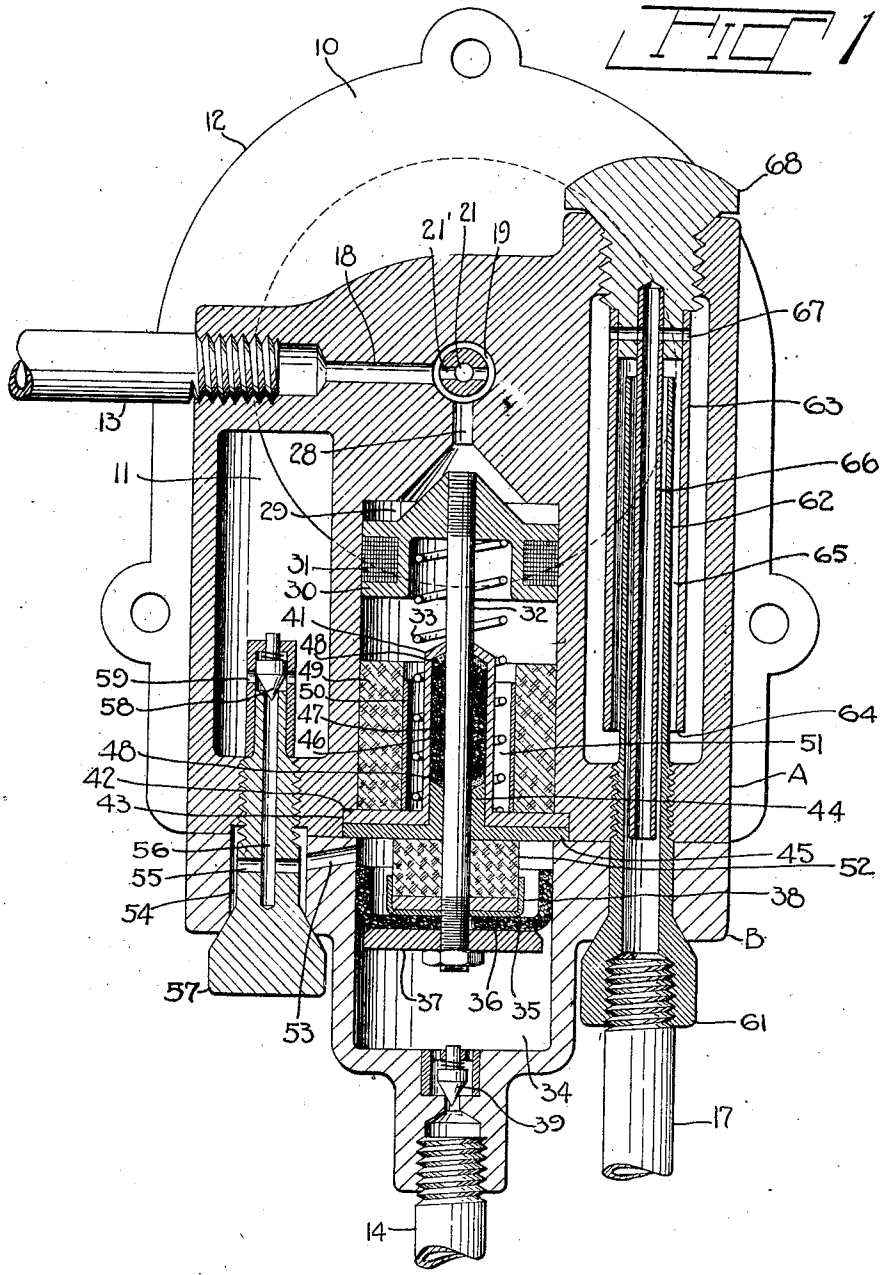
Jan. 23, 1923.

1,443,102

H. C. SUEKERT.
FUEL DELIVERY APPARATUS.
FILED NOV. 4, 1919.

4 SHEETS-SHEET 1

FIG 1



Inventor
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Jan. 23, 1923.

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4 SHEETS-SHEET 2

FIG 2

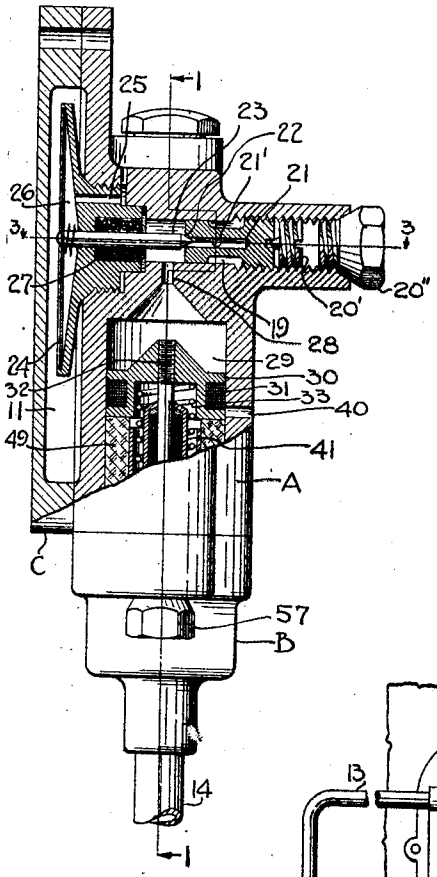


FIG 3

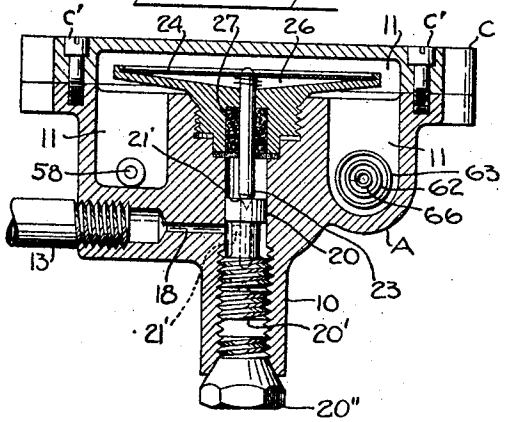
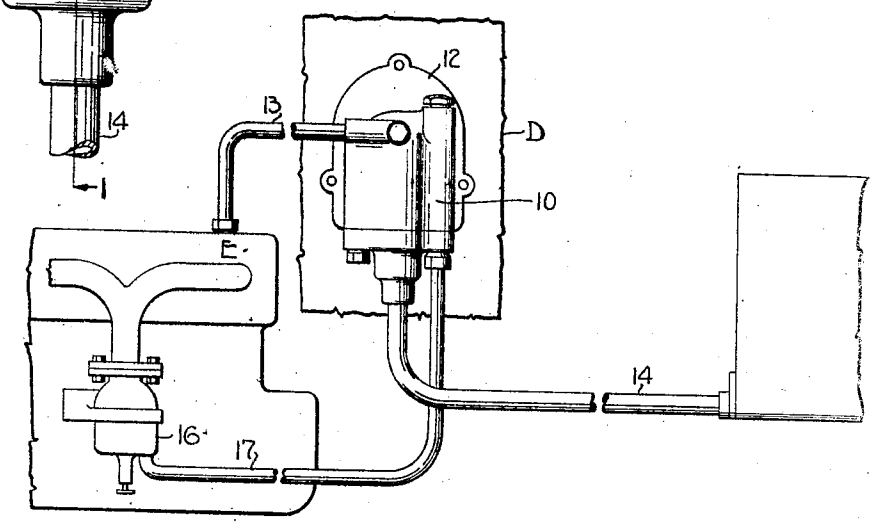


FIG 4



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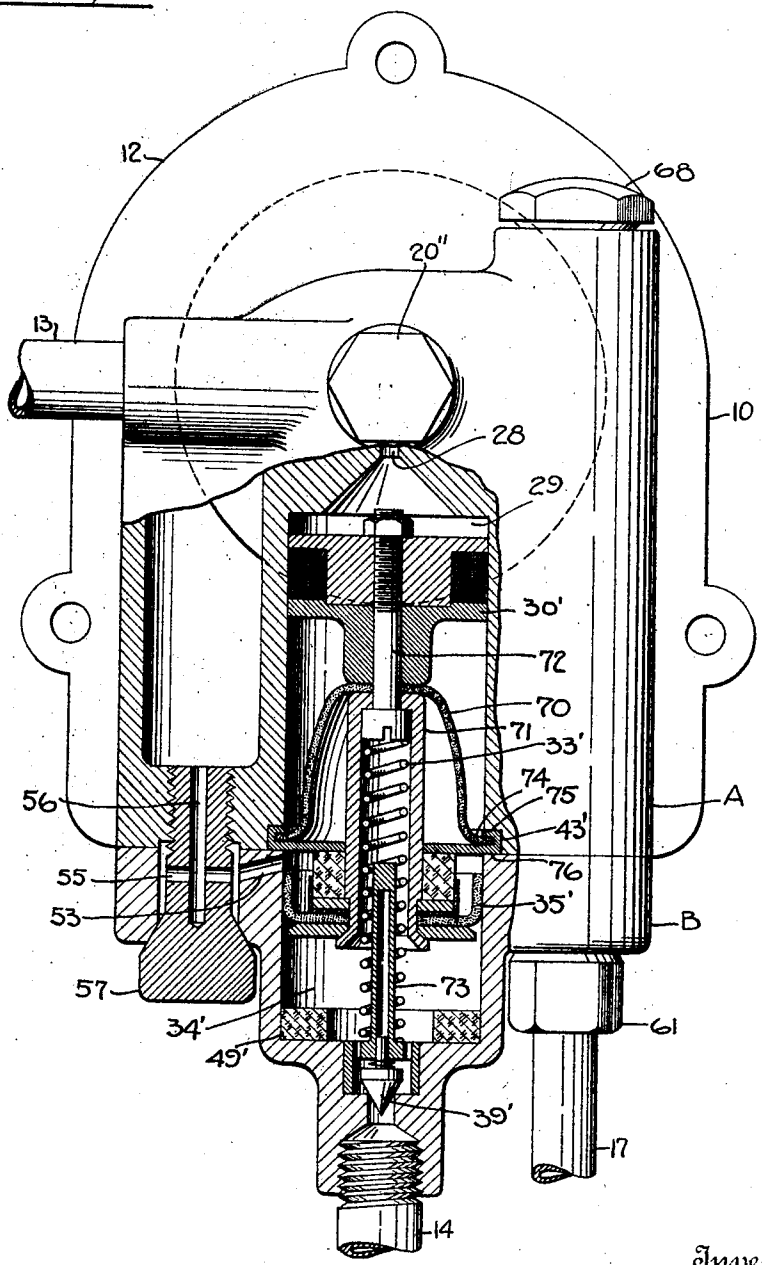
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4 SHEETS-SHEET 3

FIG 5



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4 SHEETS-SHEET 4

FIG 6

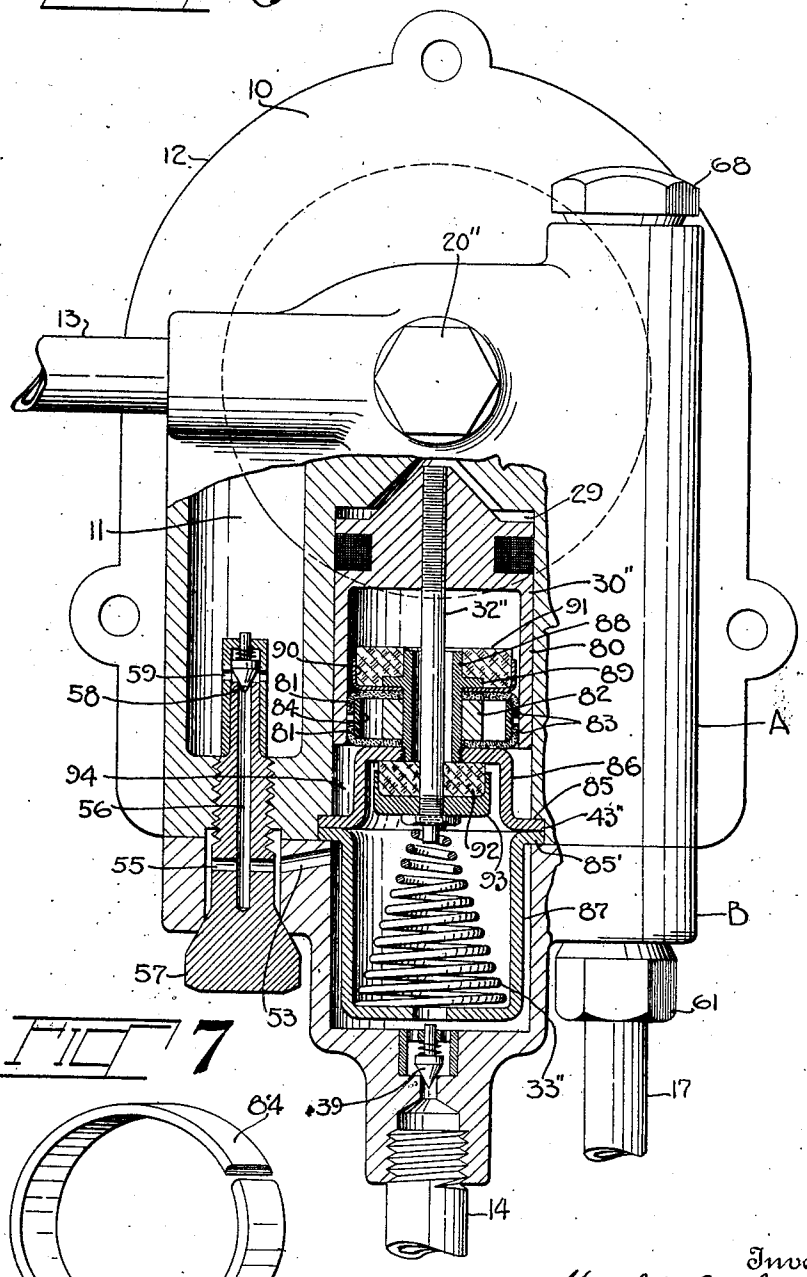


FIG 7

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Patented Jan. 23, 1923. 1,443,102

UNITED STATES PATENT OFFICE.

HAROLD C. SUEKERT, OF NEW YORK, N. Y., ASSIGNOR TO AUTOMOTIVE SUPPLY CO., INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

FUEL-DELIVERY APPARATUS.

Application filed November 4, 1919. Serial No. 335,648.

To all whom it may concern:

Be it known that I, HAROLD C. SUEKERT, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Fuel-Delivery Apparatus, of which the following is a specification.

My invention relates to devices for automatically delivering fuel from a supply tank to an internal combustion engine, and making use of a pressure pump operated from an engine cylinder.

One object of the invention is to provide an apparatus of this sort, which is entirely out of operation except when fuel is required to be pumped, whereby simplicity and long life of working parts is secured. This result is obtained in accordance with the present invention by the provision of means for automatically shutting off communication with the engine cylinder when the supply of fuel delivered is sufficient for the time being, and for opening up such communication when additional fuel is required. Thus the apparatus is entirely out of use when fuel is not required to be pumped.

Another object of the invention is the provision of a closed auxiliary fuel reservoir, from which fuel is delivered to the engine under pressure, so that loss by evaporation is avoided.

Another object of the invention is the provision of a fuel delivery conduit, leading from the auxiliary fuel reservoir, of such character that substantially all the fuel may be drawn off therefrom when needed, and the provision of means whereby any surplus air which gets into the reservoir may be delivered through the fuel delivery conduit without preventing the delivery of fuel.

Other objects of my invention will appear in connection with the following description of the construction and operation of certain embodiments of the invention.

In the drawings forming a part of this specification, Fig. 1 is a vertical sectional view of one form of device embodying my invention, taken substantially on the broken line 1—1, of Fig. 2. Fig. 2 is a side view, partly in central vertical section. Fig. 3 is a horizontal sectional view taken on line 3—3, Fig. 2. Fig. 4 is a diagrammatical view showing the apparatus connected with the engine, carburetor, and fuel tank of an automobile. Fig. 5 is a front view, partly in section, of a modified form of apparatus, in which a flexible diaphragm is substituted for the gland or stuffing box of the form shown in Figs. 1 to 4. Fig. 6 is a similar view of a further modification in which the separate pump piston is dispensed with and the packing device is of large area and is arranged within the skirt of the pressure piston. Fig. 7 is a detail perspective view of a spreading spring for use with the packing shown in Fig. 6.

The apparatus is indicated as a whole by reference numeral 10, and may be constructed in various ways. It may be conveniently formed, for example, by casting from preferably light material, such as aluminum. The casting may conveniently be in three separate pieces, as shown, consisting of the main casting A, the lower casting B, and a third or back casting C. The casting C may be secured to the principal casting A by screws C'.

The device has a hollow interior to provide a reservoir 11 for liquid fuel, as gasoline or the like. Said hollow interior 11, also preferably receives the working parts, though same may be otherwise located, if desired. The reservoir need not be large, as the auxiliary storage is required only for short intervals and the device may therefore be made quite small and compact. The back 12 of the device is preferably made flat so that it can conveniently be attached to a support, such as the automobile dash D. The connection to the source of operating pressure is obtained through pipe 13, shown connected to a cylinder of an automobile engine E. The gasoline or other liquid fuel is admitted through pipe 14, and the fuel outlet to carburetor 16 is through pipe 17.

The liquid fuel is maintained under pressure in the reservoir 11, which is not vented to the atmosphere, whereby loss of fuel by evaporation is prevented. The pressure pump, hereinafter referred to, serves to

maintain the supply of fuel in the reservoir under predetermined pressure. When the pressure exceeds a predetermined amount, communication with the engine cylinder is shut off automatically, and the pump does not operate again until the pressure in the reservoir falls, upon consumption of fuel, whereupon the communication is automatically restored and the pump goes into operation again. The pipe 13, leading from a source of pulsating pressure, such as found in the engine cylinder, communicates with passage 18 leading to the annular recess 19, which may be formed by cutting a groove in the adjustable member 20, screwed into the casting A and locked by screw plug 20′, the opening being closed with a plug 20″. The passage 21 in said member 20 is in communication with the annular recess or passage 19 through one or more holes 21′. See Fig. 2. The inner end of passage 21 provides an adjustable valve seat 22 for a needle valve 23, which controls the communication with the source of variable pressure.

Means actuated by the pressure of the fuel pumped into the reservoir are used to operate valve 23. In the form shown, a diaphragm 24, is made use of, and is exposed on one side (the left hand side, as the parts are shown in Fig. 2) to the pressure maintained in reservoir 11, and on the other side thereof is vented to the atmosphere at 25. Between the vented chamber 26, behind diaphragm 24, and the passage 21, the stem of valve 23 is passed through suitable packing means for preventing leakage about the valve stem. Good results are secured by making use of a bored cylinder 27 of graphite to form a packing about the stem of valve 23. This provides a self-lubricating packing, in which the valve stem moves readily.

It will be seen that when the reservoir 11, and therefore diaphragm 24, is under sufficient pressure, the pressure duct 21 is closed by valve 23. The valve seat 22 may be adjusted with respect to valve 23 so that the valve will be closed when the pressure within the reservoir reaches a desired point. It will be observed that diaphragm 24, as illustrated, is of comparatively large diameter, so that no great amount of pressure is necessary in order to close off the valve 23. Usually a few ounces pressure in the fuel reservoir is sufficient for the requirements of ordinary use, as in delivering fuel to the float valve chamber of the usual form of carburetors. Beyond the needle valve 23, passage 28 leads to the pressure cylinder 29, which contains piston 30, provided with suitable packing 31. Piston rings may be used if desired. To the piston 30 is secured the piston rod 32. Spring 33 exerts a resilient upward thrust on piston 30. Piston 30 and the piston rod 32 are reciprocated or oscillated by the combined effect of varying pressure upon the head of piston 30 and the action of spring 33. As the average pressure exerted upon the head of piston 30 increases, the spring 33 is compressed to a greater or less extent, and the region of movement of piston 30 under such increased average pressure is somewhat lower in cylinder 29 than when a less average pressure is available. When the average pressure acting on piston 30 is reduced, the spring 33 raises the piston and it reciprocates higher up in the cylinder. The reciprocation of piston 30, obtained in the manner described, is utilized for pumping liquid fuel, such as gasoline from a storage tank to the reservoir 11 where it is immediately available for the carburetor supply. In the form shown in Figs. 1–4, the bottom casting B is provided with a cylinder bore 34 in alignment with cylinder 29, and shown as being of about the same diameter, and the piston rod 32 projects into said cylinder 34 and serves to actuate the fuel pump piston 35. Such piston may be of various forms adapted to move the liquid fuel therewith in one direction of its movement, and when moved in the opposite direction to permit the passage of liquid fuel past the piston to be advanced on the next stroke. In the form shown, a leather cup piston 36 is illustrated, held between plates 37 and 38. As the piston is moved upward the liquid fuel is forcibly moved therewith and when it is moved down the fuel may flow past the sides of the flexible cup, as will be readily understood. A check valve 39 is provided for preventing backward flow of liquid fuel into supply pipe 14. A vent 40 to the atmosphere is provided below pressure piston 30 in order that piston 30 may be pressure actuated in an effective manner, and there can be no building up of pressure behind the piston, due to such slight leakage as may take place past the piston.

As this exposes the space around the piston rod 32 to the atmosphere, it becomes necessary to provide suitable stuffing means for said piston rod 32, which will prevent inward passage of air or outward passage of the gasoline or other liquid fuel being pumped. An effective form of packing or stuffing for this purpose may be obtained in the manner illustrated in the drawings. 41 is the outer stuffing box member, having a bottom flange 42 adapted to be seated in the recess 43 in the bottom of the main casting A, and 44 is the inner stuffing box member which is provided with a flange 45 similar to flange 42, and also received in recess 43, so that when the parts are assembled, the packing in the intermediate packing

chamber 46 is compressed somewhat. The packing in the chamber 46 preferably consists of cotton, yarn or the like 47, located between a pair of preferably conical washers 48, of cork or similar material, and adapted to hug closely about the piston rod 32, and with the interposed wicking, yarn or the like 47, to provide effectively against leakage past the reciprocating piston rod 32.

With the extreme pressure variations encountered in the cylinder of an internal combustion engine, the piston 30, exposed thereto, is subjected at times to severe shocks. Means are provided for damping or cushioning the shocks to which piston 30 and parts connected thereto are subjected, and in the form shown in Figs. 1–4, a ring 49 of cork is provided and is seated upon the flange 42 of the packing shell 41. A metallic ring or thimble 50 is provided to support the inner wall of said cushion member 49, and between said members 50 and 41 an annular space 51 is left which serves conveniently for the reception of the lower portion of the piston spring 33. The cushion member 50 serves as a cushioning device against downward shocks, and a second cushioning member 52 is provided to cushion upward shocks or recoil of piston 30. In the form shown this cushion member 52 is also of cork, and encircles piston rod 32 between the plate 45 and piston 35 and reciprocates with the piston rod 32. Felt also makes a good cushioning material and when equipped with cushions of this material the operation of the apparatus is practically noiseless.

The liquid fuel, such as gasoline and the like, delivered by piston 35, is pumped into reservoir 11. In the form shown in Fig. 1, it is delivered through the side passage 53 to an annular chamber 54 in the casting B, whence it passes through openings 55 and 56 provided in the screw threaded plug 57, past the check valve 58, and out through openings 59 into the reservoir 11. The screw threaded plug 57 with a similar plug on the opposite side of the device, may be used for connecting castings A and B firmly together if desired.

The pressure control of the pumping apparatus by valve 23 has already been described, and it will be apparent that, as the pump is operated, fuel is sucked through pipe 14, delivered under pressure to reservoir 11, and is available to supply the carburetor through pipe 17, and that when the pressure in the reservoir 11 gets sufficiently high, the valve 23 is shut off by diaphragm 24, and the pumping stopped until some of the gasoline has been used up and the pressure reduced. It should be observed here that more or less air is always contained in the reservoir, and of course collects at the upper part thereof, so that by putting such air under pressure, more or less compression of the total contents of the reservoir is possible.

However, it is possible at times, as, for example, when the gasoline is low and splashing about in the supply tank, to pump an unduly large proportion of air into the apparatus, and unless provision is made to take care of this situation, air, instead of gasoline, may be delivered to the carburetor, resulting in stoppage of the engine. This situation is taken care of by the discharge conduit arrangement shown in Fig. 1. The outlet pipe 17 is connected to the screw threaded bored plug 61 which has an extension 62 projecting upwardly into the interior of reservoir 11 to a point preferably near the top thereof. Such pipe 62 is surrounded by the larger pipe or conduit 63, which is closed at its upper end and extends downwardly to its open end at a point near the bottom of the reservoir 11, as shown at 64, Fig. 1. This provides a simple form of siphon outlet for delivering fuel from the lower part of reservoir 11. Fuel rises in the annular space 65 around the pipe 62 passes into the upper end of pipe 62, and is delivered thereby to the outlet pipe 17. Once the siphon column is formed in the siphon consisting of pipes 62 and 63, said pipes will remain filled with fuel until the reserve supply in reservoir 11 gets to be lower than the siphon inlet 64 and the reservoir is substantially drained.

Provision is made for conducting air accumulating in the upper portion of the reservoir to the outlet pipe and delivering same to the outlet conduit to a point below the siphon inlet 64, so that the air will be carried out along with the gasoline and removed from the interior of the reservoir 11. In the form shown, a relatively small pipe 66 is provided for this purpose, and extends downwardly within pipe 62, to a point near the bottom of plug 61, and is in communication with the interior of reservoir 11 near the top thereof, as by means of ducts 67. This pipe 66, as well as the larger or outermost pipe 63, is shown carried on a plug 68 screwed into the upper portion of casting A, which, with plug 61, provides for the convenient assembly of the various parts of the outlet apparatus. It will be apparent that when the liquid in the reservoir 11 gets above the ducts 67 it is discharged through pipe 66, as well as through pipe 62, and that an air space is left above ducts 67 so as to always have more or less air in the reservoir, and to enable the contents of the reservoir to be kept under pressure. Also it will be apparent that when the apparatus is inverted, as may happen, for example, in use with airplane motors, fuel may be delivered to pipe 17 through the ducts 67 and pipe 66.

The modified form shown in Fig. 5 differs principally from that shown in Figs. 1–4,

by the substitution of a flexible diaphragm 70 for the stuffing box or gland. Such diaphragm may be conveniently constructed of leather impregnated with material insoluble in the liquid fuel, as gasoline, and adapted to close the pores of the leather or other flexible material. Leather impregnated with Other suitable materials may be used, however. With the use of diaphragm 70, the piston rod and spring construction are also bakelite may be made use of to advantage. preferably modified somewhat. In the form shown in Fig. 5, the pump piston 35′ is attached to a hollow sleeve 71 secured by screw 72 to the pressure piston 30′, and the spring 33′ for actuating piston 30′ to move upwardly is received within the hollow sleeve 71, and extends downwardly over a guide stem 73 attached to the cage of the check valve 39′. Also the cushioning ring 49′ is placed at the bottom of the pump cylinder 34′ instead of being placed directly below the pressure cylinder. The center of diaphragm 70 is clamped between the pressure piston 30′ and sleeve 71, and its outer margin 74 is received under the inturned flange 75 of plate 76, received in recess 43′, and adapted to be clamped tightly upon the margins of the diaphragm 70 when the casting parts A and B are secured together.

Apparatus as so far described operates as follows:—

The pressure piston is reciprocated by the combined effect of varying pressure on the top thereof and the spring beneath it. This operates the pump piston and delivers gasoline under pressure to the reservoir 11. The pressure piston and the pump piston may work at various heights in their respective cylinders, according to the average pressure acting on the pressure piston head, the spring under the pressure piston being compressed more or less, as such average pressure varies from time to time, but the cylinders are sufficiently elongated to permit pumping action to take place with the varying average pressures available when connected to a source of variable pressure, such as the cylinder of an internal combustion motor. When the pressure in reservoir 11 becomes sufficiently high, according to the position in which the adjustable valve seat 22 has been set, the communication between the source of pressure and the pressure cylinder is shut off by the pressure on diaphragm 24 closing valve 23. When the gasoline runs out to the carburetor and reduces the pressure, valve 23 is automatically opened and the pumping is recommenced. If an unduly large amount of air should get into the reservoir 11 in any way, it is discharged through the openings 67 and pipe 66 with the gasoline, which passes upwardly through pipe 63 and downwardly through pipe 62; but sufficient air is always left in the apparatus to enable the desired pressure to be obtained by compression thereof, since when the gasoline rises to the level of the duct 67, only gasoline is discharged and the remaining air is retained.

With the construction shown in Fig. 6 the separate pump piston is dispensed with, and the apparatus is constructed to operate as a simple form of pulsation pump. The pressure piston 30″ is provided with a skirt or flange 80 which encircles a relatively fixed gland member, having large wearing surface and consequently long life. As shown said gland comprises a pair of faced cups 81, 81 of flexible material such as leather, separated on their interiors by a ring 82 and having their marginal portions 83 pressed outwardly into engagement with skirt 80 by the expansion ring 84 (Fig. 7) inserted therein. The flanges 85 and 85′ of a pair of apertured metallic cups 86, 87 are held in recess 43″, and the collar or sleeve 88 having a flange 89 is screwed into a threaded opening in cup 86 and holds the composite gland structure in place, the flanged washer 90 being inserted between the upper leather cup 81 and said flange 89. A bumper 91 of felt, cork or the like, serves to cushion the piston shocks on the down stroke, and a similar bumper 92 serves to cushion shocks in the opposite direction, being received within the flanged washer 93, on the piston rod 32″. Spring 33″ interposed between piston rod 32″ and the bottom of cup member 87 serves to thrust the piston 30″ upwardly.

With this arrangement a considerable amount of open space is provided below the piston 30″ and above the fuel entering through valve 39, the upper portion whereof is normally filled with air above the liquid fuel, and the pulsations of piston 30″ are communicated to the fuel through the intermediation of such air. The pumping operation differs from that of the remaining figures, in that the delivery of fuel to reservoir 11 takes place on the down stroke of piston 30″. It is to be understood, of course, that the space 94 under piston 30″ is vented to the atmosphere, substantially as shown in Fig. 2, so that back pressure cannot build up therein. It will be seen that the gland in this construction has large surface so that wear thereon is well distributed, and further, that it is self-adjusting for wear, the expansion of the spring ring 84 serving to take up whatever slight wear there is. With the exceptions noted above, the operation is the same as already explained with reference to the other forms illustrated and described.

It is to be understood that the forms illustrated are intended only for the purpose of affording a clear understanding of the invention, and that modifications and changes

may be resorted to within the scope of my claims without departing from the invention or sacrificing the advantages thereof.

I claim:

1. A pulsation pump comprising a piston spring actuated in one direction and adapted to be operated by pulsating pressure in the opposite direction, means for connecting the pump with the pressure side of the piston in communication with the cylinder of an internal combustion engine for supplying a source of pulsating pressure, a reservoir to which liquid fuel is supplied by the pump under pressure, and means whereby the communication between the source of pulsating pressure and the pump is controlled by the pressure in the reservoir.

2. A pulsation pump comprising a piston spring actuated in one direction and adapted to be operated by pulsating pressure in the opposite direction, means for connecting the pump with the pressure side of the piston in communication with the cylinder of an internal combustion engine to supply a source of pulsating pressure, a reservoir to which liquid fuel is supplied by the pump under pressure, and adjustable means whereby the communication between the source of pulsating pressure and the pump is automatically controlled by the pressure in the reservoir.

3. A pressure actuated pump, means for connecting said pump to the cylinder of an internal combustion engine for supplying a source of varying pressure for operating the pump, a reservoir to which liquid fuel is supplied under pressure by said pump, a diaphragm exposed to the pressure in the reservoir, and means actuated by movement of the diaphragm for controlling the communication between the pump and the source of pressure.

4. A pulsation pump comprising a piston spring actuated in one direction and adapted to be operated by pulsating pressure in the opposite direction, means for connecting said pump with the pressure side of said piston in communication with the cylinder of an internal combustion engine for supplying a source of pulsating pressure, a reservoir wherein liquid fuel is pumped by the pump under pressure, and means operated by the pressure in said reservoir for controlling the operation of the pump by shutting off and opening up communication between the pump and the source of pulsating pressure.

5. A pressure pump, means for connecting said pump with the cylinder of an internal combustion engine for supplying a source of variable pressure for operating the pump, a closed reservoir for liquid fuel pumped by the pump and means operated by differences in pressure between the interior of the reservoir and the outside atmosphere for controlling the communication between the source of pressure and the pump.

6. A pressure actuated fluid pump, means for connecting the pump with the cylinder of an internal combustion engine for supplying a source of varying pressure therefor, a reservoir to which liquid fuel is supplied under pressure by the pump, a flexible member exposed to the reservoir pressure, and a valve operated from said flexible member to open and close communication between the source of pressure and the pump.

7. In fuel delivery apparatus, the combination of reciprocable pump actuating means adapted to be exposed on one side to a source of varying pressure, and having its other side exposed to the atmosphere, a spring for moving said means in opposition to its movement under pressure, a fuel pump operated by said actuating means, and means actuated by the pressure of fuel pumped for controlling the communication between said pump actuating means and the source of pressure.

8. In fuel delivery apparatus, the combination of a reciprocable pump operating member, spring means applied to one side of said member, varying pressure means applied to the opposite side of said member, a fuel pump operated from said member, a closed reservoir for fuel pumped thereby and from which the fuel is delivered under moderate pressure, and means exposed on one side to the pressure within said reservoir for controlling the application of pressure to said member.

9. A reservoir to which liquid fuel is supplied under pressure, and an outlet conduit therefor extending from near the bottom of the reservoir to near the top thereof and then downwardly.

10. A reservoir to which liquid is supplied under pressure, an outlet conduit for taking fluid from near the bottom of the reservoir, and an air conduit extending within the outlet conduit and communicating with the reservoir at the upper part thereof.

11. A reservoir to which liquid is supplied under pressure, a fluid outlet conduit therefor comprising a sleeve open at the lower end and extending upwardly in the reservoir from near the bottom thereof, and an outlet pipe extending upwardly within said sleeve and open at the upper end thereof.

12. A reservoir, means for supplying liquid thereto under pressure, an outlet conduit therefor extending to near the top of the reservoir, and an enclosure for said conduit having an opening near the bottom of the reservoir.

13. A reservoir, means for supplying liquid thereto under pressure, an outlet conduit therefor, and means for conducting air trapped in the reservoir into the conduit at a substantial distance below the opening thereto.

14. The combination of a fuel reservoir, means for supplying liquid fuel thereto under pressure, a siphon outlet conduit having its opening near the bottom of the reservoir and extending upwardly therein and then down and out, and means for conducting air from the upper part of the reservoir into the stream of outgoing fuel, whereby trapped air is discharged without interfering with the delivery of liquid fuel.

In testimony that I claim the foregoing, I hereto set my hand, this 3rd day of November, 1919.

HAROLD C. SUEKERT.