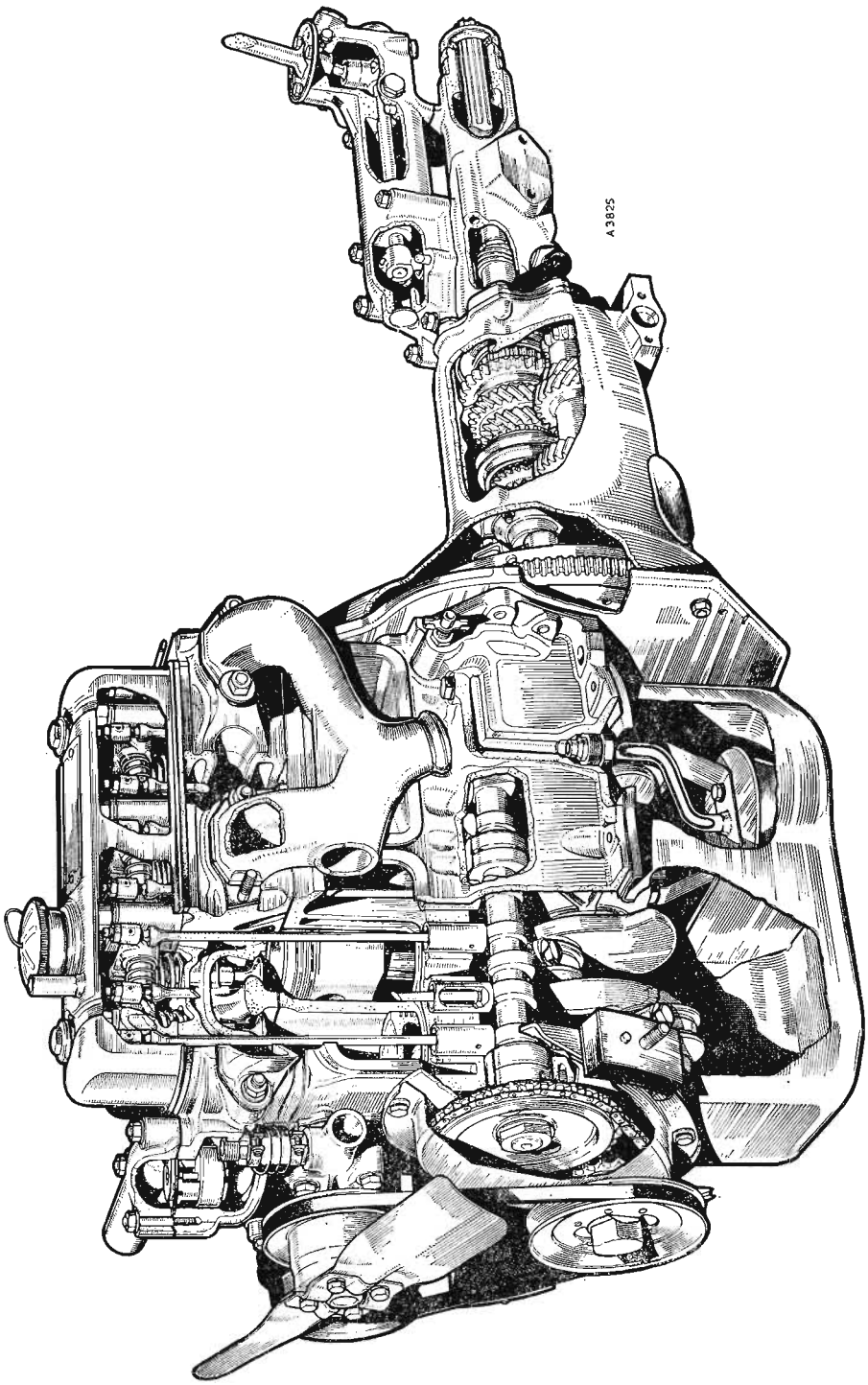
SECTION A

THE ENGINE

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THE POWER UNIT



GENERAL DESCRIPTION

The four-cylinder in-line overhead-valve engine is of unit construction and incorporates a detachable cylinder head of cast iron carrying the push-rod-operated valve gear. The push-rods are operated from the camshaft situated on the left-hand side of the engine. Oil seals are fitted to the valves and there is the normal provision on the rockers for clearance adjustment.

A centrifugal water pump and a fan are driven from the crankshaft by the fan belt. Large-area water-circulating passages and full-length water jackets enable the engine to be cooled even under the most arduous conditions.

The camshaft is roller-chain-driven from the crankshaft with all three journals running in steel-backed white-metal bearings. The distributor is driven from the camshaft by a transverse shaft with helical gear drive.

Pistons are fitted with three compression rings and one oil control ring.

The gudgeon pins on early cars are clamped to the connecting rods, which have renewable, steel-backed, lead-bronze or copper-lead bearings with lead-indium surfaces. On later cars the gudgeon pins are of the fully floating type.

The eccentric-vane non-draining-type oil pump is mounted on the rear end of the crankcase and is driven by the camshaft. Oil drawn through a gauze strainer in the sump is delivered to a gallery on the right-hand side of the crankcase. The oil then passes by way of drilled passages to the main, big-end, and camshaft bearings.

The connecting rods have jet holes to deliver oil quickly to the cylinder walls when starting up. The camshaft front bearing feeds oil at a reduced pressure to the overhead-valve rocker gear and also to the timing chain. The tappets are lubricated by oil returning from the rocker gear by way of the push-rod apertures and by splash.

The external oil filter carried on the right-hand side of the engine crankcase is of the full-flow, renewable-element type. It is connected to the main oil gallery by a drilled passage. An oil pipe connects the rear end of the main oil gallery with the oil gauge on the instrument panel, and below the oil pipe union is a non-adjustable pressure relief valve.

Section A.1

LUBRICATION

Checking the engine oil level

Inspect the oil level in the engine, and top up if necessary to the 'MAX' or 'FULL' mark on the dipstick. The oil filler cap is on the top of the engine valve cover and is released by turning it anti-clockwise.

Changing the engine oil

Drain the oil from the engine by removing the drain plug on the right-hand side of the engine sump.

The oil will flow more readily if drained when the engine is hot; allow at least 10 minutes for draining before replacing the plug

NOTE.—Disconnect the battery cable from its terminal on the starter before commencing work on the filter.

Changing the engine oil filter

The oil filter is of the full-flow type and the bowl should be washed in fuel. The filter is released by unscrewing the central bolt securing the filter to the filter head. When refitting, ensure that the seating washer for the filter body is correctly positioned, clean, and serviceable. Care must also be taken to ensure that the washers below the element inside the bowl are fitted correctly. The small felt washer must be positioned between the element pressure plate and the metal washer above the pressure spring.

It is essential for correct oil filtration that the felt washer should be in good condition and be a snug fit on the centre-securing bolt.

Section A.2

OIL PRESSURE

The normal operating pressure is 30 to 60 lb./sq. in. (2·1 to 4·2 kg./cm.^{2}).

The oil gauge is combined with the thermometer on the instrument panel.

A pressure of 10 to 25 lb./sq. in. (0·7 to 1·7 kg./cm.^{2}) should be registered when the engine is idling. **If no pressure is registered by the gauge, stop the engine at once and investigate the cause.**

NOTE.—The automatic relief valve in the lubrication system deals with any excessive oil pressure when starting from cold.

Checking for low oil pressure

Check the level of the oil in the sump by means of the dipstick, and top up if necessary. Ascertain that the gauze strainer in the sump is clean and not choked with sludge, also that there is no leakage at the strainer union on the suction side of the pump.

In the unlikely event of the oil pump being defective, remove the unit and rectify the fault (see Section A.5). The oil relief valve should be examined (see Section A.3).

If the engine bearings are worn the oil pressure will be reduced. A complete bearing overhaul and the fitting of replacement parts is the only remedy, necessitating the removal of the engine from the vehicle.

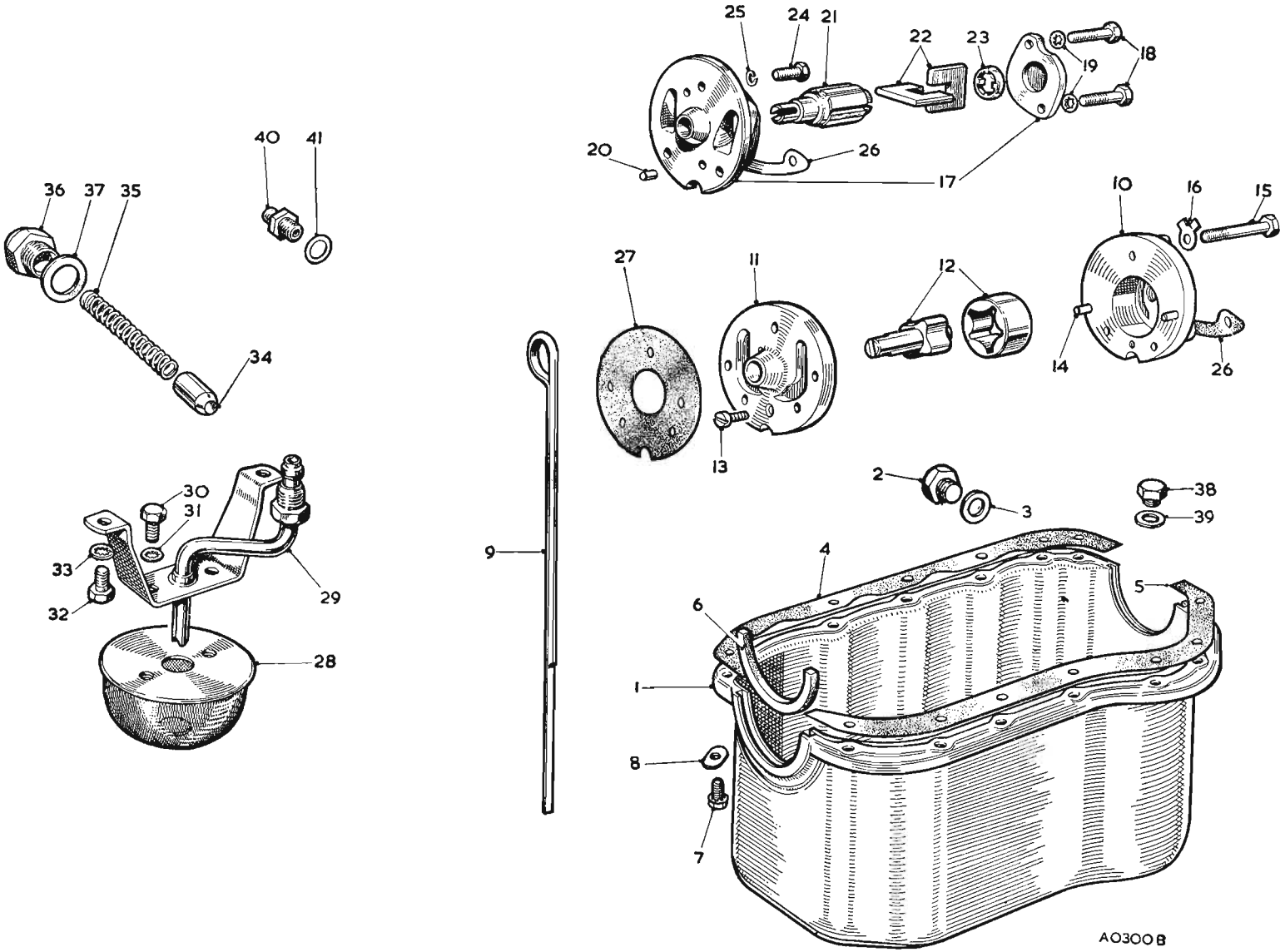
Continuous cold running and the unnecessary use of the mixture control are often the causes of oil dilution by petrol (gasoline) and a consequent fall off in pressure.

Section A.3

OIL PRESSURE RELIEF VALVE

The non-adjustable oil pressure relief valve is situated at the rear right-hand side of the cylinder block and is held in position by a compressed coil spring; this compression is maintained by two fibre washers and a domed screw plug.

THE OIL PUMP AND SUMP



KEY TO THE OIL PUMP AND SUMP

No.	*Description*
1.	Sump.
2.	Sump drain plug.
3.	Washer.
4.	Sump to crankcase joint—R.H.
5.	Sump to crankcase joint—L.H.
6.	Main bearing cap oil seal.
7.	Screw and captive washer.
8.	Washer.
9.	Dipper rod.
10.	Oil pump body.
11.	Cover (plain hole).
12.	Driving shaft with inner and outer rotors.
13.	Cover to body screws.
14.	Dowel.
15.	Pump to crankcase screw.
16.	Lock washer.
17.	Body and cover assembly.
18.	Screw.
19.	Shakeproof washer.
20.	Dowel.
21.	Rotor.
22.	Vane.
23.	Sleeve.
24.	Pump to crankcase screw.
25.	Spring washer.
26.	Lock plate (for all pumps).
27.	Pump to crankcase joint.
28.	Oil strainer.
29.	Suction pipe with oil strainer bracket.
30.	Screw.
31.	Shakeproof washer.
32.	Screw (bracket to bearing cap).
33.	Shakeproof washer.
34.	Oil relief valve.
35.	Spring for oil relief valve.
36.	Cap nut.
37.	Washer.
38.	Oil priming plug.
39.	Washer (copper).
40.	Oil pressure union.
41.	Washer (fibre).

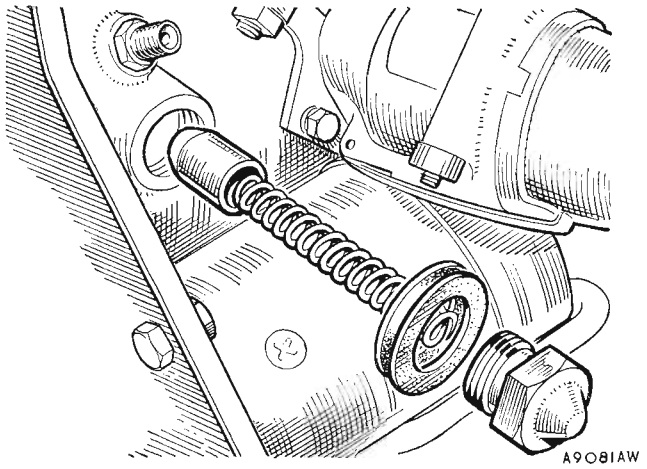


Fig. A.1
The location of the oil pressure relief valve

The relief valve spring maintains a pressure on the valve cup, which in turn seats on the machined face in the cylinder block to provide an extra oil return passage should the pressure become excessive.

The valve cup should be examined to ensure that it is seating correctly and that the spring has not lost its tension. The cup can be removed and ground into its seating with Service tool 18G 69 and the spring checked by measuring its length; to give the required relief pressure see **'GENERAL DATA'.**

A new cup and spring should be fitted if required.

Section A.4

SUMP AND GAUZE STRAINER

Removing

Drain the oil into a suitable container. Remove the set screws and spring washers and lower the sump.

Unscrew the oil suction pipe at its connection with the crankcase. Remove the two set screws securing the strainer support bracket to the main bearing cap. Remove the strainer and support bracket from the engine. Clean the strainer in petrol (gasoline) and dry thoroughly with a non-fluffy rag.

Refitting

Refit the strainer and its securing bracket, ascertaining that the oil suction pipe is located in its connection to the crankcase.

Secure the suction pipe connection and the two strainer support bracket set screws.

Clean the sump thoroughly inside and out, paying particular attention to the joint faces. Remove all traces of cleaning fluid.

Refit the sump by reversing the sequence of operations for removal, using a new joint washer if necessary.

Section A.5

OIL PUMP

Removing

Remove the engine as described in Section A.31.

Remove the flywheel, clutch assembly, and the engine back plate as detailed in Section A.20, thus gaining access to the oil pump.

Tap back the locking washers and remove the screws securing the pump to the crankcase. Withdraw the pump, noting the position of the slot in the driving shaft in order to assist in replacement.

Dismantling and reassembling (Hobourn-Eaton)

The pump cover is located on the pump body by two dowels and a machine screw. When the screw is removed the pump can be separated for examination, and new parts fitted as required.

Dismantling and reassembling (Burman)

Unscrew and remove the two screws and spring washers securing the cover to the pump body. Remove the cover and withdraw the rotor and vane assembly. Prise off the retaining sleeve from the end of the rotor and extract the vanes.

Reassembling is the reverse of the dismantling procedure.

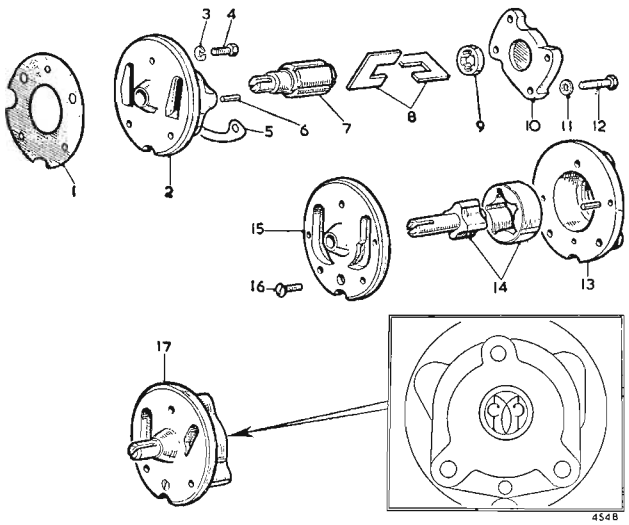


Fig. A.2
The three types of oil pump which may be fitted

Burman

1. Joint washer.
2. Pump body.
3. Washer.
4. Set screw.
5. Lock plate.
6. Dowel.
7. Rotor.
8. Vane.
9. Sleeve.
10. Body cover.
11. Shakeproof washer.
12. Screw—cover to body.

Hobourn-Eaton

13. Body.
14. Shaft and rotor.
15. Cover.
16. Screw—cover to body.

Concentric (Engineering) Ltd.

17. Pump (serviced as assembly only).

Refitting

The refitting of the pump to the cylinder block is the reverse of the removal procedure; particular attention must, however, be given to the fitting of the paper joint washer to ensure that the intake and delivery ports are not obstructed. Use a new paper joint washer if the old one is damaged in any way.

Section A.6

ROCKER SHAFT ASSEMBLY

Removing

Drain the cooling system, using a clean container for the coolant if it contains anti-freeze intended for further use.

Remove the securing screws and lift off the rocker cover, care being taken not to damage the cork gasket.

Release the rocker shaft bracket securing nuts and the external cylinder head stud nuts gradually, a turn at a time, in the order shown in Fig. A.6, until all the load is released.

It is of great importance that the external cylinder head fixing nuts should be released at the same time in order to eliminate any distortion that might take place and result in water finding its way into the cylinder bores and the engine sump.

Remove the rocker shaft bracket nuts and lift off the rocker assembly together with the brackets.

Withdraw the push-rods, at the same time marking them for replacement in their original positions.

Dismantling

Remove the grub screw locating the rocker shaft in the front rocker mounting bracket. Withdraw the split pins, flat washer, and spring washer from the end of the shaft and slide the rockers, brackets, and springs from the shaft. Remove the screwed plug fitted to one end of the shaft and clean out the oilway.

Reassembling

When reassembling commence with the front mounting bracket, securing it with the grub screw. Follow up with the remaining brackets and springs, replacing them in their original positions on the shaft. The screwed plug end of the shaft should be positioned to the front of the engine.

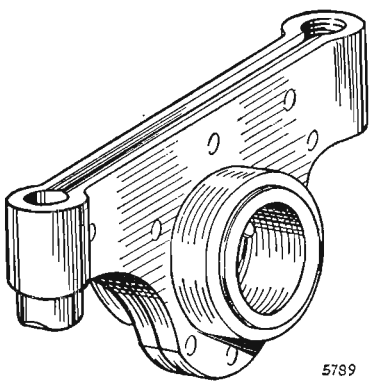


Fig. A.3

The pressed-steel type of valve rocker, which must not be rebushed

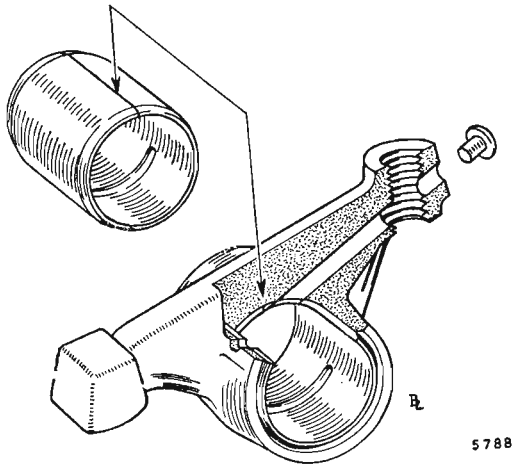


Fig. A.4

When rebushing the forged-type rocker make certain that the joint in the bush is in the position indicated

Refitting

Refitting is the reverse of the removal procedure, with special emphasis on the tightening of the rocker bracket and cylinder head stud nuts; these must be tightened in the order shown in Fig. A.6 and to the torque wrench figure given under **'GENERAL DATA'.**

Refer to Section A.18 for details of valve rocker adjustment.

Section A.7

TAPPETS

Removing

Remove the carburetters and manifold and the rocker cover.

Remove the rocker assembly and withdraw the push-rods, keeping them in their respective positions to ensure their replacement onto the same tappets. Remove the tappet covers and lift out the tappets, also keeping them in their correct order to assist in replacing them in their original locations.

Refitting

Refitting is the reverse of the removal sequence.

New tappets should be fitted by selective assembly so that they just fall into their guides under their own weight when lubricated.

Assembly is the reverse of the above procedure, but care should be taken to see that the tappet cover joints are oil-tight and that the rockers are adjusted to give the correct valve clearance.

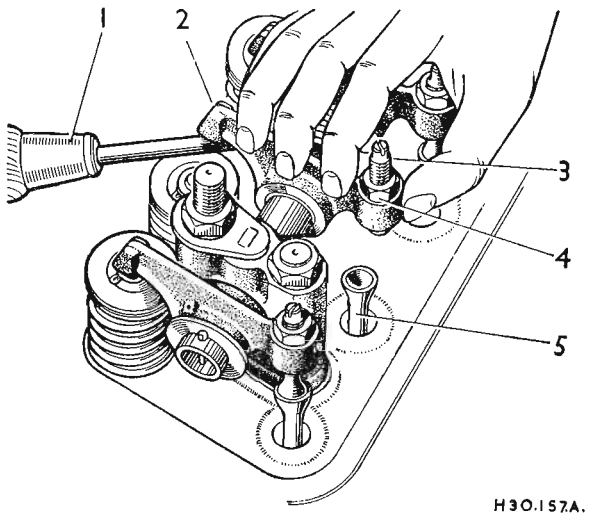


Fig. A.5

Push-rod removal

1. Screwdriver.
2. Valve rocker.
3. Adjusting screw.
4. Locknut.
5. Push-rod.

Section A.8

ROCKER BUSHES

Pressed-steel type

Remove and dismantle the rocker shaft assembly as detailed in Section A.6.

Rebushing is not practicable and must not be undertaken. When bushes become worn new rocker assemblies must be fitted.

Forged type

To rebush, the use of special Service tools 18G 226 and 18G 226 A comprising a drift and anvil is recommended. Bushes and rockers are very easily damaged by the use of improvised drifts.

The anvil is recessed to hold the rocker in position while the worn bush is driven or pressed out.

Press the new bush into the rocker bore with the butt joint of the bush positioned at the top of the bore as in Fig. A.4. The drift is recessed to prevent the bush opening when being driven into position.

It will be necessary to drill the oil holes in the bush to coincide with the oilways in the rocker. Should the oil hole to the adjuster end be drilled before the bush is fitted, extra care must be taken to keep the holes in the bush and rocker in line during the pressing-in operation. If the holes are drilled after fitting, the following procedure must be adopted. Remove the adjuster screw and use a No. 43 drill (·089 in. [2·26 mm.] diameter) to drill out the end plug and to continue the oilway through the bush. Replug the end after the operation with a rivet (Part No. 5C 2436) and weld it in position.

The hole in the top of the rocker barrel must be continued through the bush with a No. 47 (·0785 in. [1·98 mm.] diameter) drill. Finally, burnish-ream the bush to the dimensions given under **'GENERAL DATA'.**

Section A.9

CARBURETTERS AND AIR CLEANERS

Removing

Remove the air cleaners as detailed in Section D.6. Disconnect the mixture and throttle control cables, the suction advance pipe, and the fuel delivery hose from their respective positions on the carburetters.

Release the interconnecting coupling tension springs and the throttle stop return spring.

Remove the nuts and spring washers securing the carburetters to the manifold flanges. Lift off the carburetter assemblies as one unit. The carburetter interconnecting couplings are fitted in sleeved nuts, and when the carburetter assemblies are removed the couplings can be lifted away from both carburetters.

It should be noted that the heat shield fitted between the carburetters and the manifold flanges has gaskets, which should be renewed if the shield has been removed.

Refitting

Reverse the removal procedure when refitting.

Section A.10

EXHAUST SYSTEM

Removing

Release the securing clip and disconnect the down pipe from its fixing point on the clutch housing and from the two locations on the rear body section.

Refitting

Refitting is the reverse of the removal procedure.

Section A.11

INLET AND EXHAUST MANIFOLD

Removing

Remove the carburetters and air cleaners as detailed in Section A.9. Slacken off and release the exhaust pipe clamp. Remove the nuts and washers securing the manifold to the cylinder head; withdraw the manifold.

When a heater is fitted remove the water pipe brackets from the induction manifold.

Refitting

Reverse the above order, but thoroughly clean the joint faces and fit a new gasket, placing the perforated metal face of the gasket towards the manifold.

Section A.12

CYLINDER HEAD

Removing

Remove the bonnet.

Drain the cooling system by means of the drain taps on the radiator bottom tank and at the rear left-hand side of the cylinder block. If anti-freeze mixture is in use it should be drained into a clean container.

Disconnect the negative cable from the battery. Slacken the retaining clip on the hose connecting the radiator to the thermostat housing and pull the hose clear of the housing.

Remove the carburetters and air cleaners as described in Section A.9. Take out the rocker cover retaining screws and rubber cups and remove the cover.

Detach the high-tension cables and remove the sparking plugs, taking care not to damage the porcelain insulators.

Remove the suction pipe clip from its fixture on the hot water control valve. If a heater is fitted release the retaining clip and detach the inlet hose.

Slacken the top clip on the water by-pass hose.

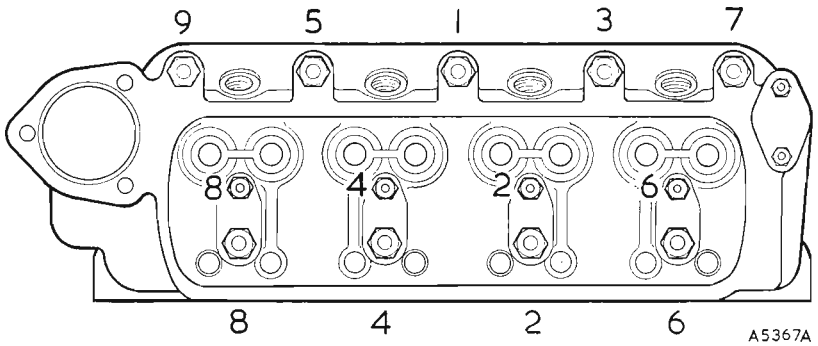


Fig. A.6

The order of loosening and tightening the cylinder head nuts

When a heater is fitted remove the water pipe from the induction manifold.

Remove the inlet and exhaust manifold as described in Section A.11.

Remove the rocker assembly as described in Section A.6, not forgetting to slacken the external cylinder head holding nuts at the same time. Withdraw the push-rods, keeping them in order of removal.

The cylinder head may now be removed.

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. Lift the head squarely to prevent the studs binding in their holes.

Refitting

Make sure that the surfaces of both the cylinder block and the cylinder head are clean; it is not necessary to use jointing compound or grease for the gasket. It will be noticed that the cylinder head gasket is marked 'FRONT' and 'TOP' so that it will be replaced correctly. Having slipped the gasket over the studs, lower the cylinder head into position and fit the five cylinder head securing nuts finger-tight.

Insert the push-rods, replacing them in the positions from which they were taken. Replace the rocker assembly and securing nuts and fit the nuts finger-tight. Tighten all the nuts gradually, a turn at a time, in the order given in Fig. A.6.

Whenever the head has been moved or the valves have been ground in or otherwise disturbed it is necessary to check the valve clearances as in Section A.18. These, of course, will be finally adjusted after the engine has been completely reassembled and run for a short period.

Replace the inlet and exhaust manifold.

If a heater is fitted attach the hose to the heater inlet pipe.

Replace the rocker cover, being careful to fit its cork gasket correctly into position and securing it by its nuts, washers, and rubber cups.

Replace the carburetters and air cleaners (as in Section A.9).

Connect the negative cable to the battery terminal; close the water drain taps and refill the cooling system.

Check, adjust, and replace the sparking plugs, and clip on the high-tension leads.

Switch on and check the fuel system for leaks.

Start the engine and run it until the normal working temperature is reached. Remove the rocker cover and check the valve clearances (see Section A.18). Replace the rocker cover.

Refit the bonnet.

Section A.13

DECARBONIZING

Remove the cylinder head as described in Section A.12.

Withdraw the valves as described in Section A.14.

Remove the cylinder head gasket and plug the waterways with clean rag.

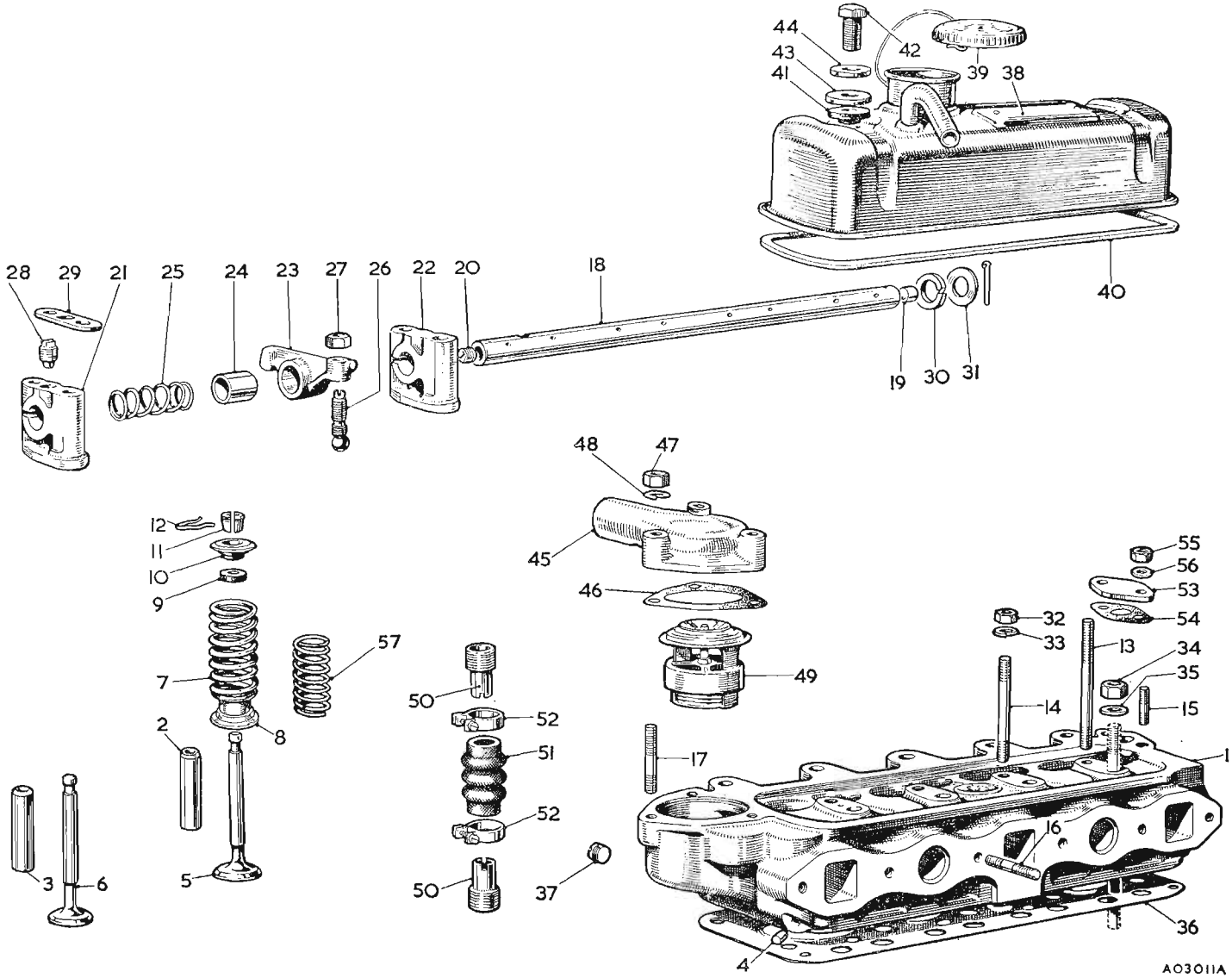
If special equipment is not available scrape the carbon deposit from the piston crowns, cylinder block, and cylinder head, using a blunt scraper.

A ring of carbon should be left round the periphery of the piston crown and the rim of carbon round the top of the cylinder bore should not be touched. To facilitate this an old piston ring can be sprung into the bore so that it rests on top of the piston.

The cylinder head is next given attention. The sparking plugs must be cleaned and adjusted. Clean off the carbon deposit from the valve stems, valve ports, and combustion spaces of the cylinder head. Remove all traces of carbon dust with compressed air, then thoroughly clean with paraffin and dry off.

Fit a new gasket when replacing the head if the old one has been damaged, noting that the gasket is marked to indicate the top face and the front end.

THE CYLINDER HEAD AND VALVE GEAR



KEY TO THE CYLINDER HEAD AND VALVE GEAR

No.	*Description*
1.	Cylinder head with valve guides.
2.	Inlet valve guide.
3.	Exhaust valve guide.
4.	Oil hole plug.
5.	Inlet valve.
6.	Exhaust valve.
7.	Outer valve spring.
8.	Shroud for valve guide.
9.	Valve packing ring.
10.	Valve spring cup.
11.	Valve cotter.
12.	Valve cotter circlip.
13.	Rocker bracket stud (long).
14.	Rocker bracket stud (short).
15.	Cover-plate stud.
16.	Manifold stud.
17.	Water outlet elbow stud.
18.	Valve rocker shaft (plugged).
19.	Rocker shaft plug (plain).
20.	Rocker shaft plug (screwed).
21.	Rocker shaft bracket (tapped).
22.	Rocker shaft bracket (plain).
23.	Rocker (bushed).
24.	Rocker bush.
25.	Rocker spacing spring.
26.	Tappet adjusting screw.
27.	Locknut.
28.	Rocker shaft locating screw.
29.	Rocker shaft bracket plate.
30.	Spring washer.
31.	Washer.
32.	Nut.
33.	Spring washer.
34.	Cylinder head nut.
35.	Washer.
36.	Cylinder head gasket.
37.	Thermal indicator boss screwed plug.
38.	Valve rocker cover.
39.	Oil filler cap.
40.	Cover joint.
41.	Cover bush.
42.	Nut.
43.	Distance piece.
44.	Cup washer.
45.	Water outlet elbow.
46.	Joint.
47.	Nut.
48.	Spring washer.
49.	Thermostat.
50.	By-pass adaptor.
51.	By-pass connector (rubber).
52.	By-pass clip.
53.	Cover-plate.
54.	Joint (plate to cylinder head).
55.	Cover nut.
56.	Spring washer.
57.	Inner valve spring.

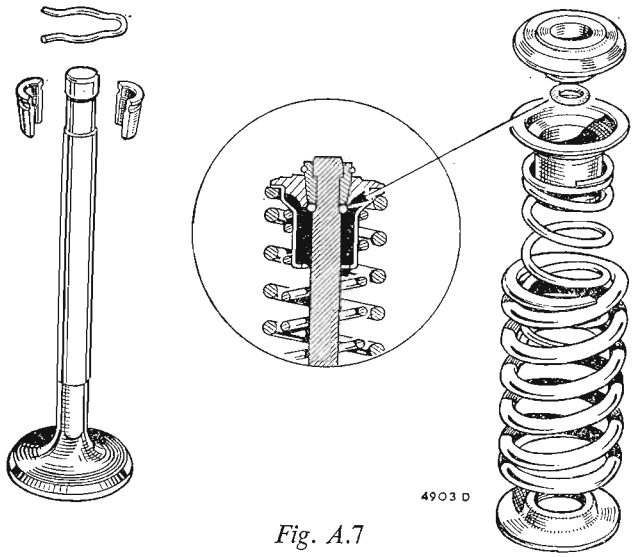


Fig. A.7

The component parts of the valve assembly. The inset shows the valve seal fitted correctly at the bottom of the cotter groove below the cotters

Section A.14

VALVES

Removing

Remove the cylinder head as detailed in Section A.12.

Before removing the valves stamp the head of each with a number to indicate its position. Commence with No. 1 at the front of the engine.

Remove the cotter clip, compress the valve springs and remove the split cotters.

Release the valve springs and remove the compressor. Remove the retaining cap, shroud, valve springs, and rubber seal. Withdraw the valve from the guide.

Keep the valves in their relative positions when removed from the cylinder head to ensure replacement in their original valve guides. The exhaust valve heads are concave and are smaller than the inlet valves.

Refitting

Place each valve in its respective guide and fit the springs, spring shroud, and the retaining cap. Compress the springs and fit a new sealing rubber to the valve stem, push the seal against the bottom shoulder of the cotter recess, and refit the cotters. Ensure that the rubber seal is not pushed out of the cotter recess onto the larger diameter of the stem, release the compressing tool, and fit the split cotter retaining clip.

Section A.15

VALVE-GRINDING

Remove the valves as in Section A.14.

Clean each valve thoroughly and examine for pitting. Valves in a pitted condition should be refaced or new valves should be fitted. Stamp any new valve with the number of the port to which it is fitted.

If the valve seats show signs of pitting or unevenness they should be trued by the use of the Service cutting tools. When using a cutting tool take care to remove only as much metal as necessary to ensure a true surface. Worn valve seats usually have a glass-hard surface, and the glaze breaker should be used to prepare the valve seat surface for any recutting that may be necessary. Narrowing cutters should be used to restore the valve seats to the original standard.

When grinding a valve the face should be smeared lightly with fine- or medium-grade carborundum paste and then lapped in with a suction grinder. Avoid the use of excessive quantities of grinding paste and see that it remains in the region of the valve seating only.

A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve should be ground 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. Carry out the grinding operation until a dull, even, mat surface free from blemish is produced on the valve seat and valve face.

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

Refer to Section A.14 for details of valve refitting.

Section A.16

VALVE SEAT INSERTS

Should the valve seatings become so badly worn or pitted that the normal workshop cutting and refacing tools cannot restore them to their original standard of efficiency, special valve seat inserts can be fitted.

The seatings in the cylinder head must be machined to the dimensions given in Fig. A.9. Each insert should have an interference fit of ·0025 to ·0045 in. (·063 to ·11 mm.) and must be pressed and not driven into the cylinder head.

After fitting, grind or machine the new seating to the dimensions given in Fig. A.9. Normal valve-grinding may be necessary to ensure efficient valve-seating.

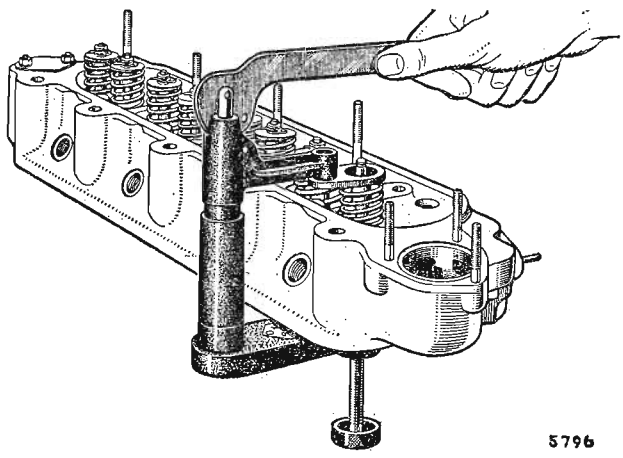


Fig. A.8

Compressing a valve spring, using the special compressing tool 18G 45

Section A.17

VALVE GUIDES

Removing

Remove the cylinder head as shown in Section A.12.

Remove the appropriate valve and spring as in Section A.14. Rest the cylinder head with its machined face downwards on a clean surface and drive the valve guide downwards into the combustion space with a suitably sized drift. This should take the form of a hardened-steel punch $\frac{7}{16}$ in. (11 mm.) in diameter and not less than 4 in. (10 cm.) in length, with a locating spigot $\frac{9}{32}$ in. (7·14 mm.) diameter machined on one end for a length of 1 in. (2·5 cm.) to engage the bore of the guide.

Refitting

When fitting new valve guides they should be driven in from the top of the cylinder head. The inlet valve guides must be inserted with the largest chamfer at the top, and the exhaust valve guides should have their counterbored ends at the bottom. The valve guides should be driven into the combustion spaces until they are $\frac{19}{32}$ in. (15·1 mm.) above the machined surface of the valve spring seating (see Fig. A.11).

Section A.18

VALVE ROCKER ADJUSTMENT

If the engine is to give its best performance and the valves are to retain their maximum useful life it is essential to maintain the correct valve clearance. Accordingly it is recommended that the clearance be checked at regular intervals and any necessary adjustments made.

The engine has been designed to run with a valve rocker clearance of ·012 in. (·305 mm.) and performance will be impaired if this is changed.

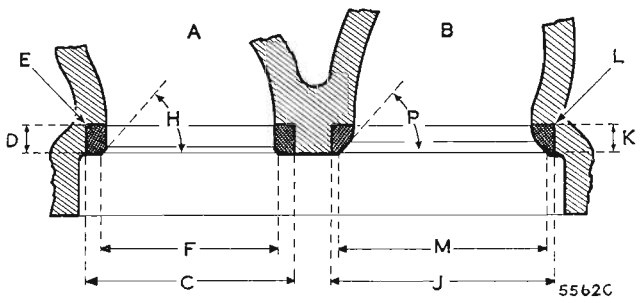


Fig. A.9

Valve seat machining dimensions

	Exhaust (A)		Inlet (B)
C.	1·124 to 1·125 in. (28·55 to 28·58 mm.).	J.	1·187 to 1·188 in. (30·16 to 30·17 mm.).
D.	·186 to ·188 in. (4·72 to 4·77 mm.).	K.	·186 to ·188 in. (4·72 to 4·77 mm.).
E.	Maximum radius ·015 in. (·38 mm.).	L.	Maximum radius ·015 in. (·38 mm.).
F.	1·0235 to 1·0435 in. (25·99 to 26·50 mm.).	M.	1·0855 to 1·1055 in. (27·58 to 28·07 mm.).
H.	45°.	P.	45°.

(1098-c.c. engines as above except)

J. 1·3075 to 1·3085 in. (33·178 to 33·203 mm.).
M. 1·1435 to 1·1635 in. (29·045 to 29·553 mm.).

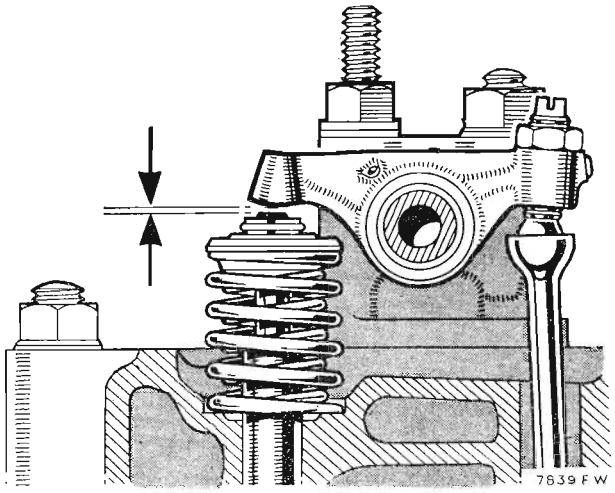


Fig. A.10

The clearance between the valve stem and the valve rocker indicated above must be ·012 in. (·305 mm.) with the enigne cold

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

The rocker adjusting screw is released by slackening the hexagon locknut with a spanner while holding the screw against rotation with a screwdriver. The valve clearance can then be set by carefully rotating the rocker screw while checking the clearance with a feeler gauge. This screw is then relocked by tightening the hexagon locknut while again holding the screw against rotation.

While the clearance is being set it is important to have the tappet on the back of its cam, i.e. opposite to the peak.

As this cannot be observed accurately the rocker adjustment is more easily carried out in the following order, and this also avoids turning the crankshaft more than is necessary.

Adjust No. 1 rocker with No. 8 valve fully open
" " 3 " " " 6 " " "
" " 5 " " " 4 " " "
" " 2 " " " 7 " " "
" " 8 " " " 1 " " "
" " 6 " " " 3 " " "
" " 4 " " " 5 " " "
" " 7 " " " 2 " " "

Section A.19

DISTRIBUTOR DRIVING SPINDLE

Removing

Remove the distributor as detailed in Section B.7.

Take out the screw securing the distributor housing to the cylinder block and withdraw the housing.

Screw a $\frac{5}{16}$ in. UNF. bolt approximately $3\frac{1}{2}$ in. (89 mm.) long into the tapped end of the distributor drive spindle and withdraw the spindle.

Refitting

Turn the crankshaft until No. 1 piston is at T.D.C. on its compression stroke. When the valves on No. 4 cylinder are 'rocking' (i.e. exhaust just closing and inlet just

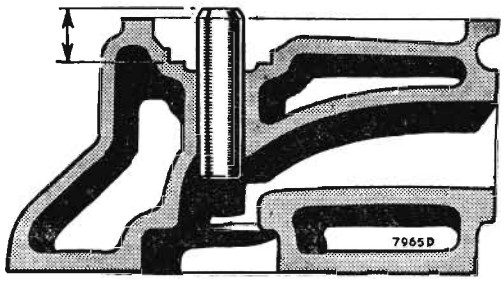


Fig. A.11

When fitting valve guides they must be driven in until they are $\frac{19}{32}$ in. (15·1 mm.) above the machined face of the valve spring seat

opening) No. 1 piston is at the top of its compression stroke. If the engine is set so that the groove in the crankshaft pulley is in line with the largest pointer on the clutch cover, or the dimples in the crankshaft and camshaft gears are in line, the piston is exactly at T.D.C.

Screw the $\frac{5}{16}$ in. by $3\frac{1}{2}$ in. UNF. bolt into the threaded end of the distributor drive gear and, holding the drive gear with the slot just below the horizontal and the large offset uppermost, enter the gear. As the gear engages with the camshaft the slot will turn in an anti-clockwise direction until it is approximately in the two o'clock position.

Remove the bolt from the gear, insert the distributor housing, and secure it with the special bolt and washer.

Ensure that the correct bolt is used and that the head does not protrude above the face of the housing.

Refit the distributor, referring to Section B.7 if the clamp plate has been released.

Section A.20

CLUTCH, FLYWHEEL, AND ENGINE REAR PLATE

Removing

Remove the engine as detailed in Section A.31. If the engine complete with gearbox has been removed, see Section F for gearbox removal.

Release the clutch cover screws, a turn at a time, by diagonal selection until the spring pressure is relieved. Two dowels locate the clutch cover on the flywheel.

Tap back the tabs on the lock plates, release the four securing bolts, and remove the flywheel.

Remove the set screws and withdraw the engine rear plate.

Refitting

Before reassembling, the engine rear plate should be checked for distortion, and a new joint washer fitted if necessary.

Care must also be taken when refitting the flywheel. All bolts and set screws should be fitted to the torque wrench settings given under **'GENERAL DATA'.**

Refitting is the reverse of the removal procedure.

NOTE.—Use pilot shaft 18G 139 for driving plate centralization.

Section A.21

FITTING FLYWHEEL STARTER RINGS

To remove the old starter ring from the flywheel flange split the ring gear with a cold chisel, taking care not to damage the flywheel. Make certain that the bore of the new ring and its mating surface on the flywheel are free from burrs and are perfectly clean.

To fit the new ring it must be heated to a temperature of 300 to 400° C. (572 to 752° F.), indicated by a light-blue surface colour. If this temperature is exceeded the temper of the teeth will be affected. The use of a thermostatically controlled furnace is recommended. Place the heated ring on the flywheel with the lead of the ring teeth towards the flywheel register. The expansion will allow the ring to be fitted without force by pressing or tapping it lightly until the ring is hard against its register.

This operation should be followed by natural cooling, when the 'shrink fit' will be permanently established and no further treatment required.

Section A.22

TIMING COVER

Removing

Drain the cooling system as described in Section C. Remove the radiator (see Section C). Release but do not remove the dynamo attachment bolts and lift off the fan belt. Tap back the tab on the crankshaft pulley nut locking washer. Remove the pulley nut, using Service tool 18G 98, and carefully lever the pulley from the crankshaft.

Remove the set screws securing the timing cover to the front engine plate and lift off the cover.

Refitting

Reverse the removal procedure when refitting the cover.

The oil seal in the cover must be renewed if it shows signs of damage or deterioration, using Service tool 18G 134 together with adaptor 18G 134 D. A new cover gasket should also be fitted.

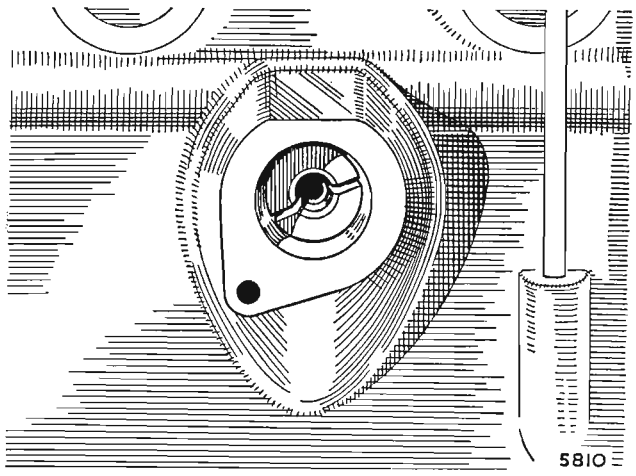


Fig. A.12

The distributor drive with the slot in the correct position and the large offset uppermost

Ensure the oil thrower behind the crankshaft pulley is fitted with the face marked 'F' away from the engine.

Fill the annular groove between the lips of the oil seal with grease and use Service tool 18G 1044 to centralize the oil seal on the crankshaft.

NOTE.—The early type front cover and oil thrower must be used together. When refitting; ensure the oil thrower is fitted with its concave side facing away from the engine. Use Service tool 18G 138 to centralize the rubber seal on the crankshaft or use the crankshaft pulley as follows:—

The crankshaft pulley should be assembled to the cover before the cover is fitted and used to ensure correct centralization of the oil seal. Lubricate the hub of the pulley and insert it into the oil seal, turning the pulley in a clockwise direction to avoid damaging the lip of the seal. Push the pulley and cover onto the crankshaft, making sure that the keyway on the pulley bore is lined up with the Woodruff key fitted to the crankshaft before finally drifting the pulley into position. Replace the cover set screws and tighten them evenly.

Section A.23

TIMING GEARS

Removing

Remove the timing cover and oil thrower as in Section A.22.

Unlock and remove the camshaft chain wheel nut and remove the nut and lock washer. Note that the locating tag on the lock washer fits into the keyway of the camshaft chain wheel.

The camshaft and crankshaft chain wheels may now be removed together with the timing chain, by easing each wheel forward a fraction at a time with suitable small levers. Note the packing washers immediately behind the crankshaft gear.

Refitting

When reassembling, replace the same number of washers as was found when dismantling unless new

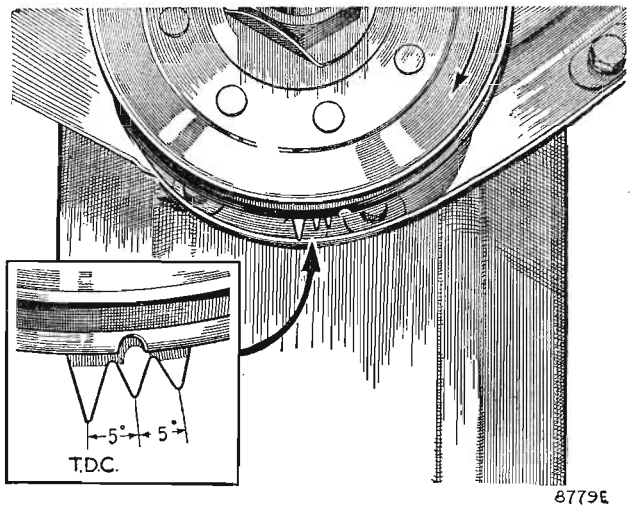


Fig. A.13

The notch in the pulley approaching the T.D.C. position for pistons 1 and 4. The pointers are provided to assist in accurate ignition timing

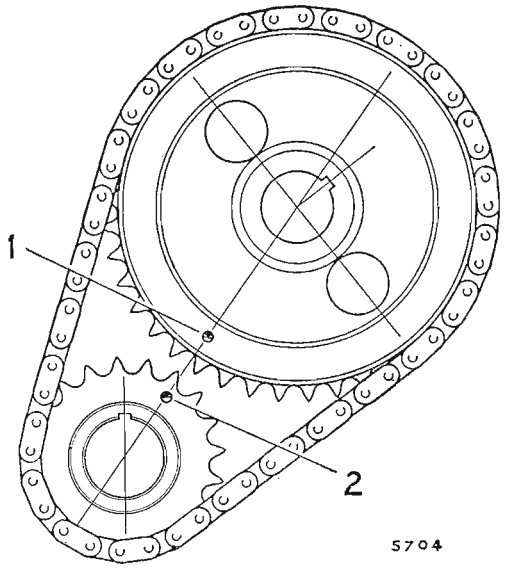


Fig. A.14

The timing gears assembled into the timing chain with the two marks on the gears opposite each other

camshaft or crankshaft components have been fitted which will disturb the alignment of the two gear wheels. To determine the thickness of washers required place a straight-edge across the sides of the camshaft wheel teeth and measure with a feeler gauge the gap between the straight-edge and the crankshaft gear.

When replacing the timing chain and gears set the crankshaft with its keyway at T.D.C. and the camshaft with its keyway approximately at the one o'clock position as seen from the front. Assemble the gears into the timing chain with the two marks on the gear wheels opposite to each other, as in Fig. A.14. Keeping the gears in this position, engage the crankshaft gear keyway with the key on the crankshaft and rotate the camshaft until the camshaft gear keyway and key are aligned. Push the gears onto the shafts as far as they will go and secure the camshaft gear with the lock washer and nut.

Replace the oil thrower; with the face marked 'F' or the concave side (early type) away from the engine, and the remaining components as detailed in Section A.22.

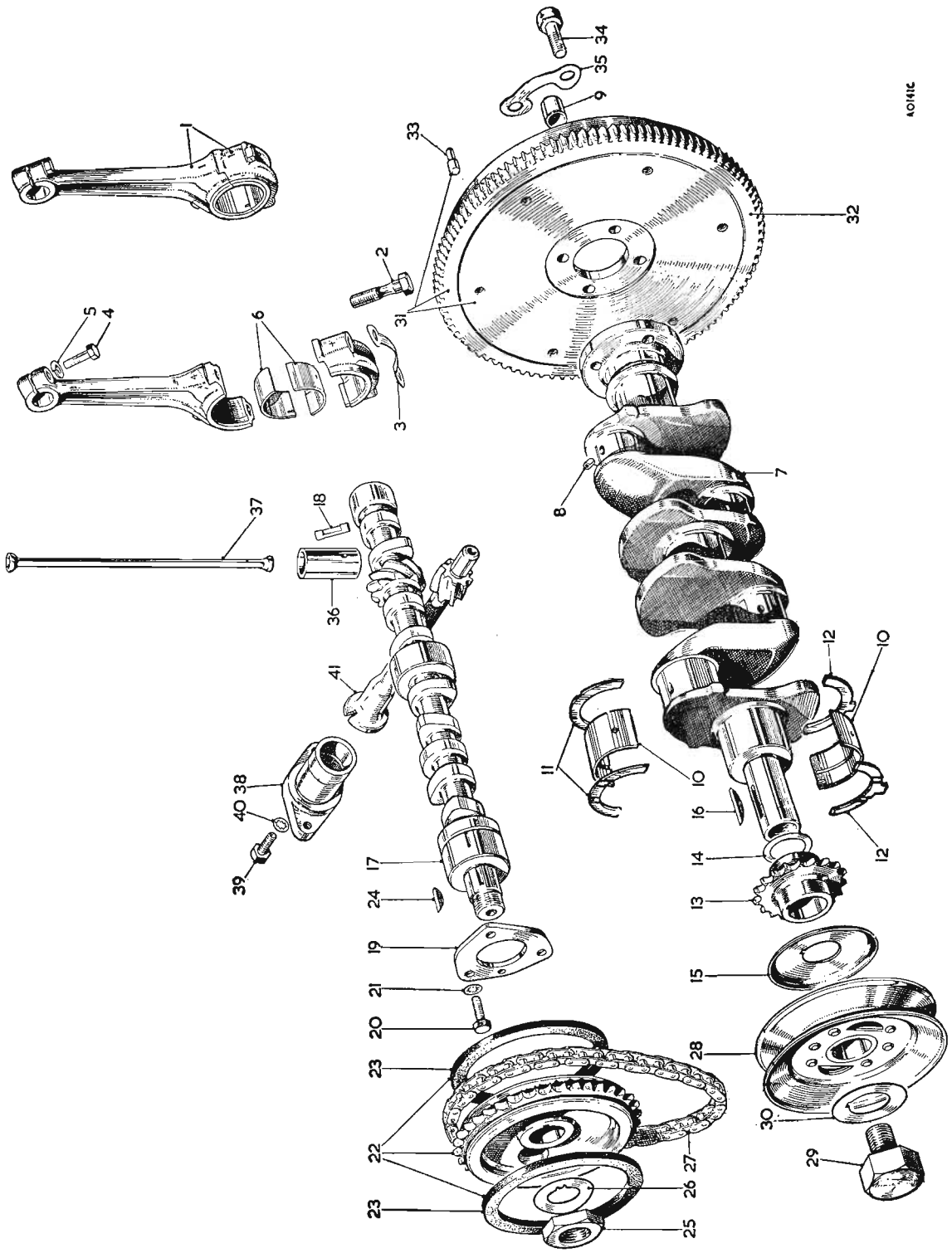
Section A.24

VALVE TIMING

Set No. 1 cylinder inlet valve clearance to ·029 in. (·74 mm.) with the engine cold, and then turn the crankshaft until the valve is about to open. The indicator groove in the flange of the crankshaft pulley should then be opposite the centre pointer (this indicates T.D.C. of No. 1 and No. 4 pistons) on the indicator bracket, situated beneath the crankshaft pulley. The other two pointers indicate T.D.C. and 10° B.T.D.C. respectively.

NOTE.—It is not possible to check the valve timing accurately with the valve rockers set at their normal running rocker clearance. Reset the inlet valve rocker clearance to ·012 in. (·305 mm.) when the timing check is completed (engine cold).

THE ENGINE INTERNAL COMPONENTS



KEY TO THE ENGINE INTERNAL COMPONENTS

No.	*Description*
1.	Connecting rod cap.
2.	Cap bolt.
3.	Lock washer for bolt.
4.	Clamping screw.
5.	Spring washer for clamping screw.
6.	Big-end bearing.
7.	Crankshaft with oil restrictors and bush.
8.	Oil restrictor.
9.	First motion shaft bush.
10.	Main bearing.
11.	Upper thrust washer.
12.	Lower thrust washer.
13.	Crankshaft gear
14.	Packing washer.
15.	Oil thrower.
16.	Gear and crankshaft key.
17.	Camshaft with oil pump driving pin.
18.	Oil pump driving pin.
19.	Locking plate.
20.	Plate to crankcase screw.
21.	Shakeproof washer.
22.	Camshaft gear with tensioner rings.
23.	Tensioner ring.
24.	Gear key.
25.	Gear nut.
26.	Lock washer.
27.	Camshaft driving chain.
28.	Crankshaft pulley.
29.	Pulley retaining bolt.
30.	Lock washer.
31.	Flywheel with starter ring and dowels.
32.	Starter ring.
33.	Dowel.
34.	Flywheel to crankshaft screw
35.	Lock washer.
36.	Tappet.
37.	Push-rod.
38.	Distributor housing.
39.	Screw.
40.	Shakeproof washer.
41.	Distributor driving spindle

Section A.25

CAMSHAFT

Drain the sump and remove it from the engine.

Remove the rocker assembly, push-rods, and tappets (Sections A.6 and A.7), the timing cover and gears (Sections A.22 and A.23), and the oil pump (Section A.5).

Remove the distributor assembly (Section A.19).

Remove the set screws securing the camshaft locating plate to the cylinder block, and withdraw the camshaft forward, rotating it slowly to assist this operation.

Camshaft bearings

If the camshaft bearing clearances are excessive new bearings must be fitted. Steel-backed white-metal bearings are used, and removing and refitting are facilitated by the use of a special camshaft liner removing and replacing tool. New bearings must be reamed to give the correct running clearance (see **'GENERAL DATA').**

Removing the liners

Centre

Insert the pilot adaptor 18G 124 K into the camshaft liner front bore from the inside of the block and the adaptor 18G 124 B into the centre liner from the rear, small end first.

With the body of the tool positioned on the centre screw, pass the screw through the pilot adaptor and the adaptor in the centre liner.

Place the slotted washer on the flat at the rear of the centre screw and insert the tommy-bar into the screw behind the slotted washer.

Tighten up the wing nut to withdraw the liner.

Front and rear

Insert the small end of the adaptor 18G 124 K into the camshaft front liner from the inside of the cylinder block, thread the body of the tool onto the centre screw, and pass the screw through the adaptor from the front of the block. Place the slotted washer on the flat at the rear of the centre screw and insert the tommy-bar into the centre screw behind the slotted washer.

Tighten up the wing nut to withdraw the worn liner.

The rear liner is withdrawn by the same method, using the adaptor 18G 124 M and withdrawing the liner from the rear of the block.

Replacing the liners

Line up the oil holes in the liners and the cylinder block and make certain that they remain correctly positioned during the whole operation.

Front and rear

Place the new liner on the smallest diameter of the adaptor 18G 124 K and insert the adaptor into the camshaft front liner bore from the inside of the block, largest diameter first.

Thread the body of the tool onto the centre screw and pass the screw through the adaptor located in the front liner from the front of the block.

Position the larger of the two 'D' washers on the centre screw with the cut-away portion turned away from the butt joint of the liner: this joint **must** be covered by the washer.

Place the slotted washer on the flat at the rear of the centre screw and insert the tommy-bar into the screw behind the slotted washer.

Tighten the wing nut to pull the liner squarely into position.

The rear liner is replaced by the same method, using the adaptor 18G 124 M and pulling the liner into position from the rear of the block. The 'D' washer **is not** to be used when refitting a rear liner.

Centre

Insert the pilot adaptor 18G 124 K into the camshaft front liner from the inside of the block.

Place a new liner on the small end of the adaptor 18G 124 B and position the adaptor in the centre liner bore from the rear, largest diameter first.

With the body of the tool positioned on the centre screw insert the screw through the pilot adaptor and the adaptor in the centre liner bore.

Position the larger 'D' washer on the centre screw with the cut-away portion turned away from the butt joints of the liner; this joint must be covered by the washer.

Place the slotted washer and the tommy-bar in the centre screw and tighten up the wing nut to pull the liner into position.

Reaming the liners

It is essential that the cutter flutes are kept clear of swarf at all times during the cutting operation, preferably with air-blast equipment. The cutter should be withdrawn from the liner half-way through the cut and the swarf removed from the cutter and the liner.

Feed the reamer very slowly and keep the cutters dry.

The arbor should be lightly lubricated before assembling the cutters and pilots. All oilways should be thoroughly cleaned when the cutting operations have been completed.

Front and rear

Insert the taper pilots 18G 123 AT and 18G 123 BA into the centre and rear liners respectively.

Place the parallel pilot 18G 123 AQ on the arbor, followed by the cutter 18G 123 AN.

Thread the arbor through the front and centre liners, fit the cutter 18G 123 AP on the arbor, and thread the arbor through the taper pilot in the rear liner.

Secure the cutters and pilots in their respective positions; 18G 123 AN is located in No. 10 and 18G 123 AP is located in No. 7 on the arbor.

The cutter for the front liner will cut first with the arbor piloting in the centre and rear liners. The cutter for the rear liner will follow with the arbor piloting in the front and centre liners. Clear away all the swarf before the plain pilot is allowed to enter the front liner.

When the cut in the rear liner is finished, free the cutters and withdraw the arbor.

Centre

Set up for the second part of the operation by inserting the pilots 18G 123 BC and 18G 123 BB in the front and rear liners.

Thread the arbor through the pilot in the front liner and place the cutter for the centre liner on the arbor. Thread the arbor through the centre liner and the pilot located in

the rear liner. Secure the cutter and pilots in position; 18G 123 B is located in No. 7 position on the arbor.

Ream the centre liner, release the cutter, and withdraw the arbor.

Refitting

Refitting is the reverse of the removal procedure.

Section A.26

PISTONS AND CONNECTING RODS (Early Cars)

Removing

Remove the cylinder head assembly (Section A.12), and drain and remove the sump. Tap back the two locking plate tabs and remove the big-end securing bolts. Remove the bearing cap and release the connecting rod from the crankshaft.

Dismantling

The gudgeon pin is rigidly held in the split little-end of the connecting rod by a clamp bolt engaging the central groove of the gudgeon pin.

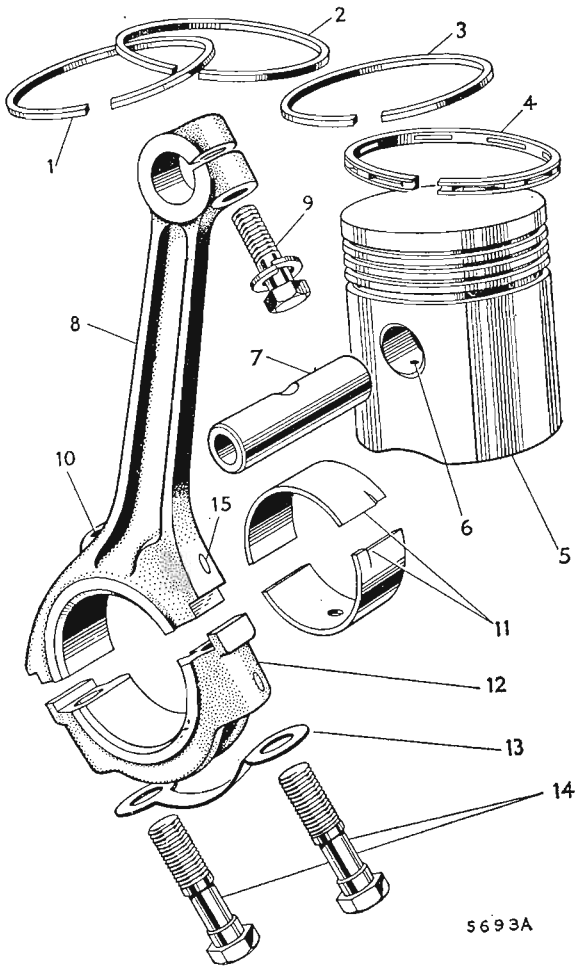


Fig. A.16

A piston and connecting rod assembly

1. Piston ring—parallel.
2. Piston ring—taper.
3. Piston ring—taper.
4. Piston ring—scraper.
5. Piston.
6. Gudgeon pin lubricating hole.
7. Gudgeon pin.
8. Connecting rod.
9. Clamping screw and washer.
10. Cylinder wall lubricating jet.
11. Connecting rod bearings.
12. Connecting rod cap.
13. Lock washer.
14. Bolts.
15. Connecting rod and cap marking.

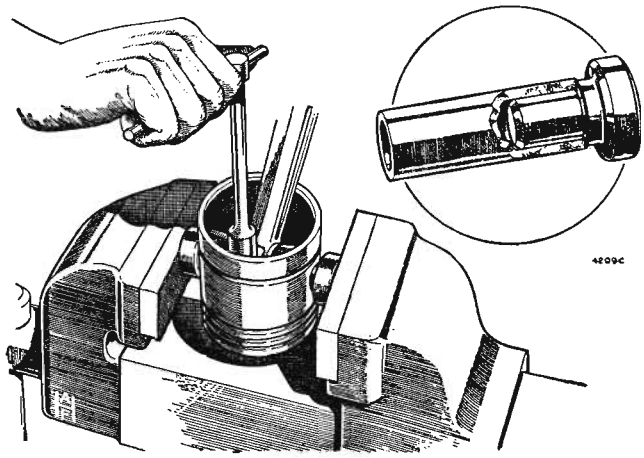


Fig. A.17

The use of special gudgeon pin plugs to hold the connecting rod and piston assembly while the gudgeon pin clamp screw is tightened or loosened is essential

Before the piston and gudgeon pin can be dismantled from the connecting rod it is necessary to remove the clamp screw. To hold the assembly in a vice for this operation without damage special holding plugs should be inserted in each end of the gudgeon pin.

Unscrew the gudgeon pin clamp screw and remove it completely. Push out the gudgeon pin.

Reassembling

A certain amount of selective assembly must be used when fitting new gudgeon pins. They must be a thumb-push fit for three-quarters of their travel, to be finally tapped home with a rawhide mallet. This operation must be carried out with the piston and gudgeon pin cold.

When reassembling, particular attention must be given to the following points:

(1) That the piston is fitted the same way round on the connecting rod. The connecting rod is fitted with the gudgeon pin clamp screw on the camshaft side.

(2) That the gudgeon pin is positioned in the connecting rod so that its groove is in line with the clamp screw hole.

(3) That the clamp screw spring washer has sufficient tension.

(4) That the clamp screw will pass readily into its hole and screw freely into the threaded portion of the little-end, and also that it will hold firmly onto the spring washer.

Refitting

Replacement of the piston and connecting rod is a direct reversal of removal, but the piston ring gaps should be staggered at 90° to each other.

It is essential that each connecting rod and piston assembly should be replaced in its own bore and fitted the same way round, the gudgeon pin clamp screw on the camshaft side of the engine.

Refit the big-end bearings in their original positions.

The top and bottom halves of new bearings are, however, interchangeable, each being drilled for cylinder wall lubrication.

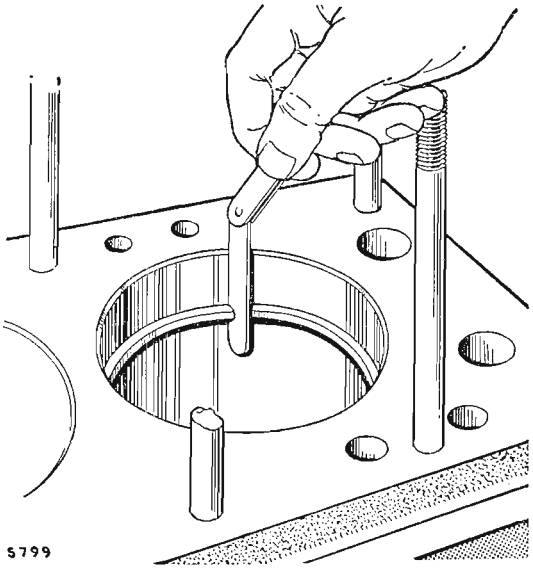


Fig. A.18

Checking the piston ring gap

Section A.27

PISTON RINGS

Removing

If no special piston ring expander is available use a piece of thin steel such as a smoothly ground hacksaw blade or disused ·020 in. (·50 mm.) feeler gauge.

Raise one end of the ring out of its groove. Insert the steel strip between the ring and the piston. Rotate the strip round the piston, applying slight upward pressure to the raised portion of the ring until it rests on the land above the ring grooves. It can then be eased off the piston.

Do not remove or replace the rings over the piston skirt, but always over the top of the piston.

Refitting

Before fitting new rings clean the grooves in the piston to remove any carbon deposit. Take care not to remove any metal, or side-play between the ring and the groove will result, with consequent excessive oil consumption and gas leakage.

Test new rings in the cylinder bore to ensure that the ends do not butt together. The best way to do this is to insert the piston approximately 1 in. (2·54 cm.) into the cylinder bore and push the ring down onto the top of the piston and hold it there in order to keep the ring square with the bore. The correct ring gap is given in **'GENERAL DATA'.**

The second and third rings are tapered and must be fitted with the narrow taper upwards. A letter 'T' is stamped on the narrow face to facilitate identification.

The cylinder bore glazing should be removed before fitting new rings to a worn cylinder bore.

Section A.28

PISTON SIZES AND CYLINDER BORES
(Early Cars)

In addition to the standard pistons there is a range of four oversize pistons available for Service purposes. Oversize pistons are marked with the actual oversize dimensions enclosed in an ellipse. A piston stamped ·020 is suitable only for a bore ·020 in. (·508 mm.) larger than the standard bore and, similarly, pistons with other markings are suitable only for the oversize bore indicated.

The piston markings indicate the actual bore size to which they must be fitted, the requisite running clearance being allowed for in the machining.

After reboring an engine, or whenever fitting pistons differing in size from those removed during dismantling, ensure that the size of the piston fitted is stamped clearly on the top of the cylinder block alongside the appropriate cylinder bore.

Pistons are supplied in the sizes indicated in the following table:

Piston marking	*Suitable bore size*	*Metric equivalent*
STANDARD	2·4778 to 2·4781 in.	62·935 to 62·940 mm.
OVERSIZE		
+·010 in. (·254 mm.)	2·4878 to 2·4881 in.	63·189 to 63·194 mm.
+·020 in. (·508 mm.)	2·4978 to 2·4981 in.	63·443 to 63·448 mm.
+·030 in. (·762 mm.)	2·5078 to 2·5081 in.	63·697 to 63·702 mm.
+·040 in. (1·016 mm.)	2·5178 to 2·5181 in.	63·951 to 63·956 mm.

Section A.29

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is statically and dynamically balanced and is supported in the crankcase by three renewable

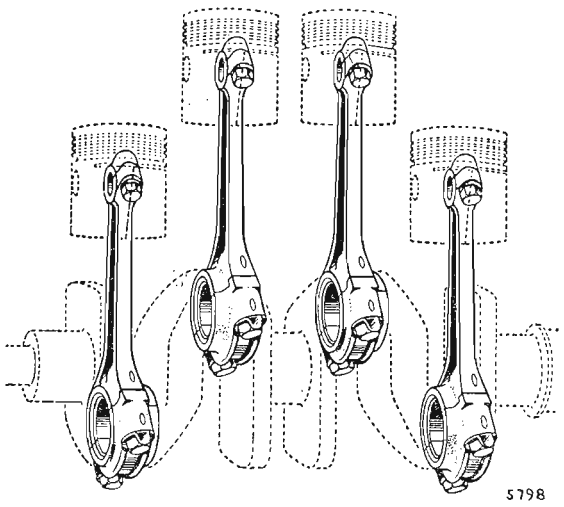


Fig. A.19

The correct assembly of connecting rods to the pistons and crankshaft

main bearings. The end-float is controlled by a thrust washer fitted on each side of the centre main bearing.

Removing

Drain the sump. Remove the engine (Section A.31) and place upside-down in a dismantling fixture.

Remove the oil strainer, timing chain and gears, and the flywheel and engine rear plate. Remove the sparking plugs to facilitate turning the crankshaft.

Check the crankshaft end-float to determine whether renewal of the thrust washers is necessary.

Remove the connecting rod bearing caps and shells, keeping the shells with their respective caps for correct replacement, and release the connecting rods from the crankshaft.

Withdraw the main bearing caps complete with the bottom bearing shells; caps and their respective shells must be kept together.

Remove the screwed plug from the rear bearing cap oil return pipe and withdraw the pipe. Note that each main bearing cap is stamped with a number, this number being repeated on the web of the crankcase near the bearing cap. The bottom halves of the two thrust washers will be removed with the centre main bearing cap.

Remove the crankshaft, the two remaining halves of the thrust washers, and the top half-shells of the main bearings from the crankshaft.

Inspecting

Inspect the crankcase main journals and crankpins for wear, scores, scratches, and ovality. If necessary, the crankshaft may be reground to the minimum limits shown under **'GENERAL DATA'.** Main bearings for reground crankshafts are available in sizes shown under **'GENERAL DATA'.**

Clean the crankshaft thoroughly, ensuring that the connecting oilways between the journals and crankpins are perfectly clear. They can be cleaned out by applying a pressure gun containing petrol or paraffin. When clean inject engine oil in the same manner.

Thoroughly clean the bearing shells, caps, and housings above the crankshaft.

Examine the bearing shells for wear and pitting, and look for evidence of breaking away or picking up. Renew the shells if necessary.

Bearings are prefinished with the correct diametral clearance, and do not require bedding in. New bearings should be marked to match up with the marking on the caps, and **on no account should the caps be filed to take up wear or to reduce running clearance.**

Check the thrust washers for wear on their bearing surfaces, and renew if necessary to obtain the correct end-float.

Refitting

Installation of the crankshaft and bearings is a reversal of the removal procedure, particular attention, however, being given to the following points:

(1) Ensure that the thrust washers are replaced the correct way round (the oil grooves should face outwards) and locate the bottom half tab in the slot in the bearing cap.
(2) The bearing shells are notched to fit the recesses machined in the housing cap.
(3) Remember to fit the packing washers behind the crankshaft timing chain wheel.
(4) Lubricate the bearings freely with engine oil.
(5) The rear main bearing cap horizontal joint surfaces should be thoroughly cleaned and lightly covered with Hylomar Jointing Compound before the cap is fitted to the cylinder block. This ensures a perfect oil seal when the cap is bolted down to the block.
(6) Tighten the main bearing bolts (see **'GENERAL DATA'** for torque spanner settings.)

Section A.30

CYLINDER LINERS

Should the condition of the cylinder bores be such that they cannot be cleaned up to accept standard oversize pistons, dry cylinder liners can be fitted. This operation may be carried out by the use of specialized proprietary equipment or with a power press using pilot adaptors to the dimensions shown in Fig. A.20. The press must be capable of 3 tons (3048 kg.) pressure to fit new liners and 5 to 8 tons (5080 to 8128 kg.) to remove old liners.

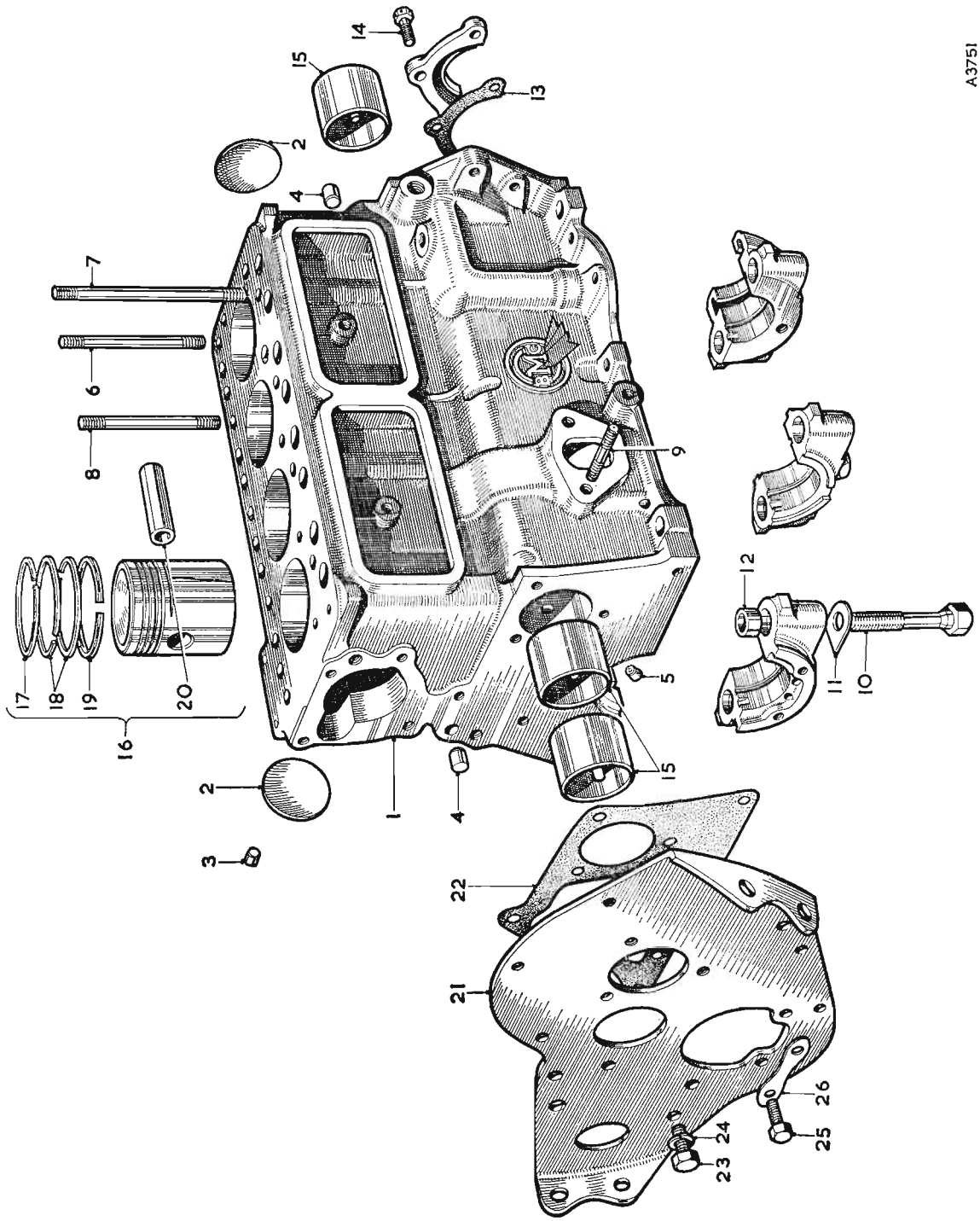
Remove the engine from the vehicle as detailed in Section A.31. Dismantle the engine and remove the cylinder head studs. If liners have not previously been fitted the bores must be machined and honed to the dimensions given in the table below.

Removing worn liners

Place the cylinder block face downwards on suitable wooden supports on the bed of the press, making sure that there is sufficient space between the block and the bed of the press to allow the worn liner to pass down. Insert the pilot in the bottom of the liner and carefully press the liner from the bore.

Engine type	*Liner Part No.*	*Machine bores of cylinder block to this dimension before fitting liner*	*Outside diameter of liner*	*Interference fit of liner in cylinder block bore*	*Machine liner bore to this dimension after fitting*
'A' (948 c.c.)	2A 784	2·6035 to 2·604 in. (66·128 to 66·14 mm.)	2·606 to 2·60675 in. (66·19 to 66·21 mm.)	·002 to ·00325 in. (·05 to ·08 mm.)	2·477 to 2·4785 in. (62·915 to 62·954 mm.)
'A' (1098 c.c.)	12G 164	2·64075 to 2·64125 in. (67·076 to 67·088 mm.)	2·64325 to 2·64400 in. (67·139 to 67·158 mm.)	·002 to ·00325 in. (·05 to ·08 mm.)	2·542 to 2·5435 in. (64·566 to 64·605 mm.)

THE ENGINE EXTERNAL COMPONENTS



KEY TO THE ENGINE EXTERNAL COMPONENTS

No.	*Description*
1.	Block assembly.
2.	Welch plug.
3.	Oil pressure relief valve passage plug.
4.	Oil gallery plug.
5.	Camshaft bearing oil feed restrictor.
6.	Cylinder head stud.
7.	Cylinder head stud (long).
8.	Cylinder head stud (short).
9.	Fuel pump stud.
10.	Main bearing cap set screw.
11.	Lock washer.
12.	Main bearing cap dowel.
13.	Rear cover joint.
14.	Rear cover set screw.
15.	Camshaft bearing liners.
16.	Piston assembly.
17.	Compression ring (plain).
18.	Compression ring (taper).
19.	Scraper ring.
20.	Gudgeon pin.
21.	Engine mounting plate (front).
22.	Mounting plate joint.
23.	Mounting plate screw to crankcase.
24.	Washer.
25.	Mounting plate to bearing cap screw.
26.	Locking plate.

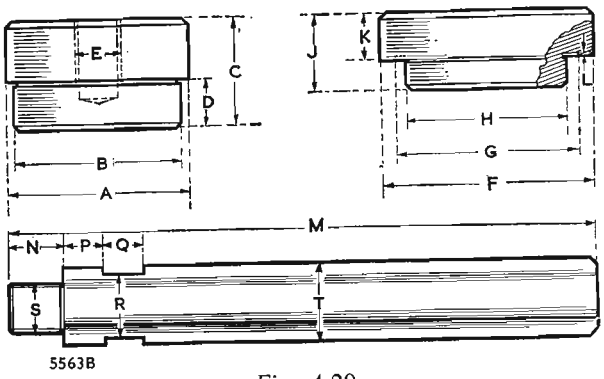


Fig. A.20

Cylinder liner pilots should be made to the above dimensions from case-hardening steel and case-hardened. The pilot extension should be made from 55-ton hardening and tempering steel hardened in oil and then tempered at 550° C. (1,020° F.)

	948-*c.c. engine*	1098-*c.c. engine*
	Pressing-out pilot	Pressing-out pilot
A.	$2\frac{37}{64}{}^{+\cdot005}_{-\cdot000}$ in. (65·48 $^{+\cdot127}_{-\cdot000}$ mm.).	$2\frac{5}{8}{}^{+\cdot005}_{-\cdot000}$ in. (66·68 $^{+\cdot127}_{-\cdot000}$ mm.).
B.	2·465$^{+\cdot000}_{-\cdot005}$ in. (62·61 $^{+\cdot000}_{-\cdot127}$ mm.).	2·537$^{+\cdot000}_{-\cdot005}$ in. (64·44$^{+\cdot000}_{-\cdot127}$ mm.).
C.	$1\frac{3}{4}$ in. (44·45 mm.).	$1\frac{3}{4}$ in. (44·45 mm.).
D.	$\frac{3}{4}$ in. (19·05 mm.).	$\frac{3}{4}$ in. (19·05 mm.).
E.	$\frac{3}{4}$ in. B.S.W. thread.	$\frac{3}{4}$ in. B.S.W. thread.
	Pressing-in pilot	Pressing-in pilot
F.	3 in. (76·20 mm.).	$3\frac{1}{16}$ in. (77·79 mm.).
G.	$2\frac{5}{8}$ in. (66·68 mm.).	$2\frac{11}{16}$ in. (67·26 mm.).
H.	2·455$^{+\cdot000}_{-\cdot005}$ in. (62·35$^{+\cdot000}_{-\cdot127}$ mm.).	2·515 $^{+\cdot000}_{-\cdot005}$ in. (63·88$^{+\cdot000}_{-\cdot127}$ mm.).
J.	$1\frac{1}{4}$ in. (31·75 mm.).	$1\frac{1}{4}$ in. (31·75 mm.).
K.	$\frac{3}{4}$ in. (19·05 mm.).	$\frac{3}{4}$ in. (19·05 mm.).
L.	·015 in. (·38 mm.).	·015 in. (·38 mm.).
	Pilot extension	Pilot extension
M.	$14\frac{1}{2}$ in. (36·83 cm.).	$10\frac{1}{2}$ in. (26·67 cm.).
N.	$\frac{7}{8}$ in. (22·22 mm.).	$\frac{7}{8}$ in. (22·22 mm.).
P.	$\frac{5}{8}$ in. (15·87 mm.).	$\frac{5}{8}$ in. (15·87 mm.).
Q.	$\frac{5}{8}$ in. (15·87 mm.).	$\frac{5}{8}$ in. (15·87 mm.).
R.	1 in. (25·4 mm.) flats.	1 in. (25·4 mm.) flats.
S.	$\frac{3}{4}$ in. B.S.W. thread.	$\frac{3}{4}$ in. B.S.W. thread.
T.	$1\frac{1}{4}$ in. (31·75 mm.).	$1\frac{1}{4}$ in. (31·75 mm.).

Pressing in new liners

Thoroughly clean the inside of the bores and the outside of the liners. Stand the cylinder block upright on the bed of the press, insert the pilot guide in the top of the liner, and position the liner with its chamfered end in the top of the bore. Make certain that the liner is square with the top of the block and that the ram of the press is over the centre of the pilot. Press the liner into the bore.

Each liner must be machined to the dimensions given on page A.21 after pressing into position.

Section A.31

ENGINE

Removing

Disconnect the earth lead from the battery and remove the bonnet from the bonnet hinges.

Remove the radiator as in Section C, and if a heater is fitted disconnect the inlet and outlet hoses at the heater unit.

Disconnect the choke and throttle cables from the carburetter assemblies and remove the oil pressure gauge pipe from its terminal on the right-hand rear of the cylinder block. When the vehicle is fitted with a tachometer unit (drive type) the cable complete with the reduction drive must be removed from the rear end of the dynamo.

All Lucar connectors fitted to the generator, coil, and distributor low-tension cables should be disconnected.

Detach the high-tension cables from their connections at the coil and the sparking plugs and remove the distributor cap.

Remove the starter cable from its connection on the front end of the starter motor and disconnect the fuel inlet pipe at the fuel pump union. Release the clamp attaching the exhaust manifold to the down pipe and lower the down pipe from the manifold.

With gearbox

NOTE.—The following operations apply only when the engine is removed complete with the gearbox assembly.

Working from within the vehicle, remove the self-tapping screws securing the gear lever aperture cover to the gearbox surround and lift off the cover. Remove the anti-rattle cap, spring, and plunger. Remove the gear change lever retaining plate set screws and extract the gear change lever complete with the retaining plate. Turn back the carpet and remove the gearbox rear mounting set screws. From beneath the car remove the speedometer drive cable at its union with the gearbox rear extension and release the securing clip on the bell housing. Detach the slave cylinder from the gearbox bell housing by removing the securing set screws and withdrawing the push-rod from the rear of the cylinder. Disconnect the propeller shaft from the rear axle and remove it from the vehicle over the axle assembly and to the left-hand side of the differential casing. Remove the remaining gearbox mounting set screws.

Without gearbox

NOTE.—The following operations apply only when the engine is removed as a single unit.

Remove the filter bowl and the starter motor from the right-hand rear of the cylinder block. Take the weight of the gearbox on a suitable jack and remove the set screws securing the gearbox to the engine crankcase.

Remove the left-hand front engine mounting complete with its bracket and the right-hand front engine mounting rubber together with the front exhaust down pipe support bracket from its fixing on the gearbox bell housing.

Take the weight of the assembly or assemblies with suitable lifting equipment and remove the engine from the vehicle.

Refitting

Refit the engine by reversing the sequence of operations detailed for removal.

Section A.32

ENGINE MOUNTINGS

Removing

Support the engine assembly with suitable lifting equipment and remove both the left- and right-hand mounting rubber securing nuts and mounting rubber bracket-to-body securing set screws. Release the exhaust down pipe manifold clamp and remove the front down pipe strap from the support bracket. Lift the engine approximately $\frac{3}{4}$ in. (19 mm.), ensuring that the fan assembly will not foul the radiator fan cowling. Swing the engine to the left as far as possible and remove the right-hand rubber mounting together with its body bracket.

The left-hand front rubber mounting and bracket assembly can now be easily removed.

Refitting

When refitting, the right-hand front rubber mounting and bracket should be positioned first. Both mounting rubbers and brackets should be fitted before any set screws or nuts are replaced.

Section A.33

PISTONS AND CONNECTING RODS (Later Cars)

Should the piston or connecting rod suffer damage or the small-end bush require renewal, the pistons and connecting rods are supplied as matched sets only. Therefore, under no circumstances should the small-end bush, piston, or connecting rod be renewed separately.

Removing and refitting

See Section A.26.

Dismantling

The gudgeon pins are fully floating; remove the two circlips locating each pin and press the pins out. It is essential that the piston assemblies should be replaced in their own bores and fitted the same way round: they should be marked to facilitate this.

Reassembling

Assemble the pistons to the connecting rods with the gudgeon pin, which should be a hand push fit at a room temperature of 20° C. (68° F.). Secure each pin in its piston with two circlips, ensuring that they fit well into their grooves.

Section A.34

PISTON SIZES AND CYLINDER BORES (Later Cars)

In production, piston and connecting rod assemblies are fitted by selective assembly.

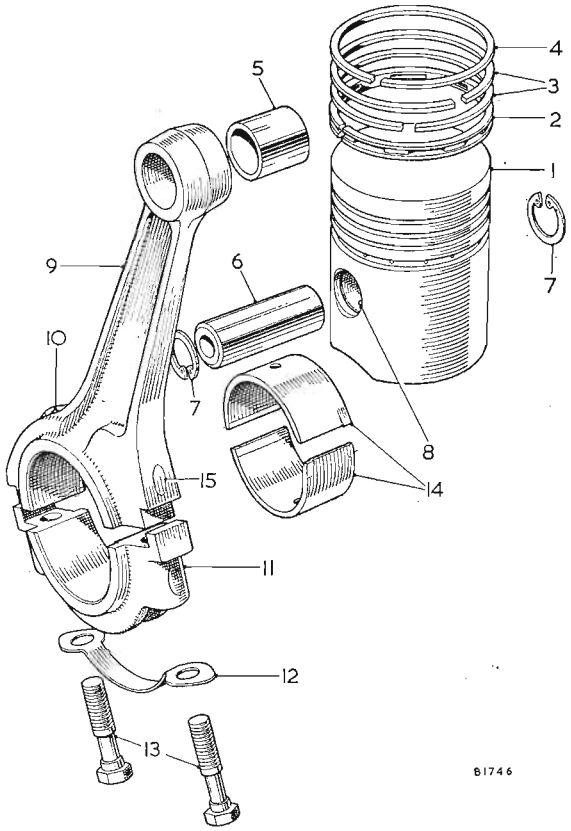


Fig. A.21

Piston and connecting rod

1. Piston
2. Piston ring—scraper.
3. Piston rings—taper.
4. Piston ring—parallel.
5. Small-end bush.
6. Gudgeon pin.
7. Circlip.
8. Gudgeon pin lubricating hole.
9. Connecting rod.
10. Cylinder wall lubricating jet.
11. Connecting rod cap.
12. Lock washer.
13. Bolts.
14. Connecting rod bearings.
15. Connecting rod and cap marking.

In addition to the standard piston and connecting rod assemblies there is a range of two oversize piston and connecting rod assemblies available for Service purposes.

Piston marking	*Suitable bore size*	*Metric equivalent*
STANDARD	2·5424 to 2·5447 in.	64·576 to 64·635 mm.
OVERSIZE		
+·010 in. (·254 mm.)	2·5524 to 2·5547 in.	64·830 to 64·889 mm.
+·020 in. (·508 mm.)	2·5624 to 2·5647 in.	65·084 to 65·143 mm.

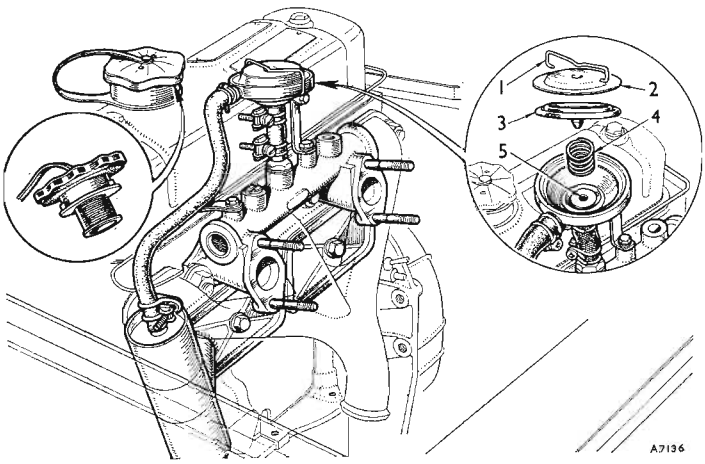


Fig. A.22

Closed-circuit breathing arrangement: (Inset) oil filler cap with combined air filter and the breather control valve.

1. Retaining clip.
2. Cover.
3. Diaphragm.
4. Spring.
5. Control orifice.

Section A.35

CRANKCASE CLOSED-CIRCUIT BREATHING

In order to conform to the air pollution regulations in certain countries crankcase fumes are directed into the induction manifold via the tappet chamber and a non-return valve on the manifold. A filter element is included on the rocker cover and in the oil filler cap.

Servicing

Remove the spring clip and lift out the diaphragm and top control spring. Clean all parts thoroughly and flush in methylated spirits. Examine the valve interior, the control orifice, the diaphragm, and the control needle. If the diaphragm is punctured, fit a new one. Reassemble the valve taking care to locate the spring centrally under the diaphragm.

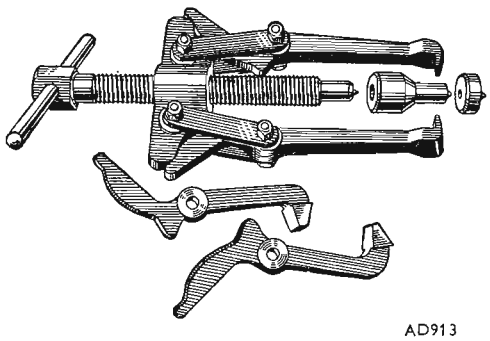
NOTE.—Solvents such as Trichlorethylene, Cresol, Acetone, and Benzene are not recommended for cleaning as they will damage the diaphragm and the backfire-valve seat.

(*For* **'SERVICE TOOLS'** *see page A. 27*)

SERVICE TOOLS

18G 2. Crankshaft Gear, Pulley, and Propeller Shaft Flange Remover

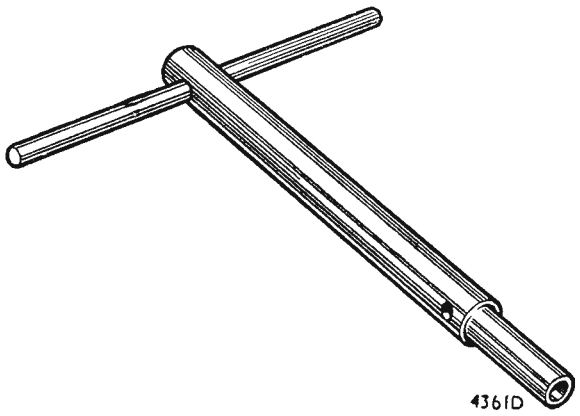
A multipurpose tool, with alternative legs readily interchangeable: one pair has thin flat ends designed for removing crankshaft gears and propeller shaft and bevel pinion flanges, the other pair has tapered ends suitable for fan pulley grooves other than later-type models fitted with narrow-section fan belts.



18G 2

18G 27. Valve Seat Cotter and Pilot Handle

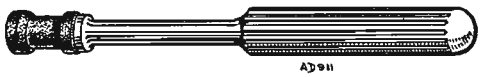
For use with pilot 18G 167 D, cutters 18G 167, 18G 167 C, 18G 167 B, and glaze breaker 18G 167 A.



18G 27

18G 29. Valve Grinding-in Tool

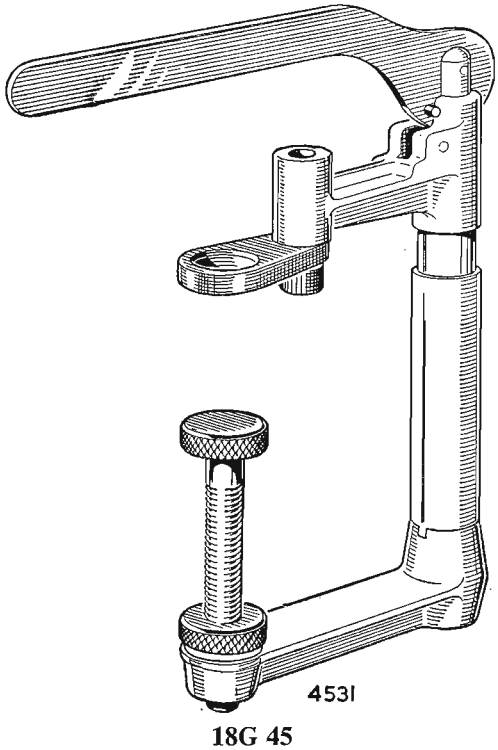
A metal handle complete with a detachable suction pad. For the Sprite (Mk. II) and Midget use alternative suction pad 18G 29 B.



18G 29

18G 45. Valve Spring Compressor

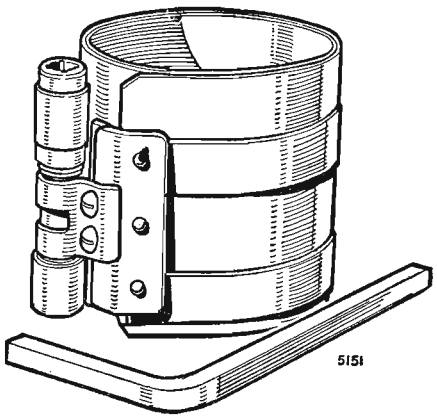
This tool is designed for o.h.v. engines. It has a cam and lever action and screw adjustment. The adaptor ring is shaped to facilitate the fitting of cotters.



18G 45

18G 55 A. Piston Ring Clamp

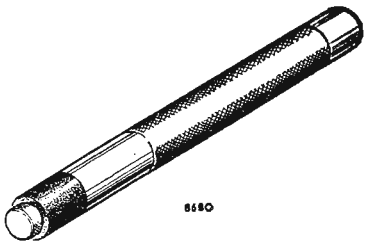
Designed to cover a wide range of pistons, it is easy to operate and will compress the strongest piston ring, making assembly to the bore a quick and easy operation.



18G 55 A

18G 69. Oil Pump Relief Valve Grinding-in Tool

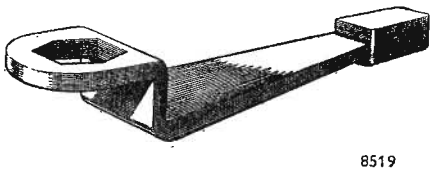
Designed to facilitate the removal and grinding in of the engine oil relief valve. Tightening the set screw when inserted into the hollow oil relief valve expands the rubber plunger, which ensures that the tool is a tight fit.



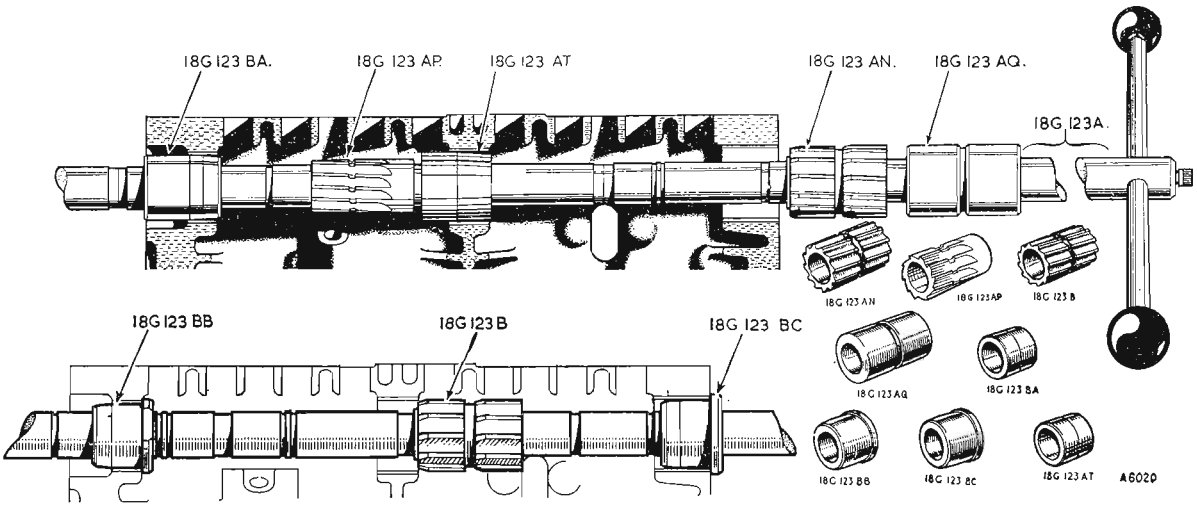
18G 69

18G 98. Nut Spanner

This shock-type spanner enables the nut to be removed without the need for locking the crankshaft with improvised means, which may cause damage to the components.



18G 98



18G 123 A. Camshaft Liner Reamer

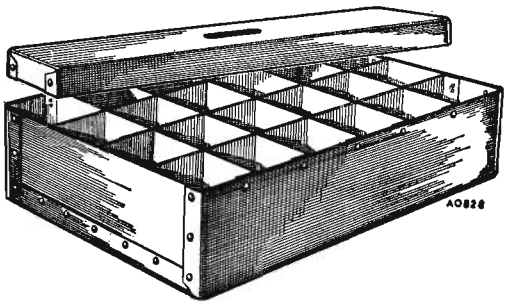
This equipment is essential when reconditioning cylinder blocks, otherwise camshaft liners cannot be reamed in line, and in consequence the clearance between the camshaft journal and liner will be incorrect. Full instructions for using the equipment will be supplied with each basic tool.

CUTTERS
18G 123 AN, 18G 123 AP,
18G 123 B

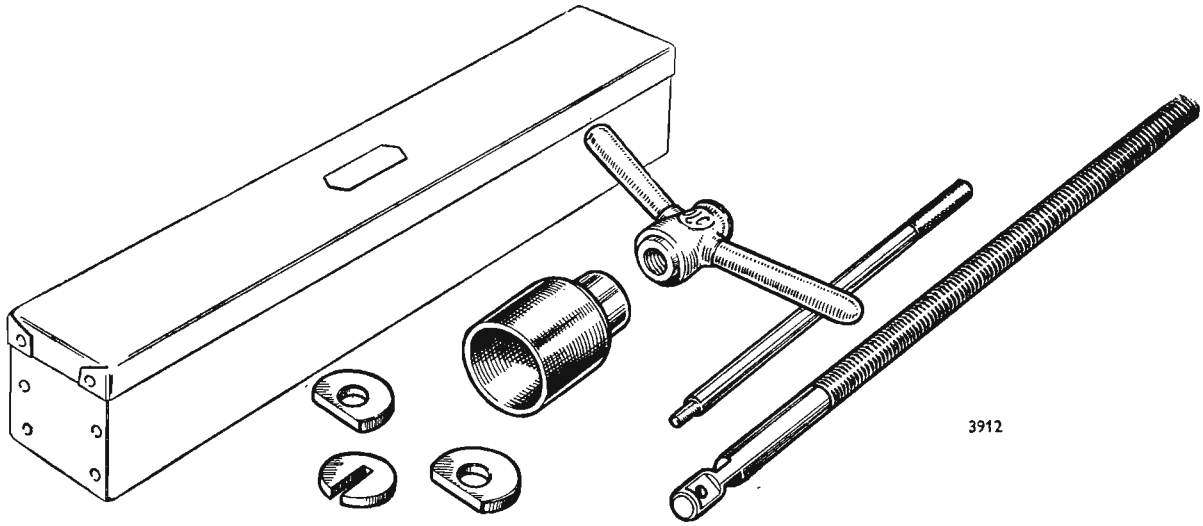
PILOTS
18G 123 AQ, 18G 123 AT,
18G 123 BA, 18G 123 BB,
18G 123 BC

18G 123 AL. Fibre Box (Camshaft Reamers)

A fibre box for the storage of camshaft liner reamer cutters and pilots, and partitioned to protect the edge of the cutters.



18G 123 AL



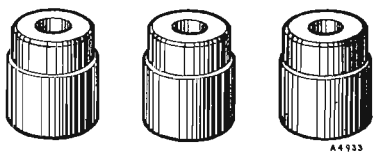
18G 124 A

18G 124 A. Camshaft Liner Remover and Replacer (basic tool)

The equipment consists of a basic tool 18G 124 A and various adaptors (supplied separately) for different types of engine. Liners can be renewed and replaced without the damage invariably associated with the use of improvised drifts. Full instructions for using the equipment will be supplied with each basic tool.

18G 124 K, 18G 124 B, and 18G 124 M. Camshaft Liner Remover Adaptors

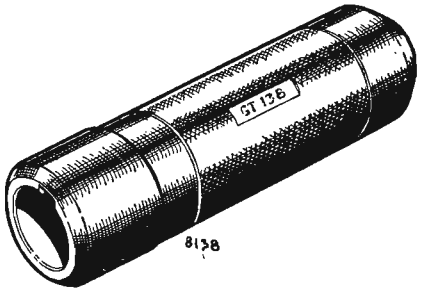
For use with 18G 124 A.



18G 124 K, 18G 124 B, 18G 124 M

18G 138. Crankshaft Gear, Pulley, and Propeller Shaft Flange Replacer

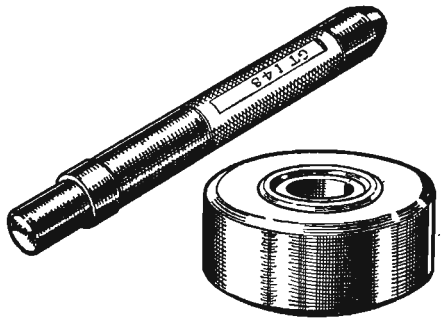
This tool is used for driving on the crankshaft gear and for lining up the timing cover.



18G 138

18G 148. Valve Rocker Bush Remover and Replacer

The flange of the driver is recessed to prevent the split bush from opening when being driven into position. The anvil is also recessed to retain the rocker during the operation. Use of a light press is desirable when using this tool, alternatively a vice or copper-faced hammer may be used.

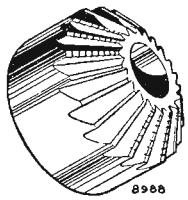


8154

18G 148

18G 167. Valve Seat Finishing Cutter

Use with pilot 18G 167 D and handle 18G 27.

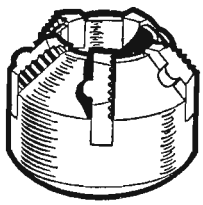


8988

18G 167

18G 167 A. Valve Seat Glaze Breaker

For use with pilot 18G 167 D and handle 18G 27.

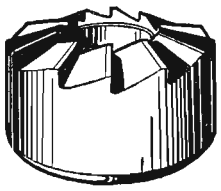


9165

18G 167 A

18G 167 B. Valve Seat Narrowing Cutter—Top

Designed to enable seats to be maintained at their original dimensions. Use with pilot 18G 167 D and handle 18G 27. These cutters must not be used on hardened valve seat inserts—the inserts must be renewed.

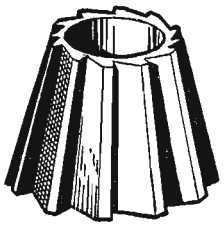


9021B

18G 167 B

18G 167 C. Valve Seat Narrowing Cutter—Bottom

Use with pilot 18G 167 D and handle 18G 27.



9021A

18G 167 C

18G 167 D. Valve Seat Cutter Pilot

For use with glaze breaker 18G 167 A, cutters 18G 167, 18G 167 B, 18G 167 C, and handle 18G 27.



18G 167 D

18G 187. Radiator Reverse-flush Adaptors

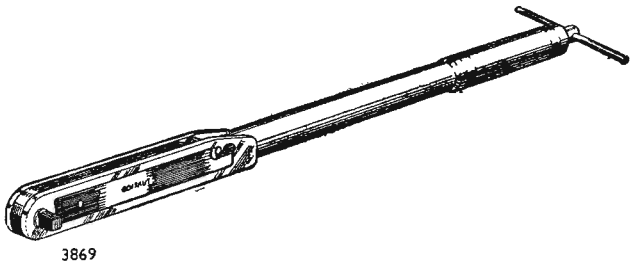
The adaptors should be used in pairs, one for the radiator inlet hose and one for the outlet hose. The hose connection is 1 in. (25·4 mm.) diameter.



18G 187

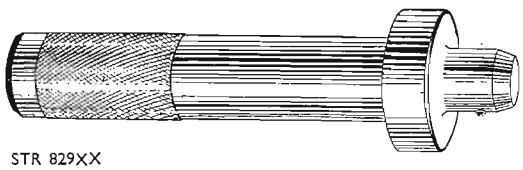
18G 372. Torque Wrench—30 to 140 lb. ft. (4·15 to 19·4 kg. m.)

A universal torque spanner for use with standard sockets. This tool is essential if the recommended maximum torque for various studs and nuts is not to be exceeded.



18G 372

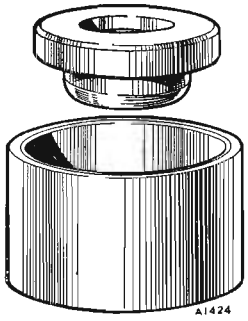
18G 134 Bearing and Oil Seal Replacer (basic tool)



18G 134

18G 134 BD Timing Case Oil Seal Replacer Adaptor

The fitting of the timing case oil seal must be carried out with extreme care use with basic tool 18G 134.



18G 134 BD