

Part 2

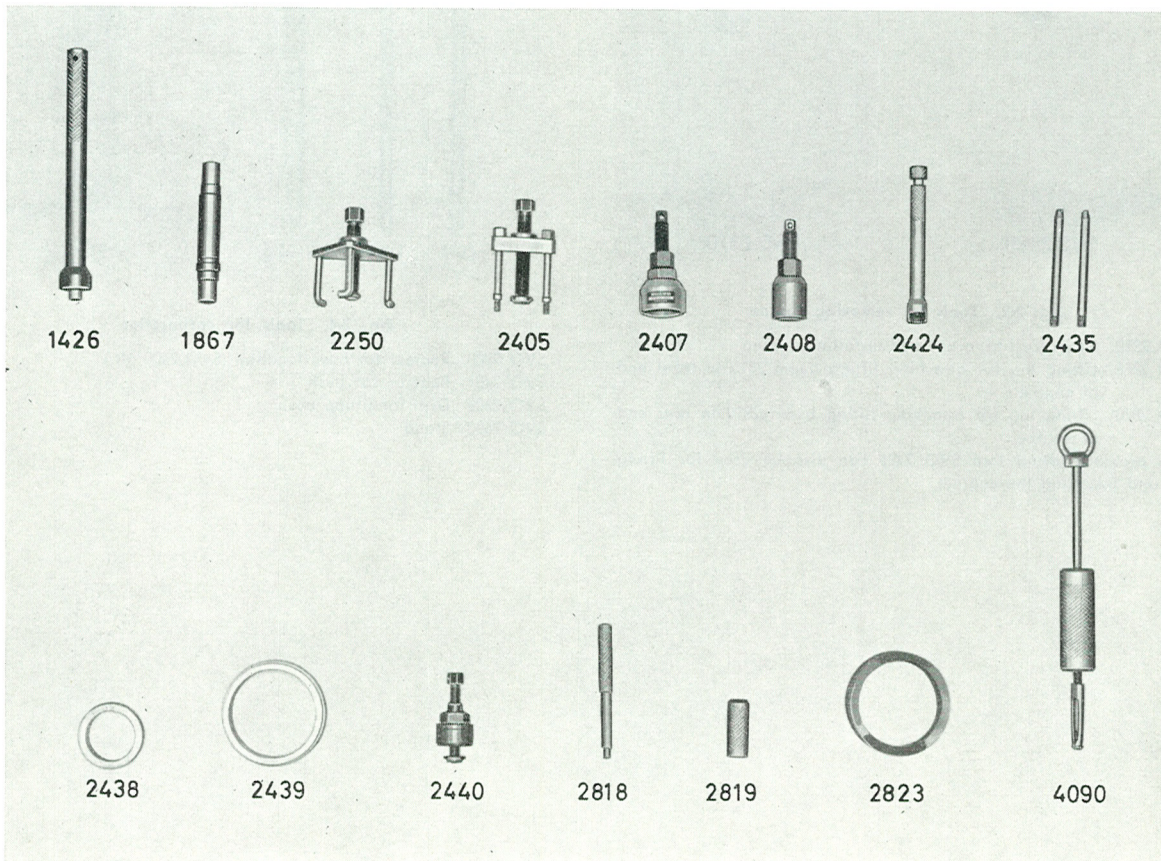
ENGINE

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TOOLS

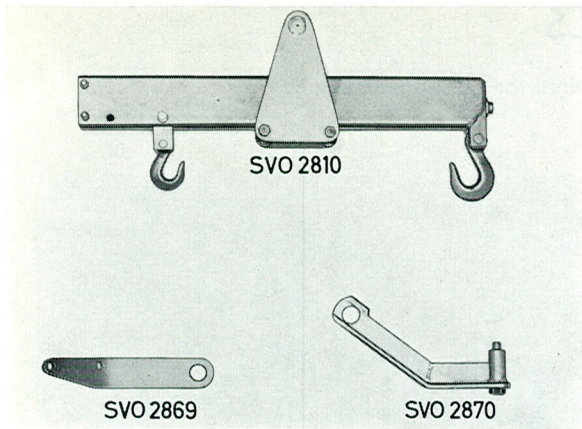
The following special tools are required for work on the engine.



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Fig. 2-1. Tools for engine

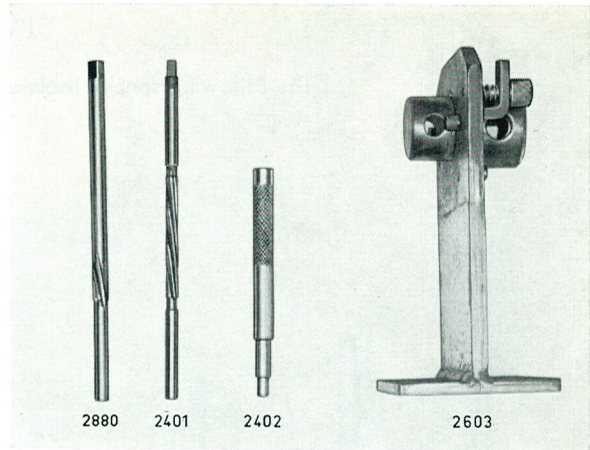
- | | | | |
|----------|--|----------|--|
| SVO 1426 | Drift for fitting pilot bearing | SVO 2438 | Centering sleeve for timing gear casing and fitting ring circlip |
| SVO 1867 | Drift for removing and fitting bush in rocker arm and connecting rod | SVO 2439 | Centering sleeve for rear sealing flange and fitting felt ring circlip |
| SVO 2250 | Puller for camshaft gear | SVO 2440 | Puller for crankshaft hub |
| SVO 2405 | Puller for crankshaft gear (SVO 2822 can be used as alternative) | SVO 2818 | Drift for removing valve guide |
| SVO 2407 | Press tool for fitting crankshaft gear | SVO 2819 | Drift for fitting valve guide |
| SVO 2408 | Press tool for fitting camshaft gear | SVO 2823 | Ring for fitting standard piston |
| SVO 2424 | Grip tool for removing and fitting valve tappets | SVO 4090 | Puller for crankshaft pilot bearing |
| SVO 2435 | Dowels (2) for fitting cylinder head | | |



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Fig. 2-2. Tools for removing engine

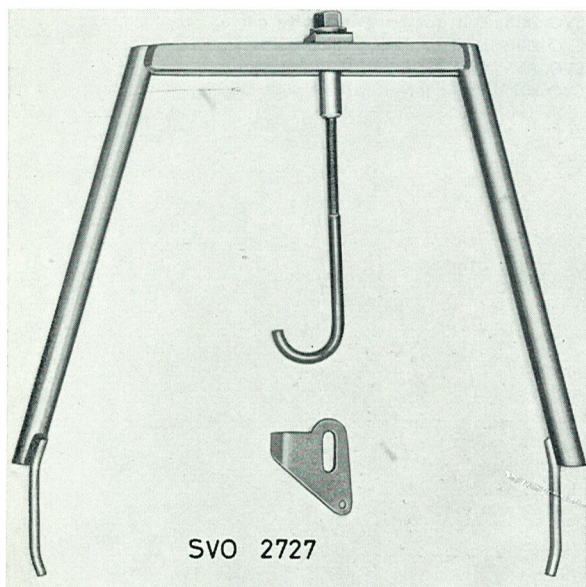
- SVO 2810 Beam for lifting out and installing engine
 SVO 2869 Lifting lug for attaching lifting beam 2810 in front end of engine
 SVO 2870 Lifting lug for attaching lifting beam 2810 in rear end of engine
 (The previous lifting tool SVO 2425 can also be used for lifting out and installing the engine).



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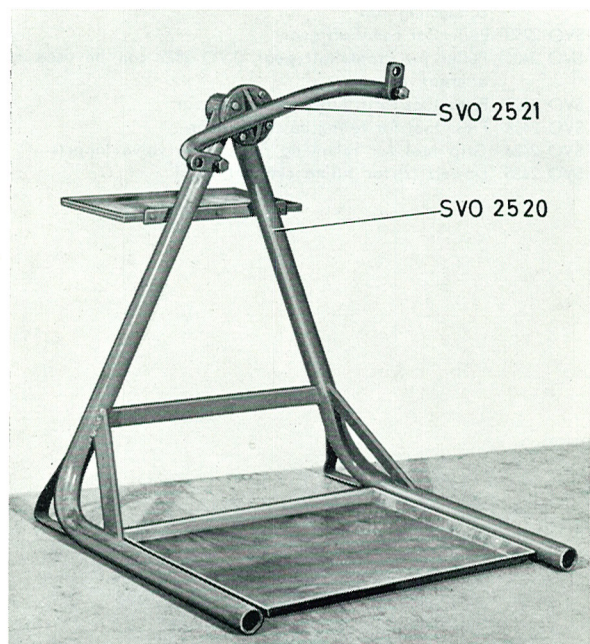
Fig. 2-4. Tools for carburettor

- SVO 2880 Reamer for bush location (SVO 2400 alt.)
 SVO 2401 Reamer for bush
 SVO 2402 Drift for fitting bush
 SVO 2603 Stand



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Fig. 2-3. Lifting tool used when removing oil sump, 140-series



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Fig. 2-5. Stand SVO 2520 and fixture SVO 2521 for engine

GROUP 20

GENERAL DESCRIPTION

Output and torque are:

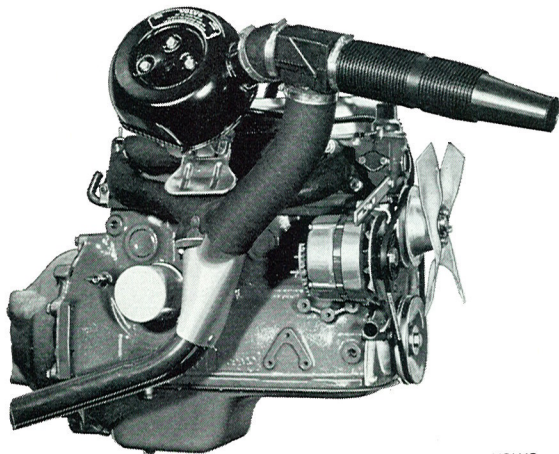
B 20 A	B 20 B
SAE	SAE
90 b.h.p. at 4,800 r.p.m.	118 b.h.p. at 5,800 r.p.m.
16.5 kgm (119) at 3,000 r.p.m.	17 kgm (123) at 3,500 r.p.m.
DIN	DIN
82 b.h.p. at 4,700 r.p.m.	100 b.h.p. at 5,500 r.p.m.
16 kgm (116) at 2,300 r.p.m.	15.5 kgm (112) at 3,500 r.p.m.

The B 20 engine has two type designations, B 20 A (Figs. 2-6 and 2-8) and B 20 B (Figs. 2-9 and 2-11).

The engine is a four-cylinder, water-cooled overhead-valve unit. The Crankshaft is journalled in five bearings. The B 20 A and B 20 B units have different camshafts compression ratios but similar positive crankcase ventilation, exhaust emission control system and, for most cars, air conditioning.

The B 20 A engine is fitted with a single horizontal carburettor, while the B 20 B unit has two horizontal carburettors and an air-intake branch pipe with pre-heating chamber. On certain cars, the B 20 B engine is fitted with a slip coupling type fan.

Engine output is shown in Figs. 2-7 and 2-10 below and also in the "Specifications".



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Fig. 2-6. Engine B 20 A viewed from right

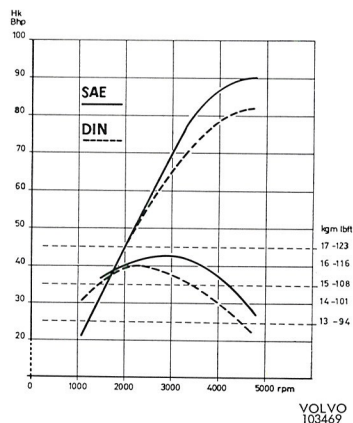
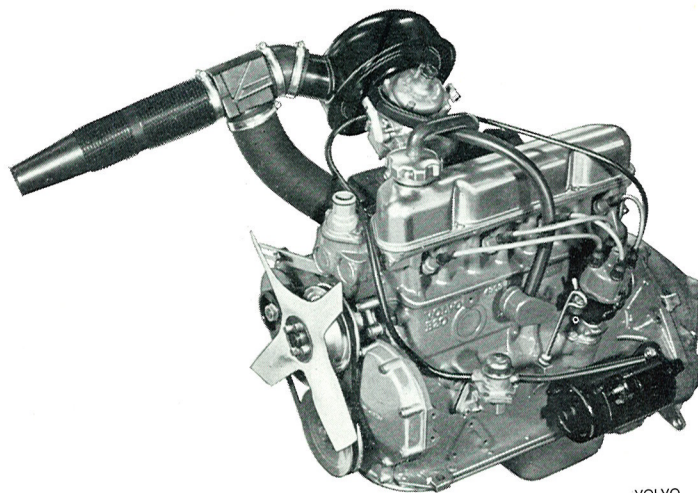


Fig. 2-7. Output and torque curves, B 20 A



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Fig. 2-8. Engine B 20 A viewed from left

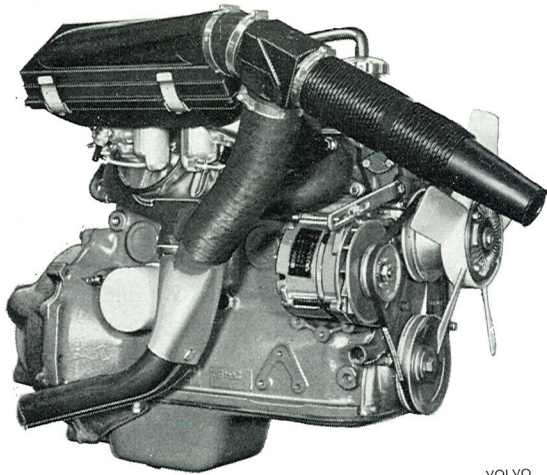


Fig. 2-9. Engine B 20 B viewed from right

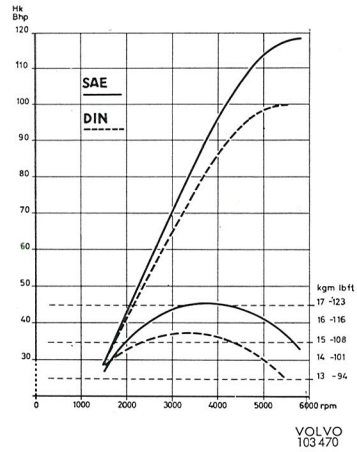


Fig. 2-10. Output and torque curves, B 20 B

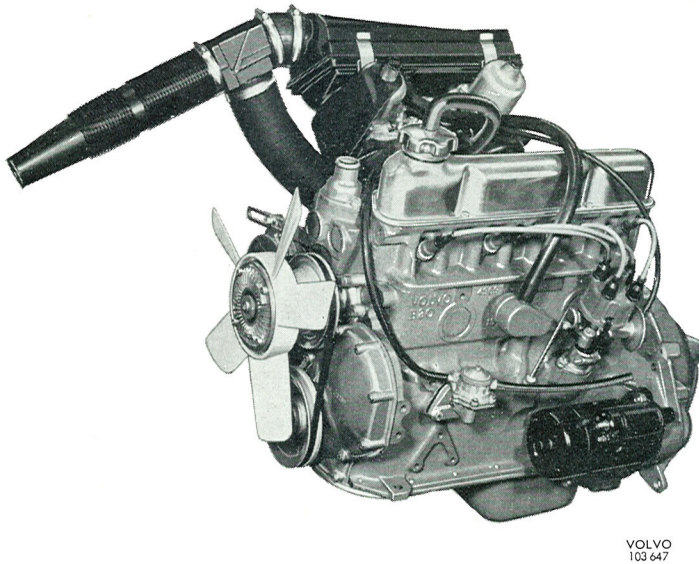


Fig. 2-11. Engine B 20 B viewed from left

REPAIR INSTRUCTIONS

REMOVING THE ENGINE

1. Remove the hood from the hinges.
2. Drain off the coolant. (Open the tap at right-hand side of engine and disconnect the lower radiator hose at the radiator). Remove the expansion tank together with the hose.
Remove the air cleaner and cleaner cover with hoses.
3. Remove the cover plate in front of the radiator.
4. Remove the upper radiator hose. Remove the radiator.
5. Remove the plus lead from the battery.
6. Remove the following: electric cables from the starter motor and ignition coil, the ingoing fuel hose from the fuel pump (to be plugged), the electric cables from the temperature and oil pressure sending units and from the dynamo, the vacuum hose for the servo cylinder, the choke control, the heater hoses at the engine.
7. Remove the throttle control shaft from the pedal shaft, intermediate shaft and bracket.

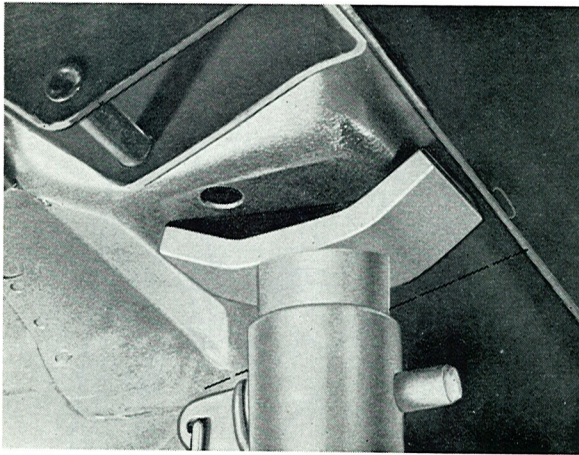


Fig. 2-12. Location of the block stand

8. Remove the nuts at the branch pipe flange of the exhaust manifold.
9. Place the gears in neutral. Remove the gear lever and put on a protective cover.
10. Jack up the vehicle with four blocks (under the front jack attachment and in front of the rear jack attachment according to Fig. 2-12).
11. Place a jack under the gearbox. Remove the return spring from the throw-out fork. Disconnect the clutch cable from the throw-out fork and from the flywheel housing.
12. Disconnect the electric cables for the back-up lights (and, if fitted, also for the overdrive).
13. Remove the drive cable for the speedometer from the gearbox.
14. Remove the clamp for the exhaust manifold.
15. Separate the flange of the gearbox (overdrive) from the front universal joint.
16. Remove the nuts for the cross-member of the rear engine mounting.
17. Disconnect the earth cable from the engine.

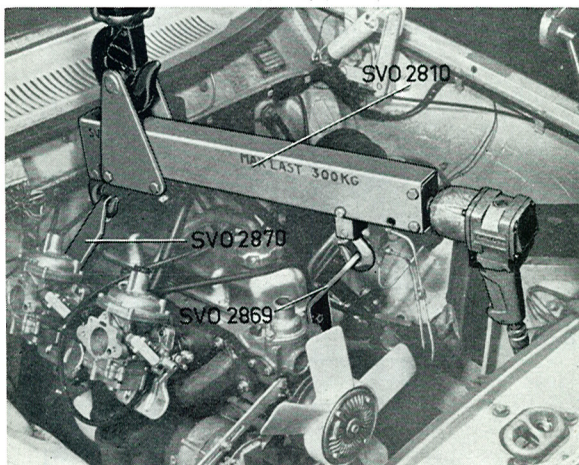


Fig. 2-13. Lifting out the engine

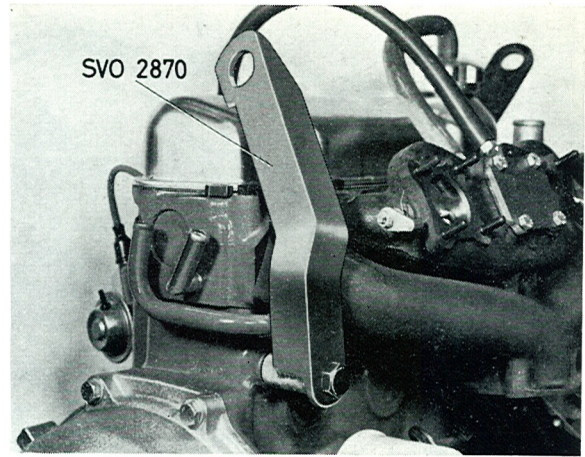


Fig. 2-14. Lifting lug on engine rear end

18. Remove the cross-member and brackets for the exhaust manifold and rear engine mounting.
19. Remove the lower nuts for the front engine mounting.
20. Fit lifting lug SVO 2870 as shown in Fig. 2-14, and lifting lug SVO 2869 according to Fig. 2-15. The lifting lug is attached by 2 bolts 3/8" UNC-1"- resp. 1 1/4". Fit on lifting tool SVO 2810 according to Fig. 2-13 and lift out the engine.

INSTALLING THE ENGINE

1. Fit on the lifting lugs and beam according to Figs. 2-14, 2-15 and 2-13.
2. Lift in the engine. Place a jack under the gearbox and guide the engine into position. **N.B. Be careful not to damage the oil filter and oil pressure sending unit against the exhaust pipe.**
3. Tighten the nuts for the front engine attachments.
4. Connect up the electric cables for the back-up lights (and overdrive).
5. Fit the brackets for the exhaust manifold and rear engine mounting, the cross-member and the nuts for the rear engine mounting.
6. Remove the jack and lifting tool.
7. Tighten the flange of the exhaust pipe against the exhaust manifold.
8. Fit the clamp for the exhaust manifold, the front universal joint to the flange (make sure the contact surfaces are clean), the drive cable of the speedometer, the earth cable, the clutch cable and return spring.
9. Adjust the clutch play according to Part 4 (41) "Adjusting the clutch pedal play".
10. Remove the blocks from under the vehicle.
11. Fit: heater hoses, electric cables to the temperature and oil pressure sending units, the throttle control shaft, the choke cable, the electric cables for the dynamo, starter motor and ignition coil.

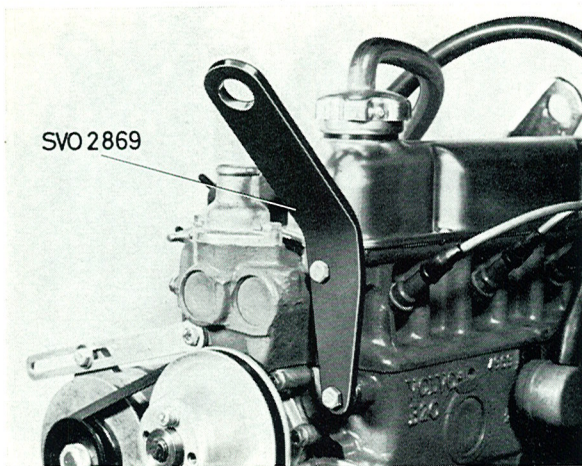


Fig. 2-15. Lifting lug on engine front end

12. Fit the fuel hose and vacuum hose to the servo cylinder and battery cable.
13. Place the radiator in position and firmly secure it. Fit the cooling system hoses and expansion tank with hose, which is drawn from the radiator and **in front of** the expansion tank so that it does not come into contact with the fan. Fit the air cleaner.
14. Fit the cover plate in front of the radiator. Fill the radiator with coolant and check the oil in the engine.
15. Fit the hood. Fit the gear lever.

REPLACING THE SUMP GASKET

1. Fit the plate of the lifting tool SVO 2727 at the upper bolt for the timing gear casing. (Remove the washer.) Place the lifting tool and fix the hook in the plate according to Fig. 2-16. Raise the front end of the engine until there is no weight on the engine mountings. Remove the oil dipstick.
2. Lift up the vehicle by placing blocks under the front jacking points. Drain off the engine oil.
3. Remove the lower nuts for the engine mountings. Remove the steering rods from the pitman arm and relay arm with tool SVO 2294 according to Fig. 2-17.
4. Place a jack under the front axle member. Remove the rear bolts on the front axle member and screw on instead two auxiliary screws (UNC 1/2—13×114). Remove the front bolts for the front axle member. Lower and remove the jack so that the front axle member is suspended in the two auxiliary bolts.
5. Remove the plug for the oil temperature gauge and reinforcing bracket at the flywheel housing.
6. Remove the bolts for the sump and lift off the sump.

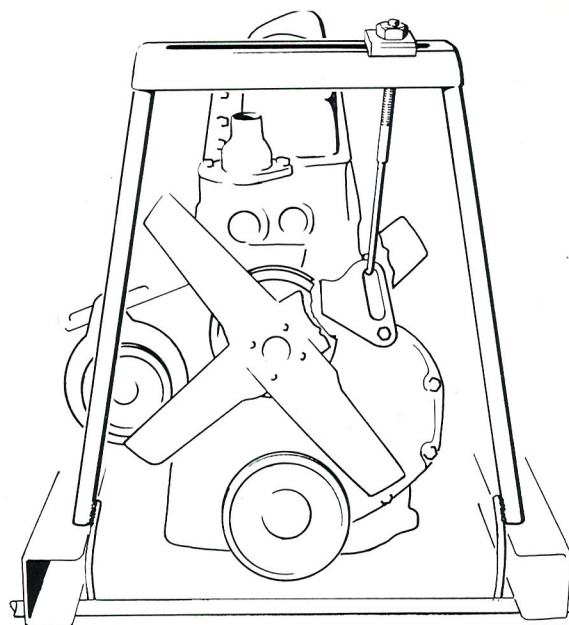


Fig. 2-16. Lifting tool SVO 2727

7. Remove the old gasket and clean the contact surfaces of the cylinder block and sump.
8. Place the sump and gasket in position and fit the bolts. Tighten well the drain plug as well as the plug for the oil temperature gauge.
9. Place the reinforcing bracket in position and tighten all the bolts by hand. Screw in firmly the bolts in the flywheel housing and then the bolts in the cylinder block.
10. Raise the front axle member, tighten the front bolts. Remove the auxiliary bolts, fit and tighten the rear bolts.
11. Fit the nuts for the engine mountings as well as the steering rods.
12. Remove the blocks from under the vehicle. Take off the lifting tool with plate. Fit the bolt (with washer) for the timing gear casing.
13. Top up with oil and insert the oil dipstick.
14. Start the engine and check for leakage.

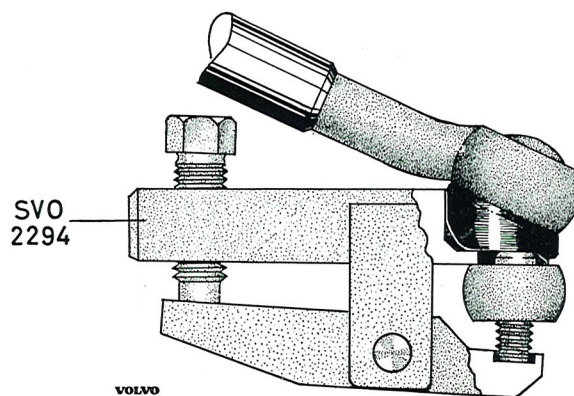


Fig. 2-17. Removing the steering rod

GROUP 21

ENGINE

DESCRIPTION

CYLINDER BLOCK

The cylinder block (Illustrations A and B) is made of special cast iron and is cast in a single unit. The cylinder bores, which are surrounded by cooling jackets, are machined directly in the block. The oilways in the block are arranged so that the oil filter, which is of the full-flow type, is directly attached to the right-hand side of the block. A reinforcing bracket is mounted to the cylinder block and timing gear casing for taking up vibrations, see Fig. 2-18.

CYLINDER HEAD AND VALVES

The cylinder head is secured to the block by means of bolts. All the combustion chambers are machined throughout and have separate inlet and exhaust ports, one for each valve.

The valves, which are fitted suspended in the cylinder head, are made of special steel and are carried in replaceable guides. The valve stems are chromed.

The valve collet is provided with three lands and the valve with corresponding grooves, which hold the valve but also make suitable rotation possible. (Compare with Fig. 2-29.) The valves are provided with valve guide rubber seals, which are mounted on the guides.

The cooling jackets are designed so that the air around the spark plugs is also cooled. Water distribution is by means of a pipe, the water being directed towards the warmest parts of the engine.

The difference in compression between the B 20 A and B 20 B engines is due to their having different cylinder head gasket thicknesses.

CRANKSHAFT AND BEARINGS

The crankshaft is made of steel and has ground, case-hardened bearing journals. It is carried in five main bearings, the rear flange bearing of which also functions as a pilot bearing axially. There are drilled oilways in the crankshaft for the lubricating oil.

The big-end bearing shells, which are replaceable, consist of a steel backing with indium-plate lead-bronze bearing metal.

CAMSHAFT AND VALVE TAPPETS

The camshaft is made of special-alloy cast iron and has case-hardened cams. It is driven from the crank-

shaft through a gear train which has a ratio of 1:2. Camshaft axial location is maintained by means of a bronze axial washer located at the front end of the camshaft. Axial play is determined by a spacer ring behind the camshaft gear, which has a steel hub. The valve tappets are actuated directly by the camshaft. They are located in holes in the block above the camshaft and transfer movement to the valves by means of push rods and rocker arms. There are no inspection covers for the valve tappets since these are accessible after the cylinder head has been removed.

CONNECTING RODS, PISTONS AND PISTON RINGS

The connecting rods are made of drop-forged steel and are provided with a precision-machined bush which acts as a bearing for the gudgeon pin. The big-end bearing shells are precision-manufactured and are replaceable.

The pistons are made of light-alloy and have two compression rings and one oil scraper ring. The upper compression ring is chromed in order to reduce cylinder wear.

The gudgeon pin has a floating fit in both the piston and connecting rod. The axial movement of the gudgeon pin is limited by circlips in the gudgeon pin hole.

INTAKE AND EXHAUST MANIFOLDS

The intake and exhaust manifolds are integrally cast to a branch pipe. With a view to the exhaust control

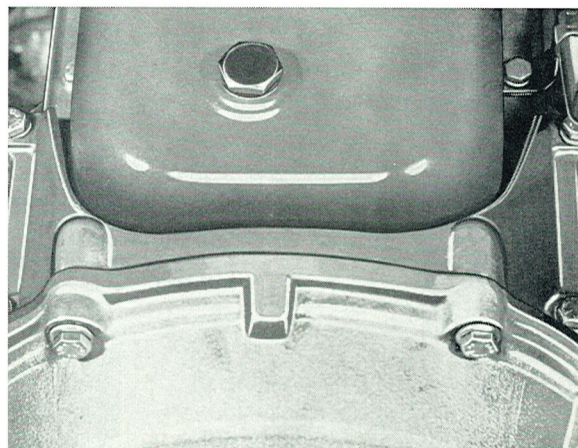


Fig. 2-18. Reinforcing bracket, cylinder block—flywheel housing

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system, the arrangement on the B 20 B engine incorporates a preheating chamber where the fuel/air mixture temperature is raised by the heat from the exhaust gases.

A spring-loaded throttle (secondary throttle) is to be found in each of the intakes.

POSITIVE CRANKCASE VENTILATION

This arrangement prevents crankcase gases from being released into the atmosphere. They are instead sucked into the engine through the intake manifold and take part in the combustion process. The residue is blown out through the exhaust pipe together with the other combustion residues.

Between the rocker arm casing and the intake manifold there is a hose (4, Fig. 2-19). It is connected to the intake manifold by means of a calibrated nipple (3). (This nipple should be cleaned every 40,000 km = 25,000 miles.) Between the oil trap, which is connected to the crankcase, and the air cleaner there is a hose (2) connected for the fresh-air supply. At the connection to the oil trap there is a flame guard (5),

which consists of a metal filter. The partial vacuum which arises in the intake manifold when the engine is driven, brings about a partial vacuum in the rocker arm casing and crankcase through the hose (4). Fresh air is supplied to the crankcase through the air cleaner via the hose (2).

As the fresh air supply passes through the carburettor air cleaner, impurities are prevented from getting into the engine. Where there is a high or medium degree of partial vacuum in the crankcase (intake manifold), which happens during idling and when operating under a light load, the system functions as described above. When the partial vacuum in the crankcase is less than that in the air cleaner, which occurs at full load and/or with large flow quantities, no fresh air is supplied. Instead the flow in the connection between the flame trap and air cleaner reverses and the crankcase gases go both ways, partly through the hose (4) and partly through the air cleaner and carburettor to the intake manifold. In this way, the crankcase ventilation system can deal with relatively large quantities of crankcase gases without any escaping into the atmosphere.

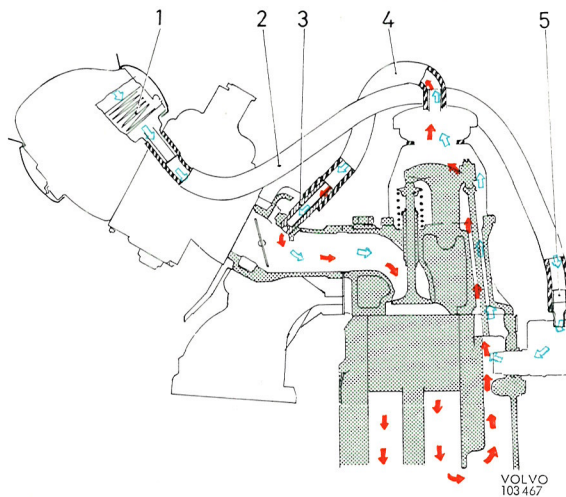


Fig. 2-19. Positive crankcase ventilation

- | | |
|------------------------------|-----------------------------|
| 1. Cleaner insert | 4. Hose for crankcase gases |
| 2. Hose for fresh air supply | 5. Flame guard |
| 3. Nipple | |

REPAIR INSTRUCTIONS

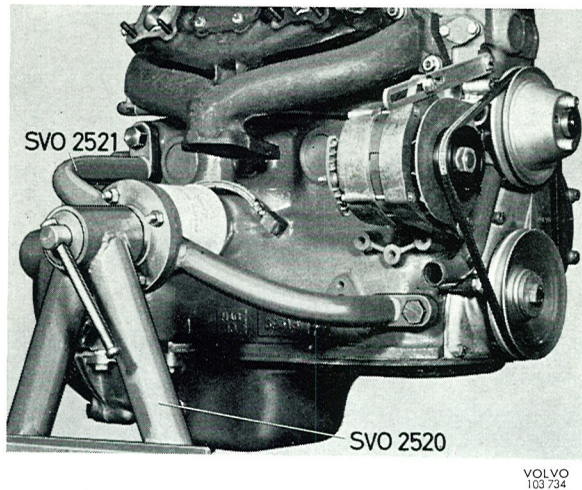


Fig. 2-20. Engine in stand

DISMANTLING THE ENGINE

After the engine has been lifted out of the vehicle, dismantling is carried out as follows. (Instructions for the individual parts are given under the separate headings concerned.)

1. Place the engine on stand SVO 2520 with fixture SVO 2521 (see Fig. 2-20). Check that the oil has been drained off.
2. Remove the starter motor and reinforcing plate on the lower front edge of the flywheel housing. Remove the flywheel housing together with the gearbox and then remove the clutch and flywheel.
3. Remove the rear flange, taking care not to damage the contact surfaces, thereafter the alternator,

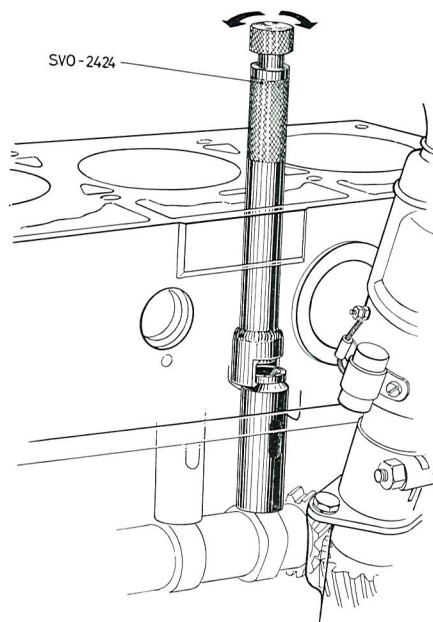


Fig. 2-21. Removing the valve tappets

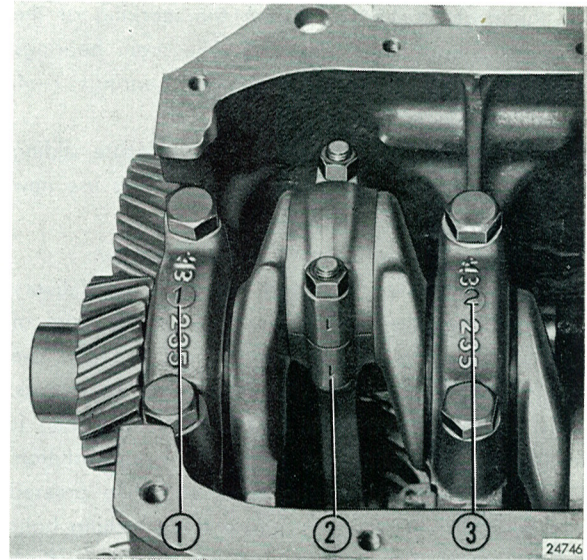


Fig. 2-22. Marking the main and big-end bearings

1. Main bearing No. 1
2. Big-end bearing No. 1
3. Main bearing No. 2

water pump and distributor, the rocker casing, rocker arms, cylinder head and oil filter.

Remove the valve tappets with tool SVO 2424, see Fig. 2-21.

4. Remove the timing gear casing and the timing gears. Concerning tools, see under the heading "Replacing the timing gears". Remove the camshaft.
5. Remove the carbon ridge from the cylinder bores. Remove the sump, oil pump and connecting rods with pistons. Replace the caps correctly on their respective connecting rods.
6. Turn the engine upside down and remove the crankshaft. Replace the caps correctly in their respective positions.

CLEANING

After dismantling, all the parts should be thoroughly cleaned. Parts made of steel or cast iron can be washed in a degreasing tank with a caustic soda solution. Light-alloy parts can, however, be destroyed by caustic soda so that they should preferably be cleaned with white spirit.

Pistons and bearing shells must never be washed in caustic soda. Rinse the parts with warm water and blow them dry with compressed air after washing. Clean the oilways with particular thoroughness. All sealing plugs at the oilway openings in the cylinder block must be removed during the cleaning process.

ASSEMBLING THE ENGINE

When assembling the engine, follow the instructions for the parts concerned. Check the marking of the bearings according to Fig. 2-22. The main bearings are marked 1—5, and the big-end bearings 1—4, counting from the front.

Check that all parts are clean and lubricate sliding surfaces with oil before assembling. Always use new gaskets, split pins and lock washers.

No adhesive should be used on the gaskets.

The seals on the ends of both the oil pump delivery pipe and the water pump pipes are in the form of rubber rings. These rings, which seal radially, are made of special rubber with very close tolerances. Only genuine Volvo parts should be used. Fitting is facilitated by coating the rings with soap solution. The rings are fitted on the pipes and then pressed into their correct positions before the attaching bolts are tightened. The oil pump flange should lie flush against the cylinder block before tightening.

Note that the water pump rubber rings are thicker (9.5 mm = 0.4") for the B 20 A unit than for the B 20 B (8.5 mm = 0.3").

The timing gear casing and rear sealing flange must be accurately centred when fitting. See under the headings "Replacing the timing gear casing" and "Fitting the rear sealing flange".

The big-end bearing bolts and nuts should be replaced with new ones when reconditioning.

The reinforcing bracket on the flywheel housing is fitted according to point 9 "Replacing the sump gasket" (page 2 : 6).

The cylinder head is fitted with the help of guide pins (SVO 2435). The bolts must be tightened in a certain sequence as shown in Fig. 2-23, in order to avoid unnecessary stresses. Check that the oil hole (Fig. 2-24) for lubricating the rocker arms is clear.

The pilot bearing (5, Fig. 2-25) should be lubricated before fitting with heat-resistant ball bearing grease. The bearing and protecting washer are held in position by a circlip (6).

The most important bolts and nuts should be tightened with a torque wrench, see "Tightening Torques" in "Specifications". B 20 A: Re-tighten the cylinder head bolts. See point 10 "Valve grinding and decarbonizing".

VALVE GRINDING AND DECARBONIZING

1. Drain off the coolant from the radiator and cylinder block. To do this open the cock on the right-hand side of the engine and disconnect the lower radiator hose.

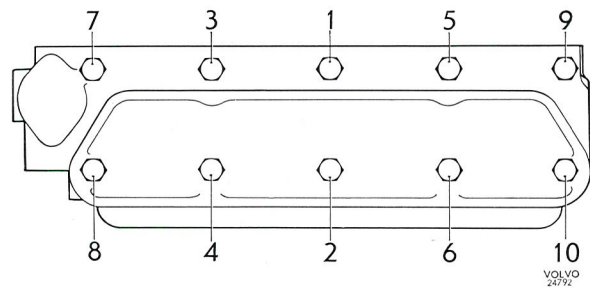


Fig. 2-23. Tightening sequence for cylinder head bolts

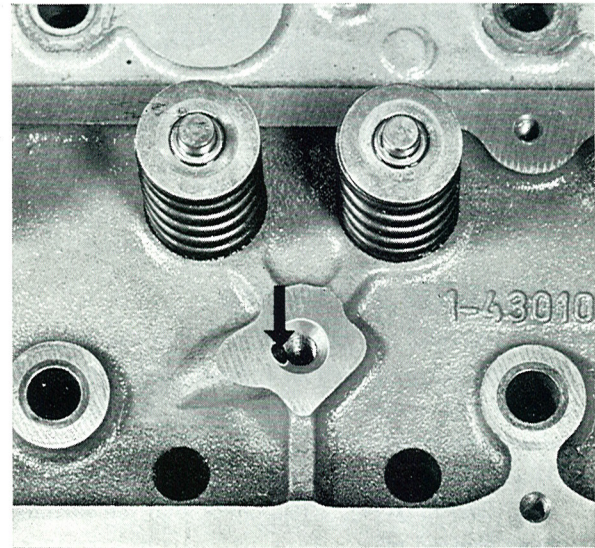


Fig. 2-24. Oil hole in cylinder head

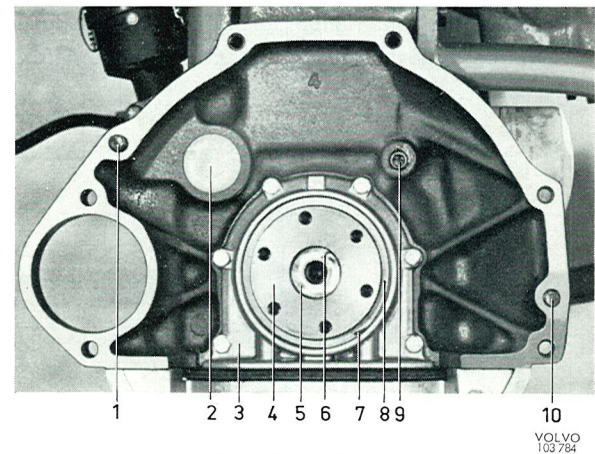


Fig. 2-25. Rear end of engine

- | | |
|-------------------|-------------------|
| 1. Guide pin | 6. Circlip |
| 2. Core plug | 7. Circlip |
| 3. Sealing flange | 8. Sealing washer |
| 4. Crankshaft | 9. Plug |
| 5. Pilot bearing | 10. Guide pin |

2. Dismantle the throttle control. Disconnect the choke control.
3. Remove the air cleaner and carburettor.

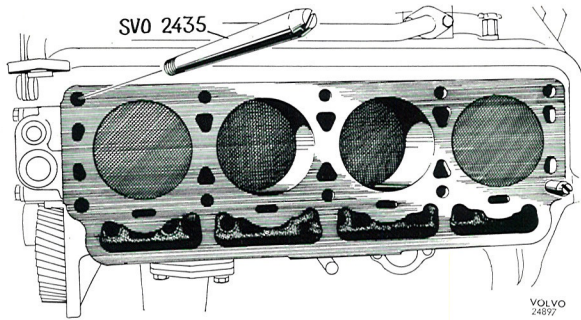


Fig. 2-26. Guide pins for fitting the cylinder head

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 casing, 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 alternator tensioner arm. Lift off the cylinder head.
7. Clean the piston crown, combustion 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 consequently cause scoring.
8. Recondition the valve system as described under the heading "Cylinder head and valves".
9. Fit the valves. Screw the guide pins SVO 2435 into the block, one in the front right-hand hole and the other in the left-hand rear hole, see Fig. 2-26. Install a new cylinder head gasket and new sealing rings for the water pump and fit the cylinder head. Screw out the guide pins and fit the bolts in these holes as well. For tightening sequence and tightening torques, see Fig. 2-23. The tightening torque is 8.5—9.5 kgm (60—70 lb.ft.). Fit the other parts. Fill up with coolant according to the instructions given under "Filling with coolant when the system has been emptied".
10. Adjust the valve clearance to **0.50—0.55 mm (0.020—0.022")**. Run the engine until it is fully warm. **Re-tighten** the cylinder head bolts to 8.5—9.0 kgm (60—65 lb.ft.) within 20 minutes after running the engine warm. (Re-tightening is not required on the B 20 B.) **Re-adjust** the valve clearance to 0.40—0.45 mm (0.016—0.018") for the B 20 A and 0.50—0.55 mm (0.020—0.022") for the B 20 B unit.

CYLINDER HEAD AND VALVES

DISMANTLING

1. Remove the valve springs by first compressing them with valve pliers and removing the valve collets, after which the pliers are released. Place

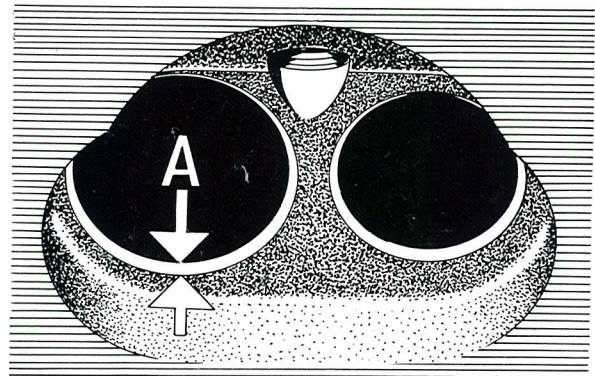


Fig. 2-27. Valve seat width A=2 mm (0.08")

the valves in order in a valve rack. Remove the valve guide seals.

2. Measure the clearance between the stem and guide. With a new valve the clearance should not exceed 0.15 mm (0.006"). Also check that the valves are not excessively worn. See the "Specifications" under the headings "Valve system" and "Wear tolerances".

CLEANING

Remove carbon and combustion deposits from the valves, combustion chambers and ports by using rotating brushes.

GRINDING THE VALVES AND VALVES SEATS

1. Grind the valves in a machine after they have been cleaned. Fit new valves if they are excessively worn.
2. Grind the valve seats. Use an electrically driven grinder or a hand milling cutter. A pilot spindle must be carefully fitted before work is started and any worn guides must be replaced with new ones. The seat should be ground until a good sealing surface is obtained. The angle is 45° and the width of the sealing surface should be approx. 2.0 mm (0.08"), see "A" Fig. 2-27. If the sealing surface is too wide after grinding, it can be reduced by using a 70° grinding stone from the inside and a 20° grinding stone from the outside.
3. Coat the valve sealing surfaces with a thin layer of fine grinding paste and lap in the valves against their seats. Then clean the valves and seats and check that good sealing is obtained.

REPLACING THE VALVE GUIDES

1. Press out the old guides with tool SVO 2818.
2. Press in the new guides using drift SVO 2819 which gives the correct depth, see Fig. 2-28.
3. Check that the guides are free from burr and that the valves move easily in them.

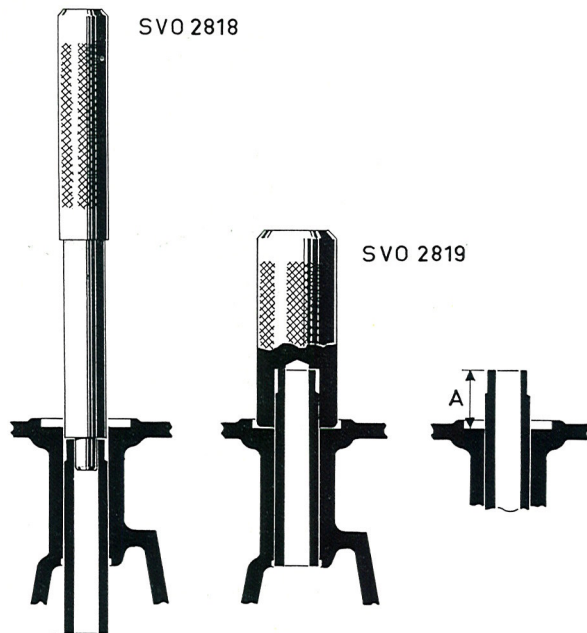


Fig. 2-28. Replacing the valve guides
A=17.5 mm (0.689")

ASSEMBLING

1. Check that the parts are in good condition and clean. Test the springs to ensure that they maintain the values given in the "Specifications".
2. Place the valves in position. Fit the valve guide seal, valve spring, upper washer and collet.

REPLACING THE ROCKER ARM BUSHES AND GRINDING THE ROCKER ARMS

1. If wear amounts to 0.1 mm (0.004"), replace the rocker arm bush. Use tool SVO 1867 for pressing the bush out and in, see Fig. 2-31. Then ream the bush out and in, see Fig. 2-30. Then ream the fit on the shaft is obtained. The hole in the bush should coincide with the hole in the rocker arm.
2. If necessary grind the pressure surface against the valve in a special machine.

FITTING THE CYLINDER HEAD

1. Check that the cylinder head, the cylinder block, the pistons and cylinder bores are clean.
2. Check that the oilway to the rocker arm mechanism on the valve tappet side in the middle of the head is clean. In the cylinder head oil goes up through the bolt hole, between the bolt and hollow partition, through a diagonal oilway to the attaching bolt for the rocker arm shaft and then up into the shaft.
3. Screw down the guide pins SVO 2435, one in the front right and one in the rear left bolt hole, see Fig. 2-26. Fit a new cylinder head gasket and then fit the cylinder head. Note that the cylinder head gasket for the B 20 A engine is thicker than

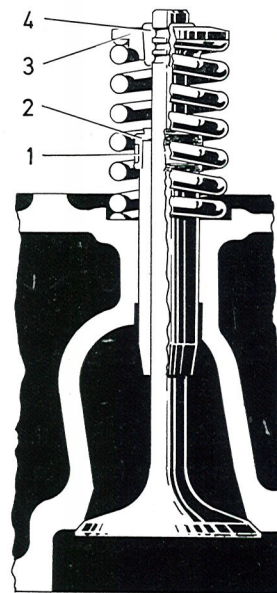


Fig. 2-29. Valve collet and valve guide seal

- | | |
|----------------|-----------------|
| 1. Metal ring | 3. Washer |
| 2. Rubber seal | 4. Valve collet |

the gasket for the B 20 B unit, see "Specifications". Screw in the cylinder head bolts lightly. Remove lastly guide pins and also fit bolts in these holes as well.

- Tighten the bolts in the correct order and to the correct torque. See Fig. 2-23 and "Specifications".
4. Fit the rocker arm mechanism. Adjust the valve clearances. Fit the other parts.

N.B. The valve clearance for the B 20 A engine should be set to the same as that for the B 20 B and then adjusted to the value given in the "Specifications", after running the engine warm and re-tightening the cylinder head bolts to a torque of 8.5—9.0 kgm (60—65 lb.ft.).

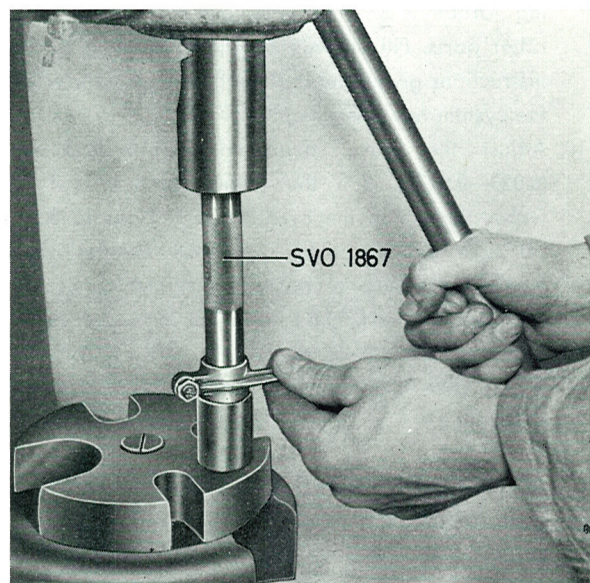


Fig. 2-30. Replacing bush in rocker arm

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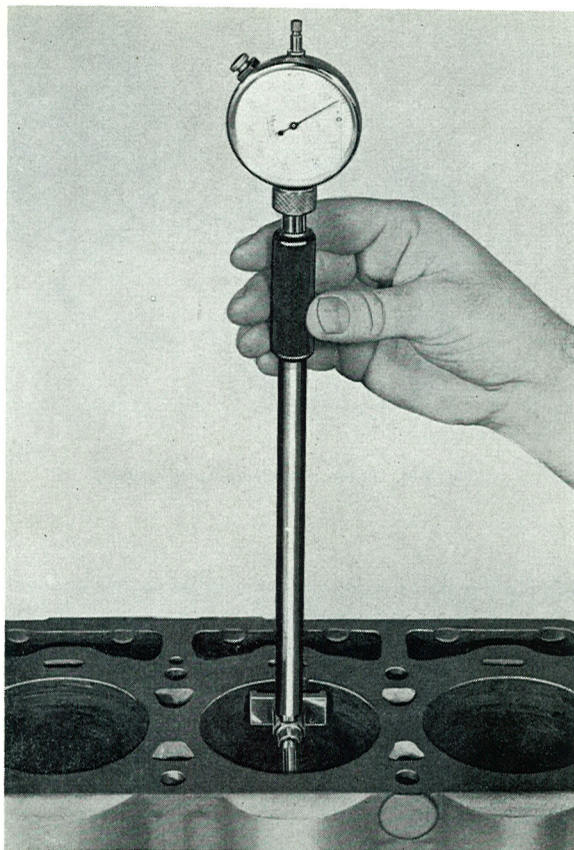


Fig. 2-31. Measuring the cylinder bore

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- Run the car for a short distance. Check that the engine is running well and adjust the valve clearances. On the B 20 A re-tighten the cylinder head bolts according to point 4. Re-adjust the valve clearance.

ADJUSTING THE VALVE CLEARANCE

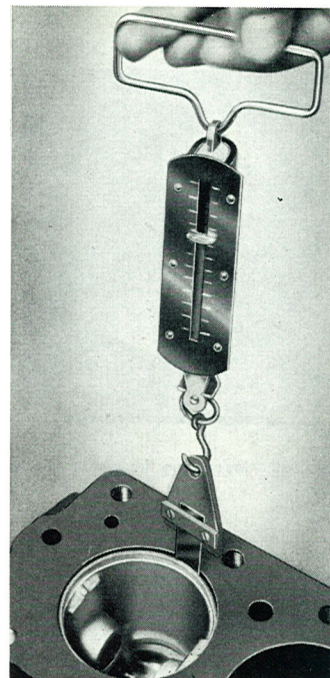
The valves clearance can be adjusted satisfactorily with the engine stationary, irrespective of whether or not it is cold or warm. The clearance is the same for both the inlet and exhaust valve. When adjusting, use two feeler gauges, one "Go" 0.40 mm (0.016") thick and the other "No-Go" 0.45 mm (0.018") thick for the B 20 A (0.50 and 0.55 mm = 0.020—0.022" for the B 20 B). The clearance is adjusted so that the thinnest gauge can be inserted easily while the thicker one must not enter.

When the piston in No. 1 cylinder is at top dead centre (the compression stroke), valve Nos. 1, 2, 3 and 5 (counted from the front) are adjusted, and with the piston in No. 4 cylinder at top dead centre, valves Nos. 4, 6, 7 and 8.

CYLINDER BLOCK

MEASURING THE CYLINDER BORES

The cylinder bores are measured with a special dial



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Fig. 2-32. Measuring the piston clearance

indicator as shown in Fig. 2-31. Measuring should be carried out just below the top edge of the bore and only in the transverse direction of the engine.

A letter is stamped on each cylinder bore indicating the classification of the bore and piston (only on standard models).

PISTONS, PISTON RINGS AND GUDGEON PINS

Measuring the pistons

The pistons are measured with a micrometer at right angles to the gudgeon pin hole 2.5 mm (0.098") from the lower edge.

Fit of pistons in cylinders

The fit of the pistons in their respective cylinders is tested without the piston rings being fitted. The clearance at right angles to the gudgeon pin hole is measured with a feeler gauge 1/2" wide and 0.03 mm (0.0012") thick attached to a spring balance. The force applied should be 1 kg (2.2 lb.). 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 feeler gauge used. Feeler gauges which are 0.02 mm (0.0008") or 0.04 mm (0.0016") thick can, therefore, also be used. The test is carried out at several different depths. See Fig. 32. Standard bore cylinders have a letter stamped on which shows the dimensions, and the pistons concerned should be marked with the same letter.

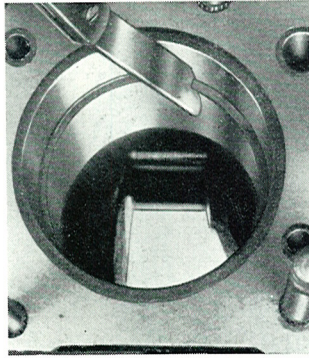


Fig. 2-33. Measuring the piston ring gap

Piston ring fit

IN A NEW OR RE-BORED CYLINDER

1. Push down the piston rings one after another in the cylinder bore. Use a reversed piston to ensure that the rings come into the correct position.
2. Measure the ring gap with a feeler gauge, see Fig. 2-33. The gap should be 0.40—0.55 mm (0.016—0.022"). If necessary, the gap can be increased with the help of a special file.
3. Check the piston rings in their respective grooves rolling then in the groove. Also measure the clearance at a few points. See "Specifications" for measurements.

IN A WORN CYLINDER BORE

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

Gudgeon pins

The gudgeon pins are available in oversize 0.05 mm (0.002") larger than the standard diameter 22.00 mm (0.866"). If the gudgeon pin hole in the piston is worn so much that an oversize is necessary, the hole should first be reamed out to the correct measurement. Use a reamer fitted with a pilot guide and only take small cuts at a time.

The fit is correct when the gudgeon pin can be pushed through the hole by hand with light resistance.

CONNECTING RODS

Replacing the bushes

If the old bush in a connecting rod is worn, press it out by using drift SVO 1867 and press in a new bush with the same tool, see Fig. 2-35. Make sure that the

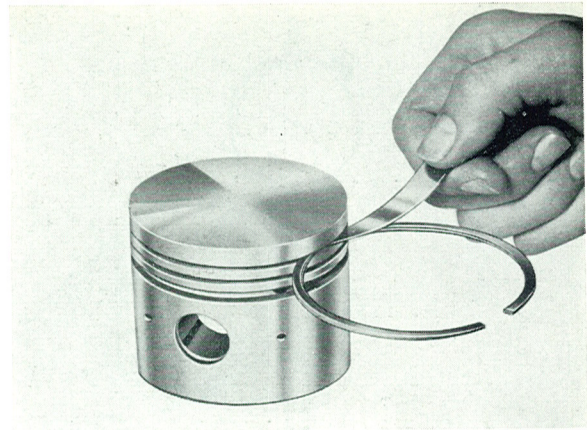


Fig. 2-34. Piston ring clearance in groove

lubricating holes index with the holes in the connecting rod. Then ream the bush to the correct fit. The gudgeon pin should slide through the hole under light thumb pressure but without any noticeable looseness, see Fig. 2-36.

Straightening

Before being fitted, the connecting rod should be checked for straightness, twist and any S-distortion. Straighten then if necessary, see Fig. 2-37. Nuts and bolts should be replaced with new ones when reconditioning is being carried out.

ASSEMBLING AND FITTING PISTON AND CONNECTING ROD

When assembling make sure that the piston is facing correctly so that the slot on the piston crown points

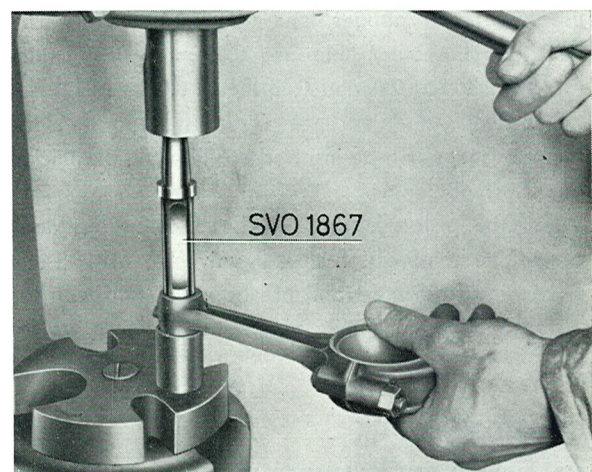
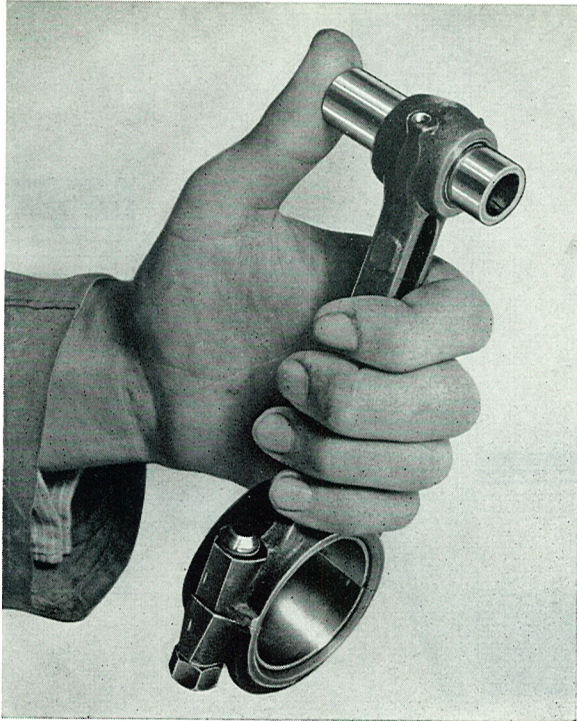


Fig. 2-35. Replacing the brush in connecting rod



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Fig. 2-36. Gudgeon pin fit

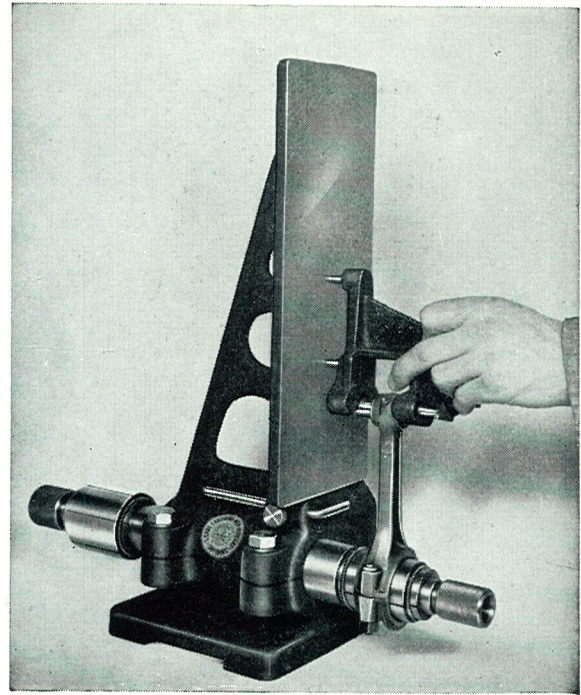
forwards, see Fig. 2-38. A loud noise will arise if the piston is turned the wrong way. The connecting rod marking should face away from the camshaft side. The gudgeon pins are then fitted, the circlips placed in position and the piston rings installed.

Use piston ring pliers for fitting the rings. The compression rings are "TOP" marked, and the upper one is chromed. Place the bearing shells in their seats. Turn the rings so that their gaps are not opposite one another. Lubricate the piston and bearing surfaces.

Use installation ring SVO 2823, see Fig. 2-39 when fitting the piston a torque wrench, see "Specifications" for the correct tightening torque.

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-roundness on the main bearing journal should not exceed 0.05 mm (0.002"), and 0.07 mm (0.003") on the big-end bearing journals. Taper should not exceed 0.05 mm (0.002") on any of the journals. If the values obtained are close to or exceed the wear limit mentioned above, the crankshaft should be ground to undersize. Suitable bearing shells are available in 2 undersizes. The measurements concerned are to be found in the "Specifications".



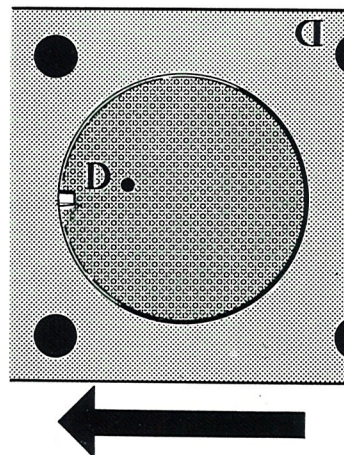
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Fig. 2-37. Checking the connecting rod

Check that the crankshaft is straight to within 0.05 mm (0.002") by using a dial gauge. The crankshaft is placed on two V-blocks and a dial gauge placed against the centre bearing journal after which the crankshaft is rotated. If necessary, straighten the crankshaft in a press.

GRINDING THE CRANKSHAFT

Before the crankshaft is ground, a check should be made to ensure that it is straight, this being done as



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Fig. 2-38. Marking on piston and block

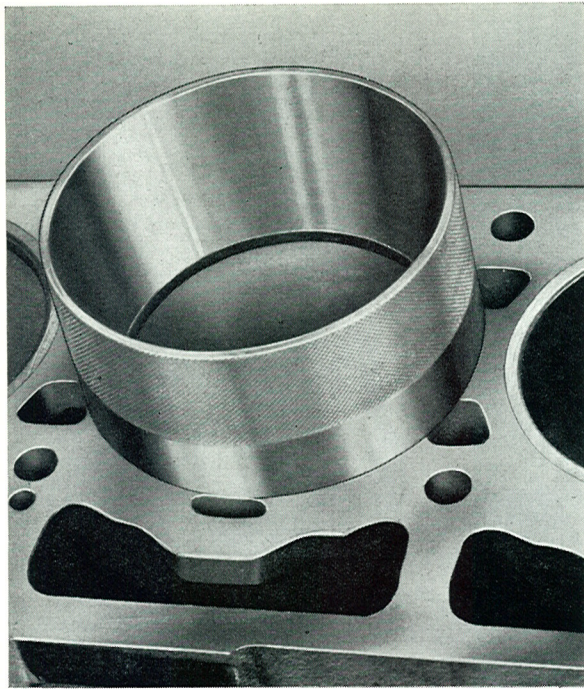


Fig. 2-39. Fitting the piston
Installation ring SVO 2823

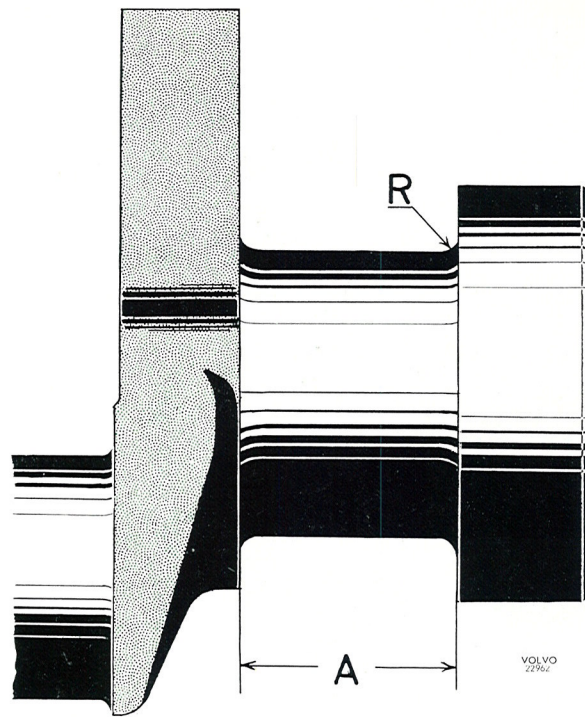


Fig. 2-40. Bearing journal

described previously. Grinding is carried out in a special machine whereby the main bearing journals and the big-end bearing journals are ground to identical measurements. These measurements, which are given in "Specifications", must be carefully followed in order to ensure correct clearance with ready-machined bearing shells.

On no account must the bearing shells be shaved or the bearing caps filed.

The fillets at the ends of the journals should have a radius of 2.0—2.5 mm (0.080—0.100") on all journals, see Fig. 2-40. The width measurement (A) for the pilot bearing depends on the size of the journal and should be ground in order to obtain the correct measurement.

After grinding has been completed, all the burr should be carefully removed from the oilway openings and all the journals lapped with a fine grinding paste to the finest possible surface finish. The crankshaft should then be washed. All the oilways should be cleaned with particular thoroughness in order to remove any metal chippings and grinding residue.

Main and big-end bearings

In addition to standard sizes, bearing shells are available in undersizes of 0.010" and 0.020". The rear main

bearing shells are provided with flanges and have a larger width relative to their size. If the crankshaft has been ground to the correct measurement, the right bearing clearance is automatically obtained when the bearing shell concerned is fitted. The bearing shells must not be shaved and the caps must never be filed in order to obtain closer bearing fit.

The bolts should be tightened with a torque wrench, see "Specifications" for the tightening torque.

FITTING THE REAR SEALING FLANGE

1. Make sure that the seal is in good condition and that the flange is clean. The drain hole must not be blocked by incorrect fitting of the sump gasket. The sealing ring must not be fitted in the flange.
2. Fit on the sealing flange but do not tighten the bolts.
3. Centre the flange with sleeve SVO 2439, Fig. 2-41. Turn the sleeve round while tightening the bolts and adjust the position of the flange if the sleeve jams. Check that the flange comes flush against rotate easily.
4. Fit a new felt ring and place on the washer and circlip. Press the circlip into position with the centering sleeve. Check that the circlip engages in its groove.

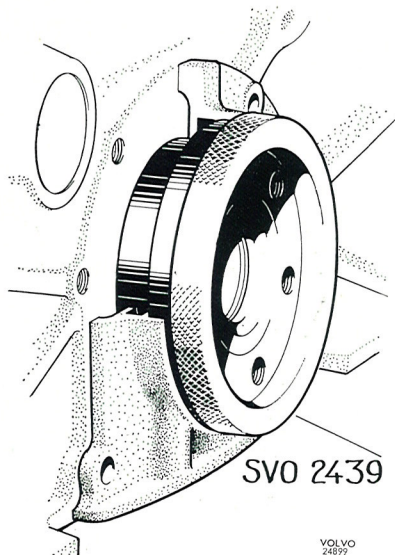


Fig. 2-41. Centering the rear sealing flange

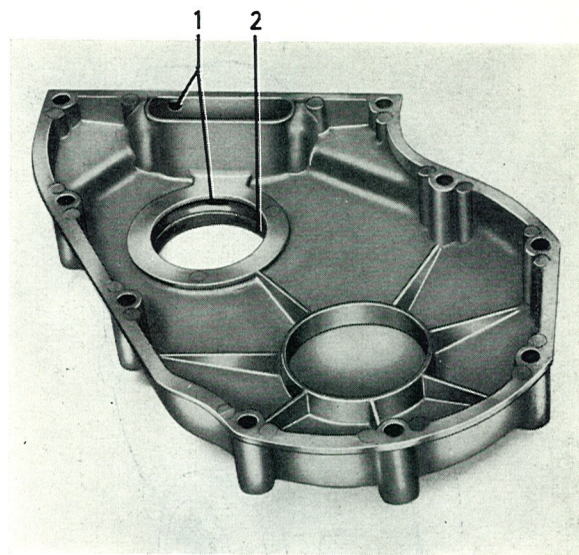


Fig. 2-42. Timing gear casing
1. Drain holes 2. Sealing ring

GRINDING THE FLYWHEEL

If the wear surface of the flywheel is uneven or burnt, the surface can be ground in a saddle-mounted grinding machine. Not more than 0.75 mm (0.03") of the original thickness must be ground off.

PILOT BEARING FOR INPUT SHAFT

The pilot bearing circlip and protecting washer are removed, the pilot bearing pulled out with tool SVO 4090 and checked after having been washed in white spirit. If the bearing is worn, it should be replaced with a new one. Before fitting, pack the bearing with heat-resistant ball bearing grease. The bearing is fitted with drift SVO 1426, after which the protecting washer and circlip are fitted.

TIMING GEARS REPLACING THE OIL SEAL IN TIMING GEAR CASING

1. Release the fan belt. Loosen the attachment of the stabilizer at the frame.
2. Screw out the bolt in the crankshaft. Remove the belt pulley.
3. Remove the circlip for the washer which retains the felt ring. Remove the washer and felt ring. Check that the casing is correctly fitted by inserting a 0.10 mm (0.004") feeler gauge in the gap between the casing and hub on the crankshaft and moving it all round. If the feeler gauge jams at any point, the casing should be centered, see under "Replacing the timing gear casing".

4. Fit a new felt ring. Place the washer in position and fit the circlip. Check that the circlip fits properly in position.
5. Fit the remaining parts and tension the fan belt.

REPLACING THE TIMING GEAR CASING

1. Loosen the fan belt. Remove the fan and pulley on the water pump. Disconnect the stabilizer attachment from the frame.
2. Remove the bolt for the crankshaft belt pulley and remove the pulley.
3. Remove the timing gear casing. Slacken a couple of extra bolts for the sump and be careful not to damage the gasket. Remove the circlip, 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 inside the timing gear casing which is to be fitted, see Fig. 2-42.
5. Place the casing in position and fit the bolts without tightening them.
6. Center the casing with sleeve SVO 2438, see Fig. 2-43. 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 circlip. Push them into their position with the centering sleeve SVO 2438. Check that the circlip has engaged in its groove.

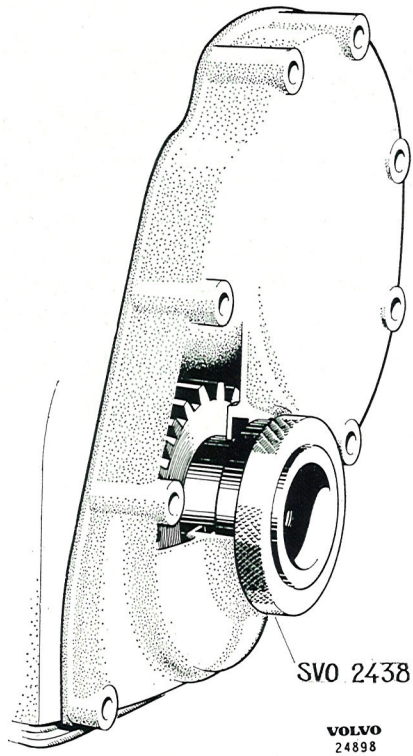


Fig. 2-43. Centering the timing gear casing

8. Fit the other parts and tension the fan belt. See "Specifications" for the tightening torque. Fix the stabilizer attachments firmly to the frame.

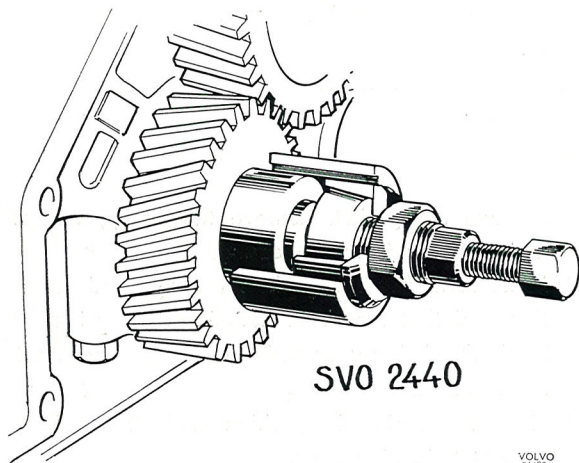


Fig. 2-44. Removing the hub on the crankshaft

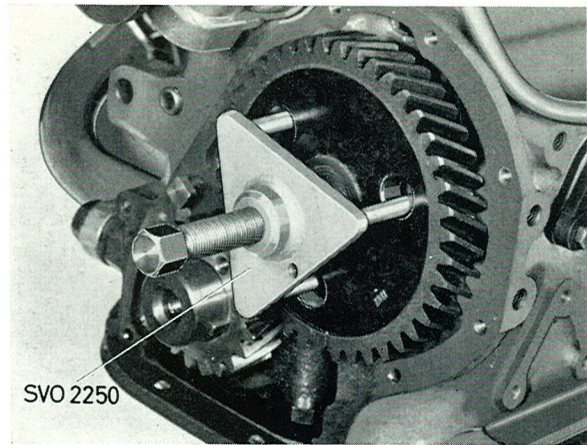


Fig. 2-45. Removing the camshaft gear

REPLACING THE TIMING GEARS

1. Drain off the coolant and remove the cover plate and radiator.
2. Carry out operations 1—3 in previous section.
3. Remove the hub from the crankshaft with puller SVO 2440. See Fig. 2-44.

Before applying the tool, its large nut must be screwed backwards so that the cone is not tensioned. The centre bolt should also be screwed back.

Then apply the tool, screw in the large nut so that the hub is firmly held and 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. 2-45.
5. Pull off the crankshaft gear by using puller SVO 2405, Fig. 2-46. Screw out the oil nozzle, blow it clean and then refit it as shown in Fig. 2-49. The gears are lubricated by oil fed through this nozzle.
6. Fit the crankshaft gear by using tool SVO 2407 and the camshaft gear by using SVO 2408, see Figs. 2-47 and 2-48. 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. 2-49.

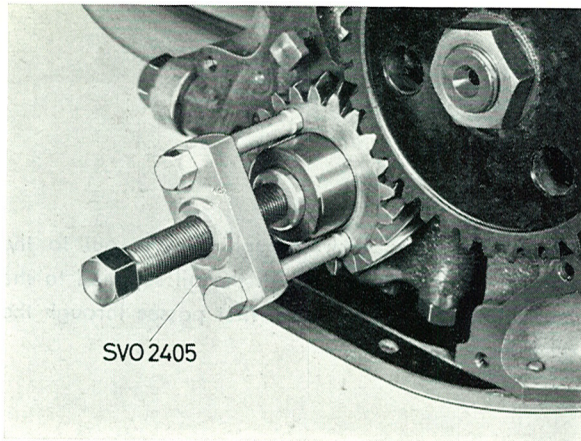


Fig. 2-46. Removing the crankshaft gear

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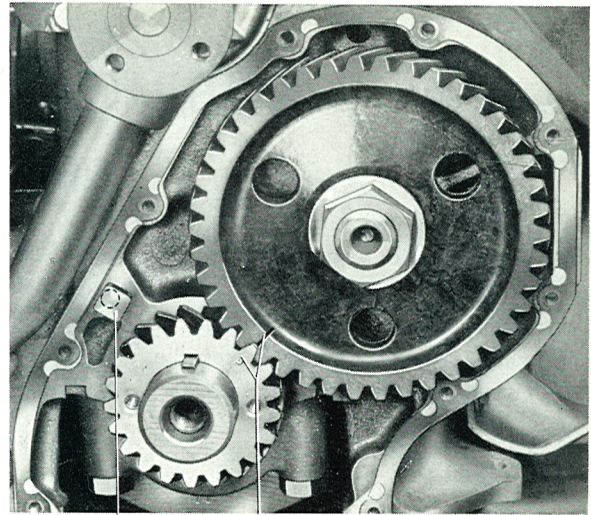


Fig. 2-49. Marking on timing gears
1. Oil nozzle 2. Markings

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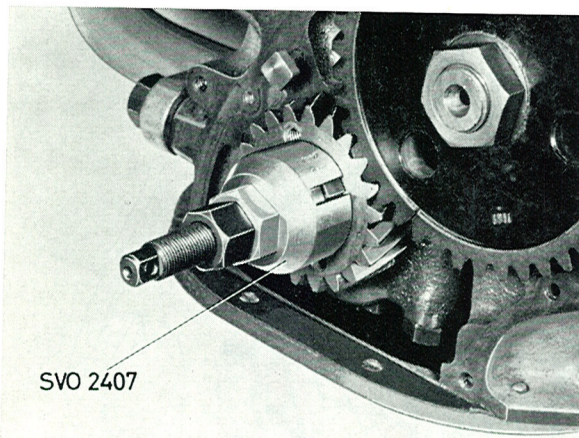


Fig. 2-47. Fitting the crankshaft gear

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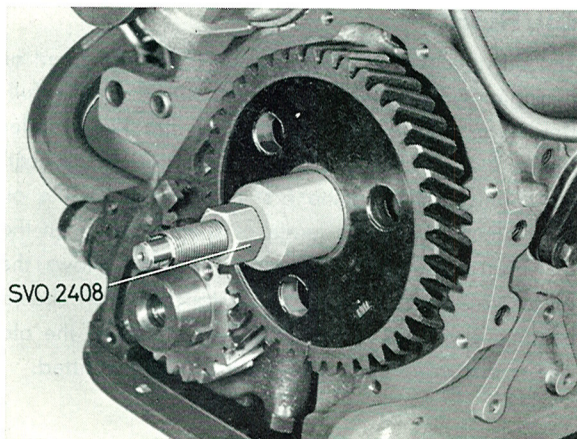


Fig. 2-48. Fitting the camshaft gear

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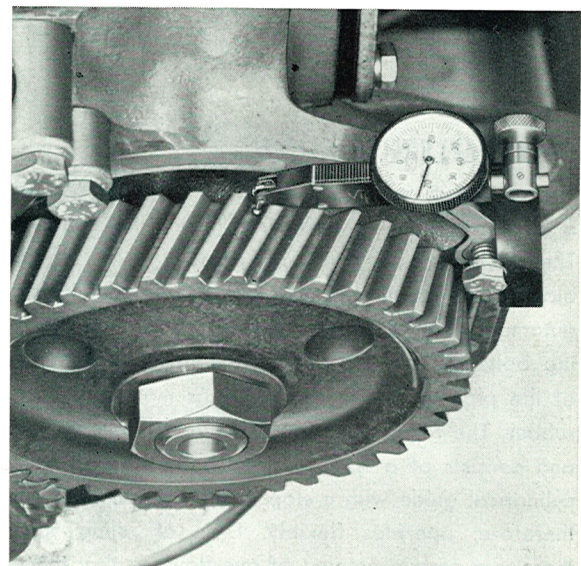


Fig. 2-50. Measuring the tooth flank clearance

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Check to make sure that the gears are correctly located in relation to one another, see Fig. 2-49. Tool SVO 2407 has a socket intended for turning the crankshaft.

The tooth flank clearance and camshaft axial clearance, determined by the spacer ring behind the camshaft gear, are given in the "Specifications".

Center and fit the timing gear casing as well as the other parts according to operations 4—8 in the previous section.

POSITIVE CRANKCASE VENTILATION

OVERHAUL

At intervals of 40 000 km (25 000 miles) unscrew and clean the nipple (3, Fig. 2-19). Check the hoses at the same time. Replace any that are in a poor condition.

LUBRICATING SYSTEM

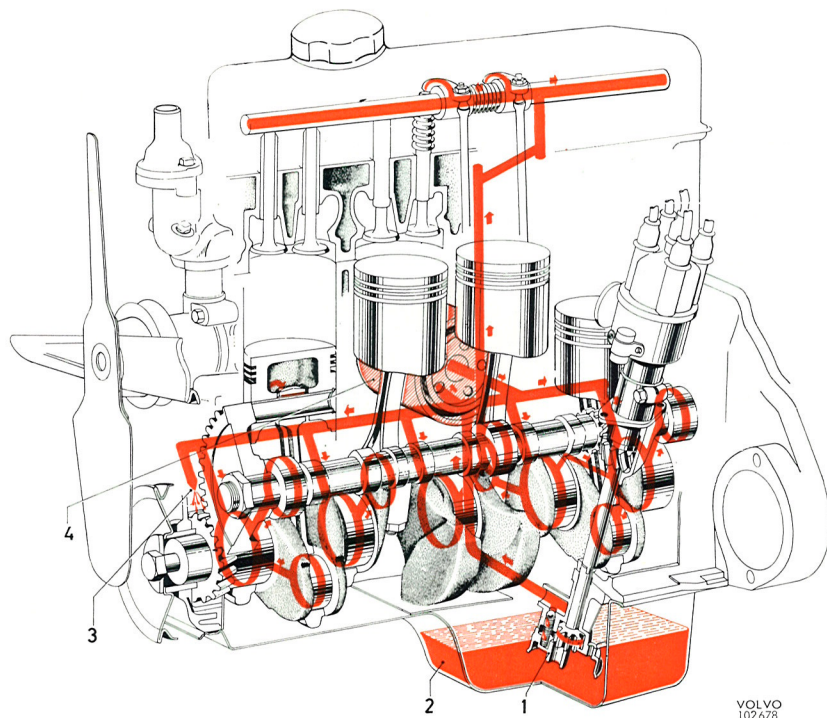
DESCRIPTION

The engine has a force-feed lubricating system, see Fig. 2-51. Pressure is provided by a gear pump driven from the camshaft and fitted under the crankshaft in the sump. The gear pump forces the oil past the relief valve, which is also fitted on the pump, through

the oil filter and then through oilways out to the various lubricating points. All the oil supplied to the lubricating points, therefore, first passes through the oil filter.

Fig. 2-51. Lubricating system

1. Oil pump
2. Sump
3. Nozzle
4. Oil filter



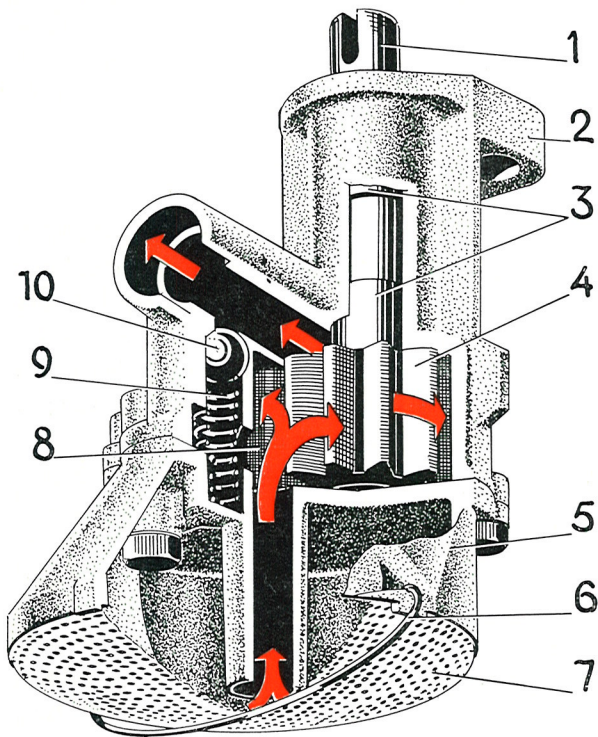
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OIL PUMP, RELIEF VALVE

The oil pump, see Fig. 2-52, is of the gear type and is driven through a gear train from the camshaft. The delivery pipe from the pump to the cylinder block does not have screw unions and is, therefore, automatically tightened in position when the attaching bolts for the pump are tightened. At each end of the pipe there are sealing rings made of special rubber. The relief valve is fitted directly on the pump and consists of a spring-loaded ball. The ball has a cylindrical guide with a stop at the end position and, therefore, operates flexibly. Even at idling speed there is a certain amount of overflow, so that the oil pressure is then relatively low.

OIL FILTER

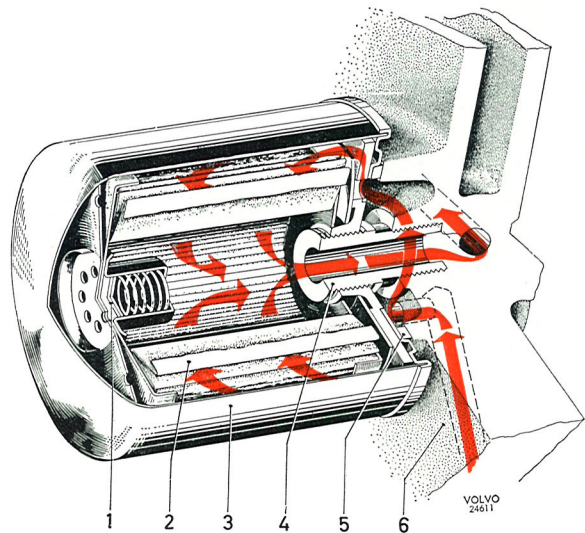
The oil filter (see Fig. 2-53), which is manufactured as a single unit complete with element, is of the full-flow type and is screwed directly into the cylinder block. The oil which is fed out to the various lubricating points in the engine first passes through the oil filter element which is made of special paper. In the oil filter there is a by-pass valve which allows the oil to by-pass the element if resistance to flow should become excessive. When replacing the filter, the old one is discarded completely and a new one fitted.



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Fig. 2-52. Oil pump

- | | |
|-----------------|----------------------------|
| 1. Drive shaft | 6. Retainer clip |
| 2. Pump body | 7. Strainer |
| 3. Bushes | 8. Drive gear |
| 4. Driving gear | 9. Spring for relief valve |
| 5. Cover | 10. Valve ball |



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Fig. 2-53. Oil filter

- | | |
|-------------------|-------------------|
| 1. Overflow valve | 4. Nipple |
| 2. Element | 5. Gasket |
| 3. Body | 6. Cylinder block |

REPAIR INSTRUCTIONS

REPLACING THE OIL FILTER

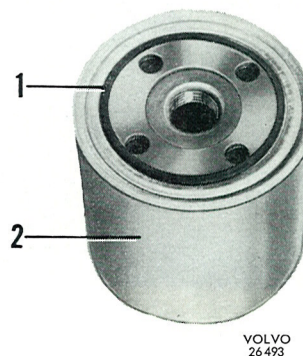
Together with the element and relief valve, the oil filter (see Fig. 2-53) is screwed as a complete unit on to a nipple fitted in the cylinder block.

The filter should be replaced every 10 000 km (6 000 miles), when the old filter is discarded. With a new or reconditioned engine, the filter should also be changed the first time after 5 000 km (3 000 miles).

1. Remove the old filter with the help of chain tongs, see Fig. 2-55.
2. Coat the rubber gasket (1, Fig. 2-54) of the new filter with oil and make sure that the contact surface for the oil filter is free from dirt. By smearing it with oil, the gasket slides into better contact with the sealing surface. Screw on the filter by hand until it just touches the cylinder block.

the engine and check that there is no leakage at the joint. Fill up with oil if necessary.

3. Screw on the oil filter a further half turn by hand. **Chain tongs must not be used when fitting.** Start



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Fig. 2-54. Oil filter ready for fitting

- | | |
|-------------------|-----------|
| 1. Gasket (oiled) | 2. Filter |
|-------------------|-----------|

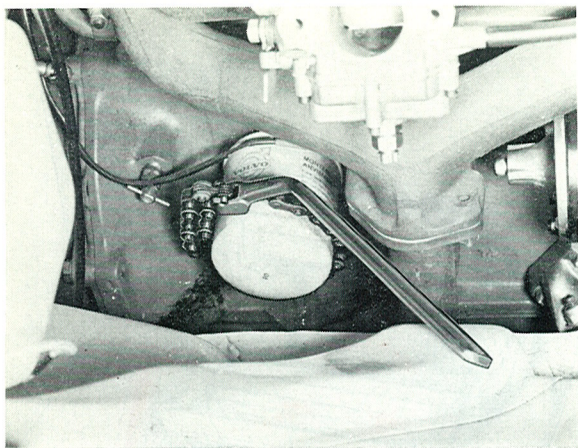


Fig. 2-55. Removing the oil filter

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OIL PUMP AND RELIEF VALVE

After the pump has been dismantled and cleaned, check that all the parts are in good condition. Test the relief valve spring (2, Fig. 2-56), see "Specifications" for the values concerned.

Check that the tooth flank clearance is 0.15—0.35 mm (0.006—0.014"), see Fig. 2-57.

Measure the end float, 0.02—0.10 mm (0.0008—0.0040"), with a feeler gauge and a new cover or the old one if not noticeably worn. If the bushes or shaft are worn, replace them with new ones. Note that the driving shaft with gear is replaced as a single unit. The new bushes should be reamed after pressing in with a reamer provided with a pilot guide.

The sealing rings at the ends of the delivery pipe are made of special rubber and are manufactured to very close tolerances, see Fig. 2-59. Use only genuine Volvo spare parts. The delivery pipe must be clamped in its correct position first in the oil pump and then the oil pump and pipe together clamped against the block. The pump connecting flange should lie flush against the block before being tightened. Before being fitted, the rubber rings on the pipe can be coated with soapy water since this enables the pipe to take up its position more easily. Tap lightly on the pipe with a soft mallet if necessary.

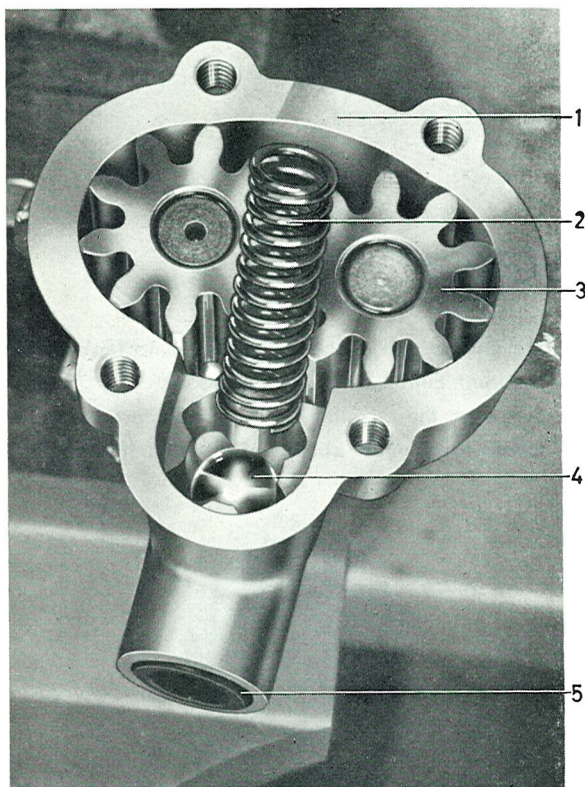


Fig. 2-56. Oil pump

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

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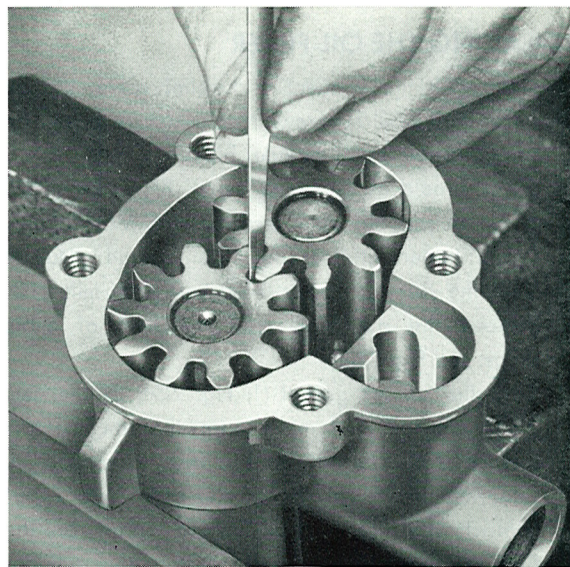


Fig. 2-57. Measuring tooth flank clearance

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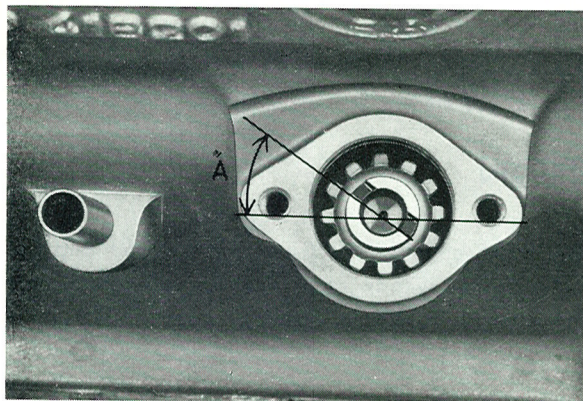


Fig. 2-58. Distributor drive position
A = approx. 35°

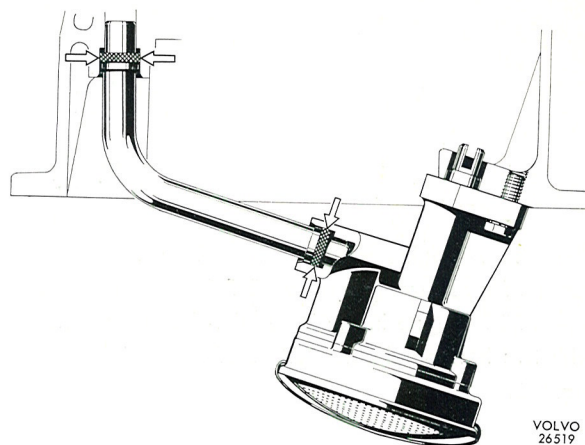


Fig. 2-59. Delivery pipe sealing rings

OILWAYS

Before being fitted, all the oilways must be cleaned very thoroughly to avoid damage to the bearings, bearing journals and other components.

To clean the cylinder block oilways, remove the sealing plugs. After cleaning and drying with compressed air, fit new plugs.

FITTING THE OIL PUMP

When No. 1 cylinder is at top dead centre, fit the oil pump drive and distributor. The small part at the groove is turned obliquely upwards-backwards and the groove set at an angle of 35° to the longitudinal axis of the engine, see Fig. 2-58 (A). Make sure that the shaft goes down into its groove in the pump shaft.

(N.B. When the timing gear marks are opposite each other, then the piston for No. 4 cylinder is in the top dead center position, firing position.)