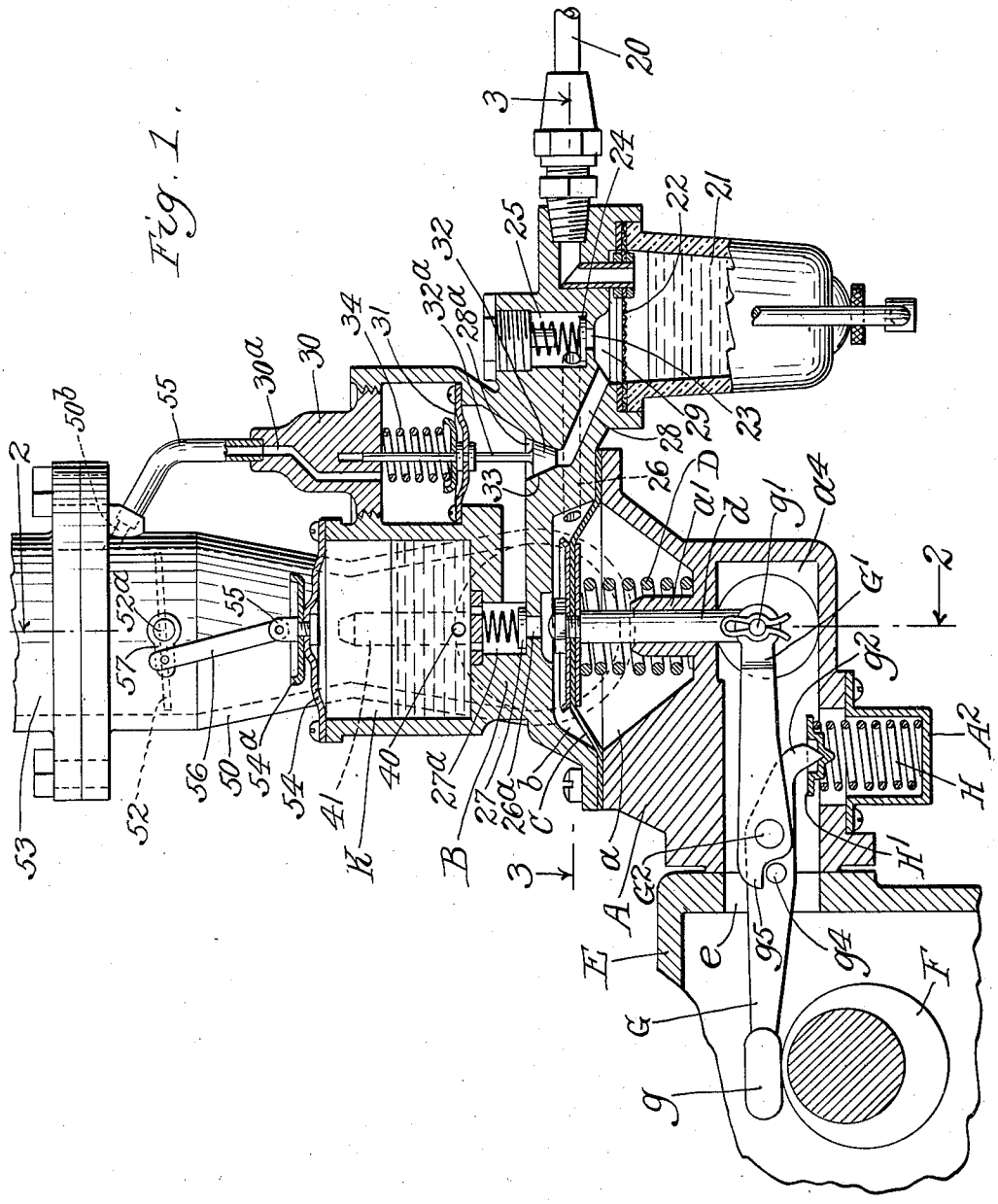
Oct. 11, 1932. W. H. MUZZY 1,881,860

FUEL PUMP

Filed Jan. 24, 1930 2 Sheets-Sheet 1

Fig. 1.




Witness,
Edward T. Wray.

Inventor
William H. Muzzy
by Burton & Burton
his Attorneys.

Oct. 11, 1932. W. H. MUZZY 1,881,860

FUEL PUMP

Filed Jan. 24, 1930 2 Sheets-Sheet 2

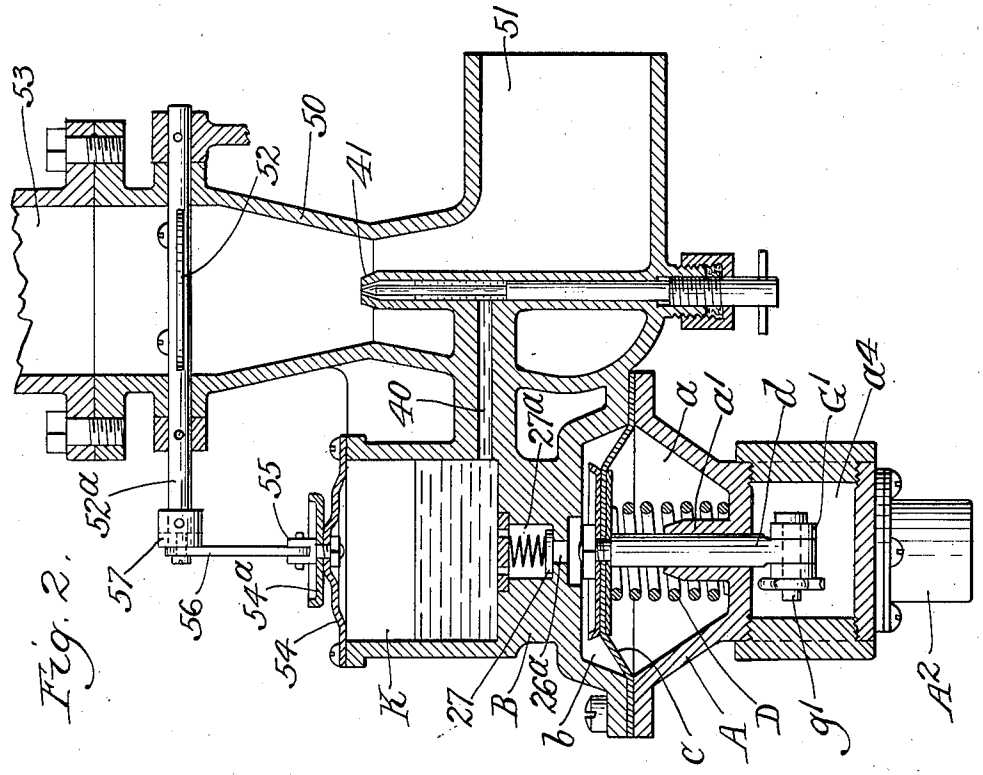



Fig. 2.

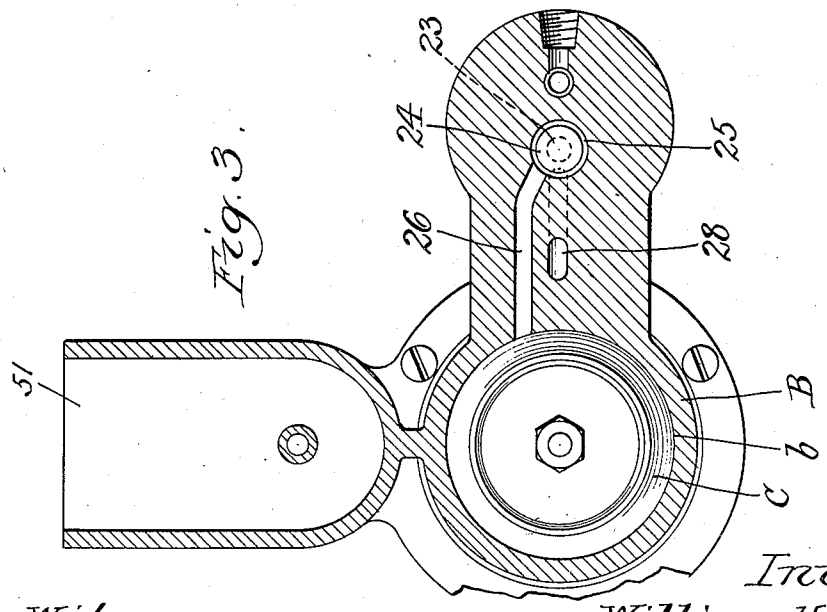



Fig. 3.

Witness
Edward T. Wray.

Inventor
William H. Muzzy
by Burton & Burton
his Attorneys.

Patented Oct. 11, 1932 1,881,860

# UNITED STATES PATENT OFFICE

WILLIAM H. MUZZY, OF EVANSTON, ILLINOIS, ASSIGNOR TO STEWART-WARNER CORPORATION, OF CHICAGO, ILLINOIS, A CORPORATION OF VIRGINIA

## FUEL PUMP

Application filed January 24, 1930. Serial No. 423,013.

One purpose of this invention is to provide an improved construction for supplying fuel to an internal combustion engine, particularly adapted for maintaining the supply under super-atmospheric pressure, in quantity variable automatically according to engine requirements, and with provision for automatically momentarily increasing the supply upon acceleration.

Another purpose of this invention is to provide an apparatus comprising a carbureter and a fuel pump constructed for mounting as a unit on the engine.

The invention consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:

Figure 1 is a vertical section of a construction embodying this invention, section being axial with respect to the pumping chamber and carbureter fuel chamber.

Figure 2 is a section at the line 2—2 on Figure 1.

Figure 3 is a section at the line 3—3 on Figure 1.

Referring to the drawings:—The pumping device comprises body members, A and B, formed with mated faces having respectively recesses, *a* and *b*, and mounted one upon the other with their mating faces clamping between them a flexible diaphragm, C, which constitutes the pumping member, the cavity, *b*, of the body member, B, constituting the pumping chamber, and a cavity, *a*, serving to accommodate a feed spring, D, which reacts upon the diaphragm, C, for giving it the feeding stroke. At the center of the diaphragm there is secured its operating stem, *d*, which is afforded guidance in a boss, $a^1$, of the body member, A, said boss protruding up in the cavity, *a*, of said body member, and in addition to affording guidance for the diaphragm stem, *d*, serving for centering the coil spring, D, in the chamber, *a*, and about the stem, *d*.

The body member, A, is formed at the left hand end (referring to Figure 1) for mounting on the engine crank case, indicated at E, at an aperture therein, indicated at *e*; and said body member, A, has at the lower part below the cavity, *a*, a horizontally extended recess, $a^4$, open at the left hand end of said member, which recess accommodates a lever construction comprising levers, G and $G^1$, hereinafter more particularly described, by which the pumping member,—the diaphragm, C,—derives actuation from an engine cam indicated at F, the lever member, G, having a terminal, *g*, arranged for cooperating with the cam, and the opposite end of the lever member, $G^1$, being pivotally connected, as seen at $g^1$, with the lower end of the diaphragm stem, *d*.

The two levers, G and $G^1$, are pivoted on a common fulcrum, as seen at $G^2$. The pump body member, A, has at the lower side a pocket preferably formed by a detachable stamping, $A^2$, for accommodating a compression spring, H, which has at its upper end a cap, $H^1$, having a central depression for pivotal lodgement of the inner end of the lever member, G, as seen at $g^2$. Said lever, G, at a short distance outward from the fulcrum, $G^2$, carries a laterally projecting stud, $g^4$, which constitutes an abutment for engagement of a shoulder, $g^5$, formed at the outer end portion of the lever, $G^1$, said stud and shoulder being relatively positioned on said lever members, respectively, for stopping against each other when the two levers are substantially in alignment. The parts are dimensioned and relatively positioned for such alignment of the levers when the terminal, *g*, of the lever, G, is in contact with the cam, F, at the point of least protrusion of the cam; and the diaphragm, C, is at the upper or inner limit of its feeding stroke. With this construction it will be understood that upon the rotation of the cam through its active phase, the two levers will be actuated as a single lever rocking about the fulcrum, $G^2$, and causing the diaphragm to be retracted to the limit of an intake stroke; and that in such movement the terminal, $g^2$, of the lever, $G^2$, operates to compress the spring, H; and that upon the continuing revolution of the cam through its idle phase, the reaction of the spring, H, will cause the lever member, G, to follow the

cam, the terminal, *g*, remaining in contact therewith, and the spring, D, reacting on the diaphragm, C, will give the latter its feeding stroke.

And it will be understood that when unusual conditions are such as to cause undue resistance to the feeding stroke, such as stoppage of the nozzle, tending to prevent the diaphragm from being returned by the spring to the initial position, the folding of the two levers relatively to each other about their fulcrum, will permit the lever, G, to noiselessly follow the cam, as mentioned, notwithstanding the lever, $G^1$, is prevented from making full return movement; and the rupture of the fabric diaphragm is thus prevented. This pumping construction will be recognized as designed for the purpose of delivering the fuel to the carbureter nozzle under predetermined controlled super-atmospheric pressure, so that the fuel supply may correspond to high speed multiple cylinder engines of recently developed type.

The fuel is led to the pump from the fuel source, (not shown) by a pipe connection, seen at 20, through which the fuel is delivered into a fuel receiving and filter chamber, 21, from which it passes through a filtering partition, 22, to a port, 23, controlled by a check valve 24 opening for flow from the chamber 21, to the valve chamber, 25, from which it passes by a horizontal passage, 26, to the pumping chamber, *b*, from which it is delivered in the feeding stroke of the pumping member, C, through a port, $26^a$, past the discharge valve, 27, and through the valve chamber, $27^a$, to the carbureter fuel chamber, K, the valves, 24 and 27, being spring-seated, opening for flow toward the carbureter and seating against reverse flow.

The pump body member B, is formed with a return flow passage, 28, leading from the valve chamber, $27^a$, to the upper part, 29, of the fuel receiving chamber, which part is formed as a recess in the lower side of said body member B, above the filtering partition, 22, and below the valve, 24. Said return flow passage, 28, has an enlargement forming a chamber, $28^a$, closed at the upper end by an adjustable plug, 30, and having a flexible diaphragm partition, 31, to which there is secured at the center the stem, $32^a$, of a valve, 32, arranged to seat at 33, for cutting off flow through the return flow passage, 28, and a spring, 34, reacting between the plug, 30, and the diaphragm, 31, for holding said valve normally seated for thus cutting off flow through said return flow passage, the reaction of said spring being determined according to the requirement of the particular installation by the adjustment of the plug, 30.

From the carbureter fuel chamber, K, a duct, 40, leads to the nozzle, 41, positioned for discharging in the carbureter discharge conduit, 50, leading to the engine intake, said conduit being of the customary form having air inlet, 51, at the lower end, and having the throttle valve, 52, mounted near the upper end, at which said conduit is connected for discharge at the engine intake, as seen at 53. The fuel chamber, K, is provided with a flexible closure member, 54, normally flexed upwardly by the pressure of the fuel fed from the pump, and having mounted above it a guard plate, $54^a$, and attached at its center a lug, 55, for connection of a link, 56, which extends to a crank arm, 57, with which the throttle valve stem, $52^a$, is provided outside the conduit, 50.

The chamber, K, is closed at the top, as more particularly hereinafter described, and it will be understood that thus the upper part of said chamber constitutes a fluid pressure trap operating for maintaining continuous pressure for fuel discharge from the nozzle in the intervals between the feed strokes of the pumping member, C.

The flexible closure, 54, of the chamber, K, and the operating connections therefrom to the throttle valve stem are dimensioned so that said closure, 54, is flexed upwardly, as seen in Figure 1, when the throttle valve is at the approximately closed position for idling of the engine, as indicated in said Figure 1, and is susceptible of downward flexure to fully open position of the throttle. The plug, 30, has a duct, $30^a$, extending through it from end to end, and the carbureter discharge conduit, 50, has an aperture, $50^b$, beyond the seated position of the throttle valve; and a pipe member, 55, is provided connecting the upper end of said duct, $30^a$, with said aperture, $50^b$.

From the foregoing description it may be understood that when the engine is running, causing fuel to be pumped from the source by way of the fuel receiving and filter chamber, 21, and the pumping chamber, *b*, to the carbureter fuel chamber, K, and to be discharged from the latter by the nozzle, 41, into the carbureter discharge conduit, 50, the fuel will be thus normally fed and discharged by the pressure exerted by the resilient reaction of the pump spring, D. It will be understood, therefore, that this spring is made stronger than necessary for maintaining fuel flow and discharge from the nozzle, 41, at a rate for meeting maximum engine requirement, but this feeding action is limited to the degree of resilient reaction of the vacuum-controlled spring 34, because the latter spring, yielding to fuel pressure on the under side of the diaphragm, 31, because of the vacuum above it will cause the latter to open the valve, 32, relieving and reducing the pressure at the nozzle to that measured by the reaction of the vacuum-controlled spring, 34.

It may be understood that the purpose of the provision for return flow to the fuel re-

ceiving and filter chamber, 21, by-passing the pumping chamber and resulting in idle feeding of the fuel in endless circuit through the pumping chamber and said fuel receiving chamber,—is to vary the amount of fuel fed to the nozzle, 41, in accordance with the varying engine requirement, notwithstanding the unchanging resilient reaction and feeding force of the feed spring, D. This desired result is obtained by the provision for opening the cut-off valve, 32, as described, by the action of the diaphragm, 31, permitting said flow in endless circuit of more or less of the fuel discharge past the valve, 32, when the vacuum communicated above the diaphragm, 31, by way of the connection described from the intake manifold beyond the throttle, causes the diaphragm, 31, to be flexed upwardly by the fuel pressure at the lower side against the reaction of the spring, 34, opening the valve, 32, more or less according as the degree of said vacuum is greater or less. The spring, 34, being dimensioned and adjusted for holding the valve, 32, normally seated so long as the maximum fuel requirement of the engine,—running with wide open throttle and under load,—takes the full amount of fuel fed past the valve, 27, by the reaction of the feed spring, D, and no longer, the valve, 32, will be opened by the operation of vacuum above the diaphragm, 31,—derived from the intake manifold, as described,—when the throttle is closed more or less, for reducing speed, thereby reducing engine fuel requirement.

Under such circumstances, the increase of vacuum at the engine intake beyond the partly closed throttle, operates by the connection described to cause the movement of the diaphragm, 31, for opening the valve, 32, more or less, thereby relieving the pressure by which the fuel is fed to the nozzle, and thereby reducing the amount of fuel feed and causing more or less of the surplus fuel to be fed in endless circuit through the chamber, 1.

It will be seen, therefore, that the construction described operates for automatically reducing the fuel discharge to the engine in accordance with the fuel requirement of the engine under varying running conditions.

The purpose and operation of the connection described by which the opening and closing movement of the throttle operates the flexible closure, 54, of the carbureter fuel chamber, K, is to produce a momentary excess air pressure upon the fuel in the chamber, K, for discharging excess fuel from the nozzle, 41, in a jet, for enriching the fuel mixture to cause the engine to suddenly pick up speed when the driver suddenly operates the accelerator to increase the opening of the throttle for quick increase of speed in a traffic emergency, or to make a quick start after a period of idling of the engine.

While I have shown the features constituting the present invention as applied to a forced feed from the nozzle, supplemented as usual by engine suction, it should be understood that the construction may be readily modified so as to utilize the invention in conjunction with the usual gravity and suction feed from a governed level fuel chamber or float bowl; and although certain features of the construction are especially designed for forced feed, I do not wish to limit myself to such feed as distinguished from the more familiar and commonly employed suction and gravity or "governed level" feed.

I claim:—

1. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine, intake and discharge valves seating against reverse flow, a pumping element reciprocably arranged in said pumping chamber; engine-actuated means for giving the pumping member its intake stroke; resilient means for giving it its feeding stroke; a conduit leading from a point in the discharge line beyond the discharge valve back to a point in the fuel supply line antecedent to the intake valve, and means for regulating the flow through said conduit, the regulating means consisting of a valve with means holding it normally seated, and means for opening it connected for operation by pressure derived from the intake of the engine served; whereby the return flow of fuel, reducing the fuel supply delivered to the engine, is varied in accordance with the variation of said engine pressure.

2. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine, intake and discharge valves seating against reverse flow, a pumping element reciprocably arranged in said pumping chamber; engine-actuated means for giving the pumping member its intake stroke; resilient means for giving it its feeding stroke; a conduit leading from a point in the discharge line beyond the discharge valve back to a point in the fuel supply line antecedent to the intake valve, and means for regulating the flow through said conduit, the regulating means consisting of a valve in the return flow conduit; a variable capacity chamber having a movable wall member, by whose movement the capacity is varied, operatively connected with said valve for opening and closing the valve by the movement of said wall member, and a fluid pressure conduit connecting said variable capacity chamber with the engine intake, whereby the engine pressure operates said valve.

3. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine, and a pumping member operating in said chamber; engine-operated means for reciprocating the pumping member; a fuel receiving chamber interposed in the supply line from the fuel source at a point antecedent to the inflow controlling valve; a conduit leading from a point in the fuel discharge line beyond the outflow controlling valve back to said antecedent fuel receiving chamber, and means for controlling the backflow to said antecedent chamber consisting of a valve with means holding it normally seated, and means for opening it connected for operation by pressure derived from the intake of the engine served; whereby the return flow of fuel to the antecedent receiving chamber, reducing the fuel supply delivered to the engine, is varied in accordance with the variation of said engine pressure.

4. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine, and a pumping member operating in said chamber; engine-operated means for reciprocating the pumping member; a fuel receiving chamber interposed in the supply line from the fuel source antecedent to the inflow controlling valve; a conduit leading from a point in the fuel discharge line beyond the outflow controlling valve back to said antecedent fuel receiving chamber, and means for controlling the backflow to said antecedent chamber consisting of a valve in the return flow conduit; a variable capacity chamber having a movable wall member, by whose movement the capacity is varied, operatively connected with said valve for opening and closing the valve by the movement of said wall member, and a fluid pressure conduit connecting said variable capacity chamber with the engine intake; whereby engine pressure operates said valve.

5. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine, intake and discharge valves seating against reverse flow, a pumping element reciprocably arranged in said pumping chamber; engine-actuated means for giving the pumping member its intake stroke; resilient means for giving it its feeding stroke; a conduit leading from a point in the discharge line beyond the discharge valve back to a point in the fuel supply line antecedent to the intake valve, and means for regulating the flow through said conduit, the antecedent fuel accumulating chamber having its connection for inflow from the fuel source and its connection for outflow to the pumping chamber at the upper part, whereby fuel is trapped and accumulated in the lower part, and having a filtering screen interposed as a partition between the inlet and outlet of said chamber, the return flow conduit being connected at the outflow side of said filtering partition.

6. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine, and a pumping member operating in said chamber; engine-operated means for reciprocating the pumping member; a fuel receiving chamber interposed in the supply line from the fuel source at a point antecedent to the inflow controlling valve; a conduit leading from a point in the fuel discharge line beyond the outflow controlling valve back to said antecedent fuel receiving chamber, and means for controlling the backflow to said antecedent chamber, the antecedent fuel receiving chamber having a filtering partition between the inflow and outflow connections of said chamber, said partition being located toward the upper part of said chamber and extending in general horizontally, the return flow conduit being connected above and at the outflow side of said partition; whereby the return flow is discharged upon and passes down through said filtering partition for clearing the latter of sediment adhering to the under side thereof.

7. In combination with an internal combustion engine, a pumping apparatus arranged for yielding resilient feeding stroke and positive intake stroke, and having a pumping chamber connected for fuel inflow from the fuel source and fuel discharge toward the engine; a filter chamber interposed in the fuel supply line from the fuel source antecedent to the pump chamber; a return conduit from the discharge line back to the filter chamber by-passing the pump chamber; a variable capacity chamber having a movable wall member; a valve operatively connected with said movable wall member and arranged for controlling said by-pass return conduit, and a fluid pressure conduit from said variable capacity chamber to the engine intake beyond the throttle.

8. The construction defined in claim 7, in combination with the carbureter of the engine served, the pumping chamber body comprising a plurality of members, one of which contains the discharge passage and discharge controlling valve, the fuel chamber of the engine carbureter being integrally with said pumping chamber member.

9. The construction defined in claim 7, in combination with the carbureter and intake conduit of the internal combustion engine

served, the pumping chamber body comprising a plurality of members, one of which contains the fuel discharge passage and discharge controlling valve, the governed level fuel chamber of the carbureter and the variable capacity chamber mentioned in claim 7 being both formed integrally with said pumping chamber member.

10. The construction defined in claim 7, in combination with the carbureter and intake conduit of the internal combustion engine served, the pumping chamber body comprising a plurality of members, one of which contains the fuel discharge passage and discharge controlling valve, the governed level fuel chamber of the carbureter and the variable capacity chamber mentioned in claim 7 being both formed integrally with said pumping chamber member, said variable capacity chamber and said governed level chamber being laterally adjacent to each other and both at the upper side of the pumping chamber member.

11. The construction defined in claim 7 in combination with the carbureter and intake conduit of the internal combustion engine served, the pumping chamber body composed a plurality of members, one of which contains the fuel discharge passage and discharge controlling valve, the governed level fuel chamber of the carbureter and the variable capacity chamber mentioned in claim 7 being both formed integrally with said pumping chamber member, said variable capacity chamber and said governed level chamber being laterally adjacent to each other and both at the upper side of the pumping chamber member, the antecedent fuel receiving chamber being mounted at the lower side of said pumping chamber member.

12. An apparatus for supplying fuel to the carbureter of an internal combustion engine comprising in combination with the pumping means arranged to feed the fuel with a predetermined pressure, a fuel chamber to which the fuel is thus fed, said chamber being connected for discharge from its lower part to the mixing chamber of the carbureter and being closed except as to inflow connection and said low discharge connection, whereby it becomes at the upper part a pressure trapping chamber, said chamber having a wall member inwardly and outwardly movable for varying the capacity of the chamber, and operating connections from the engine throttle to said movable wall member arranged to move the latter inwardly with respect to the chamber for reducing the chamber capacity by opening movement of the throttle.

13. A pumping device for supplying fuel to an internal combustion engine comprising a pumping chamber having fuel inflow and outflow connections valve-controlled for flow from a fuel source toward the engine and a pumping member operating in said chamber; engine-actuated means for giving the pumping member its intake stroke, and resilient means for giving it yieldingly its feeding stroke; a fuel-accumulating chamber interposed in the fuel supply line antecedent to the inflow controlling valve and below the level thereof, said fuel accumulating chamber having its connection for flow toward said pumping chamber inflow valve at the upper part of said accumulating chamber; a conduit leading from a point in the discharge line beyond the outflow valve back and downwardly to said antecedent fuel accumulating chamber, and means controlling backflow from the discharge line to said accumulating chamber.

In testimony whereof, I have hereunto set my hand at New York, New York, this 13th day of January, 1930.

WILLIAM H. MUZZY.