

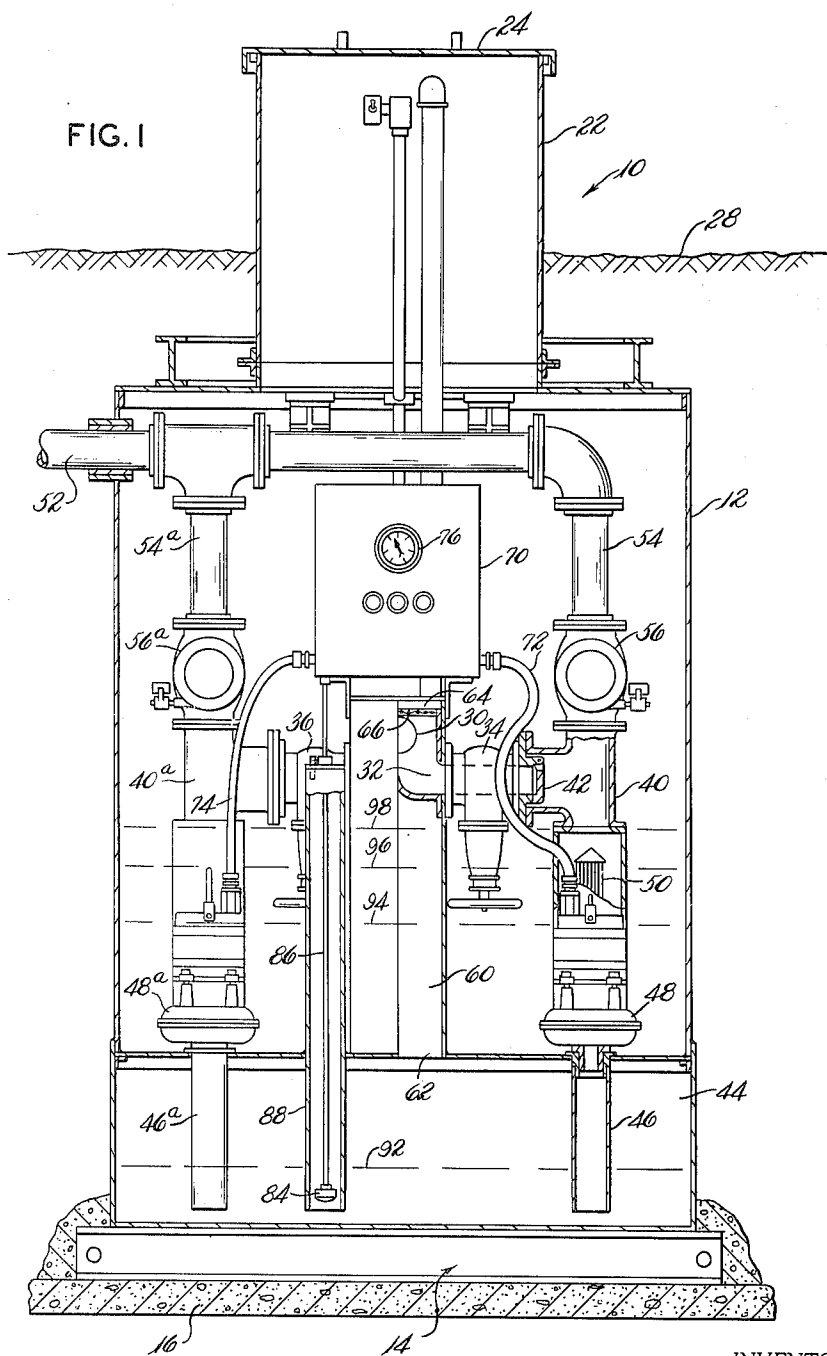
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SEWAGE LIFT STATION

3,247,864

Filed Oct. 22, 1963

2 Sheets-Sheet 1



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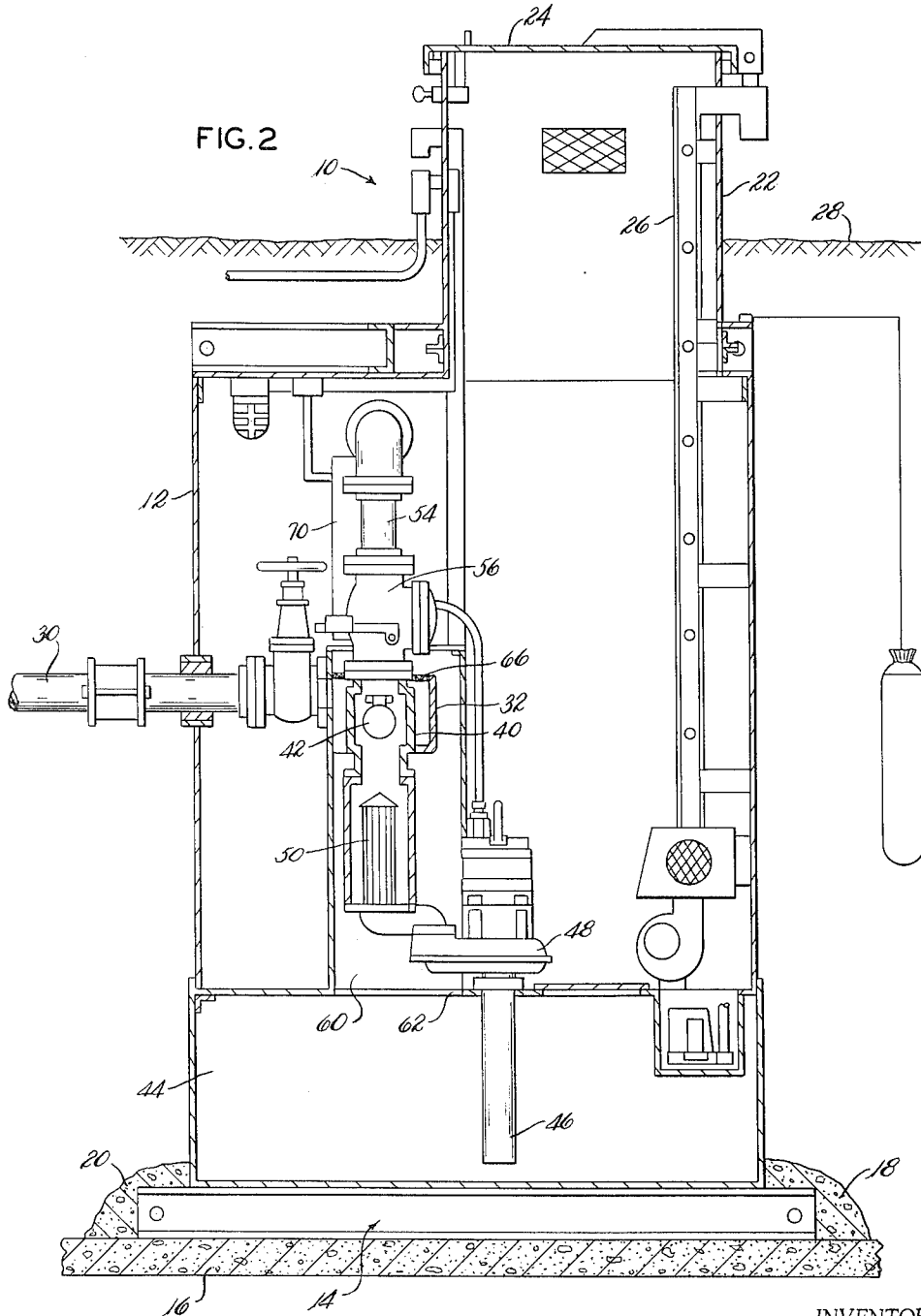
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SEWAGE LIFT STATION

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This invention relates to a sewage lift station, and more particularly to a novel construction for a sump type sewage collection, storage and/or pumping system.

Heretofore it has been known that there are many and various types of sewage lift stations. However, at present most of these stations require a separate wet well upon which to take pumping suction, and considerable expense, equipment, and construction costs are required to provide a wet well. Further, present sewage lift stations require periodic cleaning and maintenance in order to insure proper operation, and this cleaning and maintenance is difficult, cumbersome, expensive, and usually unsatisfactory due to the inaccessibility of the pumping equipment because of the required wet well.

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of prior art practices by the provisions of a sewage lift station which is preformed and tested as a unit and which requires no wet well for operation.

A further object of the invention is to provide a sewage lift station which utilizes a pair of small sewage water pumps designed to operate alternately, or together to provide sewage water pumping, from a receiver sump, and to use the action of one pump to clean its own inlet.

Another object of the invention is to provide a sewage lift station which can be installed as an essentially integral unit to provide sewage pumping in an efficient, essentially continuous, thorough, and economical manner.

A further object of the invention is to provide a sewage pumping system which utilizes strainer means at the pump inlet to insure that no large solid materials are passed through the pumping means and with liquid only flowing through the pump to enter the sump to insure longer life, and more efficient operation and construction of the pumping system.

Another object of the invention is to provide a sewage pumping system which has an inlet wall which has a screened overflow section connecting to the receiver chamber, or sump.

The aforesaid objects of the invention and other objects which will become apparent as the description proceeds are achieved by providing in a system for pumping sewage water the combination of a receiver sump, a distributor box positioned above the receiver sump and adapted to receive sewage water, pipe means operatively connecting the distributor box to the receiver sump and adapted to permit gravity flow of the sewage water thereto, pump means operatively connected to the pipe means to allow gravity flow of sewage water therethrough when not energized but connecting to and drawing liquid from the receiver sump when energized, check valve means operatively positioned in the pipe means adjacent the distributor box to allow only one way flow of the sewage water to the associated pump means, strainer means operatively positioned in the pipe means between the pump means and the check valve means to strain any large solid material from the sewage water, discharge pipe means operatively connected to the pipe means between the strainer means and the check valve means and adapted to carry only pressured flow of sewage water, and pressure actuated control means operatively mounted in the receiver sump and connected to power supply means to control operation of the pump means.

For a better understanding of the invention, reference

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should be had to the accompanying drawings, wherein:
FIG. 1 is a front elevation, partially shown in section, of a sewage lift station embodying the principles of the invention; and

FIG. 2 is a vertical, diametric, cross-sectional elevational view of the sewage lift station of FIG. 1 with the enclosure box, sump, well, and distributor box shown in cross section substantially on the straight line 2-2 of FIG. 1, and with the pipe line, strainer, and pump shown also in section as taken on the offset portion of line 2-2.

With reference to FIG. 1 of the drawings, the numeral 10 indicates generally a sewage lift station comprising an enclosure frame, box or housing 12 surrounding the internal apparatus of the station 10, and which frame 12 is mounted on a suitable base structure 14 in any convenient manner. As seen with reference to FIG. 2, the base structure 14 can be mounted on a horizontal concrete support slab 16 with concrete layers 18 and 20 poured over the support structure 14 after leveling to anchor the support structure 14 to the concrete support slab 16. An entrance tube 22, having a top cover 24, is operatively connected to the top surface of the frame 12 while a ladder 26 is provided inside the frame.

The invention contemplates that the sewage lift station 10 be installed in the ground so that the surface ground level is somewhere on the entrance tube 22 as indicated by line 28. In this manner, the station 22 is positioned so that the internal components, to be described hereinafter, are below an inlet sewage line 30, as seen most clearly in FIG. 2.

One of the novel internal components of the sewage lift station 10 operatively mounted inside the housing frame 12 is a distributor box 32 which is suitably connected to and receives the sewage from the inlet pipe 30. The distributor box 32 is operatively connected on opposed sides to flow control means such as gate valves 34 and 36, respectively. The gate valves 34 and 36, respectively, are operatively connected to pipe lines, indicated generally by numbers 40 and 40a. The pipe lines 40 and 40a are essentially identical, and therefore, the pipe line 40 only will be described, with corresponding parts of the pipe line 40a having the same number with sub a designation.

In order to provide for one directional flow through the gate valve 34, a conventional check valve 42 is operatively mounted at the entrance to the pipe line 40, as indicated in FIG. 1. The pipe line 40 extends vertically downwardly and is operatively connected to a receiving chamber, or sump 44 which is formed at the base of the frame 12. In order to provide for suction withdrawal of liquid from the sump 44, a suction pipe 46 is operatively connected to the pipe line 40 and extends to a point adjacent the bottom of the sump 44. The operation of the system will be described hereinafter, but suffice it to say at this point that sewage water enters the inlet 30, passes by gravity flow through the receiver box 32, gate valve 34, check valve 42 and through the pipe line 40 and suction pipe 46 into the sump 44.

In order to provide for liquid removal from the sump 44, a sealed sewage pump 48 is operatively positioned, or connected in the pipe line 40 and is adapted to draw liquids up through the suction pipe 46. The pump 48 allows sewage water to flow by gravity therethrough into the sump 44, but forces the sewage water vertically upwardly in the pipe line 40 when the pump 48 is energized. As a feature of the novel pumping system and in order to insure that large solid material cannot enter the pump 48 to cause damage thereto or to flow to the sump; a strainer 50, made from a suitable material, such as stainless steel, may be operatively positioned between the pump 48 and the check valve 42 in the pipe line 40. Thus, it will be seen that the sewage inlet line preferably has two

branches for reasons set forth hereinafter in more detail.

A discharge pipe line 52 is operatively connected to the pipe lines 40 and 40a by a pair of pipe sections 54 and 54a, respectively. In order to insure no backup of pumped sewage from the outlet pipe line 52, weighted type check valves 56 and 56a, respectively, are provided to insure one way flow through the pipe sections 54 and 54a.

As a further feature of the invention, an overflow tube, or well 60 is operatively connected to the upper surface of the sump 44 and extends vertically upwardly and is operatively positioned around the distributor box 32. A hole 62 provides access from the top of the sump 44 into the overflow well 60. Further, the distributor box 32 is open at its top at 64 so that if sewage water comes in through the inlet pipe 30 at a flow rate greater than can be adequately handled through the normal flow path to the sump 44, or if the sewage water backs up in the system, it can overflow through the top opening 64 directly into the overflow well 60 and thence directly into the sump 44. An overflow screen 66 is provided to cover the opening 64 to insure that if overflow does occur, no solid matter will pass to the sump 44 to cause possible damage to the pumps 48 and 48a.

In order to provide suitable electrical controls for the sewage lift station 10, an electrical control cabinet 70 is provided which is operatively positioned above the sewage inlet pipe 30 and the distributor box 32. Electrical control cables 72 and 74 are provided from the electrical control cabinet 70 to the drive motors (not shown) for the pumps 48 and 48a, respectively. For the purpose of showing the sewage water level in the sump 44, a gage 76 is located on the front portion of the electrical control cabinet 70 and suitably connects to the sump.

Automatic operation of the sewage lift station 10 through the control box 70 is achieved by conventional means including a diaphragm control 84 operatively mounted in the sump by a push rod 86, and this combination is operatively positioned in a control housing tube 88. The diaphragm control 84 operatively connects to suitable means in the electrical control cabinet 70 to energize or de-energize, alternately, one of the pumps 48 or 48a, or both of the pumps, dependent upon the level of liquid in the sump and overflow well 60. To achieve this effect, the diaphragm control 84 is pressure sensitive and indicates the height of sewage water in the sump 44 well 60. To this end, four pressure levels have been provided. Namely, a level 92, which is the turn off level, level 94, which is the turn on level for one pump, level 96, which is the turn on level for the second, and level 98, which is the alarm level that may either sound an audible or electrical alarm, or which may cause pumps 48 and 48a to operate at higher capacity. The circuit controls of the electrical control cabinet 70 do not form a part of the invention and can be of conventional design.

For clarity, the operation of the sewage lift station 10 will now be described. Sewage enters the distribution box 32 through the inlet pipe 30 and flows therefrom through the gate valve 34 and the check valve 42 into the pipe line 40. The sewage water then further flows by gravity through the strainer 50, the pump 48, and the suction pipe 46 into the sump 44. All big solids, rags, sticks, and trash catch on the strainer 50 which connects to the outlet of the pump 48. Hence, only the sewage water continues to flow into the sump 44 until it rises in the overflow well 60 to the level 94 to turn on the pump 48 by the action of the control diaphragm 84. When the sewage water rises to the level 94 in the overflow well 60, it also rises to the level 94 in pipes 40 and 40a so that the pumps 48 and 48a are primed. When the pump 48 starts, it draws liquid through the suction pipe 46 from the sump 44 and discharges sewage water through the strainer 50 flushing off any solids, rag, etc. thereon. This surge in pressure on liquid in the pipe 40 closes the check valve 42, preventing the return of the sewage water to the dis-

tribution box 32 and permitting discharge through the pipe 52. When the sewage water level in the sump 44 drops to the level 92, the pump 48 automatically is turned off.

During the time that the pump 48 is operating, any sewage water that may run into the distribution box 32 through the inlet pipe 30 flows through the gate valve 36, pipe line 40a, pump 48a, and suction pipe 46a to the sump 44. If the incoming flow of sewage water is of sufficient volume that even with the pump 48 energized, the level in the overflow well 60 continues to rise, both pumps 48 and 48a will be energized if the level 96 is reached. At the time both of the pumps 48 and 48a are operating, if water continues to flow into the distribution box 32 from the inlet pipe 30, the sewage water will overflow through the opening 64 directly into the overflow well 60. If both pumps fail to lower the level of sewage water, and the level reaches point 98, a visual or audible alarm may be sounded to indicate that trouble is approaching. Further, if the pumps 48 and 48a are of such design, they may be energized to a higher speed, when the alarm level 98 is reached. Normally, of course, the flow of sewage water will be such that one or both pumps operating at normal capacity can easily handle the volume thereof.

The invention contemplates further that the electrical control cabinet 70 will alternate the energization successively to pumps 48 and 48a so that the strainers 50 and 50a will be flushed clean on successive pumping operations to insure proper sewage water flow.

Any suitable venting and blower means may be provided for use with the apparatus of the invention.

The invention contemplates that the housing frame 12, the entrance tube 22, the sump 44, and the base support 14 be operatively attached together to form an integral unit, such as by welding, riveting or other convenient means. Further, the invention contemplates that all the pumps, piping, and electrical control equipment positioned inside the sewage lift station 10 be operatively assembled and tested at the factory prior to installation. Thus, after the station 10 is installed in the ground at the correct level, only the sewer inlet and outlet pipes, and electrical power leads need be connected to place the station 10 in condition for operation.

By the apparatus of the invention, the use of a wet well is eliminated, and maintenance and upkeep to the pumping station are greatly facilitated. Also, since the pumps are pumping only sewage water without any big solids therein, the pumps can be relatively small thereby decreasing costs and increasing efficiency. Alternate operation of the pumps insures that the strainers are properly cleaned. However, periodic cleaning of the strainers is readily available through the easy access thereto. Adequate valves are provided to isolate the station for periodic maintenance or repair.

While in accordance with the patent statutes one best known embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby, but that the inventive scope is defined in the appended claims.

What is claimed is:

1. In a system for pumping sewage water, the combination of
 - a closed receiver sump,
 - a distributor box positioned above said receiver sump and adapted to receive incoming sewage water,
 - two similar pipe means operatively connecting said distributor box to said sump and adapted to permit gravity flow of said sewage water thereto,
 - pump means for each of said pipe means operatively connected individually for energization in said pipe means to allow said gravity flow of said sewage water when not energized, but drawing suction on said sump when energized to pump said sewage water through said pipe means against the flow of gravity, said pump means being above the level of the sump,

check valve means operatively positioned in said pipe means adjacent said distributor box to allow only one way gravity flow of said sewage water to said receiver sump from said distributor box,
 strainer means operatively positioned in said pipe means between said pump means and said check valve means and adapted to strain any large solid material from said sewage water,
 discharge pipe means operatively connected to said pipe means between said strainer means and said check valve means and adapted to carry only pressured flow of said sewage water,
 said sump having a reduced area section extending above said pump means to provide priming for said pump means when said sump is full of sewage water and at least one of said pump means is to be started,
 electrical control means,
 said reduced area section of said sump being of materially less cross sectional area than the cross sectional area of said sump,
 and pressure actuated means operatively mounted adjacent the bottom of said receiver sump and connected to said electrical control means to energize alternately one of said pump means when the sewage water reaches a certain level in said reduced area section and to de-energize said one pump means when the sewage water falls to a certain level in said receiver sump, said electrical control means being constructed and arranged to energize both of said pump means if the level of the sewage water in said reduced area section increases a predetermined amount after the energization of one of said pump means.

2. In a sewage lift system, the combination of
 a distribution box adapted to receive incoming sewage and water, said distribution box having an open overflow hole in its top,
 an enclosed receiver sump located below said distribution box,
 pipe means connecting said distribution box to said sump to pass said sewage and water thereto by gravity flow,
 a pump means operatively located in said pipe means above the sump and adapted to allow one way gravity flow of at least some of said sewage and water from said distribution box to said receiver sump when not energized and one way pressure flow of said sewage and water out of said receiver sump when energized,
 discharge pipe means operatively connected to said pump means,
 an overflow well of materially less cross section than the cross section of the sump operatively connected to said sump and extending vertically therefrom towards and operatively positioned around said distribution box, said overflow well being adapted to fill with sewage and water when said sump is filled, said overflow well being adapted to receive any sewage water overflow from said distribution box, and
 pressure means operatively mounted in said sump and adapted to energize said pump means when the sewage and water rises to a certain level in said overflow well, said pressure means being further adapted to de-energize said pump means when the sewage and water fall to a certain level in said sump.

3. In an apparatus to pump fluid sewage, the combination of
 a sump,
 first means connected to and positioned above said sump for gravity flow of incoming sewage to said sump and for suction withdrawal of sewage therefrom,
 strainer means to restrict the flow of solid material through said first means,

second means operatively connected to said first means to receive upwardly directed pressured flow of fluid sewage from said sump,
 valve means operatively positioned in said first means in a downstream direction from said connection thereof to said second means to allow only gravity flow of fluid sewage therethrough,
 pump means above the level of the sump and connected to said first means and sump to pull sewage fluid from said sump when energized and discharge it into said first means downstream from said strainer means to effect pressured flow of fluid sewage from said sump up through said first means and said strainer means and out through said second means, and
 well means connected to said sump of materially less cross section than the cross section of the sump and extending upwardly therefrom beyond said pump for receiving liquid therefrom and enabling liquid to stand in said first means up to said pump means for priming same.

4. In a sewage lift station for pumping sewage water, the combination of
 a hollow water-tight housing,
 a closed sump operatively connected to the bottom of said housing,
 an overflow pipe of materially less cross section than the cross section of the sump operatively connected to said sump and extending upwardly thereof in said housing,
 inlet pipe means including a distributor and a screened overflow means positioned internally of said overflow pipe, said inlet pipe means dividing in said distributor into a plurality of branches which are operatively connected to said sump to allow gravity flow of sewage water to said sump,
 said overflow pipe being positioned to receive any sewage water overflow from said overflow means of said inlet pipe means and lead it to said sump,
 means operatively positioned in each branch of said inlet pipe to allow only gravity flow of sewage water therethrough,
 outlet pipe means operatively connected to said branches of said inlet pipe above said last means and adapted to receive only pressured flow of said sewage water,
 strainer means operatively positioned in said branches of said inlet pipe below said outlet pipe means, and
 separate pump means operatively positioned in each of said branches of said inlet pipe means below said strainer means and above the sump, said pump means when de-energized being constructed and arranged to allow gravity flow of said sewage water therethrough, said pump means when energized being adapted to pump liquid from said sump and discharge it through said outlet pipe means, said branches of the inlet pipe extending vertically above said pump means to permit sewage water to rise above said pump means in said branches and prime said pump means when the sewage water fills the sump and rises also in the overflow pipe.

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