ZENITH CARBURETTOR.

THE following notes relate to the construction and fundamental working principle of the Zenith carburettor, which is a standard fitting on the Siddeley "Puma" 240 B.H.P. engine.

It is, however, pointed out that this instrument is one of great reliability and that adjustments of any kind whatever to it are very rarely necessitated, as once set it should not require any attention over long periods of time, except an occasional inspection and washing out. On no account should any tampering with the jet orifices be permitted, and it is largely with a view to emphasising the importance of leaving the carburettor alone that the following notes are given, as no such tampering would ever be undertaken by anyone who possessed a working knowledge of the principles of the Zenith carburettor.

In a spray carburettor of ordinary construction the speed of the two fluids concerned, *i.e.*, air and petrol, through their respective passages, is not modified proportionately under the influence of varying speeds of suction. Effect of inertia comes into play, producing an excess of petrol at high speeds and a want of it at low speeds. The ratio of petrol and air can then be represented by a curve which has an upward tendency with an

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increase of engine speed. This effect can clearly be best neutralised by introducing a device which on its own account would produce a similar shaped but downward curve, giving a decreasing ratio as the speed of the engine increases. If two such curves are compounded the result is a straight line representing the desired effect of a constant ratio between petrol and air. In order to accommodate the requirements of the downward curve suggested above it is found that a second petrol jet answers the purpose, providing that it yields a constant flow of petrol for a given unit of time. This, therefore, must consequently be independent of the suction inside the carburettor.

Rear view of the Zenith Carburettor from which the slow running device has been withdrawn and is shown leaning against the float chamber.

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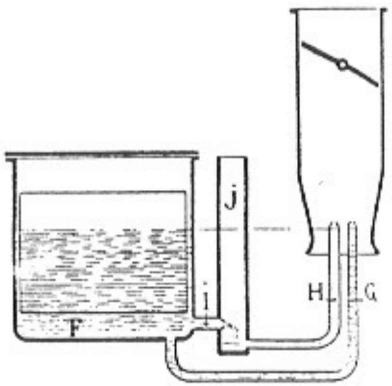
The accompanying diagrammatic section shows how this condition has been fulfilled in the Zenith carburettor. To a jet of the ordinary type G, which draws petrol from the



Diagrammatic section of Zenith Carburettor

float chamber F, is added a compensating jet H, the latter drawing its supply of petrol from a pipe J of fairly large diameter, which has its free end in the open air. The supply of petrol to the base of this pipe comes from the float chamber and is regulated by a gauged orifice, the flow being determined not by the suction of the engine but by the height of the column of petrol above the orifice I, and this height is in itself constant owing to the principle of the float chamber. The section of J being considerably larger than that of H, the result

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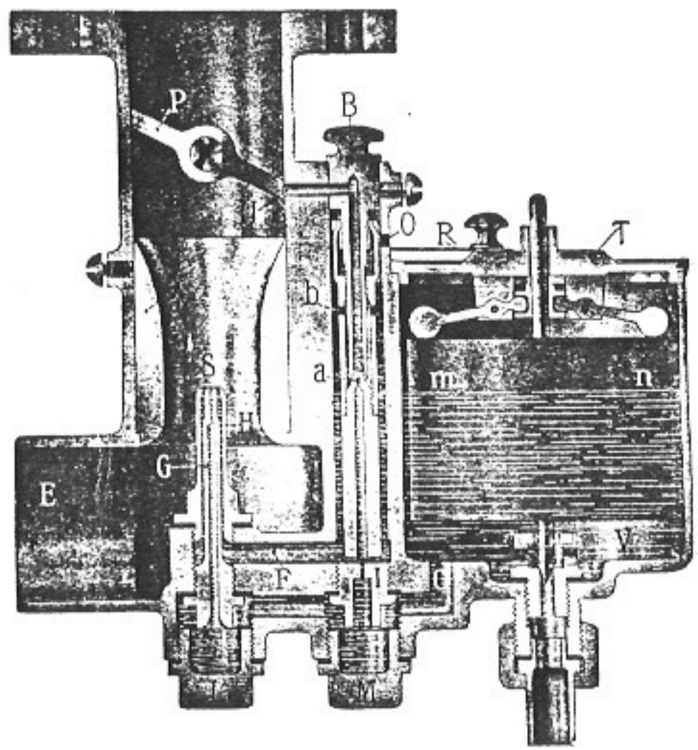
is that changes of pressure within the carburettor remain without influence over the flow of petrol through the gauged orifice I, which, therefore, plays the part which has been shown to be necessary in the theoretical consideration above. The result is that through all ranges of varying engine speed the ratio of petrol and air passed through the carburettor remains constant, and in the ordinary way no additional compensating devices are necessary.



ZENITH CARBURETTOR—*continued.*

A sectional view of the complete carburettor is given herewith. The two jets, main G and compensating H, are disposed concentrically, one within the other, the main jet being in the centre and the compensating jet round it. It will be seen that the latter is connected through a horizontal pipe to a chamber immediately above the gauged orifice I. The main jet is fed in the ordinary way direct from the float chamber, the passage being sealed with the plugs L and M, which permit the removal of the main jet and gauged orifice. The choke tube X surrounds the main and compensating jets and regulates the velocity of the air past the opening of these jets, which is necessary to ensure proper vaporization of the petrol. The choke tube, which is removable, also regulates the quantity of mixture that is passed to the cylinders under the varying conditions of work. At very low engine speeds, however, such as when the aeroplane is on the ground, the depression or suction on the jets is very weak, since the throttle P is very nearly closed. This being so, practically no petrol can pass through the jets, so that the mixture for slow running is inclined to be too weak, and would in fact be so if no arrangement was made to cope with this difficulty. In the above circumstance, however, the suction at the

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edge of the throttle disc is very strong and advantage is taken of this for furnishing a suitable mixture for very low speeds, as when starting and for slow running, by connecting the orifice adjacent to the edge of the throttle disc with a jet taking its petrol from a well immediately over the gauged orifice I.

It will be seen from the preceding remarks that for easy starting up and good slow running the throttle must only be open very slightly to ensure a good suction over the slow running jet H.

The latter, secured to a separate body B, forms in effect a completely independent carburettor, providing a rich mixture which is drawn into the cylinders by the air rushing past the edges of the butterfly throttle at U. It is necessary, however, to be able to regulate the amount of petrol that can pass through this slow running jet, and the arrangement adopted consists of a screw device ending in a conical choke tube which controls the suction over the jet A. By altering the position of this little choke tube in relation to the jet the mixture for slow running can be regulated.

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The bypass hole adjacent to the throttle is drilled in such a position that as the throttle opens it gradually uncovers this orifice and gives an even increase of mixture such as is necessary to ensure smooth acceleration until the main jets come into operation, consequently there is no hesitation from the point where the bypass or slow running jet goes out of action and the main jet comes into play and the engine accelerates smoothly up to full speed.

In order to regulate the slow running carburettor the body B is removed, after which the bottom part of the slow running carburettor can be unscrewed or screwed up two or three notches, as the case may be, and replaced.

If when the engine is running slowly explosions and flames take place in the exhaust, this is evidence of too rich a mixture from the bypass jet. To correct this the tube should be slightly unscrewed. If on the contrary the engine runs for a few seconds and then stops, this is evidence of too weak a mixture and the bottom part of the tube should be screwed up a notch or two. A view of

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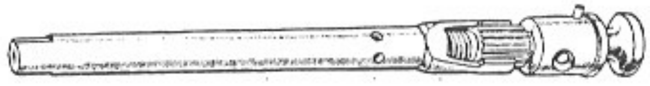
the bypass complete, showing the method of adjustment, is given in a sketch herewith.



The slow-running device of the Zenith Carburettor, showing the screw adjustment and locking arrangement. In the carburettor itself it is placed vertically.

Owing to the varying density of air at different altitudes above the surface of the earth carburation is seriously affected at considerable heights, and in order to get full power from the engine it is necessary to adopt a means of correcting this. The tendency is for the mixture with increasing altitudes to become too rich, and in the Zenith carburettor this effect is neutralised mechanically by a very simple device. Herewith is a diagrammatic section of the carburettor, leaving out the compensating jet and starting jet, neither of which are affected by the principle about to be described.

The rate of discharge from the main jet, which is in direct communication with the float chamber, is due to the difference in pressure between the air over the float chamber and the air in the mixing chamber over the jet. Advantage is taken of this

ZENITH CARBURETTOR—*continued.*

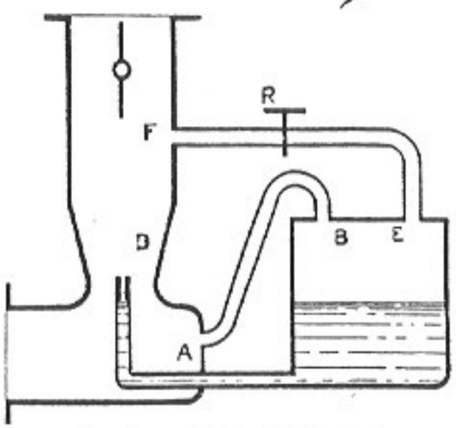


Diagram showing principle of Altitude Correction.

fact for arriving at a means of varying the discharge from the main jet. This is effected by providing a means for altering the pressure over the float chamber and thereby varying the discharge of petrol from the main jet. Reference to the sketch will show that the float chamber is hermetically sealed, and communication A B is established between the top of the chamber and the air inlet of the carburettor. A second communication, E F, connects the top of the float chamber to the mixing chamber above the choke tube, and in this passage is placed a hand-controlled tap. If the engine is running there will be a certain suction or vacuum in the mixing chamber D, whilst at A the pressure will be that of the

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atmosphere; the greatest vacuum will be at the mouth of the choke tube. In all cases the pressure at A will be greater than at D because of the resistance offered by the choke tube to the flow of air. If the tap R is closed the discharge of petrol from the main jet is determined by the vacuum or depression at D minus the depression in the float chamber, which will be the same as at A. If the tap R is opened the pressure in the float chamber is lowered and it becomes nearer to that which exists at D. In this way the flow from the jet is lessened as the total resulting pressure forcing the petrol through the jet is decreased. In practice such an arrangement is carried out by simply drilling passages in the body of the carburettor. The third hole that will be seen inside the float chamber is to allow the compensating jet to work at the same pressure as the float chamber as previously explained. As the carburettor is adjusted on the ground with the tap shut it is only necessary to open the latter more or less to correct the mixture at high altitudes.

GENERAL HINTS ABOUT CARBURETTORS.

If misfiring takes place and explosions occur in the exhaust pipe the mixture is too rich. This may be caused by a punctured float, a dented float needle, or the existence of dirt on the seating of the needle, so preventing the valve closing properly.

Should the engine after several minutes' running, gradually tend to overheat and lose power, this is probably due to want of petrol. This may be caused by inadequate petrol supply owing to the filter being clogged up with dirt, or the jet might be stopped up through the same cause.

Short red flames from the exhaust indicate a rich mixture; long blue ones are a sign of too weak a mixture. A black sooty exhaust is a sign of an extremely rich mixture.

Inlet pipe joints must be perfectly sound and tightened up properly. Any air leakage through them will increase petrol consumption, reduce power, and make starting difficult.

The carburettors should be frequently cleaned out with petrol in order to avoid drops of water collecting. This water may exist as an impurity

in the petrol or may arise from condensation. The petrol filters must be dismantled and cleaned with great frequency to ensure a free supply of fuel.

In the event of jets becoming stopped up, wash them in petrol and blow out the obstruction either by mouth or an air pump. Do not clean them with a piece of wire.

In the event of a damaged or punctured float do not repair it, fit a new one.

Never grind in a float needle, it ruins both needle and seating.