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CARBURETOR OF THE FUEL INJECTION TYPE

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2 Sheets-Sheet 2

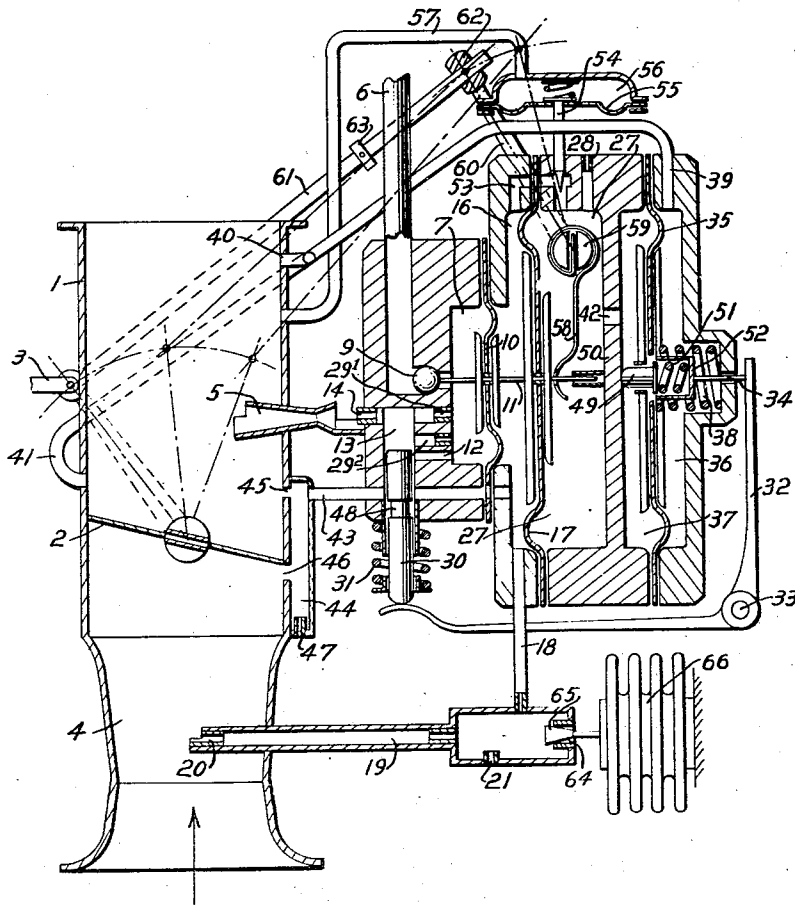


Fig. 2.

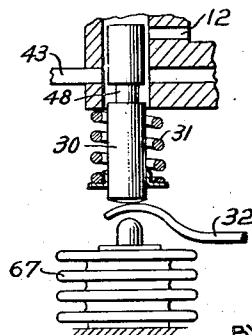


Fig. 2a.

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CARBURETOR OF THE FUEL INJECTION
TYPEMarcel Louis Mennesson, Neuilly - sur - Seine,
France; vested in the Alien Property CustodianApplication May 5, 1941, Serial No. 391,968
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5 Claims. (Cl. 261—69)

The present invention relates to carburetors of the fuel injection type, that is to say carburetors without a float chamber and capable of working in all positions, in which carburetors fuel is injected under the action of a pressure which varies automatically and in accordance with the pressure existing in the intake conduit before the throttle means (butterfly valve) which determine the useful section of flow of said conduit. The invention is more especially, although not exclusively, concerned, among these carburetors, with those intended for the feed of airplane engines, and engines for vehicles intended to move over very rough ground.

The object of the invention is to provide a carburetor of this type which is better adapted to meet the requirements of practice than those made up to the present time.

According to a first feature of the present invention, the injection pressure is modified, in a carburetor of the type above referred to, through the use of stopping means (a valve) operative by a movable or deformable member, such as a membrane for instance, so as to have said means opened by the suction existing in the engine intake conduit before the throttle means, and closed by the pressure under which the fuel is fed, the action of the suction being transmitted to said member through a second deformable or movable member, and this second mentioned member is given an active area greater than that of the first mentioned member, so as to multiply the effect of the force by means of which the injection pressure is varied, the effect due to the suction acting preferably simultaneously on both of the members above mentioned the active surfaces of which are different.

According to a second feature of the invention the carburetors of the type above mentioned are provided with means for automatically modifying the conditions of carburetion in accordance with the load of the engine to be fed.

According to a third feature of the present invention, which relates more particularly to the preceding feature, the engine is fed with fuel through at least two fuel jets one of which serves to the feed when the engine is running under small loads, while the feed of the engine running under higher loads is ensured through the other jet or jets, the output of which is substituted or added, preferably in an automatic manner, to the output of the first mentioned jet.

According to a fourth feature of the present invention, which relates more especially to the preceding feature, means are provided for in-

creasing the injection pressure when passing from operation under high loads to operation under small loads.

According to a fifth feature of the present invention, which relates more especially to the preceding feature, the system of jets is provided with means for automatically ensuring the distribution of the outputs of said jets, preferably under the control of the suction existing at a point of the engine intake conduit, either before or behind the throttle means, or under the control of the suctions existing respectively and simultaneously at several points of said conduit, before and/or behind said throttle means, or at points which are either before or behind said throttle means according to the position of said means.

According to a sixth feature of the present invention, which is more especially used in connection with the preceding feature, the deformable or movable member (membrane) above mentioned which is subjected to the action of the suction or suctions to be considered is arranged in such manner that it can serve temporarily to increase the injection pressure when it suddenly causes a change from "operation under small loads" to "operation under high loads."

According to a seventh feature of the invention, I adjoin to the means for obtaining a suitable distribution of the outputs of the feed jets, means responsive to pressure variations, such as a barometric box, for limiting the action of the first mentioned means when the air intake pressure to the carburetor decreases.

According to an eighth feature of the invention, the means operatively connected with the stopping means (valve) for obtaining a variation of the injection pressure are associated with an elastic element (such for instance as a spring) which is brought into and out of action by a distinct maneuver and/or by the operation of the throttle means (butterfly valve) when the latter is closed to the position in which it is fully opened so as to give the maximum of power of the engine, with a view to temporarily increasing the injection pressure and, consequently, the percentage of fuel in the mixture when the engine is to work under certain particular conditions.

According to still another feature of the present invention, I provide, in the conduit through which is transmitted the suction which controls the injection pressure, at least one orifice opening into the atmosphere or communicating with the air intake of the carburetor.

According to still another feature of the in-

vention, I provide, in the conduit through which is transmitted the suction which controls the injection pressure, at least one orifice adapted to be placed in communication, either with the atmosphere or with the air intake of the carburetor through stopping means (such as a needle valve for instance) controlled by pneumatic means (membrane or manometric box) placed in a medium where the pressure is substantially equal to that existing at the intake of the carburetor, in such manner that this orifice is opened when said pressure drops below a predetermined value, and is closed when said pressure becomes equal to said value or exceeds it.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

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

Fig. 1 is a diagrammatic vertical section of a fuel injection carburetor made according to a first embodiment of the present invention;

Fig. 2 is a similar view of a carburetor made according to another embodiment of the invention;

Fig. 2a is a fragmentary detail showing a modification of the carburetor of Fig. 2.

In order to make a carburetor according to the invention, the general structure of the carburetor proper is of any suitable type which is adapted to the feed of an engine by injection of fuel without a float chamber, and which is capable of working in any position.

This carburetor includes a body 1, in which the gases flow, for instance, in the upward direction, as shown by the arrow of Fig. 1. A throttle valve 2 is provided in said body and it is operated from a distance through control means 3. A choke tube 4 communicates with the air intake of the carburetor, and at least one Venturi-shaped nozzle 5 opens into the body 1 of the carburetor, downstream of throttle valve 2.

Concerning the means for controlling the amount of fuel to be fed into the carburetor, they constitute a control system which is for instance mounted laterally on the body 1 of the carburetor (on the right hand side thereof on the drawings).

To this control system, I connect a pipe 6 for the feed of fuel under pressure, supplied by a pump or any other suitable source capable of providing the desired pressure, preferably uniform. This pipe 6 opens into a chamber 7 through an orifice 8 the edges of which form a seat for a valve 9. The wall of chamber 7 opposite valve 9 is constituted by a flexible diaphragm 10 or the like, connected to said valve by a rod 11. This chamber 7 is connected, through a passage 12, with a chamber 13 intended to feed a jet 14, constituted, for instance, by a calibrated orifice, which opens outwardly opposite the inlet of the Venturi-shaped nozzle 5 above mentioned and preferably at a short distance from this inlet. The interval existing between jet 14 and Venturi tube 5, which interval is in the atmosphere, is such that the jet in question is not subjected to the action of the suction existing in the body 1 of the carburetor.

The pressure at which the fuel is injected into body 1 depends upon the position occupied by valve 9 with respect to its seat, and this pressure will be the higher as valve 9 is more widely opened. As valve 9 is connected with diaphragm 10 or the like, its position depends upon the de-

formation of said diaphragm, and this deformation should be such that it depends upon the suction existing in tube 4 when the engine is working. It is known that this suction is the higher as the speed of the engine is higher and throttle valve 2 more widely opened.

In order to subject diaphragm 10 to the action of this suction, I provide, in the body 15 of the control system, a chamber 16, adjoining chamber 7 so that diaphragm 10 constitutes a movable partition between said chambers 7 and 16, and the wall of chamber 16 which is located opposite diaphragm 10 is constituted by a second flexible diaphragm or the like, designated by 17, which is also fixed to the rod 11 of valve 9. The second mentioned chamber 16 is connected through a conduit 18 with a chamber 19 which communicates, through an outlet 20, with tube 4 at the point thereof where the suction is maximum when the engine is running. Chamber 19 may communicate, on the other hand, through a calibrated orifice 21, with the atmosphere or the air intake of the carburetor.

In the wall of chamber 19, I may, advantageously, provide an orifice 22 adapted to be closed by a spring valve 23 fixed to a flexible diaphragm 24 which constitutes the movable or deformable wall of a box 25 connected through a tube 26 with the body 1 of the carburetor behind throttle valve 2. Diaphragm 24 is also subjected, on the outer face thereof, to the action of the atmospheric pressure or of the carburetor air intake pressure. The opposite face is subjected to the combined actions of the return spring of valve 23 and of the suction existing in the carburetor body behind throttle valve 2.

In the body 15 of the control system, I provide, adjacent the second mentioned chamber, to wit 16, a third chamber 27, whereby diaphragm 17 forms a deformable partition between said chambers 16 and 27. This chamber 27 is connected, through a calibrated orifice 28, with the atmosphere. Thus the pressure in this chamber 27 is higher than in the second chamber 16 when the engine is working, since the pressure in chamber 16 is then equal to the suction transmitted from tube 4 through chamber 19 and conduit 18.

It follows that diaphragm 17 undergoes, under the effect of these differences of pressure, a thrust toward the left (in the arrangement disclosed by Figs. 1 and 2) which moves in the same direction diaphragm 10, and, consequently, valve 9 which is thus moved more or less away from its seat. Consequently, the fuel supplied under pressure through pipe 6 is admitted under a high pressure into chamber 7 and penetrates, after flowing through passage 12, into chamber 13, from which it is injected through jet 14 into Venturi nozzle 5 and the body 1 of the carburetor. The fuel thus injected is then mixed with the air admitted into body 1 through tube 4 and forms the fuel mixture which is to be fed to the engine.

However, the inflow of fuel into chamber 7 exerts a pressure on diaphragm 10 and when the latter undergoes from the fuel a thrust higher than that exerted on diaphragm 17 by the pressure of the air admitted through calibrated orifice 28, both of the diaphragms, which are connected together by rod 11, are moved toward the right so as more or less to close valve 9.

For a given suction transmitted to chamber 16 from tube 4, the pressure in chamber 7 assumes a given value which determines the fuel

injection, whereby a correct composition of the fuel mixture is obtained for all velocities of the air stream flowing through tube 4 and consequently for all speeds of the engine.

It is known that the suction in tube 4 drops to a very low value when the engine is running at low speed and throttle valve 2 is but little opened, more especially when the engine is idling on no load.

Under these conditions, the injection pressure is also very low and the possible inclinations of the carburetor, same as the accelerations to which might be subjected the leaking liquid which flows therethrough might vary to a considerable degree the injection pressure adjacent jet 12. This would involve considerable differences in the compositions of the fuel mixture fed to the engine and, as a consequence, serious perturbations in the working of said engine.

In order to obviate this drawback and according to the invention, diaphragm 17 is made of an area much greater than that of diaphragm 10, whereby the injection pressure is multiplied to a considerable amount since this pressure P , for the suction h in tube 4, becomes equal to

$$h \frac{(S-s)}{s}$$

S and s designating the active surfaces of diaphragms 17 and 10, respectively.

With such an arrangement, it is possible to obtain a very high pressure of injection which keeps a sufficient value, for certain applications, at low speeds of the engine.

However, an arrangement such as above described does not work with sufficient safety when it is mounted on vehicles capable of moving with very great inclinations to the horizontal, such as aircraft, and more especially airplanes, or vehicles intended to run on very rough ground.

For these particular uses, the device according to the invention might be defective for small openings of throttle valve 2. In order to obviate this drawback, the fuel feed means of the injection carburetor is arranged in such manner as automatically to substitute for the feed device adapted to work under high power conditions, a feed device especially intended for running under small loads, by calling into play, on the one hand, a jet of small section, and, on the other hand, a modification of the injection pressure conditions.

This result is obtained, in the simplest manner, as shown in Fig. 1, by adjoining to the main jet 14 and auxiliary jet 29, of reduced section, which affords a permanent communication between chamber 7 and chamber 13 in addition to the communication supplied by passage 12, both of the jets working, in series with each other, in this embodiment, especially for small loads of the engine.

The adjustment of the feed device to change from the use of jets 14, 12 and 29, for high power working, to the use of jets 14 and 29, for working under small loads, and vice versa, is obtained by means of a slide valve 30 movable in a housing provided in the body 1 of the control system. This slide valve is so devised that it can be displaced, opposite passage 12, so as to close or to open this passage. When passage 12 is opened fuel is fed to chamber 13 chiefly through passage 12 and through auxiliary jet 29, and this corresponds to high power working of the engine. On the contrary, when passage 12 is closed, the whole of the fuel fed to chamber 13

passes through jet 29, in series with main jet 14, the engine then running under small loads.

The displacements of the slide valve 30 may be controlled through a return spring 31 and a bell-crank lever 32, pivoted at a fixed point 33 and actuated by a push piece 34 rigid with a diaphragm 35 which forms a partition between two compartments 36 and 37 of a chamber located adjacent to chamber 27, above mentioned. A return spring 38, housed in compartment 36, acts on diaphragm 35 in a direction tending to place push-piece 34 out of contact with lever 32.

Compartment 36 communicates, through tube 39, with the body 1 of the carburetor, as shown in Fig. 1, through an outlet 40 opening into said body downstream of throttle valve 2.

The other compartment 37 communicates, in a permanent way, through at least one orifice 42, with chamber 27.

In the embodiment of Fig. 1, slide valve 30 has been shown in the position it occupies when the engine is running at full power. In this case, chamber 7 feeds fuel to chamber 13 and consequently to the main jet 14 through passage 12, of relatively large cross section, and accessorially through jet 29 of small section.

When slide valve 30 is displaced upwardly by lever 32 under the action of diaphragm 35, as it will be hereinafter explained, said slide valve closes passage 12 and the feed of fuel takes place only through auxiliary jet 29.

As the section of flow is reduced, it is clear that, in order to maintain the proper percentage of fuel in the mixture, it becomes necessary to increase the injection pressure to a substantial degree.

For this purpose, chamber 16 communicates through a conduit 43 with a chamber 44 provided laterally on the body 1 of the carburetor. This chamber communicates with the inside of this chamber through orifices such as 45 and 46 which are located close to the edge of throttle valve 2. Chamber 44 is connected also through a calibrated orifice 47 with the atmosphere. The passage of fluid, through conduit 43, is controlled by slide valve 30 which is provided, for this purpose, with a peripheral groove 48 adapted to come into register with conduit 43 when passage 12 is closed by slide valve 30. On the contrary, when this passage 12 is opened, the groove 48 is located at a distance from conduit 43, and this conduit is closed, either wholly or partly, by slide valve 30.

Chamber 44 is provided with at least one orifice 45 located downstream of throttle valve 2, that is to say in a place where the suction is high when the throttle valve 2 is but little open and therefore there is but little suction in tube 4.

In order to obtain a suitable injection pressure for each position of throttle valve 2 within the limits of operation of the device when working under small loads, I provide one orifice 46 which is upstream of throttle valve 2 when it is closed, and downstream when it is open.

The suction in the body 1 of the carburetor close to orifices 45 and 46 is transmitted to chamber 44 and through conduit 43 to chamber 16 so as to act on diaphragms 10 and 16 in addition to the suction transmitted through conduit 18 so as to produce a suitable opening of valve 9.

The location of the orifices 45 and 46, their section or their outline, permit of obtaining correct curves of injection pressure and, therefore, correct curves of carburetion when the engine is running under small loads.

Diaphragm 35 is used for displacing slide valve 30 through the lever 32. This diaphragm 35 is subjected, on the face thereof which limits compartment 36, to the action of spring 38 and to the suction transmitted through tube 39. The other face of this diaphragm, which limits compartment 37 is subjected to the action of the pressure existing in chamber 27 which, as above stated, communicates through orifice 28 with the atmosphere.

Spring 38 is given a strength such that the force exerted on diaphragm 35 by the difference of the pressures existing respectively in compartments 36 and 37, when the engine is idling or is subjected only to a small load, overcomes the action of spring 38. Consequently, diaphragm 35 is moved toward the right of Fig. 1 so that push piece 34 comes into contact with lever 32 which, when pivoting, pushes slide valve 30 until the latter occupies a position in which it closes fuel passage 12 and opens air conduit 43.

When the suction existing in the body 1 of the carburetor downstream of throttle valve 2 drops below a given value, the reverse operations take place, that is to say slide valve 30 comes back to the position shown by Fig. 1.

When the suction, transmitted through tube 39, acts through orifice 40, the displacements of slide valve 30 take place in accordance with the pressure existing in the intake conduit of the engine, since this orifice is located at a substantial distance from throttle valve 2.

In addition to its action for producing displacements of slide valve 30, diaphragm 35 is adapted to act to increase the percentage of fuel in the fuel mixture. As a matter of fact when passing from working conditions under small load to power working conditions, diaphragm 35 moves suddenly toward the left in chamber 36—37.

A portion of the air present in compartment 37 escapes through orifice 42 into chamber 27, which temporarily increases the pressure in said chamber and exerts a thrust on diaphragm 17, which corresponds to an increased opening of valve 9 and temporarily increases the percentage of fuel in the fuel mixture. The value of this increase of pressure and its duration are determined by the section of orifice 28.

In the example above described, the factor which determines the injection pressure when running under small load conditions is the suction existing in chamber 44. When throttle valve 2 is widely opened, the suction in box 25 and acting upon diaphragm 24 is insufficient to overcome the action of the return spring of valve 23 and the latter closes the opening 22 of chamber 19. The suction in this chamber 19 is therefore maximum, the same as the injection pressure in the chamber 7. When, as a result of the partial closing of the throttle valve 2, the suction in the body 1 opposite the outlet of tube 26 reaches a given value, the valve 23 starts to open, thus allowing air to enter chamber 19 through the orifice 22, more and more as the value of the suction increases in the intake conduit. The shape of the curve corresponding to this increase depends upon the shape of the axial section of valve 23 and the elasticity of its return spring. This inflow of air into the chamber 19 decreases the suction in chamber 16, whereby the amount of fuel in the mixture fed to the engine is reduced.

I also provide in chamber 27 a spring 58 fixed to a spindle 59 adapted to be turned by a lever 60. When lever 60 is moved toward the right, spring 58 is brought into contact with diaphragm 17 and

exerts thereon a pressure to the left, which increases the injection pressure and therefore facilitates the starting of the engine.

In the form of the device shown in Fig. 2, the operation of the carburetor is as follows:

When the engine is idling or running under small loads, the suction existing downstream of throttle valve 2 is very great. This suction is transmitted, preferably through orifices 41 and 40 and tube 39, to compartment 36. Diaphragm 35 is pushed to the limit toward the right against the action of spring 38 and slide valve 30 closes channel 12 and jet 29². The feed of fuel is only through jet 29¹ and the injection pressure depends upon the suction in box 44 since the groove 48 of slide valve 30 is located opposite conduit 43.

When, as a consequence of the partial opening of throttle valve 2, orifice 41 is upstream of said valve, the suction in chamber 36 is suddenly reduced and diaphragm 35 is moved toward the left, being limited in its displacement by a stop 49 (position shown in Fig. 2) which bears against the partition 50 provided between chamber 27 and compartment 37 provided that the action of the suction opposite orifice 40, to which is added that of spring 51, has kept a value sufficient for overcoming the action of spring 38.

As a consequence of this partial displacement of diaphragm 35 toward the left, I obtain a corresponding displacement of bell crank lever 32 under the effect of the expansion of the return spring 31 of slide valve 30, which opens jet 29² and closes conduit 43. The section of jet 29² has been chosen in such manner the total of the outputs of jets 29¹ and 29², feeding fuel to main jet 14 are, for a given pressure, lower than the value of the output through main jet 14, if the latter were fed directly from chamber 7. Stop 49 is adapted to slide freely with respect to diaphragm 35 and it is urged toward partition 50 by an auxiliary spring 51 which bears against the bottom of a cup-shaped extension 52 of push piece 34.

When the suction in the intake conduit at the level of orifice 40 drops below a predetermined value, spring 38 overcomes the tension of spring 51, stop 49 enters its housing, constituted by part 52, and diaphragm 35 keeps moving toward the left, allowing slide valve 30 to move down, which uncovers passage 12. In this way, the output of jet 14 is increased and the amount of fuel in the mixture is increased.

I reduce the amount of fuel in the mixture, by connecting chambers 16 and 27 together through a by-pass 53 (Fig. 2) the section of which can be modified by obturating means actuated either manually or automatically. For instance, as shown by Fig. 2, said means consist of a needle valve 54 controlled by a diaphragm 55 mounted on a chamber 56 which communicates, through a tube 57, with the carburetor body downstream of throttle valve 2.

In this case, the suction transmitted in chamber 27 through by-pass 53 exerts an action not only on diaphragm 17 but also on diaphragm 35 through orifice 42. This action serves to maintain the operation corresponding to power working conditions for higher suctions in the intake conduit of the engine.

The lever 60 may be connected to the means 3 for operating throttle valve 2 (Fig. 2) for instance through a rod 61 interposed between lever 60 and said means 3, and sliding in a sleeve 62 pivoted to lever 60. An abutment 63 carried by said rod is adapted to come into contact with said sleeve 62 when throttle valve 2 occupies a position close

to its fully opened position and is nearing the position corresponding to an excess of power (more especially in the case of an airplane engine). In this way, I obtain the automatic displacement of lever 60 in one direction corresponding to spring 58 coming into contact with diaphragm 17 and pushing said diaphragm toward the left in Fig. 2 in order to increase the percentage of fuel in the mixture, which is generally necessary when an excess of power is to be obtained.

I may also, as shown in Fig. 2, join to chamber 19 means for correcting the adjustment in accordance with the atmospheric pressure, said means consisting for instance in an orifice 64 provided in a wall of said chamber 19 and opening to the atmosphere. The section of this orifice can be modified by a valve 65 carried by a barometric box 66.

This correcting device is adjusted in such manner that, at the usual intake pressure (barometric pressure on the ground level or inlet pressure in the case of an engine fitted with a supercharger located before the injection carburetor) valve 65 closes orifice 64.

When, under the effect of an increase of height, the pressure acting on box 66 decreases, said box expands and permits an inflow of air into chamber 19. This inflow of air has for its effect to reduce the suction existing in chamber 19 and consequently to reduce the injection pressure.

If orifice 64 is made of suitably shaped section and valve 65 is of suitable profile, it is possible to maintain a desired composition of the mixture when the height varies.

This correction might also be effected, as shown in Fig. 2a, by means of a barometric box 67 located opposite the free end of slide valve 30, i. e. the end which is normally acted upon by lever 32. The box 67 is then so located that at the atmospheric pressure on the ground level (or at the usual inlet pressure) slide valve 30 can work over the whole of its stroke. On the contrary, at lower pressure, box 67 expands and acts as an abutment for said slide valve so as more and more to limit the displacement thereof in the direction corresponding to an increase of the percentage of fuel.

What I claim is:

1. In a carburetor, the combination of an intake conduit having an air inlet; a throttle in said conduit; a fuel nozzle opening into said intake conduit downstream of said throttle; a fuel chamber; a fuel conduit adapted to supply fuel under constant pressure to said chamber; a valve in said fuel conduit; a fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second chamber adjacent said fuel chamber; a flexible diaphragm separating said fuel chamber and said second chamber, and operatively connected to said valve; a third chamber adjacent said second chamber, and having an opening therein communicating with the atmosphere; a flexible diaphragm separating said second and third chambers, and operatively connected to said first diaphragm; a conduit connecting said second chamber with said intake conduit upstream of said throttle; a second conduit connecting said second chamber with said intake conduit downstream of said throttle; a spring-pressed slide valve adapted to open the second mentioned fuel conduit from the fuel chamber, and to close the second mentioned con-

duit from the second chamber, and vice-versa; a fourth chamber adjacent said third chamber; a pressure-responsive flexible diaphragm dividing said fourth chamber into two compartments, the third chamber being connected with the compartment adjacent thereto by an opening between the third and fourth chambers; a conduit connecting the other compartment with the intake conduit downstream of the throttle; and a bell-crank lever, one arm of which is rocked by the movement of said third diaphragm, and the other arm of which moves the slide valve.

2. In a carburetor, the combination of an intake conduit having an air inlet; a throttle in said conduit; a fuel nozzle opening into said intake conduit downstream of said throttle; a fuel chamber; a fuel conduit adapted to supply fuel under constant pressure to said chamber; a valve in said fuel conduit; a fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second chamber adjacent said fuel chamber; a flexible diaphragm separating said fuel chamber and said second chamber, and operatively connected to said valve; a third chamber adjacent said second chamber and having an opening therein communicating with the atmosphere; a flexible diaphragm separating said second and third chambers, and operatively connected with said first diaphragm; a conduit connecting said second chamber with said intake conduit upstream of said throttle; an inlet pipe connecting said second chamber conduit with the atmosphere; a valve adapted to open and close said inlet pipe; a flexible diaphragm on which said valve is mounted; a casing of which said valve diaphragm forms a wall; a spring urging said inlet valve toward closing position; a pipe connecting said casing with the intake conduit downstream of the throttle, the suction through said casing pipe tending to move said inlet valve toward opening position; a second conduit connecting said second chamber with said intake conduit downstream of said throttle; a spring-pressed slide valve adapted to open the second mentioned fuel conduit from the fuel chamber, and to close the second mentioned conduit from the second chamber, and vice-versa; a fourth chamber adjacent said third chamber; a pressure-responsive flexible diaphragm dividing said fourth chamber into two compartments, the third chamber being connected with the compartment adjacent thereto by an opening between the third and fourth chambers; a conduit connecting the other compartment with the intake conduit downstream of the throttle; and a bell-crank lever, one arm of which is rocked by the movement of said third diaphragm, and the other arm of which moves the slide valve.

3. In a carburetor, the combination of an intake conduit having an air inlet; a throttle in said conduit; a fuel nozzle opening into said intake conduit downstream of said throttle; a fuel chamber; a fuel conduit adapted to supply fuel under constant pressure to said chamber; a valve in said fuel conduit; a fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second chamber adjacent said fuel chamber; a flexible diaphragm separating said fuel chamber and said second chamber, and operatively connected to said valve; a third chamber adjacent said second chamber, and having

an opening therein communicating with the atmosphere; a passage connecting said second and said third chambers; a valve in said passage adapted to open and close said passage; a flexible diaphragm on which said passage valve is mounted; a casing of which said last mentioned diaphragm forms a wall; a spring urging said passage valve toward closing position; a pipe connecting said casing with the intake conduit downstream of the throttle, the suction through said casing pipe tending to move said passage valve toward open position; a flexible diaphragm separating said second and third chambers, and operatively connected to said first mentioned diaphragm; a conduit connecting said second chamber with said intake conduit upstream of said throttle; a second conduit connecting said second chamber with said intake conduit downstream of said throttle; a spring-pressed slide valve adapted to open the second mentioned fuel conduit from the fuel chamber, and to close the second mentioned conduit from the second chamber, and vice-versa; a fourth chamber adjacent said third chamber; a pressure-responsive flexible diaphragm dividing said fourth chamber into two compartments, the third chamber being connected with the compartment adjacent thereto by an opening between the third and fourth chambers; a conduit connecting the other compartment with the intake conduit downstream of the throttle; and a bell-crank lever, one arm of which is rocked by the movement of said third diaphragm, and the other arm of which moves the slide valve.

4. In a carburetor, the combination of an intake conduit having an air inlet; a throttle in said conduit; a fuel nozzle opening into said intake conduit downstream of said throttle; a fuel chamber; a fuel conduit adapted to supply fuel under constant pressure to said chamber; a valve in said fuel conduit; a fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second chamber adjacent said fuel chamber; a flexible diaphragm separating said fuel chamber and said second chamber, and operatively connected to said valve; a third chamber adjacent said second chamber, and having an opening therein communicating with the atmosphere; a flexible diaphragm separating said second and third chambers, and operatively connected to said first diaphragm; a conduit connecting said second chamber with said intake conduit upstream of said throttle; an inlet pipe connecting said last mentioned conduit with the atmosphere; a valve adapted to vary the cross-section area of said inlet pipe; a barometric pressure device connected to said valve, and adapted to move said valve in said inlet pipe; a second

conduit connecting said second chamber with said intake conduit downstream of said throttle; a spring-pressed slide valve adapted to open the second mentioned fuel conduit from the fuel chamber, and to close the second mentioned conduit from the second chamber, and vice-versa; a fourth chamber adjacent said third chamber; a pressure-responsive flexible diaphragm dividing said fourth chamber into two compartments, the third chamber being connected with the compartment adjacent thereto by an opening between the third and fourth chambers; a conduit connecting the other compartment with the intake conduit downstream of the throttle; and a bell-crank lever, one arm of which is rocked by the movement of said third diaphragm, and the other arm of which moves the slide valve.

5. In a carburetor, the combination of an intake conduit having an air inlet; a throttle in said conduit; a fuel nozzle opening into said intake conduit downstream of said throttle; a fuel chamber; a fuel conduit adapted to supply fuel under constant pressure to said chamber; a valve in said fuel conduit; a fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second fuel conduit from said chamber to supply fuel from said chamber to said fuel nozzle; a second chamber adjacent said fuel chamber; a flexible diaphragm separating said fuel chamber and said second chamber, and operatively connected to said valve; a third chamber adjacent said second chamber, and having an opening therein communicating with the atmosphere; a flexible diaphragm separating said second and third chambers, and operatively connected to said first diaphragm; a conduit connecting said second chamber with said intake conduit upstream of said throttle; a second conduit connecting said second chamber with said intake conduit downstream of said throttle; a spring-pressed slide valve adapted to open the second mentioned fuel conduit from the fuel chamber, and to close the second mentioned conduit from the second chamber, and vice-versa; an adjustable stop for limiting the movement of said slide valve; a barometric pressure device adapted to adjust said stop; a fourth chamber adjacent said third chamber; a pressure-responsive flexible diaphragm dividing said fourth chamber into two compartments, the third chamber being connected with the compartment adjacent thereto by an opening between the third and fourth chambers; a conduit connecting the other compartment with the intake conduit downstream of the throttle; and a bell-crank lever, one arm of which is rocked by the movement of said third diaphragm, and the other arm of which moves the slide valve.

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