

Jan. 17, 1939.

P. X. A. GISTUCCI

2,144,017

CARBURETOR

Filed May 11, 1936

2 Sheets-Sheet 1

Fig. 1

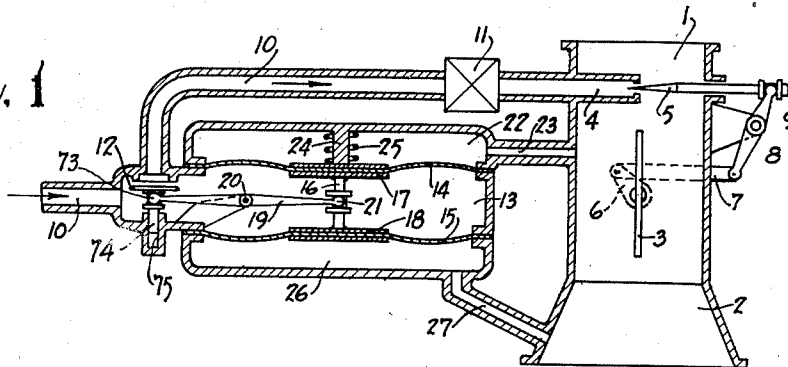


Fig. 2

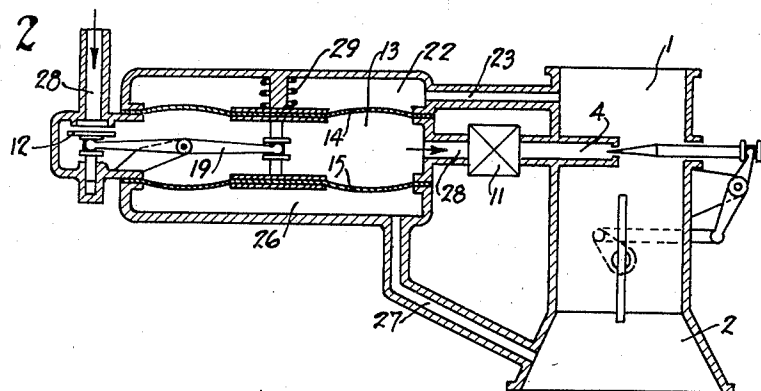
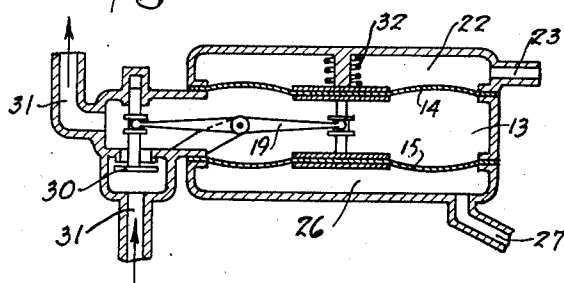


Fig. 3



INVENTOR.
PAUL XAVIER AUGUSTE GISTUCCI
BY *Q. R. McCordy*
ATTORNEY.

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Fig. 4

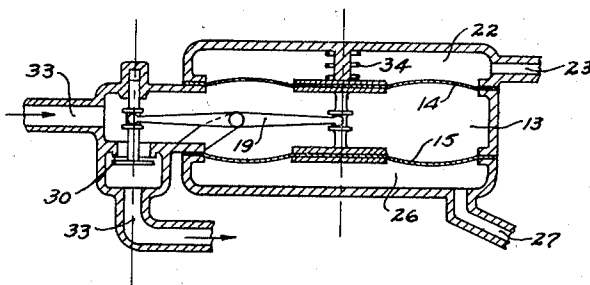


Fig. 5

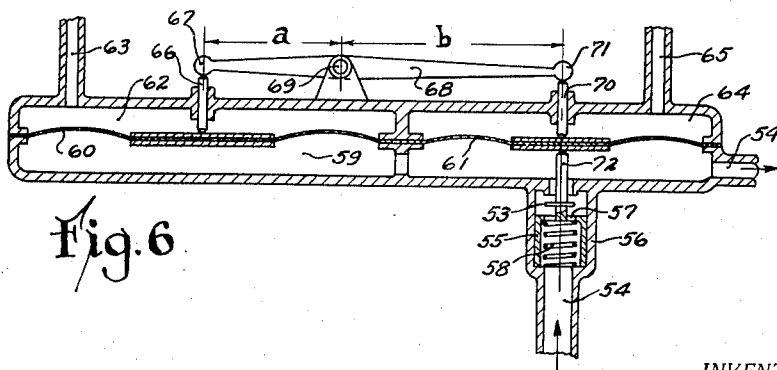
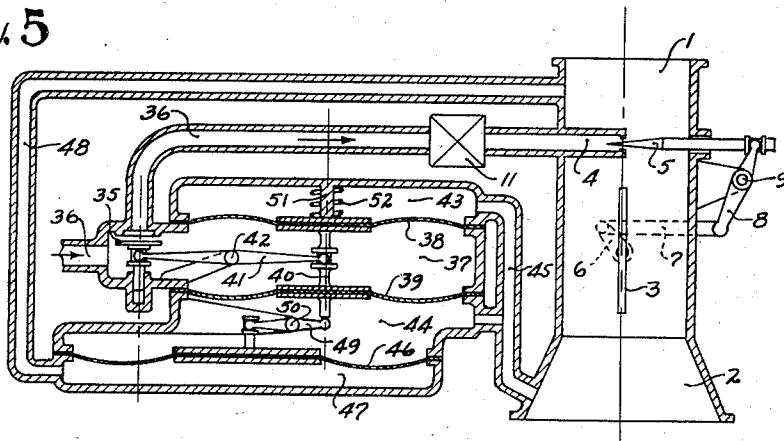


Fig. 6

INVENTOR.
PAUL XAVIER AUGUSTE GISTUCCI.
BY *Q. Q. M. Crady.*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,144,017

CARBURETOR

Paul Xavier Auguste Gistucci, Paris, France, assignor to Societe Generale des Carburateurs Zenith, Levallois-Perret, France, a corporation of Switzerland

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In Belgium May 18, 1935

9 Claims. (Cl. 261-69)

The present invention relates to carburetors for internal combustion motors, and more particularly to means for interrupting the fuel supply when the motor is stopped. The invention contemplates particularly means in which a valve, placed in the liquid fuel supply line, is connected to a membrane located in the wall of a fuel chamber communicating with the fuel line, and which is controlled by the depression existing in the induction passage of the carburetor. The connection between said membrane and said valve is such that the valve is closed when the motor is inoperative and the depression is zero, and open when the membrane is actuated by the depression created by the motor while in operation.

Such arrangements are necessary when the fuel is supplied to the motor under a certain pressure, in order to avoid the continuation of fuel flow into the motor when the same stops.

A difficulty in providing a practical arrangement of this type lies in the fact that the depression created by the motor drops to a very low value during acceleration, hence it is necessary that the arrangement be sufficiently sensitive to enable this very weak depression to maintain the fuel valve open, since otherwise the valve will close and interrupt the supply of fuel to the motor.

Viel U. S. Patent 1,955,037, dated April 17, 1934, and assigned to the assignee of the instant application, discloses an arrangement designed to give such mechanism great sensitivity. In said arrangement the membrane located in the wall of the fuel chamber is of small dimensions and is connected to the movable wall of a chamber to which is transmitted the depression created by the motor. This movable wall is of large dimensions in comparison to the membrane, so that the effect of the depression on this membrane is multiplied and the mechanism is thereby rendered very sensitive to slight depressions. The operation of such an arrangement is satisfactory when the same is placed in a fuel line in which the pressure is low; for instance, if it is placed in a line receiving fuel through a pressure regulator which supplies the fuel under a pressure of approximately 10 to 20 grams per square centimeter. But such an arrangement cannot be placed in a fuel line supplied directly by a fuel pump of the usual type which creates a pressure around 300 grams per square centimeter, since such pressure acting on the membrane would exert on the same, in spite of its small dimensions, a considerable force, and it would be necessary to make the movable wall subject to the depression, of a size altogether impractical in order that a weak depression would be sufficient to operate the mechanism.

An object of the present invention is to pro-

vide a fuel shut-off arrangement, the operation of which is not affected by variations in the pressure of the fuel, and the dimensions of which are smaller than the dimensions of mechanisms of known types.

In accordance with the present invention an additional membrane is placed in the wall of the fuel chamber and is connected to the membrane actuated by the depression in such a manner that the pressure exerted by the fuel on the additional membrane effectively balances the pressure exerted by the fuel on the membrane actuated by the depression.

Under these conditions the fuel exerts on the assembly of membranes a resultant force which is actually zero no matter what the pressure of the fuel, and a very slight depression suffices to operate the mechanism even if the same is placed in a fuel line in which the pressure is high.

Obviously, the single membrane actuated by the depression may be replaced by several membranes actuated by the depression. Similarly, the single additional membrane may be replaced by several additional membranes. In such case the various membranes will be interconnected in such a manner that the assembly of the membranes constitutes a system of membranes under substantially balanced pressures. The fuel exerts on each membrane a predetermined pressure which is equal to the product of the effective area of the membrane by the fuel pressure. The term "system of membranes under balanced pressures" is intended to include a system in which the membranes are interconnected in such a manner that the total of pressures exerted by the fuel on the different membranes constitutes a system of balanced forces. If the balance is obtained under a given fuel pressure, it will obviously be maintained at all pressures, since the forces acting on the different membranes will vary proportionately to the pressure. The design of a membrane system under balanced pressures is an elementary problem, which may be readily solved, and such a system constitutes an arrangement clearly defined.

The effective area of a membrane is the ratio of the total pressure exerted by the fluid on that membrane to the unit pressure of the fluid. The physical equivalent of the effective area of the membrane is the surface area of a piston upon which the fluid exerts a total pressure equal to that which it exerts on the membrane. It is common practice to use as membranes flexible discs, for example discs made of fabric impregnated with a substance designed to make it impervious, and to place in the center of the membrane a rigid metallic disc of a smaller diameter than the membrane. The membrane or membranes actuated by the depression created by the motor may

be subjected either directly to such depression, or may be connected to the movable wall of a chamber which is subjected to such depression, in a manner similar to the arrangement described in Viel Patent No. 1,955,037, heretofore mentioned. If a throttle valve is mounted in the induction passage of the motor it will be preferable to utilize the depression existing posterior to the throttle valve.

The additional membrane or membranes may be subjected to the atmospheric pressure or to the pressure existing at the motor air intake. When the motor is supplied with air from a supercharger, this membrane or membranes may be subjected to the pressure existing at the supercharger air outlet.

The fuel valve is preferably placed in such a manner that it opens against the direction of fuel flow, since such an arrangement increases the sensitivity of the mechanism, as will be apparent hereinafter.

Preferably a spring tends to close the fuel valve.

In a preferred embodiment of the invention, the membrane actuated by the depression and the additional membrane are parallel and are connected by their centers, and both have the same effective areas.

The following description, and the attached drawings, are given as an example for better understanding of the way in which the invention may be applied.

Figure 1 shows schematically in longitudinal section a carburetor provided with an arrangement embodying the invention.

Figures 2, 3 and 4 show schematically in longitudinal section modifications of the arrangement shown in Figure 1 which differ from the same by the arrangement of the fuel valve.

Figure 5 shows schematically in longitudinal section a further modification of the arrangement shown in Figure 1 in which the membrane actuated by the depression is not directly subjected to it.

Figure 6 shows schematically in longitudinal section a modification of the arrangement shown in Figure 1 but differing therefrom in the arrangement of the membranes.

The carburetor shown in Figure 1 comprises an induction passage 1 supplied with air through air intake 2, and controlled by a throttle valve 3. The induction passage receives fuel from a fuel outlet 4, which is controlled by a needle 5, and discharges posterior to the throttle valve 3. The movements of needle 5 are mechanically controlled by the movements of throttle valve 3 by means of a lever 6 fixed to the throttle valve shaft, connecting link 7, and lever 8 pivoted at 9.

The fuel outlet 4 is supplied with fuel under pressure through a conduit 10 which receives fuel from a fuel pump of the usual type or from a headed reservoir (not shown). The arrows indicate the direction of fuel flow. A pressure regulator 11 of any suitable type may be placed in conduit 10 in such a manner as to reduce the pressure of the fuel supplied to the fuel outlet 4 to a predetermined value which may, for example, be around 10 to 20 grams per square centimeter, whereas the pressure in conduit 10 is usually around 300 grams per square centimeter if the conduit is supplied by a pump. The pressure regulator 11 may be omitted, if desired.

A valve 12 is located in conduit 10, and a fuel chamber 13 communicates with said conduit.

The walls of chamber 13 comprise membranes 14

and 15 which are parallel and have the same effective area. The two membranes are connected at their centers by means of rod 16. Membranes 14 and 15 may be formed of fabric discs impregnated with a substance rendering them impervious and provided at their central portions with metallic discs 17 and 18. These fabric discs are formed, as known in the art, in such a way as to permit them to follow slight displacements in either direction from their median position. Membranes made in this manner possess very negligible stiffness, so that their displacement does not require any appreciable force. Membranes 14 and 15 are connected to valve 12 by lever 19. Lever 19 is pivoted at 20, and one of its ends 21 is engaged between two flanges of rod 16, while its opposite end 23 is engaged by flanges of stem 74 which is fixed to valve 12 and guided in a recess 75.

Membrane 14 separates the fuel chamber 13 from a chamber 22 which communicates through passage 23 with induction passage 1 posterior to the throttle valve 3. In chamber 22 is located a rod 24 which serves as a stop for membrane 14. A spring 25 placed around rod 24 tends to repel membrane 14 from this rod. This spring may, however, be omitted.

Membrane 15 separates fuel chamber 13 from a chamber 26 which, in the case of a carburetor supplied with air by a supercharger, communicates through passage 27 with air intake 2. The air intake 2 communicates with the supercharger outlet so that the pressure existing at the supercharger outlet is transmitted to chamber 26 and membrane 15. When the carburetor is not provided with a supercharger, chamber 26 may be omitted and membrane 15 is then exposed directly to the atmosphere.

The operation of the device shown in Figure 1 is as follows:

Since the two membranes 14 and 15 have the same effective area, the forces exerted by the fuel pressure on these membranes are actually equal and balance each other through rod 16 which connects the centers of the two membranes.

When the motor stops, valve 12 is held against its seat by the fuel pressure in chamber 13 and also by spring 25, the pressure of which is transmitted to valve 12 by rod 16 and lever 19. The purpose of spring 25 is merely to assure the closing of valve 12 in case the pressure in chamber 13 is insufficient. This spring may be very light.

When the motor is started, throttle valve 3 being closed, the operation of the motor creates a depression in the induction passage 1, and this depression is transmitted to chamber 22 and membrane 14. Under the effect of this depression, membrane 14 is displaced toward rod 24 against the pressure of spring 25 and against the pressure exerted by the fuel on valve 12. Membrane 14 carries with it membrane 15 and lever 19, thereby opening valve 12. The displacement of the membranes is limited by contact of rod 24 with membrane 14.

Once the valve 12 is open, the fuel outlet 4 is supplied with fuel and the motor operates in the usual manner. The seat of valve 12 is sufficiently large that the pressures existing in passage 10 on either side of the valve are practically the same when the valve is open, so that during normal operation the valve is subjected only to a negligible pressure differential. The only force tending to close the valve, then, is the pressure of spring 25, and a depression only strong enough

to overcome the pressure of spring 25 is sufficient to keep the valve open by acting on membrane 14. Since the spring 25 may be selected as weak as desired and can even be omitted, it is obvious that a very light depression is capable of maintaining the valve 12 open to prevent interrupting the fuel supply during acceleration.

In fact, in the position of the mechanism shown in Figure 1 the weight of the liquid contained between the two membranes tends to lower the membranes and consequently is added to the pressure of spring 25 tending to close valve 12. This influence of gravity may be diminished by reducing the height of chamber 13 to the lowest possible minimum, or by balancing this weight by a counterweight placed on lever 19. Likewise, the membranes may be disposed vertically so that the weight of the liquid will have no influence whatever when the mechanism is in normal position.

It was stated above that the two membranes 14 and 15 have the same effective area. In practice, two identical membranes 14 and 15 may be used, but it should be noted that the effective area of a membrane is not absolutely constant and that it varies slightly when the membrane is displaced one way or other from its median position. Actually the displacements of membranes 14 and 15 are very slight and the resulting variations in the effective areas of membranes 14 and 15 due to these displacements are negligible and do not interfere with the functioning of the mechanism.

Instead of making the effective areas of membranes 14 and 15 equal in order to form a balanced membrane system, one may make them slightly different so that the system comprising these membranes and valve 12 will be in balance when the valve is closed. In this manner the force necessary to open the valve during starting is reduced. Since the size of valve 12 is small in comparison to membranes 14 and 15 the difference between the effective areas of the membranes which is required to fulfill this condition is slight, so that membranes 14 and 15 may in fact be considered as a system of balanced pressures. Furthermore, the effective area of membrane 15 may be made slightly larger than that of membrane 14 in order to increase the force tending to close valve 12. However, such slight variations in the effective areas of the membranes do not affect the essence of the invention.

In the foregoing description the depression existing in the induction passage 1 and transmitted to membrane 14 was discussed. When the air intake 2 is supplied by a supercharger, the pressure existing in the induction passage may be higher than the atmospheric pressure, so that, properly speaking, there is no depression in this passage relative to the atmospheric pressure. However, the motor causes a depression relative to the pressure existing in air intake 2, the carburetor being operated by said depression. Conforming to general usage, the term "depression" is used herein in a general sense both in case of supercharged motors and motors supplied with air at atmospheric pressure.

In the arrangement shown in Figure 2, the fuel supply conduit is designated by reference numeral 28, and the arrangement is such that the fuel pressure tends to open valve 12, whereas in the arrangement shown in Figure 1 the fuel pressure tends to close this valve. Spring 29 of Figure 2, which corresponds to spring 25 of Figure 1, must be sufficiently strong to maintain valve 12

closed against the fuel feeding pressure when the motor is inoperative. During normal operation a greater depression will be required to maintain valve 12 open, since spring 29 of Figure 2 is stronger than spring 25 of Figure 1.

In Figure 3 valve 30, corresponding to valve 12 in the arrangement shown in Figures 1 and 2, is placed in the fuel supply conduit 31 and opens outwardly of chamber 13, whereas in the arrangements shown in Figures 1 and 2 valve 12 opens inwardly of chamber 13. Furthermore, the fuel pressure tends to close valve 30, consequently spring 32 may be made very weak. During normal operation a very slight depression will be sufficient to maintain valve 30 open.

In the arrangement shown in Figure 4, valve 30 in the fuel supply conduit 33 also opens outwardly of chamber 13, but the fuel pressure tends to open this valve. Spring 34 obviously will have to be stronger than spring 32 in Figure 3, because it must be able to keep valve 30 closed against the fuel pressure. Consequently during normal operation a greater depression will be required to maintain the valve open than in the arrangement shown in Figure 3.

Comparing the operation of the arrangements shown in Figures 1 and 4, it is evident that it is of very little importance whether the fuel valve opens inwardly or outwardly of the fuel chamber. The direction of the valve opening relative to the fuel flow direction, however, is important. Preferably the valve should be located in such a manner as to open against the direction of the fuel flow (Figures 1 and 3). The depression required to maintain the valve open during normal operation is consequently slighter and the mechanism is more sensitive. The placing of the valve so that the same opens against the direction of fuel flow constitutes a preferred feature of the present invention.

In the arrangement shown in Figure 5 a valve 35 is placed in the fuel supply conduit 36. A fuel chamber 37 communicates with conduit 36. The walls of the fuel chamber comprise two membranes 38 and 39 having equal effective areas, their centers being connected by a rod 40. The rod 40 is connected to valve 35 by means of a lever 41 pivoted on axis 42. Membrane 38 also separates the fuel chamber 37 from a chamber 43. A rod 51 extends into chamber 43 and serves as a stop for membrane 38. Around rod 51 is mounted a spring 52 which tends to repel membrane 38 from rod 51. Membrane 39 separates the fuel chamber 37 from a chamber 44. Chambers 43 and 44 communicate with a conduit 45 which in turn communicates with the carburetor air intake 2. These two chambers may if desired communicate with the atmosphere.

Chamber 44 comprises a movable wall consisting of membrane 46 which may, however, be replaced by a piston. Membrane 46 separates chamber 44 from a depression chamber 47 which communicates through passage 48 with the induction passage 1. Membrane 46 is connected to membrane 39 by means of lever 49 pivoted at 50. The two arms of lever 49 may be made of unequal length in order to multiply the force transmitted by the lever from membrane 46 to membrane 39.

The operation of the mechanism shown in Figure 5 is as follows:

When the motor stops, the only forces acting on the assembly of the membranes and the fuel valve are the pressure exerted by the fuel on valve 35 and the pressure of spring 52. These two forces cooperate to keep the valve closed.

When the motor is started, the depression transmitted to membrane 46 acts through lever 49, rod 40, and lever 41, to open valve 35 against the fuel pressure acting on valve 35 and against the pressure of spring 52.

Since the pressure acts on membrane 46 instead of acting directly on one of the membranes enclosing the fuel chamber as in the arrangements shown in the preceding figures, the membranes 38 and 39 which enclose the fuel chamber may be made very small. In practice it is sufficient to make these dimensions such as to permit the necessary displacement of valve 35 without rendering the membranes so stiff as to cause a considerable resistance to their displacement. By making the membranes 38 and 39 of reduced dimensions the importance of slight differences between the effective areas of membranes 38 and 39 is diminished. This arrangement is advantageous in cases where the fuel supply pressure is very high.

The invention obviously is not limited to any particular arrangement of membranes or to any particular arrangement of mechanical connections between the different membranes and the valve.

In the arrangement shown in Figure 6, a valve 53 is placed in the fuel supply conduit 54. This valve is fixed to a sleeve 55 slidably guided in cylinder 56, and is perforated by ports 57 which permit the free passage of fuel. A spring 58 acts on the valve and tends to hold the same against its seat.

A fuel chamber 59 communicates with fuel conduit 54, and comprises movable walls formed by membranes 60 and 61. Membrane 60 separates the fuel chamber 59 from a chamber 62 communicating through passage 63 with the motor induction passage. Membrane 61 separates the fuel chamber 59 from a chamber 64 which communicates through passage 65 with the atmosphere or the air intake.

A rod 66 passing through a guide incorporated in the wall of chamber 62 extends between the center of membrane 60 and the end 67 of a lever 68 which is pivoted at 69. Similarly, a rod 70 extends between the center of membrane 61 and the end 71 of lever 68. The fuel pressure acting on the membranes 60 and 61 maintains rods 66 and 70 in contact with lever 68. The two arms *a* and *b* of lever 68 are of lengths inversely proportional to the corresponding effective areas of the membranes, so that membranes 60 and 61 and lever 68 form a system of balanced pressures. Valve 53 carries an extension 72, the end of which contacts with the center of membrane 61.

When the motor stops, spring 58 maintains the valve 53 closed. During the operation of the motor, this valve is maintained open against the pressure of spring 58 by the depression acting on membrane 60, the movements of which are transmitted to membrane 61 and valve 53 by lever 68. It will be noted that the arrangement of Figure 6 comprises two unequal membranes having no positive mechanical connections with each other, the contact between the different parts being effected by the fuel pressure or by a spring.

The invention obviously is not confined to any one type of carburetor. The drawings disclose a carburetor of the anterior throttle type, since it is chiefly in this type of carburetor that the

fuel outlet is supplied under a positive pressure, but the invention is obviously applicable in connection with any type of carburetor and particularly posterior throttle carburetors of the usual type. The invention is also applicable where the fuel is not supplied to the motor by a carburetor, properly speaking, but is supplied to the immediate vicinity of the inlet ports, or is injected directly into the motor cylinders.

I claim:

1. A fuel shut-off mechanism for internal combustion motors comprising a valve located in the motor fuel supply conduit, a membrane located in the wall of a fuel chamber communicating with the fuel conduit and controlled by the depression existing in the motor induction passage, and a connection between said membrane and said valve arranged in such a manner as to cause the opening of the valve when said membrane is actuated by the depression created by the motor during its operation; characterized by an additional membrane located in the wall of the fuel chamber and connected to said membrane controlled by the depression, said connection being such that the pressure exerted by the fuel on said additional membrane effectively counterbalances the pressure exerted by the fuel on said membrane controlled by the depression.

2. An arrangement as specified in claim 1, characterized by the said membrane actuated by the depression being subjected directly to the motor depression.

3. An arrangement as specified in claim 1, characterized by the said membrane actuated by the depression being connected to a movable wall of a depression chamber which communicates with the induction passage of the motor.

4. An arrangement as specified, in claim 1, characterized by the fuel valve opening against the direction of fuel flow.

5. An arrangement as specified in claim 1, characterized by a spring tending to close the fuel valve.

6. An arrangement as specified in claim 1, characterized by the valve closing being controlled by the depression existing posterior to a throttle valve located in the motor induction passage.

7. An arrangement as specified in claim 1, characterized by the said additional membrane being subjected to the pressure of the motor air intake.

8. An arrangement as specified in claim 1, characterized by the membrane controlled by the depression and the additional membrane being parallel, having equal effective areas and being connected at their centers.

9. In a fuel supply system for an internal combustion engine having an induction passage and a throttle therein, means for supplying air to the induction passage at superatmospheric pressure, a liquid fuel chamber having opposed movable walls interconnected to balance each other, a fuel line supplying said fuel chamber, a valve controlling the inflow of fuel to said chamber, means for subjecting one of said movable walls to the pressures in the induction passage posterior to the throttle, means for subjecting the other of said movable walls to said superatmospheric pressure, and an actuating connection between said movable walls and said valve.

PAUL XAVIER AUGUSTE GISTUCCI.