

Feb. 22, 1966

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3,236,506

CARBURETORS FOR INTERNAL COMBUSTION ENGINES

Filed April 23, 1963

Fig. 1.

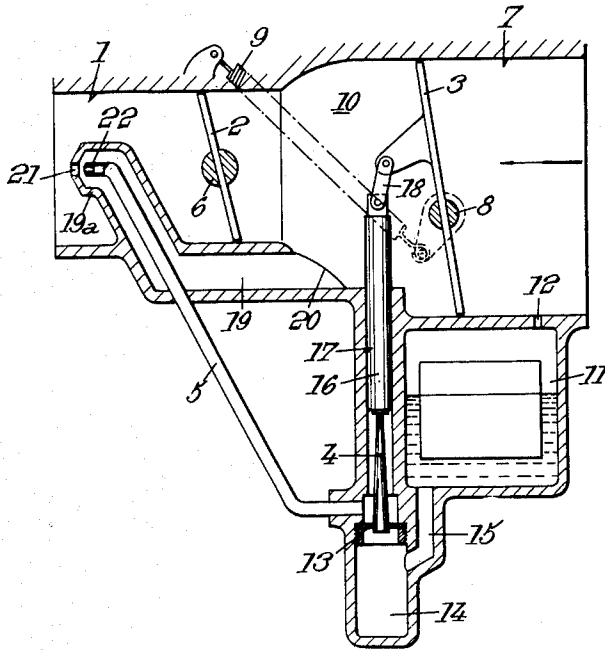
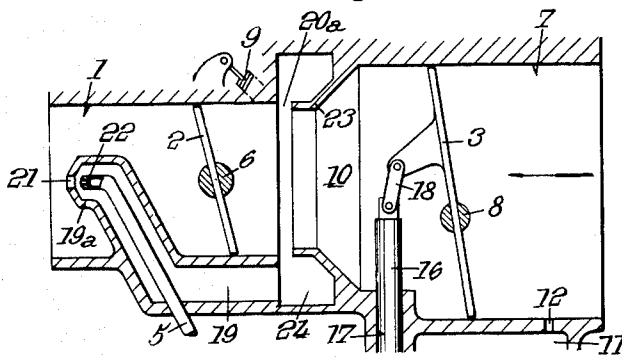


Fig. 2.



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3,236,506

CARBURETORS FOR INTERNAL COMBUSTION ENGINES

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Filed Apr. 23, 1963, Ser. No. 275,143

Claims priority, application France, May 2, 1962,
896,226

6 Claims. (Cl. 261—50)

The present invention relates to carburetors for internal combustion engines which comprise, in their induction pipe, upstream of the main throttle valve actuated by the driver, an auxiliary throttle valve which opens automatically and gradually as the flow rate of the air passing through said pipe increases and which controls a fuel metering member determining the flow rate of fuel through a fuel feed conduit opening into said induction pipe at a place where the suction is substantially the same as between said two throttle valves.

It is known that in such carburetors the cross sectional area of the air flow passage determined by said auxiliary throttle member and the cross section of the fuel flow passage determined by said fuel metering member are theoretically proportional to each other so that the air and the fuel supplied under the same pressure differences form a mixture of constant richness.

In devices of this kind such as already known the conduit through which fuel is sucked toward the induction pipe opened directly into the portion of this pipe located between the main throttle valve and the auxiliary throttle valve. Experience has taught that such an arrangement involved some drawbacks.

A first drawback is due to the fact that the fuel sucked into the induction pipe upstream of the main throttle valve is partly projected in the liquid state onto said main throttle valve and also onto the portion of the induction pipe wall adjoining said valve. When evaporating, this fuel produces a substantial temperature drop which causes ice to deposit on the main throttle valve, thus preventing it from closing correctly.

A second drawback is due to the fact that the eddies existing in said space between the two throttle valves project liquid fuel onto the wall of said space.

When the driver suddenly closes the main throttle valve this fuel deposited on the inner wall of the induction pipe is driven along as far as said throttle valve and closes the very thin annular zone for the passage for idling air between the main throttle valve and the wall of the induction pipe. The air and fuel mixture is thus exaggeratedly enriched for a time, which causes the engine to stall.

The object of the present invention is to provide a carburetor which obviates the above mentioned drawbacks.

For this purpose the carburetor according to the present invention is characterized in that the conduit through which fuel is sucked toward the induction pipe opens into an air conduit by-passing the main throttle valve, the end of said air conduit that opens into the induction pipe portion located between the throttle valves being of large area, whereas the end of said air conduit that opens into the induction pipe portion located downstream of said main throttle valve is of small area, so that the pressure in said air conduit is approximately the same as in the induction pipe portion located between the two throttle valves.

Preferred embodiments of the present invention will be hereinafter described with reference to the appended drawings given merely by way of example and in which:

FIG. 1 is a diagrammatic vertical section of a carburetor made according to the present invention;

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FIG. 2 is a view similar to FIG. 1 but showing a modification.

The carburetor shown by the drawings comprises, in its induction pipe 1, a main throttle valve 2 adapted to be actuated by the driver (through suitable link means not shown) and, upstream of said main throttle valve, an auxiliary throttle valve 3 which opens automatically and gradually as the flow rate of air passing through said induction pipe (in the direction of the arrows of FIGS. 1 and 2) increases, this auxiliary throttle valve 3 controlling a fuel metering member 4 which determines the flow rate of fuel through a fuel feed conduit 5 opening into induction pipe 1 at a place where the suction is substantially the same as between the two throttle valves 2 and 3.

In the example shown by the drawings, the main throttle valve 2 is in the form of a butterfly valve fixed on a rotating spindle 6. The auxiliary throttle valve 3 is mounted in the air intake 7 which constitutes the inlet of pipe 1 and which is protected by an air filter (not shown), and in the example shown it has the form of a disc mounted in an offset manner on a spindle 8, so that it tends to open under the effect of the air stream flowing through the air intake, and this against the action of a return device such as a counterweight or a spring 9. Of course, the auxiliary throttle means might be of any other type, for instance as known in the art (sliding piston adapted to project into the air intake 7, spring valve, etc.). As it is well known, auxiliary throttle valve 3 which, together with the main throttle valve 2, limits a chamber 10 in induction pipe 1, serves to keep, in this chamber, a substantially constant suction or at least a suction which varies according to a given law when the air flow rate varies.

Fuel comes from a suitable source, such as a constant level chamber 11 vented through a conduit 12 in communication with the air intake 7. Fuel is sucked through a metering orifice 13 from a chamber 14 which communicates with chamber 12 through a passage 15. The fuel feed conduit 5 starts from a space located downstream of metering orifice 13.

The metering member 4 consists of a needle the cross section of which varies along its length. This needle is rigid with a cylindrical rod 16 slidable in a cylinder 17 disposed in line with chamber 14. Rod 16 projects into chamber 10, where it is connected to auxiliary throttle valve 3 by means of a link 18. Thus the angular displacements of throttle valve 3 between the closed position shown by the drawings and its maximum opening position produce sliding displacements of metering needle 4 in orifice 13, i.e. variations of the annular cross section area of the passage through which fuel flows. The fuel sucked in through conduit 5 is therefore metered in accordance with the flow rate of the air passing through induction pipe 1.

Now, according to the present invention, conduit 5 opens not in chamber 10 as in the known devices but in an air conduit 19 by-passing the main throttle valve 2. Furthermore the end 20 (or 20_a) of this conduit 19 which opens into the portion of induction pipe 1 located between throttle valves 2 and 3 is of large cross section, whereas the end 21 of said conduit 19 which opens into induction pipe 1 downstream of the main throttle valve 2 is of small cross section.

As shown by the drawings, conduit 19 advantageously comprises a portion 19_a projecting into pipe 1 so that the downstream end 21 of said conduit 19 opens substantially along the axis of said induction pipe 1, being directed in the downstream direction. The downstream portion of fuel conduit 5, which is advantageously fitted with a calibrated orifice or fuel nozzle 22, is in line with orifice 21.

The difference between the respective cross section areas

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of orifices 20 and 21 must be such that the suction in conduit 19 is substantially the same as in chamber 10. By way of example, orifice 21 may be given a cross section area equal to the area of a circle having a diameter of 2.5 mm. whereas orifice 20 (or 20_a) is given a cross section area equal to that of a circle having a diameter of 12 mm. With such dimensions, it is found that if the suction existing in chamber 10 is 50 gr./cm.² it does not exceed 52/53 gr./cm.² in conduit 19 in the vicinity of orifice 22, even when the suction existing in pipe 1 downstream of the main throttle valve 2 averages 500 gr./cm.²

In the construction of FIG. 1 the inlet orifice 20 of conduit 19 is located in one region of the periphery of pipe 1. But, in this case, the suction collected through this orifice 20 may be slightly influenced by the shape of the air streams which flow through the annular space left free between throttle valve 3 and the wall of air intake 7.

In order to obtain in conduit 19 a suction which is less influenced by the position of the auxiliary throttle valve 3, it is advantageous, as shown by FIG. 2, to make the communication between the upstream end of said conduit 19 and induction pipe 1 in the form of an annular orifice 20_a limited on the upstream side by a convergent wall 23 and extending over the whole periphery of induction pipe 1. This annular orifice opens into an annular chamber 24 forming the upstream end of conduit 19. With such an arrangement, the suction in said conduit 19 is equal to the mean value of the local suctions over the periphery of chamber 10 so that the disturbances due to the degree of opening of the auxiliary throttle valve 3 are reduced.

The operation of this carburetor is as follows:

It is known that in such carburetors the suction in the space 10 between throttle valves 2 and 3 has a value which depends upon the characteristics of throttle valve 3 and of the return spring 9 thereof. This suction may be substantially constant or it may vary according to a predetermined law as a function of the working conditions of the engine.

The area of fuel flow determined by needle 4 in orifice 13 and the area of air flow determined by the opening of throttle valve 3 are substantially proportional to each other, so that air and fuel are at any time fed through orifices of proportional cross sections and under the same pressure difference, since the end of conduit 5 through which fuel is fed is always subjected to a suction substantially equal to that existing in chamber 10 as above explained. Thus the air and fuel mixture is of substantially constant richness whatever be the working conditions of the engine.

The feed of fuel to a point of induction pipe 1 located downstream of throttle valve 2 has the advantage that evaporation of fuel on said throttle valve and the resulting formation of ice are eliminated, same as the film of fuel which otherwise would be formed on the wall of pipe 1 upstream of throttle valve 2.

In a general manner, while the above description discloses what are deemed to be practical and efficient embodiments of the invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:

1. For use in connection with an internal combustion engine to be controlled by an operator, a carburetor which comprises, in combination, an induction pipe, a main throttle valve in said induction pipe directly operative by the operator, an auxiliary throttle valve in said induction pipe located upstream of said main throttle valve, said auxiliary throttle valve being mechanically independent of said main throttle valve and arranged to open automatically more and more as the air flow rate through said induction pipe increases, a constantly open primary air conduit by-passing said main throttle valve, said primary air conduit having an inlet orifice opening from

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a first portion of said induction pipe located between said two throttle valves, and a fixed outlet orifice opening directly into a second portion of said induction pipe located downstream of said main throttle valve, said primary air conduit and said inlet orifice being of sufficiently large cross section to ensure, at the downstream end of said conduit, a pressure substantially equal to that existing in said first portion of said induction pipe and said outlet orifice being of a cross section several times smaller than that of said conduit, any portion of said induction pipe downstream of said outlet orifice being of fixed cross section, a fuel feed circuit including a variable cross section fuel feed metering orifice and a fuel conduit extending downstream of said fuel feed metering orifice and opening into said primary air conduit opposite said outlet orifice thereof, and means operatively connected with said auxiliary throttle valve for controlling the cross section of said metering orifice in accordance with the position of said auxiliary throttle valve.

2. A carburetor according to claim 1 wherein the downstream end portion of said primary air conduit projects into said induction pipe so that its outlet orifice is located approximately on the axis of said induction pipe.

3. A carburetor according to claim 1 wherein said outlet orifice has a cross-section approximately equal to the area of a circle of 2.5 mm. diameter and said inlet orifice has a cross-section approximately equal to the area of a circle of 12 mm. diameter.

4. A carburetor according to claim 1 wherein said primary air conduit includes, at the upstream end thereof, an annular portion coaxially surrounding said induction pipe, the upstream wall of said annular portion being convergent in the direction of flow through said induction pipe, said conduit upstream end orifice consisting of an annular space left between said annular portion and said induction pipe.

5. For use in connection with an internal combustion engine to be controlled by an operator, a carburetor which comprises, in combination, an induction pipe, a main throttle valve in said induction pipe directly operative by the operator, an auxiliary throttle valve in said induction pipe located upstream of said main throttle valve, said auxiliary throttle valve being mechanically independent of said main throttle valve and arranged to open automatically more and more as the air flow rate through said induction pipe increases, a constantly open primary air conduit by-passing said main throttle valve, said primary air conduit having an inlet opening from a first portion of said induction pipe located between said two throttle valves, and a fixed outlet orifice opening directly into a second portion of said induction pipe located downstream of said main throttle valve, said primary air conduit and said inlet orifice being of sufficiently large cross section to ensure at the downstream end of said conduit a pressure substantially equal to that existing in said first portion of said induction pipe and said outlet orifice being of a cross section several times smaller than that of said conduit, any portion of said induction pipe downstream of said outlet orifice being of fixed cross section, a fuel feed circuit including a variable cross section fuel feed metering orifice and a fuel conduit extending downstream of said fuel feed metering orifice and provided at its downstream end with a fuel nozzle opening into said primary air conduit opposite said outlet orifice thereof, and means operatively connected with said auxiliary throttle valve for controlling the cross section of said metering orifice in accordance with the position of said auxiliary throttle valve.

6. For use in connection with an internal combustion engine to be controlled by an operator, a carburetor which comprises, in combination, an induction pipe, a main throttle valve in said induction pipe directly operative by the operator, an auxiliary throttle valve in said induction pipe located upstream of said main throttle valve, said auxiliary throttle valve being mechanically inde-

pendent of said main throttle valve and arranged to open automatically more and more as the air flow rate through said induction pipe increases, a constantly open primary air conduit by-passing said main throttle valve, said primary air conduit having an inlet orifice opening from a first portion of said induction pipe located between said two throttle valves, and a fixed outlet orifice opening into a second portion of said induction pipe located downstream of said main throttle valve, said primary air conduit and said inlet orifice being of sufficiently large cross section to ensure, at the downstream end of said conduit, a pressure substantially equal to that existing in said first portion of said induction pipe and said outlet orifice being of a cross section several times smaller than that of said conduit, any portion of said induction pipe downstream of said outlet orifice being of fixed cross section, a fuel feed circuit including a variable cross section fuel feed metering orifice and a fuel con-

duit extending downstream of said fuel feed metering orifice and opening into said primary air conduit upstream of said outlet orifice thereof, and means operatively connected with said auxiliary throttle valve for controlling the cross section of said metering orifice in accordance with the position of said auxiliary throttle valve.

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