

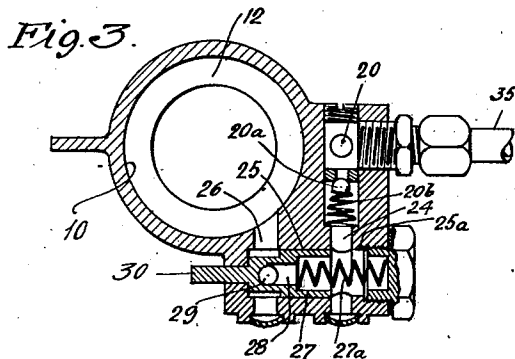
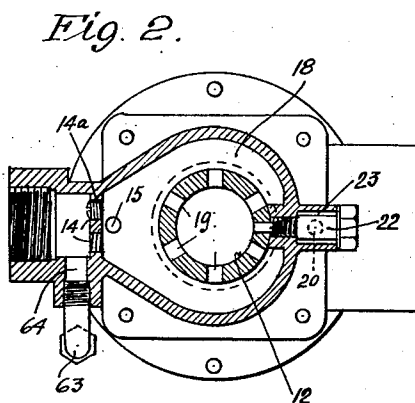
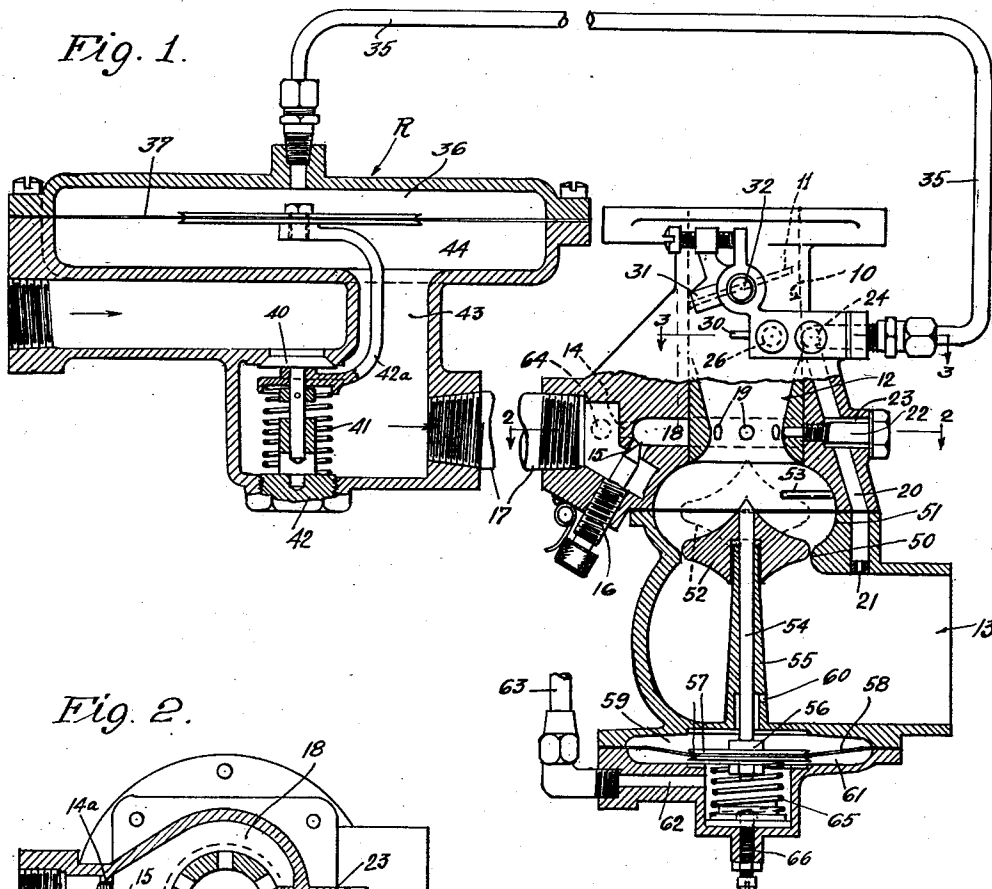
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GAS CARBURETOR

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GAS CARBURETOR

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15 Claims. (Cl. 48—180)

This invention relates to gas carburetors; and one of the general objects of the invention is to provide a carburetor so constituted and so functioning that it will be capable of operating when supplied with gas at a normal pressure less than atmospheric; or less than that at which the carburetor is supplied with air. And it is a general object of the invention to provide a simple mechanism which will accurately proportion the fuel throughout the range of operation and automatically stop the flow of gas whenever the engine stops operation.

In Patent No. 2,073,299, granted March 9, 1937, on Gas carbureting apparatus, I have described a carburetor and gas regulator apparatus of somewhat different type and which in general accomplishes the same objects; and in certain broad features the arrangement shown in this present application is similar to that of my prior application. In other particular features, however, and particularly with regard to the arrangement for automatically causing gas flow when the engine is in operation, the present invention provides a different specific structure and action for accomplishing the same general purposes. There are also certain novel features in connection with the economizer control which will be explained hereinafter.

One of the difficulties encountered in the operation of any carburetor on gas at low pressure lies in the fact that the motor will not idle at low speeds because the venturi, when large enough to accommodate the air flow for maximum power, is too large to create a sufficient suction at low speeds to draw the required amount of gas from a regulator which has been set to deliver at sufficiently below atmosphere to insure that its valve will close when the suction on its outlet ceases. Another difficulty is that the gas pressure at the carburetor gas intake usually varies one hundred per cent or more because of the varying inlet pressures on the regulator. While regulators are known which will deliver a substantially uniform pressure with varying initial pressures, the average regulator in use does not do that, and delivers a varying regulated pressure on account of the varying initial pressure in gas mains, or the varying pressures obtainable from the very commonly used tanks of liquid petroleum gas, in which the pressures vary greatly with temperature changes. Such changes in the gas pressure supplied to the carburetor make it very difficult to maintain a combustible mixture ratio properly through

the operating ranges of the engine, and particularly at low speed idling operation.

The present invention overcomes such difficulties by providing an automatic proportioning means in connection with the venturi, which will cause the provision of the proper mixture for starting, and idling at low speeds, and for operation through the other operating ranges, regardless of the varying sub-atmospheric pressure of the gas supply. This is done by so placing a floating air valve that it forms a yielding obstruction in the air flow to the venturi. By utilizing a diaphragm tending to close the floating air valve, and by applying to that diaphragm the pressure of the gas supplied to the carburetor, a balance of forces is set up which insures at all times a proper proportioning of the air and the gas supply.

A carburetor in typical and illustrative embodiment of the present invention, and in association with the gas regulator typical of any gas regulator, but having certain special features hereinafter described, is shown in the accompanying drawing, in which:

Fig. 1 is a view, predominantly in central vertical section, illustrating the carburetor and its association with the regulator;

Fig. 2 is a detail cross section of the carburetor taken on line 2—2 of Fig. 1; and

Fig. 3 is a detail cross section of the carburetor taken on line 3—3 of Fig. 1;

The carburetor here illustrated has a suction passage generally indicated by the numeral 10, containing the usual throttle 11, a venturi 12 and an air inlet 13, the upper end of the suction passage being adapted to connect with the engine manifold (not shown). These features are all typical; their particular design is of no moment in my invention, and the venturi may be substituted by any device which creates a fuel inspiring depression by reason of air velocity. Formed in the carburetor casting are gas inlets 14 and 15, one of which, 15, is controlled by the adjustment needle 16; the other two of which 14, are threaded and may be plugged, as indicated at 14a, for larger adjustment controls of the gas inlet, depending upon the B. t. u. content of the gas being used. These gas inlets are shown as fed by the pipe connection 17 which leads from the outlet of regulator R; and the inlets feed into a substantially annular passage 18 that surrounds the venturi. The venturi has at its throat the gas inlet orifices 19.

The economizer arrangement includes a bal-

ance passage 20 communicating with air inlet 13 through a calibrated bore 21. In the construction as here shown a screw plug 22 holds this screw plug via an enlarged bore 23 surrounding the plug. At its upper end passage 20 joins a cross bore 24 which intersects the valve bore 25; and the valve bore intersects another bore 26 which enters the main suction passage of the carburetor at a point far enough under throttle 11 that the throttle does not pass it. Bore 26 is therefore a port which is subjected to the throttle controlled suction in the main suction passage below the throttle.

A sliding valve 27 occupies valve bore 25, this valve having a hollow interior 28 which, via port 29, is always in communication with port 26. A light spring 27a holds the valve normally in the position shown in Fig. 3, and in this position passages 20 and 24 are in open communication with port 26. Valve bore 25 extends to the right of passage 24, as illustrated at 25a; so that when valve 27 is moved over to the right in Fig. 3 it gradually and then finally cuts off communication of passages 20 and 24 with port 26.

Valve 27 has a projecting stem 30 which is engaged by lug 31 mounted on throttle shaft 32, when the throttle is moved toward and to wide open position. Thus, as the throttle approaches and then finally reaches wide open position, valve 27 is moved to cut off communication of port 26 with passages 24 and 20.

Leading off from passages 20 and 24 is a tube 35 that goes to the upper chamber 36 of regulator R, above its diaphragm 37. Passage 20 and the interconnecting pipe 35 form a balance connection between the air intake of the carburetor and the reference pressure chamber of regulator R. When the engine is not in operation atmospheric pressure will thus stand in regulator chamber 36; and when the engine is in operation the carburetor intake pressure, whatever it may be, is placed upon the regulator diaphragm, modified by the action of the economizer port 26. At idling operation when the depression (the amount by which the pressure is below atmospheric) is slight, the economizer may have little influence upon the reference pressure placed upon the regulator diaphragm. In order to prevent that slight depression from drawing air from the balance passage, spring seated valve 20a may be inserted in passage 20; the spring 20b being strong enough to keep the valve seated against slight depressions but allowing the valve to open when the depression in the suction passage grows greater as medium running ranges are approached. But as the throttle 11 opens, increasing the depression in the suction passage below the throttle, an increasing depression is placed upon the balance passage from port 26; the effect of that depression in lowering the pressure in connection 35 being modified by the inflow of air at the calibrated orifice 21. Then, as the throttle comes to full open position, movement of valve 27 cuts off the depression from port 26, so as again to put full intake pressure on the regulator diaphragm.

In the regulator here illustrated it will be noted that increase of the reference pressure in chamber 36 tends to lower the diaphragm and to open the pressure controlling valve 40. The spring 41, adjustable in pressure by the regulation of plug 42, or by substitution of other springs, tends to close valve 40. This spring also, through the medium of the interconnecting arm 42a, supports

the weight of diaphragm 37 and the interconnected parts. In normal operation spring 41 will be so set as to cause valve 40 to close surely and tightly when atmospheric pressure is present in the regulator outlet; the outlet being connected via passage 43 with chamber 44 under diaphragm 37. Assuming that operation of the engine now applies suction to the outlet, pressure in chamber 44 is reduced, and the reference pressure in chamber 36 above the diaphragm opens the regulator valve 40. Under these conditions, variation in the reference pressure in chamber 36 will vary the pressure of gas delivery at the regulator outlet; and the action of the economizer in lowering the reference pressure throughout the medium of running ranges of the engine (throughout medium throttle positions) will cause valve 40 relatively to close and thus relatively to decrease the delivery pressure of the outlet, and thus relatively to thin the mixture formed by the carburetor throughout medium operating ranges. As noted, this action of the economizer is slight at closed position of the throttle, so that the economizer has little effect on the mixture when the engine is idling; and the economizer effect is cut off entirely at wide open throttle, allowing the mixture then to be richer.

In the lower part of the main suction passage there is a valve seat 50, and above it is a flare 51 in the passage wall; so that the valve 52 which seats downwardly, or nearly seats, on seat 50, can rise into the flared part of the passage, and thus increase, proportionately as it rises, the air passage around the valve. In its uppermost position, shown in dotted lines in Fig. 1, the valve strikes the stop pin 53 at its position of widest opening.

A valve stem 54 carries valve 52 and slides vertically in the stem guide 55. The lower end of stem 54 rests on the head 56 of the bolt that secures the two plates 57 to diaphragm 58. Diaphragm 58 has above it chamber 59 in constant communication with the intake air pressure via port 60; and below it the diaphragm has a chamber 61 which is in constant communication with the gas pressure at the carburetor inlet, via passage 62, tube 63, and port 64. The spring 65 supports diaphragm 58, the supporting pressure of the spring being adjustable by means of the adjusting screw 66. Spring 65 is in practice so adjusted that it practically balances the weight of the valve and the weight of the diaphragm, leaving only a sufficient unbalanced downward force that the valve will return to its normal lowermost position, seating or almost seating on valve seat 50, when the motor is not in operation.

When the motor is cranked for starting, the valve 52 rises and, assisted by the spring pressed diaphragm 58, floats on the air stream, and by checking the air stream reduces the pressure in the suction passage above the valve. This reduced pressure will of course be immediately communicated to the gas intake of the carburetor and thence, via port 64, connecting tube 63 and port 62, to the underside of diaphragm 58. Acting on that diaphragm, the lowered pressure tends to draw the diaphragm down (the unbalanced pressure above the diaphragm tends to push the diaphragm down) and the lowered pressure at the gas intake, communicated to diaphragm chamber 61, tends to take away a portion of the supporting force that supports valve 52. As a result valve 52 will tend to fall and put a greater restriction on the air flowing through the main passage; resulting in an increased depres-

sion in the passage above the valve, and again resulting in further downward movement of diaphragm 58. The cycle of actions is thus cumulative; so that very quickly after the motor starts to turn over the pressure in the carburetor gas inlet will be reduced to the pressure at or below that at which the regulator discharges. As soon as this condition has been reached, the regulator valve opens to feed in gas to maintain the pressure at the carburetor inlet at an equilibrium point. The carburetor then begins to take gas through the Venturi ports, and the floating valve 52 continues to play its part in maintaining, at the Venturi throat, even during idling operation, the reduced pressure which is essential to drawing the gas into the throat. Immediately upon receiving the mixture the engine starts. During this condition of operation, at or near idling, valve 20a in the passage 20 prevents the depression above valve 52 from being passed on to the balance system and the regulator, where it would undesirably tend to affect the regulator action to lower the delivered gas pressure during idling.

As the throttle is opened to increase the flow through the carburetor, valve 52 rises. So long as the engine is operating at idling or at low speeds, diaphragm 58 follows the valve upwardly; so that at all low speeds the valve is under the diaphragm control described. However, as the speed is increased and more air passes through the carburetor as the engine goes into medium ranges of operation, the diaphragm control is no longer needed, and the air valve rises free of the diaphragm, floating on the air current, until the air valve strikes the limiting stop 53, which it does at moderate air velocities through the carburetor; and in this position it remains throughout the higher operating ranges. The upward movement of diaphragm 58 is limited, in this particular design, by the bolt head 56 striking the upper wall of the diaphragm chamber. The valve and stem must of course be sufficiently heavy to put the required restriction on the air stream to reduce the pressure as described. I find that the valve may be well made of aluminum, the valve stem of steel; and the whole valve and diaphragm system operate nicely in equilibrium when the effective diaphragm area is equal to the horizontal area of valve 52.

Whenever during the operation of the motor it is throttled down to low speed or idling, valve 52 lowers until it again comes in contact with the diaphragm and comes again under diaphragm control. With the motor warmed up screw 56 may be adjusted to adjust the idling mixture for the engine, and when this adjustment is made valve 52 will then stand in correct position for starting when the motor is at rest. This adjustment takes care of any slight mixture thinning action the economizer may have at slight throttle openings or idling. Valve 52 not only thus provides correct starting conditions but also acts to give the motor a somewhat richer mixture during idling. Port 60 located in the air intake, communicates to the upper side of diaphragm 58 the pressure existing at any time in the carburetor air intake, and thus compensates the diaphragm action, just as balance port 21 compensates for the regulator and economizer action, for any change in the intake pressure due to air resistance that may be caused by a heater or cleaner, or the like.

It will be understood that in referring to atmospheric and sub-atmospheric pressures in the

foregoing specific descriptions, I have assumed that the carburetor is being fed with air at atmospheric pressure. If the air feed is at a different pressure, say a higher pressure, then the gas pressure at the carburetor will be correspondingly different, but always below the air pressure. The term atmospheric may thus be taken as meaning whatever air pressure the carburetor is operating under. It is the relative difference in these pressures that concerns that part of the invention which causes lowering of pressure in the carburetor. The economizer arrangement, however, is operative regardless of whether the gas feed to the carburetor is at a pressure less than that of the air feed, although in practice the gas feed pressure may always be less.

I claim:

1. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle in the passage, means including a pressure regulator for feeding gaseous fuel to the passage at a point at the inlet side of the throttle and at a pressure less than that in the air inlet, a valvular obstruction in the suction passage tending normally to close the passage and capable of opening movement by the air current flowing through the suction passage, a diaphragm on the upper face of which the valvular obstruction rests, and gas pressure communication between the lower face of the diaphragm and the fuel feed.

2. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle and a venturi in the passage, the throttle being toward the outlet from the venturi, means for feeding gaseous fuel to the Venturi throat at a pressure less than that in the air inlet, a valvular obstruction in the suction passage at the inlet side of the venturi, tending normally to close the passage and capable of opening movement by the air current flowing through the suction passage, a diaphragm on the upper face of which the valvular obstruction rests, and a gas pressure communication between the lower face of the diaphragm and the fuel feed.

3. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle and a venturi in the passage, the throttle being toward the outlet from the venturi, means for feeding gaseous fuel to the Venturi throat at a pressure less than that in the air inlet, the suction passage having therein an enlargement at the inlet side of the venturi, with a valve seat at the inlet end of the enlargement, a floating air valve adapted to seat upon said seat and adapted to be raised into the passage enlargement by the air stream flowing through the suction passage, a diaphragm on which the air valve rests when in closed position, a chamber at the upper side of said diaphragm communicating with air in the air inlet, and a chamber at the lower side of said diaphragm communicating with the fuel feed for transmitting the pressure of the fuel feed to the lower side of said diaphragm, and adjustable means for balancing the valve and diaphragm.

4. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle in the passage, pressure regulator means for feeding gaseous fuel to the suction passage at a point at

the inlet side of the throttle and at a regulated pressure less than that existent in the air inlet, means in the suction passage at the inlet side of the point of fuel feed acting to reduce the air pressure in the suction passage to a point below that of fuel delivery, said regulator including a pressure regulating valve, an actuating diaphragm and a reference pressure chamber at one side of the diaphragm, and means to transmit to said reference pressure chamber the air pressure existent in the air inlet of the suction passage.

5. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle in the passage, pressure regulator means for feeding gaseous fuel to the suction passage at a point at the inlet side of the throttle and at a regulated pressure less than that existent in the air inlet, means in the suction passage at the inlet side of the point of fuel feed acting to reduce the air pressure in the suction passage to a point below that of fuel delivery, said regulator including a pressure regulating valve, an actuating diaphragm and a reference pressure chamber at one side of the diaphragm, means to transmit to said reference pressure chamber the air pressure existent in the air inlet of the suction passage, and means for modifying that pressure by suction from the suction passage.

6. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle in the passage, pressure regulator means for feeding gaseous fuel to the suction passage at a point at the inlet side of the throttle and at a regulated pressure less than that existent in the air inlet, means in the suction passage at the inlet side of the point of fuel feed acting to reduce the air pressure in the suction passage to a point below that of fuel delivery, said regulator including a pressure regulating valve, an actuating diaphragm and a reference pressure chamber at one side of the diaphragm, a pressure transmitting passage extending between the suction passage inlet and said reference pressure chamber, and a branch passage from said pressure transmitting passage communicating with the suction passage to apply suction to the pressure transmitting passage.

7. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle in the passage, pressure regulator means for feeding gaseous fuel to the suction passage at a point at the inlet side of the throttle and at a regulated pressure less than that existent in the air inlet, means in the suction passage at the inlet side of the point of fuel feed acting to reduce the air pressure in the suction passage to a point below that of fuel delivery, said regulator including a pressure regulating valve, an actuating diaphragm and a reference pressure chamber at one side of the diaphragm, and a pressure communicating passage extending between the suction passage and the reference pressure chamber to apply suction to said chamber.

8. A gas carburetor system for engines, embodying a carburetor having a suction passage with a suction outlet and an air inlet and a throttle in the passage, pressure regulator means for feeding gaseous fuel to the suction passage at a point at the inlet side of the throttle and at a regulated pressure less than that existent in the air inlet, means in the suction passage at the inlet side of the point of fuel feed acting to re-

duce the air pressure in the suction passage to a point below that of fuel delivery, said regulator including a pressure regulating valve, an actuating diaphragm and a reference pressure chamber at one side of the diaphragm, a pressure communicating passage extending between the reference pressure chamber and the suction passage at a point therein on the inlet side of the throttle, and valvular means actuated by throttle movement to control said passage.

9. In a gas carbureting system for engines, a carburetor having a suction passage with a suction outlet and an air inlet and a throttle valve in the passage, pressure controlling means for feeding gaseous fuel to the suction passage, and means for controllably varying the pressure upon the fuel feed to the suction passage, said means including a passage communicating with the suction passage at a point at the air inlet side of the throttle and communicating with the fuel pressure controlling means to apply pressure thereto, a spring seated valve in said communicating passage and adapted to open the passage upon the application of a predetermined amount of suction thereto from the suction passage, and a controlling valve in said communication passage adapted to be actuated by throttle movement to close said passage as the throttle approaches open position.

10. In a gas carbureting system for engines, a carburetor having a suction passage with a suction outlet and an air inlet and a throttle valve in the passage, pressure controlled means for feeding gaseous fuel to the suction passage at a controlled pressure less than the air pressure existent in the air inlet, means in the suction passage at the inlet side of the point of fuel feed acting to reduce the air pressure in the suction passage to a pressure below that of the fuel feed, means for controllably varying the pressure upon the fuel feed to the suction passage, said means including a passage communicating with the suction passage at a point at the air inlet side of the throttle and communicating with the fuel pressure controlling means to apply suction thereto, and a valve in said passage adapted to open when a predetermined amount of suction is applied thereto from the suction passage.

11. In a gas carburetor for engines, a body having vertically extending suction passage there-through with an upper suction outlet and a lower air inlet and with a throttle valve and a venturi in the passage, the throttle valve being toward the outlet from the venturi, a fuel feed passage leading to the Venturi throat, an enlargement in the suction passage below the venturi and a valve seat at the base of said enlargement, a vertically moving air valve adapted to seat on said valve seat and to float on the air stream passing through the suction passage, a valve controlling diaphragm mounted in the body below the air valve and having diaphragm chambers above and below the diaphragm, the upper diaphragm chamber communicating with the air inlet, an adjustable supporting spring beneath the diaphragm, and communication between the lower diaphragm chamber and the fuel feed.

12. In a gas carburetor for engines, a body having vertically extending suction passage there-through with an upper suction outlet and a lower air inlet and with a throttle valve and a venturi in the passage, the throttle valve being toward the outlet from the venturi, a fuel feed passage leading to the Venturi throat, an enlargement in the suction passage below the venturi and a valve

5 seat at the base of said enlargement, a vertically
moving air valve adapted to seat on said valve seat
and to float on the air stream passing through the
suction passage; a diaphragm mounted in the
10 body below the air valve and on which diaphragm
the air valve freely rests; and said diaphragm hav-
ing a limited upward movement less than the up-
ward movement of the air valve, a chamber in the
body above the diaphragm and in communication
15 with the air inlet, a chamber in the body below
the diaphragm and in communication with the
fuel feed, and an adjustable supporting spring
below the diaphragm tending to support the dia-
phragm and valve.

15 13. A gas carburetor system, embodying a car-
buretor having a suction passage with a suction
outlet and an air inlet and a throttle in the pas-
sage, means for feeding fuel to the passage at a
point at the inlet side of the throttle and at a
20 pressure less than that in the air inlet, a valvular
obstruction in the suction passage at the air inlet
side of the point of fuel feed tending normally to
close the passage and capable of opening move-
ment by the air current flowing through the suc-
25 tion passage, and means, independent of the air
current movement of the obstruction, whereby the
pressure existent at the fuel feed tends to move the
obstruction in opening movement direction.

30 14. A gas carburetor system, embodying a car-
buretor having a suction passage with a suction
outlet and an air inlet and a throttle in the pas-
sage, means for feeding fuel to the passage at a

point at the inlet side of the throttle and at a
pressure less than that in the air inlet, a valvular
choke means positioned in the suction passage at
the air inlet side of the point of fuel feed, said
valvular choke means adapted to be opened by 5
decrease of pressure in the suction passage be-
tween said choke means and the throttle, and
means, acting independently of said last men-
tioned choke opening, actuated by the pressure of
10 the fuel at the point of fuel feed and tending to
open said choke means with a force which is a
function of the fuel feed pressure.

15 15. In a gas carbureting system for engines, a
carburetor having a suction passage with a suc-
tion outlet and an air inlet and a throttle valve in
the passage, pressure controlled means for feed-
ing gaseous fuel to the suction passage, and means
for controllably varying the pressure upon the
fuel feed to the suction passage, said means in-
cluding a passage communicating with the fuel 20
pressure controlling means to apply thereto a
pressure substantially equal to that existent at the
air inlet, and including also a passage communi-
cating with the suction passage at a point at the
air inlet side of the throttle and communicating 25
with the fuel pressure controlling means to apply
suction thereto, and a controlling valve in said
last mentioned communication passage adapted
to be actuated by throttle movement to close said
passage as the throttle approaches open position. 30

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