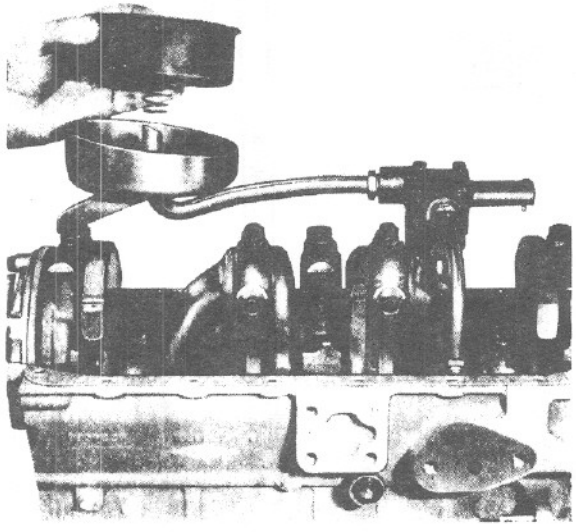
SECTION M
Lubrication System



M1

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

THE LUBRICATING OIL PUMP

The oil pump fits into a machined bore in the clyinder block and is located by means of a screw locked by a tab washer. (Refer to No. 24 "Index to Engine Photographs" for its location).
The oil pump is driven through spiral gears from the camshaft, on the other end of the drive shaft is pressed and pinned a four lobed rotor. This rotor meshes with and drives a five lobed rotor which is free to rotate within the cast iron pump body.

To Remove the Sump

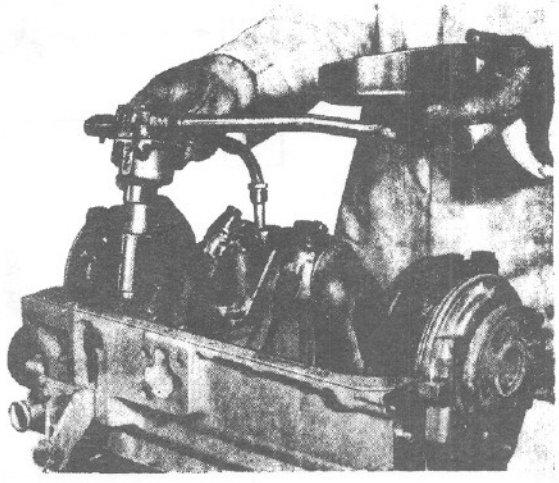
1. Remove the sump drain plug and drain the oil.
2. Remove the dipstick, sump securing setscrews and remove the sump.

To Refit the Sump

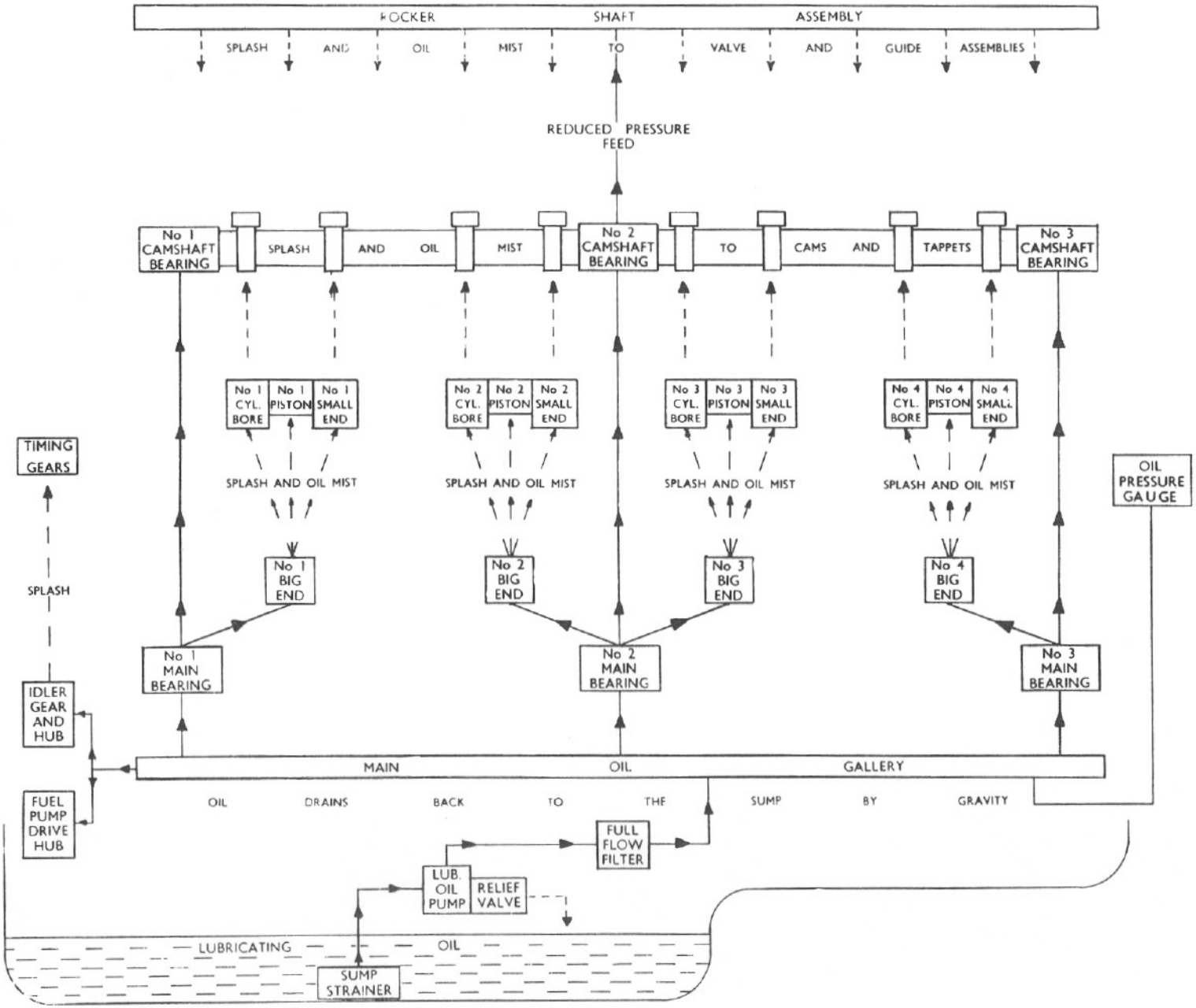
1. Lightly apply a coating of a suitable jointing compound to the crankcase and sump faces, position the joints so that all the holes align.
   NOTE : When the joints are being placed in position it is important that the mitred ends go right up into the recesses in the front and rear main bearing caps.
2. Lightly apply a coating of jointing compound to the cork strips, then press these strips into the grooves provided in the main bearing caps.
3. Place the sump in position and fit all the retaining setscrews, tighten evenly.
4. Replace the dipstick and sump drain plug, then refill with clean new oil of an approved grade to the correct level. Do not overfill.

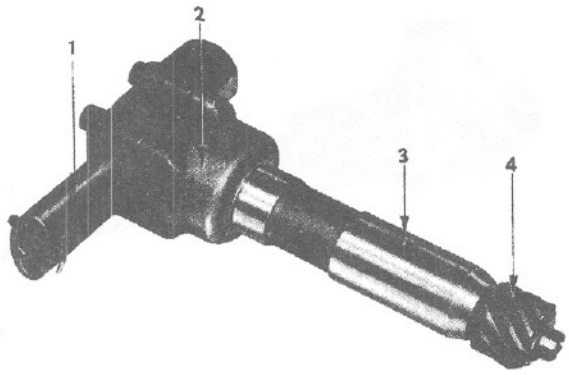
To Remove the Oil Pump

1. Drain the engine oil and remove sump.
2. Remove the strainer from the end of the lubricating oil suction pipe. (Refer to Fig. M.1).
3. Unscrew the delivery pipe securing nut to the cylinder block and the setscrew securing the suction pipe assembly to the rear main bearing cap.



M2


ROCKER SHAFT ASSEMBLY
SPLASH AND OIL MIST TO VALVE AND GUIDE ASSEMBLIES
REDUCED PRESSURE FEED
No 1 CAMSHAFT BEARING
SPLASH AND OIL MIST
No 2 CAMSHAFT BEARING
TO CAMS AND TAPPETS
No 3 CAMSHAFT BEARING
No 1 CYL. BORE
No 1 PISTON
No 1 SMALL END
No 2 CYL. BORE
No 2 PISTON
No 2 SMALL END
No 3 CYL. BORE
No 3 PISTON
No 3 SMALL END
No 4 CYL. BORE
No 4 PISTON
No 4 SMALL END
SPLASH AND OIL MIST
TIMING GEARS
OIL PRESSURE GAUGE
SPLASH
No 1 BIG END
No 2 BIG END
No 3 BIG END
No 4 BIG END
No 1 MAIN BEARING
No 2 MAIN BEARING
No 3 MAIN BEARING
IDLER GEAR AND HUB
MAIN OIL GALLERY
FUEL PUMP DRIVE HUB
OIL DRAINS BACK TO THE SUMP BY GRAVITY
FULL FLOW FILTER
LUB. OIL PUMP
RELIEF VALVE
LUBRICATING OIL
SUMP STRAINER



M4

1. Relief Valve Housing
2. Rotor Housing
3. Hole for Locating Screw
4. Pump Drive Gear

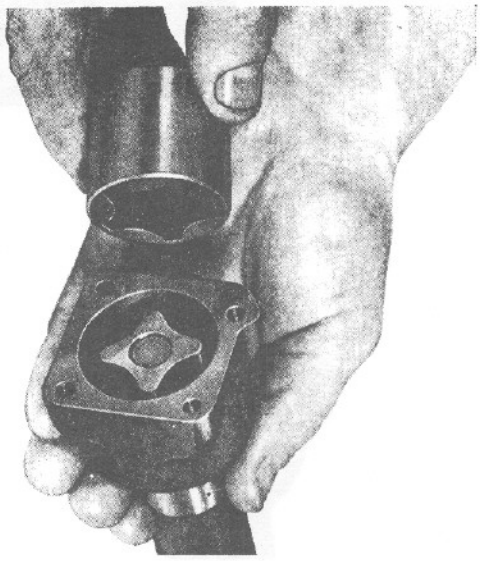
4. Tap back the tab washer locking the location screw and support the lubricating oil pump assembly (if the engine is the normal way up), whilst the locating screw is removed.
5. Remove the lubricating oil pump assembly from the cylinder block as shown in Fig. M.2.

To Dismantle the Oil Pump

1. Remove the delivery and suction pipes. The pump will now be as shown in Fig. M.4.
2. Withdraw the drive gear by means of a suitable puller.
3. With the pump suitably held in a vice, (using protective clamps) remove the four securing setscrews and remove the end cover assembly.
   N.B. This end cover assembly also incorporates the pressure relief valve housing.
4. Withdraw the drive shaft complete with inner rotor.
   N.B. It is advisable not to remove this inner rotor from the shaft as this item is not available as a separate part (See later note).
5. Withdraw the outer rotor.

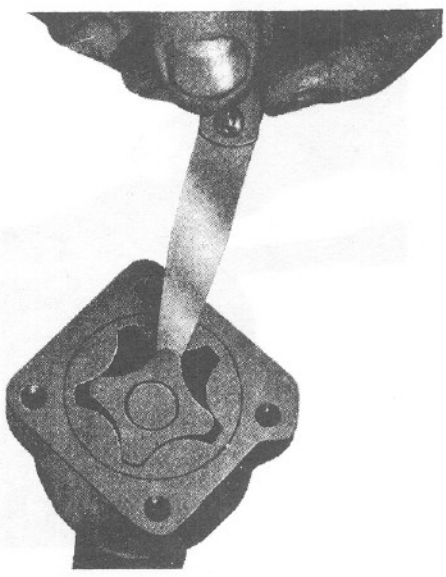
Inspection

1. Inspect for signs of wear, cracks, pitting, etc.

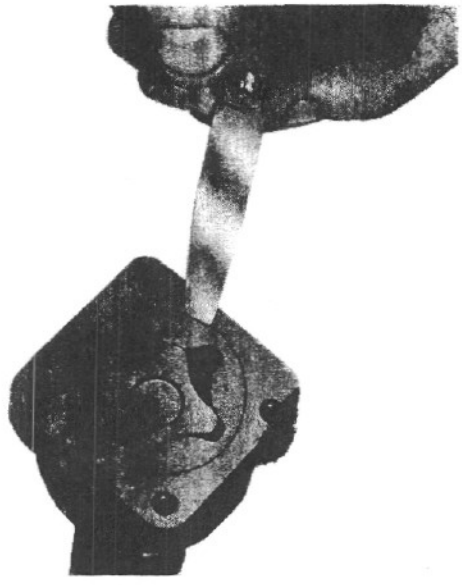


M5

2. Install the drive shaft complete with inner rotor, then the outer (driven) rotor ensuring that the face which carries the chamfered edge enters the pump body first (Refer Fig. M.5), now carry out the three following dimensional checks.
   (a) Check the clearance between the inner and outer rotors. (Refer Fig. M.6).
   (b) Check the clearance between the outer rotor and the pump body (Refer Fig. M.7).
   (c) Check the clearance between the rotors and the end cover assembly using a straight edge and feeler gauges (Refer Fig. M.8).



M6

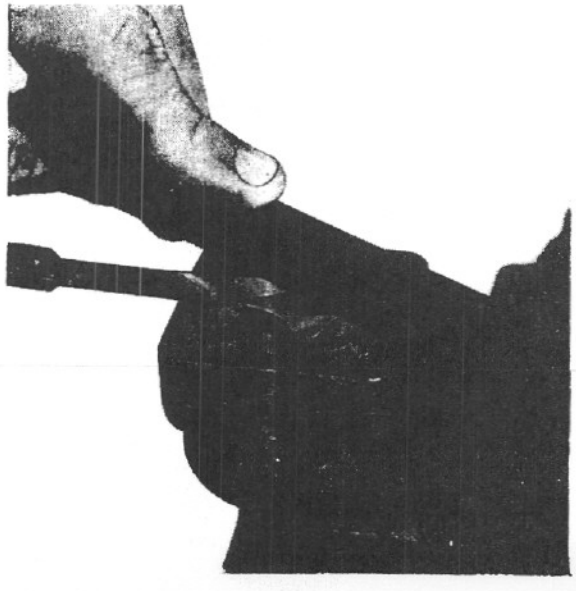


M7

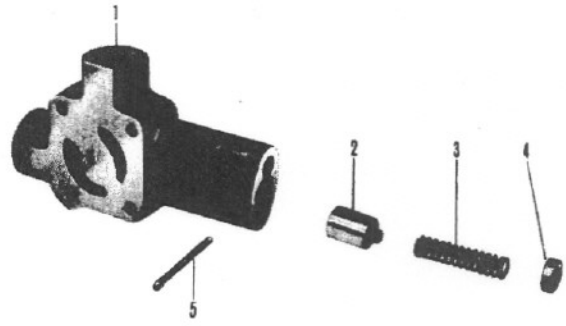
NOTE: The relevant clearances for these dimensional checks are given on Page B.10, they are the clearances applicable to a new pump and are intended to be used as a guide. Should a lubricating oil pump be worn to such an extent that it adversely effects the working oil pressure, then a replacement pump should be obtained.

To Re-Assemble the Oil Pump

1. Insert the outer rotor ensuring that the face which carries the chamfered edge enters the pump body first. (Refer Fig. M.5).



M8



M9

1. Outlet to Main Oil Filter
2. Relief Valve Plunger
3. Plunger Spring
4. Spring Cap
5. Retaining Splitpin

2. Insert the drive shaft complete with inner rotor into the pump body.
3. Replace the end cover assembly and fit the four securing setscrews. Ensure correct positioning so that the suction and delivery pipes will locate correctly.
4. Press the oil pump drive gear onto the shaft.
5. Finally rotate the pump by hand to ensure that it turns quite freely.

To Refit the Oil Pump

1. Refit the suction and delivery pipes, do not tighten the pipes at this stage.
2. Place the lubricating oil pump assembly in position, locate with the securing screw and lock it with the tab washer.
3. Tighten the delivery pipe at both ends, refit the setscrew securing the suction pipe assembly.
4. Tighten the suction pipe at the pump end then refit the strainer on the end of the suction pipe.
   NOTE: The strainer which fits on the end of the suction pipe should be thoroughly cleaned in suitable cleaning fluid before being refitted. It is good practise to remove this strainer and clean it thoroughly on every occasion when the sump is removed.
5. Replace the sump as previously detailed and secure with the setscrews.
6. Fill the sump to the correct level with clean oil of an approved grade.

NOTE : Caution should be exercised when restarting the engine, as it will take a moment or two for the oil pump and pipes to prime, therefore the engine speed should be kept to a minimum until either the gauge shows satisfactory pressure (where fitted) or the oil pressure warning light is extinguished.

The most satisfactory way to prime the lubricating oil pump is to motor the engine for approximately 10/20 seconds before any attempt is made to start the engine.

OIL PRESSURE RELIEF VALVE

The oil pressure relief valve is contained in a housing integral with the oil pump end cover, which is secured to the rotor housing by four setscrews. This relief valve controls the maximum oil pressure by allowing a spring loaded plunger to move and by-pass excess oil back to the sump when the pre-determined spring pressure given on page B.10 is exceeded.

To Dismantle the Oil Pressure Relief Valve

1. Drain the engine oil from the sump.
2. Remove the sump securing setscrews and carefully remove the sump.
3. Continue as for removing the oil pump as previously detailed.
4. Remove suction and delivery pipes.
5. Remove the four securing setscrews and remove the end cover assembly.
6. Remove the split pin from the end of the housing and withdraw the spring cap, spring and plunger. An exploded view of the assembly is shown in Fig. M.9.
7. Thoroughly clean the parts, inspect for wear or damage and renew if necessary.

To Re-Assemble the Oil Pressure Relief Valve

1. Replace the plunger, spring and spring cap then secure with the split pin.
2. Secure to the lubricating oil pump body by means of the four setscrews.
3. Continue as detailed for refitting the lubricating oil pump.

OIL PRESSURE

Always ensure that with the engine running, oil pressure is registering on the gauge or the oil pressure warning light is extinguished.

Pressures do vary according to climatic conditions and even between individual engines, but the oil pressure range at normal working speed and temperature is given on Page B.9. The pressure will drop whilst the engine is idling and also a slight drop will be experienced when the oil is hot, this is quite normal. If, however, the oil pressure is suspected of being too high or too low then reference to the possible faults listed under these headings given on Page D.1, may prove helpful.

LUBRICATING OIL FILTERS

To ensure cleanliness of the lubricating oil a sump strainer and a main full flow type of oil filter are fitted. The sump strainer consists of a gauze wire container which is fitted over the end of the lubricating oil pump suction pipe. All oil must pass through this strainer before it reaches the oil pump.

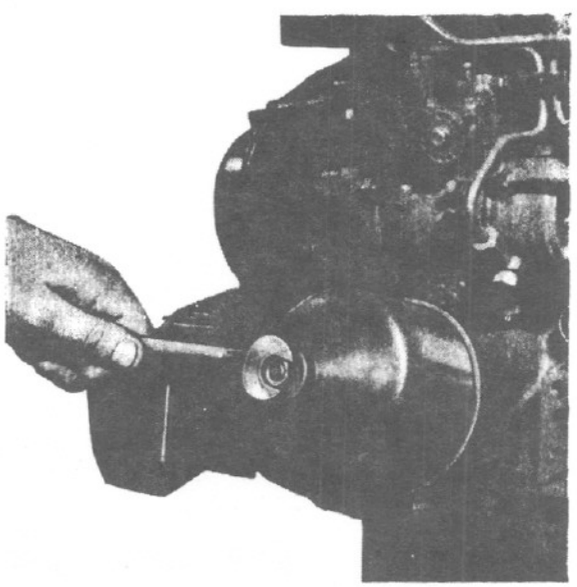
The main full flow type oil filter is mounted externally on the side of the cylinder block. All the oil passes through this filter after it leaves the pump, but before it reaches the bearings.

The full flow filter may incorporate a paper element in a bowl or a screw on canister in which the element is an integral part of the canister. At the appropriate time, as given on page C.1, the paper element or the canister should be renewed as detailed below.

To Renew the Paper Filter Element

1. Unscrew the filter bowl securing setscrew as shown in Fig. M.10.
2. Withdraw the filter bowl (Fig. M.11), remove the element and discard.
3. Clean the bowl in a suitable cleaning fluid.
4. Renew the sealing ring in the filter head, where necessary.
5. Place the new element centrally in the bowl, position the bowl and element assembly squarely and centrally on the filter head and tighten the bowl securing setscrew.
6. As the filter element will normally be changed at the same time as the engine lubricating oil, refill the sump with oil, run the engine and check for oil leaks. Recheck the oil level after running the engine and top up as necessary.

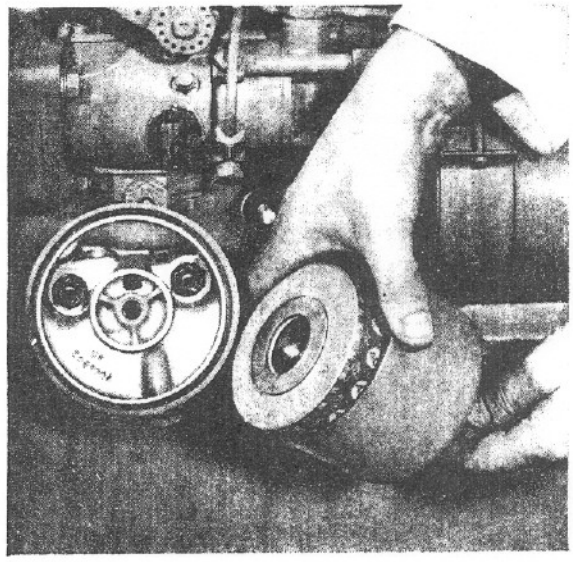
The filter bowl securing setscrew should be checked for tightness after 1000 miles (1500 km) or 24 hours running following a filter element change.



M10

To Renew the Filter Canister

1. Unscrew the canister from the filter head.
2. Check that the threaded adaptor is secure in the filter head and discard the old canister. Clean the filter head.
3. Using clean engine lubricating oil, lightly oil the top seal of the new canister.
4. Screw the new canister on to the filter head until the canister seal just touches the head and then tighten by hand a further half of a turn. If the canister is overtightened, difficulty may be experienced in its removal.
5. As the filter canister will normally be changed at the same time as the engine lubricating oil, refill the sump with oil, run the engine and check for oil leaks. Recheck the oil level after running the engine and top up as necessary.



M11

Oil Filter Assembly

In some instances the setscrews securing the filter head to the cylinder block are enclosed within the filter head and bowl assembly as shown in Fig. M.11. With this arrangement, the filter bowl has to be removed before the filter head can be detached from the block.
When fitting the filter head joint, ensure that the holes in the joint line up with the corresponding drillings in the cylinder block.

By-Pass Valve

Should the lubricating oil filter element be allowed to become contaminated to the extent where the lubricating oil has difficulty in passing through the element, then a pressure difference will build up between the inlet and outlet sides of the filter assembly. When this pressure reaches the figure given on Page B.10, a ball valve will open in the filter headcasting and allow unfiltered oil to by-pass the filter element to prevent the engine being starved of oil.