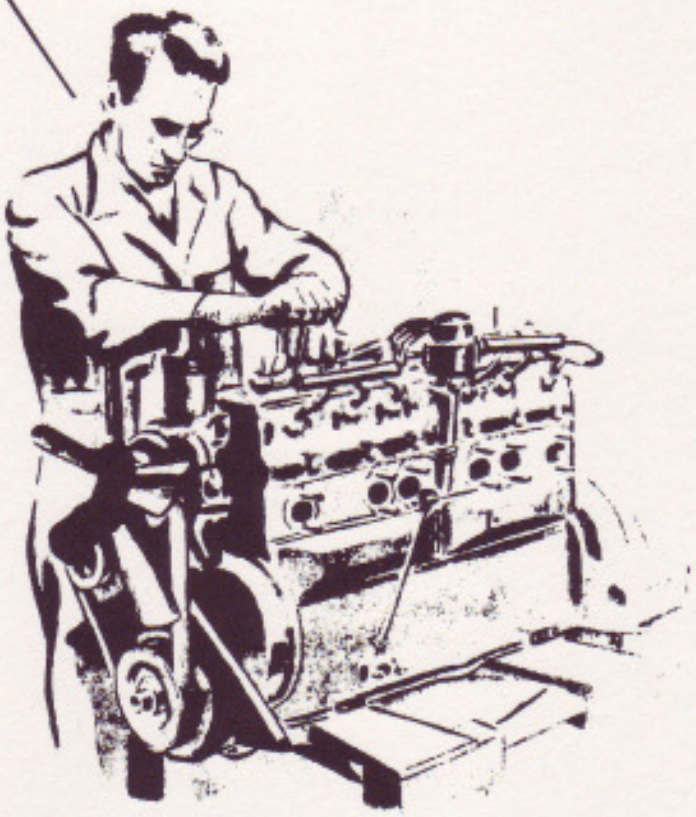
# ENGINE



# SECTION E.

# E N G I N E.

## INDEX TO SUB-SECTIONS.


| | SUB-SECTION |
|---|---|
| ENGINE LUBRICATION ... ... ... ... ... ... ... General. | BE.1 |
| TO REMOVE AND REPLACE CRANKCASE LOWER HALF ... ... ... | BE.2 |
| OIL PUMP AND FLOATING STRAINER ... ... ... ... ... Oil Pump Intake Strainer - The Oil Pump - To Remove Oil Pump - Dismantling Oil Pump - Service - Re-assembling Oil Pump - Refitting Oil Pump to Engine. | BE.3 |
| OIL RELIEF VALVES ... ... ... ... ... ... ... General - Service - Re-assembling and Refitting Relief Valve. | BE.4 |
| OIL PRESSURE ... ... ... ... ... ... ... ... | BE.4a |
| BY-PASS OIL FILTER ... ... ... ... ... ... ... General - Service - To Remove and Refit Filters. | BE.5 |
| CYLINDER HEAD - REMOVAL AND REPLACEMENT ... ... ... General - To Remove the Cylinder Head - To Replace the Cylinder Head - Adjusting the Inlet Valve Rocker Clearances - To Refit Manifolds, Carburetters and Distributor etc. | BE.6 |
| DECARBONISING ... ... ... ... ... ... ... General - To Remove the Exhaust Valves - Cleaning Pistons and Head - To Remove the Inlet Valves - Refacing Valves and Valve Seats - Hand "Grinding In" Valves - Testing Valve Springs - To Replace Inlet Valves - To Replace Exhaust Valves - Adjusting Exhaust Valve Tappet Clearances. | BE.7 |
| CHANGING VALVE SPRINGS IN SITU ... ... ... ... ... To Change Inlet Valve Spring - To Change Exhaust Valve Spring. | BE.8 |

SECTION E.

# INDEX TO ILLUSTRATIONS.


| TITLE | FIG. NO. |
|---|---|
| Arrangement - Exhaust Valve, Bronze Guide ... ... | 13 |
| Arrangement - Exhaust Valve, Cast Iron Guide ... | 12 |
| Arrangement - Inlet Valve ... ... ... ... | 15 |
| By-Pass Oil Filter - Exploded View ... ... ... | 8 |
| Compressing Tool - Exhaust Valve Springs ... ... | 11 |
| Compressing Tool - Inlet Valve Springs ... ... | 19 |
| Cylinder Head Nuts ... ... ... ... ... | 9 |
| Diagram - Engine Lubrication ... ... ... ... | 1 |
| Head - Exhaust Valve ... ... ... ... ... | 17 |
| Head - Inlet Valve ... ... ... ... ... | 16 |
| Inlet and Exhaust Valve Mechanism - Exploded View | 14 |
| Oil Pressure Relief Valve - Exploded View ... ... | 6 |
| Oil Pressure Relief Valve - Section ... ... ... | 7 |
| Oil Pump and Drive Dismantled ... ... ... ... | 5 |
| Oil Pump and Drive - Section ... ... ... ... | 4 |
| Oilways - Camshaft Thrust Button ... ... ... | 2 |
| Oilways - Rocker Shaft and Arm ... ... ... | 3 |
| Spanner - Rocker Arm Adjusting Screws ... ... | 10 |
| Tool- Holding Exhaust Valve Tappet ... ... ... | 18 |

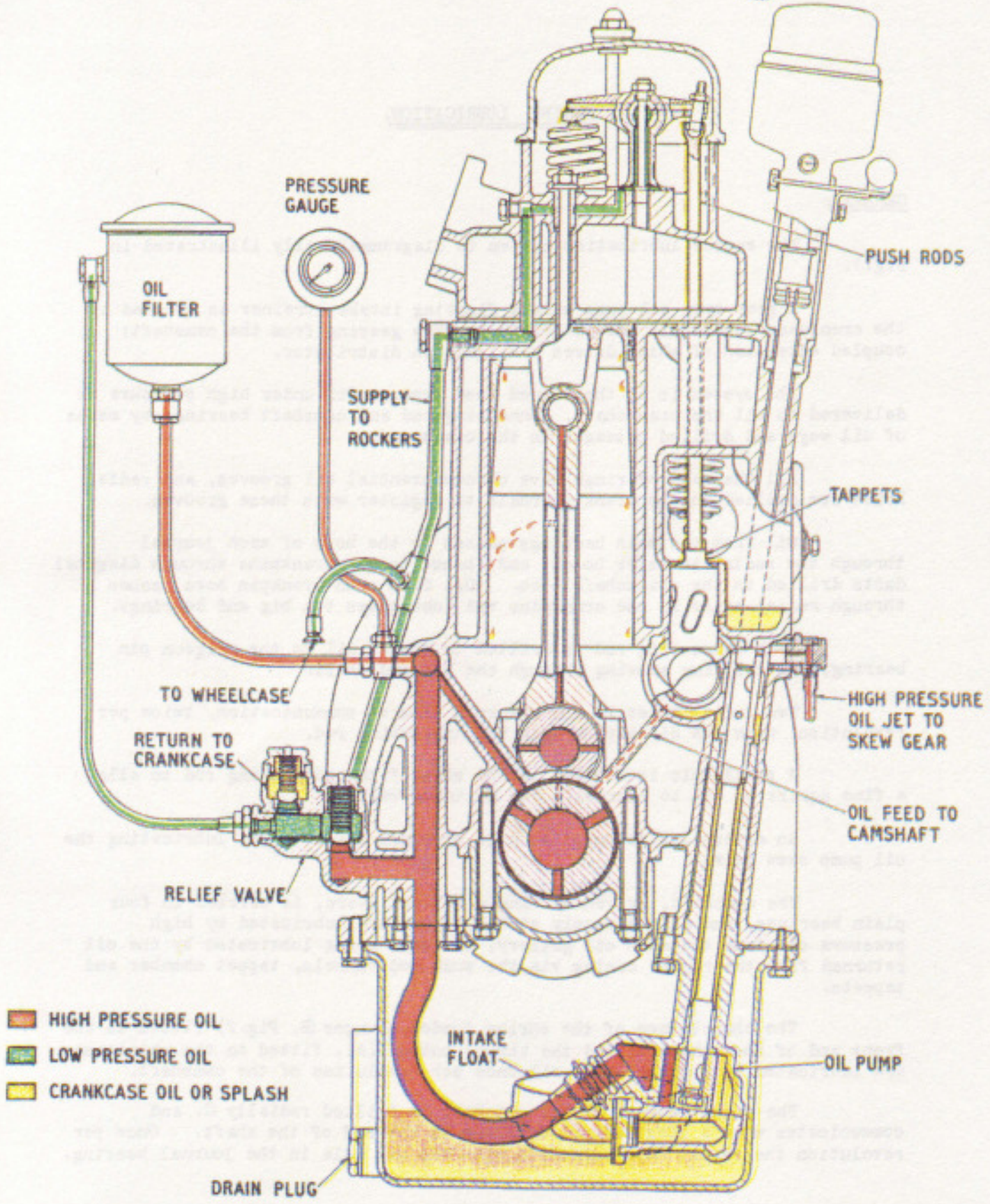



FIG. 1. ENGINE LUBRICATION SYSTEM

# 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.

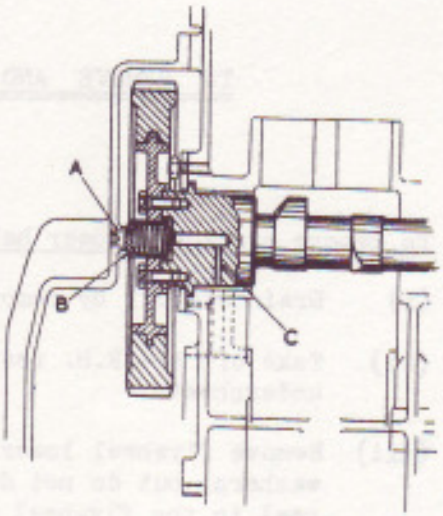



FIG. 2. OILWAYS LUBRICATING CAMSHAFT THRUST BUTTON.

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.

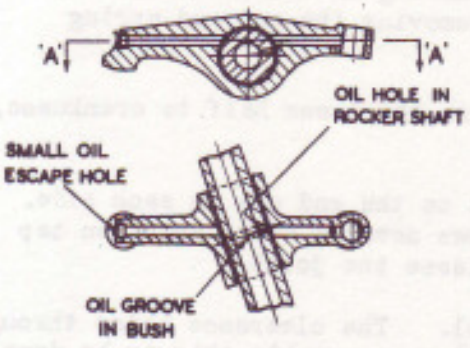



FIG. 3. OILWAYS IN ROCKER SHAFT AND ROCKER ARM.

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,

(i) 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.

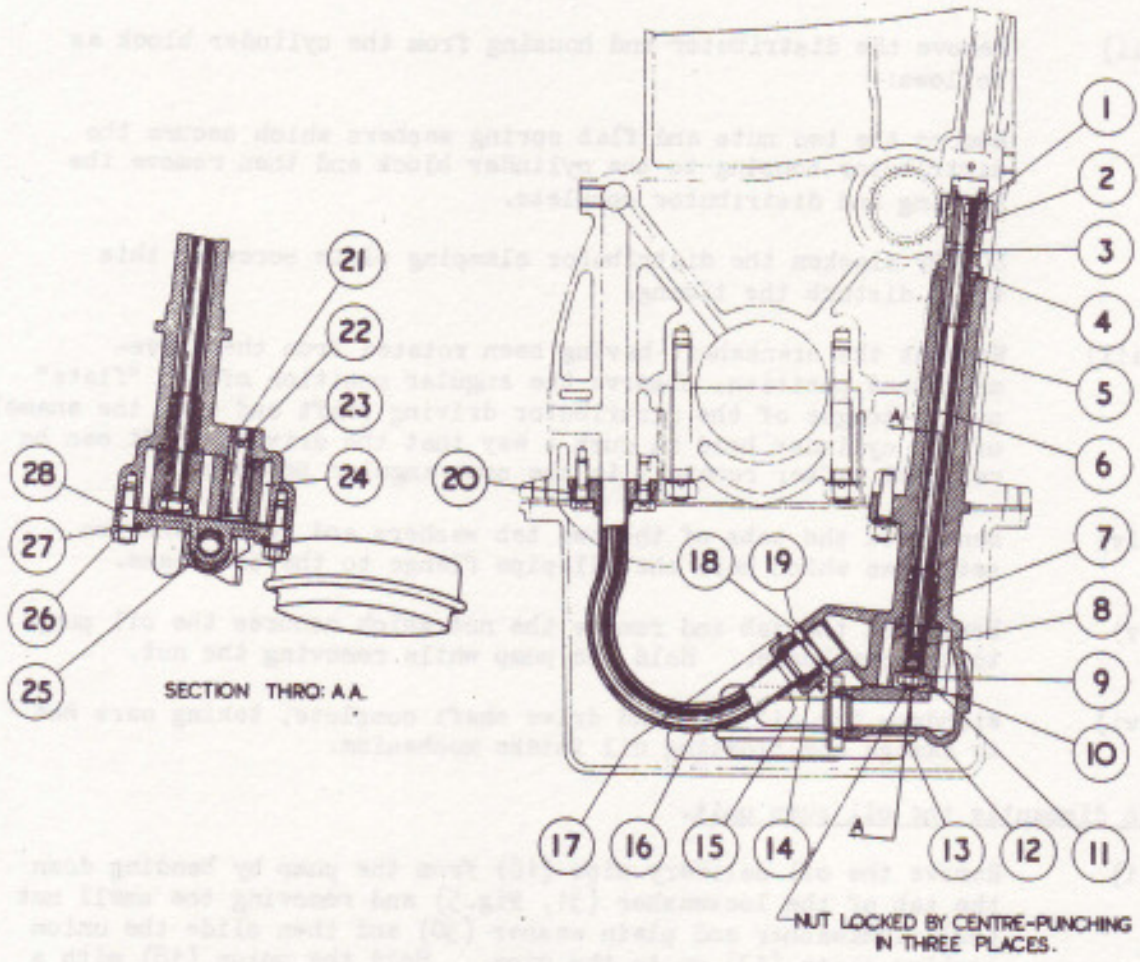



FIG. 4. SECTION THROUGH OIL PUMP AND DRIVE

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

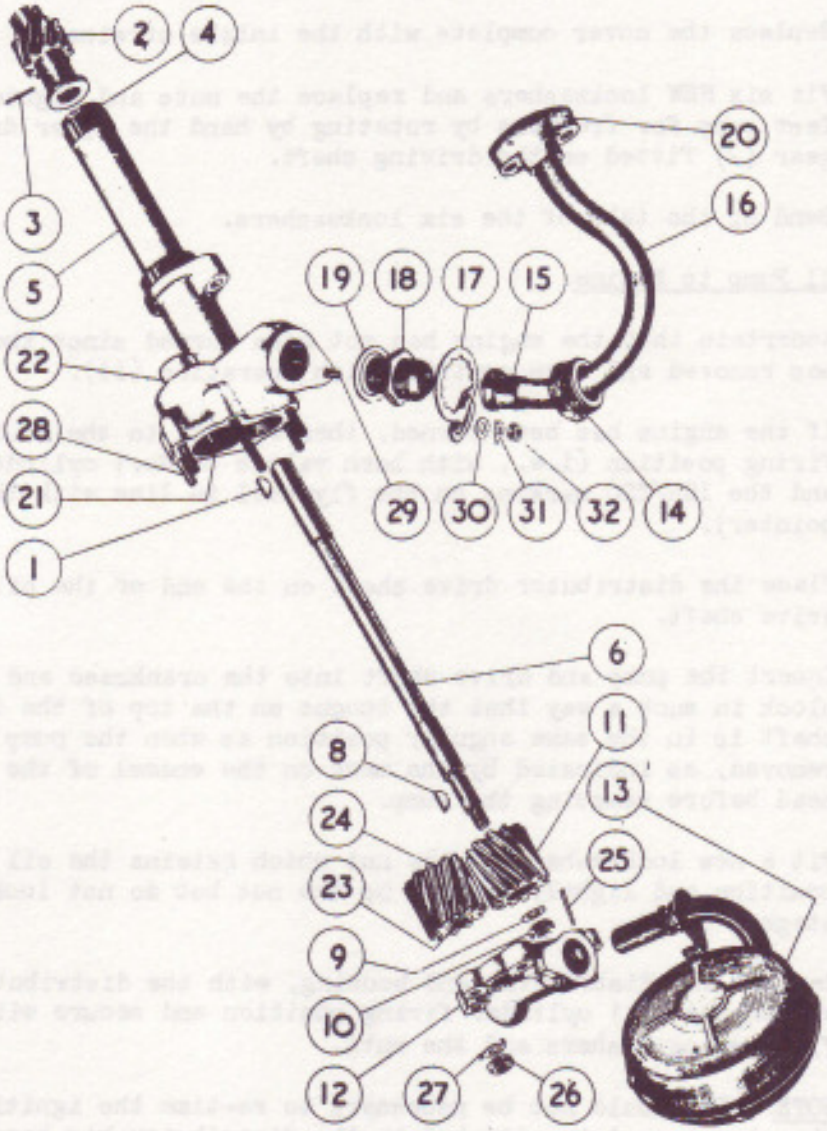



FIG. 5. OIL PUMP AND DRIVE DISMANTLED.

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.

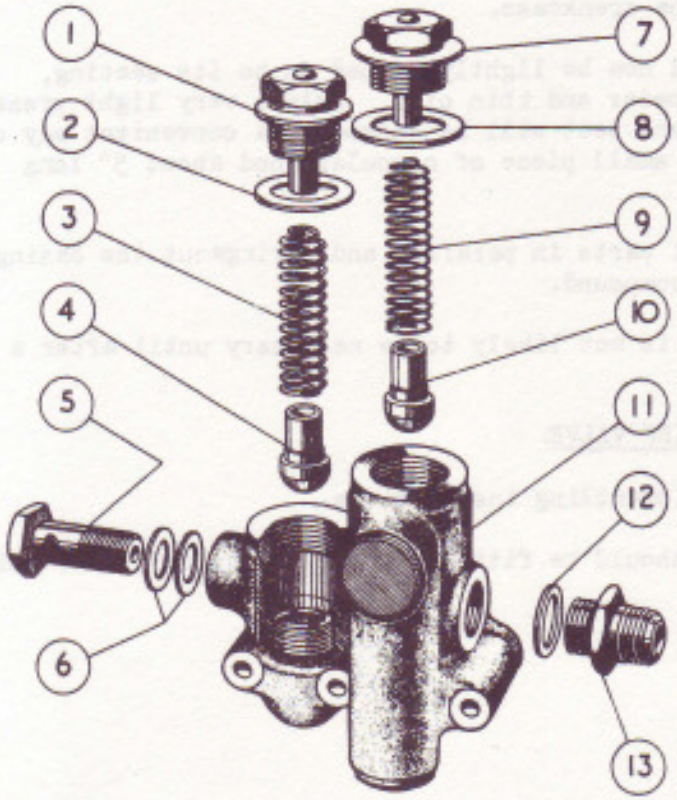



FIG. 6. EXPLODED VIEW OF OIL PRESSURE RELIEF VALVE UNIT.

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.

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.

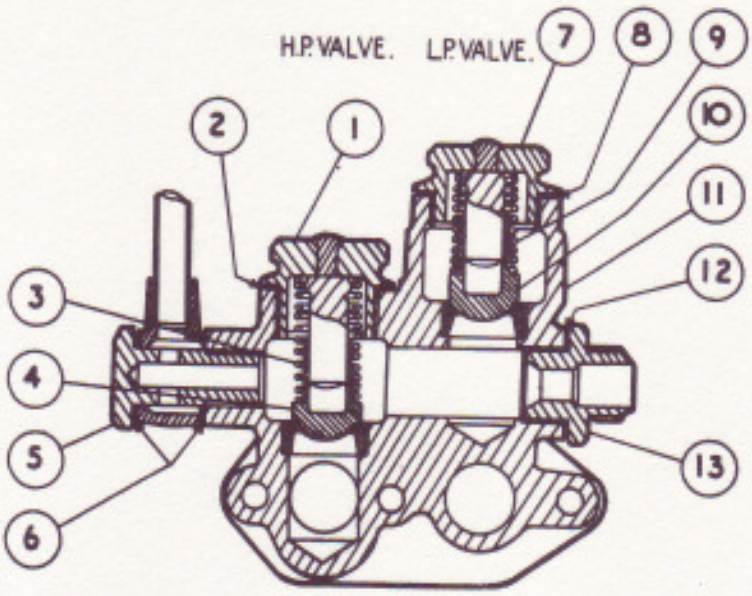



FIG. 7. SECTION OF OIL PRESSURE RELIEF VALVE UNIT.

(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.

## 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.

---

# 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 shall 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.

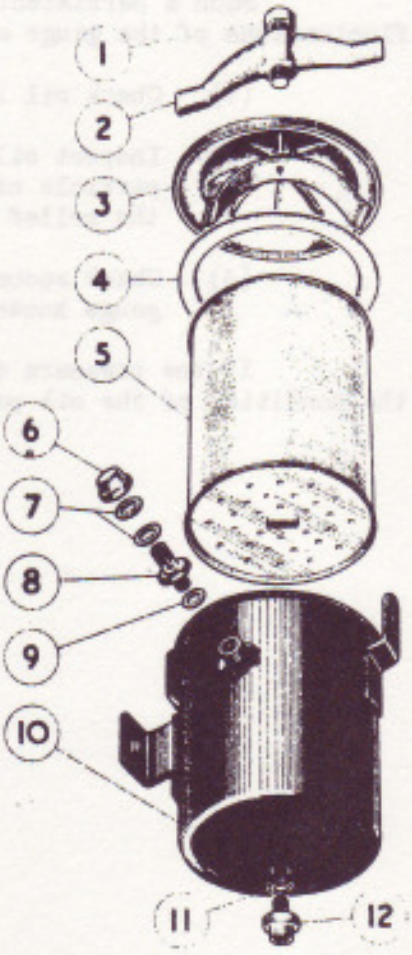



FIG. 8. EXPLODED VIEW OF "GENERAL" BY-PASS OIL FILTER.

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 slackened 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.

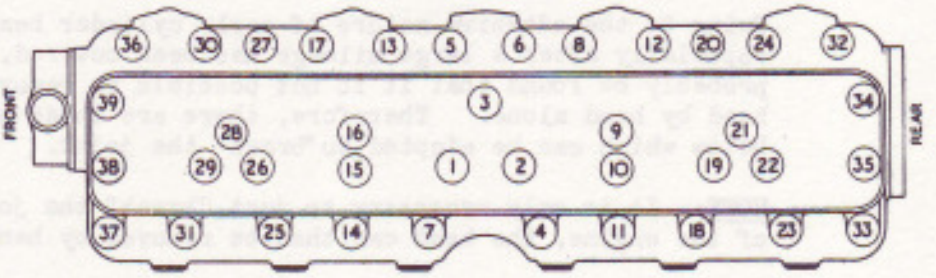



FIG. 9. ORDER IN WHICH THE CYLINDER HEAD NUTS SHOULD BE TIGHTENED.

(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.

| Tool No. | Description | Fig.No. |
|---|---|---|
| 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, CARBURETTERS 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.

(xiii) Reconnect mixture control rod to the bottom of the front carburetter jet lever.

(xiv) Remove and clean the small filter located in each of the float chamber covers, and then reconnect the petrol feed pipe to the carburetters fitting new C and A washers if found necessary.

(xv) Replace ignition wire tubes, and secure with the nuts and washers. Reconnect the wires from the distributor to the ignition coil, and the high tension cables to the sparking plugs. The firing order is 1, 4, 2, 6, 3, 5.

(xvi) Fit a new C and A washer to each joint face and replace the exhaust manifold.

(xvii) Reconnect car heater pipe to the tap on the cylinder head. Do not fit the breather pipe to the rocker cover at this stage.

(xviii) Fill the cooling system with the anti-freeze mixture previously removed, first making sure that the cylinder coolant jacket drain tap is closed. The "off" position of the tap is when the handle is in a horizontal position. Also make sure that the radiator drain tap is closed. The "off" position of the tap is when it is pointing downwards.

(xix) Change the engine oil if considered necessary.

Remove temporary cover and replace the oil dipstick and check the oil level.

(xx) Reconnect the positive earthing lead to the battery.

(xxi) Start up engine and check for leakages etc.

(xxii) Stop the engine and remove the rocker cover, restart the engine and ascertain that oil is escaping from both ends of all the rockers. Fig.3 Sub-Section BE.1 shows the oilways in the rocker. Replace the rocker cover.

(xxiii) Refit breather to rocker cover (this only applies to chassis B-198 BH and onwards) by placing the plain aluminium washer on to the special fixing bolt and lightly screwing it in. Line up the breather pipe until the clip on the pipe can be slipped on to the stud on the crankcase. Secure clip in position and tighten up the fixing bolt.

(xxiv) Refit bonnet and secure by fitting the small bolt into the hinge pin bracket on the dashboard.

(xxv) It is very important that the cylinder head nuts should be tightened again (in the correct sequence as shown in Fig.9) after the engine has done sufficient running to become thoroughly warmed, and then allowed to completely cool off.

To carry out the above it will be necessary to remove the rocker shaft. It will also be necessary to re-set the inlet valve rocker clearances as already described (i.e. .006" cold), owing to the fact that the joint gasket will have become further compressed, with a consequent reduction in inlet tappet clearances.

The inlet valve rocker clearances should again be checked after approximately 500 miles of running and re-adjusted if necessary.

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# DECARBONISING

## REFACING VALVES AND VALVE SEATS.

### GENERAL.

There should be no need to decarbonise the engine or reface the valves and seats, unless one or more of the following symptoms are in evidence:-

(a) Poor slow running associated with lack of compression.

(b) Detonation even when good fuel is being used and the ignition timing correct.

(c) Loss of power attributable to poor condition of valves.

### REMOVAL OF CYLINDER HEAD.

Remove the cylinder head as per instructions in Sub-Section BE.6.

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

### TO REMOVE THE EXHAUST VALVES.

Before removing the exhaust valves, temporarily fit suitable corks to, or cover up with clean rag, the four oil return holes in the bottom of the tappet chamber. Also, cover up large hole leading from side of tappet chamber to wheelcase. This will prevent the wedges from falling into the crankcase or wheelcase if they are accidentally dropped when removing the exhaust valves.

Leave the holes covered up until the exhaust valves have been re-assembled to the engine and then remove the corks or rag.

Fig.11 shows the exhaust valve spring compressing tool (RF.4385) in position. To remove valves proceed as follows:-

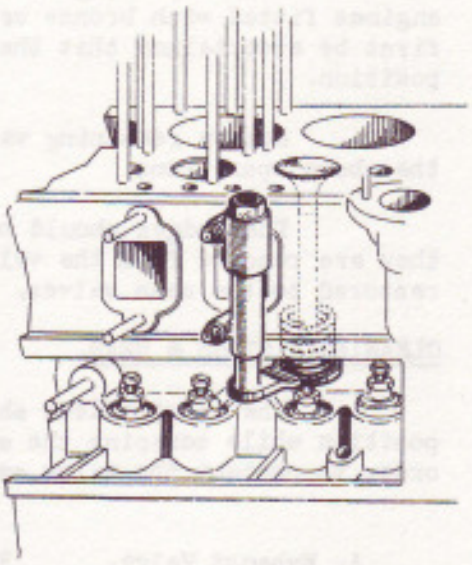
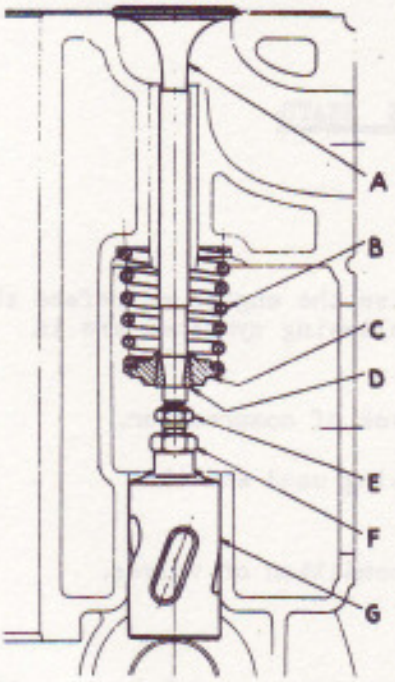


FIG.11. EXHAUST VALVE SPRING COMPRESSING TOOL IN POSITION.

Unscrew sleeve nut of compressing tool sufficiently to allow the fork to be placed under bottom washer (C, Fig. 12) of the valve to be removed.




A. Exhaust Valve.
B. Spring.
C. Bottom Washer.
D. Wedge.
E. Adjusting Screw.
F. Locking Nut.
G. Exhaust Tappet.

FIG. 12. ARRANGEMENT OF EXHAUST VALVE WITH CAST IRON GUIDE.

With the valve closed, place the tool on the appropriate exhaust manifold retaining studs, and engage the fork piece under the bottom washer of the exhaust valve. Secure tool in position with two nuts, and then with a suitable spanner, turn the sleeve nut to compress the valve spring sufficiently to remove the wedges. Slacken off sleeve nut and remove tool, then withdraw the valve from its guide and remove the valve spring together with the bottom washer.

NOTE: On certain early chassis, cast iron valve guides were fitted. Subsequently, bronze valve guides (B, Fig.13) with retaining flanges were introduced together with a top washer (C).

Should this washer become dislodged when removing the valve spring, smear with grease and replace it in position as shown in Fig.13.

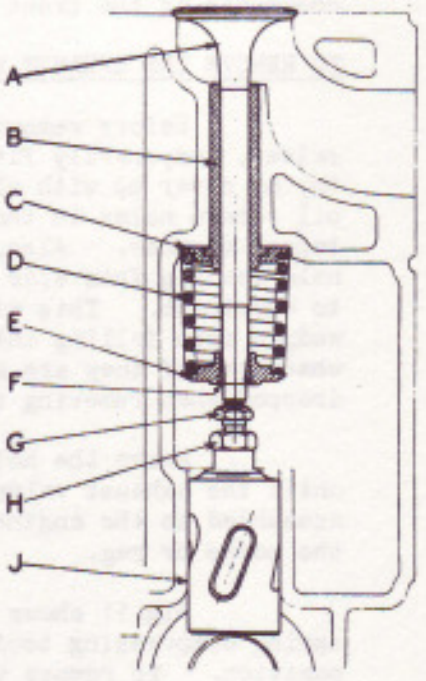
When replacing an exhaust valve on engines fitted with bronze valve guides, it must first be ascertained that the top washer is in position.

Remove remaining valves by repeating the above operations.

The wedges should be kept in pairs as they are removed from the valve stems, and restored to the same valves.

CLEANING PISTONS & HEAD.

The inlet valves should be left in position while scraping the cylinder head, in order to protect the valve seats.




A. Exhaust Valve.
B. Valve Guide.
C. Top Washer.
D. Spring.
E. Bottom Washer.
F. Wedge.
G. Adjusting Screw.
H. Locking Nut.
J. Exhaust Tappet.

FIG. 13. ARRANGEMENT OF EXHAUST VALVE WITH BRONZE GUIDE.

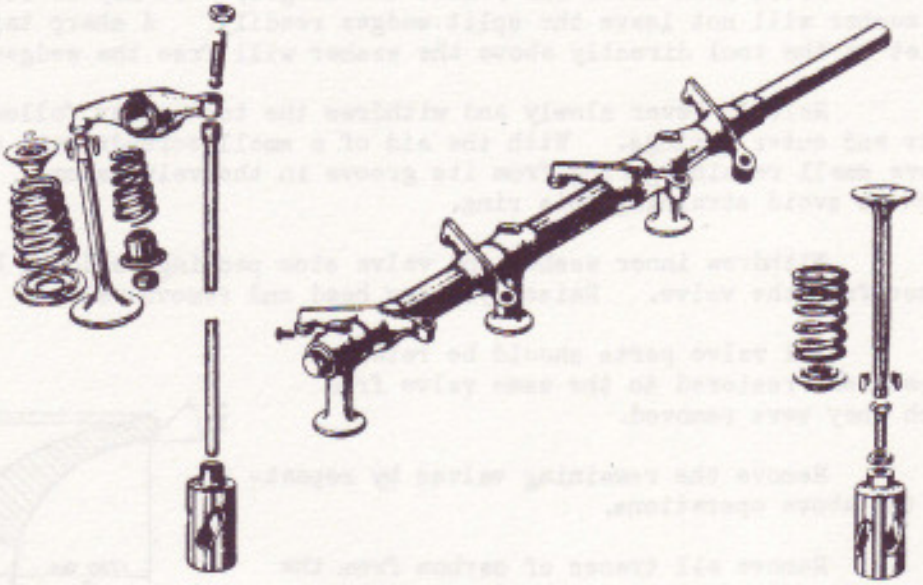


FIG. 14. EXPLODED VIEW OF INLET AND EXHAUST VALVE MECHANISM.

As the pistons and cylinder head are made of an aluminium alloy, take great care not to score them when scraping away the carbon deposit.

Only a blunt rounded tool should be used and applied with very moderate pressure. Precautions must be taken to prevent carbon getting into the coolant holes of the cylinder block.

Emery cloth, sandpaper or other abrasives must not be used for cleaning the pistons or cylinder head.

TO REMOVE THE INLET VALVES.

Insert a block of wood of suitable size in the combustion chamber to support the valve. Place inlet valve spring compressing tool (RF.4391) on to the appropriate rocker shaft pedestal stud as shown in Fig. 19 Sub-Section BE.8 and attach it by screwing

A. Top Washer.
B. Retaining Ring.
C. Inner Spring.
D. Outer Spring.
E. Inner Washer.
F. Outer Washer.
G. Valve Stem packing.
H. Inlet Valve.
J. Wedge.
K. Adjusting Screw.
L. Locking Nut.
M. Push Rod.

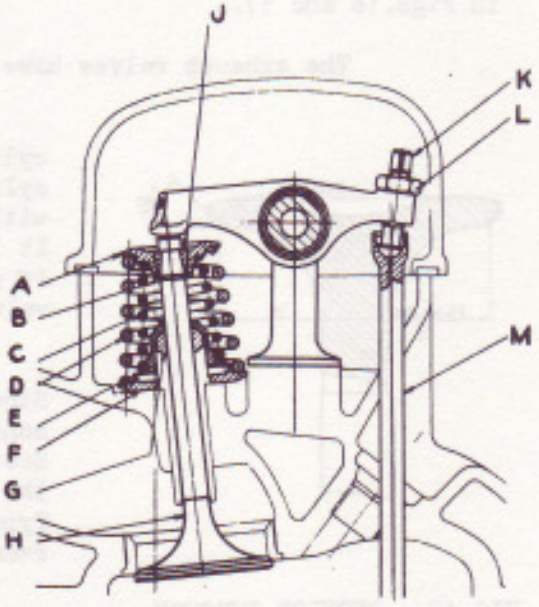



FIG 15. ARRANGEMENT OF INLET VALVE.

down the fulcrum pillar (B) on to the stud. Place the stirrup (C) over the top washer (A, Fig.15) of the valve and lock slide in position by means of the thumb screw.

Press down lever and remove the wedges. It may be found that the top washer will not leave the split wedges readily. A sharp tap with a hide mallet on the tool directly above the washer will free the wedges.

Release lever slowly and withdraw the top washer followed by the inner and outer springs. With the aid of a small screwdriver, carefully remove small retaining ring from its groove in the valve stem. Care must be taken to avoid straining this ring.

Withdraw inner washer and valve stem packing followed by the outer washer from the valve. Raise cylinder head and remove valve.

All valve parts should be retained in sets and restored to the same valve from which they were removed.

Remove the remaining valves by repeating the above operations.

Remove all traces of carbon from the valves with fine emery cloth and paraffin, taking care not to scratch the seats or stems.

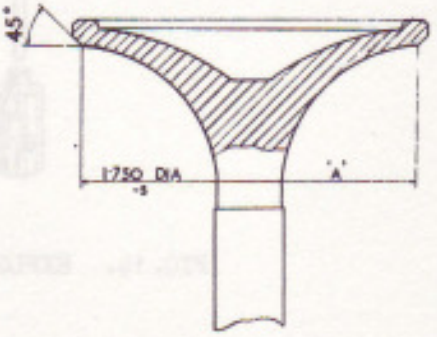



FIG.16. SECTION THROUGH HEAD OF INLET VALVE

REFACING THE VALVES AND VALVE SEATS.

The inlet and exhaust valves are numbered (etched) 1 to 6 near the bottom of the valve stem. The numbering commences at the front of the engine.

The valve face angle of both inlet and exhaust valve is 45° as shown in Figs.16 and 17.

The exhaust valves have stellite seats, see Fig.17.

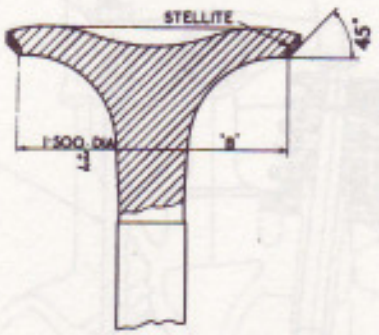



FIG.17. SECTION THROUGH HEAD OF EXHAUST VALVE.

The inlet valve seat inserts in the cylinder head and the exhaust valve seats of the cylinder block, should be refaced by grinding with standard valve seat reconditioning equipment. It is assumed that this equipment is available, if not, it will be necessary to grind-in the valve by hand as described later.

Bentley Motors (1931) Ltd., recommend a Sioux Valve Face Grinder type No.662 for reconditioning the valves, a Hall's Portable Valve Seat Grinder type No.E J.A.10 for reconditioning the exhaust valve seats and a Hall's Production Type Valve Seat Grinder type No.V.P.A.36 for the reconditioning of the inlet valve seats.

When retrimming the seating of the inlet valve, it is necessary to grind off the material to the correct angle (i.e. 45° as shown in Fig.16) and sufficiently to remove pitting. Metal must then be removed from the underside of the valve in order to maintain the dimension 'A' also shown in Fig.16.

When retrimming the seating of the exhaust valve, grind off the material to the correct angle (i.e. 45° as shown in Fig.17) and sufficiently to remove pitting and then remove metal from the underside of the valve as in the case of the inlet valve, in order to maintain dimension 'B' as shown in Fig.17. However, prior to carrying this out, the locking nut (F, Fig.12) of each exhaust valve tappet should be released and the adjusting screw (E), screwed down several turns. To carry out this operation, slip the special exhaust tappet holding spanner (RF.3838 Fig.18) on to the flats provided at the top of the exhaust tappet, and placing the other end of the spanner on to the inlet tappet. Then, with the aid of the two $\frac{1}{4}$" and 5/16" B S.F. single ended spanners (RF 3834 and RF.4372), the locking nut can be released and the adjusting screw screwed down.

FIG.18. TOOL FOR HOLDING EXHAUST TAPPET.

It should be observed that when using the recommended equipment for reconditioning the valve seats of the block, and the valve seat inserts of the head,

(a) Valve guides must be clean.

(b) It is most important that the pilot to be used should be tightened securely in place, and must be a close fit in the valve guide, (i.e. Diameter of stem of pilot for inlet valve guide must be .343" dia. Diameter of stem of pilot for exhaust valve guide must be .375" dia.). The portion of the stem of the pilot which fits into the valve guides should be about 3.250" long.

(c) Precautions must be taken not to allow any grinding dust or foreign matter to find its way on to the tappets or into the valve tappet chamber and the cylinder bores.

(d) The grinding stone should be frequently cleaned up with the diamond dressing tool to ensure a correct angle and a true and clean cutting face.

The seat face angle in the cylinder head and the cylinder block is also 45°. After grinding the valves and seats, test by smearing the seating on the valve with a small amount of prussian blue and then pressing the valve on to its seating and lifting away again, without rotating it. A complete circle of marking should appear on both valve face and seating indicating a good bedding.

When refacing valves and seats, remove the least amount necessary to give a clean face.

The inlet valve seats which are made of nickel chrome steel, tend to harden with use.

After these operations have been carried out, great care must be taken to make certain that all grinding dust and foreign matter is removed from the valves, seatings, guides and ports of both the cylinder head and the cylinder block, and also the tappet chamber.

HAND "GRINDING-IN" THE VALVES.

In the event of standard electrical valve seat reconditioning equipment not being available, then the valves will have to be ground-in by hand. A suction type valve holding tool will be needed for this operation.

Good quality grinding paste should be used, the valve being rotated backwards and forwards in different positions and pushed from its seat occasionally. Only a light pressure should be applied, to prevent scoring of the valve and seat. Care must be taken not to allow any grinding paste to get on the valve stems or in the guides.

Test seatings with prussian blue as previously explained.

After this operation, it is essential that all traces of grinding compound are removed from the engine.

TESTING VALVE SPRINGS.

The inlet and exhaust valve springs should be cleaned and examined for visible defects and also checked for poundage. Fatigue cracks commence on the inside diameter of the coils. Normally the springs should give long service.

The springs should be tested for poundage on an accurate Valve Spring Tester. When testing, the springs should be compressed to the valve closed length, i.e.:

Inlet Valve Spring - inner.

(i) Compress the spring to 1.300", in this condition the spring should exert a load (poundage) of not less than 12 lbs.

Inlet Valve Spring - outer.

(ii) Compress the spring to 1.600", in this condition the spring should exert a load of not less than 39 lbs.

Exhaust Valve Spring.

(iii) Compress the spring to 1.525", in this condition the spring should exert a load of not less than 40 lbs.

TO REPLACE INLET VALVES.

With all parts thoroughly cleaned including the valve guides, replace the first valve after smearing the stem with grease and then place the wooden block beneath the cylinder head in the combustion chamber, to keep the valve in position.

Mount the inlet valve spring compressing tool on the appropriate rocker shaft pedestal stud.

Replace the outer washer (See Fig.15) followed by a new valve stem packing and the inner washer.

Replace the retaining ring in its groove on the valve stem. Should the ring be damaged or sprung open, then a new ring must be fitted. It is preferable to fit a new set of retaining rings.

Replace the inner and outer valve springs, and fit the top washer. Compress the springs and fit the wedges.

Repeat the above procedure for the remaining valves, making sure that each valve is replaced in its corresponding guide together with a new valve stem packing.

After the valves have been replaced and the wooden block removed, tap on the top of each valve with a hide mallet to ensure that the valve wedges are seating correctly.

TO REPLACE THE EXHAUST VALVES.

First, make sure that the four oil return holes in the bottom of the tappet chamber and the hole leading through to the wheelcase are still covered up, then, with all parts including the valve guides thoroughly clean, proceed as follows to fit the first exhaust valve.

Ascertain that the tappet is at its lowest position of travel in its guide. Place the bottom washer on the valve spring and then place the washer and spring in position in the tappet chamber. Lubricate the stem with grease and then drop the valve into place.

Mount the exhaust valve spring compressing tool in position, and while the valve is held down, compress the spring and refit the wedges making sure that they are correctly located. This can be done with the aid of a hand lamp and mirror. Repeat the above procedure for the remaining valves making sure that each valve is replaced in the guide from which it was removed.

When all the exhaust valves have been assembled, proceed to set the exhaust tappet clearance as described in the following paragraph.

ADJUSTING THE EXHAUST VALVE TAPPET CLEARANCES.

The correct clearance for the exhaust tappets is .012" (.305 m/m) with the engine cold.

Before commencing to adjust a tappet 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:-

| Tool No. | Description | Fig.No. |
|---|---|---|
| RF.4277 | Set of feeler gauges. | - |
| RF.3838 | Exhaust tappet spanner. | 18 |
| RF.3834 | ¼" B.S.F. Single ended jaw spanner. | - |
| RF.4372 | 5/16" B.S.F. Single ended jaw spanner. | - |

The method of adjusting the exhaust tappet clearances is:-

Place the exhaust tappet spanner on to the exhaust and inlet tappets to prevent the exhaust tappets from turning while adjusting. Slacken the locknut (F, Fig.12) and then adjust the adjusting screw (E), to give the correct clearance.

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

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

Repeat these operations for the remaining valves.

Remove all the corks or rag covering up the oil return holes in the tappet chamber.

Replace the two side tappet covers, first ascertaining that the cork joints are in good condition and that the distance pieces are in position. No distance pieces are required with cast aluminium tappet covers.

Normally the exhaust valve tappet clearances should not need attention between decarbonising periods of the engine.

Refit the cylinder head and other parts as described in Sub-Section BE.6.

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## CHANGING VALVE SPRINGS IN SITU.

### TO CHANGE INLET VALVE SPRING.

Remove the rocker cover and rocker shaft assembly as described in Sub-Section BE.6.

Place the inlet valve spring compressing tool (RF 4391) and the valve holder (RF.5214) in position on the engine as shown in Fig.19.

The locking nut (D) on the valve holder should first be unscrewed sufficiently to release a split taper collet which grips the spindle (E) and the bent portion of the latter inserted through the sparking plug hole, after which the holder (F) should be screwed into position.

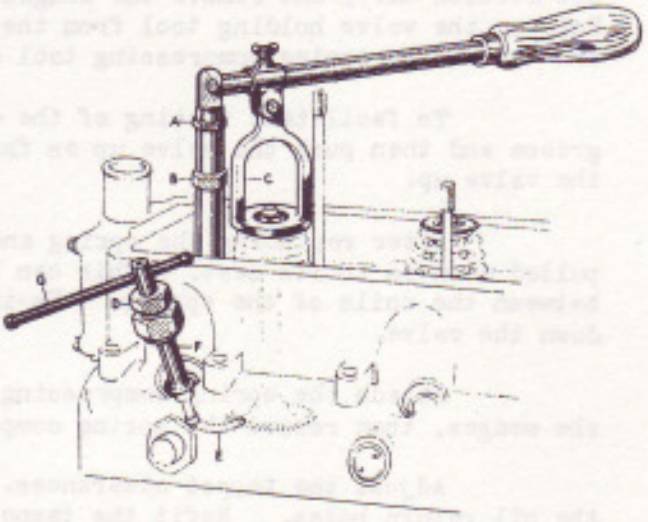

FIG.19. VALVE SPRING COMPRESSING TOOL AND VALVE HOLDER IN POSITION.

The spindle should then be turned and simultaneously pulled away from the head, so that it is bearing in the hollow of the appropriate valve head of the spring to be removed, as shown in the illustration, and the locking nut (D) tightened while holding the spindle in position by means of the tommy bar (G).

Remove the valve spring as described in Sub-Section BE.7.

Should it be found necessary to replace the valve stem packing, then the small retaining ring will have to be removed from its groove in the valve stem and subsequently refitted or replaced by a new one as found necessary.

If the spring ring has been removed, care must be taken not to disturb the valve holder until it has been replaced, otherwise the valve would fall into the cylinder.

Replace valve spring etc. as described in Sub-Section BE.7. Adjust the rocker clearance and then replace the rocker cover etc.

### TO CHANGE AN EXHAUST VALVE SPRING.

Remove the exhaust manifolds and tappet covers as described in Sub-Section BE.6, and cover up the oil return holes in the tappet chamber. Release the locking nut of the tappet adjusting screw concerned and screw down the tappet screw as far as it will go. Place the valve holder in position. It should be

noted, however, that whereas the inlet valves have a deep hollow in the head, the head of the exhaust valves have a shallow hollow (See Figs.16 and 17, Sub-Section BE.7) and care will therefore have to be taken to ensure that the curved portion of the spindle of the valve holder correctly locates on the valve head.

Attach the exhaust valve spring compressing tool as shown in Fig.11, Sub-Section BE.7, and remove the wedges and then remove the valve holder. Release the valve holding tool from the valve head. Push the valve upwards and remove the spring compressing tool and the spring and washer.

To facilitate fitting of the new spring, smear the valve stem with grease and then push the valve up as far as it will go. The grease will hold the valve up.

After replacing the spring and bottom washer, the valve should be pulled down on to its seat. This can be done by passing a small screwdriver between the coils of the spring. Re-insert the valve holding-tool, to hold down the valve.

Attach the spring compressing tool, compress the spring and replace the wedges, then remove the spring compressing tool and the holding down tool.

Adjust the tappet clearances. Remove the corks or rag covering up the oil return holes. Refit the tappet covers. Refit the exhaust manifolds.

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## SPRING DRIVES - "WRAITH" & "BENCH" TYPES

## (CRANKSHAFT VIBRATION DAMPERS)

1. DESCRIPTION:

There are two types of Low Inertia Spring Drives, known for production purposes as the "Wraith" and "Bench" type. The "Wraith" type has to be fitted to the crankshaft in a partly assembled condition, whereas the "Bench" type can be assembled on the bench and offered up to the crankshaft as a complete unit.

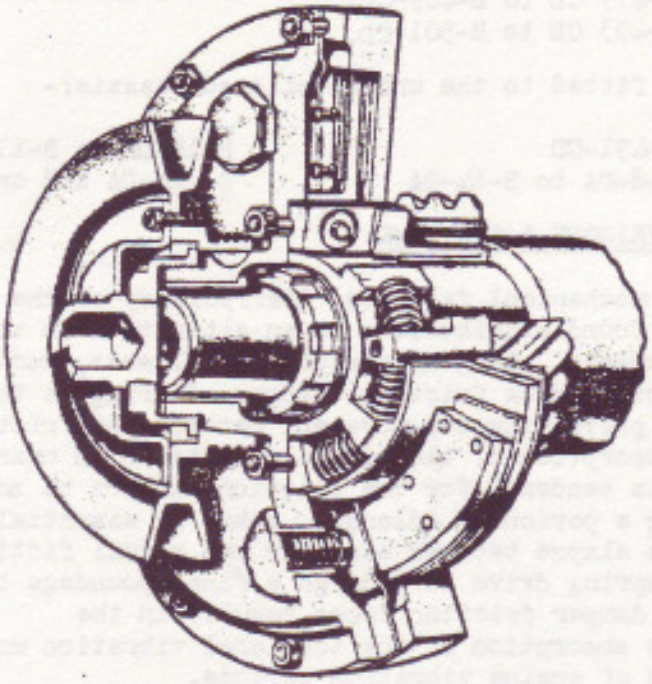


FIG. 20. "CUT-AWAY" VIEW - SPRING DRIVE "WRAITH" TYPE.

The device is a composite component which deals with two different and distinct conditions.

THE SPRING DRIVE provides a flexible coupling between the Crankshaft and the Crankshaft Pinion, its function being to maintain a constant pressure at the driving teeth irrespective of the variations in load - as imposed by the camshaft. The pinion is driven by radially disposed Coil Springs (32 & 33 Fig.21 and 24 & 25 Fig.28).These springs are interposed between Dog members which are attached to the Crankshaft and the Pinion.

THE VIBRATION DAMPER deals with torsional oscillations of the Crankshaft which are overcome by friction imposed by the inertia of a small Flywheel. To keep the natural oscillation frequency of the front end of the crankshaft as high as possible, the weight of material rigidly attached to the Crankshaft at this point must be and is kept to a minimum. It will be noted that this is the friction drum only (29 Fig. 21 and 20 Fig. 28). On both types of Spring Drives, the Pinion, Fan Pulley, Damper Flywheels and Starter Dog, are the floating mass parts for inertia effect.

With this arrangement, movement of the Damper Flywheel is limited to within the radial movement of the Spring Driven Pinion, as the periodic movements of the Damper are considerably less than the deflections of the Springs (caused by load variations) no restriction to the Damper action takes place.

Friction is provided between the Damper Flywheel and the Crankshaft by Cotton Duck Friction Washers loaded by Coil Springs. (28 & 20 Fig. 22 & 21 & 18 Fig. 29). This friction is also effective between Pinion and Crankshaft

movement and serves to damp out any periodic occillations of the Pinion Drive Springs.

NOTE. As the Starter Dog is attached to the floating part of the device, it is essential that the engine is turned from the rear at the main Flywheel, and in its normal direction of rotation when checking the timing or timing the engine.

The "Wraith" type is fitted to the following chassis:-

| | | |
|---|---|---|
| B-2-AK to B-254-A.K. | B-2-CF to B-500-CF. | B-2-DA to B-6-DA. |
| B-1-AJ to B-247-A.J. | B-1-CD to B-473-CD. | B-16-DA. |
| B-2-BH to B-400-B.H. | B-479 CD to B-489-CD. | B-118-DA to B.126-D.A |
| B-1- B.G to B-401.BG. | B-493 CD to B-501-CD. | |

The "Bench" type is fitted to the undermenticned chassis:-

| | | |
|---|---|---|
| B-475-CD | B-491-CD | B-18-DA to B-116-DA |
| B-477-CD | B-8-DA to B-14-DA | B-128-DA and onwards |

2. DERANGEMENT OF THE DAMPER - REASONS & SYMPTOMS.

Apart from unlikely mechanical failures, inefficiency of the damper will, in the main, be found attributable to an alteration in the pre-determined slipper drive poundage. Lengthy periods of idleness, such as car storage, may result in the cotton duck friction washers adhering to the damper friction plates, thus preventing the movement between the friction faces so necessary for the absorption of the minute variations in crank-shaft angular movement. This tendency for the friction washers to adhere to the friction plates during a period of idleness, makes it essential. should some considerable time elapse between assembly and actual fitting to the engine for an assembled spring drive to undergo a final poundage test. Loss of movement between the damper friction faces results in the accentuation, rather than the absorption of the torsional vibration movement, thus causing the introduction of engine vibration periods.

These periods produce engine gear rattle which can be heard most noticeably at 2500 engine R.P.M. - this is the half torsional period of the crankshaft. In top gear, 2500 engine R.P.M. = approximately 55 M.P.H. or 88 K.P.H.

3. TOOLS (Special)

The undermentioned special tools, will be required:-

| Tool No. | Description | Application |
|---|---|---|
| 1617/ T1001 | Box Spanner. | Withdrawal Nut - Fan Pulley - Spring Drive "Wraith" type. |

or use a standard box spanner having 1.581" width across flats.

| | | |
|---|---|---|
| 1649/T3. | Box spanner. | Starting Dog-Spring Drive ("Bench" type) |

or, use a standard 7/8" B.S.F. Box Spanner.

STD-504 Key For use with 1617/T1001 & 1649/T3, Box Spanners.

3759/T1007 Serrated Spanner. Nut-Crankshaft-Spring Drive(Both types).

1617/T1003 Extractor Spring Drive ("Wraith" type)

This extractor can be used on the "Bench" type Spring Drive, providing the four 13/32" dia. holes in the clamp plate of the tool are elongated to suit the 2.900" (73.66 m/m) dia. hub stud centres as against the 2.800"(71.12 m/m) stud centres of the "Wraith" type. Future supplies of this Extractor, which has been commonised to suit both types of spring drives, will bear the Part No: 3759/T1016.

1617/F1005 Mandril. Spring Drive Assembly (Both types)

1617/G1003 Poundage Checking Lever. Damper-Spring Drive (Both types)

Before this lever can be used on the "Bench" type Spring Drive, it will be necessary to elongate the 17/64" dia. holes in the lever to suit the 2.900" dia. hub stud centres. (See "Note" and further tools over.)

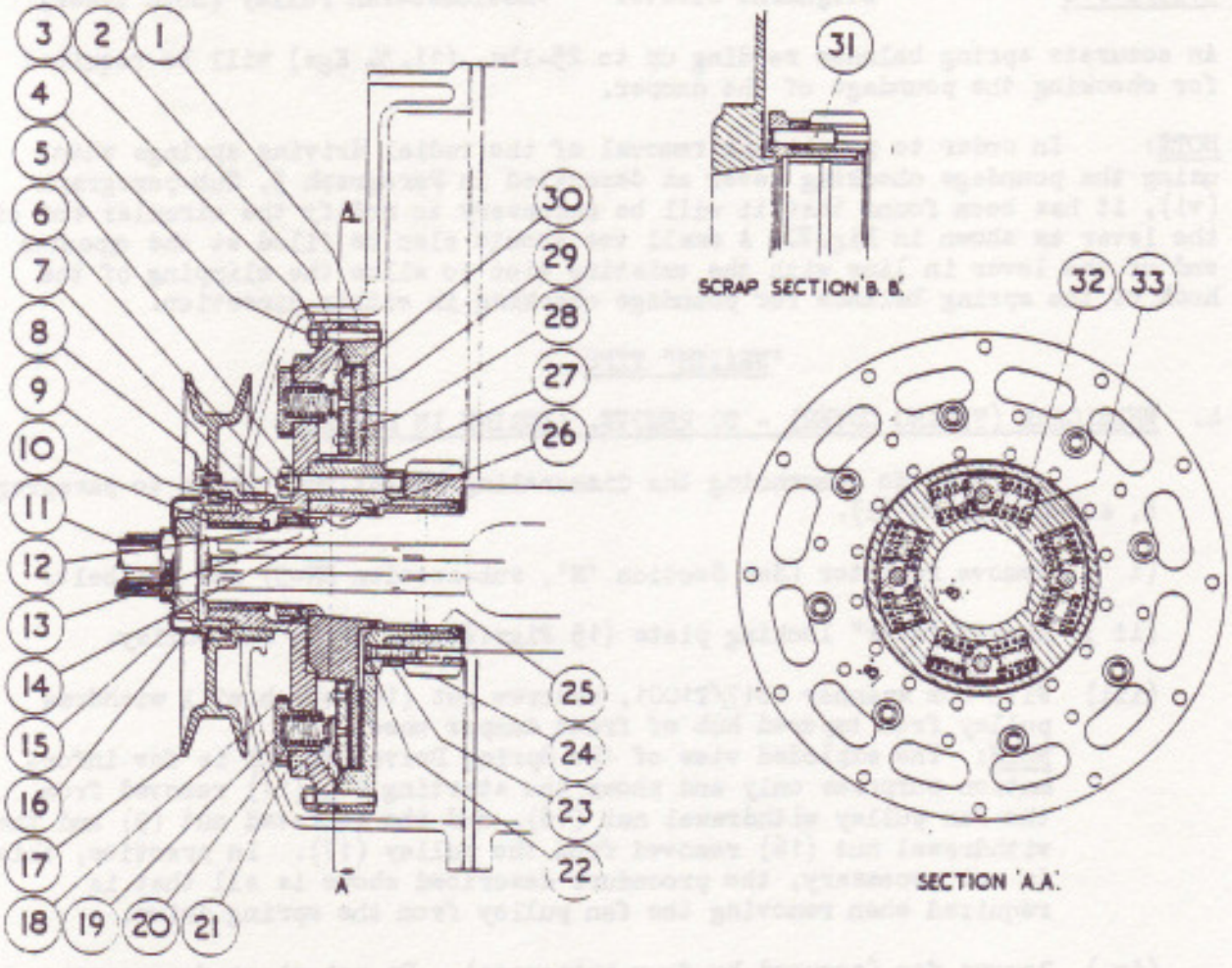



FIG. 21. SECTION - SPRING DRIVE ("WRAITH" TYPE.)

Notation List for Fig.21.

1. Damper Wheel (rear)
2. Damper Wheel (front)
3. Nut and Lockwasher.
4. Stud.
5. Nut and Lockwasher.
6. Stud.
7. Woodruff Key.
8. Screw & F.S. Washer.
9. Nut (serrated)
10. Bush. (front)
11. Starting Dog.
12. Nut. ( serrated)
13. Lockwasher.
14. Washer. (plain)
15. Star Locking Plate.
16. Withdrawal nut-fan pulley.
17. Fan Pulley.
18. Plug.
19. Adjusting Washer.
20. Damping Spring.
21. Lockwasher.
22. Countersunk Screw.
23. Distance Piece.
24. Crankshaft Pinion.
25. Bush (rear)
26. Woodruff Key. (3 Off)
27. Driven Dog.
28. Friction Washers. (2 Off)
29. Friction Drum.
30. Presser Plate Assembly.
31. Driving Pin - Pinion.
32. Driving Spring. (outer)
33. Driving Spring. (inner)

3759/T1018 Alignment Sleeve. Wheelcase-Fan Pulley (Both types)

An accurate spring balance reading up to 25-lbs. (11.34 Kgs) will be required for checking the poundage of the damper.

NOTE: In order to permit the removal of the radial driving springs when using the poundage checking lever as described in Paragraph 5, Sub-paragraph (vi), it has been found that it will be necessary to modify the circular end of the lever as shown in Fig.27. A small vee should also be filed at the opposite end of the lever in line with the existing slot to allow the clipping of the hook of the spring balance for poundage checking in either direction.

"WRAITH" TYPE.

4. WHEELCASE (TIMING COVER) - TO REMOVE. (ENGINE IN FRAME.)

Prior to commencing the dismantling operations, refer to paragraph 8, sub-paragraph (i).

(i ) Remove radiator (See Section 'N', sub-section EN-5) and fan belt.

(ii ) Remove "star" locking plate (15 Figs.21 & 22) from fan pulley.

(iii) With box spanner 1617/T1001, unscrew nut (16) which will withdraw pulley from tapered hub of front damper wheel.
NOTE: The exploded view of the Spring Drive (Fig.22) is for information purposes only and shows the starting dog (11) removed from the fan pulley withdrawal nut (16), and the serrated nut (9) and the withdrawal nut (16) removed from the pulley (17). In practice, this is not necessary, the procedure described above is all that is required when removing the fan pulley from the spring drive.

(iv ) Remove fan (secured by four setscrews). Do not place fan reverse way round when refitting it.

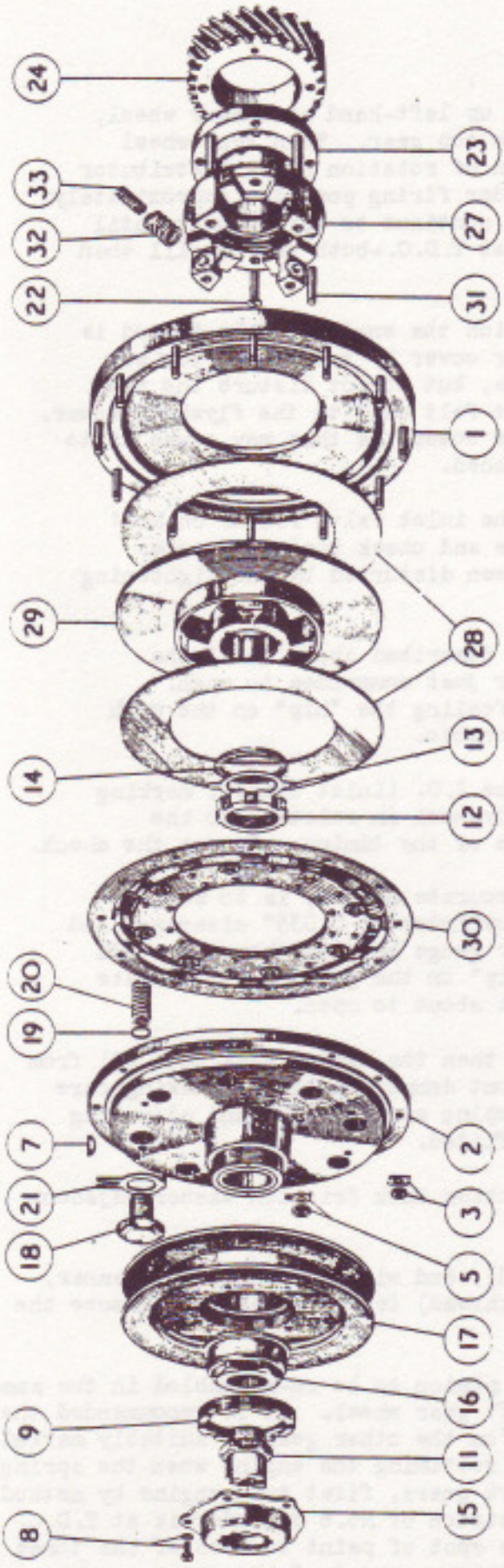



FIG. 22. Exploded View - Spring Drive("Wraith" Type)

(v ) Place a jack under front end of crankcase lower half, interposing a wooden board between lower half and jack to spread load. Screw up jack just sufficiently to take load off engine front support arch.

(vi ) Remove the four bolts (two on either side) securing support arch to frame cross-member brackets.

(vii) Undo the two 5/16" B.S.F. nuts from the nose bearing at top of arch, remove front plate, arch and rubber bushes.
NOTE: Temporarily attach each packing piece, fitted between ends of support arch and frame cross-member brackets, to their respective bracket.

(viii) Remove nose bearing from wheelcase secured by four 5/16" B.S.F. nuts.

(ix ) Disconnect oil feed pipe from oil nozzle on wheelcase, unscrew nozzle and remove it.

(x ) Remove nuts, setscrews and bolts securing wheelcase to crankcase and remove wheelcase. On early type engines, two dowels are fitted to the crankcase face for wheelcase alignment, whereas on later type engines, three close fitting bolts are fitted in place of the dowels.

5. SPRING DRIVE, TO REMOVE FROM CRANKSHAFT:

(i ) Before removing the spring drive, it will be advisable to check and note the valve timing as this will assist when checking it after refitting the spring drive.

Valve timing is carried out on No.1 cylinder on I.O. i.e. inlet opens. To check, proceed as follows:-

a) Open cover of flywheel marking inspection hole.

b) Remove sparking plugs, jack up left-hand side rear wheel, release handbrake and engage top gear. Turn rear wheel (engine) in normal direction of rotation until distributor rotor approaches No.1 cylinder firing position(approximately 11-o'clock on distributor), continue to turn slowly until piston of No.1 cylinder is at T.D.C.-both valves will then be closed.

NOTE: Another method by which the engine can be turned is to remove the flywheel lower cover by taking off the six nuts and flat spring washers, but do not disturb the two small bolts which secure 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.

c) With the engine cold, set the inlet valve rocker on No.1 cylinder to 0.030" clearance and check that the rocker clearance setting has not been disturbed by the tightening of the locknut.

d) Again turn engine by method described above until the inlet valve on No.1 cylinder just commences to open. This can be ascertained by feeling the "nip" on the push rod which should be just turnable.

e) Now check the position of the I.O. (Inlet Opens), marking scribed on the rim of the flywheel in relation to the timing pointer and take note of the timing. Repeat the check.

f) Another, and perhaps more accurate method, is to set the inlet valve rocker on No.1 cylinder to 0.035" clearance and insert a 0.005" thick feeler gauge between the rocker and the valve stem. A light "nip" on the gauge will indicate that the inlet valve is just about to open.

(ii ) Remove the four nuts (5 Fig.21), then the twelve 2-BA nuts (3) from rim of damper wheel. Remove front damper wheel (2), taking care not to lose any of the eight damping springs (20) and adjusting washers (19) if the latter are fitted.

(iii) Remove presser plate (30) and cotton duck friction washer adjacent to it.

(iv ) Bend back tabs of lockwasher (13), and with the serrated spanner, 3759/T1007, remove nut 12 (R.H. thread) from crankshaft. Remove the plain washer (14).

NOTE: To enable the crankshaft pinion to be re-assembled in the same position relative to the camshaft gear wheel. It is recommended that a tooth on one gear and a"space"on the other gear be suitably marked. This will also save the work of re-timing the engine when the spring drive is being refitted. To mark gears, first turn engine by method previously described until the piston of No.6 cylinder is at T.D.C. on the firing stroke and apply a spot of paint to each of the three mating teeth prior to complete disengagement of the gears.

(v ) Attach the extractor, 1617/T1003 to the four hub studs (6 Fig. 21) and remove "rear half" of spring drive complete with pinion from crankshaft.

NOTE: It will be observed upon reference to Fig. 22, that Items 22, 23, 24, 27 and 31, comprising the crankshaft pinion assembly, are shown "exploded". It is not necessary to separate these parts.

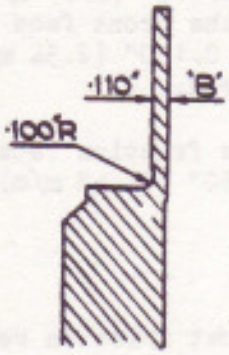
(vi ) The next operation is to remove the outer and inner radial driving springs (32 & 33) from the friction drum (29) and the driven dog (27). Proceed as follows:-

a) Place the mandril, 1617/F1005 in a vice and firmly secure.

b) Place "rear half" of spring drive on the mandril, making sure it is keyed in position.

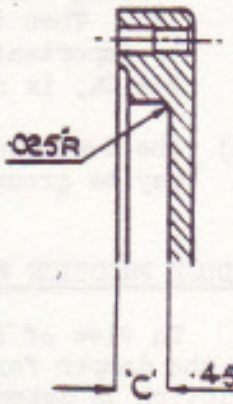

PRESSER PLATE

FIG. 23.




FRICTION DRUM

FIG. 24.




REAR DAMPER WHEEL

FIG. 25.

c) Attach the poundage checking lever, 1617/G1003 to two of the four 1/4" B.S.F. hub studs and take the strain one way which will ease the tension on four pairs of springs and make removal of them easier. It should be noted that the driving springs are retained in position at one end only (See "Section A.A." Fig. 21)and thus require to be compressed before they can be extracted. To effect this, the blade of a suitable screwdriver should be inserted between a spring and the corresponding driving dog of the friction drum (29) and the spring compressed and prised upwards until it is clear of the friction drum. Take care not to distort springs during their removal.

(vii) Discard used cotton duck friction washers. Clean dismantled parts.

6. FRICTION FACES (GRINDING LIMITS):

(i ) Examine all friction faces for scoring and regrind or turn where necessary.

(ii) The sectional drawings, Figs.23, 24, 25, illustrate the limits to which the various friction faces may safely be ground or turned. All friction faces must have a smooth and highly polished surface. Grinding or turning of the faces should only be carried out should they be found to be pitted or scored and the least amount of metal possible should be removed to give a clean face. In most cases, it should be possible to recondition the friction faces by polishing only.

a) The minimum permissible working thickness for the presser plate is 0.150" (3.81 m/m). See Fig.23, Dimension 'A'. This dimension does not include the thickness of the spring plate.

b) The flange of the friction drum must not be ground below a working thickness of 0.110" (2.79 m/m). See Fig.24, Dimension 'B'. When truing up the front face of the friction drum. it is important that the 0.100" (2.54 m/m) radius as shown on Fig.24, is not destroyed.

c) The depth to which the friction face of the rear damper wheel may be ground, is 0.450" (11.43 m/m). See Fig.25, Dimension 'C'.

7. COTTON DUCK FRICTION WASHERS:

In view of the fact that friction represents the main principle used in the damper for the absorption of torsional oscillation, and that this friction is dependent upon the washers themselves, it is obvious that the efficient functioning of the damper will be governed by the condition of these washers.

The tendency for these to become hard, ingrained with carbon and superficially glazed, thus losing their original properties, makes it essential for the existing friction washers to be replaced by new ones at each overhaul period. Before assembly, the replacement friction washers must be reduced to a state approximating to that in which they will operate when actually assembled, and, as this entails a reduction in material thickness, care should be taken to ensure uniformity in all-round working thickness, particularly at the scarf joint. This is of the utmost importance, as the fitting of unevenly ironed friction washers will only result in rapid deterioration in damper efficiency.

8. PREPARATION OF NEW FRICTION WASHERS PRIOR TO FINAL ASSEMBLY & SETTING THE DAMPER POUNDAGE (SLIPPING LOAD).

In order to prepare the friction washers for final assembly, the following procedure should be carried out:-

(i) Soak washers in a first quality oil of viscosity S.A.E. 20, overnight and then place them under a press (between flat surfaces) for about twelve hours to flatten.

(ii ) Place the mandril, 1617/F1005 in a vice and firmly secure.
NOTE: The radial driving springs (32 & 33 Fig. 21) must be omitted during these operations.

(iii) Place the crankshaft pinion assembly on to the mandril.
NOTE: The following parts are stamped with a co-relation mark 'O' and on assembly, all these marks should coincide.
Driven Dog (27 Fig.22), Rear Damper Wheel (1), Friction Drum (29), Spring Plate (30) and the Front Damper Wheel (2)

(iv ) Place rear damper wheel on to driven dog. Liberally oil first replacement washer and place it on to rear damper wheel.

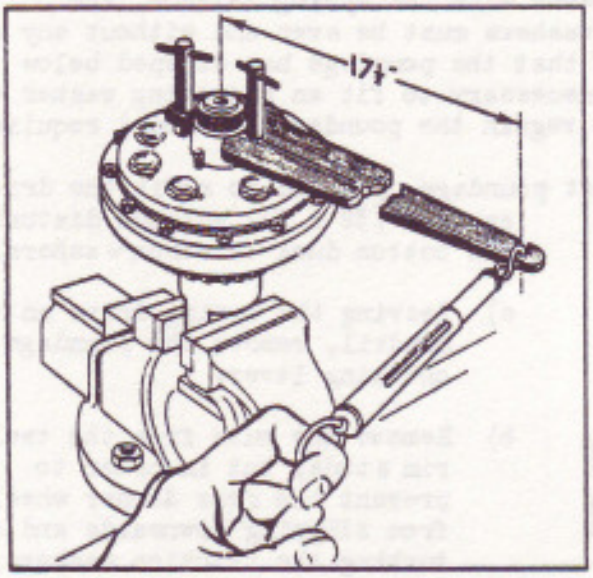



FIG. 26. CHECKING DAMPER POUNDAGE.

(v ) Place friction drum on mandril and push it fully home.

(vi ) Liberally oil second replacement washer and place it on flange of friction drum. It is important that the two washers are assembled concentrically and that the scarf joints are fitted diametrically opposite to one another.

(vii) Fit presser and spring plate assembly on to rear damper wheel. NOTE: If it is found that an adjusting washer or washers (19) have been fitted behind each of the damping springs (20), then they should be removed.

(viii) With damping springs in position on front damper wheel, fit it to rear damper wheel. The springs should be smeared with a soft type of grease to keep them in position in the hollow plugs (18).

(ix ) Tighten up the four nuts of the hub studs (6 Fig. 21) and then evenly tighten up nuts of the twelve rim studs and leave friction washers under compression for about twelve hours if time permits.

(x ) Attach poundage testing lever to spring drive as shown in Fig. 26 and with the lever, rotate damper wheels backwards and forwards through the limit of their travel for about 15 to 20 minutes in order to iron the washers. NOTE: The recommended slipping load of the damper wheels is 14-lbs.+ 1-lb.(6.35 Kgs) applied at a radial distance of 17½" (44.45 cms). The load is checked with the spring drive assembled but less the driving springs (32 & 33).

The above represents the force necessary to overcome the friction between the cotton duck washers and the corresponding friction faces of the friction drum, the rear damper wheel and the presser plate. The effort required to overcome the frictional drag exerted by the damping springs (20) is measured on a spring balance(See Fig. 26).

(xi ) Slip the spring balance on to the lever at a radial distance of 17½"

(xii) Pull on free end of balance and read poundage required to cause damper wheels to move relative to the friction drum. The poundage should always be checked in both directions. Should the poundage be found to be 16-lbs. for example, then continue the ironing process for a further period of about ten minutes. Again check poundage. It should be noted that the ironing process should be continued until two or three consecutive readings (poundage test) show no further fall in poundage which indicates that the friction washers are ironed to their limit.

NOTE: When pulling the lever with the spring balance, the frictional drag from the washers must be even and without any signs of judder. If it is found that the poundage has dropped below 14-lbs., it will then be necessary to fit an adjusting washer or washers to each spring to regain the poundage (14-lbs.) required.

(xiii) Having obtained the correct poundage, proceed to refit the driving springs (32 & 33) without disturbing the cotton duck friction washers.

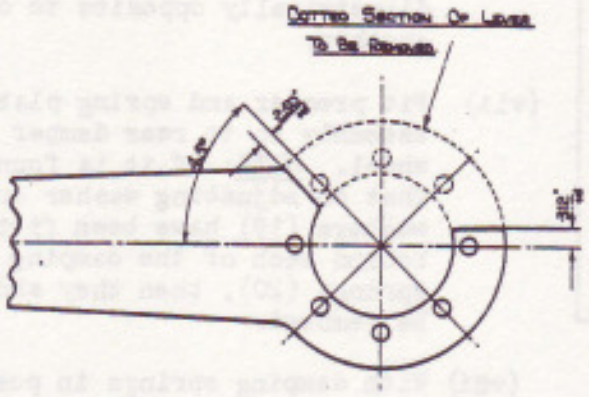



FIG. 27. POUNDAGE CHECKING LEVER MODIFIED.

a) Leaving the spring drive on the mandril, remove the poundage checking lever.

b) Remove the nuts from the twelve rim studs, but in order to prevent the rear damper wheel (1) from slipping downwards and disturbing the friction washers, hold it upwards prior to removing all the nuts.

c) Remove the front damper wheel with damping springs (20 Fig. 21), taking care not to disturb or lose any adjusting washers (19) that may be fitted.

d) To keep the remaining parts from coming adrift, temporarily secure the spring plate (30) to the rear damper wheel by means of two nuts and washers as necessary.

e) Again place the poundage lever in position, refit the driving springs by reversing the procedure for removal. Remove the lever.

9. TO REFIT THE "REAR HALF" OF THE SPRING DRIVE & CHECK THE VALVE TIMING:

(i ) Fit the "rear half" of the spring drive to the crankshaft as described in Service Bulletin No.BB-91 "Valve Timing" (Section E) and check the valve timing.

(ii ) After finally tightening up and locking the large serrated nut(12), refit the front damper wheel, making sure that the co-relation marks 'O' on both damper wheels coincide. Tighten up the hub nuts first and then the rim nuts and lock.

10. TO ALIGN & REFIT THE WHEELCASE & THE REMAINING DISMANTLED PARTS:

NOTE: Prior to refitting the wheelcase, inspect that all nuts etc. are correctly locked.

(i ) There is a working clearance of 0.006" to 0.008" (0.15 - 0.2 m/m) between the outer diameter of the Acme oil return thread of the fan pulley and the corresponding bore in the wheelcase which must be maintained when refitting the wheelcase to the engine. To obtain this clearance, proceed as follows:-

a) Place a new Vellumoid joint on to front face of crankcase.

b) Fit wheelcase in position and lightly tighten nuts and setscrews.

c) Place the tapered end of Alignment Sleeve, Tool No. 3759/T1018, on to hub of front damper wheel and over Woodruff Key and tap it fully home. With a 0.002" (0.05 m/m) thick feeler gauge, check the clearance between the Alignment Sleeve and corresponding bore in wheelcase in about six different positions - the clearance should be equal the whole way round, if not, centralise wheelcase as necessary.

NOTE: The diameter of the bore in the wheelcase is, 2.4375" + .002 (61.91 m/m). The outside diameter of the Alignment Sleeve (both ends) is 2.435" - .001 (61.85 m/m). The outer diameter of the Acme oil return thread on the fan pulley is 2.425" - .002 (61.6 m/m).

d) Progressively tighten the three close fitting bolts (if fitted, see paragraph 4, sub-paragraph x) and then tighten setscrews and remaining nuts and re-check clearance. Remove the Alignment Sleeve.
NOTE: If tapered dowels were previously fitted, these should be tapped back into position from wheelcase side.

(ii ) Refit the fan pulley and the starting dog and lock.

NOTE IMPORTANT: If the serrations of the star locking plate (15), do not coincide with the hexagon of the starting dog (11) when assembled, the cap nut (16) should be hammered up. On no account should the nut or dog be slackened back in order to fit the locking plate.

(iii) Check the ignition timing and reset if found necessary. (Refer to Service Bulletin No. BB-77, Section 'E').

(iv ) Refit the radiator and reset the inlet rocker clearance on No.1 cylinder to .006" With the engine fully warmed up, inspect that there are no oil leakages from the wheelcase and also no coolant leakages.

"BENCH" TYPE.

11. DESCRIPTION:

For the description, refer to paragraph 1. It will be observed upon reference to Fig. 28, that in order to remove the serrated nut(14) retaining the spring drive to the crankshaft, it is not necessary to first remove the front damper wheel (2) as in the case of the "Wraith" type. The serrated nut is exposed by removing the hub (23) secured by four nuts.

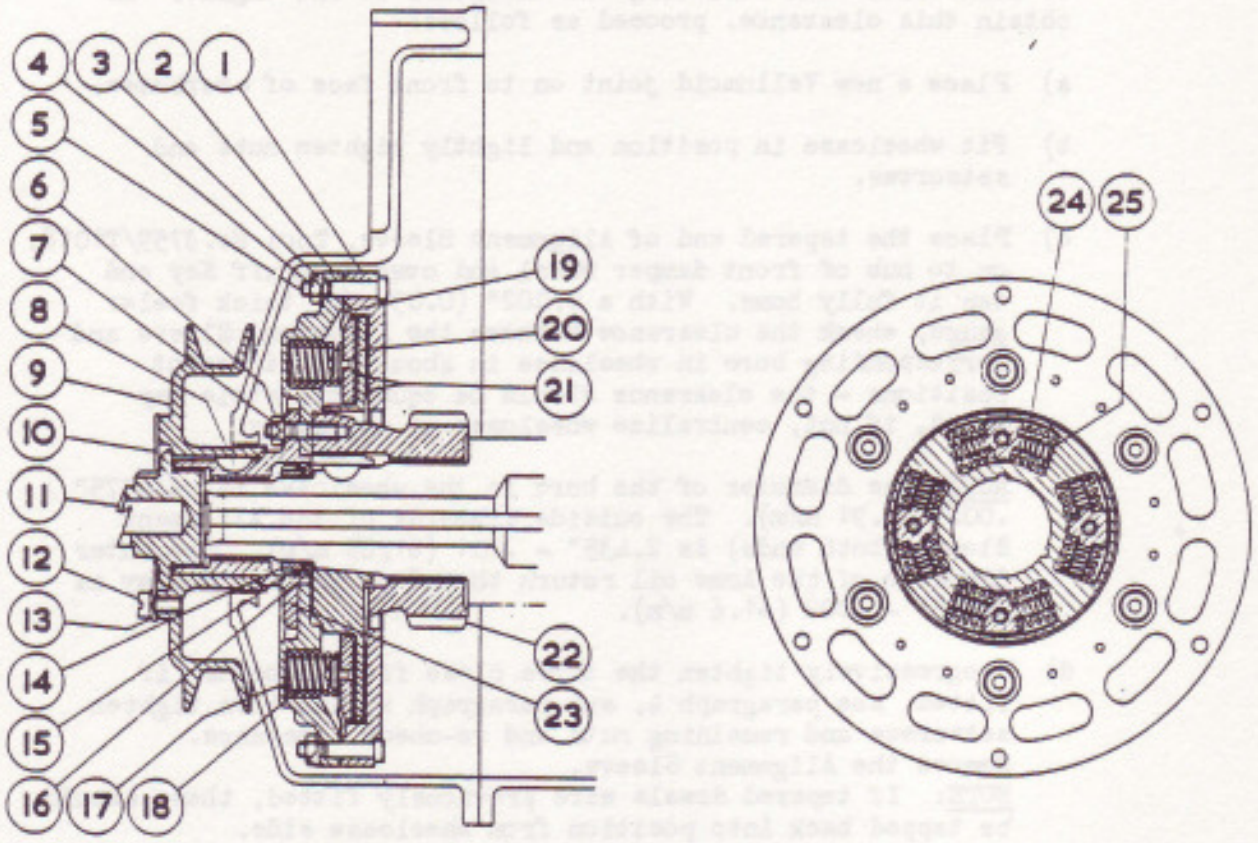



FIG. 28. SECTION - SPRING DRIVE ("BENCH" TYPE).

1. Damper Wheel (Rear)
2. Damper Wheel (Front)
3. Lock Washer.
4. Nut.
5. Bolt.
6. Tab Washer.
7. Nut.
8. Woodruff Key.
9. Pulley.
10. Locking Plate.
11. Starting Dog.
12. Screw.
13. Spring Washer.
14. Nut (Serrated)
15. Locking Washer.
16. Plain Washer.
17. Washer (Adjusting)
18. Damper Spring.
19. Presser Plate Assembly.
20. Friction Drum.
21. Friction Washer (2 Off)
22. Crankshaft Pinion Assembly.
23. Hub.
24. Driving Spring (outer.)
25. Driving Spring (inner.)

12. DERANGEMENT OF THE DAMPER - REASONS & SYMPTOMS:

Refer to paragraph 2.

13. TOOLS (SPECIAL) REQUIRED:

Refer to paragraph 3.

14. WHEELCASE (TIMING COVER) - TO REMOVE. (ENGINE IN FRAME)

(i ) Remove radiator (See Section N, Sub-section EN-5) and fan belt.

(ii ) Remove star locking plate (10 Figs. 28 & 29) from fan pulley.

(iii) With box spanner 1649/T3, unscrew starting dog (11) from hub (23) and pull off the fan pulley - if necessary, ease it back with two small levers.

(iv ) Remove fan, engine front support arch and wheelcase, as described in paragraph 4, sub-paragraphs (iv) to (x).

(v ) Remove the four nuts (7 Fig. 28) and withdraw hub.

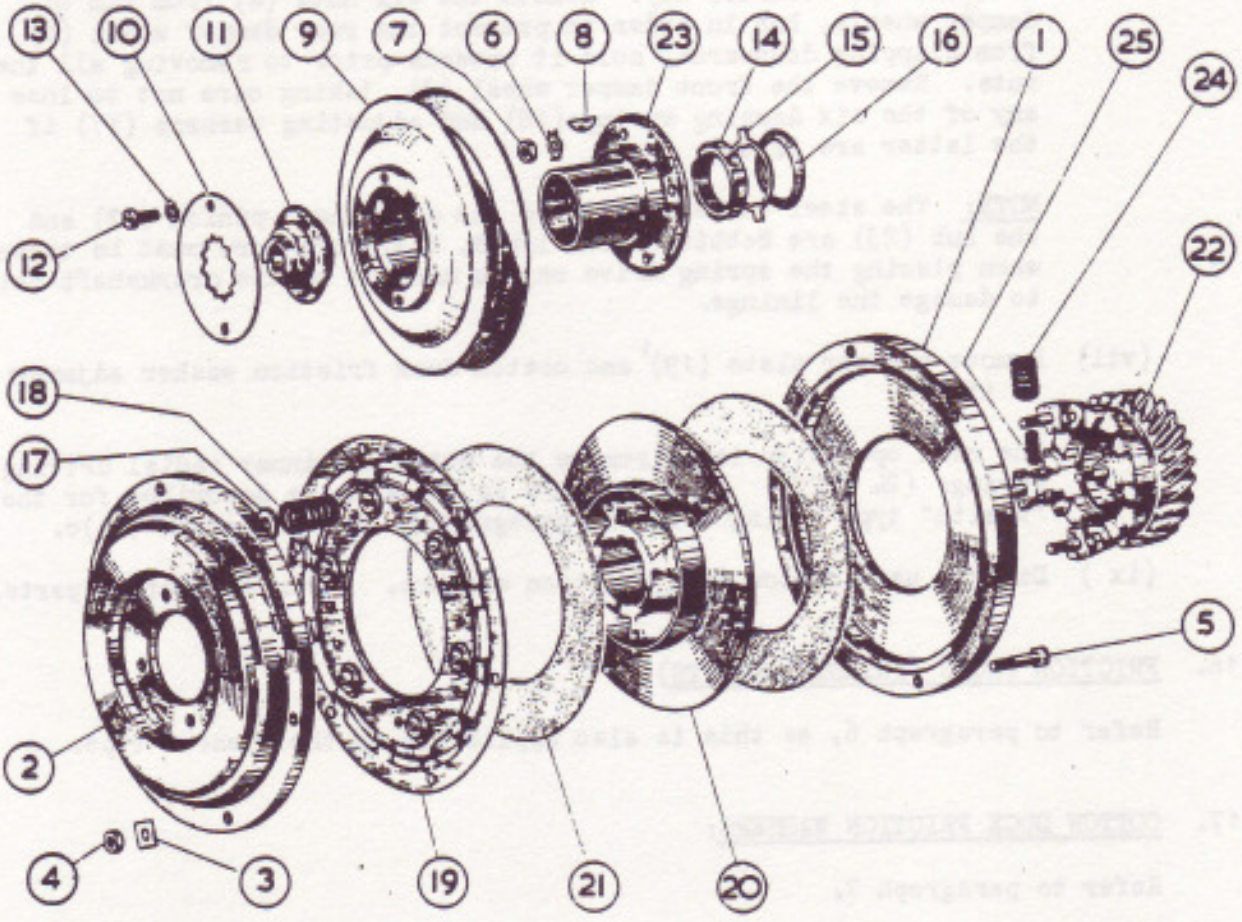



FIG. 29. EXPLODED VIEW - DRIVE ("BENCH" TYPE).

15. SPRING DRIVE - TO REMOVE FROM CRANKSHAFT:

(i ) Before removing the Spring Drive, it will be advisable to check and note the valve timing as described in paragraph 5, sub-paragraph (i).

(ii ) Bend back tabs of lockwasher (15 Fig.28), and with the serrated spanner 3759/T1007, remove nut 14, (R.H. thread) from crankshaft. Remove the plain washer (16).

(iii) Mark crankshaft pinion and camshaft gear wheel as described under "NOTE" in paragraph 5.

(iv ) Attach the extractor 1617/T1003, to the four hub studs and withdraw spring drive from Crankshaft.

(v ) Place the mandril 1617/F1005, in a vice and firmly secure. Make sure that the mandril is clean and free from damage marks.

(vi ) Carefully place the spring drive on the mandril (see "NOTE" below) and over the Woodruff key. Remove the six nuts (4) from rim of damper wheels, but in order to prevent the rear damper wheel (1) from slipping downwards, hold it upwards prior to removing all the nuts. Remove the front damper wheel (2), taking care not to lose any of the six damping springs(18) and adjusting washers (17) if the latter are fitted.

NOTE: The steel bushes fitted to the crankshaft pinion (22) and the hub (23) are Babbitt metal lined, therefore care must be taken when placing the spring drive on the mandril or the crankshaft not to damage the linings.

(vii) Remove presser plate (19) and cotton duck friction washer adjacent to it.

(viii) The next operation is to remove the outer and inner radial driving springs (24 & 25). The procedure is the same as described for the "Wraith" type spring drive in paragraph 5, sub-paragraph (vi)c.

(ix ) Discard used cotton duck friction washers. Clean dismantled parts.

16. FRICTION FACES (GRINDING LIMITS):

Refer to paragraph 6, as this is also applicable to the "Bench" type.

17. COTTON DUCK FRICTION WASHERS:

Refer to paragraph 7.

18. PREPARATION OF NEW FRICTION WASHERS PRIOR TO FINAL ASSEMBLY & SETTING THE DAMPER FOUNDAGE. (SLIPPING LOAD)

NOTE: The following parts are stamped with a co-relation mark '0', and on assembly, all these marks should coincide.
Crankshaft Pinion Assembly (22 Fig.29), Rear Damper Wheel (1), Friction Drum (20), Spring Plate (19), Front Damper Wheel (2) and Hub (23).
The recommended slipping load of the damper wheels is 14-lbs. + 1-lb. (6.35 Kgs) applied at a radial distance of 17½" (44.45 cms). The load is checked with the spring drive assembled, but less the driving springs (24 & 25 Fig. 28).

The procedure of preparing, fitting and ironing the friction washers and the checking of the damper slipping load is basically the same as paragraph 8. Note should be taken of the fact that it will be necessary to temporarily fit the hub (23 Fig.28) securing it with two nuts placed diametrically opposite to one another prior to ironing the washers and the subsequent checking of the slipping load.

19. TO REFIT THE SPRING DRIVE & CHECK THE VALVE TIMING:

(i ) Fit the spring drive to the crankshaft as described in Service Bulletin No.BB-91 "Valve Timing" (Section E) and check the valve timing.

(ii ) After finally tightening up and locking the large serrated nut(14), refit the hub (23), making sure that the co-relation marks on the front damper wheel and hub coincide. Tighten up the hub nuts first and then the rim nuts and lock.

20. TO ALIGN & REFIT THE WHEELCASE & THE REMAINING DISMANTLED PARTS:

NOTE: Prior to refitting the wheelcase, inspect that all nuts etc. are correctly locked.

(i ) Refer to paragraph 10, Sub-paragraph i, as this is also applicable to the "Bench" type with the exception of the positioning of the Alignment Sleeve 3759/T1018, which should be reversed, i.e. the non-tapered end should be placed on the hub.

(ii ) Refit the fan pulley and the starting dog and lock.

NOTE IMPORTANT: If the serrations of the star locking plate (10) do not coincide with the hexagon of the starting dog (11) when assembled, the starting dog should be hammered up. On no account, should the dog be slackened back in order to fit the locking plate.

(iii) Check the ignition timing and reset if found necessary. (Refer to Service Bulletin No.BB-77, Section 'E').

(iv ) Refit the radiator and reset the inlet rocker clearance on No.1 cylinder to .006". With the engine fully warmed up, inspect that there are no oil leakages from the wheelcase and also no coolant leakages.