Aug. 13, 1935. T. LINGA 2,010,956

CARBURETOR

Filed Aug. 7, 1933 2 Sheets-Sheet 1

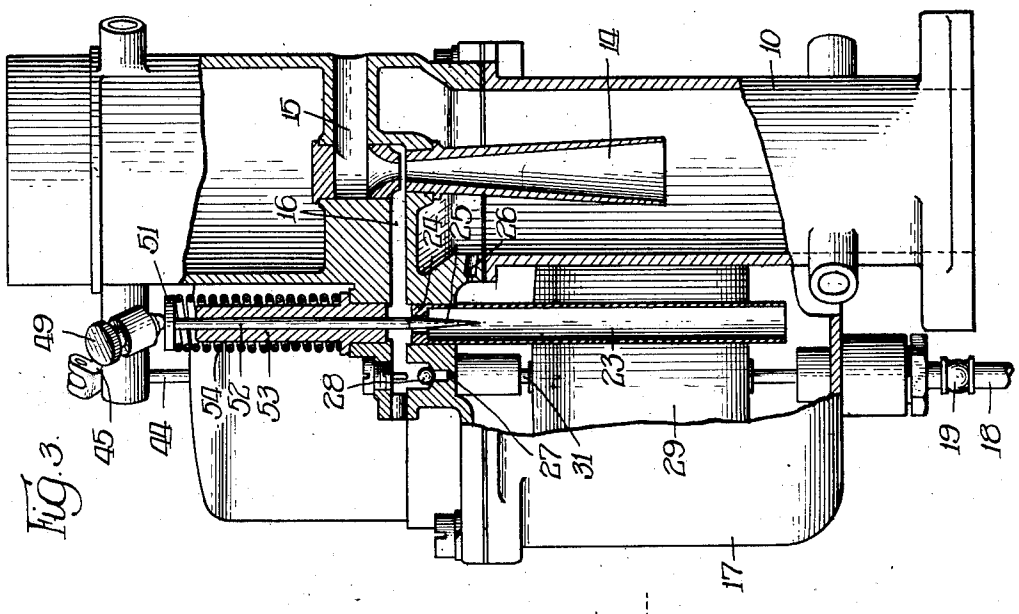


Fig. 3.

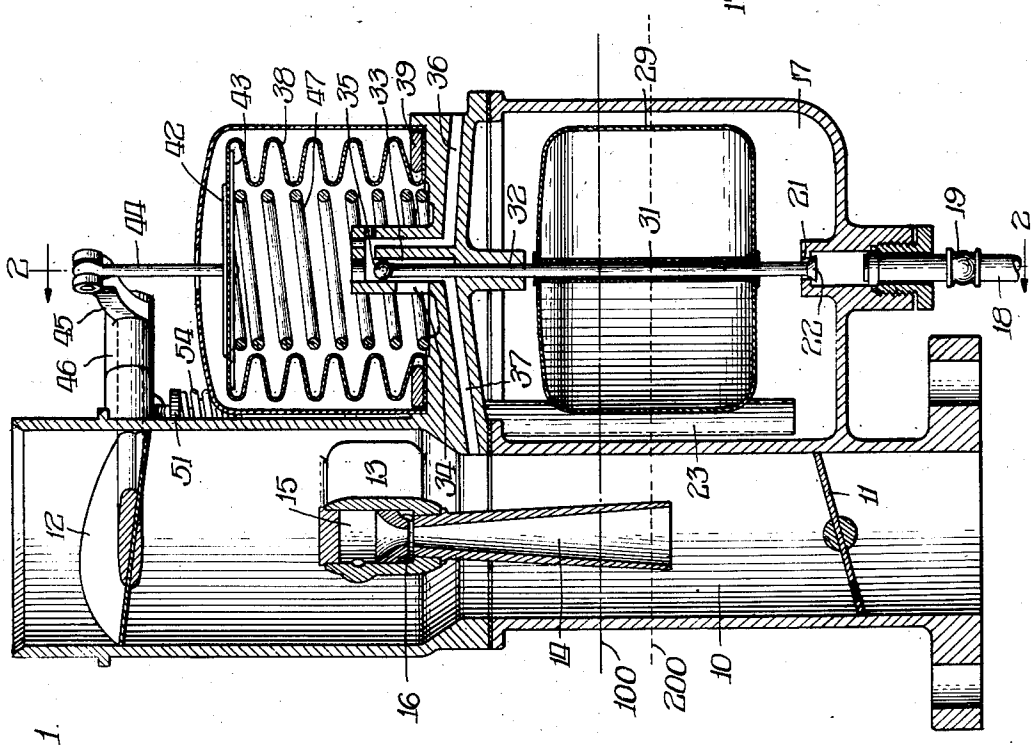


Fig. 1.

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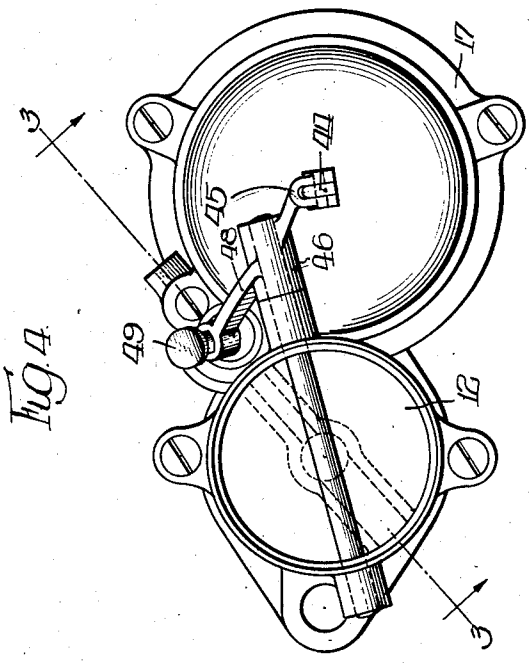


Fig. 4

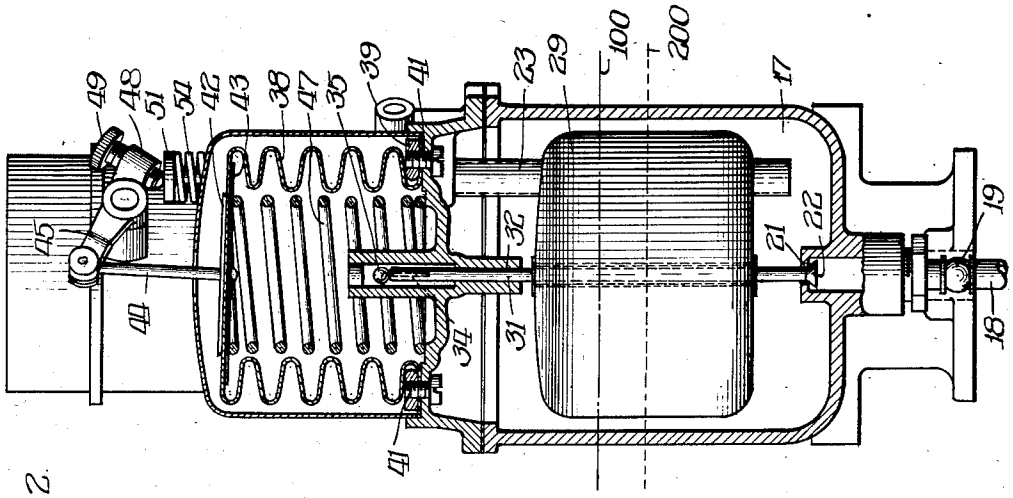


Fig. 2

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Patented Aug. 13, 1935 2,010,956

UNITED STATES PATENT OFFICE

2,010,956

CARBURETOR

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Application August 7, 1933, Serial No. 683,934

14 Claims. (Cl. 261—72)

The present invention relates to carburetors and concerns more particularly the type of such appliances adapted and capable of supplying fuel to the internal-combustion engine of an automobile from a fuel supply tank ordinarily at a lower level than the carburetor without the employment of any separate auxiliary means, such as a pump or a vacuum tank.

One leading object of the invention is to provide a carburetor with means to assure that a suitable quantity of fuel will always be present in its float-chamber regardless of whether the fuel supply tank is on the same level as the carburetor or is at a reasonable distance or height above or below such level.

In the ordinary automobile using a carburetor directly associated with the engine at the front of the vehicle and a fuel supply tank at its rear, there may well be a distance of ten or more feet between such carburetor and the supply tank, and when such an automobile is traveling on a level road the supply tank might be at about the same level as the carburetor, whereas when the vehicle is traveling up a steep incline the carburetor might be four or five feet above the supply tank, while when the vehicle is descending the hill the supply tank might be a similar distance higher than the carburetor.

It will therefore be appreciated that a carburetor of the type mentioned must be capable of elevating the fuel five or six feet or even more in order to provide for all conditions of operation of the vehicle in ordinary service.

One of the main purposes of this invention is to supply a carburetor in which a high suction is not maintained in the float chamber at all times but only a sufficient suction to take care of the fuel elevating requirements substantially at each particular moment; or, stated in other words, if the vehicle is traveling on a level road the carburetor would maintain a suction in the float chamber of, for example, 10 to 15 inches of water, and would automatically increase this suction to whatever might be required when the vehicle is ascending a hill.

The advantage of a carburetor constructed on this principle, as compared with an appliance in which a constant suction is maintained in the fuel chamber adequate to cover the maximum requirements as to fuel lift is the increased volumetric efficiency obtained of the motor.

In the improved carburetor incorporating this invention the desired object is accomplished by regulating the suction in the float chamber by the float itself or by the fuel level which determines the position of the float.

In order to enable those skilled in this art to understand this invention fully both from structural and functional standpoints, in the accompanying drawings, forming a part of this specification and to which reference should be had in connection with the following detailed description, a present, preferred embodiment of the invention has been shown, and, for simplicity, like reference numerals have been used to designate the same parts of the structure in the several views.

In these drawings:—

Figure 1 is a central, longitudinal section through the improved and novel carburetor;

Figure 2 is an upright section on line 2—2 of Figure 1;

Figure 3 is a vertical section on line 3—3 of Figure 4; and

Figure 4 is a top plan view of the carburetor.

By reference to these drawings, it will be observed that the appliance includes a suitably-shaped casting providing a main, upright induction-passage 10 equipped at its lower end with a throttle-valve 11 and at its upper or inlet portion with a balanced, air-admission valve 12, an intermediate section of such passage having a hollow arm 13 in which a downwardly-extended, divided Venturi-tube 14 is mounted, such arm having an air-inlet passage 15 leading to the top end of the venturi and also having a smaller fuel conduit 16 connecting with the circular gap in the venturi.

A float-chamber 17 also forms part of such casting and at its lower portion it has a fuel-admission pipe 18 connected thereto and fitted with an appropriate check-valve 19, the bottom of the chamber having a valve-port 21 with which a conical valve 22 coacts to establish and break connection between the fuel-inlet pipe 18 and the interior of the chamber.

A tube or pipe 23 extends downward from the top wall of the float-chamber to near the bottom thereof, the upper part of such tube being in communication with the fuel-passage 16 through a ported disc 24 in the aperture of which a needle-valve 25 is located.

From the foregoing it will be apparent that the air flowing downwardly through the Venturi-tube occasioned by the suction present in the main induction-passage 10 imposes an increased suction in passage 16 to draw the liquid fuel out of the float-chamber through tube 23, the port of valve-disc 24, and passage 16 into the

divided tube where it becomes intimately mixed with the air traveling therethrough.

For a purpose hereinafter indicated, the induction passage 10 is connected to the interior of the fuel or float chamber 17 by a small metered port or aperture 26, and a similar metered orifice 27 fitted with a ball-valve 28 connects the upper portion of the float or fuel chamber with passage 16, all as is clearly presented in Figure 3.

From this description it will be observed that the suction in passage 16 will be substantially greater than that in passage 10 because of the Venturi construction employed, and, due to the use of the two ports or orifices 26 and 27, this suction in the fuel or float chamber will be determined in relation to the respective suctions in the passages 10 and 16, by the relative areas of the metered ports 26 and 27.

Chamber 17 houses a float 29 mounted fixedly on a sliding rod or stem 31 which at its lower end carries the fuel-inlet valve 22, the upper part of such rod being guided for reciprocation in a bearing 32 in the top wall of the chamber, such wall being formed with a cylindrical vertical passage 33 larger in diameter than, and accommodating, the upper terminal portion of the rod or stem, one upright wall of such passage being vertically slotted or ported at 34, the passage housing a ball-valve 35 which at all times rests on the top end of the rod 31 and which is of approximately the same diameter as the passage which it occupies.

Thus the position of the float, whose height is determined by the fuel-level in chamber 17, governs the location or position of the ball-valve 35.

When the float is in its uppermost position, valve 35 closes the upper part of passage or port 33, and, when the float is at an intermediate height, the valve will be opposite some part of the slot or port 34.

As may be seen from an inspection of Figure 1, the upper end of passage 33, which is sealed off from the interior of bellows 38 by plugs, is connected with the external air through an angular conduit 36, whereas the lower end of such passage 33 is in direct communication through a conduit 37 with passage 10.

As is most clearly illustrated in Figure 2, the lower, marginal flange of a rubber, sheet-metal, or other appropriate flexible bellows 38 is clamped by a ring 39 and its securing screws 41, 41 against the upper face of the top wall of the fuel or float chamber 17, so that the bellows encloses port 34, valve 35 and associated parts, the top, flat wall of the bellows being secured between outer and inner stiffening and strengthening discs 42, 43, as is usual practice, the two discs and their associated part of the bellows being connected by a rod or link 44 to one arm 45 of a hub 46 secured to the rock-shaft of the air-inlet valve 12.

In the chamber or compartment formed by the top wall of the fuel or float chamber and the bellows, a coiled expansion spring 47 is used, resting at its lower end on such top wall and pressing at its upper end upwardly against the flat wall of the bellows, this spring serving to provide an initial or minimum suction in the air-induction passage 10 and a corresponding augmented suction in the float or fuel chamber 17.

A second arm 48 of the hub 46 carries an adjustable screw 49, the lower end of which bears on the head 51 of the long stem 52 of the fuel needle-valve 25, such stem being vertically slidable in a bearing in a sleeve 53 appropriately mounted in the main casting of the carburetor in alignment with the ported disc 24, a spring 54 surrounding the sleeve and bearing at its lower end on a shoulder thereof and pressing upwardly at its other end against the head of the valve-stem, thereby tending normally to raise the needle-valve and correspondingly open the port of the associated valve-member 24.

Spring 47 is of such strength that it will assure a predetermined, minimum suction present in the float-chamber and, if the internal-combustion engine to which the carburetor is coupled is not running, such spring will keep valve 12 closed.

It will be noted that owing to the specified connection between the air-inlet valve 12 and the needle-valve 25, as the former is opened the latter will be correspondingly lifted to allow a proportionately greater amount of fuel to flow through the port of disc 24.

Assuming that there is no fuel in the float-chamber and that the engine is started in the usual way, a partial vacuum will be at once established in the main induction-passage 10, because the air-admission valve 12 is held closed by the action of spring 47.

Some air, however, will enter the carburetor through the inlet passage 15 and it will flow through the Venturi-tube into passage 10 and on into the engine or motor.

Such air travel through the Venturi-tube will create an augmented or substantially greater degree of suction in passages 16, 27 and 26, as well as in the port of member 24, tube 23 and the float-chamber 17, with the result that fuel will be lifted into such chamber through the fuel pipe line 18.

As soon as the fuel-level ascends in the float chamber to the bottom open end of the fuel-delivery pipe 23, the suction in the latter will immediately raise the fuel therein up to the fuel needle-valve 25 which meters it into the passage 16 from which it is drawn into the venturi and discharged therefrom, commingled with the air flowing therethrough into the main induction-passage 10.

Passage or conduit 16 may be more or less aptly characterized as a fuel-air passage because, in addition to the fuel entering such passage through the port around the needle-valve, a small volume of air is drawn into the passage through the small, metered orifice 27.

Because of the suction-increasing action of the venturi, the suction created thereby in passage 16 is substantially greater than that in the main induction-passage 10, and, consequently, air will flow from the latter through the small orifice 26 into the float-chamber and from there through the small aperture 27 into the so-called fuel-air passage 16, and at the fuel needle-valve 25 this air will become mixed with the fuel passing by the needle-valve and flow on into the venturi.

As soon as the fuel in the float-chamber reaches the level designated 100, the float-stem 31 will have elevated the ball 35 in the passage 33 to shut off the connection between the outer air and the space in the bellows, with the result that, whenever the suction in such passage 10 is strong enough to overcome the action of spring 47, the bellows will start to collapse and thereby open the air-admission valve 12, with, of course, a corresponding opening of the needle-valve 25, so that there will always be a balanced condition; that is to say, a suction will be maintained in the

bellows 38 just sufficient to overcome the force of the spring.

Whenever valve 35 closes off the outside air-connection referred to, a free connection through port 34 will be maintained between the inside of the bellows and the main induction-passage 10.

Assuming that a spring 47 has been selected of such strength that it requires 10-inches-of-water suction in the bellows to overcome it, as long as the fuel-level in the float-chamber is at, or nearly up to, the position 100, ball 35 closes off the outer atmosphere connection from the inside of the bellows and the degree of suction in the main induction-passage 10 will be substantially the same as that in the bellows; that is, about 10 inches, but the suction in the float-chamber will be considerably greater due to the vacuum-augmenting feature of the venturi, for example, 20 inches, and so long as the 20-inch suction is adequate to lift the fuel into the float-chamber and maintain the fuel-level therein, the specified suction condition will be automatically maintained.

If, however, the automobile fitted with such carburetor starts up a sufficiently steep grade or incline to require more than the 20-inch suction in the float-chamber to lift the fuel into it and maintain a proper fuel-level, such level will of course begin to descend and the float will be correspondingly lowered permitting a like descent of the ball-valve 35 which will soon uncover at least a part of the port 34 allowing outside air, at least in some degree, to enter the space in the bellows.

It will now require a greater suction in the induction-passage to overcome and balance the action of the spring and such suction will therefore increase, and this increase will be augmented by the venturi, as previously explained, so that the suction in the float-chamber will be increased correspondingly until it is high enough to lift fuel into such chamber, and the fuel-level in the float-chamber will be kept always between the lines 100 and 200. It should be noted that the fuel-level in the float-chamber will not always be the same for all positions of inclination of the car, but it will be perceived that the degree of suction is automatically changed as required to provide a proper lifting-power for the fuel under all conditions.

In ordinary use of the carburetor the fuel-level is maintained at times by the automatic opening and closing of valve 22 and at other times by the movements of valve 35. Which one or the other of these valves is operative depends on the height of the required fuel lift at any particular moment, and, secondly, on the degree of initial or minimum suction provided for by the use of spring 47. For instance, if a spring 47 of such strength is chosen that it necessitates 10 inches of water suction within the bellows to overcome it, then the suction in passage 10 can never be below 10 inches as long as the motor is running. Now, if the venturi is of such amplifying power that the suction in the float or fuel chamber is augmented to twice that in the passage 10, then there will always be maintained a suction in the float or fuel chamber of at least 20 inches. At such times as the required height of fuel lift is less than 20 inches the fuel-level in the float-chamber will be maintained at or near line 100 by the automatic opening and closing of valve 22, but, whenever the required height of fuel lift exceeds 20 inches, then the fuel-level in the float-chamber will be lowered, the float will take a lower position until the valve 35 comes into play and raises the suction sufficiently for the required fuel lift at the moment.

Thus a suitable quantity of fuel is kept in the float-chamber at all times with a restriction of the passage of air through the carburetor by the action of air-admission valve 12 sufficient only to raise the fuel as needed moment to moment, and this is one of the prime features or outstanding characteristics of a carburetor incorporating the present invention.

Hence, instead of constantly keeping a suction in such chamber requisite for maximum fuel lifting effect with resulting unnecessarily-high vacuum in the induction-passage, the suction is varied to meet the changing conditions as they arise and consequently the degree of vacuum in the induction-passage need not be kept relatively high except under more or less short or momentary exceptional conditions, such as the ascent of the automobile of unusually steep grades.

In the foregoing example, provision has been made for the maintenance of a certain minimum suction in the induction passage 10, which may be more or less than the specified amount. The purpose for establishing such lower limit of suction is to assure a minimum air velocity through the venturi for proper and efficient mixing of the fuel and air.

An important and salient feature of the novel and improved carburetor is the preservation of a suitable differential between the suction in the float-chamber and that in the conduit 16, as there must necessarily be a higher suction in the latter than in the former, as otherwise a flow of fuel through the needle-valve orifice could not be effected, and this difference in the degree of suction must change because the pressure drop through the air-inlet valve 12 is a variable factor.

Due to the suction-increasing characteristic of the venturi, the suction in passage 16 is greater than that in the main induction-passage 10 and air flows from the passage 10 through the orifice 26 into the float-chamber 17 and from the latter through aperture 27 into conduit 16 and thence into the venturi.

On account of the restricted nature of the two openings 26 and 27, a pressure drop will take place at each.

If, for example, there is a suction of 40 inches of water in conduit 16 and of 20 inches in passage 10, thus making a total pressure drop of 20 inches and, if the orifices are of the same size and there are no other obstructions, the pressure drop will be equally divided between the openings, that is to say, with a 10-inch drop at each.

The one orifice 27, however, has an added restriction in the ball-valve 28, the reason for its employment being that in the construction shown the fuel discharge into the venturi is at a higher level than the fuel in the float-chamber.

Therefore, in the illustrated construction, with the two metered orifices 26 and 27 of approximately the same size, we have the following condition present: A pressure drop at orifice 26 of 8½ inches, at orifice 27 of 8½ inches and another 3-inch drop on account of the ball-valve, giving a total of 20-inch drop.

Consequently, if the suction in conduit 16 is 40 inches and in the main induction passage 10 is 20 inches, the suction in the float-chamber will be 40 inches minus the 3-inch drop due to the valve and the 8½-inch drop due to the orifice, whereby the float-chamber suction will be 28½ inches.

The improved carburetor may conveniently incorporate other features of construction, as for

starting the engine in cold weather, but inasmuch as this forms no important part of the present invention, illustration and description thereof have not been presented.

The invention as defined by the appended claims is susceptible of a variety of satisfactory embodiments, and, consequently, is not limited to the precise and exact details of structure shown and described, with the result that various minor and more or less radical changes may be made in this preferred embodiment of the invention without departure from the fundamental principles underlying its construction and without the loss of any of the valuable advantages accruing from the employment of the invention.

In this connection it should be borne in mind that whereas in the present, preferred embodiment of the invention a bellows has been shown and described, there are several other mechanical equivalent structures which can be readily substituted therefor.

The term "varying fuel lifting requirements" as used in the appended claims should be construed to involve the suction necessary to overcome the resistance whereby to secure the proper flow of fuel from the supply to the carburetor, since this resistance, in addition to the actual difference in height between the supply and carburetor, includes the friction in the fuel line.

I claim:

1. In a carburetor, the combination of an induction-passage, an air-inlet valve for said passage, a fuel-chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, and means including said air-inlet valve governed by said float to maintain a suction in said fuel-chamber changing automatically to conform substantially to the varying fuel lifting requirements between said fuel-supply and fuel-chamber and at any moment sufficient to lift fuel into said chamber under the then existing conditions.

2. In a carburetor, the combination of an induction-passage, a fuel-chamber, a fuel-conduit connecting said chamber and passage, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, and means including an air-inlet valve for said induction-passage and a pressure-responsive device governed by said float to maintain a suction in said fuel-chamber changing automatically to conform substantially to the varying fuel lifting requirements between said fuel-supply and fuel-chamber and at any moment sufficient to lift fuel into said chamber under the then existing conditions.

3. In a carburetor, the combination of a main induction-passage, a fuel-chamber, a fuel-conduit connecting said chamber and passage, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, an air-inlet valve for said induction-passage, a pressure-responsive device to actuate said air-inlet valve, conduit means to connect said device to said induction-passage and to the external air, and a valve governed by said float to control said conduit means of said device to maintain a suction in said fuel-chamber changing automatically to conform substantially to the varying fuel lifting requirements between said fuel-supply and fuel-chamber and at any moment sufficient to lift fuel into said chamber under the then existing conditions.

4. The construction presented in claim 3 in combination with a valve regulating the fuel-flow through said fuel-conduit, and means connecting said air-inlet and fuel-regulating valves whereby they will both open and close correspondingly.

5. In a carburetor, the combination of a main induction-passage, a fuel-chamber, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, means to increase the suction developed in said induction-passage, means to apply a portion only of said increased suction to said fuel-chamber to lift the fuel into the same through said fuel-inlet conduit, a fuel-conduit connecting said fuel-chamber to said suction-increasing means, whereby the increased suction conveys fuel from said fuel-chamber to said suction-increasing means, and means to automatically change the suction in said fuel-chamber to conform substantially to the varying fuel lifting requirements between said fuel-supply and fuel-chamber whereby the suction in said chamber at any moment will be sufficient to lift fuel into said chamber under the then existing conditions.

6. In a carburetor, the combination of a main induction-passage, an air-inlet valve for said passage, a suction-increasing venturi in said passage, a conduit connecting said venturi to the external air, a fuel-chamber, a fuel-inlet conduit for said chamber and adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, a bellows, means connecting said bellows to said air-inlet valve whereby contraction and expansion of said bellows opens and closes said air-inlet valve, a spring acting on said bellows, conduit means connecting the interior of said bellows to the outer air and to said induction-passage, a valve controlling said bellows conduit means, means whereby said float actuates said last-mentioned valve, a fuel-conduit leading from said chamber to the suction-increasing portion of said venturi, a fuel-valve in said fuel-conduit, and means connecting said air-inlet valve and said fuel-valve to compel their movements to be simultaneous and corresponding, the carburetor having a metered orifice connecting said induction-passage to the interior of said chamber and another metered orifice connecting the interior of said chamber to said fuel-conduit, whereby a fuel-lifting suction is maintained in said fuel-chamber and which changes automatically to conform substantially to the varying fuel lifting requirements between said fuel-supply and said fuel-chamber and which at any moment is sufficient to lift the fuel into said chamber under the then existing conditions.

7. The construction presented in claim 6 in combination with a valve in said fuel-inlet conduit, and means to operate said valve by said float.

8. In a carburetor, the combination of a fuel-chamber, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a fuel and air mixing structure having means to admit air to said structure, means to deliver fuel from said fuel-chamber to said structure, means to subject said fuel-chamber to suction to raise the fuel through said conduit into said chamber, means actuated by change of fuel-level in said chamber to vary said fuel-chamber

suction and to maintain the fuel-level in said chamber within predetermined limits, and means operated by said fuel-level-change actuated means to control the inflow of fuel into said chamber when the fuel-supply is above said chamber.

9. In a carburetor, the combination of an induction-passage having air-inlet means, a valve controlling at least a portion of said air-inlet means, a fuel-chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, means to apply suction induced in the carburetor to the interior of said fuel-chamber, a float in said chamber, and a variable connection between said float and said air-inlet control valve, whereby said air-inlet control valve is governed by said float to change the suction in said fuel-chamber automatically to conform substantially to the varying fuel-lifting requirements between said fuel-supply and said fuel-chamber.

10. In a carburetor, the combination of an induction-passage having air-inlet means, a valve controlling at least a portion of said air-inlet means, means to operate said air-inlet control valve by suction in the carburetor, a fuel-chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, a fuel-inlet conduit for said chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, and means controlled by the fuel-level in said chamber to increase the suction therein when required to lift the fuel from said supply into said chamber.

11. In a carburetor, the combination of an induction-passage having air-inlet means, a valve controlling at least a portion of said air-inlet means, a fuel-chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, a fuel-valve in said fuel-conduit, a fuel-inlet conduit for said fuel-chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, means to apply suction induced in the carburetor to the interior of said fuel-chamber, a connection between said float and said air-inlet control valve, whereby said air-inlet control valve is governed by said float to change the suction in said fuel-chamber automatically to conform substantially to the varying fuel-lifting requirements between said fuel-supply and said fuel-chamber, and means to adjust said fuel-valve automatically coincidentally with the movements of said air-inlet valve.

12. In a carburetor, the combination of a main induction-passage having air-inlet means, a valve controlling at least a portion of said air-inlet means, a fuel-chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, a fuel-valve in said fuel-conduit, a fuel-inlet conduit for said fuel-chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, means to increase the suction developed in said induction-passage and to apply said increased suction to the interior of said fuel-chamber, a connection between said float and said air-inlet control valve, whereby said air-inlet control valve is governed by said float to change the suction in said fuel-chamber automatically to conform substantially to the varying fuel-lifting requirements between said fuel-supply and said fuel-chamber, and means to adjust said fuel-valve automatically coincidentally with the movements of said air-inlet control valve.

13. In a carburetor, the combination of an induction-passage having air-inlet means, a valve controlling at least a portion of said air-inlet means, a fuel-chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, a fuel-valve in said fuel-conduit, a fuel-inlet conduit for said fuel-chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a float in said chamber, means to increase the suction developed in said induction-passage and to apply said increased suction to the interior of said fuel-chamber, a variable connection between said float and said air-inlet control valve, whereby said air-inlet control valve is governed by said float to change the suction in said fuel-chamber automatically to conform substantially to the varying fuel-lifting requirements between said fuel-supply and said fuel-chamber, and means to adjust said fuel-valve automatically coincidentally with the movements of said air-inlet control valve.

14. In a carburetor, the combination of a main induction-passage having air-inlet means, a fuel-chamber, a fuel-inlet conduit for said fuel-chamber adapted to be connected to a fuel-supply capable of varying its height with relation to that of said chamber, a fuel-conduit connecting said fuel-chamber to said induction-passage, Venturi-means to create suction greater than that in said induction-passage, means to apply said greater suction to said fuel-conduit, means to maintain suction in the interior of said fuel-chamber to lift the fuel from said supply into said chamber, and means to modulate said fuel-chamber suction automatically to conform substantially to the varying fuel-lifting requirements between said fuel-supply and said fuel-chamber.

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