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(54) Title: METHOD FOR SETTING UP, AND CONTROLLING A WATERWORKS

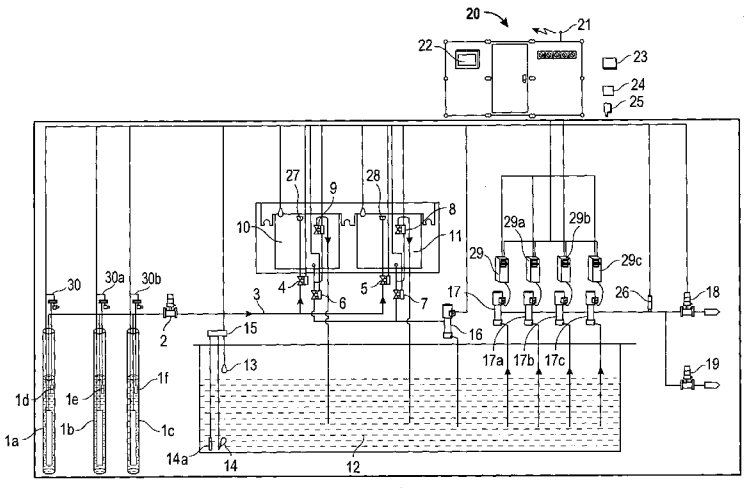

FIG. 1

(57) Abstract: By operation of waterworks, the invention discloses a method by use of a parameter representation of the waterworks, that makes it possible to set up, start up and control the waterworks, said waterworks is connected to a plurality of physical units, such as pumps, valves, filters, level sensors etc. The parameter representation consist of electrical signals in the form of measured values and control signals to/from the physical units that is led to a calculation unit. The calculation unit has a number of storage cells, which is divided into groups, each group representing a particular type of physical units. In this way it is possible, due to the parameter representation, to set up the waterworks with low cost, since it is not necessary to create the whole set up from scratch using tailor-made hardware and software, Moreover, it is not necessary to invest in expensive software licenses.

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Method for setting up, and controlling a waterworks.

This invention relates to a method for setting up, controlling and operation of a waterworks, by use of a parameter representation of the waterworks, said waterworks is connected to a plurality of groundwater borings.

By constructions of waterworks that is connected to a number, valves of groundwater borings it is common to use sophisticated software in order to control pumps, valves, filters and other components that goes in the operation of the waterworks. This software is normally programmed from scratch, every time a new waterworks is put in operation. Such a construction is somewhat costly, since it is necessary to choose tailor made hardware and software solutions. In addition, expensive license agreements are involved in the software.

It is on this background a propose with the invention to provide a method for setting up, and operate a waterworks without the above-mentioned disadvantages.

The purpose is fulfil according to the method defined in the introductory part of claim 1, which further comprises the following steps:

a) Establishing the numbers of physical units being connected to the waterworks
b) Establishing characterizing parameters of the physical units
c) Conversion the parameters of the physical units into electrical values in the form of measuring values and control signals to/from the physical units.
d) Transferring the measured values and the control signals to a calculation unit, said calculation unit has a plurality of storage cells for storing the measured values and the control signals, and where the calculation unit is adapted on basis of the

stored measured values and control signals, to set up, controlling and operate the waterworks.

In this way a standard solution is provided in construction of waterworks, where the control is provided by leading physical data, measured values and data to a calculation unit, the beforehand is prepared to be supplied characteristic parameters, measured values etc. for a particular waterworks.

In other words, it is not necessary to start from scratch when setting up the control.

Two particular advantageous embodiments of the invention is as stated in claim 2 that the numbers of the plurality of storage cells are bigger that the number of the parameters representing the waterworks, and as stated in claim 3 the electrical values are divided into groups, where each group represents a particular type of physical units.

In this way, it becomes easy to couple the physical units to the calculation unit.

Advantageous as stated in claim 4, beyond the measured values and control signals operation conditions for the physical units are supplied to the calculation unit then the physical working conditions can be optimized appropriate.

It is further advantageous as stated in claim 5, that the physical units consist of pumps, valves, flow gauges, level gauges, filters and other physical units connected to the waterworks.

Advantageous as stated in claim 6, is that the operation conditions comprises determination of the levels in a clean water reservoir and in dependence thereof it is determined, when a given pump shall be stated or set stand by.

It is also advantageous as stated in claim 7, that the filters in the waterworks are cleaned in dependency of its operation time and/or the amount of water flowing through the filters.

As energy resources nowadays are paid high attention it is advantageous as stated in claim 8, that electricity consumption is survived and/or registered, and that the surveillance is use to optimizing the overall efficiency of the waterworks.

The invention will now be explained more detailed under the illustrated examples on the drawing on which

Fig. 1 shows a principal construction of a waterworks,

Fig. 2 shows set up menu for controlling a waterworks, whereas

Fig. 3A - 3D shows different process steps in the method according to the invention.

Fig. 1 shows the principal construction of a waterworks, in which $1a_a$, 1_b, 1_c symbolic denotes groundwater borings comprising recovering pumps. The number of pump can vary, and some of them can be placed in the waterworks or in a distance therefrom.

Water is pumped from the ground water borings $1a_a$, 1_b, 1_c through a flow gauge 2 and valves 4, 5, here shown parallel coupled filters 10, 11 having outlets 27, 28 and from the outlets 27, 28 through non shown filter material to a water reservoir 12 via valves 8, 9. The filter material can, depending on the water type, be a course filter or a fine filter. These filters is also called a for filter or a back filter.

In the water borings actual water level is measured by use of level gauges 1_d, 1_e, 1_f.

A pump 16 pumps water from the water reservoir 12, via valves 6, 7 into the filters 10, 11 for cleaning those when it is necessary.

From the water reservoir 12 water is pumped by pumps 17, 17_a, 17_b, 17_c via flow gauges to the consumers.

The pumps are connected to frequency converters 29, 29_a, 29_b, 29_c that regulates the velocity of the pumps.

As it further can be seen from the figures, a cleaning rinsing pump is provided, that is adapted to pump water into the filters 10, 11 for cleaning of those.

A level gauge 14_a for measuring the actual level in a clean water reservoir 12 is connected to a junction box 15 that is connected to a control unit 20.

This level gauge can be formed as a pressure transducer, where the measured water pressure corresponds to the level in the water reservoir 12.

To the junction box is further coupled an overflow detector 13 and a detector for registration of the minimal level in the clean water reservoir 12. These detectors are used for controlling the recovering pumps.

30, 30_a 30_b denotes closing contacts for covers on the water borings, that in case that they are opened, shuts the pumps.

As it further can be seen, the control unit can have a communication link to other units, as shown at 21, that can be a telephone line.

Moreover an efficiency gauge 23 is connected to a control unit 20, an extern stop contact 24, and a survive device 25 for surveying of the physical units.

Here shall only be mentioned that all the physical units have electrical outlets, being connectable to a control unit 20 having a display 22, that comprises a calculation unit, such as a PLC unit, in which the calculation

unit has a number of storage cells for connecting the physical units electrical outlets.

The storage cells are divided in groups each group representing a physical units electrical characteristic.

The above description of a waterworks is described in general, it is being noted that other units can be coupled than those described, such as fans, valves, compressors, pressure air aggregates and the like.

As it will be understood, it is easy to set up a waterworks having a particular mix of physical units to a calculation unit.

On fig. 2 the display 22 is seen, here shown a set up menu for activating icons for setting up and controlling a waterworks.

As it can be seen there is four activating icons, namely one for basic information, one for borings one for filters and one for outlet pumping.

Other not shown activating icons, such as a data icon can be added, depending of what kind of a waterworks is to be controlled.

On fig. 3A an illustration of the basic information from fig 2, when the basic information are activated by a pressure on the arrow.

As it can be seen parameters for a flow gauge is inserted for registration of pumping to the consumers, and two flow gauges for registration of recovering from the water reservoirs.

Further parameters are shown in form of level for allowable values for a clean water reservoir in form of level information and alarm conditions is activated.

Fig. 3B shows a picture in which the activating icon for boring is activated. On the shown picture three borings are illustrated, where for the boring 1 is shown a quote (high-level curve) on 55,5 m, a distance on 25,5 m and level conditions for the boring expressed as an electrical value in the interval 4mA to 20 mA.

In praxis thee pumping activity functions in the following way:

The pumps are controlled as a start/stop function on basis of the preadjusted levels in the clean water reservoirs 12, such as, when the level for start (low level) is reached, a pump is started, that continues to pump until the stop level in the clean water reservoir 12 is reached. These levels are provided by the level detector 14_a.

Pumps can be coupled in or out depending how much is pump from the clean water reservoir 12.

By the way, the pumps can be controlled manually or automatically.

Moreover, it is possible to show the current status of the pumps, being the number of stars for a pump, the number of running hours for a pump etc.

On fig. 3C a picture of a filter activating icon.

On this picture, working conditions for cleaning of for filters a back filters are shown.

The cleaning of the for filters is determined on basis of the out pumped water amount expressed in m^3. That amount of water determine a clean can be decided by a user, having in mind that a boundary of a maximum of number of days that must be between cleaning must be met.

The cleaning itself can be done by units M1, M2 as a sequence consisting of cleaning with air, cleaning with air and ware and cleaning with water, and having a stop between the cleaning activities.

M3 s denotes a unit, that provides air to the filters under operation.

Fig. 3D shows a picture of the activating icon out pumping and the conditions bound to them.

Here pump that supplies water to the consumers are controlled.

These pumps can be controlled such, that a wanted pressure and flow are provided.

The pump is controlled after requirement, and data such as the number of operation hours are surveyed.

As it can be seen on the figure the outline for pumping as an example is shown as 38 Hz and 46 Hz. These values is chosen for instance for meeting a max value of the efficiency of pumps is met.

Above is only explained amongst many possibilities how waterworks can be controlled and surveyed.

Of course there is many variant of these control courses, but the decisive is that it is possible from a standard concept, to provide a control course, without it being necessary to analyse, how it is possible to provide control by software, the reason being that the invention open the possibilities to connect all physical unit electrical standard outlets to a preprepared calculation unit.

CLAIMS

1. Method for setting up, controlling and operation of a waterworks, by use of a parameter representation of the waterworks, said waterworks is connected to a plurality of groundwater borings, comprises the following steps:

   a) Establishing the numbers of physical units being connected to the waterworks
   b) Establishing characterizing parameters of the physical units
   c) Conversion the parameters of the physical units into electrical values in the form of measured values and control signals to/from the physical units.
   d) Transferring the measuring values and the control signals to a calculation unit, said calculation unit has a plurality of storage cells for storing the measured values and the control signals, and where the calculation unit is adapted on basis of the stored measured values and control signals, to set up, controlling and operate the waterworks.

2. Method according to claim 1, wherein the numbers of the plurality of storage cells are bigger that the number of the parameters representing the waterworks.

3. Method according to clam 1 – 2, wherein the electrical values are divided into groups, where each group represents a particular type of physical units.

4. Method according to claim 1 – 3, wherein beyond the measured values and control signals operation conditions for the physical units are supplied to the calculation unit.

5. Method according to claim 1 – 4, wherein the physical units consist of pumps, valves, flow gauges, level gauges, filters and other physical units connected to the waterworks.

6. Method according to claim 5, wherein the operation conditions comprises determination of the levels in a clean water reservoir and in dependence thereof it is determined, when a given pump shall be stated or set stand by.

7. Method according to claim 5 or 6, wherein the filters in the waterworks are cleaned in dependency of its operation time or/and the amount of water flowing through the filters.

8. Method according to claim 1 – 7, wherein, electricity consumption is survived and/or registered, and that the surveience is use to optimizing the overall efficiency of the waterwork.

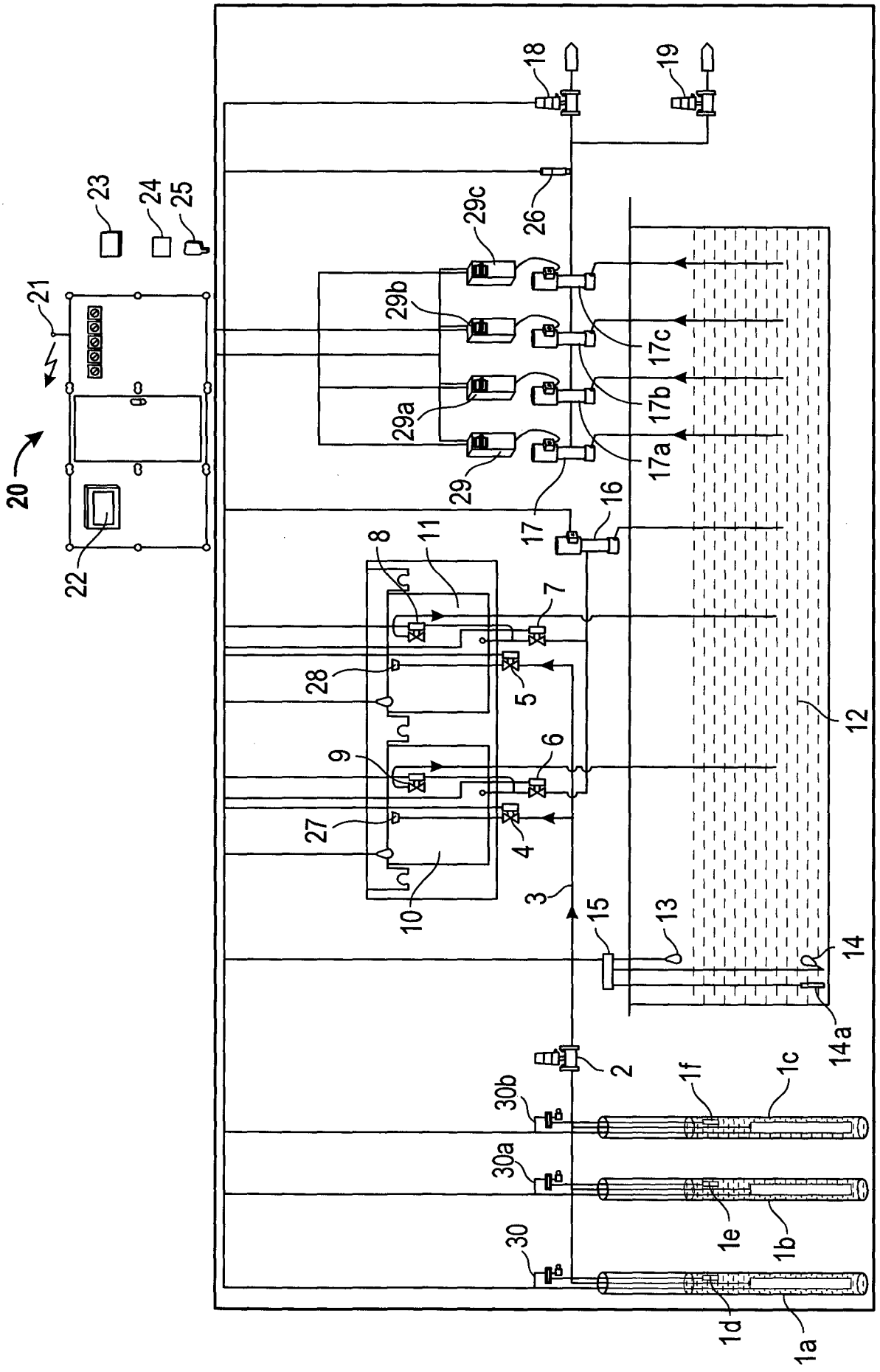
18
19
23
24
25
26
29c
29b
29a
29
17c
17b
17a
17
16
21
20
22
8
11
7
28
5
9
6
27
4
10
3
15
13
14
12
14a
2
30b
30a
30
1f
1c
1e
1b
1d
1a

FIG. 1

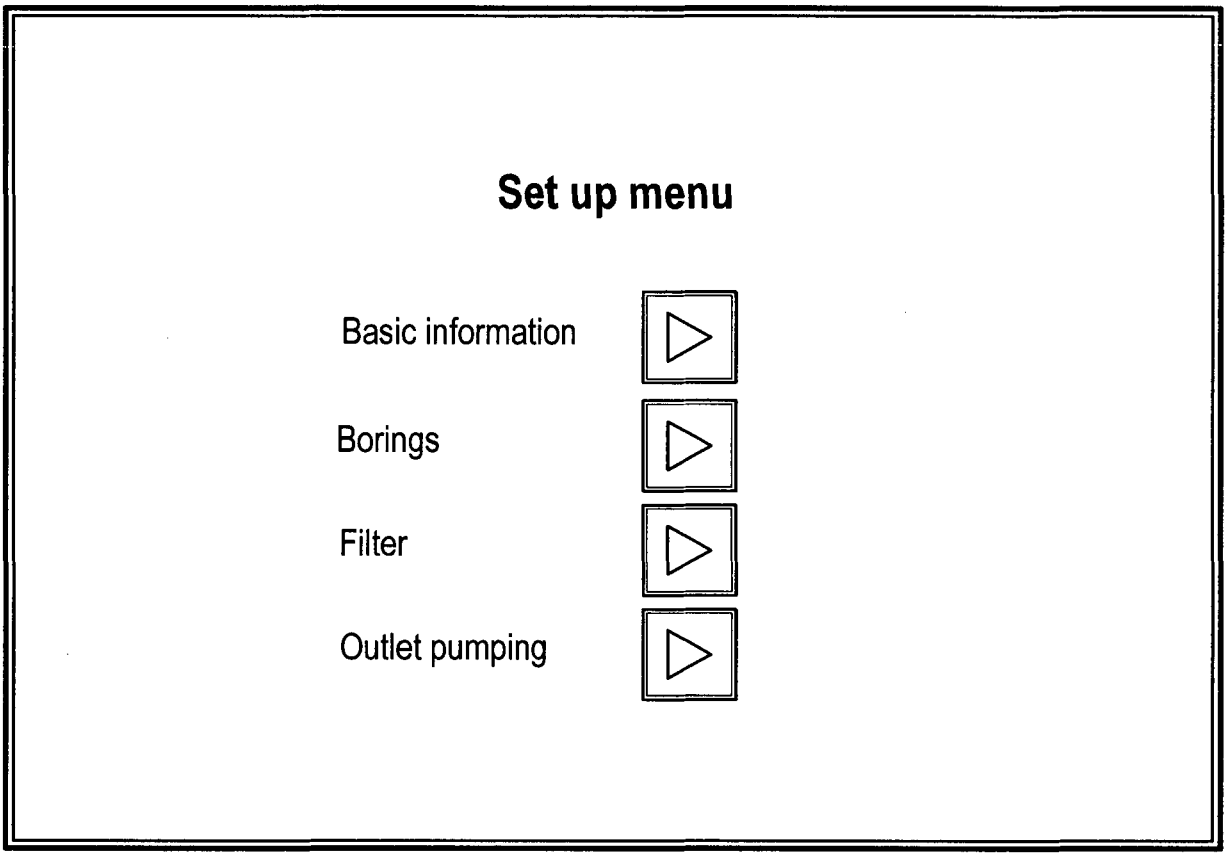
Set up menu
Basic information
Borings
Filter
Outlet pumping

FIG. 2

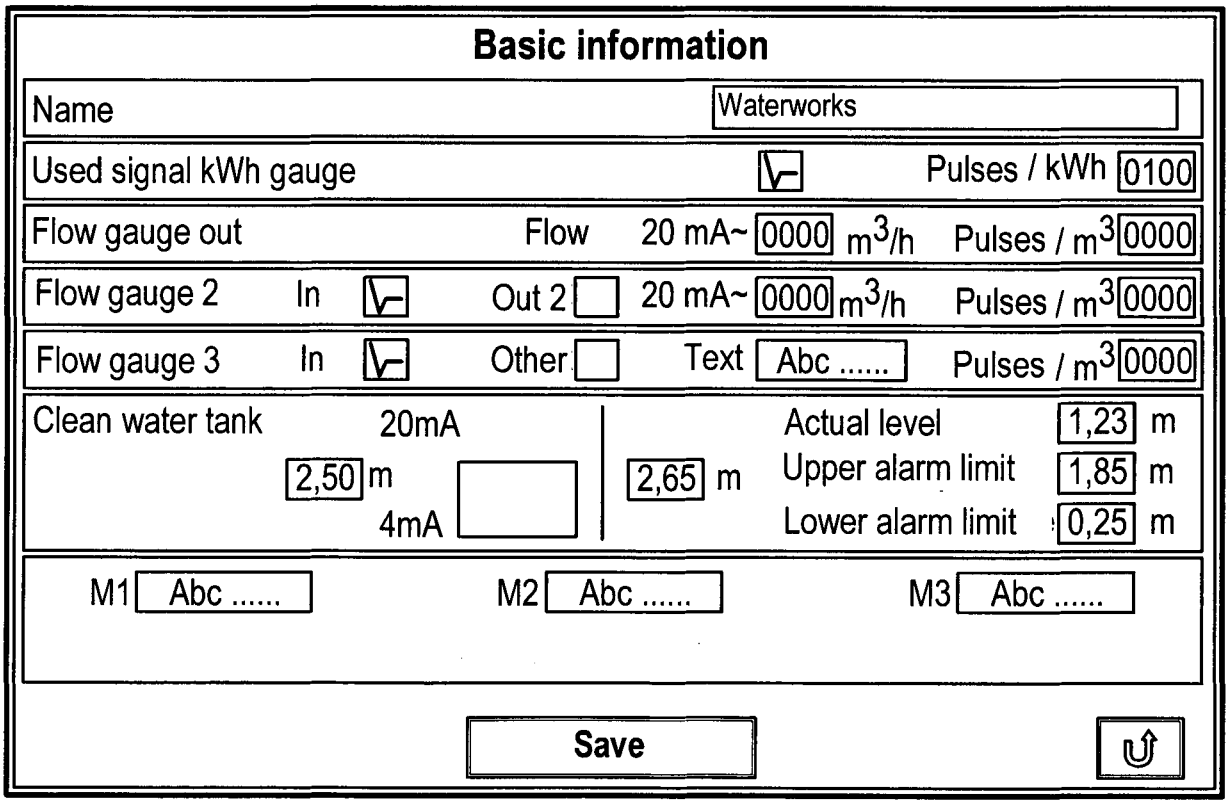
Basic information
Name
Waterworks
Used signal kWh gauge
Pulses / kWh 0100
Flow gauge out
Flow
20 mA~ 0000 m3/h
Pulses / m3 0000
Flow gauge 2
In
Out 2
20 mA~ 0000 m3/h
Pulses / m3 0000
Flow gauge 3
In
Other
Text Abc .....
Pulses / m3 0000
Clean water tank
20mA
2,50 m
4mA
2,65 m
Actual level 1,23 m
Upper alarm limit 1,85 m
Lower alarm limit 0,25 m
M1 Abc .....
M2 Abc .....
M3 Abc .....
Save

FIG. 3A

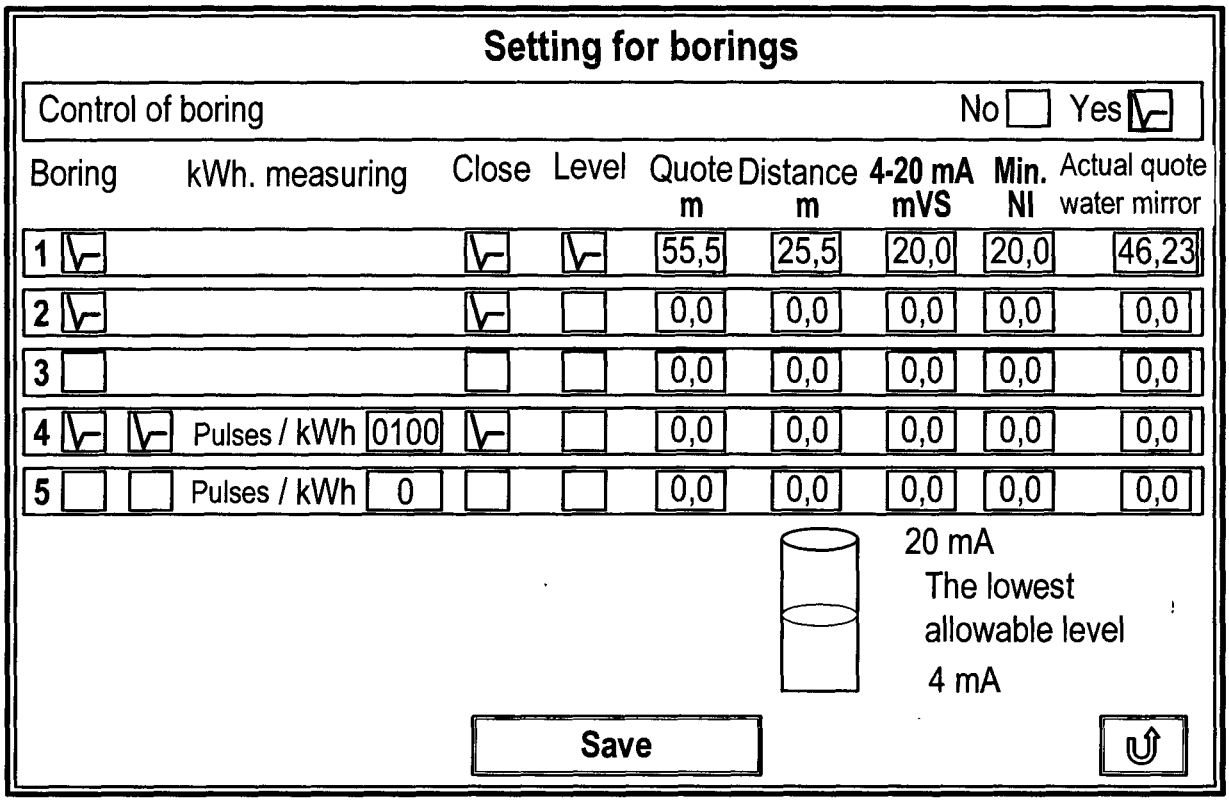
Setting for borings
Control of boring
No
Yes
Boring
kWh. measuring
Close
Level
Quote m
Distance m
4-20 mA mVS
Min. NI
Actual quote water mirror
1 55,5 25,5 20,0 20,0 46,23
2 0,0 0,0 0,0 0,0 0,0
3 0,0 0,0 0,0 0,0 0,0
4 Pulses / kWh 0100 0,0 0,0 0,0 0,0 0,0
5 Pulses / kWh 0 0,0 0,0 0,0 0,0 0,0
20 mA
The lowest allowable level
4 mA
Save

FIG. 3B

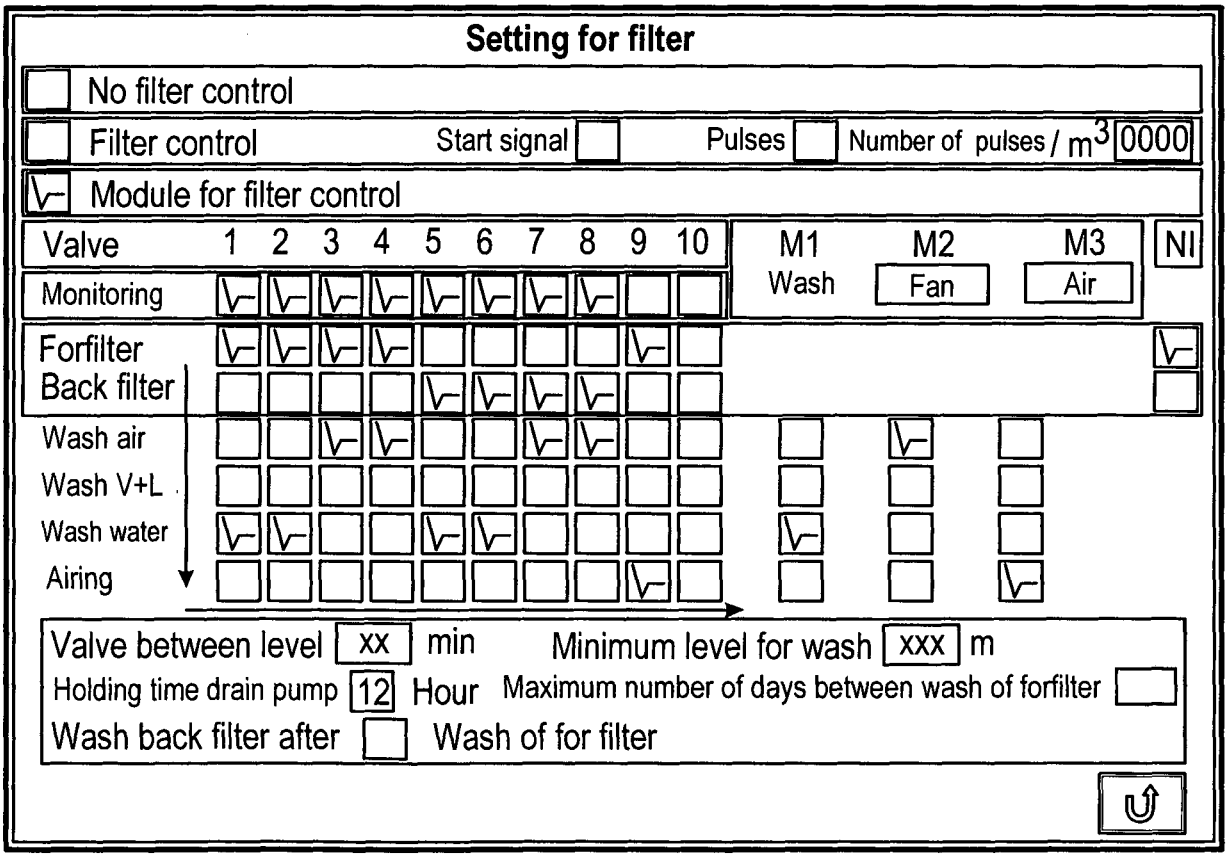
Setting for filter
No filter control
Filter control
Start signal
Pulses
Number of pulses / m3 0000
Module for filter control
Valve 1 2 3 4 5 6 7 8 9 10
M1 Wash
M2 Fan
M3 Air
NI
Monitoring
Forfilter
Back filter
Wash air
Wash V+L
Wash water
Airing
Valve between level xx min
Minimum level for wash xxx m
Holding time drain pump 12 Hour
Maximum number of days between wash of forfilter
Wash back filter after
Wash of for filter

FIG. 3C

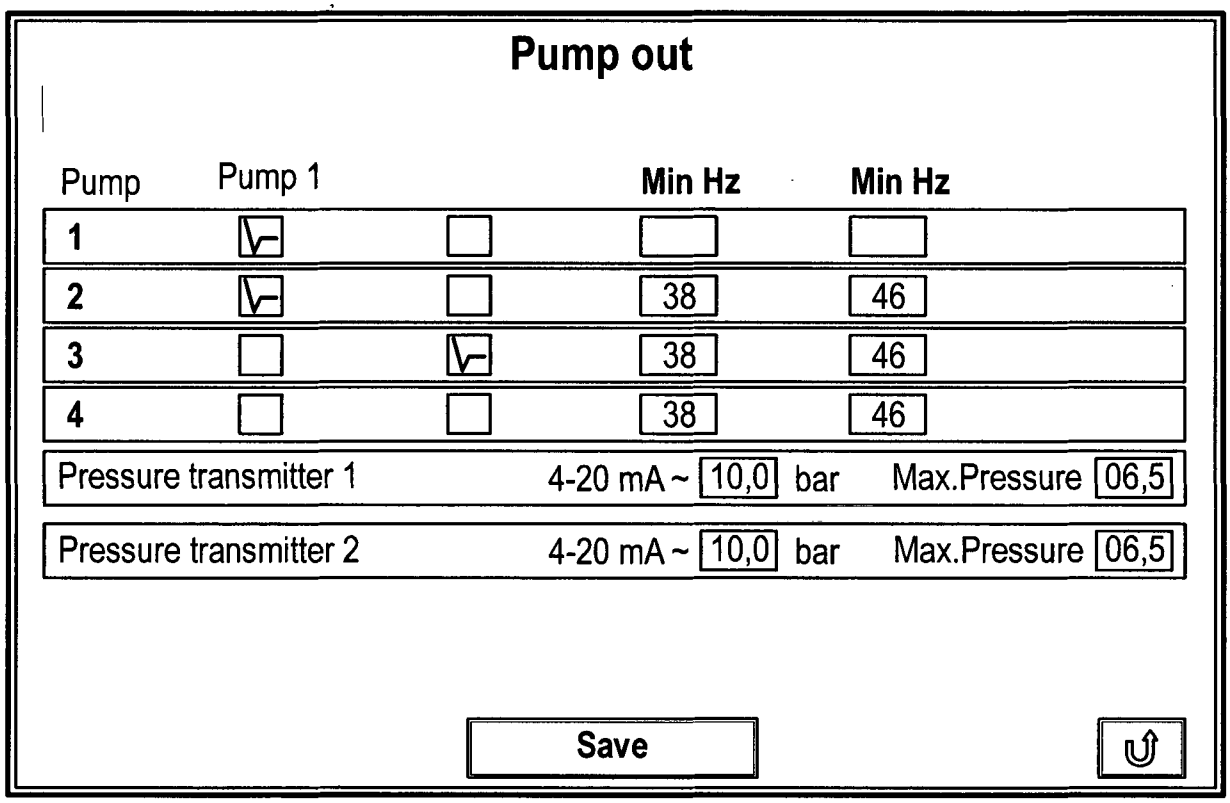
Pump out
Pump
Pump 1
Min Hz
Min Hz
1
2
38
46
3
38
46
4
38
46
Pressure transmitter 1
4-20 mA ~
10,0
bar
Max.Pressure
06,5
Pressure transmitter 2
4-20 mA ~
10,0
bar
Max.Pressure
06,5
Save

FIG. 3D

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2013/000042

A. CLASSIFICATION OF SUBJECT MATTER
INV. E03B1/00 E03B3/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 260 424 A (WELSH WATER ENTERPRISES LTD [GB]; WATERTEC ENVIRONMENTAL SYSTEMS [GB]) 14 April 1993 (1993-04-14) page 12, line 27 - page 21, line 12; figures	1-8
X	WO 2005/026053 A2 (RES FOUNDATION OF THE UNIVERSI [US]; WANIELISTA MARTY [US]; MCDANIEL J) 24 March 2005 (2005-03-24) page 1, paragraph 2 page 11, last paragraph - page 32, paragraph 2; figures	1-8
X	WO 95/02126 A1 (FISHERMAN HOLDINGS LTD [NZ]; DOWNS HAROLD TIMOTHY [NZ]) 19 January 1995 (1995-01-19) page 6, paragraph 1 - page 19, last paragraph; figures	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
21 October 2013	28/10/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	De Coene, Petrus

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/DK2013/000042

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2260424 A	14-04-1993	AU 2555092 A	05-04-1993
		GB 2260424 A	14-04-1993
		WO 9305246 A1	18-03-1993
		ZA 9206859 A	11-03-1993
WO 2005026053 A2	24-03-2005	NONE	
WO 9502126 A1	19-01-1995	AU 7196594 A	06-02-1995
		WO 9502126 A1	19-01-1995
		ZA 9404936 A	09-04-1996