THE S.U.

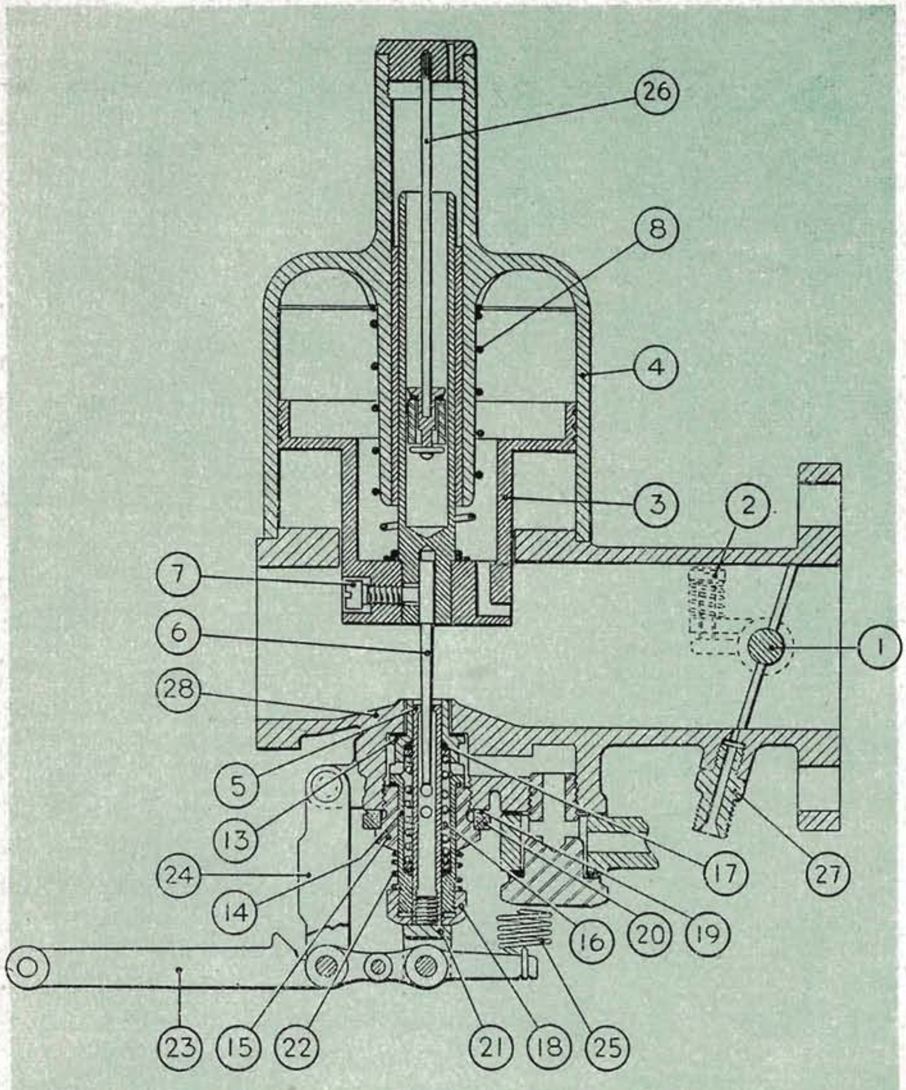

Fig. 1. General arrangement diagram of a horizontal S.U. carburetter.

THE S.U. carburetter is of the automatically expanding choke type, in which the cross-sectional area of the main air passage adjacent to the fuel jet, and the effective orifice of the jet, is variable. This variation takes place in accordance with the demand of the engine as determined by the degree of throttle opening, the engine speed, and the load against which the engine is operating.

The distinguishing feature of this type of carburetter is that an approximately constant air velocity, and hence an approximately constant degree of depression, is at all times maintained in the region of the fuel jet. This velocity is such that the air flow demanded by the engine in order to develop its maximum power is not appreciably impeded, although good atomisation of the fuel is assured under all conditions of speed and load.

The maintenance of a constant high air velocity across the jet, even under idling conditions, obviates the necessity for a separate idling jet. A single jet only is employed in the S.U. carburetter.

The main constructional features of the carburetter in its simplest form are shown in Figs. 1 and 2, which illustrate a typical horizontal-type carburetter. These diagrams illustrate the main body, butterfly throttle, automatically expanding choke and variable fuel-jet arrangement. They also indicate the means whereby the jet is lowered by a manual control to effect enrichment of the mixture for starting and warming up. A float-chamber of the type normally employed is illustrated in Fig. 2.

Turning to Fig. 1 it will be seen that a butterfly throttle mounted on the spindle (1) is located close to the engine attachment flange, at one end of the main air passage, and that an adjustable idling stop screw (2) is arranged to prevent complete closure of the throttle, thus regulating the flow of mixture from the carburetter under idling conditions with the accelerator released.

Towards the other end of the main passage is mounted the piston (3), its lower part constituting a shutter, restricting the cross-sectional area of the main air passage in the vicinity of the fuel jet (5) as the piston falls. This component is enlarged at its upper end to form a piston of considerably greater diameter which moves axially within the bore of the suction chamber (4) and at the bottom of the piston is mounted the tapered needle (6) which is retained by means of the set screw (7).

The piston component (3) is carried upon a central spindle which is slidably mounted within a bush fitted in the central boss forming the upper part of the suction chamber casting.

An extremely accurate fit is provided between the spindle and the bush in the suction chamber so that the enlarged portion of the piston is held out of contact with the bore of the suction chamber, within which, nevertheless, it operates with an extremely fine clearance. Similarly, the needle (6) is restrained from contacting the bore of the jet (5) which it is seen to penetrate, moving axially therein in correspondence with the rise and fall of the piston.

Piston Operation

It will be appreciated that, as the piston rises, the air passage in the neighbourhood of the jet becomes enlarged, and passes an additional quantity of air. Provided that the needle (6) is of a suitably tapered form, its simultaneous withdrawal from the jet (5) ensures the delivery to the engine of the required quantity of fuel corresponding to any given position of the piston, and hence to a given air flow.

The piston, under the influence of its own weight and in certain cases assisted by the light compression spring (8), will tend to occupy its lowest position, two slight protuberances on its lower face contacting the bottom surface of the main air passage adjacent to the jet. The surface in this region is raised somewhat above the general level of the main bore of the carburetter, and is referred to as the " bridge " (28).

Levitation of the piston is achieved by means of the induction depression, which takes effect within the suction chamber, and thus upon the upper surface of the enlarged portion of the piston through drillings in the lower part of the piston which make communication between this region and that lying between the piston and the throttle. The annular space beneath the enlarged portion of the piston is completely vented to atmosphere by ducts not indicated in the diagram.

The Float-chamber

It will be appreciated that, since the weight of the piston assembly is constant, and the augmenting load of the spring (8) approximately so, a substantially constant degree of depression will prevail within the suction chamber, and consequently in the region between the piston and the throttle, for any given degree of lift of the piston between the extremities of its travel.

It will be clear that this floating condition of the piston will be stable for any given air-flow demand as imposed by the degree of throttle opening, the engine speed and the load; thus, any tendency for the piston

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CARBURETTER

The first of a series of four articles based on official S.U. service data, providing a complete description and details for adjustment of this well-known and widely used intrument

to fall momentarily will be accompanied by an increased restriction to air flow in the space bounded by the lower side of the piston and the bridge, and this will be accompanied by a corresponding increase in the depression between the piston and throttle, which is immediately communicated to the interior of the suction chamber, instantly counteracting the initial disturbance by raising the piston to an appropriate extent.

The float-chamber, which is indicated in Fig. 2, is of orthodox construction, comprising a needle valve (9) located within a separate seating which, in turn, is screwed into the float-chamber lid, and a float (10), the upward movement of which, in response to the rising fuel level, causes final closure of the needle upon its seating through the medium of the hinged fork (11).

It will be seen that the float-chamber is a unit separate from the main body of the carburetter, to which it is attached by means of the bolt (12), suitable drillings being provided therein to lead the fuel from the lower part of the float-chamber to the region surrounding the jet.

The buoyancy of the float, in conjunction with the form of the lever (11), is such that a fuel level is maintained approximately ⅛ in. below the jet bridge (Fig. 1). This can easily be observed after first detaching the suction chamber and suction piston, and then lowering the jet to its full rich position. The level can vary a further ⅛ in. downwards without any ill effects on the functioning of the carburetter.

Jet Assembly

The only parts of importance in Figs. 1 and 2 not so far described are those associated with the jet.

Under idling conditions the piston is completely dropped, being then supported by the two small protuberances provided on its lower surface, which are in contact with the bridge (28); the small gap thus formed between piston and bridge permits the flow of sufficient air to meet the idling demand of the engine without, however, creating enough depression on the induction side to levitate the piston.

The fuel discharge required from the jet is very small under these conditions, hence the diameter of that portion of the needle now obstructing the mouth of the jet is very nearly equal to the jet bore. Initial manufacture of the complete carburetter assembly to the required degree of accuracy to ensure perfect concentricity between the needle and the jet bore under these conditions is impracticable, and an individual adjustment for this essential centralisation is therefore provided.

It will be seen that the jet is not mounted directly in the main body, but is housed in the parts (13) and (14) referred to as the jet bushes, or jet bearings.

The upper jet bush is provided with a flange which forms a face seal against a recess in the body, while the lower one carries a similar flange contacting the upper surface of the hollow hexagon locking screw (15).

The arrangement is such that tightening of the hollow hexagon locking screw will positively lock the jet and jet bushes in position. Some degree of lateral clearance is provided between the jet bushes and the bores formed in the main body and the locking screw. In this manner the assembly can be moved laterally until perfect concentricity of the jet and needle is achieved, the screw (15) being slackened for this purpose. This operation is referred to as "centring the jet"; on completion the jet locking screw (15) is finally tightened.

In addition to this concentricity adjustment, an axial adjustment of the jet is provided for the purpose of regulating the idling mixture strength.

Since the needle tapers throughout its length, it will be clear that raising or lowering the jet within its bearing will alter the effective aperture of the jet orifice, and hence the rate of fuel discharge. To permit this adjustment the jet is slidably mounted within its bearings and provided with adequate sealing glands.

A compression spring (16) will be observed which, at its upper end, serves to compress the small sealing gland (17) and thus prevent any fuel leakage between the jet and the upper jet bearing.

At its lower end this spring abuts against a similar sealing gland, thus preventing leakage of fuel between the jet and the lower jet bearing.

In both locations a brass washer is interposed between the end of the spring and the sealing gland to take the spring thrust. A further sealing gland (19), together with a conical brass washer (20), is provided, to prevent fuel leakage between the jet screw (15) and the main body.

It will be seen from the diagram that the upward limit of slidable movement of the jet is determined by the position of the jet-adjusting nut (18), since the enlarged jet head (21) finally abuts against this nut as the jet is moved upwards towards the "weak" or running position.

The position of the nut (18) therefore determines the idling mixture ratio setting of the carburetter for normal running with the engine hot, and it is prevented from unintentional rotation by means of the loading spring (22).

The cold-running mixture control mechanism comprises the jet lever (23) supported from the main body by the link member (24) and attached by means of a clevis pin to the jet head (21). A tension spring (25) is provided, as shown, to assist in returning the jet-moving mechanism to its normal running position. Connection is made from the outer extremity of the jet lever (23) to a control situated within reach of the driver.

Drillings in the float-chamber attachment bolt (12), the main body of the carburetter, the jet (5) and slots in the upper jet bearing (13) serve to conduct the fuel from the float-chamber to the jet orifice.

The Damper

One final feature of the carburetter may be noted from Fig. 1. It will be seen that the spindle upon which the piston (3) is mounted is hollow, and that it surrounds a

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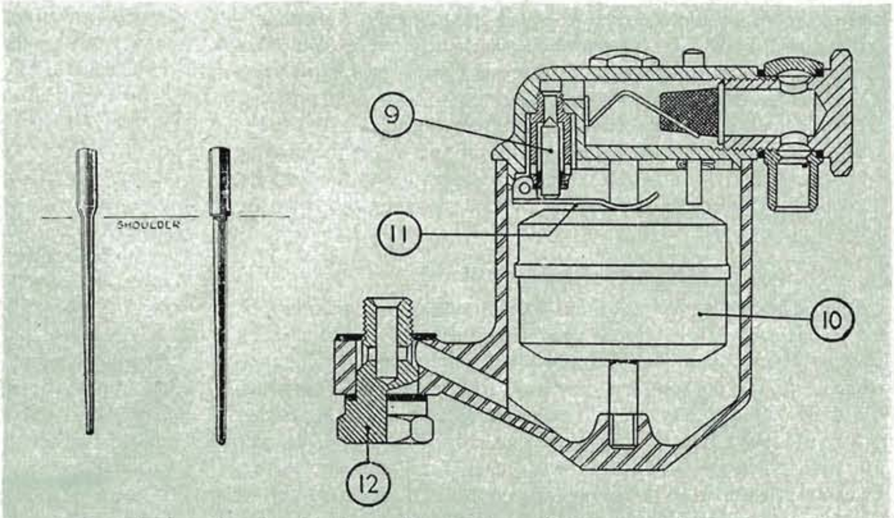

Left: Fig. 1a. Showing the jet needle shoulder which must be flush with the face of the piston. *Right:* Fig. 2. General arrangement diagram of the float-chamber.

small stationary damper piston suspended from the suction chamber cap by means of the rod (26). The hollow interior of the spindle contains a quantity of thin engine oil, and the marked retarding effect upon the movement of the main piston assembly, occasioned by the resistance of this small piston, provides the momentary enrichment desirable when the throttle is abruptly opened. The damper piston is constructed to provide a one-way valve action which gives little resistance to the passage of the oil during the downward movement of the main piston.

A throttle-edge connection (27) is provided for use in conjunction with suction-operated ignition advance mechanism, when this method of ignition control is used.

The initial choice of the needle (6) (Fig. 1) to suit the air/fuel requirements of a given type of engine is invariably determined, in the first instance, by careful observations of power and specific consumption on the test bed. It is not, therefore, a common requirement that the needle form should be changed in practice, in cases where the marking on the needle coincides with the original maker's specification. Where any doubt exists as to the suitability of the form of the needle fitted, this part may be withdrawn by removing the suction chamber (4) and loosening the screw (7), enabling the needle to be pulled out. Identification figures or letters will be found stamped either upon the outside of the needle shank, or upon its head.

When reinserting the needle, it is important that the shoulder, or junction between the parallel part of the shank and the tapered working section of the needle, should coincide with the bottom of the piston rod into which it is inserted. After ascertaining the suitability of the needle form, tuning of the carburetter is necessarily confined to correct idling adjustment. This operation is carried out by means of the idling stop screw (2) (Fig. 1) and the jet stop nut (18) (Fig. 1).

Before attempting to effect these adjustments, it is essential that the engine should have attained its normal running temperature. The throttle should then be gradually shut by means of the stop screw (2) until the slowest possible idling speed is achieved. The mixture strength should then be adjusted by vertical movement of the jet head (21), that is to say, by movement of the mixture control lever (23).

Mixture Adjustment

The object to be achieved is to obtain the mixture strength which will at this position of the screw (2) provide the fastest idling speed consistent with stable running. Before carrying out this operation, it is convenient to raise the jet stop nut (18) to its highest possible position (weakest mixture) by screwing this away from the jet head (21). It may also prove convenient temporarily to detach the return spring (25) (Fig. 1) to give access to the jet stop nut and independent control of the jet head.

Having moved the jet head (21) into the situation which provides the best engine speed at this throttle setting with even idling, it will probably be found that this idling speed is now somewhat excessive. The throttle should, in this case, be closed further by means of the adjusting screw (2) until an acceptable idling speed is achieved. Some final readjustment of the jet head (21) may now be beneficial. Finally, the jet stop nut (18) should be screwed downwards until it just contacts the upper face of the jet head (21) without altering the setting just attained.

It may be found that it is impossible to obtain a sufficiently weak idling mixture, even when the stop nut is screwed upwards to its fullest extremity, and the jet head raised to meet it. Alternatively, it may be found that the final idling setting is only achieved by an adjustment which involves the jet stop nut being screwed down several complete revolutions from its highest position.

Jet Needle Mounting

In the first case, the indications are that the needle has been inserted too far into the piston rod, and in the second case, that the needle has not been inserted far enough.

It will be realised that the final effective size of the jet orifice depends upon the combination of the needle position in the piston and the vertical position of the jet. For this reason, care should be taken to ensure that the needle is inserted with the shoulder flush with the lower surface of the piston rod, in accordance with the advice already given (see Fig. 1A).

It cannot be emphasised too strongly that any condition of adjustment other than that described, that is to say, any adjustment other than that necessary to provide the best possible idling condition, is quite useless for providing a richer or weaker mixture over the higher range of speeds and loads, that is to say, under actual driving conditions.

If, having carefully adjusted the idling mixture strength as described above, the mixture strength under driving conditions appears to be too weak, as indicated by lack of power, or too rich, as suggested by heavy petrol consumption, the only remedy consists in a change of needle form.

Before arriving at the conclusion that a change of needle is advisable or necessary, a careful examination should be undertaken for the detection of other possible defects in the carburetter, the ignition system, or in the general mechanical condition of the engine.

It should be noted that where some alteration in the main air/fuel ratio is required, it is the needle alone that is changed , all jets being of the same size for a given type and size range of carburetter.

As a result of the constant air speed in the region of the jet discharge and the consequent constant and fairly substantial depression in this neighbourhood (approximately eight inches of water-head) the S.U. carburetter is relatively insensitive to the float-chamber fuel level, which does not therefore constitute a major tuning factor.

Finally, one point of great importance bearing upon the performance of the carburetter should be noted. Where an air cleaner or intake silencer is provided, this fitting, together with any air pipe connecting it to the carburetter intake, can rarely be removed, or replaced by a cleaner or pipe of different type, without some alteration becoming necessary to the needle form.

(To be continued)