LUBRICATION SYSTEM

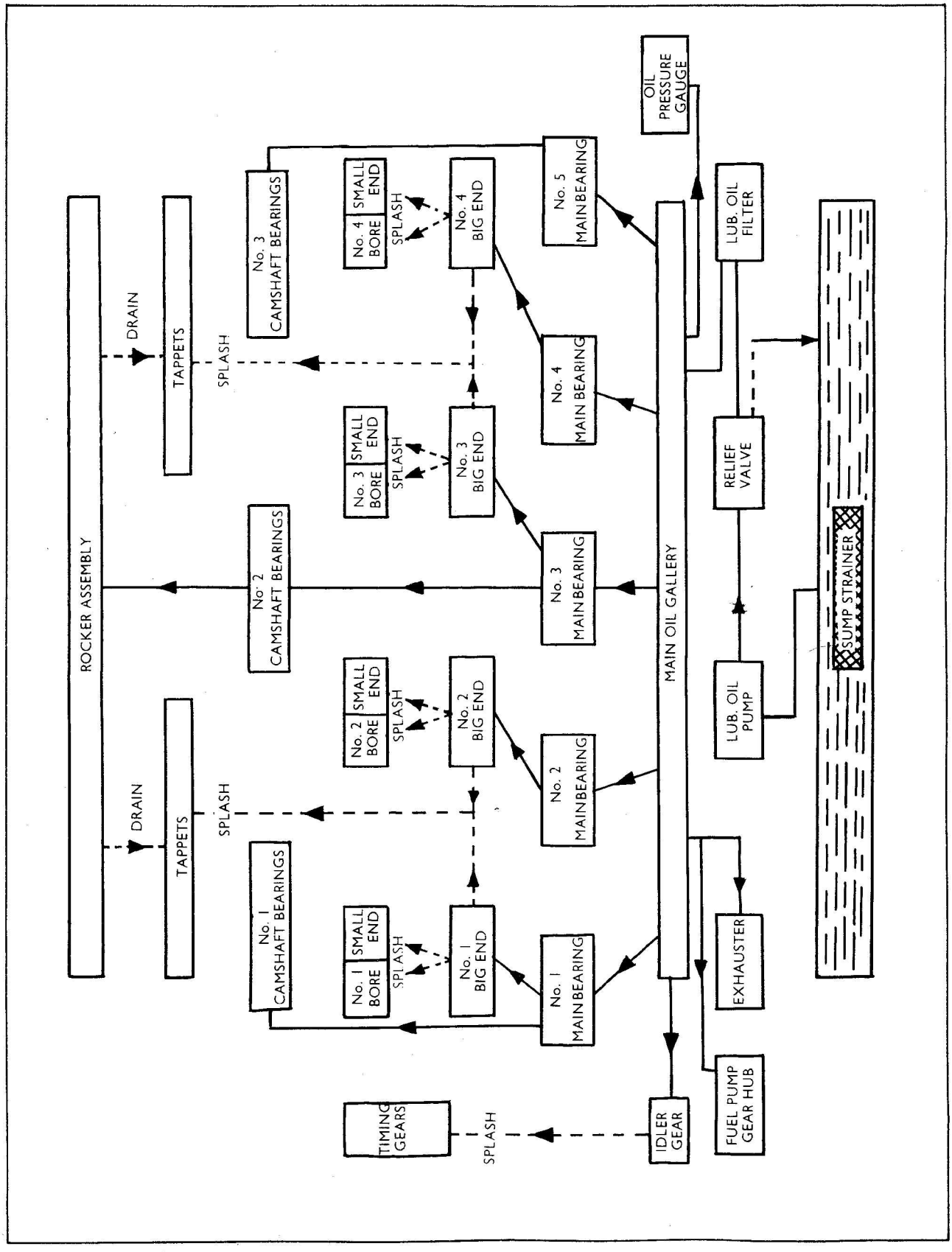

Fig. 1

The importance of correct and clean lubrication cannot be stressed too highly and all reference to engine oil should be taken to mean lubricating oil which fails within the specification given in the appendix. Care should be taken that the oil chosen is that specified for the climatic conditions under which the engine is operated.

Description

The lubrication is of the forced feed type, the oil being circulated by a lobed rotor type oil pump driven through an idler gear by the crankshaft gear or by a gear type oil pump driven from the rear of the balance unit (when fitted). The oil is drawn through a sump strainer to the pump. Oil is then pumped to the relief valve housing and the full flow filter.

Oil passes through the filter to the pressure rail.

From the pressure rail the oil is fed to the main bearings and big ends. A seal prevents oil leaking along the crankshaft at the rear end.

The camshaft bearings are lubricated from numbers one, three and five main bearings.

The camshaft centre bearing supplies a controlled feed of oil to the rocker shaft assembly. This is achieved by allowing oil to be forced to the rocker shaft only when the oilways in the camshaft journal and camshaft centre bearing are in line. Oil from the rocker shaft escapes through a small bleed hole in each rocker lever and lubricates the valves and guides by splash.

The idler gear and hub are pressure lubricated direct from the pressure rail. Oil enters the rear of the hub and passes through drillings to lubricate the idler gear bush and gear retaining plate. Where hydraulically governed pumps are fitted the fuel pump hub is also pressure lubricated from the pressure rail (Fig. 12). Timing gear teeth are splash lubricated by surplus oil from the front camshaft bearing idler gear hub and fuel pump hub.

Pistons, cylinder liners and connecting rod small end bearings are lubricated by splash and oil mist, also the cams and tappets of the valve mechanism.

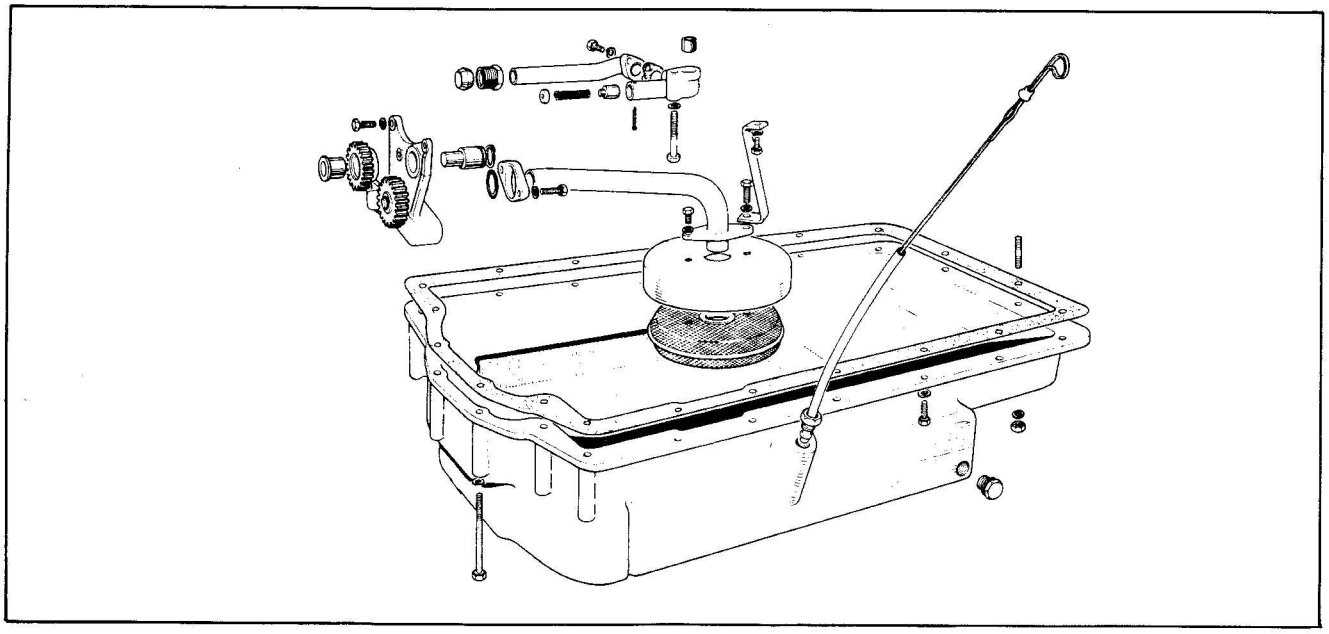

Fig. 2 *On later engines, the sump strainer cover is fitted on the upper side of the suction pipe flange (see Fig. 3)*

The Oil Pump

The oil pump is secured to the front main bearing cap by three setscrews.

The oil pump gear is driven through a bushed idler gear.

The oil pump drive gear is pressed and keyed on to the pump driven shaft on the other end of which is pressed and pinned a three of four lobed rotor. This rotor meshes with a four or five lobed driven rotor, which is free to rotate in the cast iron pump body.

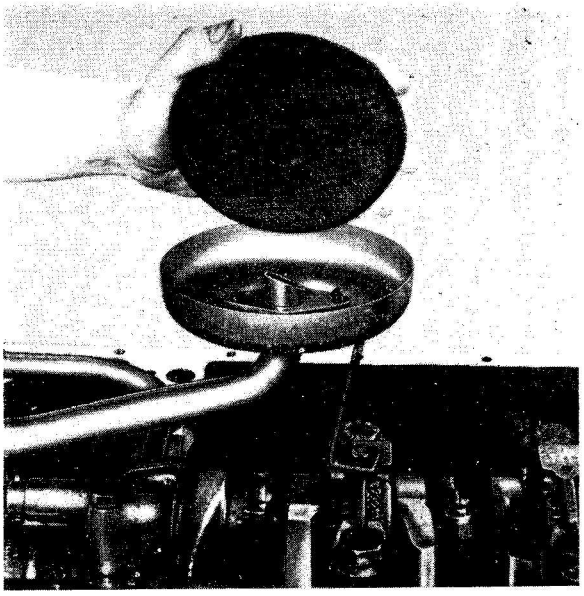

Fig. 3

To Remove the Oil Pump

1. Remove the sump.
2. Remove the strainer (Figs. 3 and 4).
3. Remove the suction pipe.
4. Remove the oil delivery pipe between the pump and relief valve housing.
5. Remove the crankshaft pulley, timing case front cover, timing gears and timing case.
6. Remove the idler gear circlip and idler gear (Figs. 5 and 6).
7. Remove the three setscrews securing the pump to No. 1 main bearing cap and withdraw the pump from the cap (Fig. 7).

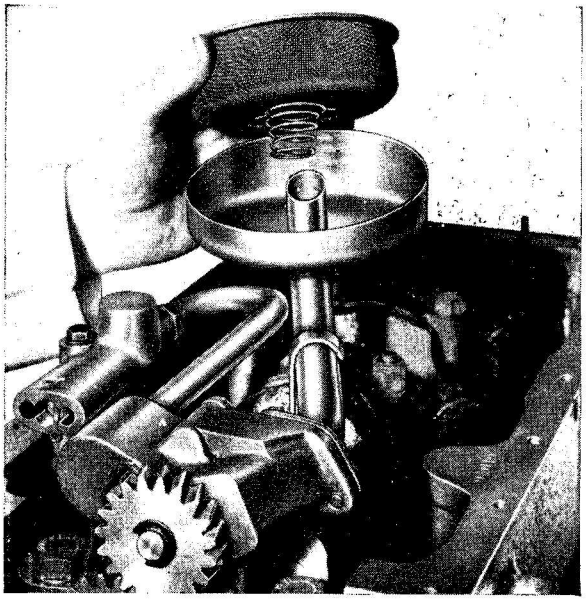

Fig. 4

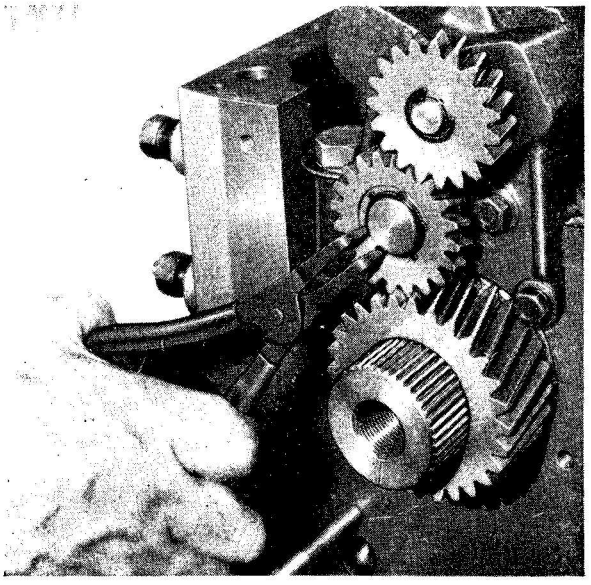

Fig. 5

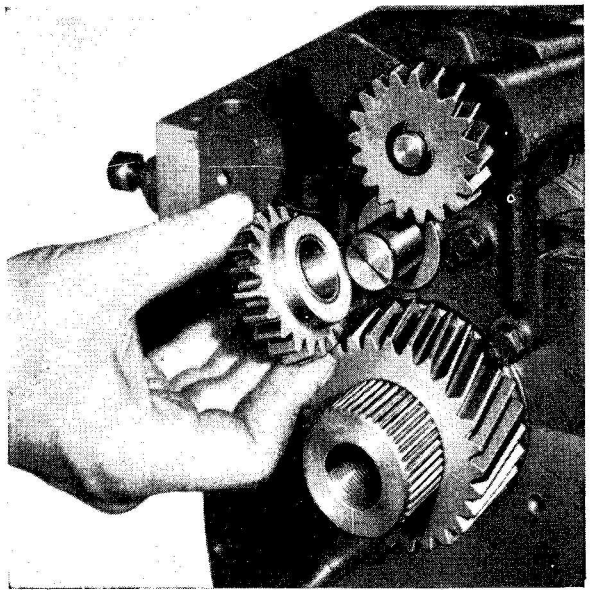

Fig. 6

To Dismantle the Oil Pump

1. Remove the oil pump drive gear retaining circlip and the drive gear.

2. Remove the key from the keyway of the drive shaft.

3. Remove the end plate.

4. Remove the drive and driven rotors from the pump body.

5. Remove the "O" sealing ring from the pump body (Fig. 8).

Inspection

1. Examine all parts for signs of cracking, wear or corrosion.

2. Install the inner and outer rotors in the pump body. The chamfered edge of the outer rotor enters the pump body first.

3. The clearances of a new pump are given and are checked as shown in Figs. 9, 10 and 11.

Note: Should an oil pump be worn to such an extent it adversely affects the working pressure, a replacement pump should be fitted. Parts of the pump are not supplied individually.

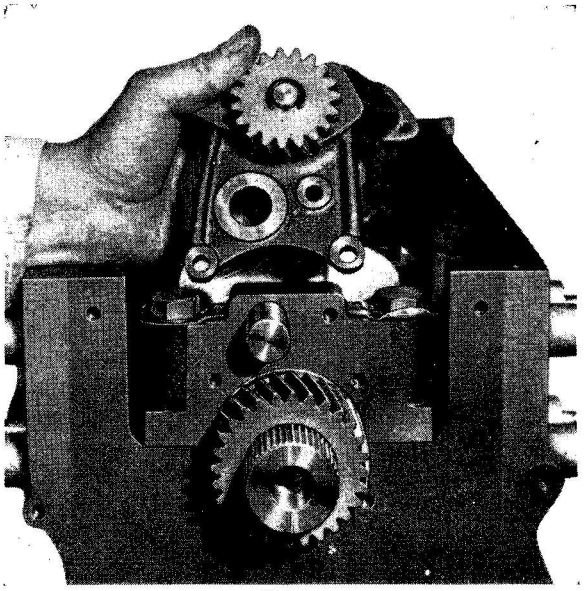

Fig. 7

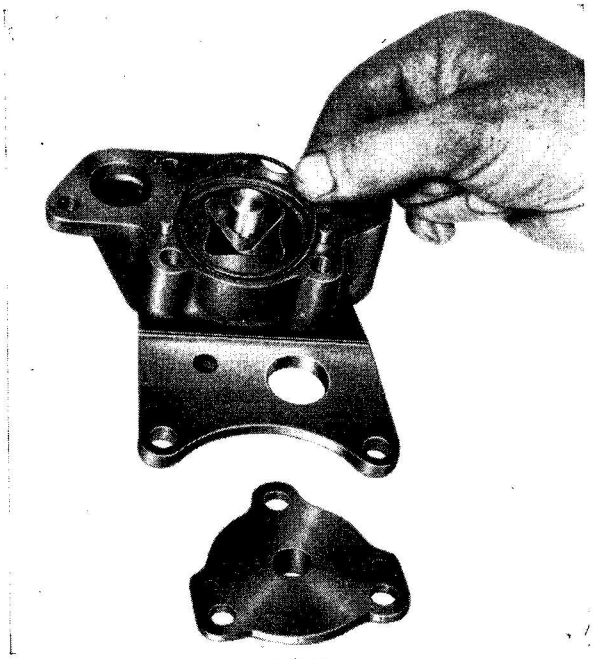

Fig. 8

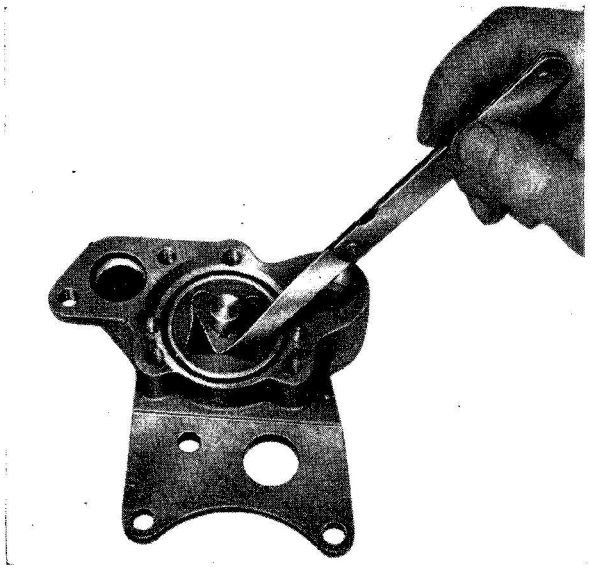

Fig. 9

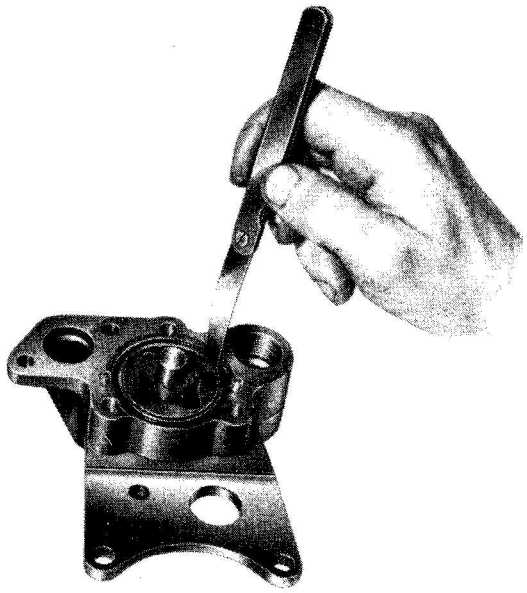

Fig. 10

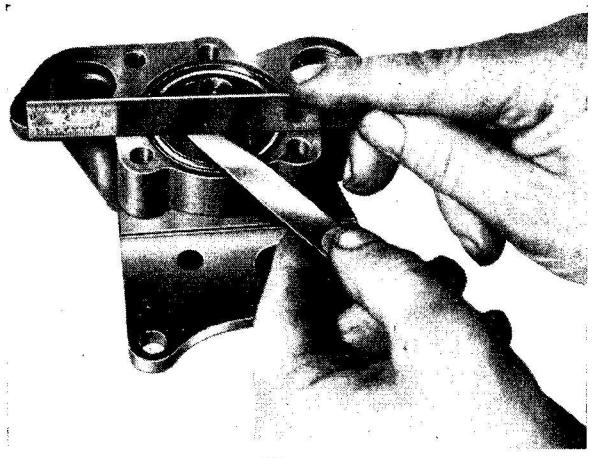

Fig. 11

To Assemble the Oil Pump

1. Fit the drive and driven rotors to the pump body entering the chamfered end of the outer rotor to the body first. Refit end plate using a new "O" sealing ring.

2. Refit the key in the keyway of the drive shaft and refit the drive gear to the shaft. With earlier pumps, the boss on the drive gear was positioned towards the rear of the gear, the flat face of the gear being towards the circlip groove. The correct clearance for the gear was 0,08/0,18 mm(0.003/0.007 in) between the rear face of the gear and the pump body.

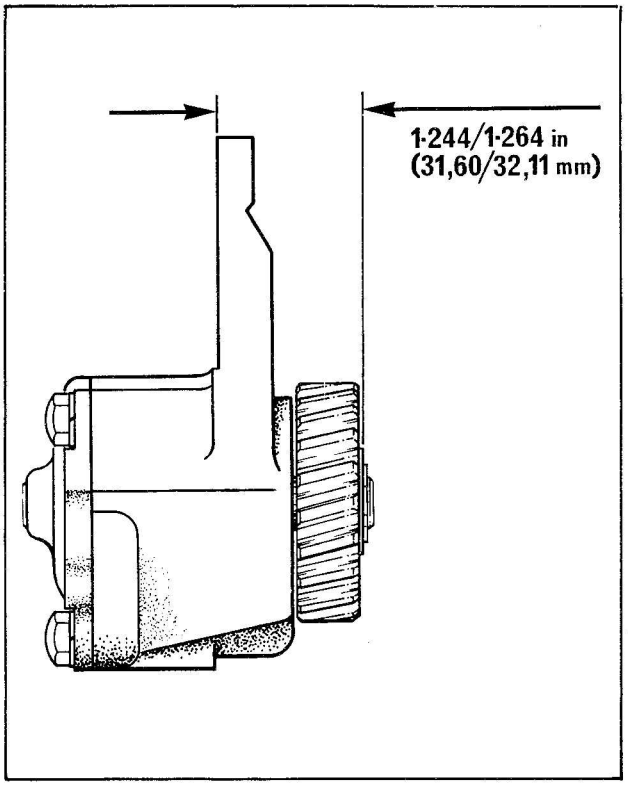

Fig. 12

With current pumps, the boss on the gear is positioned on the front of the gear towards the circlip groove and the correct clearance for the gear is 31,60/32,11 mm (1.244/1.264 in) when measured from the front face of the gear box to the rear face of the pump mounting flange as shown in Fig. 12.

3. Fit the drive gear retaining circlip. Prime the pump with clean engine lubricating oil before fitting to the engine.

To Refit the Oil Pump

1. Fit the oil pump to No. 1 main bearing cap.

2. Refit the idler gear to the shaft with the recessed face towards the front and secure with the circlip. Check the idler gear end float which should be 0,05/0,41 mm (0.002/0.016 in). Check the backlash between oil pump gear and idler gear which should be 0,15/0,23 mm (0.006/0.009 in), Fig. 13.

3. Refit timing case, timing gears, timing case front cover and crankshaft pulley.

4. Refit the oil delivery pipe between the oil pump and pressure relief valve housing.

5. Refit the suction pipe to the oil pump.

6. Fit the sump strainer to the pump suction pipe, and refit the sump to the engine. Refill the sump with oil of an approved grade. Before starting, crank the engine over using the starter motor with the stop control out until oil pressure is indicated.

Oil Pressure Relief Valve

The oil pressure relief valve is contained in a housing bolted to the bottom face of the cylinder block and is set to operate at 3,52/4,22 kgf/cm^2 (50/60 lbf/in^2).

To Remove and Dismantle the Relief Valve Assembly

1. Remove the sump.

2. Disconnect the oil pump delivery pipe at the relief valve end.

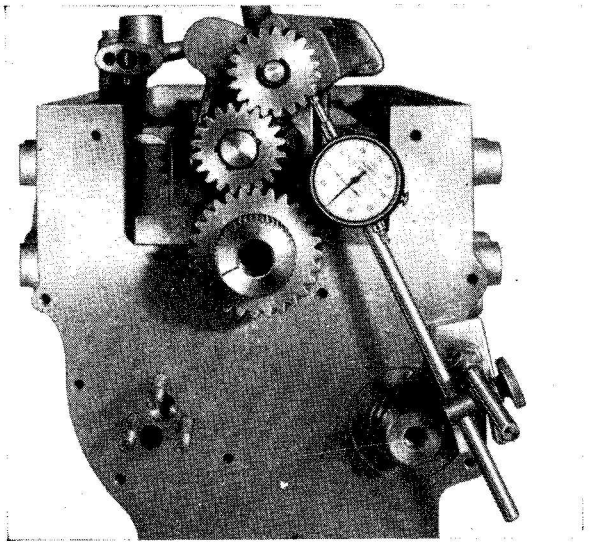

Fig. 13

3. Remove the relief valve housng, later type (Fig. 14).

4. Remove the splitpin from the end of the relief valve housing and withdraw the cap, spring and plunger (Fig. 15).

5. Thoroughly clean all parts and inspect them for wear or damage.

To Assemble and Refit the Relief Valve Assembly

1. Fit the plunger, spring and cap to the relief valve housing and secure with the split pin.

2. If possible, check the pressure setting of the relief valve. If not, extreme caution is advised when starting the engine until it is certain that the pressure relief valve is working correctly.

3. Refit the relief valve housing to the cylinder block. (Fig. 16 illustrates early type arrangement.)

4. Connect the oil pump delivery pipe to the relief valve housing.

5. Ensure that the sump strainer is correctly positioned on the oil pump suction pipe.

   Refit the sump and refill with oil of an approved grade.

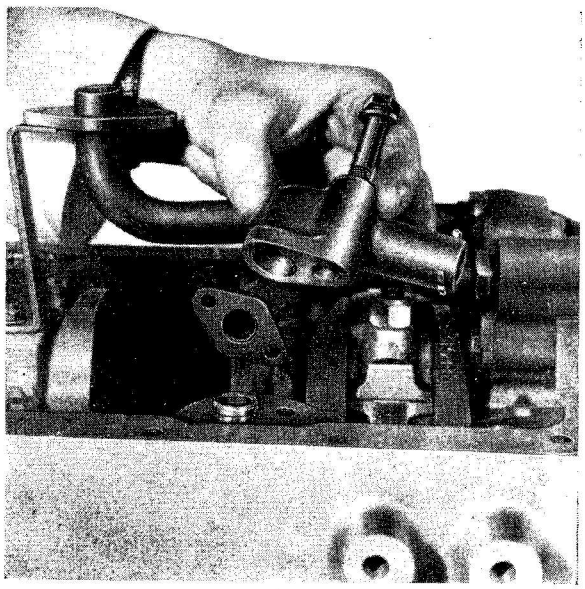

Fig. 14

Lubricating Oil Filters

A sump strainer and a full flow main filter are fitted.

The main oil filter is mounted on the side of the cylinder block. The paper element or canister should not be cleaned, but renewed at the intervals stated in the Service Schedule.

The lubricating oil filter can be fitted to either side of the engine, but it is important to note that to change the filter position necessitates removal of the sump and changing the lubricating oil pump feed to the opposite side of the cylinder block. A different oil relief valve must also be fitted. Where a balance unit is fitted, then this must also be changed and an adaptor plate fitted in the old filter position as all these modifications are ncessary to permit delivery of lubricating oil to the working parts of the engine.

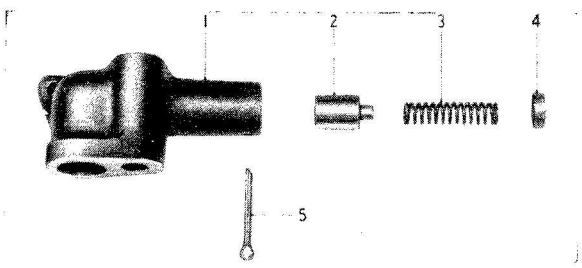

Fig. 15
1. RELIEF VALVE BODY
2. PLUNGER
3. SPRING
4. SPRING RETAINING CAP
5. SPLIT PIN

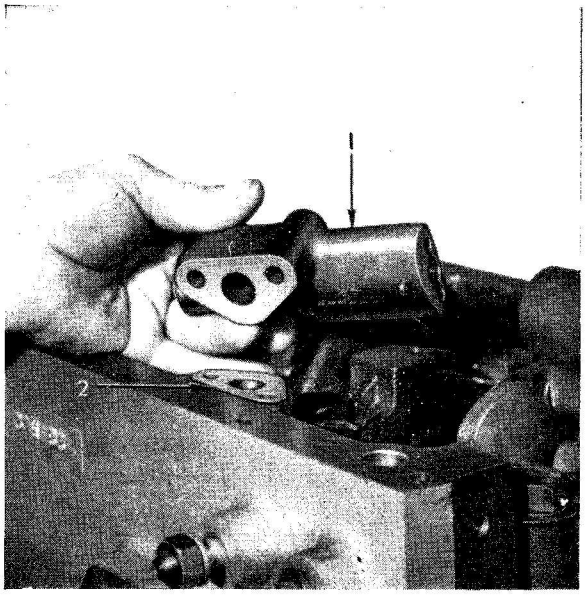

Fig. 16
1. OIL RELIEF VALVE
2. JOINT

Fig. 17

To Change the Filter Element

1. Remove filter bowl (Figs. 17 and 18).

2. Remove the old element and clean out the container.

3. Part fill the container with new oil and fit the new element so that it locates correctly on the spring loaded guide in the base of the container.

4. Fit the new container seal in the filter head.

5. Offer up the container and element assembly to the filter head ensuring a correct seating in the filter head and secure to a torque of 2,1/2,8 kgf m (15/20 lbf ft).

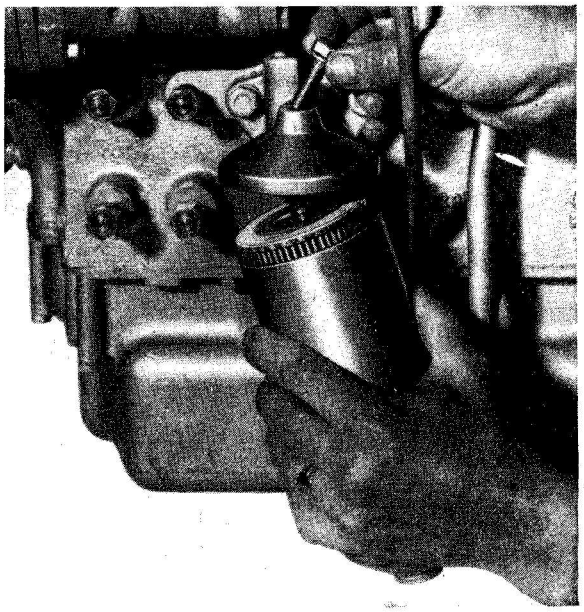

Fig. 18

To Renew Screw Type Oil Filter Canister

1. Unscrew filter canister from filter head (Fig. 19).

2. Discard old canister.

3. Clean filter head

4. Using clean engine oil, liberally oil top seal of replacement canister.

5. Fill canister with clean lubricating oil allowing time for the oil to filter through the element. Screw replacement canister onto filter head until seal just touches head and then tighten as per instructions on canister. Where a tool is available, tighten to 20 Nm (15 lbf ft).

6. Run engine and check for leaks.

Fig. 19

To Remove and Replace Oil Filter Assembly

Withdraw the two setscrews securing the filter to the cylinder block and remove the filter assembly. Refit with new joint and torque setscrews to 3,6/4,2 kgf m (26/30 lbf ft).

Check the sump level after running the engine and top up as necessary.