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(54) **PRESSURE SEWER SYSTEM AND METHOD THEREFOR**

(57) The pressure sewer systems comprised of the pressure main (1) and the house connecting pressure pipes (2) are dimensioned in the stage of designing to accommodate the nominal flow rate (Q_n) and the nominal pressure (P_n) of flowing wastewater. During common use, the instantaneous flow rate (Q_i) and instantaneous pressure (P_i) are several times lower, which results in the pressure main (1) fouling by waste. The method describes a temporary controlled change in the instantaneous

pressure (P_i) and the instantaneous flow rate (Q_i) of wastewater up to the value approaching the nominal pressure (P_n) and nominal flow rate (Q_n) for the purpose of flushing the pressure main (1) of the pressure sewer system. The subject of the invention is also the system for generation the temporary controlled change in the instantaneous pressure (P_i) and the instantaneous flow rate (Q_i) of wastewater.

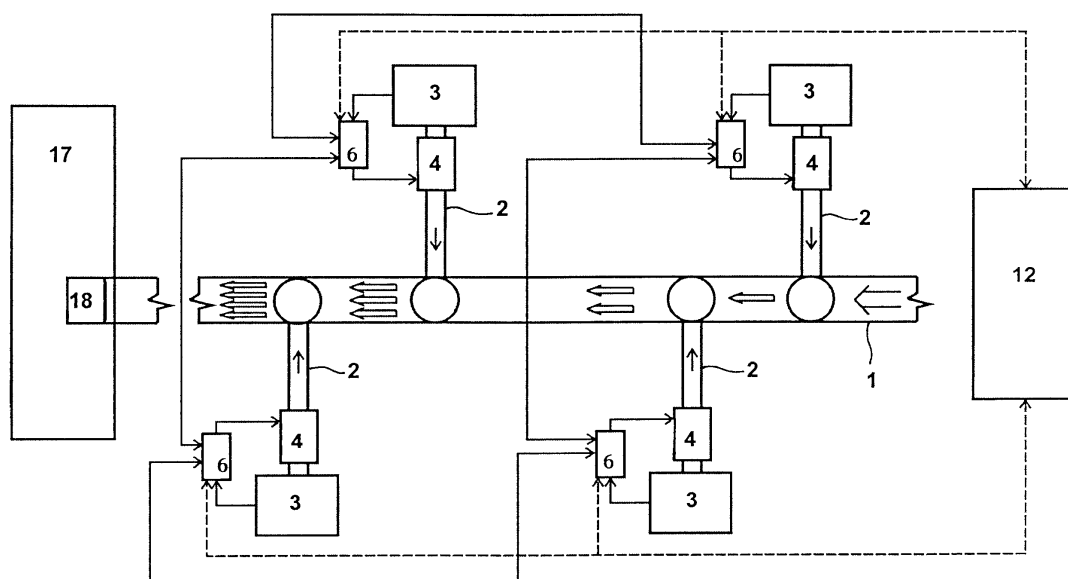


FIG. 1

Description

Field of the invention

[0001] The invention concerns a system for automatic flushing of the pressure sewer system preventing its fouling by solidifying waste.

Background of the invention

[0002] The pressure sewer system is used where it is not possible to use a gravity sewer system no matter whether due to the terrain layout or transported wastewater type. The pressure sewer system consists of pump sumps equipped with pumps, house connecting pressure pipes and the pressure main. Gravity house connecting pressure pipes from individual houses are routed into house pump sumps or pump sumps designed for a group of houses from where wastewater is pumped into the pressure main. The pressure main is usually routed into the wastewater treatment plant. Water gathered in the pump sump is then transported by the pump into the house connecting pressure pipe and from here it is pumped over into the pressure main. A combination of a pump sump and a pump connected to the pressure sewer system can be referred to as the pump unit for the purposes of this document.

[0003] The control of pumps installed in pump sumps on house connecting pressure pipes of the pressure sewer system can be executed on an as-needed basis by the operator who activates the pump once the pump sump is full. The disadvantage of this solution is that the caretaker, or the pump sump owner must monitor the pump sump water level. The pump sump water level can also be monitored by an automatic control unit which is connected both to the pump and a group of sensors installed in the pump sump for the water level monitoring. The sensors monitor the minimum wastewater level in the pump sump at which the pump must be switched off, the current wastewater level in the pump sump and the maximum wastewater level in the pump sump at which the pump must be switched on, or other optional wastewater levels where necessary. This solution is known for example from the Czech utility design CZ 23662 U1. The known technical solution works automatically without the necessity of any control to be executed by the operator. The automatic control unit is electrically connected to the sensors installed in the pump sump and to the pump. The technical solution is described as a closed autonomous system. The disadvantage of this solution is that in the case of an unexpected event concerning the pressure sewer system, such as an accident, reconstruction, etc., it is necessary to circumvent all the installed control units and control their operation on a temporary basis for example to interrupt the drawing of the pump sumps into the pressure sewer system when parts of the pressure main are being replaced.

[0004] The patent application AU 2012318281 A1 pro-

vides a solution that also includes a pump sump, a pump connected to the house connecting pressure pipe for the pump sump emptying, an automatic control unit electrically connected to the pump sump and sensors for measuring the pump sump water level. The automatic control unit is connected, either by wire or in a wireless way, to a remote server by a communication interface. The remote server is connected with several automatic control units which can be switched over from automatic to remote-controlled operation. Through the automatic control units the remote server can control the operation of the pumps installed in the pressure sewer system, so that, for example at the time of reconstruction of the pressure main, the pumps are not switched on and wastewater discharged at the construction site.

[0005] Among the disadvantages of the aforementioned known solutions is the fact that they do not eliminate one of the key problems of the pressure sewer system, which is the pressure sewer system pipes fouling. The pipes of the pressure sewer system are built with the capacity given by the nominal flow rate in its individual parts (house connecting pressure pipes, the pressure main) with a relevant margin which is utilized in exceptional cases. For the purposes of this background information, the nominal flow rate and nominal pressure refer to the values for which the house connecting pressure pipes and the pressure main are dimensioned according to the design. During common operation wastewater from individual house connecting pressure pipes flows towards the pressure main gradually, so that the flow in the pressure main is very low compared to its nominal capacity. The unused nominal capacity of the pressure sewer system pipes (in particular of the pressure main) is exposed, in particular as a result of the pump units emptying, to the continuous sedimentation and solidification of solid residues from wastewater at the bottom of the pressure main, which may ultimately result in the obstruction of the pressure sewer system pipes.

[0006] The task of the invention is the creation of the method and system for automatic flushing of the pressure sewer system effectively protecting the pressure sewer system pipes against obstruction, removing the solidifying sediments of waste contained in wastewater from the pressure sewer system on a regular basis, while it is desirable, from the point of view of investments, operation and maintenance, not to add any additional mechanical equipment to the system if possible.

Summary of the invention

[0007] The set task has been resolved by the method and system of automatic flushing of the pressure sewer system according to this invention.

[0008] The method for automatic flushing of the pressure sewer system consisting of the pressure main and at least two house connecting pressure pipes connecting at least two wastewater pump sumps to the pressure main. The pump sumps are equipped with sensors for

measuring the pump sump water level and each house connecting pressure pipe or pump sump is fitted with a pump for transporting wastewater to the pressure main via the house connecting pressure pipes. Each pump is connected to an autonomous electronic control unit with inputs for the analysis of data from the sensors, outputs for the pump control, at least one processor, at least one database for at least one software module deposition and at least one communication interface for wire or wireless communication.

[0009] The core of the invention is based on the fact that the activation of the pumps for the removal wastewater from the pump sumps is executed in a synchronised manner resulting in a temporary controlled change of instantaneous flow rate and instantaneous pressure in at least part of the pressure main. The instantaneous flow rate during the controlled change corresponds to the required flushing flow rate of the given part of the pressure main and the instantaneous pressure during the controlled change does not exceed the nominal pressure of the pressure main. The removal of wastewater from the pump sumps is executed according to the order of the house connecting pressure pipe outlets into the pressure main and/or based on data concerning wastewater level in individual pump sumps. The instantaneous flow rate reaching the value required for flushing flushes a majority of waste sediments in the pressure pipes. With repeated automatic flushing, the pressure sewer system is maintained in good operating condition. Flushing takes into account the position of the house connecting pressure pipes with respect to the pressure main so that new wastewater is continuously added to the mass of wastewater without any damage to the pressure pipes that would be sustained if the nominal pressure were exceeded in any single point. In addition, the total volume of wastewater intended for the generation of a change in the instantaneous flow rate and instantaneous pressure is taken into account.

[0010] In the preferred embodiment of the method of automatic flushing of the pressure sewer system according to the invention a reserve is created in at least some of the pump sumps before the generation of the controlled change in instantaneous flow rate and instantaneous pressure to accumulate wastewater and ensure the complete flushing of the given part of the pressure main. By creating the reserve, a sufficient amount of wastewater for flushing is secured. The total volume, which is necessary for flushing the respective pipe segment, refers to the sum of volumes in individual co-operating pump sumps. The total volume is determined according to the dimension and length of the pipe segment subject to flushing based using the calculation in the hydraulic simulation model of the low pressure sewerage network.

[0011] In the preferred embodiment of the method of automatic flushing of the pressure sewer system according to the invention, data concerning wastewater level in the pump sumps for planning the controlled change in instantaneous flow rate and instantaneous pressure is

acquired from the sensors. Alternatively, the data concerning wastewater level in the pump sumps is acquired from the database of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system for the previous period of time. Alternatively, the data concerning wastewater level in the pump sumps is acquired from the database of records and/or weather forecasts. The correct estimate of wastewater level in the pump sumps is of key importance for the planning of flushing because if the volume of wastewater is insufficient, flushing is ineffective.

[0012] In addition, the invention comprises a system for automatic flushing of the pressure sewer system.

[0013] The system for automatic flushing of the pressure sewer system consisting of the pressure main and at least two house connecting pressure pipes connecting at least two wastewater pump sumps to the pressure main. The pump sumps are fitted with sensors for measuring the pump sump water level where each house connecting pressure pipe or pump sump includes a pump for wastewater transporting to the pressure main via the house connecting pressure pipes. Each pump is connected to the autonomous electronic control unit fitted with inputs for the analysis of data from the sensors, outputs for the pump control, at least one processor, at least one database for at least one software module deposition and at least one communication interface for wire or wireless communication. At least two control units are connected to one to the other via a communication interface.

[0014] The core of the invention is based on the fact that at least one control unit is fitted with equipment for real time monitoring and its backup power supply unit, and that at least one control unit is equipped with a software module for pumping synchronization that includes a basic plan of flushing with statistically expected wastewater level in the pump sump and individual real times of the pump activation. The interconnection of the control units ensures information sharing between them allowing subsequent organization. The backup power supply unit and the equipment for real time monitoring protect the control units against a loss of real time which would result in a mismatch of statistically expected wastewater level in the pump sumps where, for example, a twelve-hour lasting failure of power supply would completely invert the basic flushing plan for day and night.

[0015] In the preferred embodiment of the system for automatic flushing of the pressure sewer system according to the invention, the system is equipped with a remote server to which at least some of the control units are connected via a communication interface. The remote server is fitted with a database with a software module for pumping synchronization which includes a basic plan of flushing and individual times of activation for the pumps in all pump sumps in the given location of the pressure sewer system. In addition, the remote server comprises the controlling software module to establish the master/slaves communication with the control units. This arrangement put the controlling software module in charge

of the control units which then behave in accordance with the flushing plan transmitted from the remote server.

[0016] In the preferred embodiment of the system for automatic flushing of the pressure sewer system according to the invention the remote server is connected via the communication interface to at least one database of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system for the previous period of time. Alternatively, the remote server is connected via the communication interface to at least one database of records and/or weather forecasts. Thanks to the receipt of up-to-date data from the databases by the remote server, the system can update the flushing plan within the limits allowed by wastewater levels in the pump sumps.

[0017] Among the advantages of the invention is the possibility of deployment in the existing pressure sewer systems, the relatively low demands for hardware modifications of the currently used control units or the low costs related to the manufacture of the new modified control units. The system interconnectedness and the utilization of the until now negative impact of a change in instantaneous flow rate and instantaneous pressure up to the values of the nominal flow rate and nominal pressure for the pressure sewer system flushing. Another advantage of the invention is that no additional mechanical equipment is necessary and no additional service water is needed except for wastewater itself.

Explanation of drawings

[0018] The present invention will be explained in detail by means of the following figures where:

- Fig. 1 illustrates the flow diagram of the pressure sewer system and the system with the indicated direction of wastewater flow,
- Fig. 2 illustrates the diagram of the pump unit,
- Fig. 3 illustrates the flow diagram of the control unit,
- Fig. 4 illustrates an example of a realistic control unit,
- Fig. 5 illustrates the flow diagram of the remote server.

Examples of the preferred embodiments of the invention

[0019] It shall be understood that the specific cases of the invention embodiments described and depicted below are provided for illustration only and do not limit the invention to the examples provided here. Those skilled in the art will find or, based on routine experiment, will be able to provide a greater or lesser number of equivalents to the specific embodiments of the invention which are described here. Also such equivalents will be included in the scope of the following claims.

[0020] Fig. 1 illustrates a diagram of the pressure sewer system consisting of the pressure main 1 with four house connecting pressure pipes 2 routed from four pump sumps 3. In this example of the invention embod-

iment, the house connecting pressure pipes 2 are equipped with the pumps 4 which transport wastewater from the pump sumps 3 into the pressure main 1. From Fig. 1 it is obvious that each pump sump 3 is fitted with the control unit 6. The pressure main 1 drains wastewater to the wastewater treatment plant 17 where the pressure main 1 is equipped with the flowmeter 18. The flowmeter 18 provides data concerning the flow rate and the volume of wastewater leaving the pressure sewer system for the wastewater treatment plant 17 to be used in the database 14 of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system. In addition, Fig. 1 illustrates the interconnection of the control units 6 and also their connection to the remote server 12. It is obvious to those skilled in the art that the control units 6 are connected to the remote server 12 either by wire or in a wireless manner. The remote server 12 in this example consists of a computer. The control units 6 are connected to the sensors 5 not included in the illustration for sensing wastewater level in the pump sump 3 and to the pumps 4 to control the removal of wastewater from the pump sumps 3.

[0021] According to the applicable ČSN standard for regular flushing of the pressure sewer system it is necessary that each segment of the pressure main 1 is at least once a day flushed with wastewater flowing at a speed of 0.7 m/s. The nominal flow rate Q_n is determined by calculation based on the dimension of the given segment of the pressure main 1.

[0022] Fig. 2 illustrates the diagram of the pump unit comprised of the pump sump 3, house connecting pressure pipe 2 equipped with the pump 4, the control unit 6 connected to the sensors 5 positioned in the pump sump. The pump sump 3 refers to a leakproof tank where the wastewater inlet is installed. The pump 4 is powered by electric current from the power mains. The sensors 5 can be resistance, capacitance, or for example pressure based. The control unit 6 can be created by a programmable logic automaton. In addition, Fig. 2 indicates that the control unit 6 can receive signals using the inputs, or where applicable it can itself be a source of signals by means of the outputs.

[0023] Fig. 3 illustrates a diagram of the control unit 6 showing its connection to the power supply unit 19. The control unit 6 comprises the communication interface 7, which can include, for example, a GSM modem, GPRS modem, GPS modem, modem for connection to a wireless computer network (LAN, Wi-Fi), etc. In addition, it includes the power supply module 20 from which it is powered by means of the power supply unit 19, and the measuring current module 21. In addition, the processor 16 coordinating the cooperation of individual components of the control unit 6 and executing steps defined by the software modules deposited in the database 8. In addition, the module 22 for the receipt of signals from the sensors 5, and the power control module 23 of the pump 4. The control unit 6 also includes the equipment for real time monitoring 9 comprising an electrically powered

clock which can also be comprised of a software module. The backup power supply unit 10 powers either the electrically powered clock, which after the power supply recovery of the power supply module 20 informs the control unit 6 of the current time. Alternatively, the backup power supply unit 10 powers the whole control unit 6 for the entire duration of a power failure of the power supply unit 19 if a software clock is used.

[0024] Fig. 4 illustrates an example of the embodiment of the controlling part of the system which includes the plastic electrical installations box 25. Inside the box 25 some components of the system are fixed. For example the modules 22 for the reception of signals from the sensors 5, control unit 6, power supply module 20, communication interface 7, measuring current module 21 and pump power control module 4. The electrical installations box 25 is also fitted with the aerial output 24, input 28 for the receipt of signals from the measurement of wastewater level in the pump sump 3, the inputs 26 for power supply connection and output 27 for the penetration of cabling of the power control unit output of the pump 3.

[0025] Fig. 5 provides an illustration of the remote server 12 connected to one control unit 6. The remote server 12 is fitted with the communication interface 7, comprised of, as in the case of the control unit 6, by a GSM modem, GPRS modem, or a GPS modem, modem for the connection to a wireless computer network (LAN, Wi-Fi), etc. The remote server 12 is also connected via the communication interface 7 to the database of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system for the previous period of time 14 and to the database of records and/or weather forecasts 15. A person skilled in the art will be able to determine without significant problems that the connection to both databases 14, 15 is resolved by communication with the server where the databases are saved. The remote server 12 is also fitted with the processor 16 and database 8. The database 8 includes the software module for pumping synchronization 11 and the controlling software module 13.

[0026] In the example of the embodiment with no illustrations provided, the system comprises only interconnected control units 6. The control units 6 are equipped with the software module for pumping synchronization 11. This module 11 can be installed in the control units 6 subsequently, which means that this example of embodiment is suitable also for the existing pressure sewer systems.

[0027] The software module for pumping synchronization 11 is programmed based on the statistical processing of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system. Thanks to the statistical analysis of data, a basic plan of flushing is created. The plan estimates the wastewater level in the pump sumps 3 based on an empirical model of flow rate and determines the order of the activation of the pumps 4 in real time according to the hydraulic simulation model of the low pressure sewerage network. The

empirical model of flow rate utilizes statistical information on the outflow of wastewater from the pressure sewer system during a day with individual days of week distinguished, and the effect of the average and maximum daily temperatures and the total precipitation amount are taken into account. Based on statistical probability the wastewater level in the pumps sumps can be determined and their inclusion into the flushing plan can be designed. The hydraulic model of the low pressure sewerage network is the calculation analysis of the pressure sewer system based on which the order of activation of the pumps 4 in the pump sumps 3 and the time of their operation can be determined with a view to creating a flow rate sufficient for the removal of sediments without exceeding the nominal flow rate Q_n and the nominal pressure P_n in the pipes of the pressure sewer system. Each control unit 6 is identified in the basic flushing plan while taking into account the position of the outlet of the respective house connecting pressure pipe 2 into the pressure main 1, and the real time of its activation is determined so that the synchronized activation of the pumps 4 in the pressure sewer system created a controlled change in the instantaneous pressure P_i and instantaneous flow rate Q_i . The change can be expressed by the following formula $Q_i = Q_1 + \dots + Q_n$, where Q_n is the last contribution to the instantaneous flow rate Q_i from the n -th pump unit.

[0028] In the case that the actual wastewater level in the pump sumps 3 fails to correspond to the statistically expected wastewater level, the control units 6 skip the planned flushing of the pressure sewer system and start creating a reserve in the minimum amount of 50% of the capacity of the pump sumps 3.

[0029] In the illustrated example of the invention embodiment, the remote server 12 assumes the role of the master in communication and the control units 6 fulfil the role of the slaves. The remote server 12 controls, using the software module for pumping synchronization 11 and the controlling software module 13, the change in the instantaneous pressure P_i and instantaneous flow rate Q_i during the pressure sewer system flushing. In addition, the system is able to create, based on the knowledge of records from the databases 14 and 15, a modified plan of flushing for one planned or unplanned flushing. For example if it is discovered based on the database 14 that the wastewater inflow from the pump sumps 3 was not sufficient, the flushing cycle is skipped, or, on the other hand, the system can plan the flushing of the pressure sewer system in excess of the framework of the basic flushing plan based on records on precipitation in the respective location provided in the database 15. The basic flushing plan remains unchanged so that in the case of the remote server 12 failure the system of interconnected control units 6 follows the basic flushing plan.

Industrial applicability

[0030] The method and system for automatic flushing

of the pressure sewer system according to the invention can be employed in the field of operation of the pressure sewer system, in particular in the area of its operation and maintenance.

The overview of the positions used in the drawings

[0031]

1	pressure main	10
2	house connecting pressure pipe	
3	pump sump	
4	pump	
5	sensor for measuring the pump sump water level	5
6	control unit	
7	communication interface	15
8	database	
9	equipment for real time monitoring	
10	backup power supply unit	
11	software module for pumping synchronization	20
12	remote server	
13	controlling software module	
14	database of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system for the previous period of time	25
15	database of records and/or weather forecasts	
16	processor	
17	wastewater treatment plant	
18	flowmeter	30
19	power supply unit	
20	power supply module	
21	measuring current module	
22	module for the reception of signals from sensors	
23	pump power control module	35
24	aerial output	
25	electrical installations box	
26	power supply unit input	
27	pump power control module output	
28	input of the pump sump water level measuring	40
Q_i	instantaneous flow rate	
P_i	instantaneous pressure	
Q_n	nominal flow rate	
P_n	nominal pressure	45

Claims

1. The method for automatic flushing of the pressure sewer system consisting of the pressure main (1) and at least two house connecting pressure pipes (2) connecting to the pressure main (1) at least two pump sumps (3) for wastewater fitted with the sensors (5) for measuring the wastewater level where each house connecting pressure pipe (2) or pump sump (3) is equipped with the pump (4) for transferring wastewater via the house connecting pressure

pipes (2) into the pressure main (1); each pump (4) is interconnected with the electronic control unit (6) fitted with inputs for analysing data from the sensors (5), outputs for the control of the pump (4), at least one processor (16), at least one database (8) allowing at least one software module to be deposited, and at least one communication interface (7) for wire or wireless communication, **characterized in that** the activation of the pumps (4) for the withdrawal of wastewater from the pump sumps (3) is executed in a synchronized manner where a temporary controlled change in the instantaneous flow rate (Q_i) and instantaneous pressure (P_i) is generated at least in a segment of the pressure main (1), where the instantaneous flow rate (Q_o) during the controlled change corresponds to the required flushing flow rate (Q_n) of the pressure main (1) and the instantaneous pressure (P_i) during the controlled change does not exceed the nominal pressure (P_n) of the pressure main (1), and the withdrawal of wastewater from the pump sumps (3) is executed according to the order of the house connecting pressure pipes (2) inlets into the pressure main (1) and/or according to data concerning the wastewater level in the pump sumps (3).

2. The method according to the claim 1, **characterized in that** prior to the generation of the controlled change in the instantaneous flow rate (Q_i) and instantaneous pressure (P_i) at least in some of the pump sumps (3) a reserve for the accumulation of wastewater is generated to ensure the thorough flushing of the given segment of the pressure main (1).
3. The method according to the claims 1 or 2, **characterized in that** the data concerning the wastewater level in the pump sumps (3) for planning the controlled change in the instantaneous flow rate (Q_i) and instantaneous pressure (P_i) is acquired using the sensors (5).
4. The method according to any of the claims 1 through 3, **characterized in that** the data concerning the wastewater level in the pump sumps (3) is acquired from the database of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system for the previous period of time (14).
5. The method according to any of the claims 1 through 4, **characterized in that** the data concerning the wastewater level in the pump sumps (3) is acquired from the database of records and/or weather forecasts (15).
6. The system for automatic flushing of the pressure sewer system according to any of the claims 1

through 5, where the pressure sewer system comprises the pressure main (1) and at least two house connecting pressure pipes (2) connecting to the pressure main (1) at least two wastewater pump sumps (3) fitted with the sensors (5) for measuring the wastewater level, where each house connecting pressure pipe (2) or pump sump (3) is equipped with the pump (4) for transferring wastewater via the house connecting pressure pipes (2) into the pressure main (1); each pump (4) is interconnected with the autonomous control unit (6), equipped with inputs for the analysis of data from the sensors (5), outputs for the control of the pump (4), at least one processor (16), at least one database (8) allowing at least one software module to be deposited, and at least one communication interface (7) for wire or wireless communication, where at least two control units (6) are interconnected using the communication interface (7), **characterized in that** at least one control unit (6) is equipped with equipment for real time monitoring (9) and its backup power supply unit (10), and at least one control unit (6) is equipped with the software module for pumping synchronization (11) which includes the basic flushing plan with the statistically expected wastewater level in the pump sump (3) based on the empirical model of wastewater flow rate and individual real times of the activation of the pumps (4) according to the hydraulic simulation model of the pipe network of the pressure sewer system.

7. The system according to the claim 6, **characterized in that** it is fitted with the remote server (12), to which, via the communication interface (7), at least some of the control units (6) are connected; the remote server (12) is equipped with the database (8) with the software module for pumping synchronization (11) which includes the basic flushing plan and individual times of the activation of the pumps in all pump sumps (3) in the given location of the pressure sewer system, and which also includes the controlling software module (13) to establish the master/slaves type of communication with the control units (6).
8. The system according to the claim 7, **characterized in that** the remote server (12) is, via the communication interface (7), connected to at least one database of records on water inflow into the pressure sewer system and wastewater outflow from the pressure sewer system for the previous period of time (14).
9. The system according to the claims 7 or 8, **characterized in that** the remote server (12) is, via the communication interface (7), connected to at least one database of records and/or weather forecasts (15).

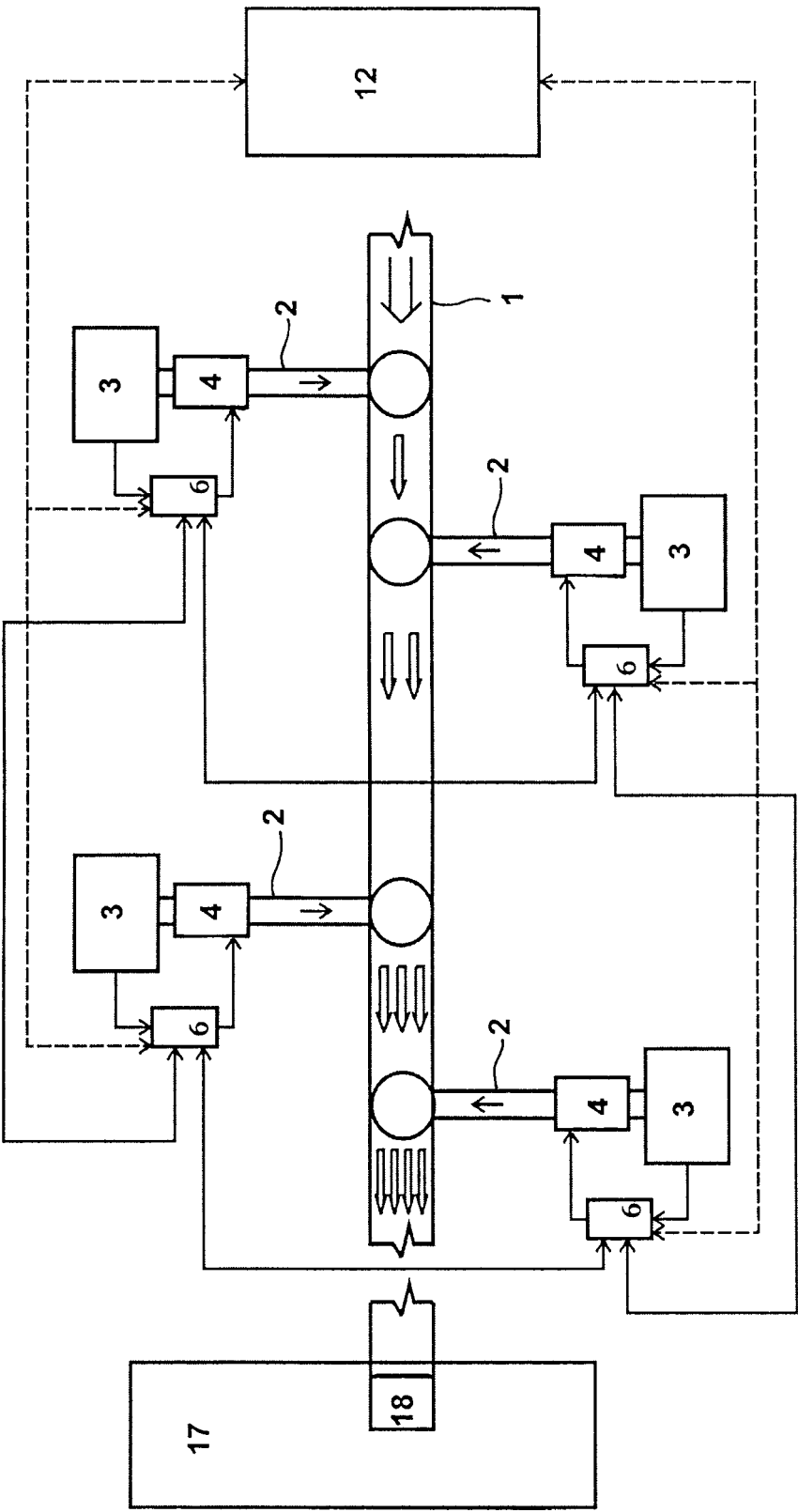


FIG. 1

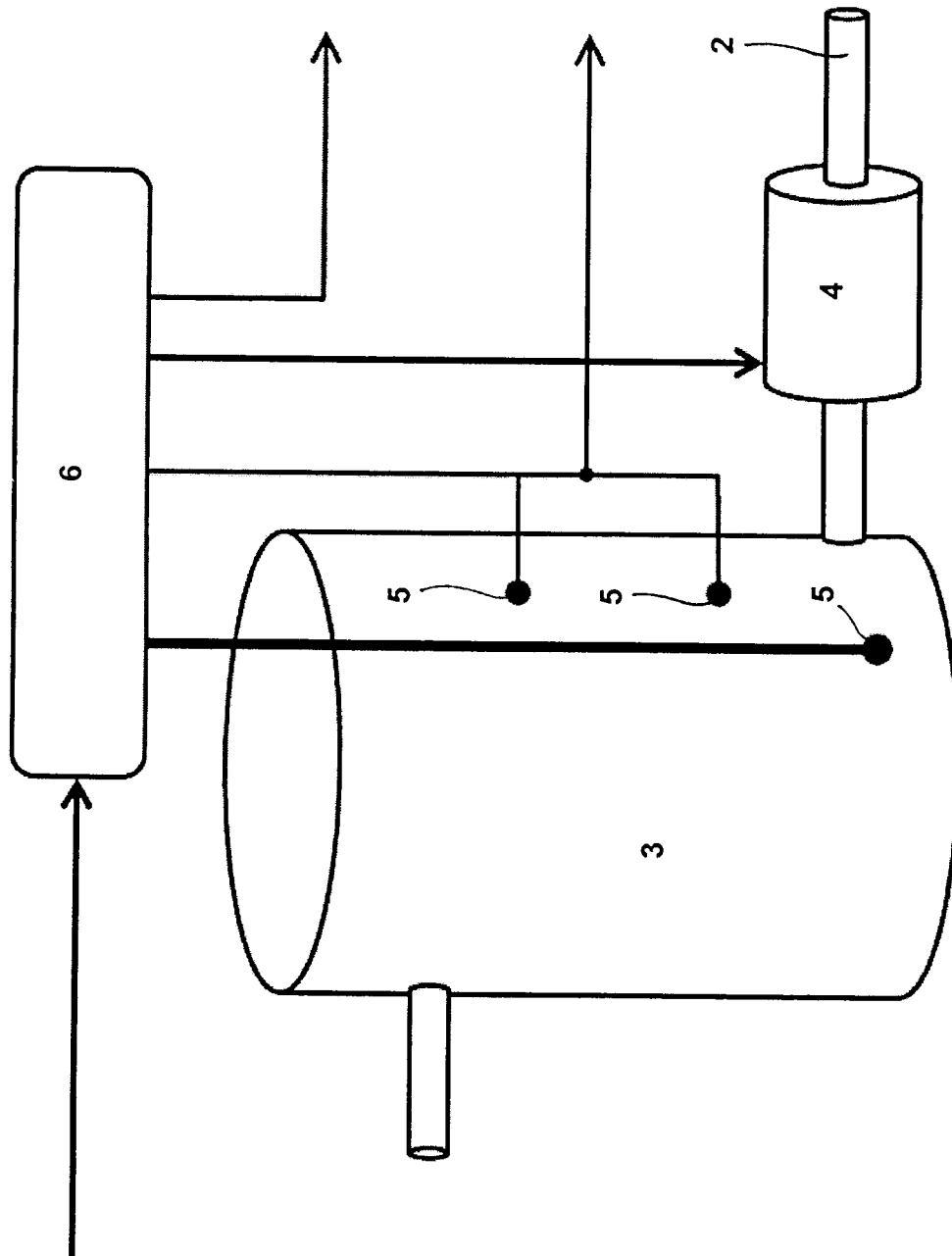


FIG. 2

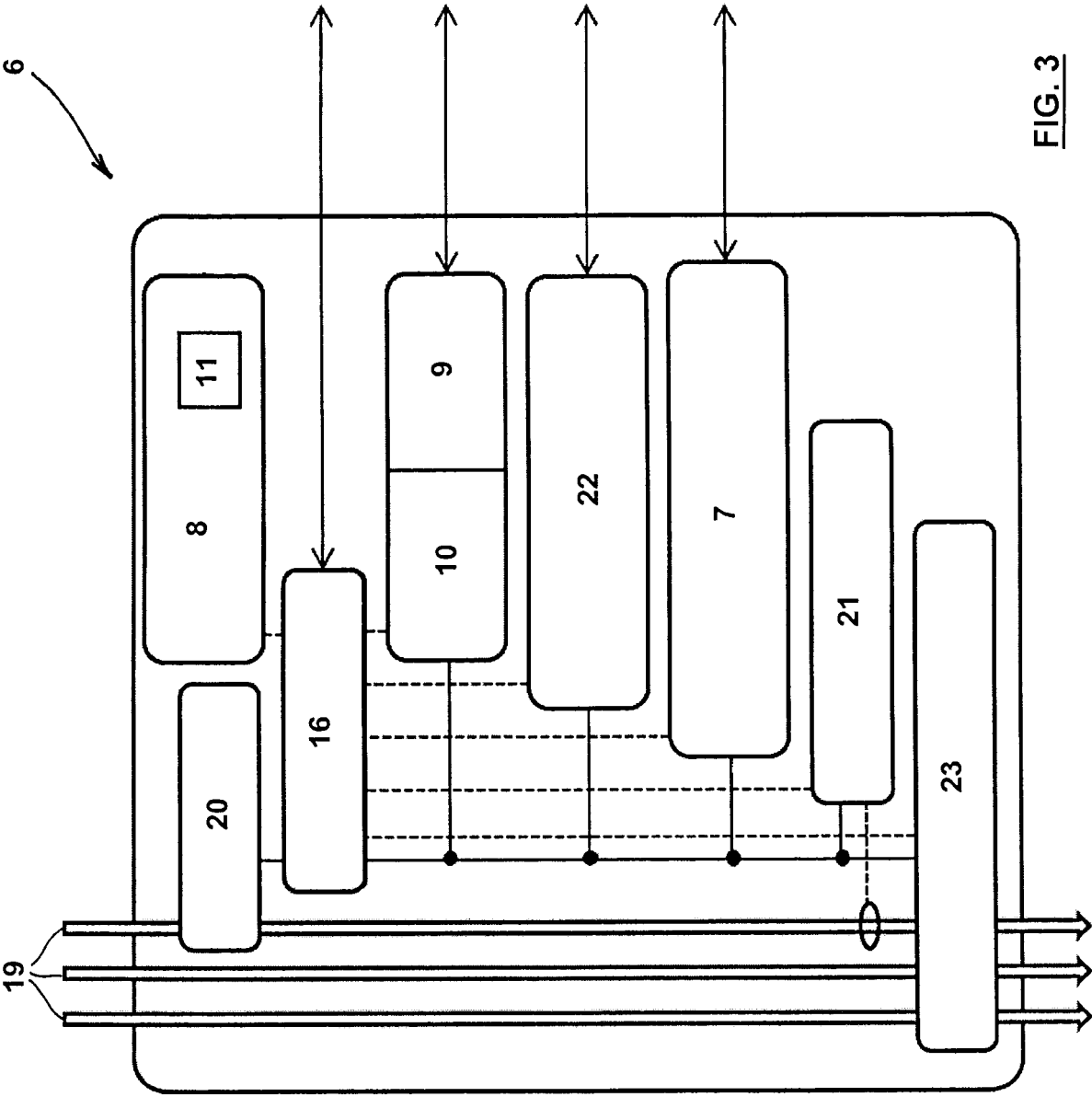


FIG. 3

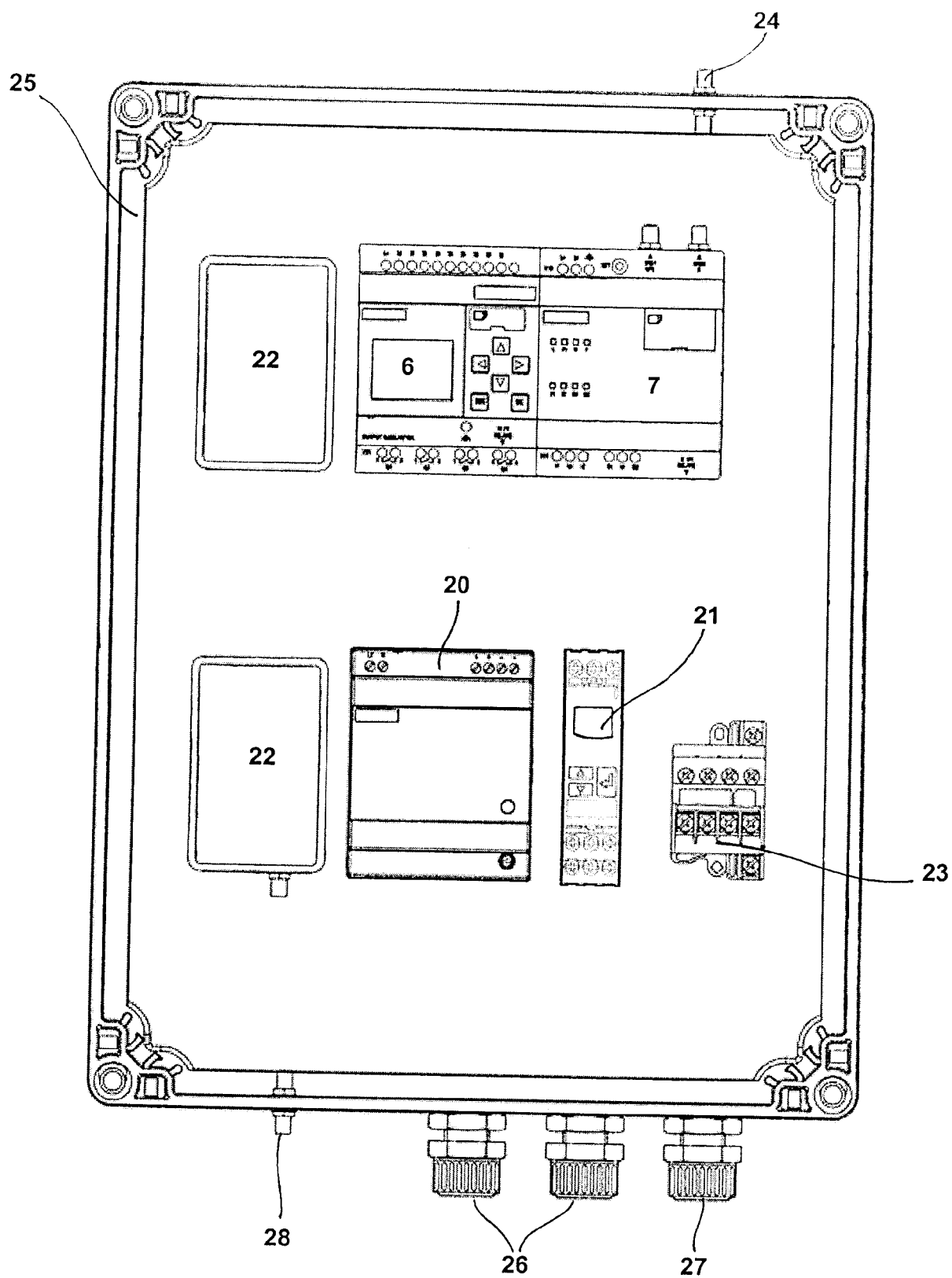


FIG. 4

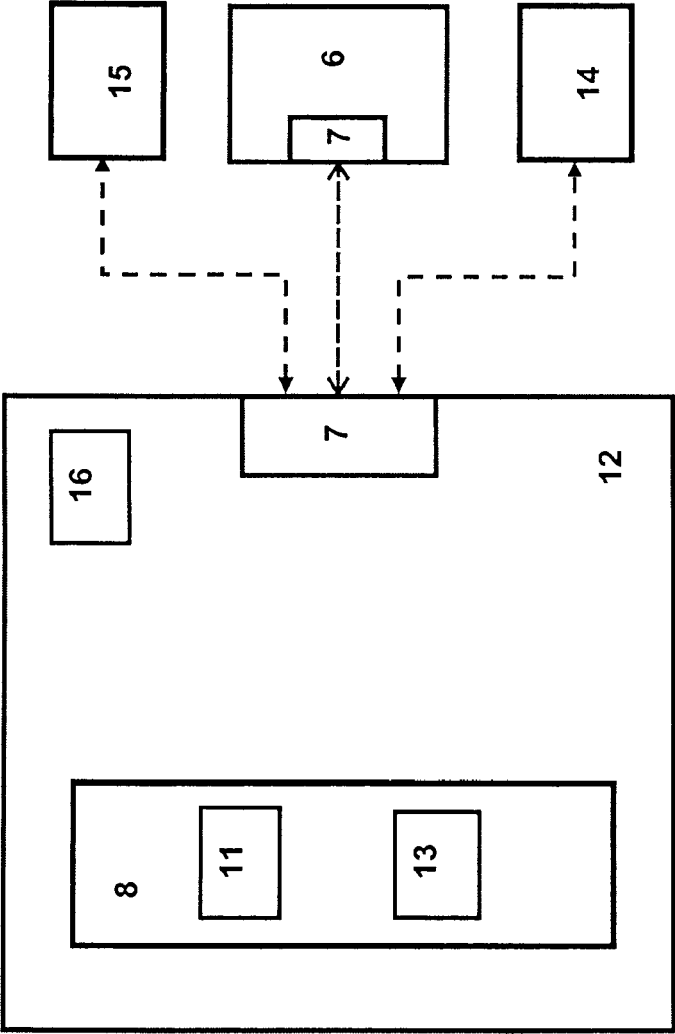


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 17 17 7818

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 November 2017	Examiner Flygare, Esa
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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