

May 28, 1946.

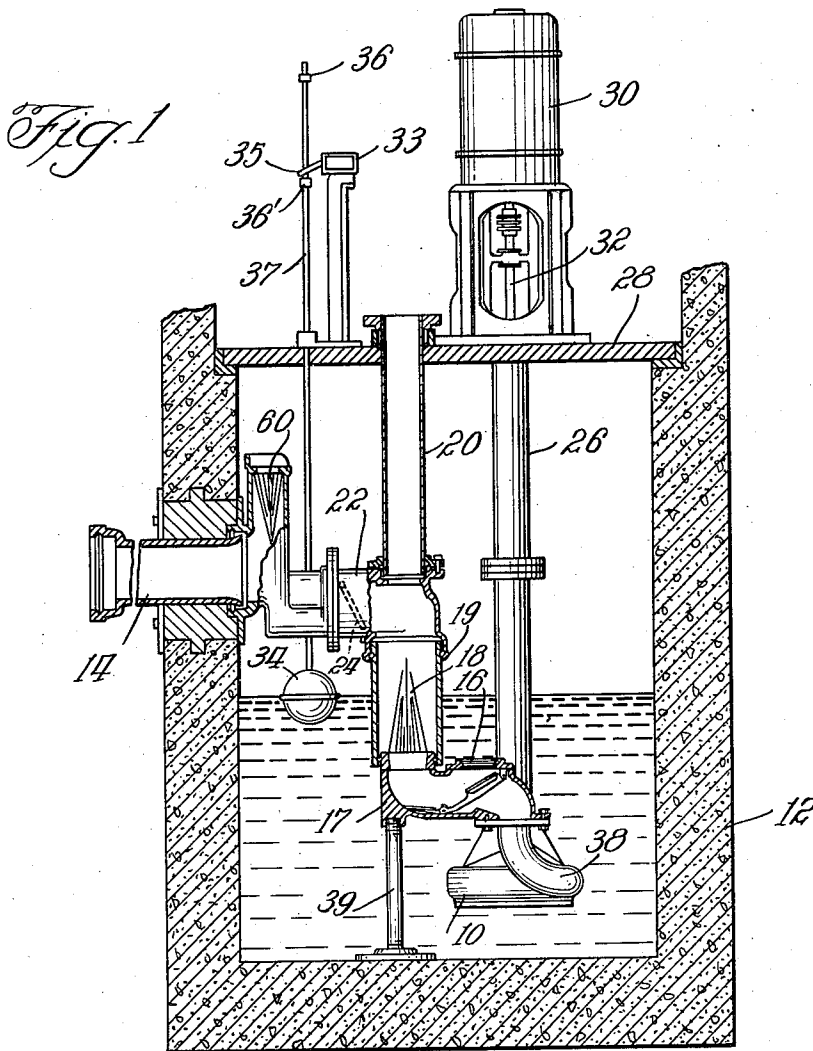
W. H. LANNERT

2,401,254

PUMPING APPARATUS

Filed Dec. 7, 1942

2 Sheets-Sheet 1



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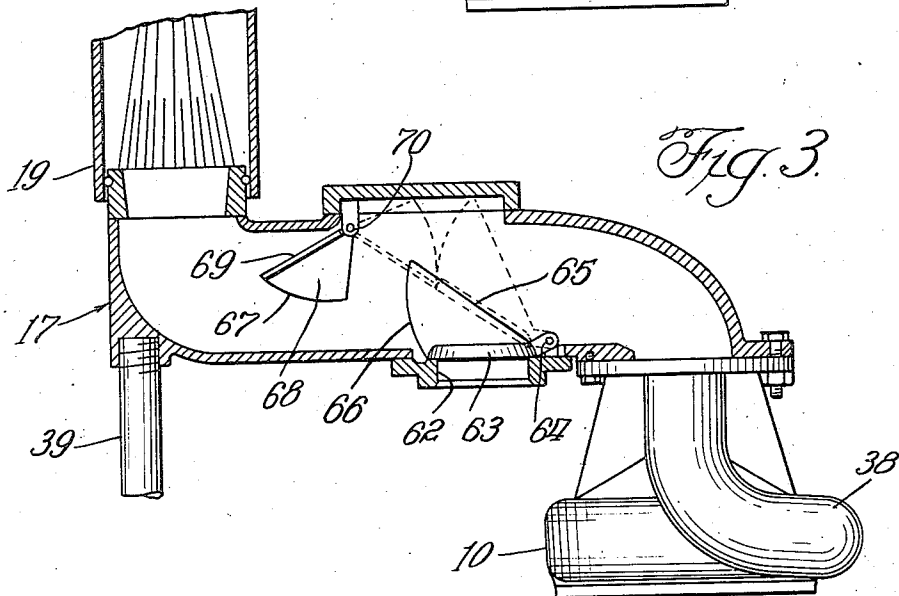
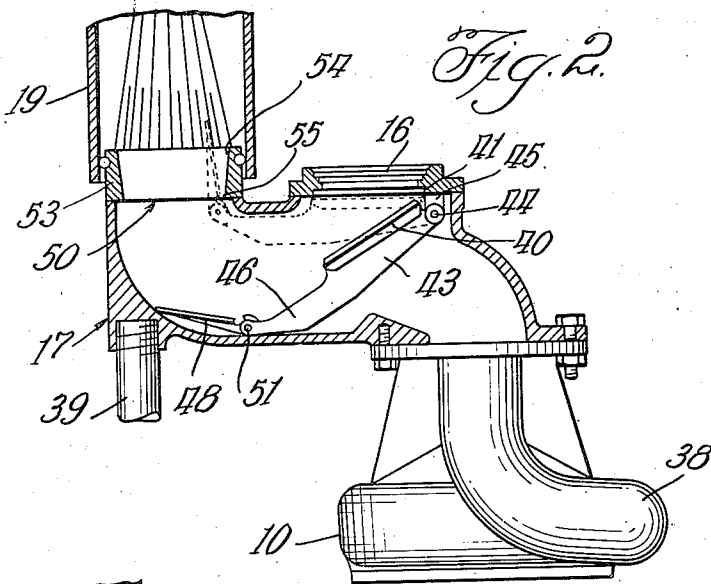
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,401,254

PUMPING APPARATUS

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Application December 7, 1942, Serial No. 468,042

4 Claims. (Cl. 103—26)

This invention relates to apparatus for pumping liquids containing solids and more particularly to apparatus for pumping sewage. In apparatus to which this invention relates, sewage or other liquid containing solids flows into a basin containing or associated with a pump in a direction reversed to the direction of flow when the pump is operating.

It is now common practice to interpose a screen in the path of flow of the incoming fluid to intercept and screen out solids in the fluid in order to prevent these solids from entering the pump and clogging it or otherwise deleteriously affecting it. It is also common practice to permit the screened fluid to flow through the pump, while it is idle, to enter the fluid into the basin and to then operate the pump to discharge the fluid from the basin. In passing the screened fluid into the basin in this manner, a resistance to the flow is developed for the following reasons.

The inflow, reversed to the ordinary pumped flow, causes the impeller of the pump to spin backwards and creates a whirling vortex within the pump chamber. The centrifugal force generated by this vortex together with the frictional resistance to flow through the passages in the pump impeller develop this undesirable resistance to inflow. In consequence the capacity of the unit to handle the desired flow is impaired, requiring costly modifications of the pump to compensate for the low inflow rate.

Attempts have been made to avoid this resistance to inflow by by-passing the pump and entering the liquid into the basin at some point in advance of the pump. Thus, the incoming strained liquid has been introduced into the basin from a point intermediate the strainer and the pump. From the basin, the liquid was pumped back through the strainer, thereby freeing the latter from the accumulated solid substances, and the liquid together with the solid substances discharged into a sewer or other suitable place.

The means employed, a by-pass valve, to effect this by-passing of inflowing liquid have not been satisfactory because the valve did not operate sufficiently positively and developed excessive noise and water hammer when opening and closing. In accordance with the present invention I have made an improvement in such by-pass valve mechanisms, including therein an independent element responsive to the flow of water to operate the by-pass valve, thereby operating the valve more positively and without developing objectionable noise and water hammer when opening and closing it.

The foregoing advantages as well as others will be readily apparent from a consideration of the illustrative embodiments of my invention shown in the drawings taken with the detailed description thereof. It is to be understood that my invention is not to be considered as limited to the specific forms shown and described except as included in the accompanying claims which form a part of my specification.

Referring to the drawings:

Figure 1 is a vertical, transverse section, partly in elevation, of sewage pumping apparatus embodying one form of my invention;

Fig. 2 is an enlarged, fragmentary, vertical section, with parts in elevation, of the by-pass valve mechanism shown in Fig. 1; and

Fig. 3 is a similar view of a modified form of by-pass valve mechanism in accordance with my invention.

In the drawings, there is shown a pump 10, preferably of the centrifugal type, located within a basin or sump 12 into which the sewage or other source of liquid supply to be pumped is delivered. The sewage to be pumped is entered through inlet pipe 14, which passes through a wall of the basin, and flows into basin 12 through a valve-controlled opening 16 in a fitting 17, forming part of the inlet passageway, interposed between the pump and a strainer 18. Strainer 18 is located in the lower portion of a pipe 19 which communicates with inlet pipe 14 through pipe 22 and is in direct communication with discharge pipe 20. The strainer serves to intercept sewage solids or solids contained in the liquid to be pumped and thus prevents them from entering the basin and, ultimately, the pump. A check valve 24 in pipe 22 allows the sewage to pass to strainer 18, but is forced shut when the pump discharges liquid, thus preventing the pump from discharging through inlet pipe 14.

Pump 10 is supported adjacent the bottom of basin 12 by a hanger pipe 26 which is carried by cover 28 of the basin. Electric motor 30, supported on cover 28, and its motor shaft are connected to the impeller shaft 32 of the pump in a conventional manner. As shown, impeller shaft 32 extends through hanger pipe 26. The suction inlet of the pump is through the bottom of the pump casing and the discharge is through a volute 33 which is connected to and communicates with fitting 17 and, in turn, with pipe 19 and discharge pipe 20. The discharge pipe extends upwardly in basin 12 and through cover 28, and is connected by suitable fittings to a carry-off pipe (not shown) through which the

ejected sewage or other liquid and accumulated screened solids are carried to a sewer or other place of disposal. When the pumping apparatus is located in a dry pit, the suction inlet of the pump is connected by a suitable conduit with an associated basin and opening 16 is in communication with this conduit or with the wet wall, as is well understood.

The operation of motor 30 in driving pump 10 is controlled by a switch 33 which is operated by a float 34 within basin 12. In the form of switch operating mechanism shown, switch lever 35 is operated by buttons 36, 36' mounted upon a switch actuating rod 37 which has the float 34 secured to its lower end. The arrangement of the parts of the switch mechanism is such that when the liquid in basin 12 is at a low level, switch 33 is open and the motor and pump are at rest. When, however, the level of the liquid in the basin reaches a predetermined high level, switch 33 is closed by button 36', thereby closing the electric circuit through the motor to operate it and, in turn, the pump.

Fitting 17, as shown, is a horizontally disposed conduit and is joined with fluid-tight connections to the lower portion of pipe 19 and to the exit end of volute 38. A post 39 aids in supporting fitting 17 and the discharge pipes. Additional support for the discharge pipe and associated pipes and the fitting is provided by cover 28.

Strained sewage entering fitting 17 when pump 10 is not in operation flows through opening 16, in the upper portion of fitting 17, into the basin. A valve disc 40, designed to be urged onto valve seat 41 by the liquid discharged from the pump, prevents the flow of liquid into the basin when the pump is in operation. Valve disc 40 is carried by a lever 43 hinged at one end, as at 44, to a depending lug 45. The other end 46 of lever 43 extends outwardly from the valve disc for a substantial distance, sufficient to allow a flap 48, forming a hinged extension of this end of the lever, to be urged upwards into pipe 19, as hereinafter described. Flap 48 is of such shape and dimensions as to substantially block an opening 50 in fitting 17 when disposed across the opening. This opening is preferably but not necessarily in direct alignment with the bore of pipe 19. The hinged connection 51 between the flap and end 46 of lever 43 is of a construction simulating an elbow-like joint to permit the upward movement of the flap and to restrain the downward movement to a position approximately in line with lever extension 46, as shown in full lines in Fig. 2. A ring or annular member 53 is positioned intermediate fitting 17 and the lower extremity of pipe 19. Ring 53 has an inner downwardly tapered surface 54 which terminates in a lower inwardly extending edge 55 against which hinged flap 48 bears when the latter is urged upwardly to the dotted line position shown in Fig. 2.

With the by-pass valve mechanism in the full line position shown in Fig. 2 the major portion of the sewage or other liquid to be pumped flows through opening 16 into basin 12. With the by-pass valve mechanism in the dotted line position shown in this figure pump 10 is pumping liquid from basin 12 and discharging it through discharge pipes 19 and 20.

In the operation of this device, assuming that the by-pass valve mechanism is in the dotted line position shown and the pump at rest, sewage or other liquid enters inlet 14 and passes

through strainer 18. The solid matter contained in the liquid is intercepted by the strainer and begins to accumulate around it. Almost instantaneously, the sewage or other liquid passing down the lower pipe portion 19 of the discharge pipe builds up a pressure behind flap 48 and this pressure together with the force of gravity causes it to fall to substantially a horizontal position across the opening 50, in substantial alignment with lever 43. In this position the flap almost obstructs the flow of liquid passing through the strainer. Since hinge 51 is of such construction as to limit the downward relative independent movement of flap 48 with respect to lever 43, when flap 48 is in the substantially horizontal position across opening 50 the flow of water through the strainer forces flap 48 still further downward, carrying lever 43 and valve disc 40 with it to permit the liquid to by-pass the pump. Because of the substantial pressure on flap 48, the opening of valve disc 40 is relatively quick and positive. As soon as the liquid in basin 12 reaches the predetermined high level, switch 33 is closed and the pump motor is started thereby operating the pump. The water discharged by the pump exerts a pressure against valve disc 40 and, in turn, against flap 48 forcing the by-pass valve mechanism to the dotted line position shown. The liquid discharged from the pump passes through fitting 17, up through strainer 18, carrying with it the solid matter accumulated therearound, and is discharged with the solid matter through discharge pipe 20. When the liquid in basin 12 reaches the predetermined low level, the switch is opened, the pump stopped and the former operation repeated.

In the operation of the device as described it is manifest that the operation of the pump is intermittent, depending upon the level of the liquid in basin 12. If it is desired to introduce sewage or other liquid continuously into basin 12 and to pump it continuously therefrom the pumping apparatus, motor and motor control mechanism hereinabove described may be duplicated within the basin as in Durdin, Jr., Patent No. 1,785,480 and my Patent No. 2,265,650, and operated as therein described to accomplish this.

In pumping apparatus of the type herein described now in commercial use, a valve is provided in a suitable place in inlet line 14, usually in advance of it, whereby the apparatus may be shut off from the source from which the sewage or other liquid is delivered. Many times the flow of this fluid is of considerable volume, beyond the capacity of the apparatus to handle it in the manner described above, and to take care of this large fluid flow a strainer 60 is secured in an opening in the top of inlet conduit 14, as shown, through which some of the liquid passing through inlet passageway 14 may escape directly into basin 12.

In the modified form of valve by-pass mechanism disclosed in Fig. 3, a by-pass opening 62 in the lower part of fitting 17 is provided. This opening is designed to be closed by a valve disc 63 in response to the discharge flow from the pump. Valve disc 63 is hinged at the end adjacent the pump, as at 64. Secured to or formed integral with the top of valve disc 63 is a cam member 65, of relatively small cross-sectional dimensions, having a cam surface 66 rising upwardly from the free end of the valve disc. This cam surface is designed to cooperate with a cam surface 67 on a cam member 68 on one side of a depending, hinged flap 69 to open valve disc

63. As shown, flap 69 is pivotally mounted, in advance of the valve disc, as at 70.

With the pump in operation, the valve mechanism members are in the full line positions shown, having been carried there by the force of the liquid discharged from the pump. The dotted line positions of the valve mechanism members represent the open valve position. In this position the pump is at rest and liquid is flowing into basin 12 through opening 62. It is to be noted that the function of flap 69 is the same as flap 48; however, instead of being connected to disc 63, flap 69 operates disc 63 through its cam member 68 and the cam member attached to disc 63. When flap 69 is swung counter-clockwise by gravity and the inflowing liquid, cam 67 rolls on cam 66 and forces disc 63 upwardly away from the opening. When flap 69 is swung clockwise by the pump flow disc 63 closes. It is preferred that cams 66 and 67 be so designed that they roll on one another without any substantial sliding; however, this is not essential. The design of the preferred cams is a matter known to skilled workers in the art.

I claim:

1. In apparatus for pumping liquids wherein the liquid flows into a basin containing or associated with a pump in a direction reversed to the direction of flow when the pump is operating, a pump by-pass passageway, a valve operable to open said passageway when liquid is entered into said basin and to close said passageway when liquid is pumped from said basin and a valve control mechanism, said valve control mechanism comprising a valve actuating member secured to said valve and extending outwardly therefrom and a valve actuator hinged to the outer extremity of said actuating member, said actuator being in the path of liquid flow and responsive to liquid flow towards said basin to operate said actuating member and, in turn, said valve to open said passageway, and said valve, while in open position, being in the path of liquid flow from the basin and responsive to said flow to close said passageway.

2. In the apparatus set forth in claim 1 wherein said actuator is so hinged to the outer extremity of said actuating member as to be relatively freely swingable in the direction of liquid flow from said basin and to have a limited swinging movement in the direction of liquid flow towards said basin.

3. In the apparatus set forth in claim 1 wherein said valve is in disc form and, in its closed position, lies in a substantially horizontal plane and said actuating member lies in substantially the same plane as said disc and wherein said actuator is so hinged to the outer extremity of said actuating member as to be freely swingable to a plane substantially vertical to the plane of said disc and actuating member when the liquid flows from said basin and to be swingable only to substantially the same plane as said disc and actuating member when the liquid flows to said basin.

4. In apparatus for pumping liquids wherein the liquid flows into a basin containing or associated with a pump in a direction reversed to the direction of flow when the pump is operating, a pump by-pass passageway, a wafer-like valve operable to open said passageway when liquid is entered into said basin and to close said passageway when liquid is pumped from said basin and a valve control mechanism, said valve control mechanism comprising an actuating cam member secured to said valve and an independent swingable member responsive to liquid flows either to or from said basin, said swingable member having a cam member secured thereto and said swingable member being so positioned with respect to said valve that the aforesaid cam members are in opposed relationship, said swingable member being responsive to liquid flow towards said basin to bring said cam members in operative relationship to open said valve and responsive to liquid flow from said basin to carry its cam member out of operative relationship and permit the liquid flow to close said valve.

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