



**CARS**

PART 2  
ENGINE  
B 20 A, B 20 B

# **SERVICE MANUAL**

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## SPECIFICATIONS

**GENERAL**

Type, designation .....	B 20 A	B 20 B
Output, h.p. at r.p.m. (SAE) .....	90/4800	118/5800
(DIN) .....	82/4700	100/5500 (105/5500)*
Max, torque, kgm (lb.ft.) at r.p.m. (SAE) .....	16.5 (119)/3000	17.0 (123)/3500
(DIN) .....	16.0 (15.5)/2300	15.5 (112)/3500 (16/3500)*
Compression pressure (warm engine when turned over with starter motor) 250–300 r.p.m. ....	11–13 kg/cm <sup>2</sup> (156–185 lb/sq.in.)	12–14 kg/cm <sup>2</sup> (170–200 lb/sq.in.)
Compression ratio .....	8.7:1	9.5:1
Number of cylinders .....	4	4
Bore .....	88.90 mm (3.500")	88.90 mm (3.500")
Stroke .....	80 mm (3.150")	80 mm (3.150")
Displacement .....	1.99 litres	1.99 litres
Weight, including electrical equipment and carburettor, approx. ....	155 kg (341 lb.)	155 kg (341 lb.)

**CYLINDER BLOCK**

Material .....	Special alloy cast iron
Bore, standard .....	88.90 mm (3.499")
oversize .....	89.66 mm (3.530")

**PISTONS**

Material .....	Light alloy
Weight, standard .....	500 ± 5 grammes (17.5 ± 0.18 oz.)
Permissible weight deviation between pistons in same engine .....	10 grammes (0.35 oz.)
Height, total .....	71 mm (2.79")
Height from piston pin centre to piston crown .....	46 mm (1.81")
Piston clearance .....	0.02–0.04 mm (0.0008–0.0016")

**PISTON RINGS**

Piston ring gap, measured in ring opening .....	0.40–0.55 mm (0.016–0.022")
Oversize on piston rings .....	0.76 mm (0.030")

**Compression rings**

Marked "TOP". Upper ring chromed.

Number on each piston .....	2
Height .....	1.98 mm (0.078")
Compression ring clearance in groove .....	0.045–0.072 mm (0.0017–0.0028")

**Oil scraper rings**

Number on each piston .....	1
Height .....	4.74 mm (0.186")
Scraper ring clearance in groove .....	0.045–0.072 mm (0.0017–0.0028")

**GUDGEON PINS**

Floating fit. Circlips at both ends in piston.

Fit:

In connecting rod .....	Close running fit
In piston .....	Push fit
Diameter, standard .....	22.00 mm (0.866")

\* Applies to B 20 B in 1800 model.

## B 20 A, B 20 B

### CYLINDER HEAD

Height, measured from cylinder contact face to face for bolt heads ..	86.7 mm (3.41")
Distance from top side of head to overflow pipe upper end (pipe placed under thermostat) .....	35 mm (1.38")
Cylinder head gasket, thickness (unloaded), B 20 A .....	2 mm (0.08") (loaded 1.65 mm=0.065")
B 20 B .....	0.8 mm (0.031") (loaded 0.7 mm=0.028")

### CRANKSHAFT

Crankshaft, end float .....	0.047–0.138 mm (0.0018–0.0054")
Main bearings, radial clearance .....	0.038–0.089 mm (0.0015–0.0035")
Big-end bearings, radial clearance .....	0.039–0.081 mm (0.0015–0.0032")

### 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")
Width on crankshaft for pilot bearing shell	
Standard .....	38.930–38.970 mm (1.5327–1.5342")
Oversize 1 (undersize shell 0.010") .....	39.031–39.072 mm (1.5367–1.5382")
2 (undersize shell 0.020") .....	39.133–39.173 mm (1.5407–1.5422")

#### 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")
undersize 0.020" .....	2.239–2.245 mm (0.0881–0.0884")

### BIG-END BEARINGS

#### Big-end bearing journals

Width of bearing recess .....	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")
undersize 0.020" .....	53.581–53.594 mm (2.1095–2.1100")

#### Connecting rod bearing shells

Thickness, standard .....	1.833–1.841 mm (0.0722–0.0725")
undersize 0.010" .....	1.960–1.968 mm (0.0772–0.0775")
undersize 0.020" .....	2.087–2.095 mm (0.0822–0.0825")

### CONNECTING RODS

End float on crankshaft .....	0.15–0.35 mm (0.006–0.014")
Max. permissible weight deviation between connecting rods in same engine .....	6 grammes (0.21 oz.)
Length, centre–centre .....	145 ± 0.1 mm (5.7 ± 0.04")

### FLYWHEEL

Permissible axial throw, max. ....	0.05 mm (0.002") at a diameter of 150 mm (5.9")
Ring gear (bevel at front) .....	142 teeth



## B 20 A, B 20 B

### Valve guides

Length, inlet valve .....	52 mm (2.047")
exhaust valve .....	59 mm (2.323")
Inner diameter .....	8.000–8.022 mm (0.32–0.321")
Height above upper face of cylinder head .....	17.5 mm (0.689")
Clearance, valve stem–valve guide, inlet valve .....	0.030–0.067 mm (0.0012–0.0026")
exhaust valve .....	0.060–0.097 mm (0.0024–0.0038")

### Valve springs

Length, unloaded, approx. ....	46 mm (1.81")
with a loading of $29.5 \pm 2.3$ kg ( $65 \pm 5$ lb.) .....	40 mm (1.57")
with a loading of $82.5 \pm 4.3$ kg ( $181.5 \pm 9.5$ lb.) .....	30 mm (1.18")

## LUBRICATING SYSTEM

Oil capacity, including oil filter .....	3.75 litres (6.60 Imp. pints=
excluding oil filter .....	7.91 US pints)
excluding oil filter .....	3.25 litres (5.72 Imp. pints=
excluding oil filter .....	6.86 US pints)
Oil pressure at 2000 r.p.m. (with warm engine and new oil filter) .....	2.5–6.0 kg/cm <sup>2</sup> (35–85 p.s.i.)
Lubricant .....	Engine oil for Service MS
viscosity, all year round .....	Multigrade oil SAE 10W–30
at constant temperature below $-20^{\circ}$ C ( $-4^{\circ}$ F) ..	Multigrade oil SAE 5W–20
or	
viscosity, below $-10^{\circ}$ C ( $14^{\circ}$ F) .....	SAE 10W
between $-10^{\circ}$ and $+30^{\circ}$ C ( $14$ and $90^{\circ}$ F) .....	SAE 20W/20W
above $+30^{\circ}$ C ( $90^{\circ}$ F) .....	SAE 30

### Lubricating oil filter

Type .....	Fullflow
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### Oil pump

Oil pump, type .....	Gear
number of teeth on each gear wheel .....	9
end float .....	0.02–0.10 mm (0.0008–0.0040")
radial clearance .....	0.08–0.14 mm (0.0032–0.0055")
tooth flank clearance .....	0.15–0.35 mm (0.0060–0.0140")

### Relief valve spring (in oil pump)

Length, unloaded .....	approx. 39.2 mm (1.54")
loaded with $5.0 \pm 0.4$ kg ( $11.0 \pm 0.8$ lb.) .....	26.25 mm (1.03")
$7.0 \pm 0.8$ kg ( $15.4 \pm 1.7$ lb.) .....	21.0 mm (0.83")

## FUEL SYSTEM

### Fuel pump

Diaphragm type pump, B 20 A .....	AC-YD
Diaphragm type pump, B 20 B and as alt. on B 20 A .....	Pierburg APG
Fuel pressure, measured at same level as pump .....	min. 0.11 kg/cm <sup>2</sup> (1.56 p.s.i.)
	max. 0.25 kg/cm <sup>2</sup> (3.55 p.s.i.)

### Carburettors

#### STROMBERG, B 20 A

Type .....	Horizontal carburettor
Make and designation .....	Zenith-Stromberg 175 CD-2 SE

Number .....	1
Air intake diameter .....	41.3 mm (1.63")
Metering needle, designation .....	B 2 AF
Idling speed .....	700 r.p.m.
Oil for damping cylinder .....	Oil approved as "Oil for Automatic Transmissions, Type A"

**SU, B 20 B**

Type .....	Horizontal carburettor
Make and designation .....	SU-HS 6
Number .....	2
Air intake diameter .....	41.3 mm (1.63")
Metering needle, designation .....	KN
Idling speed .....	800 r.p.m.
for cars with automatic transmission .....	700 r.p.m.
Oil for damping cylinder .....	"Oil for Automatic Transmissions, Type A"

**STROMBERG, B 20 B**

(in P 1800 and cars for USA and Canada)

Type .....	Horizontal carburettor
Make and designation .....	Zenith-Stromberg 175 CD-2 SE
Number .....	2
Air intake diameter .....	41.3 mm (1.63")
Metering needle, designation .....	B 1 S
Idling speed .....	800 r.p.m.
for cars with automatic transmission .....	700 r.p.m.
Oil for damping cylinders .....	"Oil for Automatic Transmissions, Type A"

**IGNITION SYSTEM**

Voltage .....	12 V
Firing order .....	1-3-4-2

**B 20 A:**

Ignition timing, 97 octane (ROT*) at 1500 engine r.p.m. (vacuum governor disconnected) .....	21-23° B.T.D.C.
Spark plugs .....	Bosch 175 T 35 or corresponding
Tightening torque .....	3.5-4.0 kgm (25.3-29.0 lb.ft.)
Thread .....	14 mm (0.56")

**B 20 B:**

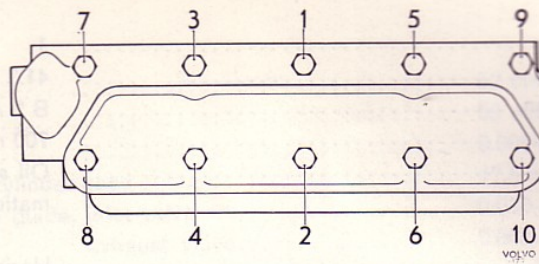
Ignition timing, 100 octane (ROT*) at 600-800 engine r.p.m. (vacuum governor disconnected) .....	10° B.T.D.C.
Spark plugs, normal driving .....	Bosch W 200 T 35
hard driving .....	Bosch W 225 T 35 or corresponding
Spark plug gap .....	0.7-0.8 mm (0.028-0.320")
Tightening torque .....	3.5-4.0 kgm (25.3-29.0 lb.ft.)
Thread .....	14 mm (0.56")

**COOLING SYSTEM**

Type .....	Sealed system
Radiator cap valve opens at .....	0.7 kg/cm <sup>2</sup> (10.0 p.s.i.)
Capacity .....	Approx. 8.5 litres (1.87 Imp. galls = 2.24 US galls)

\* ROT = Research Method

## B 20 A, B 20 B



Tightening sequence for cylinder head bolts

Fan belt, designation .....	HC - 38×888	
right-steered car .....	HC - 38×988	
Fan belt tension: for a force of 5.6–7.6 kg (12.3–16.7 lb.), on the belts between the pulleys obtained with a depression of .....	10 mm (0.39")	
Thermostat .....	Type 1	Type 2
Type .....	Wax	Wax
Marking .....	170	82°
Begins opening at .....	75–78° C (168–172° F)	81–83° C (177–181° F)
Fully open at .....	89° C (192° F)	90° C (195° F)

## WEAR TOLERANCES

### CYLINDERS:

To be rebored when wear amounts to (if engine has abnormal oil consumption) ..... 0.25 mm (0.010")

### CRANKSHAFT

Permissible out-of-round on main bearing journals, max. .... 0.05 mm (0.0020")  
 Permissible out-of-round on big-end bearing journals, max. .... 0.07 mm (0.0028")  
 Crankshaft end float, max. .... 0.15 mm (0.0060")

### VALVES

Permissible clearance between valve stems and valve guides, max. ... 0.15 mm (0.0060")  
 Valve stems, permissible wear, max. .... 0.02 mm (0.0008")

### CAMSHAFT

Permissible out-of-round on main bearing journals, max. .... 0.07 mm (0.0028")  
 Bearings, permissible wear, max. .... 0.02 mm (0.0008")

### TIMING GEARS

Permissible backlash, max. .... 0.12 mm (0.0048")

## TIGHTENING TORQUES

	Kgm	Lb. Ft.
Cylinder head .....	8.5–9.5	61–69
Main bearings .....	12–13	87–94
Big-end bearings .....	5.2–5.8	38–42
Flywheel .....	5.0–5.5	36–40
Spark plugs .....	3.5–4.0	25–29
Camshaft nut.....	13–15	94–108
Bolt for crankshaft pulley .....	7–8	50–58
Alternator bolt (1/2") .....	7.1–8.6	50–60
Nipple for oil filter .....	4.5–5.5	32–40
Sump bolts .....	0.8–1.1	6–8

# TOOLS

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

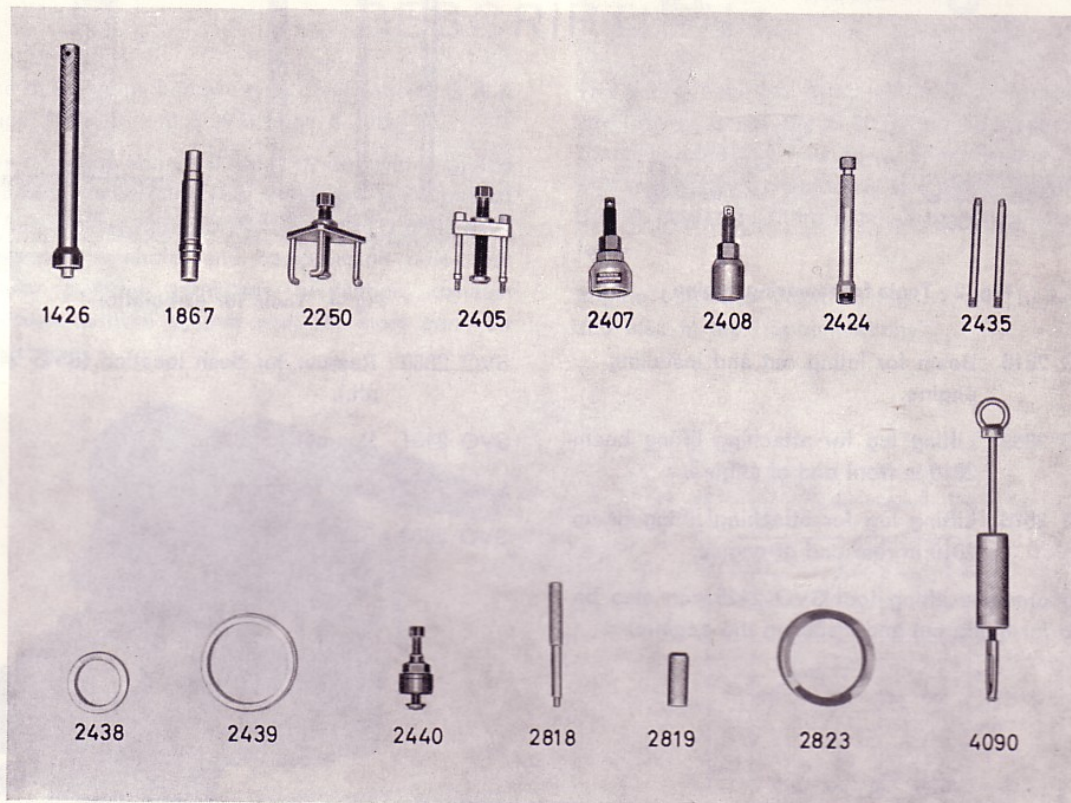
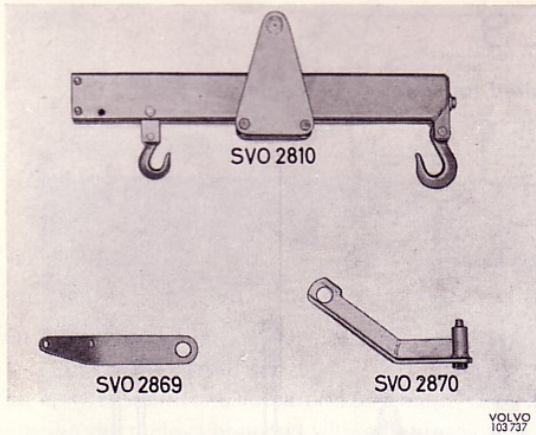


Fig. 1 Tools for engine

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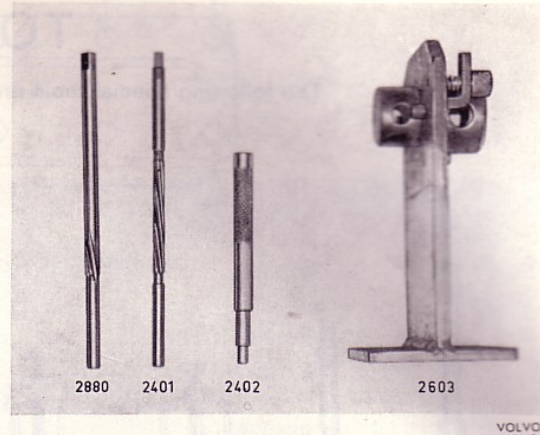
- |          |                                                                       |          |                                                                         |
|----------|-----------------------------------------------------------------------|----------|-------------------------------------------------------------------------|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



**Fig. 2 Tools for removing engine**

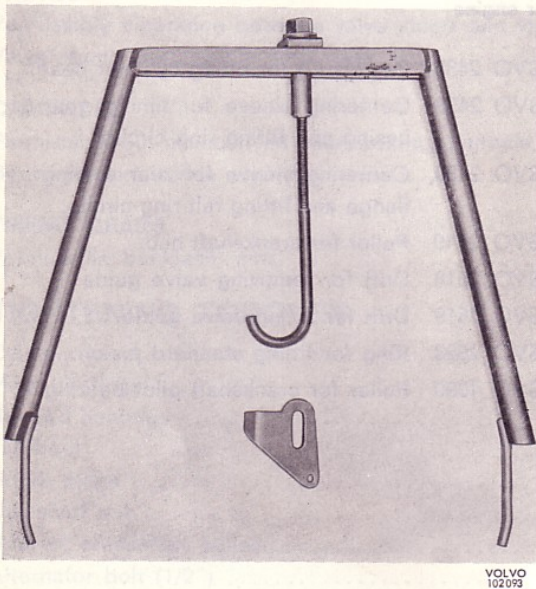
- SVO 2810 Beam for lifting out and installing engine.
- SVO 2869 Lifting lug for attaching lifting beam 2810 in front end of engine.
- SVO 2876 Lifting lug for attaching lifting beam 2810 in rear end of engine.

(The previous lifting tool SVO 2425 can also be used for lifting out and installing the engine.)



**Fig. 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.



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



**Fig. 5 Stand SVO 2520 and fixture SVO 2521 for engine**

## GROUP 20

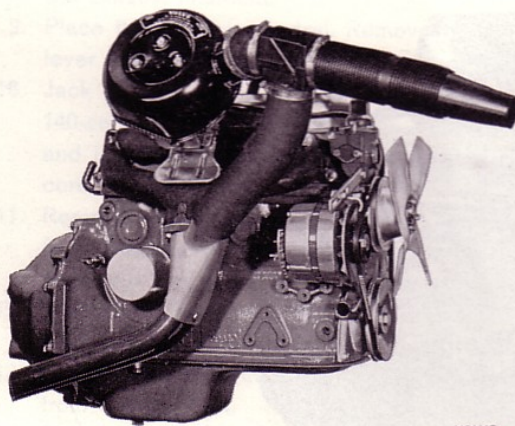
# GENERAL DESCRIPTION

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

The engine is an in-line 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 and compression ratios but similar positive crankcase ventilation, exhaust emission control system and, for most cars, air preheating.

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 preheating chamber. On certain cars, the B 20 B engine is fitted with a slip coupling type fan.

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



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Fig. 6 Engine B 20 A viewed from right

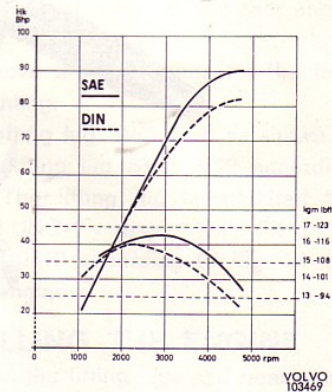
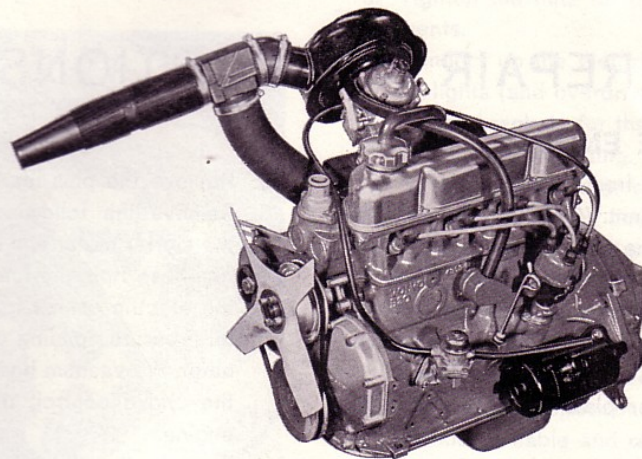


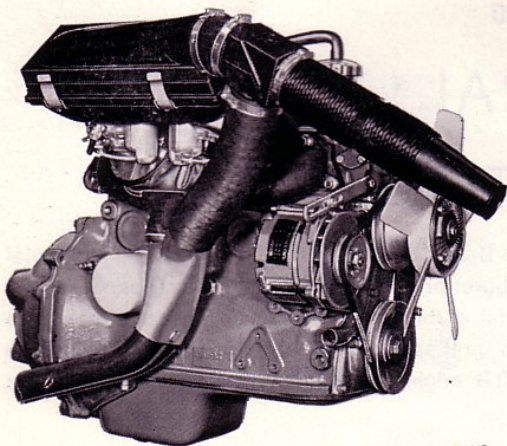
Fig. 7 Output and torque curves, B 20 A



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Fig. 8 Engine B20 A viewed from left

## B 20 A, B 20 B



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Fig. 9 Engine B 20 B viewed from right

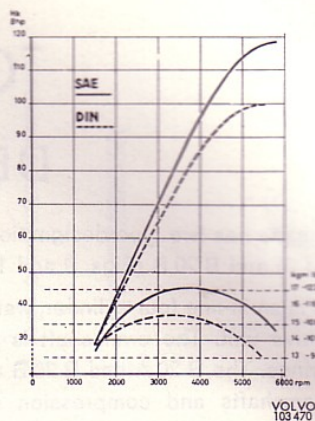
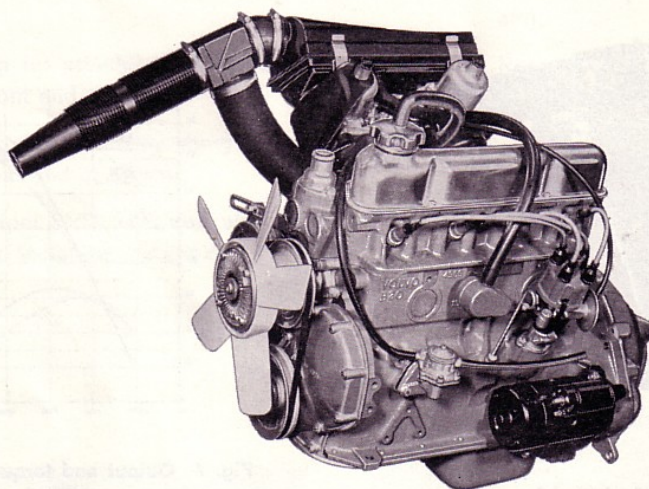


Fig. 10 Output and torque curves, B20 B



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Fig. 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 (140-series).
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 alternator, 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.

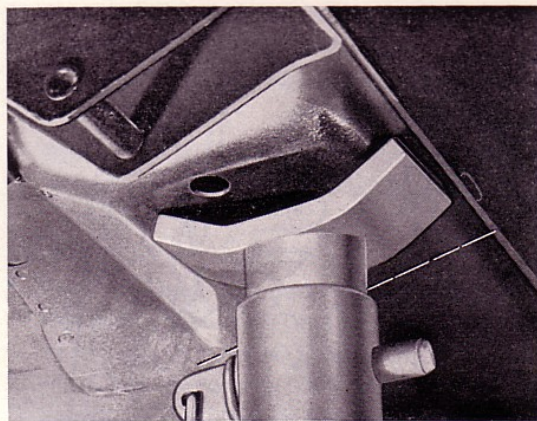


Fig. 12 Location of the block stand, 140-series

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 (for the 140-series under the front jack attachment and in front of the rear jack attachment according to Fig. 12).
11. 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.

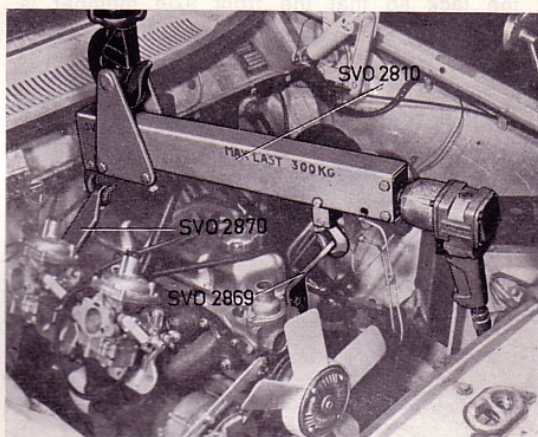


Fig. 13 Lifting out the engine

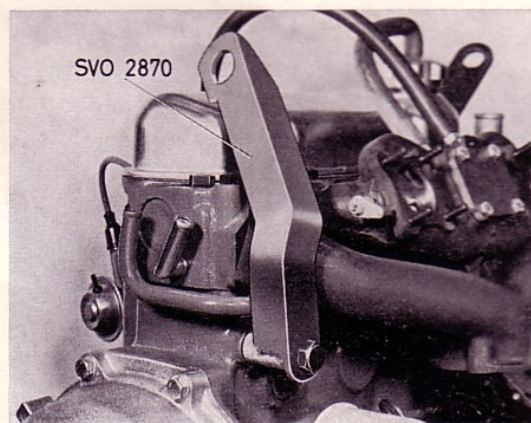


Fig. 14 Fitting lifting lug on engine rear end

17. Disconnect the earth cable from the engine.
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. 14. and lifting lug SVO 2869 according to Fig. 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. 13 and lift out the engine.

### INSTALLING THE ENGINE

1. Fit on the lifting lugs and beam according to Figs. 14. 15 and 13.
2. Lift in the engine. **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 lifting tool and jack.
7. Tighten the flange of the exhaust pipe against the exhaust manifold.
8. Fit the clamp for the exhaust pipe, the front universal joint for the flange (make sure that 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".

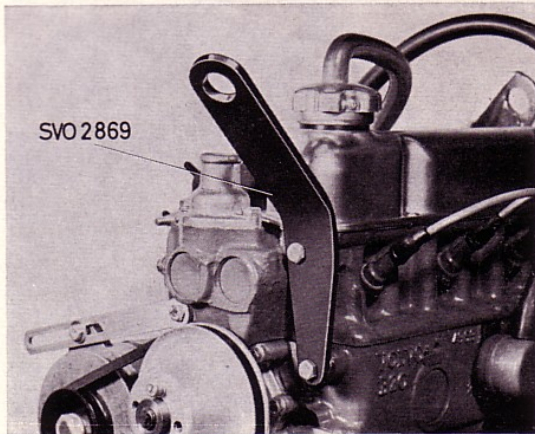


Fig. 15. Fitting lifting lug on engine front end

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 alternator, starter motor and ignition coil.
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 (140-series). Fill the radiator with coolant and check the oil in the engine.
15. Fit the hood. Fit the gear lever.

### SUMP

Since time can be saved for certain kinds of work on the engine by removing the sump without having to lift out the engine, the following procedure should be followed:

#### 140-series Removing

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. 16.

2-12

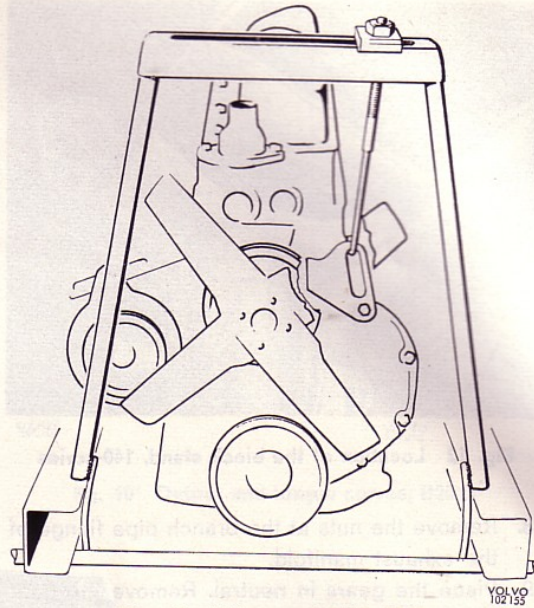


Fig. 16 Lifting tool SVO 2727

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. 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 1/2-13x114). 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.

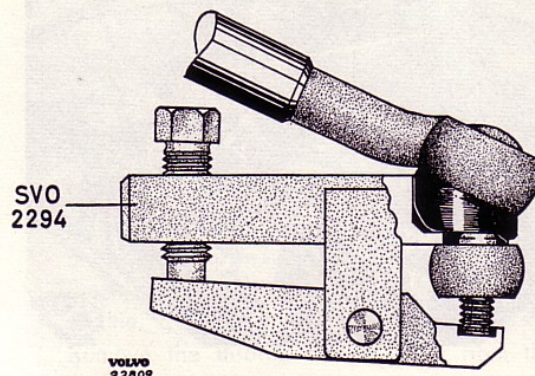


Fig. 17 Removing the steering rod

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.
7. Remove the old gasket and clean the contact surfaces of the cylinder block and sump.

### Fitting

1. 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.
2. Place the reinforcing bracket in position and tighten all the bolts by hand. Screw in firmly the flywheel housing bolts and then the cylinder block bolts.
3. Raise the front axle member, tighten the front bolts. Remove the auxiliary bolts, fit and tighten the rear bolts.
4. Fit the nuts for the engine mountings as well as the steering rods.
5. Lower the vehicle. Take off the lifting tool with plate. Fit the bolt (with washer) for the timing gear casing.
6. Top up with oil and insert the oil dipstick.
7. Start the engine and check for leakage.



Fig. 18 Reinforcing bracket, cylinder block and flywheel housing

## 120 and 1800

### Removing

1. Lift up the vehicle about 30 cm (12") from the floor and place blocks underneath, near the jack attachments.
2. Attach the lifting device under, for example, the engine mountings. **N.B. Do not lift the water pump.** Release the nuts on the bottom side of the front engine mounting blocks. Lift the engine as high as possible avoiding components mounted on the cowl. Let the engine hang from a workshop crane or similar.
3. Place a jack under the front member. Slacken, but do not remove, both front bolts on the front member. Take care not to lose any shims. Remove the four rear bolts and lower the front end as far as it will go.
4. Remove the oil sump in the usual way.

### Fitting

1. Re-fit the oil sump.
2. Clean the front member carefully and check to make sure that the shims are fitted properly.
3. Lift up the front member and secure it.

## 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 vibration, see Fig. 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. 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 cylinder head gaskets of different 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 crankshaft 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.

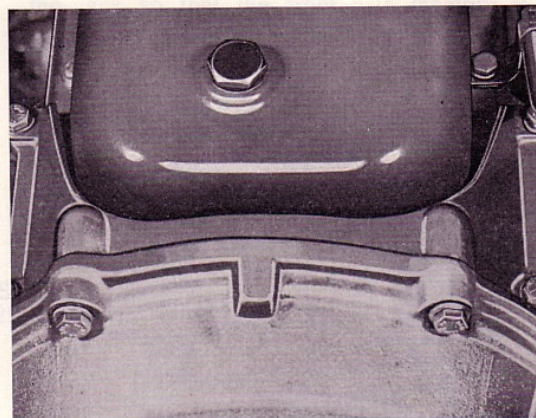


Fig. 18 Reinforcing bracket, cylinder block—flywheel housing

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 emission control 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.

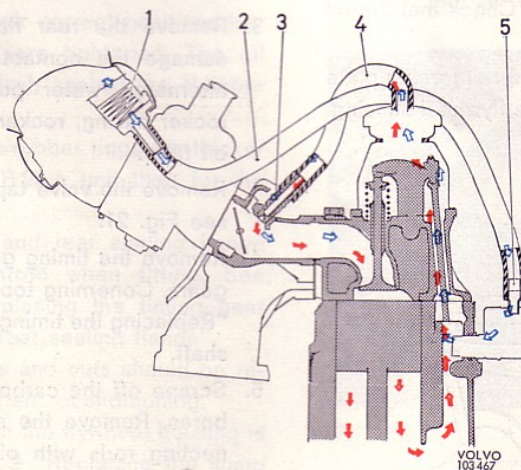
A spring-loaded throttle (secondary throttle) is to be found in each of the intakes.

**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.

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 crank-



**Fig. 19 Positive crankcase ventilation**

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

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. 19). It is connected to the intake manifold by means of a calibrated nipple (3). (This nipple should be cleaned every

case 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.

# REPAIR INSTRUCTIONS

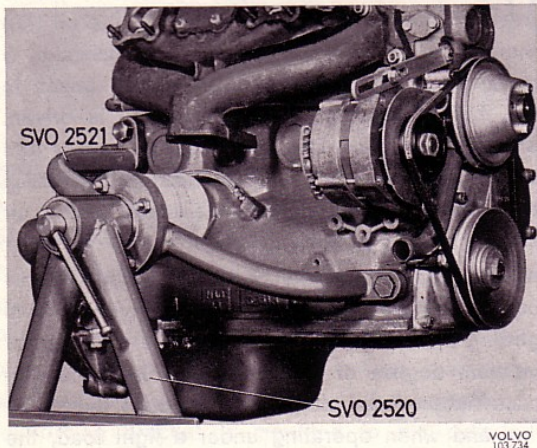


Fig. 20 Engine on stand

## 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. 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.

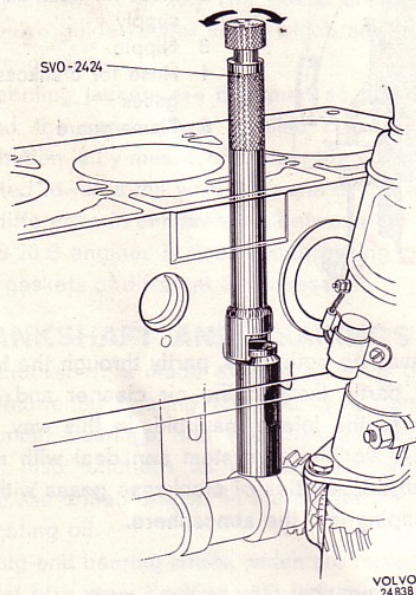


Fig. 21 Removing the valve tappets

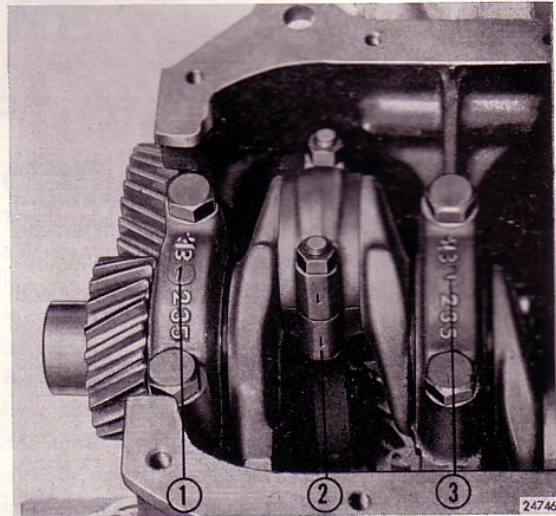


Fig. 22 Marking the main and big-end bearings

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

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

Remove the valve tappets with tool SVO 2424, see Fig. 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. Scrape off 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 the 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. 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 2-13).

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. 23, in order to avoid unnecessary stresses. Check that the oil hole (Fig. 24) for lubricating the rocker arms is clear. Note that the cylinder head gasket for the B 20 A engine is thicker than that for the B 20 B unit, see "Specifications".

The pilot bearing (5, Fig. 25) should be lubricated before fitting with heat-resistant ball bearing

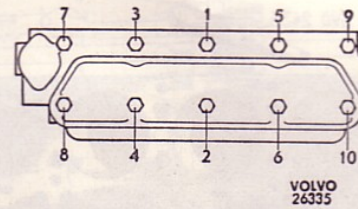


Fig. 23 Tightening sequence for cylinder head bolts

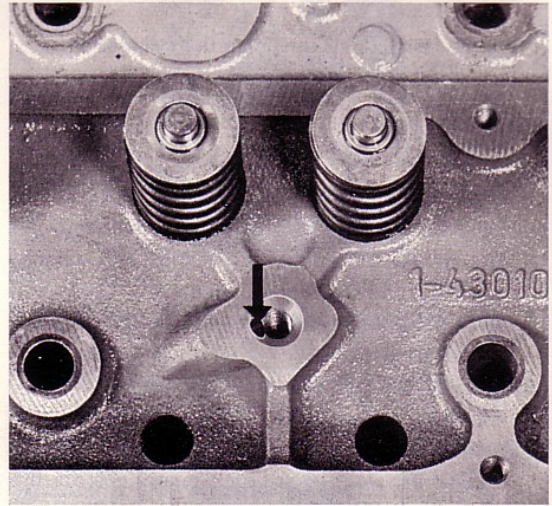


Fig. 24 Oil hole in cylinder head

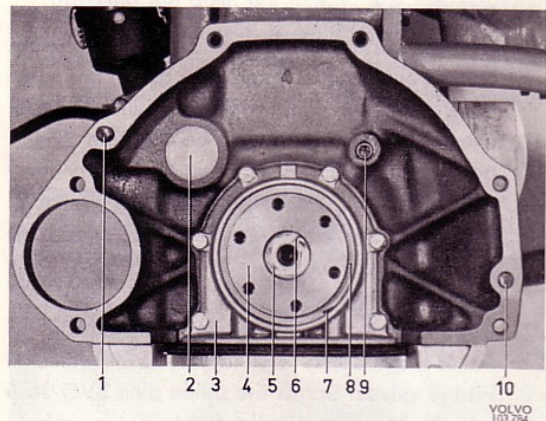


Fig. 25 Rear end of engine

- |                  |                  |
|------------------|------------------|
| 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     |

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, B 20 B

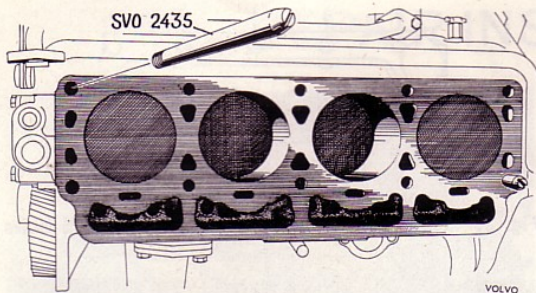


Fig. 26 Guide pins for fitting the cylinder head

### 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.
2. Dismantle the throttle control. Disconnect the choke control.
3. Remove the air cleaner and carburettor.
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. 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. 23. The tightening torque is 8.5–9.5 kgm (61–69 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".

2-18

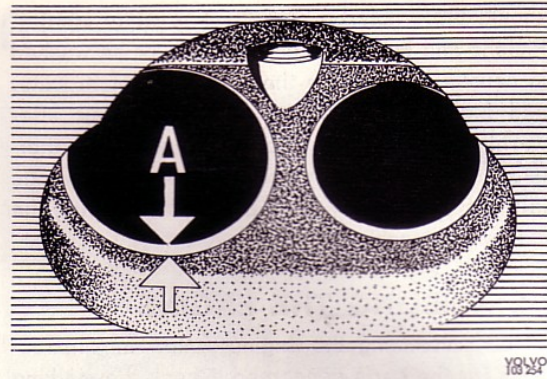


Fig. 27 Valve seat width A=2 mm (0.08")

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 (61–69 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

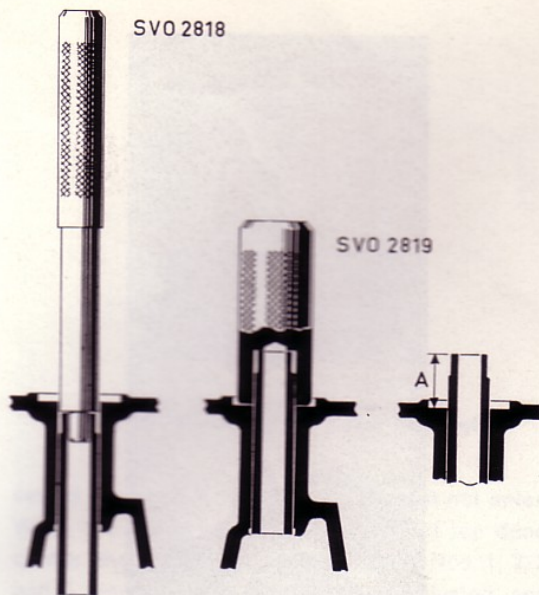
1. Remove the valve springs by first compressing them with valve pliers and removing the valve collets, after which the pliers are released. Place the valves in order in a valve rack. Remove the valve guide seals.
2. Measure the clearance between the stem and guide. With a new valve the clearance should 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 valve seats

1. Grind the valves in a machine after they have been cleaned. Fit new valves if the old ones are excessively worn.
2. Grind the valve seats. Use an electrically driven grinder or a hand milling cutter. The pilot spindle must be carefully fitted before work is



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

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. 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.

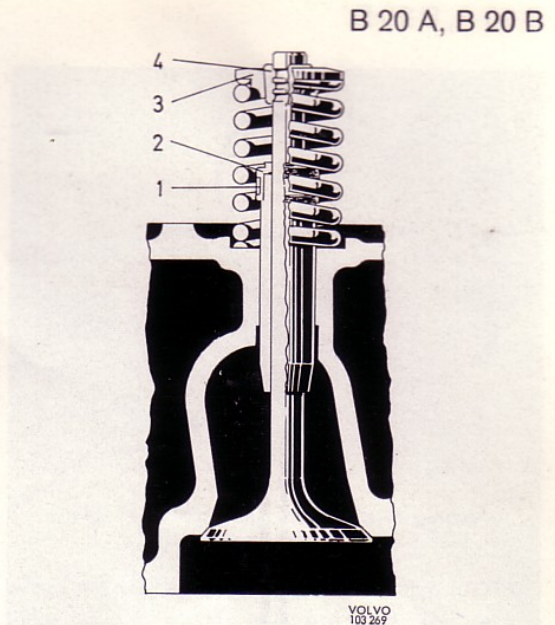
3. Coat the valve sealing surfaces with a thin layer of fine grinding paste and lap in the valves against their seats. Then clean the valves and seats and check that good sealing is obtained.

### 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. 28.
3. Check that the guides are free from burr and that the valves move easily in them.

### Assembling

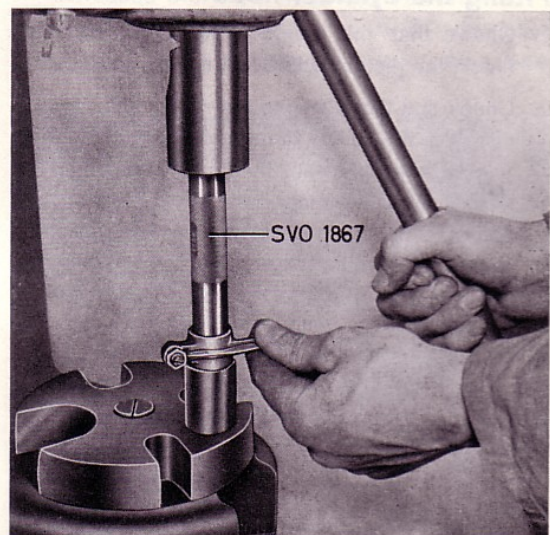
1. Check that the parts are in good condition and clean. Test the springs to ensure that they maintain the values given in the "Specifications".
2. Place the valves in position. Fit the valve guide seal, valve spring, upper washer and collet.



**Fig. 29 Valve collet and valve guide seal**  
1 Metal ring                      3 Washer  
2 Rubber seal                    4 Valve 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. 30. Then ream the bush with a suitable reamer until an accurate fit on the shaft is obtained. The hole in the bush should coincide with the hole in the rocker arm.



**Fig. 30 Replacing bush in rocker arm**

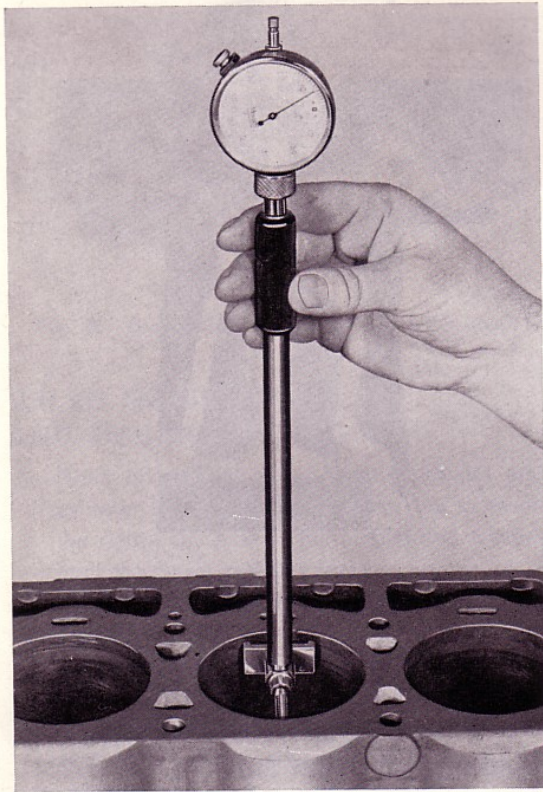


Fig. 31 Measuring the cylinder bore

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. 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 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.

2-20

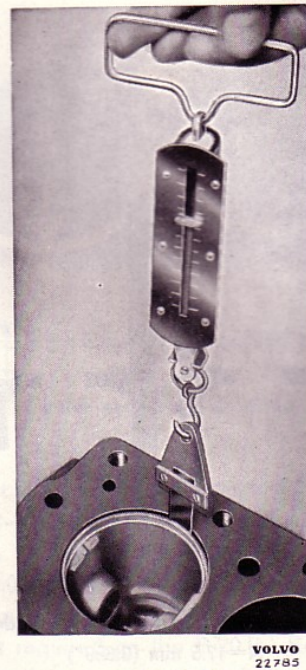


Fig. 32 Measuring the piston clearance

Tighten the bolts in the correct order and to the correct torque. See Fig. 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 (61–69 lb.ft.).

5. 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 valve 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 in-

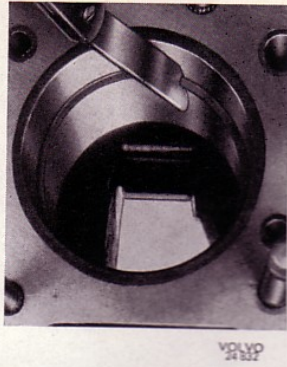


Fig. 33 Measuring the piston ring gap

serted 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 indicator as shown in Fig. 31. Measuring should be carried out just below the top edge of the bore and only transverse to 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

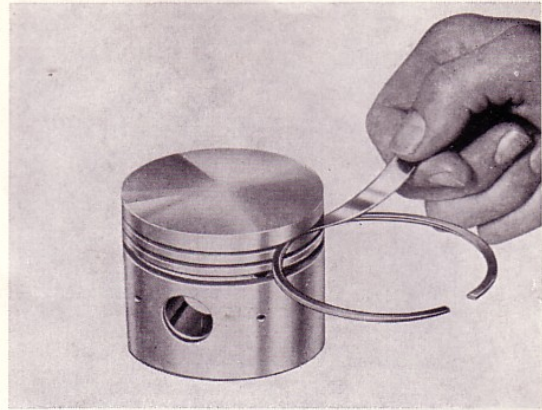


Fig. 34 Piston ring clearance in groove

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.

## 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. 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 mea-

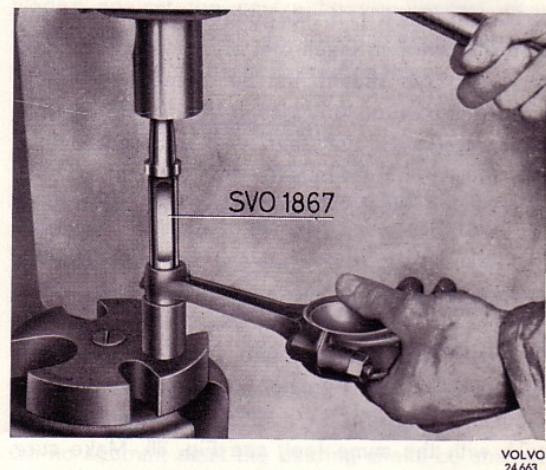


Fig. 35 Replacing the brush in connecting rod



VOLVO  
20348

Fig. 36 Gudgeon pin fit

sure 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.

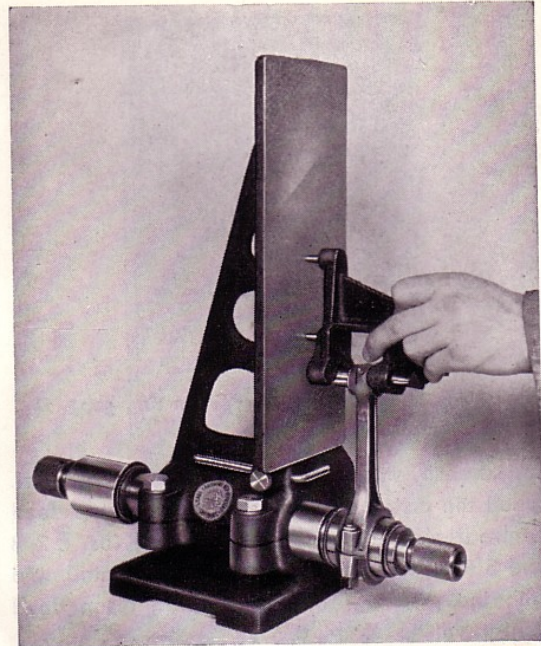
**Gudgeon pins**

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. 35. Make sure that the lubricating holes index with the holes in



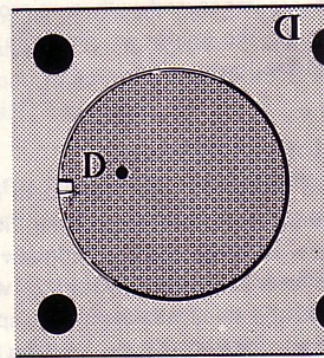
VOLVO  
20355

Fig. 37 Checking the connecting rod

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. 36.

**Straightening**

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



VOLVO  
103270

Fig. 38 Marking on piston and block

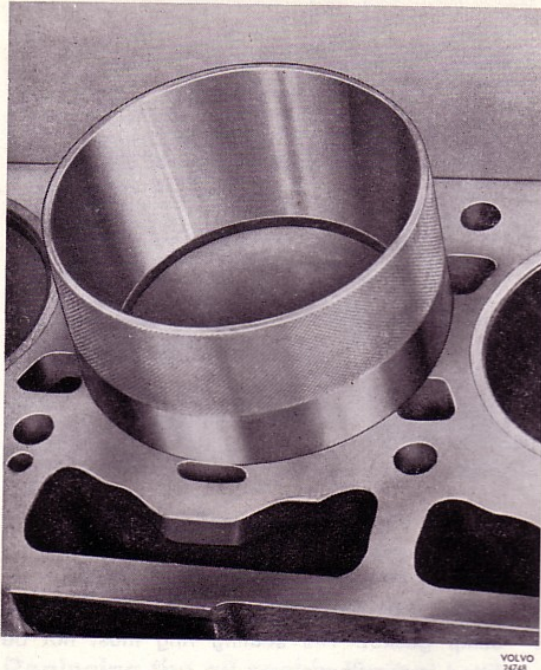


Fig. 39 Fitting the piston  
Installation ring SVO 2823

### 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 forwards, see Fig. 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 pin is 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. 39 when fitting the piston in the bore. Tighten the crankshaft bolts with 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 bear-

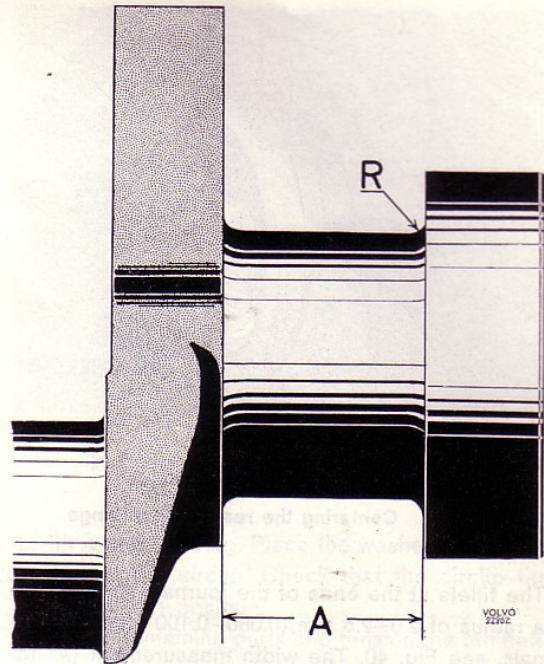


Fig. 40 Bearing journal

ing 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".

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 described previously. The main bearing journals and the big-end bearing journals are ground to identical measurements in a special machine. 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.

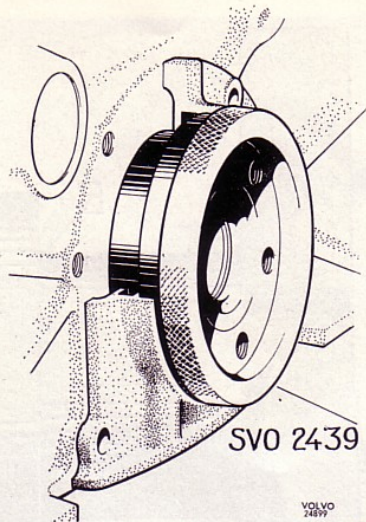


Fig. 41 Centering the rear sealing flange

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. 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 a 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

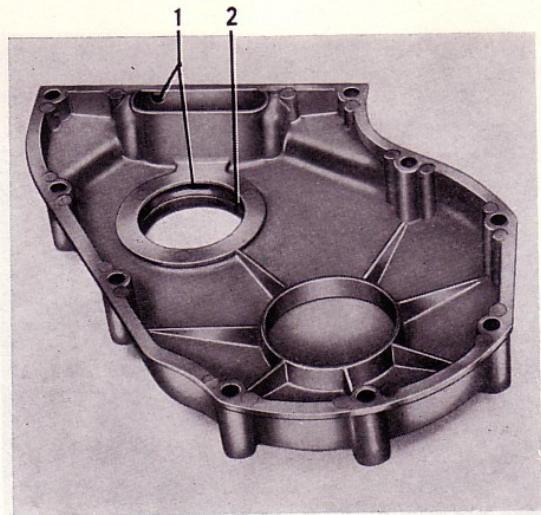


Fig. 42 Timing gear casing

- 1 Drain holes 2 Sealing ring

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. 41. Turn the sleeve round while tightening the bolts and adjust the position of the flange if the sleeve jams. Check that the bottom edge of the flange lies flush with the bottom edge of the block.
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.

### 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.

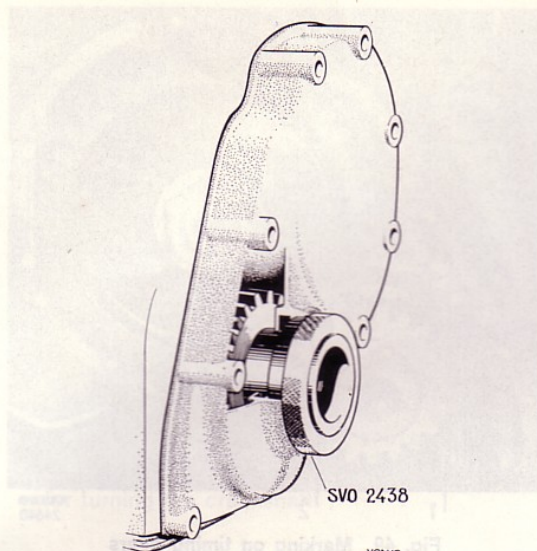


Fig 43 Centering the timing gear casing

## 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".

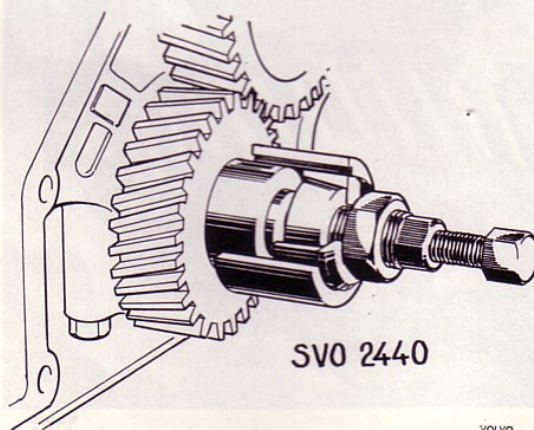


Fig. 44 Removing the hub on the crankshaft

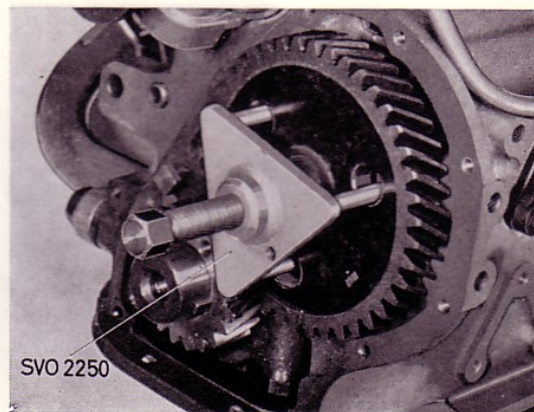


Fig. 45 Removing the camshaft gear

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. 42.
5. Place the casing in position and fit the bolts without tightening them.
6. Center the casing with sleeve SVO 2438, see Fig. 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.
8. Fit the other parts and tension the fan belt. See "Specifications" for the tightening torque. Fix the stabilizer attachments firmly to the frame.

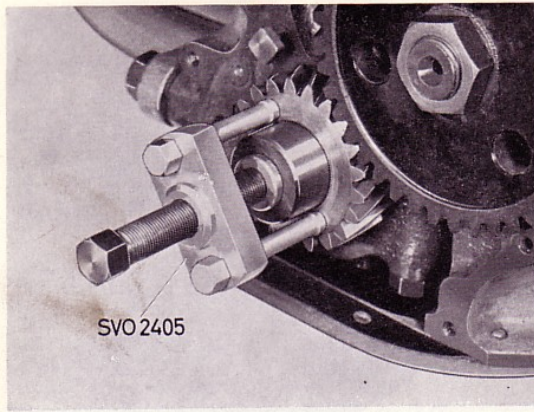


Fig. 46 Removing the crankshaft gear

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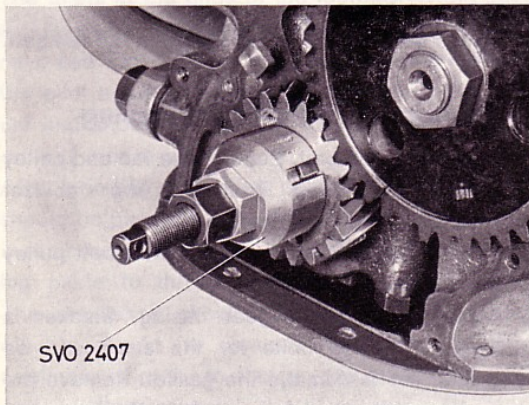


Fig. 47 Fitting the crankshaft gear

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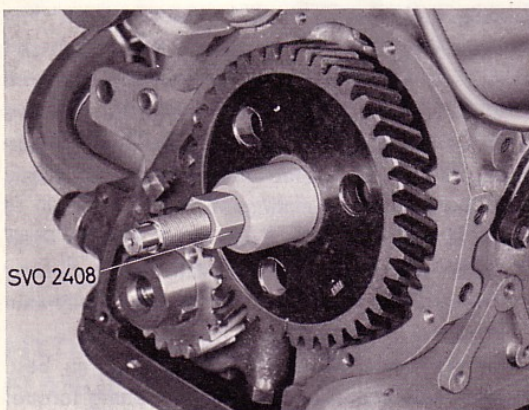


Fig. 48 Fitting the camshaft gear

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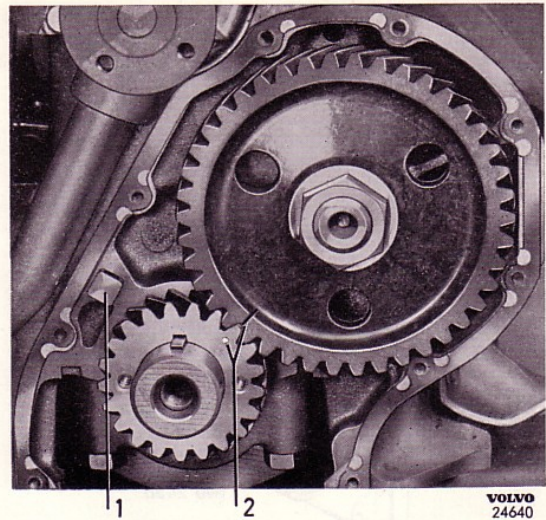


Fig. 49 Marking on timing gears  
1 Oil nozzle 2 Markings

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24640

### 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. 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 centre bolt.

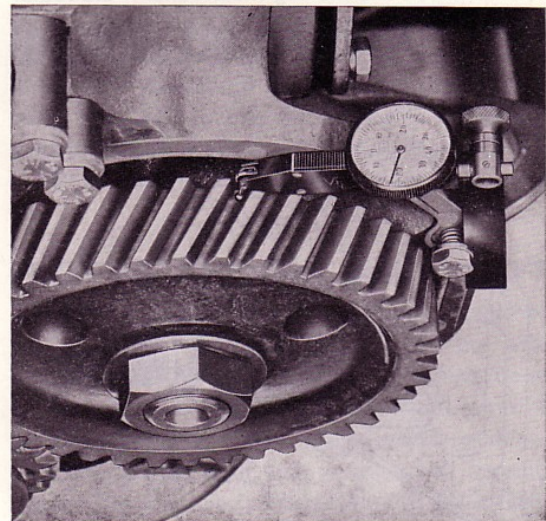


Fig. 50 Measuring the tooth flank clearance

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4. Remove the camshaft nut and pull off the gear by using puller SVO 2250, see Fig. 45.
5. Pull off the crankshaft gear by using puller SVO 2405, Fig. 46. Screw out the oil nozzle, blow it clean and then refit it as shown in Fig. 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. 47 and 48. Fit the hub on the crankshaft. Do not push the camshaft backwards so that the seal washer on the rear end loosens. Check to make sure that the gears are correctly located in relation to one another, see 49. Tool SVO 2407 has a spanner grip 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. 19). Check the hoses at the same time. Replace any that are in a poor condition.

## GROUP 22

# LUBRICATING SYSTEM

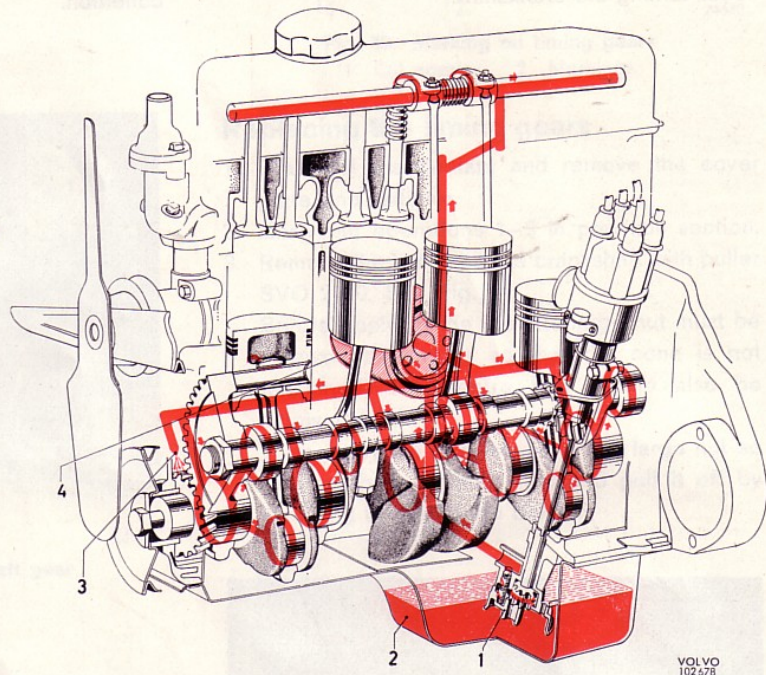
## DESCRIPTION

The engine has a force-feed lubricating system, see Fig. 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. 51 Lubricating system**

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



### OIL PUMP, RELIEF VALVE

The oil pump, see Fig. 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. 53), which is manufactured as a single unit complete with element, is of the fullflow 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.

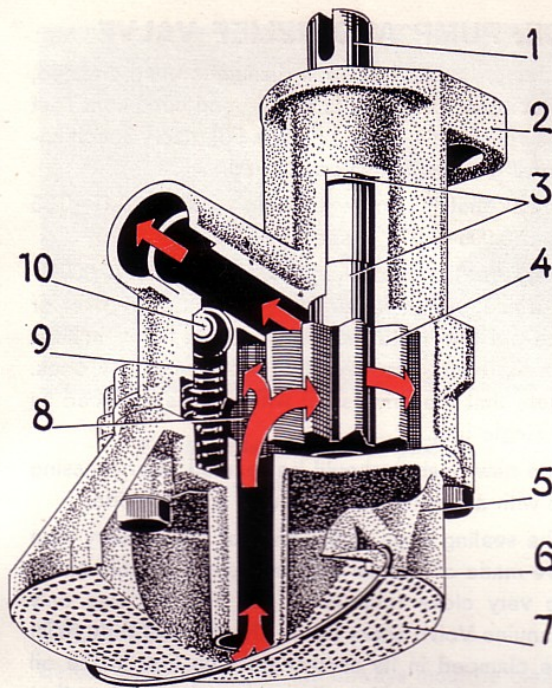


Fig. 52 Oil pump

- |                |                           |
|----------------|---------------------------|
| 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             |

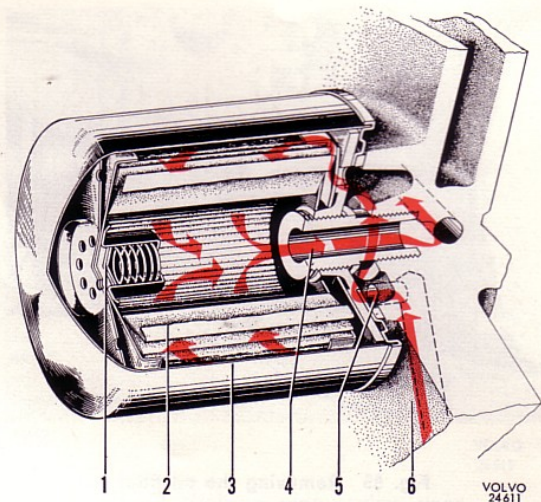


Fig. 53 Oil filter

- |                  |                  |
|------------------|------------------|
| 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. 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. 55.
2. Coat the rubber gasket (1, Fig. 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.

3. Screw on the oil filter a further half turn by hand. **Chain tongs must not be used for fitting on the filter.** Start the engine and check that there is no leakage at the joint. Top up with oil if necessary.

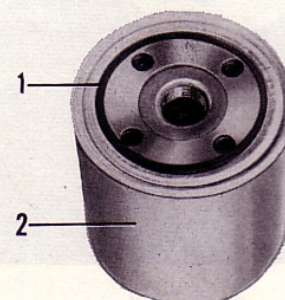
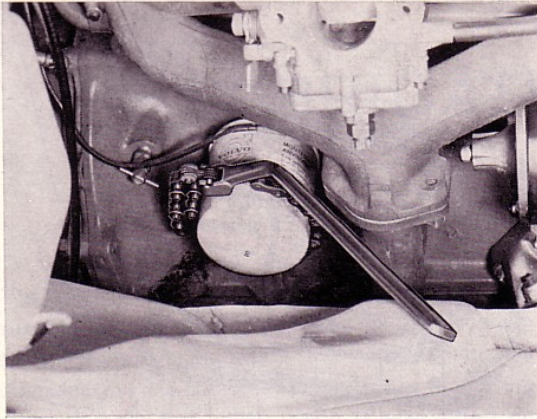


Fig. 54 Oil filter ready for fitting

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



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Fig. 55 Removing the oil filter

### OIL PUMP AND RELIEF VALVE

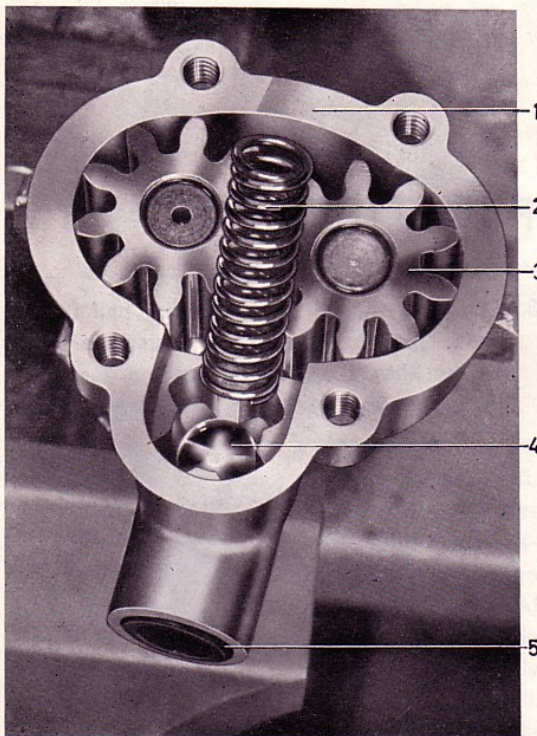
After the pump has been dismantled and cleaned, check that all the parts are in good condition. Test the relief valve spring (2, Fig. 56), see "Specifications" for the values concerned.

Check that the tooth flank clearance is 0.15–0.35 mm (0.006–0.014"), see Fig. 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 drive 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.

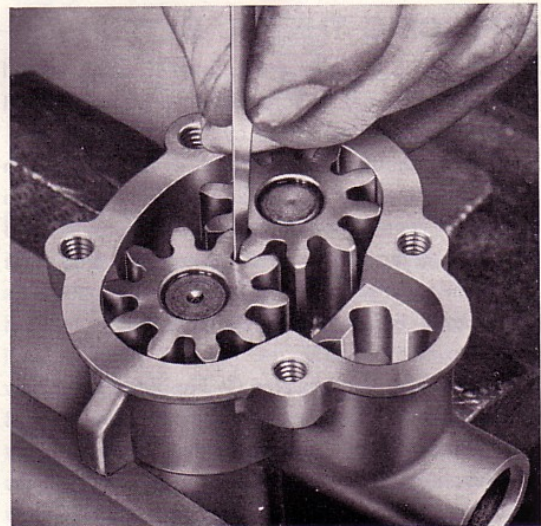
The sealing rings at the ends of the delivery pipe are made of special rubber and are manufactured to very close tolerances, see Fig. 59. Use only genuine Volvo spare parts. The delivery pipe must be clamped in its correct position first in the oil pump and then the oil pump and pipe together clamped against the block. The pump connecting flange should lie flush against the block before being tightened. Prior to 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.



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Fig. 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. 57 Measuring tooth flank clearance

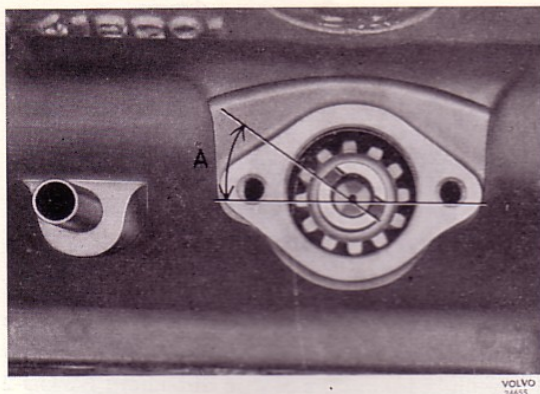


Fig. 58 Distributor drive position  
A=approx. 35°

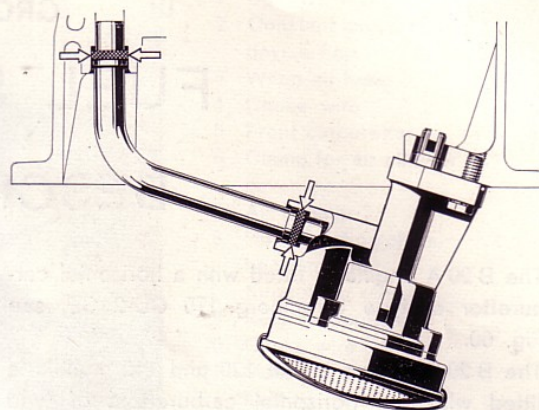


Fig. 59 Delivery pipe sealing rings

### 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. 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 centre position, firing position.)

GROUP 23

# FUEL SYSTEM

## DESCRIPTION

The B 20 A engine is fitted with a horizontal carburettor of type Stromberg 175 CD-2 SE, see Fig. 60.

The B 20 B engine in the 120 and 140 models is fitted with two horizontal carburettors of type SU-HS 6, see Fig. 61. (Right-hand steered 1800

cars are also fitted with this type of carburettor).

The B 20 B engine in the 1800 model and in cars intended for USA and Canada is fitted with two horizontal carburettors of type Stromberg 175 CD-2 SE, see Figs. 62 and 63.

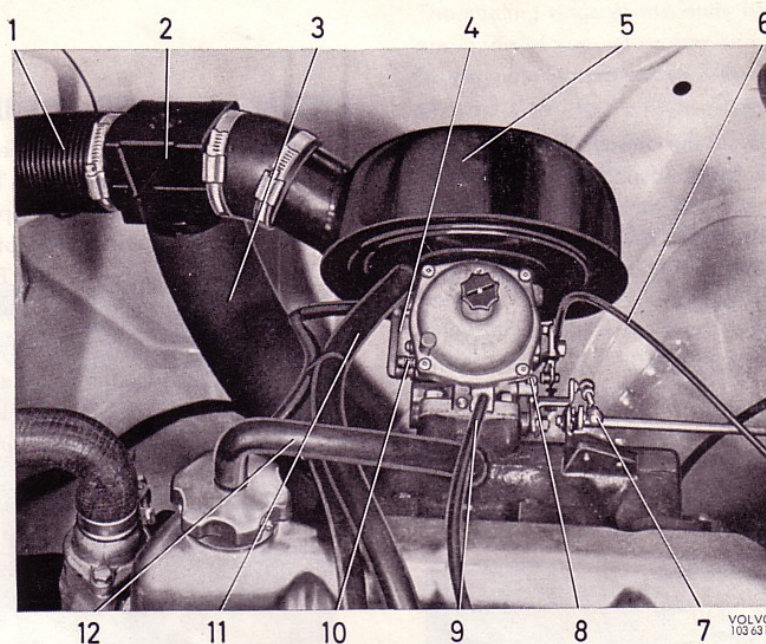
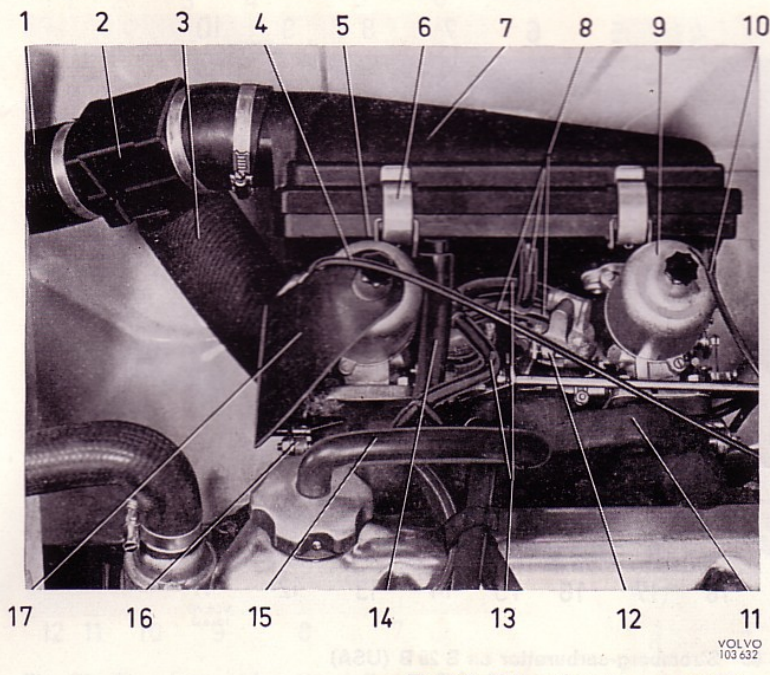


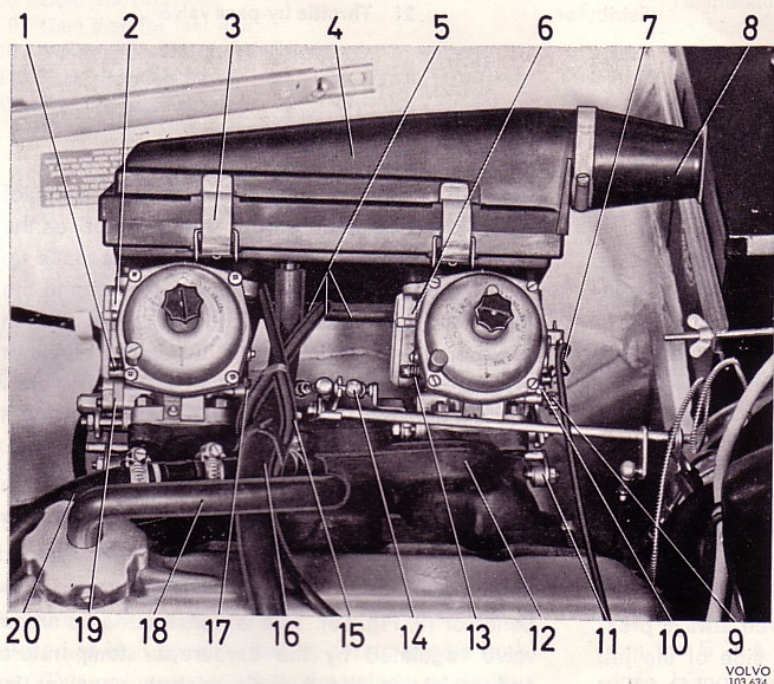
Fig. 60 Stromberg-carburettor on B 20 A

- |                               |                                             |
|-------------------------------|---------------------------------------------|
| 1 Cold-air hose               | 8 Throttle stop screw                       |
| 2 Constant temperature device | 9 Vacuum hose for distributor               |
| 3 Warm-air hose               | 10 Idle trimming screw                      |
| 4 Temperature compensator     | 11 Fresh-air hose for crankcase ventilation |
| 5 Air cleaner                 | 12 Hose for crankcase gases                 |
| 6 Choke wire                  |                                             |
| 7 Throttle control            |                                             |



- 1 Cold-air hose
- 2 Constant temperature device flap
- 3 Warm-air hose
- 4 Choke wire
- 5 Front carburettor
- 6 Clamp for air cleaner cover
- 7 Air cleaner
- 8 Hose for floatchamber ventilation through air cleaner
- 9 Rear carburettor
- 10 Choke wire
- 11 Manifold with preheating chamber
- 12 Throttle control
- 13 Fuel hoses
- 14 Fresh-air hose for crankcase ventilation
- 15 Hose for crankcase gases
- 16 Throttle spindle for secondary throttle
- 17 Rubber guard

Fig. 61 SU-carburettor on B 20 B



- 1 Idle trimming screw
- 2 Temperature compensator
- 3 Clamp for air cleaner
- 4 Air cleaner
- 5 Fuel hoses
- 6 Temperature compensator
- 7 Choke wire
- 8 Air intake
- 9 Fast-idle stop screw
- 10 Throttle stop screw
- 11 Throttle spindle for secondary throttle
- 12 Manifold with preheating chamber
- 13 Idle trimming screw
- 14 Throttle control
- 15 Vacuum hose for distributor
- 16 Fresh-air hose for crankcase ventilation
- 17 Throttle stop screw
- 18 Hose for crankcase gases
- 19 Throttle by-pass valve
- 20 Vacuum hose for brake servo

Fig. 62 Stromberg-carburettor on B 20 B in 1800

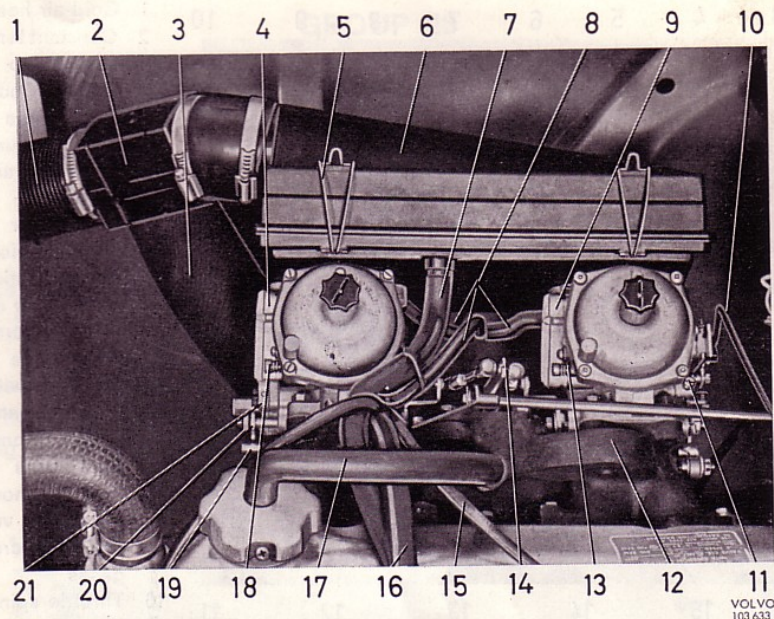


Fig. 63 Stromberg-carburettor on B 20 B (USA)

- |                                            |                                     |                                            |
|--------------------------------------------|-------------------------------------|--------------------------------------------|
| 1 Cold-air hose                            | 9 Temperature compensator           | 16 Vacuum hose for brake servo             |
| 2 Air preheating flap                      | 10 Choke wire                       | 17 Hose for crankcase gases                |
| 3 Warm-air hose                            | 11 Throttle stop screw              | 18 Idle trimming screw                     |
| 4 Temperature compensator                  | 12 Manifold with preheating chamber | 19 Throttle spindle for secondary throttle |
| 5 Clamp for air cleaner                    | 13 Idle trimming screw              | 20 Throttle spindle for primary throttle   |
| 6 Air cleaner                              | 14 Throttle control                 | 21 Throttle by-pass valve                  |
| 7 Fresh-air hose for crankcase ventilation | 15 Vacuum hose for distributor      |                                            |
| 8 Fuel hoses                               |                                     |                                            |

## ZENITH-STROMBERG CARBURETTOR

The carburettor for the B 20 A engine is shown in Figs. 64 and 65. It has been designed with a view to obtaining cleaner exhaust gases by means of an exhaust emission control system.

It is provided with a fixed jet, pressed into the carburettor housing, the fuel flow orifice area of which is varied by means of a movable tapered needle. The position of the needle is determined by the carburettor housing vacuum operating an air valve in which the needle is fitted in a spring-loaded suspension. The spring force always presses the needle against the same side of the jet, and this ensures an accurately controlled fuel flow through the jet.

The carburettor consists of three main parts of light-alloy, the middle part of which comprises the carburettor housing. The lower section is made up of a floatchamber, which encloses the jet and the float. The upper section consists of a suction chamber cover, which forms a suction chamber together with a diaphragm fixed in the air valve. The suction chamber regulates the air valve lift and thereby the location of the needle in the jet. By means of channels in the valve, the suction chamber is linked to the space between the carburettor throttle and valve.

The carburettor is fitted with a temperature compensator (8, Fig. 65). This is constructed as an air valve regulated by the carburettor temperature and maintains the fuel-air mixture constant irrespective of the fuel temperature.

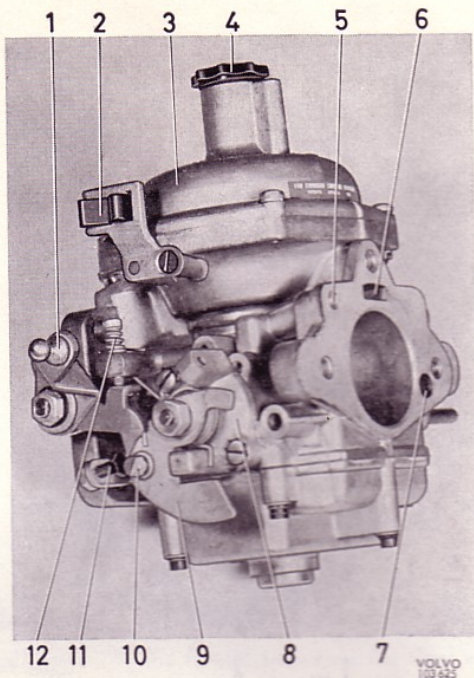


Fig. 64 Stromberg-carburettor, left side, B 20 A

- 1 Lever for throttle control
- 2 Clamp for choke wire
- 3 Suction chamber
- 4 Hydraulic damper
- 5 Vent drilling from floatchamber
- 6 Drilling for air supply under diaphragm
- 7 Drilling for air supply to temp. compensator and idle trimming screw
- 8 Cold-start device
- 9 Cam disc for fast idle
- 10 Connection for choke control
- 11 Fast-idle stop screw
- 12 Throttle stop screw

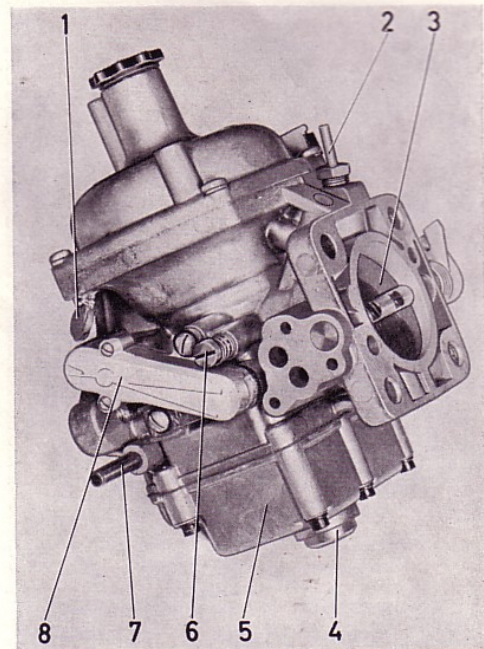


Fig. 65 Stromberg-carburettor, right side, B 20 A

- 1 Sealed plug
- 2 Connection for vacuum hose to distributor
- 3 Primary throttle
- 4 Floatchamber plug
- 5 Floatchamber
- 6 Idle trimming screw
- 7 Connection for fuel hose
- 8 Temperature compensator

The throttle spindle is provided with seals to reduce wear on the spindles and bushes and also to eliminate air leakage.

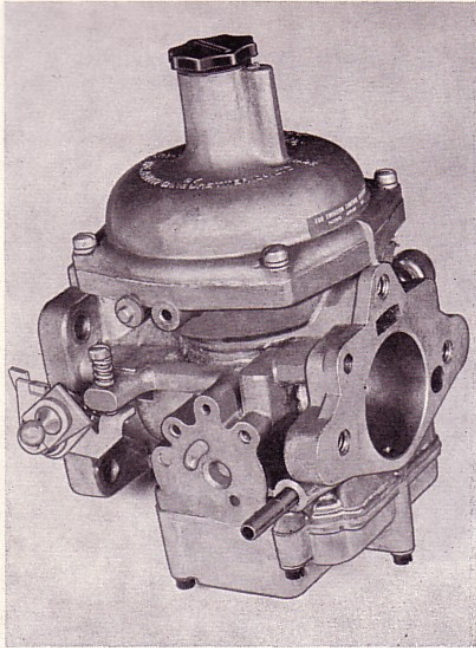
On B 20 B engines with twin Stromberg carburettors, these differ structurally from the carburettor for the B 20 A engine as follows: (see Figs. 66, 67, 68 and 69).

The front carburettor is provided with a throttle by-pass valve (2, Figs. 67 and 75), the purpose of which is to by-pass a regulated flow of fuel-air mixture past the carburettor throttle when this is closed at high speeds, that is, during engine braking. This reduces powerfully the volume of noxious exhaust gases produced.

The choke device is to be found only on the rear carburettor, see Fig. 68.

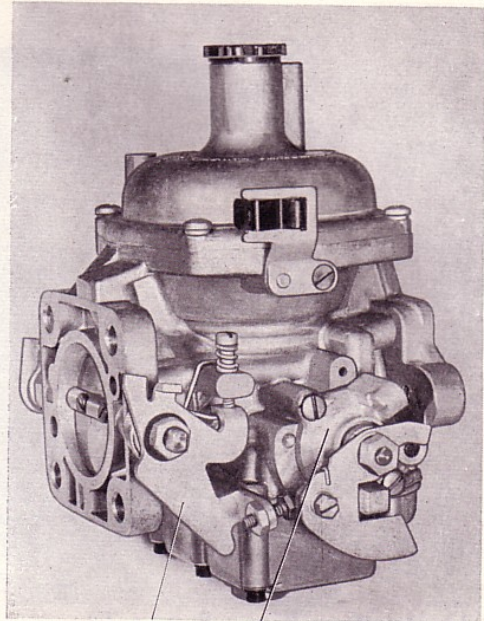
The throttle spindle in the respective carburettors is provided with a cam (see Figs. 67 and 68), the purpose of which is to open the secondary throttle in the manifold at higher output.

The vacuum connection for the ignition distributor is located on the front carburettor (see 4, Fig. 66) and is connected to the side of the throttle which is against the manifold. This gives the distributor a so-called "negative vacuum setting" as distinct from the B 20 A distributor, the vacuum setting of which is positive, that is, the connection opens out between the carburettor throttle and air valve.



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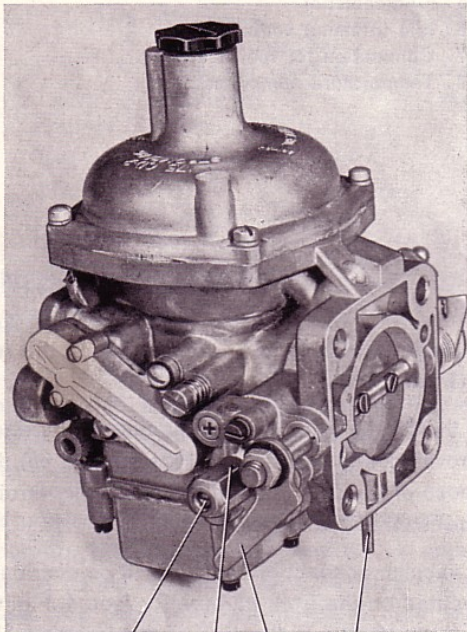
Fig. 66 Stromberg-carburettor, front, left side, B 20 B



1 2 VOLVO  
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Fig. 68 Stromberg-carburettor, rear, left side, B 20 B

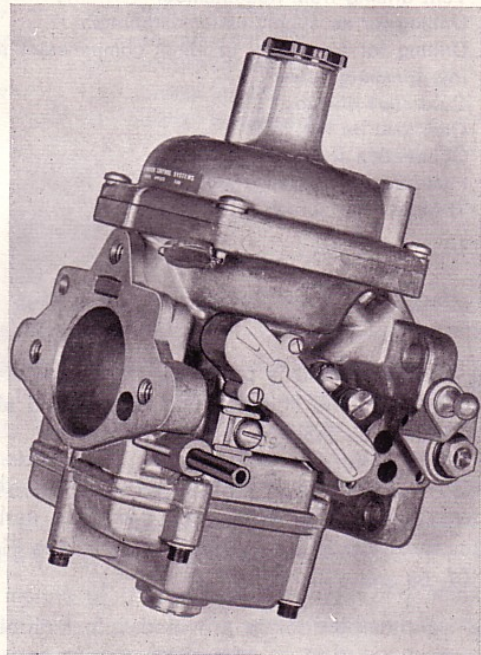
- 1 Cam for regulating secondary throttle
- 2 Cold-starting device



1 2 3 4 VOLVO  
103 627

Fig. 67 Stromberg-carburettor, front, right side, B 20 B

- 1 Adjusting screw
- 2 Throttle by-pass valve
- 3 Cam for regulating secondary throttle
- 4 Vacuum hose connection for distributor



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Fig. 69 Stromberg-carburettor, rear, right side, B 20 B

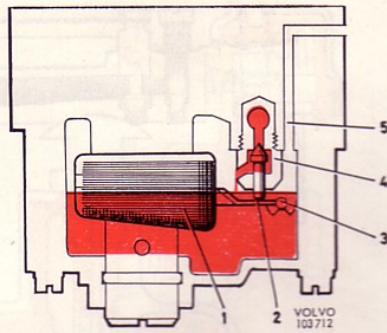


Fig. 70 Float system

- |               |                                                    |
|---------------|----------------------------------------------------|
| 1 Float       | 5 Venting channel from floatchamber to air cleaner |
| 2 Float arm   |                                                    |
| 3 Float shaft |                                                    |
| 4 Float valve |                                                    |

### Float system

Fuel flows into the floatchamber via the float valve (4, Fig. 70). The float (1), which is made up of twin expanded rubber floats, is carried on a bridge in the lower part of the carburettor housing. As the fuel level rises, the float lifts and closes the needle on its seating when the correct level has been attained.

The fuel flows through holes in the floatchamber plug to the inside of the jet, where the level is the same as in the floatchamber. Sealing between the floatchamber plug and chamber is provided by an O-ring.

### Cold-start device and fast idle

To facilitate starting during cold weather, the carburettor is provided with a cold-start device (Figs. 71 and 72). (For the B 20 B engine, only on the rear carburettor.)

The cold-start device consists of a choke lever (3, Fig. 71) which is provided with four calibrated holes and an elongated opening as well as a channelled disc (4) mounted on a spindle which is operated by the choke control. On the same spindle, outside the housing (5), there is a cam disc (9, Fig. 64) with connection for the choke control pull wire. When the cold-start device is engaged, the valve disc turns and this links up the channel (1, Fig. 71) from the floatchamber via one or several of the calibrated holes to the channel on the other side of the valve disc and the drilling in the channel (2), which terminates in the venturi between the vacuum plunger and choke flap. By means of this

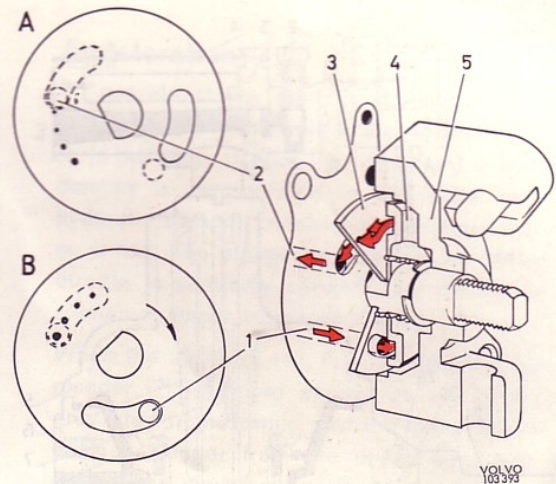


Fig. 71 Cold-start device

- |                                 |                  |
|---------------------------------|------------------|
| A Cold-start device, disengaged |                  |
| B Cold-start device, engaged    |                  |
| 1 From floatchamber             | 4 "Channel disc" |
| 2 To venturi                    | 5 Housing        |
| 3 Choke lever                   |                  |

link-up, the engine receives extra fuel (richer mixture) to facilitate cold starting. At the same time, a little extra air is obtained by means of the choke device. When the choke control is pushed in, the valve disc turns and closes the inlet to the channel. At the same time as the cam disc is operated, the throttle flap opening is also influenced in such a way that turning the cam disc opens the throttle through the fast idle stop screw (11, Fig. 64) and the lever, before any of the calibrated holes open the connection to the fuel drilling. With this arrangement, the idling speed can, if necessary, be raised by the driver of the vehicle during the warming-up period of the engine.

### Idling

When the engine is idling, the vacuum in the carburettor suction chamber is low and the column between the air valve and the bridge will be small (see Fig. 73). At this stage, the thicker section of the metering needle is in the jet and thus only a small quantity of fuel, corresponding to idling requirements, is sucked into the engine. The temperature compensator (Fig. 72) is regulated by a bi-metal spring (4) which influences a valve (3). When the engine is warm and the temperature in the carburettor rises, the valve opens and air is

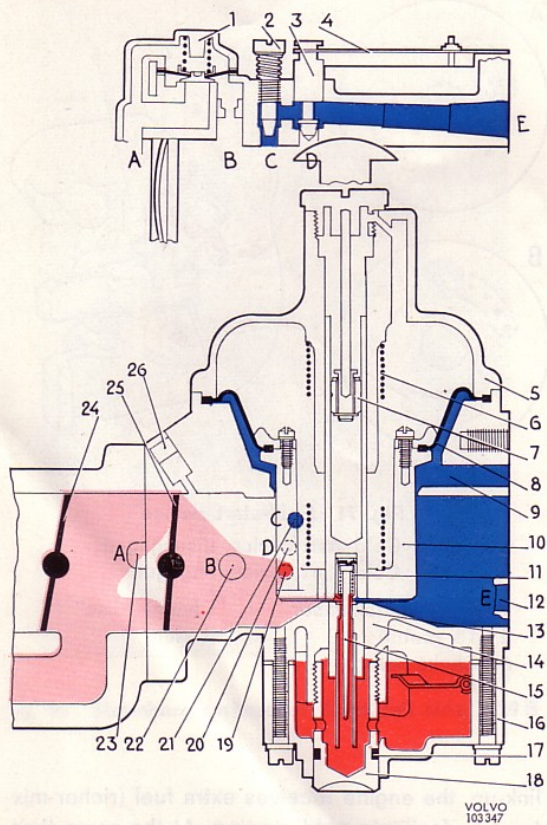


Fig. 72 Cold starting, principle

(Carburettor on B 20 B engine. Vacuum outlet located as for B 20 A engine)

- 1 By-pass valve (B 20 B)
- 2 Idle trimming screw
- 3 Valve for temperature compensator
- 4 Bi-metal spring for temperature compensator
- 5 Suction chamber
- 6 Spring
- 7 Damper piston
- 8 Diaphragm
- 9 Drilling for air supply under diaphragm
- 10 Air valve
- 11 Metering needle suspension
- 12 Drilling for air supply to temp. compensator and idle trimming screw
- 13 Fuel jet
- 14 Carburettor housing (middle section)
- 15 Metering needle
- 16 Floatchamber
- 17 Rubber ring
- 18 Floatchamber plug
- 19 Drilling for cold-start fuel (located in carb. opposite wall)
- 20 Drilling for extra air through temperature compensator
- 21 Drilling for extra air through idle trimming screw
- 22 Inlet channel for fuel-air mixing through by-pass valve (B 20 B)
- 23 Outlet channel for fuel-air mixing through by-pass valve (B 20 B)
- 24 Secondary throttle (B 20 B)
- 25 Primary throttle
- 26 Vacuum outlet for distributor, B 20 A. (Has another location on B 20 B)

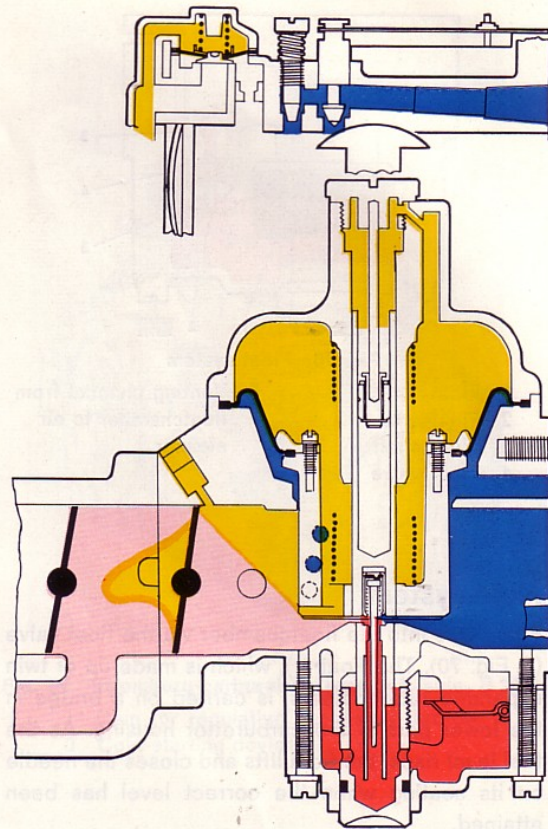


Fig. 73 Idling, warm engine

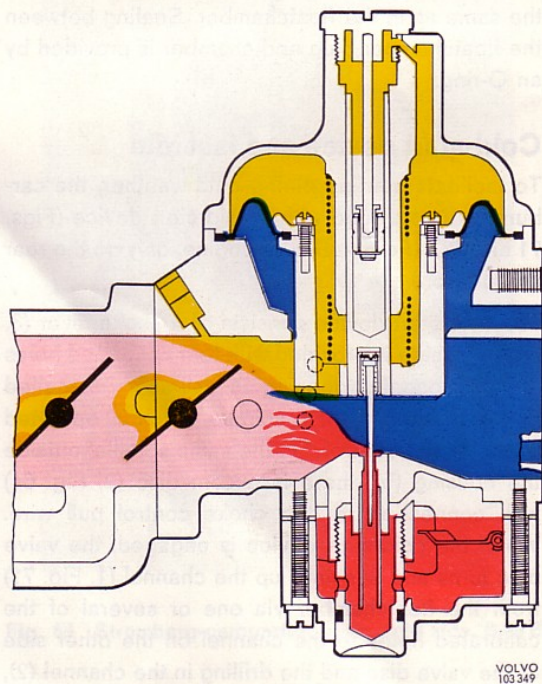


Fig. 74 Normal operation (with open secondary throttle)

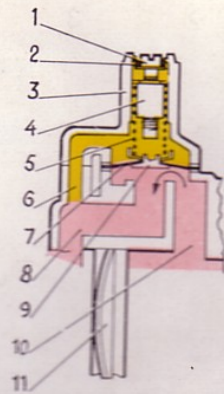


Fig. 75 Throttle by-pass valve

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| 1 Adjusting screw                    | 7 Diaphragm                          |
| 2 Rubber ring                        | 8 Outlet channel for fuel/air mixing |
| 3 Cover                              | 9 Valve                              |
| 4 Nut                                | 10 Inlet channel for fuel/air mixing |
| 5 Spring                             | 11 Flap                              |
| 6 Drilling to underside of diaphragm |                                      |

supplied to the carburettor venturi to compensate for the increase in the fuel flow, which is obtained due to the alteration in the fuel's viscosity, see Fig. 73. Fine adjustment of the engine idling speed can be carried out with the idle trimming screw (2, Fig. 72).

### Normal running

When the throttle flap opens, approximately the same vacuum is obtained in the suction chamber as in the engine intake manifold. Due to the pressure difference between the underside of the air valve, where there is pressure in the carburettor inlet port, and the upper side of the valve, where there is vacuum, the valve lifts from the bridge. This also lifts the tapered metering needle (15, Fig. 72), which is attached to the valve, out of the jet. The effective choke area widens and increases the fuel flow. See Fig. 74.

Since the vacuum in the engine induction manifold is dependent upon the engine speed and load, the correct fuel flow is obtained under all operating conditions.

Because of the variable choke area between the bridge and the valve, the air velocity and pressure drop across the jet orifice will always remain approximately constant, thus ensuring good fuel atomization at all speeds.

### Acceleration

To provide at any point in the throttle range a temporarily richer mixture at the moment the throttle is suddenly opened (acceleration) a hydraulic damper is incorporated in the valve rod. The hydraulic damper consists of a plunger mounted on a rod. The plunger operates in oil. When the throttle is suddenly opened, the vacuum in the suction chamber increases rapidly.

When the air valve (10, Fig. 72) lifts, the damper plunger (7) is forced against its seat and oil is prevented from flowing past the lower side of the damper plunger from the upper side, and this retards the movement of the valve (10). A more powerful vacuum is temporarily obtained above the jet so that the fuel-air mixture becomes for the moment richer.

The down stroke of the air valve is assisted by the spring (6). The rod in the valve should be filled to approximately within 1/4" from the upper edge with oil approved as "Oil for Automatic Transmissions, Type A".

### SU-CARBURETTORS

Both the SU-type carburettors are shown in Figs. 76, 77, 78 and 79. The carburettor consists of a carburettor housing, a float chamber and a suction chamber in which a movable spring-loaded air valve is located. The metering needle is mounted in a spring-loaded suspension secured in the air valve (see Fig. 80). The spring force always presses the needle against the same side of the adjustable jet, and this ensures an accurately regulated fuel flow through the jet.

The primary throttle is fitted with a spring-loaded valve (9, Fig. 77), which opens when the throttle closes at retardation (engine braking).

A regulated quantity of fuel/air mixture then passes through the valve with the result that there is a considerable reduction in the volume of noxious exhaust gases.

Accelerator pedal movement is transferred to the accelerator throttles by means of the shaft which links up the carburettors and which is flexibly journaled in the throttle spindle levers. On starting with a cold engine, the fuel/air mixture is enriched by the lowering of the jet. This also operates the fast idle. The following text describes the function of the various carburettor components.

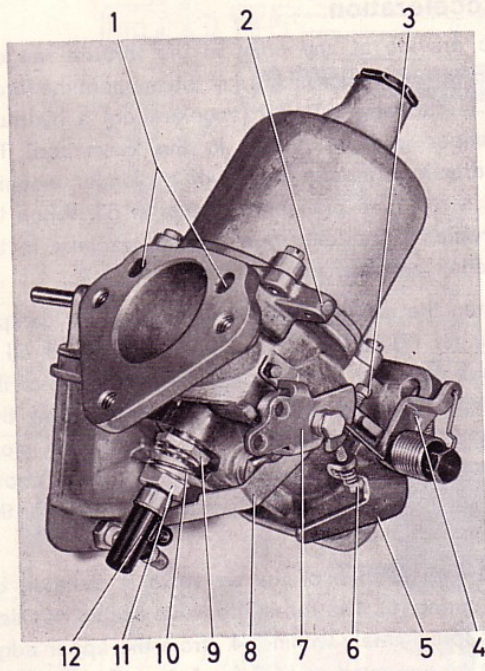


Fig. 76 SU-carburettor, front, right side

- |                                |                                        |
|--------------------------------|----------------------------------------|
| 1 Ventilation hole             | 7 Lever for choke control              |
| 2 Attachment for choke control | 8 Link (for lowering jet when choking) |
| 3 Throttle stop screw          | 9 Lock nut                             |
| 4 Throttle spindle flange      | 10 Spring                              |
| 5 Cam for secondary throttle   | 11 Adjusting nut                       |
| 6 Fast-idle stop screw         | 12 Jet                                 |

### Float

The floatchamber is attached to the carburettor housing by means of screws. The valve (5, Fig. 81) which is opened and closed by the float, is fitted in the cover. The fuel is taken to the lower end of the jet through a flexible hose from the lower part of the floatchamber (9).

The floatchamber ventilation hole is connected to the air cleaner through the hose (8, Fig. 61).

### Cold start

When the engine is started from cold, the fuel/air mixture can be enriched by lowering the jet (see Fig. 82), which is done through a linkage system from the choke control of the instrument panel. Since the metering needle is tapered, the cross-sectional area for the fuel flow increases when the jet is lowered.

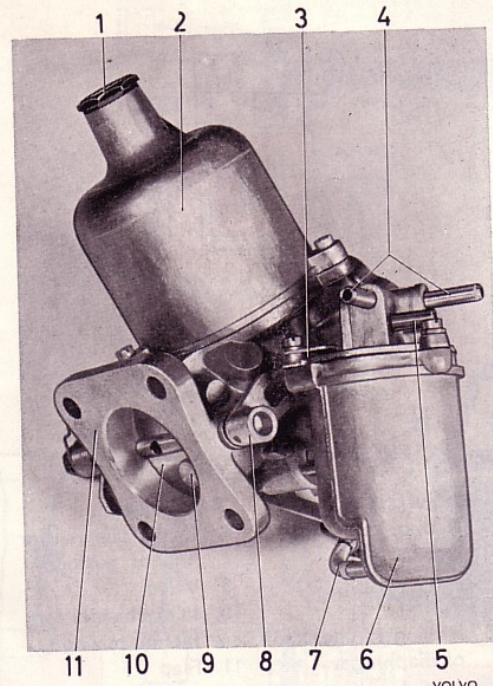


Fig. 77 SU-carburettor, front, left side

- |                                                                  |                                          |
|------------------------------------------------------------------|------------------------------------------|
| 1 Hydraulic damper                                               | 6 Floatchamber                           |
| 2 Suction chamber                                                | 7 Fuel line between jet and floatchamber |
| 3 Designation plate                                              | 8 Lever                                  |
| 4 Connection for fuel lines                                      | 9 By-pass valve                          |
| 5 Connection for hose to air cleaner (float-chamber ventilation) | 10 Primary throttle                      |
|                                                                  | 11 Connection flange                     |

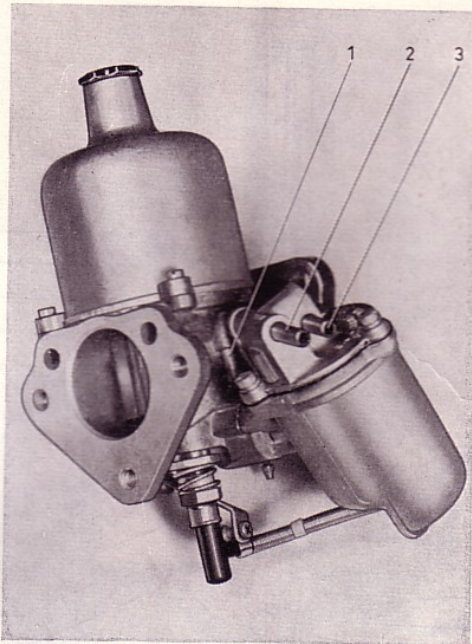
When the choke control is pulled out, the outer end of the lever (3) is pressed downwards and operates the jet so that this is also pressed down. In addition, the fast idling screw is operated by the cam on the lever (2, Fig. 85) and the throttle flap opens slightly.

### Running

The air flow passing through the carburettors when the engine is running increases in speed on passing through the constriction known as the bridge (16, Fig. 83).

Fuel is supplied to the flow of air through the jet which opens out at the bridge.

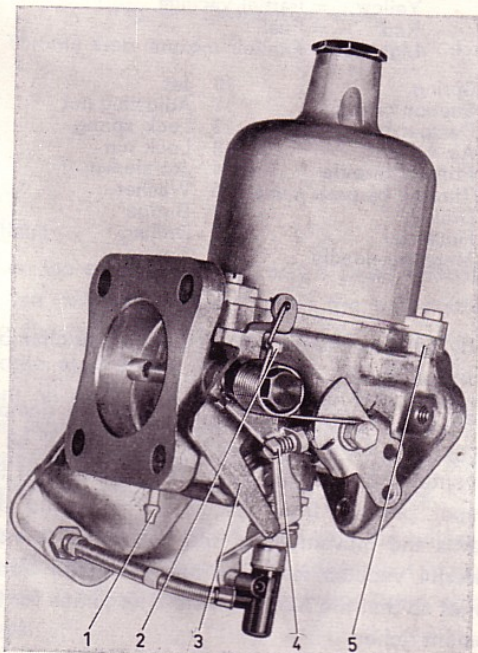
The vertical position of the air valve is determined by the difference between the vacuum in the carburettor and atmospheric pressure since the top of the piston has access to the space between the throttle flap and bridge, whereas the underside of



VOLVO  
103 621

**Fig. 78 SU-carburettor, rear, right side**

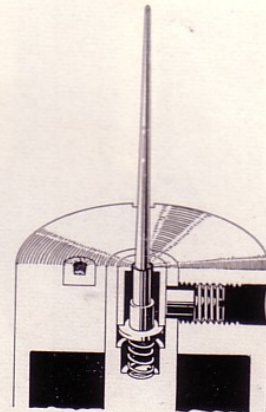
- 1 Lift pin
- 2 Fuel inlet
- 3 Hose connection for air cleaner (floatchamber ventilation)



VOLVO  
103 622

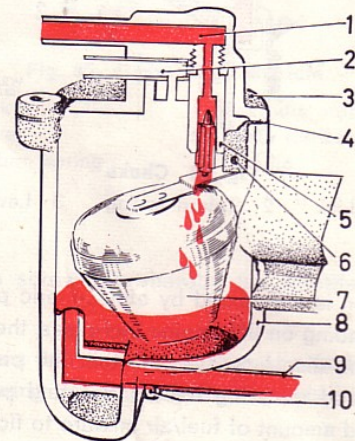
**Fig. 79 SU-carburettor, rear, left side**

- 1 Vacuum hose connection from distributor
- 2 Throttle stop screw
- 3 Cam for secondary throttle
- 4 Fast-idle stop screw
- 5 Attachment for choke control



VOLVO  
103 652

**Fig. 80 Spring-loaded needle suspension**



VOLVO  
103 640

**Fig. 81 Float**

- 1 Fuel inlet
- 2 Hose connection to floatchamber ventilation
- 3 Floatchamber cover
- 4 Gasket
- 5 Valve
- 6 Pin
- 7 Float
- 8 Floatchamber
- 9 Fuel line
- 10 Screw union

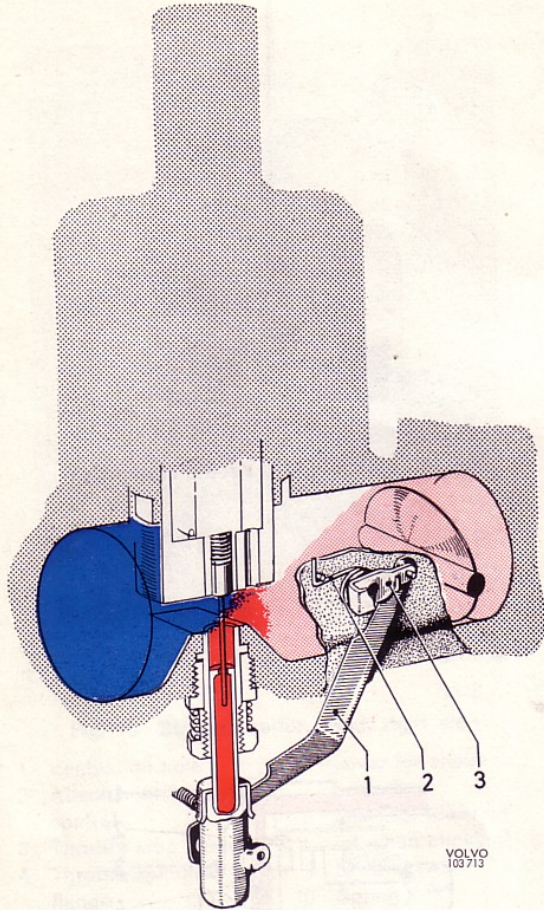


Fig. 82 Choke

- 1 Link 2 Return spring 3 Lever

the piston is influenced by atmospheric pressure. When loading on the engine increases, the degree of vacuum also increases, so that the piston and the tapered metering needle rise and permit an increased amount of fuel/air mixture to flow to the cylinders.

The supply of fuel and air is thus dependent upon the degree of vacuum in the carburettor venturi, so that the carburettors work in accordance with the continuously variable principle.

### Acceleration

To provide at any point in the throttle range a temporary richer mixture at the moment the throttle is suddenly opened, a hydraulic damper is incorporated in the valve rod. The hydraulic damper consists of a plunger mounted on a rod. The plunger operates in oil. When the throttle is sud-

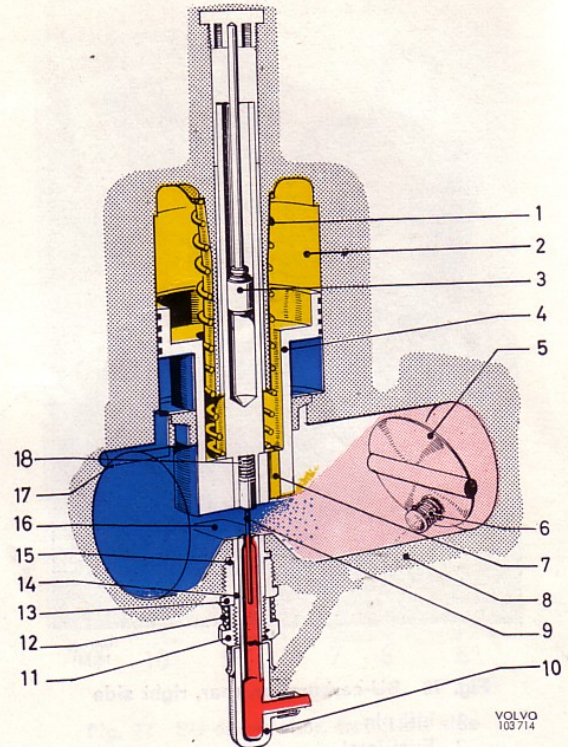


Fig. 83 Carburettor, function

Blue = Atmospheric  
Yellow = Partial vacuum  
Red = Fuel  
Light-red = Fuel/air mixture

- |                          |                  |
|--------------------------|------------------|
| 1 Spring                 | 10 Jet           |
| 2 Suction chamber        | 11 Adjusting nut |
| 3 Damper plunger         | 12 Lock spring   |
| 4 Air valve              | 13 Lock nut      |
| 5 Primary throttle       | 14 Jet sleeve    |
| 6 Throttle by-pass valve | 15 Washer        |
| 7 Drilling               | 16 Bridge        |
| 8 Housing                | 17 Drilling      |
| 9 Metering needle        | 18 Spring        |

dently opened, the vacuum in the suction chamber increases rapidly.

When the air valve (4, Fig. 83) lifts, the damper plunger (3) is forced against its seat and oil is prevented from flowing past the lower side of the damper plunger from the upper side, and this retards the movement of the valve (4). A more powerful vacuum is temporarily obtained above the jet so that the fuel-air mixture becomes for the moment richer.

The downward stroke of the air valve is assisted by the spring (1). The rod in the valve (4) should be filled to approximately within a 1/4" from the upper edge with oil which is approved as "Oil for Automatic Transmissions, Type A".

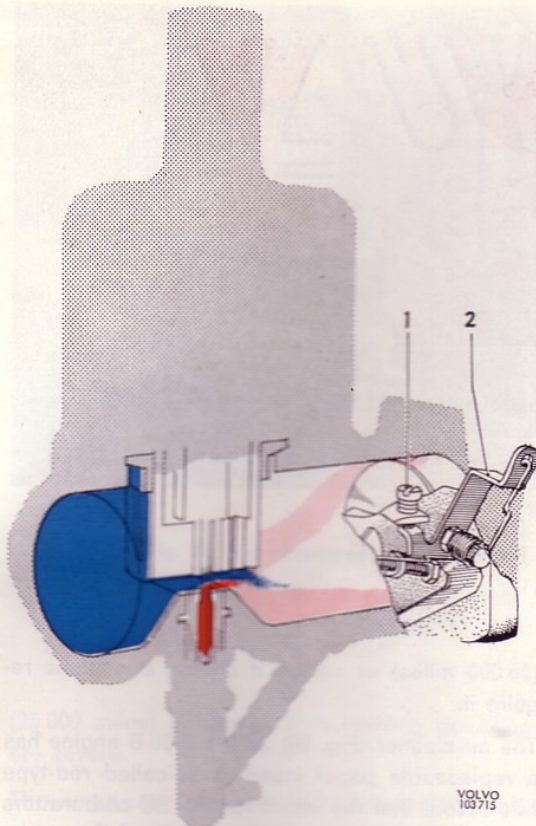


Fig. 84 Carburettor, idling

- 1 Throttle stop screw    2 Lever for return spring

### Idling

When the engine is idling, only a small amount of fuel-air mixture passes through the carburetors. The throttle flaps are held slightly open by the throttle stop screw (1, Fig. 84). The idle adjustment on each carburettor is done independently. The shaft between the carburetors is not permanently fixed to the throttle flap spindle but is flexibly mounted in the ends of the levers.

The fuel/air mixture is adjusted with the adjusting nut (11, Fig. 83) at the jet and adjustment is carried out at idling speed to cover the entire speed range.

### Fast idle

When the choke control is pulled out, the throttle flap is operated. One end of the lever (2, Fig. 85) is in the form of a cam which presses on the fast-

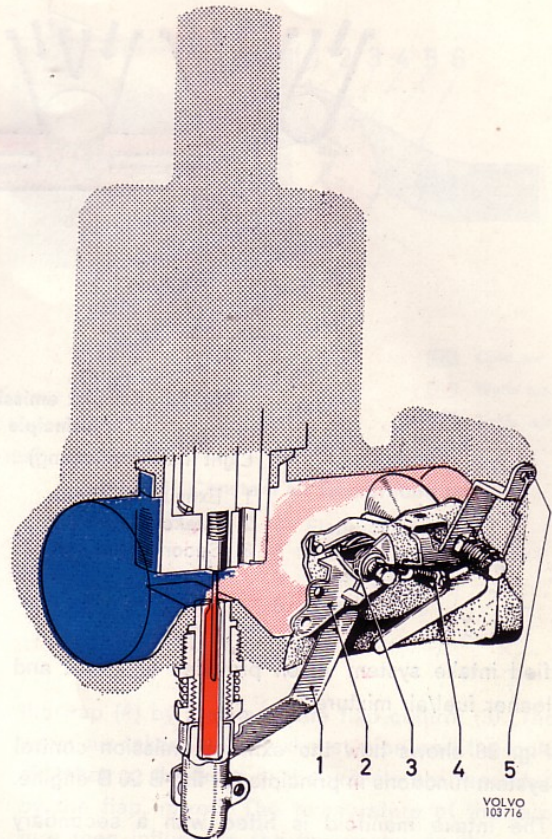


Fig. 85 Carburettor, fast idle

- 1 Link                                    4 Fast-idle stop screw  
2 Lever                                    5 Lever for throttle  
3 Return spring                        spindle

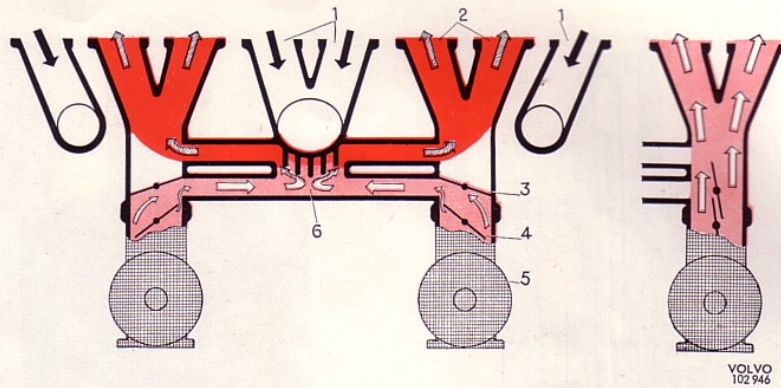
idle stop screw (4) whereby the throttle flap is opened.

This means that the engine runs at a faster idling speed during the time the choke control is pulled out.

## EXHAUST EMISSION CONTROL SYSTEM

Exhaust emission is controlled by means of an exhaust emission control system which reduces the contents of carbon monoxide and hydrocarbons in the exhaust gases to an acceptable level. On the B 20 A engine, exhaust emission control is obtained by the special carburettor fitted on the unit.

Exhaust emission control for the B 20 B engine is provided by the special carburetors and a modi-



**Fig. 86 Exhaust emission control system, B 20 B, principle of operation**

- |                         |                           |
|-------------------------|---------------------------|
| Light load (preheating) | Heavy load (direct inlet) |
| 1 Exhaust manifold      | 4 Primary throttle        |
| 2 Intake manifold       | 5 Carburettor             |
| 3 Secondary throttle    | 6 Preheating chamber      |

fied intake system which provides an exact and leaner fuel/air mixture.

Fig. 86 shows how the exhaust emission control system functions in principle for the B 20 B engine.

The intake manifold is fitted with a secondary throttle (3) at each carburettor. For normal driving (with low power output) the throttles (3) are closed. This forces the mixture of fuel and air from the carburettors to a central preheating chamber (6) where the intake charge is heated and thoroughly mixed, whereby a completely evaporated and homogeneous mixture is obtained.

When higher output is required, that is, the primary throttles (4) are opened wider, the secondary throttles (3) also open up and the mixture of fuel and air passes from the carburettors directly to the cylinders without having to go through the preheating chamber.

No particularly accurate synchronizing of the carburettors is required since they are linked to each other through the intake manifold.

### AIR CLEANER

The air cleaner functions both as a cleaner for the intake air and as an intake silencer. (However, the air cleaner shown in Fig. 89 has no silencing function.)

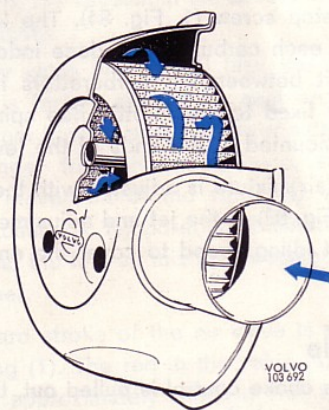
The air cleaner (Fig. 87) on the B 20 A unit is replaced complete. Change it every 40 000 km

(25 000 miles) or earlier if driving conditions require it.

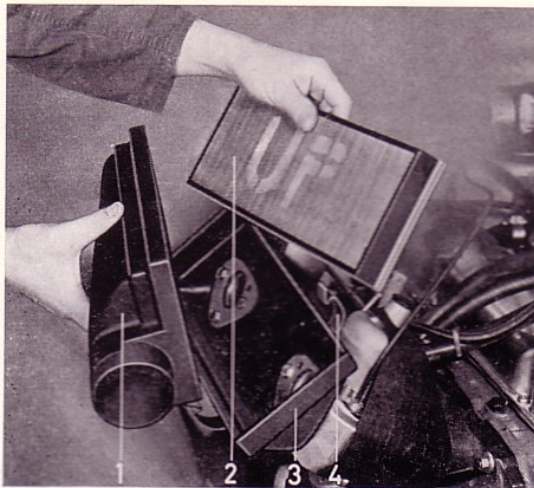
The air cleaner (Fig. 88) on the B 20 B engine has a replaceable paper insert, a so-called rod-type filter. Note that the insert for the SU-carburettors and the Stromberg carburettor differ from one another and must not be confused.

On certain markets where driving conditions are particularly dusty, an air cleaner with a foam plastic sleeve (see Fig. 89) is fitted.

The paper insert must neither be washed nor moistened. The only servicing to be done to it is replacement. Replace the insert every 40 000 km



**Fig. 87 Air cleaner B 20 A**



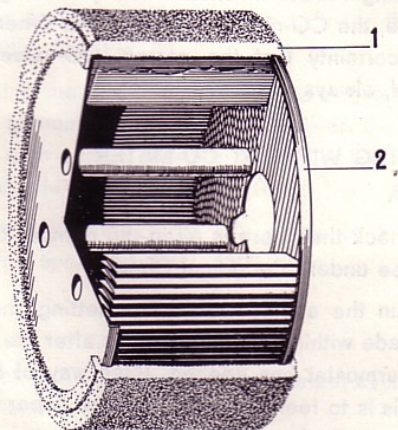
**Fig. 88 Air cleaner B 20 B**

- |                              |                                       |
|------------------------------|---------------------------------------|
| 1 Air cleaner housing, cover | 3 Air cleaner housing, bottom section |
| 2 Cleaner insert             | 4 Clamp                               |

(25 000 miles) or earlier if the driving conditions are severe.

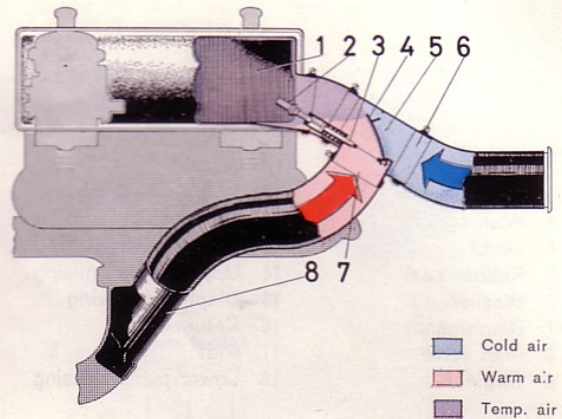
The engine is fitted with a constant air temperature unit for the air cleaner, see Fig. 90.

The constant air temperature unit consist of a flap housing (5), a hose (6) for cold air and heat-resistant hose (7) for warm air as well as a heater plate (8), which is secured to the exhaust pipe. The thermostat (2) fitted in the flap housing is inserted in the air cleaner housing and regulates



**Fig. 89 Air cleaner with foam plastic sleeve**

- |                       |               |
|-----------------------|---------------|
| 1 Foam plastic sleeve | 2 Air cleaner |
|-----------------------|---------------|



**Fig. 90 Constant air temperature unit**

- |                |                   |
|----------------|-------------------|
| 1 Air cleaner  | 5 Flap housing    |
| 2 Thermostat   | 6 Cold-air intake |
| 3 Flap control | 7 Warm-air intake |
| 4 Flap         | 8 Heater plate    |

the flap (4) by means of the flap control (3). The warm air taken at the exhaust pipe and the cold air taken at the front of the vehicle are regulated by the flap, mixed. The temperature of the mixture then influences the thermostat. In this way, the air supplied to the carburettors is maintained at a constant temperature of approximately 35° C (90° F).

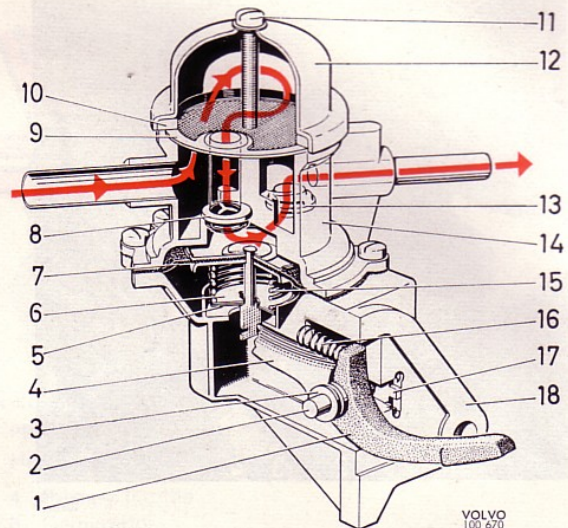
This device eliminates the formation of ice in the carburettor. It also ensures that the driving properties of the vehicle are independent of the temperature of the outside air.

## FUEL PUMP

The fuel pump is of the diaphragm type and is driven by a cam on the camshaft. When the rocker arm in the pump is pressed upwards by the cam, the diaphragm is pulled downwards and fuel is drawn up to the pump. When the rocker arm returns, the diaphragm is pressed upwards by a spring (15, Fig. 91) and fuel is fed to the float-chamber in the carburettor. When the level in the float-chamber is sufficiently high, the float valve closes and the pressure in the delivery line rises until the force on the upper side of the diaphragm exceeds the spring pressure, and the pumping action ceases. The red arrows show the direction taken by the fuel.

**Fig. 91 Fuel pump**

- |               |                       |
|---------------|-----------------------|
| 1 Rocker arm  | 10 Gasket             |
| 2 Pin         | 11 Screw with washer  |
| 3 Washer      | 12 Cover              |
| 4 Lever       | 13 Outlet valve       |
| 5 Rubber seal | 14 Upper pump housing |
| 6 Washer      | 15 Diaphragm spring   |
| 7 Diaphragm   | 16 Return spring      |
| 8 Inlet valve | 17 Rider              |
| 9 Strainer    | 18 Lower pump housing |



## REPAIR INSTRUCTIONS

### ZENITH-STROMBERG CARBURETTOR

The carburettor is specially set by the manufacturer and fine-adjusted with a CO-meter at the factory. **In order not to disturb the setting of the carburettor, it is absolutely essential that the following repair instructions are accurately followed when any work is to be done on the carburettor.**

#### Periodical check

Every 10 000 km (6 000 miles) check that there is oil in the damper cylinder(s). The spindle in the piston should be filled to about a 1/4" from the upper edge with oil approved as "Oil for Automatic Transmissions, type A". See Fig. 94.

**Before any adjustment or repair to the carburettor is carried out, the following should be checked and, if necessary, remedied:**

Valve clearance, spark plugs, compression, contact breaker (dwell angle) and ignition setting.

Also check that there is no air leakage on the intake side and that the air cleaner is not blocked. To be on the safe side, check also the flap function of the constant air temperature unit.

The function of the throttle control and throttle(s) should be checked as well. It should be noted

here that the B 20 B engine drops its idling speed, after the engine speed has been raised, somewhat more slowly than the B 20 A unit because of the by-pass valve's function.

#### Setting the carburettor

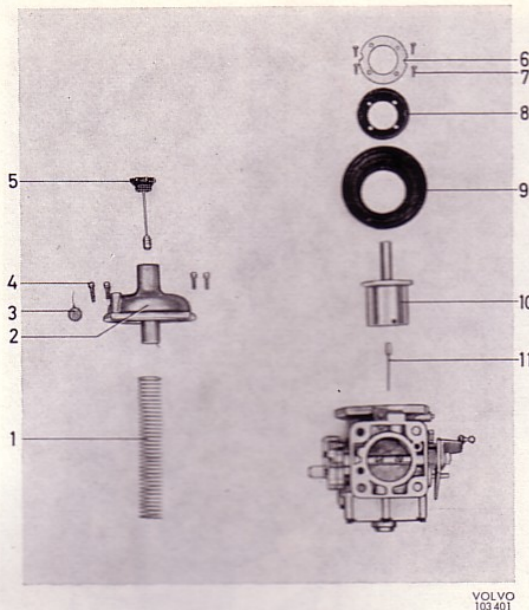
**The best setting of the carburettor is obtained by using a CO-meter.**

However, the setting can be checked without the use of this meter, but if the method used for checking results in unsatisfactory running of the engine, the CO-meter must be used. Where there is uncertainty that the correct CO-value is obtained, **always** use a CO-meter.

#### SETTING WITHOUT CO-METER

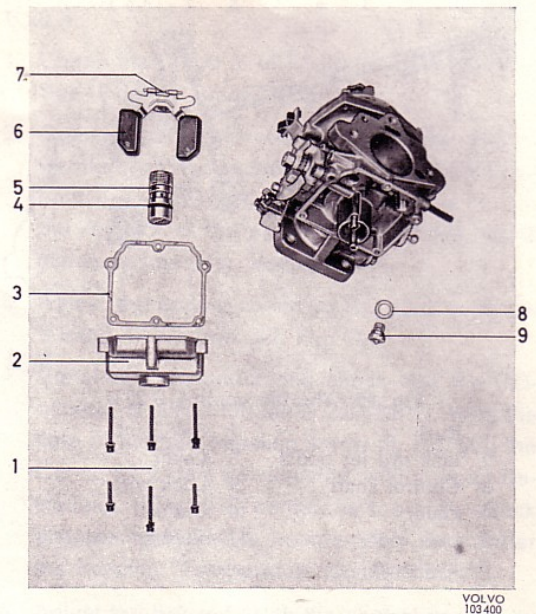
##### B 20 A

1. Check that there is oil in the damper cylinder. See under "Periodical Check".
2. Run the engine warm. The setting should be made within about 10 minutes after the coolant thermostat has opened. (One way of knowing this is to feel the radiator at the upper radiator hose, which suddenly becomes warm.)
3. Adjust the engine speed to 700 r.p.m. with the throttle stop screw (12, Fig. 64).



**Fig. 92 Upper section dismantled**

- |                         |                       |
|-------------------------|-----------------------|
| 1 Spring                | 6 Washer              |
| 2 Suction chamber cover | 7 Screw for diaphragm |
| 3 Sealing plug          | 8 Washer              |
| 4 Screw                 | 9 Diaphragm           |
| 5 Hydraulic damper      | 10 Air valve          |
|                         | 11 Metering needle    |



**Fig. 93 Floatchamber dismantled**

- |                           |                     |
|---------------------------|---------------------|
| 1 Screw for float-chamber | 5 Floatchamber plug |
| 2 Floatchamber            | 6 Float             |
| 3 Gasket                  | 7 Float pin         |
| 4 Rubber ring             | 8 Washer            |
|                           | 9 Float valve       |

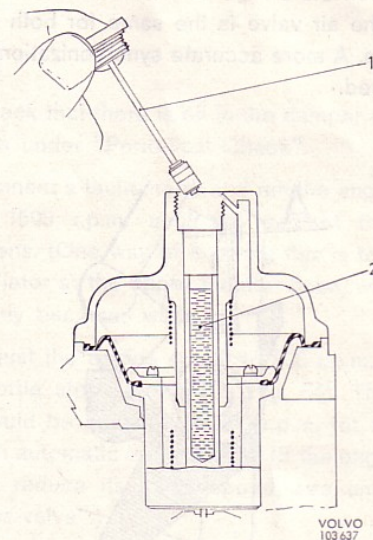
4. Adjust with the idle trimming screw (6, Fig. 65) from the basic setting, which is 2 screwed-out turns of the screw, so that the best idling speed is obtained.
5. Adjust the link rod. With the control against its stop on the manifold bracket, the link rod should be adjusted so that there is a clearance of about 0.1 mm (0.004") between the lever and the flange of the primary throttle spindle. See Fig. 96.
6. Setting the fast idle: Pull out the choke 23–25 mm (almost 1") so that the mark on the rapid idle cam comes opposite the centreline of the rapid idle screw. See Fig. 97.

Then adjust the rapid idle screw to give an engine speed of 1100–1300 r.p.m.

**B 20 B**

1. Check that there is oil in the damper cylinders. See under "Periodical Check".
2. Run the engine warm. The adjustment should be carried out within about 10 minutes after the coolant thermostat has opened. (One way

of finding this out is by feeling the upper radiator hose at the radiator, which suddenly has become warm.)



**Fig. 94 Checking the damper oil**

- 1 Damper piston
- 2 Oil approved as "Oil for Automatic Transmissions, type A"

B 20 A, B 20 B

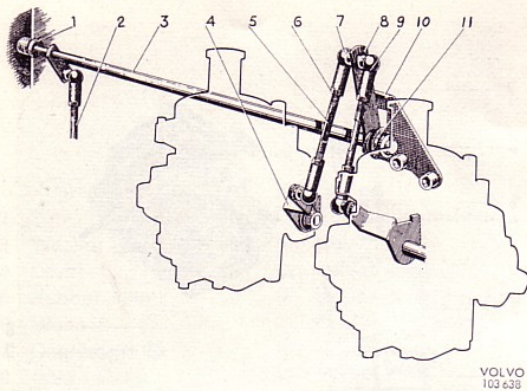


Fig. 95 Throttle control, B 20 B

- |                      |                    |
|----------------------|--------------------|
| 1 Bush               | 7 Ball joint       |
| 2 Link rod for pedal | 8 Lever            |
| 3 Control shaft      | 9 Lock wire        |
| 4 Lever              | 10 Bracket         |
| 5 Link rod           | 11 Rubber mounting |
| 6 Lock nut           |                    |

- Adjust the engine speed to 800 r.p.m. with the throttle stop screws (12, Fig. 64). The speed should be adjusted to 700 r.p.m. for a vehicle with automatic transmission. (If the engine does not reduce its idling speed, see under the heading "By-pass valve".)

N.B. Screw equally for both carburettors. Check to make sure that both carburettors have the same air valve lift. This is easily checked by simply making sure that the distance visually between the bridge of the carburettor housing and the air valve is the same for both carburettors. A more accurate synchronization is not required.

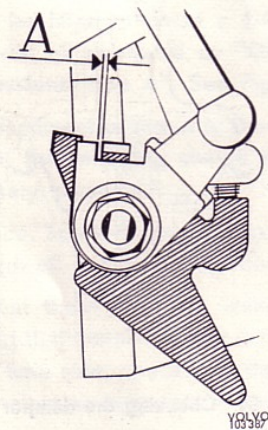


Fig. 96 Setting the control  
A=0.1 mm (0.004")

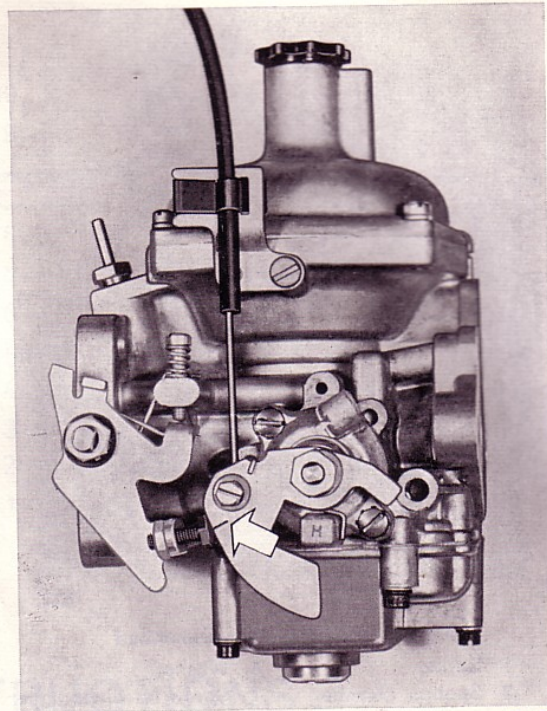


Fig. 97 Fast idle

- Adjust with the idle trimming screws (6, Fig. 65) from the basic setting, which is 2 screwed-out turns of the screw so that the best idling speed is obtained. Screw equally for both carburettors.
- Adjust the link rods. With the control against its stop on the manifold bracket, the link rods should be adjusted so that there is a clearance of about 0.1 mm (0.004") between the lever and the primary throttle spindle flange. See Fig. 96.
- Setting the fast idle: Pull out the choke control 23–25 mm (almost 1") so that the mark on the rapid idle cam comes opposite the centreline of the rapid idle screw. See Fig. 97. Then adjust the rapid idle screw to give an engine speed of 1100–1300 r.p.m.

#### SETTING WITH CO-METER

The setting should be made at a temperature of 15 to 25° C (60–80° F) and must be made within 8 minutes after the coolant thermostat has opened. Warming-up should be done with a completely cold engine.

When measuring with a CO-meter, it is important that the carburettor temperature is the correct one.

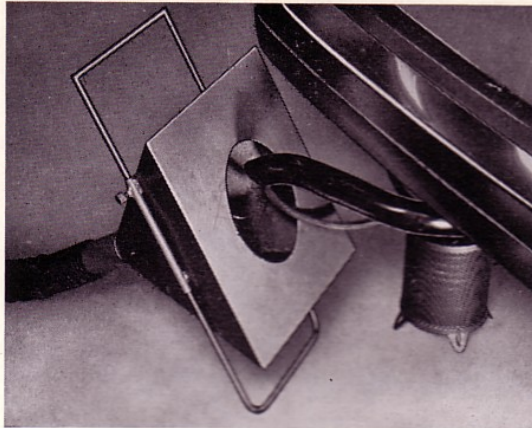


Fig. 98 Funnel for exhaust evacuation

When the engine is idling, the floatchamber is exposed to heat radiation from the exhaust manifold while the flow of cold fuel through the floatchamber is small. The resultant rise in temperature causes an increase in the fuel flow through the jet due to the alteration in the viscosity and the increase in the CO-value. Racing the engine speed cools the carburettor to a certain extent due to the step up in the fuel flow. The temperature can be checked to make sure that it is not excessive by feeling the floatchamber with the hand. It should "feel cold", that is, it more or less should not exceed room temperature.

In order to be certain that the measured CO-value is correct, **measuring should be carried out within the time period mentioned above.**

There are a number of different types of CO-meters available which function with acceptable accuracy. The instructions on their use accompany each meter. Note that when connecting the hose for evacuating the exhaust gases, the hose must not be placed so that the exhaust gases are completely evacuated from the CO-meter connection to the exhaust manifold. A funnel, see Fig. 98, could suitably be used here. With the funnel installed, the suction at the connection would not be so great as to upset the measuring but sufficient to suck up the exhaust gases so that they do not fill the workshop. When doing any measuring with the CO-meter, it is important that the exhaust pipe and silencer are in good condition, that is, they do not leak.

#### B 20 A

1. Check that there is oil in the damper cylinder. See under "Periodical Check".
2. Connect a tachometer and run the engine warm at 1500 r.p.m. until the coolant thermostat opens. (One way of finding this out is to feel the radiator at the upper radiator hose, which suddenly becomes warm.)
3. Adjust the engine speed to 700 r.p.m. with the throttle stop screw (12, Fig. 64).
4. Connect a CO-meter and check that the CO-content is within the limits 2.5–3.5 %. With the help of the idle trimming screw (6, Fig. 65), the CO-content can be adjusted within small deviations. (If the CO-content is too high, check first the temperature compensator, see under the heading "Temperature Compensator".)
5. Adjust the link rod. With the control against its stop on the manifold bracket, the link rod should be adjusted so that there is a clearance of about 0.1 mm (0.004") between the lever and the flange of the primary throttle spindle. See Fig. 96.
6. Setting the fast idle: Pull out the choke control 23–25 mm (almost 1") so that the mark on the fast idle cam comes opposite the centreline of the fast idle screw. See Fig. 97. Then adjust the fast idle screw to give an engine speed of 1100–1300 r.p.m.

#### B 20 B

1. Check that there is oil in the damper cylinders. See under "Periodical Check".
2. Connect a tachometer and run the engine warm at 1500 r.p.m. until the coolant thermostat opens. (One way of knowing this is to feel the radiator at the upper radiator hose, which suddenly becomes warm.)
3. Adjust the engine speed to 800 r.p.m. with the throttle stop screws (12, Fig. 64). The speed should be adjusted to 700 r.p.m. for a vehicle with automatic transmission. (If the engine does not reduce its idling speed, see under "By-pass valve".)

**N.B.** Screw equally for both carburettors. Check that both carburettors have the same air valve lift. This is easily checked by measuring with the eye the distance between the car-

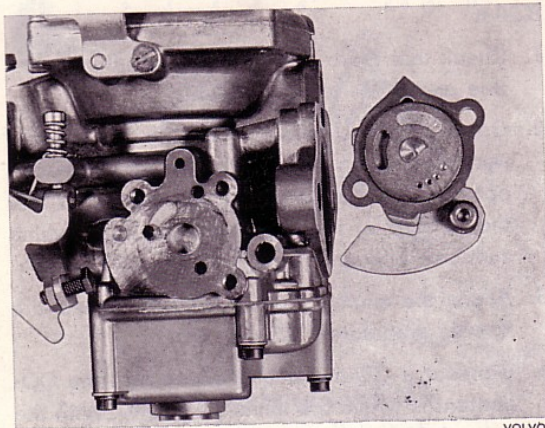


Fig. 99 Cold-start device

burettor housing bridge and the air valve. The distance should be the same for both carburettors. More accurate synchronization is not required.

4. Connect a CO-meter and check that the CO-content is within the limits 2.5–3.5 %. With the help of the idle trimming screws (6, Fig. 95) the CO-content can be adjusted within small deviations. (If the CO-content is too high, check first the temperature compensator, see under "Temperature Compensator".)
5. Adjust the link rods. With the control against its stop on the manifold bracket, the link rods should be adjusted so that there is a clearance of about 0.1 mm (0.004") between the lever and the flange of the primary throttle spindle. See Fig. 96.
6. Setting the fast idle: Pull out the choke control 23–25 mm (almost 1") so that the mark on the fast idle cam comes opposite the centreline of the fast idle screw. See Fig. 97.  
Then adjust the fast idle screw to give an engine speed of 1100–1300 r.p.m.

### Faulty carburettor function

1. Check to make sure that the reason for the fault in the function is not due to wrong damper oil or oil level, impurities in the floatchamber or a faulty float valve and float. See under the respective headings.
2. Remove the air cleaner and check that the suction valve(s) operate easily and without jamming. (The damper piston(s) removed.) If this is not the case, remove the suction chamber

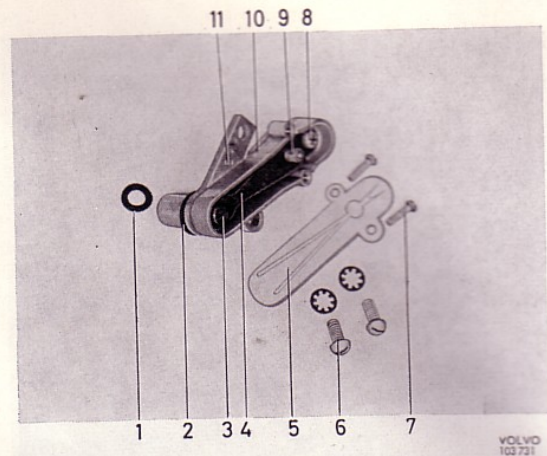


Fig. 100 Temperature compensator

- |                                     |                       |
|-------------------------------------|-----------------------|
| 1 Rubber seal                       | 7 Screw for cover     |
| 2 Rubber seal                       | 8 Cross-slotted screw |
| 3 Valve                             | 9 Adjusting nut       |
| 4 Bi-metal spring                   | 10 Housing            |
| 5 Cover                             | 11 Marking            |
| 6 Screw for temperature compensator |                       |

cover and clean the pistons. At the same time, check to make sure the diaphragm is in good condition. Plug-seal after fitting.

N.B. If the metering needle must be released or moved, it should be adjusted, see under the heading "Replacing the metering needle".

**A CO-meter is recommended for this purpose.**

### TEMPERATURE COMPENSATOR

3. Should there be a powerful drop in the idling speed during idling for a lengthy period, especially when the weather is warm, check the function of the temperature compensator by removing the plastic cover and pressing in the valve (3, Fig. 100). This should move under very light pressure and return to its position without jamming. This applies at a temperature above 20° C (70° F). The valve starts opening at 10° C (50° F).

Pressing the valve inwards deteriorates the quality of the idle. If the valve has a tendency to be stiff in operation or if the compensator is incorrectly adjusted, the latter should be replaced complete. See under "Replacing the temperature compensator".

For adjusting slacken one of the cross-slotted screws (8), for the bi-metal spring and center the valve so that its function will be as above. If necessary adjust as follows:

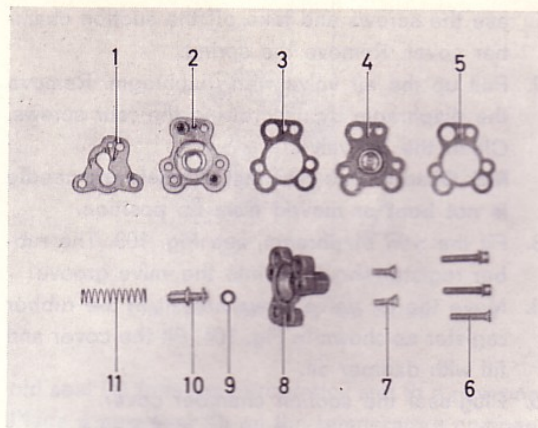


Fig. 101 Throttle by-pass valve

- |                           |                    |
|---------------------------|--------------------|
| 1 Gasket                  | 7 Screw for cover  |
| 2 Housing                 | 8 Cover            |
| 3 Gasket                  | 9 Rubber ring      |
| 4 Diaphragm               | 10 Adjusting screw |
| 5 Gasket                  | 11 Spring          |
| 6 Screw for by-pass valve |                    |

At 20° C (70° F) the valve should open 0.1–0.3 mm (0.004–0.012"). When checking the setting, remove the temperature compensator from the carburettor and store it at a temperature of 20° C (70° F) until it has reached this temperature. Adjust with the nut (9) for the bi-metal spring.

#### Only for B 20 B

#### THROTTLE BY-PASS VALVE (FRONT CARB.)

- With faulty function of the throttle by-pass valve, or if the engine does not reduce speed at idle (first check that the throttle control is correctly adjusted) or if the valve does not open, then adjust as follows:

##### A Engine does not reduce speed at idle:

Turn the adjusting screw (1, Fig. 67) to the left until the engine reduces idling speed.

Check the function by running the engine briefly up to about 2000 r.p.m. The engine should then return to idling speed. (Note that the engine will return to idle somewhat slower than is the case with a carburettor without a by-pass valve, see under point B.)

When correct function is obtained (that is, even the function according to B), turn the screw a further 1/2 turn to the left.

##### B The valve does not open:

Normally the air valve of the front carburettor should go down to the bridge a little after that of the rear carburettor on racing the engine speed. Set the adjusting screw at higher speed until normal function is obtained.

If this is not possible, replace the by-pass valve complete, see under "Replacing the throttle by-pass valve".

**N.B. When adjusting,** do not press the adjusting screw inwards since the rubber ring (9, Fig. 101) sealing between the screw and cover can drop out of position. Check for air leakage by e.g. placing a finger over the rubber ring hole.

#### Removing the carburettors

Remove the air cleaner. Remove the link rod ball joints from the carburettors. Take off the fuel hoses, vacuum hose and choke wire.

Remove the nuts for the carburettors and take off the carburettors. Remove the protection plates and gaskets. Mask over the intake holes with tape.

#### Fitting the carburettors

Clean the gasket surface. Fit the protection plates, new gaskets and then the carburettors. Connect the ball joints, fuel hoses, vacuum hose and choke wire. Make sure that the choke control on the dashboard is pushed in. Then secure the pull wire in the clamping screw of the rapid idle cam. After this clip on the outer sleeve of the pull wire.

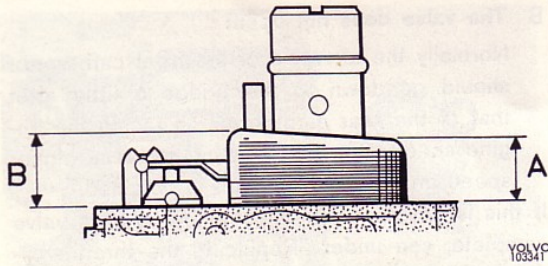
Fit the air cleaner and connect the hose for the crankcase ventilation. Adjust the carburettors, see under "Setting the carburettors".

#### Checking the secondary throttles

Check to make sure that the secondary throttles are centered and can be turned without jamming. Check the location ("A", Fig. 116) of the levers. When the secondary throttle is closed, the distance "A" between the lever pin and the intake manifold flange should be 2.7–4.3 mm (0.11–0.17"). Check to make sure that the rubber seal (1, Fig. 117) is not damaged, and that its inner edge seals well against the intake manifold. When fitting a new seal, make sure that it is not damaged by the sharp edges of the spindle and that it is fitted so that the measurement "B" is 4.5–5.0 mm (0.18–0.20"), see Fig. 117.

#### Cleaning the floatchamber

The floatchamber is removed by unscrewing the



**Fig. 102 Float level**

A=9–13 mm (5/8") B=15–17 mm (1/2")

floatchamber plug (5, Fig. 93) and the screws (1). Clean the gasket surface and fit a new rubber ring (4). Fit the floatchamber with a new gasket.

### Float level

Before checking the float level, remove the carburettor, invert it and take out the floatchamber.

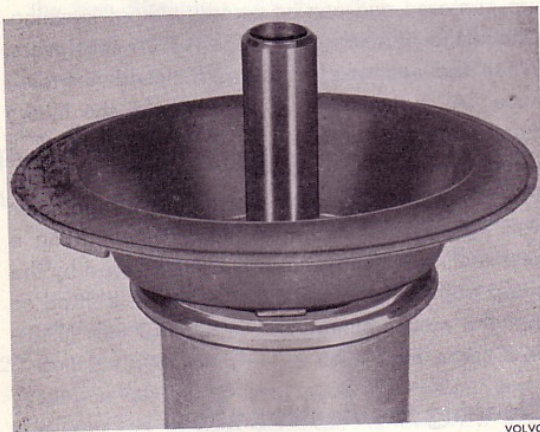
The float is removed by carefully breaking the float spindle from the bridge. The float is fitted with the sloping side facing away from the carburettor housing.

At the correct float level, the top point on the float should lie 15–17 mm (5/8") and the rear edge 9–13 mm (1/2") above the sealing surface (see Fig. 102). If the level is incorrect, adjust by bending the tag at the float valve.

**N.B.** Do not bend the arm between the float and the pin.

### Replacing the diaphragm

1. Screw out the damper piston. Make line-up marks on the suction chamber cover and carburettor housing. Remove the seal plug, re-



**Fig. 103 Diaphragm in air valve**

2. Pull up the air valve with diaphragm. Remove the diaphragm by unscrewing the four screws. Clean the air valve.

**N.B.** Observe due care that the metering needle is not bent or moved from its position.

3. Fit the new diaphragm, see Fig. 103. The rubber register should fit into the valve groove.
4. Move the air valve down and fit in the rubber register as shown in Fig. 104. Fit the cover and fill with damper oil.
5. Plug-seal the suction chamber cover.

### Replacing the throttle by-pass valve

The throttle by-pass valve is replaced complete. The valve is removed from the carburettor by screwing out the three screws (6, Fig. 101). Clean the gasket surface and fit the new valve with gasket (1). Carry out a function test.

Note that the by-pass valve for the B 20 B is marked X on the cover.

**N.B.** After the valve has been fitted on the carburettor, remove the screw (A, Fig. 107) on the by-pass valve. If the screw is not removed and it loosens, it will jam the cam so that the throttle cannot be closed. The only purpose the screw has is to keep the by-pass valve components together before being fitted on the carburettor.

### Replacing the temperature compensator

The temperature compensator is replaced complete. It is removed from the carburettor by unscrewing the screws (6, Fig. 100). Take out the



**Fig. 104 Diaphragm in carburettor housing**

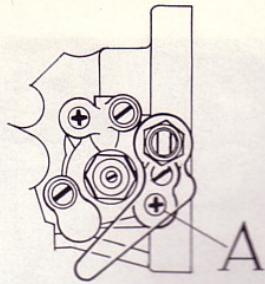


Fig. 105 Removing the screw

old seal (1) from the carburettor and fit a new one. Place a new seal (2) on the temperature compensator and fit the compensator.

**N.B.** The temperature compensator is marked "120°" for the B 20 A engine and "60°" for the B 20 B engine (see 11, Fig. 100).

### Replacing the metering needle

After replacing the metering needle, the following check with a CO-meter is recommended.

1. Remove the air valve from the carburettor and clean it.
2. Remove the needle by unscrewing the lock screw and pull the needle out with the spring suspension.
3. Before fitting the screw needle, check the needle designation.  
For B 20 A: B2 AF  
For B 20 B: B1 S  
The designation is punched on the needle and can be read by pulling the needle out of the spring suspension far enough to reveal the designation.
4. Fit the needle with the spring suspension so that the flat surface faces the lock screw. The needle should incline to the holes in the air valve, i.e. in towards the carburettor throttle. The needle should be inserted so far that the plastic washer lies flush with the valve, see Fig. 106. Tighten the lock screw.
5. Fit the air valve in the carburettor. Plug-seal the suction chamber cover.

### Damper device

If the engine does not react properly during acceleration, the reason may be a faulty clearance on the damper plunger, the axial clearance of which (see A, Fig. 107) should be 0.5–1.1 mm (0.02–0.04").

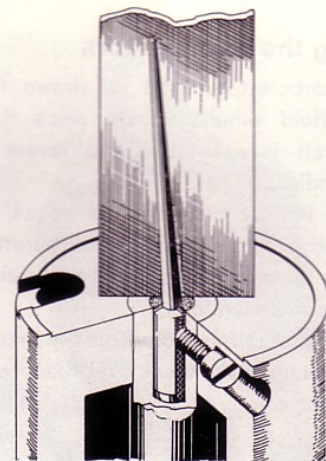
VOLVO  
100 651

Fig. 106 Fitting the metering needle

The repair kit should be used to remedy any fault in the damper plunger.

If the damper device is to function correctly, then the level of the damper oil must be correct (see Fig. 94). The interval prescribed for the periodical check is 10 000 km (6 000 miles).

### SU-CARBURETTORS

The vehicles are delivered from the factory with the carburettors fine-adjusted with a CO-meter.

### Periodical check

Check regularly every 10 000 km (6 000 miles) to make sure that there is oil in the damper cylinders. See Fig. 94.

The spindle in the piston should be filled to about 6 mm (1/4") from the upper edge with oil approved as "Oil for Automatic Transmissions, type A".

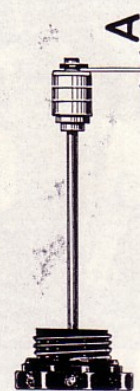
VOLVO  
103 818

Fig. 107 Damper plunger clearance

### Removing the carburettors

Both the carburettors must be drawn from the intake manifold simultaneously, since the intermediate shaft is carried in the levers on the throttle spindles.

1. Remove the air cleaner, fuel hoses, vacuum hose and controls from the carburettors.
2. Unscrew all the nuts securing the carburettors to the intake manifold.
3. Pull both the carburettors from the intake manifold simultaneously. Mask over the intake holes with tape.

### Dismantling the carburettors

1. Remove the damper plunger and suction chamber with valve.
2. Screw off the floatchamber cover and lift it up. Then remove the chamber.
3. Unscrew the screws holding the levers for the choke and fast idle control, pull them off and remove the jet.
4. Wash all parts in white spirit and blow them dry with compressed air.

### Re-bushing the carburettors

If there is throttle spindle play in the chamber, this can be re-bushed as follows:

1. First slacken the screws and remove the throttle spindle.
2. Secure stand SVO 2603 in a vise and mount the carburettor on the stand with the hooks as shown in Fig. 108. For work with SU-carburettors, use the thick pin of the stand. Make sure that the pin hole comes in line with the throttle spindle hole.

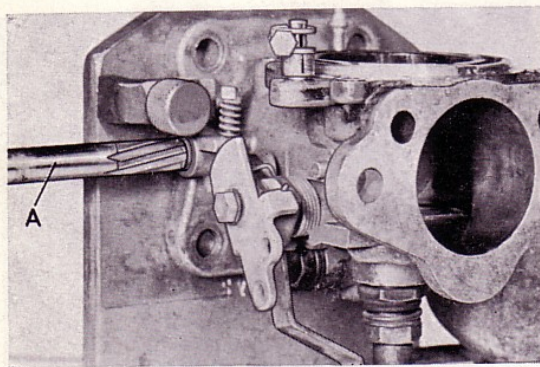


Fig. 108 Reaming the location for bush  
A=SVO 2880 (2400 as alternative)

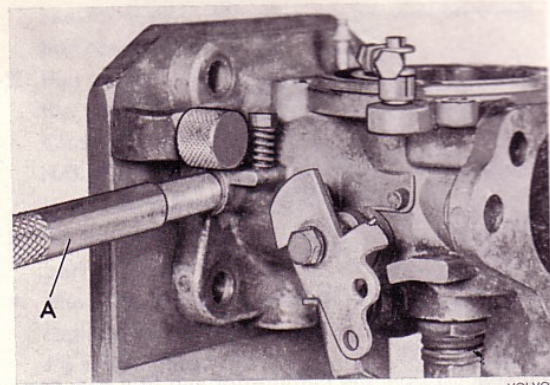


Fig. 109 Pressing in the bush  
A=SVO 2402

3. Ream off the bushes and the holes for the throttle spindle in the housing with reamer SVO 2880 (SVO 2400 as alternative). See Fig. 108. Do not pull the reamer back through the hole, but release the attachment and push the reamer in the direction of operation through the hole in the bottom plate. If the reaming is done in a vertical drilling machine, a minimum speed must be used and the reamer carefully secured so that it does not throw. If the reamer throws, the holes will be too large. The bushes will then become loose so that the housing must be scrapped.

**N.B.** It may happen when re-bushing the carburettor housing for the SU-carburettors that the reamer jams with a screeching sound when reaming the location for the bush. The reason for this is that a part of the old bush in the housing has fastened on the reamer. Pull out the reamer, remove the bush and continue reaming.

4. After completing the reaming, turn the stand pin 90° so that it forms a stop inside the carburettor housing for the bushes. Then drive in the bushes with drift SVO 2402, see Fig. 109.
5. Turn the stand pin a further 90° and ream the driven-in bushes with reamer SVO 2401, see Fig. 110.
6. Fit the throttle with a new throttle spindle. Turn or rivet the throttle screws.
7. Fit the flange yoke as shown in Fig. 111 (with the throttle fully closed and the throttle stop screw out). Make sure that there is a clearance of 1.5 mm (0.06") between the flange yoke and the throttle housing. With the flange in position (see Fig. 111) and a 3.0 mm (approx. 1/8")

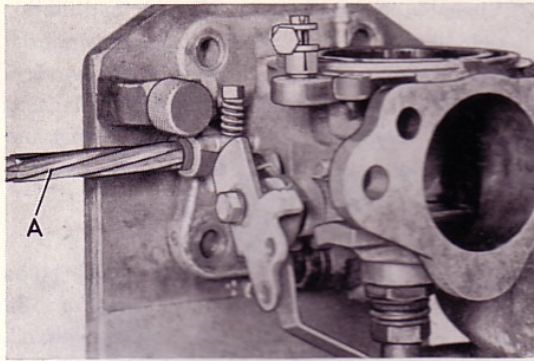


Fig. 110 Reaming the bush  
A=SVO 2401

drill, make a hole for the lock pin (the hole should be drilled at right angles to the longitudinal shaft of the carburettor when the throttle is closed) through the throttle spindle. Remove drillings, fit the flange yoke and the lock pin.

### Checking and assembling the carburettors

Before assembling the carburettor check to make sure that all the parts are free from damage. The air valve fit in the chamber has been accurately determined and its character must not be altered either by filing or shaving. Minor unevennesses can be carefully removed with a fine emery cloth.

1. **The spring-suspended metering needle should be installed so that it inclines towards the carburettor throttle.**

This position is attained when the line (A, Fig. 112) points towards the holes in the air valve. This line marks where the pin, which presses on the needle, is located. The needle is fitted so that the spring sleeve lies flush with the valve, see Fig. 112.

2. Fit the jet sleeve and lock nut. Centering of the jet is required for certain carburettors, see under "Centering the jet". Tighten the lock nut.
3. Fit the spring and valve in the suction chamber and secure the chamber to the carburettor housing.
4. Fit the spring, adjusting nut and jet, see Fig. 113. Connect the link.
5. Check and secure the float valve, see Fig. 114.

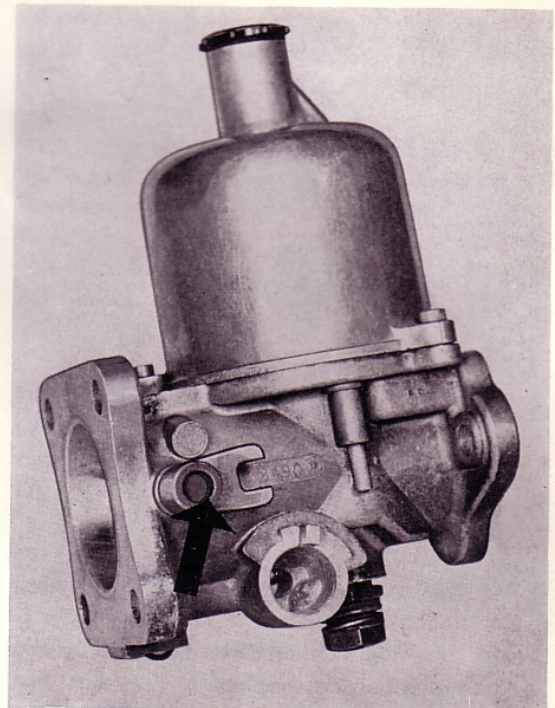


Fig. 111 Location of flange yoke

Fit the float and the cover. Secure the float-chamber and the line to the jet.

6. Screw the jet in to the stop position. Then unscrew it so far that it just touches the air valve when the latter rests on the bridge. From this position screw out the adjusting nut 15 hex flats.
7. Place the carburettor with the 4-holed flange facing downwards. Move the air valve to its topmost position. The valve should move easily without jamming. When it is released, it should

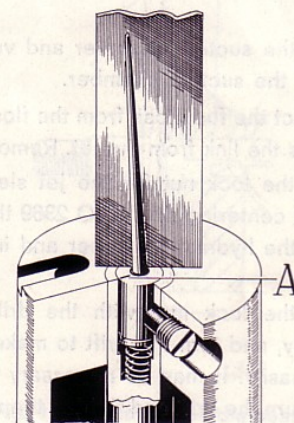


Fig. 112 Fitting the metering needle

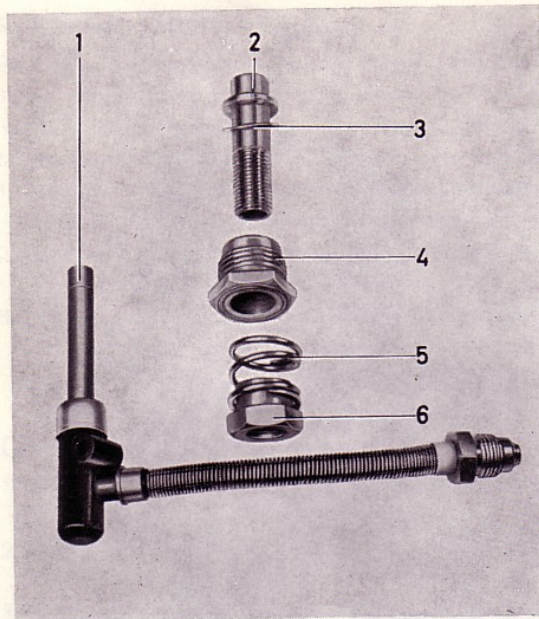


Fig. 113 Jet dismantled

- |                                |                 |
|--------------------------------|-----------------|
| 1 Jet with fuel line, complete | 4 Lock nut      |
| 2 Jet sleeve                   | 5 Spring        |
| 3 Seal                         | 6 Adjusting nut |

return at even speed and strike against the bridge with a **sharp metallic click**.

### Centering the jet on carburettor marked AUD 305

On the carburettor marked AUD 331 the jet **cannot be centered** on the plate which is secured to the floatchamber. However, a small number of carburettors have this centering arrangement still. These are marked AUD 305. The centering drift SVO 2369 (used for the B 16 B engine) should be used.

1. Remove the suction chamber and valve. Then refit only the suction chamber.
2. Disconnect the fuel hose from the floatchamber as well as the link from the jet. Remove the jet.
3. Release the lock nut for the jet sleeve. Push down the centering drift SVO 2369 through the hole for the hydraulic damper and into the jet sleeve.
4. Tighten the lock nut, with the drift pressed down fully, and turn the drift to make sure that it turns easily. It may be necessary to slacken the nut, turn the drift and tighten the nut several times after one another before a satisfactory result is obtained.

2-56

5. Assemble the carburettor. Fit the carburettor with the 4-holed flange facing downwards. Check the centering by lifting the valve 5-6 mm (1/4") from the bridge and then releasing it. The valve should then strike against the bridge (jet) with a **sharp metallic click**.

### Fit of air valve

The fit can be checked by plugging the air holes in the valve with, for example, small corks. The damper plunger is fitted but not filled with oil. The air valve spring is not fitted. Normally the valve should sink to the bottom, from the position shown in Fig. 115, in about 5-7 seconds.

### Replacing the float valve

1. Remove the floatchamber cover and invert the chamber.
2. Remove the pin for the float lever. Remove the float.
3. Screw out the valve and fit a new one. Refit the float.
4. Check to make sure that the cover gasket is not damaged and place on the cover and secure it.

### Checking the float level

This type of carburettor is relatively insensible to variations in the float level. To ascertain the correct level, check the position of the float according to the measurement given in Fig. 114.

### Fitting the carburetors

1. Remove the masking tape from the intake ports. Fit on new gaskets.
2. Fit the intermediate shaft in position between the carburetors, see Fig. 118. Make sure that the protective plate is not damaged and that the sealing surfaces are clean.

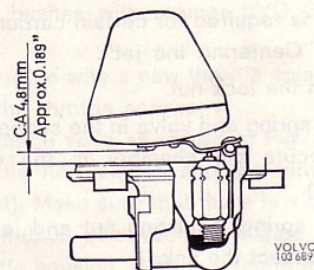
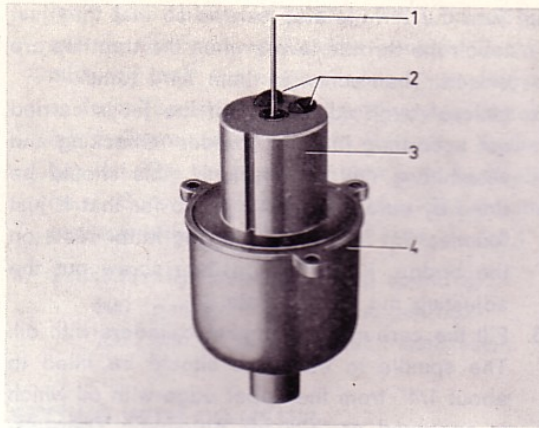


Fig. 114 Checking the float level



**Fig. 115 Air valve fit**

- |                                 |                   |
|---------------------------------|-------------------|
| 1 Metering needle               | 3 Air valve       |
| 2 Plugs of, e.g. rubber or cork | 4 Suction chamber |
- Fit both the carburetors at the same time with the intermediate shaft in position. Tighten the nuts and connect up the control and lines.
  - Carry out any necessary carburettor setting adjustments, see under "Setting the carburetors".

### Checking the secondary throttles

Check to make sure that the secondary throttles are centered and that they can be turned without jamming. Check the location ("A", Fig. 116) of the levers. When the secondary throttle is closed, the distance "A" between the lever pin and the intake manifold flange should be 2.7–4.3 mm (0.11–0.17"). Check to make sure that the rubber seal (1, Fig. 117) is not damaged and that its inner edge seals properly against the intake manifold. When fitting the seal make sure that it is not damaged against the sharp edges of the spindle and that it is installed so that the measurement "B" is 4.5–5.0 mm (0.18–0.20").

### Damper device

If the engine does not react properly during acceleration, the reason may be a faulty clearance on the damper plunger, the axial clearance of which (see A, Fig. 107) should be 0.4–0.8 mm (0.016–0.032").

The repair kit should be used to remedy any fault in the damper plunger.

If the damper device is to function correctly, then the level of the damper oil must be correct (see

Fig. 94). The interval prescribed for the periodical check is 10 000 km (6 000 miles).

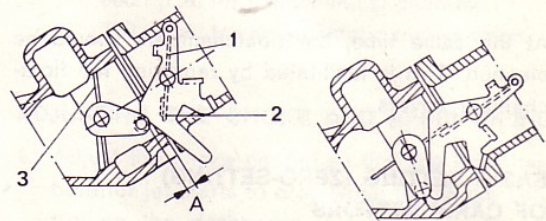
### Setting the carburetors

**Before carrying out any adjustment or repair to a carburettor, the following should be checked and if necessary remedied:**

Valve clearance, spark plugs, contact breakers (dwell angle) and ignition timing.

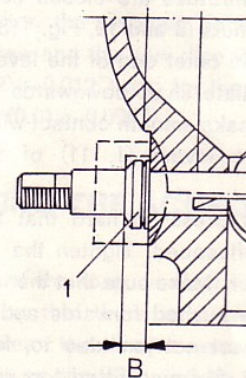
Also check that there is no air leakage on the intake side and that the air cleaner is not blocked. Check, too, the function of the flap for the constant temperature device.

The function of the throttle control and throttles should also be checked. Note here that the B 20 B engine reduces idle, after the engine speed has been raced, somewhat more slowly than for the B 20 A engine (which does not have by-pass valves) because of the function of the by-pass valves. At certain intervals, for example, when changing the air cleaner, it is suitable to remove and thoroughly clean the suction chamber and air valve.



**Fig. 116 Throttle position**

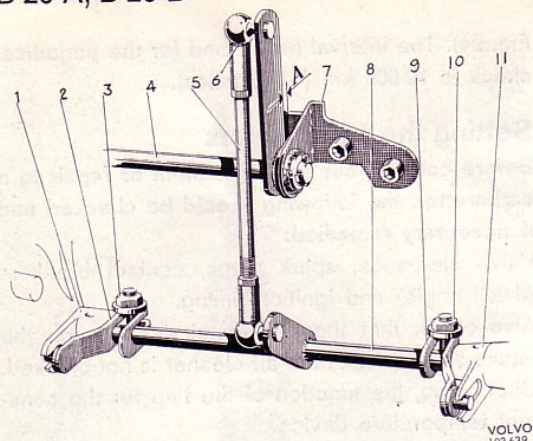
- Throttle position at low output      Fully open throttle
- |                    |         |                      |
|--------------------|---------|----------------------|
| 1 Primary throttle | 2 Valve | 3 Secondary throttle |
|--------------------|---------|----------------------|
- "A" = 2.7–4.3 mm (0.11–0.17")



**Fig. 117 Throttle spindle sealing**

- |               |
|---------------|
| 1 Rubber seal |
|---------------|
- "B" = 4.5–5.0 mm (0.18–0.20")

## B 20 A, B 20 B



**Fig. 118 Intermediate shaft and levers**

A = Clearance between stop and lever

- |                                 |                               |
|---------------------------------|-------------------------------|
| 1 Lever on throttle spindle     | 7 Bracket                     |
| 2 Lever on intermediate spindle | 8 Intermediate shaft          |
| 3 Lock nut                      | 9 Lever on intermediate shaft |
| 4 Control shaft                 | 10 Lock nut                   |
| 5 Link rod                      | 11 Lever on throttle spindle  |
| 6 Lock wire                     |                               |

At the same time, the float chambers should be cleaned. This is facilitated by removing the float-chamber covers.

### BASIC SETTING (ZERO-SETTING) OF CARBURETTORS

The basic setting should always be the reference point for the final setting.

- Place a feeler gauge 0.5 mm (0.02") at "A" Fig. 118, between the lever and its stop. Screw out the fast-idle stop and throttle stop screws so that the throttles are closed completely.
- Release the nuts (3 and 10, Fig. 118) and carefully press the outer end of the levers (2, 9) on the intermediate shaft downwards so that the flange pins make smooth contact with the lower tooth on the levers (1, 11) of the throttle spindles.  
**N.B.** Do not press so hard that the primary throttle is influenced. Tighten the nuts (3, 10) in this position. Make sure that the intermediate shaft can be pushed forwards and backwards a little. It must not jam due to, for example, the levers (2, 9) being fitted too near the carburetors.
- Remove the feeler gauge. Then check by lifting the lever at "A" that both the primary throttles are influenced simultaneously.

- Turn the throttle stop screws so that they just touch the throttle levers when the throttles are closed. Then screw in them 1 1/2 turns.
- Unless rough adjustment of the jet is carried out according to point 6 under "Checking and assembling the carburetors", this should be done by screwing in the jet so far that it just touches the air valve when the latter rests on the bridge. From this position screw out the adjusting nut 15 hex flats.
- Fill the carburettor damping cylinders with oil. The spindle in the valve should be filled to about 1/4" from the upper edge with oil which is approved as "Oil for Automatic Transmissions, type A".  
Compare with Fig. 94.

### SETTING THE FUEL/AIR MIXTURE AND IDLING SPEED

The best setting of the carburetors is obtained by using a CO-meter. However, the setting can be carried out without a CO-meter, but if there is uncertainty about the correct CO-value obtained, a CO-meter should be used.

### SETTING WITHOUT CO-METER

The setting should be made at a temperature of 15 to 25° C ((60 to 80° F) and must be made within 1-3 minutes after the coolant thermostat has opened. Warming-up should be done with a completely cold engine.

- Connect a tachometer and run the engine warm to 1500 r.p.m. until the coolant thermostat opens. (Feel the radiator at the open radiator hose which suddenly becomes warm.)
- Adjust the engine speed to 800 r.p.m. with the throttle stop screws.  
**N.B.** Screw equally for both carburetors. Check that the carburetors have the same air valve lift. This is easily checked by measuring with the eye the distance between the carburettor housing bridge and the air valve. This distance should be the same for both carburetors. More accurate synchronizing is not required.
- From the basic setting (15 hex flats) on each carburettor, adjust the fuel/air mixture for the rear carburettor until max. idling speed is obtained.  
**N.B.** If more than four hex flats are required to reach the max. idling speed, adjust also the front carburettor in order to avoid getting too

large an unbalanced setting. Then screw the nut on the rear carburettor inwards (leaner mixture) until the engine speed just begins to drop. This is the correct setting. As a checking measure, screw the nut inwards a further hex flat. The speed should then drop by 25–50 r.p.m. Screw back the nut a hex flat (to the position where the speed just starts to fall.)

4. Subsequently adjust the idling speed to:
  - 800 r.p.m. for a mechanical gearbox
  - 700 r.p.m. for an automatic transmission.

#### SETTING WITH CO-METER

The setting should be made at a temperature of 15 to 20° C (60 to 80° F) and must be made within 1–3 minutes after the coolant thermostat has opened. Warming-up should be done with a completely cold engine.

When measuring with a CO-meter, it is important that the carburettor temperature is the correct one. When the engine is idling, the floatchamber is exposed to heat radiation from the exhaust manifold while the flow of cold fuel through the floatchamber is small. The resultant rise in temperature causes an increase in the flow through the jet due to the alteration in the viscosity and the increase in the CO-value. Raising the engine speed cools the carburettor to a certain extent due to the step up in the fuel flow. The temperature can be checked to make sure that it is not excessive by feeling the floatchamber with the hand. It should "feel cold", that is, it more or less should not exceed room temperature.

In order to be certain that the measured CO-value is correct, measuring should be carried out within the time period mentioned above.

There are a number of different types of CO-meters available which function with acceptable accuracy. The instructions on their use accompany each meter. Note that when connecting the hose for evacuating the exhaust gases, the hose must not be placed so that the exhaust gases are completely evacuated from the CO-meter connection to the exhaust manifold. A funnel, see Fig. 98, could suitably be used here. With the funnel installed, the suction at the connection would not be so great as to upset the measuring but sufficient to suck up the exhaust gases so that they do not fill the workshop. When doing any measuring with the CO-meter, it is important that the

exhaust pipe and silencer are in good condition, that is, they do not leak.

1. Connect a tachometer and a CO-meter. Run the engine warm to 1500 r.p.m. until the coolant thermostat opens. (Feel the radiator at the upper radiator hose, which should suddenly become warm.)
2. Adjust the engine speed to 800 r.p.m. with the throttle stop screws.

**N.B.** Screw equally for both carburettors. Check that the carburettors have the same air valve lift. This is easily checked by measuring with the eye the distance between the carburettor housing bridge and the air valve. The distance should be the same for both carburettors. More accurate synchronization is not required.

3. From the basic setting (15 hex flats on each carburettor), adjust the fuel/air mixture until a CO-value of 2.5–3.5 % is obtained. Adjust equally for both carburettors.
4. Subsequently adjust the idling speed to:
  - 800 r.p.m. for a mechanical gearbox
  - 700 r.p.m. for an automatic transmission

#### ADJUSTING THE CHOKE AND RAPID IDLING

1. Adjust the choke control so that the front carburettor jet starts to drop when the choke control on the dashboard is pulled out 20 mm (3/4") and the rear carburettor jet starts to drop when the choke control is pulled out 30 mm (1 1/8").
2. The throttle stop screws are adjusted with the choke control fully pushed in. For the front carburettor, the distance between the throttle stop screw and the cam disc should be 0.1–0.3 mm (0.004–0.012") and for the rear carburettor 0.3–0.5 (0.012–0.020").

#### ADJUSTING THE ACCELERATOR PEDAL

The length of the long, vertical link for the pedal is adapted so that there is a clearance of 1 mm (0.04") between the throttle lever lug and the full throttle stop on the carburettors, when the accelerator pedal is fully depressed. With a fully depressed pedal, the force of the driver's foot is taken up by the toe-plate without imposing unnecessary loading on the throttle control.

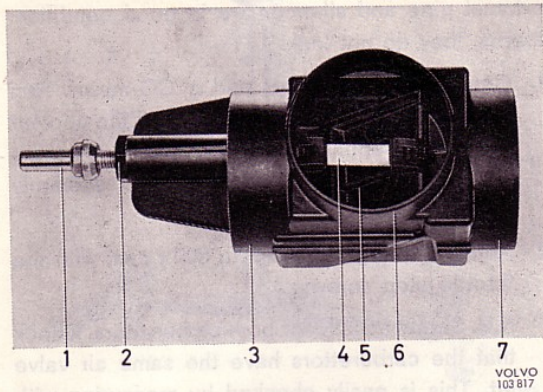


Fig. 119 Constant air temperature device flap

- |                          |                   |
|--------------------------|-------------------|
| 1 Thermostat             | 5 Flap            |
| 2 Lock                   | 6 Warm-air intake |
| 3 Air cleaner connection | 7 Cold-air intake |
| 4 Flap control           |                   |

### FLAP HOUSING FOR CONSTANT AIR TEMPERATURE DEVICE

If the flap (5, Fig. 119) does not open, there will be too high a temperature for the intake air and this will have a negative effect on the engine.

The flap location can be checked with the flap housing fitted in position. A small tab (see 3, Fig. 120) on the flap spindle projects from both sides of the housing. The longitudinal pin for these tabs coincides with that of the spindle and turns parallel with the spindle. In other words, the location of the flap can be seen at different temperatures by comparing the angle of a tab in relation to the stops outside the housing. (On a number of early prod. flaps there are no tabs. These have instead a scribed mark.)

The thermostat can be checked in lukewarm water. The flap should be closed for cold air at 20 to 25° C (70 to 80° F) and closed for warm air at 35 to 40° C (95 to 105° F). If correct function is not obtained, change the flap housing with thermostat complete.

### AIR CLEANER

The air cleaner on the B 20 A should be changed every 40 000 km (25 000 miles) unless the driving conditions are severe, in which case replacement should take place more frequently.

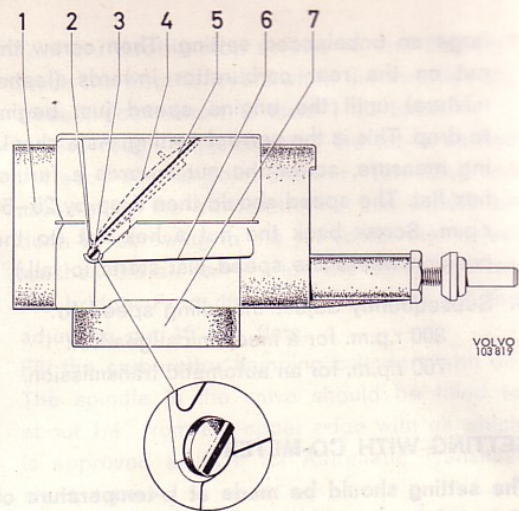


Fig. 120 Checking the flap function

- 1 Cold-air intake
- 2 Flap spindle
- 3 Tab
- 4 Flap
- 5 Stop for marking flap position at temp. below 20–25° C (58–77° F)
- 6 Stop for marking flap position at temp. above 35–40° C (95–104° F)
- 7 Warm-air intake

The insert in the air cleaner on the B 20 B should be changed every 40 000 km (25 000 miles). However, the same principle applies here as in the previous paragraph.

No cleaning of any kind should be done between the changes.

**On no condition must the insert be moistened or oiled.**

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

### AIR CLEANER WITH FOAM PLASTIC SLEEVE (see Fig. 89):

Normally the foam plastic sleeve should be washed or changed after every 20 000 km (12 500 miles). Abnormal fuel consumption or a weak engine may be signs of a blocked air cleaner, in which case the foam plastic sleeve should be replaced and even the paper filter, irrespective of the distance driven.

Normally a foam plastic sleeve can be washed or changed three times, when even the paper filter

must be replaced. Under special circumstances, the paper filter can also be cleaned (but **not**, however, washed).

**Cleaning the foam plastic sleeve:**

Remove the foam plastic sleeve and shake out the particles. The sleeve is then placed in a bath containing one of the following solutions:

- a) Warm soapy water
- b) Warm water with a non-lathery or a low-lather washing agent (dish washing)
- c) Paraffin
- d) Fuel oil

The sleeve should be squeezed in the solution until it is clean, and then rinsed in clean water and dried, but not under direct heat.

**Cleaning the paper filter:**

The paper filter is cleaned by simply tapping the top and bottom against a flat base. Take care when doing this not to damage the paper folds.

**Oiling the foam plastic sleeve:**

Before refitting the foam plastic sleeve, dip it in 15 cm<sup>3</sup> oil SAE 30. Squeeze the sleeve in the oil until it is thoroughly permeated. Any surplus oil can be removed by rolling the sleeve in a clean cloth.

**Fitting the foam plastic sleeve:**

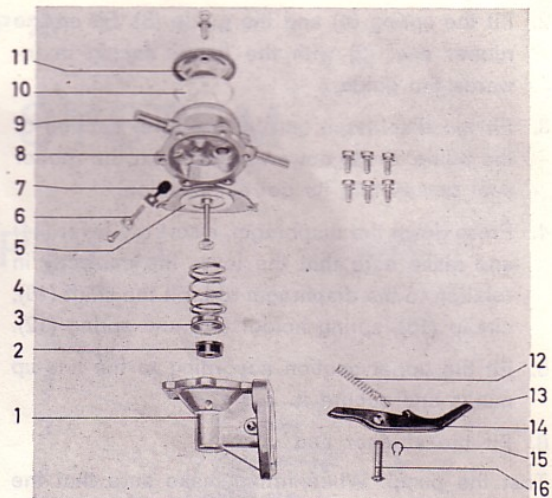
The foam plastic sleeve is fitted on the paper filter without touching the paper folds. The bevel edges of the sleeve should lie above the filter edges round the entire circumference.

**FUEL PUMP**

**Pierburg**

**DISMANTLING**

1. Make line-up marks on the upper and lower sections. Remove both the upper and lower sections.
2. Remove a circlip (15, Fig. 121) from the lever shaft (16). Press out the shaft. Pull out the lever (14) and the spring (12).
3. Remove the diaphragm with spring (4), the guide (3) and the rubber seal (2). The spring can be removed after the rubber seal has been levered over the nylon washer.



**Fig. 121 Fuel pump, Pierburg**

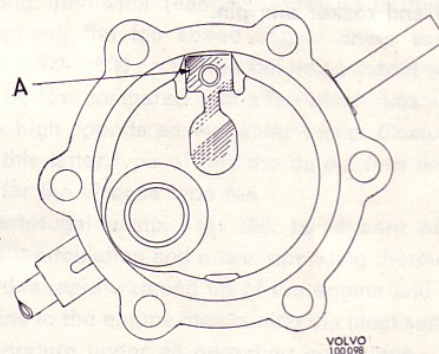
- |                      |                      |
|----------------------|----------------------|
| 1 Lower pump housing | 9 Inlet pipe         |
| 2 Rubber seal        | 10 Strainer          |
| 3 Guide              | 11 Cover with gasket |
| 4 Diaphragm spring   | 12 Return spring     |
| 5 Diaphragm          | 13 Spring holder     |
| 6 Stop arm           | 14 Lever             |
| 7 Spring             | 15 Circlip           |
| 8 Upper pump housing | 16 Lever shaft       |

4. Remove the screw on the underside of the lower section, take out the stop arm (6) and the spring valve (7). The exhaust valve cannot be removed.

Check the parts for wear.

**ASSEMBLING**

1. Fit the spring according to Fig. 122 and the stop arm. Tighten the screw sufficiently so that the spring fits well against the pump housing.



**Fig. 122 Location of leaf spring**

A Recess

## B 20 A, B 20 B

2. Fit the spring (4) and the guide (3). Fit on the rubber seal (2) with the flange facing in towards the guide.
3. Fit the diaphragm unit in the lower section of the pump. Press downwards so that the rubber seal comes into its correct position.
4. Press down the diaphragm, insert the lever (14) and make sure that the lever fits correctly in relation to the diaphragm rod. Fit the shaft (16), circlip (15), spring holder (13) and spring (12).
5. Fit the upper section according to the line-up marks and secure it.
6. Fit the strainer and cover.

Test the pump. When fitting make sure that the lever fits correctly above its cam.

## Fuel pump AC

### DISMANTLING

1. Remove the cover.
2. Make line-up marks on the upper and lower sections of the pump and dismantle them.
3. Remove the diaphragm by turning it a 1/4 of a turn.
4. Remove the spring (15, Fig. 123) by turning the washer (6) so that the hole in the washer coincides with the wide end of the diaphragm rod.
5. Remove the peening for the rocker arm rider (17) with, for example, a grinding rod, and remove the rocker arm (1) with pin (2) and lever (4).
6. Pull out the rocker arm pin. Check the parts for wear.

### ASSEMBLING

1. Assemble the link arm, rocker arm with washers (3) and rocker arm pin.

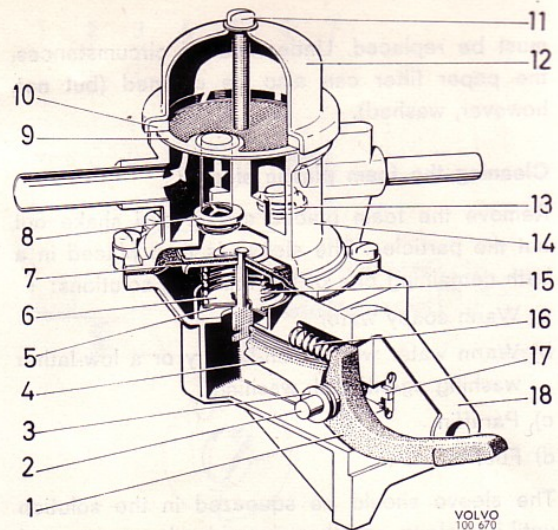


Fig. 123 Fuel pump, AC

1 Rocker arm	10 Gasket
2 Pin	11 Screw with washer
3 Washer	12 Cover
4 Lever	13 Outlet valve
5 Rubber seal	14 Upper pump housing
6 Washer	15 Diaphragm
7 Diaphragm	16 Return spring
8 Inlet valve	17 Rider
9 Strainer	18 Lower pump housing

2. Insert the linkage system with return spring (16) into the housing.
3. Fit and lock the riders in the housing by peening with a suitable drift.
4. Assemble the diaphragm, spring and washers. Place the unit in position and put together the upper and lower sections and then fit on the cover.

Test the pump. When installing make sure that the lever takes up its correct position above the cam.

## GROUP 25

## COOLING SYSTEM

## DESCRIPTION

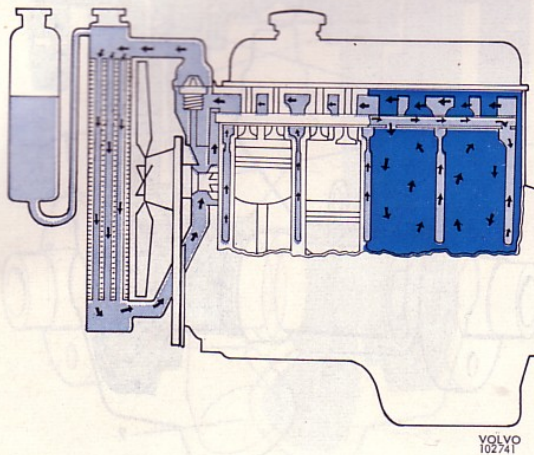


Fig. 124 Sealing cooling system

## GENERAL

The engine is water-cooled and the cooling system is of the sealed type, see Fig. 124. The B 20 A engine is fitted with a fixed fan. A speed-regulated fan (does not apply to models 1300 and 1800, which have a fixed fan), a so-called viscous type (see Fig. 125), is fitted on the B 20 B unit. Its function is to ensure that the fan blades do not exceed a certain speed even if the engine speed is exceeded. See Fig. 131. The five fan blades are mounted asymmetrically to keep down the noise level. The fan coupling consists of the casing (11, Fig. 125) in which the plastic fan blades (12) are secured with the bolt (2). The casing (11) has two halves which, however, cannot be separated for repairs, the fan coupling then being replaced complete. The hub (8) has a light fit on the water pump flange (6) and is locked by means of the centre bolt (7). The hub is provided with a slip disc of friction material (9) surrounded by oil. During idling and at low speeds, slipping is insignificant, so that the fan provides an air current for good cooling. When the ingoing speed (that of

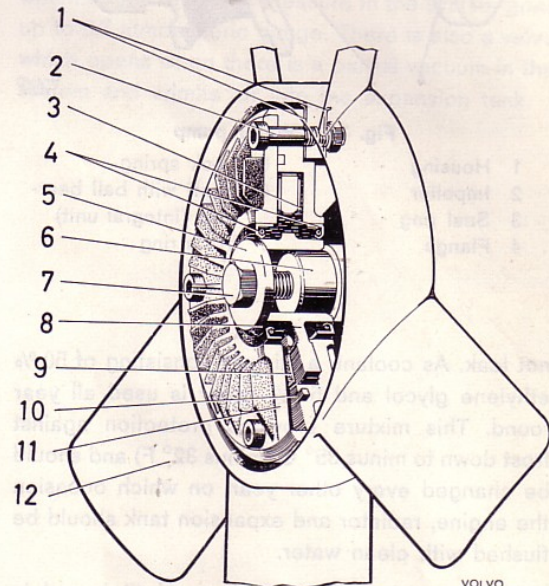


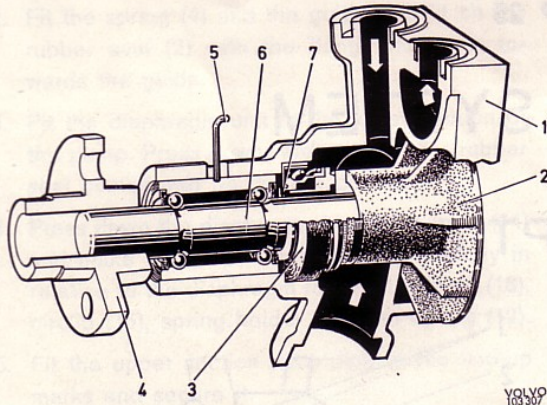
Fig. 125 Viscous fan

- |                      |                     |
|----------------------|---------------------|
| 1 Washers            | 7 Centre bolt       |
| 2 Bolt               | 8 Hub               |
| 3 Oil                | 9 Friction material |
| 4 Seals              | 10 Rubber ring      |
| 5 Washer             | 11 Casing           |
| 6 Flange, water pump | 12 Fan blade        |

the water pump) exceeds about 2600 r.p.m., the slipping increases (see Fig. 131). With this arrangement, the fan speed should never exceed about 3000–3500 r.p.m. The fan noise output would then be low compared with a fan which runs at the same high speeds as the water pump. Compared with this latter type of fan, the output loss will be less for the viscous type fan.

A centrifugal pump, Fig. 126, takes care of the coolant circulation and a twin operating thermostat provides rapid warming up of the engine and contributes to the engine maintaining the most suitable temperature under all operating conditions.

In order to achieve the desired effect with the sealed cooling system, it must be well filled and



**Fig. 126 Water pump**

- |             |                                            |
|-------------|--------------------------------------------|
| 1 Housing   | 5 Lock spring                              |
| 2 Impeller  | 6 Shaft with ball bearings (integral unit) |
| 3 Seal ring | 7 Wear ring                                |
| 4 Flange    |                                            |

not leak. As coolant, a mixture consisting of 50 % ethylene glycol and 50 % water is used all year round. This mixture provides protection against frost down to minus 35° C (minus 32° F) and should be changed every other year, on which occasion the engine, radiator and expansion tank should be flushed with clean water.

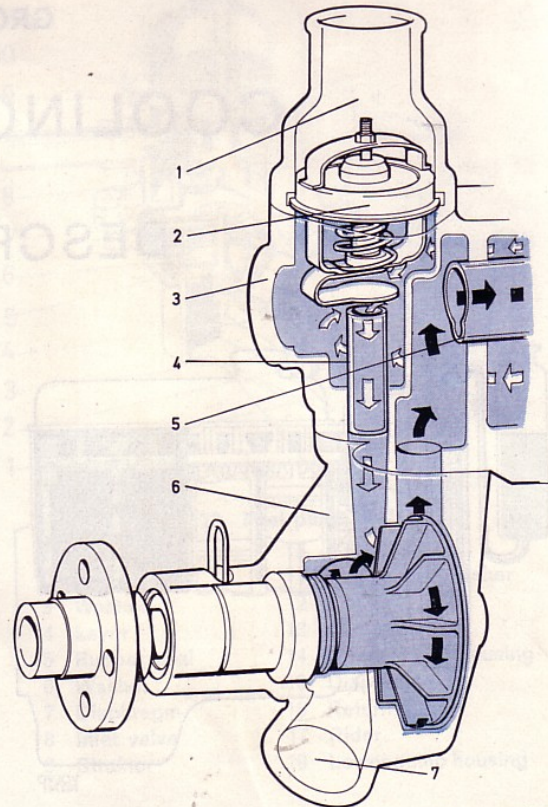
If Volvo anti-frost for cars is used (it is red in colour), it should not be mixed with other types of anti-frost.

### COOLING SYSTEM INNER CIRCUIT (BY-PASS)

The cooling system consists of two circuits, an inner and an outer one.

When the engine is warming up and in very cold weather when large quantities of heat are required for warming up the inside of the car, the coolant circulates almost exclusively through the inner circuit (the by-pass). This circuit covers the engine and car heater. The thermostat is closed, that is, the outlet to the radiator is shut off. The coolant passes through the thermostat by-pass to the distributor pipe (5, Fig. 127) in the cylinder head. This results in a uniform cooling of the warmest parts in the cylinder head. Even the parts around the spark plugs are also cooled and thereby maintained at a constant temperature. The coolant surrounding the cylinder walls is circulated by means of thermo-syphon action.

2-64



**Fig. 127 Coolant flow, thermostat closed**

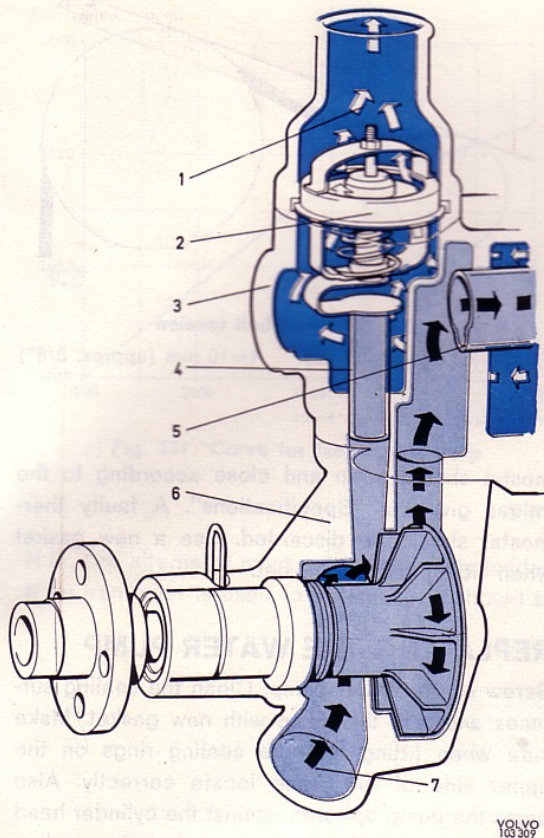
- |                 |                    |
|-----------------|--------------------|
| 1 To radiator   | 5 Distributor pipe |
| 2 Thermostat    | 6 Water pump       |
| 3 Cylinder head | 7 From radiator    |
| 4 By-pass pipe  |                    |

### COOLANT SYSTEM OUTER CIRCUIT

When the coolant in the inner circuit reaches a suitable temperature for the engine, the thermostat begins to open, during which time the by-pass between the thermostat housing and the pump gradually closes, see Fig. 128.

Coolant flows from the engine into the upper part of the radiator, is cooled and then sucked by the pump out from the lower part of the radiator from where it is conveyed into the engine through the distributing pipe.

An air cushion forms in the upper part of the expansion tank and permits the coolant to expand without involving any loss of coolant so that there is air suction at reduced temperature and volume. This arrangement ensures that the cooling system is always filled with coolant, thus minimizing the risk of corrosion.



**Fig. 128 Coolant flow, thermostat open**  
Concerning numbers above, see previous figure

When the cooling system is being topped up, it will probably be difficult to prevent air from entering this system. The air, however, is subsequently separated and forced out into the expansion tank where it is replaced by coolant from this tank. It is, therefore, important to check the coolant level after the system has been emptied and filled with new coolant.

The expansion tank cap is provided with a valve which opens when the pressure in the system goes up to 0.7 atmospheric gauge. There is also a valve which opens when there is a partial vacuum in the system and admits air into the expansion tank.

## REPAIR INSTRUCTIONS

### RADIATOR

#### Topping up with coolant

Topping up with coolant, consisting of 50 % ethylene glycol and 50 % water (all year round) is done in the expansion tank, when the level has fallen to the "Min" mark.

N.B. Never top up with water only.

#### Draining the cooling system

To drain the cooling system, open a cock on the engine and remove the lower radiator hose. The expansion tank is emptied by first taking it off its mounting and holding it at a sufficient height so that the coolant runs into the radiator. Another way to empty the tank is by turning it upside down.

#### Filling empty system with coolant

Before filling, flush the cooling system with clean water. When filling with coolant (see above), through the filler opening on top of the radiator, the heater control should be set at max. heat. Fill the radiator to the top and fit the cap. Fill also the expansion tank to the "Max" mark or to max. 30 mm (1/8") above this mark. Run the engine for several minutes at different speeds. If necessary, top up with more coolant and then fit the expansion tank cap. After driving for a short time, check the coolant level and top up with more coolant since it takes some time before the system is completely devoid of air.

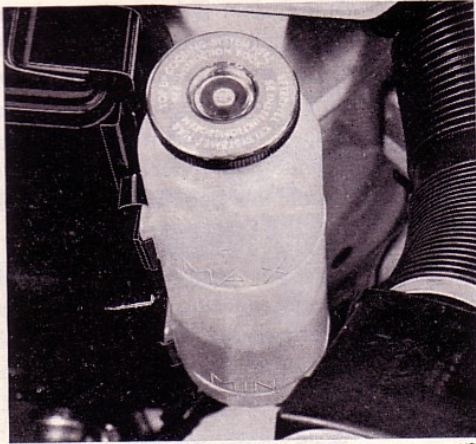


Fig. 129 Expansion tank

### Cooling system leakage check

The cooling system is checked for leakage as follows: Remove the expansion tank cap and make sure that the filling hole and sealing surface are clean. Connect a cooling system pressure tester to the filling hole according to the instructions of the manufacturer. Make sure that the rubber bush (if one is fitted) faces correctly. Carefully pump up the pressure to 0.7 kg/cm<sup>2</sup> (10 lb./sq.in.). Observe the pressure tester gauge. The pressure must not drop noticeably during 30 seconds. If it does, examine and remedy the leakage.

### Replacing the radiator

1. Remove the radiator cap and drain the coolant from the system by disconnecting the lower radiator hose.
2. Remove the expansion tank with hose and empty out the coolant. Remove the upper radiator hose.
3. Remove the bolts for the radiator and fan casing. Lift off the radiator.
4. Place the radiator in position and tighten the bolts for the radiator.
5. Fit the radiator hoses as well as the expansion tank with hose.
6. Fill with coolant, see under "Filling empty system with coolant". Start the engine and check for leakage.

### THERMOSTAT

After being removed, the thermostat can be tested in a vessel containing heated water. The ther-

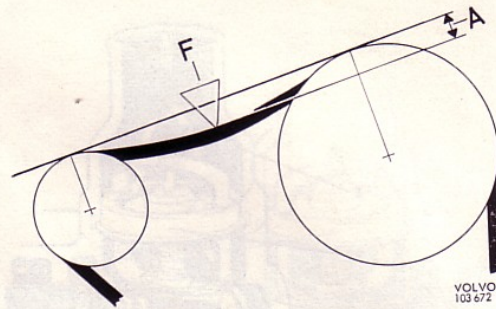


Fig. 130 Fan belt tension

F=5.6–7.6 kg (12–17 lb.) A=10 mm (approx. 3/8")

mostat should open and close according to the values given in "Specifications". A faulty thermostat should be discarded. Use a new gasket when fitting the thermostat.

### REPLACING THE WATER PUMP

Screw off the water pump. Clean the sealing surfaces and refit the pump with new gasket. Make sure when fitting that the sealing rings on the upper side of the pump locate correctly. Also press the pump upwards against the cylinder head extension under the bolting, so that the sealing between the pump and cylinder head will be satisfactory. Make sure that the sealing rings at the water pipes are not damaged and press in the pipes well when attaching.

Note that the sealing rings for the B 20 A engine are thicker (9.5 mm=0.4") than those for the B 20 B unit (8.5 mm=0.3"). The dimensions apply to new rings.

### TENSIONING THE PULLEY BELT

The pulley belt tension should be such that it can be deflected 10 mm (approx. 3/8") with a force of 5.6–7.6 kg (12–17 lb.) applied to the belt in the middle between the water pump pulley and alternator pulley (see Fig. 130).

The amount of force applied will depend on the location of the bolt in the oblong slot in the tensioner. With the bolt at the end of the slot (long belt), the force applied should be 5.6 kg (12 lb.); and with the bolt at the beginning of the slot (short belt), a force of 7.6 kg (17 lb.) should be applied. If the bolt is located anywhere between these extremes, the force applied should be proportionally within the two limits given.

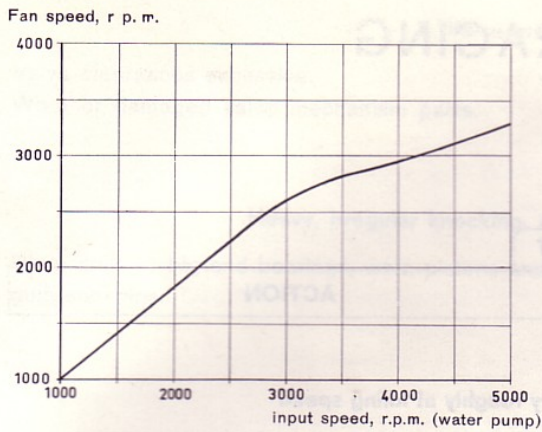


Fig. 131 Curve for fan coupling slip

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N.B. The alternator must not be obliquely loaded. If an iron lever is used for adjusting, it should be

placed between the engine and the **front alternator end**.

Note that if the lower alternator bolt is not slackened when adjusting, there will be heavy stresses on the drive end bearing shield.

On fitting a new belt, final tensioning should be carried out after driving for about 10 minutes. This will ensure a longer lifetime for the pulley belt.

### FAN COUPLING

The fan coupling function can be checked with a stroboscope with variable blinking frequency. Make a mark on the fan and one on the water pump pulley. Find out the speed relationship between fan and pulley by means of the stroboscope. The fan speed should follow the speed of the water pump according to the curve given in Fig. 131.

# FAULT TRACING

FAULT	
REASON	ACTION

### The engine stalls or runs very roughly at idling speed

<p>Faulty spark plug or suppressor. Air leaks at carburettor connections.</p> <p>Idling speed too low. Dirt in carburettor. Faulty temperature compensator.</p>	<p>Check or replace spark plug or suppressor. Check for tightness. Replace faulty gaskets and washers. Increase the idling speed. Clean carburettor. See under "Temperature Compensator".</p>
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### The engine does not reduce speed at idling

<p>Leaking by-pass valve.</p>	<p>Check the by-pass valve, adjust or replace it.</p>
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### The engine runs jerkily (may spit) during acceleration

<p>Dirty spark plug insulators. Faulty spark plugs. Dirty, faulty or moist distributor cap. Damaged or damp cables. Dirt in carburettors.</p> <p>Fuel/air mixture too lean. Faulty fuel pump, supplies too little fuel. Too low damper oil level or faulty damper plunger clearance.</p>	<p>Clean the insulators. Check or replace spark plugs. Remove and clean or change the distributor cap. Check, clean or replace cables. See also Part 3. Remove the floatchamber and needle valve and clean them. Check carburettor settings. Check fuel pump pressure and capacity. See under "Damper Device".</p>
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### Weak engine

<p>Air cleaner blocked. Poor fuel being used, too low octane rating. Faulty ignition setting.</p> <p>Faulty carburettor setting. Faulty valve clearances. Low compression on a cylinder.</p> <p>Seizing piston. Binding wheel bearings or badly adjusted brakes.</p>	<p>Fit new insert and cleaner resp. Check fuel grade, use correct fuel. Adjust the ignition setting with stroboscope. See under "Ignition setting". Check and adjust the carburettor setting. Check and adjust the valve clearances. Measure the compression measure. If the value is too low, remove the cylinder head for closer examination of the engine. Remove the cylinder head and investigate. See Part 5.</p>
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**Valve mechanism knocks**

Valve clearances excessive.  
Worn or damaged valve mechanism parts.

Adjust the valve clearances.  
Recondition or replace parts where necessary.

**Heavy, irregular knocking, more obvious when engine is on load**

Worn main or big-end bearings, worn pistons and gudgeon pins.

Locate the sound by short-circuiting the spark plugs one after another.  
Then dismantle as far as required to examine the bearings and the pistons.

**Low oil pressure**

Blocked oil filter. (The engine must run for a longer time than usual after starting before pressure is registered.)  
Low pressure at minimum idling, after hard driving.

Replace the oil filter.

Faulty oil pressure contact, pressure gauge or pipe.  
Faulty spring in relief valve or worn oil pump.  
One or more bearings worn.  
Excessive wear generally.

No action required. The pressure is normally rather low under these conditions.  
Measure the pressure with reference pressure gauge. Replace parts that are faulty.  
Remove the oil pump, check the spring and pump.  
Examine and replace the bearing shells.  
Replace or recondition the engine.

**High oil consumption**

Hard driving.  
  
Leakage at joints.  
  
Oil level too high.  
  
Worn valve guides.  
Worn piston rings.

No action necessary. Oil consumption can increase to a certain extent when the car is driven very hard.  
Tighten bolts and screws, replace faulty or poor gaskets and washers all round.  
Do not top up with oil until the level starts to go down towards the lower mark on the dipstick.  
Recondition the valve system.  
Replace the piston rings.

**High fuel consumption**

Hard driving on motorways or much town driving.  
  
Blocked air cleaner.  
Flooding carburettor.  
  
Faulty carburettor setting, too rich fuel/air mixture.  
Poor suppressors or spark plugs. Faulty contact breaker points.  
Faulty dwell angle and ignition timing.

No action necessary. This oil consumption is normal under these conditions.  
Replace the blocked air cleaner.  
Check and if necessary replace the float valve.  
Check also the fuel pump pressure.  
Adjust the setting.  
Replace the spark plug suppressors. Adjust the distributor.  
Adjust the dwell angle and ignition timing. Use a stroboscope for adjustment of the ignition timing.

**Engine runs abnormally warm**

Not enough coolant.  
Poorly tensioned fan belt.  
The fan coupling slips too much.  
Faulty temperature gauge.

Fuel has too low an octane rating (knocking).  
Faulty thermostat.  
Faulty ignition setting.

Faulty carburettor setting (too lean fuel/air mixture).  
Blocked cooling system.  
Blocked cooling jacket or distributor pipe in the cylinder head. Distributor pipe may be insufficiently run-in.

Fill up with coolant.  
Adjust the tension.  
Check the fan coupling function.  
Check and if necessary replace the temperature gauge.

Fill up with fuel of correct octane rating.  
Replace the thermostat.  
Check and adjust the ignition setting with the help of a stroboscope.  
Adjust the carburettor setting.

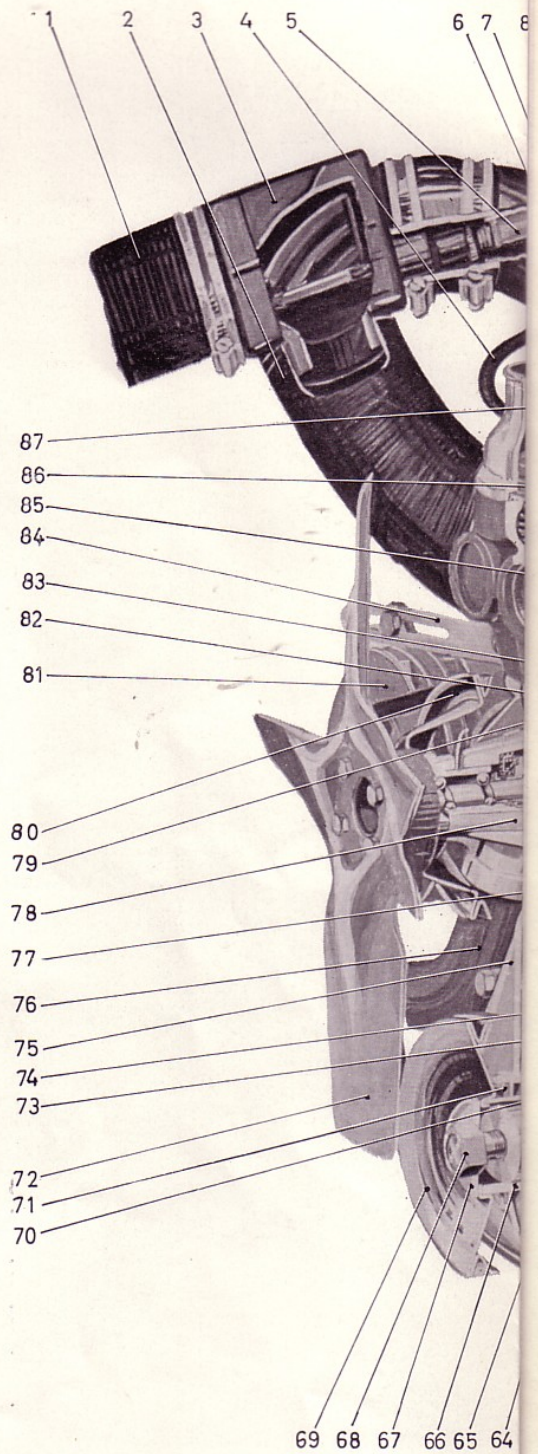
Clean out the cooling system.  
Measure the coolant temperature at the outlet to the right of the thermostat and at the outlet for the temperature gauge, at the rear of the cylinder head. If a high temperature at the outlet for the temperature gauge at the rear is obtained, the cylinder head should be removed for examination

**Coolant losses**

Leaking hose connections.  
Faulty radiator cap.  
Worn cylinder head gasket (oil in coolant).

Check or replace hoses and hose clips.  
Replace the radiator cap.  
Replace the cylinder head gasket.

- |                                         |                            |
|-----------------------------------------|----------------------------|
| 1 Cold-air hose                         | 44 Reinforcing bracket     |
| 2 Warm-air hose                         | 45 Bush                    |
| 3 Flap, constant air temperature device | 46 Seal                    |
| 4 Fuel line                             | 47 Oil pump                |
| 5 Thermostat                            | 48 Main bearing cap        |
| 6 Valve guide                           | 49 Delivery pipe           |
| 7 Valve spring                          | 50 Main bearing shell      |
| 8 Washer                                | 51 Crankshaft              |
| 9 Valve collet                          | 52 Sump                    |
| 10 Exhaust valve                        | 53 Piston rings            |
| 11 Connection for crankcase hose        | 54 Connecting rod cap      |
| 12 Valve guide seal                     | 55 Connecting rod          |
| 13 Intake valve                         | 56 Camshaft                |
| 14 Oil filler cap                       | 57 Piston                  |
| 15 Carburettor                          | 58 Bush                    |
| 16 Damping device                       | 59 Big-end bearing shell   |
| 17 Air cleaner                          | 60 Gudgeon pin             |
| 18 Hose for crankcase gases             | 61 Washer                  |
| 19 Vacuum hose for distributor          | 62 Spacing ring            |
| 20 Choke wire                           | 63 Camshaft gear           |
| 21 Rocker arm                           | 64 Nut                     |
| 22 Rocker arm shaft                     | 65 Crankshaft gear         |
| 23 Spring                               | 66 Hub                     |
| 24 Push rod                             | 67 Washer                  |
| 25 Bearing bracket                      | 68 Bolt                    |
| 26 Rocker arm casing                    | 69 Pulley                  |
| 27 Rubber seal                          | 70 Key                     |
| 28 Cable terminal                       | 71 Seal                    |
| 29 Rubber seal                          | 72 Fan                     |
| 30 Cylinder head                        | 73 Oil nozzle              |
| 31 Vacuum hose                          | 74 Key                     |
| 32 Vacuum governor                      | 75 Timing gear cover       |
| 33 Distributor                          | 76 Coolant inlet           |
| 34 Condenser                            | 77 Gasket                  |
| 35 Valve tappet                         | 78 Water pump              |
| 36 Retainer                             | 79 Gasket                  |
| 37 Flywheel casing                      | 80 Pulley                  |
| 38 Cylinder block                       | 81 Alternator              |
| 39 Gear wheel                           | 82 Sealing ring            |
| 40 Pilot bearing                        | 83 Cylinder head gasket    |
| 41 Flywheel                             | 84 Tensioner               |
| 42 Flange bearing shell                 | 85 Water distributing pipe |
| 43 Sealing flange                       | 86 Thermostat              |
|                                         | 87 Coolant outlet          |



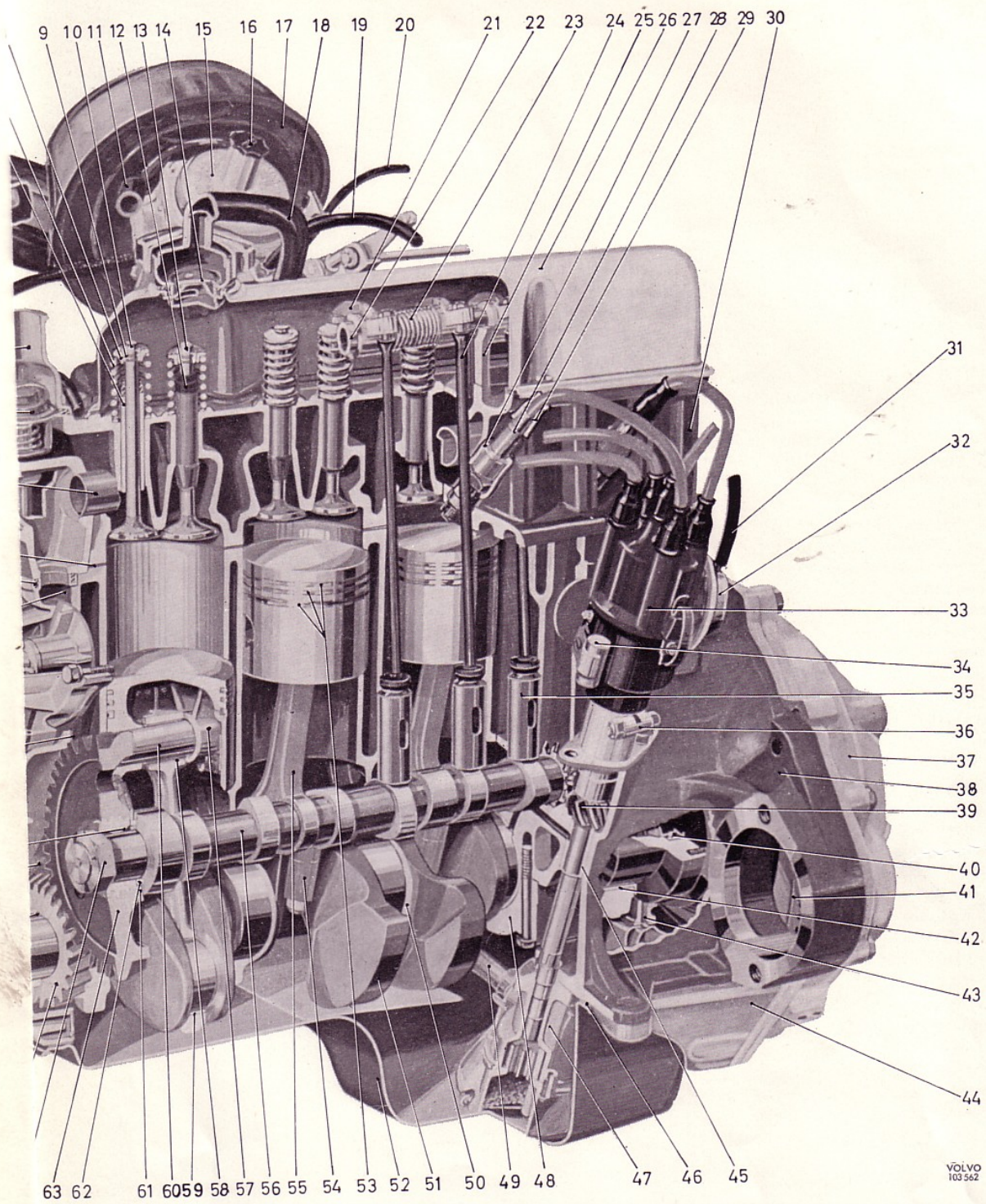
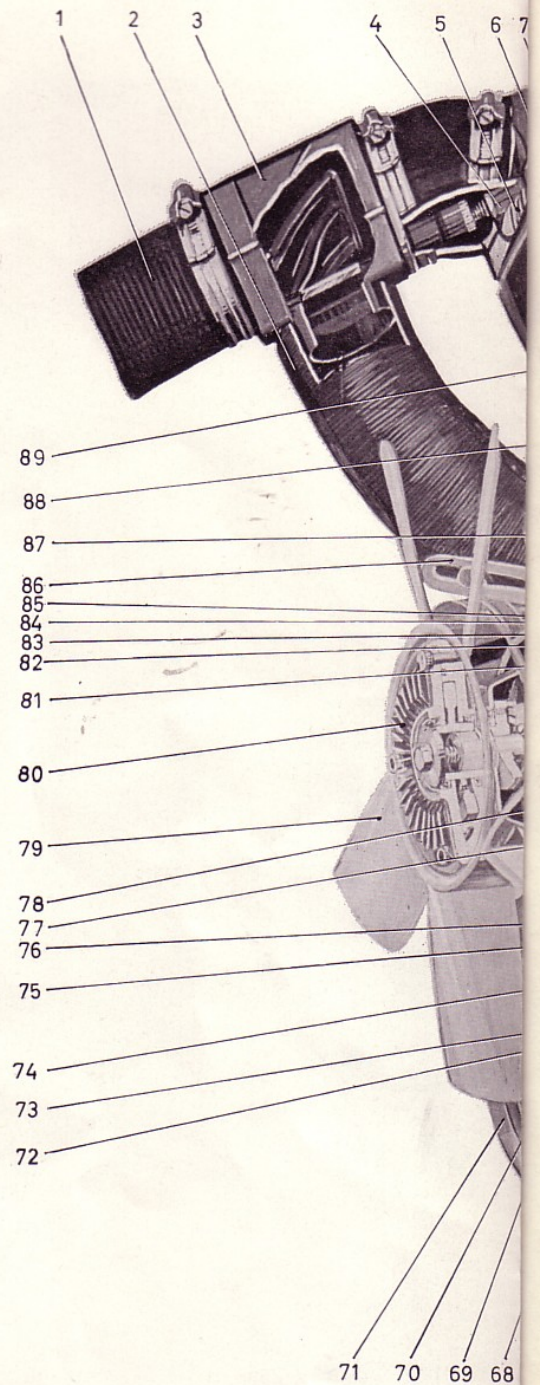


Illustration A. B 20 A engine

- |                                                  |                            |
|--------------------------------------------------|----------------------------|
| 1 Cold-air                                       | 45 Flywheel                |
| 2 Warm-air inlet                                 | 46 Flange bearing shell    |
| 3 Flap, constant air temperature device          | 47 Sealing flange          |
| 4 Thermostat                                     | 48 Reinforcing bracket     |
| 5 Air cleaner insert                             | 49 Gasket                  |
| 6 Air cleaner                                    | 50 Sump                    |
| 7 Choke wire                                     | 51 Oil pump                |
| 8 Valve guide                                    | 52 Main bearing cap        |
| 9 Valve spring                                   | 53 Crankshaft              |
| 10 Washer                                        | 54 Piston rings            |
| 11 Valve collet                                  | 55 Connecting rod          |
| 12 Exhaust valve                                 | 56 Connecting rod cap      |
| 13 Carburettor                                   | 57 Camshaft                |
| 14 Damping device                                | 58 Piston                  |
| 15 Hose connection for crankcase                 | 59 Connecting rod bush     |
| 16 Valve guide seal                              | 60 Big-end bearing shell   |
| 17 Hose for floatchamber ventilation             | 61 Gudgeon pin             |
| 18 Intake valve                                  | 62 Washer                  |
| 19 Fuel hose                                     | 63 Spacing ring            |
| 20 Hose connection for brake servo               | 64 Camshaft gear           |
| 21 Air cleaner hose for floatchamber ventilation | 65 Key                     |
| 22 Clamp                                         | 66 Nut                     |
| 23 Hose for crankcase gases                      | 67 Crankshaft gear         |
| 24 Choke wire                                    | 68 Hub                     |
| 25 Rocker arm                                    | 69 Washer                  |
| 26 Rocker arm shaft                              | 70 Bolt                    |
| 27 Spring                                        | 71 Pulley                  |
| 28 Thrust rod                                    | 72 Key                     |
| 29 Bearing bracket                               | 73 Seal                    |
| 30 Rubber seal                                   | 74 Oil nozzle              |
| 31 Cable terminal                                | 75 Timing gear casing      |
| 32 Rubber seal                                   | 76 Coolant inlet           |
| 33 Rocker arm casing                             | 77 Gasket                  |
| 34 Cylinder head                                 | 78 Water pump              |
| 35 Vacuum hose                                   | 79 Fan blade               |
| 36 Distributor                                   | 80 Fan coupling            |
| 37 Vacuum governor                               | 81 Gasket                  |
| 38 Flywheel casing                               | 82 Sealing ring            |
| 39 Condenser                                     | 83 Pulley                  |
| 40 Retainer                                      | 84 Cylinder head gasket    |
| 41 Valve tappet                                  | 85 Alternator              |
| 42 Cylinder block                                | 86 Tensioner               |
| 43 Gear wheel                                    | 87 Water distributing pipe |
| 44 Pilot bearing                                 | 88 Thermostat              |
|                                                  | 89 Coolant outlet          |



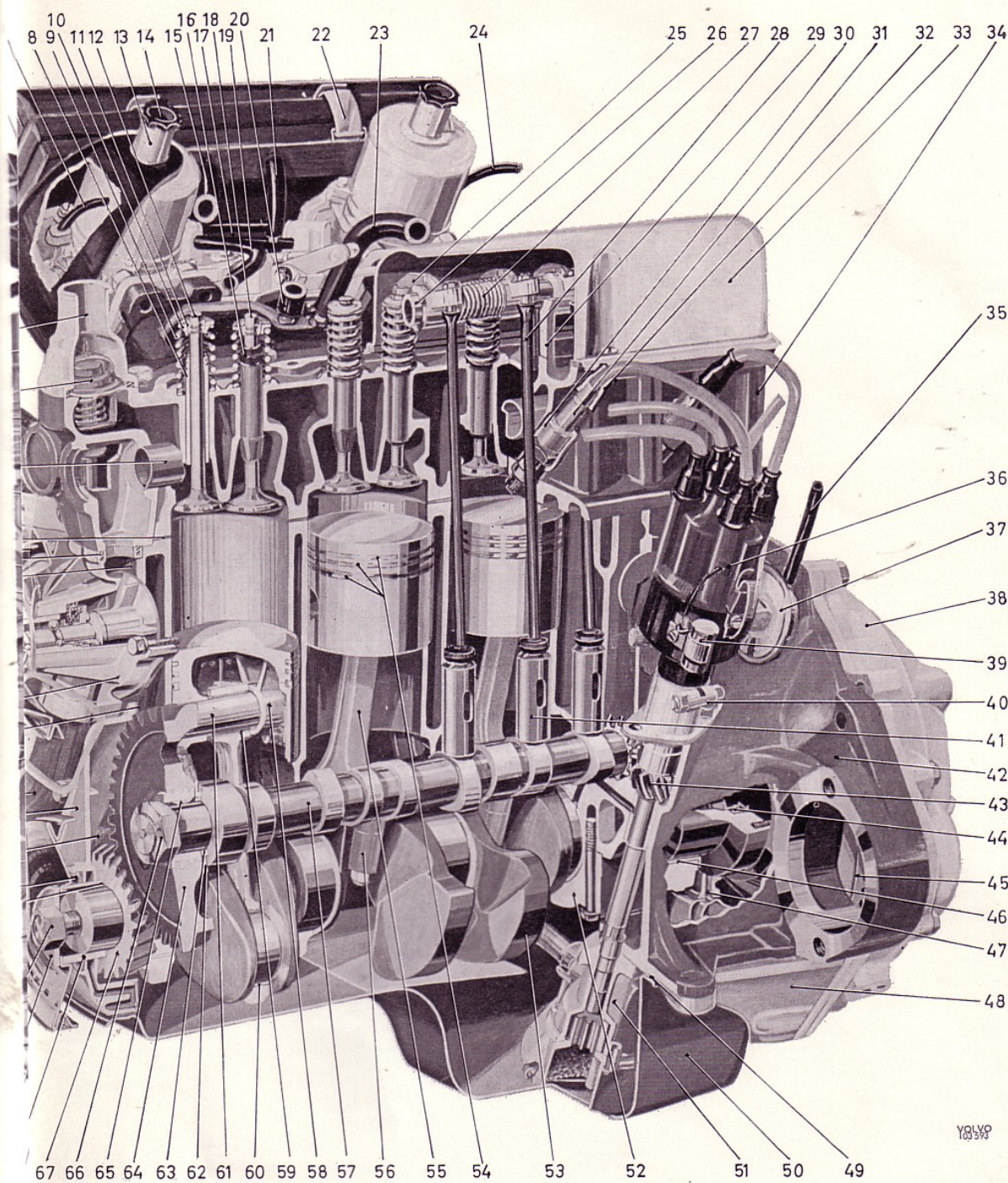


Illustration B. B 20 B engine (with SU-carburettors)

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## REFERENCES TO WORKSHOP BULLETINS

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