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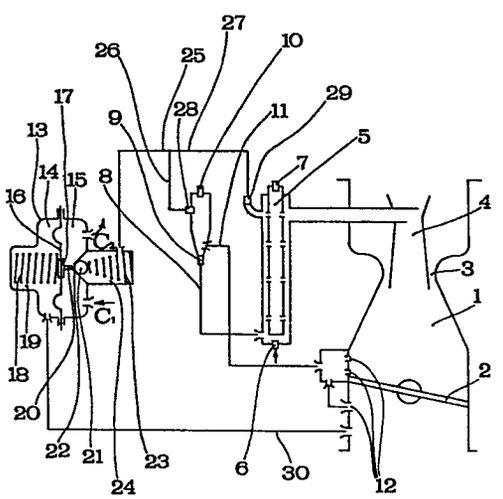
(54) Device adapted to enrich the mixture supplied by a carburetor for internal combustion engines.

(57) A vacuum capsule opens an additional fuel circuit when the vacuum in the suction manifold has a comparatively low value because the engine functions at heavy duty conditions and full power; said circuit has two branch conduits to feed fuel both to the main feed circuit and the idling circuit of the carburettor. The amount of fuel supplied to these two circuits is adapted to maintain the correct strength of the mixture supplied by the carburettor in the running conditions for which the vacuum capsule opens said circuit.



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Device adapted to enrich the mixture supplied by a carburettor for internal combustion engines.

The invention relates to carburettors for internal combustion engines and in particular to a system adapted to supply, under certain conditions of operation of the engine, additional fuel to the conventional main feed and idling circuits of the carburettor.

Devices for supplying additional fuel to the aforesaid circuits are known; they mainly consist in additional fuel circuits controlled by a vacuum capsule whose movable partition actuated by the vacuum existing downstream of the throttle valve is capable of opening the connection means between the additional circuits and the main circuit or the idling circuit.

Said devices do not supply the two aforesaid circuits simultaneously, but act separately with additional fuel in the first or second circuit; this not only involves the disadvantage of not solving the problems of bulkiness and economy of the used materials, but moreover does not permit to obtain a correct metering of the mixture in all operating conditions of the engine as the separate vacuum members act on the respective circuits, which are separate, in different ways and at different times.

It is the main object of the present invention to provide a device which in certain operating conditions of the engine increases the amount of fuel supplied simultaneously to the main circuit and the idling circuit to maintain the correct strength of the mixture

in said operating conditions.

Another object of the invention is to provide a circuit controlled by a vacuum member adapted to minimize the times required for feeding the fuel to said main and idling circuits when the load applied to the engine increases rapidly from a low rate of rotation.

The device according to the invention is characterized by what is set forth in the first claim; other characteristics, advantages and embodiments of the invention are set forth in the subsequent claims and in the description referring particularly to the accompanying drawing given by way of a non-limiting example.

In its preferred embodiment the invention is incorporated in a carburettor with only one main conduit 1 controlled by the throttle valve 2 actuated by the driver; arranged in the main conduit 1 is a venturi 3 in the interior of which there is a centring member 3 which communicates directly with the emulsioning tube 5. This latter receives the fuel from the constant level float chamber, not shown; the fuel is metered by the main jet 6 and emulsified with air coming in known manner from the calibrated nozzle 7.

The circuit 8 for the formation of the mixture supplied during the idling and low performance steps of the engine starts at the bottom of the emulsioning tube 5. The conduit 8 leads to the calibrated orifice 9 to which air is supplied from the calibrated nozzle 10 to form an emulsion which through the conduit 11 is fed into the main conduit 1 through a plurality of holes 12 arranged in the area controlled by the throttle valve 2. Said elements which are known per se constitute the main and idling circuits of the carburettor.

The device according to the invention consists of a vacuum capsule 13 which is inwardly divided into two chambers 14 and 15, which do not communicate with each other, by means of an elastic diaphragm 16 reinforced in its central portion by a rigid disk 17 biassed by a spring 18 housed in the chamber 14 and more precisely

in a cylindrical projection 19; said spring is adapted to bias the disk 17 towards the right with a predetermined load; secured to the right side of the disk 17 is a pin 20 adapted to shift under the action of the spring 18 the ball 21 from its sealing seat 22 against the action of a spring 23 arranged in the cavity 24 in front of the capsule 13.

The chamber 15 of the capsule 13 communicates with the constant level float chamber, not shown, through a first and a second conduit C_1 and C_2 which respectively permit the flow of the fuel from the float chamber to the chamber 15 and from the latter to the float chamber; the conduit C_2 mainly has the purpose of removing from the chamber 15 any fuel vapour bubbles which may form therein.

When the ball 21 is removed from its seat 22 by the pin 20, the chamber 15 also communicates with the cavity 24 from which departs a conduit 25 which then extends in a vertical plane until it reaches a certain height over the constant level float chamber whereafter it extends horizontally; two branch conduits 26 and 27 depart from the horizontal portion of the conduit 25 and lead into the idling circuit 11 in the area of the calibrated orifice 9 and into the emulsioning tube 5, respectively. The two conduits 26 and 27 are provided with two calibrated orifices indicated by 28 and 29, respectively,whose functions will be explained in greater detail hereinafter.

The chamber 14 of the capsule 13 communicates with the conduit 1 through a conduit 30 which transmits to it at any moment the vacuum prevailing downstream of the throttle valve 2.

The operation of the device and particularly of the vacuum capsule 13 is evident from the accompanying drawing.

When the vacuum in the conduit 1 downstream of the throttle valve 2 is comparatively high due to little opening of the throttle valve 2, the diaphragm 16 and the disk 17 are withdrawn to the left so that the pin 20 does not urge the ball 21 away from the sealing seat 22. Under these conditions the conduit 25 is not fed with fuel from the float chamber through the conduit C_1, the chamber 14, the

sealing seat 22 and the cavity 23 which accommodates the spring 24.

When the main circuit does not yet supply fuel, a fuel mixture is obtained whose fuel component is determined by the idling jet 9 and air coming both from the nozzle 10 and the nozzle 7 through the conduits 26 and 27 and the nozzle 28; as a result, the mixture is made lean to an extent limited by the dimensions of the nozzles through which the air flows.

When also the main circuit is supplying fuel but the vacuum in the suction manifold is still sufficient to keep the seat 22 closed by the ball 21, the leaning effect persists but is progressively reduced until it eventually disappears.

When the same vacuum is comparatively low, the diaphragm 16 and the disk 17 are urged to the right by the spring 18; the pin 20 removes the ball 21 from the seat 22 and the conduit 25 receives fuel from the float chamber along the described path to supply the main and idling circuits.

To appreciate the utility of the invention it should be kept in mind that it is necessary to maintain the strength of the mixture at values in conformity with often contradictory but nevertheless important requirements such as fuel saving, the reduction of exhaust pollutants and the performance of a modern engine. In particular, it is necessary to keep the mixture supplied by the carburettor lean during the steps of idling and low and medium performance of the engine, i.e. when the throttle valve of the carburettor is only partially open; it is then necessary to enrich the mixture during the steps of high performance of the engine, i.e. when the throttle valve 2 is nearly or completely open.

To meet the criteria of fuel saving and reduction of exhaust pollutants, feeding of the engine in the steps of idling and low and medium performance is ensured by a carburettor with particularly reduced basic dimensioning (of the main and idling circuits) which in itself does not permit to feed the engine with a mixture of the correct strength during high performance and at full power. This

makes necessary an additional supply of fuel in these latter steps to ensure correct operation of the engine. The circuit controlled by the vacuum capsule 13 provides the main and idling circuits of the carburettor with an additional fuel supply to meet the feed requirements of the engine for high performance, but excludes this supply when the engine is idling or operating at low or medium performance.

An appropriate dimensioning of the spring 18 with respect to the diaphragm 16 permits to open the seat 22 for lower vacuum values, for example of 200 mmHg, i.e. when the throttle valve 2 is sufficiently but not completely open and protects the centering member 4 from the pulsating effects of the engine. Under these conditions the supply of the additional fuel takes place both through the branch 26, which leads to the idling circuit, and the branch 27 which leads to the main circuit, as in both these circuits signals are acting which are sufficiently powerful to attract fuel from the conduit 25.

By appropriately dimensioning the orifices 28 and 29 it is possible to obtain a prevalence of the amount of fuel fed through the branch 26 over the amount of fuel fed through the branch 27 at least in the beginning of the operation of the circuit controlled by the capsule 13. As the throttle valve 2 is gradually opened, the vacuum in the manifold diminishes, but the vacuum in the choke 3 increases; consequently, the supply of additional fuel through the conduit 26 diminishes progressively, but the supply of additional fuel through the conduit 27 increases progressively. When the throttle valve 2 has reached the completely opened condition, the idling circuit does not supply fuel because the signal of delivery actuation in the area of the holes 12 becomes very low; the additional fuel is only supplied by the branch 27 which feeds the main circuit. In this manner the engine is supplied with a mixture of the correct strength also in the completely open condition when the enrichment becomes particularly important due to the pulsating effect.

The device according to the invention permits the engine to be accelerated from a low rate of rotation to reach within the shortest

possible time values of rotation and torque permitted by partial, even if large, opening of the throttle valve 2 and this as a result of the short times of response of the circuits controlled by the capsule 13. Said times of response remain low even though the ascending column of the channel 25 contains a considerable hydrostatic head over the level of the float chamber. This can be explained by considering that in the open condition of the capsule 13 the conduit 25 receives both the signal coming from the conduit 1 downstream of the throttle valve 2 through the holes 12 and the signal coming from the venturi 3 through the centring member 4 and thus a resulting signal which is at any rate kept high and such as to keep high the speed of the fluid in all the conduits with supercharging circuit insertion times in the order of some hundredths of a second.

What has been described is but one of the possible embodiments of the invention in which many changes may be made which do not modify the essence. In particular, the conduit 27 may lead into the tube 5 at its base through an orifice, possibly a calibrated orifice, arranged parallel to the main jet 6 and which replaces the calibrated orifice 29.

The shapes, materials used and dimensions do not limit the scope of the present invention.

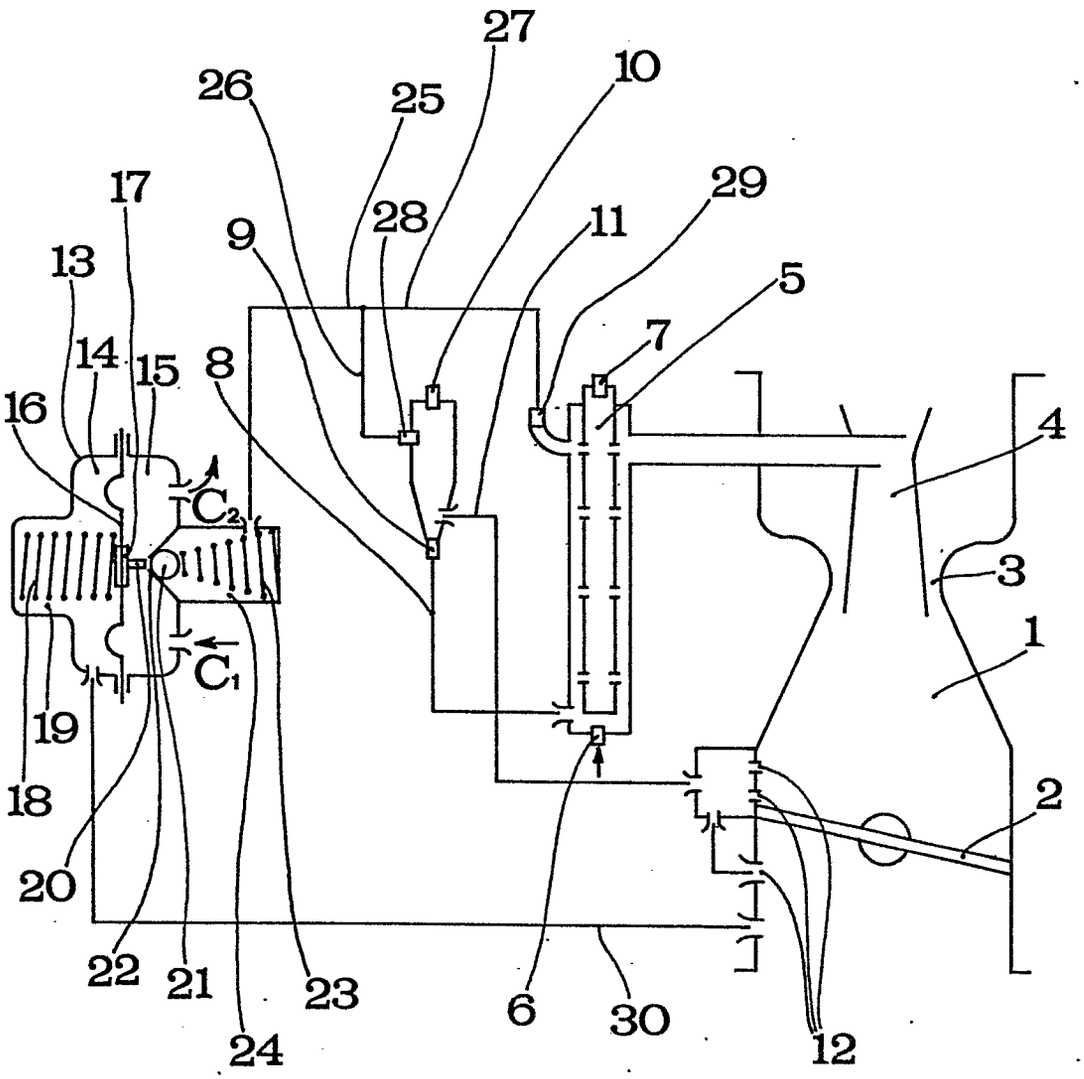
CLAIMS:

1) Device adapted to enrich the mixture supplied by a carburettor for internal combustion engines, provided with at least one main circuit for feeding the engine at high performance and full power and with a circuit for feeding the engine when it is idling or operating at low or medium performance, said circuits leading into the main conduit of the carburettor respectively adjacent the venturi and in the area of the idling delivery holes controlled by the main throttle valve, with a capsule responsive to the vacuum prevailing in the main conduit of the carburettor downstream of the throttle valve and adapted to open and close communication means between the constant level float chamber and a conduit arranged in the carburettor downstream of said communication means, characterized in that from said conduit there branch off a second and a third conduit which lead into the idling circuit and the main circuit of the carburettor, respectively.

2) Device adapted to enrich the mixture, according to claim 1, with a portion of said conduit arranged vertically until it reaches a certain height over the float chamber, characterized in that there is a first and a second calibrated orifice on said second and said third conduit, respectively.

3) Device according to claims 1 and 2, characterized in that said third conduit leads into the emulsioning tube at its base through a calibrated orifice arranged parallel to the main jet.

4) Device according to any of the preceding claims, characterized by what has been described and illustrated.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