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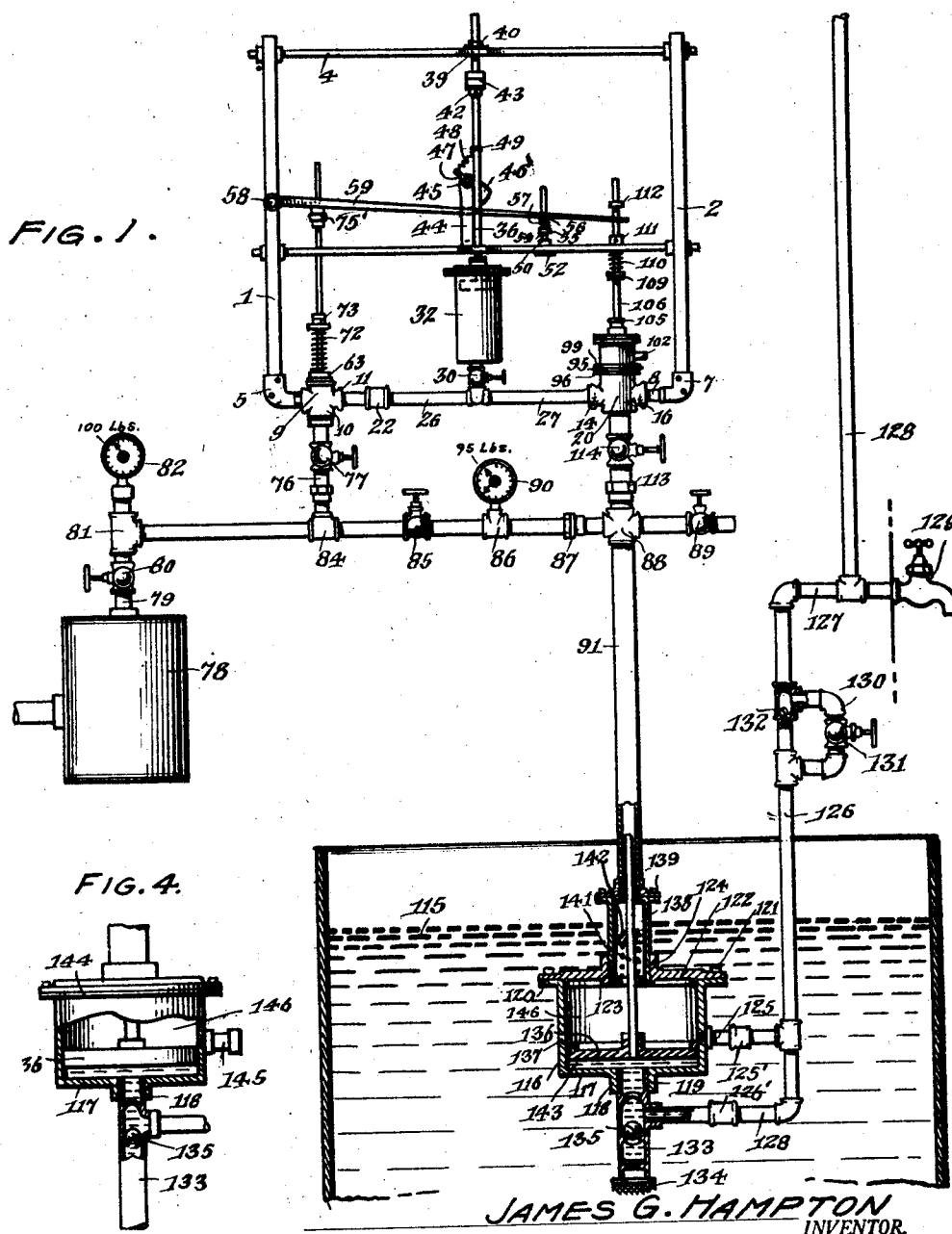
1,528,541

J. G. HAMPTON

PUMPING SYSTEM

Filed April 3, 1924

3 Sheets-Sheet 1



Mar. 3, 1925.

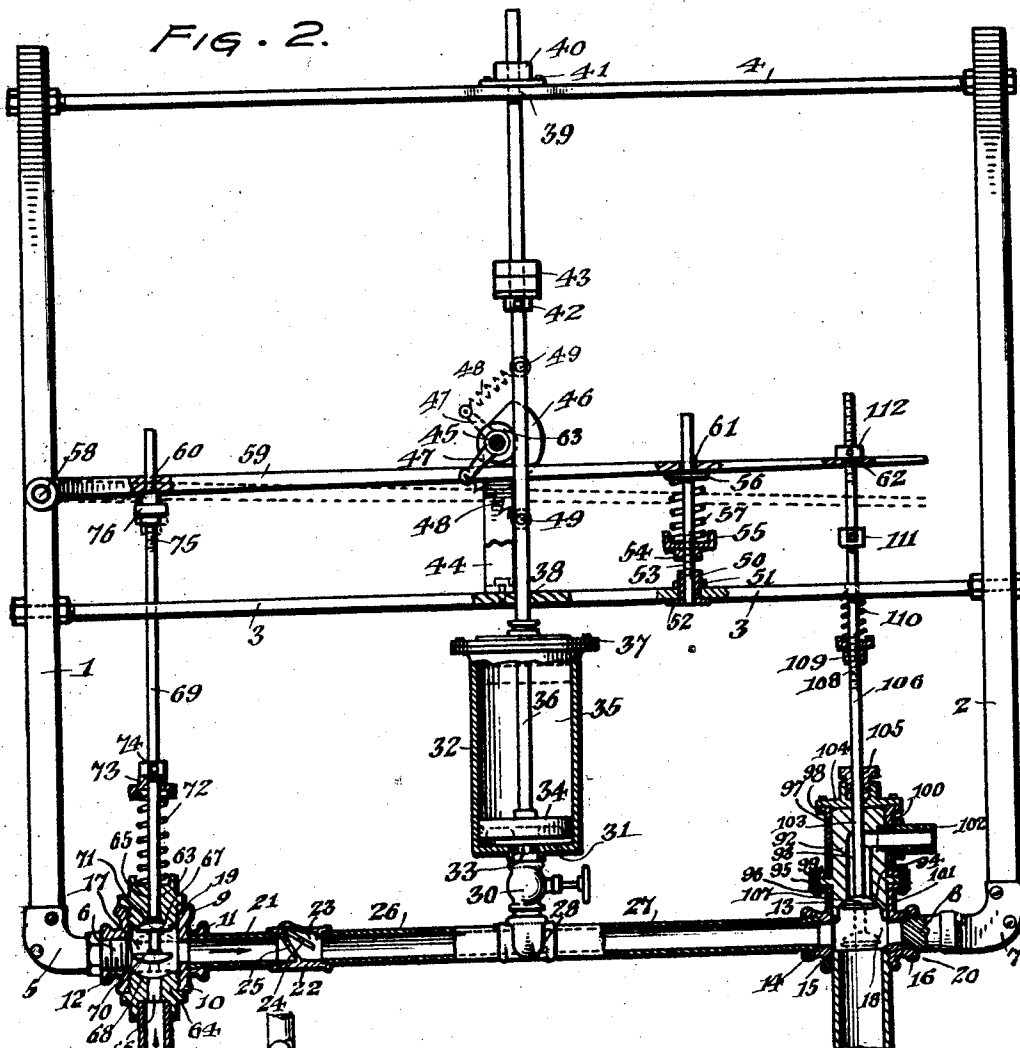
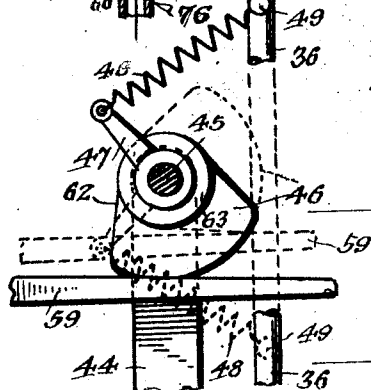
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PUMPING SYSTEM

Filed April 3, 1924

3 Sheets-Sheet 2



JAMES G. HAMPTON
INVENTOR.

BY
Geot. Kimmel
ATTORNEY.

Mar. 3, 1925.

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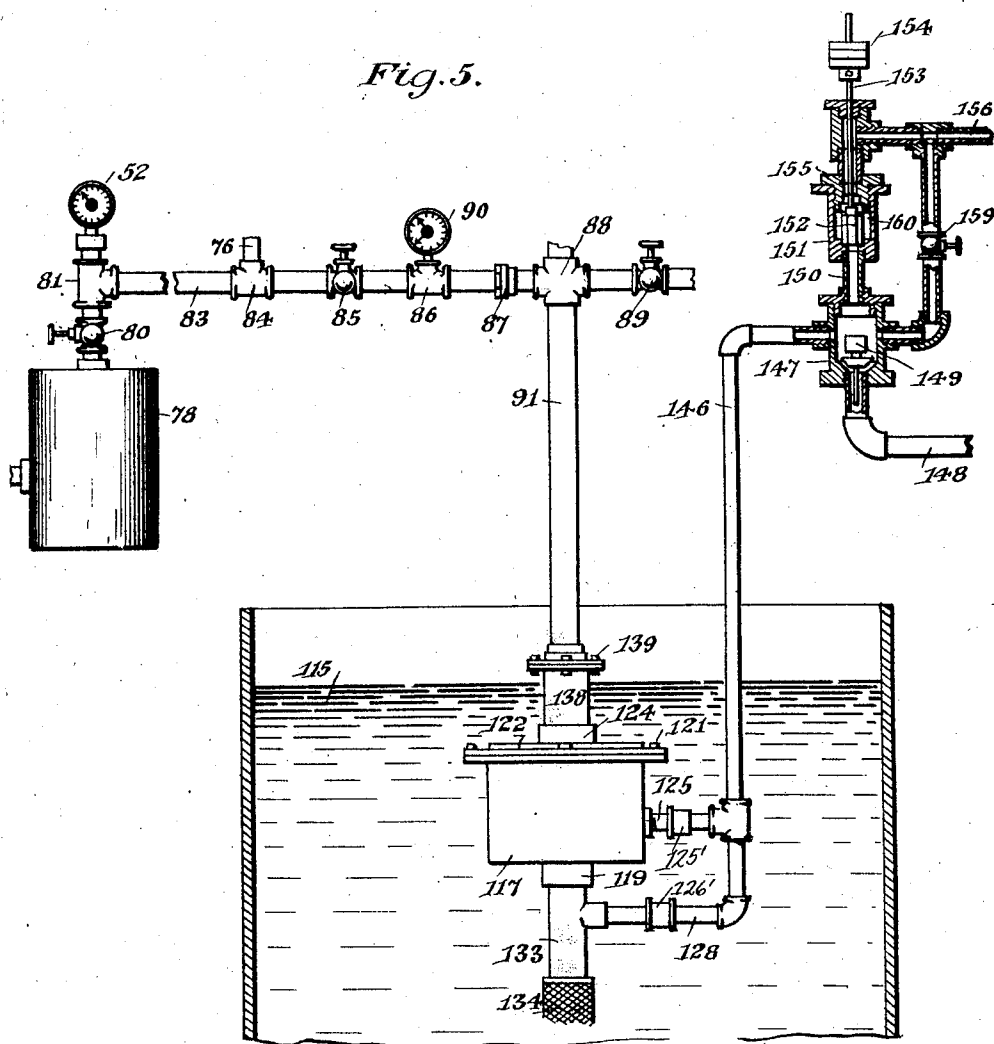
J. G. HAMPTON

PUMPING SYSTEM

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3 Sheets-Sheet 3

Fig. 5.



James G. Hampton, INVENTOR.

BY
Geo. P. Kimmel

ATTORNEY.

Patented Mar. 3, 1925.

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UNITED STATES PATENT OFFICE.

JAMES G. HAMPTON, OF LAFONTAINE, KANSAS.

PUMPING SYSTEM.

Application filed April 3, 1924. Serial No. 704,026.

To all whom it may concern:

Be it known that I, JAMES G. HAMPTON, a citizen of the United States, residing at Lafontaine, in the county of Wilson and State of Kansas, have invented certain new and useful Improvements in Pumping Systems, of which the following is a specification.

This invention relates to a pumping system, more particularly to a compressed air operated controlling device for the lifting step of the system, and the invention has for its object to provide, in a manner as hereinafter set forth a pumping system including means whereby compressed air is utilized for the lifting of fluid such as water or oil, from a lower to a higher level for service purposes and furthermore including means operated by compressed air for automatically controlling or regulating the lifting step of the system.

A further object of the invention is to provide a pumping system, in a manner as hereinafter set forth, with means independently operated from a source other than directly by the lifting fluid, under such conditions the conduit for conducting off the liquid such as oil or water, from the source thereof can be tapped for service purposes at any point, or as many points as may be desired and further whereby the controlling or regulating device, which is operated from compressed air will not freeze as would be the case if such device was operated from the liquid fuel.

A further object of the invention is to provide a pumping system, in a manner as hereinafter set forth, with a compressed air operated regulating and controlling device for the lifting step of the pump and whereby said device can be placed in proximity to the source of fluid, so as to obtain a great saving of air pressure when exhausting the pressure to refill the fluid collecting tank arranged at the source of the fluid.

A further object of the invention is to provide a pumping system, in a manner as hereinafter set forth, with a fluid controlling tank provided with a spring controlled piston to set up a suction action to provide for the expeditious filling of the fluid collecting tank.

A further object of the invention is to provide, in a manner as hereinafter set forth, a pumping system including a fluid collecting tank and a compressed air

operated controlling and regulating device for the lifting step of the pump and further with means whereby the said device is not operated for controlling purposes until the contents of the fluid collecting tank have been forced therefrom, thereby preventing accumulation of air pressure until all of the contents of the fluid collecting tank has been forced therefrom.

Further objects of the invention are to provide, in a manner as hereinafter set forth, a pumping system, which is simple in its construction and arrangement, automatic in its action, strong, durable, compact, thoroughly efficient in its use, readily assembled and installed, and comparatively inexpensive.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts, as hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which come within the scope of the claims hereunto appended.

In the drawings wherein like reference characters denote corresponding parts throughout the several views:—

Figure 1 is an elevation, partly in section of a pumping system in accordance with this invention.

Figure 2 is an enlarged fragmentary view of the upper portion of the system or apparatus and with certain of the elements thereof in section.

Figure 3 is an enlarged fragmentary view, in side elevation illustrating the controlling cam in its normal position in full lines and its operative position in dotted lines.

Figure 4 is a sectional elevation of a modified form of fluid controlling tank.

Figure 5 is a fragmentary view in side elevation, illustrating the liquid conducting conduit provided with means to prevent the exhaust of pressure from the compressed air storage receptacle.

Referring to the drawings in detail, 1 and 2 denote a pair of spaced vertical standards connected intermediate their ends by a combined brace, supporting and guide bar 3. The upper ends of the standards 1, 2, are connected together by a combined brace and guide bar 4. The standards 1, 2 and bars 3, 4 provide a supporting frame.

The lower end of the standard 1 has fixedly secured thereto an inwardly extending coupling member 5 having a reduced threaded terminal 6. The lower end of the standard 2 has fixedly secured therewith an inwardly extending coupling member 7 having a reduced threaded terminal 8. Secured to the reduced terminal 6 is a four-way coupling having the vertical legs thereof indicated at 9, 10, and the horizontal legs at 11, 12. The terminal 6 is secured to the horizontal leg 12 and closes the same. Secured to the terminal 8 is a four-way coupling having the vertical legs thereof indicated at 13, 14 and the horizontal legs at 15, 16. The terminal 8 is secured to the leg 16 and closes the same. The legs 9, 10, 11 and 12 of that four-way coupling secured to the coupling member 5, are interiorly threaded. The legs 14, 15 and 16 of the four-way coupling secured to the member 7 are interiorly threaded. The four-way coupling secured to the coupling member 5 provides a valve chamber 17, and the four-way coupling secured to the coupling member 7 forms a valve chamber 18.

The four-way coupling secured to the coupling member 5 is indicated generally by the reference character 19, and the four-way coupling secured to the coupling member 7 is referred to generally by the reference character 20.

Extending at right angles with respect to the four-way coupling 19, as well as threadedly engaging with the leg 11 thereof is a pipe section 21, having secured therewith a union 22, which provides a valve chamber 23 for a check valve 24. The union 22 is provided with an apertured partition 25 constituting a valve seat for the check valve 24. The pipe section 21 is connected to one end of the union 22 and to the other end of the union 22 is secured a pipe section 26. Extending at right angles with respect to the four-way coupling 20, as well as threadedly engaging with the leg 14 of said coupling, is a pipe section 27 which opposes the pipe section 23, and the said sections 23, 27, have their opposed ends connected by a three-way coupling 28, having a vertically disposed leg 29 projecting from the upper side thereof. Secured to the leg 29 is a vertically disposed air regulating valve 30, which is connected to the bottom 31 of a compressed air receiving cylinder which forms an element of the compressed air operated controlling and regulating device for the lifting step of the pump. The valve 30 opens into the cylinder 32, at the bottom thereof, as at 33, and provides means for regulating the amount of compressed air supplied to the cylinder 32.

The compressed air controlling and regulating device for the lifting step of the pump not only includes the compressed air receiving cylinder 32, but further comprises a piston

head 34 operating in the chamber 35, formed by the cylinder 32 and having connected therewith a substantially elongated piston rod 36 which extends through the closed head 37, at the upper end of the cylinder 32 and further a substantial distance above said head. The piston rod 36 passes through a guide opening 38, in the bar 3, and also through a guide opening 39 in the bar 4, as well as through a collar 40 secured upon the upper face of the bar 4, by the hold-fast device 41.

Adjustably connected to the rod 36, above the bar 3, is a supporting collar 42, for one or more weights 43 acting as a means to maintain the piston 33 in a lowered position, and the lifting of the latter by the incoming compressed air is had against the action of the weights 43.

Secured to the bar 3, as well as projecting upwardly therefrom and in proximity to the piston rod 36, is a yoke-shaped support 44, carrying a shiftable shaft 45, provided with a cam 46 and formed with a crank arm 47. The outer end of the crank arm 47 is connected by a coiled spring 48 to the piston rod 36, as at 49.

Fixedly secured to the bar 3, at a point between its center and the standard 2, is an interiorly threaded flanged bushing 50, which extends through the bar 3, as well as projects upwardly therefrom. The bushing 50 is also peripherally threaded for the engagement therewith of a clamping nut 51, whereby the latter in connection with the flange 52 of the bushing will clamp it to the bar 3. Threadedly engaging with the bushing 50 is a vertically disposed post 53, carrying an adjusting nut 64, for a flanged holding member 55. The post 53 has a shiftable disk 56 mounted thereon, and interposed between the disk and the member 55, as well as surrounding the post 53, is a coiled expansible and contractile spring 57.

Pivotally connected at one end, as at 58, to the standard 1, is a lever arm 59 of a length to extend in close proximity to the standard 2. The lever arm 59 is provided with openings 60, 61 and 62. The cam 46 is of quadrant shape and when in normal position has one of its side edges 62 seated upon the lever arm 59. When the cam 46 is shifted to operative position its curved edge 63 rides against the lever arm 59 and depresses it. The cam 46 is shifted by the piston rod 36 when the latter moves upwardly. The normal position of the cam and piston rod is shown in full lines, Figure 2, and the shifted position of the cam 46 is shown in full lines, Figure 3. The post 56 extends through the opening 61 in the lever arm 59, and the latter when in normal position as shown in Figure 2, rests on the disk 56. The shifting downwardly of the lever arm 59 is had against the action of the spring 57. The

function of the spring 57 is to return the lever arm 59 to and to maintain it in normal position. The function of the openings 60 and 62 will be presently referred to.

5 The air compressed controlling and regulating device for the lifting step of the pump associates with an intake valve mechanism and an exhaust valve mechanism for the purpose of controlling the
10 supply and exhaust of the compressed air which is employed for pumping or lifting the fluid, and the said device normally maintains the exhaust valve mechanism in closed position and further synchronously operates
15 said valve mechanisms to close the intake valve mechanism and to open the exhaust valve mechanism.

The intake valve mechanism consists of a pair of oppositely extending spaced bushings 63, 64. The former has threaded engagement with the leg 9 of the four-way coupling 19 and projects upwardly therefrom, and the latter has threaded engagement with the leg 10 of the four-way coupling 19 and depends therefrom. The bushing 63 has a centrally disposed opening 65, and the bushing 64 has a centrally disposed inlet port 66. The inner end of the bushing 63 provides a valve seat 67 and the inner
20 end of the bushing 64 provides a valve seat 68. Extending through the bushing 63 and having its inner end arranged in the valve chamber 17, is a vertically disposed valve stem 69 of a length sufficient to extend
25 through the bar 3 and also through the opening 60 and above the arm 59. The inner terminus of the stem 69 has secured thereto a valve 70 for closing the supply of compressed air through the valve chamber
30 17, and said valve 70 when the stem 69 is in its lowered position engages the seat 68 and closes the intake port 66.

The valve stem 69 has secured to the inner terminal portion thereof, in spaced relation
35 with respect to the valve 70, a valve 71, adapted to engage the seat 67 to close the opening 65 through which the stem 69 passes. The valve 71 is normally in engagement with the seat 67, and the valve 70 is normally off its seat 68 whereby under normal conditions the intake port 66 will be opened and the opening 63 closed. The valves are maintained in the position just stated, through the medium of a controlling spring
40 72 which is mounted on the stem 69, and is interposed between the bushing 63 and a stop element 73, adjustably secured to the stem 69 through the medium of a set screw 74.

60 The rod 69, near its upper end, is provided with a threaded portion 75, and adjustably engaging with the threaded portion, is a stop 75' which abuts against the lever arm 59, whereby when the latter is
65 shifted through the action of the cam 46,

the rod 69 will be moved downwardly so that the valve 70 will engage the seat 68 and close the intake port 66, and the valve 67 will be lowered from the inner end of the opening 65 so that the valve chamber 17 will
70 communicate with the atmosphere.

Connected to the bushing 64 and depending therefrom, is a pipe branch 76, having interposed therein a controlling valve 77.

The reference character 78 denotes a compressed air storage receptacle having leading therefrom a compressed air supply conduit consisting of a vertically disposed pipe branch 79, which communicates with the receptacle 78 and has interposed therein a cut-off valve 80, a three-way coupling 81, and the upper end of the branch 79 has a gauge 82 connected therewith. The compressed air supply conduit further includes pipe branches 83, 91, and the pipe branch 83 has
75 interposed therein a three-way coupling 84, a cut-off valve 85, a three-way coupling 86, a union 87, a four-way coupling 88 and a cut-off 89. The pipe branch 76 is connected to the three-way coupling 84. The
80 gauge 90 is connected with the three-way coupling 86. The four-way coupling 88 is interposed between the union 87 and the cut-off 89.

The pipe branch 83 extends at right
85 angles to the pipe branch 79, and the pipe branch 91 extends at right angles with respect to the pipe branch 83 and is connected to the lower vertical leg of the four-way coupling 88.
90

The exhaust valve mechanism comprises a cylindrical casting 92, formed with an angle-shaped passage 93, having the vertical leg thereof opening into the valve chamber 18. The casting 92 extends into the leg 13
95 of the four-way coupling 20 and has its inner end shaped to provide a valve seat 94. The casting 92 is peripherally flanged, as at 95, and which seats on a lateral annular flange 96, at the upper end of the leg 13.
100 The casting 92 projects upwardly from the leg 13 and is inclosed by a cylindrical casing 97, flanged at its upper and lower ends, as at 98, 99, respectively. The flange 99 seats on the flange 95. The flanges 95, 96
105 and 99 are suitably secured together. One side of the casing 97 is formed with an opening 100 and also with an annular flange 101 registering with said opening. Extending through the flange 101 and connected to the
110 casing 93, is a discharge pipe 102 which registers with the horizontally disposed portion of the angle-shaped passage 93. The casting 92 has its upper portion provided with a vertical opening 103 which communicates with the passage 93. Secured to the flange 98 is an apertured head plate 104, provided with a packing element 105.
115

Extending through the vertical portion of the passage 93 as well as through the
120 125

opening 103, head plate 104 and packing element 105, is a vertically disposed valve stem 106 of substantial length and which also extends through the bar 3 and the opening 62. The inner end of the stem 106 is provided with a valve 107 which normally engages the seat 94 for the purpose of closing the valve chamber 18 to the passage 93, thereby preventing exhaust of compressed air. The valve stem 106 has a threaded portion 108 with which adjustably engages an abutment member 109, and interposed between the latter and the bar 3, as well as surrounding the stem 106 is an expansible and contractile coiled spring 110. The stem 106 above the bar 3 has adjustably connected therewith a stop collar 111. The stem 106, above the lever arm 59, has adjustably connected therewith, a stop collar 112. The collar 112 engaging with the lever arm 59 maintains the valve 107 against the seat 94, and against the action of the spring 110, but when the lever arm 49 is lowered through the medium of the cam 46, the spring 110 acts to shift the stem 106 to move the valve 107 to the position shown in dotted lines, Figure 2, whereby communication is established between the valve chamber 18 and the passage 92 to provide for exhaust to the atmosphere.

Connected to the lower vertical leg 15 of the four-way coupling 20 and to the upper vertical leg of the four-way coupling 88, is a pipe branch 113 provided with a cut-off 114.

The source of fluid or water supply is indicated at 115, in which is submerged a fluid collecting tank consisting of a cylindrical body portion 116, formed with a bottom 117, having a centrally disposed opening 118 and a collar 119 depending therefrom and surrounding the opening 118. The body portion 116 is flanged at its top, as at 120, and secured to the flange 120 by hold-fast devices 121, is a closure plate 122 having a centrally disposed opening 123 and a vertically disposed collar 124 which surrounds the opening 123. The body portion 116 has a pipe branch 125 connected therewith above the bottom thereof and said pipe branch 125 communicates with the interior of the body portion 116 and forms a section of the fluid conducting conduit through which fluid is lifted from a lower to a higher level for service purposes. The fluid conducting conduit further includes a pipe branch 126, a pipe branch 127 and a pipe branch 128. The pipe branch 127 extends at right angles with respect to the upper end of the pipe branch 126 and has connected therewith, intermediate its ends, a stand pipe 128. A faucet 129 is secured to the free end of the pipe branch 127. The pipe branch 126 has interposed therein a by-pass 130 provided with a cut-off 131 and a check valve 132.

The pipe branch 125 opens into the branch 126, and the pipe branch 128 extends from the lower end of the branch 126 and communicates with a fluid intake pipe 133, which is connected by the collar 119 to the body portion 116 and provides means for supplying the fluid thereto. The intake pipe 133 has a filter 134 at one end, and said pipe 133 is further provided with a check valve 135.

Arranged within the body portion 116 is a spring controlled piston head 136 to which is attached a piston rod 137 which extends up into the pipe branch 91.

Secured to the collar 124 and projecting upwardly therefrom is a cylindrical casing 138, which is connected to and communicates with the lower end of the pipe branch 91. The coupling element 139 is employed for connecting the lower end of the pipe branch 91 to the upper end of the casing 138. Within the lower end of the casing 138 is secured a stop collar 140, and seating thereon is a coiled spring 141 which abuts against the disk 142, secured to the stem 137. The downward movement of the piston 136 is had against the action of the spring 141 so that when pressure is relieved upon the top of the piston 136, the spring 141 acts to elevate the piston 136, under such conditions the piston 136 will set up a suction action and draw the fluid into the body portion 116 which provides what may be termed a fluid collecting chamber 143. The check valve 135 does not interfere with the intake of the fluid into the chamber 143, but closes the lower portion of the intake pipe 133 when the piston 136 moves downwardly in the chamber 143, and the downward movement of the piston 136 is had through the supply of compressed air thereagainst and such downward movement provides for the lifting of the fluid up through the fluid conducting conduit.

The fluid controlling tank, as shown in Figure 1, is employed for deep wells from two hundred to one thousand feet deep, but for shallow wells from twenty to two hundred feet deep a larger tank would be employed. It is possible with wells ranging from ten to fifteen feet deep to place the suction tank above the surface of the ground. When using the system in connection with a shallow well, the form of collecting tank as shown in Figure 4 would be employed and which is referred to generally by the reference character 144. The opening in the body portion of the tank to which the pipe branch 125 is connected is closed by a plug 145.

Although the fluid collecting tank is shown of the successive type, yet if desired the tank can be set up without the suction feature included.

With reference to Figure 5, the fluid con-

ducting conduit is provided with means for closing the apparatus when a well is pumped dry, thus protecting the storage pressure. For this purpose the fluid conducting conduit, which is indicated at 146, has interposed therein a fluid receiving chamber 147, provided with an outlet pipe 148, controlled by a float operated valve 149. Communicating with the upper end of the chamber 147 is a pipe branch 150 which opens into a compressed air cylinder 151 in which is arranged a piston 152, to which is connected a piston rod 153, which projects from the cylinder 151 and is provided at its outer end with weights 154. Communicating with the upper end of the cylinder 151, through a head member 155, is a discharge pipe 156. The piston rod 153 operates through the head member 155. Leading from the chamber 147 to the pipe 156 is a pipe branch 158, provided with a cut-off 159.

The piston 151 is polygonal in contour, thus allowing low pressure to escape around the same and out through the discharge pipe 156. The upper end of the piston 152 constitutes a valve adapted to engage a valve seat 160, formed at the lower end of the head member 155 for the purpose of shutting off communication between said member and the interior of the cylinder 151. When the piston 152 is raised by high pressure it engages the seat 160 and closes the head member 155 to the cylinder 151. If the well is pumped dry or fluid fails to enter the liquid collecting tank at the source of supply, a direct line from the receptacle 78 to the cylinder 151 and tank 147 is provided and unless some means is employed to close such line the receptacle 78 would soon become exhausted of compressed air. The piston 152 is provided whereby high pressure will shift the same upwardly to close the head member and arrest the discharge of compressed air. When no liquid is supplied to the tank 147, the fluid operated valve closes the pipe 148, under such conditions the compressed air exhausts through the pipe 156. The valve or cut-off 159 is normally closed and is employed for exhausting the pressure when it is desired to start the operation of the apparatus.

The volume of air pressure admitted through the intake valve is governed by the valve 80. The spring controlling exhaust valve should be set to throw off at a pressure just a little above the spring pressure of the suction liquid tank which may be not more than ten or twelve degrees in most cases. The above applies to when the air follows the liquid out the liquid pipe. When the liquid is all forced out of the tank into the vertical liquid pipe, the air pressure builds up as the liquid rises, if the valve 80 is properly adjusted, and the air will now begin raising the piston in air cylinder and

should reach top a little before liquid reaches point of utilization.

The pipes 125 and 128 are provided with check valves 125', 128', respectively, and function to prevent the air pressure in pipe 126 from being drawn into the fluid tank when the piston therein is lifted by its spring.

The by-pass drainage valve is used only on shallow wells where the air does not follow the liquid up the pipe. In this case no check valve in pipe near water tank is required. The by-pass valve is all that is required.

The valves 85 and 89 are used at will when the apparatus is out of order, or for adjusting spring pressure on exhaust valve stem, also weight pressure on air cylinder connecting rod, guided by air gauge 90.

Now pressure is cut off but is built up a little above the required pressure for lifting this amount of liquid, therefore, its expanding power will start the liquid flowing out, reducing the load against the air. The pressure of the air is soon destroyed except the back pressure produced by suction spring. Now all of the liquid is expelled from pipe, or if some is left at the time the exhaust comes on, it will remain in the pipe held by air and check valves until the next load of pressure is admitted. Will do no harm to close faucet at any time. The air cylinder valve and weights may also be set so as to open just after the water leaves the vertical liquid pipe at surface entering the horizontal one provided the vertical pipe opening is reduced at surface, that is, vertical pipe one-half inch, horizontal pipe three-eighths inch. This will cause air pressure to build while the piston in the air cylinder rises to cut off pressure. Then the volume of pressure existing in pipes and liquid tank will expel the liquid now in the pipe. With this system one-half more liquid is lifted with the same tank of air as under all of the air pressure exhausting systems one-half of the pressure required to lift water is exhausted or wasted. Thus a great saving of power. Also by using low pressure air danger of leading joints is reduced.

When suction piston in liquid tank is forced down to bottom all of the liquid in said tank is now expelled from tank into vertical liquid pipe through pipes 125 and 128 that all of the liquid now is in the vertical pipe but not yet raised to surface, say that it only fills this pipe 100 feet in height. Next the air pressure follows up under this liquid load through pipe 125 while air cylinder piston is slowly rising to cut off pressure storage tank, thus raising its load to surface, (that is the upper portion of the 100 feet of liquid), by the time air pressure is cut off. Now the air pressure being raised a little above required pressure

for lifting this load said pressure will deliver its load to surface or into utilization tank by the expanding power of the air volume contained in liquid tank and pipes, without any further pressure from storage tank, it being cut off. The surplus pressure, after liquid is expelled will pass off through automatic at the end of liquid pipe through pipe 156, (low pressure), liquid pipe being in size in proportion to liquid tank.

As the liquid passes out the load is reduced, so is the air pressure, contained in liquid tank and liquid pipe proportionally reduced, thus the exhaust valve will open as soon as pressure reduces sufficiently for spring to throw open the exhaust valve closed in the meantime.

The check valves 125', 128' in the pipes 125 and 128 not only prevent the air pressure in liquid pipe from being drawn back into liquid tank under such piston when it is lifted upward by spring, but also form a footing or base for pressure to expand against in lifting its load after exhaust valve opens.

The foregoing explains why liquid may be raised 1000 feet with a pressure of no more than fifty or one hundred.

What I claim is:—

1. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, and a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank.

2. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, and a compressed air operated spring controlled fluid suction and expelling piston operating in said tank.

3. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid

therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, and a check valve in said pipe branch and arranged between said device and intake valve mechanism.

4. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, and a check valve in said pipe branch and arranged between said device and intake valve mechanism.

5. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, and said device including a manually operated regulating valve.

6. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device

opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, and said device including a manually operated regulating valve.

7. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, and a manually operated controlling valve arranged between each of said mechanisms and said line.

8. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, and a manually operated controlling valve arranged between each of said mechanisms and said line.

9. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, and a manually operated controlling valve arranged between each of said mechanisms and said line.

ling valve arranged between each of said mechanisms and said line, and said device including a manually operated regulating valve.

10. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, and said device including a manually operated regulating valve.

11. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, and a check valve interposed in said conduit below said tank.

12. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a pipe branch leading from said conduit and opening into said

tank and provided with a check valve, and a check valve interposed in said conduit below said tank.

13. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, and a check valve interposed in said conduit below said tank.

14. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, and a check valve interposed in said conduit below said tank.

15. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air

to said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, said device including a manually operated regulating valve, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, and a check valve interposed in said conduit below said tank.

16. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operating controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, said device including a manually operated regulating valve, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, and a check valve interposed in said conduit below said tank.

17. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, a check valve interposed in said conduit below said tank, and a by-pass interposed in said conduit above said tank and provided with a cutoff and a check valve.

18. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing

communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, a check valve interposed in said conduit below said tank, and a by-pass interposed in said conduit above said tank and provided with a cutoff and a check valve.

19. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, a check valve interposed in said conduit below said tank, and a by-pass interposed in said conduit above said tank and provided with a cutoff and a check valve.

20. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, a check valve interposed in said conduit below said tank, and a by-pass interposed in said conduit above said tank and provided with a cutoff and a check valve.

21. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operated controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, said device including a manually operated regulating valve, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, a check valve interposed in said conduit below said tank, and a by-pass interposed in said conduit above said tank and provided with a cutoff and a check valve.

22. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operating controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, a manually operated controlling valve arranged between each of said mechanisms and said line, said device including a manually operated regulating valve, a pipe branch leading from said conduit and opening into said tank and provided with a check valve, a check valve interposed in said conduit below said tank, and a by-pass interposed in said conduit above said tank and provided with a cutoff and a check valve.

23. In a pumping system a fluid collecting tank provided with an intake pipe having a cutoff, a conduit leading from said intake pipe for conducting off the collected fluid from said tank and provided with a cutoff, a pipe branch leading from said conduit to said tank and having a cutoff, a piston operating in said tank for expelling the collected fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to act on said piston, an intake valve mechanism opening into said line, an exhaust valve mech-

- anism opening into said line, and a compressed air operating controlling device communicating with said mechanisms, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, said device permanently engaging with the valve stems of said mechanisms.
24. In a pumping system a fluid collecting tank provided with an intake pipe having a cutoff, a conduit leading from said intake pipe for conducting off the collected fluid from said tank and provided with a cutoff, a pipe branch leading from said conduit to said tank and having a cutoff, a piston operating in said tank for expelling the collected fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to act on said piston, an intake valve mechanism opening into said line, an exhaust valve mechanism opening into said line, a compressed air operating controlling device communicating with said mechanisms, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, said device permanently engaging with the valve stems of said mechanisms, a controllable by-pass interposed in said conduit and including a check valve, and a stand pipe opening into said conduit above said by-pass.
25. In a pumping system a fluid collecting tank provided with an intake pipe having a cutoff, a conduit leading from said intake pipe for conducting off the collected fluid from said tank and provided with a cutoff, a pipe branch leading from said conduit to said tank and having a cutoff, a piston operating in said tank for expelling the collected fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to act on said piston, an intake valve mechanism opening into said line, an exhaust valve mechanism opening into said line, a compressed air operating controlling device communicating with said mechanisms, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, said device permanently engaging with the valve stems of said mechanisms, and means communicating with said conduit for closing the same when a source is pumped dry to protect the storage pressure.
26. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operating controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, and means communicating with said conduit for closing the same when a source is pumped dry to protect the storage pressure.
27. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operating controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated spring controlled fluid suction and expelling piston operating in said tank, and means communicating with said conduit for closing the same when a source is pumped dry to protect the storage pressure.
28. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operating controlling device opening into said pipe branch, independent of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a check valve in said pipe branch and arranged between said device and intake valve mechanism, and means communicating with said conduit for closing the same when a source is pumped dry to protect the storage pressure.
29. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid therefrom, a compressed air supply line leading to said tank for supplying compressed air thereto to force the collected fluid therefrom into said conduit, an exhaust valve mechanism opening into said line, an intake valve mechanism opening into said line, a pipe branch establishing communication between said mechanisms, a compressed air operating controlling device opening into said pipe branch, independent

of said conduit and including means for simultaneously operating said mechanisms for controlling the supply of compressed air to said tank, a compressed air operated
5 spring controlled fluid suction and expelling piston operating in said tank, a check valve in said pipe branch and arranged between said device and intake valve mechanism, and means communicating with said conduit for
10 closing the same when a source is pumped dry to protect the storage pressure.

30. In a pumping system a fluid collecting tank, a conduit for conducting off the fluid expelled from said tank, means arranged in

said tank for expelling the collected fluid 15 therefrom, means for supplying compressed air to said tank for operating said expelling means, a compressed air operated controlling device interposed in said means for controlling the supply of compressed air to
20 said tank, and a valve mechanism communicating with said conduit for closing the same when a source of fluid is pumped dry, thereby protecting the storage pressure within the apparatus. 25

In testimony whereof, I affix my signature hereto.

JAMES G. HAMPTON.