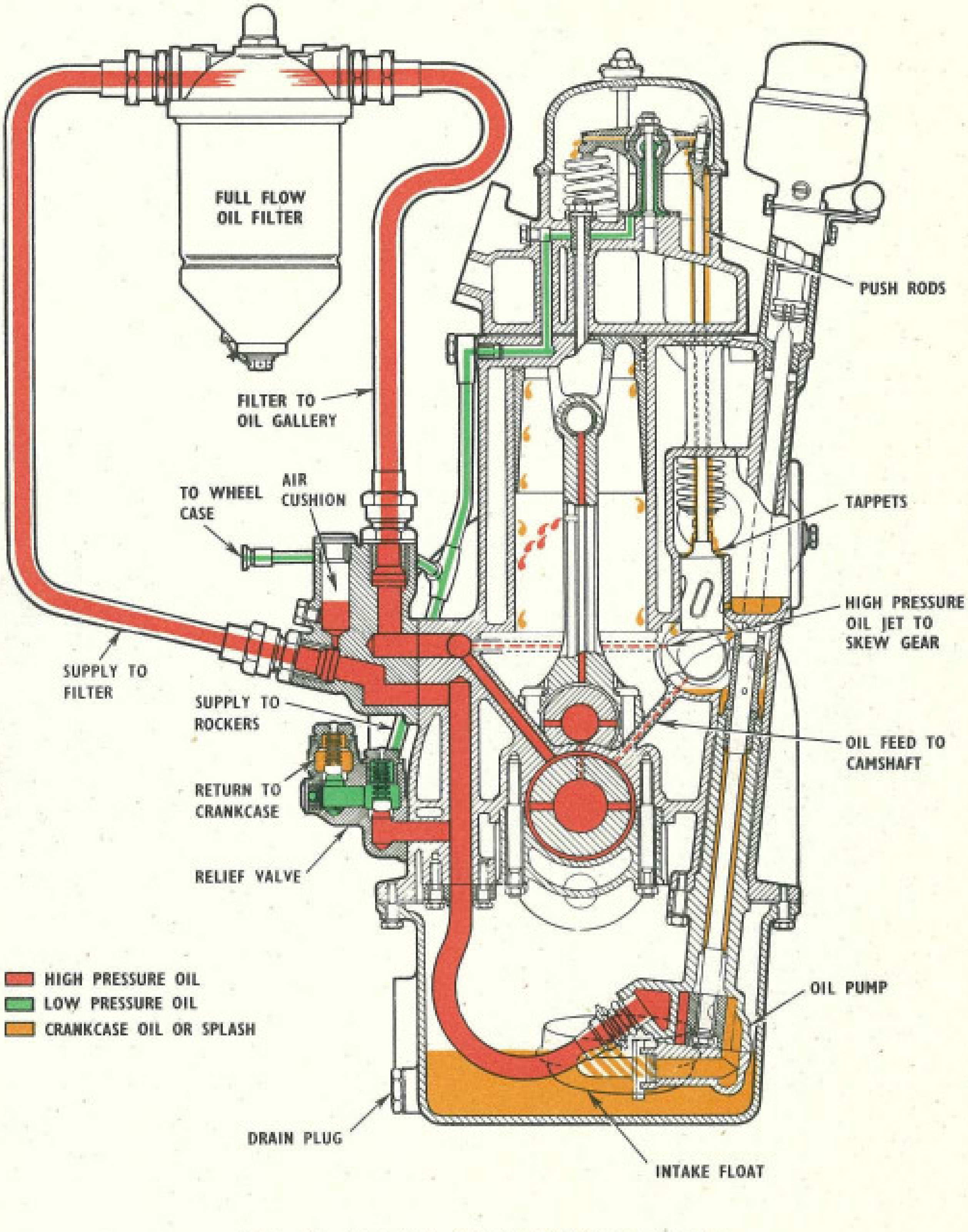

FIG. 6. ENGINE LUBRICATION SYSTEM

CHAPTER IV

Engine Lubrication System

Filling the System—Oil Pump—Crankshaft—Connecting Rods—Relief Valves—Valve Rockers, Push Rods and Tappets—Camshaft—By-pass Oil Filter—Oil Sump—Oil Level Indicator—Oil Pressure.

The engine lubrication system is diagrammatically illustrated in Fig. 6.

Recommended oils will be found on page 27.

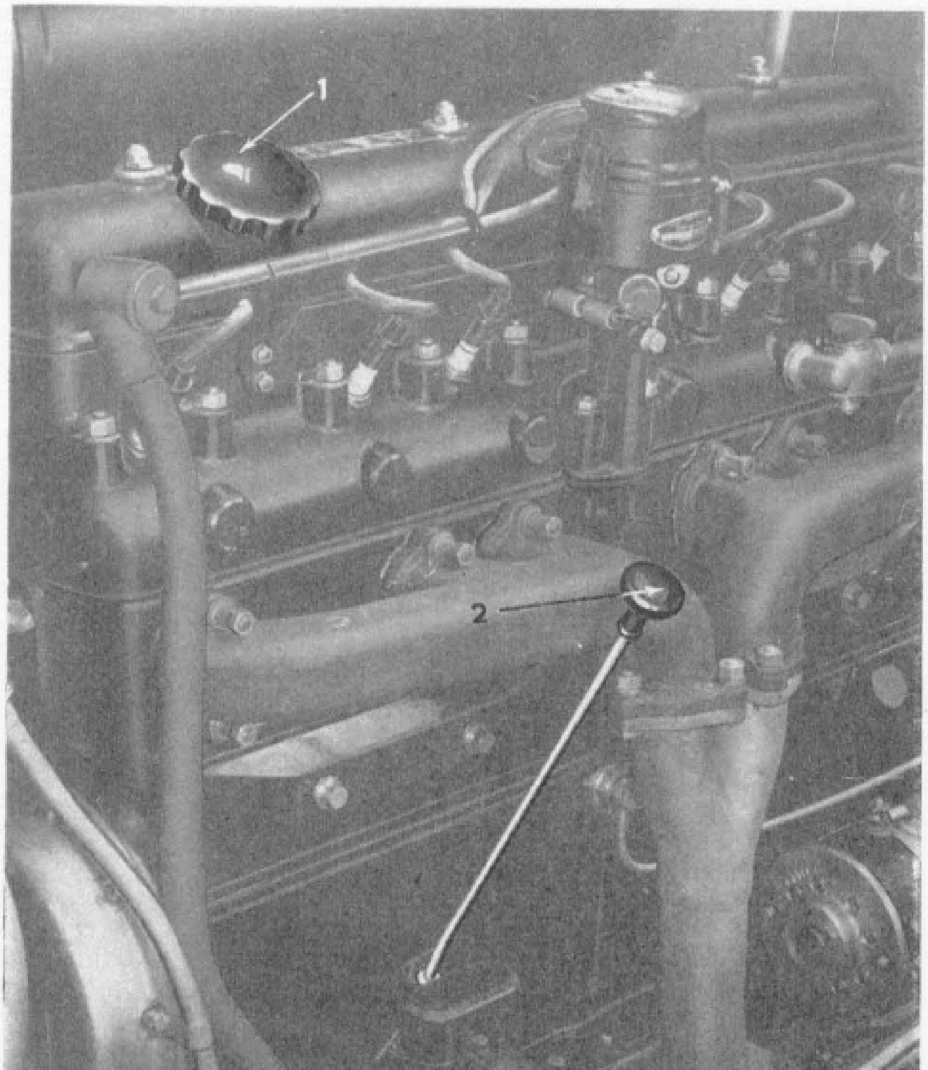

Fig. 7.—FILLER CAP AND DIPSTICK.

1. Engine oil filler cap. 2. Dipstick.

Filling the System.

The system is filled, or topped up, by removing the oil filler cap (**1**, Fig. **7**), located on the inlet rocker cover, and pouring in the required amount of recommended oil.

It should be appreciated that it takes a little time for the oil to drain through to the sump, especially if the oil is cold.

The level of the oil should be frequently checked with the dipstick **when the engine is not running** (**2**, Fig. **7**), and the system regularly topped up as required (see page 29), so as to keep the level of the oil up to the "Max" mark.

Oil Pump.

A gear type pump is mounted in the lower half of the crankcase, and is driven by means of a vertically-mounted shaft and skew gears from the centre of the camshaft, a coupled extension of which drives the ignition distributor.

The oil intake from the sump is of the floating gauze filter type, ensuring the collection of clean oil, free from sludge, water or grit.

Oil is drawn by the pump through the floating intake and is delivered direct to the oil gallery, which is incorporated in the crankcase casting.

Crankshaft.

From the internal oil gallery, oil is fed through oil ways drilled in the crankcase webs to each of the seven main crankshaft bearings, which are of the copper-lead-indium lined, steel shell type.

The crankshaft journals and crankpins are bored for lightness and to act as oil conduits, the ends of the holes being plugged with caps.

All the main bearings have circumferential oil grooves, and radial holes are drilled in the crank journals to register with these grooves.

Oil from the main bearings passes to the bore of each journal through the radial transfer holes, and thence to the crankpins through diagonal ducts drilled in the crankshaft webs. Oil from each crankpin bore issues through radial holes in the crankpins to lubricate the big end bearings.

Connecting Rods.

The big end bearings are of similar type and material to that of the main bearings.

Each connecting rod is drilled to convey oil to the gudgeon pin bearing, the drilling passing through the big end bearing shell.

Two radial holes in the crankpin ensures communication, twice per revolution, with the oil way up the connecting rod. Thus, all the crankshaft bearings, and all the connecting rod bearings, are supplied with oil under pressure.

Relief Valves.

A drilling through the casting conveys oil to a double relief valve located in an accessible position on the right-hand side of the crank-case. (See Fig. **8**.)

The two valves are in series, and their combined effect is to regulate the pressure of the main high-pressure supply to the crankshaft and connecting rod bearings to approximately 25 lbs. per square inch.

Oil passing the high-pressure valve (**3**, Fig. **8**) enters the low-pressure chamber, and from there via pipe (**4**) to the inlet valve rocker shaft.

In order to ensure a supply of oil to the low-pressure system under all conditions of running, small slots are cut in the seating of the high-pressure valve (**3**).

If it should be suspected that the relief valves are not working properly, they can be inspected by removing the plugs (**3**), above the high-pressure valve, and (**2**), above the low-pressure valve (Fig. **8**). In each case the valve spring will be found retained on the plug. The valves can then be lifted out and the valves and seats cleaned and inspected.

No attempt must be made to alter the spring settings by interfering with the springs themselves, or by varying the washers under the plugs.

Care must be taken to replace all parts in a perfectly clean state.

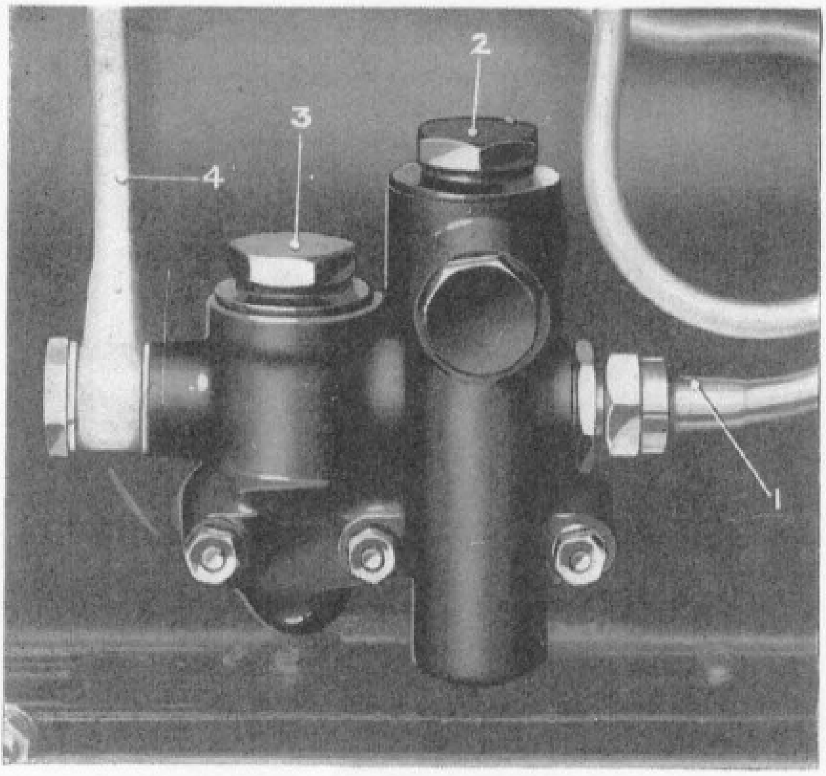

Fig. 8.—OIL RELIEF VALVES.

1. Return from by-pass filter.
2. Low-pressure valve.
3. High-pressure valve.
4. Outlet to rockers.

Valve Rockers, Push Rods and Tappets.

The centre pedestal of the inlet valve rocker shaft is drilled and communicates through an oil hole in the head with a union on the right-hand side, to which pipe (**4**, Fig. **8**) is connected.

The rocker shaft is drilled radially where each rocker works to lubricate the bearings of the latter. The rocker arms are also drilled, the holes running through the bearing bushes. By this means oil is fed on to the push-rod ball ends and the ends of the valve stems.

Each valve guide is provided with a packing gland, held in position by the valve spring, which prevents excess oil from percolating down the valve guides. Oil is returned from the rocker casing to the crankcase through the push-rod tunnels.

Camshaft.

The camshaft is driven by single helical gears and carried in four plain bearings, the latter being lubricated with high-pressure oil through drillings in the crankcase webs.

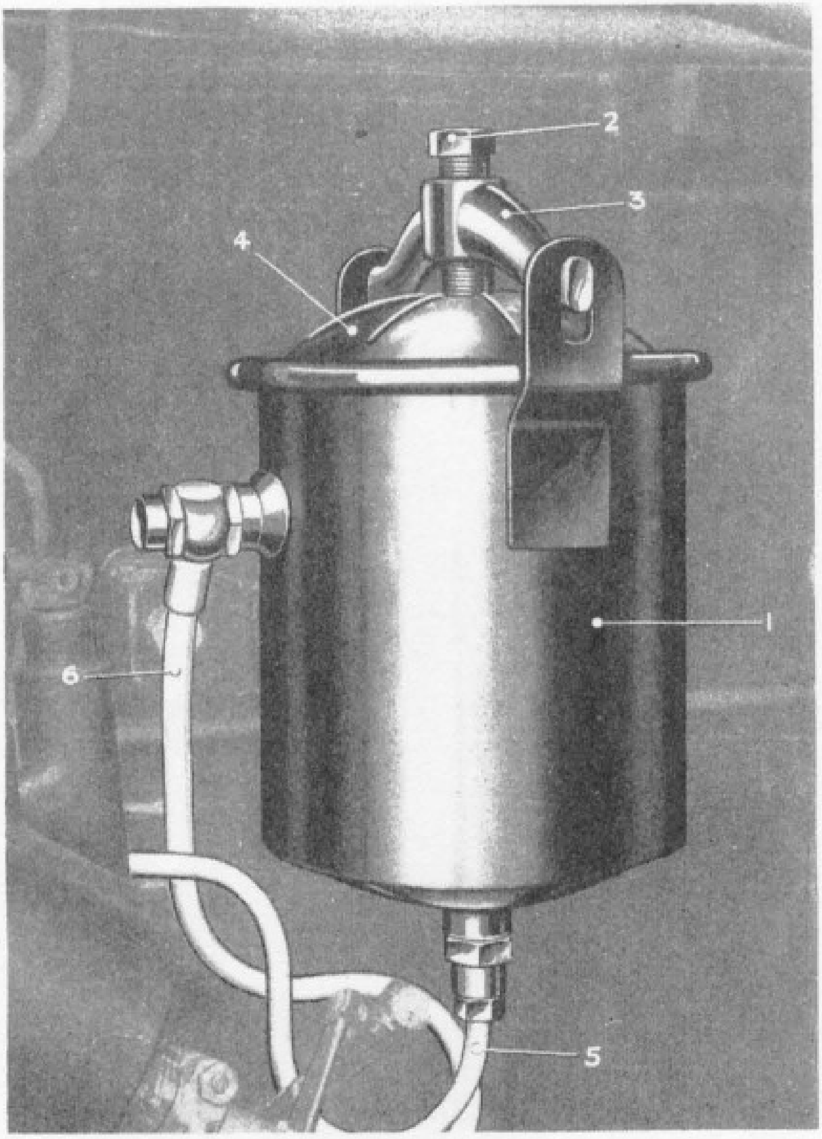

Fig. 9.—BY-PASS FILTER.

1. Filter.
2. Cover screw.
3. Yoke.
4. Cover.
5. Supply to filter.
6. Return from filter.

By-Pass Filter.

A special filter is provided on the right-hand side of the crankcase, as shown at (**1**, Fig. **9**), which is fed with oil under maximum pressure from a bleed hole in the high-pressure oil gallery, via pipe (**5**). The filter element restricts the flow of the by-passed oil, and so ensures that the by-passing effect of the filter shall not appreciably rob the main pressure system.

A proportion of high-pressure oil being thus continuously forced through the filter, it follows that the whole of the crankcase oil passes through the filter in a short time.

Oil from the filter is conveyed back to the crankcase via pipe (**6**), which is connected to the low-pressure chamber of the relief valve.

Every 10,000 miles, as directed on page 31, the filter element should be discarded and replaced with a new one. It is not practicable to clean the filter element, and no attempt must be made to do so.

To remove the element, the screw (**2**) should be released, and the yoke (**3**) removed. The cover (**4**) can then be taken off and the element removed.

When fitting the new element, care must be taken to ensure that the cork washer, under the cover (**4**), is in position, and that the screw (**2**) is well tightened. On next running the engine, it should be inspected for oil leaks around the filter cover.

Oil Sump.

Under normal circumstances, and with proper attention, the by-pass filter will maintain the oil in a clean condition.

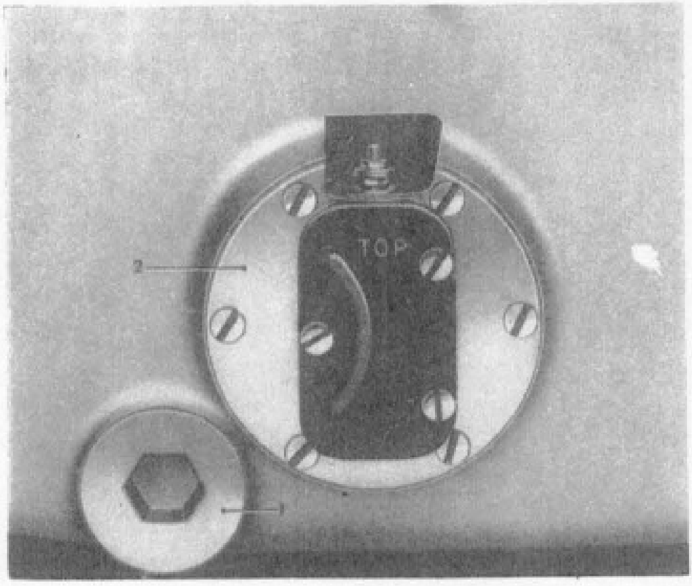

Fig. 10.—CRANKCASE DRAIN PLUG.
1. Drain plug. 2. Oil level indicator float unit.

Owing to the risk of dilution of the oil, however, it is advisable to drain the sump and renew the oil every 10,000 miles, as directed on page 31.

To drain the oil, a plug (**1**, Fig. **10**) is provided, which should be unscrewed and the oil allowed to drain out. On replacing the plug, care must be taken that the joint washer is also refitted in position.

Oil Level Indicator.

In order that a quick check may be obtained, the petrol gauge on the instrument panel has been so arranged that by depressing the switch (see Fig. **1**), it will register the approximate quantity of oil in the engine sump.

The gauge is electrically connected to a float unit fitted into the right-hand side of the crankcase sump (**2**, Fig. **10**.)

The reading should be taken when the car is standing as nearly level as possible.

The amount of oil should be maintained at **"Full"**, this corresponding with the **"Max"** mark on the dipstick, and showing that there is approximately 16 pints of oil present. A red line on the gauge indicates "minimum", and the engine should never be run with the oil level below this mark.

Oil Pressure.

Under normal conditions of engine temperature and speed, the instrument board pressure gauge should read approximately 25 lbs.

On starting the engine from cold, however, a higher oil pressure will be indicated, but this need not cause alarm, as the pressure will fall when the engine becomes warmed up.

When the engine is idling and hot, the pressure may fall to 4 lbs., but provided that it increases as the engine speed increases, this is in order.

The car must on no account be run if the gauge reads as low as this *continuously*.

Such a persistently low pressure, which may be accompanied by fluctuations of the gauge needle, may be due to one or more causes.

In the first place, it should be ascertained that there is sufficient oil in the sump by referring to the oil level indicator.

If this is found to be in order, the trouble may be due to a particle of foreign matter having lodged on one of the relief valve seatings and preventing the valve from closing. If the latter is suspected, the relief valve should be inspected and cleaned as directed on page 39.

CHAPTER V

The Fuel System

The Fuel System—Fuel Pumps—Faulty Operation of Pumps—Fuel Tank—Strainers—Fuel Gauge—The Carburetters (Action)—Hand Starting Control—Adjustment of Carburetters—Automatic Air Valve—Throttle Control—Mixture Control and Slow Running—Float Feed Mechanisms—Further Dismantling of Carburetter—Air Cleaner and Silencer—Warning.

The Fuel System.

The fuel supply from the 18-gallon tank at the rear of the chassis is by means of a double electric pump (**1** and **2**, Fig. **11**), mounted inside the right-hand side chassis frame member below the rear floor.

A pipe is arranged along the right-hand side frame member conveying fuel from the tank to the pumps. The pipe is seen at (**4**). A strainer is provided on this pipe line, being located on the frame cross member immediately in front of the tank, as shown in Fig. **12**.

Location of a strainer on the suction side of the pumps ensures that the latter, as well as the carburetter, are protected from the deleterious effects of dirt or sediment in the fuel.

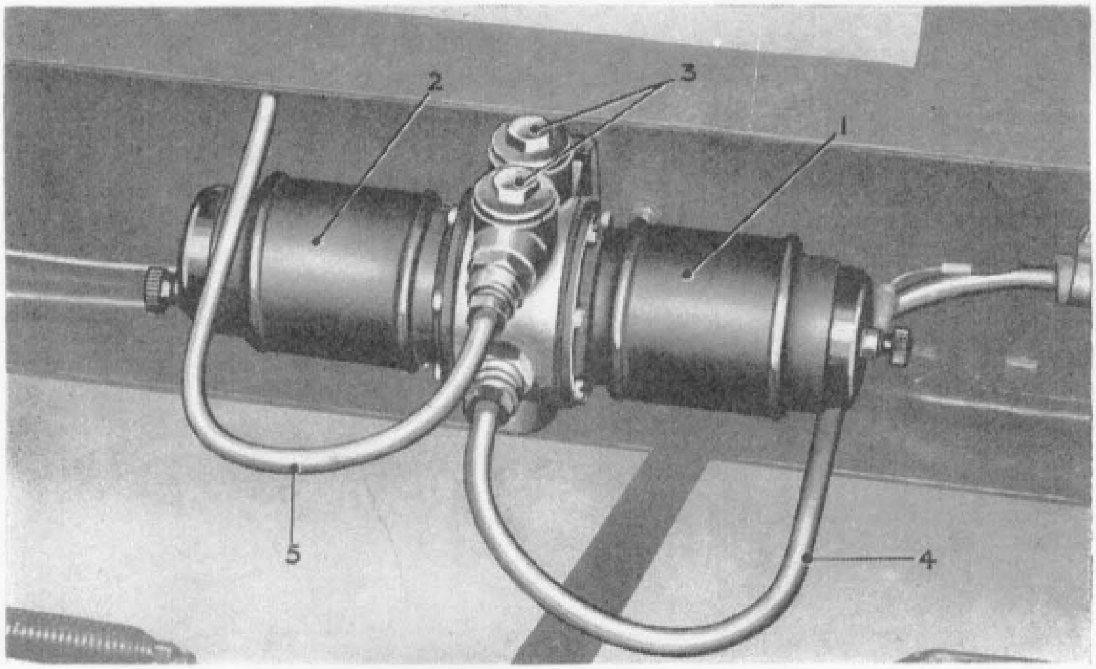

Fig. 11.—FUEL PUMPS.

1. Fuel pump.
2. Fuel pump.
3. Valve caps.
4. Inlet pipe.
5. Outlet pipe.

From the strainer the fuel passes to the suction side of the pumps, and is delivered to the carburetter float chamber by way of a pipe (**5**), and another strainer located at the float chamber.

Fuel Pumps.

The fuel pumps (**1** and **2**, Fig. **11**) are of the electric, solenoid-operated, diaphragm type, and comprise two independent pumps complete with diaphragms, solenoids, contact trip mechanisms, and suction and delivery valves.

Both pumps deliver into a common chamber and are simultaneously rendered operative when the ignition and master switches are **"On"**.

Duplicate pumps are provided primarily to ensure reliability. They also ensure that there shall be no starvation of fuel at maximum engine demands.

If it should ever be necessary to disconnect the fuel pipes at the pumps, it is important first to release the cover of the suction strainer (See page 46.) This will prevent loss of fuel by syphoning, due to the location of the pumps below the level of the main tank.

The current supply for the pumps is taken through the ignition fuse, No. **5**, in the fuse box.

Faulty Operation of Pumps.

This would cause failure, or shortage, of fuel supply to the carburetter, and may be due to one or more of the following causes:—

1. *Shortage of fuel in the tank.*—This should have caused the green warning lamp to light, but if the tank has been allowed to run dry, the pumps will tick continuously and noisily. On severe gradients and side slopes, these symptoms may occur before the tank is completely empty, due to surging of fuel in the tank, which may uncover the suction pipe.
2. *Air leak on the suction side.*—Either at the strainer or on the pipe line. A slight air leak will cause the pumps to work rather faster than normal, but if sufficiently bad to cause a complete air lock, the pumps will tick continuously and noisily as if short of petrol.
3. *Pump valves not seating.*—The delivery valves do not give any easily detectable signs of their functioning. If a suction valve is not seating, the pump will tick continuously when the engine is switched on but not running. It is probable that foreign matter is lodged under one of the valves.
   If the above is suspected, remove the caps (**3**, Fig. **11**), the valves and valve cap assemblies may then be lifted out and cleaned.
4. *Sluggish operation of the pumps.*—Check that the electrical connection and contact points are clean and in proper order. Verify, by alternately disconnecting the pipes at the unions, that it is the pump, and not due to a blockage in the pipe line. If with the pipes disconnected the pumps still work sluggishly, the unit should be removed and returned to Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers" for overhaul.

Note—The pumps will not work with both petrol pipes disconnected; in such circumstances, the pumps must be earthed to the chassis frame.

Fuel Tank.

The 18-gallon tank is shown in Fig. **12**. The fitting (**9**) carries the suction pipe. Normally there should be no occasion to disturb these parts.

Every 20,000 miles as directed on page 33, the drain plug at the bottom of the tank should be released. It is not necessary to remove the plug. It need only be unscrewed a turn or two, and must afterwards be securely retightened. This will flush out any accumulation of sediment or water.

Strainers.

The rear strainer shown in Fig. **12**, is provided with two circular gauzes located above a large settling sump. Fuel passes upwards through these gauzes, and dirt settles on their lower faces and in the sump.

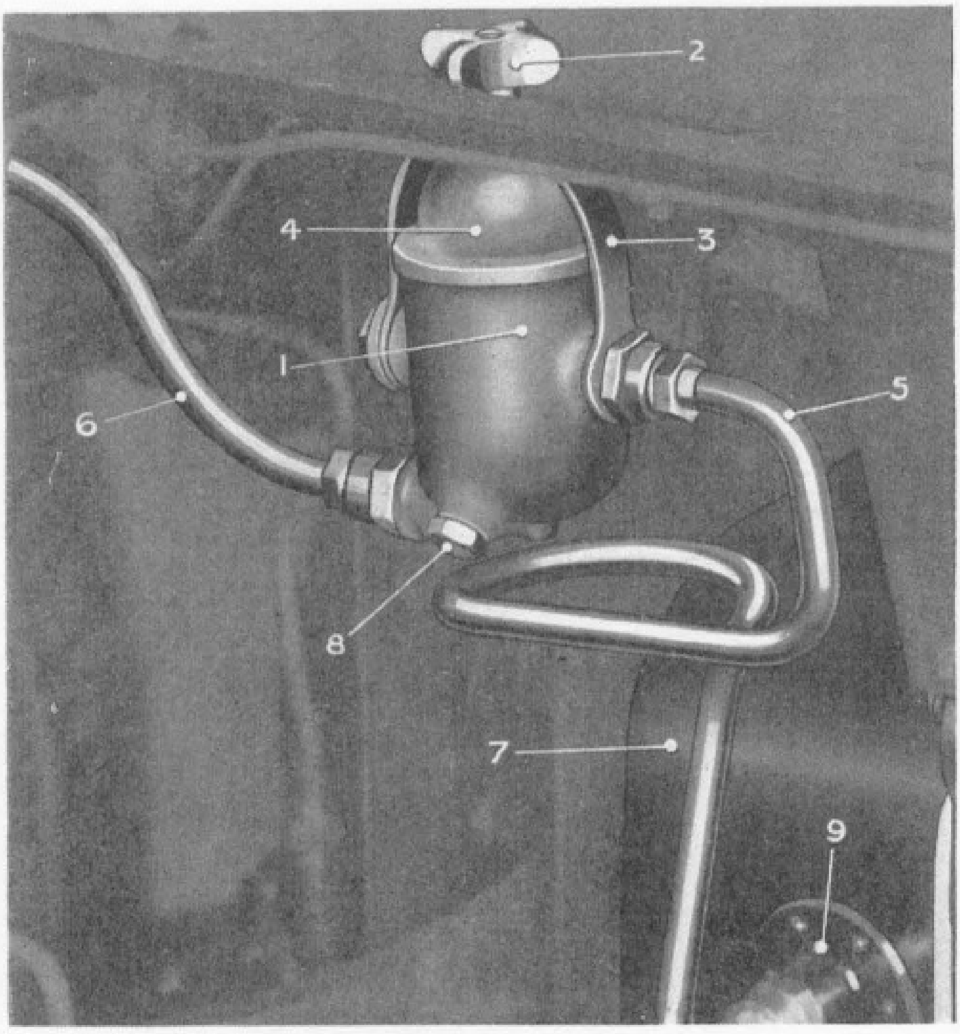

Fig. 12.—FUEL TANK AND STRAINER.

1. Body.
2. Cover nut.
3. Yoke.
4. Cover.
5. Inlet pipe.
6. Outlet pipe.
7. Main fuel tank.
8. Strainer drain plug.

The filter should be cleaned every 20,000 miles, as directed on page 33.

When refitting the cover, care must be taken that the cork washer is sound, and properly in position, and the nut (**2**, Fig. **12**) tightly screwed up. Any leaks on this—the suction side of the pumps—although they may not be apparent by leakage of fuel, will impair the proper functioning of the pumps by admitting air.

In addition a small gauze strainer, shown at (**12**, Fig. **14**), is arranged on each carburetter. These should be removed and cleaned every 20,000 miles, as directed on page 33.

Removal is effected by unscrewing the two union nuts (**2**, Fig. **13**). The strainer gauzes can then be removed and cleaned in petrol.

When refitting the parts, care must be taken to replace each gauze with its open end outwards and that the aluminium joint washers are in position on the unions.

Fuel Gauge.

The fuel gauge registers when the master and ignition switches are **"On"**.

As mentioned on page 41, this gauge also registers the amount of oil in the engine sump, when the appropriate switch is depressed.

The Carburetters (Action).

Two carburetters of the S.U. controllable jet type are fitted as shown in Figs. **13** and **14**, one being shown in section to illustrate the principal parts.

This type of carburetter automatically adjusts both its choke area and its jet to suit the engine demands. This is effected by using the manifold depression to operate a piston or air valve, which carries a tapered needle to regulate the fuel passage. The upper side of the piston is connected by passage ways to the base of the piston facing the throttle valves, and is subject to the depressions in the throttle body.

As the air flow through the carburetter increases, so the depression between the piston and the throttle valve increases, thereby causing the piston to rise and admit more air, and consequently the needle to be withdrawn from the jet, thus allowing more fuel to flow. Similarly, as the air flow falls, due to reduced engine requirements, so the piston falls. In this way, a state of balance is maintained whereby the piston keeps at a certain height, dependent on the engine speed and the throttle opening. Thus the carburetter automatically adjusts itself to the varying requirements of the engine under all conditions.

Hand Starting Control.

The jet is so mounted that it is vertically adjustable by hand from the steering wheel.

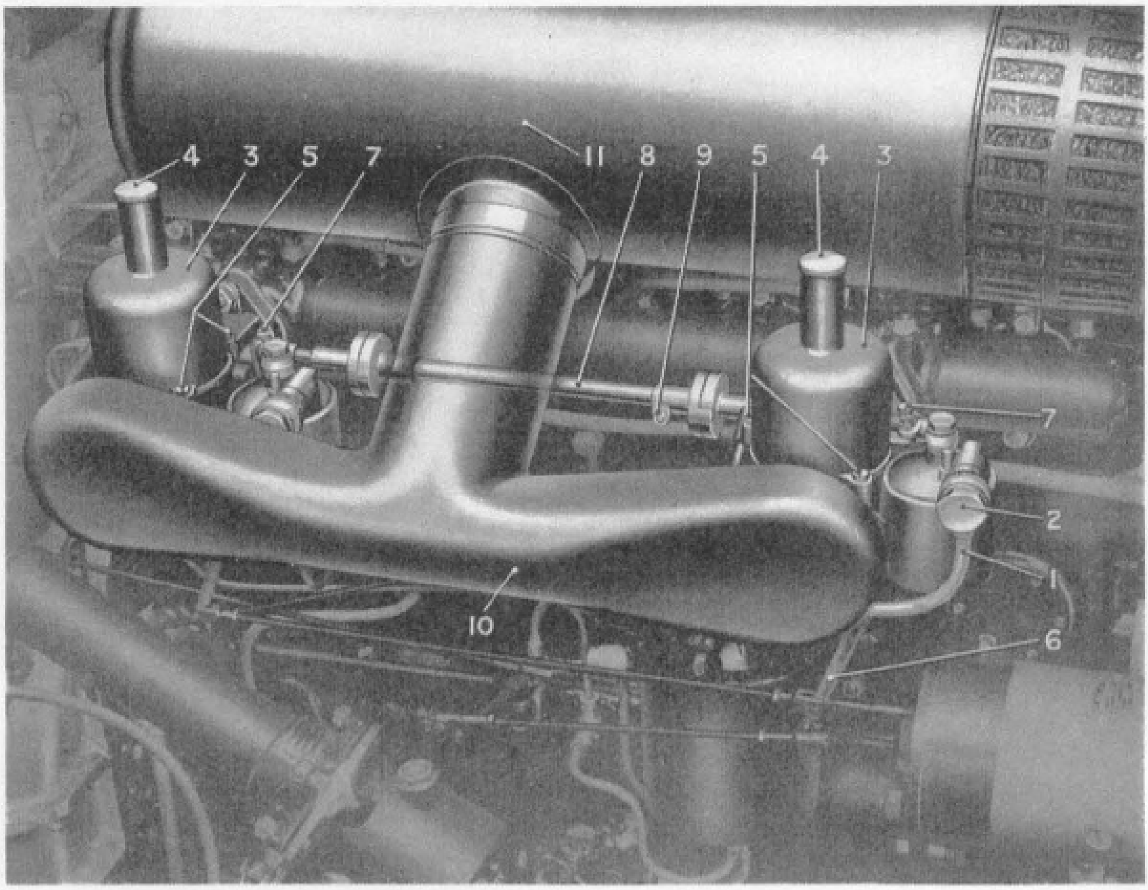

Fig. 13. CARBURETTERS IN POSITION ON ENGINE.

1. Fuel pipe.
2. Union.
3. Air valve cylinder
4. Oil cap nut.
5. Cylinder retaining screws.
6. Mixture lever.
7. Throttle stop.
8. Throttle coupling rod.
9. Pinch bolt.
10. Air intake.
11. Air silencer and cleaner.

For starting, the jet is lowered away from the needle by setting the mixture control to **"Start"**. This provides an enriched mixture to ensure easy starting and even running when the engine is cold. As soon as the engine has warmed up, the control lever should gradually be re-set to **"Run"**.

Adjustment of Carburetters.

There should be no necessity for any variation of the adjustment of the carburetters as fixed by the makers.

It is realised, however, that information as to the methods for restoring adjustments may prove valuable under special circumstances, and is consequently given, as far as practicable, in the paragraphs which follow.

Automatic Air Valve.

The automatic air valve is of the conventional S.U. pattern, and includes a hydraulic suction piston damper to delay the rise of the air valve piston during acceleration and when starting the engine from cold. The damper consists of a small cylindrical brass plunger (**2**, Fig. **14**), attached by a thin steel rod to the oil cap nut (**4**, Fig. **13**). Inside the plunger is a one-way ball valve which seats in an upward direction. The plunger is a free fit in the hollow guide rod of the automatic air valve piston, the chamber being filled with a thin oil. The action of the device being as follows:—

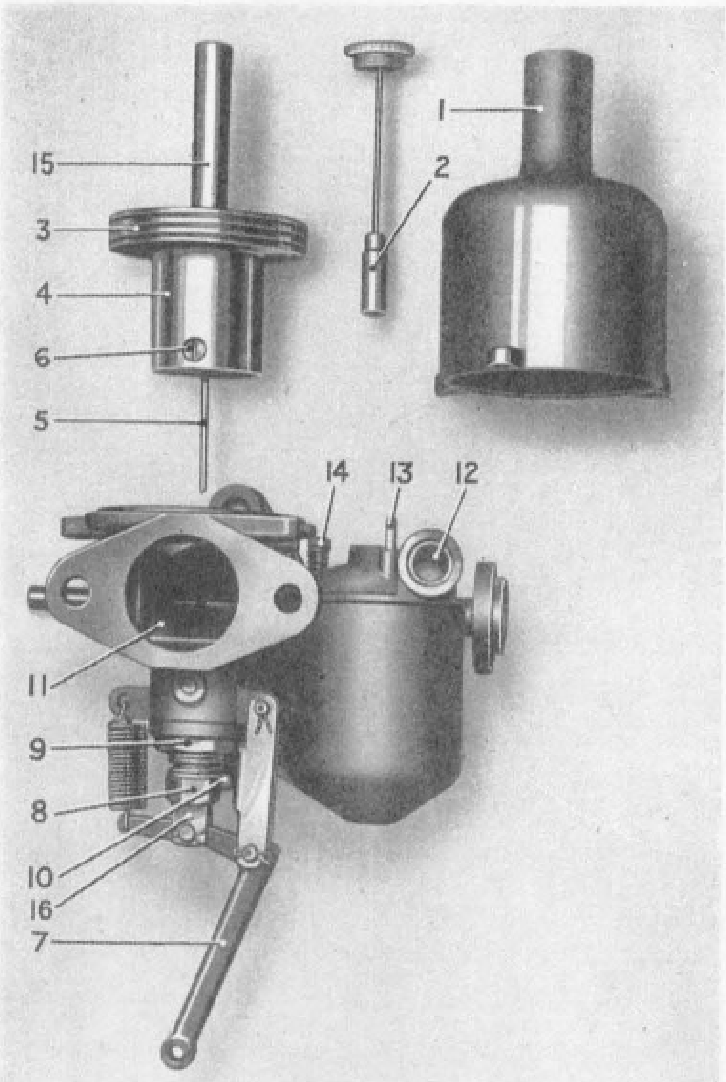

Fig. 14.—CARBURETTER—EXPLODED VIEW.

1. Air valve cylinder.
2. Hydraulic damper piston.
3. Suction disc.
4. Piston, air valve.
5. Needle valve.
6. Grub screw.
7. Mixture lever.
8. Adjustable stop.
9. Nut (**not to be disturbed**).
10. Plug securing float chamber.
11. Throttle valve.
12. Gauze strainer.
13. Float depressing plunger.
14. Throttle stop.
15. Piston guide rod.
16. Jaw, jet head.

When the automatic air valve piston rises in accordance with the demands of the engine, the movement is retarded due to the displacement of oil through the clearance existing between the damper plunger and the guide rod. The fall of the automatic air valve is unimpeded due to the ball valve being opened, which allows the unrestricted passage of the displaced oil. No attention should be necessary other than the replenishment of the oil in the reservoir.

Every month, as directed on page 30, the oil reservoir cap nut (**4**) (Fig. **13**), should be unscrewed and the plunger withdrawn, *great care being taken to avoid damage to the plunger rod by bending*, the reservoir should be topped up, if required, with the recommended oil, so as to maintain the level of the oil to the top of the guide rod only. The plunger should then be replaced, taking care that no dirt or grit is present. A slight steady pressure may be required to displace the oil sufficiently to allow the engagement of the thread of oil reservoir cap nut.

If it is suspected that the automatic air valve is not working correctly, the air intake (**10**, Fig. **13**), should be removed, and a check made by lifting the piston with the fingers, when it should be noted that the piston falls quite freely on to its seat when released.

If any sticking or sluggishness is apparent, it will be necessary to dismantle the air valve assembly; first remove the hydraulic piston damper, next remove the three screws (**5**, Fig. **13**), and lift off the cylinder (**3**). The piston valve can be then lifted out, *the utmost care being taken not to bend or damage its depending needle valve* (**5**, Fig. **14**), *or to bruise the valve in any way.* The valve, cylinder and guide, should be carefully wiped with a piece of clean cloth dipped in petrol, and the piston rod ONLY lubricated with a few drops of thin oil.

No polishing paste or abrasives should be used to clean the valve or cylinder.

The suction disc (**3**, Fig. **14**), does not touch the walls of the cylinder, there being a small clearance, and it is centralised solely by the piston rod working in the guide. Therefore, any sluggishness in movement is probably due to dirt in the guide, or on the cylinder walls.

When replacing the valve, it will be noticed that there is a slot which must engage a tongue provided on the carburetter body. The cylinder can only be replaced in one position, the three screw holes being unevenly spaced to ensure this.

If the above treatment does not effect a cure, the fault may be due to a bent jet needle or alternatively to the needle fouling the jet. If this is suspected it is recommended that communication is made with Messrs. Bentley Motors (1931) Ltd., or one of their Special Retailers.

The needle valve is secured in position by means of a grub screw, (**6**, Fig. **14**), and if it should be necessary to remove this, as, for instance, when replacing an accidently damaged needle, it must be particularly noticed that the location of the valve is determined by a shoulder. The valve should be pushed into the piston until this shoulder is just flush with the lower face and the grub screw tightened.

If a needle should be accidently damaged, a new one must be obtained from either Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers". A number is stamped on the end of the needle, denoting the size, and it is essential that only one of the same number is refitted.

Throttle Control.

The quantity of mixture for slow running is determined by means of an adjustable screw stop on the front carburetter (**7**, Fig. **13**), which limits the closing movement of both throttles. This is so adjusted that the engine will idle slowly but reliably when the hand throttle lever on the steering wheel is set right to the bottom of its range and the accelerator pedal released. The stop on the rear carburetter is normally inoperative, and is only used to help initial adjustment.

Re-adjustment of the jets, and of the control shaft between the carburetters, should not normally be required. If, however, the whole adjustment has been disturbed, first adjust the throttles so that both carburetters function equally at "fast idle". An indication that both pistons have risen can be felt by depressing the top of the piston guide rod (**15**, Fig. **14**) by means of a small rod inserted through the top of the cylinder (**3**, Fig. **13**), after removal of the oil cap nut and hydraulic piston damper (**4**, Fig. **13**). The jets should then be adjusted subsequent to this operation, as described below.

Mixture Control and Slow Running.

The mixture control lever on the steering wheel operates to raise or lower the actual fuel orifice or jet, through the medium of the levers (**6**, Fig. **13**.). Raising the jet causes the taper needle to sink further into the orifice, so weakening the mixture. Conversely, lowering the jet enriches the mixture. This control is only intended to provide a means of strengthening the mixture for starting from cold, for normal running the jets must be in their highest position, the back of both the jaws (**16**, Fig. **14**), abutting against the adjustable stops (**8**, Fig. **14**), simultaneously.

The strength or quality of the mixture for slow running is set by means of these adjustable stops, the procedure being as follows:—

With the engine warm, the control rods should be disconnected from the ends of the levers (**6**, Fig. **13**), and the latter pushed up until the jaws (**16**, Fig. **14**), are against the stops (**8**, Fig. **14**). Then, with the engine running, the stops should be manipulated until the engine runs regularly. Any sign of "hunting" is due to the mixture being too rich, and one or both of the stops must be screwed further in and the lever pushed up so that the jaw is against it.

On the other hand, irregular firing, indicated by irregular pulsations from the exhaust pipe, shows the mixture to be weak, and one or both stops must be screwed out a little.

The correct positions for the stops having been found, the control rods must be adjusted so that the jaws of both jets are definitely against the stops when the lever on the steering wheel is at **"Run"**.

Float Feed Mechanisms.

These are of the usual "top feed" pattern, whereby, as the level of the petrol rises in the float chamber, a lever bearing on the top of the float moves the conical seat "needle" upwards on to its seating, so shutting off the supply.

If it is required to dismantle the float chambers, it will be most convenient to remove them bodily—after removing the fuel pipes—by unscrewing the hexagon plugs (**10**, Fig. **14**), which secure each to its carburetter body.