The upper radiator water pipe should be removed. It may be found more convenient also to remove the chassis oil pump from the front of the dashboard.

The ignition wires should be disconnected from the plugs and the H.T. distributor moulding removed. The wires complete in their tube can then be removed by unscrewing the nuts which hold the tube brackets to the cylinder head.

Removing Rocker Cover and Shaft. The rocker cover can be removed after unscrewing the three knurled nuts.

The rocker shaft is carried in seven pedestals, each having a stud running up its centre and through the shaft. The seven nuts of these studs should be removed, together with the small nuts which secure the bases of the front and rear pedestals to the head for making oil-tight connections. The shaft, complete with rockers and pedestals, can then be lifted off.

The twelve valve push rods should be withdrawn from the cylinders.

Removing Exhaust and Inlet Manifolds. The union on the inlet pipe, connecting the latter by means of a copper pipe with the vacuum petrol feed tank, should be disconnected.

The nuts securing the exhaust manifold to the head and to the down-take pipe should next be removed and the exhaust manifold withdrawn, care being taken not to drop and bruise the spherical washer between manifold and down-take. The nuts of the inlet manifold can then be unscrewed and the manifold withdrawn.

Removing Cylinder Head. On the left-hand side of the cylinder head are three unions, which require disconnecting, namely, the water jacket thermometer connection and two valve rocker oil supply pipes.

The thermometer must be withdrawn clear of the head, a coil being arranged in the connecting tube to provide flexibility for this purpose. Great care is necessary, however, as injury to the thermometer or its tube would render the apparatus useless.

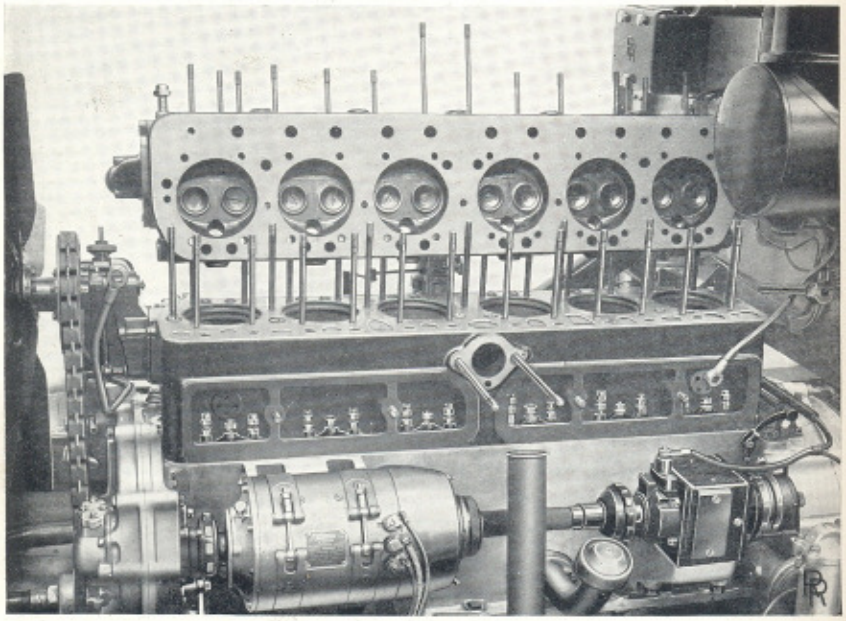

FIG. 9. CYLINDER HEAD REMOVED FOR DECARBONISING.

The head is held in position by long studs, running from the crankcase and through the cylinder block. In order to avoid straining the head, the nuts of these studs should be released gradually, commencing with those in the centre, and working outwards towards the end ones.

This operation should be repeated several times, only turning each nut slightly each time.

With all nuts and washers removed, it should be possible to lift off the head. This operation is best performed by two people, one standing on either side of the engine. If the head be found difficult to remove, it should be lightly tapped with a wood mallet on either side. This will probably be found sufficient to free the joint.

The head must be raised evenly or it will bind on the studs.

The joint gasket should be removed and discarded, a new one being used when the head is replaced.

Cleaning Pistons and Head. When scraping the aluminium piston heads, great care should be taken not to score these. Only a blunt rounded tool should be used, and applied with very moderate pressure.

Carbon deposit should be scraped from the head before removing the valves. To remove the valves the spring must be compressed, carrying with it the washer **A** (Fig. 10), the valve meanwhile being held on its seat.

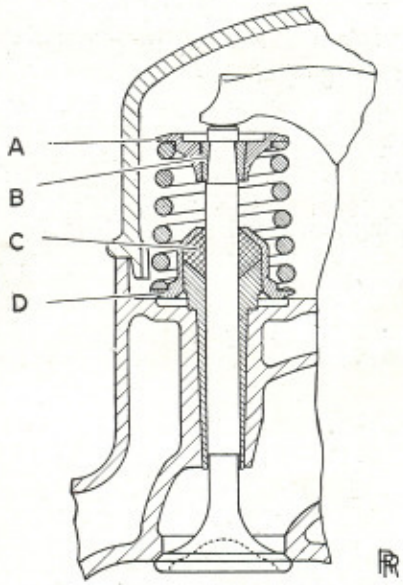

FIG. 10. SECTION THROUGH VALVE GUIDE.

A special tool is provided in the kit for this purpose. It consists of a screw clamp, the clamp being formed with a ring for the reception of the valve spring washer. The point of the screw should engage the head of the valve and on tightening the screw the spring will be compressed. The split conical washer **B** will then fall out, and the valve can be removed. The asbestos packing washer **C**, and gland **D**, should also be removed.

Grinding in the Valves. This should be done by assembling on the valve, after insertion in the head, a spring washer, **A**, and conical washer, **B** (Fig. 10). The valve can then be manipulated quite easily by means of the washer, the first and second fingers being placed under the latter and the thumb against the end of the valve stem.

Each valve should be ground in the seat where it has been working.

A good quality grinding paste should be used, the valve being rotated backwards and forwards in different positions, and pushed from its seat occasionally. Only a light pressure should be applied or valve and seat will become scored.

Care must be taken not to allow any grinding paste to get on the valve stems or in the guides.

After this operation, the cylinder head and valves should be well washed in paraffin to remove every trace of grinding compound, valve guides and ports being syringed through with paraffin.

The valves, springs, and washers can then be replaced, the special tool being used to compress the springs. Care must be taken that the asbestos packing washers and glands are in position, and that the valves are replaced in the seatings from which they were removed and in which they were ground.

The valve guides should be lubricated with a little engine oil.

Replacing Cylinder Head. Before replacing the head, the joint faces should be carefully wiped to remove all particles of foreign matter. A new joint gasket should be utilised, and placed on the cylinder block and the head carefully lowered in position.

Too much emphasis cannot be laid upon the necessity for exercising care in tightening the nuts which secure the head.

These should be screwed down very gradually, commencing with those at the centre of the head and working outwards towards the two ends. This process should be repeated several times, the nuts being turned only a comparatively small amount at each stage. By this means the pressure on the joint faces will be evenly distributed and the joint rendered sound.

Reassembling. Before replacing the rocker shaft, all the valve tappet heads must be screwed down as far as possible by releasing the locknut **V** (Fig. 11), and screwing the head **U** into the tappet. This will avoid the risk of bending the push rods as the rocker shaft is secured in position.

In order to facilitate replacement of the push rods in their original positions, they are numbered 1 to 12 commencing from the front of the engine.

The rockers themselves are also marked, but it should not be necessary to remove these from their shaft.

The push rods should then be arranged in their correct positions in the tappet heads, and the rocker shaft replaced.

Each pedestal of the rocker shaft is recessed around its stud-hole for a spherical washer, and it should be observed that these are in position before putting on the nuts.

The inlet and exhaust manifolds should be replaced with a *new* gasket for each joint face.

The stud-centres of all these are the same, but there are three different sizes of port opening. The largest are for the exhaust ports, the middle size for the two inlets nearer the centre, and the smallest for the two end inlet ports. Great care must be taken that they are fitted in the correct positions.

Before tightening the nuts the spherical washer should be inserted between the exhaust manifold and the down-take pipe. The nuts must be tightened gradually and evenly.

The oil supply unions may then be reconnected, care being taken to fit aluminium washers, one on either side of each union.

A similar type of union is adopted for the vacuum feed pipe coupled to the inlet manifold, and similar care should be exercised in its replacement.

The water jacket thermometer and the upper radiator water pipe should be replaced.

Adjusting Tappets. The valve tappets are provided with adjustable heads, access to which is obtained by removing the two covers on the left-hand side of the engine. In Fig. 11 these covers are shown removed for adjusting the tappets.

The tappet head, **U**, is screwed into the tappet, and locked with a nut, **V**. On releasing this nut, the tappet can be screwed in or out as may be required.

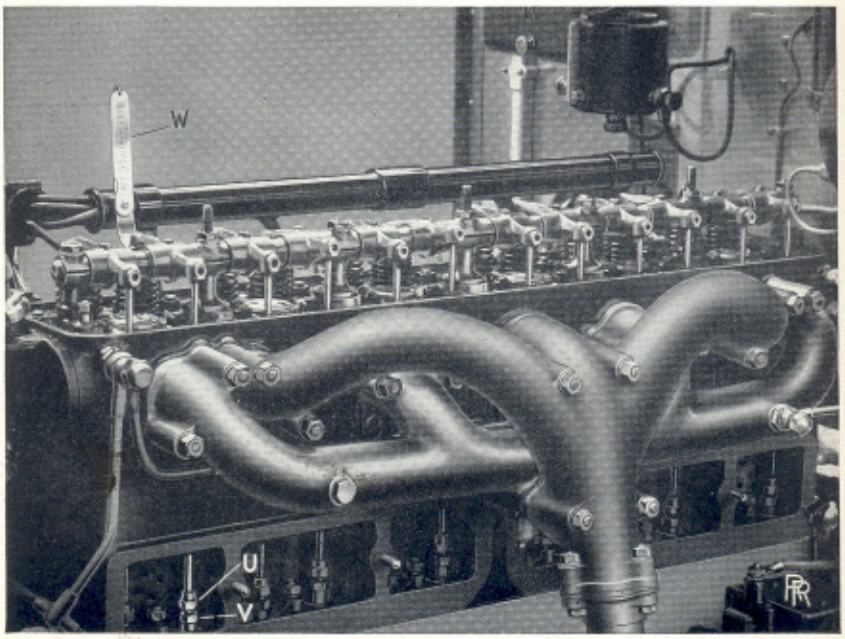

FIG. 11. ADJUSTING THE TAPPETS.

With the engine cold, and the valve roller on the base of the cam, there should be .003" clearance, measured between valve stem and rocker. A feeler gauge is provided in the tool-kit, and is shown in position for measuring the tappet clearance at **W**.

Before commencing to adjust a tappet, it should be ascertained that that particular tappet roller is well away from the cam, which is best done by turning the crankshaft by hand until the valve has

opened and closed, and then cranking round half a revolution beyond this point.

As each tappet is adjusted, its locknut should be tightened up.

When checking the tappet clearances every 2,000 miles, or four weeks, as directed on page 130, the rocker cover should be removed, and a feeler gauge used as described. It is not sufficient merely to remove the tappet covers and estimate the clearance by lifting each push rod.

After replacing the tappet covers, the rocker cover, the chassis oil pump, the high-tension ignition leads, filling up the radiator with water, and adding the correct quantity of oil to the crankcase, the car should be ready for running once more.

It is very important that the cylinder head nuts should be tightened again after the engine has done sufficient running to become thoroughly warmed. In order to do this the valve rocker shaft must be removed.

It will subsequently be necessary to re-set the tappet clearances as already described, owing to the fact that the joint gasket will have become further compressed, with a consequent reduction of the tappet clearances.

It is advisable to repeat this inspection of the clearances during the next few hundred miles of running, readjusting if necessary.

Further, if the car should have been returned to the makers for decarbonising, or any other purpose involving removal of the cylinder head, it is very desirable, afterwards, that the owner should inspect the tappet clearances when he has run the car a certain amount.

In spite of the fact that the car will have been carefully tested by the makers after overhaul, the amount of running involved may have been insufficient to ensure that the joint gasket has entirely settled down.

CHAPTER III.

Fuel Feed System and Carburation.

The Fuel System—Action of Vacuum Feed—Failure of Supply—Fuel Strainers and Filter—Fuel Tank—Fuel Gauge—Action of the Carburetter—Cleaning the Air Valve—Faulty Adjustment of Carburetter—Setting of the Jets—Mixture Control—Slow Running—Starting Carburetter—Float Feed Mechanism—Crankcase Breather Pipe to Carburetter—Dismantling the Carburetter.

The Fuel System. A vacuum feed tank is located on the dashboard, and fuel from the tank at the rear of the chassis is drawn through one of two pipes arranged inside the near side frame member. These pipes terminate in the rear tank, the one extending to the bottom of the tank and the other to a point just short of the bottom in order to create a "reserve" supply of fuel. A cork-seated change-over tap (V1, Fig. 12) is located on the dashboard and controlled from the driver's side, having its dial plate marked **R** (Reserve), **O** (Off), and **M** (Main). In the off position the supply from the main tank to the vacuum tank is shut off, and also that from the vacuum tank to the carburetter.

Some chassis have a 14-gallon fuel tank with a reserve of 2 gallons, while other chassis have an 18-gallon tank with a reserve of $2\frac{1}{2}$ gallons.

Normally, the tap should stand at **M**, under which circumstances, with the tank full, 12 or $15\frac{1}{2}$ gallons of fuel (as the case may be) will be available.

A catch must be depressed before the tap can be turned to the **R** position, its object being to prevent accidental movement towards **R** when turning the fuel off.

A fuel level indicator is provided on the instrument board. It is desirable in order to avoid emptying the vacuum feed tank, that

the reserve should be brought into use before the engine actually stops through lack of fuel.

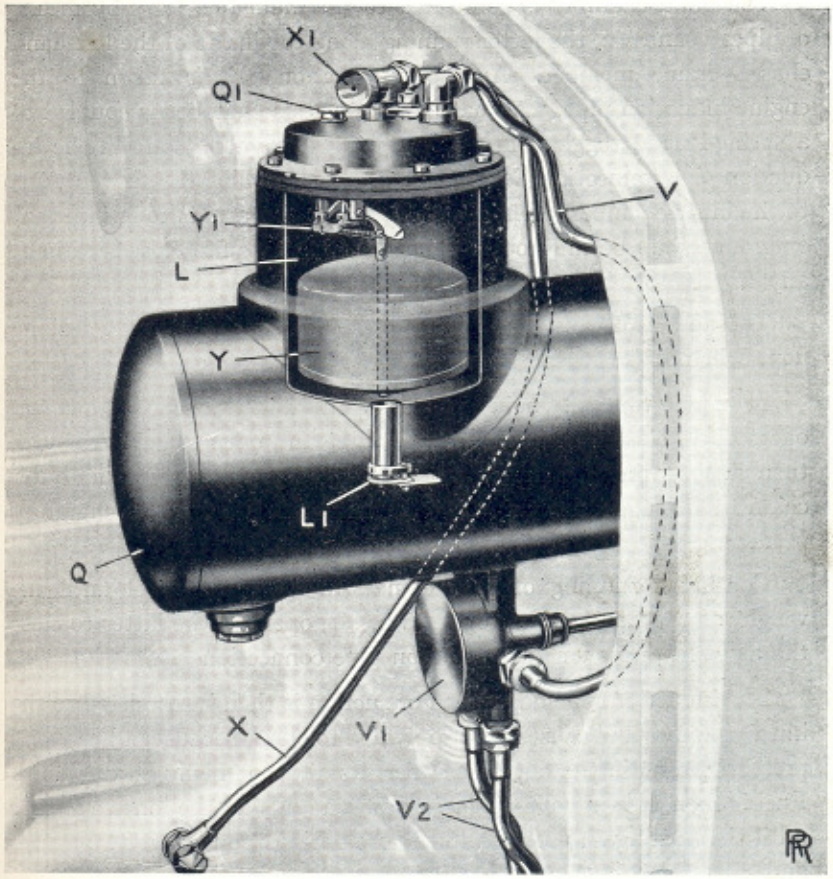

FIG. 12. VACUUM FEED TANK.

Action of Vacuum Feed. The working of the automatic fuel feed will be understood by reference to Fig. 12. This illustrates the vacuum tank on the dashboard, and shows its internal working parts.

The apparatus consists of two chambers, one within the other, these being in communication through the medium of a non-return or drop valve, L1, situated at the base of the inner chamber L.

The outer chamber, Q, is fitted with an air vent, Q1, and is

connected to the carburetter float chamber through the cork-seated change-over tap V1.

The inner chamber is connected to the main fuel tank by means of pipes V and V2, the latter running along the inside of the left-hand chassis frame member. Another connection, X, is taken to the engine induction pipe. A float, Y, within this chamber is coupled to a spring-loaded toggle arm, Y1, carrying two valves, one in the induction pipe connection, X, and the other controlling the air vent, Q1, to the inner chamber. The object of this toggle arm is to ensure that one valve shall be fully open when the other is quite closed, without any appreciable intermediate period.

The float is arranged to be self-draining, hence a slightly leaking float will not impair the functioning of the apparatus.

Assuming that the engine is running and that the float, Y, has just operated to close the induction pipe valve and open the air vent, Q1, then fuel within the inner chamber, L, will gravitate into the outer chamber through the drop valve, L1, until the level in both chambers is alike.

Continued running of the engine will lower the level until the weight of the float on the toggle arm, Y1, operates the latter to close the air vent and open the induction pipe connection, X.

The induction pipe depression or suction is then transmitted to the inner chamber and causes the drop valve to close, because atmospheric pressure exists in the outer chamber, its air vent being always open. Fuel is then drawn from the main tank and fills up the inner chamber until the float again operates to reverse the position of the two valves and repeat the cycle.

During the suction period, the engine has, of course, to run on fuel contained in the outer chamber, which is made of ample capacity to meet this demand.

When the engine is idling the depression in the induction pipe is considerable but the amount of mixture taken by the engine from the carburetter is, of course, at a minimum. Consequently, the suction period of the vacuum feed is liable to upset smooth idling of the engine owing to the fact that the air which it then draws from the inner chamber is heavily carburetted, and an over-rich mixture results.

To obviate this, a spring-controlled piston valve is arranged at X1 in the pipe between the induction pipe and the inner chamber which, under such circumstances, automatically restricts the passage to the induction pipe and extends the suction period. By this means the change in quality and quantity of the idling mixture is rendered negligible. As the main engine throttle is opened the spring returns the piston valve towards its open position.

Failure of Supply. To fill the vacuum tank when it has been emptied, due to running out of fuel or draining for cleaning, close the main throttle, see that the starting carburetter control is in the closed position, then use either the starting motor to turn engine for a few seconds, or crank by hand ; the vacuum produced in the induction system will then draw fuel from the main tank.

Its presence can be checked by turning on the fuel tap and removing the plug on the float chamber cover. The end of the float needle will then be exposed. This may be raised with the fingers and should cause flooding.

Should cranking the engine with the throttle closed not have the desired effect, it may be due to foreign matter on the drop valve, or to the fact that the valves are dry owing to the vacuum tank having been standing empty for a considerable time.

Under these circumstances, the fuel supply pipe should be removed and a little fuel syringed into the inner tank to wash away sediment from the drop valve and moisten the valves.

This should result in the apparatus functioning correctly. If it does not, the inner tank should be removed and the drop valve inspected.

The two unions should be disconnected, and the screws which hold the inner chamber in position removed. Care should be taken not to damage the joint washers when lifting out the inner chamber. To avoid doing so, a knife or similar instrument should be run round between the washer and the outer tank facing.

With the inner chamber removed, the drop valve can be inspected and cleaned if necessary. It occasionally happens that a black deposit forms on the valve, which prevents it from closing properly. This should be carefully cleaned off.

Fuel Strainers and Filter. A small conical strainer gauze is located on top of the inner chamber of the vacuum tank at the junction of the main fuel supply pipe, and irregularity in the working of the vacuum feed may be due to choking of this strainer with foreign matter.

It should be removed every 5,000 miles, as directed on page 132, by disconnecting the main supply pipe, and carefully cleaned.

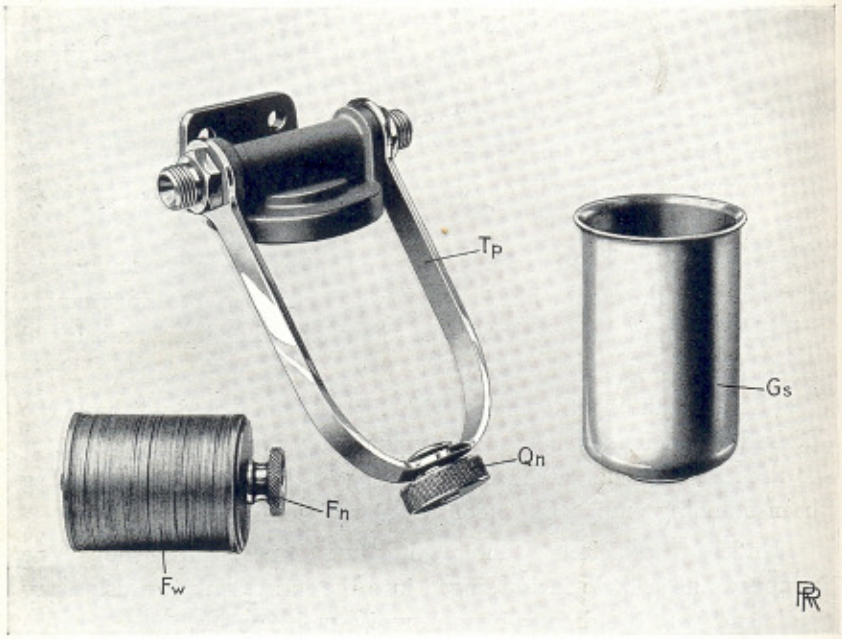

FIG. 13. DASHBOARD FILTER DISMANTLED.

The gauze must be replaced with the cone pointing upwards.

A filter is arranged in the pipe line between the vacuum feed tank and the carburetter float chamber.

This filter is mounted on the front of the dashboard, under the steering column.

It is of the type in which the fuel is caused to flow between the faces of adjacent metal washers. Small protuberances on these faces result in very small clearances being formed between the washers when they are clamped together.

The filter is shown dismantled for cleaning in Fig. 13. It should be cleaned every 1,000 miles, or two weeks, as directed on page 128.

Before dismantling, the fuel tap on the dashboard should be turned off.

The knurled nut **Q**n should be released, and the stirrup **T**p swung forward, as shown, care being taken to hold the cover or sump **G**s, or this will fall out.

The filter element **F**w can then be removed by releasing the knurled nut **F**n, and withdrawing the element downwards. It should be cleaned by shaking and washing in petrol.

The sump **G**s should be carefully cleaned out.

On certain chassis, two strainers are arranged in the main fuel tank, as shown in Figs. 14 and 15, that enclosed within the tube **T**m being on the main supply and that within the tube **T**r on the reserve supply.

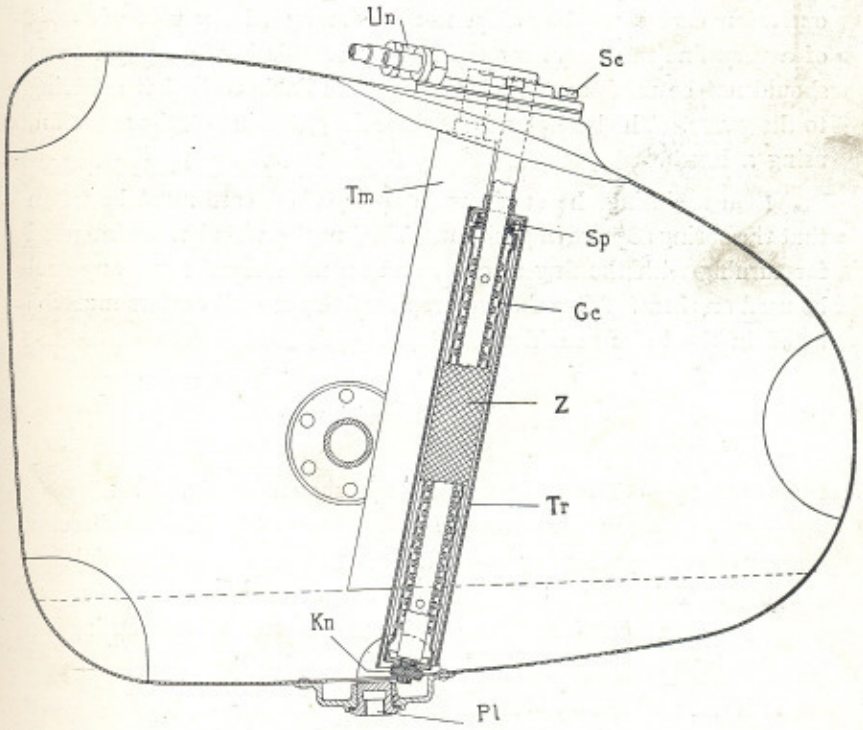

FIG. 14. FUEL TANK STRAINERS.

In Fig. 14 the reserve strainer is shown in section in order to make clear how removal of the gauze is effected for cleaning. The detail arrangements of both strainers are identical, and therefore similar remarks apply.

To remove them for cleaning every 5,000 miles, as directed on page 132, the unions, **U**n, should be disconnected and the six screws, **S**c, removed.

The strainers may then be lifted out of the tank, care being taken not to damage the leather joint washer.

Each gauze is retained in position by a knurled nut, **K**n, which is prevented from coming adrift by a split cotter. After removal of the latter, and unscrewing the knurled nut, the gauze may be removed, care being taken not to lose the small coil spring **S**p, which is arranged on top of the gauze carrier **G**c.

This can now be removed and the gauze **Z** cleaned. During this operation care must be taken not to damage the gauze, which is of a very fine mesh and somewhat fragile. Cloth of a fluffy nature should not be used, as particles of fluff are liable to be left adhering to the gauze. The best plan is to wash the gauze in petrol or paraffin, using a brush.

When replacing the strainers in their tubes, care must be taken that the springs **S**p are in position. The knurled nuts **K**n are intended for turning with the fingers only, and on no account must any tool be used on them. After they are replaced, brass split cotters must be fitted in the holes provided.

When replacing the strainers in the tank, care must be taken that the leather joint washer is in position.

Fuel Tank. The main fuel tank is shown in Fig. 15.

It should be drained every 5,000 miles, as directed on page 132, by releasing the drain plug, **P**1, with the special key provided. This will flush out any accumulation of sediment or water. The precaution is especially important when touring on the Continent.

It is not necessary to *remove* the plug. It need only be unscrewed a turn or so and must afterwards be securely re-tightened.

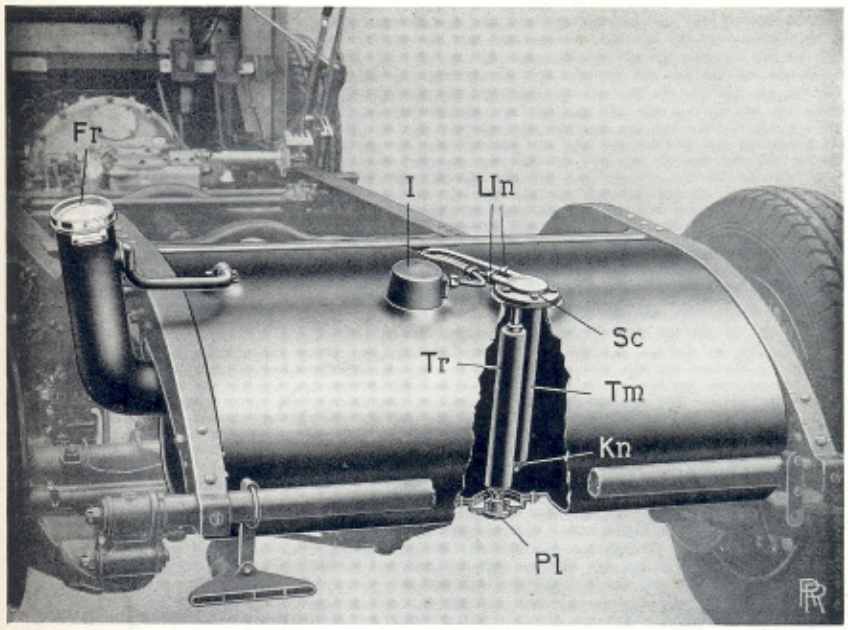

FIG. 15. FUEL TANK.

The large filler spout is closed by a hinged cap, **Fr**, which is released by pulling the toggle lever outwards. A suitable air vent is provided in the end of this spout.

Fuel Gauge. There are two pamphlets dealing with the fuel gauge at the end of this book, to suit the type of gauge which may be fitted.

The tank unit of the gauge is enclosed within a cover, **I**, Fig. 15.

Action of the Carburetter. The carburetter is of the Rolls-Royce automatic expanding type, provided with two jets adjustable by a single lever under the driver's control.

Each of these jets is located in a Venturi tube, the smaller one always being in action, and the larger one being automatically brought into action by an increase, beyond a certain value, in the depression existing within the carburetter, due to an increase of engine speed or throttle opening, or both.

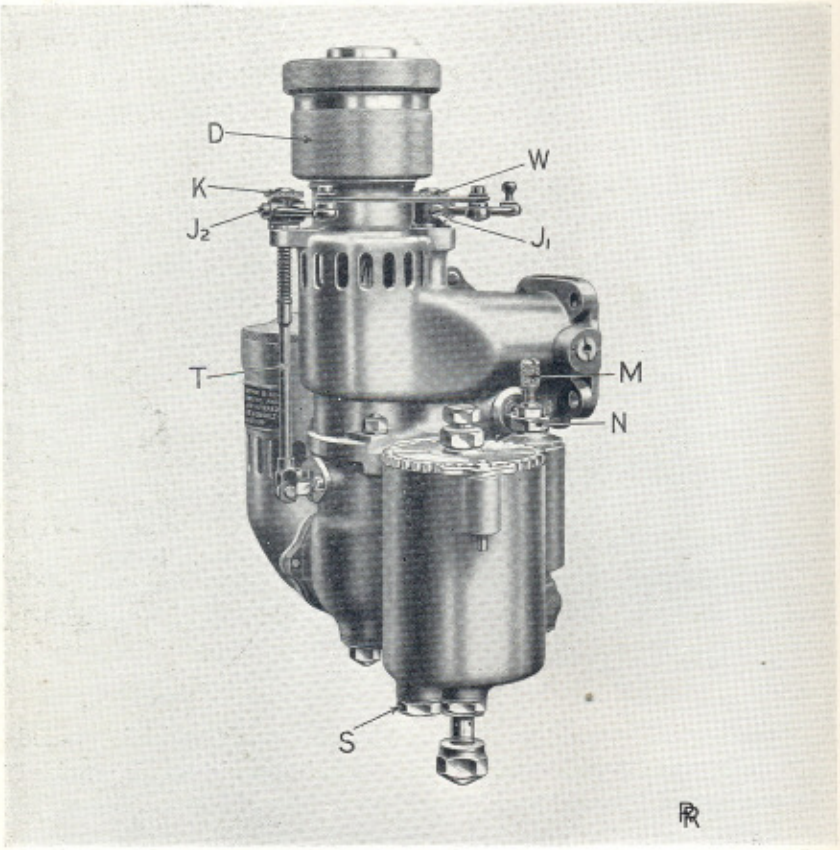

FIG. 16. CARBURETTER.

The complete carburetter is shown in Fig. 16, and in Fig. 17 it is shown with certain parts removed.

The outlets of the jets are regulated by taper needle valves, that for the small or low-speed jet being shown at **W** (Fig. 16), and the control for the large or high-speed jet needle at **T**.

The automatic " expanding " effect is attained by the provision of a suction-operated piston working in a cylinder, **D** (Figs. 16 and 17), located above the high-speed jet.

The cylinder **D** and piston **E** are shown removed for cleaning in Fig. 17. The cap **F** carrying the spring **F1** fits over the top of the cylinder, and is retained by the knurled nut **G**.

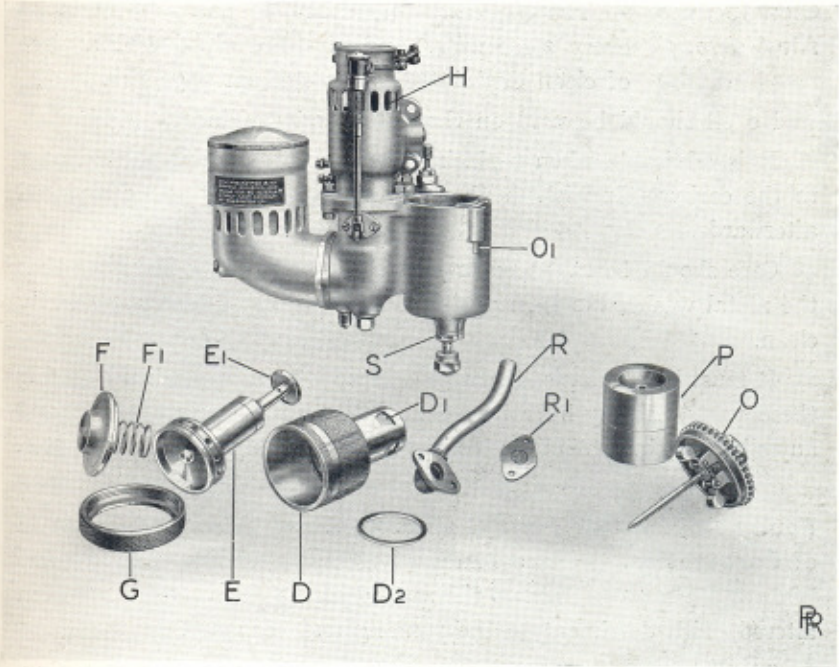

FIG. 17. CARBURETTER, WITH CERTAIN PARTS DISMANTLED.

Increased depression in the carburetter raises the piston **E** against the spring **F1**, carrying with it a diaphragm **E1**, which fits into, and, in its lowest position, blanks off the larger choke tube. The lifting of this diaphragm admits air past the high-speed jet.

More movement of the piston not only opens the high-speed choke tube still further, but also admits air by uncovering the ports **D1**, the air gaining admission through ports **H** in the carburetter, thereby counteracting the tendency for the mixture to become over-rich at increased air velocity.

The various adjustments should on no account be altered, the carburetter having been carefully set by the makers in the first instance.

The mixture control lever, which operates on both jets simultaneously, provides ample range to suit ordinary variations in running conditions, such as different atmospheric temperatures and different fuels, including the use of benzole or benzole-petrol mixtures.