

July 22, 1941.

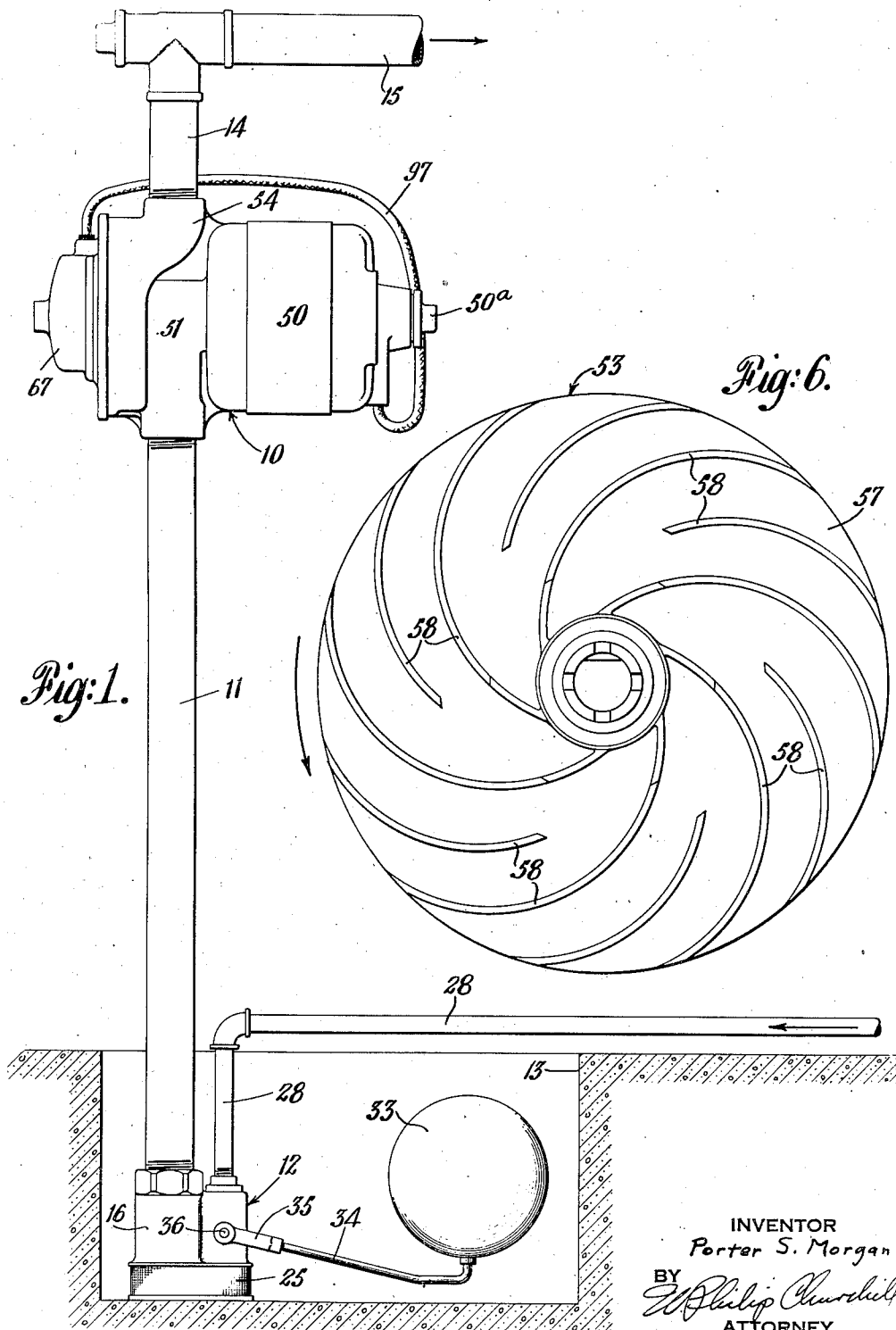
P. S. MORGAN

2,250,271

SUMP PUMP PRIMING DEVICE

Filed Nov. 18, 1940

3 Sheets-Sheet 1



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Fig. 2.

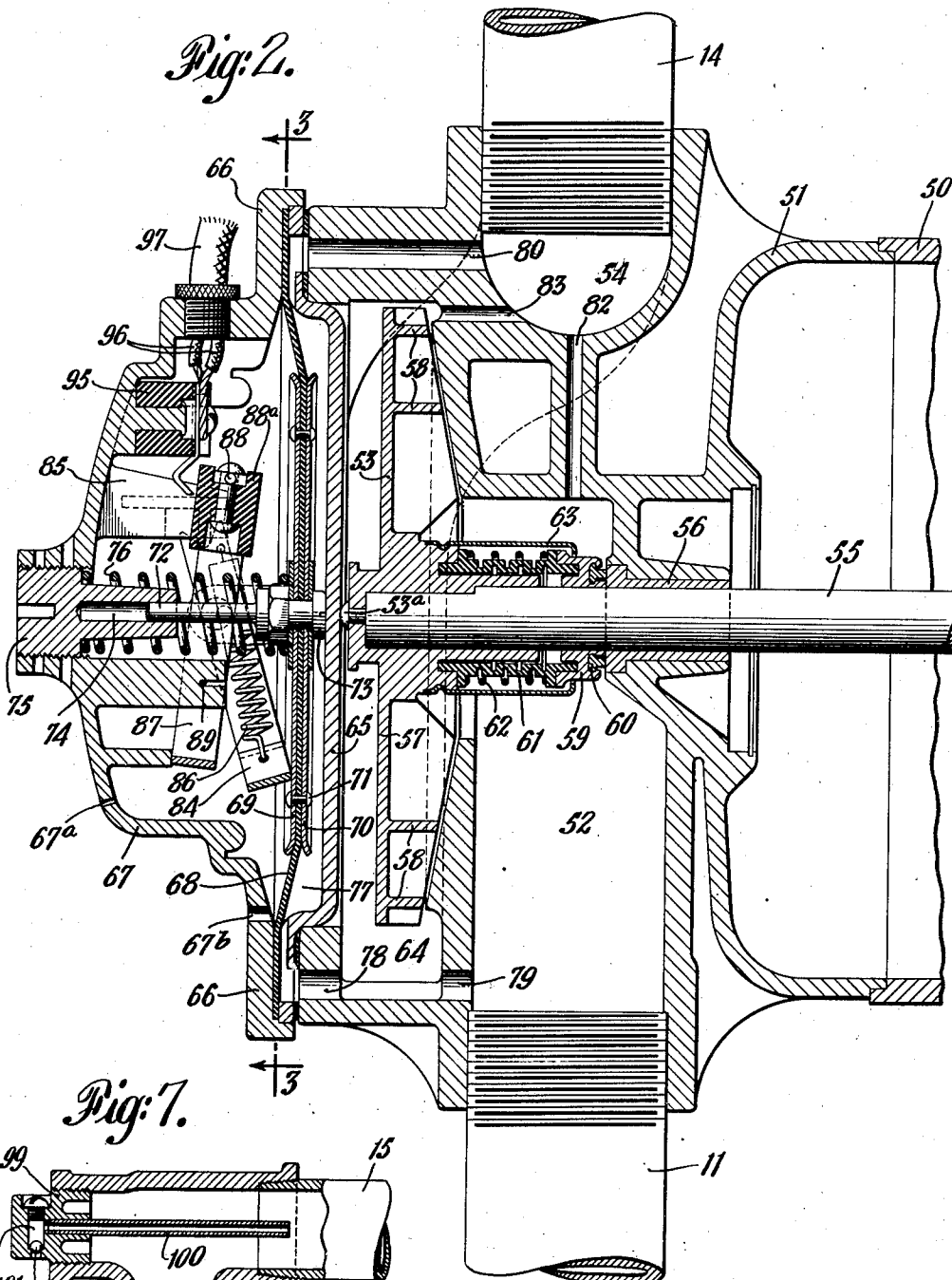
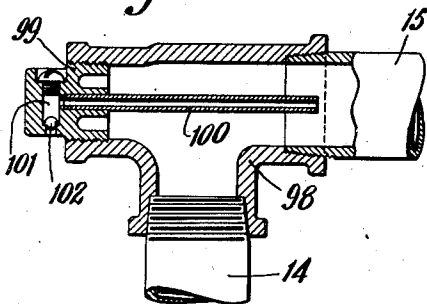


Fig. 7.



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Fig. 3.

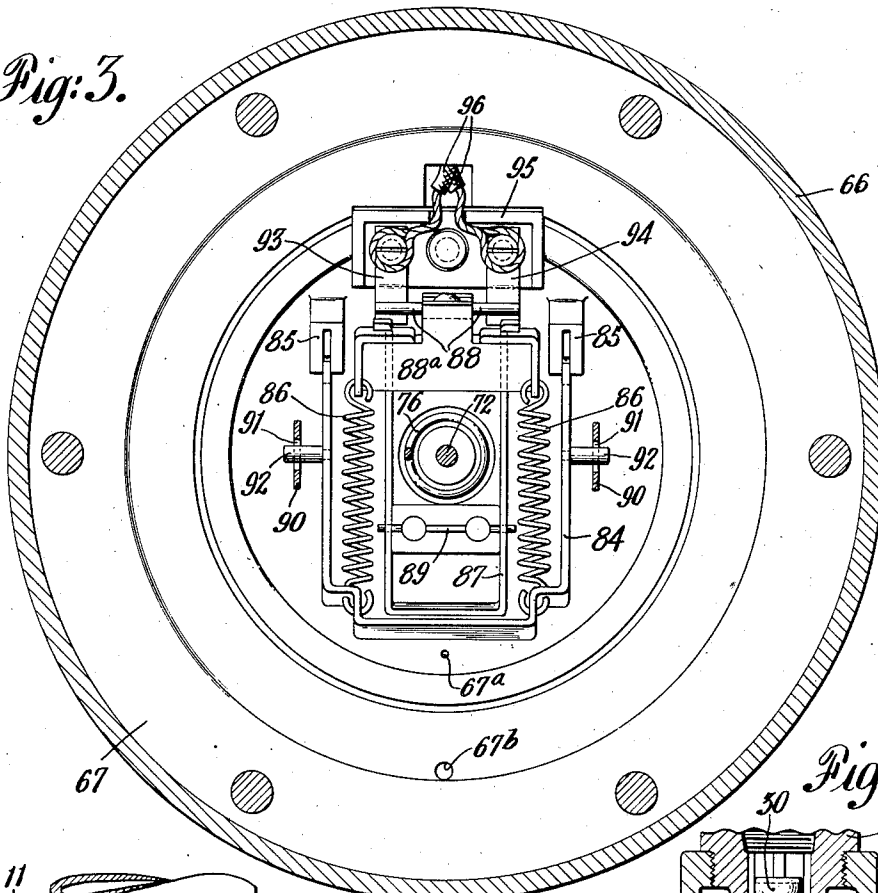


Fig. 5.

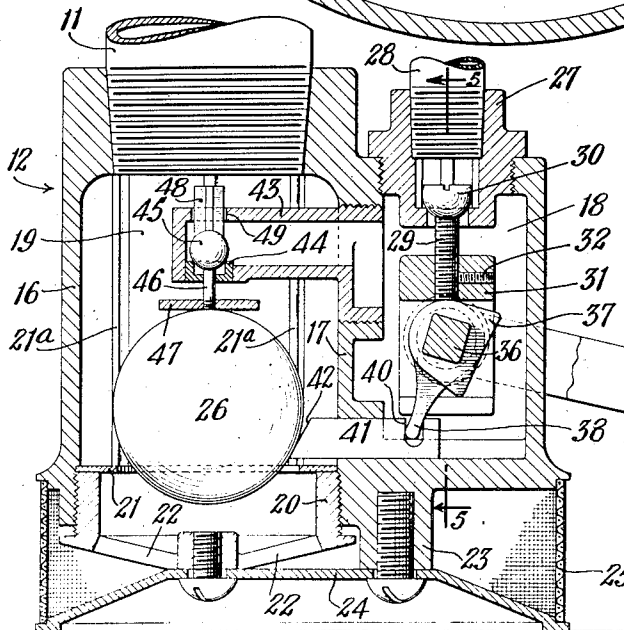
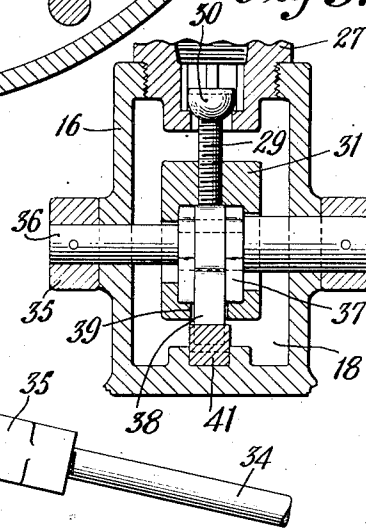


Fig. 4.

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UNITED STATES PATENT OFFICE

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SUMP PUMP PRIMING DEVICE

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Application November 18, 1940, Serial No. 366,084

18 Claims. (Cl. 103—26)

This invention relates to a pump priming and operating system that is particularly useful in places where water or other liquids accumulate intermittently or periodically.

Most sump pumps include either a cumbersome type of pump that does not require priming, an independent priming device, or the pump must be located fairly close to the surface of the liquid to be pumped to facilitate priming.

It is a relatively simple matter to provide an automatic means for starting an electric motor to drive a pump when the liquid to be pumped reaches a given level, and systems have been proposed heretofore in an attempt to accomplish automatic priming of a pump as well as starting and stopping of the motor driving the pump. Such systems have been complicated, however, involving many plumbing connections for installation and have had other objectionable features, including the flowing of priming liquid into the pump throughout its operation and poor synchronization of the motor starting and pump priming.

One object of this invention is to provide a simple and compact pump priming and operating system whereby a lightweight centrifugal pump may be automatically primed, started and stopped in accordance with the level of the liquid to be pumped.

A further object of my invention is to provide such an apparatus in which the pump may be located well above the highest probable water level, thus reducing the risk of damage to the pump and motor.

Another object of the invention is to provide such an apparatus in which the pump and motor are started at any given level of liquid in a container and continue to operate until the liquid to be pumped is substantially evacuated from the container.

Another object is the provision of a pump priming and operating system in which the supply of priming liquid is cut off when the pump is started.

One embodiment of the invention is illustrated by way of example in the accompanying drawings, in which

Figure 1 is a side elevation of an assembled apparatus showing a float valve assembly located in a typical sump below a pump assembly.

Figure 2 is a vertical sectional view through approximately the center of the pump assembly.

Figure 3 is a vertical sectional view showing the switch mechanism in elevation and taken on the line 3—3 of Figure 2.

Figure 4 is a vertical sectional view through approximately the center of the float valve assembly.

Figure 5 is a fractional vertical sectional view taken on about the line 5—5 of Figure 4.

Figure 6 is a side elevation of the impeller of the pump, and

Figure 7 is a fractional view partly in section of an anti-syphoning device that may be used with the apparatus under certain conditions.

The system according to my invention comprises a motor and pump assembly 10 connected by the pipe 11 to a float valve assembly 12 located in a suitable sump 13 or other pocket, depression or container from which water or other liquid is to be pumped. An outlet pipe 14 is connected to the outlet side of the pump and the liquid may be carried away through the pipe 15 connected thereto.

The float valve assembly 12 may comprise a housing 16 divided internally into two compartments 18 and 19 by the partition 17. The compartment 19 has an opening in its lower wall in which the plug 20 is threaded to hold the annular valve seat 21 in place. Vertical valve guides 21a may be formed inside the housing 16 to guide the ball of the valve for vertical movement. Plug 20 preferably has openings formed between the spokes 22 for the passage of liquid. Secured to the plug 20 and to a projection 23 depending from the housing 16 is a dished plate 24 serving as a base for the float valve assembly. This base may also be used to hold the annular screen 25 in place. A large ball 26 is adapted to drop into place in the seat 21. The upper portion of chamber 19 is connected directly to the pipe 11 leading to the pump.

The upper portion of chamber 18 has a valve mechanism 27 secured thereto, and the pipe 28 is fastened to this valve mechanism to supply city water or other suitable priming liquid under pressure from some other source to the assembly. A valve stem 29, provided with a suitable valve head 30 seated in the valve 27, is attached to a yoke 31 by means of the set screw 32. A suitable float valve 33 located in the sump 13 may be connected by the arm 34 and the bifurcated link 35 to the ends of a shaft 36 arranged to rotate within suitable bearings and passing through the compartment 18. The central portion of this shaft 36 carries a cam 37 disposed within the yoke 31. The sides of this cam 37 have upper and lower surfaces adapted to bear against the inner upper and lower surfaces of the yoke 31 and thus positively lift or lower the valve stem 29 and head

30 as the float valve 33 is raised or lowered. Projecting downwardly from a central part of the cam 37 is a finger 38 disposed to move back and forth freely through the slot 39 in the yoke 31. This finger 38 engages a notch 40 in a rod 41 5 that is arranged to reciprocate through a suitable opening in the partition 17. The forward end of rod 41 has an inclined surface 42 adapted to engage and raise the ball 26 off of the seat 21 when the float valve 33 is in its lowermost position. 10

A small hollow casting 43 is secured in an opening in the partition 17 so that its interior forms a part of the compartment 18. One end of this casting is provided with an opening in its lower wall to receive the valve seat 44 and guide one end of the ball and stem valve 45. This ball and stem valve 45 may be an integral piece consisting of a small stem 46 on the lower side of the ball and the upper fluted stem 48 20 adapted to slide back and forth through the opening 49 in the upper wall of the casting 43. The lower end of stem 46 is attached to the plate 47 located directly over and adapted to be contacted by the large ball 26.

The operation of the float valve assembly is as follows:

In the position illustrated in Figs. 1, 4 and 5 with only a small amount of liquid or no liquid in the sump 13, the float valve 33 is in its lowermost position, the ball 26 is raised off its seat by rod 41, valve head 30 rests on its seat and ball 45 rests on the seat 44. As water or some other liquid flows into the sump 13 and accumulates therein, the float valve 33 is raised by reason of its buoyancy. As the float valve 33 is raised, the shaft 36 and cam 37 are rotated so that the finger 38 moves the rod 41 back out of contact with the ball 26, allowing this ball to drop down on the seat 21 and thus close the only opening in the lower portion of chamber 19. 30

Continued upward movement of the float valve 33 raises the valve stem 29 and valve head 30 against the pressure of liquid in pipe 28 by the positive lifting action of the upper surfaces of cam 37 on the yoke 31. As this valve head 30 is raised, the liquid under pressure from pipe 28 flows into and fills the compartment 18. This liquid then flows out of compartment 18 around the fluted stem 48 into the compartment 19. When the compartment 19 is filled, the liquid begins to rise in the pipe 11 until it reaches the motor and pump assembly 10. The liquid thus supplied to the motor and pump assembly serves, in a manner that will be described, to prime the pump and start the motor automatically. 35

As the pump is started, a sufficient suction or rush of liquid through the pipe 11 is created to raise the ball 26 off the seat 21 and allow liquid from the sump 13 to rush in through screen 25, past the spokes 22 and through compartment 19 into the pipe 11. In other words, the capacity of the pump is such as to demand more liquid than is supplied by the flow of water under pressure from the pipe 28 via the compartment 18. The ball 26 may be hollow or made of light material and preferably is just sufficiently heavy to remain on the seat 21 when priming liquid flows into the chamber 19. As the ball valve 26 is raised by the rush of liquid against it, it contacts the plate 47 and raises the ball 45 until it seats in the opening 49, thus shutting off at this point the flow of liquid under pressure from pipe 28. 40

The pump then continues to operate until the

liquid is pumped out of the sump 13, when the float valve 33 drops back into the position illustrated. This return of the float valve to its lowermost position again closes the valve 30, cutting off the liquid under pressure from even the compartment 18. The finger 38 again moves the rod 41 into position under the ball 26 to prevent the ball from dropping down on the seat 21. As the liquid is drawn out of the sump and air flows up into the pump, the pump and motor are automatically shut off as will be described, and the liquid in the pipe 11, pipe 14 and the pump is allowed to drain back around the ball 26 into the sump 13. 45

The pump and motor assembly 10 may comprise a suitable electric motor 50 with its housing connected directly to the pump housing 51. The lower portion of the pump housing 51 has a passageway 52 connected to the inlet pipe 11 which leads to the central portion of the impeller 53. The outlet from the pump comprises a passageway 54 leading from the outer portion of the impeller 53 to the outlet pipe 14. 50

The motor shaft 55 preferably extends directly through a suitable bearing 56 into the pump housing 51 and has the impeller 53 fixed to the end thereof by a key or any other suitable means. The impeller 53 may comprise a circular plate 57 with integral spiral vanes 58 extending in the direction of the motor 50. Around the hub of the impeller and the portion of shaft 55 within the pump housing 51, a liquid seal may be provided consisting of a metallic band 59 around the shaft 55 carrying an annular shoe 60 that bears against the end of bearing 56. Between the band 59 and the hug of impeller 53 is interposed a corrugated tubular sleeve 61 of rubber or other water proof flexible material held in place by the partially compressed coil spring 62. A thin metallic covering 63 may be spun in place to cover the sleeve 61 and spring 62. This seal, of course, revolves with the impeller 53 and shaft 55, and the shoe 60 is held tightly against the bearing 56 at all times by the action of the coil spring 62 and the bellows-like rubber sleeve 61 in spite of some axial movement of shaft 55. 55

The impeller is allowed to rotate freely within the compartment 64 of the pump housing 51, the open side of which is closed by the rigid plate 65 held in place by means of the flange 66 of a switch housing 67 secured by bolts or other suitable means to the pump housing 51. The shaft 55 may be held against axial movement by means of a suitable thrust bearing 50a at one side of the motor 50 and by the round beaded rivet 53a fixed to the impeller 53 and adapted to bear against the plate 65. 60

Also clamped between the pump housing 51 and the flange 66 of switch housing 67 are the edges of the flexible diaphragm 68, which may be made of soft rubber or other suitable flexible material, and reinforced throughout its central portion by the metal plates 69 and 70 held together by the rivets 71. Movement of the diaphragm may be guided by the stem 72 secured by means of the bolt 73 and a suitable nut to the plates 69 and 70. The stem 72 is adapted to slide in an opening 74 in a plug member 75 that is threaded into an opening in the switch housing 67 for axial adjustment. A coil spring 76 may be used to urge the diaphragm against the plate 65. 65

It will be apparent, therefore, that a compartment 77 of variable size, depending upon the position of the diaphragm, is provided between 70 75

the diaphragm 68 and the plate 65. This compartment may communicate through the passageways 78 and 79 with the outer edge of the impeller compartment 64 and the passageway 52. Passageway 79 is preferably of sufficiently small size relative to the inlet of the pump not to cause any difficulty when the pump is primed and operating at full speed. The upper portion of compartment 77 communicates through the passageway 80 with the outlet passageway 54 in the pump housing, and this outlet passageway 54 also is connected to the passageway 52 and impeller compartment 64, respectively, by means of the passageways 82 and 83.

Any suitable form of switch may be provided within the switch housing 67 for operation by the diaphragm 68. One suitable switch for this purpose comprises the U-shaped frame member 84, the ends of which are notched and pivotally held against lugs 85 protruding from the inner wall of the switch housing 67 by means of the coil springs 86, 86.

The upper ends of the coil springs 86, 86 may be connected to the upper portion of a frame 87 carrying an electrical contact bar 88 mounted on the block 88a of rubber or other suitable insulating material. The frame 87 is pivotally supported by the pin 89 resting in a slot in the switch housing 67. Connecting the frame 84 to the diaphragm 68 are a pair of ears 90 integral with and projecting from the plate 69 of the diaphragm, and having relatively large central openings 91 to receive the pins 92 fixed to the frame 84. Thus, as the diaphragm is moved to the left by pressure from within the pump housing, as viewed in Fig. 2, the ears 90 in contact with the pins 92 move the lower portion of the frame 84 to the left, pivoting it about the lugs 85. As the springs 86 pass dead center, the frame 87 carrying the contact bar 88 is suddenly moved to the left by the springs, pivoting about the pin 89, to bring the contact bar 88 into contact with the electrodes 93 and 94. These electrodes may be mounted on a suitable block 95 of rubber or other insulating material within the switch housing 67 and connected by means of the wires 96 in the cable 97 to the motor 50.

Vent holes 67a and 67b may be provided in the switch housing 67 to permit easy movement of the diaphragm 68 and allow any liquid finding its way past the diaphragm to drain out of this housing.

The operation of the pump and motor assembly 10 is as follows:

As the liquid from the pipe 28 rises in the pipe 11 by reason of the operation of the float valve assembly 12 described above, this liquid flows into the passage 52 and through the passage 78, 79 into the compartment 77 and the impeller compartment 64 in the pump housing 51. As the liquid continues to rise, it fills completely all the compartments in the pump housing by means of the communicating passages 80, 82 and 83, and rises into the pipe 14. As soon as the liquid has risen to a predetermined height in the pipe 14, a sufficient head is created to force the diaphragm 68 towards the left, as viewed in Fig. 2. Adjustment of the plug 75 varies the force of spring 76 and consequently the head of liquid required may be varied to suit any given installation. Movement of the diaphragm to the left in turn through the ears 90, pins 92 moves the switch frame 84 to the left and this causes the contact bar support 87 to move over suddenly, making a contact and connecting the electrodes 93 and 94.

This connection supplies current to the motor 50, and the impeller 53 is then rotated rapidly by the motor.

Rotation of the impeller creates a suction around the central or hub portion of the impeller drawing liquid up through passageway 52 and the pipe 11. A pressure is created by centrifugal force around the periphery of the impeller, and this pressure is transmitted through the passageways 78 and 80 into the compartment 77 holding the diaphragm 68 in the extreme lefthand position against the force of spring 76. The motor and pump therefore continue to operate so long as liquid is supplied to the pump, but as soon as air is sucked up into the passageway 52, the pressure on the diaphragm 68 is relieved and the spring 76 then forces the diaphragm back to the position shown in Fig. 2. As the diaphragm moves back towards the right, it pulls the frame 84 to the right and the contact bar support 87 moves to the right with a snap action disengaging the bar 88 from the contacts 93 and 94.

In some instances, it may be desirable to bend the outlet pipe 15 downwardly, and this is apt to create a syphoning condition during operation of the pump. If such syphoning action takes place, the pressure in the pipe 14 and in the compartment 77 will be substantially reduced with the result that the motor may be prematurely shut off by return of the diaphragm 68 to the position shown in Fig. 2. Such a condition, of course, would cause the motor to be started and stopped alternately as long as liquid remains in the sump to be pumped out.

To avoid this difficulty and to make sure of a constant pressure on the diaphragm 68 keeping the motor in operation until the liquid is completely pumped out, an anti-syphoning device such as illustrated in Fig. 7 may be used when the outlet pipe 15 from the pump bends downwardly. This device may consist simply of an elbow 98 between the pipes 14 and 15, fitted with a block 99 carrying a long tube 100 that projects well past the pipe 14 into the pipe 15. The tube 100 may communicate with the atmosphere through a small opening 101 in the block 99, and this opening may be sealed against pressure from within by a small ball valve 102.

Thus, whenever a syphoning action occurs, the reduction in pressure will not be transmitted beyond the end of the tube 100 because air will be sucked in through the opening 101 and tube 100 to relieve such reduction in pressure. So long as the motor is operating, therefore, there will always be a pressure equal to the head of liquid in the pipe 14 on the diaphragm 68, ensuring continuous operation of the motor and pump so long as liquid is passing through the pump. Such an anti-syphoning device will not be necessary, of course, in any case where the outlet pipe 15 does not bend downwardly to create a syphoning condition.

It will be apparent that a pump operating and priming mechanism in accordance with my invention may be manufactured economically and very easily installed in any given location where water or other liquid is apt to accumulate and has to be pumped out from time to time. Such a device is completely automatic and enables the pump to be maintained at a high enough level so that damage to the pump and motor by the liquid is extremely unlikely.

While the apparatus illustrated is a preferred embodiment of the invention, it will be apparent that the details of this apparatus may be varied

considerably without departing from the invention. For example, various other types of such mechanisms may be employed instead of the particular arrangement for a snap switch that is illustrated. Also various other float valve assemblies may be used that utilize the principles of this invention.

In some cases it may be desirable to maintain a given level of liquid in a sump or other container, and in such an event, the float valve assembly 12 may be raised the required distance above the bottom of the container. Also, the device may be used where city water or some other source of priming fluid under pressure is not readily available by connecting the pipe 28 to an elevated tank and refilling the tank from the outlet pipe 15 each time the pump operates.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

1. Pump priming and controlling apparatus comprising a motor-driven pump, a conduit extending to a point below said pump and connected to the inlet side thereof, switch means connected to and forming an integral unit with said pump for operating said motor, and means for supplying priming liquid from a source of liquid under pressure to said pump through said conduit to prime the pump and actuate said switch means simultaneously.

2. Pump priming and controlling apparatus comprising a motor-driven pump, a conduit extending to a point below said pump and connected to the inlet side thereof, switch means connected to said pump for operating said motor, and means for supplying priming liquid from a source of liquid under pressure to said pump through said conduit to prime the pump, said switch means being actuated to start said motor solely by liquid supplied to said pump.

3. Pump priming and controlling apparatus comprising a motor-driven pump, means for supplying priming liquid from a source of liquid under pressure to fill said pump, and switch means actuated by the pressure of priming liquid in said pump for starting said motor, said switch means serving to maintain said motor and pump in operation as long as liquid is being pumped thereby.

4. Pump priming and controlling apparatus comprising a motor-driven pump, means for supplying priming liquid to fill said pump, switch means actuated by the pressure of priming liquid in said pump for starting and stopping said motor, and means for cutting off the supply of priming liquid automatically as soon as the motor and pump are started.

5. Pump priming and controlling apparatus comprising a motor-driven pump, a conduit extending to a point below said pump and connected to the inlet side thereof, switch means connected to said pump for operating said motor, means for supplying liquid to said pump through said conduit to prime the pump and actuate said switch means, and means actuated by the flow of liquid through said conduit for cutting off the supply of priming liquid when said pump is started.

6. Pump priming and controlling apparatus

comprising a motor-driven centrifugal pump, diaphragm operated switch means directly responsive to pressures within said pump for starting and stopping said motor, and means for supplying to said pump just sufficient liquid from a source of liquid under pressure to prime said pump and actuate said switch means.

7. Pump priming and controlling apparatus comprising a container for liquid to be pumped, a motor-driven pump above the level of said liquid, a conduit connected to the inlet of said pump and extending into said liquid, motor starting and stopping switch means connected to said pump and directly responsive to changes of pressure at the outlet side of said pump, and means responsive to the level of liquid in said container for supplying liquid to said pump to prime the pump and actuate said switch means after the pump is primed.

8. Pump priming and controlling apparatus comprising a container for liquid to be pumped, a motor-driven pump above the level of said liquid, a conduit connected to the inlet of said pump and extending into said liquid, motor operating switch means connected to said pump, means responsive to the level of liquid in said container for supplying liquid to said pump to prime the pump and actuate said switch means, and means actuated by the flow of liquid through said conduit for cutting off said supply of priming liquid when said pump is started.

9. Pump priming and controlling apparatus comprising a container for liquid to be pumped, a motor-driven pump above the level of said liquid, a conduit connected to the inlet of said pump and extending into said liquid, motor starting and stopping switch means connected to said pump, means responsive to the level of liquid in said container for supplying liquid from a source of liquid under pressure to said pump through said conduit to prime the pump and actuate said switch means, and means for cutting off the supply of priming liquid when said pump is started.

10. Pump priming and controlling apparatus comprising a motor-driven pump, a conduit extending to a point below said pump and connected to the inlet side thereof, switch means connected to said pump responsive to pressure within the pump for starting and stopping said motor, means for supplying liquid through said conduit to prime said pump and actuate said switch means, and means for allowing liquid in the pump to drain out of said pump and conduit after operation of the pump is stopped.

11. Pump priming and controlling apparatus comprising a motor-driven pump, a conduit extending to a point below said pump and connected to the inlet side thereof, switch means connected to said pump for operating said motor, means for supplying liquid from a source of liquid under pressure through said conduit to prime said pump and actuate said switch means, means for cutting off said supply of priming liquid when the pump is started, and means allowing liquid to drain out of said pump and conduit after operation of the pump is stopped.

12. A motor-driven centrifugal pump comprising a pump housing, a switch housing, switch means in said switch housing for operating the motor, and a diaphragm between said pump housing and switch housing responsive to fluid pressure within the pump housing during operation of the pump for actuating said switch means.

13. A motor-driven centrifugal pump compris-

ing a pump housing, a switch housing, switch means in said switch housing for operating the motor, and a diaphragm for actuating said switch means closing one side of said switch housing and responsive to fluid pressure from the outlet side of said pump.

14. A motor-driven centrifugal pump comprising a pump housing, a switch housing connected thereto, switch means in said switch housing for operating the motor, flexible fluid pressure responsive means connected to said switch housing for actuating said switch means, and conduit means for the passage of fluid between said flexible means and the outlet side of said pump housing.

15. Pump priming and controlling apparatus comprising a motor-driven pump having an outlet thereabove, means for supplying priming liquid to prime said pump, switch means actuated by the pressure of liquid in said pump for operating said motor, and valve means in said outlet a predetermined distance above said pump responsive to a pressure within said outlet less than atmospheric pressure for introducing atmospheric air into said outlet.

16. Pumping apparatus comprising a motor-driven pump, a conduit connected to the inlet

side of said pump and extending to a point therebelow, a check valve in said conduit, means for supplying priming liquid to said pump through said conduit, and means actuated by said check valve for cutting off said supply of priming liquid when the pump starts to operate.

17. Pumping apparatus comprising a motor-driven pump, a conduit connected to the inlet side of said pump and extending to a point therebelow, a check valve in said conduit, means for supplying priming liquid to said pump through said conduit, and means acting on said check valve to permit draining of liquid from said conduit and pump after said pump ceases to operate.

18. Pumping apparatus comprising a motor-driven pump, a conduit connected to the inlet side of said pump and extending to a point therebelow, a check valve in said conduit, means for supplying priming liquid to said pump through said conduit, means actuated by said check valve for arresting the supply of priming liquid when the pump starts to operate, and means acting on said check valve to permit draining of liquid from said conduit and pump after said pump ceases to operate.

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