SECTION A

THE ENGINE

GENERAL DESCRIPTION.

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

It has a four-throw crankshaft carried in three renewable steel-backed shell bearings. Thrust is taken on the centre bearing. The big-ends are also fitted with renewable steel-backed shell bearings.

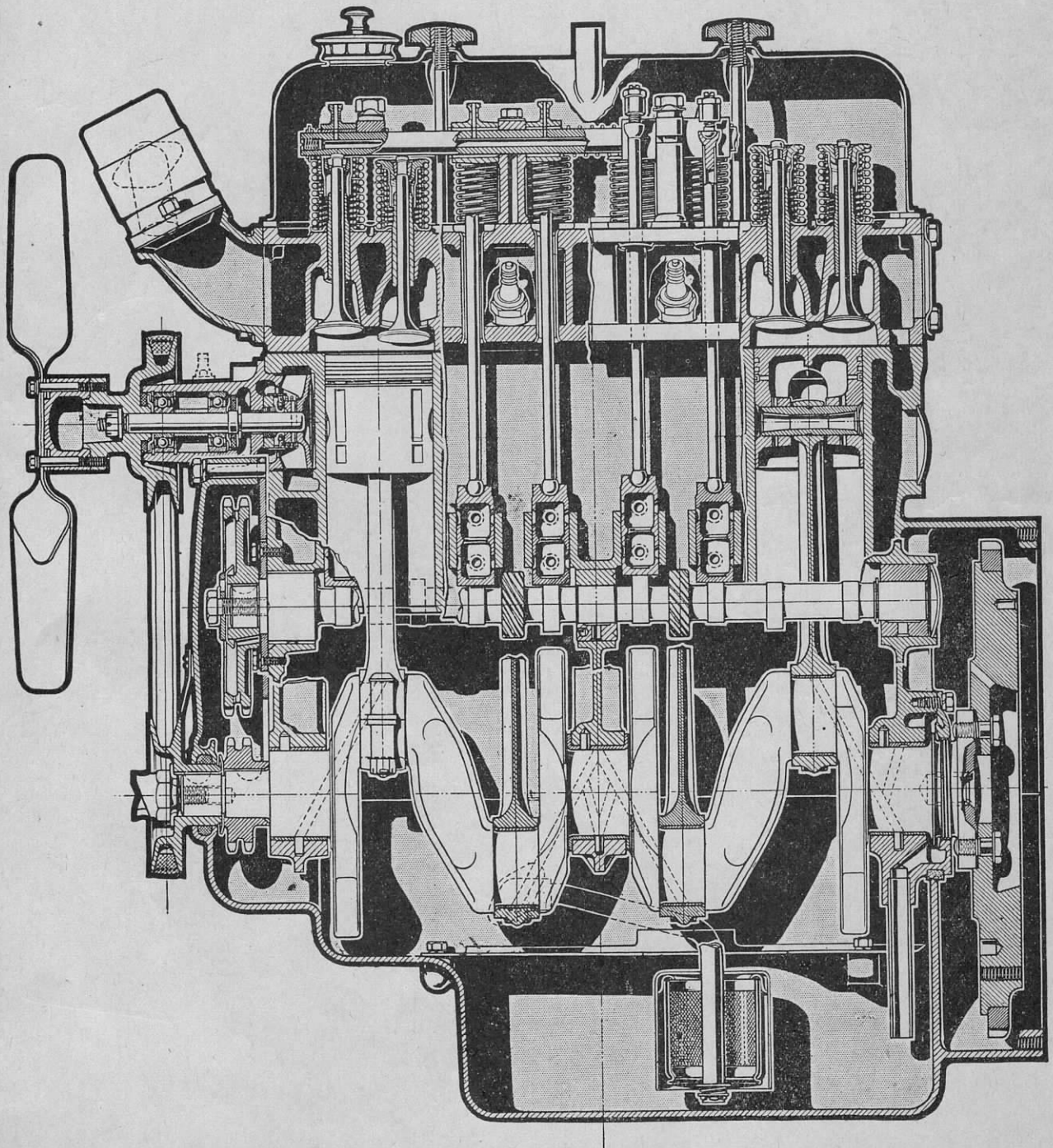

FIG. 1.—The M.G. Midget (Series "TD") engine.

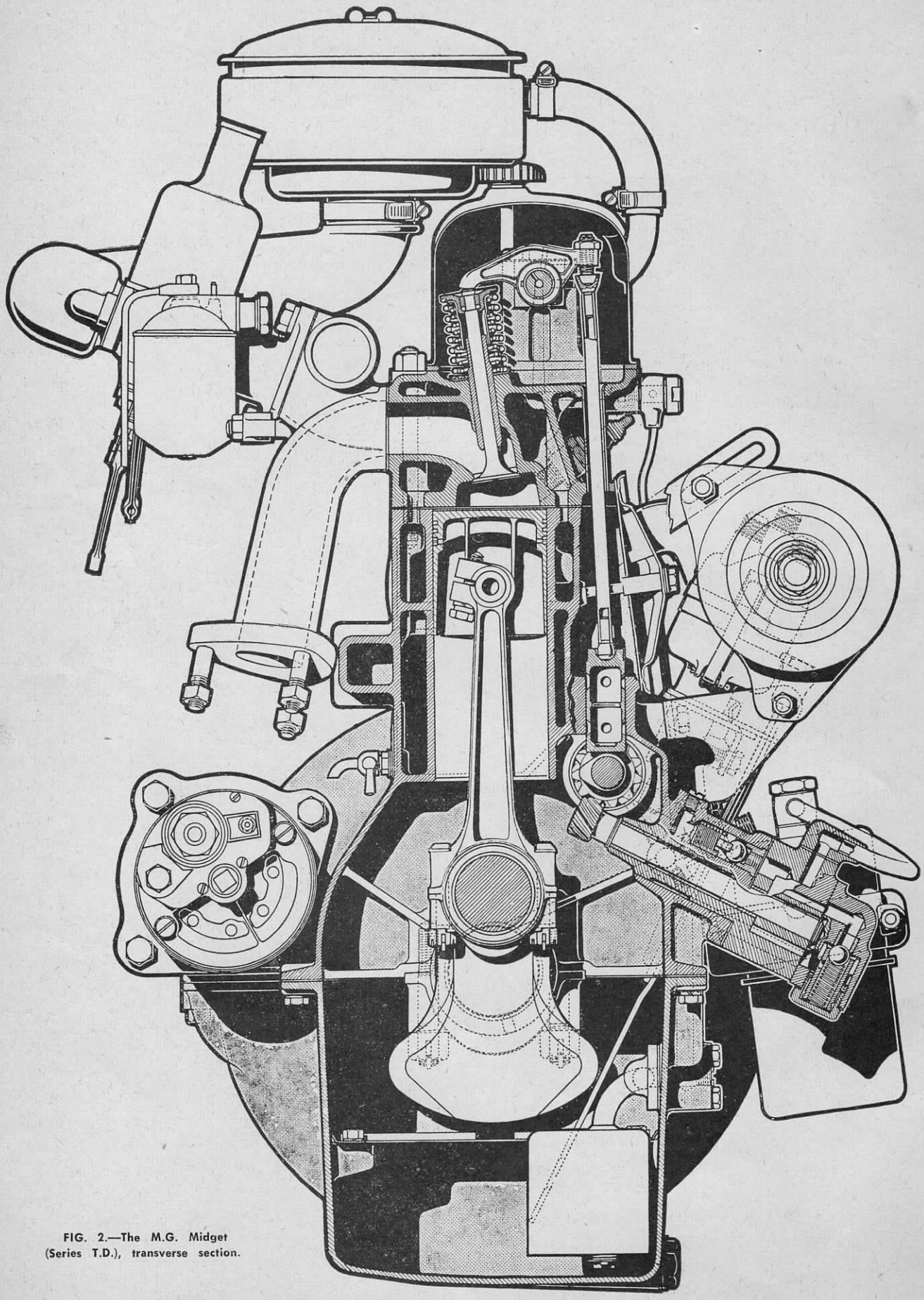

FIG. 2.—The M.G. Midget (Series T.D.), transverse section.

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 white-metal 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 end of the tappets and operate the rockers via adjustable ball-ended screws.

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

A gear-type external 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 renewable type external filter.

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

THE LUBRICATION SYSTEM.

The sump 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 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. The spring is non-adjustable, and is set to allow the valve to by-pass at 50-70 lbs. per sq. in.

The oil from the pump is delivered to the full-flow 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, 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. 3 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.

Removal of the Engine Sump.

Remove the exhaust system and drain the oil from the sump.

Remove the dipstick.

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

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

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.

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.

NOTE: If it is necessary to fit a new sump gasket, refer to Fig. 11 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. 5). THIS IS IMPORTANT.

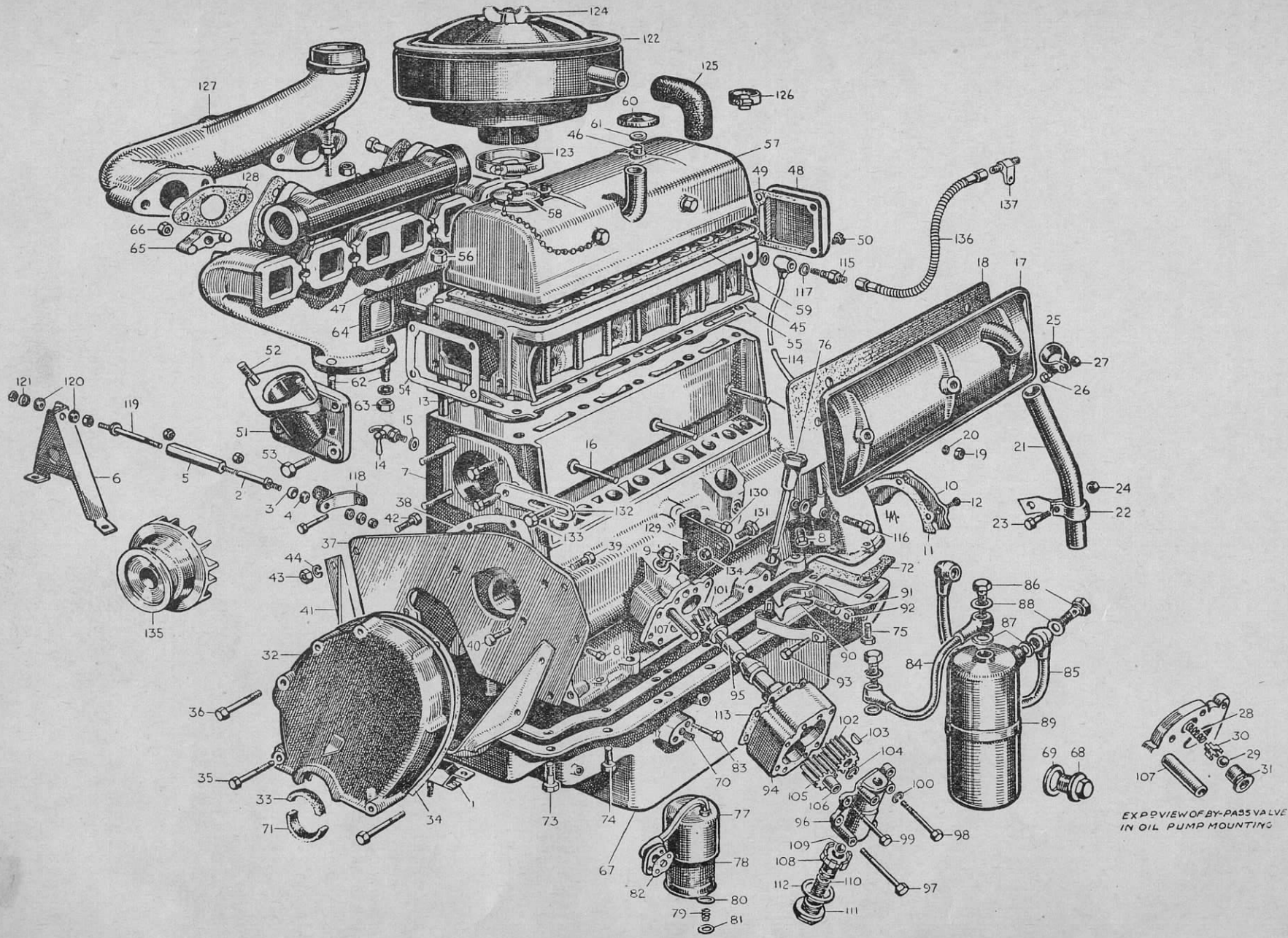

FIG. 3.—The engine components.

KEY TO FIG. 3—ENGINE COMPONENTS:

1—Mounting rubber—engine front.
2—Engine control—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 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.
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 filter 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—linkk.
134—Nut—swivel bolt.
135—Pulley—dynamo.
136—Flexible connection—oil gauge.
137—Connector—oil pipe.

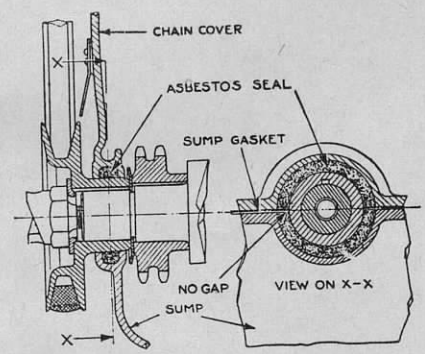

FIG. 4.—The correct fitting of the seal and sump gasket (front end).

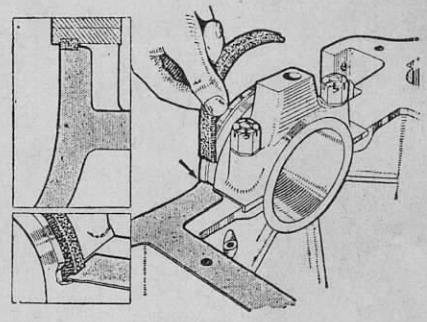

FIG. 5.—When fitting the cork seal for the rear main bearing it is important that the stepped end be in proper engagement with the sump gasket.

Examine the cork composition packing ring in the groove of the rear main bearing cap, and if damaged fit a new one. See Fig. 5 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 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 the seals.

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. The main feed oil gallery may also be primed through the special plug provided for this purpose in the cylinder block above the pump.

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.

Detach the main oil pipe from the filter to the pump.

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.

Dismantling, Reassembling and Replacing the Oil Pump.

After withdrawing the pump from the cylinder block as described, 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 —.0016 to —.0024 with a diameter of 1.2678 +.001.

The housing depth is 1.378 +.0012 with a bore of 1.2795 +.001 to —.0006.

This results in a gear end float of .0016 to .0035 with the end cover fitted, and a radial clearance of .0057 to .0064. The backlash between the teeth is approximately .020 to .025. 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.

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 of .056 diameter wire, .500 overall diameter and 1.476 free length. Total number of coils is $13\frac{1}{2}$, giving a load of 7 lb. when compressed to 1.063.

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.

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.

Emergency Relief Valve.

If the filter element becomes clogged through neglect, an automatic safety device is provided. 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. 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.

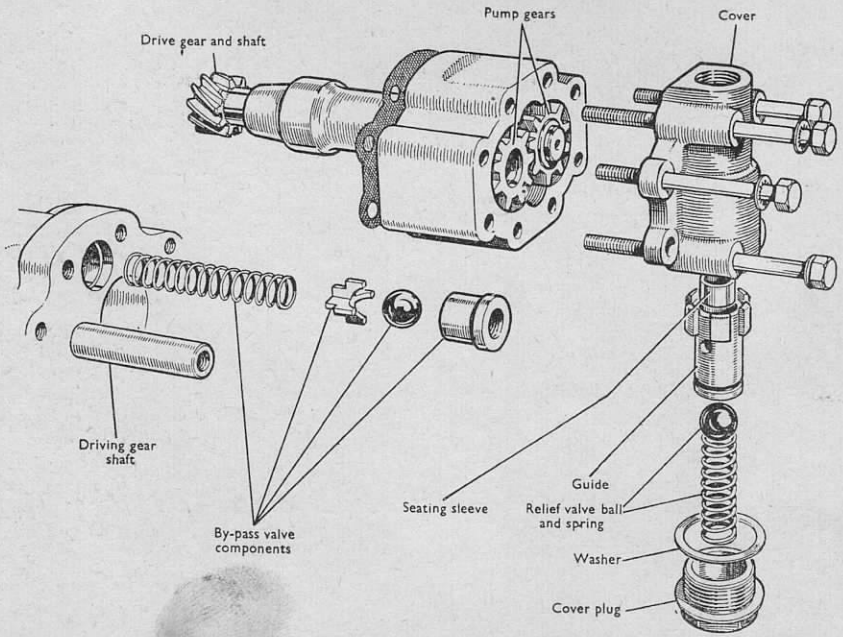

FIG. 6.—The oil pump dismantled.

The spring for this ball valve should be of .040 diameter wire, .5354 overall diameter, 2.224 free length. Total number of coils is 12, giving a load of 5 lb. when compressed to a length of .649.

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 mains and big ends. It is imperative that no adjustments be made to the bearings. Bearings which are worn should be replaced.

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. Main bearings are located in position by dowels in the bearing caps, and in the crankshaft housing.

To detach the big end bearings, remove the connecting rod caps and extract the bearing journals. No scraping is required, as the bearings are machined to give the correct diametrical clearance of between .0005 and .002 and a side clearance of from .004 to .006.

To replace the main bearings it is necessary to first remove the main bearing caps, in order to lift the crankshaft 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 to .003 and the side clearance of from .0014 to .0037 on the centre bearing. The end bearings have no end location.

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 5/16 and four $\frac{1}{4}$ 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.

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

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

Removal and Replacement of the Cylinder Head.

Drain the water system and remove the bonnet after taking out the two screws at the rear end of the bonnet hinge.

Detach the high-tension cables from the sparking plugs and take out the sparking plugs.

Disconnect the throttle controls and mixture controls and uncouple the exhaust pipe from the fuel pump, then 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 on to the air intake pipe, and that it is full of oil.

Disconnect the intake pipe steady on the manifold and undo the four bolts holding the intake pipe and remove it complete.

Remove the bolt clipping the exhaust pipe to the gearbox.

Detach 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 and 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.

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

NOTE: It is advisable to keep these in order of removal.

Release the ten cylinder head nuts a partial turn at a time in the order indicated in Fig. 7 until they are free for complete removal by hand.

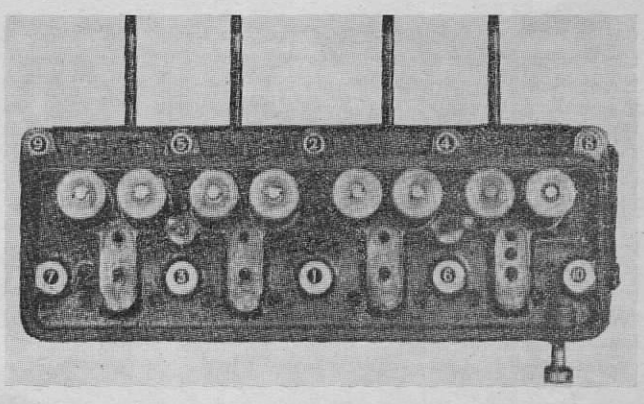

FIG. 7.—The sequence in which the cylinder head holding-down nuts should be tightened.

Lift off 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.

Reassembly is a reversal of this process but make sure that the gasket is fitted with the elongated hole for the waterways to the rear of the cylinder head.

Removal and Replacement of Pistons and Connecting Rods.

Follow the dismantling procedure as set out and withdraw the piston and connecting rod assembly past the crankshaft on the left-hand side of the engine.

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.

Dismantling and Reassembling Piston and Connecting Rod.

The gudgeon pin is clamped in the little end by means of a pinch-bolt which must 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.

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

1. The pinch-bolt will screw readily into its 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 pinch-bolt on the right-hand side.

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 rawhide 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.

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 3.00 long by $\frac{1}{2}$ wide by .02 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 and .010.

When checking this gap, make sure the ring is square to the bore by holding it on top of a piston inserted about 1.00 down the bore while the measurement is being taken.

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 to +.00049, marked "STD".

Bore of nominal size +.005 to +.00099, marked +.0005.

Bores of nominal size +.0010 to +.00149, marked +.0010.

Bores of nominal size +.0015 to +.00199, marked +.0015.

The piston clearance is .0021 minimum to .0029 maximum measured at the top of the skirt, immediately below the oil return 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 following.

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 graded in 4 sizes as the standard grading.

+.040 graded in 4 sizes as the standard grading.

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

Piston size (across thrust faces below oil ring)	Piston marking	Suitable for bore size
2.6156 2.6160	To suit "STD" bore	2.6181 2.6185
2.6161 2.6165	To suit +.0005 bore	2.6186 2.6190
2.6166 2.6170	To suit +.001 bore	2.6191 2.6195
2.6171 2.6175	To suit +.0015 bore	2.6196 2.6200.

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

OVERSIZE PISTON SIZES +.020 in range.

Piston size (across thrust faces below oil ring)	Piston marking	Suitable for bore size
2.6356 2.6360	To suit +.020 bore	2.6381 2.6385
2.6361 2.6365	To suit +.0205 bore	2.6386 2.6390
2.6366 2.6370	To suit +.021 bore	2.6391 2.6395
2.6371 2.6375	To suit +.0215 bore	2.6396 2.6400

OVERSIZE PISTON SIZES +.040 range.

Piston size (across thrust faces below oil ring)	Piston marking	Suitable for bore size
2.6556 2.6560	To suit +.040 bore	2.6581 2.6585
2.6561 2.6565	To suit +.0405 bore	2.6586 2.6590
2.6566 2.6570	To suit +.041 bore	2.6591 2.6595
2.6571 2.6575	To suit +.0415 bore	2.6596 2.6600

Removal and Replacement of the Carburetters.

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. The central wing on the cleaner attaches it to the air intake pipe and must be removed. Remember also that the cleaner is full of oil.

Take off the float-chamber overflow pipes and detach the fuel pipe at the petrol pump union.

Then disconnect the mixture control wire from its attachments to the carburetter levers and undo the throttle control link rod at its attachment to the carburetter levers and undo the throttle control 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.

Removal and Replacement of the Water Pump.

Drain the cooling system and release the dynamo on its mountings so that the driving belt may be withdrawn.

Detach the rubber hose at the pump body and remove the fan blades. 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.

Removal of the Timing Chain Case.

To carry out this operation with the engine in the frame it is necessary to remove the radiator.

Remove the fan belt and take off the engine control link.

NOTE: Mark the position of the adjuster so that this may be refitted to the same setting.

Remove the water pump as detailed.

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

Take off the crankshaft fan pulley with an extractor and remove the nine setscrews holding the timing cover to the crankcase, and withdraw the cover.

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.

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 shims. Then fit the starting handle dog nut.

Replace the water pump and refit the engine control link.

Replace the fan belt, adjust its tension, and bolt up the dynamo.

Removal of the Timing Chain.

Remove the sump and take off the timing chain case.

Undo the bolt securing the camshaft sprocket to the camshaft and remove the chain tensioner.

Extract the crankshaft and camshaft sprockets, complete with the chain, by mean sof short, flat levers, or with Tool No. T.123.

NOTE: Take care of the chain tensioner slipper and chain tensioner spring.

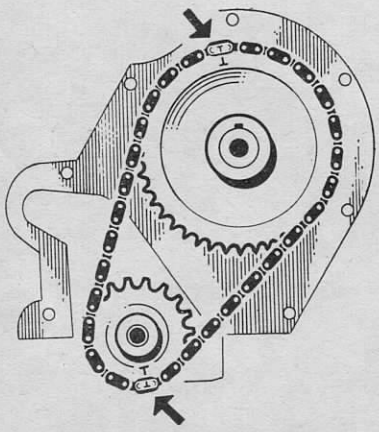

FIG. 8.—This illcstration shows how the bright links on the timing chain engage with the marked chain wheels.

Replacement of the Timing Chain.

The two timing sprockets are secured to their shafts by single keys.

The timing chain has two bright links, and each of the sprockets has one tooth marked "T". Between the bright links are thirteen black ones on one side of the chain and fifteen black links on the other. The thirteen black and the two bright links are clearly seen in Fig. 8 which shows one bright 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 bright link.

With the shorter position of the chain to the left engage the camshaft sprocket tooth marked "T" with the top bright link, and the crankshaft sprocket tooth marked "T" with the other bright link.

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

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.

To carry out this operation with the engine in the frame it will be necessary to remove the radiator.

NOTE: The engine must be turned twenty times before the links and marked teeth again coincide.

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 hedl against the chain by the tension of the spring and the oil pressure.

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 and the oil feeds through to the stem of the plunger, which is .43 in diameter, and then through the bleed hole in the plunger, which is .10 diameter. This causes an increased pressure and produces a cushioning effect between the chain and the slipper.

Removal of the Chain Tensioner.

Break the lockwire at the two setscrews 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 $\pm$.004) 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 —.004 to —.012. When refitting make sure to rewire the setscrews securing the feed block.

Removal and Replacement of the Camshaft.

Drain the radiator and remove the bonnet.

Extract the tappets and take off the sump.

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

Remove the oil pump and take off the timing chain case, the timing chain and chain wheels.

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

Remove the front thrust plate and draw the camshaft forward through the front bearing, carrying the centre bearing with it. This should be removed 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 noted:—

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

(2) 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.

(3) It is essential to make quite sure that the dowel hole in the bearing is exactly in register with the dowel screw hole in the crankcase.

(4) 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.

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 dowel screws.

Camshaft Bearings.

When fitting new camshaft bearings it will be found that the centre and rear bearings are strict replacements, but when the front bearing is pressed into the housing this will need reaming in line 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 between the back of the camshaft chain wheel and the shoulder of the camshaft front journal.

Removing the Valves and Valve Grinding.

The valve springs are secured by cups and split conical collets. In order to remove a valve the cylinder head must be removed and 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 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.

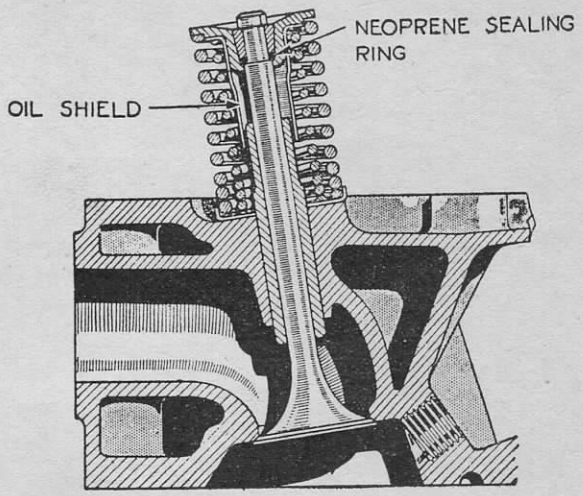

FIG. 9.—The valve springs should always be replaced with the closed coils against the cylinder head.

Removal and Replacement of Valve Guides.

Remove the cylinder head and valves and rest the head with its machined face downwards on a clean, flat surface. Then drive the valve guides downwards into the combustion chamber, using a suitably sized shouldered drift.

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

NOTE: The inlet valve guides are 7/32 longer than the exhaust valve guides, but all valve guides project .945 above the valve spring seating.

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

Removal and Replacement of Engine and Gearbox.

Drain the cooling system and take off the bonnet and radiator.

Disconnect the battery earth lead, detach the fuel line at the pump and uncouple the high-tension lead from the coil. Remove the low tension wire from the distributor body and 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, release the starter cable from the starter terminal and undo the three brass nuts holding the exhaust pipe to the manifold. Then remove the clip holding the exhaust pipe to the gearbox, this will allow the front of the exhaust pipe to drop clear of the manifold.

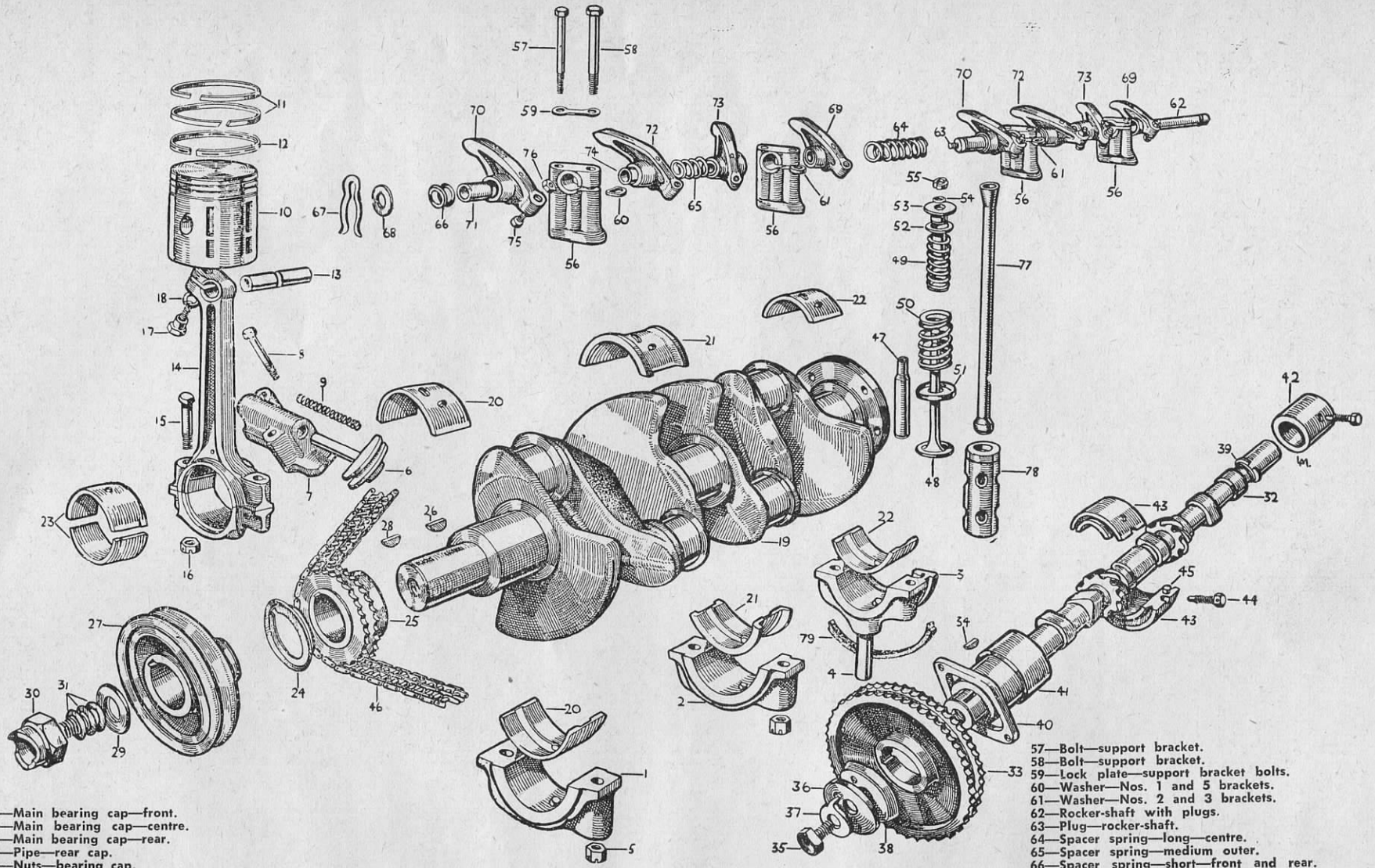

FIG. 10.—Internal engine components.

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—gudgeon pin.
18—Spring washer—clamp screw.
19—Crankshaft complete with main and 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—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.
58—Bolt—support bracket.
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.

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 and detach the clutch-operating mechanism from the side of the sump.

Remove the starter motor and take off the air cleaner and carburetters. 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 breather pipe and chassis.

Remove the seats and take up the carpets. Detach the toeboard on the passenger's side, and remove both floorboards, the gear lever knob and the gearbox cowl. Take off the gearbox top cover complete and fit a piece of cardboard over the 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. Later boxes were fitted with an extended 1st and 3rd selector shaft with a retaining circlip at the forward end to overcome this difficulty.

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.

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 upwards, taking care to disengage the steady link from its bracket.

Removal and Replacement of the Flywheel.

In order to take off the flywheel the engine and gearbox unit should be removed from the car.

Remove the clutch and break the locking wire on the flywheel fixing bolts. Take out the bolts. Pull the flywheel off with an 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 out of truth at any point.

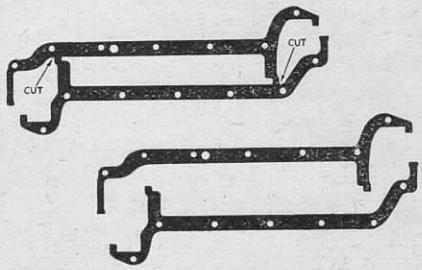

FIG. 11.—This is the correct method of cutting the new sump gasket. It is important that the small ears are left on the projecting portions of the gasket.

Removal and Replacement of the Crankshaft.

Remove the sump and take off the fan driving pulley and timing chain case.

Detach the timing chain, remove the pistons and connecting rods and remove the main bearing caps and bearings. Remove the crankshaft and flywheel.

NOTE: It is advisable to mark each bearing cap and bearing to ensure their correct replacement.

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

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.
.3 mm.	R.1	51.7 mm.	44.7 mm.	51.720 mm. 51.705 mm.
.5 mm.	R.2	51.5 mm.	44.5 mm.	51.520 mm. 51.505 mm.
.75 mm.	R.3A	51.25 mm.	44.25 mm.	51.270 mm. 51.255 mm.
1.00 mm.	R.4	51.00 mm.	44.00 mm.	51.020 mm. 51.005 mm.
1.25 mm.	R.4A	50.75 mm.	43.75 mm.	50.770 mm. 50.755 mm.

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 theese faces when assembling. Replace the gasket if it is damaged in any way.

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.

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.

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 movement.

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.

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 while this is done.

If a noise or knock is heard when the engine is rocked gently, 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 to control engine movement and it must not be subjected to constant load through being too long or too short.