

April 25, 1939.

P. X. A. GISTUCCI ET AL

2,156,115

CARBURETOR

Filed June 24, 1936

3 Sheets-Sheet 1

FIG. 1

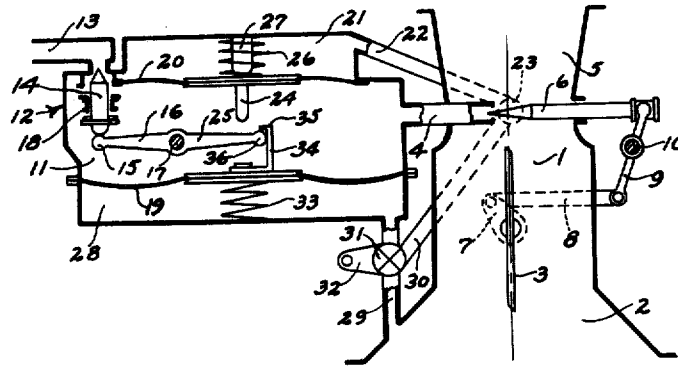


FIG. 2

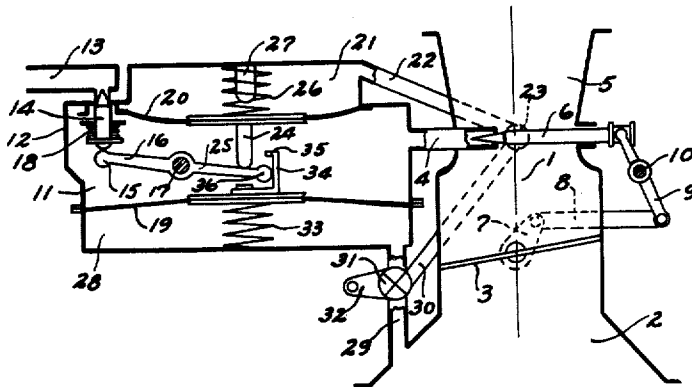
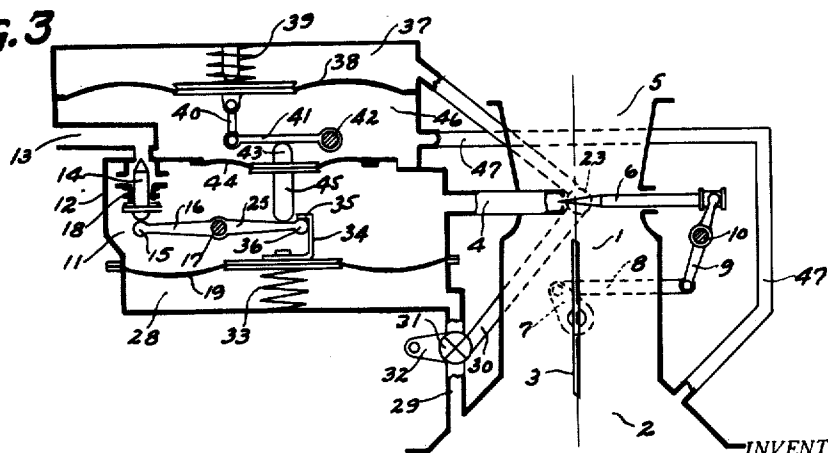


FIG. 3



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FIG. 4

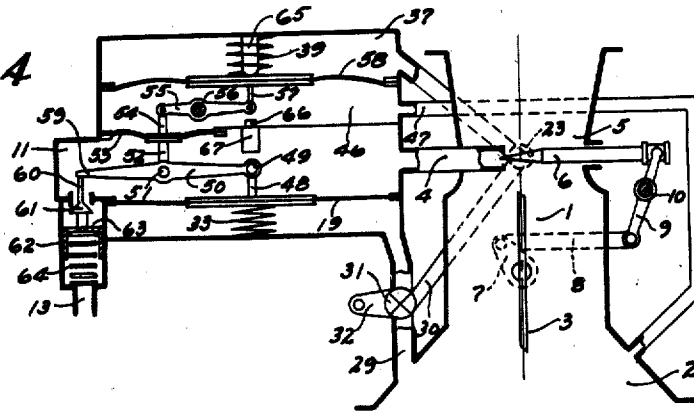


FIG. 5

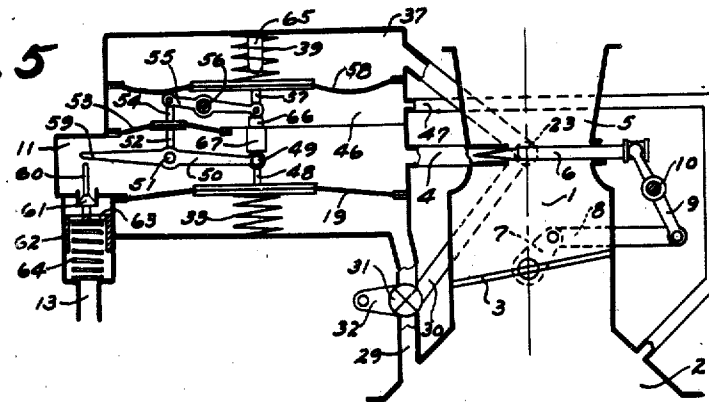
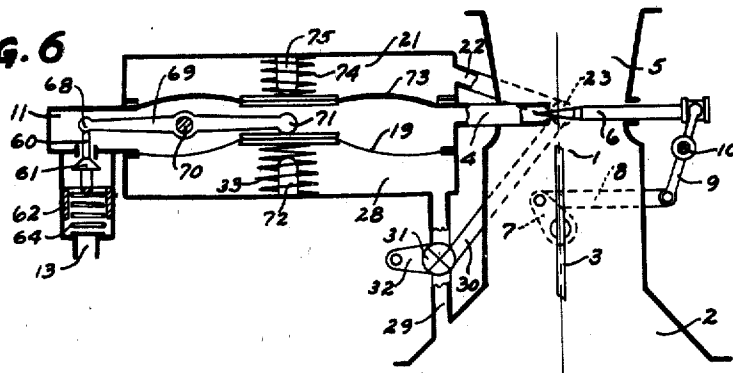


FIG. 6



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FIG. 7

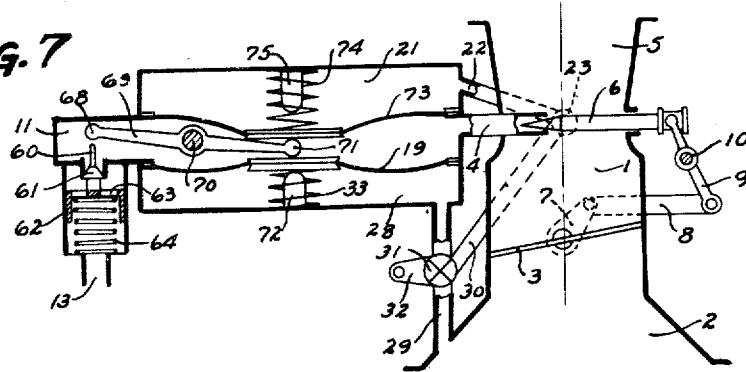
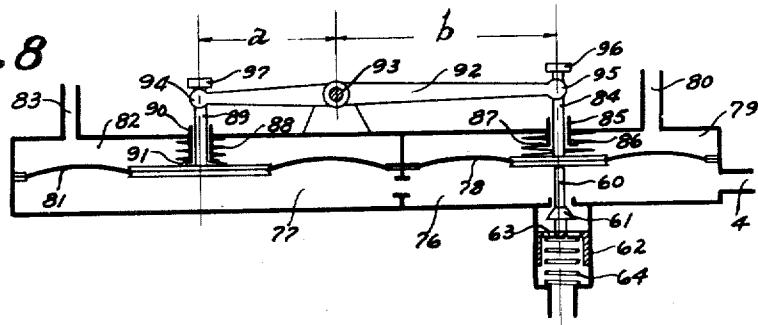


FIG. 8



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UNITED STATES PATENT OFFICE

2,156,115

CARBURETOR

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Application June 24, 1936, Serial No. 87,093
In Belgium August 9, 1935

6 Claims. (Cl. 261-69)

The present invention relates to pressure regulators of the diaphragm type designed to supply fuel to the mixing chamber of a carburetor for internal combustion motors and to control the pressure under which the fuel is supplied.

Diaphragm type pressure regulators are generally known, and applicants have described such pressure regulators in their Belgian Patents Nos. 369,960, dated May 1, 1930; 369,961, dated May 1, 1930; and 404,966, dated August 30, 1934. Essentially these pressure regulators comprise a fuel chamber supplied with fuel under pressure through a passage controlled by a valve. The outlet of the fuel chamber supplies one or more carburetor jets. A diaphragm is incorporated in the wall of the fuel chamber and connected to a valve which regulates the admission of fuel into the fuel chamber in such a manner as to close this valve when the pressure of the fuel in the fuel chamber rises above a predetermined value, and to open said valve when the pressure of fuel falls below that value. The fuel pressure in the chamber tends to be maintained in this way at a certain value and the one or more carburetor jets are thus supplied under a predetermined pressure.

It is well-known that in order to obtain automatic operation of a carburetor, that is to produce a mixture correct at all speeds of the motor and for all the openings of the throttle valve, it is generally desirable to supply the carburetor jets under a positive pressure, that is under a pressure higher than that of the air supplied to the carburetor. This arrangement is particularly necessary in the case where the carburetor jets open into the induction passage posterior to the throttle valve of the carburetor.

When the fuel pressure regulator is arranged in such a manner as to supply fuel under positive pressure, the fuel valve remains open when the motor is stopped; that is, the jets continue to supply fuel when the depression is zero. To avoid this undesirable flow of fuel upon the stoppage of the motor it is known to arrange in the fuel line either anterior or posterior to the pressure regulator an automatic shut-off arrangement which shuts off the fuel supply to the carburetor when the depression drops to zero, that is when the motor stops, and which opens in turn when a certain depression is established in the passage as a result of the operation of the motor. Such automatic shut-off arrangements have been described particularly in applicants' Belgian Patents No. 369,959, dated May 1, 1930, and No. 409,525, dated May 18, 1935. The automatic shut-

off arrangement comprises essentially a fuel chamber placed in the fuel supply line. The flow of fuel through this chamber is controlled by a valve, and a diaphragm connected to said valve and mounted in the wall of the fuel chamber is actuated by the depression in such a manner as to open the valve when the depression attains a certain value and to close said valve when the motor stops, that is when the depression drops to zero.

A carburetor in which the fuel supply is effected under positive pressure comprises usually a pressure regulator and an automatic shut-off arrangement. Up to the present time these two mechanisms have been made separate, and the fuel on its way to the carburetor traversed them in succession. With the stopping of the motor the pressure regulating valve remained open but the shut-off arrangement valve was closed. During the operation of the motor the valve of the shut-off arrangement remained open and the fuel pressure was regulated by the pressure regulator as if the shut-off arrangement were omitted.

The object of the present invention is to combine into a single mechanism the pressure regulator and the automatic shut-off arrangement. In this combined mechanism the pressure regulator and the automatic shut-off arrangement have in common a fuel chamber and a chamber controlling the flow of fuel. The diaphragm of the pressure regulator which is incorporated in the wall of the common fuel chamber regulates the opening of the valve during the operation of the motor in such a manner as to maintain in the fuel chamber a predetermined pressure while the diaphragm of the shut-off arrangement, which is also incorporated in the wall of the common fuel chamber, causes the valve to close when the depression drops to zero, that is when the motor stops. This combined arrangement is simpler than the existing arrangements as it comprises only one fuel chamber and one valve instead of two separate fuel chambers and valves.

The following description of the attached drawings is given as an example for better understanding of the application of the invention.

Figures 1 and 2 represent schematically in longitudinal section one embodiment of the invention, the parts being shown in the positions they occupy during the operation of the motor (Figure 1) and in the position they occupy when the motor is stopped (Figure 2).

Figure 3 represents a modification of the arrangement shown in Figures 1 and 2.

Figures 4 and 5 show schematically in longi-

tudinal section the position during operation (Figure 4), and during stoppage of the motor (Figure 5), of another modification of the invention, comprising a floating lever.

Figures 6 and 7 show schematically in longitudinal section, in position of operation (Figure 6) and in position of stoppage of the motor (Figure 7), a further modification of the invention, in which the diaphragm of the pressure regulator balances the diaphragm of the automatic shut-off arrangement during the operation of the lever.

Figure 8 illustrates a further modification of the arrangements shown in Figures 6 and 7.

The carburetor shown in Figures 1 and 2 comprises a mixing passage 1 supplied with air through air intake 2 and controlled by throttle valve 3. The mixing passage 1 receives fuel through fuel outlet 4 opening into the mixing passage 1 posterior to throttle valve 3 in the vicinity of the narrowest part of the venturi 5 placed in the mixing passage 1 in order to increase the depression acting on the fuel outlet 4. The section of fuel outlet 4 is varied by means of needle 6, the movements of which are controlled by throttle valve 3 by means of lever 7, link 8, and lever 9 pivoted at 10.

The fuel outlet 4 is supplied with fuel from the fuel chamber 11 of the arrangement indicated generally by the numeral 12 and constituting a combined pressure regulator and automatic shut-off arrangement. The fuel chamber 11 is supplied with fuel under pressure through a passage 13 connected for example to a fuel pump or a headed tank. The supply of fuel to the fuel chamber 11 is controlled by a fuel valve 14 which is actuated by the end 15 of lever 16 pivoted upon an axis 17. A light spring 18 keeps the stem of the fuel valve 14 in contact with the end 15 of lever 16.

In the wall of the fuel chamber 11 are incorporated two diaphragms 19 and 20. Diaphragm 19 constitutes the pressure regulating diaphragm while diaphragm 20 constitutes the diaphragm of the automatic shut-off arrangement.

Diaphragm 20 separates fuel chamber 11 from depression chamber 21 to which is transmitted through passage 22 the depression created by the motor. Passage 22 opens at 23 into the induction passage of the motor preferably in the vicinity of the fuel outlet 4, where the depression is at its maximum. Spring 26 presses against diaphragm 20. A stud 24 attached to diaphragm 20 is adapted to contact the second arm 25 of lever 16 and cause the fuel valve 14 to close when diaphragm 20 is lowered under the pressure of spring 26 (Figure 2). The movements in the reverse direction of diaphragm 20 caused by the depression transmitted to depression chamber 21, the depression of which acts against the pressure of spring 26, are limited by a stud 27 forming a stop for diaphragm 20. The assembly of fuel chamber 11, fuel valve 14, lever 16, diaphragm 20 under pressure of spring 26 carrying stud 24, depression chamber 21, and passage 22 transmitting the depression to said chamber, constitute an automatic shut-off arrangement of known construction.

Diaphragm 19 separates the fuel chamber 11 from air chamber 28 which connects with the carburetor air intake 2 through passage 29 and with the carburetor mixing chamber through passage 30. The sections of passages 29 and 30 connect chamber 28 respectively to the air intake and to the mixing chamber of the carburetor, and are adjustable by means of a suitable valve

31 which may be controlled by a lever 32. The details of valve 31 adjusting the sections of passages 29 and 30 have not been shown, as this adjustment is not a part of the present invention. The valve 31 may, for example, be a three-way valve, or it may be replaced by two separate valves placed respectively in the two passages. Chamber 28 may furthermore be connected only to the carburetor air intake 2, or may open directly into the atmosphere. Diaphragm 19 is under pressure of spring 33 and carries at its center a hooked member 34 the end 35 of which is adapted to engage the end 36 of arm 25 of lever 16 and limit the opening of the fuel valve 14 when diaphragm 19 is lowered by the fuel pressure in the fuel chamber 11, which pressure acts on diaphragm 19 against the pressure of spring 33 (Figure 1). The assembly of fuel chamber 11, fuel valve 14, lever 16, diaphragm 19, equipped with hooked member 34 and under pressure of spring 33 from air chamber 28, passages 29 and 30 connecting this chamber respectively to the air intake and the mixing chamber of the carburetor, and valve 31 regulating the sections of said passages, constitute a pressure regulator which is old per se. Such a pressure regulator is described in the above noted Belgian Patent No. 404,966.

The operation of the device is as follows:

During the operation of the motor (Figure 1), the depression transmitted to chamber 21 is sufficient to keep diaphragm 20 of the automatic shut-off arrangement in contact with stop 27 against the pressure of spring 26. Stud 24 carried by diaphragm 20 is then out of contact with arm 25 of lever 16. The opening of fuel valve 14 is in this way controlled solely by diaphragm 19 of the pressure regulator.

The pressure obtaining in the air chamber 28 is intermediate between the pressure existing in air intake 2 and pressure existing at 5 in the mixing chamber of the carburetor. The pressure depends on the relative cross sections of passages 29 and 30, controlled by valve 31. The fuel pressure in chamber 11 reaches such a value that it balances the pressure existing in chamber 28 augmented by the pressure of spring 33.

If it happens that the fuel pressure in chamber 11 exceeds this value, the fuel will force the diaphragm 19 against the pressure of spring 33 and, by means of the hooked member 34 acting on end 36 of lever 16, the diaphragm 19 will move this lever in such a way as to decrease the opening of the fuel valve 14. This will result in the diminution of the fuel pressure in the fuel chamber 11 until an equilibrium of pressure is established.

If, on the other hand, the fuel pressure in chamber 11 drops below its equilibrium value, spring 33 will force diaphragm 19 against the fuel pressure, and hooked member 34 will permit lever 16 to move in the direction corresponding to the maximum opening of valve 14. The increase in the opening of the fuel valve will cause an increase in the fuel pressure in fuel chamber 11 until the pressure equilibrium is re-established. This mode of operation of pressure regulators is of course well known.

When the motor stops, the depression transmitted to the depression chamber 21 of the automatic shut-off arrangement becomes zero. Spring 26 then forces diaphragm 20 back. Stud 24 comes in contact with arm 25 of lever 16 (Figure 2) and causes the closing of fuel valve 14 by means of lever 16. The admission of fuel to the fuel chamber 11 is in this way interrupted.

The fuel pressure in chamber 11 is under these

conditions insufficient to balance spring 33, which presses against diaphragm 19 of the pressure regulator, and this spring 33 presses diaphragm 19 back until the same is taut. The end 35 of the hooked member 34 is then out of contact with end 36 of arm 25 of lever 16.

When the motor starts, the suction created by the motor is transmitted to depression chamber 21 and draws diaphragm 20 against the pressure of spring 26. Diaphragm 20 again takes the position shown in Figure 1. Spring 18 causes the opening of the fuel valve 14 and moves lever 16 until the end 36 of this lever comes into contact with end 35 of the hooked member 34. The fuel pressure in the fuel chamber 11 immediately rises and is now again normally regulated by diaphragm 19 of the pressure regulator.

It is evident that the arrangement shown in Figures 1 and 2 comprises both a pressure regulator and an automatic shut-off arrangement. The pressure regulator and the automatic shut-off arrangement have in common the fuel chamber 11, fuel valve 14, transmitting lever 16, whereas in the existing arrangements the pressure regulator and the automatic shut-off arrangement consist of two separate mechanisms, each having its fuel chamber and its fuel valve. An important feature of the present invention consists in combining the pressure regulator and the automatic shut-off arrangement in a single mechanism and having them actuate a common valve.

In the arrangement shown in Figures 1 and 2, before the motor stops, the fuel pressure in fuel chamber 11 against diaphragm 19 is such that it balances spring 33. In order for the automatic shut-off arrangement to exercise its function with the stopping of the motor, that is, to cause the closing of the valve, it follows necessarily that spring 26 should be sufficiently strong to overcome the pressure exerted by the fuel contained in fuel chamber 11 against diaphragm 20. As the motor stops and the valve 14 is closed, the pressure in the fuel chamber 11 drops. When the motor is started up again it is necessary that the depression created by the operation of the motor be stronger than spring 26 in order that valve 14 may open and the carburetor be supplied with fuel.

In order to enable a smaller depression to cause the opening of the automatic shut-off arrangement, it is known, as shown in applicants' Belgian Patent No. 369,959, to cause the depression to act on a movable wall in the depression chamber connected mechanically to the diaphragm of the automatic shut-off arrangement located in the wall of the fuel chamber, instead of having it act directly on said diaphragm. This arrangement permits the movable wall which is actuated by the depression to be made of a greater area than the diaphragm placed in the wall of the fuel chamber, so as to multiply the effort exerted by the depression on the said movable wall by means of a suitable lever.

Such an arrangement is shown in Figure 3. According to this arrangement the automatic shut-off mechanism comprises a depression chamber 37 equipped with a diaphragm 38 under pressure of spring 39. Diaphragm 38 is connected at its center by a link 40 to lever 41 pivoted on an axis 42. Lever 41 cooperates with a stud 43 attached to diaphragm 44 located in the wall of fuel chamber 11 and having the same function as diaphragm 20 of the arrangement shown in Figures 1 and 2. Diaphragm 44 carries a stud 45 which has the same function as stud 24 in the

arrangement shown in Figures 1 and 2. The lever 41 is designed to modify the force exerted by the depression on diaphragm 38 and which is transmitted to diaphragm 44 by means of lever 41 and stud 43. Space 46 between diaphragms 38 and 44 connects with the carburetor air intake 2 through passage 47, but may be connected to the atmosphere if desired.

The arrangement shown in Figure 3 operates exactly as the arrangement shown in Figures 1 and 2 except that the depression necessary to raise diaphragm 38 at the moment of starting the motor for the purpose of permitting the opening of fuel valve 14 is less than in the arrangement shown in Figures 1 and 2.

Furthermore, the application of the automatic shut-off arrangement is of little importance in regard to the invention, since this is not the object of the invention, but the combination of the automatic shut-off mechanism with the pressure regulator. In accordance with the invention, the diaphragm of the automatic shut-off mechanism located in the wall of the fuel chamber is actuated by the depression in such a manner as to cause the closing of the fuel valve when the motor stops and the depression becomes zero, and permitting the valve to open when the motor is running and a certain depression is created by the motor in the suction passage, but the manner in which the depression acts on this diaphragm is unimportant as far as this present invention is concerned.

In the arrangement shown in Figures 4 and 5, diaphragm 19 of the pressure regulator is connected by rod 48 to the end 49 of a floating lever 50. Lever 50 is connected at a second point 51 by rod 52 to diaphragm 53 of the pressure regulator located in the wall of the fuel chamber 11. Diaphragm 53 itself is in turn connected by rod 54, lever 55 pivoted at 56, and rod 57, to diaphragm 58 located in the wall of depression chamber 37. Diaphragm 58 is under pressure of spring 39. A stop 65 limits the movements of diaphragm 58 caused by the depression against the pressure of spring 39, while a second stop 66 limits the movements of diaphragm 58 in the opposite direction. The second stop, however, may be omitted. A third stop 67 limits the movement of diaphragm 19 caused by the pressure of spring 33.

The other end 59 of lever 50 is adapted to contact with stem 60 of fuel valve 61, which controls the admission of fuel supplied through passage 13 to fuel chamber 11. Valve 61 carries a cylindrical guide 62 provided with ports 63 to allow fuel to pass therethrough. This valve is under pressure of a light spring 64 which tends to bring the valve back into closed position.

The operation of this embodiment is as follows.

During normal operation (Figure 4) the depression acting on diaphragm 53 maintains this diaphragm in contact with stop 65 against spring pressure 39 so that the point of connection 51 between lever 50 and diaphragm 53 of the automatic shut-off mechanism is stationary. Diaphragm 19 of the pressure regulator controls the opening of fuel valve 61 by means of lever 50 pivoting around the fixed point 51. Spring 64 maintains the end of stem 60 of valve 61 in contact with end 59 of lever 50.

When the motor stops (Figure 5) spring 39 presses diaphragm 58 until rod 57 contacts stop 66. Lever 55 pivots around axis 56 and raises diaphragm 53 of the automatic shut-off mechanism. This movement is transmitted to the con-

necting point 51 which moves upwardly and moves lever 50 in a direction permitting the valve 61 to close. When rod 57 contacts stop 66, end 59 is out of contact with the end of the stem 60 of valve 61. That valve can then close completely. The output of fuel is interrupted and the fuel pressure in chamber 11 drops. The spring 33 then moves diaphragm 19 of the pressure regulator, but the movement of this diaphragm is limited by stop 67 which prevents lever 50 from reaching a position at which end 59 of this lever would again come in contact with stem 60 of fuel valve 61 thereby opening said valve.

When the motor is started, the depression acting on diaphragm 58 raises the same, and the movement of this diaphragm is transmitted to diaphragm 53 at the point of connection 51, which is lowered. Lever 50 then pivots around connecting point 49 and its extremity 59 causes the valve 61 to open. The pressure in fuel chamber 11 then rises and diaphragm 19 comes into action to regulate the fuel pressure in this chamber as explained above.

In the arrangement shown in Figures 6 and 7, valve 61 is actuated by end 68 of lever 69, pivoted at 70. Spring 64 tends to maintain stem 60 of valve 61 in contact with end 68, and in pushing against that end it tends to maintain the opposite end 71 of lever 69 in contact with the center of diaphragm 19 of the pressure regulator, which is under pressure of spring 33. The connection between end 68 of the lever and the valve, also between end 71 of the lever and the diaphragm, may be positive, the valve stem and the diaphragm, for example, being provided with pivots. The movement of diaphragm 19 against the spring 33 is limited by a stop 72.

Diaphragm 73 of the automatic shut-off mechanism located in the wall of the depression chamber 21 is adapted to contact at its center with end 71 of lever 69 (Figure 7) as a result of the pressure of spring 74 which presses against diaphragm 73. Diaphragms 19 and 73 have equal working surface areas. In practice, these two diaphragms may be identical. The pressure of spring 74 is slightly greater than the pressure of spring 33. The movements of diaphragm 73 against spring pressure 74 are limited by a stop 75.

The operation of this embodiment is as follows.

During the operation of the motor (Figure 6) the depression transmitted to chamber 21 maintains diaphragm 73 in contact with stop 75 against the pressure of spring 74. Diaphragm 19 of the pressure regulator controls the opening of valve 61 by means of lever 69, the end 71 of which is maintained against diaphragm 19 by the pressure of valve spring 64.

When the motor stops (Figure 7) spring 74 forces diaphragm 73 into contact with the extremity 71 of lever 69. Both diaphragms are then in contact with this extremity 71 and the force acting on extremity 71 is the resultant of forces applied by the two diaphragms 73 and 19, which diaphragms have equal area working surfaces. The pressures exerted by the fuel on both diaphragms are equal and consequently balanced. Extremity 71 is subjected to a force equal to the difference of pressures of spring 74 and 33. This force moves end 71 downwardly and consequently permits valve 61 to close as a result of the pressure of the fuel supplied by passage 13, to which is added the force of spring 64. Spring 64 may, however, be omitted, since the pressure of the fuel on the valve is sufficient to maintain the same in closed position.

When the motor is started, the depression transmitted to diaphragm 73 tends to raise this diaphragm and permit valve 61 to open. The force opposing such opening consists of the difference between the forces of spring 74 and spring 33, augmented by the pressure of the fuel on valve 61 and the pressure of spring 64. As valve 61 has a very small pressure area in comparison to diaphragm 73, and as the pressure of spring 74 and the difference in pressures between springs 74 and 33 may be selected as light as desirable, the force necessary to raise diaphragm 73 and cause the opening of valve 61 is very small in comparison with the surface of this diaphragm, and a very light depression is sufficient to cause valve 61 to open. Then when valve 61 opens, the fuel pressure in fuel chamber 11 rises, but diaphragm 19 of the pressure regulator maintains the end 71 of lever 69 against diaphragm 73 as long as the fuel pressure in the fuel chamber 11 is insufficient to overcome the pressure of spring 33. When the fuel pressure becomes sufficient to balance the pressure of spring 33, diaphragm 19 ceases to rise and consequently valve 61 does not open further. The pressure exerted by the fuel on diaphragm 73 of the automatic shut-off mechanism is then equal to the pressure of spring 33, since diaphragms 73 and 19 have equal working surface areas and the fuel pressure on diaphragm 19 balances the pressure of spring 33. It is then sufficient that the depression transmitted to diaphragm 73 exert on this diaphragm a force greater than the difference between the pressures of springs 74 and 33 in order that diaphragm 73 may continue to move away from end 71 of lever 69 and come in contact with stop 75. Inasmuch as the difference between the pressures of springs 74 and 33 may be chosen as small as desired, it follows that the depression necessary to maintain diaphragm 73 in contact with stop 75 may be very light. Due to this, the automatic shut-off mechanism is not liable to close during the operation of the motor on account of acceleration, because even if the throttle is opened suddenly while the motor is idling, the depression remains greater than the very weak value necessary to maintain diaphragm 73 in contact with stop 75.

In order to balance the pressure exerted by the fuel on the diaphragm of the automatic shut-off mechanism against the pressure exerted by the fuel on the diaphragm of the pressure regulator when the one-way connection between these two diaphragms is operative, it is not necessary that the two diaphragms have equal working surface areas as is shown in Figures 6 and 7. These two diaphragms may have unequal working surface areas, providing that the one-way connection by which they are connected has a multiplying effect proportionate to the forces transmitted from one diaphragm to the other. Such an arrangement is shown in Figure 8.

In the arrangement shown in Figure 8, the fuel chamber comprises two compartments 76 and 77 which communicate freely. The admission of fuel to chamber 76, 77 is controlled by valve 61 and this fuel chamber supplies fuel outlet 4 which opens into the carburetor mixing passage (not shown). Diaphragm 78 of the pressure regulator separates compartment 76 from air chamber 79 which is connected to the air intake and to the carburetor mixing chamber through a passage 80 in the same manner as the air chamber 28 of arrangement shown in Figures 6 and 7. Diaphragm 81 of the automatic shut-off mechanism

nism separates compartment 77 from a depression chamber 82 which connects with the suction passage of the motor through passage 83 in the same manner as depression chamber 21 in the arrangement shown in Figures 6 and 7.

Diaphragm 78 is under pressure of a spring 86 and carries a stem 84 passing through a guide 85. The lower end 87 of guide 85 acts as a stop for diaphragm 78. Stem 80 of valve 61 is normally maintained in contact with the center of diaphragm 78 through the action of spring 84. Diaphragm 81 is under pressure of spring 88 and carries a stem 89 passing through a guide 90. The lower end 91 of guide 90 acts as a stop for diaphragm 81.

A double-armed lever 92 pivoted on an axis 93 is designed to contact at its ends 95 and 94 with two heads 96 and 97 formed respectively on stems 84 and 89. The arms *a* and *b* of lever 92 and the surfaces *S* and *S'* of diaphragms 78 and 81 are so chosen that the fuel pressure on diaphragm 78 approximately balances the fuel pressure on diaphragm 81 by means of lever 92 when heads 96 and 97 of stems 84 and 89 are both in contact with the corresponding ends 95 and 94 of lever 92. In other words, the relation is substantially $Sb = S'a$. Spring 88 is of such stiffness that its pressure is slightly greater than it would have to be to balance the pressure of spring 86.

The above described arrangement functions in the same manner as the embodiment shown in Figures 6 and 7.

During the operation of the motor, the parts occupy the positions shown in Figure 8. The depression maintains diaphragm 81 of the automatic shut-off mechanism in contact with stop 91, and end 95 of lever 92 is out of contact with head 96 of shaft 84 carried by diaphragm 78 of the pressure regulator. The opening of valve 61 is thereby regulated by diaphragm 78 which acts on stem 80 of this valve.

When the motor stops, spring 88 presses against diaphragm 81, which carries with it stem 89 and lever 92. End 95 of the lever comes in contact with head 96 and raises diaphragm 78 by means of shaft 84 against the pressure of spring 86 which, as mentioned above, is too weak to balance the pressure of spring 88. Stem 80 of valve 61 becomes disengaged and the pressure of spring 84 causes the closing of valve 61.

The only difference between the arrangement shown in Figure 8 and the arrangement shown in Figures 6 and 7 is that during the opening of the valve through the operation of the automatic shut-off mechanism as a result of the depression caused by the motor, the balance of pressure exerted by the fuel on diaphragms 78 and 81, of the unequal working surface areas, is maintained by means of lever 92, the arms of which are unequal, while in the arrangement shown in Figures 6 and 7 the balance of pressures exerted by the fuel on diaphragms 78 and 81, of equal working surface areas, is maintained by means of end 71 of lever 60 interposed between the centers of the two diaphragms.

It will be evident that the mechanical connections between the various parts may be modified in various ways within the scope of the invention. Similarly, the arrangement of the pressure regulator and of the automatic shut-off mechanism may be modified, since the specific construction of the pressure regulator or of the automatic shut-off mechanism are not part of the present invention. Finally, it is evident that the inven-

tion is not limited to any particular type of carburetor or any particular carburetor construction.

We claim:

1. In a charge forming device for an internal combustion engine, an induction passage, a throttle controlling the same, a fuel nozzle positioned posterior to said throttle, a fuel chamber having an inlet and having an outlet connected to said fuel nozzle, a valve controlling said inlet, a pressure responsive member forming a wall of said chamber and connected to said valve in such manner as to tend to close the valve upon increase of pressure in the chamber, and a second pressure responsive member forming a wall of said chamber and connected to said valve, said second pressure responsive member being biased in a direction to close said valve and being subjected to the depression in said induction passage and rendered thereby inoperative to close said valve when the depression exceeds a predetermined amount.

2. The device defined in claim 1, wherein both pressure responsive members are connected to the valve by a one-way connection operative only in the direction of closing said valve.

3. In a charge forming device for an internal combustion engine, an induction passage, a throttle controlling the same, a fuel nozzle discharging posterior to said throttle, a fuel chamber having an inlet and having an outlet connected to said fuel nozzle, a valve controlling said inlet, a flexible member forming a wall of said chamber and connected to said valve in such manner as to tend to close the same upon increase of pressure in the chamber, a second flexible member of smaller area forming an opposite wall of said chamber connected to said valve and subjected to depression in said induction passage, and yielding means urging said second flexible member in a direction to close said valve and rendered inoperative to close said valve when the depression in the induction passage exceeds a predetermined amount.

4. In a charge forming device for an internal combustion engine, an induction passage comprising a venturi, a throttle controlling the induction passage, a fuel nozzle discharging posterior to said throttle, a fuel chamber having an inlet supplied with fuel under pressure and having an outlet connected to said fuel nozzle, a valve controlling said inlet, a movable wall in said chamber connected to said valve in such manner as to tend to close the valve as the pressure in said chamber increases, a second movable wall in said chamber subjected to the fuel pressure therein and having a one-way connection with said valve, a spring operative to move said second wall into a position to close said valve whenever the engine is stopped, and means operative whenever the engine is operating to apply to said second wall a suction pressure generated by engine operation to render said spring inoperative.

5. In a charge forming device for an internal combustion engine, an induction passage comprising a venturi, a throttle controlling the induction passage, a fuel nozzle discharging posterior to the throttle, a fuel chamber having an inlet and having an outlet connected to the fuel nozzle, a valve controlling said inlet, a movable wall in said chamber connected to said valve by a one way connection in such manner as to urge the same toward closed position with a force increasing with increasing pressure in the chamber, a second movable wall in said chamber sub-

jected to the fuel pressure therein and having a one way connection with said valve, a spring operative to move said second wall into a position to close said valve whenever the engine is stopped, and means operative whenever the engine is operating to apply to said second wall a suction generated by engine operation to render said spring inoperative.

6. Fuel control apparatus for an internal combustion engine, comprising a fuel line, means for supplying fuel thereto under superatmospheric pressure, a fuel chamber in said fuel line, a valve controlling the admission of fuel to said chamber, a yielding wall in said chamber movable in a predetermined direction by increase of pressure

in said chamber, a connection between said yielding wall and said valve causing the valve to move toward closed position when the yielding wall moves in said predetermined direction, and a second yielding wall in said chamber having one of its faces subjected to the pressure of fuel in the chamber and its other face subjected to a varying depression created by operation of the engine, said second yielding wall being spring pressed and connected to said valve in such manner as to close said valve independently of the position of the first mentioned wall when the depression falls below a predetermined value.

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CERTIFICATE OF CORRECTION.

Patent No. 2,156,115.

April 25, 1939.

PAUL XAVIER AUGUSTE GISTUCCI, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 66, for "of course-well known" read of course well-known; page 4, second column, line 28, for the reference numeral "18" read 19; page 5, first column, line 40, for "therby" read thereby; and second column, line 61, claim 4, strike out "pressure"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of February, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

jected to the fuel pressure therein and having a one way connection with said valve, a spring operative to move said second wall into a position to close said valve whenever the engine is stopped, and means operative whenever the engine is operating to apply to said second wall a suction generated by engine operation to render said spring inoperative.

6. Fuel control apparatus for an internal combustion engine, comprising a fuel line, means for supplying fuel thereto under superatmospheric pressure, a fuel chamber in said fuel line, a valve controlling the admission of fuel to said chamber, a yielding wall in said chamber movable in a predetermined direction by increase of pressure

in said chamber, a connection between said yielding wall and said valve causing the valve to move toward closed position when the yielding wall moves in said predetermined direction, and a second yielding wall in said chamber having one of its faces subjected to the pressure of fuel in the chamber and its other face subjected to a varying depression created by operation of the engine, said second yielding wall being spring pressed and connected to said valve in such manner as to close said valve independently of the position of the first mentioned wall when the depression falls below a predetermined value.

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JOHANN LICHTENSTEIN.

CERTIFICATE OF CORRECTION.

Patent No. 2,156,115.

April 25, 1939.

PAUL XAVIER AUGUSTE GISTUCCI, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 66, for "of course-well known" read of course well-known; page 4, second column, line 28, for the reference numeral "18" read 19; page 5, first column, line 40, for "therby" read thereby; and second column, line 61, claim 4, strike out "pressure"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of February, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.