Jan. 2, 1962 L. M. NECHINE 3,015,279

BY-PASS FOR PUMPING APPARATUS

Filed Sept. 26, 1958 3 Sheets-Sheet 1

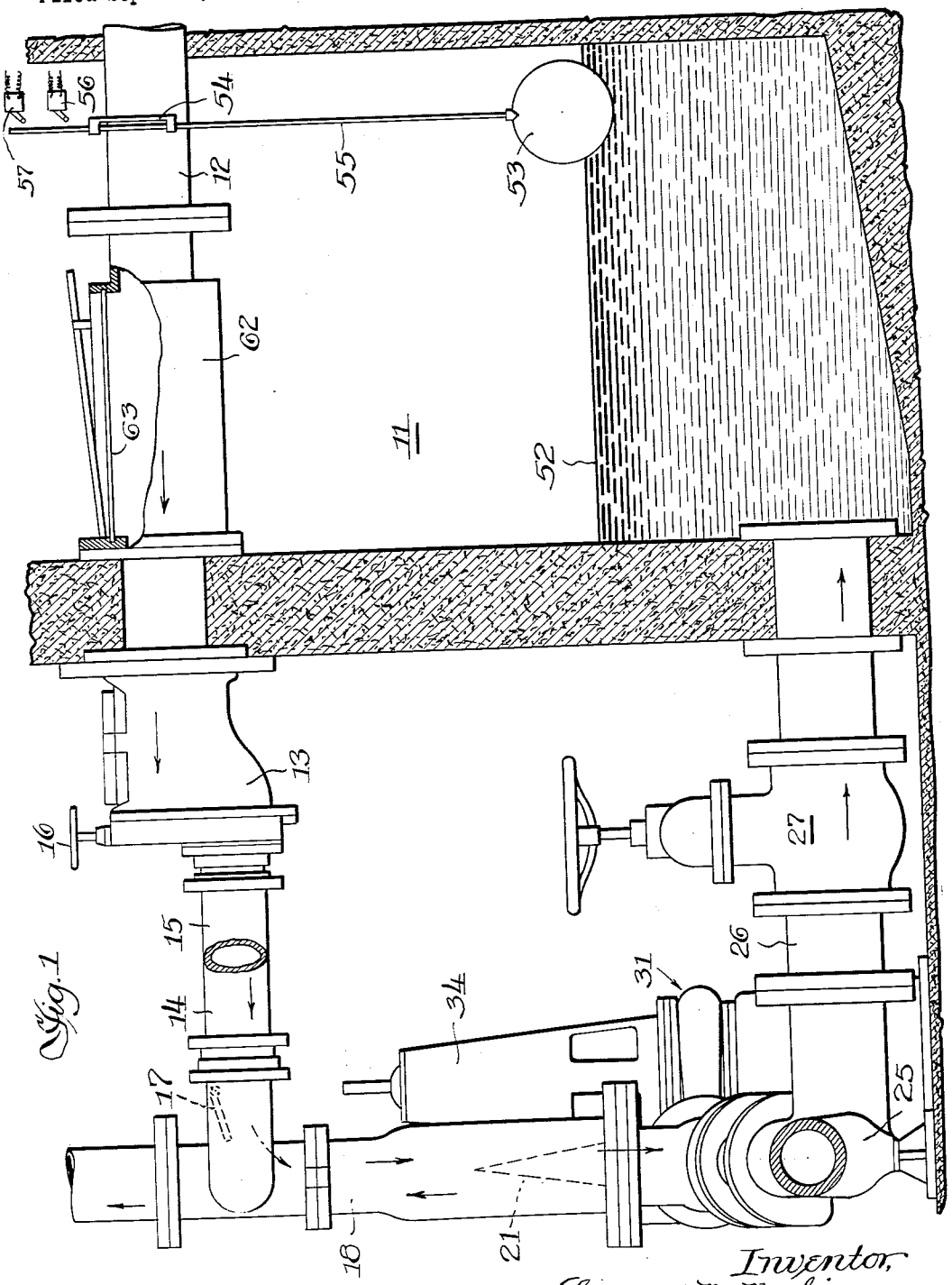


Fig. 1

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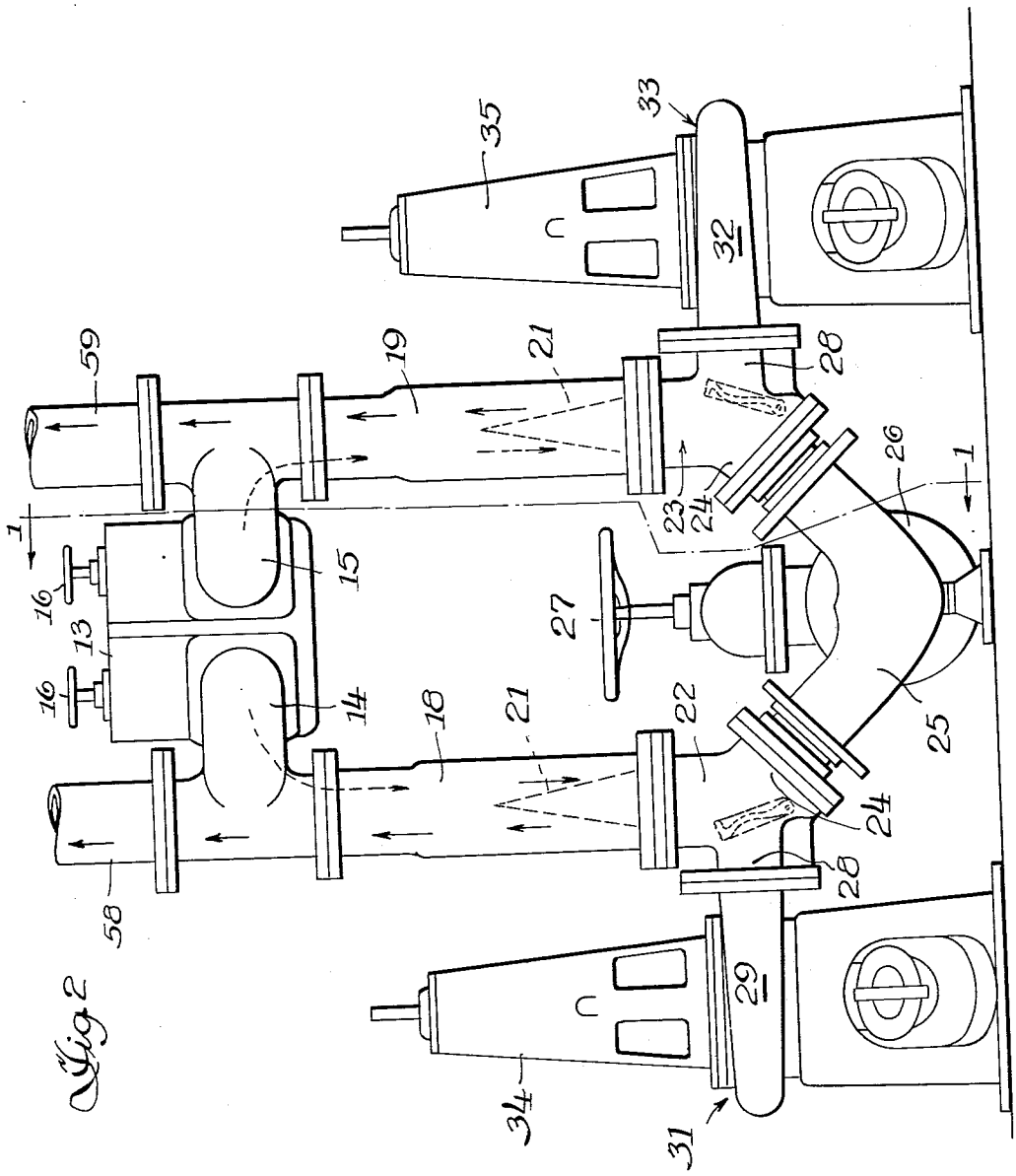


Fig 2

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Fig. 3

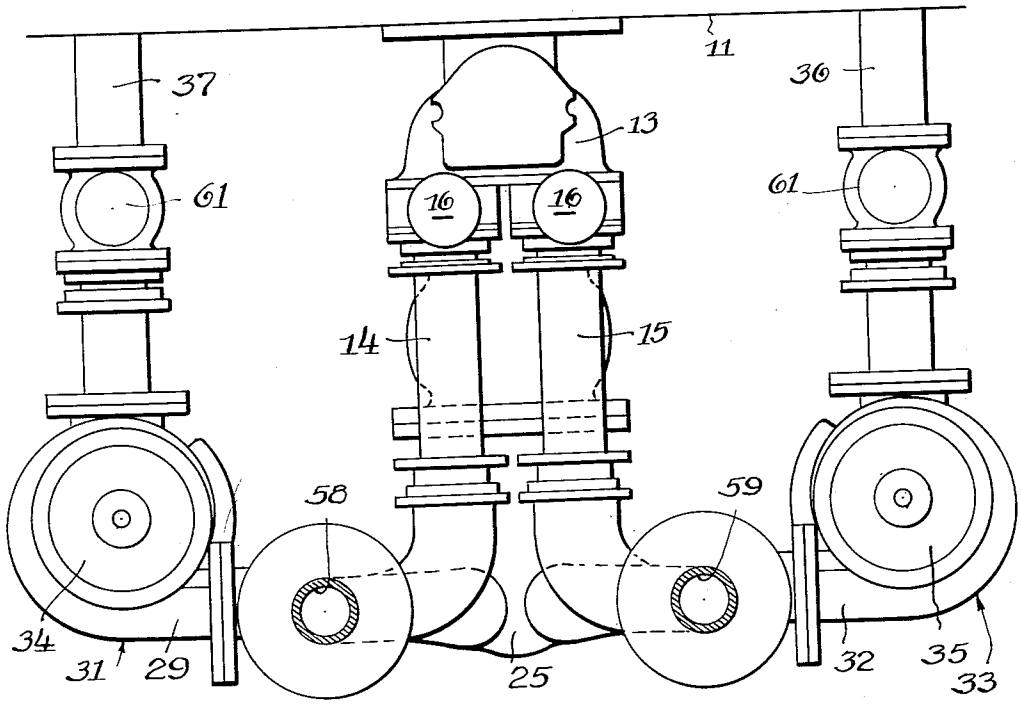
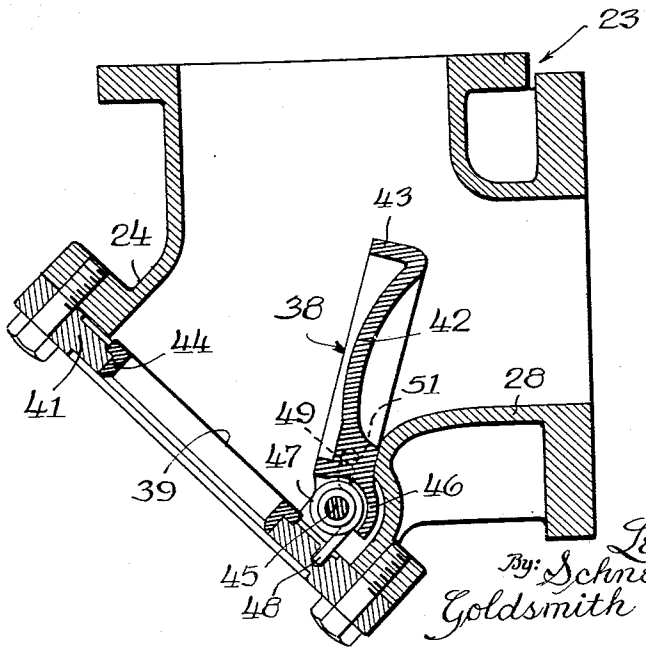


Fig. 4



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BY-PASS FOR PUMPING APPARATUS

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6 Claims. (Cl. 103—11)

This invention relates to pumping apparatus and is particularly concerned with a novel flow system through which sewage may be delivered to a sewage basin while pumps are operating to withdraw sewage through said system from said basin.

It has been customary to provide a single flow system comprising a pump and a pump by-pass valve so arranged that sewage delivered to the system through a main sewage inlet may flow through the system and around the pump to the basin when the pump is idle. In such systems the pump often was designed for greater lift than required by actual conditions, or discharge pressures changed as a result of varying operating loads. The variations in the pressure of the pump flow create greater or less differential pressures on the upstream and downstream sides of the by-pass valve. These differential pressures affect the by-pass valve in a manner to cause unstable operation of said by-pass valve, with resultant leakage and loss of pressure in the pump flow.

In accordance with the present invention the flow of sewage or other liquid to and from the sewage basin is through a flow system that preferably includes two or more pumps and associated by-pass valves selectively operated in such manner that any or all of the pumps may operate to pump sewage from the basin without impeding the flow of sewage to the basin. For convenience, the system comprising the invention will be described as a two-pump installation, but it will be understood that it is not limited to two pumps, and may be used with a single pump or with more than two pumps.

Separate pump control means are provided to sequentially start and stop the pumps. The operation of the control means is such that when the liquid in the basin reaches a predetermined high level, a first pump is operated to pump liquid from the basin. Operation of this pump closes a related by-pass valve and a check valve in the inlet conduit, thus stopping the flow of sewage therethrough to the basin. Should the continued flow of liquid to the basin through the other inlet conduit and the other by-pass valve result in the liquid level continuing to rise, a second pump is operated. Operation of the second pump automatically closes a by-pass valve related thereto and a check valve in its inlet conduit. However, when both pumps are being operated, sewage may continue to flow to the basin from the main sewage inlet conduit through a bar box provided therein.

The dual-pump system herein described includes two reverse-flow pipes or conduits in direct flow communication with a main sewage inlet conduit. Each pipe has a fitting provided with a by-pass valve and connected to a common conduit, leading directly into the sewage collecting basin so as to permit the free and uninterrupted inflow of liquid through the inflow pipe to said basin when both pumps are idle. When both pumps are operating to withdraw liquid from the basin, said withdrawn liquid is flowed under pressure through the pump by-pass fittings in such manner as to automatically close the by-pass valve in each fitting and the check valve in each inlet conduit. The liquid is then flowed through the reverse-flow conduits in a direction reverse to that of the inflow, and into discharge pipes, one of which is in flow communication wth each reverse-flow conduit, for disposal.

When the check valves in both inlet conduits and the by-pass valves in both fittings are closed by the operation

of both pumps, the inflow of liquid in the main sewage inlet line backs up therein and overflows a bar box in said line. The liquid spilling over the weir sides of the bar box is delivered directly into the basin. When only one of the pumps is operating, the flow from said pump is through the related by-pass fitting as described hereinabove, and the flow of incoming liquid continues through the by-pass fitting connected with the pump that is idle. Suitable screens and strainers are arranged in the flow system to intercept sewage solids and thus prevent such solids from entering the basin and being subsequently withdrawn through the pumps.

Chattering of the valve elements in the by-pass valves, and resultant leakage and loss of pressure in the pump flow, is avoided in the present flow system by connecting the by-pass passageway of each valve in direct flow communication with the sewage basin at a point below the lowest level of liquid therein, thereby providing a water seal for each by-pass valve.

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 a preferred embodiment of the invention, in which:

FIGURE 1 is a vertical transverse section view of a collecting basin, taken substantially on line 1—1 of FIG. 2, illustrating a sewage pumping apparatus embodying my invention connected therewith, with parts broken away to facilitate illustration;

FIG. 2 is an elevational view of the apparatus as viewed from the left side of FIG. 1;

FIG. 3 is a top plan view of the apparatus; and

FIG. 4 is an enlarged sectional view of one of the pump by-pass fittings.

Referring now to the accompanying drawings, and particularly to FIG. 1, there is provided a sewage collecting basin **11**, into which sewage for example, is delivered for subsequent pumping to a suitable place for disposal by means of the novel pumping apparatus associated with it. Sewage or other liquid containing solids, such as debris, abrasives, etc., enters the system from an influent conduit external of the structure disclosed, through a main sewage inlet conduit **12**. The inflowing liquid passes through a diversion fitting **13**, through a pair of conduits **14**, **15**, each containing a normally open service valve **16** and a check valve **17**, and into reverse flow conduits **18** and **19** respectively. A conical screen **21** is provided in each of the conduits **18**, **19** for screening out solids in the incoming liquid flowing through said conduits into valve controlled pump by-pass fittings **22**, **23** respectively. Each of these by-pass fittings has a leg **24** in direct flow communication with a Y-fitting **25** connected to a conduit **26** leading into the interior of the collecting basin **11**, adjacent to its bottom. A normally open service valve **27** may be provided in the conduit **26**.

The other leg **28** of by-pass fitting **22** is connected to the discharge volute **29** of a pump **31**, whereas the corresponding leg **28** of by-pass fitting **23** in connected to the discharge volute **32** of a pump **33**. These pumps **31** and **33** may be of any conventional construction, and each has associated with it an electric or other suitably driven motor **34**, **35** respectively, having its shaft connected to the impeller of the related pump for driving the same. The suction inlets to said pumps are connected to pipes **36**, **37** respectively, which are in direct flow communication with the interior of the basin **111**, also adjacent to its bottom.

As noted hereinabove, when both pumps **31**, **33** are idle, inflowing liquid passes freely through both pump bypass fittings **22** and **23**, through Y-fitting **25** and then into the basin. The by-pass fittings **22** and **23** are identical, hence the following specific description of one is

equally applicable to the other. As best shown in FIG. 4, pump by-pass fitting **23** has a valve element **38** mounted adjacent to the by-pass passageway **39** in plate **41** secured to the end of its leg **24**. The valve element **38** is in the form of a disc having a top wall **42** which seats on a valve seat preferably formed by an annular member **44** which is fitted into said passageway, as by a drive fit. The top wall **42** preferably has a cup shape, and its concave side is in the direct line of flow from the pump when the valve element is in the open position shown.

The valve element **38** is pivotally mounted along one of its sides on a bolt or pivot pin **45** for swinging movement into open and closed positions. A curved skirt or shroud portion **46** on said valve element overlies a helical spring **47**, which surrounds the pivot pin. Spring **47** has one end **48** anchored in the plate **41** and its other end **49** engaged in an opening **51** in the valve element. It is manifest from the drawings that the shroud **46** protects the spring against the accumulation thereon of any small solids which might pass the strainer and thus prevent successful operation of the valve. The spring **47** is a torsion spring and it is primarily adapted to maintain valve element **38** in the normally open position shown. It functions also as an anti-slam device when the flow through the fitting is sharply reversed, as when the associated pump is started.

The operation, insofar as the assembly has been described, is such that when the liquid in basin **11** is at a predetermined low level, as shown at **52**, the motors and pumps are idle. Inflowing liquid entering conduits **18** and **19**, passes through strainers **21** in said conduits. The solid matter contained in the liquid is intercepted by the strainers and begins to accumulate around them. The liquid which is thus strained passes through the respective by-pass fittings **22** and **23** and enters the basin through conduit **26**. As soon as the liquid in the basin reaches a predetermined higher level, a suitable float **53** in said basin raises sufficiently to cause an enlargement **54** on its rod **55** to engage and close a normally open switch **56**, controlling the operation of one of the pump motors **34** or **35**.

Operation of one of said motors and its pump will, in a manner to be described presently, cause the related check valve and by-pass valve to close while the pump withdraws liquid from the basin and discharges it at a suitable place for disposal. However, inasmuch as only one of the pumps is operating, incoming sewage will continue to enter the basin through the system of inflow conduits associated with the pump that is idle. Should the inflow of liquid be in excess of the capacity of the pump that is operating, the level of the liquid will continue to rise in the basin, the float will be raised further and its rod enlargement **54** will then engage and close a second normally open switch **57** controlling operation of the second pump so as to place said pump in operation. With both pumps operating to withdraw liquid from the basin, both check valves and both by-pass valves are closed, and the inflow of liquid through the flow system is stopped. When the liquid level in the basin recedes, the float returns to its lower position, thus successively opening the switches **57** and **56** and cutting off the operation of the pumps.

Closing of the by-pass valves upon operation of pumps **31** and **33**, is effected by the pump flow into by-pass fittings **22** and **23**, which flow exerts a pressure against the normally open cup shape by-pass valve elements **38** therein, forcing them to close. Liquid discharged by the pumps passes through the respective by-pass fittings **22**, **23**, up through the strainers **21**, carrying with it the solid matter accumulated around the strainers, and is discharged with the solid matter through respective discharge pipes **58** and **59** (FIG. 2). If desired, a service shut-off valve **61** may be provided in each of the pipes **36**, **37**.

The pressure of the pump flow in the conduits **18** and **19** during operation of the pumps causes check valve **17** (one shown in FIG. 1) in the respective inlet conduits **14** and **15** to close, and thereby prevents the pressure flow from entering the diversion fitting **13**. When both of these check valves are closed, the inflow of liquid through the flow system is stopped, thus causing incoming sewage to back up in the main sewage inlet conduit **12** and spill over the weir sides of a bar box **62** mounted in said conduits and into the basin. The bar box **62** is provided with a screen **63** to prevent solids of objectionable size from passing over the sides of the box into basin **11**. When the pumps stop, and the sewage resumes its normal flow, the liquid flowing through the main inlet conduit carries the solids from the underside of screen **63** through conduits **18** or **19** to strainers **21**.

Because of the use of two or more pumps and their related flow systems, the flow capacity and lift power of each pump may be much smaller than that required of a single pump, owing to the periodic operational requirements arising from varying volumes of liquid required to be drawn from the basin. As a result there is less wear on the pumps and their motors, and maintenance and operational costs are reduced. Furthermore, the lowest permitted level of liquid in the basin is maintained above the level of the by-pass valve elements so as to provide a water seal on the suction side by the by-pass valves when their related pumps are operating. This reduces the possibility of valve leakage, valve chatter, and unstable operation of the pumps through loss of pressure on their discharge side.

Although I have described a preferred embodiment 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 sewage basin, a main inlet conduit bridging the basin, a diversion fitting on said conduit, said fitting comprising a plurality of branches, a reverse flow conduit in flow communication with each branch of said diversion fitting, a pump operatively connected to each reverse flow conduit, each of said pumps being spaced from said sewage basin and operable to pump liquid from the basin through its related reverse flow conduit, a motor for operating each pump, a pump by-pass passageway in each reverse flow conduit, a common conduit connecting said by-pass passageways with the basin, a valve element in each by-pass passageway, means to hold each valve element in open position to permit flow of liquid to the basin through the related reverse flow conduit while the related pump is idle, each of said valve elements being moved automatically into closed position when the related pump is started, separate normally open switches for each motor, means for successively closing said switches in response to rises of the liquid level in the basin, the operation of each pump stopping the flow of liquid to the basin through its related reverse flow conduit, and an overflow bar box in the main inlet conduit through which liquid may spill into the basin when all of the pumps are operating.

2. In combination, a basin, reverse flow conduits through which liquid is flowed in one direction to the basin and in an opposite direction from the basin, a pump operatively connected to each reverse flow conduit and in flow communication with the basin, each of said pumps being operable to pump liquid from the basin through the related conduit, a pump by-pass passageway in each reverse flow conduit, a common conduit connecting said passageways with the basin, said by-pass passageways and the connecting conduit being arranged below the lowest liquid level in said basin to maintain liquid in said connecting conduit and by-pass passageways at all times, a

valve element in each passageway, means normally holding said valve elements in open position to permit liquid flow to the basin through any reverse flow conduit when the related pump is idle, said valve elements when in open position each lying in the path of liquid flow from the related pump when said pump is operating and being so dimensioned as to be moved by said flow into closed position against the action of said holding means, and means responsive to different predetermined high liquid levels in said basin to selectively operate said pumps while permitting liquid to flow into the basin through reverse flow conduits related to pumps not in operation, the by-pass passageways related to said idle pumps, and said connecting conduit.

3. In combination, a basin, a main inlet conduit, reverse flow conduits in flow communication with said main inlet conduit, a strainer in each reverse flow conduit to separate solids from liquid flowing to the basin, a pump operatively connected to each reverse flow conduit, means for operating each of said pumps to pump liquids from the basin through the related conduit, said means being adapted to operate any of said pumps individually or simultaneously, a pump by-pass passageway in each reverse flow conduit, a common conduit leading from said passageways to said basin, a valve element in each passageway, means for automatically moving each of said valve elements into closed position to prevent liquid flow through its passageway to said basin when the related pump is in operation, and means for permitting screened sewage to flow from said main inlet conduit directly into said basin when all of the pumps are operating.

4. In combination, a basin, a main inlet conduit, a pair of reverse flow conduits in flow communication with the main conduit, a discharge conduit in flow communication with each of said reverse flow conduits, a pump operatively connected to each reverse flow conduit, means for operating each of said pumps individually or simultaneously to pump liquid from the basin through the related reverse flow conduit and to the respective discharge conduits, a pump by-pass passageway in each reverse flow conduit, a common connecting conduit leading from said passageways to said basin, a valve element in each passageway, a spring operatively connected to each of said valve elements, each of said springs being adapted to move the valve element to which it is operatively connected automatically to open its passageway when the related pump is idle, means for automatically moving each of said valve elements to close its passageway when the related pump is in operation, said valve elements and said connecting conduit being below the lowest level of liquid in said basin to maintain a liquid seal at each of the valve elements when it is in closed position during operation of the related pump.

5. In combination, a basin, conduits for liquid flowing in one direction to the basin and in an opposite direction from the basin, a pump operatively connected to each conduit, means for operating any of said pumps individually or simultaneously to pump liquid from the basin, a pump by-pass passageway in each conduit, a common conduit connecting each of said by-pass passageways with said basin, a valve element in each passageway for opening and closing the passageways, spring means connected with each valve element to hold it in open position when the related pump is idle, each valve element when in open position being in the path of liquid flow from the related pump and being so dimensioned as to be directly responsive to said flow to be moved into closed position against the action of said spring means when the related pump is in operation, said by-pass passageways and said connecting conduit being located below the lowest level of liquid in said basin so as to maintain a liquid seal at each of the valve elements when it is in closed position during operation of the related pump.

6. In combination, a basin, a main inlet conduit, a pair of reverse flow conduits communicating with said main inlet conduit, a common connecting conduit communicating with both of said reverse flow conduits and said basin for flowing liquid to said basin, a pump operatively connected to each of said pair of reverse flow conduits, each of said pumps being spaced from said basin and operable to pump liquid through its related reverse flow conduit in the opposite direction, means to operate said pumps individually or simultaneously, a by-pass fitting in each of said reverse flow conduits adjacent said pumps, liquid being adapted to flow from said main inlet conduit through one of said reverse flow conduits and its by-pass fitting when the related pump is idle, a valve in each of said by-pass fittings to prevent flow of liquid from either of said reverse flow conduits to said connecting conduit when the related pump is in operation, and means for flowing liquid from said main inlet conduit directly to said basin when both of said pumps are operating, said valves and said connecting conduit being below the lowest level of liquid in said basin to maintain a liquid seal at each valve in its closed position.

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