

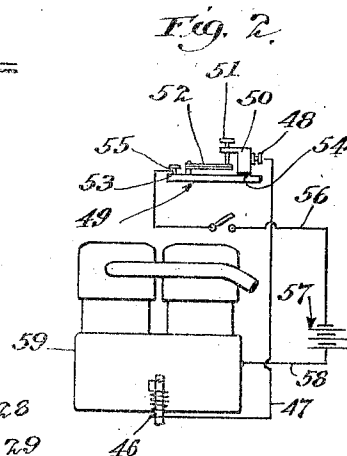
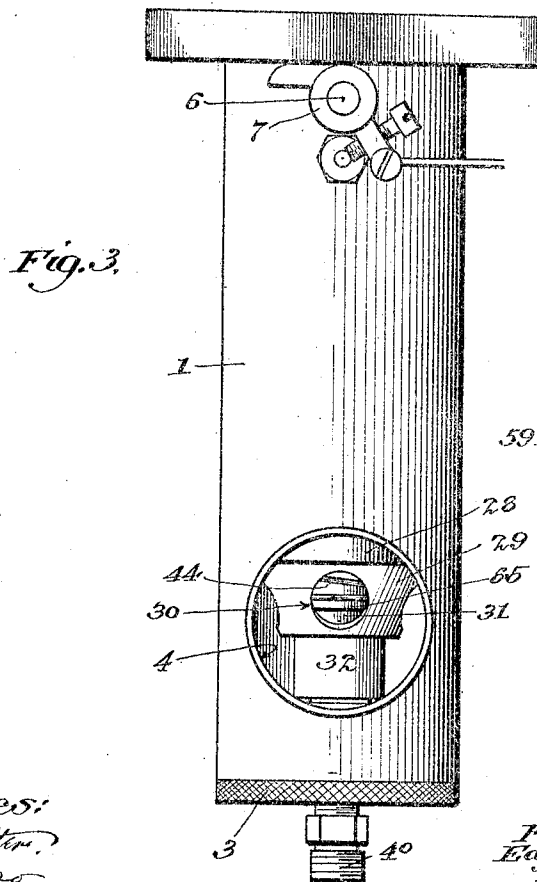
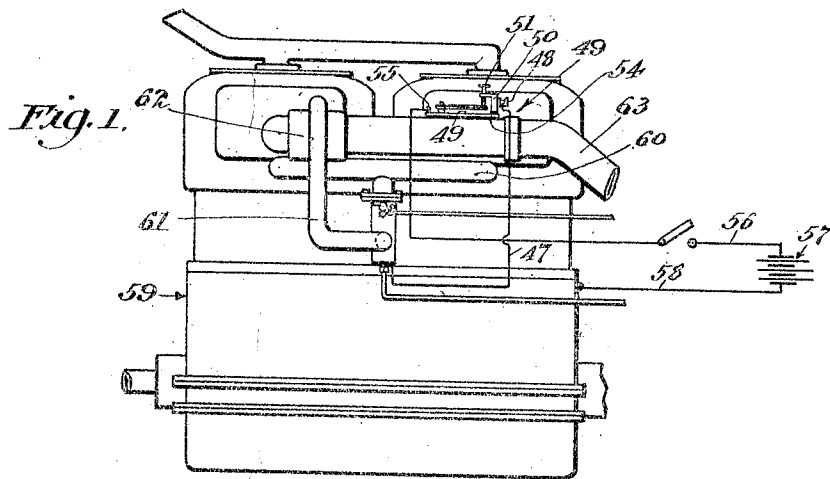
F. E. LA FEHR, E. M. HITCHCOCK AND H. V. LEAHY.
CARBURETER.

APPLICATION FILED AUG. 21, 1917. RENEWED OCT. 5, 1920.

1,376,707.

Patented May 3, 1921.

3 SHEETS—SHEET 1.



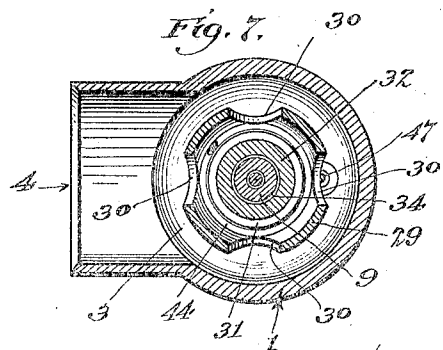
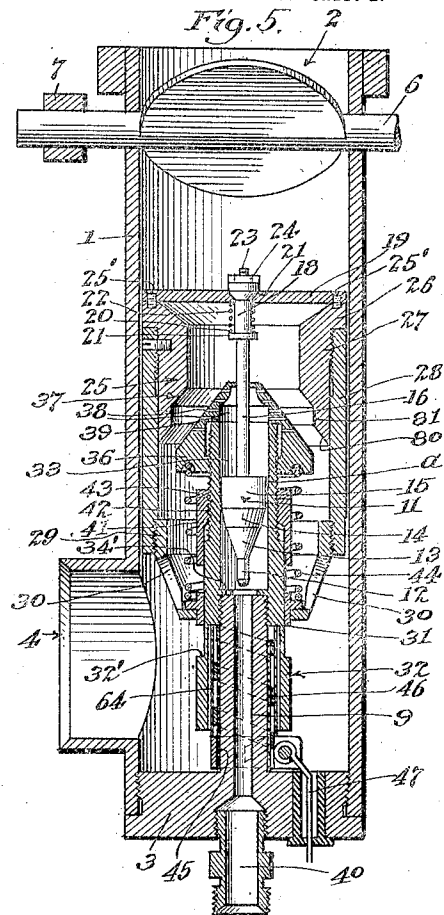
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3 SHEETS—SHEET 2.



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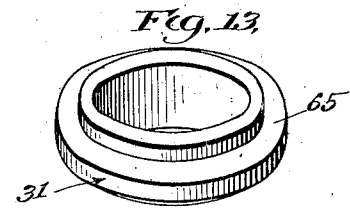
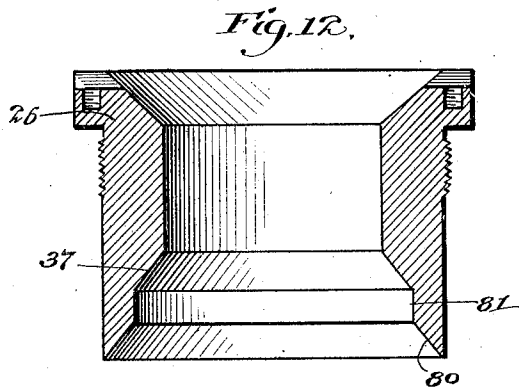
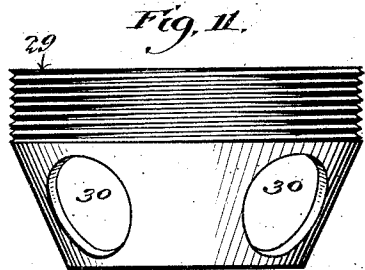
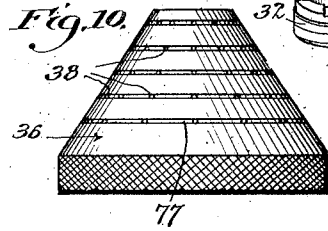
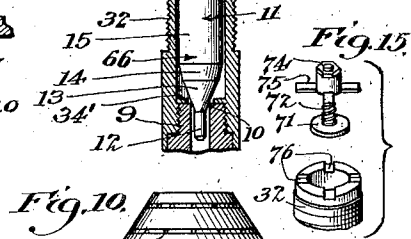
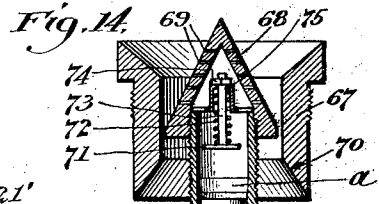
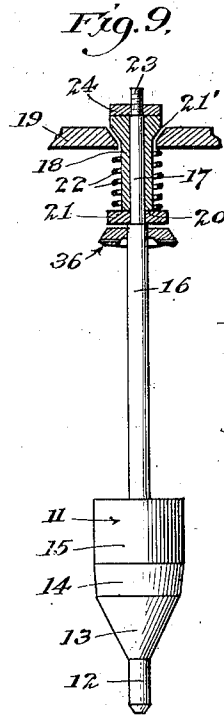
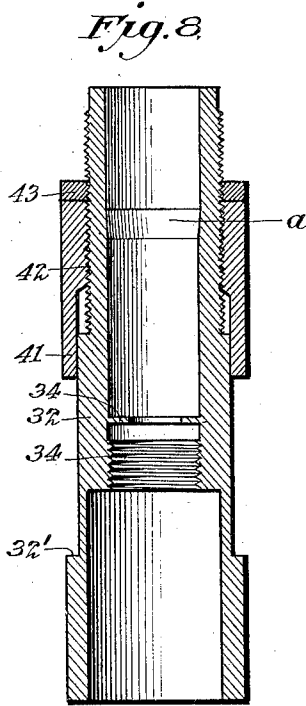
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3 SHEETS—SHEET 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

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CARBURETER.

1,376,707.

Specification of Letters Patent.

Patented May 3, 1921.

Application filed August 21, 1917, Serial No. 137,358. Renewed October 5, 1920. Serial No. 414,830.

To all whom it may concern:

Be it known that we, FRANCIS E. LA FEHR, EDGAR M. HITCHCOCK, and HERBERT V. LEAHY, citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Carbureter, of which the following is a specification.

This invention pertains to devices designed to produce combustible mixtures of air and fuel and an object of the invention is to produce a uniform mixture at all times for any particular degree of opening of the throttle valve.

Another object is to produce a mixture having the desired proportions of fuel and air for obtaining the best results in power in accordance with the degree of engine suction and degree of opening of the throttle valve.

Another object is to so construct the device that the desired ends may be obtained without it being necessary to employ a float valve.

Another object is to cause a maximum breaking up or atomizing of the fuel particles and to disperse said fuel particles uniformly throughout a stream or column of air.

Other objects and advantages will appear in the subjoined detail description.

The accompanying drawings illustrate the invention:

Figure 1 is a side elevation of an internal combustion engine equipped with the invention.

Fig. 2 is a diagrammatic view illustrating the electrical wiring.

Fig. 3 is an enlarged side elevation of the carbureter shown in Fig. 1.

Fig. 4 is a vertical mid section of the carbureter shown in Fig. 3 taken on a plane at right angles to the direction of sight.

Fig. 5 is a sectional view analogous to Fig. 4 showing the operating parts in different positions than in Fig. 4.

Fig. 6 is a plan section on line indicated by x^6-x^6 , Fig. 4.

Fig. 7 is a plan section on line indicated by x^7-x^7 , Fig. 4.

Fig. 8 is an enlarged vertical section of the tubular member, stop forming sleeve and lock nut shown in Figs. 4 and 5.

Fig. 9 is an enlarged fragmentary view of the fuel valve, stem, guide, nut and washer and spring on the stem, a fragment of the bridge, and a fragment of the distributor, all being in section excepting the valve and its stem.

Fig. 10 is an enlarged elevation of the distributor shown in Figs. 4 and 5.

Fig. 11 is an enlarged side elevation of the inlet member shown in Figs. 4 and 5.

Fig. 12 is an enlarged vertical section of the valve seat member shown in Figs. 4 and 5.

Fig. 13 is a perspective view of the bushing shown in Figs. 4 and 5.

Fig. 14 is a sectional detail of a modified plunger, valve chamber, distributor and valve.

Fig. 15 is a perspective view of the upper end of the valve chamber and the valve abutment and its parts shown in Fig. 14.

First referring to Figs. 3 to 13 inclusive, there is provided a tubular member or tube 1 having one end open to form a mixture outlet 2 and having its opposite end closed by a plug 3 which may be screw-threaded into the tubular member 1 or otherwise suitably fastened in place. Near one end of the tubular member 1 adjacent the plug 3 is an air inlet 4 which may, if desired, be connected with any suitable source of hot air supply, not shown. The volume of mixture passing through the outlet 2 may be controlled by a suitable throttle valve 5 mounted on a shaft 6 and provided with an arm 7 for turning the shaft so as to open and close the throttle valve.

The plug 3 is provided with a fuel passage 8 which extends upward inside of the carbureting chamber 1 through a tubular member 9 which, in the instance shown, forms a portion of the plug 3. The upper end of the tube 9 terminates in a valve seat 10 and said passage 8 may be closed by a valve plug 11 adapted to close onto the seat 10 as shown in Fig. 4 of the drawings. The valve, in the instance shown, is constructed of four differently shaped portions, a portion 12 of less diameter than the passage 8, which, when the valve is closed, extends a distance into the passage to aid in centering the valve 11; a frusto-conical portion 13 of comparatively great taper; a frusto-conical

portion 14 of comparatively slight taper; and a straight cylindrical portion 15; and the valve is provided with a stem 16 having a reduced portion 17 that passes through a tubular guide 18 projecting through a bridge 19. At the inner end of the reduced portion 17 is formed a shoulder 20 and resting against said shoulder is a washer 21 and resting on said washer is a coil spring 22 which surrounds the inner end of the guide 18 between the bridge 19 and the washer 21 so as to tend to hold the valve 11 down on its seat 10 when a shoulder 21' of the guide 18 is spaced from the bridge 19 which is shiftable as will be explained hereinafter. The outer end of the reduced portion 17 of the valve stem is screw-threaded at 23 to receive a nut 24.

The bridge 19 forms a detachable portion of a hollow or tubular plunger indicated in general by the character 25 and being fastened in place by screws 25' or equivalents. The plunger 25 in the instance shown in the drawings comprises a seat member 26 having a reduced portion 27; and also comprises a barrel 28 screw-threaded onto the reduced portion 27; and also comprises a hollow inlet member 29 screw-threaded into the barrel 28 and having ports 30 whereby air may pass into the interior of the plunger 25.

At one end the inlet member 29 is provided with a bushing 31 which slides upon and is guided by a tubular member 32, the lower portion of said tubular member surrounding the tube 9 and having a portion spaced from said tube, and the upper portion of the member 32 above the upper end of the tube 9 forming a valve chamber 33 for the valve 11. The tubular member 32 is stationarily mounted and in the instance shown in the drawings is screw-threaded at 34 on the upper end of the tube 9, there being an annular shoulder 34' in the tubular member 32 against which the tube 9 seats. When the plunger 25 is in its lowered position as in Fig. 4 the bushing 31 rests upon an annular shoulder 32' on the outside of the tubular member 32, and the inlet member 29 is spaced from a shoulder or abutment 65 on the outside of the bushing 31 which is loose in the inlet member.

At the upper end of the tubular member 32 is a distributor 36 which is screw-threaded or otherwise fastened to the tubular member. The distributor 36 is substantially cone shape with smaller end directed up and forms with the seat member 26 an air valve adapted when the plunger 25 is in closed position to seat at 37 in the seat member 26 so as to prevent passage of air through the plunger 25.

When the seat 37 rests on the distributor the plunger is supported entirely by the distributor, the spring 18 is compressed

slightly and the washer 21 is spaced slightly from the upper end of the distributor.

The fuel distributor 36 is provided with numerous ducts or perforations 38 and said perforations preferably extend at right angles to the axes of the distributor and plunger so that fuel sprayed from the perforations will be directed into the column of air passing through the plunger substantially transverse to the direction of flow of said air so as to obtain maximum breaking up or atomizing of the fuel and therefore uniformity of distribution of the fuel particles throughout the column of air. The valve stem 16 passes through the distributor 36 centrally thereof and the distributor is chambered at 39 to form an extension of the chamber 33. From the foregoing it is clear that a continuous fuel passage is formed by the combined passage 8 and chambers 33 and 39, and fuel is conducted to the passage 8 through a fuel supply line indicated fragmentarily at 40.

Preferably the distributor 36 is provided with annular grooves 77 communicating with the outer ends of the ducts 38 and the advantage of these grooves is that some of the fuel runs along the grooves and is thus distributed circumferentially of the distributor so as to effect as far as possible a uniform distribution of the fuel to all portions circumferentially of the column of air flowing past the distributor.

It is noted that the seat 37 is tapered or beveled and that the taper corresponds with the taper of the periphery of the distributor. The advantage of this is that air passing upward through the plunger 25 will be directed by the taper seat 37 parallel to and directly in contact with the periphery of the distributor so as to spread the fuel over the periphery of the distributor before said air takes up the fuel, thus to break up the fuel as finely as possible by friction of the air thereon.

An adjustable stop is provided on the tubular member 32 to limit upward movement of the plunger 25 and said stop, in the instance shown, is formed by the lower end of a sleeve 41 surrounding the tubular member 32 and screw-threaded thereon at 42, there being a lock nut 43 screw-threaded onto the tubular member 32 against the sleeve to lock it in adjusted position. Adjustment of the sleeve 41 along the member 32 will determine the amount of movement to which the plunger may be subjected because the bushing 31 is in line with the sleeve 41 so as to engage the same when the plunger is moved upward sufficiently far to bring about the engagement. The weight of the plunger and the valve 11 tends to resist upward movement of the plunger, and the resistance is increased by reason of there being a coil spring 44 surrounding the tubu-

lar member 32 and having one end resting against the bushing 31 and having the other end resting against the distributor 36.

Thus it is clear that the cross sectional area of the passage between the distributor 36 and plunger member 26 is dependent on the degree of suction established in the tube 1 above the plunger:

The inlet end of the seat member 26 is outwardly expanded at 80 and has a straight portion 81 between the seat 37 and the expanded portion, and the space between the inlet member 29 and abutment 65 is slightly greater than the length of the straight portion 81, when the plunger is in its lowered position, so that when the plunger is raised to just cause engagement of the inlet member with the abutment the expanded portion 80 will come opposite the large end of the distributor and thus produce an annular space between the seat member 26 and distributor so that air can pass from below the distributor to the space above said distributor.

The tube 9 is provided externally with insulation 45 and around this is placed a resistance coil 46 adapted to receive electric current from any suitable source of supply. In Figs. 1 and 2 of the drawings the resistance coil 46 is grounded at one end to the tube 9 and has its other end connected by a lead 47 to a binding post 48 of a thermostat 49. This thermostat may be of any suitable construction and is shown as being provided with a standard 50 on which the binding post 48 is mounted, there being a contact screw 51 to engage a thermostat leaf or leaves 52 mounted on a base 53. The bracket 50 is insulated at 54 from the base and said base is provided with a binding post 55 connected by a lead 56 to a suitable source of electric current supply 57. The electric current supply 57 is provided with a lead 58 which is electrically connected by any suitable means to the tube 9 and in the instance shown in Figs. 1 and 2 of the drawing said lead is grounded to an engine 59 which is equipped with the carbureter above described, the intake pipe 60 of the engine being connected to the outlet 2 and the air inlet 4 being connected by a pipe 61 to an air heater 62 mounted on the exhaust pipe 63 of the engine. The thermostat 49 is mounted on the exhaust pipe 63. When the engine is cold the thermostat is closed as shown in Figs. 1 and 2 so as to cause a current of electricity to flow through the resistance coil 46, thereby heating the tube 9 and the fuel therein so as to facilitate gasification when the engine is started into operation. When the engine heats up the heat radiated from the exhaust pipe causes the thermostat to open the circuit so that the resistance coil 46 will no longer be energized.

Outside of the coil 46 may be placed an

insulation sleeve 64. The insulation 45, 64 and coil 46 are accommodated in the space between the lower portion of the tubular member 32 and the tube 9.

In practical operation when it is desired to start the engine into operation, the throttle valve 5 will be opened slightly and the engine will be turned over by hand or any other means well known in the art and the suction produced in the engine cylinders thereby will cause the plunger 25 to rise until the inlet member 29 engages a shoulder 65 on the bushing 31. At idling speeds the power of the spring 44 is sufficient to prevent further upward movement of the plunger 25, but said plunger has moved sufficiently to allow a comparatively small volume of air to pass between the seat member 26 and distributor 36 as above explained, and the upward movement of the plunger has also raised the fuel valve 11 from its seat to permit fuel to be sucked from the passage 8 into the chamber 33, thence into the chamber 39 and outward through the perforations 38 so as to atomize or spray the fuel into the column of air passing upward around the distributor 36, thus producing a mixture of air and fuel that is substantially uniform throughout as regards the proportion of fuel and air.

It is noted that owing to the ducts 38 being directed toward the column of air at an angle to the direction of flow of the air the fuel sucked from the ducts and thereby reduced to small particles will be still further broken up by friction of the air against said particles, thus attenuating the fuel to such a degree as in effect to vaporize and partly gasify the fuel since it becomes invisible and cannot be apprehended by the sense of touch.

When it is desired to speed up the engine the throttle valve 5 will be opened farther thus increasing the degree of suction in the upper portion of the carbureting tube 1, and this increased suction will cause the plunger 25 to move still farther away from the distributor 36 so as to allow a greater volume of air to flow past said valve. Coincidentally the plunger 25 will raise the fuel valve 11 still further without however, admitting more fuel until the portion 15 of valve comes adjacent a slightly expanded portion *a* of the chamber 33, whereupon there is admitted a greater volume of fuel to the perforations 38 to supply the increased volume of air with an increased amount of fuel.

Further opening of the throttle valve successively brings the valve portions 14, 13 respectively adjacent the passage portion *a* so as to admit more and more fuel to the ducts 38. From this it is clear that owing to the particular construction of the valve and the passage 33 there is first produced a very rich

mixture for starting, and then a leaner mixture for higher speeds by increase of air and no increase of fuel, and finally a lean mixture suitable for still higher speeds since
 5 both the air and fuel volumes are increased proportionately.

During operation of the engine the plunger 25 floats in the tube 1, rising and falling with every variation in the requirements of the engine and degree of opening
 10 of the throttle valve 5 so as to increase and diminish the volume of mixture supplied to the engine through the outlet 2 and at times to vary the proportions of fuel and air.

15 In the modification shown in Figs. 14 and 15 the valve is indicated at 66 and is of similar construction to the valve 11 excepting that there is no valve stem, suction being
 20 relied upon to directly open the fuel valve instead of indirectly by way of the plunger which is indicated at 67. There is no valve seat in the plunger 67 as in the plunger 25 but when the parts are in the position shown
 25 in Fig. 14 a comparatively small volume of air passes between the plunger 67 and distributor 68. This distributor is closed at its upper end, since there is no valve stem passing
 30 therethrough and said distributor is screw-threaded onto the upper end of a tubular member corresponding to the tubular member 32 and indicated by the same reference
 35 character, said tubular member being screw-threaded on the upper end of a tube corresponding to the tube 9 and indicated by the same reference character.

When the device shown in Fig. 14 is subject to comparatively slight suction, the plunger 67 rises slightly and the fuel valve 66 is raised by the suction so as to admit
 40 fuel to the perforations 69 of the distributor. When the device is subject to greater suction the plunger 67 will rise sufficiently to cause the tapered portion 70 thereof to come adjacent the lower portion of the distributor
 45 valve 68 so as to admit a greater volume of air to pass the valve, and the increased suction will cause the valve 66 to raise an abutment 71 against the pressure of a spring 72 so as to admit more fuel to the perforations
 50 69 of the distributor. The spring 72 surrounds a stem 73 fastened to the abutment 71 and said stem is provided with a nut 74 which limits downward movement of the abutment 71 caused by the spring 72.

55 The upper end of the spring 72 rests against a bridge 75 and the ends of said bridge rest in notches 76 in the upper end of the tubular member 32.

The further operation of this modified
 60 form of the invention will be readily understood from the foregoing description of the operation of the device shown in Figs. 1 to 13 respectively.

In the form of the invention disclosed in
 65 Figs. 1 to 13, if the engine back-fires it is

clear that the plunger will be driven downward by the force of the explosion to close the seat 37 on the distributor so as to shut off the air, whereupon combustion can no longer be supported in the carbureter.

It is understood that the degree of taper of the valve portion 14 and the tube portion
 70 *a* is more or less exaggerated in the drawings, but in actual practice the taper will be very slight.

We claim:

1. In combination, a chamber having an inlet and an outlet, a tubular member having an annular shoulder and having an adjustable stop spaced from the annular shoulder, a plunger surrounding the tubular member, a bushing loose in the lower end of the plunger between the shoulder and stop and having an abutment to engage the plunger, a hollow perforated distributor on the upper
 80 end of the tubular member, and a spring between the distributor and bushing.

2. In combination, a chamber having an inlet and an outlet, a tubular member having an annular shoulder and having an adjustable stop spaced from the annular shoulder and having a valve seat, a plunger surrounding the tubular member, a bushing loose in the lower end of the plunger between the shoulder and stop and having an abutment to engage the plunger, a hollow perforated distributor on the upper end of the tubular member, a valve in the tubular member to close on the valve seat, means connecting the valve to the plunger, and a spring between the distributor and bushing.

3. In combination, a chamber having an inlet and an outlet, a fuel passage in said chamber, a cone-shaped hollow distributor at the upper end of the fuel passage provided with radially extending ducts, said distributor being provided in its periphery with annular grooves communicating with the outer ends of the ducts, and a hollow plunger surrounding the distributor and adapted to float in the chamber when suction is applied to the chamber above the plunger.

4. In combination, a chamber having an inlet and an outlet, a fuel passage in said chamber having a valve seat therein, a cone-shaped hollow distributor at the upper end of the fuel passage provided with radially extending ducts, said distributor being provided in its periphery with annular grooves communicating with the outer ends of the ducts, a hollow plunger surrounding the distributor and adapted to float in the chamber when suction is applied to the chamber above the plunger, and a valve in the fuel
 115 passage to close on the seat and connected with the plunger to be operated thereby.

5. In combination, a chamber having an inlet and an outlet, a tubular member in said chamber having a valve seat therein, a hol-
 130

low perforated distributor at the upper end of the tubular member, a hollow plunger in the chamber surrounding the distributor and provided with a bridge and provided with a seat to engage the distributor, a valve in the fuel passage to close on the seat and provided with a stem extending through the distributor, there being a shoulder on the stem, a valve resting against said shoulder, a tubular guide on the stem above the washer and extending through the bridge and having a shoulder to engage the upper face of the bridge, a spring surrounding the guide between the washer and bridge, and a nut on the stem to engage the outer end of the guide, the washer being spaced from the distributor and the shoulder of the guide being spaced from the bridge when the valve is seated and the seat of the plunger is resting on the distributor.

6. In combination, a chamber having an inlet and an outlet, a tubular member in said chamber having a valve seat therein, a hollow perforated distributor at the upper end of the tubular member, a hollow plunger in the chamber surrounding the distributor and provided with a bridge, said plunger including a seat member to close onto the distributor provided with a seat, and with a downwardly expanding inlet, there being a straight portion between the seat and inlet, a bushing surrounding the tubular member and provided with a shoulder to be engaged by the plunger, a spring between the bushing and the distributor, a stem for the valve passing through the distributor, and means connecting the valve to the bridge, the space between the plunger and the shoulder of the bushing being slightly greater when the plunger is in lowered position than the length of the said straight portion of the seat member.

7. In combination, a tube, a tubular plun-

ger in the tube, a bridge over the upper end of the plunger, a tubular member extending up inside of the plunger and provided with a valve seat in its interior, a valve to close on said valve seat, a stem for the valve extending through the bridge and provided with a shoulder, a nut on the upper end of the stem, a tubular valve guide between the shoulder and nut having a shoulder adapted to be engaged by the bridge in the upward movement of the plunger, a spring between the bridge and stem shoulder to tend to hold the valve on its seat when the shoulder of the tubular guide is spaced from the bridge, a valve seat in the inside of the plunger, and a perforated distributor on the upper end of the tubular member around the valve stem adapted to be engaged by the valve seat of the plunger when the plunger is in its lowermost position.

8. In combination, a tube, a hollow plunger in the tube, comprising a seat member and a barrel screw-threaded onto the seat member and a hollow inlet member screw-threaded into the barrel, there being ports in the peripheral wall of the inlet member, a tubular member having a valve seat and having an abutment on its periphery and having its upper end inside of the plunger, a perforated distributor on the upper end of the tubular member, a spring having one end resting against the abutment and the other end against the distributor, and a valve inside of the tubular member to engage the valve seat to control the flow of fuel.

Signed at Los Angeles, California, this 14th day of August, 1917.

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