W. JAY.

LIQUID FUEL FEEDING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAR. 9, 1916.

1,218,085.

Patented Mar. 6, 1917.

2 SHEETS—SHEET 1.

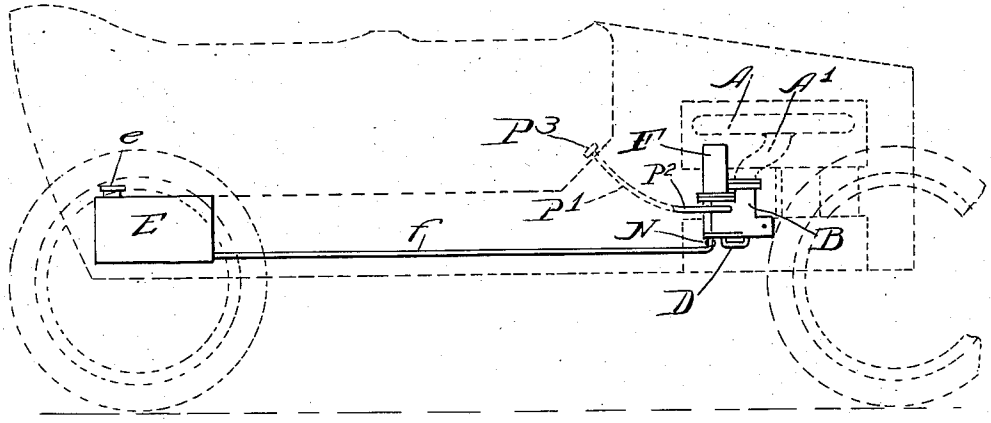


Fig. 1.

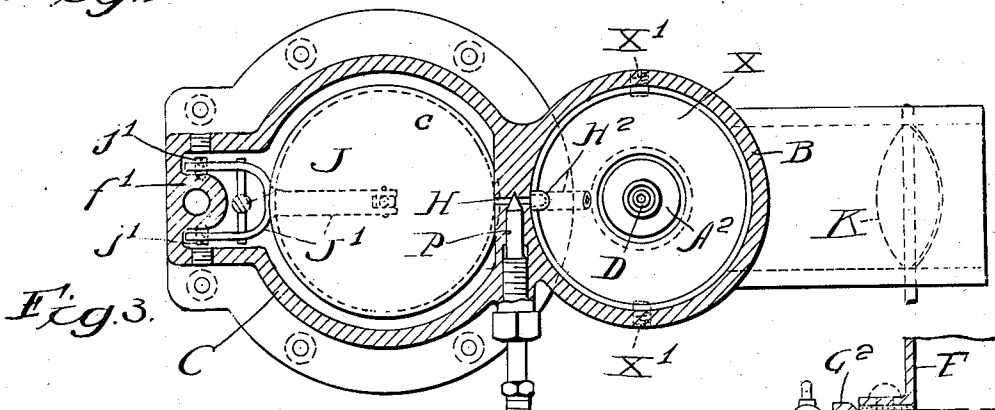


Fig. 3.

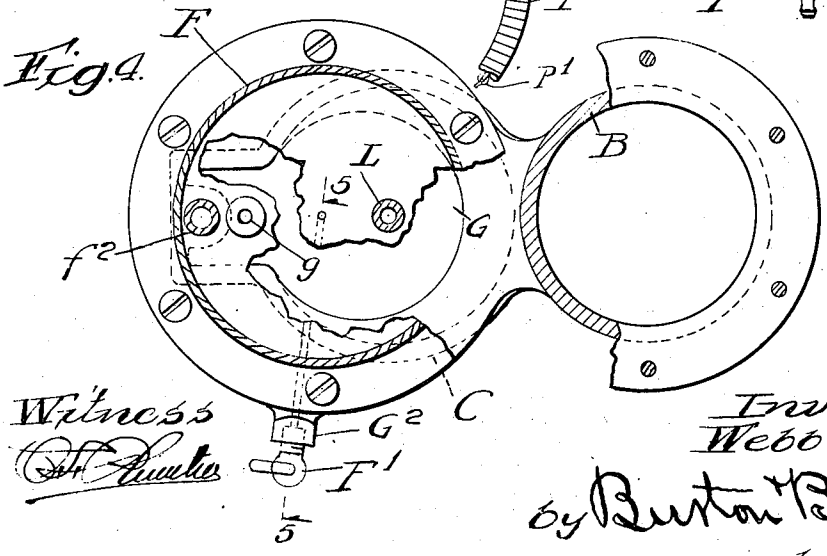


Fig. 4.

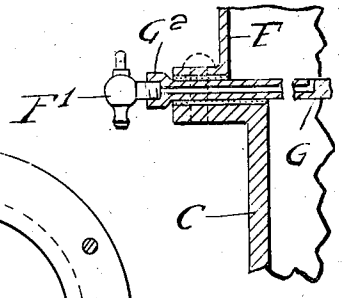


Fig. 5.

Witness

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LIQUID FUEL FEEDING DEVICE FOR INTERNAL COMBUSTION ENGINES.

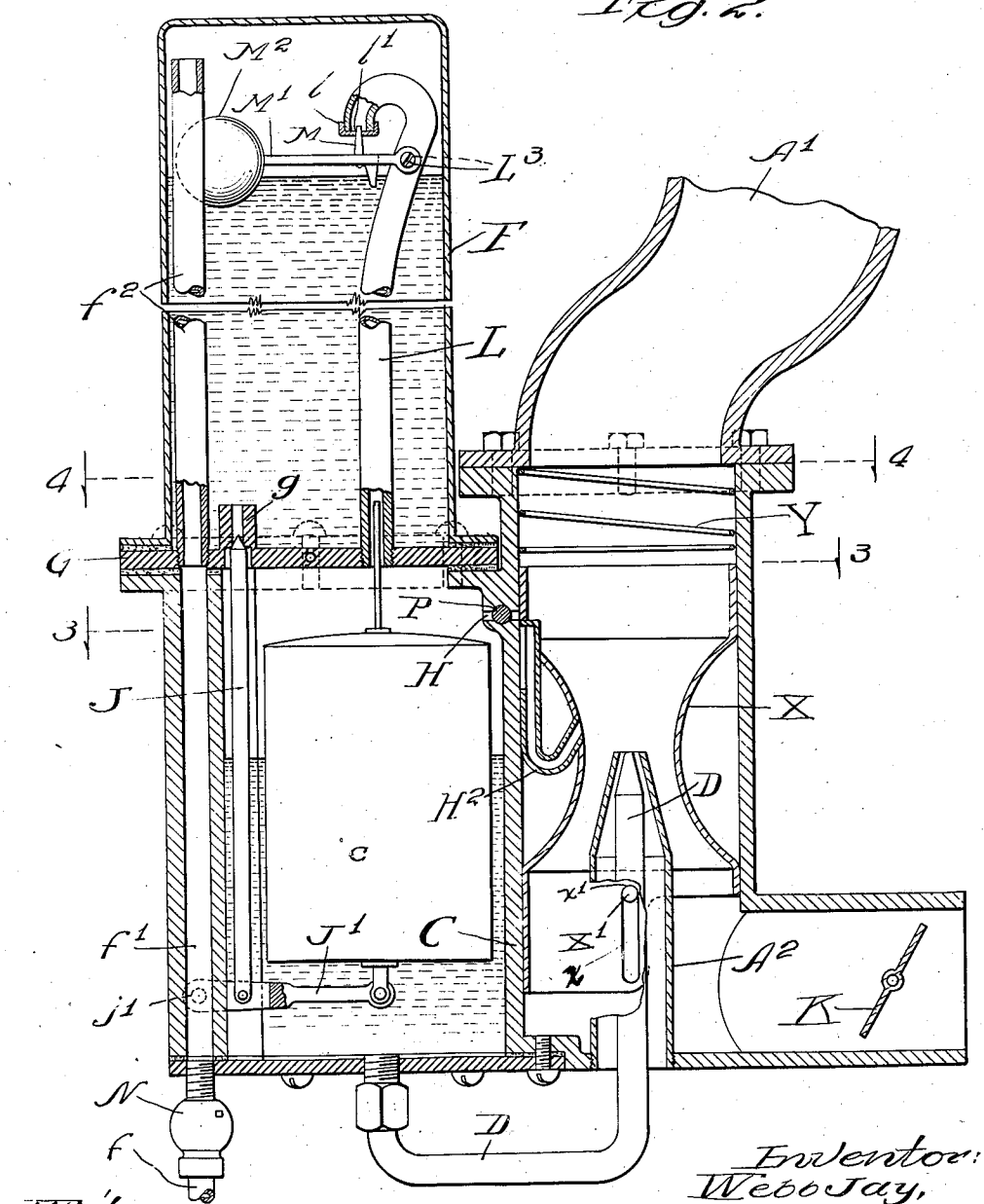
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2 SHEETS—SHEET 2.

Fig. 2.



Witness
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UNITED STATES PATENT OFFICE.

WEBB JAY, OF CHICAGO, ILLINOIS.

LIQUID-FUEL-FEEDING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,218,085. Specification of Letters Patent. Patented Mar. 6, 1917.

Application filed March 9, 1916. Serial No. 83,062.

To all whom it may concern:

Be it known that I, WEBB JAY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Liquid-Fuel-Feeding Devices for Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide an improved device for supplying the liquid fuel to an internal combustion engine through the carbureter and in part including the carbureter. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:—

Figure 1 is a side elevation of an automobile, showing diagrammatically the relative position of the several parts coöperating in this invention.

Fig. 2 is a vertical section through the carbureter and its float chamber, and an appurtenant chamber coöperating for fuel feed.

Fig. 3 is a section at the line, 3—3 on Fig. 2.

Fig. 4, is a section at the line, 4—4 on Fig. 2.

Fig. 5 is a section at the line, 5—5, on Fig. 4.

In the drawings the intake manifold of the engine is indicated at A. B is the carbureter or mixing chamber in which the liquid fuel is drawn in together with air and mixed therewith. C is the liquid-level-governing chamber or float chamber of the carbureter. A^1 is a fuel intake pipe leading from the carbureter to the manifold. D is the liquid fuel supply pipe whose terminal within the carbureter passage is hereinafter referred to as the oil nozzle. E is a main fuel supply tank shown located, as is customary, at a relatively low position at the rear of the vehicle. *f* is a liquid fuel supply pipe leading from the main tank, E, and as illustrated, through the boss, f^1, in the liquid-level-governing chamber, C, to an elevated auxiliary reservoir, F, positioned at such height that the liquid fuel will flow by gravity from it to the liquid-level-governing chamber, C, said reservoir, as illustrated, being located immediately above and rigid with said liquid-level-governing chamber. G is a plate which forms the bottom of the reservoir, F, and the top of the chamber, C. It has a passage, *g*, delivering liquid from the reservoir, F, into the chamber, C, which passage is controlled by a valve, J, operated by the float, *c*, in said chamber, C, being seated when the liquid level in said chamber, C, reaches a predetermined height,—being approximately the level of the delivery end or nozzle of the supply pipe, D.

To render the float adequate without inconvenient size to hold valve, J, closed against the head of the liquid which may be in the reservoir, F, said float is connected with the valve by a lever, J^1, as shown, which may be conveniently fulcrumed on the boss, f^1, by means of a pivot screw j^1. A^2 is an air inlet pipe surrounding the oil supply pipe, D, and having its upper end tapered narrowing so as to terminate quite close to the discharge nozzle of the pipe, D, the taper of said upper end having the purpose and effect of causing the air which is drawn in through said pipe, A^2, to be discharged against the oil delivered through the nozzle obliquely to the latter from all sides, with the effect of spraying or widely distributing the oil by the oblique impact of the air thereon from all sides. K is a valve in the air inlet passage of the carbureter located back of the discharge tip of the oil discharge nozzle and of the pipe, A^2, said valve being designed for regulating the air supply to the carbureter except as to so much thereof as may be drawn in through the pipe, A^2, for spraying the oil as described; said valve, K, is located at the position stated so that the throttling of the air supply by means of it shall not have the effect of throttling or in any manner diminishing the suction which acts upon the oil discharge nozzle produced by the partial vacuum in the intake manifold, and operating to draw the explosive charge into the manifold. The supply tank, E, is as usual provided with an air vent, *e*, to expose the contents to atmospheric pressure. The auxiliary reservoir, F, is air-tight; that is, it has no opening for or communication with atmospheric pressure except through the pipe, *f*, which leads to the lower end of a hollow boss, f^1, formed on the inner wall of the chamber, C, and constituting a continuation of the pipe, *f*, which continuation is sealed through the chamber, C, and connects with a further continuation of said pipe, *f*, effected by means of a section of

pipe, f^2, which is inserted through the plate, G, and screwed tight into the same registering with the vertical bore of said boss, F^1, and extends up in the reservoir, F, discharging into the top thereof. The passage leading from the reservoir, F, to the liquid-level-governing chamber, C, opens for delivery out of the reservoir, F, at a low point therein, preferably only a short distance above the bottom so as to provide a water trap space below said discharge opening, a drain cock, F^1, being preferably provided at the bottom for draining out of the reservoir, F, the water which may be accumulated therein. Most conveniently this drain passage is made in the plate, G, and leads out through the edge of said plate which carries a boss, G^2, for attachment of the drain cock, F^1, as shown. In order that the liquid-level-governing chamber, C, may be filled to the level at which the float, *c*, will seat the valve, J, and thus stop the inflow of liquid to said chamber, and that the liquid may be supplied to the oil nozzle by the pressure of the head of liquid standing to that level in said liquid-level-governing chamber, C, the suction or diminished atmospheric pressure operating on the liquid contents of said chamber, C, through the pipe, D, is equalized by providing a duct, H, leading from the constricted portion of the air passage of the carbureter to the upper part of said liquid-level-governing chamber, C.

The operation of the structure as thus far described is that when the engine is in operation, the partial vacuum produced in the intake manifold operating through the oil discharge nozzle of the carbureter, produces a partial vacuum in the liquid-level-governing chamber, C, and thence through the passage, *g*, produces a partial vacuum in the auxiliary reservoir, F, causing the oil to be raised by atmospheric pressure from the main supply tank, E, and discharged into said auxiliary reservoir, F, from whence it flows out by way of the passage, *g*, to the liquid-level-governing chamber, C, filling the same to the height at which the float therein operates to close the valve, J, at the inlet, *g*, from the reservoir, F. The degree of partial vacuum produced in the auxiliary reservoir, F, being nearly that existing at the discharge nozzle in the constricted portion of the carbureter air passage, will continue to operate to cause the liquid to pass from the main tank, E, up over into the said reservoir, F, after the liquid-level-governing chamber, C, is filled to the height controlled by the float, and there will thus be accumulated in the reservoir, F, a reserve supply of liquid fuel which will pass down into the chamber, C, in charges from time to time as the operation of the float opens the valve, J, thus admitting into said chamber, C, at each time as much fuel as has been withdrawn through the nozzle for supplying the engine, and by withdrawing that amount from the reservoir, F, causing the reëstablishment of the same degree of partial vacuum in that chamber, and replenishing its supply from the tank, E, to the extent to which the liquid has passed from the reservoir, F, to the liquid-level-governing chamber, C. The operation, it will be seen, consists in utilizing the suction which can be transmitted through the oil-discharge nozzle to lift the liquid fuel from the main supply tank, E, into the auxiliary reservoir, F, at the same time that that suction is operating for taking the liquid through and from the discharge nozzle for mixture with the air and drawing it into the manifold. This method should be distinguished from another method in common use which consists in alternately producing,—usually by suction from the manifold,—and relieving, a partial vacuum in an elevated auxiliary chamber for causing the liquid to be lifted from a lower main supply tank during the existence of such partial vacuum, and then delivered from said auxiliary chamber by gravity toward the carbureter while the vacuum is relieved, that is, while the chamber is subject to atmospheric pressure. In distinction from this method, it will be noted that the mode of operation of the hereinabove described apparatus involves the continuous maintenance of the partial vacuum in the auxiliary reservoir, F, except, if at any time the flow of liquid from the main supply tank should satisfy that vacuum, in excess of that which would be necessary to lift the liquid through the distance between the elevation of the two chambers, E and F.

In case of sudden changes in the degree of partial vacuum operative in the engine intake passage from the carbureter, it will sometimes occur that the partial vacuum in the supplemental reservoir, F, is for an appreciable length of time of a higher degree than in said passage; and in such case the suction which withdraws the oil from the nozzle, and which operates also at the point of delivery of oil from the reservoir, F, into the chamber, C, being of the lower degree, would not cause any oil to pass from the reservoir, F, into the liquid-level-governing chamber, C, to replace any which under those circumstances might be withdrawn from the said chamber, C, to the nozzle, and under such circumstances the suction operative for drawing oil from the liquid-level-governing chamber C, may take inadequate supply for the engine. The higher suction in the reservoir, F, may in time be satisfied by the oil coming up from the main tank, E, and occupying the partial vacuum space in said reservoir, F; and this may occur promptly enough to equalize the vacuum

in the chamber, F, with that operating at the delivery passage, *g*, before the engine has been caused to miss an explosion for want of oil. But the danger of the engine becoming embarrassed from this cause is obviated by providing a duct leading from the upper part of the reservoir, F, communicating with the carbureter air passage at a point of comparatively high vacuum therein. Preferably this connection, as in the case of the communication with the upper part of the chamber, C, is made at a point in the constricted portion of said air passage, so that the suction operating through said communication will be as nearly as possible that which is operating at the nozzle. This is most conveniently effected by providing the pipe, L, mounted in the plate, G, and leading from the upper part of the chamber, C, to the upper part of the reservoir, F, thus utilizing the duct, H, as a portion of the passage for communicating from the point indicated in the carbureter air passage to the air space in the upper part of the reservoir, F. With such a communication provided between the engine intake and the reservoir, F, the partial vacuum operated in the supplemental reservoir, F, will always be substantially the same as that operating at the nozzle, so that in case of such reduction of the partial vacuum in the passage communicating between the carbureter and the engine intake, such reduction will occur equally in the reservoir, F, and the suction operating through the nozzle drawing oil from the liquid-level-governing chamber, C, will operate in the desired manner to draw a like supply to said chamber, C, from the reservoir, F.

The existence of this conduit, L, in the absence of preventive means might result under some circumstances in causing the reservoir, F, to be completely filled so that the oil would flow over from it through said conduit, L, with the result of flooding the carbureter. This result is prevented by an automatic valve, M, positioned for closing the intake mouth of the pipe, L, within the reservoir, F, and arranged and connected in any suitable manner so as to be seated by the rise of liquid in the reservoir, F, to a height less than that which would cause it to flow out through said conduit, L. A convenient construction for this purpose consists in terminating the pipe, L, with a down-turned end closed by a disk, *l*, through which there is made a small aperture, l^1, adequate for the operation of the suction therethrough, and making the valve, M, in the form of a tapering needle for seating in said aperture, l^1, said valve, M, being mounted upon a lever, M^1, forked at one end and thereby pivoted upon the pipe, L, back of its terminal bend by means of two cone-pointed screws, L^3, L^3, said lever having at its end remote from the fulcrum thus provided for it on the pipe, L, a float, M^2. The weight of the lever and the float are easily made adequate to overcome the suction which will operate to hold the needle valve seated, and will therefore cause the valve to open whenever the liquid level in the chamber falls below the predetermined maximum.

The construction now described as a whole, it will be observed, will operate to furnish oil by gravity from the reservoir, F, to the liquid-level-governing chamber, C, to maintain the operation of the engine through a considerable period during which the suction may be inadequate for lifting the oil from the low level tank. It will be obvious that the capacity of the reservoir, F, may be made such as to maintain the operation of the engine for any desired length of time under such circumstances.

It is preferable to provide a check valve, N, in the conduit, *f*, leading from the low level tank to the reservoir, F, in order to hold the oil which may be once lifted and prevented from running back into the tank, E, when the engine stops and partial vacuum in the reservoir, F, no longer exists.

In order that the engine may be readily primed at starting in any instance in which the reservoir, F, might be left empty at the time of stopping the engine, the oil directly and immediately available being that contained in the liquid-level-governing chamber, C, there is preferably provided a valve, P, for closing the duct, H, thereby preventing the production of a partial vacuum in the upper part of the chamber, C, by the first strokes of the engine at starting, which, if it existed in the absence of any supply of liquid in the reservoir, F, ready to descend into the chamber, C, would neutralize the effect of the suction operating through the nozzle, and prevent such suction from drawing any oil into the carbureter. This valve being closed at starting, the first strokes of the engine will effect a priming by drawing oil through the nozzle out of the chamber, C, producing a partial vacuum in the upper part of that chamber which will be extended in the reservoir, F, and back through the pipe, *f*, leading thereto, causing oil to pass up from the main supply tank, E, and to be delivered down through the passage, *g*, into the chamber, C, for making good the amount withdrawn through the nozzle. By closing the throttle valve, K, the full suction of the engine will operate in this manner for drawing oil alone without air except the small quantity drawn through the pipe, A^2, for spraying and dispersing the oil thus taken from the nozzle, this accomplishes a most effectual priming.

The valve, P, may be arranged to be operated in any convenient manner from the

dash board, as by means of a small flexible shaft, P^1, contained in a proper casing, P^2, making all necessary bends and turns to reach the point on the dash-board at which the knob, P^3, may be provided for rotating the shaft to turn the valve.

In addition to or independently of the provision above described for closing the duct, H, for the purpose of priming or providing for oil supply under particular circumstances, an automatic means for closing the duct under certain circumstances may be provided consisting in forming the constriction in the air passage of the carbureter by means of a constricted sleeve, X, as shown in the drawings, said sleeve being positioned normally as shown in Fig. 2, stopped by the pins, X^1, at the upper end of the slots, x, in the lower end portion of the sleeve, X, and having a range of movement upward from said shoulder, as, for example, for the length of said slots, x. This sleeve having a portion of the duct, H, indicated by the piece of tubing, H^2, secured to it, as shown in Fig. 2, the outer end of which is out of registration with the remainder of said duct opening as described into the upper part of the liquid-level-governing chamber, will be drawn upward by the suction of the engine when the throttle valve, K, is opened and the said portion, H^2, of the duct, H, which is contained in said sleeve being thereby moved into registration with the remaining portion of the duct, the communication afforded by said duct will be opened when the sleeve is thus lifted by the friction of the air entering past the valve, K.

The most constricted point in the sleeve, X, is designed to stand at the transverse plane of the tip of the oil nozzle when the inrush of air is moderate, resulting from the partial opening of the valve, K, and operation of the engine such as to cause a moderate degree of suction through the air passage; and when the suction becomes extreme, tending to draw an excessive quantity of oil past the nozzle, the inrush of air will lift the sleeve, X, carrying the "choke" or most constricted point above the transverse plane of the nozzle tip and thereby diminish the suction on the nozzle and the quantity of oil drawn therethrough. In order that there shall be established a relation between the suction which causes the air inrush and the distance to which the sleeve, X, is lifted thereby, the resistance to such lifting obviously must increase with the distance and for this purpose a spring, Y, is provided at the upper end of the sleeve which is encountered after the sleeve has moved upward enough to fully uncover the mouth of the duct, H, and thereafter in further upward movement,—while said duct continues to be fully open on account of the elongation of the opening thereinto of the section, H^2,—the resistance of the spring increases proportionately to the upward movement of the sleeve.

The method of forming the portion, H^2, of the duct in connection with the sleeve which consists in using the tube as illustrated, has no special significance, that method being adopted merely as a convenient one when the sleeve is made of sheet metal, as it may be for the purpose of rendering it light and easily moved by the suction. The course of the duct, however, as having its end which opens into the constricted portion of the air passage trending upward and inward,—that is, substantially in the direction of the in-rushing air, is desirable for the purpose of rendering the suction as efficient as possible for drawing the air through the duct and thereby producing the proper degree of partial vacuum in the chambers with which the duct is connected.

I claim:—

1. In combination with a carbureter having an air passage; an air-controlling valve in the air passage; a liquid fuel delivery tube extending into said air passage for discharge therein at a point inwardly beyond the air-controlling valve; a liquid-level governing chamber from which said delivery tube leads; means therein for controlling the level of the liquid contents of said chamber; a main liquid fuel supply tank at a lower level; a supplementary liquid fuel reservoir at a higher level; a liquid conduit from said main tank to said reservoir; a liquid passage from said reservoir to said level-governing chamber; a duct from the upper part of said reservoir and from the upper part of said level-governing chamber communicating with the air passage proximately to the discharge of the liquid fuel delivery tube, and means in said supplemental liquid fuel reservoir for closing the opening of said duct therein at a predetermined level of liquid in such reservoir.

2. In combination with a carbureter having an air passage which is constricted for a short distance in the length of said passage; an air-controlling valve in the air passage back of said constriction; a liquid fuel delivery tube extending in the unconstricted portion of said air passage between the constriction and the air controlling valve and terminating for its discharge substantially at the transverse plane of said constriction; a liquid-level-governing chamber from which said delivery tube leads, and means therein for controlling the level of the liquid contents of said chamber; a main liquid fuel supply tank at a lower level; a supplemental liquid reservoir mounted upon and forming a unitary structure with the level-governing chamber; a conduit from the main tank which extends through the level-governing chamber sealed therefrom and fur-

ther extends up into the supplemental reservoir; a liquid passage connecting the upper part of the liquid governing chamber with the lower part of said reservoir; the liquid-level-governing means comprising a valve which is adapted to close said passage at a pre-determined level of liquid in said chamber; a tube extending in said reservoir communicating at its lower end with the upper part of the liquid-governing chamber, and opening at its upper end in the upper part of said reservoir; a valve adapted to close the upper end opening of said tube, and means in said reservoir for operating said valve adapted to close it when the liquid level in said reservoir reaches a pre-determined height, and a duct leading from the upper part of the liquid-governing chamber into said air passage and opening into the latter substantially at the level of the constriction thereof.

3. In combination with a carbureter having an air passage which is constricted for a short distance in the length of said passage; an air-controlling valve in the air passage back of said constriction; a liquid fuel delivery tube extending in the unconstricted portion of said air passage between the constriction and the air controlling valve and terminating for its discharge substantially at the transverse plane of said constriction; a liquid-level-governing chamber from which said delivery tube leads, and means therein for controlling the level of the liquid contents of said chamber; a main liquid fuel supply tank at a lower level; a supplemental fuel reservoir mounted on the top of and forming a unitary structure with the liquid-level-governing chamber; a conduit from the lower part of the main fuel supply tank to said supplemental reservoir; a communicating passage from the upper part of the liquid-level-governing chamber into the lower part of said reservoir; a duct leading from the upper part of said liquid-governing chamber into said carbureter air passage and opening in the latter substantially at the level of said constriction, and another duct leading from the upper part of said liquid-governing chamber to the upper part of said supplemental reservoir, and means in said reservoir for closing the opening of said last mentioned duct therein at a pre-determined level of the liquid in said reservoir.

4. In combination with a carbureter having an air passage which is constricted for a short distance in the length of said passage; an air-controlling valve in the air passage back of said constriction; a liquid fuel delivery tube extending in the unconstricted portion of said air passage between the constriction and the air controlling valve and terminating for its discharge substantially at the transverse plane of said constriction; a liquid-level-governing chamber from which said delivery tube leads, and means therein for controlling the level of the liquid contents of said chamber; a main liquid fuel supply tank at a lower level; a supplementary liquid fuel reservoir at a higher level; said liquid-governing chamber being immediately adjacent to and rigid with said constricted air passage, said passage and chamber being provided with a duct leading from the constricted portion of the air passage to the upper part of the governing chamber; said reservoir being positioned immediately above and made rigid with the governing chamber; a diaphragm plate which forms the top of the governing chamber and the bottom of said reservoir, said plate having a liquid passage connecting the top of the governing chamber with the bottom of the reservoir and having a drain passage terminating in a drain cock at the edge of said plate and opening through the top of said plate for draining the reservoir; a suction pipe mounted in and extending down through said plate for communication with the top of the level-governing chamber, said pipe extending up in the reservoir and opening therein near the top thereof; a valve for closing the upper end opening of said pipe and a lever fulcrumed upon the pipe and carrying said valve, and a float carried by the lever in said reservoir.

5. In combination with a carbureter having an air passage which is constricted for a short distance in the length of said passage; an air-controlling valve in the air passage back of said constriction; a liquid fuel delivery tube extending in the unconstricted portion of said air passage between the constriction and the air controlling valve and terminating for its discharge substantially at the transverse plane of said constriction; a liquid-level-governing chamber from which said delivery tube leads, and means therein for controlling the level of the liquid contents of said chamber; a main liquid fuel supply tank at a lower level; a supplementary liquid fuel reservoir at a higher level; said liquid-governing chamber being immediately adjacent to and rigid with said constricted air passage, said passage and chamber being provided with a duct leading from the constricted portion of the air passage to the upper part of the governing chamber; said reservoir being positioned immediately above and made rigid with the governing chamber; a diaphragm plate which forms the top of the governing chamber and the bottom of said reservoir, said plate having a liquid passage connecting the top of the governing chamber with the bottom of the reservoir and having a drain passage terminating in a drain cock at the edge of said plate and opening through the top of said plate for draining the reservoir; a suction pipe mounted in and extending down through said plate for communication with the top of the level-governing chamber, said pipe extending up in the reservoir and opening therein near the top thereof; a valve for closing the upper end opening of said pipe and a lever fulcrumed upon the pipe and carrying said valve, and a float carried by the lever in said reservoir; a liquid conduit from said main tank to said reservoir; a liquid passage from said reservoir to said level-governing chamber, ducts from the upper part of said reservoir and from the upper part of said level-governing chamber communicating with the air passage substantially at the constricted portion thereof, said ducts comprising a portion in common, and a valve in said portion for closing the communication through both of said ducts.

6. In combination with a carbureter having an air passage which is constricted for a short distance in the length of said passage; an air-controlling valve in said passage back of said constriction; a liquid fuel

delivery tube extending in the unconstricted portion of said air passage between the constriction and the air-controlling valve, and terminating for its discharge substantially at the transverse plane of said constriction; a liquid-level-governing chamber from which said delivery tube leads, and means therein for controlling the level of the liquid contents of said chamber; a main liquid fuel supply tank at a lower level; a supplementary liquid fuel reservoir at a higher level; a liquid conduit from said main tank to said reservoir; a liquid passage from said reservoir to said level-governing chamber; ducts from the upper part of said reservoir and from the upper part of said level-governing chamber communicating with the carbureter air passage, approximately at the transverse plane at which the liquid-fuel-delivery tube discharges in said constricted portion, and means in said supplemental reservoir for closing the opening of said duct therein at a pre-determined level of the liquid in said reservoir.

7. In combination with a carbureter having an air passage which is constricted for a short distance in the length of said passage; an air-controlling valve in the air passage back of said constriction; a liquid-fuel-delivery tube extending in the unconstricted portion of said air passage between the constriction and the air-controlling valve, and terminating for its discharge substantially at the transverse plane of said constriction; a liquid-level-governing chamber from which said delivery tube leads, and means therein for controlling the level of the liquid contents of said chamber; a source of supply of liquid fuel to said chamber and connections thereto; a duct leading from the carbureter air passage to the upper part of the said liquid-level-governing chamber, the constricted portion of said air passage being formed by means of a constricted sleeve mounted for sliding in said air passage, a portion of said duct being formed in said sleeve non-registering at the lowest position, with the remaining portion formed in the fixed wall of the air passage, the sleeve having a range of movement upward for registering the parts of said duct; whereby the duct is closed at its lowest position and is opened when the sleeve is sucked inward.

8. In a carbureter, in combination with the air passage and the liquid fuel supply pipe discharging within said passage; a sleeve mounted in said passage constricted between its ends and positioned with said constriction encompassing the discharge end of the liquid fuel pipe, said parts having a suction duct partly formed in said sleeve and partly formed in the fixed member in which the sleeve slides, the parts of the duct being out of registration at the normal position of the sleeve and being registered when the sleeve is sucked inward, whereby the sleeve acts as a valve for automatically closing said suction duct.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 4th day of March, 1916.

WEBB JAY.