(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 993 275 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**09.03.2016 Bulletin 2016/10**

(51) Int Cl.:
***E03F 3/02*** *(2006.01)*

(21) Application number: **15179298.3**

(22) Date of filing: **31.07.2015**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA ME**
Designated Validation States:
**MA**

(30) Priority: **05.09.2014 SE 1451039**

(71) Applicant: **Tekniska Verken I Linköping AB**
**581 15 Linköping (SE)**

(72) Inventor: **Lönnbring, Jörgen**
**590 71 Ljungsbro (SE)**

(74) Representative: **Awapatent AB**
**Junkersgatan 1**
**582 35 Linköping (SE)**

## (54) PUMP STATION, WASTEWATER SYSTEM AND METHOD OF TRANSPORTING WASTEWATER

(57) The document describes a pump station for conveying wastewater, which is arranged to receive the wastewater being primarily transported by gravitation in an incoming pipe to the pump station and to discharge the wastewater for continued transportation, mainly through gravitation in an outgoing pipe, wherein said pump station comprises: an inlet to the pump station which is located at a first vertical level, and connected to the incoming pipe, an outlet from the pump station which is located at a second, higher vertical level and connected to the outgoing pipe, and a pump station arranged to pump the wastewater from the inlet to the outlet and a bypass arranged to connect the inlet to the outlet so that the pump arrangement is bypassed. A wastewater system and a method of conveying wastewater are also described.

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## Description

### Technical domain

**[0001]** This document relates to a wastewater system for transporting wastewater such as surface water and wastewater from buildings, outdoor environments etc. to a collection site such as a treatment plant or suchlike. Even though the system is described for use in relation to drainage, it can also be used in similar applications such as for waste management or similar, fluid, media.

**[0002]** The document also relates to a pump station and a method for transporting the wastewater

### Background

**[0003]** The transporting of wastewater from the place where it originates to a central site, such as a treatment plant, through gravitation and/or with the aid of pressure is known. For example, inclined pipes can transport the wastewater through the effect of gravity to a collector which then pumps the wastewater to a treatment plant. In the case of this technology a very powerful pump is required which has the capacity to pump large quantities of wastewater to the treatment plant. The collector also has to be of sufficient size to be able to receive large quantities of wastewater and/or to pump the wastewater at a sufficiently high frequency. As the pipes which lead to the pump transport the wastewater over a long distance, and must be of a sufficient gradient for the wastewater to run downwards, a deep shaft depth is required. The pipe inclination usually has to be 6-10 ‰ for it not be become blocked by material present in the wastewater, which means that both the pipes and the collector must be placed at a level relatively far below ground level. This in turn means that the shaft depth of the collector increases the greater the distance the wastewater has to be transported before it reaches the collector.

**[0004]** Instead of using gravity, the wastewater system can be designed so that the wastewater is actively forced through the pipes, which can thus be laid in a horizontal or even ascending manner and do not require the same shaft depth as with gravity. However, such systems require mechanisms that are constantly active, such as a pump, for transporting the wastewater to all the parts of the system.

**[0005]** Hence there are several drawback to today's technology, in that an extensive shaft depth is required, powerful pumps are needed which are costly and designed in such a way that they must be in constant operation and pump large quantities of wastewater long distances. There are great stresses on pumps which are used constantly and a stoppage of such a pump has a major effect on the system as a whole, which in turn requires a high degree of preparedness on the part of the wastewater system operator. Actively impelling the wastewater results in high energy consumption as transporting through all the pipes in such a system takes place with some form of pressure-generating mechanism.

**[0006]** A wastewater system in which gravity is used is described in EP1279774A1. In order to be able to reduce the gradient of the pipes, pump stations are used which transport material from an incoming pipe to an outgoing pipe. In this document the pumps in the pump stations must be active in order for the wastewater to be transported. This results in great stressing of the pumps and a high level of energy consumption. In addition, a stoppage in one pump station leads to the entire flow of the wastewater coming to a standstill.

**[0007]** There is therefore a need for an improved system for transporting, for example, wastewater, which overcomes the drawbacks of the previously known systems.

### Summary

**[0008]** One aim is to bring about an improved method of transporting wastewater from the place where it originates to a central unit, such as a treatment plant or suchlike. The central unit can be a unit which then transports the wastewater further with the aid of a conventional system, such as with pressurised pipes for example.

**[0009]** A particular aim includes bringing about a system which is robust and cost-effective.

**[0010]** The invention is defined by the attached independent patent claims. Forms of embodiment are set out in the independent patent claims, the following description and the drawings.

**[0011]** According to a first aspect, a pump station for conveying the wastewater is produced, which is arranged to receive the wastewater primarily being transported by gravitation in an incoming pipe to the pump station and to discharge the wastewater for continued transportation, mainly through gravity, in an outgoing pipe. Said a pump station comprises an inlet to the pump station which is located at a first vertical level and connected to the incoming pipe, an outlet from the pump station which is located at a second, higher, level and connected to the outgoing pipe and a pipe arrangement arranged to pump the wastewater from the inlet to the outlet. The pump station also comprises a bypass arranged to connect the inlet to the outlet so that the pump arrangement is bypassed.

**[0012]** In this way the wastewater can on occasions been transported between two pipes with the aid of a pump arrangement, a bypass or through a combination of both the pump arrangement and the bypass. Specifically, the pump arrangement's main function can be to bring about an additional flow, as required or at regular intervals, in order to clean off material that has become deposited on the bottom surface of the pipe. This is particularly advantageous in the case of gradients of less than 5‰ as such a small slope does not produce a flow speed high enough to remove the material.

**[0013]** In the event of a reduction in operation of the pump arrangement there is therefore the alternative that

the wastewater can pass through the bypass which, among other things, means an increase in operational reliability and capacity in the pump station. Additionally, the energy consumption can be reduced by inactivating the pump arrangement or setting it to a state in which it transports the wastewater at reduced frequency or quantity.

**[0014]** Since the pump arrangement transports the wastewater from a first level to a higher level, the gradient of the incoming and outgoing pipes can be relatively small. As a result of this a smaller shaft depth is required, which facilitates the construction of the pump station and its maintenance and inspection.

**[0015]** The bypass can comprise an obstructing device, such as a non-return valve, which prevents the wastewater which has passed a certain position along the bypass from being transported back in the opposite direction. This is to counteract the wastewater running back into the incoming pipe once it has entered a little way into the bypass.

**[0016]** The obstructing device can be located at the highest vertical level of the bypass, where the risk of the wastewater otherwise flowing in the wrong direction is greatest.

**[0017]** The bypass can comprise a flow part part located at a third vertical level which is higher than the second vertical level. A connection from the pump arrangement to the outlet can be located higher up than the second vertical level and preferably higher up than the third vertical level. The bypass can also connect to said outgoing pipe's highest point in a direction parallel to the gravitational direction. In this manner the wastewater can fall from the bypass into the outgoing pipe mainly by way of gravitation and also continue to be transported mainly by way of gravitation.

**[0018]** The pump arrangement can also comprise a container which is arranged to receive the wastewater from the incoming pipe. In this case the pump arrangement can be arranged to transport the wastewater received in the container to the outgoing pipe, whereby the container can have an effective height which achieves a higher vertical level than the bypass and/or can be sealable.

**[0019]** "Sealable" means that the container should be able to be made adequately tight in order to prevent the wastewater leaking from it when it is pressurised. Preferably such a sealable container has a venting device which allows the venting of air enclosed in the container.

**[0020]** According to a second aspect, a wastewater system for conveying wastewater is produced which comprises at least two consecutive pump stations, a pipeline which forms the outgoing pipe on the first pump station and which forms the incoming pipe to a second pump station.

**[0021]** Such a system can effectively transport the wastewater from the place(s) it originates to a central collection site. The system can be connected, for example, to a treatment plant or to a collecting unit which then transports the wastewater onwards with a similar system or a system with with conventional technology. As at least two pump stations follow on from one another the gradient of the pipes can be relatively small.

**[0022]** The pump stations can located on essentially the same vertical level, which is advantageous during installation of the system. In this case there is no need to excavate different depths for different parts of the system.

**[0023]** The gradient of the pipe is 5 ‰ or less, preferably 4 ‰ or less, 3 ‰ or less, 2 ‰ or less or less than 1 ‰ or less, but preferably greater than zero.

**[0024]** The at least two pump stations and pipelines can be arranged in a culvert below ground level. This facilitates the construction of the system as well as maintenance and inspection work when the system is in place. It is also better protected from external influences and is therefore more robust and operationally reliable.

**[0025]** The pump stations can be arranged in respective chambers and the chambers connected by a culvert. In this way two pump stations directly following each other can be connected by one culvert.

**[0026]** Alternatively, the pumps stations can be arranged in respective chambers, wherein the chambers are connected by at least two culverts which are connected to each other via an intermediate chamber in which an incoming pipe is passively connected with an outgoing pipe. In this way each chamber does not have to contain a pump station. For example, every second or every third chamber can contain a pump station. In various sections of a system the number of pump stations can vary as required, based, for example, on the gradients and/or rises which have to be included as well as possible shaft depths.

**[0027]** According to a third aspect, a method of conveying the wastewater is provided. The method involves receiving the wastewater from an incoming pipe, which has an inlet located at a first vertical level, with the aid of pump arrangement raising the wastewater to another outlet located at a higher vertical level, and in the event of an operational reduction of the pump arrangement or excessive flow, bypassing the wastewater from the inlet to the outlet.

**[0028]** Such a method results in effective and operationally reliable conveying of the wastewater from an incoming to an outgoing pipe. The method makes it possible to transport the wastewater even when the flow increases or when the pump arranged is switched off or has a reduced capacity. As the pump arrangement raises the wastewater to a higher vertical level, the gradient of the pipes can be relatively small.

**[0029]** The method can also involve preventing the bypassed wastewater from flowing in the direction from the outlet to the inlet. It is undesirable for wastewater to run in the wrong direction in the pipes and this is thus prevented.

**[0030]** The method can also involve making the bypassed wastewater flow to a third vertical level which is

higher than the second vertical level.

**[0031]** The method can also involve taking the wastewater fed from the pump arrangement to the outlet at a vertical level which is higher than the third vertical level. This method results in effective flowing of the wastewater to the outlet.

Brief description of the drawings

**[0032]**

Figure 1 is a schematic cross-sectional view of a pump station with incoming and outgoing pipes for conveying wastewater.

Figure 2 is a schematic cross-sectional view of a wastewater system comprising a number of pump stations as shown in figure 1.

Figure 3 is a schematic cross-sectional view of a wastewater system comprising a number of pump stations as shown in figure 1 and an intermediately located chamber without a pump station.

Detailed description

**[0033]** The transporting of wastewater, such as surface water and wastewater through pipes can take place in a number of ways, principally through gravitation or in forced manner through pressurisation of the pipes. In order for the wastewater to be transported solely by way of gravitational forces, i.e. through its own weight, the pipes must be laid at a gradient in relation to a plane essentially perpendicular to the direction of gravity. Usually the pump station's outlet is placed at a higher level than the level of its inlet in a direction parallel to the direction of gravity. In this way the wastewater descends through the pipe only through the effect of gravity. The gradient of a pipe is general expressed as the fall in the pipe and is calculated as the change in height, indicated in millimetres, per unit of length, indicated in metres, wherein the height is measured in the direction parallel to the gravitational direction and length in the direction perpendicular to the direction of gravity. The unit for the gradient is therefore mm/m. As the change in height is comparatively small in relation to the length, the resulting figure is so small that it is usually expressed in per mille (‰).

**[0034]** Conveying "mainly through gravitation" means that the pipe must have a sufficient gradient to allow conveying with the aid of gravitation. This does not rule out the pipe being pressurised, either through feeding with the aid of a pump or through the incoming wastewater being supplied from a higher level.

**[0035]** The term wastewater includes all mainly fluid waste collected, for example, from households, industrial plants, roads etc. Wastewater includes surface water, e.g. rain water and water from melting snow, as well as drainage water, i.e. from toilets, washbasins, washing machines, dishwashers etc. In spite of the fact that wastewater implies that it is in liquid form, wastewater also contains more or less solid objects such as food residues, paper, gravel etc. whereby such objects also end up in the wastewater system.

**[0036]** It is clear that separate systems in accordance with what will be described below can be used for surface water, wastewater and drainage water.

**[0037]** Figure 1 shows a pump station 1 intended for use in a wastewater system for conveying wastewater. The pump station 1 is located below ground level Vm. Via an inlet 2a, the pump station 1 receives wastewater from an incoming pipe at a level V0 and then transports the wastewater on via an outlet 3a to an outgoing pipe 3. The wastewater is transported in the incoming and outgoing pipes though gravitation as the pipes are arranged with a gradient large enough for transporting the wastewater as a result of the effect of gravitational forces. The gradient of the pipe is 5 ‰ or less, preferably 4 ‰ or less, 3 ‰ or less, 2 ‰ or less or less than 1 ‰ or less, but greater than zero.

**[0038]** "Inlet" 2a and "outlet 3a" describe the positions where the pipes enter and exit the pump station. Typically, between outlet 3a and inlet 2a an essentially straight pipe, with only horizontal bends, is located.

**[0039]** The pump station 1 comprises a pump arrangement 4, 4a, 4b which pumps the wastewater from incoming pipe's inlet level V0 on to a higher vertical level V3 for it then to end up in the outgoing pipe's outlet level V1. The pump arrangement 4, 4a, 4b can comprise a container 4 into which the incoming pipe 2 opens and one or more pumps 4a, which can transport the wastewater from the container 4 and a connection 4b to the outgoing pipe 3. The pumps can have an output of 7 kW or less, preferably 5 kW or less, 3 kW or less or 2 kW or less.

**[0040]** The container 4 can be a sealable container of any height V4 and can be provided with an access hatch (not shown) which in the closed position fits tightly against the container. The container 4 can also have a venting device 9 which allows the venting of air enclosed in the container 4. Venting can take place via a tube to above the ground, or to the chamber. In the latter case it may be advantageous to vent via a carbon filter, for example. The venting device 9 can be integrated into the hatch (not shown).

**[0041]** Alternatively, the container can have a height V4 which exceeds a highest point V2 of the bypass pipeline 5 or which exceeds a highest point V3 on the connection 4b. A container of this height can, but does not have to be sealable in accordance with what has been described above. The container can therefore be permanently vented.

**[0042]** The pump 4a can, for example, be a lifting pump, i.e. it raises the wastewater from a first level to a second, higher level in a direction parallel to the direction of gravity. In practice this can mean that the pump raises the water 1-4 m, preferably 2-3 m. Other types of pump are also conceivable in this connection.

**[0043]** It can be possible to activate/deactivate the

pump arrangement 4, 4a, 4b either automatically, for examples at certain times, at certain measured loads or pressures in the incoming pipe 2 etc. or manually, for example when servicing of the pump arrangement has to be carried out etc. In addition, the pump arrangement's 4, 4a, 4b capacity can be regulated, for example by changing its frequency or capacity. A number of alternatives of how the pump arrangement can be activated, deactivated or regulated are considered as being familiar within this technical field and are not therefore described here.

**[0044]** The pump station also comprises a bypass 5 which connects the incoming pipe 2 with the outgoing pipe 3. The wastewater can therefore also pass from the incoming to the outgoing pipe through this bypass. This takes place through pressure caused by the incoming wastewater when a reduction in operation occurs in the pump arrangement 4, 4a, 4b in the pump station 1.

**[0045]** A "reduction in operation" is taken to mean that the pump arrangement 4, 4a, 4b is fully or partially at a standstill. For example, the pump arrangement can operate at lower than maximum capacity. A pressure which drives a partial quantity of the wastewater through the bypass can thus occur even if the pump arrangement 4, 4a, 4b is active when the inflow of wastewater is very great, or when for any reason the pump arrangement is pumping at a reduced frequency or reduced capacity. In the event of increased pressure the incoming pipe 2 is filled with wastewater which is then forced into the bypass 5. When the quantity of wastewater is sufficiently large it is forced through the bypass 5 and falls into the outlet of the outgoing pipe where it is transported further through gravitation.

**[0046]** The bypass 5 can comprise a stopping device 6, such as a non-return valve, which ensures that wastewater which has passed this position along the bypass does not flow back down into the incoming pipe 2, at reduced pressure for example.

**[0047]** There may be one or more connections 7 to the bypass 5 or to pipe 2 for the supply of wastewater through one or more pipes from one or more buildings, drains or suchlike. Such a connection is preferably applied to the bypass 5 at a position downstream of the stopping device 6 in the direction of flow of the wastewater in the bypass in order to prevent the wastewater being supplied in this additional connection resulting in the wastewater flowing back into the incoming pipe 2. In addition, the connection 7 is advantageously located so that it is coupled to the bypass 5 at the highest point of the bypass 5, so that wastewater discharged in the connection 7 can contribute to bringing about a pressure in the outgoing pipe 3. The connection 7 can be arranged downstream of a non-return valve 6.

**[0048]** The connections between the pump arrangement 4, 4a, 4b and the incoming pipe 2 and outgoing pipe 3 can include mechanisms for stopping the flow of wastewater, which may be necessary in the event of repairing or cleaning of the pump. More specifically, a shut-off valve can be arranged at the inlet 2a and/or a shut-off valve arranged at the outlet 3a.

**[0049]** The incoming and outgoing pipes 2, 3 are essentially of the same dimension. Preferably this dimension can be of the magnitude of 20-50 cm. The bypass can be of the same dimension as the incoming and/or outgoing pipe.

**[0050]** The connection between the pump arrangement 4, 4a, 4b and the outgoing pipe 3 can be designed so that it forms a natural resistance to the wastewater being pumped through it. This can be done, for example, by placing part of the connection 4b at a higher level V3 in the direction parallel to the direction of gravity than the outlet level V1 of the outgoing pipe and after the non-return valve 6. In this way the wastewater transported by the pump brings about a pressure in the outgoing pipe, and in the event of a stoppage therein (for example through a following pump coming to a standstill) the formed pressure helps to force the wastewater into the outgoing pipe 3.

**[0051]** The connection between the pump arrangement and the outgoing pipe can be formed by a pipe which has a smaller dimension than the bypass 5. For example, a cross-sectional area of the connection 4b can be 10% - 80% of the cross-sectional area of the bypass.

**[0052]** The drainage pipes can preferably be made of metal, such as stainless steel, or plastic.

**[0053]** The pump arrangement can raise the wastewater from the incoming pipe's inlet level V0 to a level V3 which is higher than highest level V2 of the bypass. Preferably the pump arrangement 4 connects to the bypass 5 in this way, alternatively it can connect to the outlet of the outgoing pipe 3.

**[0054]** Figure 2 shows a wastewater system 10 conveying wastewater comprising a plurality of pump stations 1 a, 1 b, 1 c connected to each other by pipes 2a, 2b. An outgoing pipe of a first pump station 1 a thus becomes the incoming pipe of the following pump station 1 b. Although the figure shows three pump stations, the number of pump stations in a system can be greater or smaller than this. Advantageously a pump station is located in close proximity to each building or other location where the wastewater is produced.

**[0055]** The distance A between two consecutive pump stations can differ between different pump stations in the system 10. For example, it can be adapted to what the terrain is like where the system is installed or how great the distance is between two buildings that are to be connected to the system. The distance can be 50-1000 metres for example. In order to facilitate the design and installation of a system as in figure 2, the pump stations 1 a, 1 b, 1 c are preferably located at the same vertical level. This means that level V0 for the inflow into each pump station is constant. In certain cases the terrain does not allow this to be done and the pump stations can then be located at different levels.

**[0056]** It is envisaged that where the conditions permit, the system can comprise a pump station 1 which receives

incoming wastewater in an incoming gravitational pipe and transports the outgoing wastewater into an outgoing gravitational pipe, wherein the outgoing gravitational pipe is connected to a treatment plant or a collection station, from where the water is transported onwards under pressure by a pump arrangement.

**[0057]** The wastewater system 10 can be installed in a culvert system which comprises tunnels 8a, 8b and chambers 8c, 8d, 8e located at least partially below ground level. Such culvert systems can be installed at an essentially constant distance below ground level and/or with no, or only very small differences in height between the chambers, which makes it particularly advantageous to use a pump station in accordance with what is described herein when wastewater is to be transported over a longer distance than height of the tunnels and chambers allow.

**[0058]** In accordance with a specific embodiment, the distance can be 50-200 metres with a gradient of a magnitude of 3 ‰ - 5 ‰. This means that with a distance A of 100 metres, the pump arrangement 4, 4a, 4b can be designed to raise the wastewater approximately 0.5 metres. With such an embodiment, pipe 2, 3 can be placed in a culvert without taking up too much space vertically. The distance V1-V0 can thus be of a magnitude of 0.3-4 m, preferably 0.5-3 m, 0.5-2 m or 0.5-1 m. For example, the entire pipe 2a, 2b can be located at a lower level than a vertical midline of the culvert 8a, 8b.

**[0059]** Culvert systems also make it possible to install the drainage pipes and other pipes and units, such as electrical cables, electrical distribution boxes, freshwater pipes , fibre networks etc. in a replaceable manner.

**[0060]** Figure 3 shows a variant of a wastewater system 10' in which one of the chambers 8d' does contain a pump but only transports the incoming wastewater further, and may have a connection 7 for supplying further wastewater from a building or suchlike. The incoming pipe 2a' to chamber 8d' is passively connected to an outgoing pipe 2b' from the chamber, i.e. no forced transporting takes places in the chamber such as with the aid of a pump. A pipe 5' arranged within the chamber connects the incoming pipe 2a' to the outgoing 2b' pipe.

**[0061]** The pipe 5' can comprise a pipeline which brings about a direct connection between the incoming pipe 2a' and the outgoing 2b' pipe. Such a pipe can also run essentially horizontally between the incoming pipe 2a' and the outgoing pipe 2b'. Alternatively the pipe 5' can have a gradient corresponding to that of the pipes 2a', 2b'. Additionally or alternatively the pipe 5' can be ascending, which means that transporting to the outgoing pipe 2b' takes place with the aid of the pressures in the incoming pipe 2a'. Additionally or alternatively a container (not shown) can be arranged between the incoming pipe 2a' and outgoing pipe 2b', wherein the incoming pipe 2a' can be connected to the container at a higher level, the same level or a lower level than the outgoing pipe 2b'.

**[0062]** The pipe 5' in the chamber 8d' can have one or more non-return valves, shut-off valves, inspection hatches, cleaning openings or suchlike. The connection 7 can advantageously be arranged downstream of a non-return valve.

## Claims

1. Pump station (1) for conveying wastewater arranged to receive the wastewater which is being primarily transported by gravitation in an incoming pipe (2) to the pump station and to discharge the wastewater for continued transportation, mainly through gravity, in an outgoing pipe (3), wherein said pump station comprises:

   an inlet (2a) to the pump station, which is located at a first vertical level (V0) and connected to the incoming pipe (2),
   an outlet (3a) from the pump station, which is located at a second, higher, vertical level (V1) and connected to the outgoing pipe (3), and
   a pump arrangement (4, 4a, 4b) for pumping the wastewater from the inlet (2a) to the outlet (3a),
   **characterised by**
   a bypass (5) arranged to connect the inlet (2a) to the outlet (3a) so that the pump arrangement (4, 4a, 4b) is bypassed.

2. Pump station according to claim 1 or 2, wherein said bypass (5) comprises an obstructing device (6), such as as a non-return valve which prevents the wastewater which has passed a certain position along the bypass from being transported back.

3. Pump station according to claim 2, wherein the obstructing device (6) is located at the highest vertical level (V2) of the bypass.

4. Pump station according to any one of claims 1-3, wherein the bypass (5) has a flow part located at a third vertical level (V2) which is higher than the second vertical level (V1).

5. Pump station according to any one of the preceding claims, wherein a connection (4a) from the pump arrangement (4, 4a, 4b) to the outlet is located higher up than the second vertical level (V1) and preferably higher up than the third vertical level (V2).

6. Pump station according to any one of the preceding claims, wherein said bypass (5) connects to said outgoing pipe's highest point in a direction parallel to the gravitational direction.

7. Pump station according to any one of the preceding claims also comprising a container which is arranged to receive the wastewater from the incoming pipe (2), and wherein the pump arrangement is designed

to transport the wastewater received in the container to the outgoing pipe (3), wherein the container has an effective height which is at a higher vertical level (V4) than the bypass (5) and/or is sealable.

**8.** Wastewater system for conveying wastewater comprising at least two pump stations (1 a, 1 b, 1 c) according to any one of the preceding claims, a pipe (2a, 2b) which forms an outgoing pipe at a first pump station (1 a, 1 b) and which forms an incoming pipe at a second pump station (1 b, 1 c).

**9.** Wastewater system according to claim 7, wherein the pump stations (1 a, 1 b, 1 c) are essentially at the same vertical level (V0).

**10.** Wastewater system according to claim 7 or 8, wherein the gradient of said pipe (2a, 2b) is 5 ‰ or less, preferably 4 ‰ or less, 3 ‰ or less, 2 ‰ or less or less than 1 ‰ or less, and greater than zero.

**11.** Wastewater system according to any one of claims 8-10, wherein said pump stations (1 a, 1 b, 1 c) and pipe (2a, 2b) are arranged in a culvert (8a, 8b, 8c, 8d, 8e) below ground level.

**12.** Wastewater system according to claim 11, wherein the pump stations (1 a, 1 b, 1 c) are arranged in respective chambers (8c, 8d, 8e) and wherein the chambers are connected by a culvert.

**13.** Wastewater system according to claim 11, wherein the pumps stations are arranged in respective chambers (8c, 8e), wherein the chambers are connected by at least two culverts which are connected to each other via an intermediate chamber 8d' in which an incoming pipe 2a' is passively connected with an outgoing pipe 2b'.

**14.** Method of conveying wastewater, involving receiving the wastewater from an incoming pipe (2) which has an inlet (2a) located at a first vertical level (V0), with the aid of a pump arrangement (4, 4a, 4b) raising the wastewater to an outlet (3a) located at a second, higher vertical level (V1), **characterised in that** in the event of operational reduction of the pump arrangement (4, 4a, 4b) or excessive flow, the wastewater is bypassed from the inlet (2a) to the outlet (3a).

**15.** Method according to claim 14, which also involves preventing bypassed wastewater from flowing in the direction from the outlet (3a) to the inlet (2a).

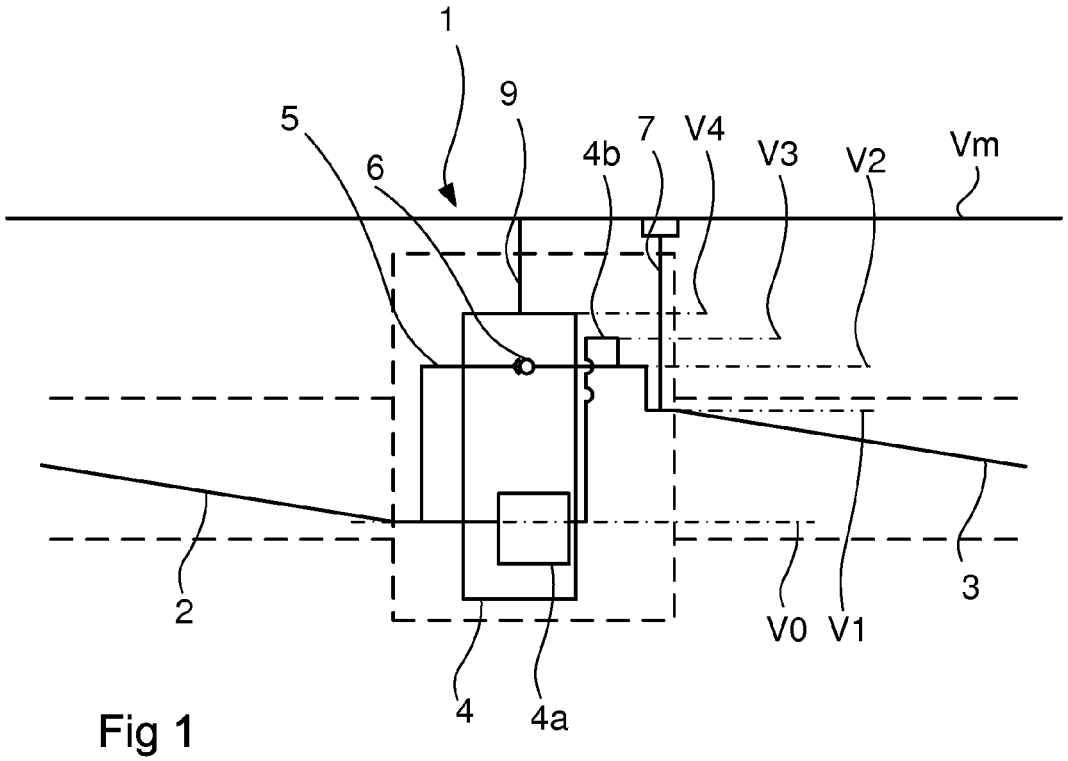
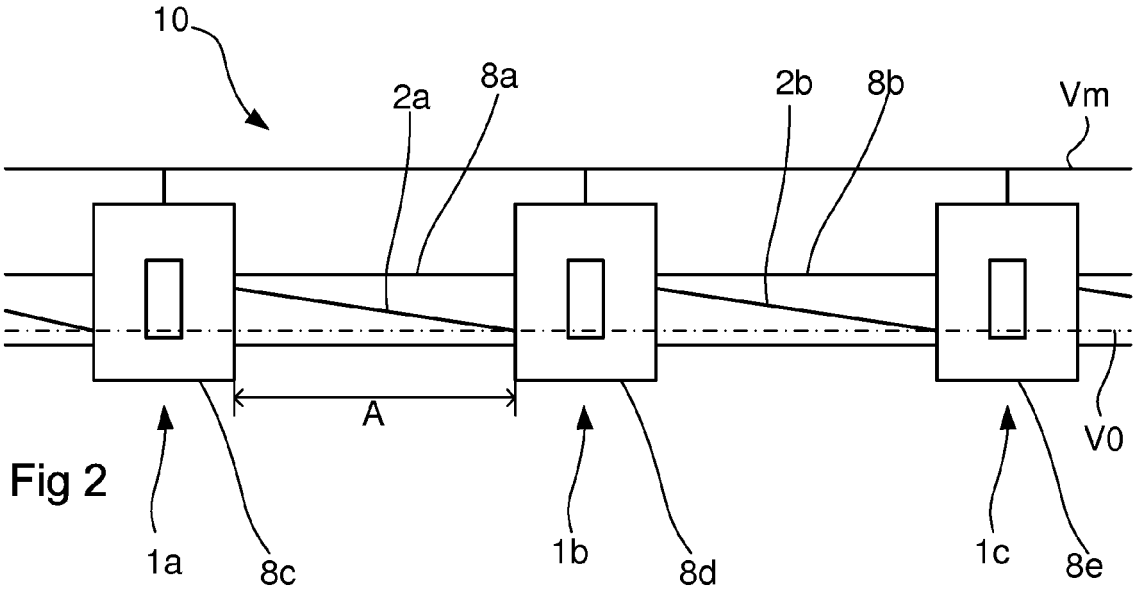

1
9
5
6
4b
7
V4
V3
V2
Vm
2
3
V0
V1
4
4a

Fig 1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2b
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Vm
A
V0
1a
8c
1b
8d
1c
8e

Fig 2

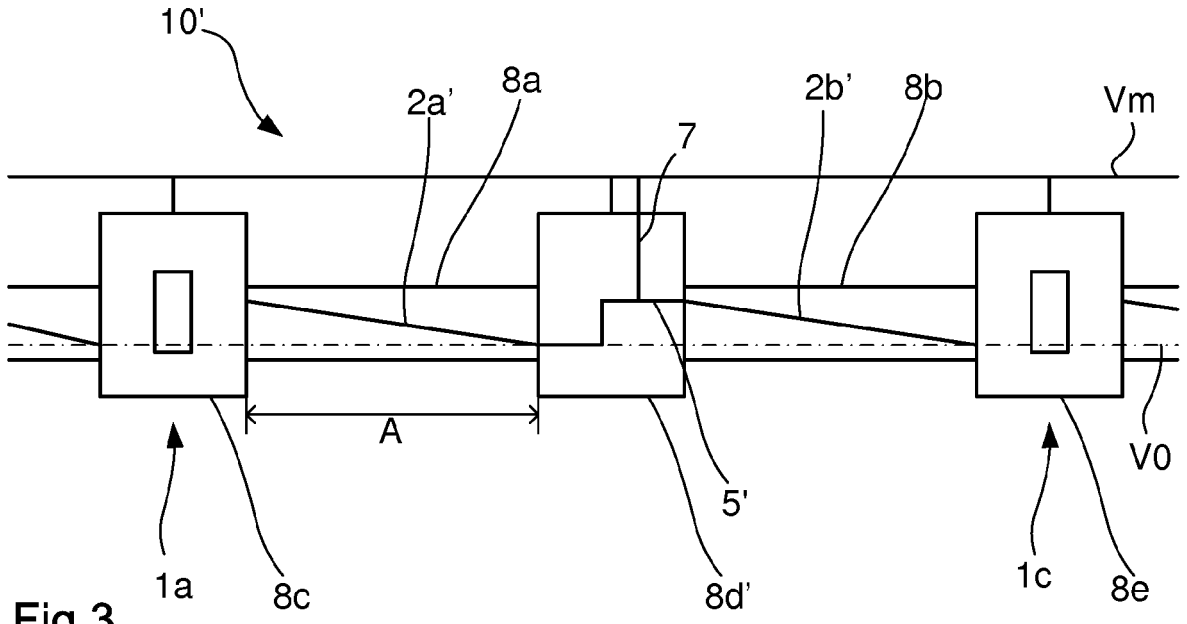


Fig 3

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# EUROPEAN SEARCH REPORT

Application Number
EP 15 17 9298

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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| Y | US 2007/241052 A1 (SWIFT GAVIN [CA])<br>18 October 2007 (2007-10-18)<br>* figures 1,3 *<br>----- | 1-15 | |
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