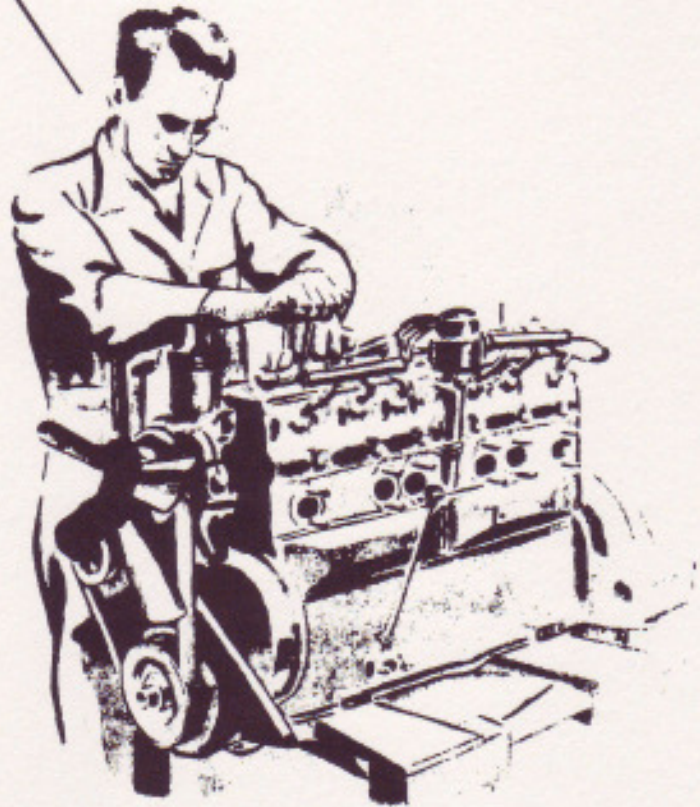




ENGINE





SECTION E.

E N G I N E .

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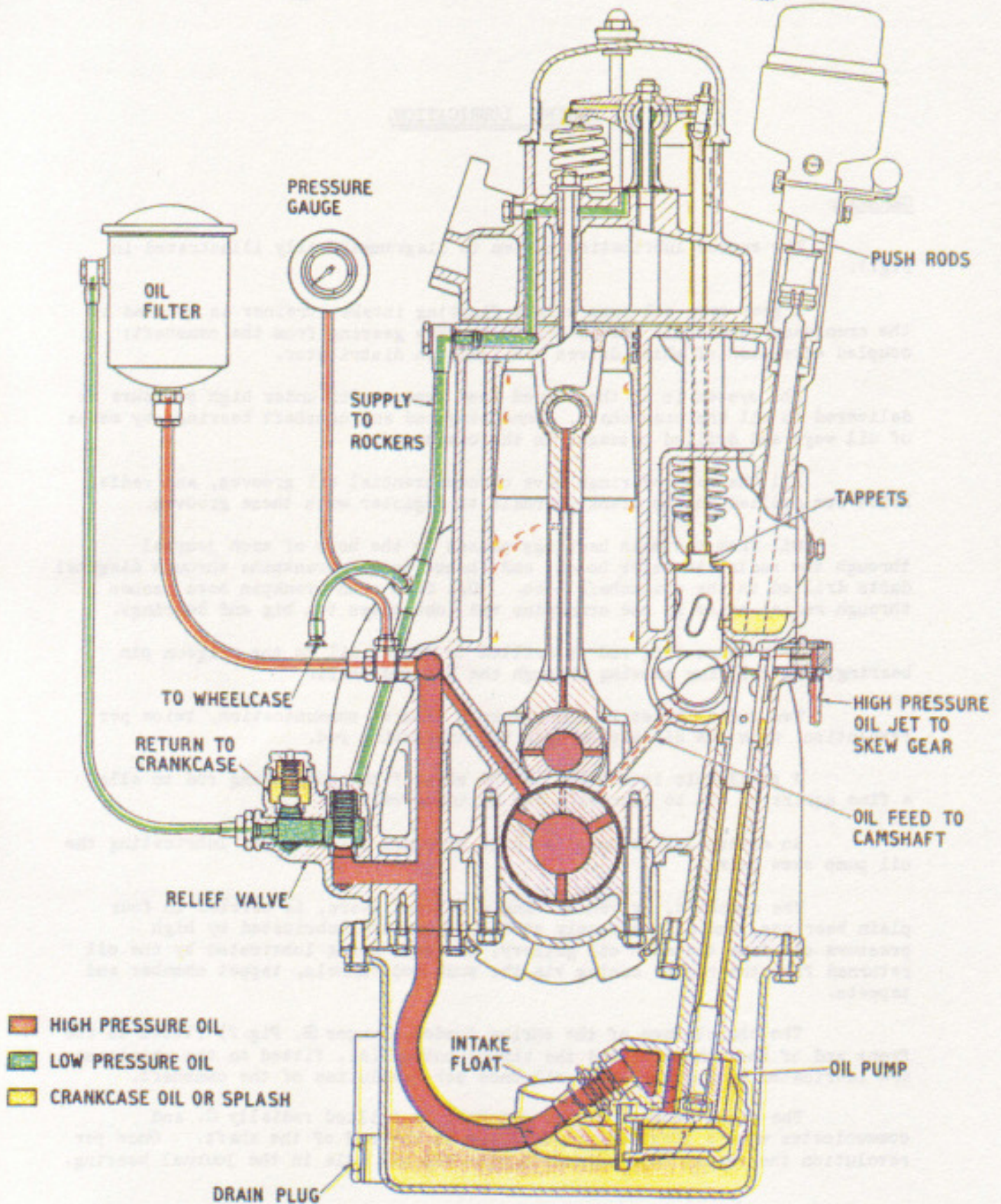


FIG. 1. ENGINE LUBRICATION SYSTEM



ENGINE LUBRICATION.

GENERAL.

The engine lubrication system is diagrammatically illustrated in Fig. 1.

A gear-type oil pump with a floating intake strainer is located in the crankcase lower-half and is driven by skew gearing from the camshaft; a coupled extension of which drives the ignition distributor.

The system is of the forced feed type. Oil under high pressure is delivered to all the crankshaft, connecting rod and camshaft bearings by means of oil ways and drilled passages in the crankcase.

All the main bearings have circumferential oil grooves, and radial holes are drilled in the crank journals to register with these grooves.

Oil from the main bearings passes to the bore of each journal through the radial transfer holes, and thence to the crankpins through diagonal ducts drilled in the crankshaft webs. Oil from each crankpin bore issues through radial holes in the crankpins and lubricates the big end bearings.

Each connecting rod is drilled to convey oil to the gudgeon pin bearing, the drilling passing through the big-end shell.

Two radial holes in the crankpin ensures communication, twice per revolution, with the oil way through the connecting rod.

A small hole is drilled in the side of the connecting rod to allow a fine squirt of oil to lubricate the cylinder walls.

An external pipe supplies high pressure oil to a jet lubricating the oil pump skew gear.

The camshaft, driven by single helical gears, is carried in four plain bearings, and as previously stated, these are lubricated by high pressure oil from the main oil gallery, the cams being lubricated by the oil returned from the rocker casing via the push rod tunnels, tappet chamber and tappets.

The thrust face of the spring loaded plunger (B, Fig. 2) fitted to the front end of the camshaft, and the thrust button (A), fitted to the wheelcase, are lubricated by high pressure oil once per revolution of the camshaft.

The front journal of the camshaft is drilled radially C, and communicates with a longitudinal drilling in the end of the shaft. Once per revolution the radial hole registers with the oil hole in the journal bearing.



Oil under reduced pressure from the relief valve, is directed on to the helical camshaft drive gears, via a branch pipe from the pipe which supplies oil to the overhead rocker shaft.

Oil is conveyed to the rocker shaft through the centre rocker pedestal, the lower face of which has a semi-circular groove which registers with an oil way in the cylinder head. A larger diameter hole, through which the holding down stud passes, is drilled in this pedestal than in the other pedestals, to allow free passage for the oil to the rocker shaft.

The hollow rocker shaft is plugged by removable plugs at each end, and is drilled radially where each rocker works to lubricate the rocker bearings.

These bearings are a press fit in the rockers, and have an internal annular groove. A drilling through the centre of the rocker arm, from end to end, passes through the annular oil groove in the bush, on the tappet adjusting screw side only, see Fig. 3. This is blanked off at one end by the tappet adjusting screw, but a small hole drilled vertically on the underside, allows a restricted flow of oil to lubricate the ball ends of the push rods.

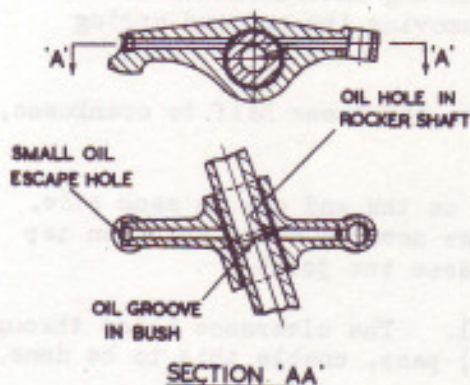


FIG. 3. OILWAYS IN ROCKER SHAFT AND ROCKER ARM.

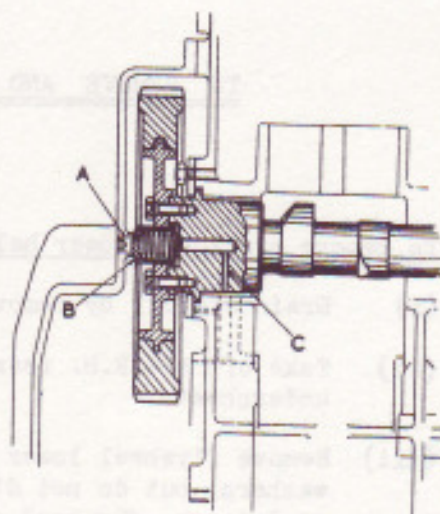


FIG. 2. OILWAYS LUBRICATING CAMSHAFT THRUST BUTTON.

At the valve end of the rocker arm drilling, a plug is fitted having a small escape hole, which allows a restricted quantity of oil to find its way on to the valve tip and stem.

Should oil cease to flow from these escape holes at any time, a fine piece of wire should be inserted to remove any foreign matter which may be causing the stoppage. These holes must never be enlarged.

Each inlet valve guide is provided with a packing gland, held in position by the inner washer and inner valve spring, to control oil and air leakage down the valve guides.



TO REMOVE AND REPLACE CRANKCASE LOWER HALF.

To remove crankcase lower half.

- (i) Drain off oil by removing plug on the R.H. side of crankcase.
- (ii) Take off the R.H. rear and the R.H. front, and also the L.H. side undersheets.
- (iii) Remove flywheel lower cover by taking off the 6 nuts and flat spring washers, but do not disturb the two small bolts which attach the felt seal to the flywheel cover. Take care not to distort the cover as this may cause it to foul the flywheel when replaced.
- (iv) Remove the exhaust downtake pipe stay by removing the two setscrews (which pass through the crankcase lower half), and remove bolt which attaches stay to pipe.
- (v) Remove the 2 nuts and bolts, and 2 setscrews and four flat spring washers, which attach the bottom of the wheelcase to crankcase lower half.
- (vi) Remove oil level gauge wire from the measuring instrument on the R.H. side of crankcase lower half, by first removing the nut and spring washer.
- (vii) Slacken off all the setscrews which attach the lower half to crankcase, a turn or two.
- (viii) Remove all the setscrews except the next to the end one on each side. Slacken off these four remaining setscrews several turns and then tap the lower half with a hide mallet to release the joint.
- (ix) Push lower half back towards the flywheel. The clearance holes through which the setscrews (holding on the sump) pass, enable this to be done.
- (x) Insert a .005" to .010" feeler between the front face of the crankcase lower half and the Vellumoid joint, in order to free the joint from the lower half.
CAUTION: This must be done carefully; if the Vellumoid jointing is damaged it will be necessary to remove the wheelcase in order to fit a new joint.
- (xi) Finally, holding lower half with one hand, remove the four remaining setscrews and gradually lower the lower half.

To replace crankcase lower half.

After thoroughly cleaning the crankcase lower half, replace as follows:-



- (i) Smear the joint face of the lower half with grease and then fit a new cork joint. (The grease will keep the joint in position).
- (ii) Make sure that Vellumoid joint washer fitted between wheelcase and crankcase is in good condition. If not, a new one will have to be fitted.

Also make sure that the joint face of the crankcase is perfectly clean.
- (iii) Carefully lift the lower half into position and secure by replacing the four setscrews, second from either end on both sides. Take care not to damage the Vellumoid joint.
- (iv) See that the two ends of the cork joint washer make full contact with the wheelcase joint washer, so as to prevent oil leaks at these points.
- (v) Replace the two setscrews and spring washers and the two bolts and nuts and spring washers which attach the wheelcase to the lower half, then replace remaining setscrews and spring washers.
- (vi) Tighten setscrews which attach the lower half to the crankcase just sufficiently to lift the lower half so that the joint faces are in contact.
- (vii) Progressively tighten up all the setscrews and bolts of the top face and front face a little at a time. This is important as if the two faces are not tightened together, then oil leaks may occur.
- (viii) Re-connect the wire to the crankcase lower half attachment of the electric oil gauge.
- (ix) Refit the flywheel lower cover and secure with the six nuts and spring washers.
- (x) Refill the engine with suitable oil to the correct level after making sure that the drain plug is tight.
- (xi) Before delivery to owner and after the engine has been run for some time (sufficiently to thoroughly warm it up), check tightness of setscrews and bolts which secure the lower half.



OIL PUMP AND FLOATING STRAINER.

OIL PUMP INTAKE STRAINER.

A floating strainer (13, Figs. 4 and 5), consisting of a wire screen fixed to the lower face of a sheet metal dome with a sealed air compartment, is attached to the inlet on the oil pump cover (12).

The inlet pipe leading to the oil pump also acts as a bearing on which the filter is free to pivot and so float on the top of the oil in the engine sump. The inlet pipe is retained in position laterally by means of a taper pin (25) and stops are fitted to limit the amount of rise or fall of the float. With the oil level at the "MAX" mark on the dipstick, the float is against the upper stop.

Should the strainer become clogged, the suction of the oil pump will cause the strainer to collapse at its centre and open a by-pass safety valve that will allow oil to be drawn unobstructed to the pump inlet.

The strainer may be cleaned by washing with paraffin.

THE OIL PUMP.

The oil pump is shown in position on the engine in Fig.4, and in Fig.5 it is shown dismantled.

As previously mentioned, oil is drawn through the floating strainer (13) into the oil pump and is then delivered through a pipe (16), to the main oil gallery, from which a connection is taken leading to the instrument board pressure gauge.

Under normal running conditions, the oil pump should only need dismantling at general overhaul periods of the engine. If, however, it should be necessary to remove the oil pump, proceed as follows:-

To Remove Crankcase lower half - See Sub-Section BE.2.

To Remove Oil Pump from Engine.

After removing the crankcase lower half,

- (1) Remove the distributor cover and then rotate the flywheel until the rotor arm is in the firing position for No.1 cylinder as indicated on the moulded cover and the "IGN/TDC" marking on the flywheel is in line with the timing pointer (this may be observed by removing the small inspection cover from the L.H. side front face of the clutch casing, just above the starter motor), i.e., rotate the flywheel until No.1 piston is at T.D.C. with both valves closed.

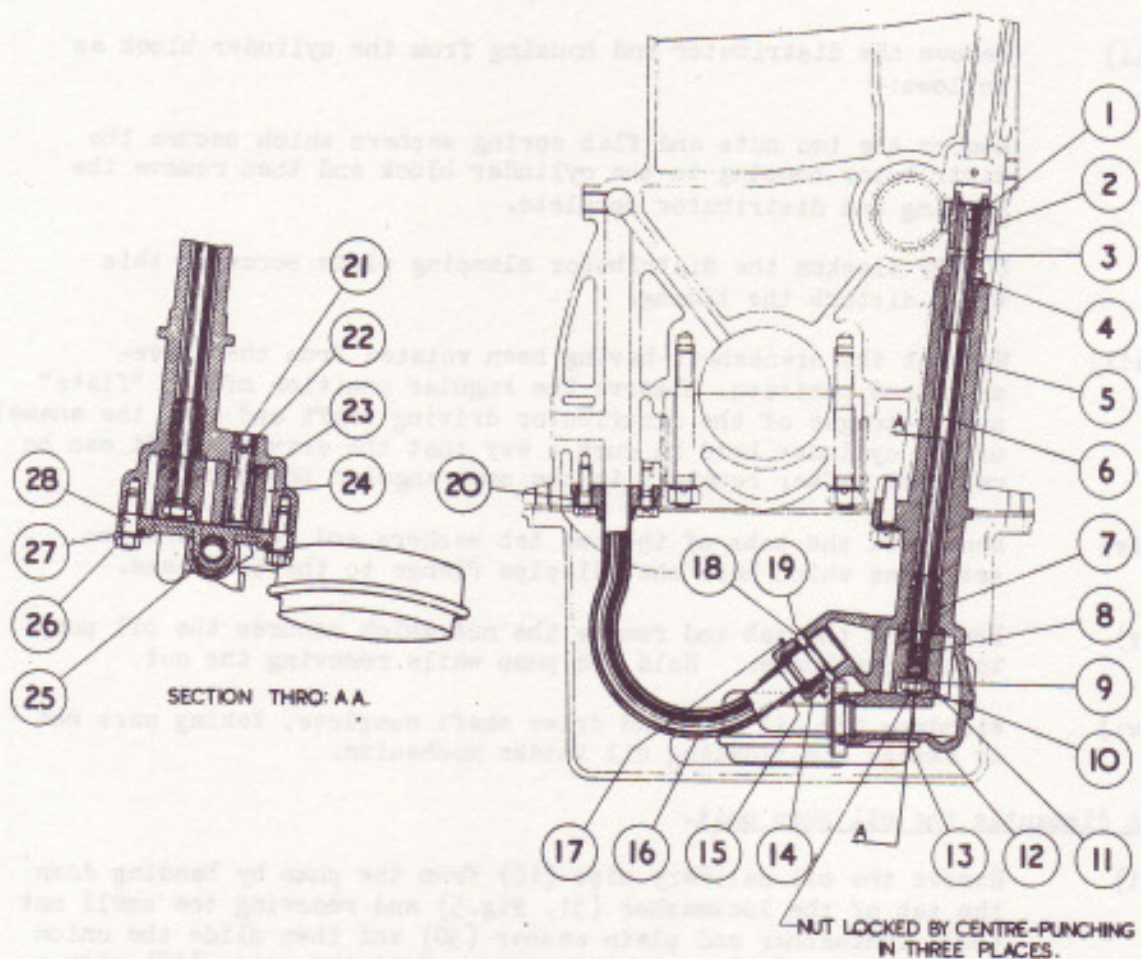


FIG. 4. SECTION THROUGH OIL PUMP AND DRIVE

- | | |
|------------------------------------|---------------------------------|
| 1. Woodruff key. | 17. Locking plate. |
| 2. Drivengear - upper. | 18. Union. |
| 3. Taper pin. | 19. Flain washer (Alum:). |
| 4. Bush - Drive shaft - upper. | 20. Flange. |
| 5. Oil pump casing. | 21. Spindle - driven gear. |
| 6. Oil pump driving shaft. | 22. Taper pin. |
| 7. Bush - Drive shaft - lower. | 23. Bush - driven gear. |
| 8. Woodruff key. | 24. Oil pump driven gear |
| 9. Flain washer. | 25. Taper pin. |
| 10. Nut - Retaining driving gear. | 26. Nut. |
| 11. Driving gear (oil pump) lower. | 27. Lockwasher. |
| 12. Oil pump cover. | 28. Stud. |
| 13. Pump float (Screened intake). | 29. Stud (Fig. 5 only). |
| 14. Union nut. | 30. Flain washer (Fig. 5 only). |
| 15. Nipple. | 31. Lockwasher (Fig. 5 only). |
| 16. Oil delivery pipe. | 32. Nut (Fig. 5 only). |



- (ii) Remove the distributor and housing from the cylinder block as follows:-
- Remove the two nuts and flat spring washers which secure the distributor housing to the cylinder block and then remove the housing and distributor complete.
- DO NOT slacken the distributor clamping plate screw as this would disturb the timing.
- (iii) Without the crankshaft having been rotated from the above-mentioned position, observe the angular position of the "flats" on the tongue of the distributor driving shaft and mark the enamel of the cylinder head in such a way that the driving shaft can be refitted (after removal) in the same angular position.
- (iv) Bend back the tabs of the two tab washers and remove the two setscrews which hold the oil pipe flange to the crankcase.
- (v) Bend back the tab and remove the nut which secures the oil pump to the crankcase. Hold the pump while removing the nut.
- (vi) Withdraw the oil pump and drive shaft complete, taking care not to damage the floating oil intake mechanism.

To dismantle the oil pump unit.

- (i) Remove the oil delivery pipe (16) from the pump by bending down the tab of the lockwasher (31, Fig.5) and removing the small nut (32), lockwasher and plain washer (30) and then slide the union locking plate (17) on to the pipe. Hold the union (18) with a spanner and slacken off the union nut (14) with a second spanner and remove the pipe.
- (ii) Bend down the tabs of the lockwashers (27) and remove the six nuts (26) and then take off the oil pump end cover (12) complete with the floating intake strainer (13).
- (iii) Remove the driven oil pump gear (24). (This will fall out if the pump is inverted).

SERVICE.

Examine the oil pump gear teeth, these should show no appreciable wear.

If necessary, lightly stone to remove any burrs or damage marks on teeth, should the wear be such as to necessitate the replacement of a gear, it is preferable to replace both as a pair. Check the backlash, this should be .004" - .006".

Check end float of gears by placing a straight-edge across the face of the housing and measuring the clearance between the straight-edge and the gears with a feeler. The clearance should be .001" - .0035". The clearance may be reduced by refacing the oil pump cover.

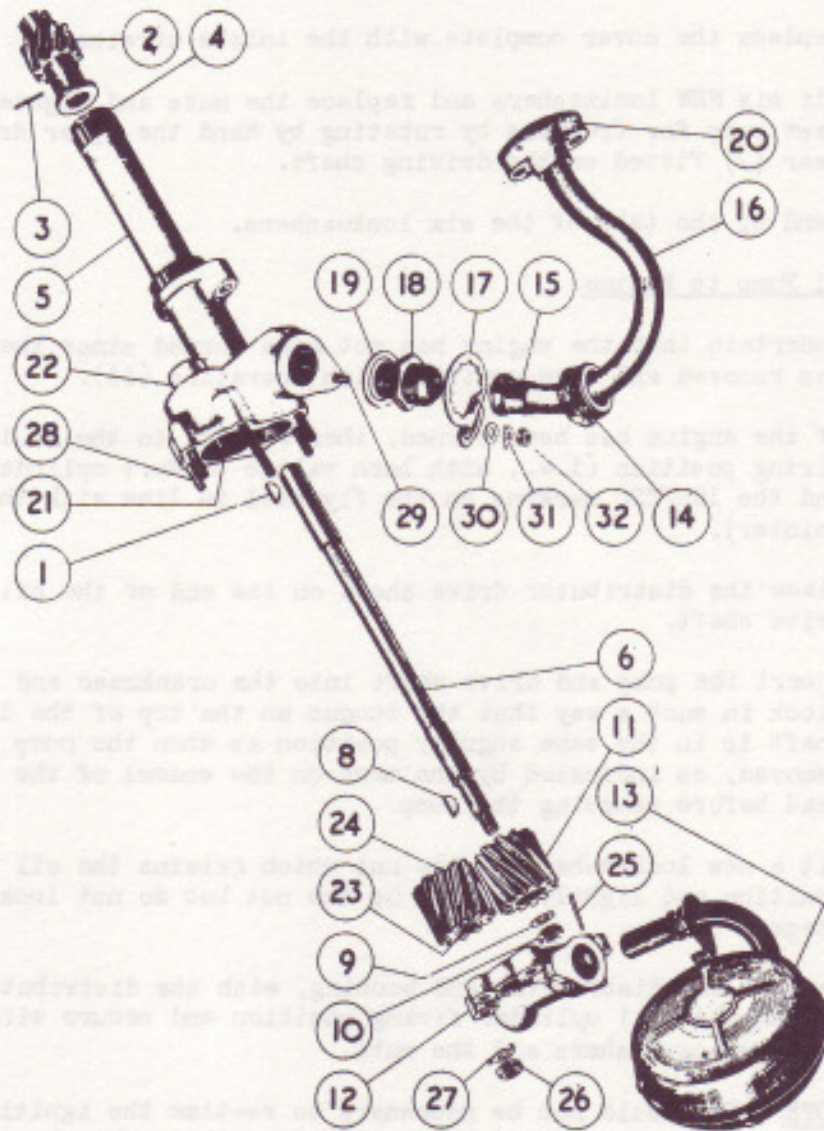


FIG. 5. OIL PUMP AND DRIVE DISMANTLED.

The oil float and screen, also the pipe (16), should be cleaned thoroughly with paraffin before replacement.

To Re-assemble the Oil Pump.

- (i) Replace the driven gear (24) in the case.

NOTE: To enable the pump gears to be re-assembled in the same relative positions, a tooth on one gear and a space on the other gear are marked by etching. To ensure silence of operation of



the pump, the gears should be re-assembled so that the marked tooth and space mesh with each other.

- (ii) Replace the cover complete with the intake strainer.
- (iii) Fit six NEW lockwashers and replace the nuts and tighten up. Test pump for freeness by rotating by hand the upper driven gear (2) fitted on the driving shaft.

Bend up the tabs of the six lockwashers.

To Refit Oil Pump to Engine.

- (i) Ascertain that the engine has not been turned since the oil pump was removed and then continue with operation (ii).

If the engine has been turned, then turn it to the No.1 cylinder firing position (i.e., with both valves of No.1 cylinder closed and the IGN/TDC marking on the flywheel in line with the timing pointer).

- (ii) Place the distributor drive shaft on the end of the oil pump drive shaft.
- (iii) Insert the pump and drive shaft into the crankcase and cylinder block in such a way that the tongue on the top of the drive shaft is in the same angular position as when the pump was removed, as indicated by the mark on the enamel of the cylinder head before removing the pump.
- (iv) Fit a new lockwasher and the nut which retains the oil pump in position and lightly tighten up the nut but do not lock at this stage.
- (v) Replace the distributor and housing, with the distributor rotor arm in the No.1 cylinder firing position and secure with the two flat spring washers and the nuts.

NOTE. It should not be necessary to re-time the ignition unless the clamping plate attached to the distributor has been disturbed by slackening off the clamping plate screw.

If it is necessary to re-time the ignition - See Section P.

- (vi) Refit the oil delivery pipe (16) and using two new lockwashers, screw in the two setscrews which attach the oil pipe flange to the crankcase.
- (vii) Replace the union nut on the union and tighten up.
- (viii) Refit the lock plate (17) and secure by placing the plain washer, a new lockwasher and the nut on the stud, and tightening up, then bend up the tabs.



- (ix) Tighten up the two setscrews at the flange end of the pipe and then bend up the tabs of the lockwashers.
- (x) Tighten up the nut holding the pump to the crankcase and bend up the tab of the lockwasher to lock.

NOTE. No jointing is fitted either between the pump and the crankcase or between the oil pipe flange and the crankcase.

To Refit Crankcase Lower Half.

See Sub-Section BE. 2.



OIL RELIEF VALVES.

GENERAL.

The oil pressure relief valve unit is mounted externally on the crankcase on the right hand side of the engine. It is of the non-adjustable type, therefore, no attempt should be made to alter the spring settings by interfering with the springs themselves or by varying the washers under the plugs.

The two valves are in series, and their combined effect is to regulate the pressure of the main high-pressure supply to the crankshaft, connecting rod and camshaft bearings to approximately 25 lbs. per square inch.

Oil from the pump reaches the relief valve casing by a port in direct communication with the main oil supply.

Oil passing the high-pressure (H.P.) valve (4 Figs. 6 and 7) enters the low pressure (L.P.) chamber and from there is conveyed by an external pipe and drilled passages in the cylinder block and cylinder head to the inlet valve mechanism, and also by a branch pipe to the wheelcase.

The pressure in the L.P. chamber is controlled by the valve (10) and the valve spring (9) and released oil from the L.P. valve is returned to the sump.

In order to ensure a supply of oil to the low pressure system under all conditions of running, four small slots are cut in the bronze seating of the high pressure valve.

The seatings form an integral part of the casing and cannot be removed.

SERVICE.

Normally the relief valve should not require any attention, unless it is suspected that a particle of foreign matter has lodged under one of the valves.

The relief valves (4 and 10) and their seating can be inspected by removing the plug (1) above the high-pressure valve and the plug (7) above the low-pressure valve, together with the joint washers (2 and 8). A box spanner should be used for this purpose.

In each case the valve springs (3 and 9) will be found retained on the cap.

The valves can then be lifted out and the valve and seats cleaned and inspected.

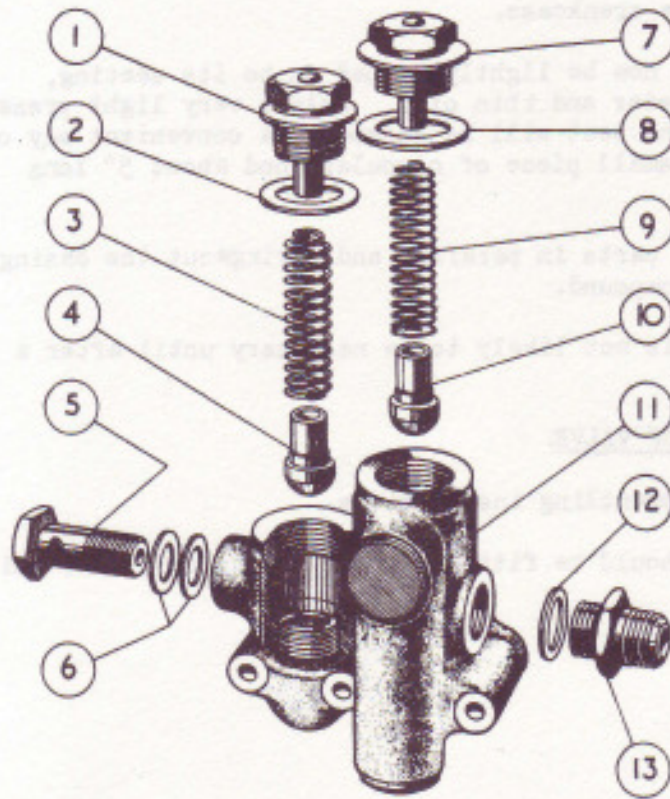


FIG. 6. EXPLODED VIEW OF OIL PRESSURE RELIEF VALVE UNIT.

1. Plug and Valve Guide Pin - H.P. Valve.
2. Joint Washer - H.P. Valve Plug.
3. Spring - H.P. Valve.
4. Valve - H.P.
5. "Banjo" connection bolt.
6. Joint Washers - "Banjo" bolt.
7. Plug and Valve Guide Pin - L.P. Valve.
8. Joint Washer - L.P. Valve Plug.
9. Spring - L.P. Valve.
10. Valve - L.P.
11. Relief Valve Casing.
12. Joint Washer - Union.
13. Union.

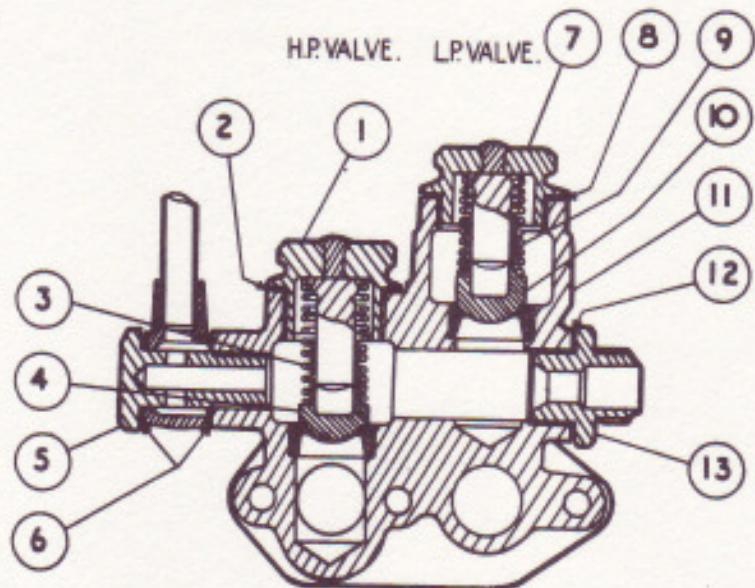


FIG. 7. SECTION OF OIL PRESSURE RELIEF VALVE UNIT.

If either of the low or high-pressure valves are found to be pitted, the unit should be removed from the engine as follows:-

- (i) Slacken off the union nut of union 13, (Figs. 5 & 6) holding the union with one spanner while slackening the nut with a second spanner. (This is necessary in order to avoid twisting the pipe). It will be advisable to slacken off a few turns the cap nut as fitted to the side of the "General" By-Pass Filter so as to partially free the oil pipe.
- (ii) Unscrew the "banjo" connection bolt (5) and remove together with the two joint washers (6).
- (iii) Remove the three 2 BA nuts and flat spring washers securing unit to crankcase.



(iv) Remove the unit from the crankcase.

The pitted valve should now be lightly lapped on to its seating, using a mixture of Turkeystone Powder and thin oil. Only a very light pressure should be applied, or the valve and seat will be scored. A convenient way of holding the valve is to insert a small piece of circular wood about 5" long inside the hollow end.

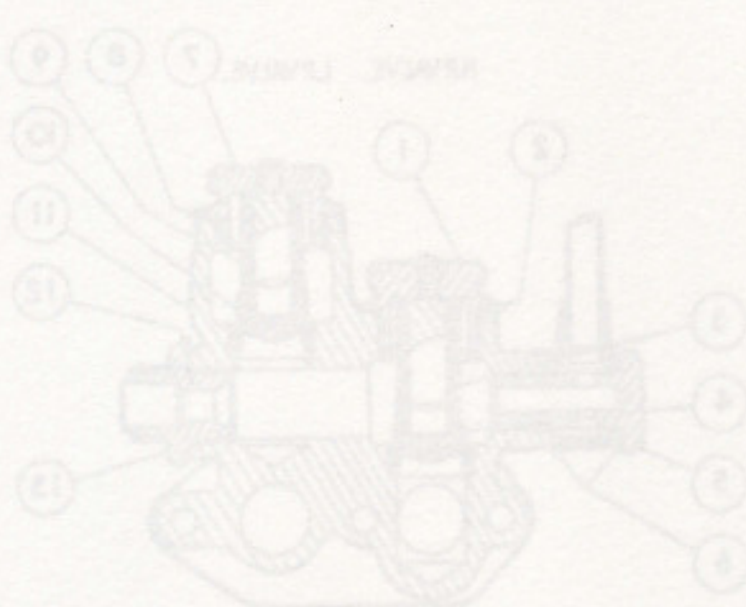
After lapping, wash all parts in paraffin and syringe out the casing to remove all traces of lapping compound.

This lapping operation is not likely to be necessary until after a considerable period of running.

RE-ASSEMBLING AND RE-FITTING RELIEF VALVE.

Reverse the previous dismantling instructions.

A new Vellumoid joint should be fitted between the relief valve unit and the crankcase.



- 1. Spring and Valve Guide Pin - 1/2" Dia.
- 2. Valve - 1/2" Dia.
- 3. Valve Seat - 1/2" Dia.
- 4. Spring - 1/2" Dia.
- 5. Valve - 1/2" Dia.
- 6. Spring - 1/2" Dia.
- 7. Valve - 1/2" Dia.
- 8. Valve Seat - 1/2" Dia.
- 9. Spring - 1/2" Dia.
- 10. Valve - 1/2" Dia.
- 11. Valve Seat - 1/2" Dia.
- 12. Spring - 1/2" Dia.
- 13. Valve - 1/2" Dia.
- 14. Valve Seat - 1/2" Dia.
- 15. Spring - 1/2" Dia.
- 16. Valve - 1/2" Dia.
- 17. Valve Seat - 1/2" Dia.



OIL PRESSURE.

Under normal conditions of engine temperature and speed (3500 r.p.m. and 80°C oil temp.), the instrument board pressure gauge should read approximately 25 lbs./sq.in.

On starting the engine from cold, a higher oil pressure will be indicated, but this will fall to normal as the oil becomes warm.

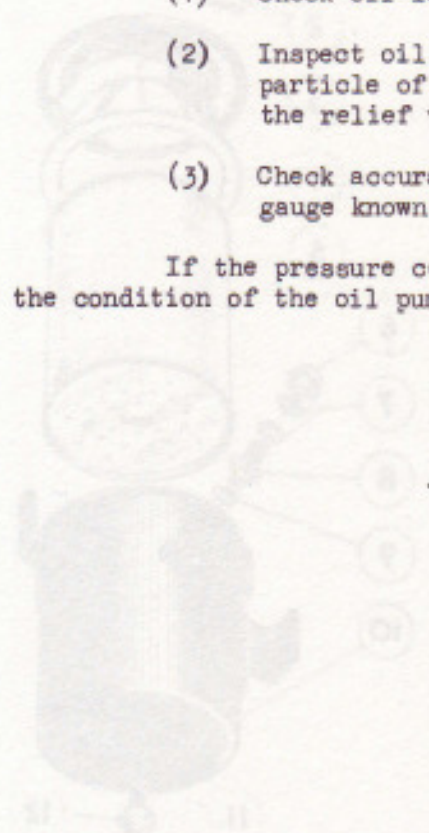
When the engine is idling and hot, the pressure may fall to 4 lbs., but provided that it increases as the engine speed increases, this is in order.

The engine must on no account be run if the gauge reads as low as this continuously.

Such a persistently low pressure, which may be accompanied by fluctuations of the gauge needle, may be due to one or more of several causes.

- (1) Check oil level and condition of the oil.
- (2) Inspect oil relief valve, the trouble may be due to a particle of foreign matter having lodged under one of the relief valves and preventing the valve closing.
- (3) Check accuracy of oil gauge. Temporarily instal a gauge known to be accurate in place of present gauge.

If the pressure continues to drop, remove the lower half and inspect the condition of the oil pump and floating strainer, see Sub-Section BE.3.



1. Cover
2. Valve
3. Cover
4. Oil Relief Valve
5. Filter Element
6. Oil Pan
7. Floating Strainer
8. Output Valve
9. Auxiliary Valve
10. Governor (Rod)
11. Auxiliary Valve
12. Cover

TO ALL CHAPTERS - BENTLEY
 GENERAL WORKING DRAWINGS



BY-PASS OIL FILTER.

GENERAL.

The oil filter is accessibly mounted on the right-hand side of the engine and is fed with oil under high pressure from the main oil gallery, by an external pipe, connected at one end to the main gallery, and the other end to the bottom of the filter, as illustrated in Fig. 1. Sub-Section BE. 1 (Engine Lubrication System).

The filter element restricts the flow of by-passed oil and so ensures that the by-passing effect of the filter shell not appreciably rob the main pressure system.

Oil from the filter is conveyed by a pipe to the low pressure chamber of the oil relief valve casing, thus supplementing the supply to the overhead valve mechanism and the camshaft drive gears.

SERVICE.

Every 10,000 miles the filter element should be discarded and replaced by a new one. Use only genuine replacement element. The filter element is sealed and therefore cannot be cleaned.

To remove the element, the screw (1) should be released and the yoke (2) removed. The cover (3) can then be taken off and the element (5) lifted out.

1. Screw.
2. Yoke.
3. Cover.
4. Cork Washer.
5. Filter Element.
6. Cap Nut.
7. Aluminium Washers.
8. Outlet Union.
9. Aluminium Washer.
10. Container (Body).
11. Aluminium Washer.
12. Inlet Union.

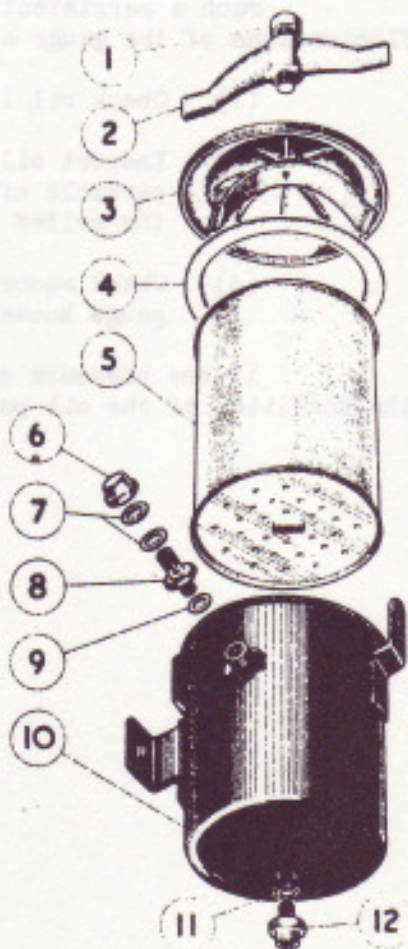


FIG. 8. EXPLODED VIEW OF "GENERAL" BY-PASS OIL FILTER.



When fitting the new element care must be taken to ensure that the cork washer (4) fitted under the cover, is undamaged and is in position, and that screw (1) is well tightened.

On next running the engine, it should be ascertained that there are no oil leaks around the filter cover.

It should seldom be necessary to remove the complete oil filter unit from the engine, however, should this at any time be necessary, then proceed as follows:-

To remove Oil Filter from Engine.

NOTE. When removing a union nut from a union, the union should be held with one spanner and the union nut slacked off with a second spanner. This is necessary in order to avoid twisting the pipe.

- (i) Remove oil pipe leading from bottom of filter to oil gallery.
- (ii) Remove oil pipe leading from side of filter to low pressure side of oil relief valve casing.
- (iii) Remove the two nuts and spring washers which attach the filter to the crankcase and remove the filter.

To refit Oil Filter to Engine.

Reverse the instructions for removal, taking care not to over tighten the union nuts in order to avoid damage and distortion.

Replace any damaged aluminium washers.

On next running the engine ascertain that there are no oil leaks.



CYLINDER HEAD

REMOVAL AND REPLACEMENT.

GENERAL.

On no account should petrol, benzole or other highly inflammable liquids be used for cleaning down the engine, as this practice has resulted in cars being destroyed by fire.

Before undoing any electrical connections, the positive earthing lead should be disconnected from the battery.

When parts are numbered for re-assembling, the numbering commences at the front of the engine.

When removing the cylinder head, do not insert any instrument, such as a screwdriver, between the cylinder head and cylinder block face, for the purpose of freeing the head, as this would damage the faces, especially that of the aluminium cylinder head.

If any coolant should find its way into the cylinder bores, wipe it away immediately.

TO REMOVE THE CYLINDER HEAD.

- (i) Remove the bonnet by withdrawing the small bolt from the hinge-pin bracket on the dashboard.
- (ii) Release the filler cap, and drain coolant from radiator by means of the drain tap in the bottom coolant pipe.

As an anti-freeze mixture should be in use in the cooling system, run it into a clean container and use again.

IMPORTANT NOTE: On earlier cars two taps are provided on the engine for isolating the pipes leading to the interior car heater. Only the tap in the feed pipe from the cylinder head (the rear tap) should be used for turning off the hot coolant feed. The tap in the return pipe to the coolant pump should never be closed, and it is accordingly wired back permanently in the open position, i.e. the handle in line with the pipe.

The reason for this is that in the event of this tap being closed, it is possible for excessive pressure to be built up in the supply to the heater with the consequent result of damage to the heater element. Later cars have the tap in the return pipe deleted altogether.



- (iii) Drain coolant from the cylinder jacket by means of the tap and drain pipe on the rear right-hand side of the cylinder block.
- (iv) Slacken off nut securing the thermometer bulb to coolant outlet connection on front of cylinder head. Remove nuts and washers securing the clips of the thermometer tube to the induction manifold. Withdraw the bulb, care being taken not to fracture or bruise either the bulb or its tube and secure in a safe position. Any damage to the tube or bulb will render the thermometer useless.
- (v) Paint with paraffin the twelve nuts holding the exhaust manifolds to the cylinder block and also the six nuts of the downtake pipe.
- (vi) Remove air silencer and air-intake casting complete as follows:-
 - (a) Slacken off jubilee clip securing air intake to air silencer.
 - (b) Uncouple throttle return spring located at rear of air intake.
 - (c) Remove nuts and flat spring washers securing the air silencer to the inlet manifold.
 - (d) Remove bell-crank control lever from its anchorage on the air intake casting, by removing nut with plain and flat spring washers, taking care not to lose the bush.
 - (e) Remove the four setscrews and washers securing the air intake to the carburetters.
- (vii) Remove throttle control rod from lever on the inter-throttle connecting shaft.
- (viii) Remove mixture control rod from the bottom of the front carburetter jet lever.
- (ix) Disconnect petrol feed pipe from carburetters by removing the two banjo bolts complete with C and A washers. Temporarily replace banjo bolts and washers in float chamber covers to retain the filters.
- (x) Disconnect carburetter hot-spot coolant return pipe at the coolant pump end by unscrewing the union nut.
- (xi) Remove nuts and washers securing the induction manifold and carburetter hot-spot coolant pipe to the cylinder head, then remove manifold complete with carburetters and coolant return pipe, taking care not to damage the petrol pipe.
- (xii) Remove top coolant connection, then remove the rubber by-pass connection from the thermostat and coolant pump.



- (xiii) Remove breather, by unscrewing the special fixing bolt securing breather to rocker cover, and disconnecting the breather pipe clip from the crankcase.

NOTE: On chassis No.B-198 BH and onwards a breather is fitted to the rocker cover replacing the earlier type which is fitted to the crankcase.

- (xiv) Unscrew three cap nuts retaining the rocker cover, remove the three chromium plated backing plates and the cover.
- (xv) Remove the oil dipstick and cover up the aperture, preferably with adhesive tape, to prevent the ingress of foreign matter.
- (xvi) Disconnect high tension cables from the sparking plugs. Unscrew the knurled terminal from the top of the ignition coil thus disconnecting the H.T. lead.
- (xvii) Remove the L.T. wire (coil to distributor) at the coil.
- (xviii) Remove four nuts and washers securing the ignition wire tubes to cylinder head, then remove tubes complete with the distributor cover.
- (xix) Remove the distributor and housing from the engine as described in Section "P". Cover the aperture on the cylinder block to prevent the ingress of foreign matter.
- (xx) Unscrew five nuts securing the valve rocker shaft pedestals to the head. Unscrew the nuts gradually, so that the reaction of the compressed valve springs lifts the rocker shaft evenly. Do not lose the spherical washers under the nuts. Remove the rocker shaft assembly.

The pedestals, distance pieces and rockers being a loose assembly on the shaft, care must be taken to lift the rocker shaft in a horizontal position.

- (xxi) Remove the two tappet covers, taking care not to damage the cork joints, then remove the four distance pieces if fitted.
- (xxii) Lift out the push rods, but to prevent displacement of the inlet tappets, it is advisable to lift slightly and at same time shake the push rods in order to free them from oil suction in the tappets. The inlet and exhaust tappets which are numbered 1 to 6, must be replaced in their respective guides, if accidentally removed.
- (xxiii) Disconnect the car heater pipe at its union on the rear L.H. side of the cylinder head, do not remove the tap from the head.
- (xxiv) Unscrew gradually the thirty nine nuts securing the cylinder head, commencing with those at the ends and working inwards towards the centre. Repeat the operation several times, turning each nut only a small amount each time.



(xxv) Lifting the cylinder head from the block:-

On early chassis the cylinder head joint was of Klingerit, this has now been changed to a copper-asbestos gasket, and a new gasket of this type should always be used when replacing the cylinder head.

Owing to the adhesive nature of early cylinder head joints, especially after a large mileage has been covered, it will probably be found that it is not possible to remove the cylinder head by hand alone. Therefore, there are three methods described below which can be adopted to "break" the joint.

NOTE: It is only necessary to just "break" the joint on one side of the engine, the head can then be removed by hand fairly easily.

- (a) Ascertain that the change gear lever is in neutral position. Reconnect the positive earthing terminal to the battery. With the sparking plugs in position, depress the starter motor button and allow the starter to "motor over" the engine in order that the compression may release the cylinder head. Should this method not be effective then try method (b).
- (b) With the rear exhaust manifold in position on the cylinder block, place a block of wood of suitable size on the top of the manifold and near the tap for the car heater pipe. Place the flat end of a tyre lever on the block of wood and under the tap, but as near to the cylinder head as possible. If with using reasonable pressure on the lever (to avoid damaging the tap) the cylinder head cannot be moved, then adopt method (c).
- (c) With the induction pipe removed, place a small car jack on the steering box and carefully locate the head of the jack under the "hot-spot" facing (boss) of the cylinder head, then carefully jack up the cylinder head, but only just sufficiently to break the joint on one side. Turn jack by hand - do not use a jack handle.

Lift off the head evenly, or it will bind on the studs. Having removed the head, again disconnect the positive earthing terminal from the battery.

(xxvi) Unscrew twelve nuts securing the exhaust manifolds to cylinder block, also the six nuts of the downtake pipe, and remove the exhaust manifolds.

(xxvii) Remove the sparking plugs.

TO REPLACE THE CYLINDER HEAD.

- (i) Loosely screw in the sparking plugs so that when the head is replaced, nuts or washers cannot be accidentally dropped into the combustion chambers.



- (ii) Clean joint faces of the cylinder block and cylinder head. Wipe both sides of the cylinder head gasket to remove any foreign matter, and then oil both sides with engine oil. Place gasket in position on cylinder block and lightly lubricate the cylinder bores with engine oil.

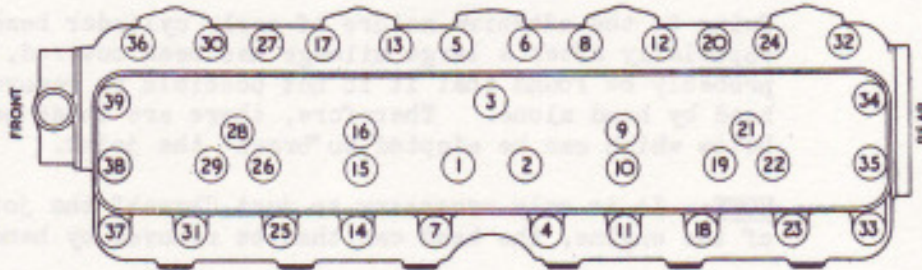


FIG. 9. ORDER IN WHICH THE CYLINDER HEAD NUTS SHOULD BE TIGHTENED.

- (iii) Lower the head squarely and carefully into position over the studs. Refit cylinder head nuts and plain washers and tighten them gradually, in the sequence shown in Fig. 9. Too much emphasis cannot be laid upon necessity for exercising care in tightening down the nuts which secure the head. These should be screwed down very gradually using a Break Back Torque Spanner set to break at 280 lbs./ins. commencing with those at the centre of the head and working outwards towards the two ends.

The process should be repeated several times, the nuts being turned only a comparatively small amount at each stage. By this means the pressure on the joint faces will be evenly distributed and the joint rendered sound.

- (iv) First see that the inlet tappets are in position, then replace the push rods with their cup ends uppermost, care being taken that they enter the recess in the tappets. The push rods are numbered to ensure correct re-assembly.

- (v) Before replacing the rocker shaft, all the tappet adjusting screws must be released as far as possible by unlocking each locknut and turning the screw in an anti-clockwise direction with the special spanner provided, i.e. Tool No. RF. 3896 (Fig. 10). This will avoid straining the rocker shaft when tightening it down.



FIG. 10. SPECIAL SPANNER (TOOL NO. RF. 3896) FOR ROCKER ARM ADJUSTING SCREWS.

- (vi) Replace rocker shaft, care being taken that the spherical ends of the rocker arm adjusting screws enter the recess in the push rods. The spherical washers must be replaced under the nuts of the



pedestals and these nuts tightened gradually (working from the centre towards the ends) to avoid bending the shaft.

- (vii) When the shaft has been tightened down check that the four distance pieces are free to rotate.

ADJUSTING THE INLET VALVE ROCKER CLEARANCES.

The correct clearance for the inlet rockers is .006" (.152 m/m) with the engine cold.

Before commencing to adjust a rocker clearance, it should be ascertained that that particular tappet is on the base of the cam (i.e. not on the cam contour), which is best done by turning the crankshaft by hand until the valve has opened and closed, and then cranking round half a revolution beyond this point.

The following tools, provided in the tool kit, will be required for this operation.

<u>Tool No.</u>	<u>Description</u>	<u>Fig.No.</u>
RF.4277	Set of feeler gauges.	-
RF.3896	Inlet tappet spanner.	10
RF.4372	5/16" B.S.F. Single ended jaw spanner.	-

The method of adjusting the valve rocker clearances is:-

The ball ended adjusting screw (K, Fig.15 - Sub-Section BE.7) is screwed into the rocker and locked by the nut L. On releasing the nut the screw can be turned by means of the inlet tappet spanner.

As each adjusting screw is adjusted, its locknut should be securely tightened up.

Check that the setting of the rocker clearance has not been disturbed by the tightening of the locknut.

Repeat the above operations for the remaining valves.

After the cylinder head and dismantled parts have been refitted and the engine has been run, it should be allowed to cool off completely and then the inlet rocker clearances should be re-checked.

The rocker clearances should be checked every 10,000 miles with the engine cold, and re-adjusted as necessary.

TO REFIT MANIFOLDS, CARBURETTORS AND DISTRIBUTOR ETC.

The following first five items, concern the refitting and adjustment of the ignition equipment. For full instructions on these operations refer to Section "P".



- (i) Clean, trim and adjust the distributor contact breaker points as required.
- (ii) If necessary, check the synchronism of the contact breaker arms.
- (iii) Remove and check the gaps of the sparking plugs and clean if necessary.
- (iv) Refit the distributor to the engine, clean the distributor cover, lubricate the distributor and clean the moulded top of the ignition coil.
- (v) Check the ignition timing.
- (vi) Replace rocker cover and secure with the three cap nuts, making sure that the rubber rings and the chromium plated backing plates are in position.
- (vii) Replace top coolant connection and tighten the hose clips. Fit two new rubber hose if the existing ones are not in a good condition. This also applies to the two rubber hose fitted to the bottom water connection from coolant pump to bottom of radiator matrix.
- (viii) Replace rubber by-pass (hose) connection to the thermostat and coolant pump, fit a new one if necessary.
- (ix) Fit a new Klingerit joint to each inlet joint face including the hot-spot face, and replace the carburetter and induction manifold assembly, taking care not to damage the petrol pipe. Secure with the ten nuts and flat spring washers, after replacing the thermometer bulb in the front of the cylinder head and the tube clips on the appropriate studs.
- (x) Re-connect carburetter coolant return pipe to the coolant pump.
- (xi) Replace air silencer and air intake complete as follows:-
 - (a) Secure air intake to the carburetters by means of the setscrews and flat spring washers.
 - (b) Secure air silencer to the inlet manifold.
 - (c) Re-tighten jubilee clip securing air intake to air silencer.
 - (d) Reconnect the throttle return spring.
 - (e) Replace bell-crank control lever complete with bush, and secure with plain and spring washers and nut.
- (xii) Reconnect throttle control rod to the lever on the inter-throttle connecting shaft.