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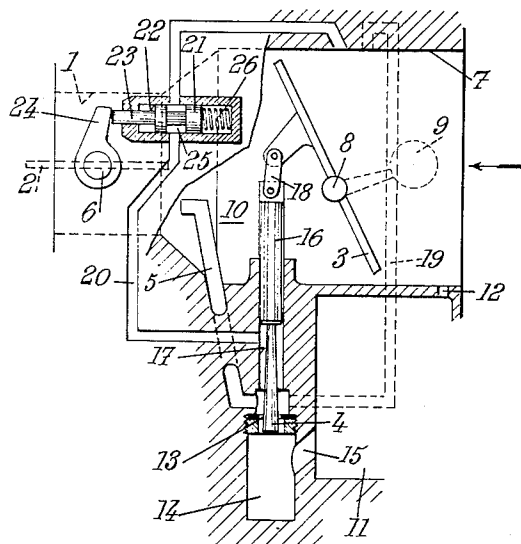
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CARBURETORS FOR INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 2

Fig. 4.



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1

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CARBURETORS FOR INTERNAL COMBUSTION ENGINES

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The present invention relates to carburetors for internal combustion engines which comprise, in their induction pipe, upstream of the throttle valve actuated by the driver, a choke valve which opens automatically and gradually as the flow rate of 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 located between said two valves.

It is known that in such carburetors the cross sectional area of the air flow passage determined by said choke valve and the cross sectional area 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.

For practical purposes, the ratio to each other of the respective cross sectional areas of the air flow passage and of the fuel flow passage should not be constant but should vary according to the type of engine on which the carburetor is mounted and, chiefly, according to the conditions in which this engine is running, i.e. according as the engine is running at full load or at part load. This ratio varies in particular with the rate at which the fuel-air mixture is supplied to the engine (which is determined by the degree of opening of the throttle valve) and with the flow rate of air admitted into the engine (which depends upon the degree of opening of the choke valve).

The object of the present invention is to provide a carburetor of the above mentioned type which is capable of correctly adapting the richness of the air and fuel mixture it supplies to the various factors of operation of the engine.

For this purpose, according to the present invention, there is provided an air bleed conduit opening into the fuel feed conduit, this air bleed conduit being controlled by valve means operated by the choke valve. This air bleed conduit may further be controlled by second valve means, actuated by the throttle valve.

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

FIG. 1 is a vertical sectional view of a carburetor made according to this invention, the throttle valve and the choke being both shown in the closed position;

FIG. 2 is a view of the same carburetor, but with both of the above mentioned valves in the open position;

FIG. 3 is a part view, similar to FIG. 1, showing a modification of the carburetor;

FIG. 4 is a view of the carburetor of FIGS. 1 and 2 in position when the throttle valve is fully opened but the choke valve is little opened.

The carburetor shown by the drawings comprises, in its induction pipe 1, a throttle valve 2 adapted to be actuated by the driver (through suitable link means not shown) and, upstream of said main throttle member, a choke 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,

2

this choke 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 located between the two throttle members 2 and 3.

In the example shown by the drawings throttle valve 2 is in the form of a butterfly valve fixed on a rotating spindle 6. Choke 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 consisting, in this case, of a counterweight 9. Of course, this choke valve might be of any other type (a sliding piston adapted to project into the air intake 7, a spring valve, etc. . .). As it is well known, choke valve 3 which, together with the 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 constant level chamber 11 vented through a conduit 12 in communication with the air intake 7. This fuel is sucked through a metering orifice 13 from a chamber 14 which communicates with chamber 11 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 and which 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 choke valve 3 by means of a link 18. Thus the angular displacements of throttle valve 3 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.

Advantageously, as shown (although this is not necessary), air is permanently admitted at the same time as fuel into conduit 5 so as to emulsify the fuel coming from orifice 13. For this purpose, the space located above chamber 14 from which starts feed conduit 5, communicates through an air inlet conduit 19 with the air intake 7, the flow rate of air through said conduit 19 being determined by an air metering orifice (not shown).

Now, according to the present invention, there is provided an air bleed conduit 20, leading into feed conduit 5, this air bleed conduit 20 communicating with the atmosphere through the air intake 7, and this air bleed conduit is controlled by valve means operated by choke valve 3.

Said valve means consists of rod 16 itself, air bleed conduit 20 opening into cylinder 17 at a level such that said conduit 20 is either opened or closed according to the angular position of choke valve 3. Generally the whole is arranged in such manner that valve means 16 opens air bleed conduit 20 when choke valve 3 is wholly or partly closed (FIG. 1) and closes said conduit 20 in the contrary case (FIG. 2).

To control air bleed conduit 20, there may be provided, in addition to valve means 16, a second valve means, actuated by throttle valve 2. Said second valve means consists of a piston 21 slidable in a cylinder 22 interposed in air bleed conduit 20. Piston 21 carries, rigid therewith, a rod 23, located across the path of travel of a lever 24 rigid with spindle 6. This piston 21 acts as a slide valve and is therefore provided with a groove 25. It is urged toward lever 24 by a spring 26. Generally, as

shown, the parts are arranged so that slide valve 21 opens the air bleed conduit 20 when throttle valve 2 is wide open (FIG. 2) and closes it in the contrary case (FIG. 1).

The utility of applicant's device is the following one:

To obtain a desired variation of the fuel to air ratio (richness of the fuel and air mixture) when the conditions of operation vary.

The embodiment of the invention illustrated by FIGS. 1, 2 and 4 relates to the specific case of a carburetor for an internal combustion engine which requires, for limited load condition, a constant richness of the mixture, and, for maximum load conditions, a richness lower for low speeds of the engine than for high speeds thereof.

Under limited load conditions, that is to say as long as throttle valve 2 is not wide open, i.e. is not very far from its fully closed position shown by FIG. 1, slide valve 21 cuts off bleed conduit 20 and fuel is fed through conduit 5 in accordance with the cross section of annular passage 13, i.e. in accordance with the position of choke valve 3, the adjustment being such that a constant richness of the mixture is obtained.

If, now, the load is maximum, that is to say if throttle valve 2 is wide open, as long as the speed of the engine fed by the carburetor is low, i.e. as long as choke valve 3 is but little open (FIG. 4) conduit 20 is cleared both by valve 21 (throttle valve 2 wide open) and by piston 16 (the lower end of which is above the opening of conduit 20 into cylinder 17) and bleed air is allowed to flow in through said conduit 20, which reduces the fuel to air ratio (richness).

On the contrary, if, the load being maximum (throttle valve 2 wide open), the speed of the engine fed by the carburetor exceeds a given value corresponding to a given opening of choke valve 3 (FIG. 2), element 16 closes bleed conduit 5 and the richness is increased to a higher constant value.

Experience teaches that in many cases the air admitted through air bleed conduit 20 is useful only when the internal combustion engine is running in conditions approximating those ensuring the maximum filling of the engine cylinders, i.e. when the throttle valve 2 is wide open (FIG. 2). This is why, outside of these conditions, piston 21 closes air bleed conduit 20 under the action of spring 26 (FIG. 1) but, for said conditions, lever 24 depresses the rod 23 of piston 21 and thus causes the groove 25 of said piston to open the air bleed conduit 20 (FIG. 2) so that bleed air reaches conduit 5.

It will be seen that this bleed air, which permits of reducing the suction acting upon metering orifice 13, thus making the mixture feed to the engine leaner, is adjusted both by cylindrical rod 16 and by piston 21, i.e. both in accordance with the degree of opening of choke valve 3, and in accordance with that of throttle valve 2. It is thus possible to modify the richness of the mixture by air bleeding, for given air flow rates and working conditions.

In the case of FIGS. 1 and 2, it has been supposed that it is desired to make the mixture leaner when throttle valve 2 is wide open and the air flow rate through intake 7 is low (engine running at low speed). But, obviously, valve means 21 may be arranged in such manner as to work in a contrary manner, i.e. to open air bleed conduit 20 for small openings of the throttle valve 2 and to close said conduit 20 for great openings of throttle member 2. It suffices for this purpose to modify the position of groove 25 in piston 21.

Likewise it would be possible to arrange valve means 16 in such manner as to cause it to work in a manner inverse of that of the preceding case, i.e. so that it opens the air bleed conduit 20 only for great openings of the choke valve 3, or for an intermediate range of openings of this valve 3, as shown by FIG. 3, where needle 4 is shown in the position corresponding to the auxiliary throttle member 3 being closed.

According to this modification, member 16 is replaced by a rod 16a provided with an intermediate groove 27,

and the opening of air bleed conduit 20 into cylinder 17 is located at a level such that said opening is closed by a solid portion of rod 16a when the valve 3 is closed (position shown by FIG. 3), whereas said opening is cleared by rod 16a when choke valve 3 is open, air bleed conduit 20 then communicating with fuel feed conduit 5 through groove 27 and a side conduit 20a (position not shown by FIG. 3). In this last mentioned position the bleed air fed downstream of the fuel metering orifice 13 makes the air and fuel mixture leaner by slightly reducing the feed of fuel through said metering orifice 13.

If conduit 20a opens very close to metering orifice 13, and if groove 27 is sufficiently long, bleed air keeps flowing to the fuel feed conduit for all openings of choke valve 3 greater than a predetermined value.

If groove 27 is shorter, or if the lower opening of conduit 20a may be closed again by the lower solid portion of rod 16a, the bleed air is allowed to pass for a given range of openings of choke valve 3, but it does not pass for small openings of this valve nor for great openings thereon.

Anyway the bleed air passing through conduit 20 may be adjusted or not in accordance with the position of throttle valve 2, by the action of valve means 21.

Of course, the choke valve 3 might operate separately, on the one hand the fuel metering member 4 and, on the other hand a valve device analogous to that consisting of rod 16 or 16a and serving to control an air bleed conduit, such as 20, opening into fuel feed conduit 5, downstream of metering orifice 13. However, the construction illustrated by FIGS. 1, 2 and 3 is much simpler and less expensive; furthermore it has the advantage of reducing the frictions that may exist in the pivoting connections between throttle member 3 and cylindrical rod 16. As a matter of fact the movements of all the parts must be as free as possible so that choke valve 3 may move accurately in accordance with even small variations of the air flow rate in the induction pipe.

It should be well understood that the constructions above described have been given merely by way of example.

What I claim is:

1. A carburetor for an internal combustion engine which comprises, in combination, an induction pipe having an air inlet, a throttle valve in said induction pipe, an automatic choke valve mounted in said induction pipe upstream of said throttle valve, said choke valve being mounted responsive to the thrust exerted thereon by the air stream flowing through said induction pipe so as to be urged toward opened position by said air stream, means for yieldingly urging said choke valve toward the closed position thereof, a fuel tank, a fuel feed conduit starting from said fuel tank and opening directly into the portion of said induction pipe located between said choke valve and said throttle valve, for conveying fuel from said fuel tank to said induction pipe, said fuel feed conduit including a throttled portion, a cylindrical passage in line with said throttled portion and opening into a part of said fuel feed conduit located downstream of said throttled portion thereof, an air bleed conduit opening into said cylindrical passage, a cylindrical rod fitting slidably in said cylindrical passage and operatively connected with said choke valve for opening or closing the communication between said air bleed conduit and said fuel feed conduit according to the position of said choke valve, said cylindrical rod being positioned relative to the opening of said air bleed conduit in such a manner as to close off said opening in response to the opening of said choke valve, a fuel metering member carried by said cylindrical rod and slidable in said throttled section for controlling the cross section therethrough, and valve means mounted on said air bleed conduit operatively connected with said throttle valve.

2. A carburetor according to claim 1 wherein said valve means is operatively connected with said throttle valve

5

so as to be opened when said throttle valve is in fully
opened position and is closed when said throttle valve is
in any other position.

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6

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