Oct. 8, 1940. R. J. JAUCH 2,216,975

LIQUID DISPENSING APPARATUS

Filed April 11, 1938 4 Sheets-Sheet 1

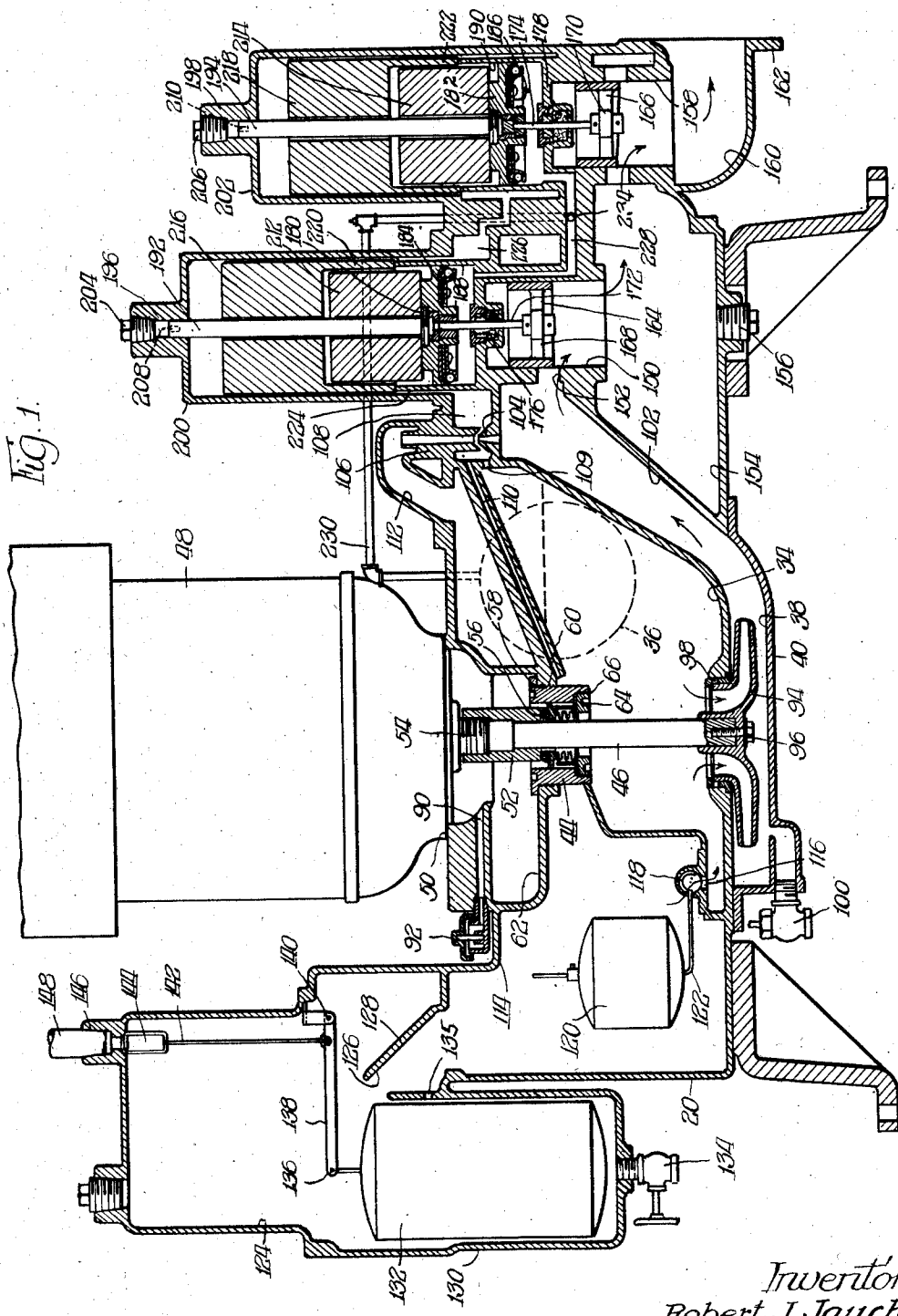

Fig. 1.

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Filed April 11, 1938 4 Sheets-Sheet 2

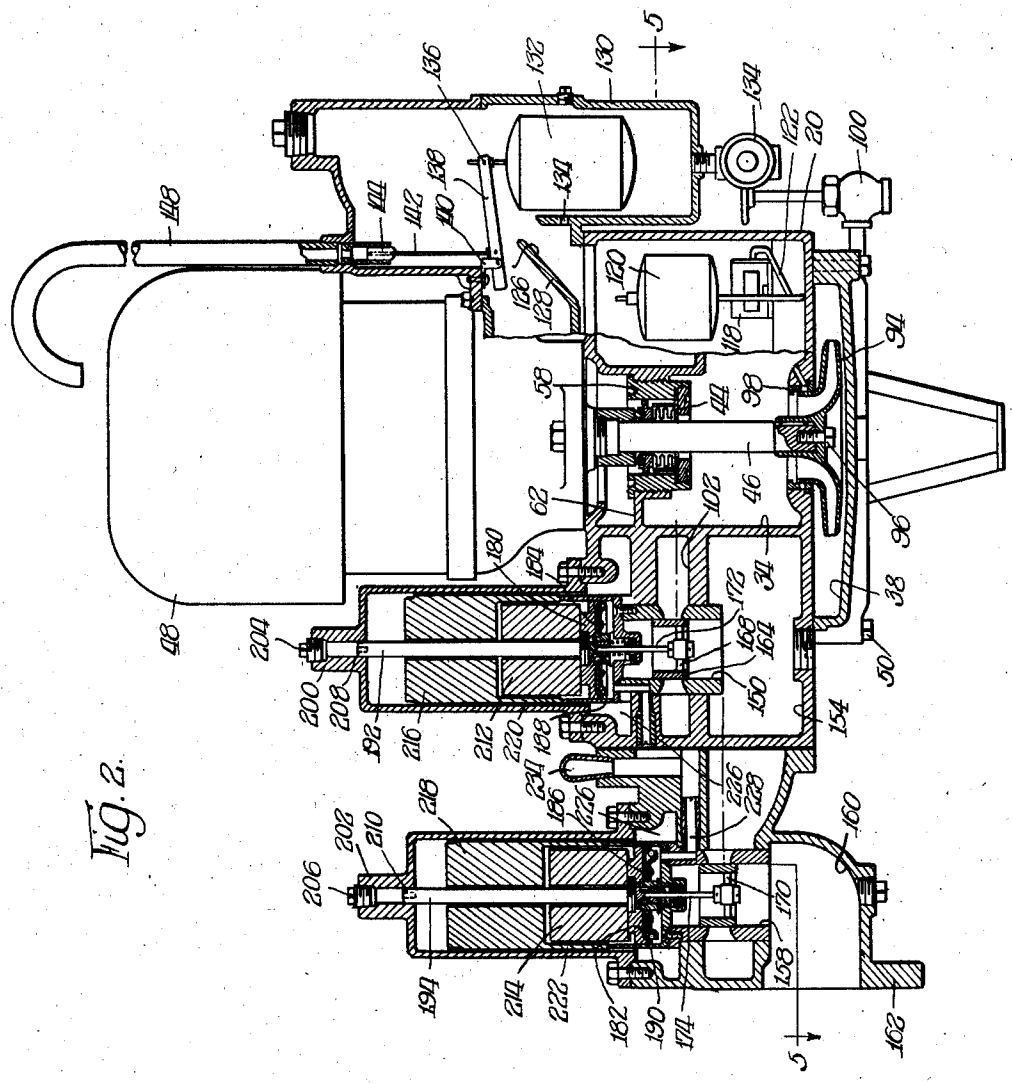

Fig. 2.

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LIQUID DISPENSING APPARATUS

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Fig. 3.

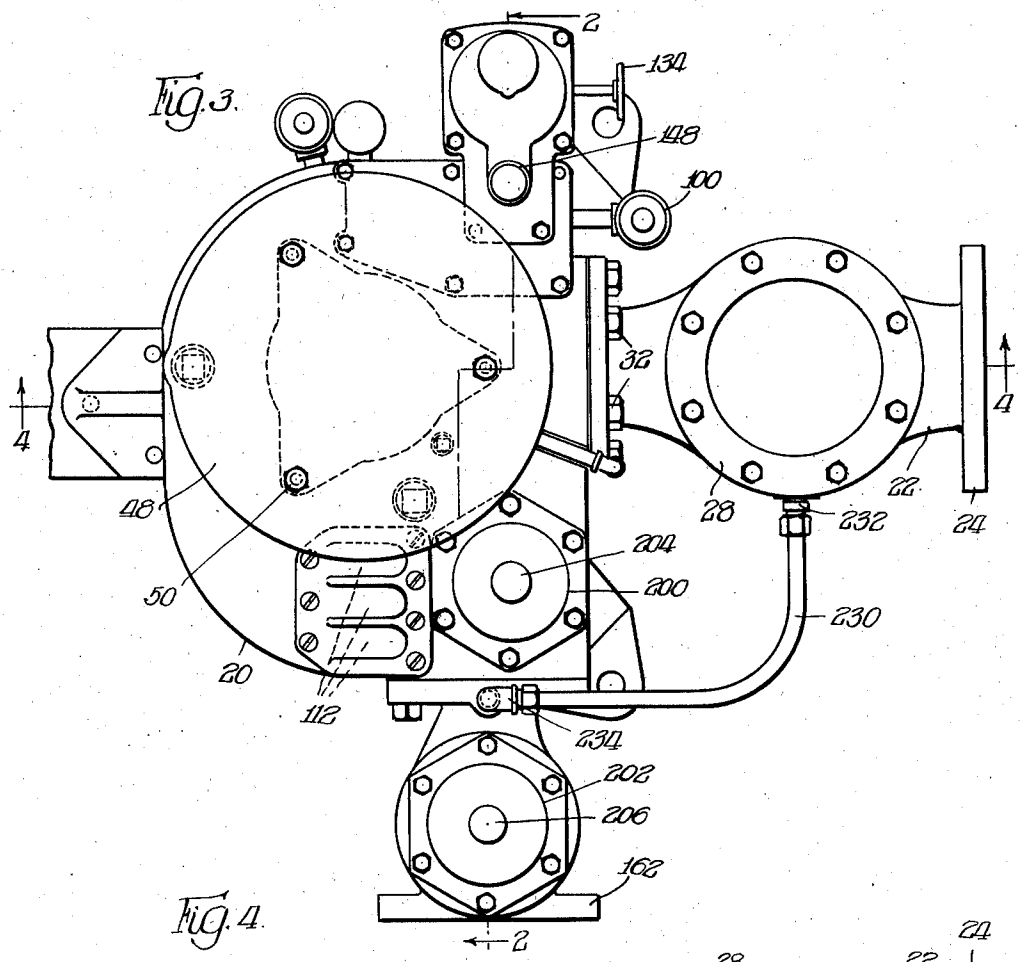
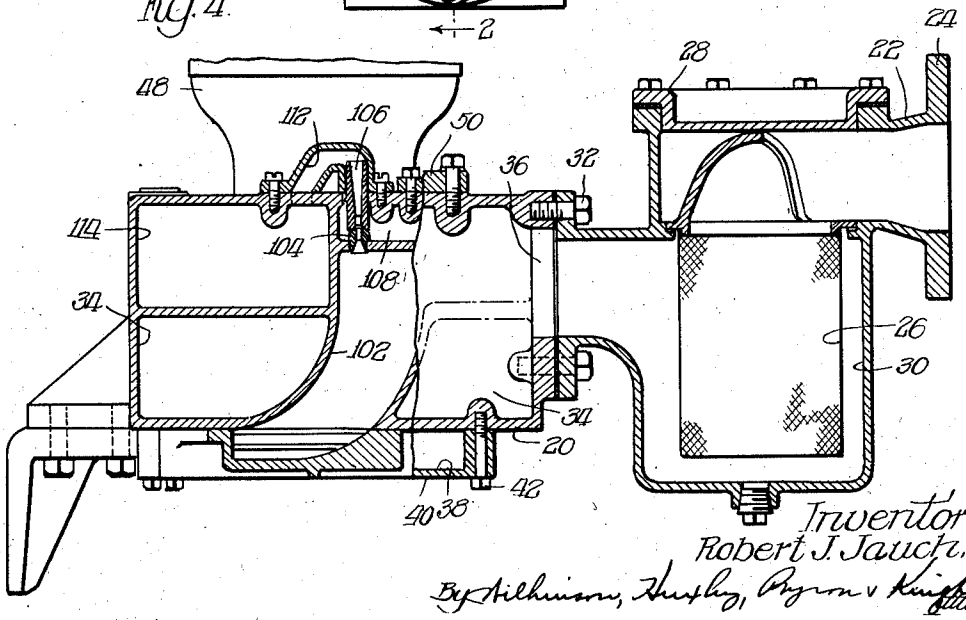



Fig. 4.

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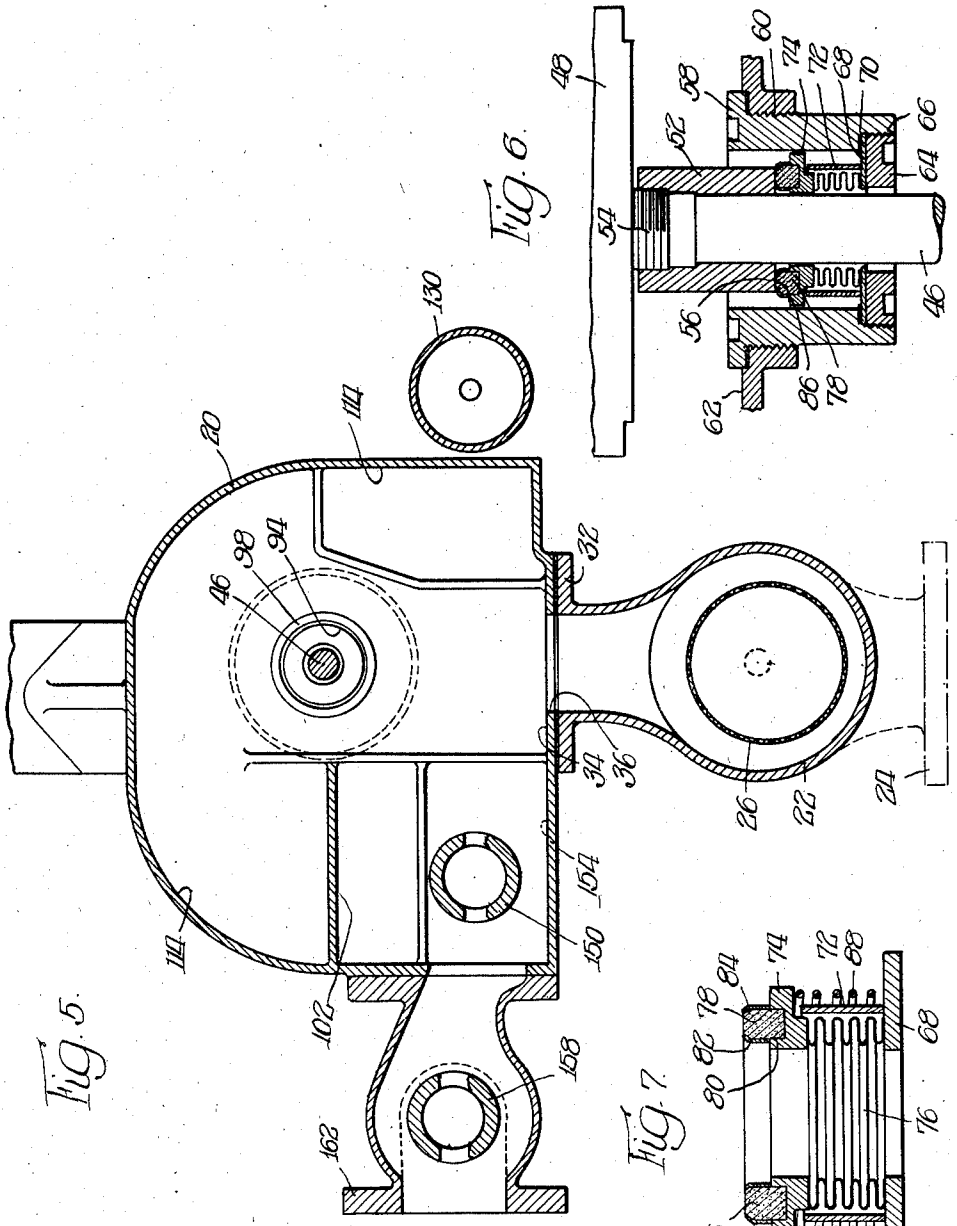
LIQUID DISPENSING APPARATUS

Filed April 11, 1938 4 Sheets-Sheet 4

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Patented Oct. 8, 1940 2,216,975

# UNITED STATES PATENT OFFICE

2,216,975

## LIQUID DISPENSING APPARATUS

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Application April 11, 1938, Serial No. 201,235

4 Claims. (Cl. 103—113)

This invention pertains to liquid dispensing apparatus and pumps to be used in connection therewith, and also pumps to be used in connection with installations for dispensing large quantities of liquid rapidly and efficiently as in bulk station installations, city pumping stations, and the like.

It is an object of this invention to provide a liquid dispensing apparatus wherein entrained air is separated from the liquid to be dispensed, on the suction side of the pump rather than on the discharge side, before the apparatus is operable to dispense clear liquid.

Another object is to provide a liquid dispensing apparatus wherein liquid is dispensed from the pump only after a predetermined vacuum is built up.

Still another object of the invention is to provide a liquid dispensing apparatus adapted to use a centrifugal pump or other pumping means but wherein the system is so constructed and arranged that it is self-priming.

A further object of the invention is to provide a liquid dispensing apparatus which is self-priming and one wherein a centrifugal pump may be used.

A still further object is to provide a liquid dispensing apparatus wherein the removal of entrained air is effected through use of an ejector.

Another further object of the invention is to provide a liquid dispensing apparatus operable to dispense liquid only after a predetermined vacuum is built up, but one which is effective without a substantial adjustment regardless of the lift of liquid from a source of supply to the pump of said apparatus.

A different object of the invention is to provide a pumping unit operable after a predetermined vacuum is attained, but capable of throttling in the event of leakage or a reduction in said vacuum.

Yet a different object is to provide a centrifugal pump which is directly connected to a vertical motor shaft wherein the motor bearings are arranged to accommodate the weight and thrust of the impeller and shaft, and one which can be changed from a vacuum suction operation to a flooded suction operation without any mechanical change of the device.

A still different object of the invention is to provide a centrifugal pump of high efficiency and one in which liquid is not dispensed until after air or vapor has been eliminated through use of an ejector construction.

Yet another object is to provide a pump construction wherein the discharge valves will not open if the pump is started against a suction leak which exceeds air removal ability of the ejectors, but if the leak is not too great liquid will be discharged after air removal but at a reduced capacity, and one wherein no back pressure valve or loaded check valve is needed beyond the measuring means or meter, and wherein no air separation or air release means of any supplementary nature need be provided.

Yet a further object is to provide a pumping unit wherein there can be no hydraulic shock to the lines and joints when the pump is placed in operation, and wherein a seal is provided which will permit the driving means to be readily dissociated from the pump casing without the removal of extensive connecting lines or parts of the pump housing.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings, which illustrate embodiments of the device and wherein like reference characters are used to designate like parts—

Figure 1 is a developed sectional elevation through the pump construction embodying the invention;

Figure 2 is a sectional elevation through the outlet and settling chamber of the pump construction embodying the invention;

Figure 3 is a top plan view of the pump construction illustrated in Figures 1 and 2;

Figure 4 is a transverse sectional elevation taken in the plane as indicated by line 4—4 of Figure 3;

Figure 5 is a sectional top plan view taken substantially in the plane as indicated by the line 5—5 of Figure 2;

Figure 6 is an enlarged fragmentary elevation, partly in section, showing the seal construction for the motor shaft;

Figure 7 is an enlarged elevation, partly in section showing a modified form of sylphon seal.

This application is a continuation-in-part of Patent No. 2,124,681, granted July 26, 1938.

In the pump construction illustrated, the pump casing 20 is provided with the inlet casting 22 which is adapted to be connected to a source of liquid supply not shown, the inlet being provided with suitable fastening means such as the flange 24 for attachment to a pipe line adapt-

ed to be connected to a source of supply (not shown).

Said inlet casting is provided with a screen 26 for preventing the entry of foreign material into the pump, the screen being accessible through the cover plate 28 suitably secured to the casting above the screen. The screen is provided in a well 30 whereby there is formed in the inlet casting a manifold or baffle for maintaining a certain predetermined liquid level in the pump casing after it has once been primed. The inlet casting is secured as at 32 to the pump casing 20 and supplies liquid to the suction chamber 34 through the inlet opening 36. The suction chamber 34 is disposed above the impeller chamber 38 which is preferably formed by the bottom plate 40 suitably secured as at 42 to the casing 20.

The upper portion of the pump casing is provided with the seal 44 adapted to have cooperative relation with the vertically extending motor shaft 46, the motor shaft 46 being rotated by means of the motor 48 mounted on the pump casing as at 50. The seal 44 is preferably designed so that the motor may be removed or replaced without the necessity of disturbing any piping after the pump is once installed and is designed so that a minimum of parts of the pump assembly need be moved in applying the motor. To this end a sleeve 52 is threaded as at 54 to the motor shaft, shellac or litharge forming a seal to prevent leakage, the sleeve having a lower bearing face 56.

The gland 58 is threaded as at 60 into the casing 20, preferably in a well or basin 62 provided in the top thereof below the motor, and a collar 64 is threaded as at 66 into the base of the gland 58, the collar being spaced from the shaft 46. The lower plate 68 is supported on the collar 64 by being fastened between said collar and the shouder 70 formed in the gland.

A vertically extending cylindrical sleeve 72 is disposed between the member 68 and the upper seal supporting member 74, the member 74 having a snug fit adjacent its periphery with the inner surface of the gland in order to form a guide for the sylphon 76 disposed between the members 68 and 74 and preferably being secured to said members. The member 74 is provided with a seal ring 78 suitably secured therein as by means of the recess 80 provided in the member 74 and the upward extending inner and outer flanged and reflanged members 82 and 84, said member 78 being preferably of carbon, having a flattened upper surface 86 adapted to have sliding and sealing engagement with the surface 56 of the sleeve 52.

The member 72 prevents the sylphon from being crushed as when the motor is being applied. The sylphon forms a seal preventing leakage into the basin 62 and in some instances it may be desired to provide an expansion spring 88 disposed between the member 68 and 74 to aid the spring action of the sylphon or to take some of the spring effect of the sylphon and thus lessen wear thereon.

The casing is provided with the passage 90 extending from the basin 62 and provided with the overflow breather member 92, causing any leakage, should it occur past the seal, to be conducted from the motor bearings. Also the passage forms means for introducing oil into the well 62 supplying lubricant to the surfaces 56—86, and this may be done by removing the cap of the breather member. This passage 90 being below the motor bearing prevents any liquid from reaching the bearing and also acts as a telltale to show excessive leakage.

The shaft 46 adjacent the lower end thereof is provided with the impeller 94, secured thereto as at 96 and rotating in the impeller chamber, the eye of the impeller being adapted to receive liquid from the suction chamber, suitable sealing means 98 being preferably provided such as shown and described in Patent 2,124,681, granted July 26, 1938, to prevent the impeller becoming air bound. The impeller chamber 38, which may be provided with the drain 100, is in communication with a passage 102 of said chamber which may conveniently be termed a pressure passage. The pressure passage communicates with a jet 104, which is aligned with and communicates with the ejector tube 106 which is preferably of the Venturi type, the jet and ejector tube forming ejector means, and being in suction communication with a jet chamber or an ejector vacuum vestibule 108 which is in communication with the suction chamber adjacent a high point thereof as at 109. The jet and ejectors may be of any convenient number, differing upon the capacity of the pump. For example, a pump rated at 100 G. P. M. using a 3 H. P. electric motor for driving means, utilizes three jets of a predetermined size which it has been found are more efficient than ejector means of any other number.

The jet chamber also is connected to the suction chamber by means of the passage 110 extending downwardly to a point near the eye of the impeller whereby when the jet is priming the vapor is drawn from the eye of the impeller or from the suction chamber 34, and after the vapor is exhausted and solid liquid is being passed through the passage 110, the efficiency of the pump is increased. The ejector tube communicates with a transfer corridor or ejector line 112 which communicates with the float chamber or ejector discharge settling chamber 114. The settling chamber 114 is provided with a small opening 116 forming communication between the settling chamber 114 and the suction chamber 34. Passage of liquid through said opening is controlled by the valve 118 which, as shown, is of the rotary sleeve type, said valve being operated from fully closed to fully open position by means of the float 120 connected to said valve by means of the stem 122, the position of the float being determihed by the amount of liquid in the settling chamber thus controlling the operation of the valve.

In order to provide a pump which may be used either on a suction line or for a flooded suction the settling chamber 114 is connected to a float chamber 124 as at 126, the baffle 128 being provided between said chambers. The chamber 124 is provided with a well 130 in which the float 132 is disposed, the bottom of the well being provided with a drain 134. The well 130 is always provided with a predetermined amount of liquid as determined by the aperture 135 and the float is pivotally connected as at 136 to the lever 138, the opposite end of said lever being pivoted at 140 to the wall of chamber 124.

The lever 138 is pivotally connected to the valve stem 142, the upper end of which is provided with the vent control valve 144, the vent valve 144 controlling the vapor outlet 146 which may be attached to the well known vent pipe 148, and a screen may be provided either in the opening 126 or the opening 146 to form further

precipitating means for vapor to be released. The pressure passage 102 communicates with the cylindrical valve chamber 150 through the opening 152, the valve chamber communicating with the inter-valve chamber 154, preferably provided with the drain 156, said valve chamber communicating with the cylindrical valve chamber 158, disposed adjacent and communicating with the outlet chamber 160, the outlet chamber preferably being provided with the flange 162 to facilitate attachment of piping to the outlet. The valve chambers 150 and 158 are provided with the vertically sliding sleeve valves 164 and 166, said sleeve valves having the planes of their lower edges angularly disposed with respect to the axes to increase the gradually throttling effect, and said valves are provided with spiders 168 and 170 adapted to be pivotally connected to the vertically extending piston rods 172 and 174, said rods extending upwardly through suitable stuffing boxes 176 and 178, the upper ends of said rods being pivotally or flexibly connected to the pistons 180 and 182, the pistons being provided with suitable leathers 184 and 186 and sliding in the cylindrical chambers 188 and 190.

The pistons are provided with the upwardly extending guide rods 192 and 194 projecting into suitable guides 196 and 198 provided in the hoods or valve covers 200 and 202. The guides are provided with removable caps 204 and 206 to facilitate freeing the valves should they stick as by the insertion of a suitable tool engaging in the threads 208 and 210. The pistons are provided with the primary weights 212 and 214 directly engaging said pistons, and disposed above the primary weights, secondary weights 216 and 218 are provided, said secondary weights being so disposed that a predetermined movement of the piston is necessary in an upward direction before the secondary weight is effective, and for this purpose the secondary weights are provided with the depending skirts 220 and 222 engaging the upper edge of the cylinders 188 and 190, the lower stop for said secondary weights thus being provided, the upper stops for the valves being provided by the removable caps 204 and 206.

The jet chamber 108 is connected to the hoods 200 and 202 and thus to the upper side of said pistons by means of the passage 224 which communicates with the hood 200, the hoods being connected above said pistons by means of the passage 226. The piston chambers below the pistons in the cylinders 188 and 190 are connected by means of the passage 228 and an external line in the form of a pipe or conduit 230 is connected at one end as at 232 to the inlet casting 22, the other end of said line being connected as at 234 to the connection 228.

In operation of this device, assuming that the pump casing is dry, enough liquid is added, preferably to establish the liquid level as determined by the inlet 36. The sleeve valves 164 and 166, of course, are closed, being maintained in this position by means of the primary weights 212 and 214. When the motor control is operated to start the motor 48, said motor causes rotation of the shaft 46, which in turn rotates the impeller 94, causing liquid supplied to the impeller from the suction chamber 34 to be discharged by said impeller into the impeller chamber and upwardly of the passage 102. The valve 164 being closed, the liquid will pass upwardly through the jet and ejector tube, tending to cause a vacuum to be formed in the jet chamber 108. The vacuum causes flow of vapor or pulls the vapor from the suction chamber through the passage 110 into the vacuum chamber where it will be exhausted by means of liquid passing through the ejector. Also, the vacuum in the jet chamber causes a vacuum in the chambers above the pistons, that is, within the valve covers 200 and 202, tending to cause the pistons 180 and 182 to move upwardly, but upward movement of the pistons is resisted by the vacuum below said pistons 180 and 182 due to the suction occurring on the suction side of the pump communicated to the said pistons below the same, through the conduit 230 and passage 228, and also upward movement of the pistons will be resisted by the primary weights 212 and 214.

Liquid passing through the ejector will flow through the ejector line 112 into the settling chamber 114 and after the liquid has reached a predetermined level, upward movement of the float 120 will cause opening of the valve 118 to permit liquid to flow through the port 116 to the suction chamber, and thence to the eye of the impeller. Vapor is released in the settling chamber and passes upwardly through the opening 126 and to the vent pipe 148, inasmuch as the valve 144 will be opened. After the air has been eliminated and the pump is pumping solid liquid, the vacuum created by the jet will overcome the primary and secondary weights and the suction vacuum below the pistons, permitting the pistons to move upwardly to open the valves 164 and 166, whereupon liquid will pass outwardly to be dispensed. By the use of the primary and secondary weights there will be less vacuum differential necessary to initially open the valves, due to the fact that the primary weight is effective prior to the time when the secondary weight becomes effective, i. e., up to the time when the valves are but slightly cracked, and by the use of sleeve valves the surge of liquid in priming has no tendency to unseat the valves to thereby decrease the amount of priming liquid provided in the pump casing.

By the use of a plurality of ejectors rather than a booster pump, a more efficient device is provided, inasmuch as the vacuum created by the ejectors is proportional to the liquid pressure going through the ejectors. The more air through the ejectors, up to a certain point (that is, the capacity of the ejector), the more efficient the ejectors become and the greater the air removing capacity possible. Should an amount of air be introduced, the valves will throttle due to the difference in vacuums, permitting greater supply of liquid to the ejectors, whereby the air is removed and more quickly vented to the atmosphere. With the use of an ejector instead of a booster pump, it is possible to increase the capacity with the increase in main pump pressure, whereas the booster type of pump is of the constant capacity type.

With the use of the two valves, leakage past the valves is prevented, though larger clearances are permitted, due to the fact that should grit or dirt get in one of them it might not wholly close, and also due to the fact that it is mechanically impossible to make a device wherein the parts fit perfectly. With the use of the two valves the pressure of any leakage past the first valve is considerably diminished when it reaches the second valve 166 and thus the latter valve will effectively hold the liquid in the casing to permit the priming operation. Use of the second valve is particularly effective

when comparatively long periods of priming are encountered as, for example, when the pump is used on a long suction line.

In the present embodiment pressure is increased by throttling the valves, which throttling results from the increase of vapor and air in the casing, so that in the embodiment shown, it is possible to obtain maximum efficiency at the time when it is most needed, that is, at the time of priming, and at this time of course the mechanical booster fails, in that its efficiency is decreased by the increase of vapor or air.

In order to accommodate a condition where the source of supply is above the pump such as a flooded suction condition, the second float chamber **124** is provided. Any air released in the float chamber **114** passes out of the vent **148** as described; however, there will be some vapor supplied to the chamber **124** which will be precipitated. When the level reaches a certain predetermined amount the float **132** will close the valve **144**, and thus there is always a predetermined amount of liquid adjacent the float and in going from normal suction condition to a flooded suction condition, the predetermined amount of liquid will permit the float **132** to close the valve **144** rapidly when the liquid level is raised to prevent a charge of liquid being lost through the vent tube **148**. Also, by maintaining a liquid level of a predetermined amount for the float **132**, a minimum of additional liquid will cause the valve **144** to close so that the float causes a quick response to any liquid supplied to the chamber **124**.

It is to be understood that I do not wish to be limited by the exact embodiments of the device shown, which are merely by way of illustration and not limitation as various and other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a pump, the combination of a casing having a suction chamber adapted to be connected to a source of supply, an impeller chamber, an impeller mounted to rotate in said impeller chamber and adapted to be supplied with liquid from said suction chamber, a jet chamber, a connection between said jet chamber and said impeller chamber, a settling chamber provided with a vent and connected to said suction chamber to supply liquid to said suction chamber after a predetermined amount of liquid is in said settling chamber, a connection between said jet chamber and said settling chamber, ejecting means in said jet chamber receiving liquid from said impeller and supplying it to said settling chamber, a valve controlling the discharge from said impeller chamber, a piston connected to said valve for operating said valve, one side of said piston being connected to said jet chamber, the other side of said piston being connected to the suction chamber, a weight normally tending to close said valve, and a secondary weight inoperative when said valve is in predetermined position but operative to tend to close said valve after said piston has moved to a predetermined position.

2. In a pump, the combination of a casing having a suction chamber adapted to be connected to a source of supply, an impeller chamber, an impeller mounted to rotate in said impeller chamber and adapted to be supplied with liquid from said suction chamber, a jet chamber, a connection between said jet chamber and said impeller chamber, a settling chamber provided with a vent and connected to said suction chamber to supply liquid to said suction chamber after a predetermined amount of liquid is in said settling chamber, a connection between said jet chamber and said settling chamber, ejecting means in said jet chamber receiving liquid from said impeller and supplying it to said settling chamber, a valve controlling the discharge from said impeller chamber, a piston connected to said valve for operating said valve, one side of said piston being connected to said jet chamber, the other side of said piston being connected to the suction chamber, and means normally tending to close said valve.

3. In a pump, the combination of a casing having a suction chamber adapted to be connected to a source of supply, an impeller chamber, an impeller mounted to rotate in said impeller chamber and adapted to be supplied with liquid from said suction chamber, a jet chamber, a connection between said jet chamber and said impeller chamber, a settling chamber provided with a vent and connected to said suction chamber to supply liquid to said suction chamber after a predetermined amount of liquid is in said settling chamber, a connection between said jet chamber and said settling chamber, ejecting means in said jet chamber receiving liquid from said impeller and supplying it to said settling chamber, a valve controlling the discharge from said impeller chamber, a piston connected to said valve for operating said valve, one side of said piston being connected to said jet chamber, the other side of said piston being connected to the suction chamber, means normally tending to close said valve, and other means inoperative when said valve is in predetermined position but so arranged that it is operative to tend to close said valve if said piston is moved to a predetermined position.

4. In a pump, the combination of a casing having a suction chamber adapted to be connected to a source of supply, an impeller chamber, an impeller mounted to rotate in said impeller chamber and adapted to be supplied with liquid from said suction chamber, a jet chamber, a connection between said jet chamber and said impeller chamber, a settling chamber provided with a vent and connected to said suction chamber to supply liquid to said suction chamber after a predetermined amount of liquid is in said settling chamber, a connection between said jet chamber and said settling chamber, ejecting means in said jet chamber receiving liquid from said impeller and supplying it to said setting chamber, a valve controlling the discharge from said impeller chamber, said valve being a sleeve valve having the lower edge disposed in a diagonal plane extending downwardly and away from the port of said discharge, a piston connected to said valve for operating said valve, one side of said piston being connected to said jet chamber, the other side of said piston being connected to the suction chamber, a weight normally tending to close said valve, and a secondary weight inoperative when said valve is in predetermined position but operative to tend to close said valve after said piston has moved to a predetermined position.

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