

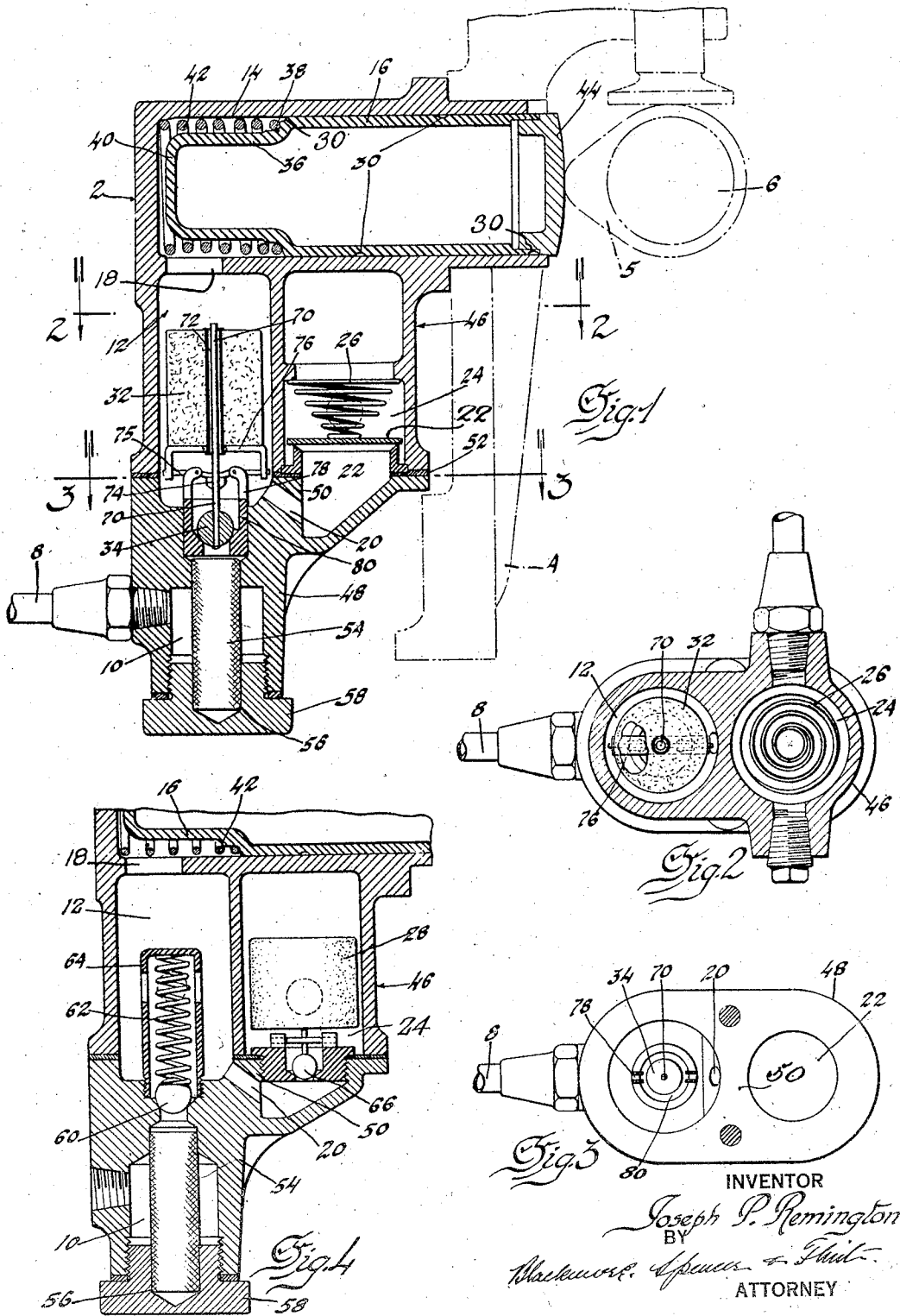
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FUEL PUMP

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UNITED STATES PATENT OFFICE

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FUEL PUMP

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This invention relates to pumps of the type shown in my prior applications Serial No. 508,076, filed Oct. 17, 1921, and Serial No. 714,409, filed May 19, 1924.

One of the objects of this invention is to increase the capacity of pumps of the type shown in my said prior applications in which a body of gas is interposed between the actuator and the fluid operated upon. This object has been accomplished by providing means in addition to the usual suction of the pump for positively seating the outlet valve, thereby decreasing the period of time required for the closing of the valve, and thus enhancing the volumetric efficiency of the pump. The means which I have provided operates by spring tension or by gravity to tend to maintain the said valve in closed position and to speed its seating when the unseating pressure has been removed.

One of the difficulties heretofore encountered in pumps of this character has been that after a period of continuous operation the body of gas between the actuator and the fluid operated upon becomes so rarefied or loses its density that subsequent actuation of the pump results merely in idle compression and expansion of such rarefied gas without any appreciable transmission of force to the liquid which is to be moved. When this condition arises the pump is said to be "vacuum bound." It is a special object of my invention to improve the construction of pumps of this type so that it will be impossible for this condition to arise. This object I have accomplished by the provision of means for replenishing the supply of gas in the pumping chamber when the pressure of said gas falls to such an extent as to impair the operation of the pump. In the embodiment shown this means consists in the provision of an opening or bleed passage establishing communication between the body of gas in the pumping chamber and a larger body or reservoir of gas of preferably relatively constant and, when the condition of being "vacuum bound" is approached, of temporarily higher pressure, said reservoir of gas being either the engine crankcase or the atmosphere itself.

It is another object of my invention to provide, in connection with the device for preventing pumps of this type from becoming "vacuum bound," which device may be regarded as means for preventing diminution of pressure of said body of gas in the pumping chamber below a certain minimum, means for preventing diminution in the volume of said gas below a certain minimum, the two means cooperating to insure a sufficient pressure and volume of gas in the pumping chamber as to enable effective operation. Specifically, I have provided in combination with the bleed opening, previously described, a float operated valve for limiting the amount of fluid entering said pumping chamber and, since the fluid that does enter the chamber displaces the gas, I thus prevent a reduction in the volume of the latter below a certain minimum value.

The disclosure of this application also constitutes an improvement upon the devices shown in my prior application Serial No. 714,409 in that more satisfactory seating and sealing means has been provided between the two main casing members of which the pump is composed, and the passage leading from the pumping chamber to the delivery chamber has been arranged in a novel manner.

I have also disclosed herein an improved construction of filter for incorporation in my pump, among the advantages of which are simplicity and ready accessibility for cleaning purposes.

As a further improvement in pumps of the type described I have provided, in one form of my invention, an improved inlet valve for the pumping chamber, said valve being so conditioned as to make its operation impossible when acted upon only by the head of liquid in the reservoir which supplies the pump with fluid. In the form shown, the said valve is yieldingly held in closed position, the force tending to seat it being greater than that exerted by any reasonable head of fluid in the reservoir but less than that exerted by the pump in its suction stroke under normal conditions of operation.

A further object of my invention is to improve continuously operated pumps by the provision of means whereby the outlet valve is rendered inoperative under predetermined conditions, the pump thereupon running idly without effective pumping action, and excessive pump pressures being avoided. This means for disabling pump operation may be resorted to in pumps of the type wherein a body of gas is interposed between the actuator and the fluid operated upon and wherein, preferably, a confined body of gas is provided on the discharge side of the outlet valve, the action of the pump, when disabled under such conditions being merely to cause the liquid between the two confined bodies of gas to surge back and forth without any pumping action.

It is a further object of my invention to provide a construction such as just outlined in combination with an inlet valve, said inlet valve being preferably so conditioned as to prevent its opening when acted upon solely by the pressure of the head of liquid in the reservoir which supplies the pump.

It is an additional object of my invention to improve the construction and operation of the type of pump heretofore mentioned and wherein a check valve is employed on the intake side of said pump, by the provision of means, preferably a float, controlled by the level of liquid in the pumping chamber for positively holding said valve upon its seat. In this connection I have also improved the mechanism whereby the float operates the valve in certain details of construction. Thus I have incorporated in the said mechanism a mechanical advantage whereby the buoyant force acting on the float is in effect multiplied.

Other objects and advantages of the invention will appear from the following description taken in connection with the accompanying drawing, in which:

Figure 1 shows a sectional view of my improved pump, in assembled relation, the operating means and portions of the crankcase being indicated in dotted lines;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a section on line 3—3 of Figure 1; and,

Figure 4 is a fragmentary sectional view of a modified form of the invention.

I shall first describe the general layout of my pump, following this by a detailed description of the improvements which it is the object of this invention to disclose and claim, taking up these improvements in the order in which they appear in the statement of objects of invention and in the claims.

Referring now particularly to Figure 1, the reference numeral 2 indicates the pump housing, which is preferably so formed as

to be readily bolted or otherwise secured to a conventional automobile crankcase shown at 4 in proximity to one of the cams 5 on the usual valve operating cam shaft 6, which in this case also functions as the pump operating means. However, the specific means for operating the pump forms no part of my invention and may be varied as desired.

The pump housing is so constructed as to provide a filter chamber, a pumping chamber, and a delivery chamber. A conduit 8 leading from the main or supply reservoir, (not shown), delivers fluid to the filter chamber 10 from which it is drawn into the pumping chamber during the intake strokes of the pump in its normal operation. The pumping chamber 12 is of composite formation and comprises a cylinder 14 within which moves a piston 16, hereinafter called the pump actuator, driven from the cam shaft 6 previously described. While I have preferred to show an actuator of the piston type it is obvious that any other form of actuator may be used, the requirements being only that some mechanism be provided for producing pulsations in the pumping chamber. Indeed, it is obviously within the scope of my invention to use as a substitute for actuators of more conventional type, the usual pistons of an internal combustion engine, these pistons having, as usual, a secondary function as pumps, and producing the well known pulsations or breathing in the crankcase. These pulsations may be used for pumping purposes either with or without an intervening diaphragm all of which is old in the prior art as illustrated by the patent to Olds, No. 792,158 granted June 13, 1905. The cylinder 14 has practically unrestricted communication by way of an orifice 18 with chamber 12, while this latter chamber is connected by a passage 20 with a second chamber 22 which communicates with the delivery chamber 24. The cylinder 14, the chamber 12, the passage 20, and the second chamber 22 together constitute the composite pumping chamber. It is into this composite pumping chamber that the fluid is drawn from the main reservoir during the intake strokes of the pump, and it is from said composite chamber 24 that the fluid is forced into the delivery chamber during the discharge strokes of the pump. While under particular conditions pumping action may be secured without the use of valves between the pumping chamber and the parts in communication with it, the usual float valve provided in connection with the carburetor, (not shown), being relied upon to prevent the discharged fluid from returning to the pumping chamber, I have nevertheless found the valve arrangements hereinafter described, to be of value in increasing the effectiveness of the pump.

For some purposes it is desirable that a

body of gas be interposed between the pump actuator 16 and the fluid operated upon and to this type of pumping action certain of the features of my invention relate while, as to certain other features, it is immaterial whether such a body of gas be provided or whether the pistons be in direct contact with the fluid which is to be moved.

I shall now describe the means which I have provided for increasing the efficiency of pumps of the type just described, wherein a body or cushion of gas is interposed between the pump actuator 16 and the fluid operated upon. Referring now to Figures 1 and 4, it will be noted that in each form of my invention I have provided means for positively closing the outlet valve, this means, in the structure shown in Figure 1, taking the form of a spring 26 co-operative with the disk valve 22', while in the structure shown in Figure 4 the weight of the float 28 normally performs the same function with respect to a ball valve 66. With this positive valve closing means the capacity of the pump is increased for the closing of the outlet valve takes place more rapidly than when, as in prior constructions, the return flow of liquid to the pumping chamber is relied upon to close the valve. This arrangement is of particular advantage in pumps wherein a cushion of gas is utilized, for, at best, in this type of pump a large portion of the stroke of the piston actuator 16 is spent in compression and expansion of the gas preliminary to the transmission of pumping force to the fluid which is to be moved. It is therefore highly desirable that the remaining portion of the stroke of the piston actuator 16 be made as effective as possible in its pumping action.

I shall now describe the means for preventing the pump from becoming "vacuum bound." This condition, as previously stated, arises when after continued pumping the body of gas interposed between the actuator 16 and the fluid becomes so rarefied that subsequent operation of the pump results merely in idle expansion and contraction of the gas without the transmission of any appreciable pumping effort to the fluid which it is desired to move. The means which I have provided for overcoming this difficulty consists of a bleed or passage communicating with the body of gas and with a body of gas which, at least at times when the "vacuum bound" condition is approached, is at a higher pressure than the body of gas in the pump. Preferably, this bleed has communication with the atmosphere and, in the form shown, I have preferred to have the communication with the atmosphere be indirect, through the intermediary of the engine crankcase. Specifically, I have provided a spiral groove 30 establishing communication between the

body of gas and the crankcase, the groove being preferably made in the wall of the actuator 16, although this is not essential. In some cases a loose fit of the piston in the cylinder, as described in my copending application 714,409, will serve the same purpose as the groove.

In the normal operation of the pump with the body or cushion of gas at normal pressure, the action of the pump is so rapid that there is very little, if any, flow of gas through the bleed 30 but should the pressure of the body of gas in the pumping chamber 12 fall very low, air or gas will flow through the bleed groove 30 in such volume as to relieve the vacuum which was in process of forming. The bleed 30 will also function effectively when the motor is stopped to restore the cushion of gas to normal pressure.

In the form shown in Figure 1, I have combined the structure just described, which may be termed means for preventing diminution in the pressure of the body or cushion of gas below a certain minimum, with additional means for preventing diminution in the volume of said body or cushion of gas below a certain minimum. One form of this latter means has been disclosed and claimed in my prior application Serial No. 714,409 previously referred to. Broadly, this means comprises a float 32 in the pumping chamber 12 which, when operated by the rising of the fluid in said pumping chamber to a certain level, forces a valve 34 firmly down upon its seat, shutting off the flow of fluid into said pumping chamber. As the specific means whereby the float 32 operates the valve 34 constitutes another novel feature of my invention it will be hereinafter described in detail. Suffice it to say that by the provision of the air bleed 30 and the float operated valve 34 I have insured the presence of a sufficient pressure and volume of gas in the pump chamber 12 as to insure effective operation of the pump at all times.

Referring now to Figure 1 it will be seen that the actuator piston 16 hereinbefore referred to as indicated by the reference character 16, is in the form of a hollow cylinder having a reduced end portion 36, preferably closed. By the provision of this reduced end portion a shoulder 38 is formed, between which and the closed end 40 of the cylinder 14 is located a coil spring 42 constantly tending to force the actuator piston 16 outwardly in opposition to the cam 5. The other end of the actuator piston 16 is closed by means of a cap 44 preferably of hardened metal in order that it may successfully withstand the wear resulting from constant contact with the cam 5.

I shall now describe the improvement which I have made in the pump casing and particularly in the seating and sealing

means between the two main casing members and in the arrangement of passages therein. Referring now to Figure 1, it will be observed that the pump casing, indicated generally by the reference character 2, is composed of two members, the upper member 46 of which is formed to provide the cylinder 14, the major or upper portion of the pump chamber 12, the delivery chamber 24, and the upper portion of a second chamber 22, while the lower portion 48 is formed to provide the filter chamber 10, the lower portion of the pump chamber 12, and the lower portion of the second chamber 22. It will also be observed that the passage 20 is entirely within the lower casing member 48, and pierces the partition 50 which is between the chamber 12 and the second chamber 22. The upper portion of the partition 50 thus serves as a bridge to assist in supporting the gasket 52 which is placed between the two casing members 46, 48. This permits a more effective sealing of the joint between the two casing members 46, 48 and the use for that purpose of a gasket 52 which is not easily displaced or distorted.

I now direct attention to the filter chamber 10 wherein is located a cylindrical screen type of filter 54, its upper end snugly fitting the passage leading to the inlet valve 34 of the pumping chamber 12, and its lower end resting in a seat 56 formed in a screw cap member 58 which closes the lower end of the filter chamber 10. The conduit 8 leading from the main reservoir, it will be noted, has communication with the filter chamber 10 through an aperture in the side wall thereof. With this construction when it is desired to clean the filter 54 it is merely necessary to unscrew the cap 58 and remove said filter whereupon it may be conveniently cleaned and replaced.

One of the difficulties heretofore encountered in the type of pump in which a gas cushion is provided in the pumping chamber has been the flooding of the pump when the inlet valve was subjected to the action of a considerable head of liquid in the main reservoir and connecting pipes, this condition arising particularly when the car is parked on an incline. One means of overcoming this difficulty has been the provision of a float operated inlet valve such as shown at 34 in Figure 1 and also in my prior application Serial No. 714,409. In Figure 4, I have disclosed another and somewhat different means for accomplishing the same object. In this form of my invention the float operated inlet valve 34 is replaced by a ball valve 60 which is normally held in closed position by a conditioning means, here shown as a spring 62, said spring located within and reacting against the closed in end of a tubular casing 64 fastened to the pump housing and projecting into the

pumping chamber 12. With this construction it is possible to condition the inlet valve 34 or 60, as by the selection of a spring 62 of proper strength, so that it will remain closed when subjected to the pressure of any reasonable head of liquid in the main reservoir, but will open when subjected to the suction of the pump on the intake stroke with or without assistance from the head of liquid in the supply reservoir and connecting piping 8.

I have also provided in one of the forms of my invention means associated with the outlet valve for rendering said valve inoperative under certain conditions. Referring again to Figure 4, it will be noted that the outlet valve 66 is connected with float 28 as previously described and is guided for vertical movement. Accordingly, when the demand for fluid has been temporarily supplied, the fluid in the delivery chamber 24 having risen to a predetermined level, the ball valve 66 is moved off its seat, thus tending to render the pump inoperative on its delivery side. Flooding of the carburetor by excessive pump pressure is thus avoided.

In this particular embodiment the delivery chamber 24 is provided with a confined body or cushion of gas, thereby serving as an equalizing dome to insure a steady outflow of fluid. The level of fluid in the delivery chamber 24 will depend upon the pressure in the equalizing dome and this, in turn, upon the head of fluid in the system beyond said delivery chamber. Consequently the means for rendering the outlet valve 66 inoperative may be regarded not only as dependent upon the level of fluid in the delivery chamber 24 but, alternatively, upon the pressure in the said delivery chamber. The delivery chamber 24 is, of course, broadly considered, nothing but a reservoir for the pumped fluid.

Another advantage of the device, for rendering the outlet valve 66 inoperative, is that when used in a pump of the type in which a body or cushion of gas is interposed between the actuator 16 and the fluid operated upon, and in which a second body or cushion of gas is provided in the delivery chamber 24, the pumping action is more effectively cut out when the demand for fluid has been temporarily supplied; this because the surging of fluid which takes place in the pump is between the two bodies or cushions of gas and is more effective than surging in the conduit leading to the main reservoir, as in the construction of my prior application Serial No. 714,409.

This means for rendering the outlet valve 66 inoperative under predetermined conditions is not restricted in its application to systems in which an inlet valve is provided nor, when such valve is provided, to use in connection with the particular type of inlet valve

60 with which it is shown in cooperation in Figure 4. However, when it is used in connection with an inlet valve 60 of the type shown in Figure 4 which is so conditioned as to remain closed when acted upon solely by the pressure of the head of liquid in the supply reservoir, a simple, compact, and effective system is provided which avoids flooding of the pump when the car is parked upon a hillside and also flooding of the carburetor owing to excessive pump pressure.

I shall now describe my improved form of float controlled inlet valve. Referring again to Figure 1, it will be remembered that the valve 34 is, under predetermined conditions, held upon its seat by the action of float 32. The stem 70 of the valve 34 is guided for sliding movement in an aperture 72 in the float 32, and is provided adjacent its lower end with an enlargement 74 adapted to be engaged by the short arms of levers 75 having their other extremities loosely connected to a strap 76 secured to the bottom of the float 32 and being pivoted at intermediate points to arms 78 projecting upwardly into the pumping chamber 12 and preferably formed integrally with the member 80 in which is formed a seat for the valve 34. In the normal operation of the device, the valve 34 is controlled by the operation of the pump without restraint from the connections just described. However, it will be seen that as the level of the fluid in the pump chamber 12 rises the float 32 will be carried with it and in doing so will rock the levers 75 upon their axes so that their opposite inner ends will engage the enlargement 74 on the valve stem 70 and hold the valve 34 upon its seat. This construction has the advantage that the slight buoyant force of the float 32 is, in effect, multiplied by virtue of the mechanical advantage in the lever system.

While I have shown and described illustrative embodiments of my invention, I desire it to be understood that my invention is not limited thereto, but is only restricted to the extent called for by the following claims.

What I claim is:

1. In a pump wherein a body of gas is interposed between an actuator and the fluid operated upon with a second body of gas influencing the outlet valve so that the fluid is pumped between two cushioning bodies of gas, the combination of an engine crankcase associated with said pump, and a spiral bleed conduit in the actuator of limited flow capacity for establishing communication between the first mentioned body of gas and the body of gas in the engine crankcase.

2. In a pump wherein a body of gas is interposed between a piston and the fluid operated upon with a second body of gas influencing the outlet valve so that the fluid is pumped between two cushioning bodies of gas, the combination of an engine crankcase

associated with said pump, and a limited-flow spiral passage in the piston wall for establishing indirect communication between the first mentioned body of gas and the body of gas in said crankcase at a relatively constant but, at times, higher pressure.

3. In the combination as set forth in claim 2, said passage being in the form of a spiral groove.

4. In a pump wherein a body of gas is interposed between an actuator and the fluid operated upon with a second body of gas influencing the outlet valve so that the fluid is pumped between two cushioning bodies of gas, the combination of an inlet valve subject to conditioning means that serves to prevent diminution in the first mentioned body of gas below a certain degree, and a spiral bleed groove in the actuator precluding diminution in the pressure of said body of gas below a predetermined minimum.

5. In the combination as set forth in claim 4, said conditioning means comprising a float in the pumping chamber, and a fluid cut-off under control of a motion-multiplying means operated by said float.

6. In the combination as set forth in claim 4, said bleed means comprising a spiralized passage establishing communication between the first mentioned body of gas and the atmosphere.

7. In a pump wherein the fluid is pumped between two cushioning bodies of gas, the combination of a unitary casing member embodying individual pumping and delivery chambers positioned at each side of a common separating wall, a second member completing and closing-in the open ends of both chambers and seating on said wall, the second member including a filter chamber, a gasket interposed between said members, and a passage formed entirely within the body of the second member to afford communication between the pumping and delivery chambers.

8. In a pump wherein the fluid is pumped between two cushioning bodies of gas, the combination of a casing member in part providing individual pumping and delivery chambers as well as a separate filter chamber; a second casing member completing and closing-in the first mentioned chambers and having a passage therethrough affording communication between the pumping and delivery chambers; said filter chamber having an open end, an inlet to the filter chamber, an outlet therefrom into the pumping chamber; a cylindrical screen in the filter chamber arranged between the inlet and the outlet, and a removable cap for closing the end of the filter chamber and securing the aforesaid screen in position.

9. In a pump in which a body of gas is interposed between an actuator and the fluid operated upon with a second body of gas

influencing the outlet valve so that the fluid is pumped between two cushioning bodies of gas, the combination of a fluid reservoir, a pumping chamber in communication with said reservoir, an inlet valve in said chamber adapted for actuation by changes of pressure in the pumping chamber produced by normal operation of the pump, and float-controlled motion-multiplying means for so conditioning said inlet valve as to prevent its opening when acted upon solely by the pressure of a head of liquid in the fluid reservoir.

10. In the combination as set forth in claim 9, said conditioning means tending to hold the inlet valve to its seat under a reasonable head of liquid pressure, but permitting its opening by the suction stroke of the pump with—or without—assistance from the first mentioned body of liquid.

11. The combination as set forth in claim 9, with an outlet valve for the pumping chamber, and means in connection with said outlet valve for rendering the same inoperative when the demand for fluid has temporarily been supplied.

12. The combination as set forth in claim 9, with a reservoir to receive fluid from the pump, an outlet valve for the pump chamber, and means controlled by the pressure in the last-mentioned reservoir for rendering said outlet valve inoperative.

13. In a pump wherein the fluid is pumped between two cushioning bodies of gas, the combination of a composite pumping unit comprising communicating chambers, a pump actuator therefor, and an inlet valve subject to float and motion-multiplying conditioning means controlling communication between said pumping chambers with a source of fluid supply under predetermined conditions.

14. In a pump of the type wherein a body of gas is interposed between the actuator and the fluid operated upon with a second body of gas influencing the outlet valve so that the fluid is pumped between two cushioning bodies of gas, the combination of a float in the pumping chamber for preventing diminution in the volume of the first mentioned body of gas below a certain minimum, and a spiral bleed groove in the actuator establishing communication between said body of gas and the atmosphere.

In testimony whereof I affix my signature.
JOSEPH P. REMINGTON.