum life with minimum trouble from a rebuilt engine not only must every part be correctly assembled but everything must be spotlessly clean, all oilways must be clear, locking washers and spring washers must always be fitted where needed and all bearings and other working surfaces must be thoroughly lubricated during assembly in order to afford initial lubrication to parts when first starting the engine. Before assembly begins renew any bolts or studs the threads of which are in any way damaged, use new spring washers whenever possible and always use new self locking nuts. Never re-use a split pin despite the fact that the removed pin may appear to be in good condition. Use soft iron locking wire, or annealed copper wire, in places where locking wire is called for.

2 Apart from your normal tools, a good supply of non-fluffy rag, an oil can filled with engine oil, a set of new gaskets and a torque wrench should be collected together.

53 Crankshaft - replacement

Ensure that the crankcase is thoroughly clean and that all the oilways are clear. A thin twist drill is handy for cleaning them out. If possible blow them out with compressed air. Treat the crankshaft in the same fashion and then inject engine oil into the crankshaft oilways.

1 Fit the top half of the rear oil seal cover assembly at the rear of the cylinder block. Fit the top half of the oil seal. Later cars have a modified rear end cover incorporating an asbestos rope oil seal, Fig.1.36, in an annular groove in place of the older type cork seal. A modified crankshaft is also introduced with the new seal. Take the new asbestos seals and carefully tap them on the side face to narrow the section of the seal. Fit the seals to the housing and press into the groove using a hammer handle until the seal does not protrude from the ends of the housing. DO NOT cut the ends off the seal if they protrude from the housing but continue pressing into the groove until both ends are flush. Using a knife or similar tool, press all loose ends of asbestos into the ends of the grooves so that they will not be trapped between the two halves of the housing when assembled. Fit the asbestos seal to the bottom half of the cover assembly in the same manner as described above. The rear oil seal should now be "sized" and this is done with a special tool, Churchill Tool No.J.17 (Fig.1.37). The rear main bearing cap is fitted less shell bearings, to the cylinder block with the two halves of the seal assembly in position, tighten the cap to a torque of 83 lb.ft. Smear a small quantity of graphite grease around the inner surface of the seal and insert the tool. Ensure that the pilot end

of the sizing bar enters the bore of the main bearing then press the bar inwards and rotate at the same time until the bar is fully home. Remove the bar by pulling and twisting at the same time. Remove the three Allen screws securing the oil seal housing to the cylinder block and remove the Allen screws securing the two halves of the seal and remove the rear main bearing. If this tool is not available there will be no option but to "work" the seal in on assembly of the crankshaft.

2 Clean the locations for the half main bearing shells in the crankcase and fit the half bearing shells.

3 Lay the crankshaft in the bearing shells.

4 Fit the bottom half of the oil return thread cover to the top half which is bolted to the cylinder block behind the rear main bearing.

5 Check the clearance between the oil return thread cover and the oil return thread on the crankshaft, this should be 0.0025" to 0.0055" (0.06 to 0.14 mm).

6 Fit the centre main bearing cap with a new thrust washer white metal side outwards, to the recess in each side of the cap. Tighten down the cap and check the crankshaft end float, this should be 0.004" to 0.006" (0.10 to 0.15 mm). The thrust washers are supplied in two sizes, standard and 0.004" (0.10 mm) oversize and should be selected to bring the end float within permissible limits. There is no objection to use of an oversize and a standard washer on the same shaft. The oversize washers are stamped + 0.004" (0.10 mm) on the steel face.

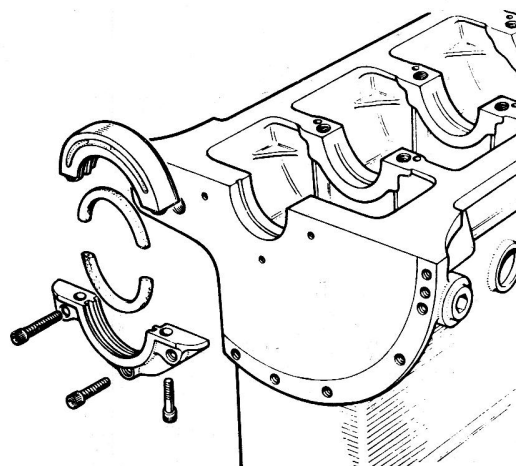


Fig.1.36. Rear oil seal - asbestos rope

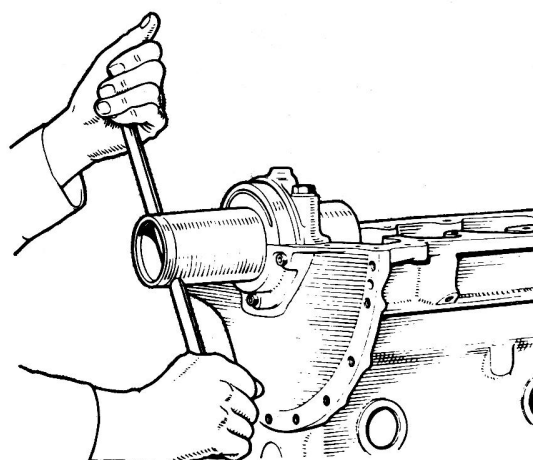


Fig.1.37. Sizing the rear oil seal

- 7 Fit the main bearing caps and shells to the crankshaft. Ensure that the numbers stamped on the caps correspond with those stamped on the crankcase.
- 8 Fit the main bearing cap bolts and tab washers and tighten down to a torque of 83 lb.f.ft. the tab washers for the rear main bearing bolts are longer than the remainder and the plain ends should be tapped down around the bolt hole bosses.
- 9 Test the crankshaft for free rotation.
- 10 If there is no undue restriction to movement of the crankshaft, knock up the tab washers to secure the bolts.

54 Piston and connecting rod - reassembly

The gudgeon pin must be replaced in the piston and then connecting rod in the same position as before removal.

- 1 If the gudgeon pin will not enter the piston, and it must not be forced, immerse the piston in a bath of hot oil for a few minutes.
- 2 Remove the piston from the oil and the gudgeon pin should now enter freely under finger pressure. Enter the pin in one half of the piston, engage the connecting rod (original way round) and push the gudgeon pin home.
- 3 Secure the gudgeon pin with a new circlip at each end.

55 Piston ring - replacement

- 1 Check that the piston ring grooves are thoroughly clean and that oilways are not blocked. Piston rings must always be fitted over the head of the piston and never from the bottom.
- 2 Refitment is the exact opposite procedure to removal, see Section 21.
- 3 Set all ring gaps at 90° to each other.
- 4 As each ring is fitted, make sure that it is free in its groove.
- 5 When new rings are fitted to the piston the side clearance in the grooves should be checked on assembly. This clearance should be 0.001" to 0.003" (0.025 to 0.076 mm).
- 6 Ensure that the rings are fitted to their correct positions and are the correct way up (Fig.1.23).

56 Piston - replacement

Fit pistons complete with connecting rods, to the cylinder bores as follows:-

- 1 Turn the engine on its side.
- 2 Wipe the cylinder bores clean with a clean non-fluffy rag.
- 3 The pistons, complete with connecting rods, must be fitted to their respective bores from the top of the cylinder block. As each piston is inserted into the bore, make sure that it is the correct assembly for that bore by checking the number stamped on the connecting rod, (No.1 cylinder is the rear of the engine).
- 4 Ensure that the pistons are the correct way round in the cylinder, the piston crown is marked "Front" to aid reassembly (Fig.1.38).

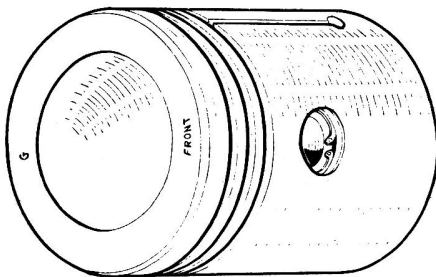


Fig.1.38. Markings on the piston crown

- 5 Check that the piston ring gaps are at 90° to each other.
- 6 Compress the piston rings in a clamp. Guide the piston into the bore until it reaches the ring compressor. Gently tap the piston into the bore with a wood or hide hammer.
- 7 Do not try to fit the pistons without a ring compressor as the chance of breaking a ring and scoring the bore is very high. If a compressor is not available then a suitable jubilee clip is better than nothing but make sure that the clip is not tightened too much.

57 Connecting rod to crankshaft - reassembly

- 1 Wipe the connecting rod half of the big end bearing location and the underside of the shell bearing clean, and fit the shell bearing in position with its locating tongue engaged with the corresponding groove in the connecting rod. Always fit new shells.
- 2 Generously lubricate the crankpin journals with engine oil and turn the crankshaft to a handy position for the connecting rod to be drawn onto it and for the connecting rod cap to be fitted.
- 3 Fit the bearing shell to the connecting rod cap in the same manner as with the connecting rod itself.
- 4 Generously lubricate the shell bearing and offer up the cap to the connecting rod, ensure that the numbers are mating.
- 5 Fit new connecting rod bolts.
- 6 Fit the nuts (new self locking nuts if being used), tighten them to a torque of 37 lb.f.ft and fit new split pins if applicable.

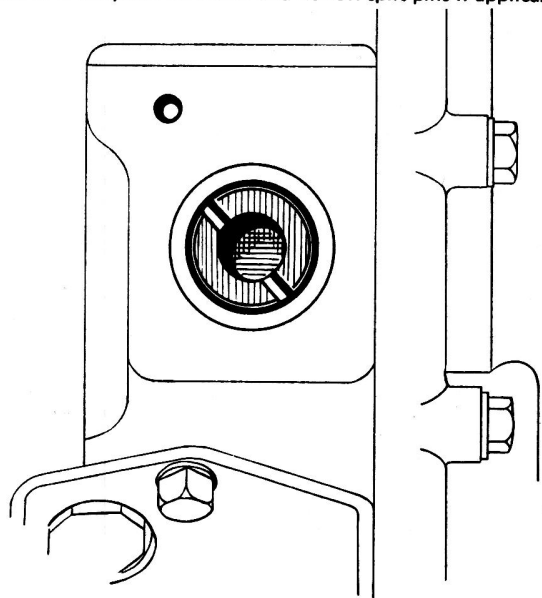


Fig.1.39. Position of the distributor drive offset when No.6 piston is at T.D.C.

58 Crankshaft gear and sprocket - reassembly

- 1 Fit the Woodruff key and drive on the helical distributor drive gear with the widest part of the boss to the rear.
- 2 Fit the Woodruff key and drive on the crankshaft timing gear sprocket.
- 3 Fit the oil thrower, washer and distance piece.
- 4 Turn the engine until No's 1 and 6 pistons are at TDC.

59 Distributor and oil pump drive gear - reassembly

- 1 Fit the distributor drive shaft to the bush on the front face of the cylinder block with the offset slot in the top of the shaft positioned as shown in Fig.1.39.

- 2 Fit the thrust washer and drive gear to the shaft, noting that the gear is keyed to the shaft.
- 3 Fit the pegged tab washer with the peg in the keyway of the drive gear.
- 4 Engage the retaining nut, fully tighten it and then check the end float of the shaft which should be 0.004" to 0.006" (0.10 to 0.15 mm). If no clearance exists fit a new oil pump/distributor driving gear which will restore the clearance.
- 5 Secure with the tab washer when the clearance is satisfactory.

60 Oil pump and pipes - reassembly

- 1 Fit the coupling shaft between the squared end of the distributor drive shaft and the driving gear of the oil pump.
- 2 Secure the oil pump to the front main bearing cap by the three dowel bolts and tab washers. Check that there is appreciable end float of the short coupling shaft.
- 3 Fit the oil delivery pipe from the oil pump to the bottom face of the crankcase with a new 'O' ring and gasket.
- 4 Fit the suction pipe with a new 'O' ring at the oil pump end and secure to its clip on the main bracket cap.

61 Timing gear - assembly

- 1 Fit the eccentric shaft to the hole in the front mounting bracket.
- 2 Insert the spring and locking plunger for the serrated plate to the hole in the front mounting bracket.
- 3 Fit the serrated plate and secure with the shakeproof washer and nut.
- 4 Fit the idler sprocket (21 teeth) to the eccentric shaft.
- 5 Fit the two intermediate sprockets (20 and 28 teeth) to their shaft with the larger sprocket forward and press the shaft through the lower central hole in the rear mounting bracket. Secure with the circlip at the rear of the bracket. The intermediate sprockets of later models are a one piece casting.
- 6 Fit the top timing chain (longer chain) to the small intermediate sprocket and the bottom timing chain (shorter chain) to the large intermediate sprocket.
- 7 Loop the upper timing chain under the idler sprocket and offer up the front mounting bracket to the rear mounting bracket with the two chain dampers interposed between the brackets.
- 8 On models other than the 2.4 litre and 240, fit the intermediate damper to the bottom of the rear mounting bracket and secure with two screwdriver slotted screws and tab washers. Pass the four securing bolts through the holes in the brackets, the chain dampers and spacers noting that shakeproof washers are fitted under the bolt heads.
- 9 Secure the two mounting brackets together with four nuts and shakeproof washers.

62 Timing gear - reassembly to engine

- 1 Fit the lower timing chain damper and bracket to the front face of the cylinder block with two set bolts and locking plate.
- 2 Offer the timing gear assembly up to the cylinder block. Loop the bottom timing chain over the crankshaft sprocket and secure the mounting brackets to the front face of the cylinder block with the four long securing bolts and the two screwdriver slotted set screws which, on the 3.4 and 3.8 litre and 340 models, also secure the intermediate timing chain damper bracket.
- 3 Do not fully tighten the two setscrews until the four long securing bolts are tight.

63 Timing chain tensioner - reassembly

- 1 Place the bottom timing chain tensioner, the backing plate

and the filter in position so that the spigot on the tensioner aligns with the hole in the cylinder block.

- 2 Fit the shims as may be necessary, between the backing plate and the cylinder to bring the rubber slipper central on the timing chain (Fig.1).
- 3 Fit the tab washer and the two securing bolts. Tighten the bolts and lock them with the tab washers.
- 4 It is important that the locking mechanism is not released until the adjuster has been finally mounted on the engine with the timing chain in position.
- 5 Remove the hexagon headed plug and tab washer from the end of the body.
- 6 Insert the Allen key into the hole until it registers in the end of the cylinder. Turn the key clockwise until the tensioner head moves forward under spring pressure against the chain. DO NOT attempt to force the tensioner head into the chain by external pressure.
- 7 Refit the plug and lock with the tab washer.

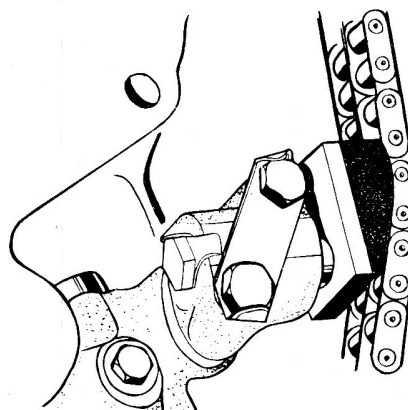


Fig.1.40. The bottom timing chain tensioner in position

64 Timing cover - refitting

- 1 Fit a new 'O' ring oil seal to the recess in the bottom face of the timing cover and ensure that the seal is well bedded in its groove.
- 2 Replace the dowels if you removed them during disassembly.
- 3 Smear the mating faces of the timing cover and the cylinder block with a good quality jointing compound and secure the timing cover to the front face of the cylinder block with the securing bolts.
- 4 Do not forget to fit the dynamo adjusting link and the distance piece, with the distance piece interposed between the link and the timing cover.

65 Oil sump - refitting

The oil sump may be refitted at this stage or, if it desired to use the base of the cylinder block on which to rest the engine for further assembly work, it may be left until later. However, to refit the sump:-

- 1 Clean the mating faces of the sump and the crankcase. Although not really necessary, they may be treated with jointing compound if desired.
- 2 Fit a new sump gasket to the bottom face of the crankcase.
- 3 Fit the oil seal to the recess in the rear main bearing cap.
- 4 Fit the sump to the crankcase and secure with the twenty-six set screws and the four nuts and washers. Remember that the short set screws goes at the right-hand front corner of the sump.
- 5 Fit the sump strainer in position using new gaskets.

66 Flywheel and clutch - refitting

- 1 Turn the engine upright.

- 2 Check the crankshaft flanges, the holes for the flywheel bolts and the dowels for freedom from burrs.
- 3 Check that No's 1 and 6 pistons are at TDC.
- 4 Fit the flywheel to the crankshaft flange so that the "B" stamped on the edge of the flywheel is approximately at BDC. This will ensure that the balance mark "B" is in line with the balance point of the crankshaft (this is a group of letters stamped on the crank throw just forward of the rear main journal).
- 5 Tap the two mushroom headed dowels into position.
- 6 Fit the locking plate and the flywheel securing set screws and tighten them to a torque of 67 lb.f.ft. Secure the screws with the locking tabs.
- 7 It is advisable to fit a new clutch driven plate now that the engine has been completely overhauled. Assemble the driven plate to the flywheel noting that one side of the plate is marked "Flywheel Side".
- 8 Centralise the driven plate by means of a dummy shaft which fits the splined bore of the driven plate and the spigot bush in the crankshaft. A constant pinion shaft may be used for this purpose.
- 9 Fit the clutch cover assembly so that the "B" stamped adjacent to one of the dowel holes coincides with the "B" stamped on the flywheel or that the marks you made, when separating the clutch from the flywheel, match up.
- 10 Secure the clutch assembly with the six set screws and new spring washers, tightening the screws a turn at a time by diagonal selection.

67 Oil filter - refitting

- 1 Ensure that the mating faces of the filter assembly and the cylinder block are clean.
- 2 Fit a new gasket between the filter assembly and the cylinder block and secure the assembly by the four set bolts.
- 3 Replace the flexible pipe between the oil filter and the sump.

68 Crankshaft damper and pulley - refitting

- 1 Fit the oil thrower followed by the distance piece.
- 2 Fit a Woodruff key to the crankshaft and assemble the split cone to the crankshaft with the widest end towards the timing cover.
- 3 Fit the damper to the cone and secure it with the flat washer, chamfered side outwards, and the bolt (nut in early models). Fit the locking plate over the bolt head (or the nut) and secure it with the two set screws.
- 4 Lock the set screws with the tabs at each end of the locking plate.

69 Distributor - refitting

- 1 Check that No.6 (front) piston is at TDC and check that the distributor drive shaft is in the position shown in Fig.1.39. It may be 180° out in which case rotate the engine through a complete revolution to again bring No.6 piston to TDC. Again check the position of the slot.
- 2 Fit the cork seal to the recess at the top of the hole for the distributor.
- 3 Secure the distributor clamping plate to the cylinder, lock with the set screw. Slacken the clamping plate bolt.
- 4 Set the micrometer adjustment in the centre of the scale.
- 5 Enter the distributor into the cylinder block with the vacuum advance unit connection facing the cylinder block.
- 6 Rotate the rotor arm until the driving dog engages with the distributor drive shaft. In this condition the rotor arm should be in the approximate position of No.6 (front) cylinder segment in the distributor cap.

70 Cylinder head - reassembly

- 1 Turn the head upside down on the bench and rest it on

wooden blocks.

- 2 Generously lubricate the valve stems with engine oil and fit them in their correct positions.
- 3 Place the wooden block that was made up for valve removal, in position to retain the valves and invert the head allowing it to rest on the block on the bench.
- 4 Fit each valve with its valve seat.
- 5 Fit oil seals to the inlet valves ensuring that the seals of the 240 and 340 models are correctly engaged with the valve guide.
- 6 Fit the valve springs and caps.
- 7 Depress the valve springs and, with the help of an assistant, fit the cotters. It has been found that a tool as illustrated in Fig.1.41 makes compression of the springs much easier. It is essentially a tube with a part section cut away and its method of use is to apply the cut away part of the valve spring and to bear down on the spring until an assistant can enter the cotters through the cut away section. Care must be taken when compressing the springs, whatever method is used, to ensure that side loads are not put on the valve stem as in all probability they would be bent.
- 8 Fit cotter retaining circlips to the valve stems (if provided for).
- 9 Replace the tappets and valve adjusting pads in their correct positions.

71 Valve clearance adjustment

Valve clearance are :-

Inlet	0.004 inch (0.10 mm)
Exhaust	0.006 inch (0.15 mm)

Important

When checking the valve clearances the camshafts must be fitted one at a time as, if one camshaft is rotated when the other shaft is in position, fouling is likely to take place between the inlet and exhaust valves. When checking of the clearances of one set of valves is completed, the shaft must either be removed or the bearing cap bolts must be slackened to the extent of relieving all pressure on the valves.

- 1 Clean the location in the cylinder head for the camshaft bearing shells. Fit the half bearing shells to the head.
- 2 Clean the bearing location in the camshaft bearing caps and fit the half shell bearings.
- 3 Fit one camshaft to the cylinder head making sure that the correct shaft is being offered to the correct set of valves. Check the numbers on the caps to that shaft and the corresponding numbers on the cylinder head and fit the caps in their correct position. Fit the nuts and 'D' washers to the bearing studs.
- 4 Tighten down on the nuts to a torque of 9 lb.f.ft.
- 5 Rotate the camshaft to bring the back of a cam to the valve tappet. Measure, and record, the clearance between the cam and the tappet. Repeat for all the valves in that bank.
- 6 Adjusting pads are available rising in 0.001" (0.03 mm) sizes from 0.85" to 0.110" (2.16 to 2.79 mm) and are etched on the surface with the letter A to Z each letter indicating an increase in size of 0.001" (0.03 mm).
- 7 Should any valve clearance require adjustment, remove the camshaft, the tappet and adjusting pad.
- 8 Observe the letter stamped on the adjusting pad and should the recorded clearance for this valve have shown, say, 0.002" (0.05 mm) in excess of the correct value, select a new adjusting pad bearing a letter two lower than the original pad.
- 9 After all the adjusting pads have been changed as may be required, reassemble the camshaft and carry out a final check to ensure that the clearances are indeed correct. Remove the camshaft or slacken all the nuts to relieve all pressure on the valves.
- 10 Repeat the foregoing to check the valve clearances for the other set of valves. When satisfied that the clearances are correct, check the security of the nuts and turn the camshaft so that the square slot in the shaft at the rear of the front bearing is at 90° to the camshaft cover face (refer to Fig.1.42).
- 11 Fit the other camshaft and position it so that its slot is also at 90° to the camshaft cover face. Fit the nuts to the studs and

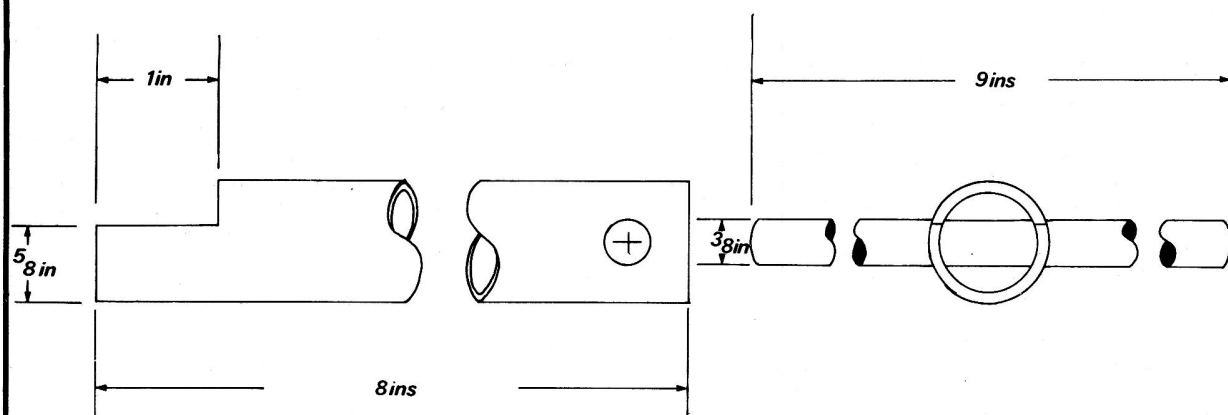
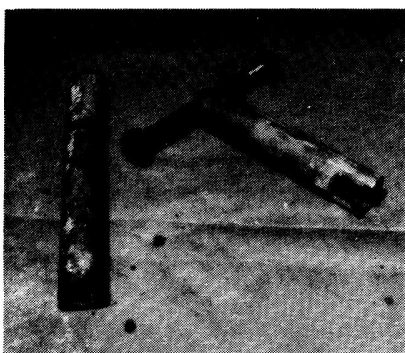


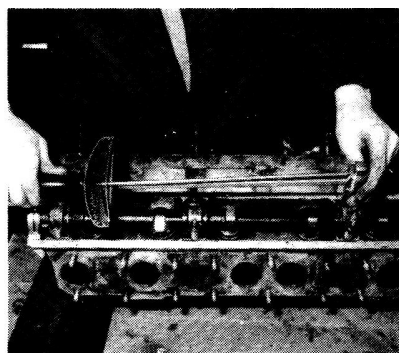
Fig.1.41. Tool for compressing valve springs



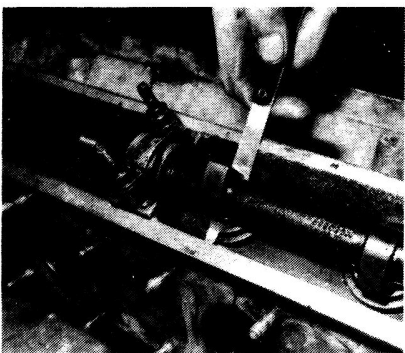
70.7a. Tools used for removing and replacing valve springs



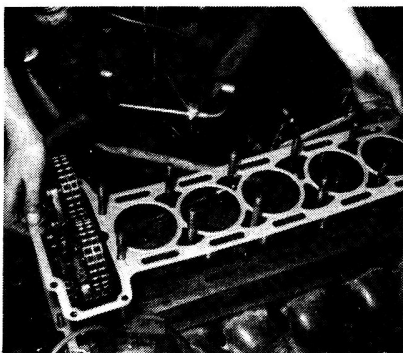
70.7b. Replacing the valve cotter pins



71.4. Tighten camshaft bearing caps to a torque of 9 lbs.f.ft



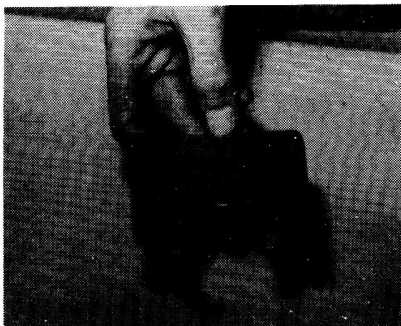
71.5. Checking tappet clearance



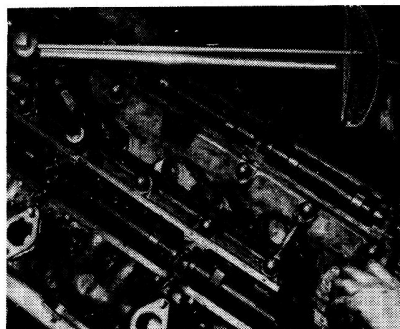
72.3a. Fit a new cylinder head gasket



72.3b. Marking on cylinder head gasket



72.4. The valve timing gauge



72.8. Tighten cylinder head nuts to a torque of 54 lb.f.ft

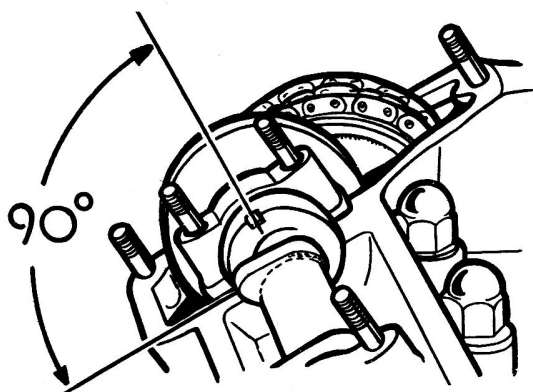


Fig.1.42. Position of slot for assembly of camshaft

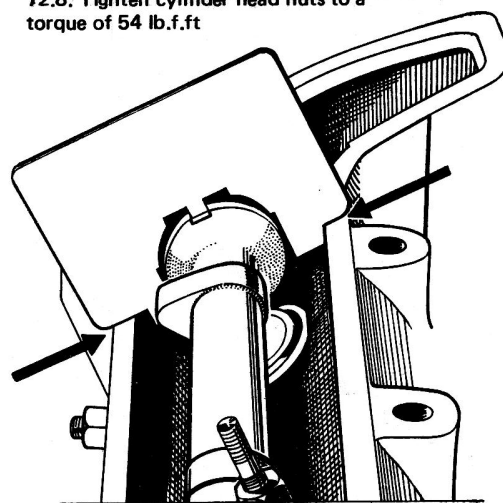


Fig.1.43. The valve timing gauge in position

tighten down (torque 9 lb.f.ft.)

12 From this point onwards the camshafts must not be rotated independently of each other.

72 Cylinder head - refitting

- 1 Ensure that the top face of the cylinder block and the mating face of the cylinder head are thoroughly clean.
- 2 Check that No.6 piston is at TDC with the distributor rotor arm opposite No.6 cylinder segment.
- 3 Fit a new cylinder head gasket to the cylinder block and make sure that it is seated right down on the top of the block, and that the side marked 'TOP' is uppermost.
- 4 Check that the slot in the camshafts are at 90° to the camshaft cover face and accurately position them by engaging the valve timing gauge. The valve timing gauge passes over the camshaft and rests on each side of the camshaft cover face and at the same time a projection engages in the camshaft slot and ensures that the slot is perpendicular, Fig.1.43 illustrates the gauge in position. It may be possible for you to borrow a gauge and apart from this no suitable alternative can be proposed for the accurate position required for the camshafts in actual valve timing (see Section 73).
- 5 Fit the cylinder head, note that the second cylinder head stud from the front on the left hand side is a dowel stud.
- 6 Fit plain washers to the 3rd and 6th stud on the right hand side, the sparking plug lead carrier will be fitted to these studs later. Fit plain washers also to the two front stud positions and 'D' washers to the remainder of the studs.
- 7 Fit the fourteen dome nuts and the nuts at the front of the head and screw down finger tight.
- 8 Using a torque wrench, tighten down the nuts a turn at a time, in the order shown in Fig.1.8, to a torque of 54 lb.f.ft.

73 Valve timing

- 1 It is important to tension the top timing chain before attempting to check or set the valve timing. If the engine is in course of reassembly, fit the sprockets to their respective camshafts. Tighten down on the securing set screws but do not lock them at this stage.
- 2 By access through the breather aperture in the front of the cylinder head, slacken the locknut securing the serrated plate (see Fig.1.44), press the locking plunger inwards and rotate the serrated plate, by engaging a tool (a pair of round nosed pliers will be found suitable), in an anti-clockwise direction. Turn the engine each way slightly and check the chain tension. When tensioned correctly there should be slight flexibility on both outer sides below the camshaft sprockets, the chain should not be dead tight. Release the locking plunger to the serrated plate and securely tighten the plate locking nut.
- 3 Remove the locking wire (if applicable) from the setscrews securing the camshaft sprockets, it may be necessary to rotate the engine to gain access to both the screws.
- 4 By reference to the timing marks on the crankshaft damper, or in early cars the timing marks on the flywheel (see Fig.1.45), turn the engine until No.6 piston is exactly on Top Dead Centre with the distributor rotor arm opposite No. 6 segment.
- 5 Tap the camshaft sprockets off the flanges of the camshafts and make provision for them not to fall into the sump.
- 6 Accurately position the camshafts with the valve timing gauge (refer to paragraph 4 of Section 72) so that the slots are perpendicular to the face of the camshaft cover.
- 7 Refer to Fig.1.46. Withdraw the circlips retaining the adjuster plates to the camshaft sprockets and press the adjusting plates forward until the serrations disengage. Replace the sprockets on the flanges of the camshafts and align the two holes in the adjuster plate with the two tapped holes in each camshaft flange.



73.2 Tool for rotating serrated plate

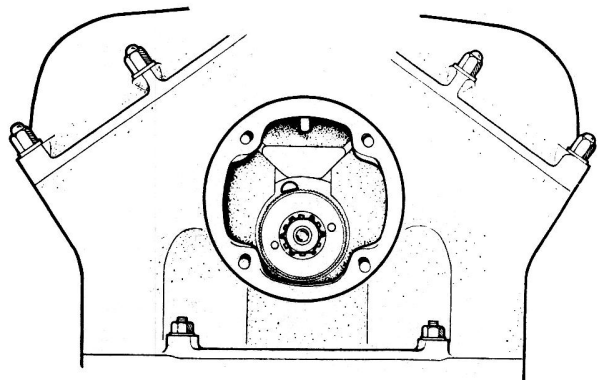


Fig.1.44. The serrated plate for adjustment of the top timing chain

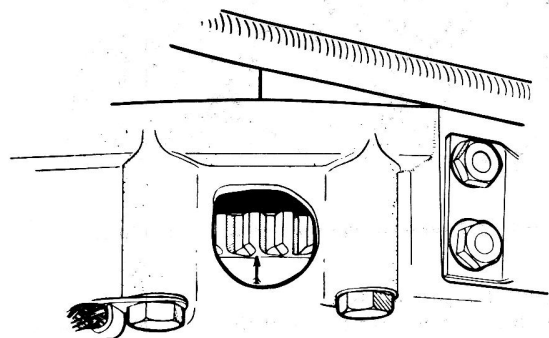
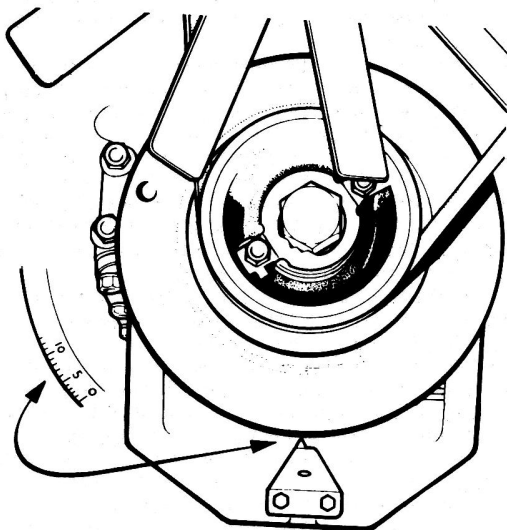
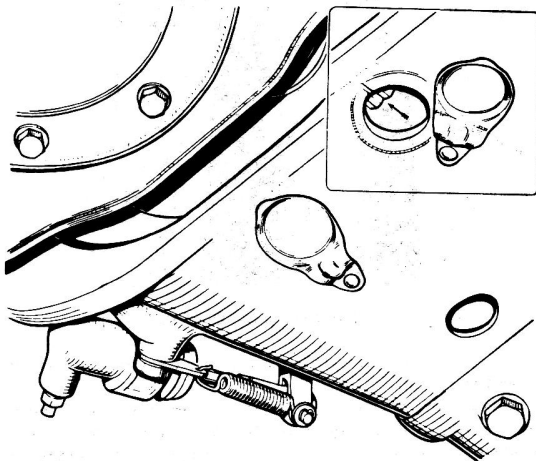


Fig. 1.45. Top dead centre marks, alternative positions (section 73.4)

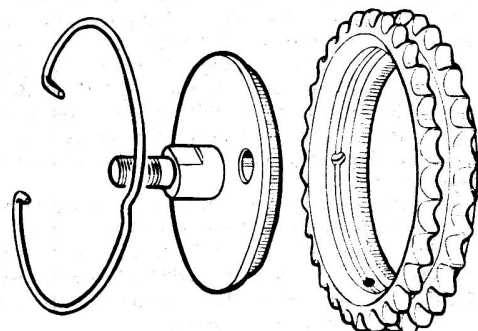


Fig.1.46. The camshaft sprocket assembly

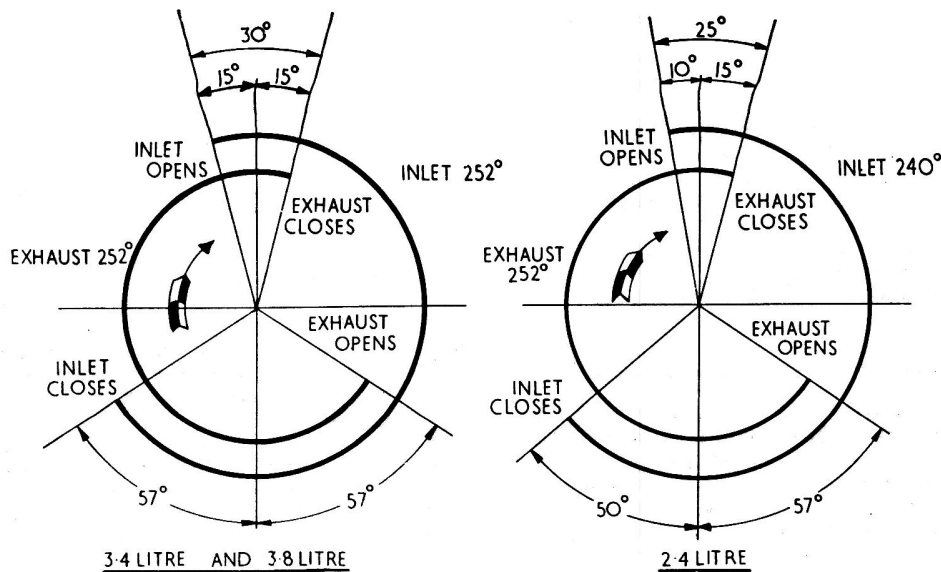


Fig.1.47. Valve timing diagrams

Engage the serrations of the adjuster plate with the serrations in the sprockets. It is important that the holes are in exact alignment, otherwise when the setscrews are fitted, the camshafts will be moved out of position.

8 If difficulty is experienced in aligning the holes correctly the adjuster plates should be turned through 180° and this, due to their construction, will facilitate alignment.

9 Refit the circlips to the sprockets and secure the sprockets with the setscrews turning the engine as necessary after one setscrew has been fitted to give access to the other screw.

10 Turn the engine and repeat the above operations to check the correctness of the valve timing.

11 If the timing is satisfactory, lock the setscrews with locking wire. It is advisable to put some rags in the front cover aperture if you have to cut off the ends of the locking wire to prevent them falling into the sump.

12 Place new gaskets on the camshaft cover faces. Refit the camshaft covers and tighten down on the dome nuts.

74 Inlet manifold - refitting

1 Clean the mating faces of the inlet manifold and the cylinder block.

2 Place a new gasket over the inlet manifold studs on the cylinder block. Offer up the inlet manifold and tighten down evenly on the nuts.

3 Fit the thermostat and, using a new gasket, refit the thermostat cover.

4 Refit the fuel pipes to the underside of the manifold. Be careful not to cross thread the nuts.

75 Cylinder head oil feed pipe - refitting

Fit the cylinder head oil feed pipe from the tapped hole in the main oil gallery to the two tapped holes in the cylinder head. Secure the pipe with the three banjo bolts fitting a new copper washer on both sides of each banjo.

76 Water pump - refitting

1 Clean the mating faces of the water pump and the timing cover. They may be treated with a sealing compound if desired.

2 Fit a new gasket over the studs in the timing cover.

3 Fit the water pump to the timing cover and secure with the

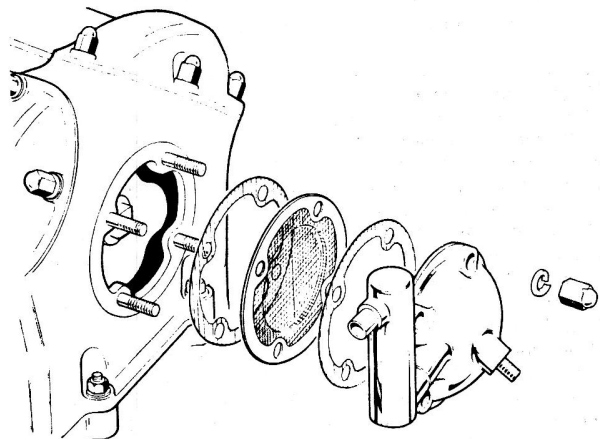


Fig.1.48. Engine breather - gauze type

six bolts and the three nuts and spring washers to the studs. Tighten down evenly all round.

4 Fit the hose from the pump to the thermostat housing and tighten the clips.

77 Engine breather assembly - refitting

1 Clean the mating faces of the engine breather and of its location at the front of the cylinder block.

2 Fit a new cork washer over the studs in the cylinder head.

3 Fit the gauze filter, or the perforated plate in early cars, over the studs followed by another cork washer.

4 Fit the breather assembly and secure with the four dome nuts.

78 Gearbox - refitting

- 1 Offer up the gearbox to the crankcase and make sure that it is fully home.
- 2 Replace the set bolts and nuts securing the clutch housing to the engine starting at the top and working downwards. The gearbox assembly must be supported during this operation to avoid straining the clutch driven plate and the constant pinion shaft.
- 3 Tilt the engine to give access to the flywheel dust cover and secure the cover with the four nuts and bolts.
- 4 Replace the starter and its curved metal rod and secure with the two nuts and bolts.

79 Final assembly

- 1 Refit the automatic fan belt tensioner where applicable (later model 3.4 and 3.8 litre cars, the 240 and 340 models).
- 2 Fit a new 'O' sealing ring to the revolution counter generator, assemble the generator to its drive in the rear of the inlet camshaft and secure in position with the plate washer, three socket head screws and locking washers.
- 3 The engine stabiliser should be fitted to the engine at this stage as assembly after the engine is installed will not be an easy task. Engage the stabiliser with its mounting and press the securing bolt through the mounting brackets and the rubber of the stabiliser. Secure the bolt with its self locking nut. Screw the flanged washer ('D' in Fig.1.34) well down the stem of the stabiliser so that it will not cause any obstruction when moving the engine into position in the car.
- 4 The engine is now ready to be replaced in the car.

80 Engine replacement

The engine and gearbox could be replaced by one man and a suitable hoist but the job will be made much easier, and safer, with the help of an assistant. Generally replacement is the reverse sequence to removal.

- 1 Ensure that all leads, cables etc., are tucked out of the way in the engine bay. It is easy to trap one and cause much additional work when the engine is replaced.
- 2 Fit the lifting plate to the engine in the manner described in Section 5 paragraph 54.
- 3 Hoist the engine into position in the engine bay, fit the rear mounting and raise the rear of the engine to bring the mounting into position on the underbody of the car. During this operation ensure that the engine stabiliser enters its mounting bracket on the front bulkhead. Ensure that the packing washers are correctly positioned to the rear mounting bracket.
- 4 Secure the engine at each front mounting.
- 5 Replace parts and make all connections generally in the

reverse order to that set out in Section 5.

- 6 Check that all drain taps have been closed and that the sump and gearbox drain plugs are tight.
- 7 Refill the cooling system and the engine and gearbox with the recommended type of lubricating oil.
- 8 Carefully check all water unions for leaks, tighten up as necessary.
- 9 Refer to Fig.1.34. Adjust the engine stabiliser by screwing the lower flanged washer (D) up the pin until the flange contacts the bottom of the stabiliser rubber mounting (C). The washer is slotted on its upper face and can be screwed up the pin by engaging a thin bladed screwdriver in the slot through the centre hole of the rubber mounting. Fit the upper flanged washer (B) and tighten down with the locking nut (A). Do not overtighten the lower flanged washer as this can cause vibration and/or fouling of the gearbox in its cowl due to the engine having been pulled up on its mountings.

81 Engine - initial start up after overhaul and major repair

Refer to Chapter 3 and follow the instructions for initial setting of the carburettors, and follow the instructions in Chapter 4 for timing of the ignition.

Make sure that the battery is fully charged and that all lubricants and fuels are replenished.

Switch on the ignition and allow the petrol pump time to fill the carburettor float chambers.

Start the engine, as soon as it fires and runs, keep it going at a fast tickover only (no faster). Watch the oil pressure gauge, after a very short wait, whilst the oil filter is being filled, it should register around 40 lbs per sq.in. If, after about 30 seconds, no oil pressure is registered, switch off the engine and investigate the cause; it may be that you have not fully tightened a union or the filter canister is not correctly seated on the rubber sealing ring in the head of the filter.

Bring the engine up to its normal working temperature, as it warms up there will be odd smells and some smoke from parts getting hot and burning off oil deposits. Look round carefully for water and oil leaks.

When the engine running temperature has been reached adjust the carburettors as described in Chapter 3.

Stop the engine and wait a few minutes to see if there are any water or oil leaks.

Before road testing the car it is advisable to have an assistant listening to the brake servo exhaust, run the engine for a few minutes and then operate the foot brake. If the brake servo connections are satisfactory the exhaust from the servo will be plainly heard.

Road test the car to check that the timing is correct and is giving the necessary smoothness and power. Do not race the engine. If new bearings or pistons or rings have been fitted, it should be treated as a new engine and run in at reduced revolutions for the first 500 miles.

Chapter 2 Cooling system

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Specifications

Type
Total capacity of coolant including heater									Pressurised system thermostatically controlled
Water pump - type									2.4 litre/240
drive									3.4, 3.8 litre/340
Fan belt - andle of 'V'									20 pints(11.40 litres)
Fan - number of blades									22 pints(12.55 litres)
Fan to engine speed ratio									Centrifugal
Cooling system control									Fan belt
Thermostat data :									40° (36° for Mk 1 models)
Jaguar Part No.	Model/Engine No.		Temperature. Degrees C			Remarks			
C.3731/1	2.4 Mk 1 BB.1001 - BB.999		73 - 85/90			Must not be replaced by C.13944 or C.13944/1			
	and BC.1001 - BC.4407								
	3.4 Mk 1 KE.1001 - KE.5732								
C.13944	Commencing BC.4408 (2.4 Mk 1)		74 - 86/91			May be replaced by C.3731/1			
	KE.5733 (3.4 Mk 1)								
	All Mk 2 models and 3.8 litre								
C.13944/1	As above		80 - 92/97			For use only in cold climates			
C.27650	Mk 2 models and 3.8 litre		85 opening						
C.27650/1	As above		93 opening			For use only in cold climates			
C.28067	240 and 340		74 - 85						
C.28067/1	240 and 340		82 - 96			For use only in cold climates			

Note:- When ordering a replacement thermostat it is advisable to quote the model and engine number as there is no guarantee that the above quoted part numbers will not be superseded.

Radiator type	...	...	...	...	...
Radiator cap					
Make and type	...	...	...	...	...
Release pressure	...	...	...	...	...
Release depression	...	...	...	...	...
Radiator flow figures ; water at 62°F (17°C)					

Film - 10 fins/inch (4 fins/cm)

A.C. - relief valve

4 lbs per sq inch

½ lb

lbs per sq. in	galls/min:	Litres/min
1	15.5	70.5
1.5	19	86.5
2	22	100.0
2.5	24.5	111.5
3	26.5	120.0
3.5	29.0	131.8
4	31.0	140.9

1 General description

Water circulation is assisted by an impeller type pump mounted on the front cover of the engine. The system is pressurised and is thermostatically controlled. It is pressurised by means of the radiator filler cap which incorporates a pressure relief valve designed to hold a pressure of up to 4lbs per sq in above atmospheric pressure; when the pressure rises above 4 lbs the spring loaded valve lifts off its seat and the excess pressure escapes via the overflow pipe. As the water cools down again a small valve, incorporated in the centre of the pressure valve unit, opens and restores atmospheric pressure if a depression is caused by the cooling of the water. The object of pressurising the system is that the boiling point of the coolant is raised by approximately six degrees and thus the risk of loss of coolant by boiling is reduced. The thermostat cuts off the coolant in the engine from that in the radiator until such time as the engine coolant reaches a certain temperature at which, determined by the thermostat setting, the thermostat opens and allows free passage of the coolant round the system. The purpose of the thermostat is to ensure that the engine is brought quickly to its most efficient operating temperature.

Water is circulated from the base of the radiator block via the water pump through the cylinder block and the cylinder head passages and is returned to the radiator header tank by way of the inlet manifold water rail (and thermostat). The water is cooled in its passage from the radiator header tank, through the radiator matrix to the base of the radiator block. Cooling is enhanced by a fan, mounted on the spindle of the water pump, which draws in air through the radiator block; early model cars were fitted with four bladed fans but all later models have twelve blades to provide more efficient cooling. The capacity of the radiator is approximately 6½ pints (3.85 litres) of coolant.

The cooling system of the 240 and 340 cars is basically similar to the other models but, because of the revised inlet manifold of those cars, the thermostat is contained in a separate housing interposed between the manifold and the water outlet elbow. In addition an air bleed valve is positioned in the air vent aperture in the water outlet elbow to ensure that any air in the system is expelled to the radiator filler neck above the coolant level.

2 Cooling system - draining

The cooling system is provided with two drain taps. One a remote controlled drain tap located in the base of the radiator block and operated by a rod positioned at the left hand side of the header tank. The other, a cylinder block drain tap, is mounted on the rear left hand side of the cylinder block below the exhaust manifold.

With the car on level ground drain the system as follows:-

- 1 If possible, wait until the engine is cold. Unscrew and remove the radiator filler cap. REMEMBER the system is pressurised so DO NOT remove the cap whilst the engine is hot without taking precautions to prevent injury to yourself by the hot liquid which will be thrown out when pressure is released.
- 2 Place the heater control at HOT.

3 Open the remote control drain tap by moving the angled arm of the rod upwards the rear of the car (it may happen that the control rod has been assembled 180° out, in which case move the arm towards the front of the car). It sometimes happens that this tap becomes blocked with sludge accumulated at the bottom of the radiator and it may be possible to clear the tap by poking out with a piece of wire but if this is not successful, the tap will have to be removed. Remove the split pin securing the forked end of the rod to the tap and push upwards out of the way. Unscrew the tap by use of a spanner on the spanner flats. Be careful not to be scalded by the coolant if the engine is at normal operating temperature.

4 Open the cylinder block drain tap. This tap may also be blocked by scale and sludge in the cylinder block passages. It may be possible to also clear this tap with a piece of wire but it will, in all probability, have to be removed. Access to the tap for removal is easier from below the engine; unscrew the tap by using a spanner on the spanner flats. Again take precautions if the engine is hot.

Note if it is desired to retain the coolant, the radiator drain tap only should be opened. Open the cylinder block drain tap when the radiator tap has stopped running to ensure that the cylinder block is clear.

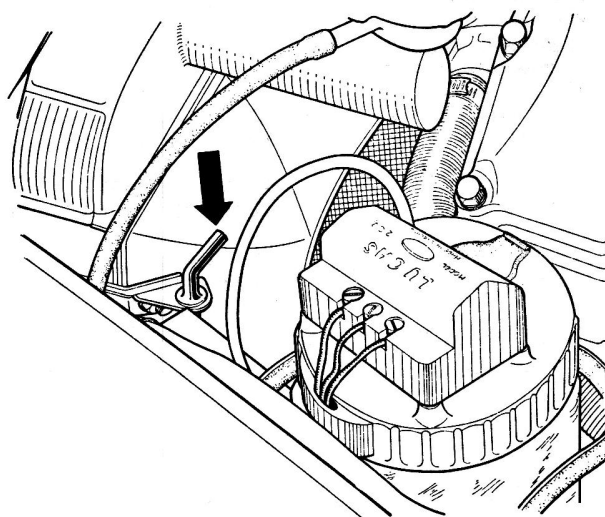


Fig.2.1. The remote control drain tap

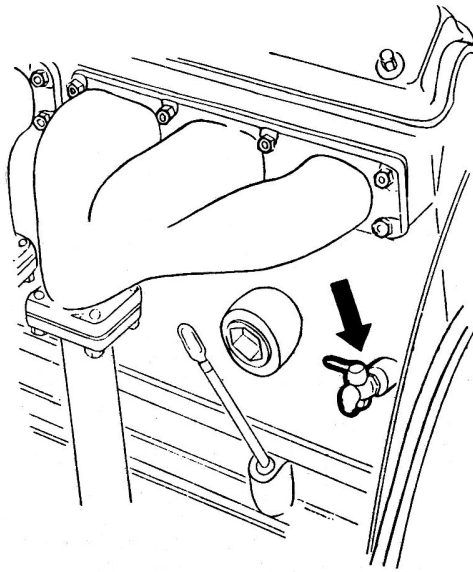


Fig.2.2. The cylinder block drain tap

3 Cooling system - flushing

1 After prolonged use it is possible that the cooling system will gradually deteriorate in efficiency as the radiator becomes choked with rust scale, deposits from the water and other sediment. The system of deterioration is boiling of the engine or high operating temperatures which cannot be accounted for by fuel or ignition or other faults. To clean the system out, remove the filler cap, the bottom hose to the radiator, the cylinder block drain tap and the thermostat (see Section 7). Replace the thermostat housing. Leave a hose running in the radiator filling hole for about fifteen minutes.

2 Reconnect the bottom hose, refit the cylinder block drain tap and the thermostat. Refill the system and at the same time add a proprietary cleaning compound. Beware of splashing the compound on paintwork as this could cause damage. The engine must now be run for the period prescribed by the makers of the compound and this should loosen all sediment and sludge which can now be removed by draining. Thoroughly flush out the system and refill with soft water.

3 In very bad cases it may be necessary to reverse flush the radiator. This can be done with the radiator in position by placing a hose in the bottom hose union of the radiator. Water under pressure is forced through the orifice and out of the filler cap hole.

4 The hose is then removed and is now placed in the filler cap hole and the radiator washed out as described above.

4 Cooling system - filling

1 Place the heater control in the HOT position.

2 Close both drain taps and fill the system slowly to ensure that no airlocks develop. It is recommended that rain water is used in the system.

3 Fill the radiator to the level of the filler hole and check that surplus water runs out of the overflow pipe. Refit the radiator cap.

4 Start the engine and run at a fast idle speed for a few minutes.

5 Stop the engine and top up the radiator as necessary.

6 Check the system for leaks at drain plugs and hoses. Rectify as necessary.

5 Radiator - removal and refitting

1 Drain the cooling system as described in Section 2.

2 Disconnect the top and bottom water hoses.

3 Remove the four nuts securing the cooling fan cowl, note that the top left hand nut also secures the bracket for the remote control drain tap rod. Remove the cowl and hang it over the fan clear of the radiator.

4 Remove the split pin securing the remote control rod to the radiator drain tap and disengage the rod.

5 On cars with automatic transmission, disconnect the two transmission oil cooler pipes running from the bracket mounted on the engine. Place a tray beneath the radiator to catch escaping oil and blank off the two unions. Blank off the pipe unions and tie the pipes up to the engine to prevent the oil syphoning out of the transmission unit.

6 Remove the set screws which attach the sides of the radiator to the body.

7 Remove the two securing nuts at the bottom mounting. Have an assistant to carefully raise the radiator; note the number of plain and rubber washers fitted to each bottom mounting bolt.

8 Carefully lift out the radiator and at the same time ensure that the matrix does not foul the fan blades. If any restriction is felt when lifting the radiator, check that it is not being caused by the tap fouling the bottom of the cowl.

Important: Always store the radiator block in an upright position to guard against any sediment which may have collected in the bottom tank passing into the small core passages and subsequently causing a blockage. Remove the cowl.

9 Refitting is the reverse sequence to the above. Ensure that the correct number of washers are fitted to each of the bottom bolts.

10 Refill the system as described in Section 4.

11 On those cars with automatic transmission, check the fluid level in the transmission unit.



5.3. Remove nuts securing cooling fan cowl



5.4. Remove remote control rod

6 Radiator - inspection and cleaning

1 Examine the top and bottom tanks for damage and leaking especially at the seams. Any leaks or possible weakness can be repaired with a compound such as Cataloy, the application of heat to the radiator, soldering for instance, is not recommended for the home enthusiast as this may result in breaking other soldered seams.

2 Examine the core for damage and corrosion. It may be possible to repair leaks from physical damage using Cataloy but if leaks are present due to corrosion it is best to replace the radiator as any repair that is made will only effect a temporary remedy. A replacement radiator can be obtained from your Jaguar agent on an exchange basis.

3 When the radiator is out of the car it is advantageous to reverse flush it in the manner described in Section 3. Clean the outside of the radiator by hosing down the matrix with a strong jet of water to clean away road dirt, dead flies etc:

4 Inspect the radiator hoses for cracks, internal and external perishing and cuts on the exterior from the hose clips. Change the hose if its condition is at all doubtful. Examine the hose clips for rust and damage and replace as necessary.

7 Thermostat - removal, testing and replacement

The thermostat is located on the top right hand water rail forward of the carburettors and is housed under an elbow

connection with a domed head.

1 To remove the thermostat first partially drain the system, approx: 8 pints will be sufficient, collect the coolant in a suitable container if it is desired to re-use.

2 Slacken the clip securing the hose to the thermostat housing and remove the hose.

3 Remove the two nuts securing the elbow pipe to the housing and remove the pipe and gasket. The thermostat will now be visible in its housing.

4 Remove the thermostat from its housing, it is possible that it will be securely held in place by scale in which case careful levering with a small screwdriver will be necessary but do not lever on the circular valve which will be seen on the top face of the thermostat.

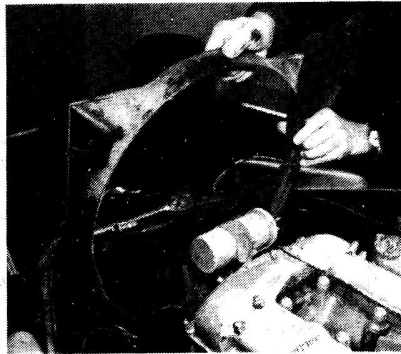
5 Clean the thermostat and ensure that the small hole on the valve is clear. If the valve is open it indicates that the thermostat is unserviceable and should be replaced with a new item of similar operating temperature, this figure will be seen on the top side of the thermostat.

6 If correct operation of the thermostat is in doubt test it by immersing it together with a 0 - 100°C thermometer in a container of cold water. Heat the water, keeping it stirred, and observe if the operation of the valve is in close agreement to the temperature marked on the body of the thermostat. Allow the water to cool down and check that the valve closes correctly.

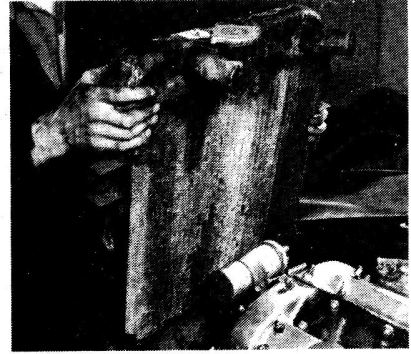
7 If the operation is satisfactory, the thermostat may be refitted in the reverse order to the above. A new gasket should be fitted between the elbow pipe and the thermostat housing.



5.7. Remove bottom securing nuts to radiator



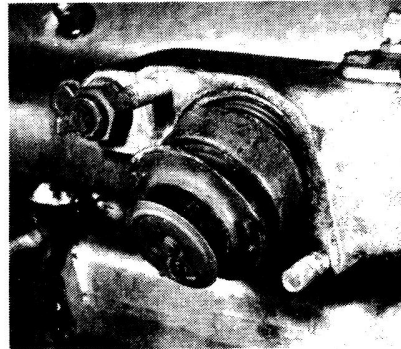
5.8a. Remove cowl



5.8b. Lift out radiator



7.3. Remove elbow pipe



7.5. Valve open. Thermostat unserviceable

8 Fan - removal and refitting

The twelve bladed fan is made in one piece and static balance is adjusted by balance pieces the position of which is marked at initial assembly with a centre punch and a small hole is also drilled through them, the fan and the hub to ensure their correct location one to the other on reassembly to preserve the balance, see Fig.2.4.

- 1 Remove the radiator as described in Section 5.
- 2 Slacken the dynamo bolts and push the dynamo towards the engine. Press against the spring on the fan belt tensioner (if fitted) to relieve tension on the belt. Then work the belt off the dynamo hub (DO NOT use a lever on it). Remove the belt.
- 3 Examine the position of the balance pieces and locating

marks, make your own marks for reassembly if you have any doubt.

- 4 Remove the fan from the hub by undoing the four set screws.

5 If it is necessary to replace any part of the fan assembly it must be rebalanced. Static balancing is effected by varying the position of the balance pieces which are retained by set screws securing the fan to the hub. These should be arranged so that the fan remains at rest in any position when set upon its hub on a ring as shown in Fig.2.5. After rebalancing, the ends of the balance pieces and the fan should be marked with a centre punch and a small hole drilled through the balance pieces, the hub and the fan. The old hole should be filled in with solder.

7 Refitting is the reverse of the procedures set out in paragraphs 1 - 5 above attention being paid to the necessity to preserve balance of the assembly.

- 8 Adjust the fan belt as described in Section 10.

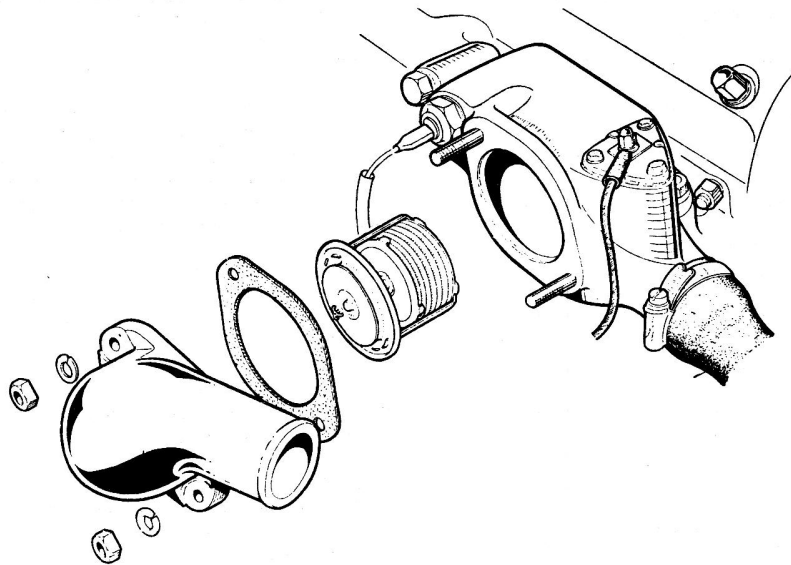


Fig.2.3. Exploded view of thermostat and housing (3.4 litre Mk.2 illustrated)

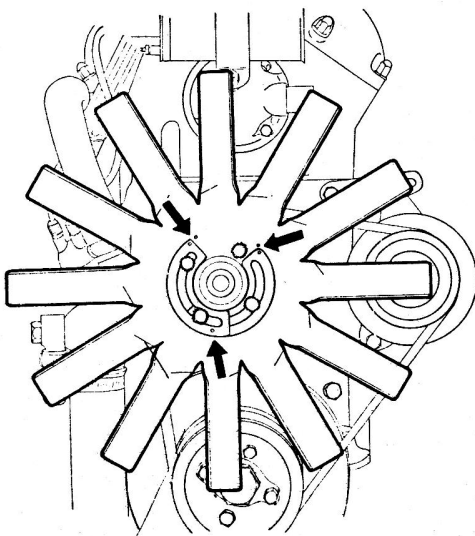


Fig.2.4. Fan showing balance pieces and location hole

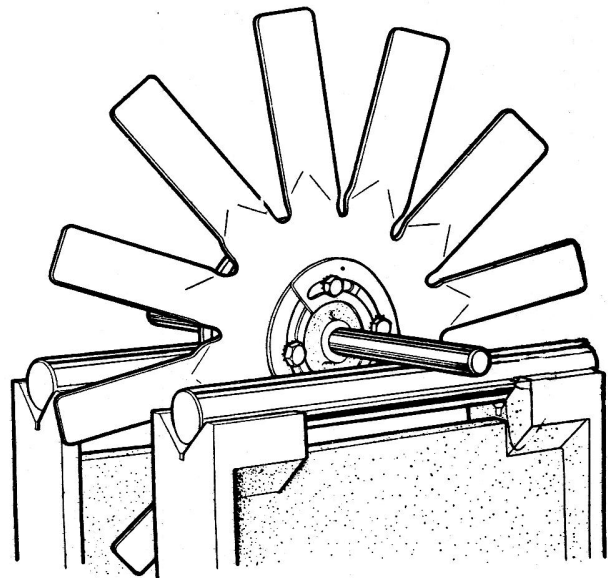
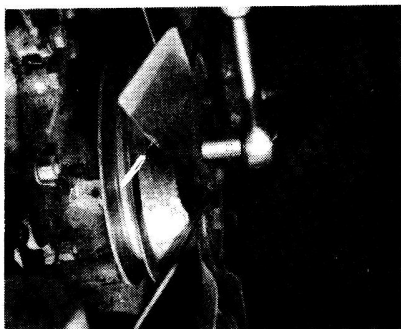


Fig.2.5. Balancing the fan assembly



8.2. Work belt off dynamo hub



8.4a. Remove setscrews securing fan



8.4b. Remove fan

9 Fan belt - removal and replacement

- 1 Loosen the dynamo mounting bolts and push the dynamo towards the engine.
- 2 If an automatic belt tensioner is fitted (see Fig.1.33), press against the spring to relieve tension on the belt.
- 3 Work the belt off the dynamo pulley by hand - do not use any leverage or the belt will be damaged.
- 4 Clear the belt from the crankshaft pulley and then lift it off over the fan.
- 5 Examine the belt. If it appears to be worn or is cracked or obviously stretched it should be renewed.
- 6 Refitting of the belt is the reverse of the above procedure.
- 7 Adjust the tension of the belt as described in Section 10.

10 Fan Belt - adjustment

It is important to keep the fan belt correctly adjusted as slackness of the belt will cause slip with the possible result of a squealing noise from the belt, a reduced charging rate from the dynamo or overheating of the engine. On the other hand too much tension on the belt will create undue wear of the belt, pulleys, water pump and dynamo bearings.

The fan belt tension is correct when the belt can be flexed approximately $\frac{1}{2}$ " (12.7 mm) either way, midway between the fan and dynamo pulleys.

To adjust the fan belt, slacken the two dynamo pivot mounting bolts and the adjusting link bolt. Swing the dynamo outwards until the tension is correct and then tighten the adjusting link bolt followed by tightening the two pivot mounting bolts. No adjustment is required on those cars fitted with an automatic fan belt tensioner.

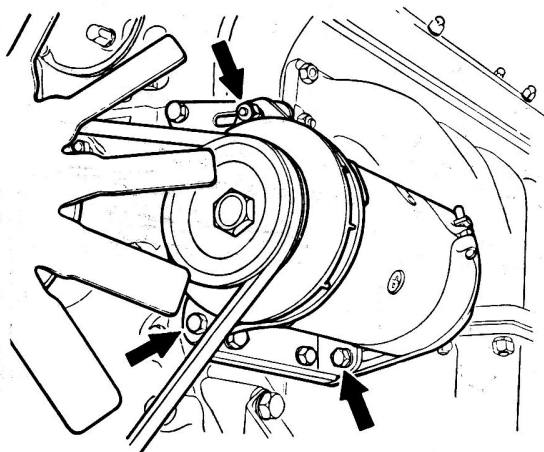


Fig.2.6. The dynamo mounting bolts

11 Water pump - removal and refitting

- 1 Refer to Section 5 and remove the cooling fan cowl and the radiator.
- 2 Refer to Section 9 and remove the fan belt.
- 3 Refer to Section 8 and remove the fan and pulley.
- 4 On the 2.4 litre and the 240 model cars the crankshaft damper must be removed as on these short stroke models the damper partially obscures the water pump. Remove the locking washer securing the damper bolt by knocking back the tabs and unscrewing the two set screws. Remove the four remaining setscrews and pull off the pulley and damper. As a protective measure, cover the split cone with a piece of rag.
- 5 Detach the hose connections from the water pump.
- 6 Unscrew the set bolts and nuts and remove the water pump from the timing cover, note the gasket.
- 7 Refitting is the reverse of the above procedure but fit a new gasket between the pump and the timing cover and a new locking washer to the damper bolt.

12 Water pump - dismantling and overhaul

If the water pump starts to leak, shows signs of excessive movement of the spindle or is noisy during operation it can be dismantled and overhauled. Before starting this task, make sure that individual parts are available but the best plan really is to obtain and fit an exchange assembly.

To dismantle the water pump:-

- 1 Remove the fan hub by means of a suitable extractor as illustrated in Fig.2.9.
- 2 Slacken the locknut and remove the Allen head screw which retains the pump bearing outer race.
- 3 Obtain a piece of tube $1 \frac{3}{32}$ " (27.77 mm) outside diameter and $31/32$ " inside diameter. Register this with the front face of the outer race of the pump bearing and drift out the pump spindle, the impeller and bearings assembly from the front of the housing. This assembly must not be pushed out by means of the spindle or the bearing will be damaged.
- 4 Press out the spindle from the impeller as illustrated in Fig.2.10 and remove the seal and rubber water thrower.
- 5 The spindle and bearing assembly cannot be dismantled any further.
- 6 Thoroughly clean all parts of the pump except the spindle and bearing or paraffin. The bearing is a permanently sealed and lubricated assembly and, therefore, must not be washed in any circumstances.
- 7 Inspect the bearings for excessive play and remove any burrs, rust or scale from the shaft with fine emery paper after taking the precaution of covering the bearing with a cloth to prevent ingress of dirt. If there are any signs of wear or corrosion in the bearing bore or on the face in front of the impeller the housing should be renewed.
- 8 To reassemble the pump, install the spindle and bearing assembly into the pump body from the rear and line up the location hole in the bearing with the tapped hole in the body.

Fit the locating screw and locknut.

9 Place the rubber thrower in its groove on the spindle in front of the seal.

10 Coat the outside of the brass seal housing with a suitable water resistant jointing compound and fit it into the recess in the pump casting.

11 Push the seal into its housing with the carbon face towards the rear of the pump and ensure that it is seated correctly.

12 Press on the impeller as shown in Fig.2.11 until the rear face of the impeller is flush with the end of the spindle.

13 Press the fan hub on to the spindle until it is flush with the end.

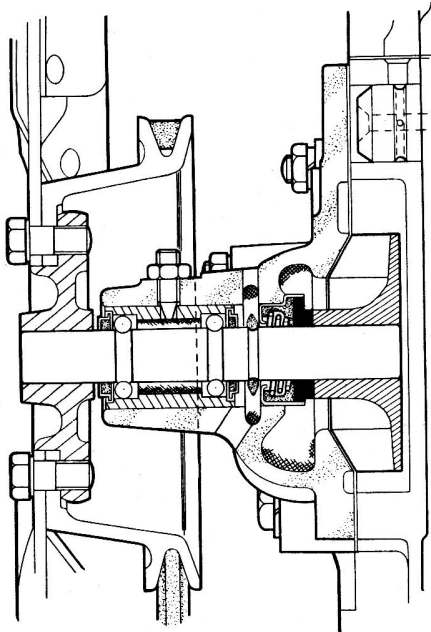


Fig.2.7. Sectioned view of the water pump

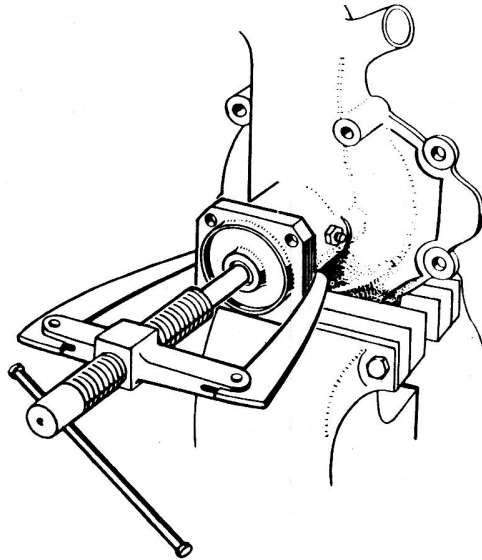


Fig.2.9. Withdrawing the fan hub from the spindle

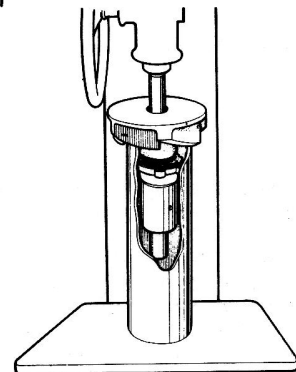


Fig.2.10. Removing the impeller from the pump spindle

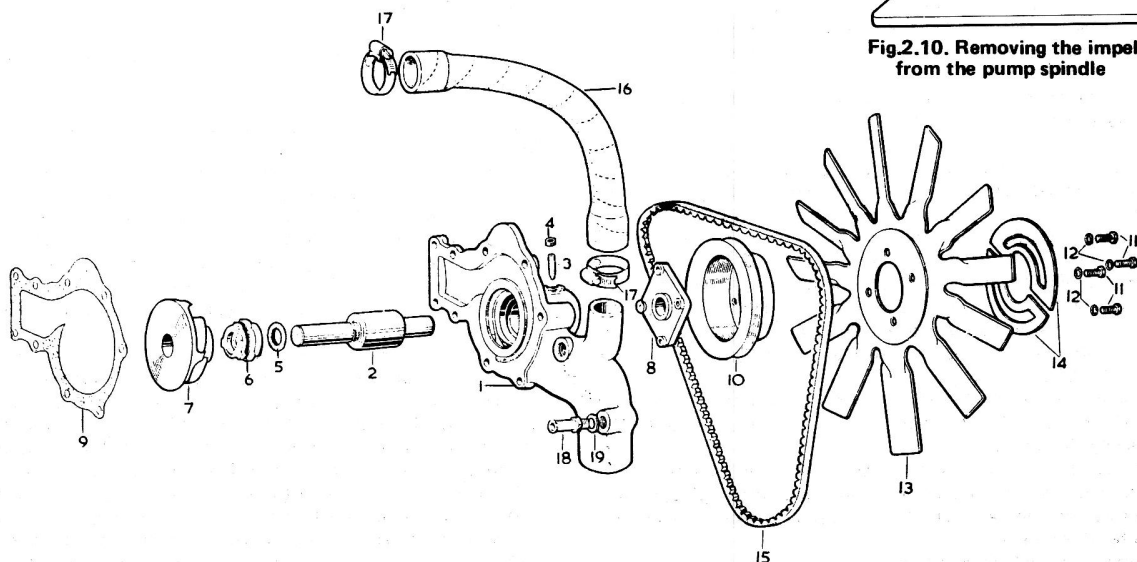


FIG.2.8. EXPLODED VIEW OF THE WATER PUMP

- 1 Pump body
- 2 Spindle and bearing assembly
- 3 Allen headed screw
- 4 Locknut
- 5 Thrower

- 6 Seal
- 7 Impeller
- 8 Pulley carrier
- 9 Gasket
- 10 Fan pulley
- 11 Setscrew

- 12 Shakeproof washer
- 13 Fan
- 14 Balance piece
- 15 Fan belt
- 16 By-pass water hose
- 17 Clip

- 18 Adaptor for heater return pipe (2.4 litre shown)
- 19 Copper washer