Aug. 8, 1961 L. M. NECHINE 2,995,142

HYDRAULIC CONTROL MEANS FOR A BY-PASS VALVE

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Fig. 1

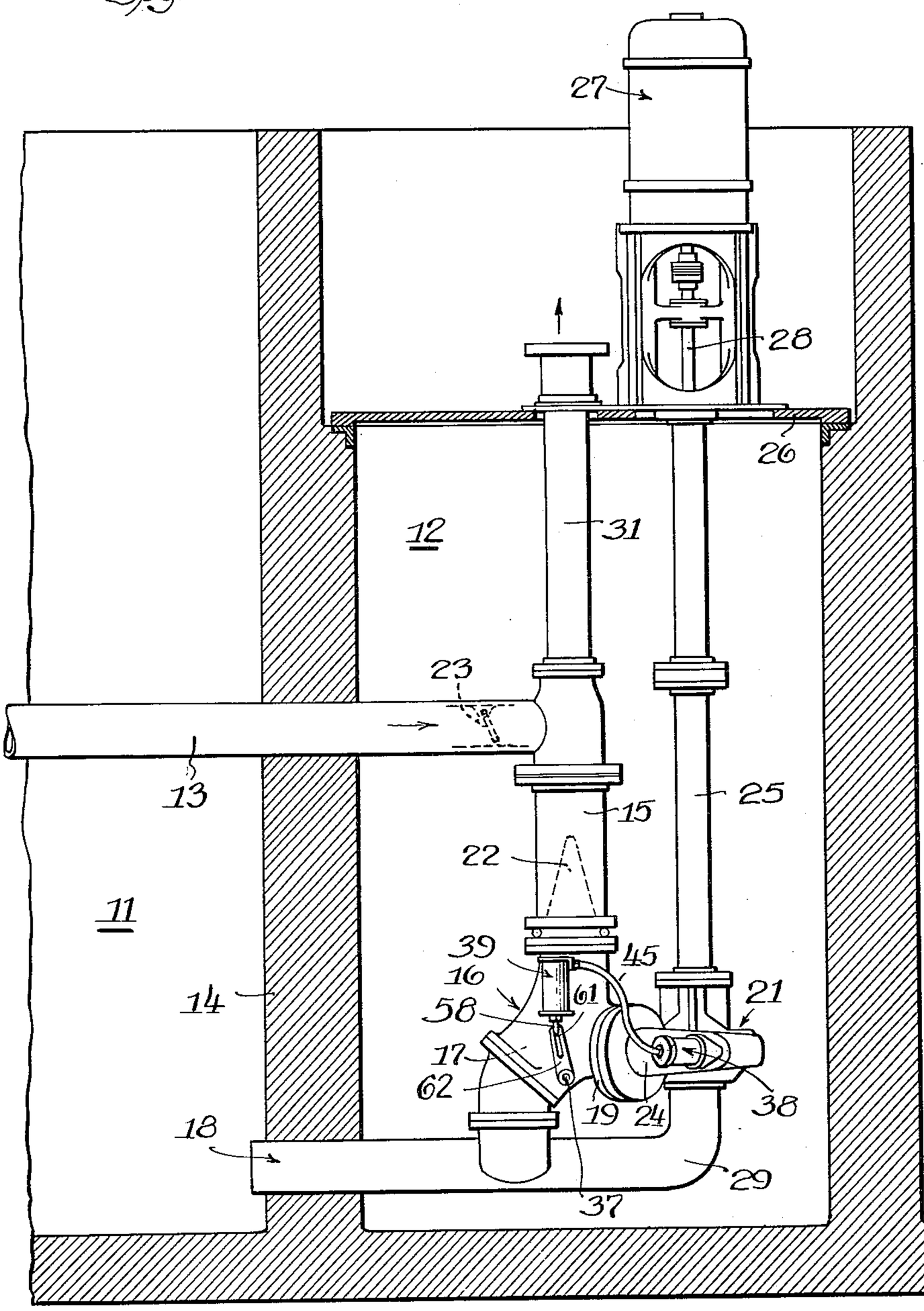

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Fig. 2

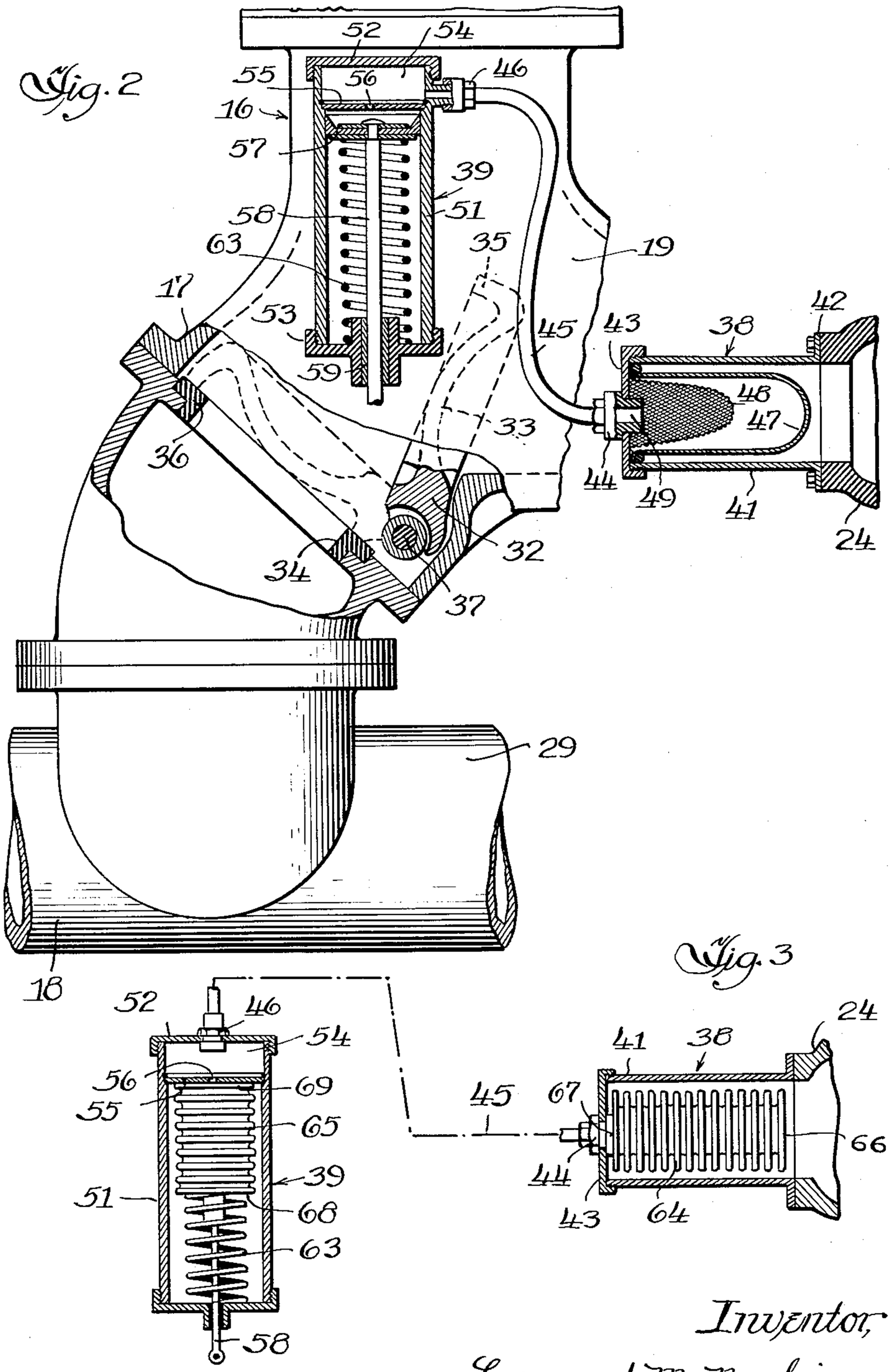

Fig. 3

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United States Patent Office

2,995,142
Patented Aug. 8, 1961

2,995,142
HYDRAULIC CONTROL MEANS FOR A BY-PASS VALVE

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Filed Aug. 29, 1958, Ser. No. 757,964
9 Claims. (Cl. 137—115)

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

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-day 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 passageway 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

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

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.

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