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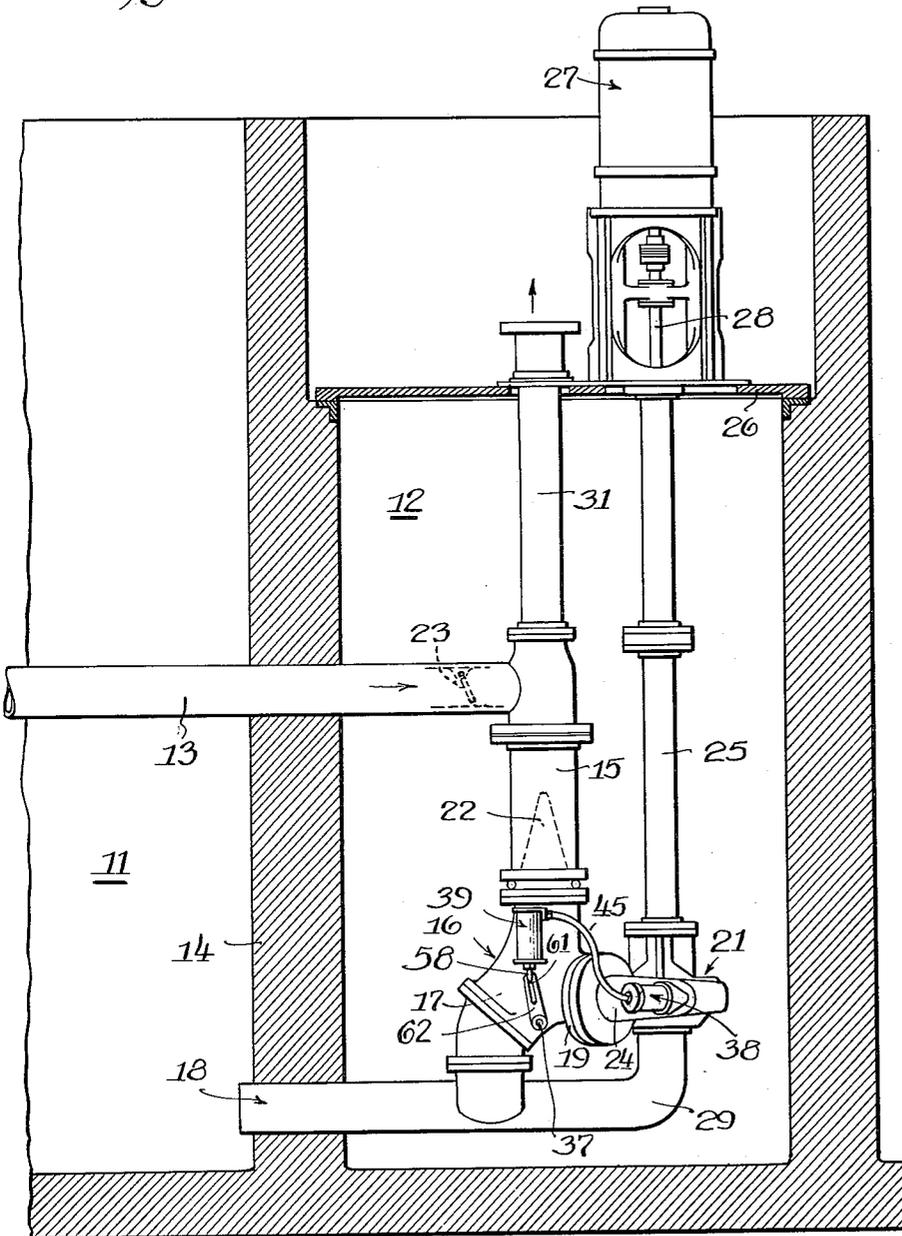
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HYDRAULIC CONTROL MEANS FOR A BY-PASS VALVE

Filed Aug. 29, 1958

2 Sheets-Sheet 1

Fig. 1



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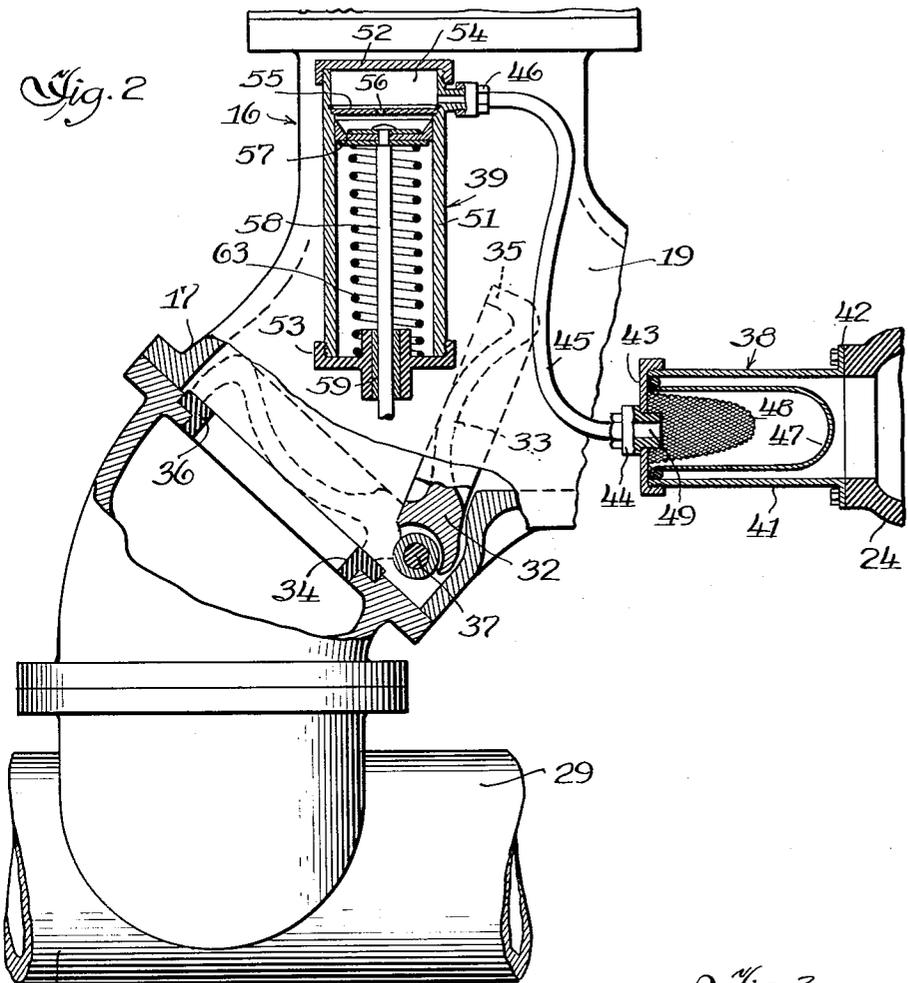
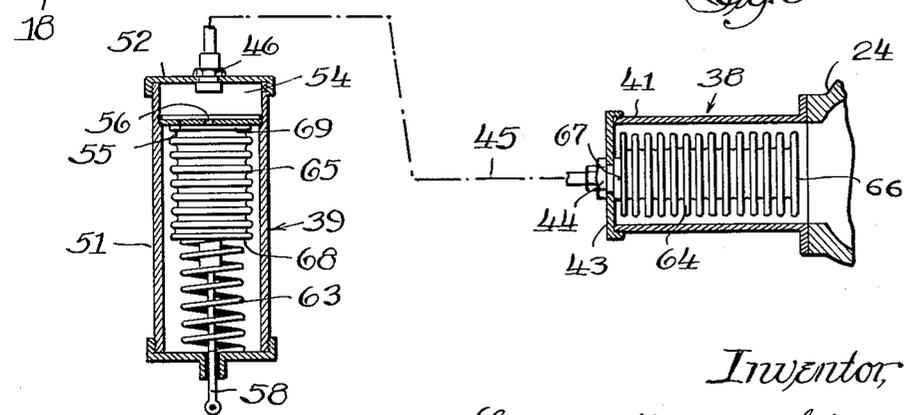


Fig. 2

Fig. 3



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HYDRAULIC CONTROL MEANS FOR A BY-PASS VALVE

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This invention relates to hydraulic control means for a by-pass valve on a sewage pump, and is particularly concerned with control means operated by a separate hydraulic system protected from the sewage controlled by the pump.

In pumps for discharging sewage from a sewage basin it has been customary to provide a valve for by-passing the pump so that the sewage flowing into the basin while the pump is idle does not flow through the pump. Such structure is disclosed in my prior Patent No. 2,760,512, issued August 28, 1956.

In accordance with the present invention, the means for controlling the by-pass valve comprises a power element connected to the mechanical linkage for opening and closing the by-pass valve, and a reservoir attached to the pump casing, pipe line or force main. The reservoir is provided with a flexible membrane or sealed bellows responsive to pressure variations in the sewage, and an orifice is provided between the reservoir and the power element. The membrane or bellows prevents the sewage from entering the reservoir.

While the pump is operating, the pressure of the sewage against the flexible membrane or bellows forces the liquid, preferably water, of the closed hydraulic system from the reservoir through the orifice and into the power element to move the by-pass valve to closed position and to hold it closed. When the operation of the pump is stopped, and the pressure of the sewage against the membrane stops, spring pressure against the piston of the power element forces the by-pass valve upwardly into open position as it forces the liquid from the power element back through the orifice into the reservoir, where it stays until the pump resumes its operation. The operation of the pump is started and stopped automatically in response to changes in the liquid level of the sewage in the basin by means not pertinent to the present invention.

The closed hydraulic system which constitutes the control means for moving the by-pass valve is protected against direct contact with the sewage, and therefore the solid foreign matter in the sewage cannot adversely affect the sensitivity or the efficiency of the valve control means.

The structure by means of which the above noted and other advantages of the invention are attained will be described in the following specification, taken in conjunction with the accompanying drawings, showing two preferred illustrative embodiments of the invention, in which:

FIG. 1 is a vertical, transverse sectional view of a dry pit and associated wet well or basin, showing a sewage pumping apparatus embodying my invention arranged in the dry pit;

FIG. 2 is an enlarged elevational view of a portion of the apparatus shown in FIG. 1, showing parts of the by-pass valve broken away and the hydraulic control system in section; and

FIG. 3 is a sectional view showing another embodiment of the hydraulic control system.

Referring now to the accompanying drawings and particularly to FIG. 1, a basin or sump 11 into which sewage to be pumped is delivered, has associated with it a dry pit 12. The sewage or other liquid enters an inlet pipe 13 which may pass through the partition wall 14 between

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the basin and pit, and flows downwardly through a pipe 15 into a valve controlled pump by-pass fitting 16 and then out through one leg 17 of said fitting and through a conduit 18 into the basin 11. The other leg 19 of said fitting is in direct communication with a pump 21. Preferably, a strainer 22 is fitted into the lower portion of pipe 15 which serves to intercept sewage solids and thus prevent solids from entering the basin and, as will become apparent presently, the pump. A one-way check valve 23 is mounted in inlet pipe 13. This valve is forced shut when pump 21 is operating to discharge liquid from the basin.

The pump 21 has its discharge volute 24 mounted in flow communication with the leg 19 of the by-pass fitting 16, as aforementioned, and it is supported adjacent to the bottom of pit 12 by a hanger pipe 25 which is carried by a pit cover 26. An electric or other suitably driven motor 27, supported on pit cover 26, and its shaft are connected to the impeller shaft 28 of pump 21 in a conventional manner. This shaft extends downwardly through hanger pipe 25. The suction inlet to the pump 21 is connected to a pipe 29, which is an extension of the conduit 18 leading from basin 11.

When pump 21 is in operation, liquid withdrawn from basin 11 flows through conduit 18, pipe 29, pump 21, by-pass fitting 16, and pipe 15, and is discharged through a pipe extension 31 that passes upwardly through pit cover 26. When the pump apparatus is located in a wet basin or sump, the suction inlet to the pump is in direct communication with the basin.

The pump by-pass fitting 16 has a valve element 32 therein (FIG. 2) in the form of a disc preferably having a top wall 33 which bridges the pump by-pass passage-way or opening 34 in the leg 17, and an annular skirt portion 35 adapted to seat on a valve seat formed by an annular member 36 which is positioned within the said opening. The top wall 33 preferably has a cup shape and the concave side thereof is in the direct line of flow from the pump when the valve is in its open position as shown in FIG. 2. The valve element 32 is mounted firmly on a pivot shaft 37 to permit it to be moved into open and closed positions. One end of the shaft 37 extends to the outside of the fitting 16 for a purpose to be explained presently.

Strained sewage entering the by-pass fitting 16 when the pump is not in operation flows through the opening 34 and into the pipe 18 to the basin 11. When the pump 21 is in operation, novel hydraulic valve control means, operably connected to the projecting end of the pivot shaft 37, moves the valve element 32 onto the valve seat to thereby prevent the flow of pumped liquid back into the basin.

One embodiment of such hydraulic control means is illustrated in FIG. 2. It includes a pressure reservoir 38 and a power element 39. The pressure reservoir 38 preferably consists of a cylindrical casing 41 which may have external flanges 42 at one end, for mounting it in direct flow communication with the pump volute 24. Its outer end is closed by a cap 43 carrying a fitting 44 to which is attached one end of a tube 45. The other end of tube 45 is connected by a fitting 46 to the power element 39. Mounted within the casing 41 is a collapsible substantially cup-shaped membrane or diaphragm 47 of sufficient size and shape to overlie a screen 48 arranged over the outlet opening 49 in the tube fitting 44 and having its open end secured to the underside of cap 43. The open end of diaphragm 47 is sealed to the underside of cap 43 beyond the circumference of the open end of screen 48.

The power element 39 preferably comprises a cylindrical body 51 capped at each end, as at 52, 53. The tube 45 is in direct communication with a chamber 54 in the upper end region of the interior of the body 51, which

chamber has as its floor a disc 55 having an orifice 56 therein. A reciprocal piston 57 mounted within the body 51 below the disc 55 is provided with a piston rod 58 extending downwardly through a gland 59 in the end cap 53. The other end of rod 58 is connected, as at 61 (FIG. 1) to one end of an arm 62 rigidly secured on the projecting end of the pivot shaft 37. A coiled compression spring 63, arranged within the body 51 between the end cap 53 and the piston 57, normally urges and holds the piston in the elevated position shown, in which position the by-pass valve element 32 is held in open position.

A suitable fluid, such as water, fills chamber 54 in piston body 51, tube 45 and the interior of the normally extended diaphragm 47. In operation, when pump 21 is operating to deliver liquid under pressure into by-pass fitting 16 for discharge through the pipes 15 and 31, the pressure of the pump flow liquid on diaphragm 47 collapses or constricts said diaphragm and causes the fluid therein to be displaced through tube 45 and delivered into chamber 54. Screen 48 prevents diaphragm 47 from becoming stuck in outlet opening 49. The increased volume of fluid delivered to chamber 54 will then flow at a controlled rate through orifice 56 and thereby displace piston 57 downwardly, against the action of its return spring 63, and carry the valve element 32 into its closed position. When the pump is stopped, the reduction in pressure on the diaphragm will permit the fluid to be returned thereinto under the force of the return spring 63, which acts to restore the piston and valve element to their normal positions. The speed of opening and closing of the by-pass valve element may be varied by changing the size of orifice 56.

In the embodiment of FIG. 3 the operation of the valve control means is essentially the same as hereinabove described. The only difference in the structure is that diaphragm 47 is replaced by a bellows 64, and piston 57 is replaced by a bellows 65. One end 66 of bellows 64 is closed, and the other end 67, which is open, is sealed to cap 43 to provide free communication between tube 45 and bellows 64. One end 68 of bellows 65 is closed and is secured to one end of rod 58. The other end 69 of bellows 65, which is open, is sealed to disc 55 to provide a closed hydraulic system that includes both bellows, tube 45, and orifice 56. The fitting 46 is shown as being connected to cap 52, but it is obvious that this fitting may be connected to chamber 54 through either the cap or the cylindrical wall of member 51.

Although I have described two preferred embodiments of my invention in considerable detail, it will be understood that the description thereof is intended to be illustrative, rather than restrictive, as many details of the structure may be modified or changed without departing from the spirit or scope of the invention. Accordingly, I do not desire to be restricted to the exact construction described.

I claim:

1. In combination, a conduit through which liquid is adapted to flow in opposite directions, a by-pass passageway connected to said conduit, a valve element to open and close said passageway, means to urge said valve element into open position when liquid is flowing through said conduit in one direction to permit said liquid to flow from the conduit through said by-pass passageway, and hydraulic means operatively connected to said valve element, said hydraulic means comprising a closed hydraulic system sealed from the liquid flowing in said conduit and responsive to the pressure of liquid flowing through said conduit in a direction opposite said one direction to move the valve element into closed position.

2. In combination, a conduit through which liquid is adapted to flow in opposite directions, a by-pass passageway connected to said conduit, a valve element operable to open and close said passageway, means urging said valve element into open position when liquid is flowing through said conduit in one direction, and hydraulic means operable in response to pressure of liquid flowing

through said conduit in a direction opposite said one direction to move the valve element into closed position, said hydraulic means comprising a reservoir, a power element, and a restricted orifice between said reservoir and said power element to control the rate of response of said hydraulic means to the pressure of the liquid.

3. In combination, a conduit through which liquid is adapted to flow in opposite directions, a by-pass passageway connected to said conduit, a valve element operable for opening and closing said passageway, spring means for moving said valve element into open position when liquid is flowing through said conduit in one direction, and hydraulic means operable in response to pressure of liquid flowing through said conduit in a direction opposite said one direction to move the valve element into closed position against the action of said spring means.

4. In combination, a conduit through which liquid is adapted to flow in opposite directions, a by-pass passageway comprising a fitting having an opening communicating with said conduit, a valve element for opening and closing said opening, a piston connected to the valve element, spring means acting on said piston to urge it in a direction for holding the valve element in open position when liquid is flowing through said conduit in one direction, and hydraulic means including a diaphragm arranged in the path of and responsive to the flow pressure of liquid to the by-pass passageway when liquid is flowing through said conduit in a direction opposite said one direction, for moving the piston in its other direction to move the valve element into closed position against the action of the spring.

5. A hydraulic valve control system including a pressure cylinder and a reciprocal piston therein, means connecting said piston to a valve in a reversible liquid flow system, means urging the piston in one direction to hold the valve element in open position when the liquid flow in said system is in one direction, and actuating means in said hydraulic valve control system operable in response to the pressure of said flow in the reverse direction for applying pressure against said piston to move the piston in the opposite direction to thereby move the valve element into its closed position.

6. In combination, a basin, a conduit for liquid flow to and from the basin, a by-pass passageway which permits liquid to flow from said conduit directly into the basin when open, a valve element for opening and closing said by-pass passageway, and fluid operated valve control means for moving said element from open to closed position, said fluid operated means including hydraulic means sealed from the liquid flowing through said conduit and responsive to the pressure of the liquid flow from the basin for moving said valve element into closed position.

7. In combination, a basin, a conduit for the flow of liquid to and from the basin, a by-pass passageway which permits liquid to flow from said conduit directly into the basin when open, a valve element for opening and closing said by-pass passageway, a pressure cylinder and a reciprocal piston therein connected with the valve element, said piston being operable to move said element into open and closed positions, spring means acting on the piston to move it in one direction to urge said valve element in open position when the liquid flow is to said basin, and hydraulic means in communication with said cylinder, said hydraulic means including a diaphragm responsive to the pressure of the fluid flow from the basin to move said piston in a direction to close said valve element.

8. In combination, a conduit through which liquid is adapted to flow in opposite directions, a by-pass passageway connected to said conduit, a valve in said passageway, said valve permitting liquid flowing through said conduit in one direction to flow through said passageway when said valve is open, mechanical linkage for moving said valve to open or closed position, and hydraulic means

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for controlling the operation of said mechanical linkage, said hydraulic means comprising a pressure cylinder and a reservoir interconnected to provide a closed hydraulic system, an impervious collapsible member in said reservoir separating the fluid of said closed hydraulic system from the liquid flowing through said conduit, said collapsible member being in contact with the liquid in said conduit to be collapsed by pressure exerted by said liquid, a piston in said cylinder, and piston rod connecting said piston to said mechanical linkage, said piston being movable by displacement of fluid from said reservoir actuated by pressure of said liquid against said diaphragm.

9. In combination, a conduit through which liquid is adapted to flow in opposite directions, a by-pass passageway connected to said conduit, a valve element movably mounted in said passageway, mechanical linkage connected to said valve element and operable to move said

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valve element to open and close said passageway, spring means adapted to hold said valve element in open position when liquid is flowing through said conduit in one direction to permit said liquid to flow through said passageway, and hydraulic means connected to said mechanical linkage, said hydraulic means comprising a closed hydraulic system sealed from the liquid flowing in said conduit and responsive to the pressure of liquid flowing through said conduit in a direction opposite said one direction to operate said mechanical linkage connected to said valve element and thereby move said valve element into closed position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,760,512 Nechine ----- Aug. 28, 1956