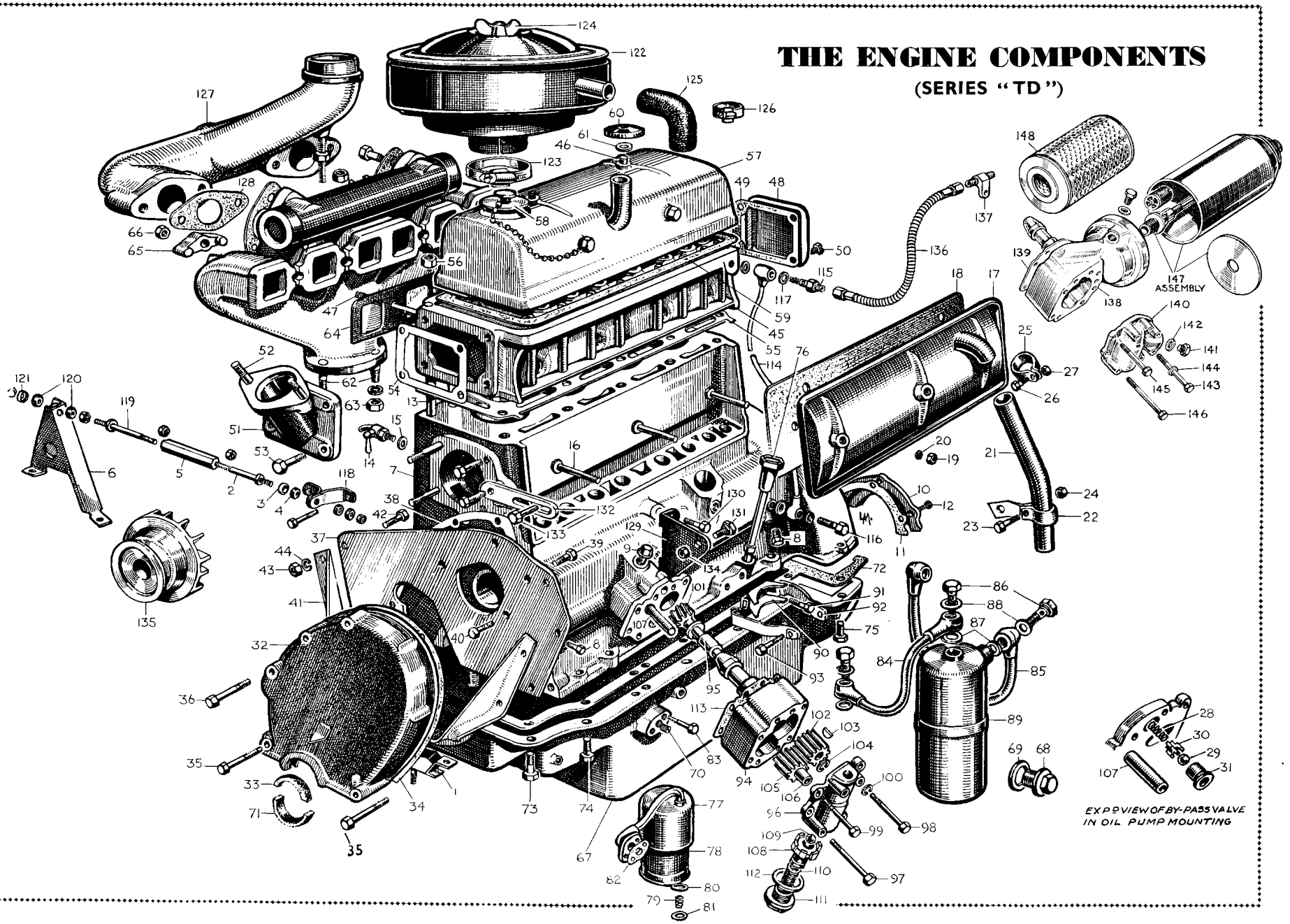
SECTION A

THE ENGINE

THE ENGINE COMPONENTS

(SERIES "TD")



KEY TO THE ENGINE COMPONENTS

No.	Description
1.	Mounting rubber—engine front.
2.	Engine control link—L/H thread.
3.	Cup—link.
4.	Link cup rubber.
5.	Adjuster.
6.	Engine control bracket.
7.	Cylinder block complete.
8.	Plug—oil feed hole.
9.	Plug—oil hole by-pass.
10.	Oil seal cover.
11.	Gasket—oil seal cover.
12.	Bolt—cover.
13.	Studs—cylinder head.
14.	Water drain tap.
15.	Washer—drain tap.
16.	Stud—tappet cover.
17.	Tappet inspection cover.
18.	Joint—cover.
19.	Nut—cover stud.
20.	Washer—cover stud.
21.	Breather pipe.
22.	Bracket—breather pipe.
23.	Bolt—breather pipe bracket.
24.	Nut—breather pipe bracket.
25.	Clip—breather pipe.
26.	Bolt—breather pipe clip.
27.	Nut—clip bolt.
28.	Spring—oil filter—by-pass.
29.	Ball—oil filter—by-pass.
30.	Guide—ball.
31.	Seat—ball.
32.	Timing chain case assembly.
33.	Packing—chain case.
34.	Joint—chain case to plate.
35.	Bolt—long—chain case to block.
36.	Bolt—short—chain case to block.
37.	Bearer plate—front.
38.	Joint—plate to block.
39.	Bolt—plate to case.
40.	Bolt—plate to block.
41.	Bracket—plate.
42.	Bolt—bracket.
43.	Nut.
44.	Spring washer.
45.	Cylinder head (studded) with guides.
46.	Stud—cover.
47.	Stud—manifold.
48.	Rear cover—cylinder head.
49.	Joint—rear cover-plate.
50.	Screw—rear cover-plate.
51.	Water outlet pipe (studded).
52.	Stud—thermostat.
53.	Bolt—water outlet pipe.
54.	Joint—water outlet pipe.
55.	Gasket—cylinder head.
56.	Nut—securing cylinder head.
57.	Cylinder head cover assembly.
58.	Oil filler cap.
59.	Joint—cylinder head cover.
60.	Nut—cylinder head cover.
61.	Washer—cylinder head cover.
62.	Stud—exhaust manifold flange.
63.	Nut—stud.
64.	Joint—exhaust manifold.
65.	Clamp—exhaust manifold.
66.	Nut—exhaust manifold clamp.
67.	Oil sump.
68.	Drain plug—sump.
69.	Washer—drain plug.
70.	Plug—oil hole.
71.	Packing.
72.	Joint—sump to block.
73.	Bolt—sump—front.
74.	Bolt—sump—short.
75.	Bolt—sump—long.
76.	Dipstick.
77.	Suction filter assembly.
78.	Filter gauze.
79.	Spring—oil suction pipe.
80.	Fibre washer.
81.	Washer.
82.	Joint—flange.
83.	Bolt.
84.	Oil pipe assembly (pump to filter).
85.	Oil pipe assembly (filter to block).
86.	Bolt—banjo.
87.	Washer—small.
88.	Washer—large.
89.	Oil filter.
90.	Support bracket for oil filter.
91.	Bolt—bracket.
92.	Strap—oil filter bracket.
93.	Bolt—strap.
94.	Oil pump (bushed).
95.	Bush—oil pump body.
96.	Oil pump cover with valve seat.
97.	Bolt—cover (long).
98.	Bolt—cover (medium).
99.	Bolt—cover (short).
100.	Lock washer.
101.	Oil pump shaft and gear.
102.	Gear—driving.
103.	Key—driving gear.
104.	Circlip—driving gear.
105.	Oil pump gear (driven) with bush.
106.	Bush—oil pump gear.
107.	Spindle—driven gear.
108.	Guide—relief valve ball.
109.	Relief valve ball.
110.	Spring—relief valve.
111.	Cover plug—relief valve.
112.	Washer—cover plug.
113.	Joint—oil pump body.
114.	Oil pipe (gallery to head).
115.	Screw (banjo to head).
116.	Screw (banjo to block).
117.	Washer—screw.
118.	Bracket—engine control link.
119.	Engine control link (R/H thread).
120.	Rubber bush.
121.	Cup washer.
122.	Air cleaner.
123.	Clip—air cleaner.
124.	Wing nut—air cleaner stud.
125.	Breather hose—air cleaner.
126.	Clip—breather hose.
127.	Pipe to air cleaner.
128.	Joint—pipe to carburetter.
129.	Bracket—dynamo.
130.	Bolt—dynamo bracket.
131.	Swivel bolt—short—dynamo.
132.	Adjusting link.
133.	Bolt—link.
134.	Nut—swivel bolt.
135.	Pulley—dynamo.
136.	Flexible connection—oil gauge.
137.	Connector—oil pipe.
138.	Oil pump body—integral filter head.
139.	Joint—oil pump body.
140.	Cover—oil pump.
141.	Plug—oil pump cover.
142.	Washer—oil pump cover plug.
143.	Bolt—pump cover (medium).
144.	Washer—pump cover bolt.
145.	Bolt—pump cover (short).
146.	Bolt—pump cover (long).
147.	Sump assembly—filter.
148.	Filter element.

GENERAL DESCRIPTION

The four-cylinder overhead-valve engine is built in unit construction with a single-plate Borg & Beck dry plate clutch and four-speed gearbox.

It has a four-throw crankshaft carried in three renewable steel-backed dowelled shell bearings fitted without shims. Thrust is taken on the centre bearing.

The big-ends are also fitted with renewable steel-backed shell bearings fitted without shims.

ends of the tappets and operate the rockers via adjustable ball-ended screws.

Cooling is by thermo-siphon action, assisted by pump and fan.

A gear-type external oil pump is driven from the camshaft by means of helical gears and draws oil from a submerged filter in the sump. Oil then passes through a full-flow type external filter.

Carburation is by two semi-downdraught S.U. carburetters, which are fed with fuel by an S.U. electric pump.

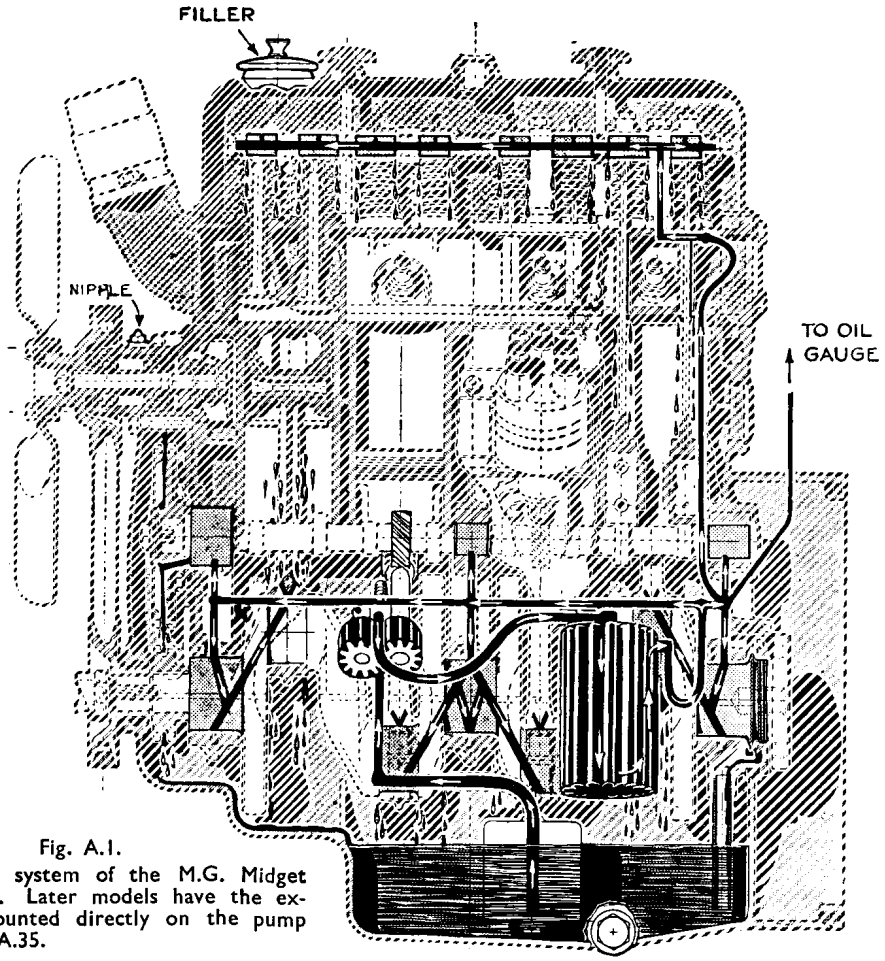


Fig. A.1.
The lubrication system of the M.G. Midget (Series "TD"). Later models have the external filter mounted directly on the pump body. See Fig. A.35.

The gudgeon pin is clamped in the connecting rod by means of a set screw with a lock washer.

Pistons are made of aluminium alloy and fitted with two compression rings and one oil control ring.

The camshaft is supported in three renewable bearings pressed into the block, and is driven from the crankshaft by means of an endless duplex chain which is automatically maintained at the correct tension by a spring-loaded plunger. Oil is fed to each bearing from the internal oil gallery running the whole length of the cylinder block.

The camshaft operates hollow tappets which run directly in the block. Push-rods locate in the concave

THE LUBRICATION SYSTEM

The main oil supply is carried in a removable aluminium sump. When full, it contains approximately 9 pints (5·1 litres) on engines up to No. 14947, and 10½ pints (5·96 litres) from engine No. 14948, of oil. It is replenished through the filler cap in the front end of the valve cover. The sump drain plug is towards the rear on the left-hand side. Three pints (1·7 litres) of oil must be added before any reading shows on the dipstick.

The gear-type oil pump draws oil from the sump through a gauze strainer which picks up the oil just above the bottom of the sump. Any sludge formed in the oil is thus allowed every opportunity to settle to the bottom.

An oil pressure relief valve, of the spring-loaded ball type, controls a passage formed in the oil pump bottom cover casting between the suction and delivery sides of the pump gears. (See Fig. A.7.) The spring is non-adjustable, and is set to allow the valve to by-pass at 50–70 lb. per sq. in. (3·5–5·0 kg./cm.^{2}).

This provides a normal working pressure of from 40 to 45 lb. per sq. in. (2·8 to 3·2 kg./cm.^{2}). But so long as a reasonable pressure is indicated it may be taken that the circulating system is working satisfactorily.

The oil from the pump is delivered to the full-flow oil filter and then to the oil gallery, whence it is distributed through the engine. There are two possible ways from the pump. First, the normal one, through the filter cleaning element. Second, an emergency path through another spring-loaded relief valve housed in the cylinder block behind the pump body, straight into the oil gallery. The spring of the by-pass valve is such that, provided the filter is attended to periodically (fit new oil filter after the first 3,000 miles or 5000 kilometres and subsequently every 6,000 miles or 10000 kilometres on engines prior to No. 14224 and new filter element on engines from No. 14224 onwards), the valve remains permanently closed. Should the filter become clogged, however, the by-pass valve will open and allow unfiltered oil to reach the engine.

From the oil filter outlet the oil is delivered into the internal oil gallery in the side of the cylinder block. Three drilled passages from this gallery pipe lead the oil to the camshaft and crankshaft bearings.

Taking these passages in order, counting from the front, No. 1 feeds the front main bearing and the camshaft front bearing. The front main bearing feeds No. 1 big-end bearing through a groove cut in the white metal and a passage drilled in the crank web, which, in turn, feeds No. 1 cylinder wall through the spray hole drilled in the right-hand side of the big-end and by splash from the surplus oil exuding from the bearing. A feed is also taken from the front main bearing to the automatic chain tensioner.

The camshaft front bearing has a forward leak passage to the camshaft chain wheel thrust face, and from there passes through three diagonal holes in the gear wheel boss to the inside of the wheel rim, where centrifugal action forces it through radial holes onto the chain links. The three diagonal holes in the sprocket are covered by a baffle plate. This plate ensures that the oil is deflected to the radial holes at low engine speeds.

Passage No. 2 feeds the camshaft centre bearing and the centre main bearing. The centre main bearing feeds Nos. 2 and 3 big-end bearings by diagonal drillings in the crankshaft and also lubricates the cylinder walls as already described.

Passage No. 3 feeds the rear main bearing and the rear camshaft bearing. The rear main bearing also feeds No. 4 big-end bearing and the cylinder walls through diagonal drillings.

A vertical pipe at the rear end of the oil gallery feeds oil to the rocker-shaft through passages drilled in the cylinder head to register with a hole drilled in the rear rocker-shaft support, which communicates with the inside of the hollow rocker-shaft. The rocker-shaft is drilled at each rocker position to feed oil to the bearings, and oil which passes the bushes finds its way down the push-rod tunnels and drain passages to the sump.

Note.—*When the engine is first started up and the oil is cold, higher oil pressure than normal will be indicated by the gauge. It is mainly for this reason that a gauge covering a large range of pressure readings is provided, and the risk of damage to the instrument is thus reduced to a minimum.*

In the event of the oil gauge being damaged, or ceasing to function correctly, it must be renewed as soon as possible.

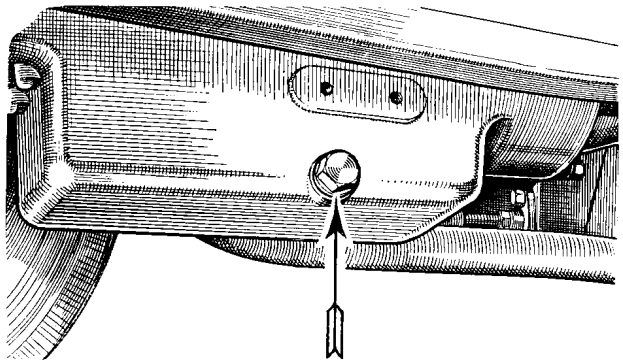


Fig. A.2.

The engine sump drain plug is located on the left-hand side of the engine. Make sure that the plug, its washer and the seating are clean when replacing the plug.

Section A.1

DRAINING THE ENGINE SUMP

The sump on new and reconditioned engines must be drained and refilled with new oil after the first 500 miles (800 km.) and then at intervals of 3,000 miles (5000 km.).

The sump should be allowed to drain for at least ten minutes and this is more effective if carried out with

the engine warm. The drain plug is located on the left-hand side of the engine sump.

Approximately 9 pints (5·1 litres) of oil are necessary to bring the level to the "Full" mark on the dipstick on early models, and slightly more if a new external filter has been fitted. On models commencing with Engine No. 14948 a larger engine sump is fitted, having a capacity of 10½ pints (5·96 litres).

Section A.2

REMOVAL AND REPLACEMENT OF THE ENGINE SUMP

Lower the exhaust system after removing the three nuts which secure the exhaust pipe to the manifold flange and the two set bolts securing the exhaust pipe bracket to the gearbox. and drain the oil from the sump. (See Section A.1.)

Remove the dipstick.

Release the clutch pedal pull-off spring from the return spring bracket.

Remove the split pin and clevis pin securing the intermediate clutch operating lever to the clutch operating rod.

On early models, with a cable-operated clutch, remove the two set bolts and spring washers securing the clutch cable abutment bracket to the sump, remove the split pin and washer and slide off the intermediate clutch operating lever.

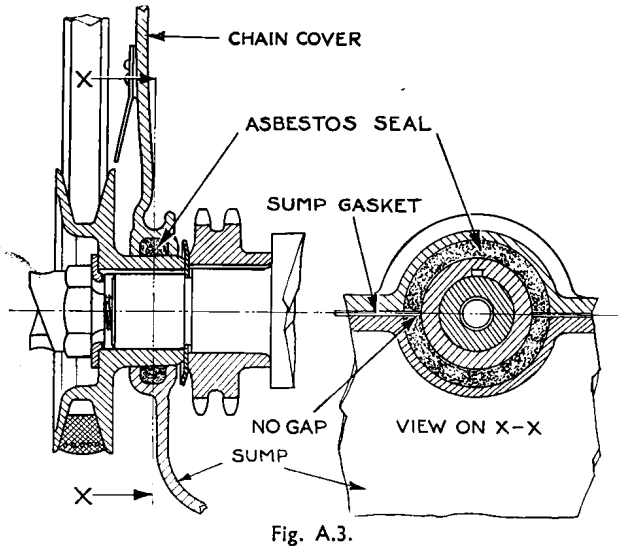


Fig. A.3.
The correct fitting of the seal and sump gasket (front end).

On later models a rod is fitted in place of the clutch operating cable. On these cars remove the split pin and washer from the operating rod lever fulcrum pin and move the operating mechanism clear of the sump.

Remove the bolts and spring washers securing the sump to the cylinder block and flywheel housing, and lower the sump to the ground. Note that the anchorage for the engine fume pipe is located on the left-hand side of the flywheel housing, on the first set screw below the crankcase and sump joint line. (In breaking the sump joint avoid damaging the gasket, or it will be necessary to fit a new one when the sump is replaced.)

The sump can now be cleaned and dried. When cleaning the sump use a stiff brush—never use rag.

Replacement of the sump is carried out in the reverse manner to that detailed for removal.

Note.—*If it is necessary to fit a new sump gasket, refer to Fig. No. A.29 for the method of cutting a replacement. Take care that the portion is left which goes between the rear main bearing cap cork seal and the crankcase.* (*See Fig.* A.4.) **This is important.**

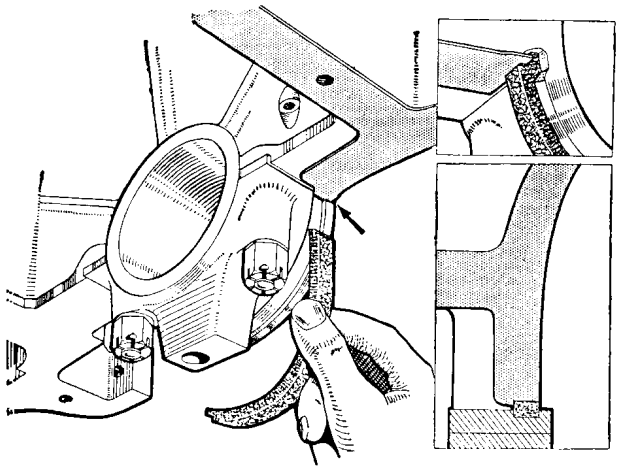


Fig. A.4.
When fitting the cork seal for the rear main bearing it is important that the stepped end be in proper engagement with the sump gasket.

Examine the cork composition packing ring in the groove of the rear main bearing cap, and if damaged fit a new one. See Fig. A.4 for the correct method of fitting this seal in conjunction with the sump gasket ; pay special attention to this point to prevent oil leaks. It is important to ensure that the ends of the sump gasket fit snugly into the recesses in the ends of the rear bearing cap cork seal.

Examine the "Karmal" asbestos seal, fitted into the recess at the front of the sump. If replacement is necessary, care should be taken that the ends of the new one are flush or a little above the face of the sump. The sump gasket must go between the ends of seals.

The flanged edges of the sump and the joint faces of the cylinder block should be cleaned before replacing the sump, or difficulty may be experienced in making an oil-tight joint. When all faces are clean, coat the cylinder block flange with an even film of suitable jointing compound, and ensure that the holes in the jointing washer coincide with the bolt holes in

the flange. Put a little grease on the sump flange, this will ensure future easy removal.

Should the engine be turned while the sump is removed or drained, thus emptying the suction passages, the pump will have to be primed with oil by disconnecting the delivery pipe on early engines. Later models have a special priming plug on the oil pump body. The main feed oil gallery may also be primed through the special plug provided for this purpose in the cylinder block above the pump (see Fig. A.8).

Section A.3

REMOVAL OF THE OIL PUMP

Drain the radiator and slack off the top and bottom water hoses.

Remove the front engine mounting bolts holding the engine bracket to the rubber block. Slightly jack up the engine at the front. This allows the pump to clear the frame member.

Note.—*On LHD models the steering column passes immediately above the oil pump, and it is not possible to lift the engine without first raising the steering column. To do this, first remove the split pins and nuts from the three bolts at the steering column universal joint; slacken the bolt and nut holding the steering column to the body steady bracket, and take out the nut and bolt from the support clip under the dash. The steering wheel may now be lowered so that the column clears the oil pump, and the engine may be lifted.*

Detach the main oil pipe from the filter to the pump on early models, or remove filter bowl and element on later models.

Remove the eight bolts securing the pump to the cylinder block. This will release the cover.

Lift off the cover from the pump body. This will release the driven gear, which can easily be withdrawn.

Remove the pump by gently tapping the side of the body and withdrawing it downwards.

Screw a suitable extractor into the end of the driven gear shaft and withdraw it from the cylinder block if it is required to remove this.

Section A.4

DISMANTLING, REASSEMBLING AND REPLACING THE OIL PUMP

After withdrawing the pump from the cylinder block as described in Section A.3, remove the circlip securing the driving gear to the oil pump shaft and helical gear.

Using a suitable drift, tap the oil pump shaft and gear partly through the driving gear. Extract the key and gear before completely removing the shaft, otherwise the key will damage the bush.

Clean all parts, examine and check for wear.

The gear depth is 1·378 in.—·0016 in.—·0024 in. (35 mm.—·04 mm.—·06 mm.) with a diameter of 1·2678 in.+·001 in. (32·2 mm.+·025 mm.).

The housing depth is 1·378 in.+·0012 in. (35 mm.+·03 mm.) with a bore of 1·2795 in.+·001 in.—·0006 in. (32·5 mm.+·025 mm.—·015 mm.).

This results in a gear end float of ·0016 in. to ·0035 in. (·04 mm. to ·09 mm.) with the end cover fitted, and a radial clearance of ·0056 in. to ·0064 in. (·145 mm. to ·162 mm.). The backlash between the teeth is

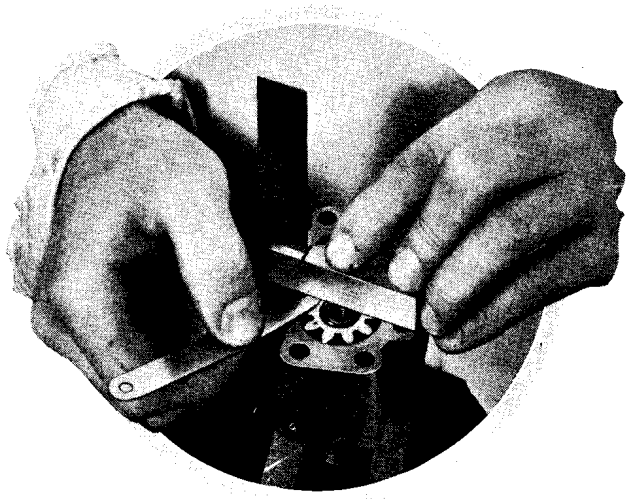


Fig. A.5.
Testing the end clearance of the oil pump gears.

Fig. A.6.
Testing the clearance between the oil pump gears and the oil pump body.

approximately ·020 in. to ·025 in. (·51 mm. to ·63 mm.). (See Figs. A.5 and A.6.)

Renew worn parts as necessary. The pump housing and driven gear are fitted with renewable bushes.

The oil pump is assembled and replaced on the engine in the reverse manner to that detailed for dismantling and removal. Care should be taken to see that the abutting faces of the cylinder block and the pump are clean before replacing, and that the paper gasket between these joints is in good condition. If there is any doubt as to its condition, replace it with a new one. No gasket is fitted between the pump body and the pump cover.

coils 13½, giving a load of 7 lb. (3·17 kilograms) when compressed to 1·063 in. (27 mm.).

It is not adjustable and should be dismantled only for cleaning and examination. The parts are dismantled by unscrewing the retaining plug in the bottom side of the oil pump cover which permits their withdrawal from the pump cover.

Care should be exercised when replacing the parts of the relief valve that the seating sleeve, ball, guide, spring and fibre washer for the plug are correctly replaced, and the fibre washer is in good condition. If there is any doubt as to its condition, replace it with a new one.

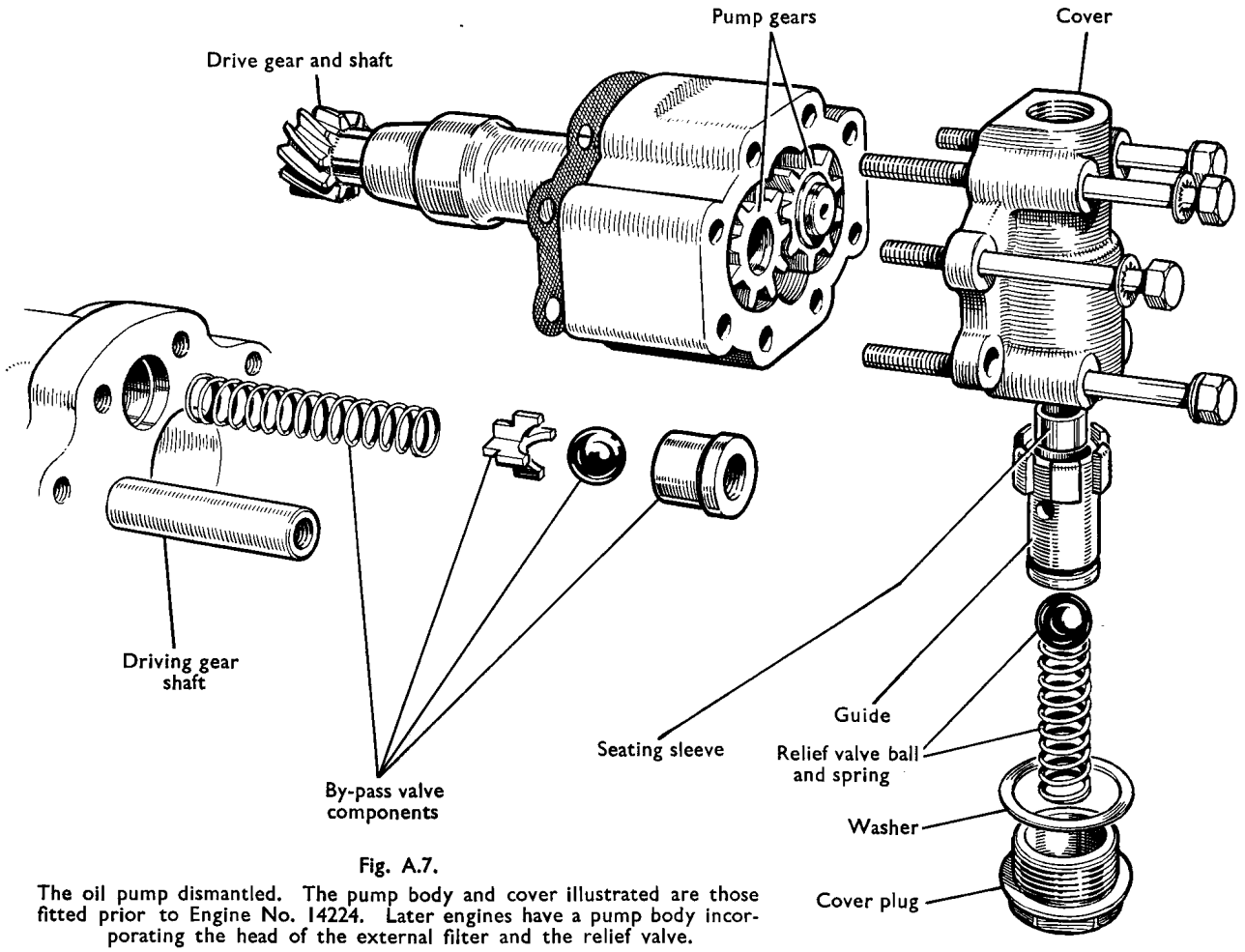


Fig. A.7.
The oil pump dismantled. The pump body and cover illustrated are those fitted prior to Engine No. 14224. Later engines have a pump body incorporating the head of the external filter and the relief valve.

Section A.5

REMOVAL AND REPLACEMENT OF THE OIL PRESSURE RELIEF VALVE

The oil pump automatic relief valve, comprising ball, spring and ball guide, is incorporated in the oil pump cover. The spring should be 17 gauge or ·056 in. (1·42 mm.), ·500 in. (12·7 mm.) overall diameter, 1·476 in. (37·5 mm.) free length. Total number of

Section A.6

EMERGENCY RELIEF VALVE

If the filter element becomes clogged through neglect, an automatic safety device is provided. This is mounted in the cylinder block above the oil pump. It can be withdrawn by the use of a suitable 8 mm. stud and distance-piece. It consists of a spring-loaded ball valve which allows the oil to by-pass the filter, thus

maintaining engine lubrication until a new filter is fitted.

The spring for this ball valve should be 19 gauge or ·040 in. (1·02 mm.), ·5354 in. (13·59 mm.) overall diameter, 2·224 in. (56·5 mm.) free length. Total number of coils 12, giving a load of 5 lb. (2·27 kilograms) when compressed to a length of ·649 in. (16·5 mm.).

Section A.7

REMOVAL AND REPLACEMENT OF THE MAIN AND BIG-END BEARINGS

The replacement of big-end bearings can be carried out after removal of the sump, without taking the engine from the frame, but in order to replace the main bearings the engine must be removed. Renewable steel-backed bearings are used for both the main crankshaft bearings and the big-end bearings.

It is imperative that no adjustments be made to the bearings. Bearings which are worn should be

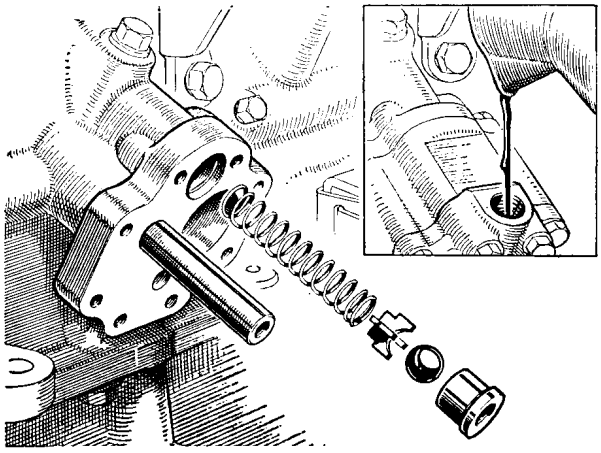


Fig. A.8.

The by-pass relief valve of the oil pump with its components withdrawn, and (inset) priming the early type oil pump through the delivery opening on the pump cover. Later pumps, with integral filter, are also primed through a similar plug, but a certain number of these pumps are not fitted with the special priming plug. (See Section A.41).

renewed. Additionally, if the crankshaft journals are found to be in a worn condition, a service reground crankshaft complete with main and big-end bearings, as supplied from the Works, should be fitted. (See Section A.34.)

The big-end bearings are located in position by a small tag on one side of each half-bearing, and the bearings are fitted so that the tags come on the same side of the bearing housing, as shown in the illustration. Main bearings are located in position by dowels in the bearing caps, and in the crankshaft housing.

To detach the big-end bearings, extract the split pins from the big-end bolts, and undo the nuts. Remove the connecting rod caps and extract the bearings. Care should be exercised to see that the bearing journals and other parts are cleaned before installing new bearings. No scraping is required, as the bearings are machined to give the correct diametrical clearance of between ·0005 in. (·011 mm.) and ·002 in. (·056 mm.) and a side clearance of from ·004 in. to ·006 in. (·10 mm. to ·15 mm.).

To renew the main bearings it is necessary first to remove the main bearing caps, by removing the split pins from the retaining studs and unscrewing the

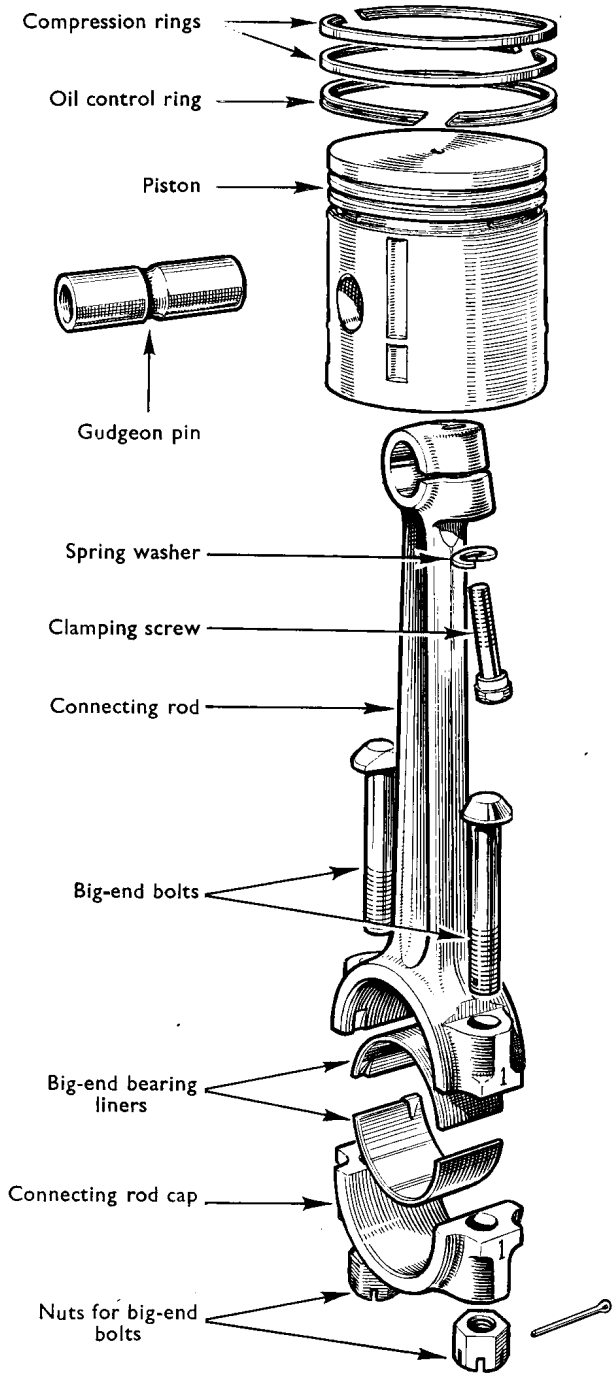


Fig. A.9.
The piston and connecting rod assembly.

slotted nuts. This enables the crankshaft to be lifted from the crankcase.

Having cleaned the oilways drilled in the crankshaft and the bearing journals, the new bearings are placed in position on their locating dowels, and the crankshaft replaced. No scraping is required as the bearings are machined to give the correct diametrical clearance of from ·0008 in. to ·003 in. (·02 mm. to ·075 mm.) and the side clearance of from ·0014 in. to ·0037 in. (·035 mm. to ·095 mm.) on the centre bearing. The end bearings have no end location.

In the case of a run bearing, it is always advisable to clean out all the oilways in the crankshaft and block. Then wash out the engine base with paraffin.

Section A.8

REMOVAL AND REPLACEMENT OF THE ROCKER ASSEMBLY

Remove the air cleaner. Detach the cylinder head cover by removing the two retaining hand nuts and fibre washers.

Tap back the tabs of the lock washers from the eight rocker-shaft bracket fixing bolts and unscrew the four $\frac{5}{16}$ in. and four $\frac{1}{4}$ in. bolts gradually, a turn at a time, until all load has been taken off the rocker-shaft, then completely unscrew the bolts. **This is important.**

Remove the rocker assembly, complete with bracket and rockers, and withdraw the eight push-rods, marking them so that they may be replaced in the same positions. To dismantle the rocker-shaft assembly, remove the two retaining clips at either end of the shaft and slide the rockers, brackets and springs from the shaft. Care should be taken not to lose the shaft bracket washers and a note made of the fact that the front and rear washers are " D "-shaped, whereas the washers fitted to the centre brackets are of the normal pattern and engage with slots in the shaft.

A note should also be made in the case of later engines, that thrust washers are fitted between the spacing springs and the end bearing faces of the rockers.

Remove the plugs from each end of the shaft so that the oilways may be cleaned.

Reassembly and replacement is a reversal of the above procedure, but care must be taken to replace rockers and springs correctly on the shaft.

Section A.9

REMOVAL AND REPLACEMENT OF THE CYLINDER HEAD

Drain the water system by opening the tap at the bottom of the radiator and the tap in the cylinder block immediately below and in front of the exhaust manifold (see Section D.1).

Remove the bonnet after taking out the two screws at the rear end of the bonnet hinge.

Detach high-tension cables from the sparking plugs.

Remove the sparking plugs, being careful not to break or damage the porcelain insulators.

Disconnect throttle controls and mixture controls.

Uncouple the exhaust pipe from the manifold.

Disconnect the fuel pipe from the fuel pump.

Disconnect the breather pipe connection.

Slacken the hose clips and remove the air cleaner, remembering that the central wing nut also serves to hold the cleaner onto the air intake pipe, and that it is full of oil.

Disconnect the intake pipe steady on the manifold.

Undo the four bolts holding the intake pipe and remove it complete. Remove the bolt clipping the exhaust pipe to the gearbox.

Remove the four nuts securing the induction and exhaust manifold to the cylinder head and withdraw the clamps and manifold.

Loosen the top clips on the thermostat by-pass pipe.

Take off the top radiator hose and thermostat.

Remove the oil feed pipe for the rocker gear from its attachment to the cylinder head.

It is also necessary to slacken the fume pipe and remove the side inspection cover. If the gasket of this cover is damaged, a new one must be fitted before the engine is run.

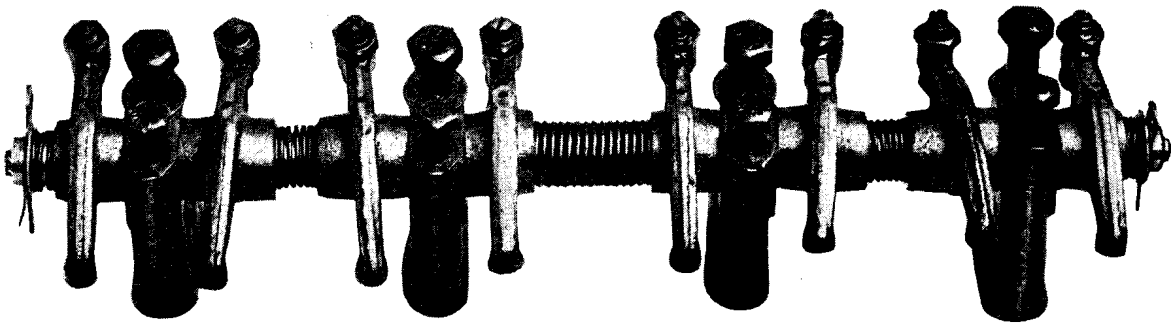


Fig. A.10.

The rocker assembly, showing the correct assembly of its components. Later assemblies have washers inserted between the spacing springs and the rocker end faces.

Remove the valve cover and rocker gear from the cylinder head as indicated in Section A.8, when the push-rods may be withdrawn.

Note.—*It is advisable to keep these in order of removal.*

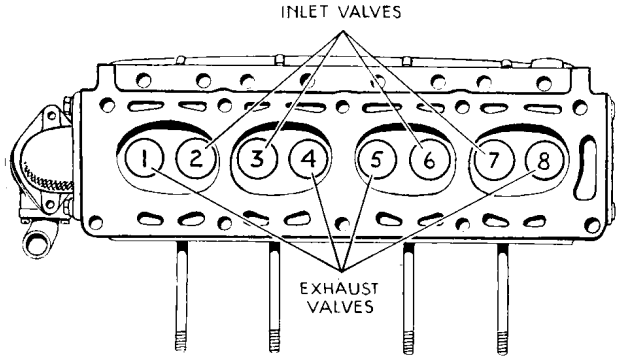


Fig. A.11.
This illustration shows the numbering of the valves.

Release the ten cylinder head nuts a partial turn at a time in the order indicated in Fig. A.12 until they are free for complete removal by hand. (Use the special spanner provided in the tool kit.)

Remove the cylinder head.

Note.—*To facilitate breaking the cylinder head joint, tap each side of the head with a hammer, using a piece of wood interposed to take the blow. When lifting the head a direct pull should be given, so that the head is pulled evenly up the studs.*

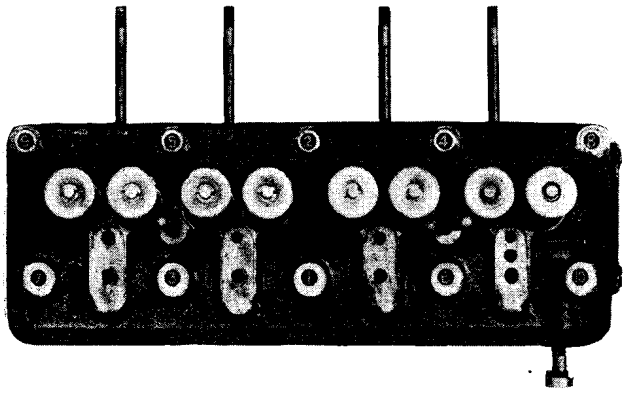


Fig. A.12.
The sequence in which the cylinder head holding-down nuts should be tightened.

Refitting the cylinder head

Make sure that the surfaces of both the cylinder block and cylinder head are clean ; it is not necessary to use jointing compound for the gasket, but it may with advantage be smeared with grease. Having slipped the gasket over the studs, next lower the cylinder head into position, and fit the cylinder head securing nuts finger-tight. Fig. A.12 shows the correct order for tightening down the securing nuts. It is essential that they should be tightened down gradually half a turn at a time in the order given if a good joint is to be achieved.

Tightening individual nuts completely before the others is liable to distort the cylinder head and makes the achievement of a gas-tight joint impossible.

Note.—*Ensure that the gasket is fitted with the elongated hole for the waterways to the rear of the cylinder head.*

The push-rods should next be fitted, after which the rocker gear is reassembled. Whenever the head has been disturbed, or the valves have been ground in or otherwise disturbed, it is necessary to check the tappet adjustment and make sure the clearances are adequate ; these, of course, will finally be adjusted after the engine has been completely reassembled and run for a short period.

Now fit the valve cover, not forgetting the cork gasket ; the gasket is not very wide, and care must be taken to see that the cover fits squarely. It is advantageous to stick the cork gasket to the cylinder head with jointing compound, but not to the valve cover.

Reconnect the oil feed pipe to the cylinder head.

Tighten the side inspection cover and fume pipe, making sure that the gasket is satisfactory. Should there be any doubt as to its condition, replace with a new one. Care should be taken that the oil drain holes in the gasket are at the bottom.

Clean out the exhaust manifold if it is carboned up.

Examine the exhaust manifold gaskets and renew if necessary.

Refit the induction and exhaust manifold complete with the carburetter assembly.

The securing nuts holding the manifold should be tightened down evenly.

Fit the mixture control, throttle controls and exhaust pipe to the manifold.

Check and adjust the sparking plugs, replace, and connect the high-tension leads to the plugs.

Replace the thermostat body and radiator connecting hose and tighten the hose clips.

Connect the fuel pipe to the fuel pump, and refit the bonnet.

Switch on the ignition, and check the fuel connections for leaks.

The engine can now be started and allowed to run briskly until the water rises to a temperature between 70° C. and 80° C. or 160° F. and 175° F.

The valve clearances should then be checked carefully (see Section A.27).

Section A.10

REMOVAL AND REPLACEMENT OF PISTONS AND CONNECTING RODS

Follow the dismantling procedure as set out in Section A.7 and withdraw the piston and connecting rod assembly carefully past the crankshaft on the left-hand side of the engine, rotating the crankshaft as necessary to give the required clearance.

Note.—*It is essential that pistons be fitted in the same bores as they were before removal. The gudgeon pin pinch-bolt must be on the right-hand side of the engine. The same connecting rod and cap, complete with bearings, must be fitted to the journal from which they were removed.*

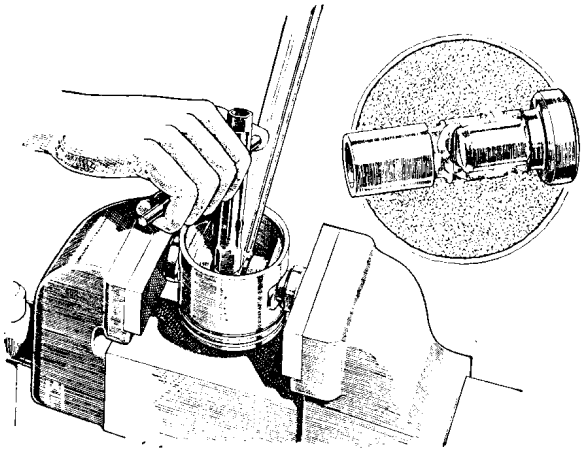


Fig. A.13.
The method of holding the gudgeon pin when taking out the clamp screw.

Section A.11

DISMANTLING AND REASSEMBLING PISTON AND CONNECTING ROD

The gudgeon pin is clamped in the little-end by means of a pinch-bolt engaging the groove in the centre of the gudgeon pin. The pinch-bolt must therefore be removed before the gudgeon pin can be pushed out.

In order to hold the assembly whilst the pinch-bolt is being undone it is essential to use two special shouldered clamping plugs engaging each end of the gudgeon pin as shown in Fig. A.13.

Important.—Care must be taken, when replacing the piston on the connecting rod, that :—

1. The pinch-bolt will screw readily into its threaded hole.
2. The spring washer has sufficient tension.
3. The gudgeon pin is positioned so that the groove clears the pinch-bolt when the latter is screwed into place.
4. The assembly is fitted to the engine with the connecting rod little-end pinch-bolt on the right-hand side.

Section A.12

FITTING THE GUDGEON PINS

Gudgeon pins must be a thumb-push fit for three-quarters of their travel, to be finally tapped home with a raw-hide mallet. For this operation the piston and gudgeon pin must be cold.

Gudgeon pin bores in the piston should not be reamed out because oversize pins are not available or permissible. Gudgeon pins must be fitted by selection.

Section A.13

REMOVAL AND REPLACEMENT OF THE PISTON RINGS

If a special piston ring expander is not available, a piece of thin steel may be used, approximately 3 in. (7 cm.) long by $\frac{1}{2}$ in. (12 mm.) wide by ·02 in. (·5 mm.) thick.

This operation is quite simple. One end of the ring should be raised whilst the steel strip is slipped under the end. Next move the strip round the piston and apply a slight upward pressure to the ring until it rests on the land above the ring grooves. It can then be eased off the piston. Do not move the rings down over the piston skirt. Always remove and replace them from the top of the piston.

Before fitting new rings the piston grooves must be cleared of carbon, but be careful not to remove any metal from the piston during the process or excessive side clearance will result.

Note.—*New rings must be tested in the cylinder bore to make quite sure they have the correct clearance between the two ends. This clearance must be between ·006 in. (·15 mm.) and ·010 in. (·25 mm.).*

When checking this gap make sure the ring is square to the bore by holding it on top of a piston inserted about 1 in. (2·54 cm.) down the bore while the measurement is being taken.

Section A.14

PISTON SIZES AND CYLINDER BORES

When fitting new pistons selective assembly is necessary, and to facilitate this the pistons are marked on their crowns, with an indication of their bore size. Note particularly that the piston markings indicate the correct size cylinder bore for which they are

suitable, the correct working clearance having been allowed in the grading operation. **The piston size should therefore correspond with the marking on the top face of the cylinder block** on the right-hand side, which indicates the actual size of each cylinder bore.

The bores and pistons are graded in four sizes :—

Bores of nominal size ±·000 in. to +·00049 in. marked " STD "

Bores of nominal size +·0005 in. to +·00099 in. marked +·0005

Bores of nominal size +·0010 in. to +·00149 in. marked +·0010

Bores of nominal size +·0015 in. to +·00199 in. marked +·0015

The piston clearance is ·0021 in. minimum to ·0029 in. maximum (·056 mm. to ·073 mm.), measured at the top of the skirt, immediately below the oil control ring, and across the thrust faces, i.e. at 90° to the gudgeon pin axis. This is important as the piston skirt is tapered and oval, and the clearance can only be measured in this one position.

To facilitate correct measurement of the bores and pistons, the actual sizes of the various gradings are given in the table below.

The markings on the top face of the cylinder block will indicate these sizes clearly.

Oversize bores on reconditioned engines supplied under the M.G. reconditioned engine scheme are limited to two oversizes :—

+·020 in. graded in 4 sizes as the standard grading

+·040 „ „ „ „

The actual sizes of these pistons and bores are provided in the following table :—

STANDARD PISTON SIZES

Production engines with bores ·002 in. oversize or over are made into +·010 in. bores and graded in the same steps as the standard bore engines.

Piston Size (across thrust faces below oil ring) in.	mm.	Piston Marking	Suitable for Bore Size in.	mm.
2·6156 2·6160	(66·436) (66·446)	To suit " STD " bore	2·6181 2·6185	(66·500) (66·510)
2·6161 2·6165	(66·449) (66·459)	To suit +·0005 bore	2·6186 2·6190	(66·513) (66·523)
2·6166 2·6170	(66·462) (66·472)	To suit +·0010 bore	2·6191 2·6195	(66·525) (66·535)
2·6171 2·6175	(66·474) (66·484)	To suit +·0015 bore	2·6196 2·6200	(66·538) (66·548)

OVERSIZE PISTON SIZES

+·020 in. RANGE

Piston Size (across thrust faces below oil ring) in.	mm.	Piston Marking	Suitable for Bore Size in.	mm.
2·6356 2·6360	(66·944) (66·954)	To suit +·0200 bore	2·6381 2·6385	(67·008) (67·018)
2·6361 2·6365	(66·957) (66·967)	To suit +·0205 bore	2·6386 2·6390	(67·021) (67·031)
2·6366 2·6370	(66·970) (66·980)	To suit +·0210 bore	2·6391 2·6395	(67·033) (67·043)
2·6371 2·6375	(66·982) (66·992)	To suit +·0215 bore	2·6396 2·6400	(67·046) (67·056)

Piston Size (across thrust faces below oil ring) in.	mm.	Piston Marking	Suitable for Bore Size in.	mm.
2·6556 2·6560	(67·453) (67·463)	To suit +·0400 bore	2·6581 2·6585	(67·516) (67·526)
2·6561 2·6565	(67·465) (67·475)	To suit +·0405 bore	2·6586 2·6590	(67·529) (67·539)
2·6566 2·6570	(67·478) (67·488)	To suit +·0410 bore	2·6591 2·6595	(67·541) (67·551)
2·6571 2·6575	(67·490) (67·500)	To suit +·0415 bore	2·6596 2·6600	(67·554) (67·564)

OVERSIZE PISTON SIZES

+·040 in. RANGE

Note.—*The later-type pistons have oval and tapered skirts, and considerable care must be exercised when making measurements.*

Section A.15

REMOVAL AND REPLACEMENT OF THE CARBURETTERS

("**TD**") Remove the air cleaner by slackening the hose clip from the branch pipe of the cylinder head cover breather and the hose clip attaching it to the air intake pipe. Remove the central wing nut on the cleaner securing it to the air intake pipe.

("**TF**") Disconnect the breather pipe from the front cleaner.

Unscrew the two bolts securing each cleaner to its carburetter flange, and remove the cleaners.

("**TD**" and "**TF**") Take off the float-chamber overflow pipes.

Detach the fuel pipe at the petrol pump union.

Disconnect the mixture control wire from its attachments to the carburetter levers.

Disconnect the throttle control link rod at its attachment to the end of the accelerator lever.

Remove the four bolts holding the carburetters to the induction manifold and lift the carburetter assembly clear of the engine.

Section A.16

REMOVAL OF THE EXHAUST AND INLET MANIFOLD

Take off the carburetters as in Section A.15.

Release the exhaust pipe from the manifold flange.

Undo the four nuts securing the manifolds to the cylinder head and remove the complete assembly.

Section A.17

REMOVAL AND REPLACEMENT OF THE WATER PUMP

Drain the cooling system through the radiator and cylinder block drain taps, and release the dynamo on its mountings so that the driving belt may be withdrawn.

("**TF**") Remove the valance tie-bar.

Detach the rubber hose at the pump body and remove the fan blades by withdrawing the four attachment set screws complete with spring washers. Undo the four bolts with spring washers attaching the pump body to the cylinder block, noting that they are of different lengths, and withdraw the pump unit.

Reassembly is the reversal of this process, but make sure the flange washer is in good order and that the pump bolts are replaced in their correct positions.

Section A.18

REMOVAL OF THE TIMING CHAIN CASE

To carry out this operation with the engine in the frame it is necessary to remove the radiator (see Sections D.2 and DD2).

Remove the fan belt as detailed in Section N.3, "Removal and replacement of the dynamo."

Remove engine control link (see Section A.38).

Note.—*Mark or measure the position of the adjuster so that this may be refitted to the same setting.*

Remove the water pump as detailed in Section A.17.

Remove the starting handle dog nut, taking care of the packing shims behind it.

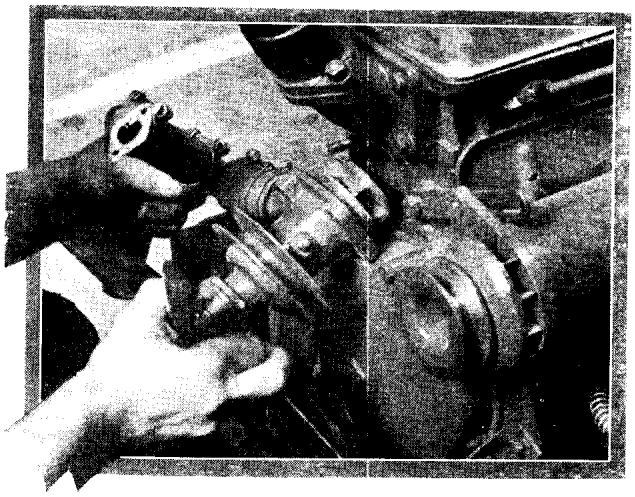


Fig. A.14.
Method of removing the water pump.

Remove the crankshaft fan pulley with a suitable extractor.

Remove the nine set screws securing the timing cover to the crankcase, and withdraw the cover.

Section A.19

REPLACEMENT OF THE TIMING CHAIN CASE

To ensure an oil-tight joint it is essential that the cork washer between the cover and the front plate is in good condition. Renew if necessary.

Examine the face of the engine bearer plate to see that it is smooth and flat. Any distortion or imperfection is likely to prevent the chain cover seating tightly.

Check that the oil thrower is in position on the crankshaft with its dished side facing towards the engine.

Check the asbestos oil seal for the crankshaft. The ends of the seal must not be **below** the mating faces of the chain cover. Coat the mating faces with jointing compound.

Place the timing cover in position, and locate it loosely with two or three fixing bolts. Fit the remainder of the securing bolts and tighten up evenly.

Place the fan driving pulley on the crankshaft, push it home and replace the starting handle dog nut, not forgetting to replace the shims beneath it so that the dogs are in the correct position for easy cranking of the engine.

Replace the water pump. Replace the engine control link and, if the position of the adjuster has not been noted, adjust as detailed in Section A.38.

Replace the fan belt, adjust its tension, and lock the dynamo in this position by tightening its attachment bolts.

Section A.20

REMOVAL OF THE TIMING CHAIN

Remove the sump as in Section A.2.

Remove the timing chain case as in Section A.18.

Remove the bolt securing the camshaft sprocket to the camshaft.

Remove the chain tensioner as detailed in Section A.23.

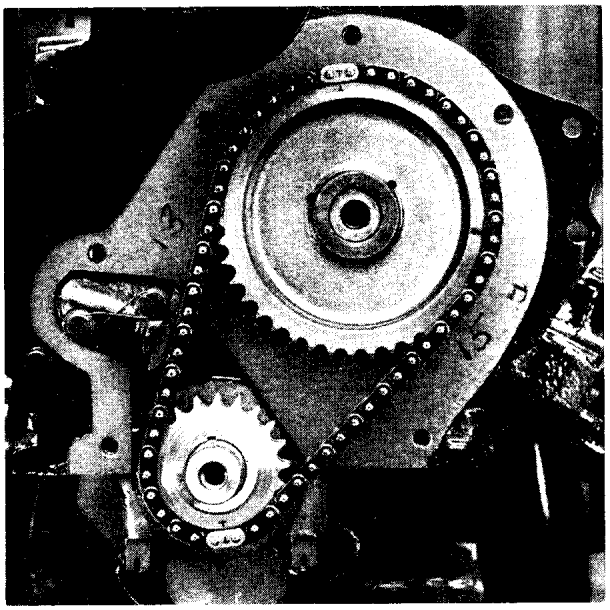


Fig. A.15.
This illustration shows how the bright links on the timing chain engage with the marked chain wheels.

Lever off the crankshaft and camshaft sprockets, complete with the chain, by means of short, flat levers, or Tool No. T.123, taking care not to damage the crankshaft and camshaft front bearings.

Note.—*Take care of the chain tensioner slipper and chain tensioner spring.*

Section A.21

REPLACEMENT OF THE TIMING CHAIN

The two timing sprockets are secured to the crankshaft and camshaft respectively by single keys. There is therefore only one position in which the sprockets can be fitted to the camshaft and crankshaft.

It will be noticed that the timing chain has two white links, and each of the sprockets has one tooth marked "T." Between the white links are thirteen black ones on one side of the chain and fifteen black links on the other. The thirteen black and the two

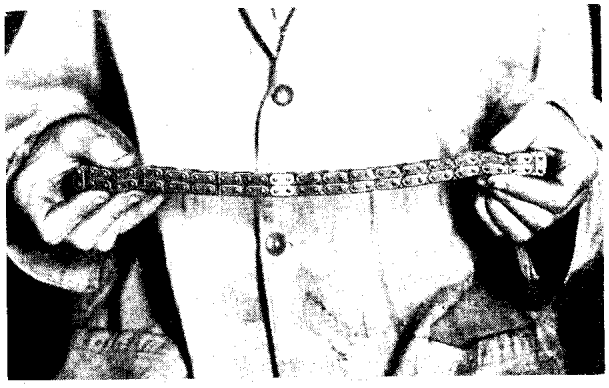


Fig. A.16.
The bright links on the timing chain should be brought together to determine the long and short chain sections.

white links are clearly seen in Fig. A.15, which shows one white link of the chain engaged with the tooth of the camshaft sprocket marked "T," while the tooth of the crankshaft sprocket marked "T" is opposite the other white link, thirteen black links behind the first one.

With the shorter portion of the chain to the left (the white links forward) engage the camshaft sprocket tooth marked "T" with the top white link, and the crankshaft sprocket tooth marked "T" with the other white link.

Place the keyways of the crankshaft and camshaft in a suitable position to register with the sprocket keyways and push home the sprockets complete, with the chain in position.

Replace the chain tensioner, checking the paper gasket to make sure an oil-tight joint is achieved.

Replace the bolt securing the camshaft sprocket to the camshaft, and knock over the lock washer into

engagement with the hole in the sprocket and one flat of the nut.

Replace the timing chain case as detailed in Section A.19.

To carry out this operation with the engine in the frame it will be necessary to remove and replace the radiator as detailed in Section D.2.

Note.—*The engine requires turning twenty times before the links and marked teeth come back to this position again.*

Section A.22

THE TIMING CHAIN TENSIONER

The chain tensioner consists of an hydraulically damped, spring-loaded plunger and combined slipper block, encased in a housing which is bolted to the cylinder block. The slipper is held against the chain by the tension of the spring and the oil pressure.

The spring, which is of 22 gauge (·71 mm.) wire, has a free length of 2·795 in. (71 mm.), an outside diameter of ·295 in. (7·5 mm.) and has 35 effective coils. It gives a load of 1·25 lb. (·57 kg.) when compressed to 1·89 in. (48 mm.).

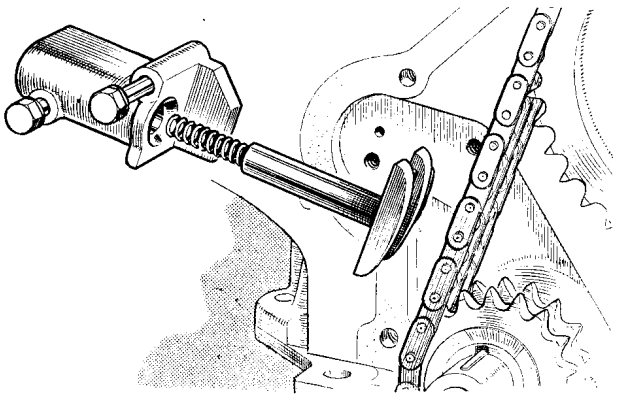


Fig. A.17.
The timing chain tensioner.

The plunger is fed with oil from the crankshaft front main bearing via an oilway drilled through the cylinder block, mating with an oilway in the tensioner housing or feed block. This oilway is then reduced in diameter to ·04 in. (1 mm.) and the oil feeds through to the stem of the plunger, which is ·43 in. (11 mm.) in diameter, and then through the bleed hole in the plunger, which is ·10 in. (2·5 mm.) diameter. This causes an increased pressure and produces a cushioning effect between the chain and the slipper. Oil passing through the bleed hole passes on to the chain and slipper, ensuring effective lubrication between the two.

Section A.23

REMOVAL OF THE CHAIN TENSIONER

Break the lockwire at the two set screws securing the chain tensioner feed block to the cylinder block and unscrew them, taking care to hold the assembly against the chain to overcome the tension of the spring.

Before replacing, examine the bore of the feed block for wear (this should be ·43 in.±·004 in. (11 mm.± ·1 mm.)) and make sure that the oilway is clear. Look for any wear on the chain tensioner—the outside diameter of the stem should be ·43 in.—·004 in. to —·012 in. (11 mm. —·1 mm. to —·3 mm.). Finally check the tensioner spring, to the details already given in Section A.22. When refitting make sure to rewire the set screws securing the feed block.

Section A.24

REMOVAL AND REPLACEMENT OF THE TAPPETS

Remove the air cleaner.

Remove the cylinder head cover. Unbolt the fume pipe from the engine side cover and remove the cover.

Remove the rocker gear from the cylinder head as indicated in Section A.8, and withdraw the push-rods.

Withdraw the tappets.

Replacement is carried out in the reverse manner to that detailed for removal, and both the push-rods and tappets should be refitted in the same positions they occupied before removal to avoid the need for extensive adjustment. Care should be taken when refitting the side cover to see that the drain holes in its gasket are at the bottom.

Section A.25

REMOVAL AND REPLACEMENT OF THE CAMSHAFT

Drain the radiator.

Remove the bonnet.

Remove the tappets as detailed in Section A.24, otherwise fouling between the cams and tappets is likely to cause damage to the running surfaces.

Remove the sump as detailed in Section A.2.

Disconnect the high-tension leads from the plugs and remove the distributor after removing its location bolt from the side of the cylinder block housing.

Remove the oil pump by removing the bolts securing the body to the cylinder block.

Remove the timing chain case, the timing chain and chain wheels as detailed in Sections A.18 and A.20.

Remove the radiator as indicated in Sections D.2 or DD.2.

Remove the dowel screws which secure the intermediate and rear bearings to the cylinder block.

Remove the front thrust plate.

Remove the camshaft by drawing it forward through the front bearing, carrying the centre bearing with it. This should be removed from the camshaft when the camshaft has been withdrawn far enough to bring the centre bearing free from its housing.

Replacement is carried out in the reverse manner to that detailed for removal, but the following points must be observed carefully :—

Ensure that all oilways are clear by removing the blanking screws from the crankcase and testing the oilways with compressed air.

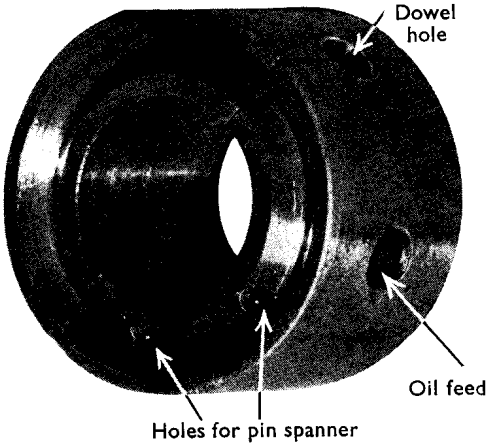


Fig. A.18.
The relative positions of the holes in the camshaft centre bearing.

The split centre bearing may easily be fitted incorrectly. Ensure that the dowel hole in the bearing is in line with that in the crankcase and that the oilway through the bearing is correctly aligned with the oil passage in the crankcase. When correctly fitted the two pin-spanner holes in the side should be towards the front of the engine in the lower half of the bearing. (See Figs. A.18 and A.19.)

It is essential to make quite sure that the dowel hole in the bearing is exactly in register with the dowel bolt hole in the crankcase before attempting to replace the dowel bolt or it may shear the edge of the hole in the bearing.

After replacing and tightening the dowel locating the centre bearing make sure that the camshaft is still free to rotate, i.e. that the dowel bolt does not " bottom " in its hole and so squeeze the bearing.

The whole of this operation is more easily carried out with the engine out of the car and the crankshaft, flywheel, pistons and connecting rods removed. Do not forget to rewire the two bearing dowel bolts.

Section A.26

CAMSHAFT BEARINGS

When fitting new camshaft bearings it will be found that the centre and rear bearings can be simply fitted as strict replacements, but when the front bearing is pressed into the housing this will need reaming in line with the centre and rear bearings with Tool No. T.111. The bearing must have the locking nick knocked into the crankcase slot.

The end float of the camshaft is taken in both directions by a plate which is interposed between the back of the camshaft chain wheel and the shoulder of the camshaft front journal.

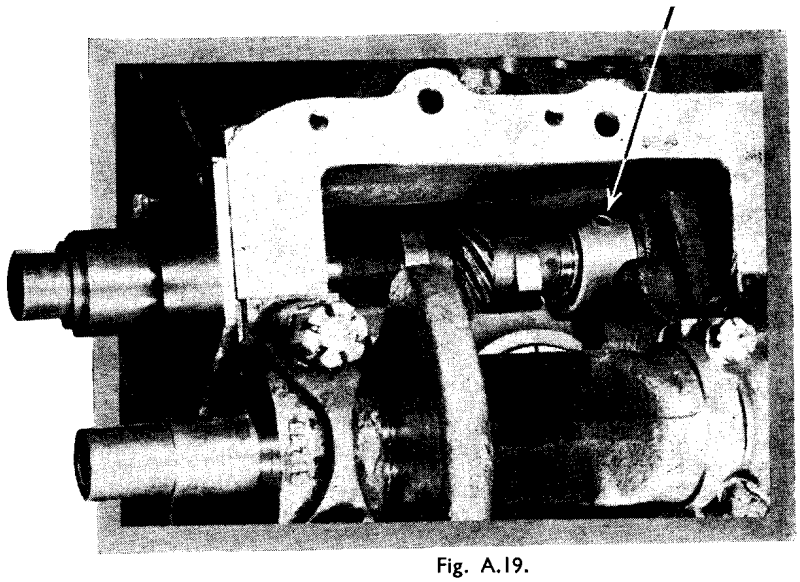


Fig. A.19.
In this photograph the camshaft has been partly inserted. Note the position of the centre bearing.

Section A.27

TAPPET ADJUSTMENT

Remove the air cleaner and rocker cover.

The tappet clearance should be set to ·019 in. (·48 mm.) (on engines prior to No. XPAG/TD2/24116, and on engines from this number onwards the clearance should be ·012 in. (·30 mm.)) for both inlet and exhaust valves with the engine hot. (See Section A.44.)

If the engine is cold an extra ·001 in. (·025 mm.) should be allowed. It is important that the clearance is set when the tappet is exactly on the heel of the cam, owing to the type of cam contour employed.

To reduce the number of times the engine need be rotated, the table on page A.18 will be useful when setting the tappets.

Adjust	No.	1	rocker	with	No.	8	valve	wide	open
,,	,,	3	,,	,,	,,	6	,,	,,	,,
,,	,,	5	,,	,,	,,	4	,,	,,	,,
,,	,,	2	,,	,,	,,	7	,,	,,	,,
,,	,,	8	,,	,,	,,	1	,,	,,	,,
,,	,,	6	,,	,,	,,	3	,,	,,	,,
,,	,,	4	,,	,,	,,	5	,,	,,	,,
,,	,,	7	,,	,,	,,	2	,,	,,	,,

Provision for adjusting the valve clearance is made in the rocker-arm by an adjustable screw and locknut.

The tappet adjusting screw is released by slackening off the hexagon locknut with a spanner, while holding the screw against rotation with a screwdriver.

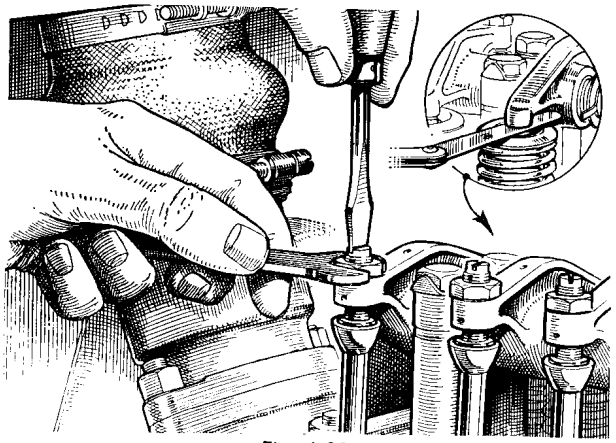


Fig. A.20.
The method of setting the tappets.
When the locknut is released the valve clearance can be set by rotating the adjusting screw with the screwdriver and setting the clearance, by means of a feeler gauge, to ·019 in. (·48 mm.) as indicated in the inset.

The valve clearance can then be set by rotating the screw carefully while checking the clearance with a feeler gauge at the valve stem.

The tappet screw is then relocked by tightening the hexagon locknut, again holding the tappet screw against rotation with the screwdriver. Test the clearance again to ensure it has not changed.

Section A.28

REMOVING AND GRINDING THE VALVES

The valve springs are secured by cups and split conical cotters. In order to remove a valve the head must be removed as indicated in Section A.9, placed face downwards on the bench with a block of wood filling the combustion space so that the valve head is resting on it. If the spring is then depressed, the collets are exposed and may be removed, together with the valve springs. On the valve stem there is a small synthetic rubber oil seal which slips off easily. A wood block with packing pieces for each combustion chamber and a bench-type spring compressor greatly facilitate the carrying out of this operation. (See Fig. A.22.)

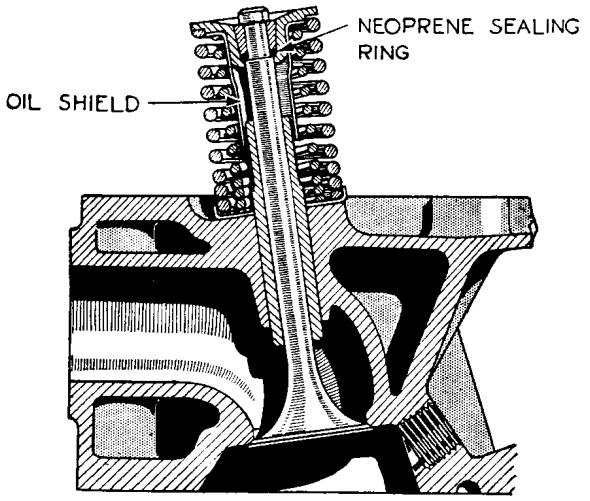


Fig. A.21.
The valve springs should always be replaced with the closed coils against the cylinder head.

A suitable bench spring compressor, special tool Part No. 67456, is available.

When the valves are refitted after attention, it is essential to fit **new** neoprene rubber sealing rings on the valve stems to avoid excessive oil consumption. Ordinary rubber is useless.

Fig. A.22.
The bench-type valve spring compressor.

Section A.29

GRINDING AND TESTING THE VALVES AND THEIR SEATINGS

Each valve must be cleaned thoroughly and carefully examined for pitting. Valves in a pitted condition should be refaced with a suitable grinder or alternatively replaced with new valves.

If the valve seats show signs of pitting or unevenness, they should be trued by the use of a suitable grinder or a special cutter such as Tool No. 301075 (Section Q). When using a cutter, care should be exercised to remove only as little metal as is necessary to ensure a true surface.

Fig. A.23.
Uneven valve seats can be trued with a special cutter.

All valves, when fitted at the factory, are numbered on their heads from 1 to 8, and should be replaced in the corresponding valve ports, No. 1 valve being fitted to the port nearest the front of the engine. When replacement valves are fitted, they should be numbered to identify the port to which they belong.

The valve face should be smeared lightly with fine or medium grade carborundum paste, and then ground to its seat, using the suction grinder, Part No. 66893. Avoid the use of excessive quantities of grinding paste ; see that it remains in the region of the valve seating only and does not reach the working surfaces of the engine. A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve should be lapped to its seat with a semi-rotary motion and occasionally allowed to rise by the pressure of the light coil spring. This assists in spreading the paste evenly over the valve face and seat. It is necessary to carry out the grinding operation until a dull, even matt surface, free from blemish, is produced on the valve seat and face. If the valve seat, which is at 30°, is found to be wide, it should be reduced with a 15° cutter to a width of 2 mm. (·080 in.) for the exhaust and 1·1 mm. (·043 in.) for the inlet seats.

On completion, the valve seats and ports should be cleaned thoroughly with paraffin-soaked rag, dried, and then thoroughly cleaned by compressed air. The valves should be washed in paraffin, and all traces of grinding paste removed.

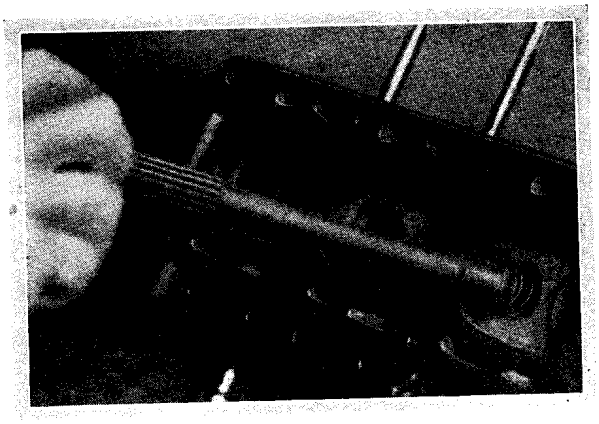


Fig. A.24.
This photograph shows the suction valve grinding tool in operation with a light spring under the valve head.

Section A.30

REMOVAL AND REPLACEMENT OF VALVE GUIDES

Remove the cylinder head and valves as detailed under Sections A.9 and A.28.

Rest the head with its machined face downwards on a clean, flat surface and drive the valve guides downwards into the combustion chamber, using a suitably sized shouldered drift. This should take the form of a hardened steel punch $\frac{1}{2}$ in. (12·7 mm.) in diameter and not less than 6 in. (15 cm.) in length with a locating spigot $\frac{5}{16}$ in. (8 mm.) in diameter machined on one end for a length of 1 in. (2·5 cm.) to engage the bore of the guide.

When fitting the new valve guides, press them in until ·945 in. (24 mm.) is protruding above the machined surface of the cylinder head.

Note.—*The inlet valve guides are* $\frac{7}{32}$ *in.* (5·56 *mm.*) *longer than the exhaust valve guides, but all valve guides project the same distance above the valve spring seating, namely* ·945 *in.* (24 *mm.*).

Recut the valve seat from the new guide, if necessary, to ensure that the valve seats correctly.

Section A.31

REMOVAL AND REPLACEMENT OF ENGINE AND GEARBOX

Drain the cooling system through the radiator and cylinder block taps.

Remove the bonnet and radiator (see Section D.2).

Disconnect the battery earth lead.

Detach the fuel line at the fuel pump.

Uncouple the high-tension lead from the coil and remove the low-tension wire from the distributor body.

Disconnect the mixture control inner and outer cables at the rear carburetter attachments.

Disconnect the throttle ball joint at the forward end of the accelerator pedal arm.

Detach the accelerator control spring and release the starter cable from the starter terminal.

Remove the three brass nuts holding the exhaust pipe to the manifold and undo the clip holding the exhaust pipe to the gearbox. This will allow the front of the exhaust pipe to drop clear of the manifold.

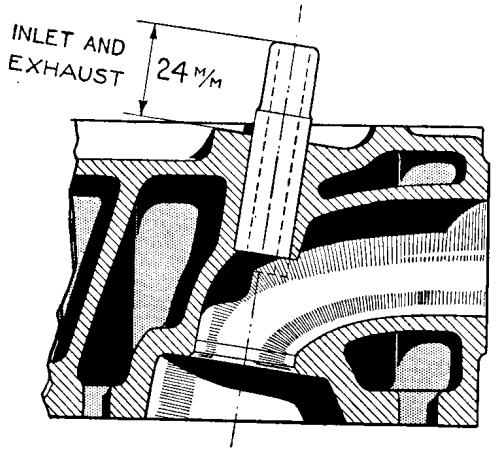


Fig. A.25.
The correct position of the valve guide in the cylinder head is shown in this illustration.

Undo the oil pressure gauge pipe at the cylinder block and detach the revolution counter drive from the rear end of the dynamo.

Disconnect the dynamo leads, noting that the **green** wire on the dynamo goes to the field terminal "F."

Remove the two bolts holding the front engine mounting to its rubber block.

Take off the outer nut on the engine steady.

Detach the clutch-operating mechanism from the side of the sump.

Remove the starter motor and take off the air cleaner and carburetters (see Section A.15). When removing the cleaner remember that the wing nut at the top holds the unit to the intake pipe.

Disconnect the earthing strip between the engine and chassis. On early models this is connected to the breather pipe and on later models to the flywheel housing.

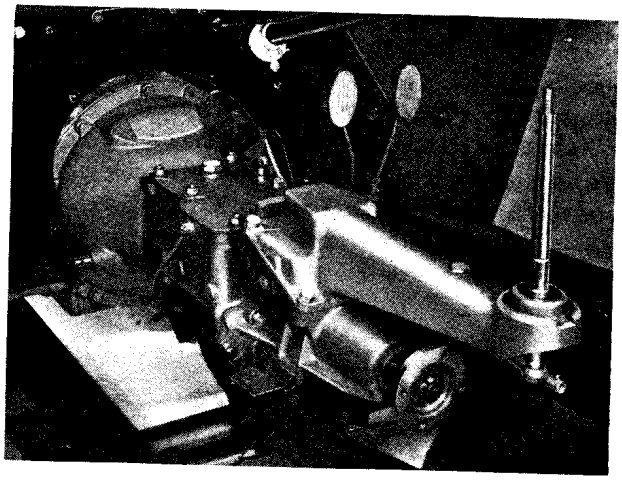


Fig. A.26.
The rear end of the engine unit prior to removal.

Remove the seats as explained in Section R.8.

Take up the carpets and detach the toeboard on the passenger's side.

Remove both floorboards, the gear lever knob and the gearbox cowl.

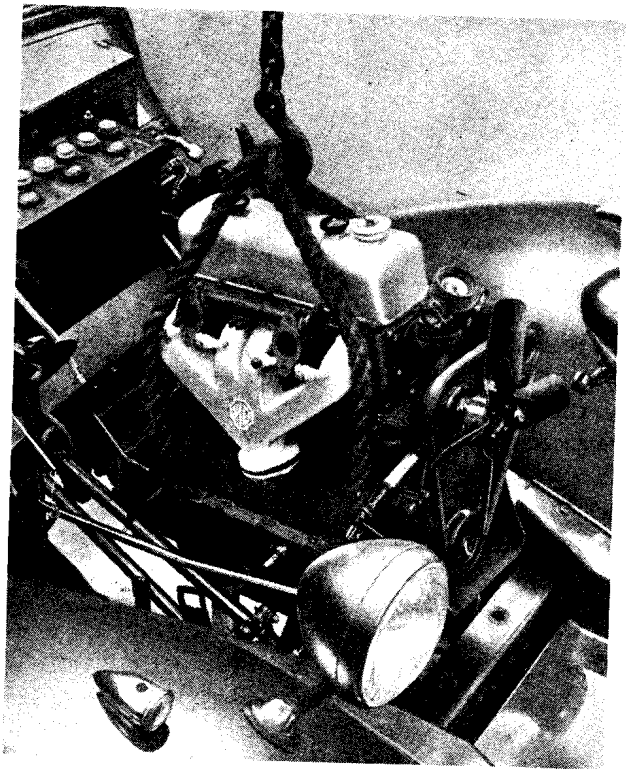


Fig. A.27.
The engine ready for removal.

Take off the gearbox top cover complete and secure a piece of cardboard over the gearbox opening in order to prevent dirt reaching the inside.

Note.—*Great care must be taken when removing or refitting the gear change lever and its housing. If the selector shaft is withdrawn past the first stop the synchromesh mechanism will slide apart and the synchro-balls will drop to the bottom of the gearbox. This means the complete gearbox must be dismantled.*

Later boxes are fitted with an extended 1st and 3rd selector shaft with a retaining circlip at the forward end which overcomes this.

Unscrew the screws round the pedal draught excluder and disconnect the speedometer drive.

Detach the forward end of the propeller shaft, marking the flanges so that they can be reassembled in the same position.

On LHD models it is necessary to disconnect and lift the steering column clear (see Section A.3).

Disconnect the rear engine mounting and place a sling round the unit, just behind the front mounting and also just forward of the flywheel housing.

Remove the unit by lifting it forward and upward, taking care to disengage the steady link from its bracket.

Note.—*See Section* A.38 *for adjustment of engine mounting.*

Section A.32

REMOVAL AND REPLACEMENT OF FLYWHEEL

In order to take off the flywheel the engine and gearbox unit should be removed from the car as detailed in Section A.31.

It is advised not to disturb the flywheel unnecessarily as it is essential for it to run absolutely true.

Remove the clutch as detailed in Section E.2.

Remove the locking wire on the flywheel fixing bolts.

Take out the fixing bolts.

Pull off the flywheel with a suitable extractor, taking care not to damage the locating dowels.

Replacement is a reversal of this process.

Check the flywheel for accuracy. It should be no more than ·002 in. (·05 mm.) out of truth at any point when rotated with a dial gauge in contact with the clutch face.

Section A.33

REMOVAL AND REPLACEMENT OF CRANKSHAFT (Engine out of Chassis)

Remove the sump as detailed under Section A.2.

Remove the fan driving pulley and timing chain case as detailed under Section A.18.

Remove the timing chain as detailed under Section A.20.

Remove the pistons and connecting rods as detailed under Section A.10.

Remove the two securing nuts from each main bearing cap and remove the caps and bearings.

Note.—*It is advisable to mark each bearing cap and bearing to ensure their correct position for subsequent replacement.*

Remove the crankshaft and flywheel.

If necessary remove the flywheel as detailed under Section A.32, but only if necessary.

Replacement of the crankshaft is carried out in the reverse manner to that detailed for removal, but before doing so, clean the oilways in the crankshaft.

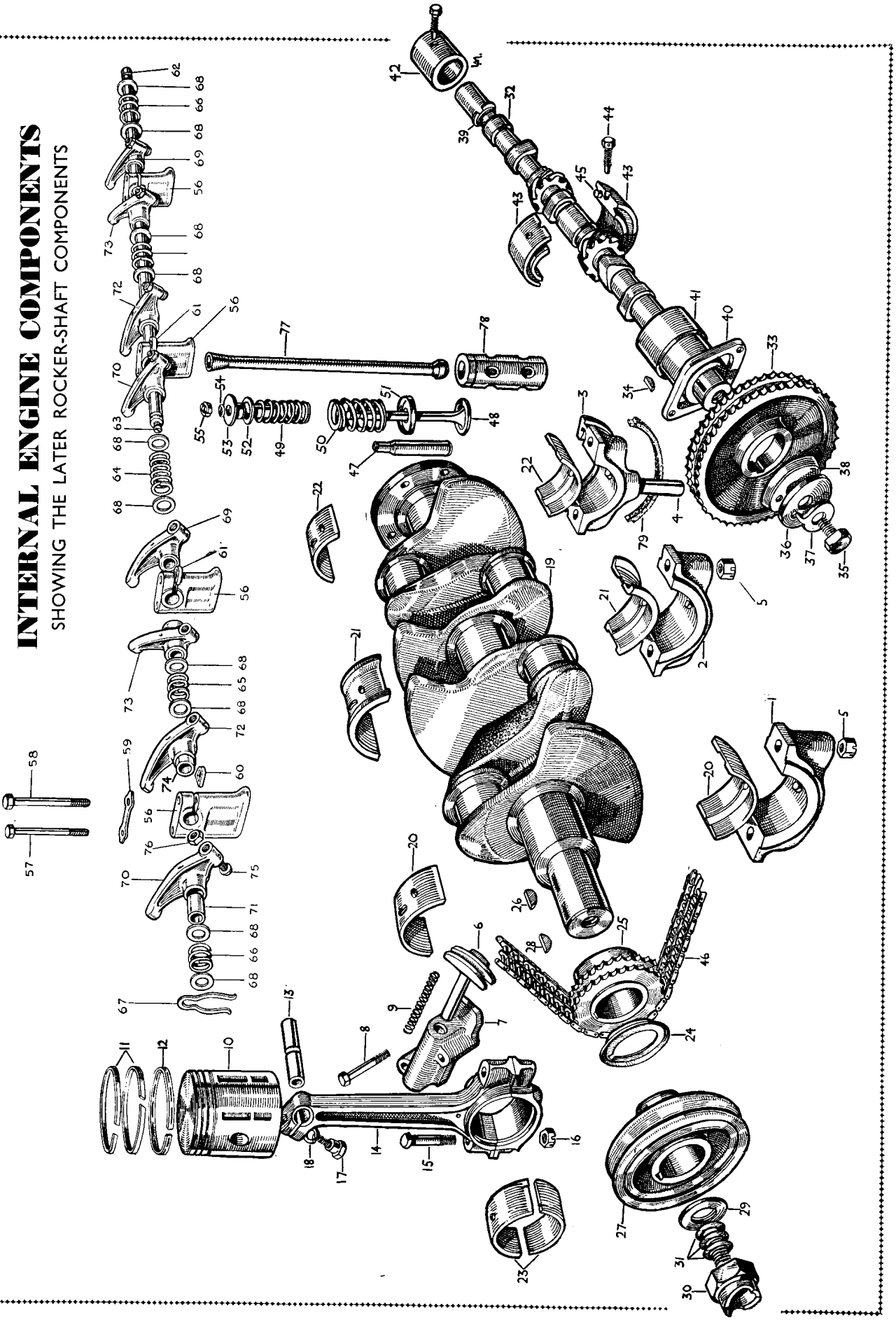
In order to clean out the oilways in the crankcase, the camshaft, filter, oil pump and pipes should be removed.

All bearings and other parts should be cleaned carefully before replacement, and care must be taken

Bearing and crankshaft diameter undersize	*Reference*	*Crankshaft main journal standard and regrind sizes*	*Crankpin journal standard and regrind sizes*	*Main bearings standard and regrind sizes*
Standard	Standard	52·00 mm.	45·00 mm.	52·020 mm. 52·005 mm.
·5 mm.	R.2	51·5 mm.	44·5 mm.	51·520 mm. 51·505 mm.
1·00 mm.	R.4	51·00 mm.	44·00 mm.	51·020 mm. 51·005 mm.

INTERNAL ENGINE COMPONENTS

SHOWING THE LATER ROCKER-SHAFT COMPONENTS



KEY TO INTERNAL ENGINE COMPONENTS

No.	Description
1.	Main bearing cap—front.
2.	Main bearing cap—centre.
3.	Main bearing cap—rear.
4.	Pipe—rear cap.
5.	Nuts—bearing cap.
6.	Tensioner—chain.
7.	Feed block—tensioner.
8.	Bolt—feed block.
9.	Spring—tensioner.
10.	Piston complete (with rings and gudgeon pin).
11.	Piston rings (compression).
12.	Piston ring (oil control).
13.	Gudgeon pin.
14.	Connecting rod with cap and bolts.
15.	Bolt—connecting rod cap.
16.	Nut—connecting rod cap bolt.
17.	Clamp screw—gudgeon pin.
18.	Spring washer—clamp screw.
19.	Crankshaft complete (with main big-end bearings)
20.	Bearing—front.
21.	Bearing—intermediate.
22.	Bearing—rear.
23.	Bearing—connecting rod.
24.	Oil thrower—crankshaft.
25.	Chain sprocket.
26	Key—chain sprocket.
27.	Pulley—on crankshaft.
28.	Key—crankshaft pulley.
29.	Washer.
30.	Nut—crankshaft.
31.	Shims—nut.
32.	Camshaft.
33.	Chain sprocket.
34.	Key—chain sprocket.
35.	Bolt—camshaft.
36.	Washer—chain sprocket.
37.	Lock washer—chain sprocket.
38.	Oil thrower—camshaft.
39.	Circlip—camshaft—rear.
40.	Thrust plate—camshaft.
41.	Bearing—camshaft—front.
42.	Bearing—camshaft—rear.
43.	Bearing—camshaft—intermediate.
44.	Screw dowel—bearing
45.	Plain dowel—bearing.
46.	Timing chain.
47.	Valve guide—inlet and exhaust.
48.	Valve—inlet and exhaust.
49.	Spring—valve—inner.
50.	Spring—valve—outer.
51.	Cap—spring—bottom.
52.	Oil deflector—valve.
53.	Cap—spring—top.
54.	Packing ring—valve.
55.	Split cotters—valve spring.
56.	Support bracket—rocker-shaft.
57.	Bolt—support bracket (8 mm.).
58.	Bolt—support bracket (10 mm.).
59.	Lock plate—support bracket bolts.
60.	Washer—Nos. 1 and 5 brackets.
61.	Washer—Nos. 2 and 3 brackets.
62.	Rocker-shaft with plugs.
63.	Plug—rocker-shaft.
64.	Spacer spring—long—centre.
65.	Spacer spring—medium—outer.
66.	Spacer spring—short—front and rear.
67.	Spring clip—rocker-shaft.
68.	Washer—spring clip.
69.	Valve rocker with bush (Nos. 4 and 8 valves).
70.	Valve rocker with bush (Nos. 1 and 5 valves).
71.	Bush for valve rocker (Nos. 1, 4, 5 and 8 valves).
72.	Valve rocker with bush (Nos. 2 and 6 valves).
73.	Valve rocker with bush (Nos. 3 and 7 valves).
74.	Bush for valve rocker (Nos. 2, 3, 6 and 7 valves).
75.	Adjusting screw—rocker.
76.	Locknut—adjusting screw.
77.	Push-rod assembly.
78.	Valve tappet.
79.	Seal—rear bearing.

to reassemble the main bearing shells to the correct bearings. Oil all parts with clean oil before assembly.

Section A.34

REGRINDING THE CRANKSHAFT

If the crankshaft journals are found to be worn, scored or oval, they must be reground undersize or alternatively the engine must be fitted with a replacement crankshaft.

The table on page A.21 gives details of the various sizes available for regrinding to ensure the supply of bearings to match.

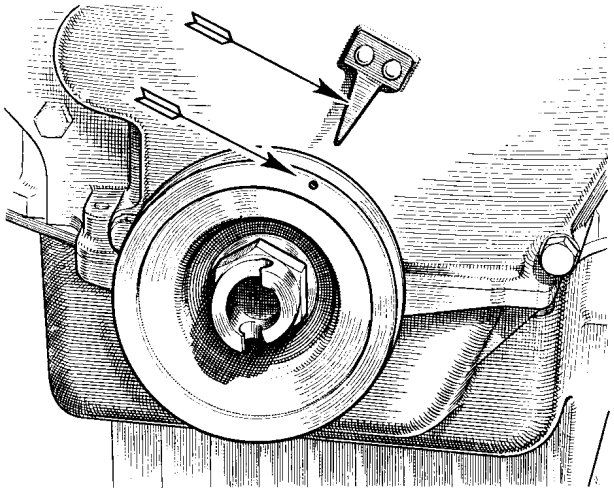


Fig. A.28.
The method of determining top dead centre.

Section A.35

OIL PRESSURE

Under normal running conditions the oil pressure should not drop below 40 lb. per sq. in. (2·8 kg./cm.^{2}) on the gauge, whilst approximately 20 lb. per sq. in. (1·4 kg./cm.^{2}) should be shown when the engine is idling.

Should there be a noticeable lack of pressure, the following points should be checked :—

1. That there is a good supply of the correct grade of oil in the engine sump.
2. That the pump gears are in order and have the correct clearances. (See Section A.4.)
3. That the gauze oil pump filter is clean and not choked with sludge.
4. That the external filter element is clean.
5. That the bearings on the delivery side to which oil is fed under pressure have the correct working clearance. Should the bearings be worn and the clearances excessive, the oil will escape more readily from the sides of the bearings, particularly when the oil is warm and fluid. This will cause a drop in the pressure recorded on the gauge, as compared with that shown when the bearings are in good order.

Note.—*The automatic release valve deals with any excessive oil pressure when the engine and oil are cold.*

Cold running and unnecessary use of the mixture control are often causes of serious oil dilution by petrol, and a consequent drop in pressure.

New engines with new oil will give considerably higher pressure readings than those given above.

Particular attention is called to the recommended change of oil every 3,000 miles (5000 km.). This is a most important factor in attaining long and trouble-free service from the engine.

Section A.36

REAR MAIN BEARING OIL SEAL COVER

This half cover is dowelled and bolted to the cylinder block, and to prevent oil leaks it is important that the extreme ends of the cover mate with the top face of the rear main bearing block. Jointing should be put between these faces when assembling. Renew the gasket (Fig. A.29) if it is damaged in any way.

Section A.37

TOP DEAD CENTRE MARK

An indicating arrow is fitted on the timing chain case and a hole is drilled or a groove cut in the outer face of the crankshaft fan pulley. Turn the engine until the hole or groove in the pulley is in line with the arrow on the cover for top dead centre on No. 1 and No. 4 cylinders (see Fig. A.28).

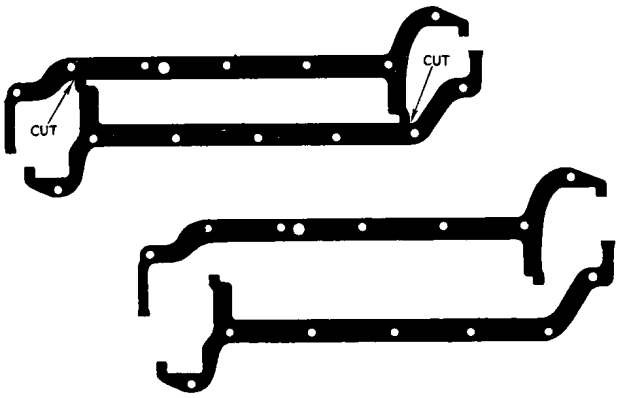


Fig. A.29.
This is the correct method of cutting the new sump gasket. It is important that the small ears are left on the projecting portions of the gasket.

Section A.38

THE ENGINE MOUNTING AND CONTROL LINK

The power unit is flexibly mounted to the chassis frame on a rubber block at the front and on two rubber blocks underneath the gearbox at the rear. As the location of these rubber mountings would permit a large rocking movement of the power unit under certain circumstances, a control link is fitted at the forward end to control the torque reaction effects on the power unit.

The rear mounting consists of two loose rubber blocks on which the engine rests and which are housed in a cradle on the chassis frame cross-member. A rebound rubber is also provided to limit the upward movements.

The exhaust system is rigidly attached to the exhaust manifold and the side of the gearbox, but attached to the chassis frame by a flexible mounting. This allows the exhaust system to float with the power unit.

Removing the control link

The engine control link is removed by withdrawing the split pins from the slotted nuts at each end, unscrewing the nuts, withdrawing the flat washers, and the cups and rubbers. If the locknuts of the central adjuster are slackened back (right- and left-hand threads) the link can be shortened by screwing the adjuster in the appropriate direction, allowing the assembly to be removed complete with inner rubbers and cups by rocking the engine.

Refitting the control link

Screw the adjuster locknuts right home on the threads of the two adjusting rods and screw the rods into the adjuster barrel as far as they will go. Place the two inner cups and rubbers on the ends of the adjusting rods. Insert one end of the assembly through the bracket on the engine and, holding it with its rubber tight against the bracket, rock the engine towards the left of the car on its rubber mounting to enable the other end of the adjusting rod assembly to be entered into the frame bracket.

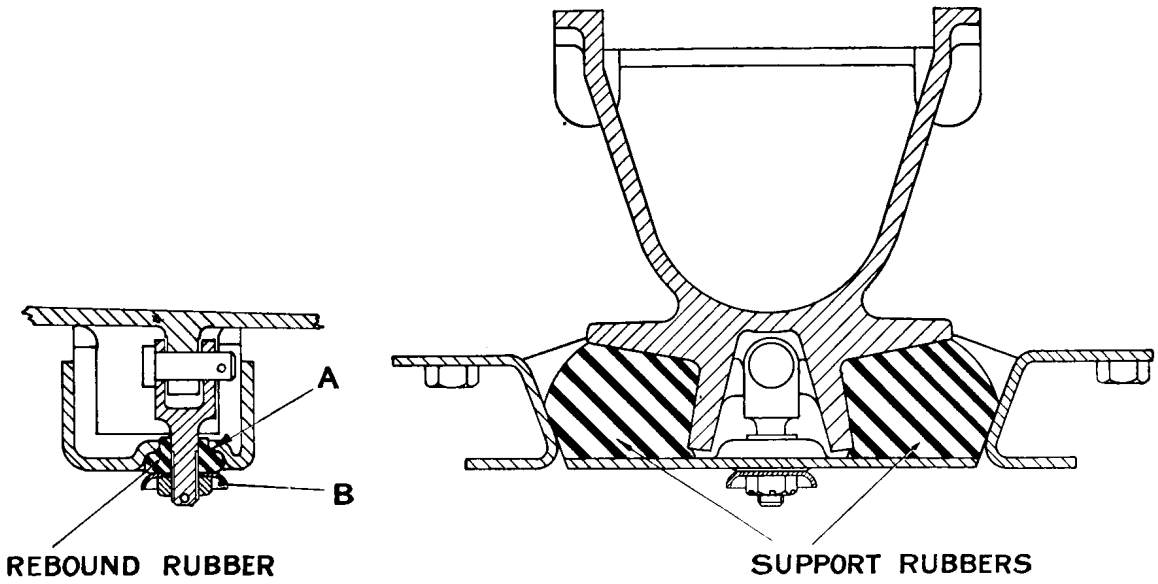


Fig. A.30.
Rear engine mounting.

Release the engine and, to ensure that it is in the natural position on its mountings, rock it gently from side to side a few times. As an additional precaution the exhaust pipe should be uncoupled from its attachments to the exhaust manifold and gearbox bracket clip while this is done.

If a noise or knock is heard when the engine is rocked gently, suggesting a foul, examine the installation to make sure there is ample clearance everywhere. Couple up the exhaust system.

Lengthen out the adjuster until the rubbers at each end are bearing lightly but firmly against the faces of the control link brackets, without disturbing the position of the engine. Fit the outer cups and rubbers, the flat washers, and finally the slotted nuts.

Tighten up the slotted nuts only just sufficiently to nip the rubbers and insert the split pins through the nearest slot.

Note.—*The engine control link is only to control engine movement and it must on no account be subjected to constant load through being too long or too short. It is most important therefore that it should be adjusted as explained above so that it carries no load, to ensure the minimum of engine vibration.*

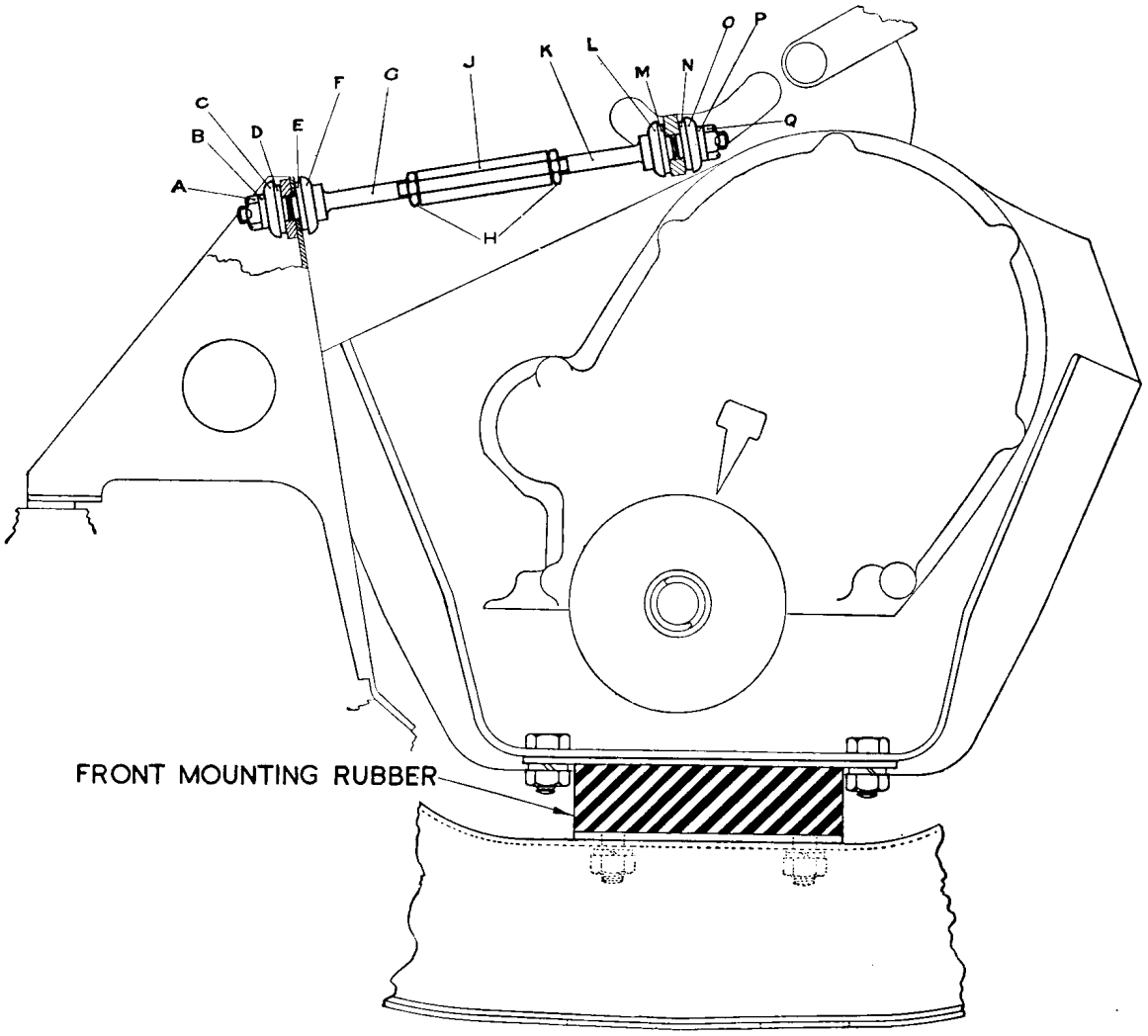


Fig. A.31.

Showing engine control link and front engine support rubber.

A. Slotted nut.
B. Washer.
C. Cup.
D. Rubber.
E. Rubber.
F. Cup.
G. Link rod.
H. Locknuts.
J. Adjuster.
K. Link rod.
L. Cup.
M. Rubber.
N. Rubber.
O. Cup.
P. Washer.
Q. Slotted nut.

Section A.39

LOCATING TROUBLES

Engine will not start

A. If the starter will not turn the engine, check the following :—
   1. Battery discharged, and/or defective.
   2. Disconnected or broken leads.
   3. Faulty starter switch.
   4. Faulty starter motor.
   5. Starter cables shorting to earth.
   6. Battery terminals badly corroded or battery leads loose.

B. If starter turns engine very slowly, check :—
   1. Partly discharged battery.
   2. Loose terminals or connections.
   3. Dirty or corroded connections.
   4. Faulty insulation on starter cables.
   5. Tightness in engine.
   6. Faulty starter brushes.

C. If starter turns engine smartly, but it will not fire, check :—
   1. Plugs not sparking.
   2. Spark at the coil. If the coil gives good spark, check :—
      (*a*) Gaps in plugs too wide or too close.
      (*b*) Plugs oiled up.
      (*c*) Plug insulators damaged, or dirty.
   3. If poor spark at coil, check :—
      (*a*) Low-tension or high-tension leads from coil to distributor loose or corroded.
      (*b*) Distributor points dry, worn or out of adjustment.
      (*c*) Carbon brush not making contact.
      (*d*) Rotor cracked.
      (e) Faulty condenser (substitute a condenser known to be in order).
      (*f*) Faulty coil (substitute a coil known to be in order).
   4. Check the carburetters for fuel supply. If no fuel in float-chambers, check :—
      (*a*) Functioning of the fuel pump.
      (*b*) Air leak in pipe line, indicated by rapid action of the pump.
      (*c*) Float-chamber needle sticking.
   5. If fuel is reaching float-chamber, check :—
      (*a*) For choked jets.
      (*b*) Water in the fuel.
      (*c*) Dirt in the carburetters.
      (*d*) Air leak in induction system.
      (e) Check adjustment of carburetter control.

If engine starts, but runs erratically

A. Check the following ignition points :—
   1. Loose high-tension leads to sparking plugs.
   2. Incorrect setting of plug points.
   3. Damaged plug or moisture on plugs.
   4. Loose connection on battery or in ignition circuit.
   5. Faulty high-tension leads.
   6. Battery charge low.
   7. Battery connections faulty.
   8. Defective contact breaker.
   9. Defective distributor.
   10. Faulty condenser.

B. Check the following carburetter points :—
   1. Water in the float-chambers.
   2. Choked filters in carburetters or fuel pump, indicated by slow pumping of fuel pump.
   3. Action of fuel pump. Suspect if sluggish.
   4. Jet partially choked.
   5. Carburetters set too rich, indicated by sooty exhaust.
   6. Fuel tank filler-cap vent choked.
   7. Obstruction in fuel feed pipe.
   8. Air leak into induction system.

C. Check the following mechanical points :—
   1. Sticking valves.
   2. Incorrect valve clearances.
   3. Burnt or broken valves.
   4. Incorrect valve timing.
   5. Incorrect ignition timing.
   6. Broken or weak valve spring.
   7. Valve guides worn, causing air leaks.
   8. Cylinder head gasket for leaks.
   9. Back-pressure due to damaged exhaust system.

If engine starts and stops

A. Check the following ignition points :—
   1. Loose low-tension leads.
   2. Loose distributor clamp screw.
   3. Faulty ignition switch contact.

B. Check the following carburetter points :—
   1. Incorrect setting of carburetter controls.
   2. Blocked fuel pipe.
   3. Water in float-chambers.
   4. Sticking needle valves.
   5. Fuel pump failing to function regularly.
   6. Air leak into fuel line.
   7. Fuel level low in tank.

If engine will not idle or run slowly

A. Check the following carburetter points :—
   1. Throttle stop screws incorrectly set.
   2. Throttle controls incorrectly set.
   3. Weak mixture or over-rich mixture.
   4. Faulty functioning of fuel pump.
   5. Carburetters not properly synchronised.

B. Check the following mechanical points :—
   1. Sticking valves.
   2. Incorrect valve clearance.
   3. Air leak in induction system.

CHECKING METHODS

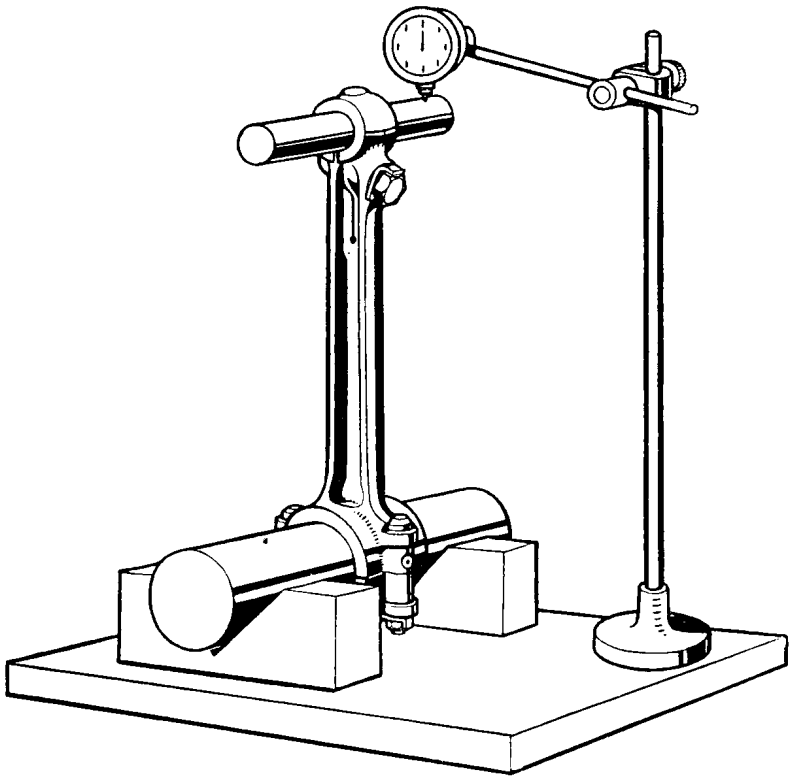


Fig. A.32.
Checking the connecting rod for alignment. The indicator dial should give the same reading at each end of the test bar clamped in the little-end.

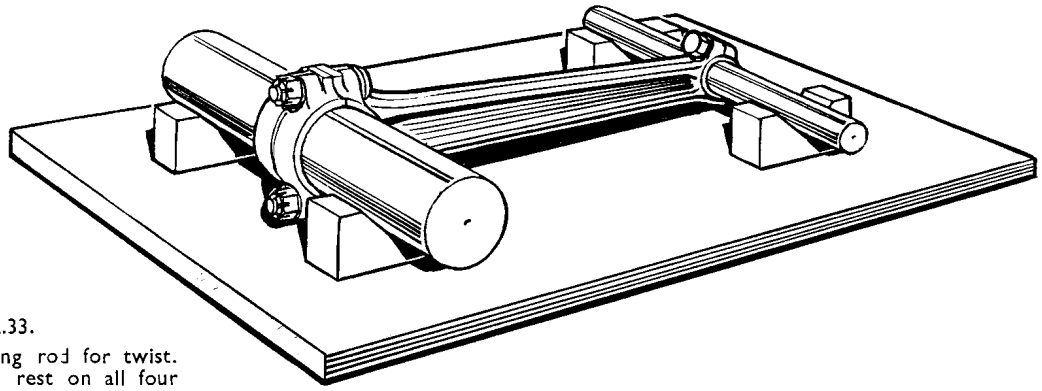


Fig. A.33.
Testing the connecting rod for twist. The test bars should rest on all four "V" blocks.

Section A.40

EXCESSIVE OIL CONSUMPTION

Some early cars of the "TD" series have been observed to have a heavy oil consumption.

In some cases this has been found to be due to oil passing from the valve cover into the air cleaner and being consumed in the engine.

This can be prevented by inserting a restrictor or washer in the air cleaner engine breather pipe as indicated in Fig. A.34.

Later production engines have this modification incorporated as standard.

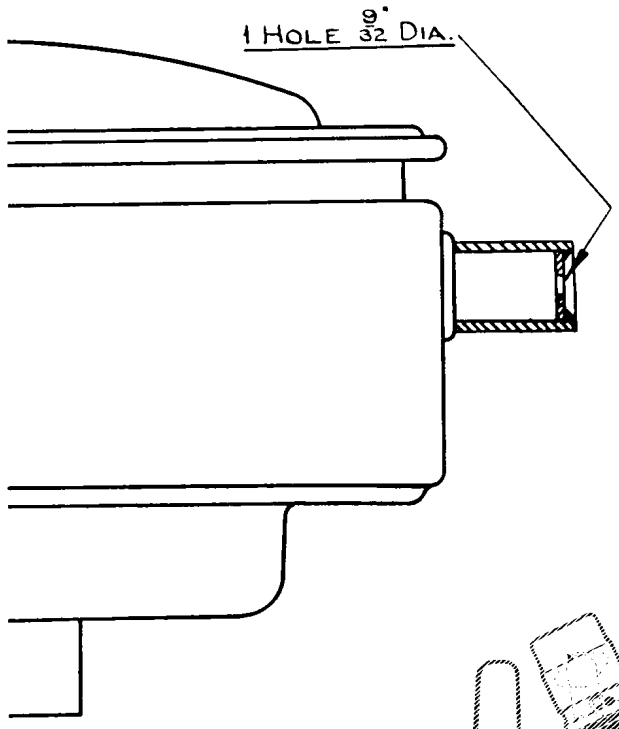


Fig. A.34.
The location of the restrictor in the air cleaner breather pipe.

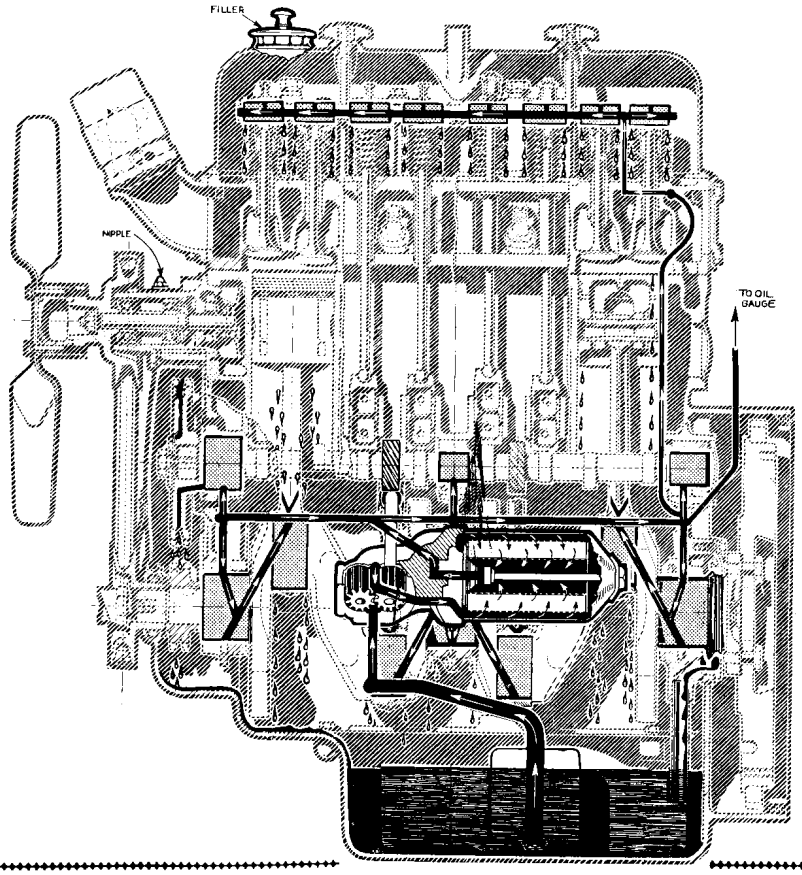
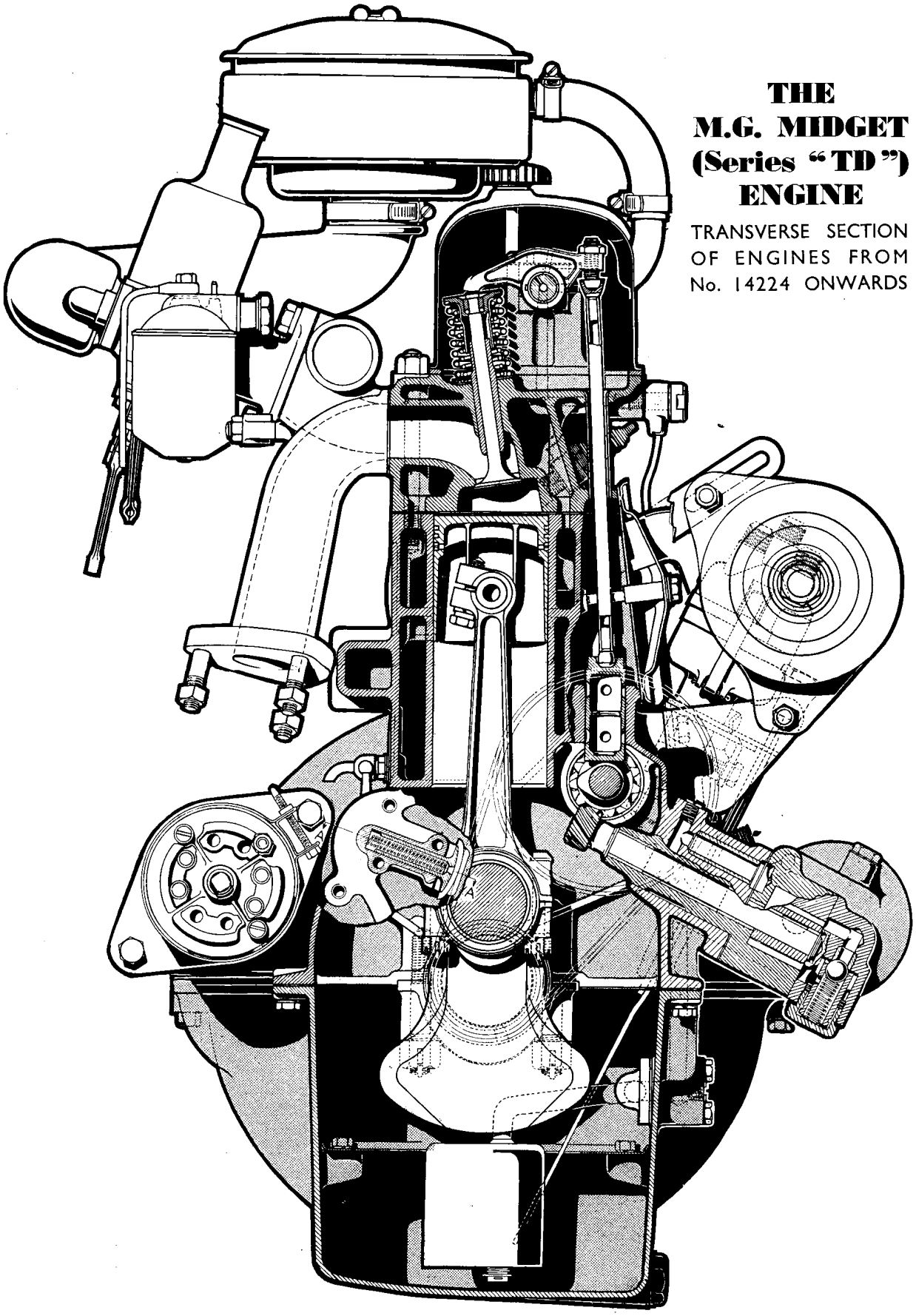


Fig. A.35.
The lubrication system of later engines commencing at Engine No. 14224 in which a renewable element filter is fitted directly to the oil pump body.

THE M.G. MIDGET (Series "TD") ENGINE

TRANSVERSE SECTION OF ENGINES FROM No. 14224 ONWARDS



Section A.41

THE MODIFIED OIL PUMP

Commencing at Engine No. XPAG/TD2/14224 a modified oil pump, incorporating the external oil filter head, has been fitted.

This has eliminated all possibility of fracture of oil pipes and introduces the advantage of a renewable filter element.

The filter element should be removed and cleaned at intervals of 3,000 miles (5000 km.) and a new filter element should be fitted every 6,000 miles (10000 km.). The filter element is a Tecalemit FG2381 (Part No. 162451), or a Purolator element (Part No. 162429).

From Engine No. XPAG/TD2/20972 a special priming plug has been fitted to the pump cover to permit the pump to be primed when the lubrication system has been drained completely (see page P.8).

Section A.42

CYLINDER HEAD AND CYLINDER BLOCK MODIFICATIONS

Starting at Engine No. XPAG/TD/17969, a modified cylinder block (Part No. SA2404/11) is fitted in conjunction with cylinder head gasket (Part No. X24481). This gasket is illustrated in Fig. A.37, and it will also service all engines prior to that quoted above and will be issued against all orders for replacement gaskets.

Engines from No. XPAG/TD2/22735 onwards are fitted with the modified cylinder block SA2404/11 and a modified cylinder head (Part No. SA2403/10). Such engines have a new gasket (Part No. 168423), and only this gasket may be used on these engines. In addition, they are fitted with Champion NA.8 sparking plugs instead of the Champion L.10.S previously used.

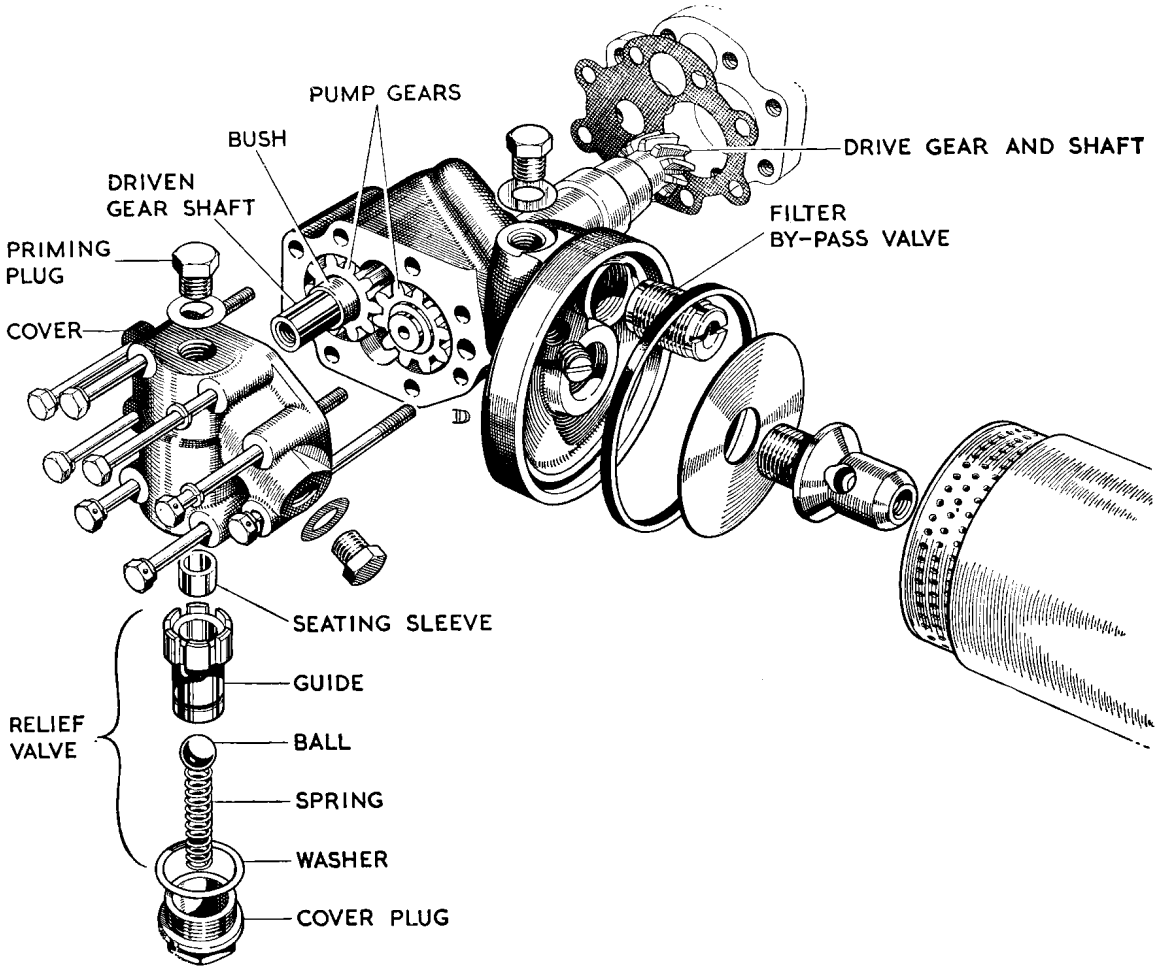


Fig. A.36.

The components of the modified oil pump.

Section A.43

MODIFIED PUSH-RODS AND ADJUSTING SCREWS

Operating in conjunction with longer adjusting screws, the push-rods on all engines starting at No. XPAG/TD2/17298 are shorter in length. Care must therefore be taken when ordering replacement push-rods or rocker adjusting screws. The new components bear the following Part Nos. :—

Push-rod assembly : 168431.
Adjusting screw for rocker : X21231.

Section A.44

THE MODIFIED CAMSHAFT

Commencing at Engine No. XPAG/TD2/24116, a new camshaft has been fitted, with different cam contours.

With this camshaft the valve clearance has been altered from ·019 in. (·48 mm.) to ·012 in. (·30 mm.).

The new camshaft is Part No. 168553, and is fitted in conjunction with a new cylinder head cover assembly (Part No. SA2407/3, and a new valve clearance plate (Part No. 162279).

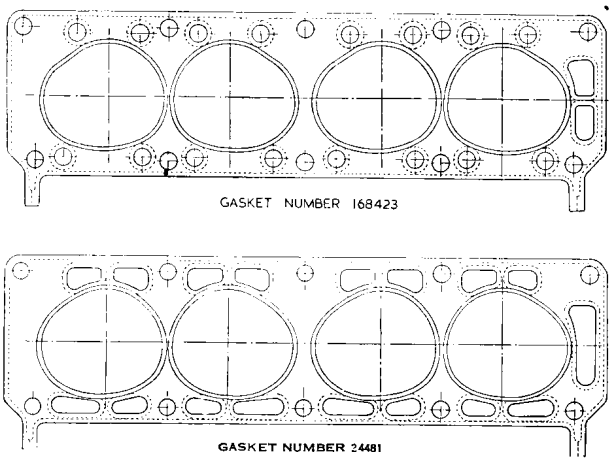
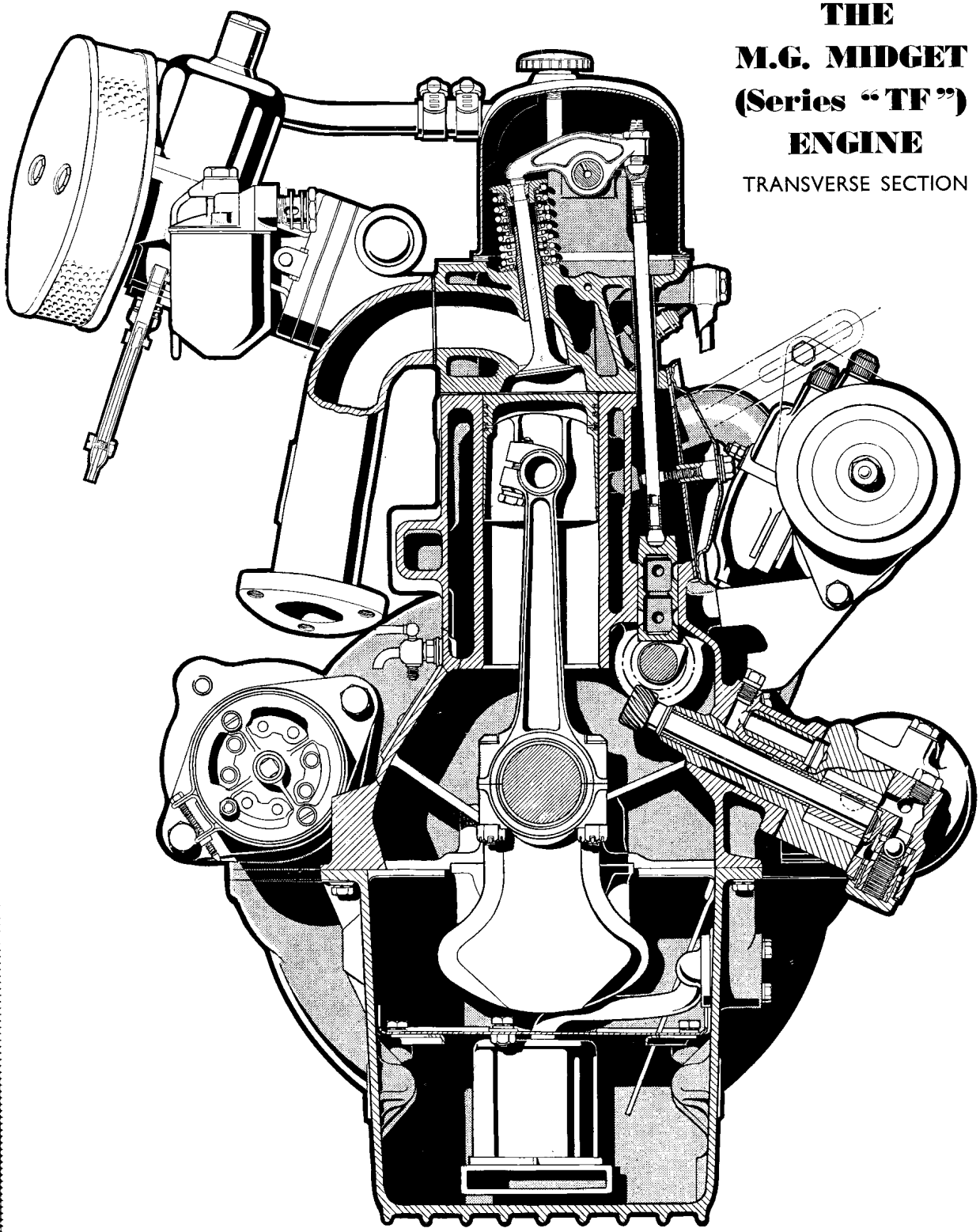


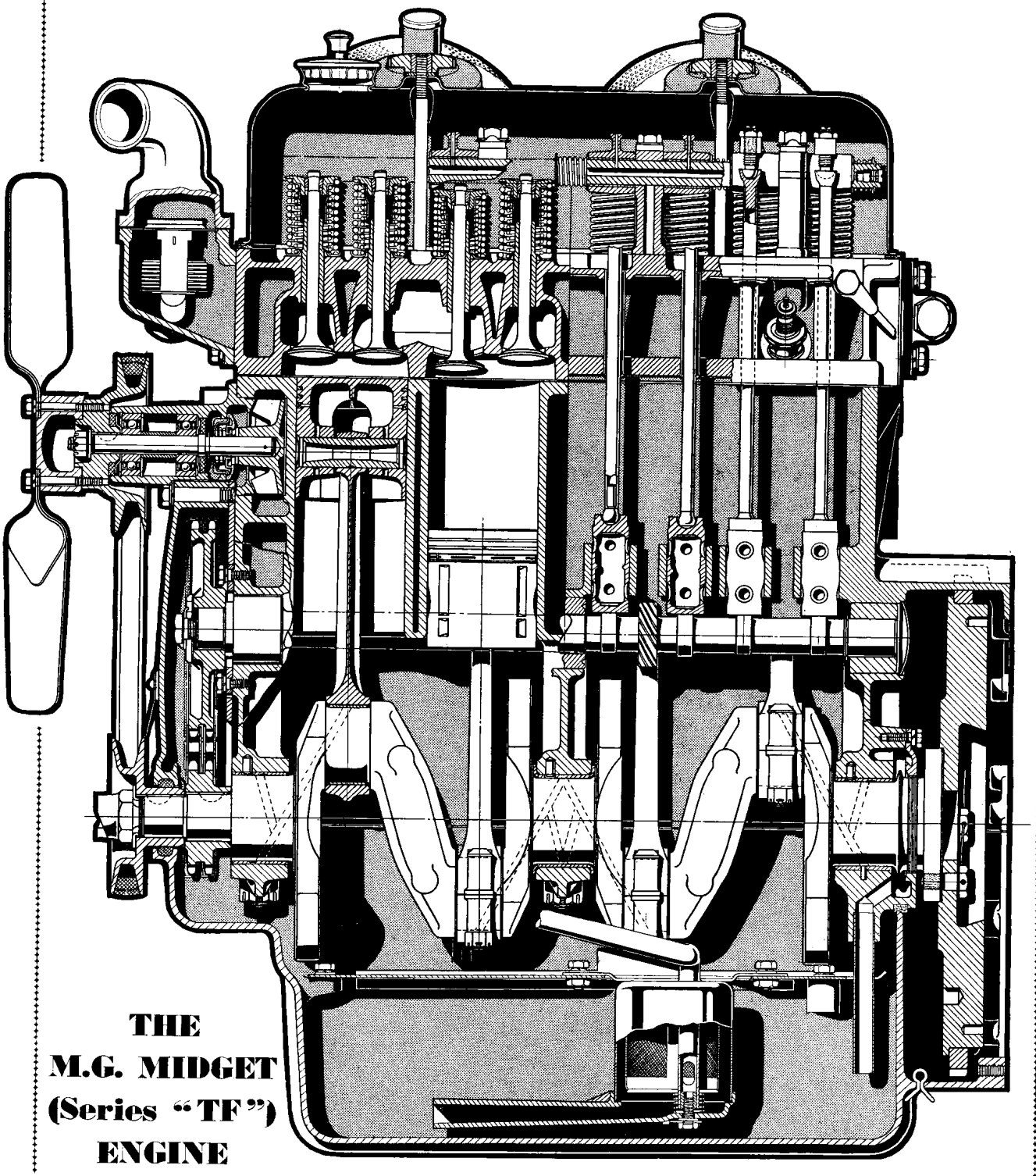
Fig. A.37.

The modified gaskets. They can readily be identified by the difference in the shape of the water passage apertures.

THE M.G. MIDGET (Series "TF") ENGINE

TRANSVERSE SECTION





THE M.G. MIDGET (Series "TF") ENGINE

LONGITUDINAL SECTION