April 8, 1941.

L. BECK

2,237,922

CARBURETOR

Filed July 10, 1937

Fig. 1

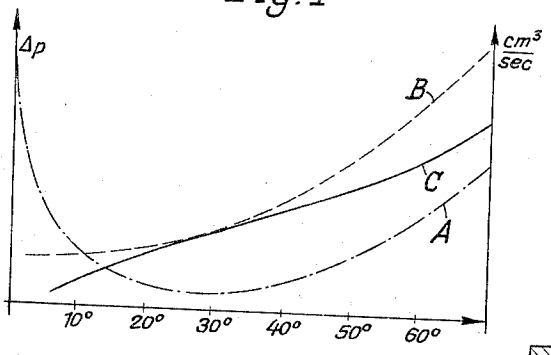


Fig. 2

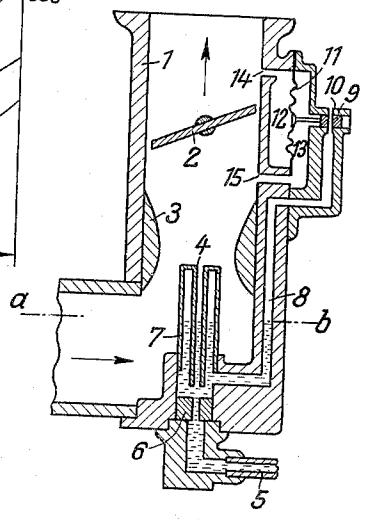


Fig. 3

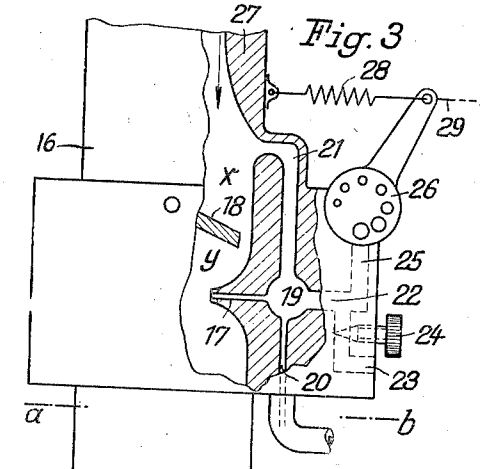


Fig. 4

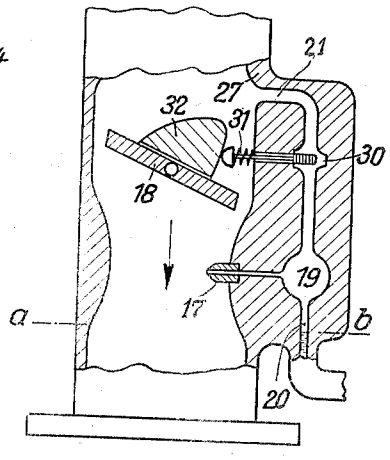
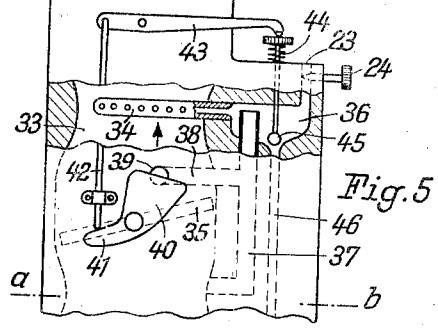


Fig. 5



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2,237,922

CARBURETOR

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Application July 10, 1937, Serial No. 152,885
In Germany July 13, 1936

4 Claims. (Cl. 261—50)

This invention relates to carburetors for internal combustion engines serving for driving vehicles; and it relates especially to such carburetors in which the air is admixed to the fuel prior to injecting the same into the mixing chamber, and in which the amount of the air supplied for that purpose into the fuel channel is controlled in a positive manner.

In the present improved carburetor the amount of the air admixed to the fuel prior to injecting it into the mixing chamber is subjected to a positive control which constitutes a continual function of the fall of pressure at the throttling member of the carburetor.

A special feature of the invention consists in a pneumatic control device for the actuation of the valve through which the air is introduced into the fuel.

Another special feature of the invention is a carburetor, the air channels and fuel channels of which communicate with the suction pipe at selective places, with the aid of which a continual dependency of the amounts of air introduced into the fuel can be obtained at the throttling member of the carburetor without the co-action of a valve.

Finally, the invention comprises a plurality of auxiliary means by which certain carburetor properties particularly important for vehicle motors equipped with carburetors of the above mentioned type are further improved.

The invention is illustrated diagrammatically and by way of example in the accompanying drawing, in which Figure 1 shows a diagram representing the fall of pressure at the carburetor throttling member, as well as the actual and theoretically correct rates of fuel supply. Figure 2 is an axial section through a carburetor provided with a diaphragm valve controlling the amount of air introduced into the fuel. Figure 3 is partly a side-view of, and partly an axial section through, a carburetor in which the amount of air introduced into the fuel is controlled purely aerodynamically. Figure 4 is chiefly an axial section through a carburetor in which the amount of air introduced into the fuel is subjected to an additional control by means of an air-valve positively coupled with the throttling member of the carburetor; and Figure 5 is a similar illustration showing a modification of the constructional form illustrated in Fig. 4, all as fully described hereinafter.

Referring to Fig. 1, the dot-and-dash line A represents the fall of pressure arising in the carburetor of a vehicle motor at the throttle valve when running with normal load (running with slowly increasing speed on a level road), said valve being quite gradually opened from 0° to 70°. The dash-line curve B indicates the fuel amount with which the motor is supplied per second by a normal carburetor, and the full-line curve C shows by way of comparison the amount of fuel with which the motor should be supplied per second if the proportion of the fuel and the air most favorable for all positions of the throttling member is to be attained and maintained and the greatest performance is to be obtained with the smallest consumption of fuel.

It appears from the diagram that there are considerable deviations between the curves B and C. To produce an ideal carburetor it would be necessary to correct the fuel supply in such a manner that the curve B passes over into the curve C. Now, I have discovered that the course of the curve A corresponds nearly accurately with the reciprocal value of the correction function required to transform the curve B into the curve C. There is, therefore, for all abscissa values of Fig. 1 approximately true the equation

$$C = k \cdot \frac{B}{A}$$

in which k denotes a definite conversion coefficient. The invention utilises this discovery in that the fall of pressure A is employed for controlling the amount of air which is usually admixed to the fuel to be introduced into the carburetor prior to the fuel being injected into the mixing chamber.

In Fig. 2 is shown a carburetor in which the amount of air is regulated with the aid of a pneumatically controlled valve. The intake pipe 1 of the carburetor contains in the usual manner a throttle valve 2, as well as a venturi 3 into which extends the nozzle 4. The dash-and-dot line *a*—*b* indicates the level of the fuel. The fuel arriving from the float receptacle (not shown) enters through the pipe 5 and flows through the (exchangeable) restricted passage 6 into the nozzle 4. The nozzle is surrounded by a tubular storage space 7 which communicates with the open air through a valve formed by a slit piston 9 shiftable in a correspondingly slit cylinder 10.

The piston 9 is controlled by a diaphragm 11 which separates chambers 12 and 13 air-tight from one another and consists preferably of an undulated sheet-metal disk such as is generally used in aneroid barometers. The chamber 12 is connected by a passage 14 with that portion of the intake tube 1 which is located behind the throttle

valve 2, and the chamber 13 is connected by a passage 15 with that portion of the intake tube which is located between the throttle valve and the venturi 3. The diaphragm constitutes, therefore, a sort of manometer which measures the fall of pressure at the valve 2 and transmits to the valve piston 9 such movements as correspond with the course of the curve A (Fig. 1).

The valve 9—10 is so adjusted that it opens the air supply passage the more, the more the diaphragm is bent to the left, that is to say, the higher the fall of pressure rises at the throttle valve 2. Owing thereto, there is admixed to the fuel through the air passage 8, in front of the nozzle 4, an amount of air which is the larger, the greater the fall of pressure at the throttle flap becomes. Of decisive importance in this respect is the fact that the channel 15 does not extend to the open air, but terminates behind the venturi 3 in the intake tube 1, as in this way there is automatically attained an increase of the fuel supply when the motor runs with a greater load.

If it be assumed, for example, that the car is running with a speed of 60 kilometers per hour on a level road, the throttle valve will be open about 45°. When the car reaches a gradient in the road, the throttle valve must be opened for about 55 to 60° so that in spite of the increased load the same speed as before can be maintained. Even if in this case the suction acting on the nozzle 4 does not vary, and when a normal carburetor would not deliver an excess of fuel for overcoming the increased load, the improved carburetor forming the subject-matter of the present invention will automatically increase the amount of fuel supplied. When the car passes from the level portion of the road to a gradient, and the throttle valve is opened for 60°, there will obviously arise at the valve an essentially smaller fall of pressure than if it were opened only for 45° at the same suction speed, in consequence whereof the piston 9 will be moved to the right and will decrease the amount of air arriving at the nozzle 4 through the channel 8. A larger amount of fuel will, therefore, be sucked into the carburetor when the load on the motor increases.

In Fig. 3 there is shown a carburetor in which the effect aimed at is attained in a still simpler way. The air streams through the suction pipe 16 of this carburetor in a downward direction. The injection nozzle 17 extends into said pipe 16 at a point below the throttle valve. The nozzle communicates with a fore-space 19 in which terminate the fuel pipe 20 and the two air channels 21 and 22. The channel 22 communicates directly with the atmosphere on the one hand by means of the branch channel 23, the sectional area of which can be subjected to a fine-adjustment by the valve-screw 24, and on the other hand by means of the branch-channel 25, the orifice of which can be adjusted in somewhat large steps by the rotary valve 26. The air channel 22 terminates in the suction pipe 16 between the throttle valve 18 and the venturi 27.

From Fig. 3 it appears at once that the amount of air streaming into the fore-space 19 through the channel 21 must depend upon the difference of pressure between the portions x and y of the suction tube, that is to say, on the fall of pressure at the throttle valve 18. This carburetor therefore, presents all the advantages claimed for the carburetor shown in Fig. 2, but besides those advantages it presents the further advantage that its construction is materially simpler and that it can be operated without the employment of a benzene pump and a float device, since by a suitable adjustment of the air valves 24 and 26 a pressure below the atmospheric pressure can be produced in the fore-space 19 which fully suffices to suck the fuel up to the nozzle 17 from a receptacle situated comparatively considerably therebelow. For the rest, a temporary additional acceleration, or a change of the carburetor from summer service to winter service can be had in a particularly simple manner with the aid of the rotary valve 26 which can be actuated, counter to the action of a helical tension spring, by means of a wire cable 29 operable from the control board (not shown) of the car.

The further modification illustrated in Fig. 4 shows a carburetor which resembles in many respects the carburetor shown in Fig. 3 and in which the members corresponding with equivalent members of Fig. 3 bear the same reference numerals. Said modification is equipped with an auxiliary device by means of which the fuel supply is rendered positively dependent upon the position of the throttle valve at the time being. The auxiliary device consists of a slide-valve 30 inserted into the air channel 21 and moved through the intermediary of a rod 31, by means of a cam 32 secured to the shaft of the throttle valve 18. The more this flap is opened, the more is the valve 30 closed. The most important advantage which this modification presents is that the channel 21 may be made large enough to prevent completely any supply of fuel to the nozzle 17 if the throttle valve is temporarily closed during running at full speed. Furthermore, said auxiliary device renders it possible to start with an increased speed.

In Fig. 5 is shown a carburetor in which the same success is attained in another manner. The air sucked into the carburetor streams in an upward direction through the suction pipe 33. The nozzle 34 is, therefore, again arranged behind the throttle valve 35 (indicated only by dotted lines). The parts 23 and 24 correspond to the same numbered parts in Fig. 3 and provide for admitting a regulated amount of air to the fore-chamber 36, as determined by the adjustment of 24. The air channel 37, terminating at one end at the fore-chamber 36, terminates at the other end at the suction tube 33 in front of the throttle-valve 35, similar to channel 21 in Fig. 3, but there is provided a branch 38 (shown in dotted lines) which leads to an aperture 39 opening to the atmosphere. The cam 40 which is affixed to the shaft of the throttle valve 35 can close said aperture more or less, according to its position. The branch 38 modifies the effect of channel 37 and causes an additional amount of air to be supplied to chamber 36 at low throttle openings and when the throttle is closed.

When the valve 35 is completely closed a lug 41 on the cam 40 lifts a rod 42 which is suspended from a double-armed lever 43, the other and longer arm of which bears upon the upper end of a valve rod 44, at the other end of which is a ball-valve 45, the object of which is to open and close the fuel channel 46 (drawn in dotted lines). This channel is closed when the cam lug 41 lifts the rod 42. The effect of this arrangement is that the motor does not receive with certainty any fuel through the main nozzle 34 when the throttle valve 35 is closed, irrespective of speed at which the car is running at the point of time at which the ball valve 45 is closed. This

second auxiliary device can be applied, of course, as an attachment also to any other of the several constructional forms of carburetors described on the preceding pages.

In the practical employment of these improved carburetors also such other known additional devices or appliances as, for instance, no-load nozzles, acceleration pumps, starting devices, and the like, may be combined with any of said carburetors without impairing the greater effect obtained by them. Additional devices of the mentioned varieties have been omitted from the drawing as they do not form parts of the invention and would, if likewise shown, only diminish the distinctness of the disclosure.

I claim:

1. In a carburetor, a suction passage terminating at one end in an air intake opening, a throttle valve located in said passage, a first venturi located in said passage between said intake opening and said valve, a second venturi located in said passage on the opposite side of said valve from said intake opening, a fuel nozzle located at said second venturi, a fuel passage for delivering fuel from a float chamber to said fuel nozzle, said nozzle having its discharge opening above the fuel level in said float chamber, an air passage opening at one end into the suction passage at said first venturi and opening at the other end into said fuel passage above the fuel nozzle opening, and means including an air valve mechanically linked with said throttle valve for controlling the amount of air delivered by said air passage to said fuel passage.

2. A carburetor as claimed in claim 1, wherein the said air valve is arranged in the air passage to directly control the flow of air through the air passage.

3. A carburetor as claimed in claim 1, wherein the said air passage is provided with an opening to the atmosphere and the air valve is arranged to control the size of said opening.

4. A carburetor as claimed in claim 1, characterized by the provision of a fuel valve in the fuel passage, and means for automatically closing said fuel valve when the throttle valve is completely closed.

LUDWIG BECK.