SERVICE MANUAL

CARS AND VANS

P

Part 1

ENGINE

B 18 A

Export Service Department

AKTIEBOLAGET

VOLVO

GÖTEBORG . SWEDEN

CONTENTS

PART 1

ENGINE

General

Engines with type designation B 18 A are four-cylinder, liquid-cooled overhead-valve units. This engine is fitted with a simple down-draught carburetor. The cylinder head has separate intake and outlet ports, one for each valve. The crankshaft is carried in five bearings.

The output of the engine is 75 b.h.p. (SAE), 68 b.h.p. (DIN) at 4500 r.p.m. and the torque is 101 lb.ft. (14.0 kgm) at 2800 r.p.m. (SAE) and 98 lb.ft. (13.5 kgm) at 2600 r.p.m. (DIN). The compression ratio is 8.5:1, the displacement 1.78 litres, bore 84.14 mm and stroke 80 mm.

Cylinder block

The cylinder block (29, Illustration 1) is cast in one unit, and is made of special cast-iron. The cylinder bores which are surrounded by cooling jackets are machined directly in the block. The lubricating oil drillings in the block are arranged so that the oil cleaner, which is of the fullflow type, is directly connected to the right-hand side of the block.

Cylinder head with valves.

The cylinder head (23), is attached to the block by means of bolts. All the combustion chambers are machined all over and have separate inlet and outlet ports, one for each valve.

The valves (4 and 8 Illustration 1), are of the overhead type and thus fitted in the cylinder head. The valves are made of special steel and are carried in replaceable guides.

The cooling jackets are designed so that even the surfaces round the spark plugs are cooled. The water is also distributed by means of a pipe and directed towards the warmest parts of the engine.

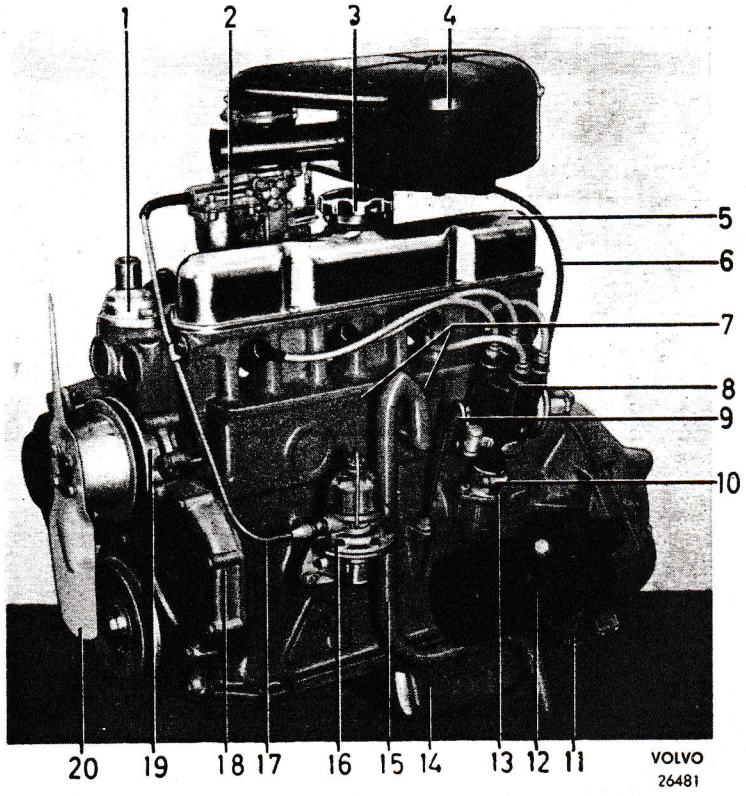

Fig. 1. The engine (distributor side)

1. Water outlet pipe
2. Carburetor
3. Oil filler cap
4. Air cleaner
5. Rocker arm casing
6. Vacuum line
7. Engine number
8. Distributor
9. Oil dipstick
10. Lock screw
11. Cover plate
12. Starter motor
13. Retainer
14. Oil pan
15. Breather pipe
16. Fuel pump
17. Fuel line
18. Timing gear casing
19. Water pump
20. Fan

Crankshaft and bearings

The crankshaft (44) is forged of steel and has ground and surface-hardened bearing journals. It is carried in five bearings, the rear bearing also functioning as a guide bearing axially. There are channels drilled through the shaft for lubricating oil.

The bearing shells, which are replaceable, consist of steel shells lined with bearing metal of indium-plated lead-bronze for the connecting rod bearings and white metal in the case of the main bearings.

Camshaft with valve lifters.

The camshaft (45) is made of special-alloy cast-iron and surface-hardened cams. It is driven from the crankshaft through a gear with a ratio of 1:2. Axial guidance is obtained by the use of an axial washer on the forward end of the shaft. The axial clearance is determined by a spacer ring behind the camshaft gear.

The valve lifters (27) are actuated directly by the camshaft. They are located in holes in the block above the shaft and transfer the movement to the valves through the medium of push rods and rocker arms. There are no inspection covers for the valve lifters since the valve lifters are accessible from the top after the cylinder head has been removed.

Connecting rods, pistons and piston rings

The connecting rods (48), of drop-forged steel, are fitted with a finely finished bushing which acts as bearing for the piston pin. The bearing shells for the connecting rod bearings are precision manufactured and replaceable.

The pistons (46) are made of light-alloy and each have two compression rings and one oil scraper ring. The upper compression ring on each piston is chromed to decrease cylinder wear.

The piston pin (50) has a floating fit in both the piston and connecting rod. The axial movements of the piston pin are limited by circlips in the piston pin hole.

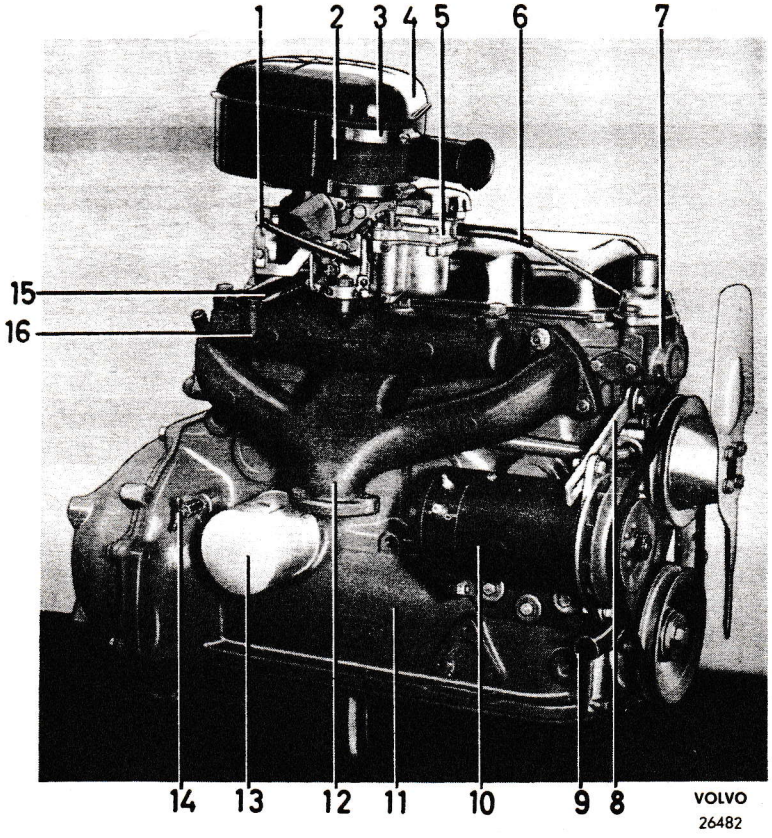

Fig. 2. The engine (carburetor side)

1. Vacuum line
2. Rubber sleeve
3. Hose clamp
4. Air cleaner
5. Carburetor
6. Fuel line
7. Cylinder head
8. Belt tensioner
9. Water inlet pipe
10. Generator
11. Cylinder block
12. Exhaust manifold
13. Oil cleaner
14. Drain cock
15. Bracket
16. Inlet manifold

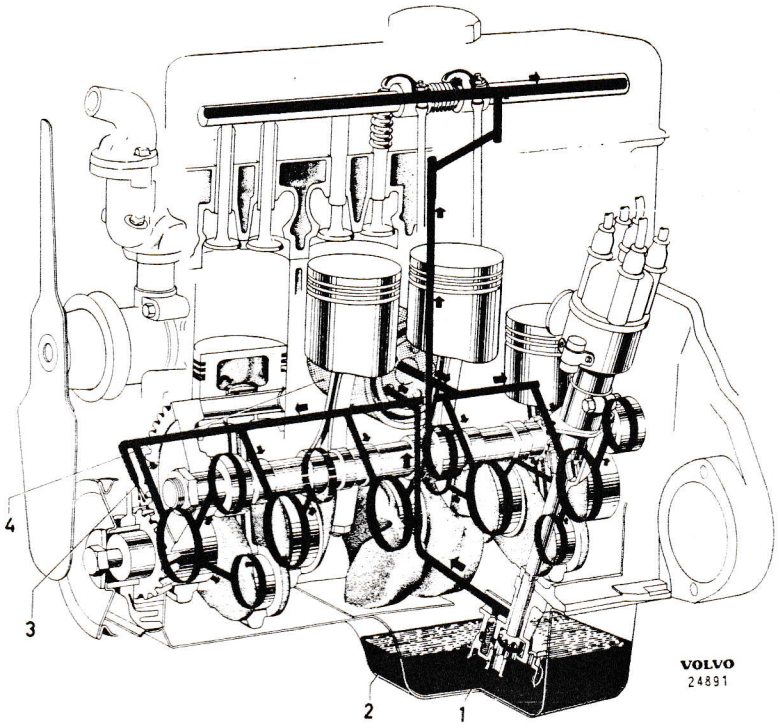

Fig. 3. Lubricating system

1. Oil pump
2. Oil pan
3. Nozzle
4. Oil cleaner

Lubricating system

The engine is lubricated with oil under pressure, see Fig. 3. This pressure is produced by a gear pump, driven from the camshaft and located under the crankshaft in the oil pan. The gears in the pump force the oil past a relief valve, also located in the pump, through the oil cleaner and then out through the drillings to the various lubricating points. The complete oil quantity being forced out to the lubricating points must thus first pass through the oil cleaner.

Oil pump, relief valve

The oil pump, Fig. 6, is of the gear type and is driven through a gear from the camshaft. When the pump gear, which is made of sintered steel, starts rotating, oil is transported in the empty teeth apertures along the walls of the pump housing from the suction to the pressure side. The pressure pipe from the pump to the block is not fitted with screw unions and is tensioned in position when the attaching bolts for the pump are tightened. At each end of the pipe there are seal rings made of special rubber.

The relief valve is located directly in the pump and consists of a spring-loaded ball. The ball has a cylindrical guide with the stop at the end position and therefore operates flexibly. Even at idling speed there is a certain amount of oil passing through, and, for this reason, oil pressure is then relatively low.

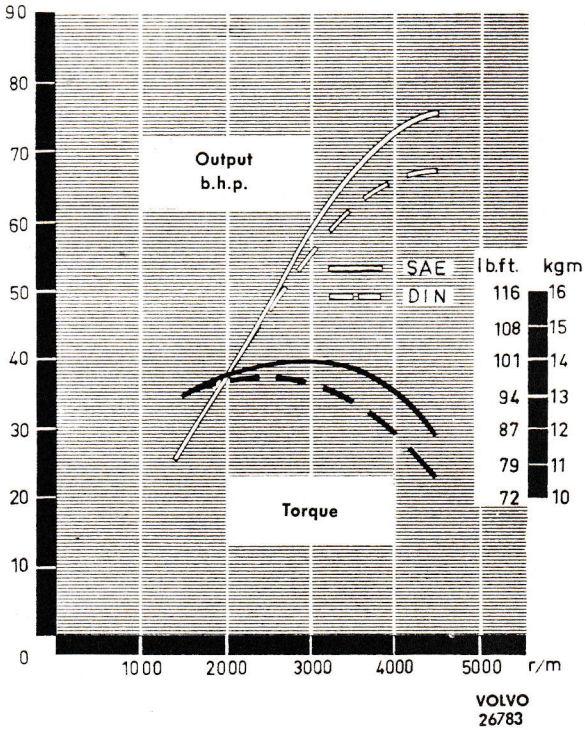

Fig. 4. Output and torque curves

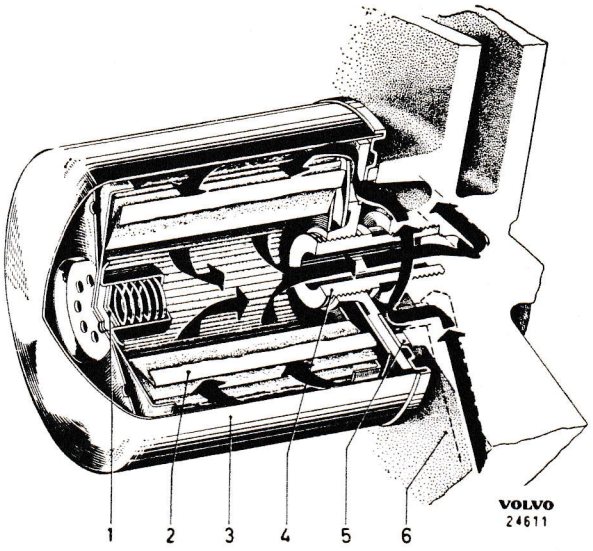

Fig. 5. Oil cleaner

1. By-pass valve
2. Insert
3. Housing (cannot be disassembled)
4. Nipple
5. Gasket
6. Cylinder block

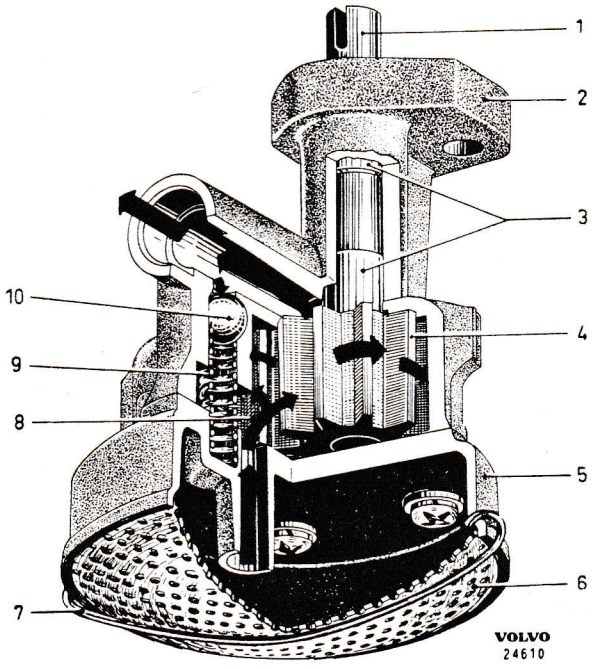

Fig. 6. Oil pump

1. Drive shaft
2. Pump housing
3. Bushings
4. Driving gear
5. Cover
6. Strainer
7. Retainer
8. Driven gear
9. Spring for relief valve
10. Valve ball

Oil cleaner

The oil cleaner (Fig. 5) which is manufactured in one single unit, complete with element, is of the fullflow type and is screwed directly onto the engine block. The oil which is forced out to the various lubricating points on the engine first passes through the oil cleaner cartridge which is made of special paper. In the oil cleaner there is a by-pass valve which releases oil and allows it to by-pass the element cartridge if resistance to flow should become too great. When replacing a block cleaner, throw away the complete old cleaner unit and fit a new.

Ignition system

The distributor (25, Illustration 1) which is driven through the medium of a right-angle gear from the camshaft has both a centrifugal and a vacuum regulator. The direction of rotation is counter-clockwise and the order of firing is 1-3-4-2. For more details see Part 10.

Fuel system

Fuel is sucked up by a diaphragm type pump from the tank through a fuel filter and then pumped up to the carburetor float bowl. The carburetor used is a down-draught unit of the Zenith 36 VN type.

Carburetor

The engine is fitted with a Zenith down-draught carburetor, type designation 36 VN. The appearance of this unit is shown in Figs. 7 and 8.

Fuel feed is controlled by fixed jets fitted in an emulsion block with a "beak" terminating in the carburetor venturi. The emulsion block also contains air channels so that a certain amount of air can be mixed with the fuel at an early stage. The carburetor has a hand-regulated choke, rapid idling device, acceleration pump, and economiser valve. The function of the carburetor is treated under the following headings.

1. Float system
2. Choke device with rapid idling
3. Idling system
4. Main jet and compensation jet Economiser valve
5. Acceleration pump.

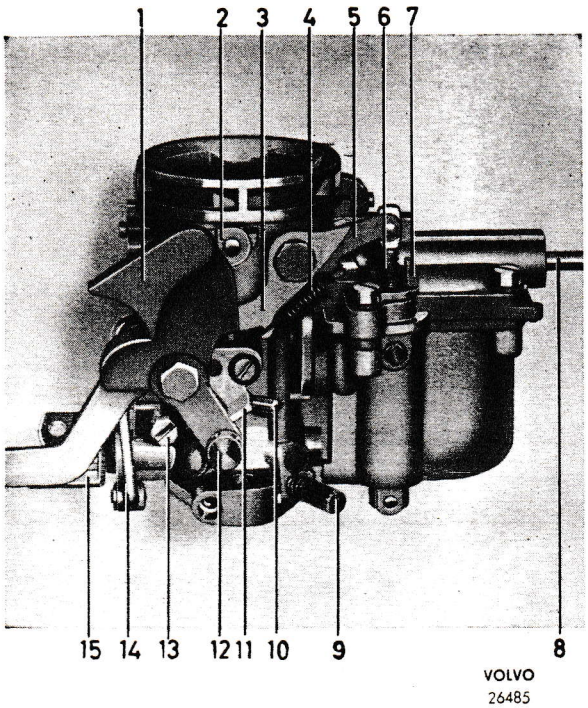

Fig 7. Carburetor

1. Lever with guide
2. Spindle for choke flap
3. Rear lever
4. Spring
5. Front lever
6. Plunger rod
7. Washer for adjustment of stroke length
8. Fuel inlet
9. Idle fuel adjusting screw
10. Vacuum connection
11. Stop
12. Attachment for choke control
13. Idle adjusting screw
14. Link
15. Connection for throttle control

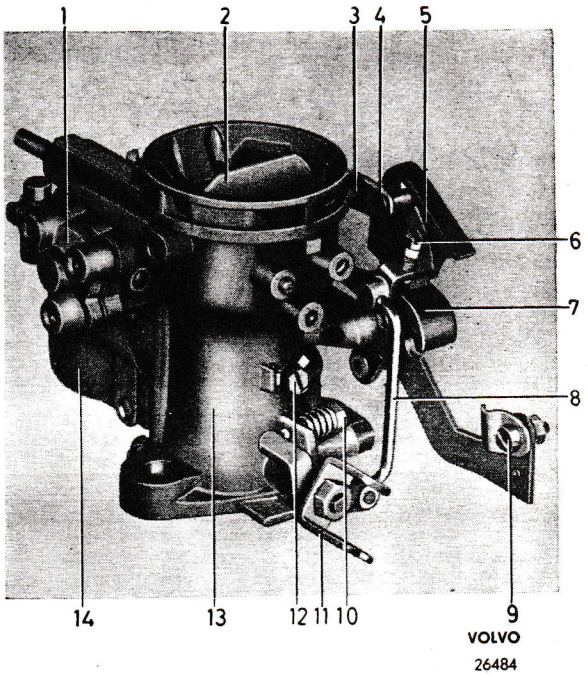

Fig. 8. Carburetor

1. Economiser valve
2. Choke flap
3. Spring
4. Lever for choke
5. Lever with guide
6. Rapid idle adjusting screw
7. Rapid idling cam
8. Link
9. Attachment
10. Idle adjusting screw
11. Connector
12. Lock screw for venturi
13. Carburetor housing
14. Float bowl

1. Float system

The float keeps the fuel at the correct level. When the fuel has increased to this level the float (4, Fig. 9) is lifted upwards and pushes the needle in the valve (2) against its seat through the medium of the float arm so that the flow of fuel is cut off. When the fuel level goes down the same procedure is repeated but in the reverse direction. The float bowl is ventilated through a hole (1) which is connected at the top with the upper part of the carburetor. The float is made of nylon and is fitted with a fixed arm.

2. Choke device with rapid idling

In order to enrich the fuel/air mixture when a cold engine is started, the choke system is

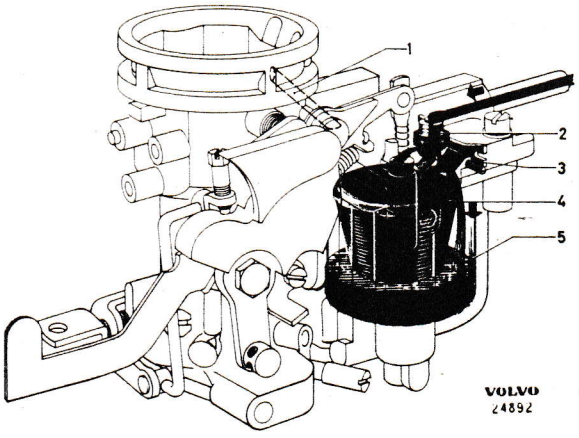

Fig. 9. Float system

1. Ventilation hole
2. Float valve
3. Lock spring
4. Float
5. Float bowl

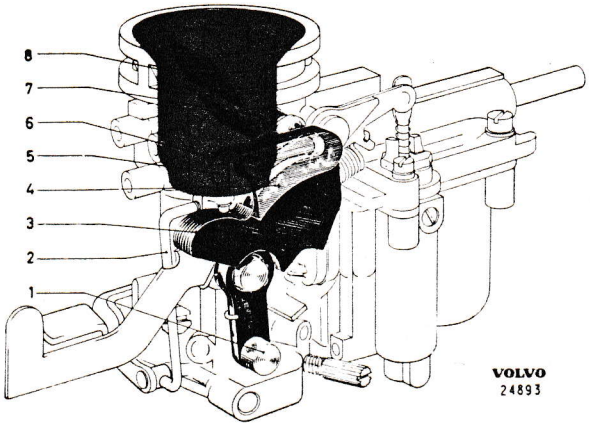

Fig. 10. Choke device with rapid idling

1. Attachment for choke control
2. Link
3. Cam (for rapid idling)
4. Lever with force guide for choke flap
5. Rapid idling adjuster screw
6. Pin
7. Spring
8. Choke flap

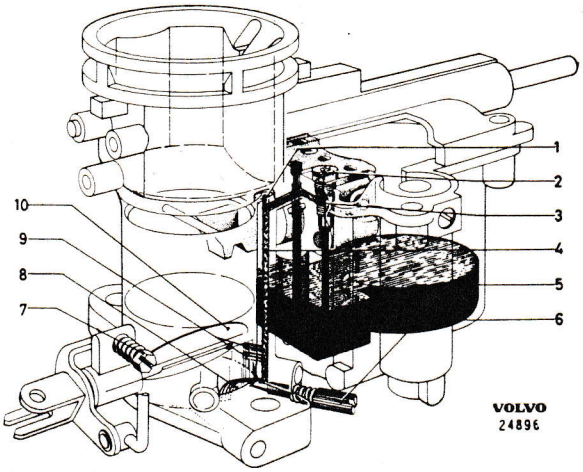

Fig. 11. Idling system

1. Air hole
2. Idling air jet
3. Idling jet
4. Idling channel
5. Main jet
6. Idle fuel adjusting screw
7. Idling adjuster screw
8. Venturi
9. Transition hole
10. Throttle flap

used and this is operated from the knob on the dashboard. When the choke control is pulled out when starting, the cam-shaped lever (4, Fig 10) is actuated. This influences the choke flap (8) through the spring (7) on the flap spindle so that it closes, this resulting in a higher degree of vacuum and a consequently higher rate of fuel flow. When the engine has started and the degree of vacuum increases, the throttle can open itself to a certain extent, since the closing force is obtained by the spring on the choke spindle. This eliminates the risk of excessively rich fuel/air mixture when the choke is completely or almost completely closed. When the choke knob is pushed in again, the choke flap is forced to open fully since the flap lever pin (6) runs in a groove on the cam-shaped lever.

One of the cams on the choke lever (3) is actuated through the rapid idling screw (5) and the link (2) as well as the throttle flap. This means that the throttle flap opens at the same time as the choke flap closes. The degree to which the throttle flap opens relative to the closing of the choke flap is determined by various settings of the screw (5). This rapid idling device enables the driver to give the engine higher idling speed during the warming-up period and thus avoid the risk of the engine stalling.

3. Idling system

While the engine is idling, the throttle flap is almost completely closed (regulated by means of a stop screw 7, Fig. 11) whereby the degree of vacuum around and under the flap is very large. Suction through the idling channel (4) will then be considerable and fuel will be sucked up from the channel above the main jet (5) through a hole and the idling jet (3) to the idling channel which terminates in the carburetor venturi with one large and two small holes.

Air is supplied through one hole (1) under the choke flap and an air jet (2) above the idling jet.

The fuel/air mixture is controlled by means of an idle fuel adjusting screw (6) by means of which the flow area for the fuel/air mixture can be varied. Since a certain amount of air passes through the throttle flap, the fuel/air mixture being fed to the engine during idling will be richer if the screw is screwed out and leaner if it is screwed in.

The two small holes (9) just above the throttle flap supply a mixture of air and fuel when the throttle flap opening is rather larger and thus co-operate with the variable hole. Smooth transition is thus obtained.

4. Main jet and compensation jet. Economiser valve

A large part of the fuel being fed to the engine when it is under loading and running at high speeds passes through the main jet (4, Fig. 12).

The main jet alone cannot supply a sufficiently well balanced amount of fuel under all conditions of operation and therefore combines with a compensation jet (3) which works in co-operation with the main jet.

Both these jets are fitted in an emulsion block (2) which terminates in a beak in the carburetor venturi. When it passes through the emulsion block, the fuel is mixed up with a certain amount of air, whereby it can mix more easily with the large quantity of air pouring into the engine through the carburetor venturi. The amount of air supplied to the emulsion block passes through a hole above the main jet space as well as through channels (1), and the air jet (8). The amount of air added is varied with the help of the economiser valve.

The space above the compensation jet forms a reservoir for fuel. High speed means a large rate of flow. The fuel then passes at a higher velocity through the hole in the partition to the main jet channel, whereby the level sinks down to the hole and an increased air flow results.

From the air channels (1) air is supplied to the three holes (6) in the partition towards the space above the main jet. When the fuel level in this space sinks more air is supplied and this air is mixed with the fuel.

With the help of the economiser valve, the fuel/air mixture is supplied with an extra amount of air when the degree of vacuum in the carburetor venturi is large.

The economiser valve disc (12) is attached to a diaphragm (11) and forced against the seat by a spring (13). In this position air supply is obtained from the upper channels only through the small hole (10) at the diaphragm.

On the back of the diaphragm, however, there is a connection with the lower part of the venturi through a channel (7). When the

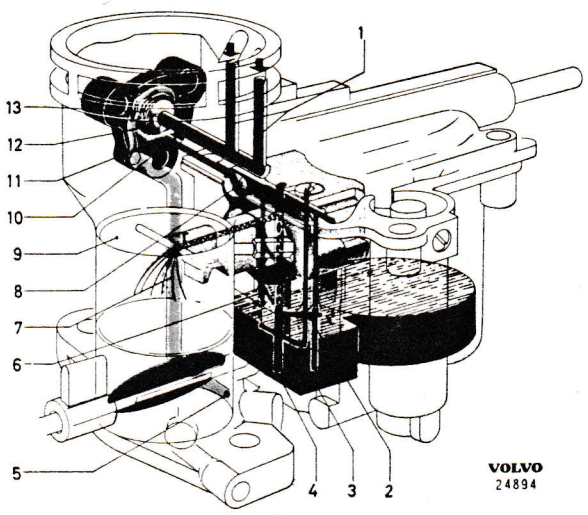

Fig. 12. Jet and economiser valve

1. Air channels
2. Emulsion block
3. Compensation jet
4. Main jet
5. Vacuum channel outlet
6. Air channels
7. Vacuum channel
8. Air jet
9. Venturi
10. By-pass hole
11. Diaphragm
12. Valve disc
13. Spring

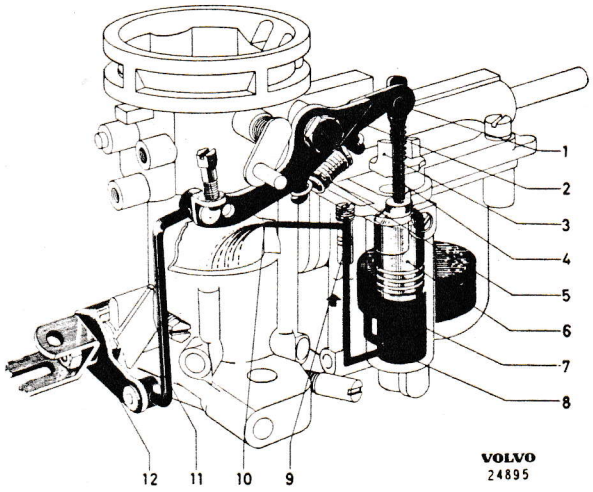

Fig. 13. Acceleration pump

1. Forward part of lever
2. Rear part of lever
3. Washer for limiting stroke length
4. Plunger rod
5. Spring
6. Plunger
7. Spring
8. Inlet valve
9. Outlet valve
10. Acceleration jet
11. Link
12. Lever

degree of vacuum in this increases, for example when driving quietly without any great degree of loading, the valve lifts from its seat and air flows into the emulsion block also through the centre hole at the valve disc.

If the degree of loading should increase, for example during acceleration, the degree of vacuum is decreased and the spring forces the disc back against its seat, whereby the supply of air decreases and the fuel/air mixture again becomes richer.

5. Acceleration pump

When the throttle is opened quickly, there is a tendency for the fuel/air mixture to be too lean, one contributory reason being that air moves more quickly than fuel and thus reaches the engine more rapidly.

In order to compensate for this sudden leaning out, a certain amount of fuel is sprayed in with the help of the acceleration pump directly into the carburetor venturi.

The pump plunger (6), Fig. 13, located in a cylinder integral with the side of the float bowl, is actuated when being pressed down by a lever with a spring-loaded joint. The pump plunger stroke can thus easily be varied by turning a washer with a cam (3), whereby the forward part of the lever is stopped by a check, higher or lower depending upon the position of the washer. The last part of the rear lever section has its movement taken up by the spring (5) and the joint.

At the inlet into the bottom of the pump barrel, there is an inlet valve (8) and at the

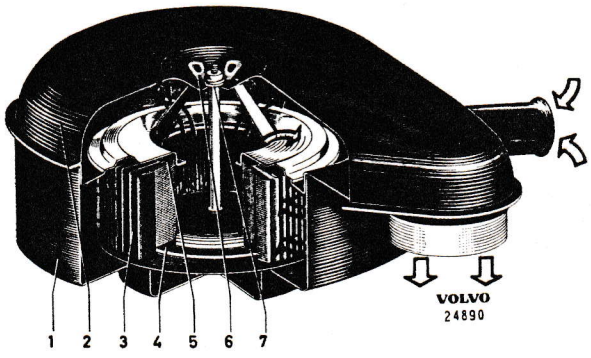

Fig. 14. Air cleaner with paper element

1. Lower section
2. Upper section
3. Element
4. Gasket
5. Gasket
6. Wing nut
7. Washer

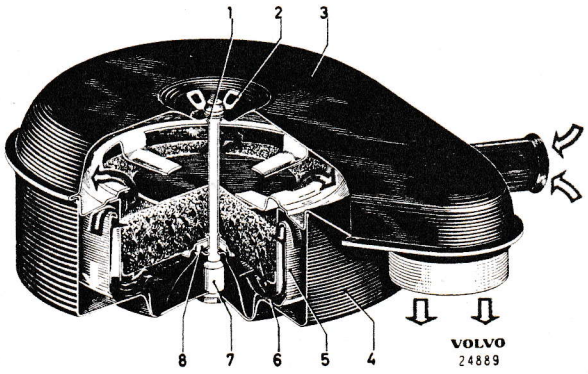

Fig. 15. Oil bath air cleaner

1. Washer
2. Wing nut
3. Upper section
4. Lower section
5. Container
6. Element
7. Bolt
8. Washer

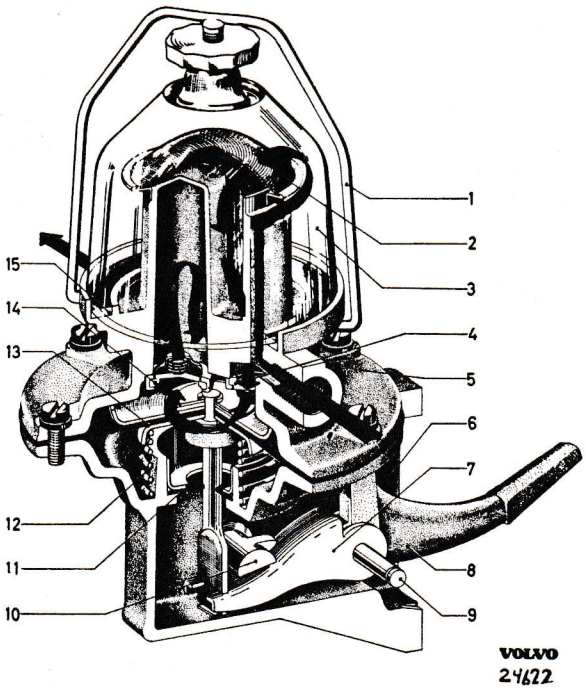

Fig. 16. Fuel pump

1. Bail
2. Strainer
3. Sludge trap
4. Inlet valve
5. Upper pump housing
6. Lower pump housing
7. Inner lever
8. Outer lever
9. Spindle
10. Check
11. Gasket
12. Spring
13. Diaphragm
14. Outlet valve
15. Gasket

outlet, behind the acceleration jet, there is an outlet valve (9). This outlet valve is fitted with a ball which lifts and closes the air hole above during the pump stroke, whereby fuel is sprayed in through the acceleration jet (10). During normal running the ball closes the connection from the float chamber and instead allows air to pass from the air hole to the acceleration jet. In this way fuel is prevented from passing through this jet when the pump is not operating.

Air cleaner

The air cleaner (Figs. 14 and 15) is placed above the entrance and function both as a cleaner for the air being sucked in and as an inlet silencer. Two models have been used, one with a paper element and the other of the oil-bath type. The paper element may not be washed or moistened, the only servicing in this connection being to replace it with a new unit.

As far as the oil-bath air cleaner is concerned, this should be disassembled for servicing and cleaned, after which new oil should be added.

Fuel pump

The fuel pump is of the diaphragm type and is driven from a cam on the camshaft. The pump is fitted with an idling device whereby the pump action ceases when a sufficiently high pressure has been reached in the float chamber. The design of the pump is shown in Fig. 16. The red arrows show the path followed by the fuel.

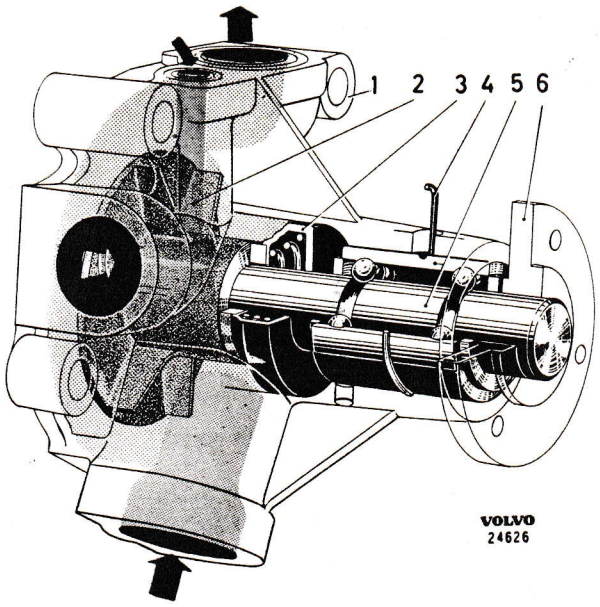

Fig. 17. Water pump

1. Housing
2. Impeller
3. Seal ring
4. Lock spring
5. Shaft with ball bearing (integral)
6. Hub

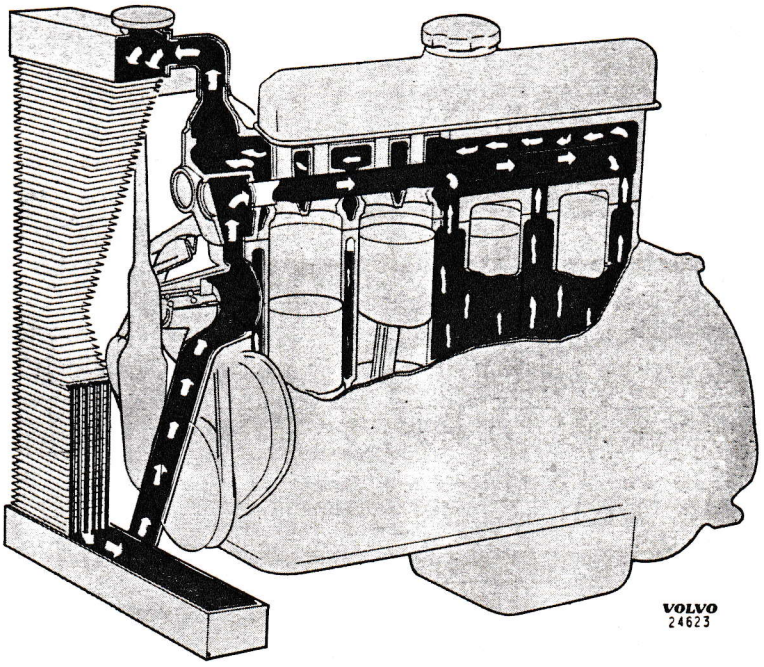

Fig. 18. Cooling system

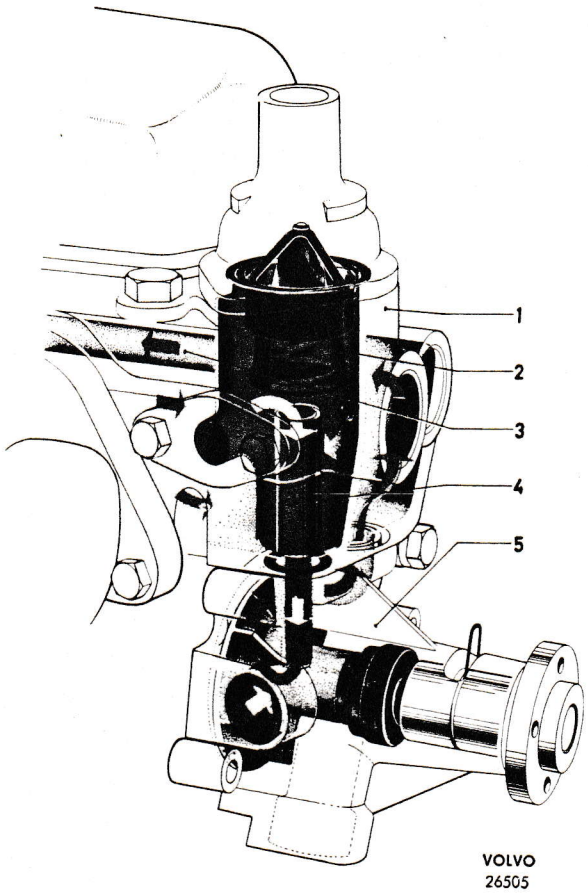

Fig. 19. Coolant flow, thermostat closed

1. Cylinder head
2. Thermostat
3. Distribution pipe
4. By-pass pipe
5. Water pump

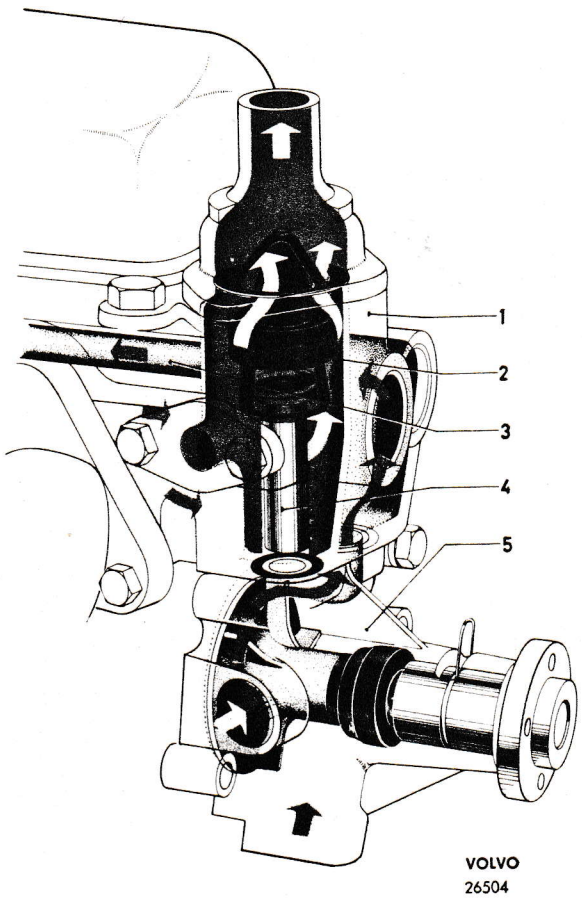

Fig. 20. Coolant flow, thermostat fully open

1. Cylinder head
2. Thermostat
3. Distribution pipe
4. By-pass pipe
5. Water pump

Cooling system

The cooling system, Fig. 18, is of the pressure type with a circulation pump (Fig. 17).

When the engine is cold, the cooling water is circulated through the engine only through a by-pass (4, Fig. 19).

When the engine has been warmed up, the thermostat starts to open the outlet to the radiator. When the thermostat is fully open, the by-pass is closed by the spring-loaded valve disc on the under side of the thermostat, and all the circulating water must pass through the radiator, (Fig. 20). Circulation is controlled while the engine is running by the thermostat so that the engine temperature is maintained within its correct limits. The distribution pipe in the cylinder head (3) ensures even cooling of the warmest parts of the cylinder head. The parts of the engine round the spark plug are also cooled and thereby maintained at a constant temperature. The cooling water round the walls of the cylinder circulates through a thermo-siphon action.

REPAIR INSTRUCTIONS

Work that can be carried out without removing the engine from the car

Measuring the compression pressure

1. Run the engine until it attains its normal running temperature. Check that the air cleaner is not blocked. Replace the element or clean an oil-bath type cleaner if necessary.
2. Remove all the spark plugs. Depress the accelerator pedal fully and lay a weight on it.
3. Hold a compression gauge in the spark plug holes one after another and run the engine by using the starter motor until the pressure does not go up any more. The battery must be in good condition so as to drive the engine sufficiently fast.
4. Note the pressure attained for each cylinder, unless the gauge used is of the self-registering type.
5. If the values obtained are low or uneven, measurement should be repeated after a small amount of heavy oil has been introduced into each cylinder. If the pressure is low in one of the cylinders, both with and without oil, this is a sign of leaking valves. If the pressure is higher after the oil has been introduced, it is probable that piston rings are worn.

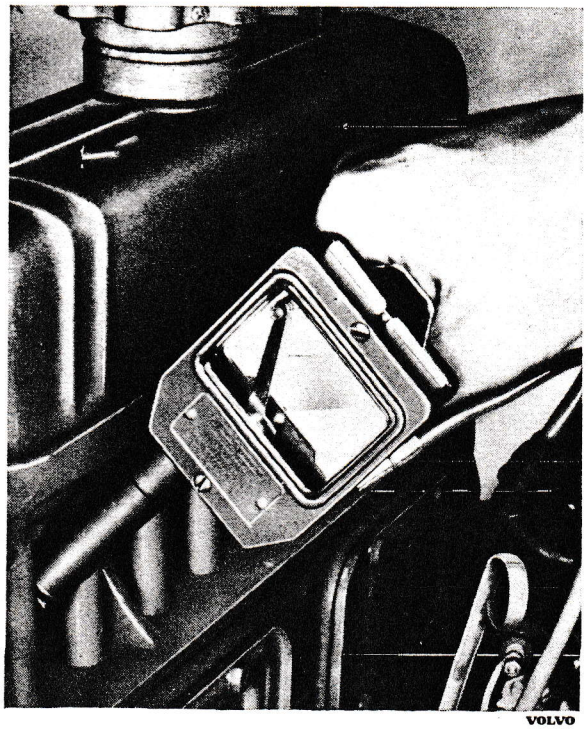

Fig. 21. Compression test

Tuning up the engine

The engine should be tuned up at regular intervals in order to obtain the best running result. The purpose of tuning up is to reset all adjustments to the correct values as well as to dispose of running interruptions, for example, dirt in sludge traps, coating on spark plugs, etc.

1. Run the engine warm and check (adjust if necessary) the contact breaker dwell angle (contact breaker gap). Replace burned breaker points. Check the ignition setting with a stroboscope at the specified speed and with the vacuum regulator disconnected. See the specifications for the value in question.
2. Check the distributor top and clean it. Clean and check the ignition cables.
3. Examine the state of charge of the battery and check the battery connections.
4. Clean the fuel pump sludge trap. Remove

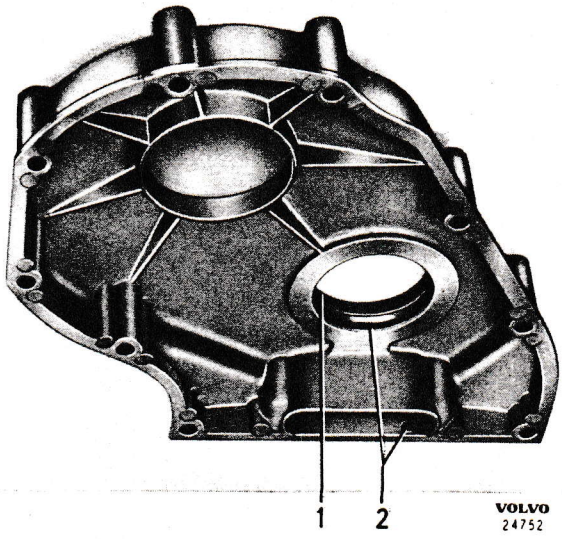

Fig. 22. Timing gear casing

1. Seal ring
2. Drain holes

the float bowl and blow it clean. Fit the parts.

5. Check the air cleaner element and replace if necessary. Clean the oil bath air cleaner if such a cleaner is fitted. See under the heading "Air cleaner" page 31.
6. Check tighten the nuts on the intake and exhaust manifolds. Check that there are no air leaks at the carburetor.
7. Remove and adjust the spark plugs or fit new spark plugs.
8. Measure the compression on all the cylinders.
9. Adjust the valve clearances. Check that there is no oil leakage. If the rocker arm cover gasket is so compressed that the cover is in contact with the cylinder head, fit a new gasket.
10. Check and adjust carburetor settings if required. Adjust idling speed. Check the accelerator pedal setting and the fan belt tension.

Replacing the cooling water pump

1. Drain off the cooling water.
2. Slacken the fan belt. Loosen the water pipe.
3. Remove the fan, pulley and pump.
4. Fit in the opposite order but make sure that the seal rings on the top of the pump come into their correct position. Also press the pump upwards against the cylinder head extension while bolting in position so that there is a good seal between the pump and the cylinder head.
5. Make sure that the seal rings on the water pipe are in good condition and push in the pipe thoroughly when attaching.
6. Fill with coolant. Test run the engine and check for leakage.

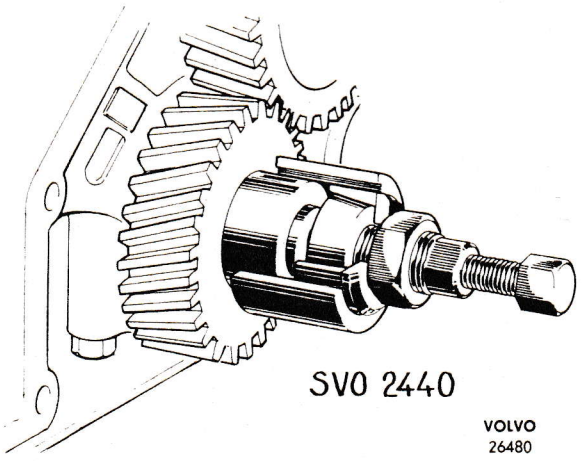

Fig. 23. Removing the hub from the crankshaft

Replacing the oil cleaner

When changing the oil cleaner, this being normally done after every 6,000 miles (10,000 km), follow the instructions on page 26.

Replacing the seal ring in the timing gear casing.

1. Release the fan belt.
2. Screw the screw into the crankshaft gear. Remove the pulley.
3. Remove the lock ring for the washer retaining the felt ring.
   Remove the washer and felt ring.
   Check that the casing is correctly fitted by introducing a feeler gauge, 0.10 mm thick, and move it round in the space between the casing and the hub on the crankshaft. If the feeler gauge jams at any point, the casing must be centered, see under the heading "Replacing the timing gear casing".
4. Fit a new felt ring. Fit the washer in position and fit the lock ring. Check that the lock ring is correctly in position.
5. Fit the remaining parts and tension the fan belt.

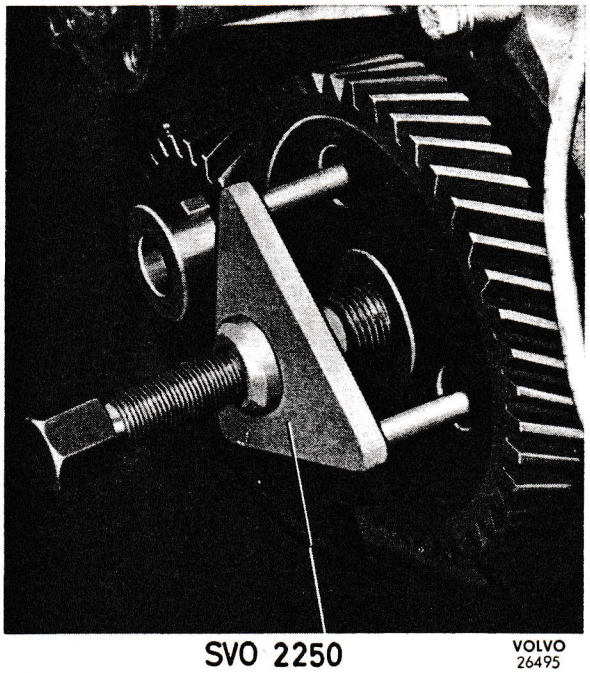

Fig. 24. Removing the camshaft gear

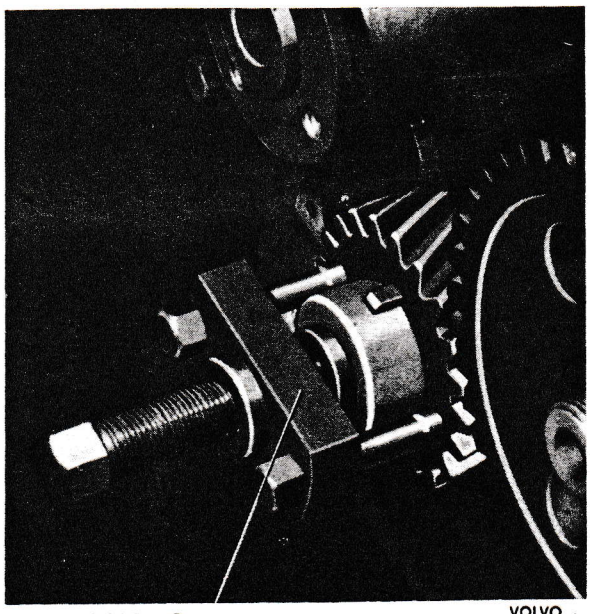

Fig. 25. Removing the crankshaft gear

Replacing the timing gear casing

1. Loosen the fan belt. Remove the fan and the pulley on the water pump.
2. Remove the bolt on the crankshaft pulley and remove the pulley.
3. Remove the timing gear casing. Loosen a couple of extra bolts for the oil pan and be careful so as to avoid damage to the gasket. Remove the lock ring, washer and felt ring from the casing.
4. Make sure that the gaskets are in good condition and that the drain hole is open and clean in the timing gear casing which is to be fitted.
5. Place the casing in position and fit the bolts without tightening them.
6. Center the casing with the sleeve SVO 2438, see Fig. 30. Turn the sleeve while tightening and adjust the position of the casing so that the sleeve is not jammed.
   Check after final tightening of the casing that the sleeve can be easily rotated without jamming.
7. Fit a new felt ring, washer and lock ring. Push them into their final position with the centering sleeve SVO 2438. Check that the lock ring has engaged in its groove.
8. Fit the other parts and tension the fan belt. See the specifications for the tightening torque.

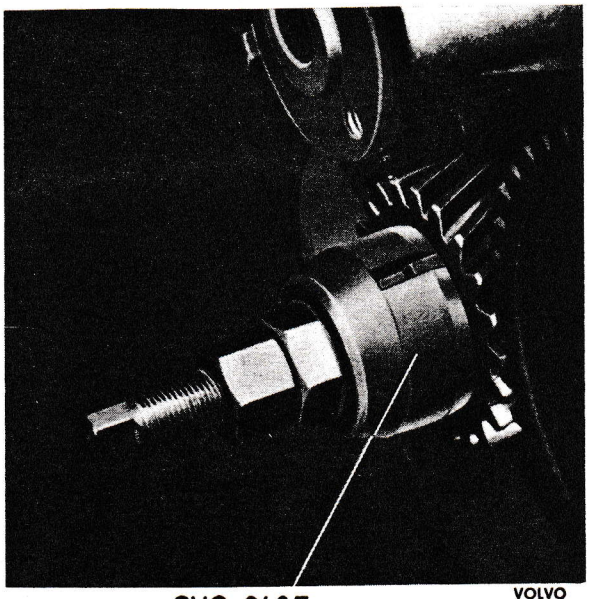

Fig. 26. Fitting the crankshaft gear

Replacing the timing gears.

1. Drain off the cooling water and remove the radiator grille (not 121/122 S) as well as the radiator.
2. Carry out operations 1—3 in the previous section.
3. Remove the hub from the crankshaft with puller SVO 2440. See Fig. 23.
   Before applying the tool, its large nut must be screwed backwards so that the cone is

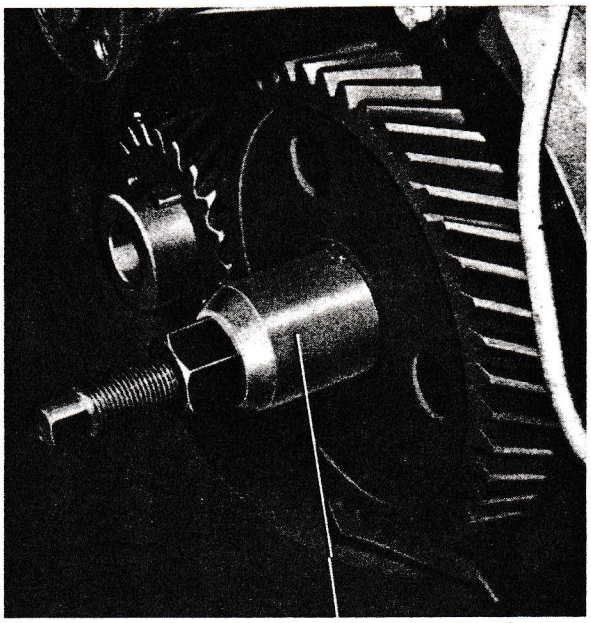

Fig. 27. Fitting the camshaft gear

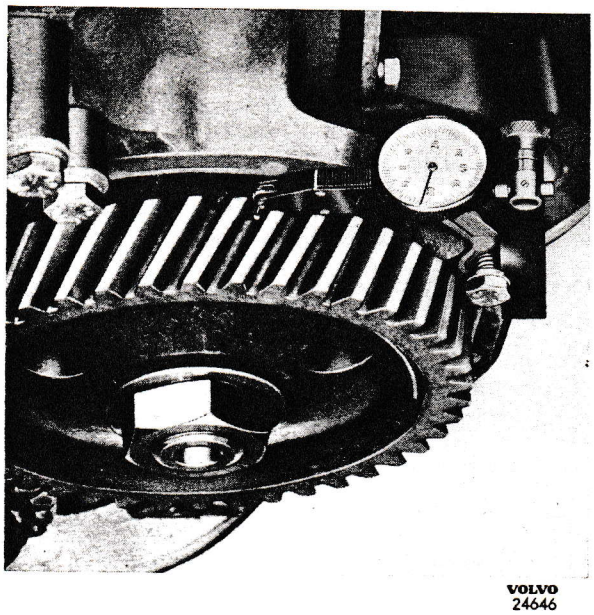

Fig. 28. Measuring backlash

not tensioned. The center bolt should also be screwed back.

Then apply the tool, screw in the large nut so that the hub is tensioned firmly and then pull it off by screwing in the center bolt.

4. Remove the camshaft nut and pull off the gear by using puller SVO 2250, see Fig. 24.
5. Pull off the crankshaft gear by using puller SVO 2405, Fig. 25. Screw out the oil jet, blow it clean and then refit it as shown in Fig. 29.

   The gears are lubricated by oil fed through this jet.

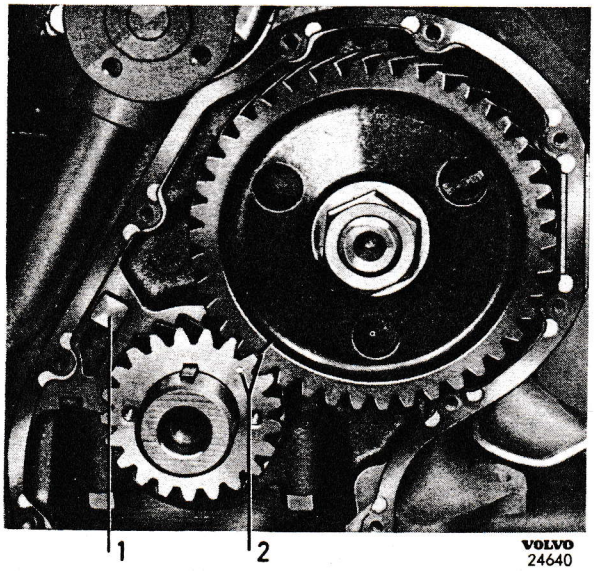

Fig. 29. Markings, timing gears

1. Oil jet 2. Markings

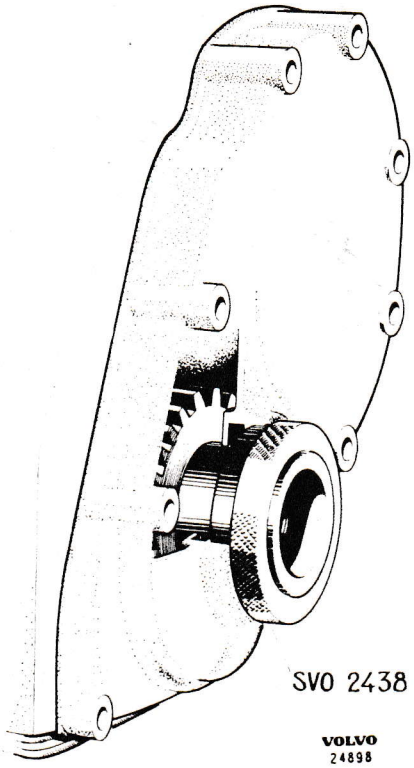

Fig. 30. Centering the timing gear casing

6. Fit the crankshaft gear by using tool SVO 2407 and the camshaft gear by using tool SVO 2408, see Figs. 26 and 27. Fit the hub on the crankshaft.

   Do not push the camshaft backwards so that the seal washer on the rear end loosens.

   Check that the gears have the correct position relative to each other, as shown in Fig. 29. Tool SVO 2407 has wrench flats, intended for turning the crankshaft.
7. Measure the backlash as shown in Fig. 28. Also measure the axial clearance of the camshaft, this being determined by means of a spacer ring behind the camshaft gear. See the specifications for the values obtained.
8. Center and fit the timing gear casing and other components as described in points 4—8 in the previous section.

Valve-grinding and decarbonising.

1. Drain off the cooling water from the radiator and engine block.
2. Disassemble the throttle control. Loosen the choke control.

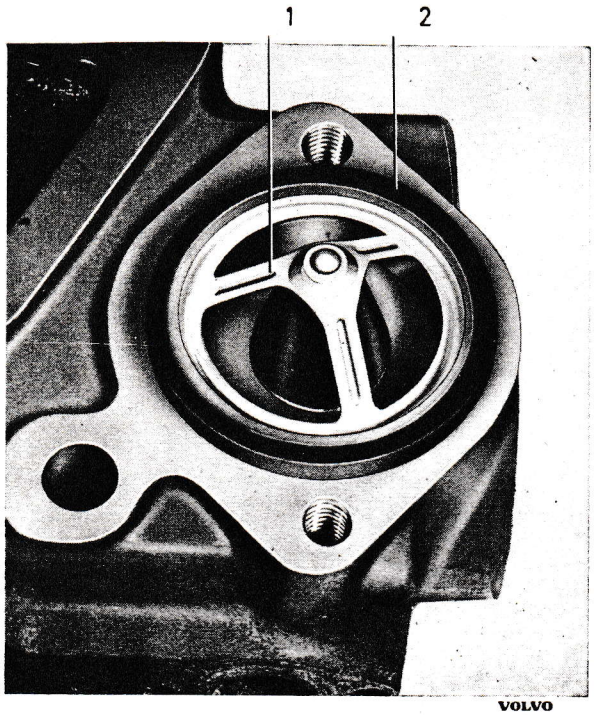

Fig. 31. Replacing the thermostat

1. Thermostat 2. Gasket

3. Remove the air cleaner and carburetor.
4. Disconnect the exhaust pipe at the exhaust manifold and disconnect the hoses to the radiator as well as other connections to the cylinder head.
5. Remove the rocker arm cover, rocker arm shaft and push rods.
6. Remove the cylinder head bolts and disconnect the water pipe as well as the attachment on the rear exhaust manifold. Loosen the generator tensioner arm. Lift off the cylinder head.
7. Clean the piston crowns, combusion chambers, inlet ports and exhaust ports very thoroughly. Do not use emery cloth since small grinding particles can get in between the piston and cylinder walls and cause scoring.
8. Recondition the valve system as described under the heading "Cylinder head with valves".
9. Fit the valves. Screw the guide pins SVO 2435 into the block, one in the front right-hand and the other in the left rear holes. Lay on a new cylinder head gasket and new sealing rings for the water pump and fit the new cylinder head. Screw out the guide pins and fit the bolts in these holes as well.

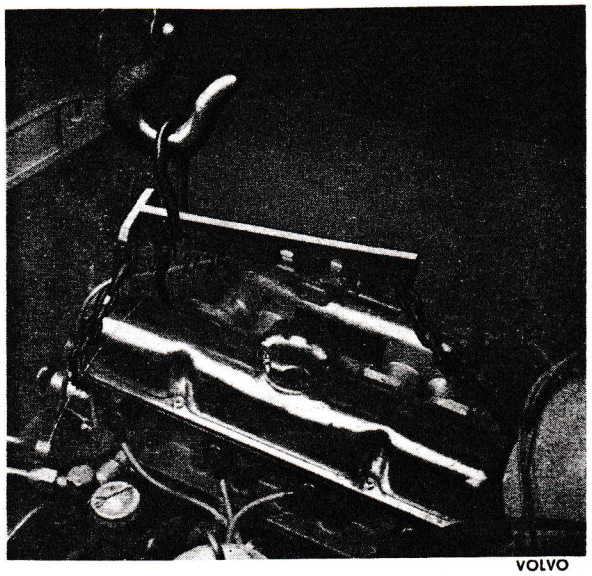

Fig. 32. Lifting out the engine

Lifting tool SVO 2425

For tightening order and tightening torques, see the end of the specifications. Fit the other parts. Fill up with cooling water.

10. Adjust valve clearances. Run the engine for a short time. Check the engine running and re-adjust valve clearances. It is not necessary to re-tighten the cylinder head bolts.

Replacing the thermostat.

1. Drain off part of the cooling water.
2. Remove the bolts for the outlet pipe over the thermostat and turn up the pipe.
3. Replace the thermostat (1, Fig. 31). Use a new gasket. Check the valve on the underside of the thermostat by pressing in and releasing the spring-loaded valve disc.
4. Screw the pipe in position. Fill with water and check for leakage.

Removing the engine

1. Lift up the car about 12″ (30 cm) above the floor and block it up.
2. Drain off the cooling water and engine oil. Remove the air cleaner and disconnect the fuel pipe at the pump. Remove the pump clamp. Disconnect the positive terminal at the battery or remove the battery. Remove the radiator.

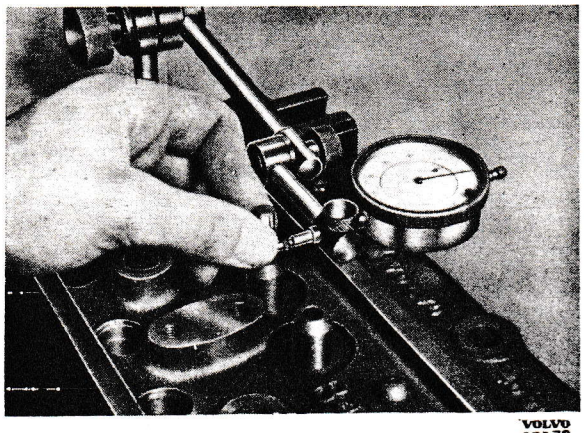

Fig. 33. Measuring valve stem clearance

3. Disconnect the accelerator and choke controls and all other connections round the engine.
4. Disconnect the exhaust pipe at the exhaust manifold and disconnect the attachment at the flywheel casing. Remove the nuts on the engine mounting blocks.
5. Remove the gear shift lever. Remove the controls for the clutch, remove the speedometer drive cable and the cables for the overdrive if fitted.
6. Disconnect the forward joint on the propeller shaft. Fit a jack under the transmission and raise slightly. Remove the support member.
7. Fit lifting tool SVO 2425 to the engine. The bolt on the tool is tightened in the hole on the forward end of the cylinder head (the bolt for the fuel pipe clamp is removed) the hooks being fitted under the front and rear ends of the manifold. See Fig. 32.
8. Lift the front end of the engine an inch or so so that it clears the mounting blocks. Lower the transmision but not more than necessary and pull the engine forwards at the same time as the front end is raised. Lift out the engine by gradually raising the front end and lowering the rear end.

Removing the oil pan

The oil pan can be removed after the engine has been lifted out of the car.

Disassembling the engine

After the engine has been lifted out of the car, disassembly is carried out on the whole as

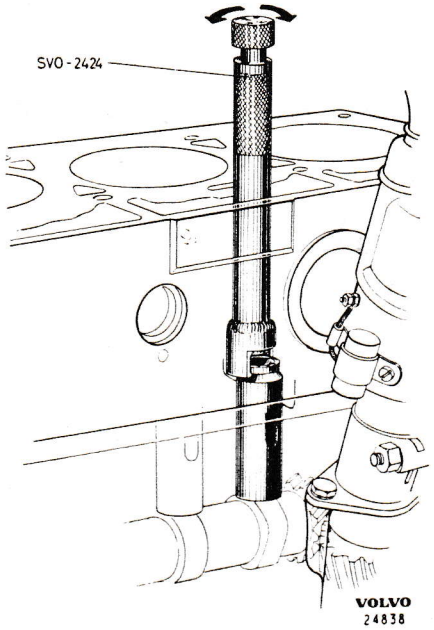

Fig. 34. Removing the valve lifters

follows. (Concerning instructions for the separate parts, see under the heading in question).

1. Place the engine in a suitable stand. Check that the oil has been drained off.
2. Remove the starter motor and the splash plates on the lower forward edge of the flywheel housing. Remove the flywheel housing together with the transmission and then remove the clutch and flywheel.
3. Remove the rear sealing flange, generator, water pump and distributor, rocker arm cover, rocker arms, cylinder head and oil cleaner.
   Remove the valve lifters by using tool SVO 2424, see Fig. 34.
4. Remove the timing gear casing under the timing gears. For tools see under the heading "Replacing the timing gears". Remove the camshaft.
5. Stand up the engine on its rear end on a bench. Place three wooden blocks under it so that the crankshaft can rotate freely. Remove the carbon ridge from the cylinder bores.
   Remove the oil pan, oil pump and connecting rods with pistons. Replace the caps correctly on their respective connecting rods.
6. Lay the engine down upside down and remove the crankshaft. Replace the caps correctly in position.

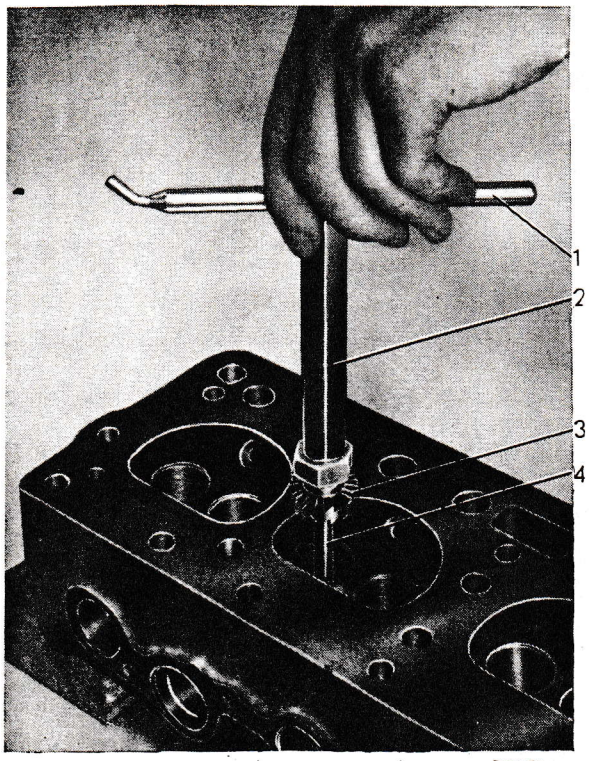

Fig. 35 Refacing a valve seat

Cleaning

After the engine has been disassembled, the parts should be cleaned very throughtly. Parts made of steel or cast-iron can be washed in a degreasing tank full of lye. Light-alloy parts can however, easily be destroyed by the lye and should therefore be cleaned preferably with white spirit. Pistons and bearing shells may never be washed in lye. Rinse the parts with warm water and blow them dry with compressed air after washing.

Clean the oil drillings particularly thoroughly. Pull them through with a special brush and then blow them out with compressed air. All sealing plugs at the openings of the drillings in the cylinder block must be removed while cleaning is carried out.

Cylinder head with valves.

Disassembling

1. Remove the rubber seals. Remove the valve springs by first compressing them with valve tongs and removing the valve key and then releasing the tongs.
   Place the valves in order in a stand.
2. Measure the clearance between the stems and guides as shown in Fig. 33. The clearance with a new valve should not exceed 0.006″ (0.15 mm). Also check that the valves are not excessively worn. See the specifications under the headings "Valve system" and "Wear tolerances".

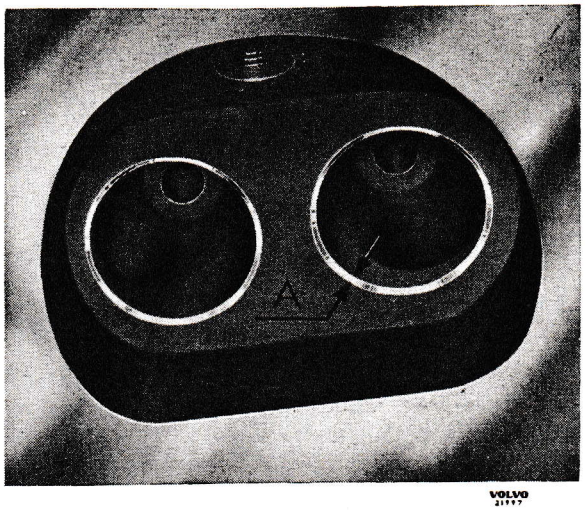

Fig. 36. Valve seat width

A = 0.060″ (1.5 mm)

Cleaning

Remove carbon and combustion residues from the valves, combustion chambers and channels by using rotating brushes.

Refacing valves and valve seats.

1. Grind the valves in a machine after they have been cleaned. Fit new valves if the valves are excessively worn.
2. Reface the valve seats. Use an electrically driven grinder or a hand milling cutter.

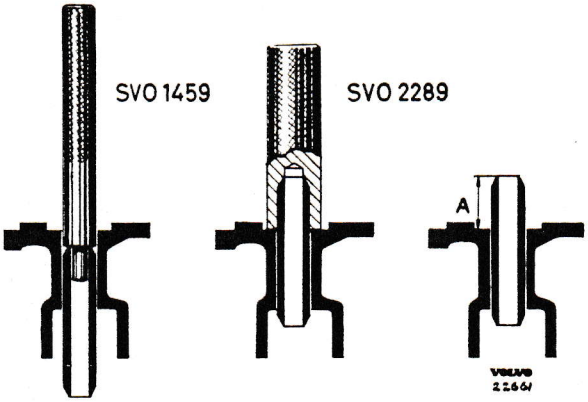

Fig. 37. Replacing the valve guides

A = 0.83″ (21 mm)

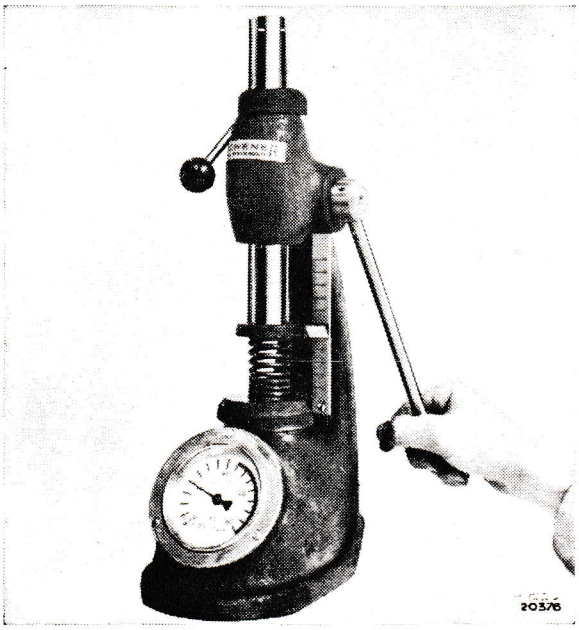

Fig. 38. Testing the springs

A pilot spindle must be carefully fitted before work is started and worn guides must be replaced by new units.

Grind the seat until a good sealing surface is obtained. The angle is 45° and the width of the sealing surface should be 0.060" (1.5 mm) see "A" in Fig. 36. If the sealing surfaces are too wide after grinding, they can be reduced from the inside by using a 70° grinding stone and from the outside by using a 20° grinding stone .

3. Smear the valve sealing surfaces with a thin layer of fine grinding compound and lap in the valves against their seats.
   Then clean the valves and seats and check the seal obtained.

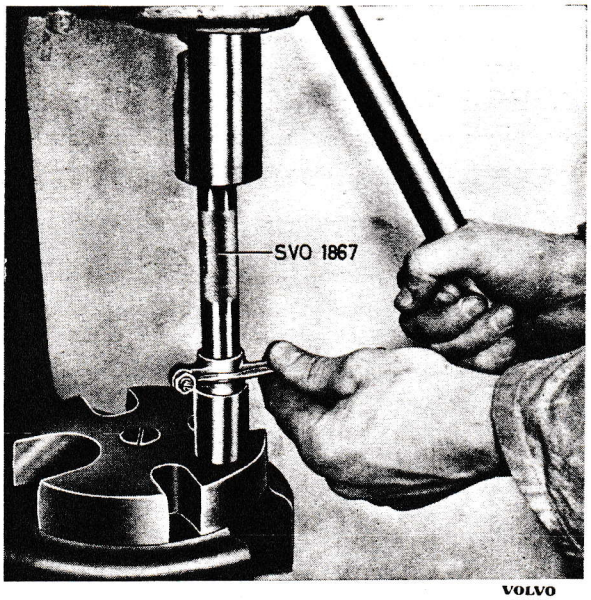

Fig. 39. Replacing a rocker arm bushing

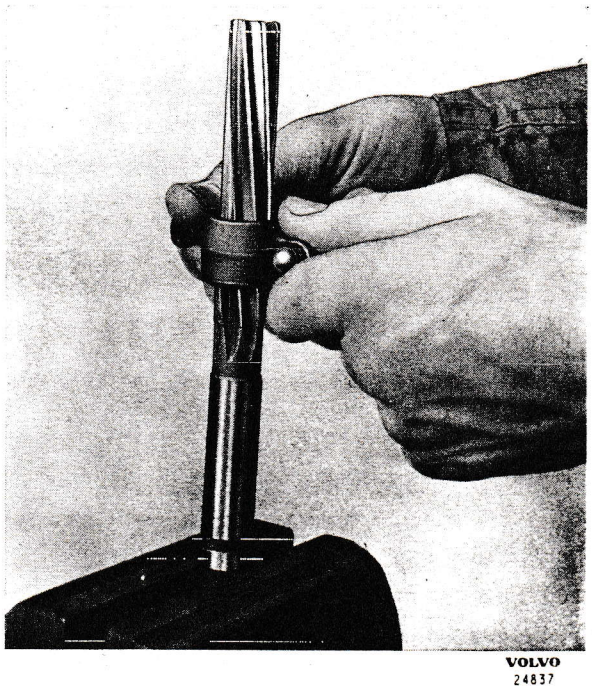

Fig. 40. Reaming a bushing

Replacing valve guides

1. Press out the old guides by using tool SVO 1459.
2. Press in the new guides, use tool SVO 2289, which gives the correct depth. See Fig. 37.

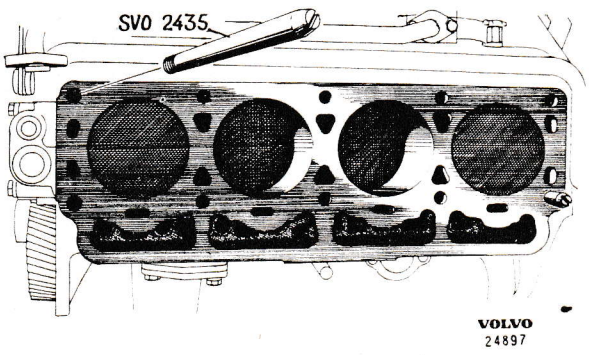

Fig. 41. The guide pins for the cylinder head

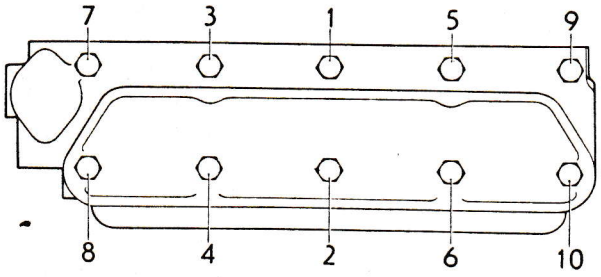

Fig. 42. Order of tightening for cylinder head

Assembling the cylinder head

1. Check that the parts are in good condition and are clean.
   Test to ensure that the springs maintain the values quoted in the specifications. See also Fig. 38.
2. Fit the valves in position. Fit the lower rubber washer, steel washer, valve spring, upper washer and key and finally the last rubber ring.

Replacing the rocker arm bushings and grinding the rocker arms

1. If wear is as great as 0.004″ (0.1 mm), replace the rocker arm bushing. Use tool SVO 1867 to press the bushing both out and in. Then ream the bushing with a suitable reamer until a accurate fit on the shaft is obtained. The hole in the bushing should index with the hole in the rocker arm.
2. If necessary grind the pressure pad in a special machine.

Fitting the cylinder head

1. Check that the cylinder head, the cylinder block, the pistons and the cylinder bores are clean.
2. Check that the oil channel to the rocker arm mechanism on the valve lifter side on the center of the block is clean. In the cylinder head the oil goes up through the bolt hole and then between the bolt and the hollow partition, the through a diagonal drilling to the attaching bolt for the rocker arm shaft and then up in the shaft.
3. Screw down the guide pins SVO 2435, one in the front right-hand and one in the left rear bolt holes.

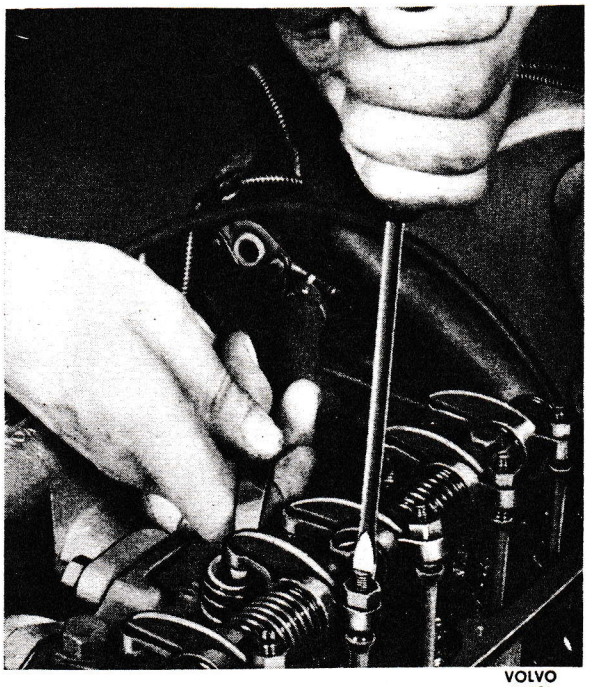

Fig. 43. Adjusting the valve clearance

Fig. 44. Measuring the cylinder bore

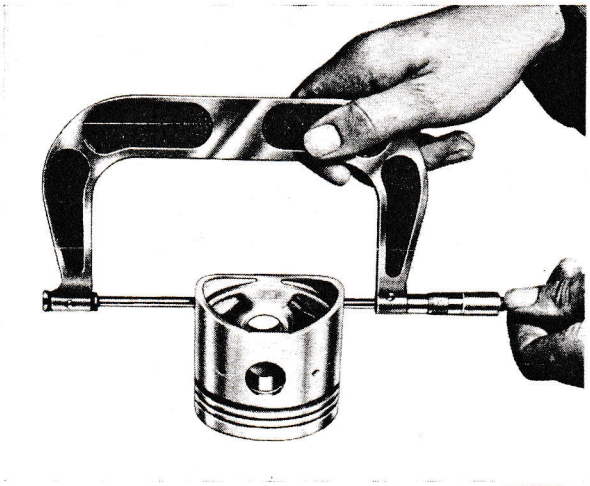

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Fig. 45. Measuring a piston

Fit a new cylinder head gasket and then fit the cylinder head. Screw in the cylinder head bolts lightly. Remove the last guide pins and also fit the bolts in these holes as well.

Tighten the bolts in the correct order and to the correct torque. See Fig. 42 and the specifications.

4. Fit the rocker arm mechanism. Adjust the valve clearances. Fit the other parts.
5. Run the car for a short distance. Check that the engine is running well and adjust the valve clearances.

   It is not necessary to re-tighten the cylinder head.

Adjusting valve clearances

The valve clearances can be adjusted in a satisfactory manner with the engine standing still, no matter whether it is cold or warm. The clearance is the same for both inlet and exhaust valves. When adjusting, use two feeler gauges, one "go" 0.016″ (0.40 mm) and the other "no-go" 0.018″ (0.45 mm). The clearance is adjusted so that the thinner gauge can be moved easily backwards and forwards while it should not be possible for the thicker gauge to gain entry. The engine should be turned over by using the fan. When the valves on cylinder no. 4 "rock", i.e. the exhaust valve closes and the inlet valve starts to open, adjust the clearance on the valves in number one cylinder and when the valves in number one cylinder "rock", adjust the clearance for the valves on number four cylinder. When the valves on number three cylinder "rock", adjust the clearance on the valves on number two cylinder and vice versa.

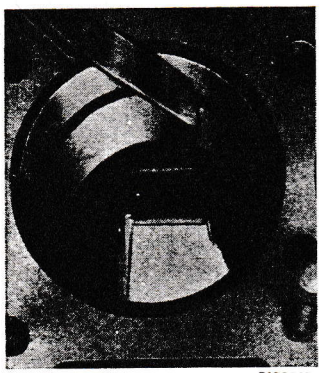

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Fig. 46. Measuring the piston ring gap

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Fig. 47. Piston ring clearance in groove

Cylinder block

Measuring the cylinder bores

The cylinder bores are measured by using

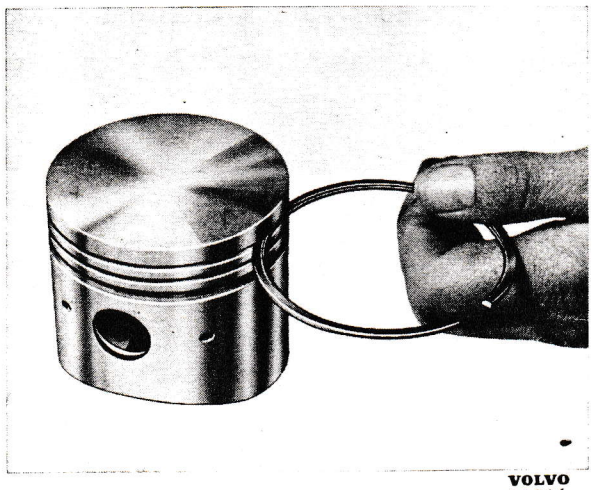

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Fig. 48. Rolling the piston rings in the groove

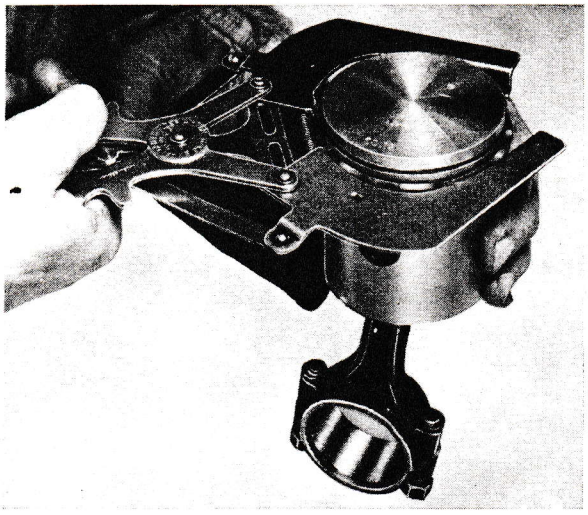


Fig. 49. Fitting the piston rings

a special indicator as shown in figure 44. On each cylinder bore there is a letter stamped showing the dimensions of the bore (only on standard models), see the specifications.

Measurement should be carried out at varying depths and in the longitudinal axis of the engine as well as the transverse. See the specifications for the correct measurements.

Re-boring the cylinders.

The cylinders are re-bored in a special machine. After this they are honed so as to obtain a good surface texture. The complete cylinder block is washed in a degreasing tank before being assembled so as to remove all grinding residue and impurities.

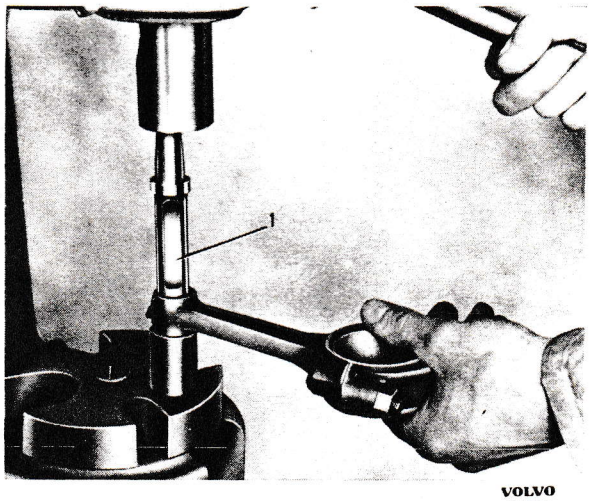


Fig. 50. Replacing the connecting rod bushing

1 = SVO 1867

Fig. 51. Piston pin fit

See the specifications for the dimensions concerned.

See also the text under the heading "The fit of the pistons in the cylinders".

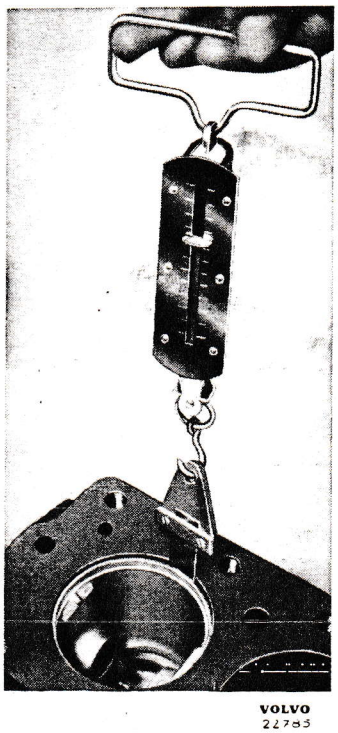


Fig. 52. Checking the piston clearance

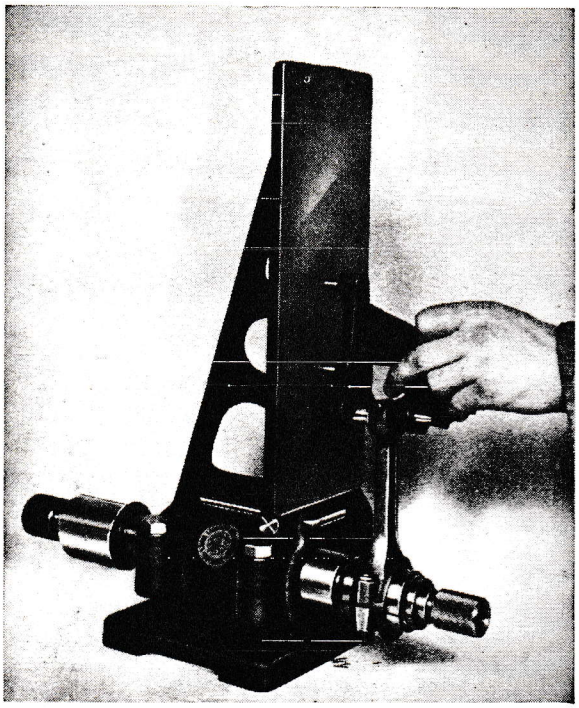


Fig. 53. Checking a connecting rod

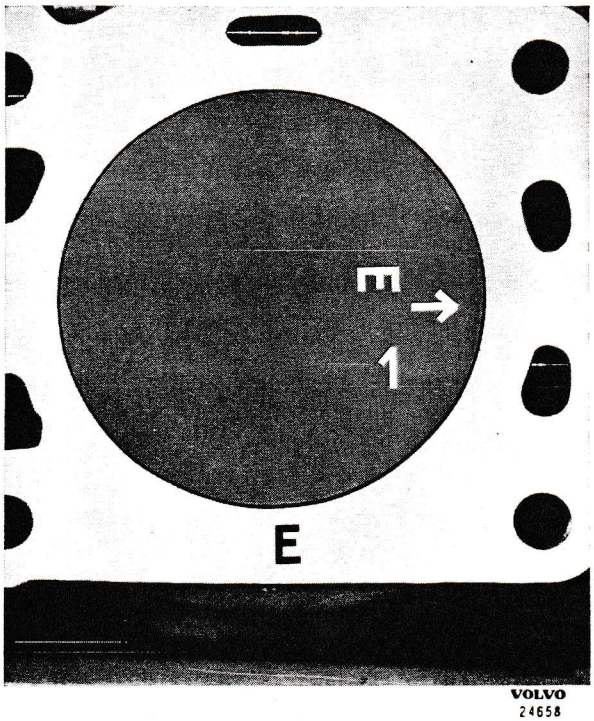


Fig. 54. Markings on the pistons and the block

Pistons

Measuring the pistons

The pistons are measured with a micrometer at right angles to the piston pin hole, 0.49″ (12.5 mm) from the lower edge, see Fig. 45. The dimensions are included in the specifications.

The fit of the piston in the cylinder

The fit of the pistons in their respective cylinders is tried out without the piston pins fitted. The clearance at right angles to the piston pin hole is measured with a feeler gauge 1/2″ wide and 0.0012″ (0.03 mm) thick attached to a spring balance. The force applied should be 2 1/4 lb, (1 kg). This gives the average value for piston clearance. When the above mentioned force is applied, the piston clearance obtained is equal to the thickness of the gauge used. Feeler gauges which are 0.0008″ (0.02 mm) or 0.0016″ (0.004 mm) thick can therefore also be used. The test is carried out at several different depths. See Fig. 52.

Standard bore cylinders have a letter stamped in showing the dimensions and the piston in this cylinder should be marked with the same letter.

Piston ring fit

In a new or re-bored cylinder

1. Push down the piston rings, one after the other, in the cylinder bore.
2. Use a reversed piston to ensure that the rings come into the right position.
   Measure the ring gap with a feeler gauge, Fig. 46. The gap should be 0.01″—0.02″ (0.25—0.50 mm). If necessary increase the gap by using a special file.
3. Check the piston rings in the respective ring grooves by rolling them in their groove, Fig. 48. Also measure the clearance at some points, Fig. 47. See the specifications for dimensions.

In a worn cylinder bore

When checking fit in a worn cylinder bore, the rings must be checked at the bottom dead center position where the cylinder bore has the smallest diameter.

Piston pins

The piston pins are available in three oversizes, these being 0.05 mm, 0.10 mm and 0.20 mm larger than the standard diameter of 22.00 mm. If the piston pin hole in the piston is worn so much that oversize is necessary, first ream the

hole up to the correct measurement. Use a reamer fitted with a pilot and only cut off a small amount of material at a time. The fit is correct when the piston pin can be pushed through the hole by hand with only slight resistance.

Connecting rods

Replacing bushings

If the old bushing in a connecting rod is worn, press it out by using tool SVO 1867 and press in a new bushing with the same tool. Make sure that the lubricating holes index with the holes in the connecting rod. Then ream the bushing to the correct fit. The piston pin should then slide through the hole under light thumb pressure but without any noticeable looseness.

Alignment

Before being fitted, the connecting rods should be checked for straightness, twist and possible S-distortion. Straighten them if necessary. See Fig. 53.

New nuts and bolts should be fitted when reconditioning is carried out.

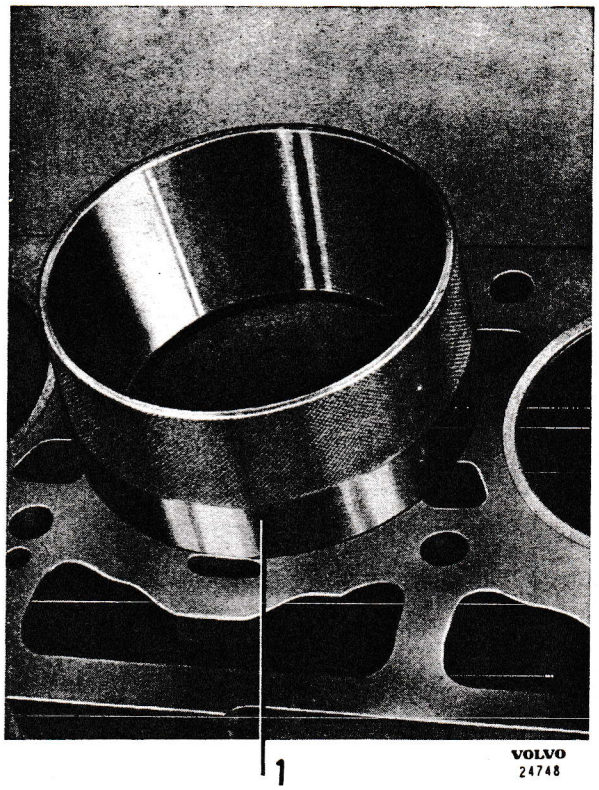


Fig. 55. Fitting a piston

1. Assembling tool SVO 2176

Assembling and fitting the piston and connecting rod.

When assembling make sure that the piston is turned correctly so that the arrow on the front of the piston faces the forward end of the engine as shown in Fig. 54. If the piston is turned the wrong way, there will be some considerable noisiness. The number marking on the connecting rod should be turned to face away from the camshaft. The piston pin is then fitted, the circlips placed in position and the piston rings fitted.

Use piston ring tongs when fitting the rings. The compression rings are marked "TOP" and the upper ring on each piston is chromed. Place the bearing shells in position.

Turn the rings so that the gaps on the rings are not under each other. Then grease the piston and friction surfaces.

Use assembly tool SVO 2176, Fig. 55, when fitting the piston in the cylinder bore. Tighten the connecting rod bolts with a torque wrench, see the specifications for the correct value.

Crankshaft

After the crankshaft has been cleaned, its journals must be measured with a micrometer. Measuring should be carried out at several points round the circumference and along the longitudinal axis of each journal. Out-of-round on the main bearing journals should not exceed 0.002" (0.05 mm) and on the connecting rod

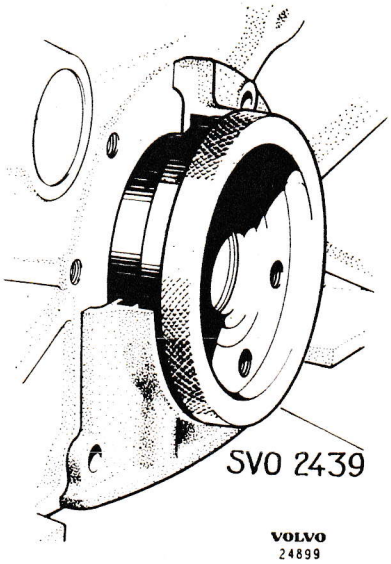


Fig. 56. Centering the rear sealing flange

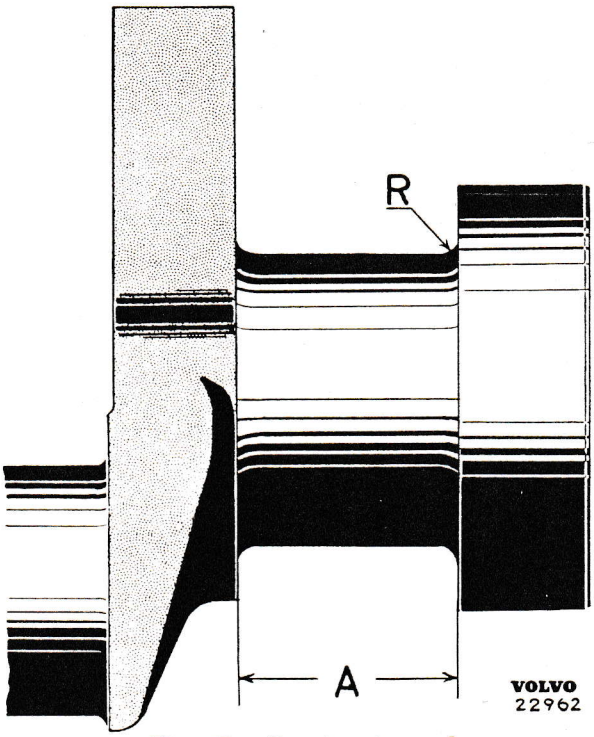


Fig. 57. Bearing journal

bearing journals it should not be greater than 0.003″ (0.07 mm). Taper should not be greater than 0.002″ (0.05 mm) for any of the journals.

If the values obtained are in the neighbourhood of or exceed the wear limits given above, the crankshaft should be ground down to undersize. Suitable bearing shells are available in five undersizes. The measurements concerned are included in the specifications.

Check that the crankshaft is straight to within 0.02″ (0.05 mm) by using a dial indicator. Lay the crankshaft in two V-blocks, place the indicator in contact with the center bearing journal, and then turn the shaft. If necessary straighten the crankshaft in a press.

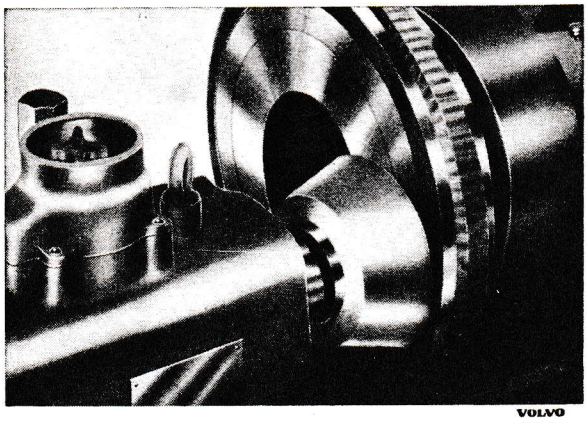


Fig. 58. Grinding the flywheel

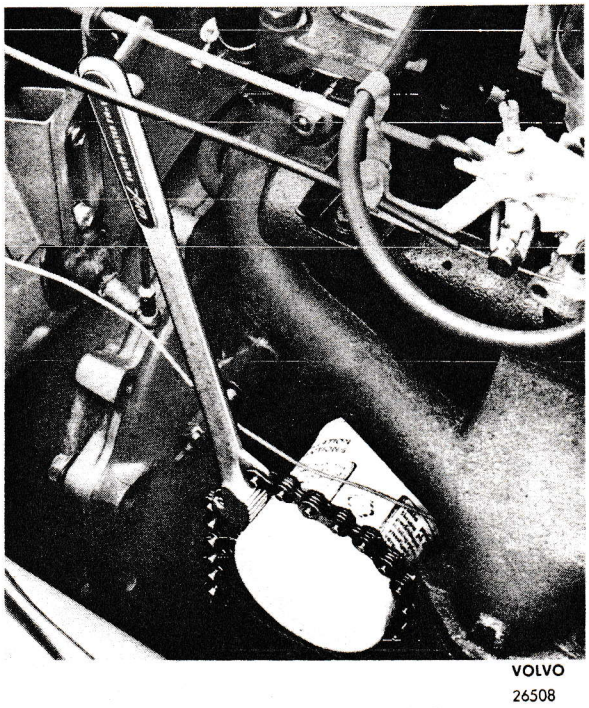


Fig. 59. Removing the oil cleaner

Grinding the crankshaft

Before the crankshaft is ground, a check should be carried out to ensure that it is straight, this being checked as already described. Grinding is carried out in a special machine whereby the main bearing journals and the connecting rod bearing journals are ground to relatively indentical measurements. These measurements, which are included in the specifications, must be carefully followed in order to ensure the correct bearing clearance together with the precision type bearing shells.

No shaving or scraping of the bearing shells or caps is permitted. The fillets at the ends of the journals should have radii of 0.080″—0.010″ (2.0—2.5 mm) on all the journals, see Fig. 57.

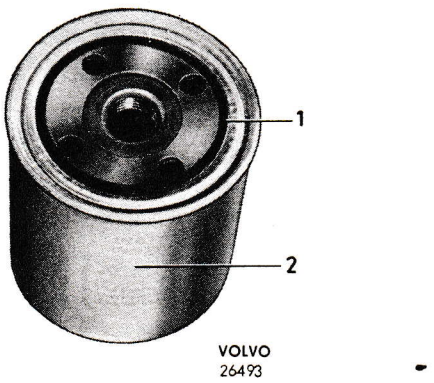


Fig. 60. The oil cleaner ready for fitting

1. Gasket, (oiled in) 2. Oil cleaner

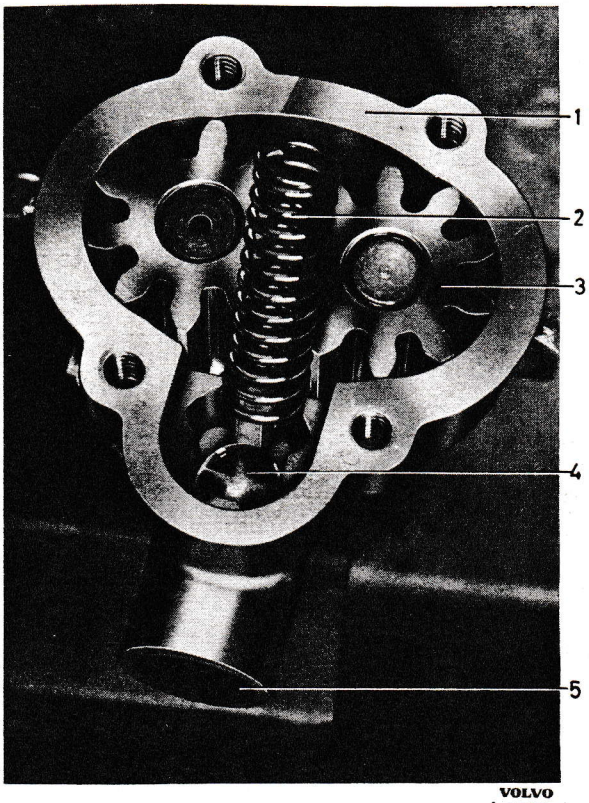


Fig. 61. Oil pump

1. Pump housing
2. Spring for relief valve
3. Gear
4. Valve ball
5. Hole for oil pipe

The width measurement (A) for the guide bearing depends on the size of the journal and this must be ground in order to obtain the correct measurement.

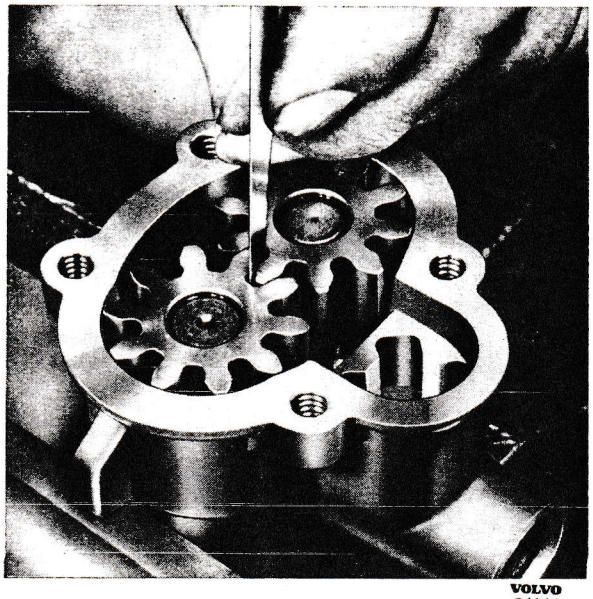


Fig. 62. Measuring backlash

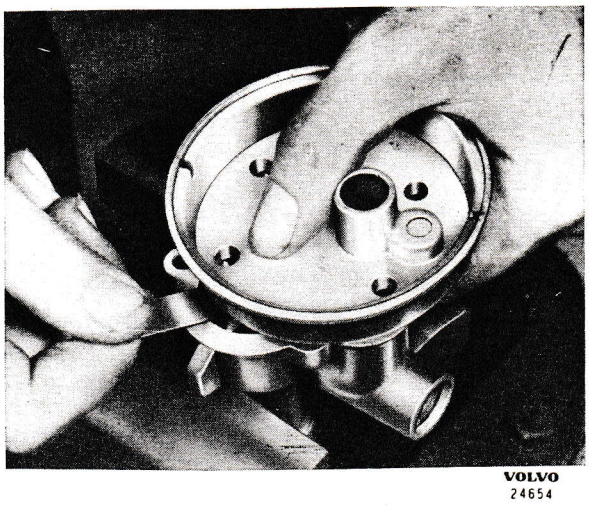


Fig. 63. Measuring axial clearance

After grinding is completed, the openings for the oil channels should be carefully bevelled and all bearing journals should be lapped with fine grinding compound to the finest surface texture. The shafts should then be washed. All the oil drillings should be cleaned particularly thoroughly in order to remove all grinding residue and grinding agent.

Main bearings and connecting rod bearings.

In addition to standard sizes, bearing shells are available in undersizes of 0.010″, 0.020″, 0.030″, 0.040″ and 0.050″. The rear main bearing shells are fitted with flanges and have a larger width measurement relative to their size.

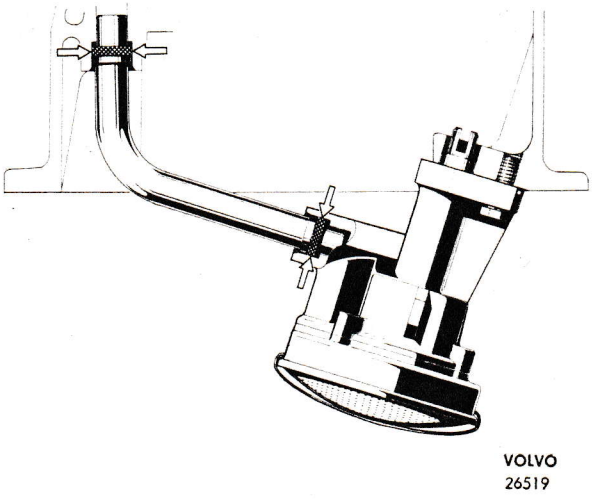


Fig. 64. Sealing rings on pressure pipe

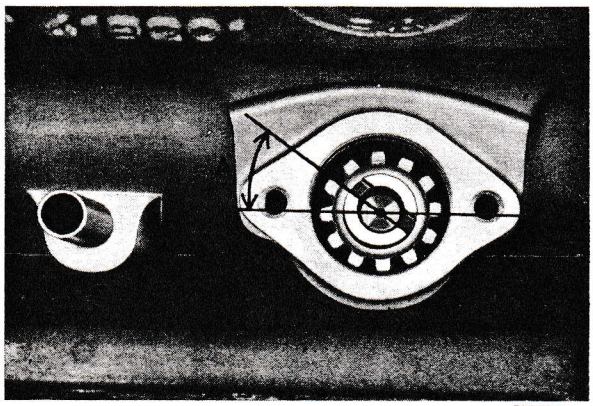


Fig. 65. Distributor drive position

A = approx. 35°

If the crankshaft has been ground to the correct dimension, the right bearing clearance is obtained when the corresponding bearing shells are fitted. The bearing shells may not be shaved and the caps may never be filed in order to obtain a closer fitting on the bearings.

The bolts should be tightened with a torque wrench, see the specifications for information concerning the tightening torque.

Fitting the rear sealing flange.

1. Make sure that the seal is in good order and that the flange is clean. The drain hole must not be blocked by faulty fitting of the oil pan gasket. The seal ring should not be fitted in the flange.
2. Fit the sealing flange but do not tighten the bolts.

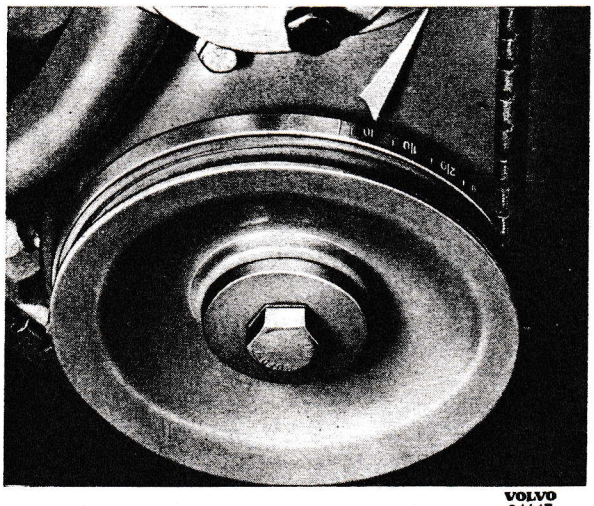


Fig. 66. Graduations for ignition timing

3. Center the flange with the tool SVO 2539. Turn the sleeve round while tightening the bolts and adjust the flange position if the sleeve jams. Check that the flange is level against the block on the underside.
   After final tightening check that the sleeve rotates easily.
4. Fit a new felt ring and fit the washer and lock ring. Press the lock ring into position with the centering sleeve. Check that the lock ring has engaged in its groove.

Pilot bearing for clutch shaft.

The pilot bearing lock ring and protective washer are removed, the bearing is pulled out by using SVO 4090 and checked after it has been washed in white spirit. If the bearing is worn it should be replaced. Before fitting, pack the bearing in with heat-resistant bearing grease. Fit the bearing by using tool SVO 1426 and then fit the protective washer and lock ring.

Grinding the flywheel

If the flywheel wear surface is uneven or burned, the surface can be ground even in a slide grinding machine, Fig. 58. The total depth available for grinding is restricted to 0.03" (0.75 mm).

Replacing the oil cleaner

The oil cleaner (Fig. 59) is, together with the element and relief valve, screwed onto a nipple in the block as one unit.

The oil cleaner should be replaced after every 6,000 miles (10,000 km) and the old cleaner should be thrown away. In the case of a new or reconditioned engine the cleaner should also be replaced for the first time after 3,000 miles (5,000 km).

1. Remove the old cleaner with the help of a tool as shown in Fig. 59.
2. Smear oil on the rubber gasket for the oil cleaner (1, Fig. 60) and make sure that the contact surface for the oil cleaner is free from dirt. A coating of oil also ensures that the gasket slides into better contact with the sealing surface. Screw the cleaner on by hand until it just touches the block.
3. Then screw the oil cleaner on a further half turn by hand. Do not use the tool when

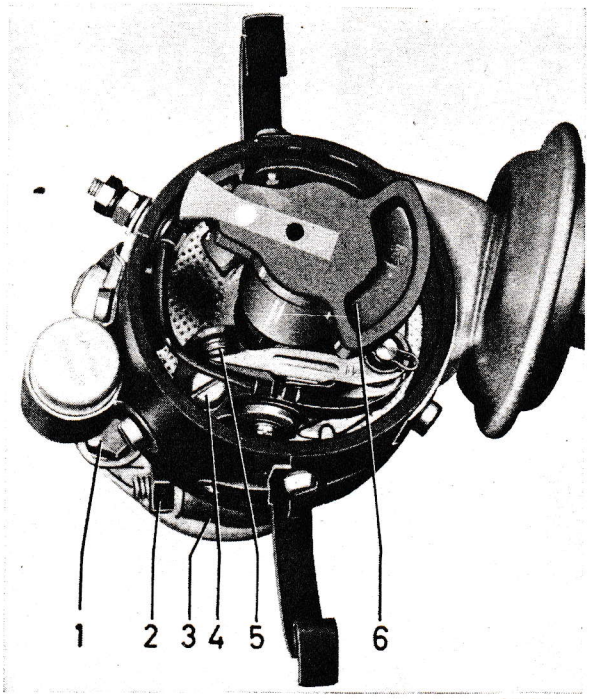


Fig. 67. Attaching the distributor

1. Screw for retainer
2. Clamp screw
3. Retainer
4. Lock screw
5. Contact breaker points
6. Distributor rotor

fitting the cleaner. Start the engine and check that there is no leakage.

Oil pump with relief valve

After the pump has been disassembled and cleaned, check that all the parts are in good condition. Check the relief valve spring (2, Fig. 61), see the specifications for the figures concerned.

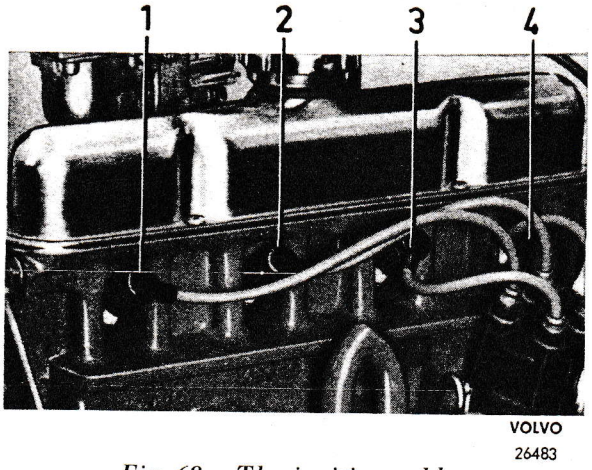


Fig. 68. The ignition cables

Order of firing 1—3—4—2

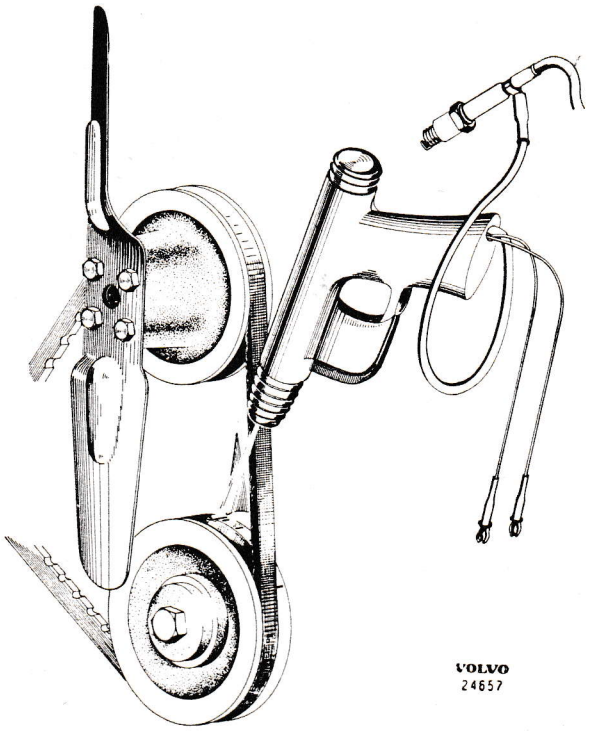


Fig. 69. Ignition timing setting

Check that the backlash is 0.06″—0.014″ (0.15—0.35 mm), see Fig. 62. Measure the axial clearance, 0.0008″—0.004″ (0.02—0.10 mm), as shown in Fig. 63. Use a new cover check that the cover is not noticeably worn. If the bushings or shaft are worn, replace with new units. Note that the drive shaft and gear are replaced as one unit.

The new bushings should be reamed after being pressed in with a reamer fitted with a pilot.

The seal rings at the ends of the pressure pipe are made of special rubber and are also made to very fine tolerances. For this reason only original Volvo spares should be used. The pressure pipe must be clamped in its correct position first in the oil pump and then the oil pump and pipe together against the block. The pump connecting flange should be flat against the block before being tightened. Before being fitted, the rubber rings on the pipe can be smeared with soap solution since this enables the pipe to come into position more easily. Tap lightly on the pipe with a soft club if necessary.

Oil channels

Oil channels must be cleaned particularly carefully before the parts are refitted on the engine in order to avoid damage to the bearings, bearing journals and other components.

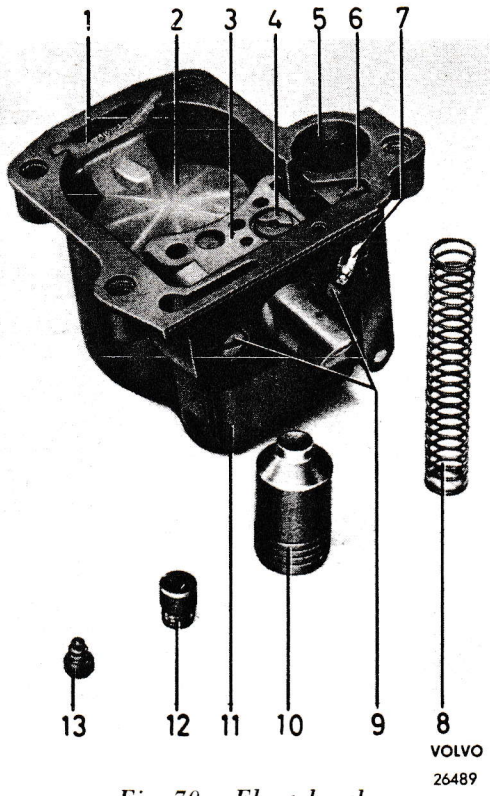


Fig. 70. Float bowl

1. Lock spring (Marked TOP)
2. Float
3. Emulsion block
4. Air jet for idling
5. Barrel
6. Outlet valve
7. Acceleration jet
8. Spring
9. Screws
10. Plunger
11. Float bowl
12. Inlet valve
13. Stop screw

To clean the cylinder block channels, remove the seal plugs and after cleaning the channels and blowing them dry, fit new plugs.

Fitting the distributor drive

When the engine is in its TDC position and clear for ignition on number one cylinder, the drive for the oil pump and distributor should be fitted. The small section at the groove is turned to face upwards to the rear and the groove is arranged so that it is at an angle of approx. 35° to the longitudinal axis of the engine, see A, Fig. 65.

Make sure that the shaft goes down into its groove in the pump shaft.

Fitting the distributor.

1. Check that the engine is in its correct position for ignition on number one cylinder (TDC) and that the distributor drive is correctly fitted as described in the previous section.
2. Fit the distributor but do not tighten it in position.
3. Turn the distributor housing slowly to the position where the contact breakers open for cylinder number one. Tighten the distributor lightly in this position. Make sure that the distributor rotor points towards the contact in the distributor cap for number one cylinder spark plug, Fig. 67.
4. Fit the cap and cables as shown in Fig. 68. The distributor rotor rotates in a counterclockwise direction.
5. Start the engine and adjust the timing carefully as described below.

Rough adjustment when fitting the distributor on the engine is only provisional and should always be finally checked with a stroboscope before the engine is run.

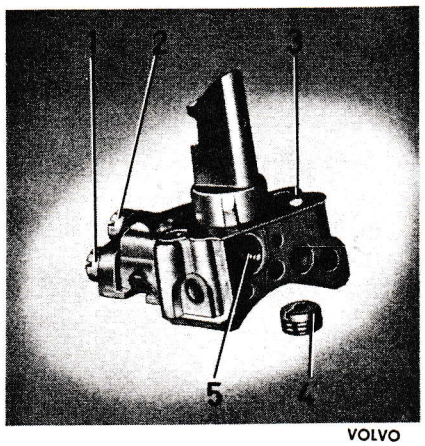


Fig. 71. Emulsion block

1. Compensation jet
2. Main jet
3. Air jet for part throttle
4. Air jet for idling
5. Idling jet

Ignition timing setting

The ignition timing setting should be checked while the engine is running with a the help of a stroboscope after the distributor has been removed or on other occasions when necessary.

1. Disconnect the vacuum regulator by disconnecting the vacuum line at the distributor.
2. Mark out the graduation 22° ± 1° before TDC on the crankshaft pulley with chalk so that it is clearly visible.

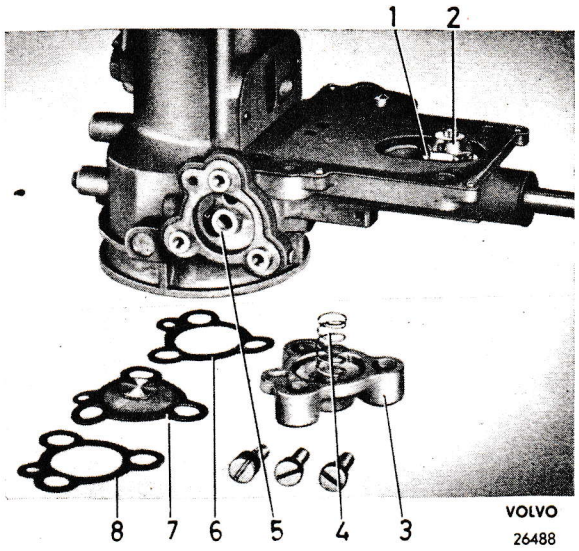


Fig. 72. Economiser valve

1. Washer
2. Float valve
3. Cover
4. Spring
5. Seat
6. Gasket
7. Diaphragm or disc
8. Gasket

3. Connect the lamp with the high tension cable to the spark plug in number one cylinder and to the battery with the other cables. See Fig. 69.
4. Start the engine and run it up to 1500 r.p.m. *Keep your hands clear of the fan.*
5. Aim the lamp at the scale on the pulley. Loosen and turn the distributor so that ignition occurs when the chalk mark mentioned in point 2, is opposite the pointer. Tighten the distributor and check that the setting does not alter.
6. Remove the lamp and fit the vacuum line.

Carburetor

Cleaning the carburetor while it is fitted on the engine

Before cleaning the carburetor, always make sure that the sludge trap on the fuel pump has been cleaned out.

When cleaning the carburetor it is often sufficient merely to move the float chamber, take out the float, screw out the air jet for idling (4, Fig. 70) as well as the actual idling jet which is located under the air jet. Also remove the acceleration pump plunger and the idle fuel screw, this screw being on the carburetor housing. Remove the needle valve and

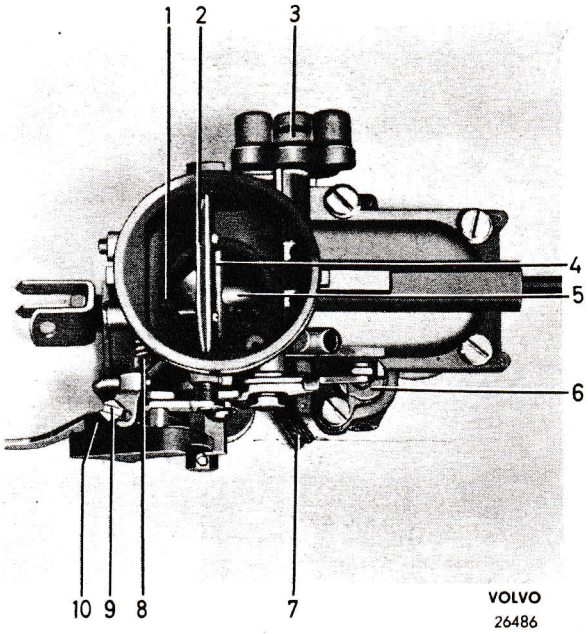


Fig. 73. Venturi position

1. Venturi
2. Choke flap
3. Economiser valve
4. Stay
5. Emulsion block beak
6. Washer
7. Idle fuel screw
8. Idler adjuster screw
9. Rapid idling adjuster screw
10. Idling cam

check or clean it. Wash the parts concerned in white spirit or alcohol. Blow through all channels and jets with compressed air, including the hole for the idle fuel screw.

Check that the jets screwed out are clean by holding them up against the light. Fit the parts, start the engine and adjust idling speed.

Removing

1. Blow the carburetor clean externally. Remove the upper part of the air cleaner. Disconnect the fuel line and vacuum line.
2. Disconnect the throttle and choke controls at the carburetor.
3. Screw off the attaching nut and lift up the carburetor. Cover the hole in the inlet manifold with masking tape.

Disassembling

1. Remove the float bowl by screwing out its attaching screws.
2. Remove the lock spring (1, Fig. 70) and lift up the float (2). Note the marking (TOP) on the lock spring.
3. Remove the emulsion block screws (9) and take up the block.

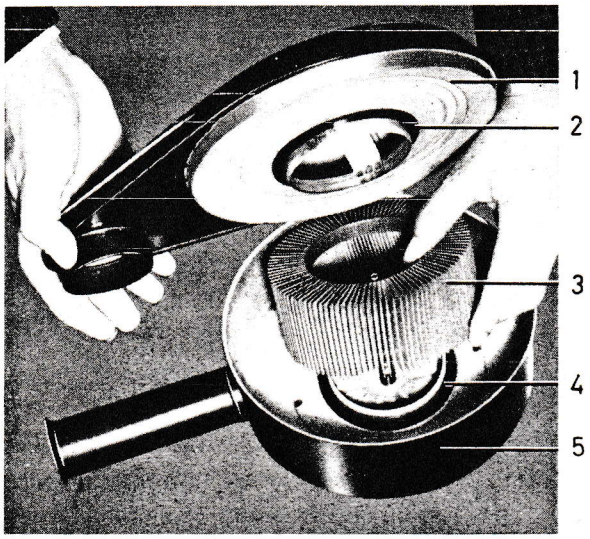


Fig. 74. Air cleaner, replacing insert

1. Upper section 3. Insert 5. Lower section
2. Gasket 4. Gasket

4. Screw out all the jets from the emulsion block, Fig. 71.
5. Remove the acceleration pump plunger, spring, inlet valve, outlet valve and acceleration jet. See Fig. 70.
6. Remove the float valve and the economiser valve, Fig. 72. Screw out the idle fuel jet.
7. Clean all parts in white spirit or alcohol. Blow out all channels and jets with compressed air. *Never clean jets with wire or a drill, this ruins them and they must then be replaced.*

Assembly

Assembly is carried out in the reverse order to that used when disassembling.

1. Check that all parts are in good condition and clean. Fit new washers and gaskets.
2. Check that the economiser valve disc (7, Fig. 72), is in good contact with its seat (5). The disc can be lapped in against the seat with fine grinding compound if necessary.
3. Fit the lock spring for the float with the "TOP" marking facing upwards. The spring under the pump plunger is pushed down so that it goes into the inlet valve in the bottom of the barrel. Check that the washer for the float has the correct thickness according to the specifications. It is not possible to adjust the level.
4. When the float bowl is fitted it should be pressed inwards and upwards when tightening the screws.
   The emulsion block beak (5, Fig. 73) should be in contact with the stay across the venturi. If this is not the case, loosen the venturi screw and adjust its position.

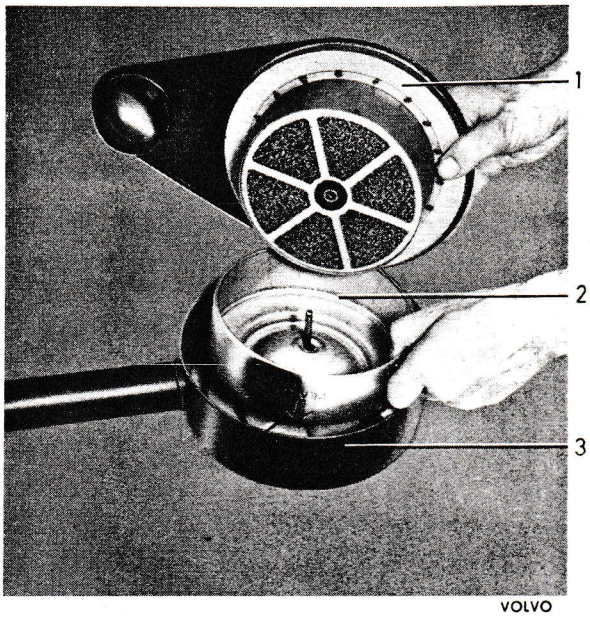


Fig. 75. Oil bath air cleaner, cleaning

1. Upper section 2. Container 3. Lower section

Acceleration pump stroke

The pump plunger can be set for a short or a long stroke by means of the washer (6, Fig. 73). To alter the setting, lift the washer and give it half a turn. The normal setting is a short stroke, the highest cam on the washer being turned against the spring on the lever.

Fitting

Clean the surface on the inlet manifold and on the carburetor. Check that the surfaces in question are not distorted or damaged. Fit a new gasket and fit the parts in the reverse way to that used when removing.

Adjusting rapid idling

Pull out the choke control the whole way and check that the forward cam on the choke lever stops against the check.

Screw out the rapid idling screw (9, Fig. 73) so that it is flat against its bracket on the underside. Then screw down the screw three and one half turns. Push in the choke control.

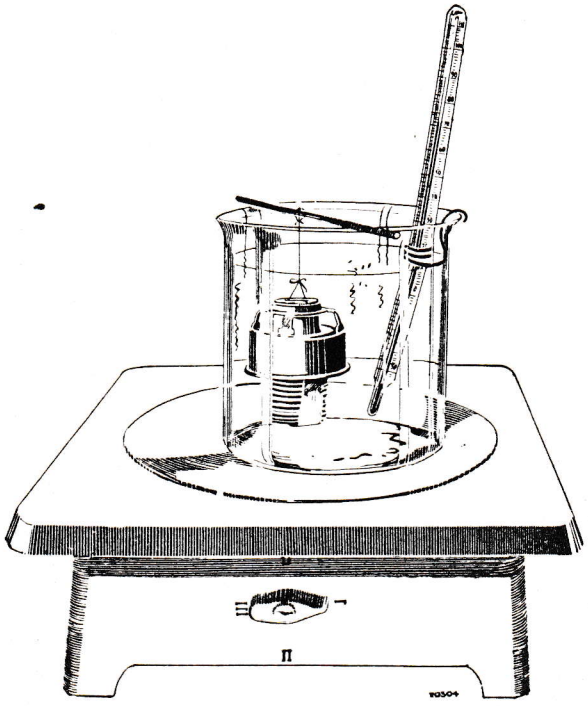


Fig. 76. Testing the thermostat

Adjusting idling.

This adjustment is carried out with a warm engine.

1. Adjust the idling speed to 500—700 r.p.m., by using the screw on the throttle flap lever (8, Fig. 73).
2. Adjust the fuel/air mixture with the idle fuel screw (7). First screw the screw inwards (leaner mixture) until the engine begins to run roughly and then slowly outwards until the engine runs evenly.
3. Adjust engine speed if necessary by means of the screw on the throttle flap lever.

Adjusting the accelerator pedal.

There should be a clearance of 0.040″ (1 mm) between the lever on the throttle flap and the full throttle stop when the accelerator pedal is fully depressed.

Adjustment is carried out by altering the length of the vertical push rod.

When the accelerator pedal is fully depressed, the force exerted by the foot of the driver will thus be taken up against the foot plate without exerting unnecessary loading on the throttle control system.

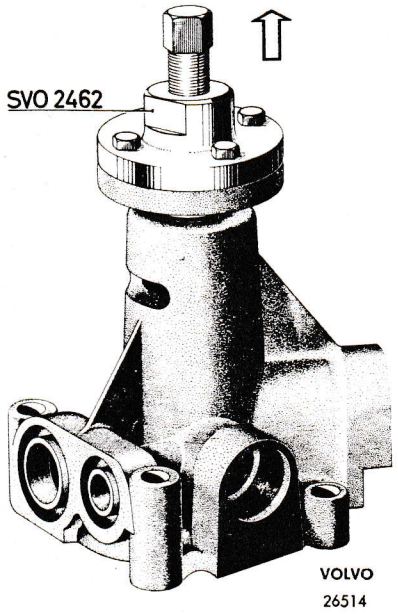


Fig. 77. Removing the hub

Air cleaner with paper insert

The insert must be replaced after every 12,000 miles (20,000 km) if the car is driven in districts with moderate air contamination. When driving in extremely dusty districts, it may be necessary to carry out replacement at shorter intervals.

No cleaning of any type may be carried out

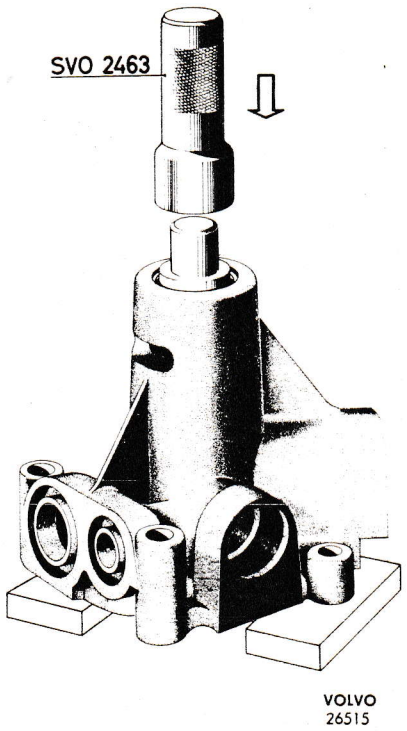


Fig. 78. Removing the shaft and impeller

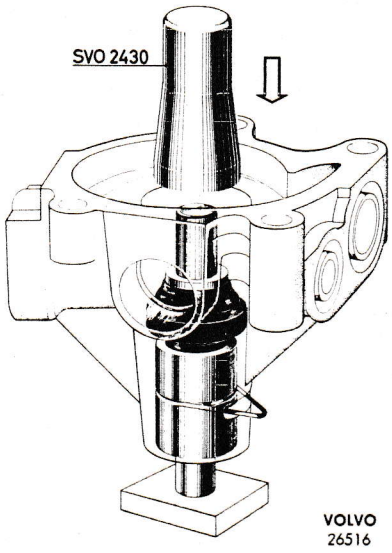


Fig. 79. Fitting the seal ring

between changes. It is absolutely forbidden to moisten or oil in the insert.

A sign of a blocked air cleaner is increased fuel consumption.

Replacing the insert

1. Loosen the upper hose clamp and remove the wing nut.
2. Lift off the upper section and remove the old insert.
3. Wipe carefully clean from dust and dirt inside the lower part of the cleaner by using a moist cloth. Also clean off the upper part of the air cleaner. Check that the gaskets (2 and 4) are in good condition or replace them.

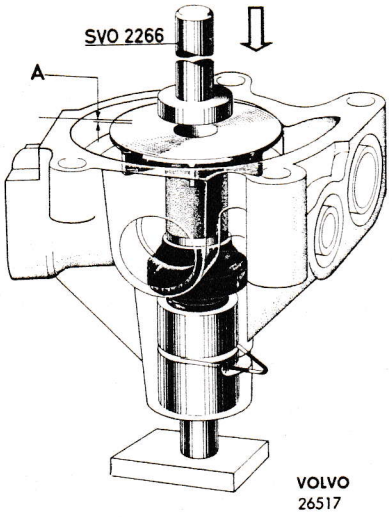


Fig. 80. Fitting the impeller

A = 0—0.016" (0—0.4 mm)

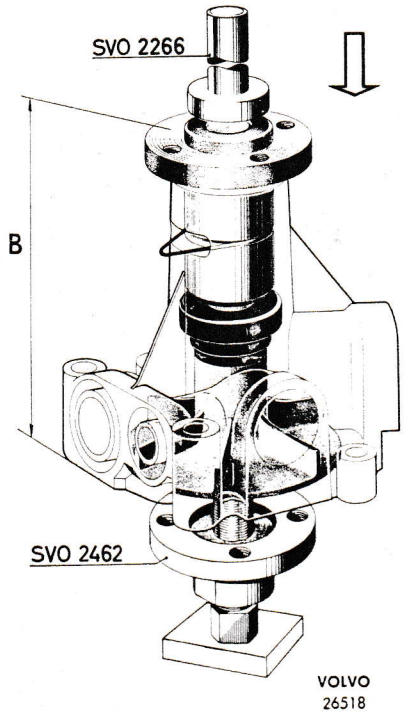


Fig. 81. Fitting the pulley

B = 4.134" ± 0.008" (105 ± 0.2 mm)

4. Take up the new insert, shape it and fit it. Then fit the upper section.

Air cleaner with oil bath

This air cleaner should be disassembled and cleaned normally after every 6,000 miles (10,000 km). When driving in particularly dusty districts, cleaning may be necessary more often however. If fuel consumption increases this can depend upon a blocked air cleaner.

Cleaning and changing the oil in the air cleaner

1. Loosen the upper hose clamp and the wing nuts. Lift off the upper section.
2. Lift up the inner container (2) and empty out the old oil. Wash the container in white spirit. Also wash the insert and clean other parts.
3. Lay the container in the lower section. Fill the container with oil up to the level mark. Note. Only add oil to the separate container, not to the actual lower section. Use the same sort of oil as in the engine.
4. Fit the upper section on the cleaner.

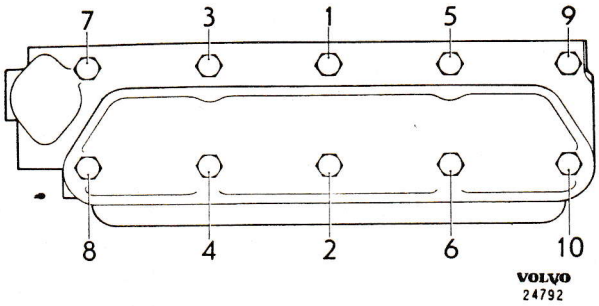


Fig. 82. Order of tightening for cylinder head bolts

Replacing the fuel pump diaphragm and/or valves

Before removing the pump, first make sure that its pressure and capacity have been measured. If the values (see the specifications) are faulty, the pump must be dissassembled for repair, this most often consisting in a replacement of the diaphragm or valves.

1. Disassemble the pump.
2. Remove the old diaphragm by pressing it down and giving it a quarter of a turn.
3. Fit the diaphragm by pressing down the rod and turning it a quarter of a turn.
4. Check or replace the valves. Assemble and test the pump before refitting it on the engine.
   Make sure to see that the lever comes in its correct position above the cam.

Cooling system

Always use as clean water as possible, with the addition of corrosion protective agent in the radiator.

Note. The water pump is made of light-alloy.

Anti-freeze.

During the winter, ethylene glycol should be added to the cooling water together with anti-rust agent in order to avoid damage by freezing. See the specifications for the amounts concerned.

Thermostat

The thermostat can be tested after being removed, in a vessel with water which is heated up. See Fig. 76.

The thermostat should open and close at the temperatures shown in the specifications.

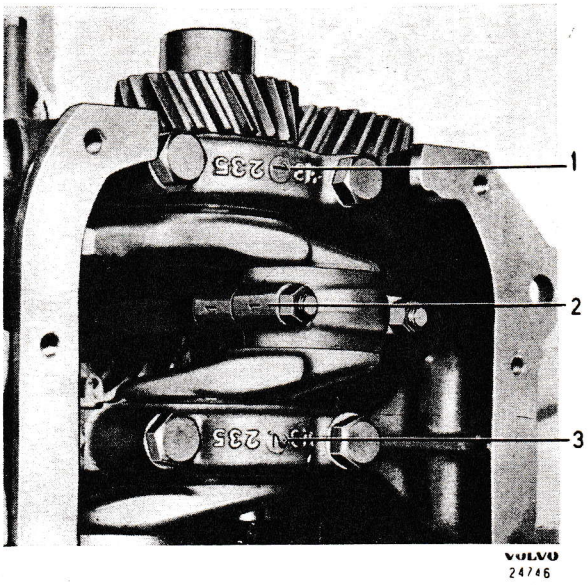


Fig. 83. Markings on main bearings and connecting rod bearings

1. Main bearing number 1
2. Connecting rod bearing number 1
3. Main bearing number 2

Reject a faulty thermostat. Use a new gasket when refitting.

Water pump

Disassembly and control

1. Pull out the lock spring.
2. Fit puller SVO 2462 on the hub with the bolts for the pulley and pull off the hub. See Fig. 77.
3. Place the pump in a press. Fit tool SVO 2463 on the bearing outer race and press out the shaft, bearing and impeller. Fig. 78.
4. Inspect the impeller and the bearing. If the bearing is worn and feels loose or if it chafes, reject the shaft and bearing. (The shaft and bearing cannot be disassembled). If the bearing can still be used, it should not be warmed up or washed in fluid since the lubricant in it will then be ruined.
   If the impeller is removed it should be replaced by a new unit since there is almost always damage and excessive clearance. The seal ring should always be replaced by a new unit.
5. When disassembling the shaft and impeller, these units are separated by pressing the seal ring down and sliding the washer SVO 2429 in under the impeller. Then press out the shaft with tool SVO 2266.

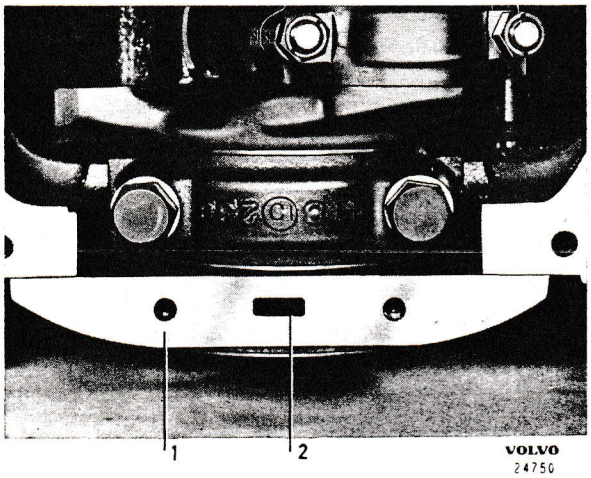


Fig. 84. Rear sealing flange

1. Flange
2. Drain hole

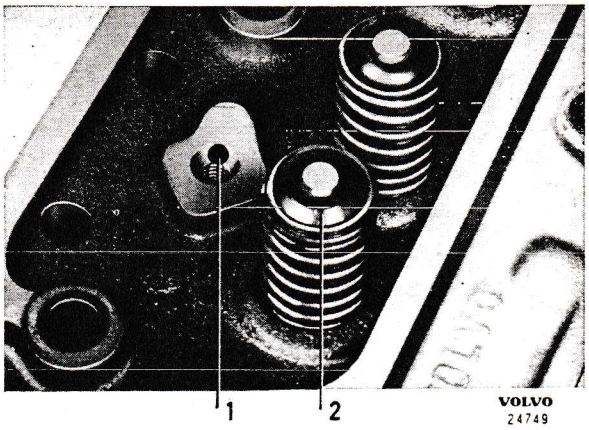


Fig. 85. Cylinder head

1. Oil hole
2. Rubber washer

Assembly

Check carefully before assembly that the parts are in good condition. The impeller sealing surface must be even and free from scratches. The bearing should run easily without chafing and should not be loose. Replace damaged parts with new parts. The seal ring should always be replaced with a new unit.

1. Press down the shaft and the bearing in the housing by using tool SVO 2463 in a similar way to that shown in Fig. 78 so far that the lock wire can be inserted into its groove. Fit the lock wire.
2. Fit the seal ring with tool SVO 2430 as shown in Fig. 79. Smear the sealing surface against the impeller with molybdenum disulphide which has been stirred up in methylated spirit.
3. Press down the impeller with tool SVO 2266 so far that the impeller is level with or up to 0.016″ (0.4 mm) below the pump housing surface. The lower end of the shaft should rest against a counterhold. See Fig. 80.
4. Turn the pump. Apply a counterhold under the end of the shaft in the impeller hole and press on the hub with tool SVO 2266. As counterhold use, for example, puller SVO 2462 with the center bolt screwed in so that it supports against the shaft. Press carefully so far that the dimension B as shown in Fig. 81 is 4.134 ± 0.008″ (105 ± 0.2 mm).
5. Check that the pump can be turned by hand without excessively large resistance and that there is no chafing.

Assembling the engine

When assembling the engine follow the instructions for the parts in question. The order of work is the reverse to that used when disassembling. Check the marking of the bearings as shown in Fig. 83. The main bearings are marked 1—5, the connecting rod bearings 1—4 counting from the front.

Check that all parts are clean and lubricate friction surfaces with oil before assembling. Always use new gaskets, washers, cotter pins and lock washers. Do not use shellac as sealing agent since it dries gradually and flakes off whereby the oil channels can be blocked. No adhesive should be used on gaskets.

Sealing at the ends of the pressure pipe on the oil pump and the pipes on the water pump is in the form of rubber rings. These rings, which seal radially are made of special rubber with very close tolerances.

Only original Volvo parts are to be used. Assembly is facilitated if the rings are smeared with soap solution. The rings should be pushed onto the pipe and then pushed into their correct position before the bolts are tightened. The oil pump flange should be in good contact with the block before tightening is carried out.

The timing gear casing and the rear sealing flange must be carefully centered when fitted. See under the headings "Replacing the timing

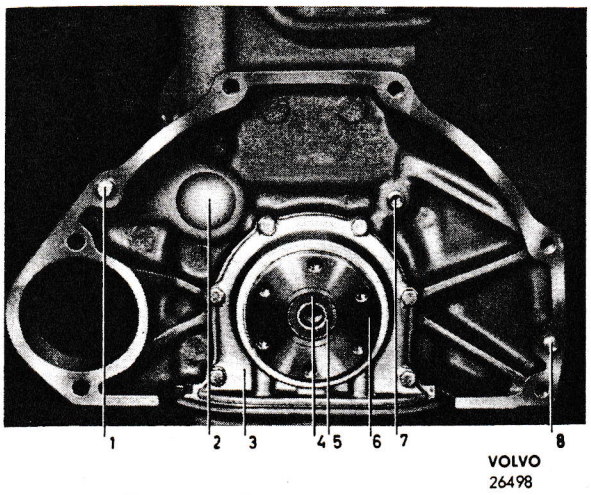


Fig. 86. Rear end of engine

1. Guide pin
2. Seal washer
3. Sealing flange
4. Lock ring
5. Pilot bearing
6. Crankshaft
7. Plug
8. Guide pin

gear casing" and "Fitting the rear sealing flange".

The connecting rod bolts and nuts should be replaced by new units when reconditioning.

The cylinder head should be fitted with the help of guide pins SVO 2435. The bolts must be tightened in a certain order as shown in Fig. 82. in order to avoid unnecessary stresses. Check that the oil hole (1, Fig. 85) for lubrication of the rocker arms is open.

The pilot bearing (5, Fig. 86) should be lubricated before being fitted with heat-resistant bearing grease. The bearing and protective washer are held in position by a lock ring (4).

The most important bolts and nuts should be tightened with a torque wrench, see the specifications for the tightening torque concerned.

Fan belt tension

The fan belt should be tensioned so that the pulley starts to slip when a force of 14 1/2—18 1/2 lb. (6.5—8.5 kg) is applied at a point about 6" (150 mm) from the center of the hub.

Rotate in the direction of rotation of the engine and use a spring balance as shown in Fig. 87.

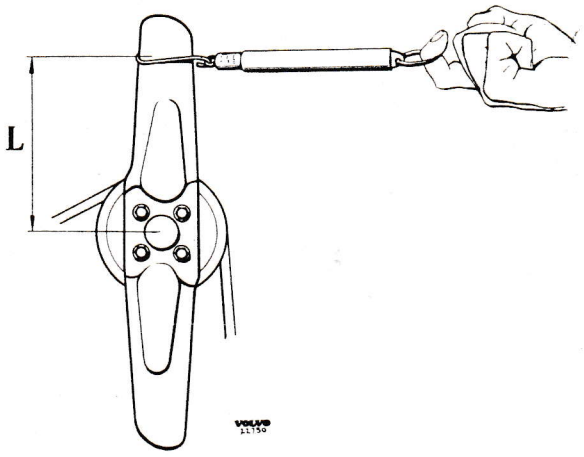


Fig. 87. Fan belt tension

L = 6" (150 mm) Force 14½—18½ lb. (6.5—8.5 kg)

Fitting the engine in the car.

When fitting the engine, use lifting tool SVO 2425.

The order of work will be the reverse of that used when disassembling, see under the heading "Disassembling the engine".

After all the parts have been fitted, top up with water and oil.

Check that all controls are properly connected up.

Running in.

An engine which has been reconditioned completely or partly must always be driven carefully during the first period of time, this bering know as the running-in period. The engine should not be run at excessively high speeds but care should also be taken to avoid excessively low speeds when it is under loading. The engine oil should be changed at closer intervals than usual. See the appropriate sections in the instruction book.

If an engine test bench is available, it is an advantage to run the engine in this bench if a more extensive reconditioning has been carried out.

FAULT TRACING

FAULT	
CAUSE	REMEDY
The engine stalls or idles very unevenly	
Faulty spark plugs or suppressors.	Check and replace spark plugs and suppressors if necessary.
Air leaks at carburetor connection.	Check tightening. Replace faulty gaskets.
Idling speed too low.	Increase idling speed.
Dirt in carburetor.	Clean carburetor, particularly idling system.
Engine runs jerkily (or even coughs) during acceleration	
Dirt on spark plug insulators.	Clean insulators.
Faulty spark plugs.	Check or replace spark plugs.
Dirty, faulty or wet distributor cap.	Remove and clean or replace.
Faulty or wet cables.	Check, clean or replace cables. See also Part 10.
Dirt in carburetor.	Remove float bowl and needle valve, clean these parts.
Fuel/air mixture too lean.	Check carburetor settings.
Faulty fuel pump supplying too little fuel.	Check fuel pump pressure and capacity.
Low engine output	
Air cleaner blocked.	Fit new paper insert. Clean oil bath type air cleaner if fitted.
Pour quality fuel, too low octane rating	Check fuel grade, use correct fuel.
Faulty ignition timing setting.	Adjust ignition timing setting by using stroboscope.
Faulty settings on carburetor.	See "Ignition setting".
Faulty valve clearances.	Check and adjust carburetor settings.
Low compression on one cylinder.	Check and adjust valve clearance.
Piston chafing.	Measure compression pressure. In the case of excessively low values, remove cylinder head for closer investigation.
	Remove cylinder head for investigation.
Chafing wheel bearings or faultily adjusted brakes.	See Part 7.
Knocking from valve mechanism	
Valve clearances too large.	Adjust valve clearances.
Worn or damaged parts in valve mechanism.	Recondition or replace parts where necessary.
Heavy regular thumping noise, louder when engine os subjected to loading	
Worn main bearings and connecting rod bearings, or worn pistons and piston pins.	Localize sound by short-circuiting spark plugs, one at a time. Then disassemble where required for investigation of bearings and pistons.
Low oil pressure	
(Engine must run longer time than usual after starting before pressure is registered).	
Oil cleaner blocked.	Replace oil cleaner.
Low oil pressure at lowest idling speed after hard driving.	No measures necessary. The pressure is normally quite low under these conditions.
Faulty oil pressure gauge contact, faulty pressure gauge or gauge line.	Measure pressure by using another instrument. Replace faulty parts.

Faulty springs in relief valve or pump worn.	Disassemble oil pump. Check spring and pump.
One or more bearings worn.	Investigate and replace bearing shells.
High degree of general wear.	Replace or recondition engine.

Large oil consumption

Hard driving.	No measures necessary. Oil consumption can increase slightly when the engine is subjected to very hard driving.
Leakage at joints.	Tighten bolts and screws, replace faulty or poor quality gaskets all round.
Oil level too high.	Do not top up with oil until level is down to lower mark on dipstick.
Worn valve guides.	Recondition valve system.
Worn piston rings.	Change piston rings.

Large fuel consumption

Hard driving on highways or intensive stop-and-go town driving.	No measure necessary. Normal in both these cases.
Blocked air cleaner.	Replace air cleaner paper insert. Clean oil bath air cleaner where fitted.
Carburetor flooding.	Check and replace float valve if necessary. Also check pump pressure.
Faulty carburetor settings, fuel/air mixture too rich.	Adjust settings.
Faulty spark plug suppressors, faulty contact breaker points.	Replace spark plug suppressors. Adjust distributor.
Incorrect dwell angle and ignition timing setting.	Adjust dwell angle and ignition timing setting. A stroboscope must be used to adjust the ignition setting.

Engine runs abnormally warm

Not enough cooling water.	Fill up with cooling water.
Fan belt insufficiently tensioned.	Adjust fan belt tension.
Faulty gauge.	Check and replace gauge if necessary.
Fuel with too low octane rating (knocking).	Fill up with fuel of correct octane rating.
Faulty thermostat.	Replace thermostat.
Faulty ignition timing setting.	Check and adjust ignition timing setting by using stroboscope.
Faulty carburetor setting (fuel-air mixture excessively lean).	Adjust carburetor settings.
Cooling system blocked.	Clean cooling system.
Cooling jackets blocked or distribution pipe in cylinder head blocked. Distribution pipe possibly not pushed in far enough.	Measure cooling water temperature simultaneously at outlet on right of thermostat and at outlet for temperature gauge at rear of cylinder head. If the temperature obtained at the temperature gauge outlet at the rear is higher, the cylinder head should be removed and investigation carried out.

Loss of cooling water

Leaks at hose connections.	Check hoses and clamps, replace if necessary.
Faulty radiator filler cap.	Replace radiator filler cap.
Faulty cylinder head gasket (oil in cooling water).	Replace cylinder head gasket.

TOOLS

The following special tools are required when carrying out repair and service work on the engine.

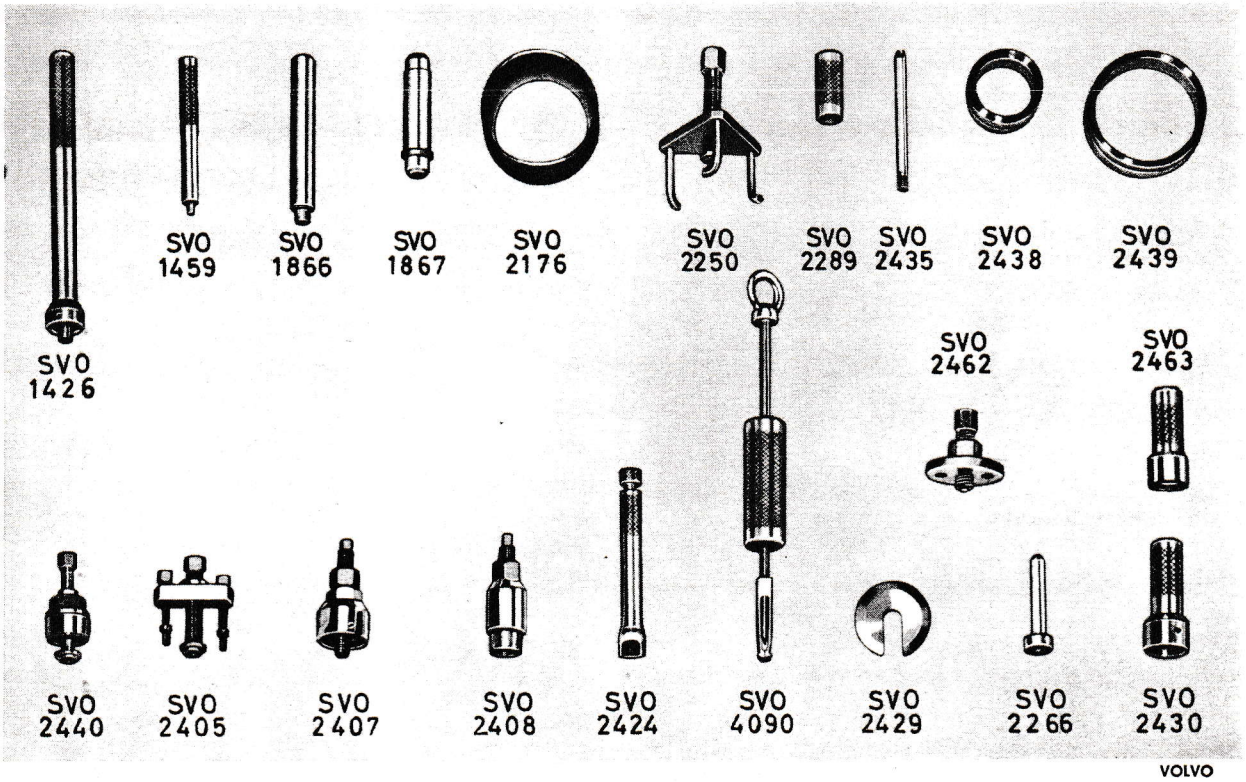


Fig. 88. Tools for engine and water pump

SVO 1426 Tool for fitting pilot bearing
SVO 1459 Tool for removing valve guides
SVO 1866 Tool for removing and fitting piston pins
SVO 1867 Tools for removing and fitting bushing in rocker arm and connecting rod
SVO 2176 Ring for fitting pistons. (Standard size)
SVO 2250 Puller for camshaft gear
SVO 2289 Tool for fitting valve guides
SVO 2435 Guide pins for fitting cylinder head (2)
SVO 2438 Centering sleeve for timing gear casing and fitting felt ring lock ring
SVO 2439 Centering sleeve for rear sealing flange and fitting felt ring lock ring.
SVO 2440 Puller for crankshaft hub
SVO 2405 Puller for crankshaft gear
SVO 2407 Press tool for fitting crankshaft gear
SVO 2408 Press tool for fitting camshaft gear
SVO 2424 Grip tool for removing and fitting valve lifters
SVO 4090 Puller for pilot bearing
SVO 2429 Press tool for removing water pump impeller
SVO 2266 Tool for removing and fitting hub and impeller in water pump
SVO 2430 Tool for fitting seal in water pump
SVO 2462 Puller for water pump hub
SVO 2463 Tool for fitting and removing water pump bearing.

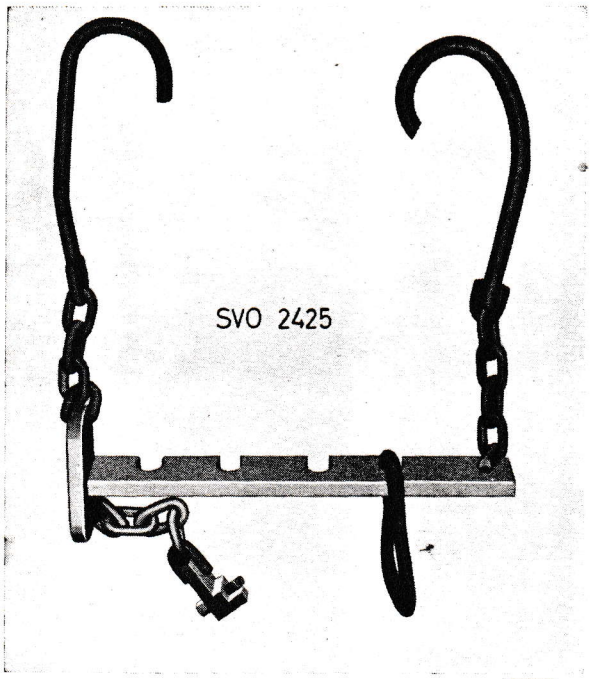


Fig. 89. Tool for removing engine

SPECIFICATIONS

General

Type designation	B 18 A
Output, b.h.p. at r.p.m (SAE)	75/4500
(DIN)	68/4500
Max. torque, kgm (lb.ft) at r.p.m. (SAE)	14.0 (103)/2800
(DIN)	13.5 (98)/2600
Compression pressure (warm engine) when turned over with starter motor, 200 r.p.m., kg/cm²	12—14
lb./sq. in	170—200
Compression ratio	8.5:1
Number of cylinders	4
Bore	84.14 mm (3.312″)
Stroke	80 mm (3.15″)
Displacement	1.78 liters

Cylinder block

Material	Special-alloy cast-iron
Bore, standard	84.14 mm (3.313″)
0.020″ oversize	84.65 mm (3.333″)
0.030″ „	84.90 mm (3.342″)
0.040″ „	85.16 mm (3.353″)
0.050″ „	85.41 mm (3.362″)

Pistons

Material	Light-alloy
Weight	425±5 g (15±0.18 oz)
Permissible weight difference between pistons in same engine	10 g (0.35 oz.)
Height, total	83.5 mm (3.29″)
Height from piston pin centre to piston top	46 mm (1.81″)
Piston clearance	0.02—0.04 mm (0.0008—0.0016″)
Diameter, measured at right angles to piston pin 12.5 mm (0.49″) from lower edge of piston:	
Standard Class C	84.095 mm (3.3108″)
Class D	84.105 mm (3.3112″)
Class E	84.115 mm (3.3116″)
0.020″ oversize	84.615±0.01 mm (3.3313±0.0004″)
0.030″ „	84.865±0.01 mm (3.3411±0.0004″)
0.040″ „	85.125±0.01 mm (3.3514±0.0004″)
0.050″ „	85.375±0.01 mm (3.3612±0.0004″)

Piston rings

Piston ring gap measured in ring opening	0.025—0.50 mm (0.010″—0.020″)
Piston ring oversizes	0.020″ 0.040″
	0.030″ 0.050″

Compression rings

Marked "TOP". Upper ring on each piston chromed.

Number of rings on each piston	2
Height	1.98 mm (0.078″)
Piston ring clearance in groove	0.054—0.092 mm (0.0021—0.0036″)

Oil control rings

Number on each piston	1
Height	4.76 mm (0.187″=3/16″)
Piston ring clearance in groove	0.044—0.072 mm (0.0017—0.0028″)

Piston pins

Floating fit. Circlips at both ends in piston.

Fit:	
In connecting rod	Close running fit
In piston	Slide fit
Diameter, standard	22 mm (0.866″)
0.05 mm (0.002″) oversize	22.05 mm (0.868″)
0.10 mm (0.004″) „	22.10 mm (0.870″)
0.20 mm (0.008″) „	22.20 mm (0.874″)

Cylinder head

Height, measured from cylinder head contact surface to bolt level	88 mm (3.46″)
Distance from upper surface of cylinder head to upper end of pipe (pipe located under thermostat)	35 mm (1.38″)

Crankshaft

Crankshaft axial clearance	0.017—0.108 mm (0.0007—0.0042″)
Main bearings, radial clearance	0.026—0.077 mm (0.0010—0.0030″)
Connecting rod bearings, radial clearance	0.039—0.081 mm (0.015—0.032″)

Main bearings

Main bearing journals

Diameter, standard	63.441—63.454 mm (2.4977—2.4982″)
undersize 0.010″	63.187—63.200 mm (2.4877—2.4882″)
0.020″	62.933—62.946 mm (2.4777—2.4782″)
0.030″	62.679—62.692 mm (2.4677—2.4682″)
0.040″	62.425—62.438 mm (2.4577—2.4582″)
0.050″	62.171—62.184 mm (2.4477—2.4482″)
Width on crankshaft for flange bearing shell	
Standard	38.930—38.970 mm (1.5327—1.5342″)
Oversize 1 (undersize shell 0.010″)	39.031—39.072 mm (1.5367—1.5383″)
2 („ „ 0.020″)	39.133—39.173 mm (1.5407—1.5422″)
2 („ „ 0.030″)	39.235—39.275 mm (1.5447—1.5463″)
2 („ „ 0.040″)	39.336—39.376 mm (1.5487—1.5502″)
2 („ „ 0.050″)	39.438—39.478 mm (1.5527—1.5543″)

Main bearing shells

Thickness, standard	1.985—1.991 mm (0.0781—0.0784″)
undersize 0.010″	2.112—2.118 mm (0.0831—0.0834″)
0.020″	2.239—2.245 mm (0.0881—0.0884″)
0.030″	2.366—2.372 mm (0.0931—0.0934″)
0.040″	2.493—2.499 mm (0.0981—0.0984″)
0.050″	2.620—2.626 mm (0.1031—0.1034″)

Connecting rod bearings

Connecting rod bearing journals

Bearing seat width	31.950—32.050 mm (1.2579—1.2618″)
Diameter, standard	54.089—54.102 mm (2.1295—2.1300″)
undersize 0.010″	53.835—53.848 mm (2.1195—2.1200″)
0.020″	53.581—53.594 mm (2.1095—1.1100″)
0.030″	53.327—53.340 mm (2.0995—2.1000″)
0.040″	53.073—53.086 mm (2.0895—2.0900″)
0.050″	52.819—52.832 mm (2.0795—2.0800″)

Connecting rod bearing shells

Thickness, standard	1.833—1.841 mm (0.0722—0.0725″)
undersize 0.010″	1.960—1.968 mm (0.0772—0.0755″)
0.020″	2.087—2.095 mm (0.0822—0.0825″)
0.030″	2.214—2.222 mm (0.0872—0.0875″)
0.040″	2.341—2.349 mm (0.0922—0.0925″)
0.050″	2.468—2.476 mm (0.0972—0.0975″)

Connecting rods.

Axial clearance at crankshaft	0.15—0.35 mm (0.006—0.014″)
Length, center—center	145±0.1 mm (5.710±0.004″)
Maximum permissible difference in weight between connecting rods in same engine	6 g (0.21 oz.)

Flywheel

Permissible runout max.	0.05 mm/150 mm diam. (0.002″/6″ diam.)
Ring gear (bevel facing forward)	142 teeth

Flywheel housing

Permissible axial throw, max.	0.05 mm/100 mm diam. (0.002″/4″ diam.)
Max. radial throw for rear guide	0.15 mm (0.006″)

Camshaft

Number of bearings	3
Front bearing journal, diameter	46.975—47.000 mm (1.8494—1.8504″)
Center bearing journal, diam.	42.975—43.000 mm (1.6919—1.6929″)
Rear bearing journal, diam.	36.975—37.000 mm (1.4557—1.4567″)
Radial clearance	0.020—0.075 mm (0.0008—0.0030″)
Axial clearance	0.020—0.060 mm (0.0008—0.0024″)
Valve clearance for check of camshaft setting (cold engine)	1.1 mm (0.043″)
Inlet valve should then open at	10° after T.D.C.

Camshaft bearings

Front bearing, diameter	47.020—47.050 mm (1.8512—1.8524″)
Center bearing, diameter	43.025—43.050 mm (1.6939—1.6949″)
Rear bearing, diameter	37.020—37.045 mm (1.4575—1.4585″)

Timing gears

Crankshaft gear, number of teeth	21
Camshaft gear, (fibre), number of teeth	42
Backlash	0.04—0.08 mm (0.0016—0.0032″)
Axial clearance, camshaft	0.02—0.06 mm (0.0008—0.0023″)

Valves

Inlet

Disc diameter	40 mm (1.58″)
Stem diameter	8.685—8.700 mm (0.3419—0.3425″)
Valve seat angle	44.5°
Cylinder head seat angle	45°
Seat width in cylinder head	1.5 mm (0.060″)
Clearance, warm and cold engine	0.40—0.45 mm (0.016—0.018″)

Exhaust

Disc diameter	35 mm (1.38″)
Stem diameter	8.645—8.660 mm (0.3403—0.3409″)
Valve seat angle	44.5°
Cylinder head seat angle	45°
Seat width in cylinder head	1.5 mm (0.060″)
Clearance, warm and cold engine	0.40—0.45 mm (0.016—0.018″)

Valve guides

Length	63 mm (2.48″)
Inner diameter	8.725—8.740 mm (0.3435—0.3441″)
Height above upper surface of head	21 mm (0.83″)
Clearance, valve stem—guide, inlet valves	0.025—0.055 mm (0.0010—0.0022″)
exhaust valve	0.065—0.095 mm (0.0026—0.0037″)

Valve springs

Length, unloaded, approx.	45 mm (1.77″)
loaded with 25.5 ± 2 kg (56 ± 4 1/2 lb.)	39 mm (1.54″)
loaded with 66 ± 3.5 kg (145 ± 8 lb.)	30.5 mm (1.20″)

Lubricating system

Oil capacity, including oil cleaner	3.75 liters (3 1/2 Imp. qts. = 4 US qts.)
excluding oil cleaner	3.25 liters (3 1/4 Imp. qts. = 3 1/2 US qts.)
Oil pressure at 2,000 r.p.m. (with warm engine and new oil cleaner	3.5—6.0 kg/cm² (50—85 lb./sq.in)
Lubricant	Engine oil, For Service MS
viscosity, below 0° C (30° F)	SAE 10 W } or Multigrade oil SAE 10 W—30
between 0° C (30° F) and +30° C (90° F)	SAE 20 } or Multigrade oil SAE 10 W—30
above +30° C (90° F)	SAE 30 } or Multigrade oil SAE 10 W—30

Lubricating oil cleaner

Type	Fullflow
Make	Wix or Mann

Lubricating oil pump

Oil pump, type	Gear pump
number of teeth on each gear	10
axial clearance	0.02—0.10 mm (0.0008—0.0040″)
radial clearance	0.08—0.14 mm (0.0032—0.0055″)
backlash	0.15—0.35 mm (0.0060—0.0140″)

Relief valve spring (in oil pump)

Length, unloaded	31 mm (1.22″)
loaded with 4.0 ± 0.2 kg (9 ± 1/2 lb.)	27.5 mm (1.08″)
9.5 ± 0.3 kg (21 ± 3/4 lb.)	22.5 mm (0.08″)

Fuel system

Fuel pump

Fuel pump, type	AC diaphragm pump UG
Fuel pressure, measured at same height as pump	min. 0.11 kg/cm² (1.5 lb./sq.in) max. 0.18 kg/cm² (2.5 lb./sq.in)

Carburetor

Type	Down-draught
Type and designation	Zenith 36 VN
Venturi	30
Main jet	117
Compensation jet	115
Idling jet	70
Idling air jet	70
Air jet for acceleration	140
Acceleration jet	40
Acceleration pump stroke	Short
Float valve	1.75
Washer for float valve, thickness	1 mm
Idling speed (warm engine)	500—700 r.p.m.

Ignition system

Voltage	12 V
Order of firing	1-3-4-2
Ignition timing setting, 97 octane (Research Method) at 1500 r.p.m. engine speed (vacuum regulator disconnected)	21—23° before T.D.C.
Spark plugs	Bosch W 175 T1 or corresponding
Spark plug gap	0.7—0.8 mm (0.028—0.032″)
tightening torque	3.8—4.5 kgm (28—32 lb.ft.)

Distributor

Type	Bosch
Designation	VJU 4 BL 33
Contact breaker gap	0.4—0.5 mm (0.016—0.018″)
pressure	0.4—0.5 mm (0.016—0.018″)
Dwell angle	60°
Direction of rotation	Counter-clockwise

Cooling system

Type	Pressure
Radiator cap valve opens at	0.23—0.30 kg/cm² (3—4 lb./sq.in.)
Capacity	Approx. 8.5 liters (2 Imp. galls. = 2 1/4 US galls.)
Fan belt, designation	HC 38×35″
tension: the pulley should start slipping when the force applied	6.5—8.5 kg (14—19 lb.)/lever of 150 mm (6″)

Anti freeze

Amount of glycol required for frost protection down to

—10° C (15° F)	2 liters (3 1/2 Imp. pints = 4 US pints)
—20° C (—5° F)	3 liters (5 1/4 Imp pints = 6 US pints)
—30° C (—22° F)	4 liters (7 Imp. pints = 9 US pints)
—40° C (—40° F)	4.5 liters (1 Imp. gall. = 1 1/4 US galls)

Thermostat

Type	Fulton Sylphon 1—1700-D 3
Marking	170
Starts to open at	75—78° C (167—172° F)
Fully open at	89° C (192° F)

Wear tolerances

Cylinders

To be rebored when wear reaches (if engine shows abnormal oil consumption)	0.05 mm (0.010″)

Crankshaft

Permissible out-of-round on main bearing journals, max.	0.05 mm (0.002″)
Permissible out-of-round on connecting rod bearing journals,	0.07 mm (0.003″)
Max. crankshaft end play	0.15 mm (0.006″)

Valves

Permissible clearance between valve stems and valve guides,	0.15 mm (0.006″)
Valve stems, permissible wear, **max.**	0.02 mm (0.0008″)

Camshaft

Permissible out-of-round (with new bearings) **max.**	0.07 mm (0.003″)
Bearings, permissible wear	0.02 mm (0.0008″)

Timing gears

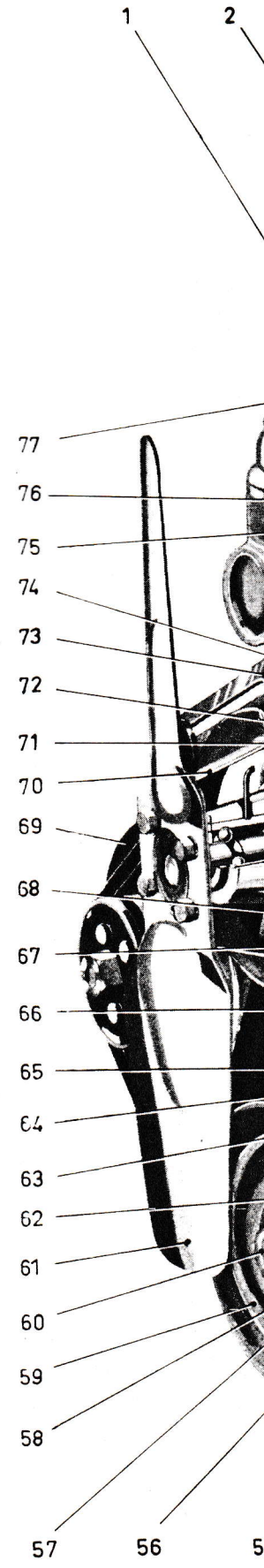
Permissible backlash, **max.**	0.12 mm (0.005″)

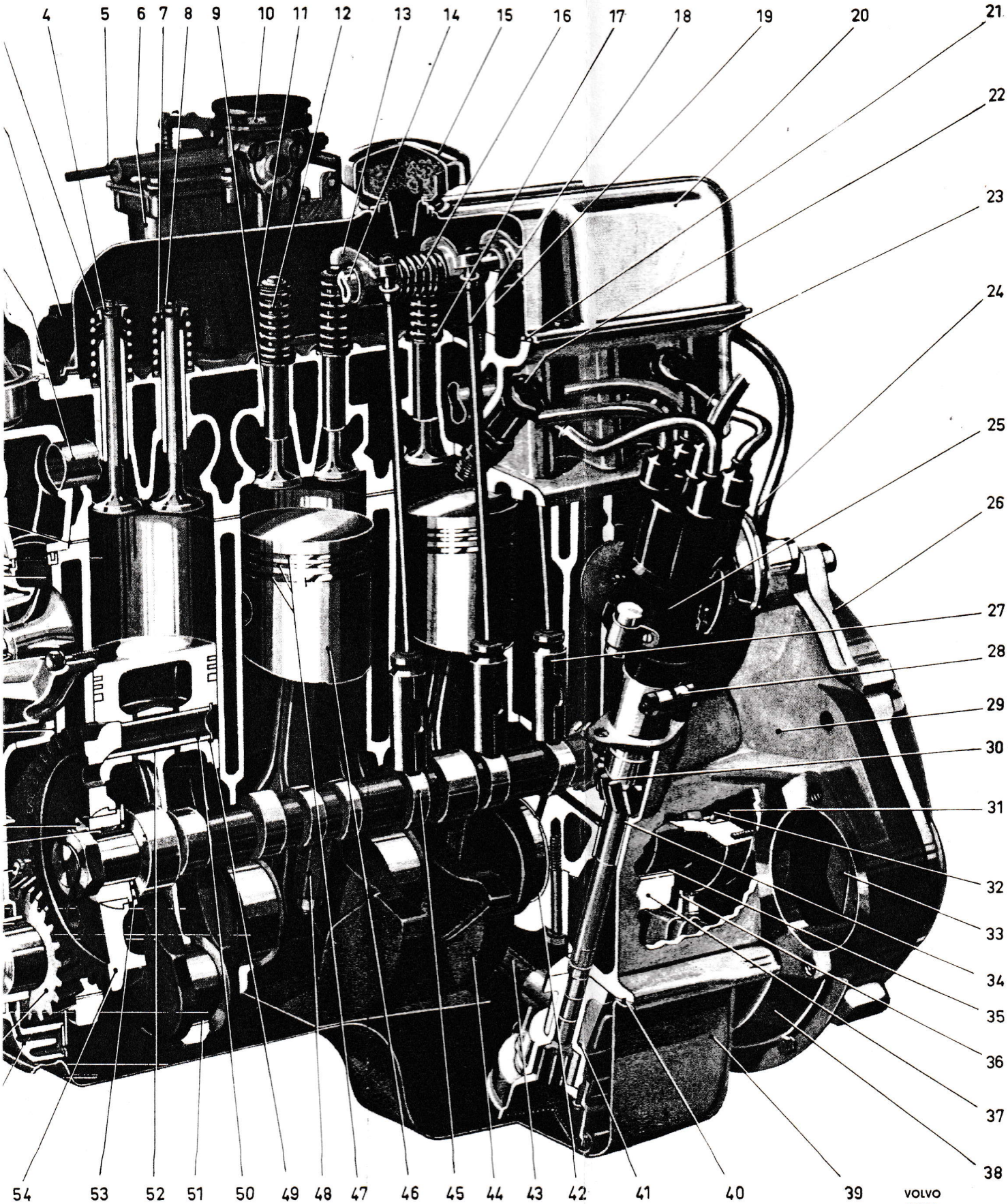
Tightening torques

	Kgm	Lb.ft.
Cylinder head	8.5—9.5	61—68
Main bearings	12—13	87—94
Connecting rod bearings	5.2—5.8	38—42
Flywheel	4.5—5.5	33—40
Spark plug	3.8—4.5	28—30
Camshaft nut	13—15	94—108
Crankshaft pulley bolt	7—8	50—58
Generator bolt (3/8″×16)	3.5—4	25—29
Oil cleaner nipple	4.5—5.5	32—39
Oil pan bolts	0.8—1.1	6—8

Illustration I, Section through B 18 A engine

1. Water distribution pipe
2. Intake manifold
3. Seal ring
4. Exhaust valve
5. Fuel inlet
6. Float bowl
7. Valve key
8. Inlet valve
9. Valve guide
10. Carburetor
11. Upper valve washer
12. Valve spring
13. Rocker arm
14. Rocker arm shaft
15. Breather (oil filler)
16. Spring
17. Lower valve washers (rubber and steel, rubber washer lowest)
18. Push rod
19. Bearing bracket
20. Rocker arm cover
21. Gasket
22. Cable terminal
23. Cylinder head
24. Vacuum line
25. Distributor
26. Flywheel housing
27. Valve lifter
28. Retainer
29. Cylinder block
30. Gear
31. Lock ring
32. Pilot bearing
33. Flywheel
34. Bushing
35. Flange bearing shell
36. Sealing flange
37. Main bearing cap
38. Cover plate
39. Oil pan
40. Gasket
41. Oil pump
42. Main bearing shell
43. Pressure pipe
44. Crankshaft
45. Camshaft
46. Piston
47. Piston rings
48. Connecting rod
49. Circlip
50. Piston pin
51. Connecting rod bearing shell
52. Connecting rod bushing
53. Thrust washer and spacer ring
54. Camshaft gear
55. Timing gear casing
56. Crankshaft
57. Hub
58. Washer
59. Pulley
60. Bolt
61. Fan
62. Key
63. Oil jet
64. Key
65. Lock washer
66. Cooling water inlet
67. Gasket
68. Water pump
69. Generator
70. Pulley
71. Gasket
72. Seal ring
73. Tensioner
74. Cylinder head gasket
75. Thermostat
76. Gasket
77. Cooling water outlet

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