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(54) Potable water system

(57) Potable water system for a building, comprising a hot water supply line (10), a cold water supply line (11) and a plurality of water consumers (12) branching of from the hot water supply line (10) and the cold water supply line (11), wherein each water consumer (12) has a mixing valve (13) having a first inlet (14) connected to the hot water supply line (10), a second inlet (15) connected to the cold water supply line (11) and an outlet (16) connected to a withdrawal line (17) conducting mixed water to a point of withdrawal (18) of the respective water consumer (12), and further comprising a controller (29) receiving an actual value of the hot water temperature and an actual value of the cold water temperature, wherein the controller (29) generates at least one control signal for preventing and/or counteracting microbiological growth within the potable water system. The controller (29) receives in addition to the hot water temperature and the cold water temperature an actual value of at least one mixed water temperature of each water consumer (12), wherein the controller (29) generates for each water consumer (12) at least one water consumer individual control signal for preventing and/or counteracting microbiological growth within the potable water system.

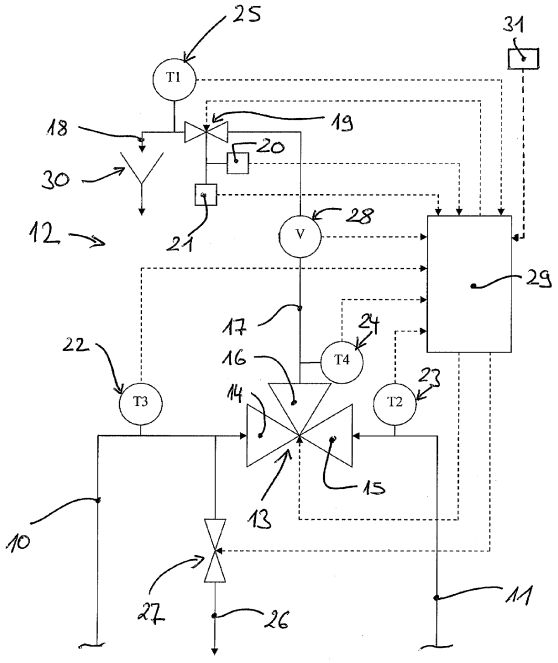

Fig 1

EP 2 722 449 A1

Description

[0001] The present patent application relates to a potable water system.

[0002] EP 2 466 019 A1 discloses a potable water system for a building comprising a hot water supply line, a cold water supply line and a plurality of water consumers branching of from the hot water supply line and the cold water supply line. In the region of each water consumer the hot water provided by the hot water supply line and the cold water provided by the cold water supply line becomes mixed thereby providing mixed water. The mixed water flows through a withdrawal line to a point of withdrawal of the respective water consumer.

[0003] The potable water system of EP 2 466 019 A1 further comprises a controller receiving an actual value of the hot water temperature within the hot water supply line and an actual value of the cold water temperature within the cold water supply line, wherein both temperatures are water consumer independent, and wherein the controller generates at least one control signal for preventing and/or counteracting microbiological growth within the potable water system on basis of the actual values of the hot water temperature and the cold water temperature.

[0004] The potable water system of EP 2 466 019 A1 allows to prevent and/or counteract microbiological growth only upstream of the mixing of the hot water and the cold water. Further on, the potable water system of EP 2 466 019 A1 provides prevention and/or counteraction of microbiological growth only commonly for all water consumers branching off from the respective hot water supply line and the respective cold water supply line.

[0005] Against this background, a novel potable water system is provided. The potable water system is defined in the claim 1. According to present application, the controller receives in addition to the hot water temperature and the cold water temperature an actual value of at least one mixed water temperature of each water consumer, wherein the controller generates for each water consumer at least one water consumer individual control signal for preventing and/or counteracting microbiological growth within the potable water system.

[0006] The potable water system according to present application allows to prevent and/or to counteract microbiological growth downstream of mixing valves individually for each water consumer. The potable water system according to present application has improved characteristics against microbiological growth.

[0007] According to a preferred embodiment, the controller receives actual values of two mixed water temperatures of each water consumer, namely an actual value of the mixed water temperature immediately downstream of the mixing valve or at the outlet of the mixing valve and an actual value of the mixed water temperature immediately upstream of the point of withdrawal of the respective water consumer. The controller generates for each water consumer at least one individual control signal for preventing and/or counteracting microbiological growth within the potable water system on basis of the actual values of the two mixed water temperatures. This provides further improved characteristics against microbiological growth.

[0008] Preferably, the controller receives in addition an actual value of the mixed water consumption volume of each water consumer. The controller generates for each water consumer at least one individual control signal for preventing and/or counteracting microbiological growth within the potable water system on basis of the actual value of the mixed water consumption volume. This provides further improved characteristics against microbiological growth.

[0009] At least the actual values of the two mixed water temperatures and the actual value of the mixed water consumption volume are individual for each water consumer. Preferably, also the actual values of the hot water temperature and the cold water temperature are individual for each water consumer, wherein the hot water temperature of each water consumer is measured at the first inlet of the respective mixing valve, and wherein the cold water temperature of each water consumer is measured at the second inlet of the respective mixing valve.

[0010] According to a preferred embodiment, the controller generates automatically a control signal for the mixing valve and a control signal for a withdrawal valve of the respective water consumer in order to flush the second inlet of the respective mixing valve and the withdrawal line of the respective water consumer if the controller determines that in case of a closed mixing valve the actual value of the cold water temperature is greater than a threshold. This allows an effective prevention against microbiological growth downstream of the mixing valve of each consumer.

[0011] According to a preferred embodiment, the controller generates automatically a control signal for the mixing valve and a control signal for a withdrawal valve of the respective water consumer in order to flush and disinfect the withdrawal line of the respective water consumer if the controller determines that in case of a closed mixing valve the actual value of at least one mixing water temperature is greater than a threshold. This allows an effective disinfection against microbiological growth downstream of the mixing valve of each consumer.

[0012] According to a preferred embodiment, the controller generates automatically a control signal for the mixing valve and a control signal for a withdrawal valve of the respective water consumer in order to flush and disinfect the withdrawal line of the respective water consumer if the controller determines that in case of a closed mixing valve the actual value of the past mixed water consumption volume is smaller than a threshold. This allows an effective disinfection against microbiological growth downstream of the mixing valve of each consumer. Preferably, the controller initiates the automatic flushing and preferably disinfection only at defined daytimes. If the controller determines regular water consumption

at a water consumer, the controller automatically stops or inhibits the automatic flushing and preferably disinfection of the withdrawal line of the respective consumer. This improves the safety of the potable water system.

[0013] A controller for operating a potable water system is defined in the claim 15. A Method for operating a potable water system is defined in the claim 16.

[0014] Preferred developments of the invention are provided by the dependent claims and the description which follows. Exemplary embodiments are explained in more detail on the basis of the drawing, in which:

Figure 1 shows a schematic detail of potable water system in the region of one water consumer.

[0015] The present application is directed to a potable water system for a building and to a controller and method for operating such a potable water system.

[0016] A potable water system comprises a hot water supply line 10, a cold water supply line 11 and a plurality of water consumers 12 branching of from the hot water supply line 10 and the cold water supply line 11. Fig. 1 shows only one water consumers 12 branching off from the hot water supply line 10 and a cold water supply line 11.

[0017] Each water consumer 12 comprises a mixing valve 13 having a first inlet 14 connected to the hot water supply line 10, a second inlet 15 connected to the cold water supply line 11 and an outlet 16 connected to a withdrawal line 17 conducting mixed water to a point of withdrawal 18 of the respective water consumer 12.

[0018] A withdrawal valve 19 is assigned to the withdrawal line 17 or point of withdrawal 18 of the respective water consumer 12, whereby the withdrawal valve 19 can be opened and closed actuated by proximity sensor 20 and/or by hand lever 21 or any other suitable device.

[0019] A first temperature sensor 22 measures an actual value of a hot water temperature T3. Preferably, the first temperature sensor 22 measures the hot water temperature T3 at the first inlet 14 of the mixing valve 13 of the respective water consumer 12. The hot water temperature T3 is therefore preferably a water consumer individual hot water temperature. A second temperature sensor 23 measures an actual value of a cold water temperature T2. Preferably, the second temperature sensor 23 measures the cold water temperature T2 at the second inlet 15 of the mixing valve 13 of the respective water consumer 12. The cold water temperature T2 is therefore preferably a water consumer individual cold water temperature.

[0020] Alternatively, it is possible to measure the actual value of a hot water temperature T3 and the actual value of a cold water temperature T2 by only one first temperature sensor 22 and only one second temperature sensor 23 commonly for all water consumers 12 branching off from the respective hot water supply line 10 and the respective cold water supply line 11. In this case the hot water temperature T3 and the cold water temperature T2 are not water consumer individual.

[0021] To the withdrawal line 18 of each water consumers 12 there are assigned preferably two temperature sensors 24 and 25. The temperature sensor 24 measures the actual value of the mixed water temperature T4 immediately downstream of the mixing valve 13 or at the outlet 16 of the mixing valve. The temperature sensor 25 measures the actual value of the mixed water temperature T1 immediately upstream of the point of withdrawal 18, preferably between the point of withdrawal 18 and the withdrawal valve 19. The mixed water temperatures T4 and T1 are water consumer individual water temperatures.

[0022] In addition, a flow sensor 28 is preferably assigned to the withdrawal line 18 of each water consumer 12. The flow sensor 28 measures an actual value of the past mixed water consumption volume V. The past mixed water consumption volume V is a water consumer individual water consumption volume.

[0023] Another valve 27 is preferably assigned to a bypass line 26 branching off from the hot water supply line 10. When the valve 27 is opened, the hot water flowing through the hot water supply line 10 can bypass each water consumer 12 connected to the hot water supply line 10. There is no stagnant leg between the by-pass line 26 and the mixing valve 13 of each water consumer 12.

[0024] The potable water system further comprises a controller 29 for the automatic operation of the potable water system.

[0025] The controller 29 receives the actual value of the hot water temperature T3 measured by the temperature sensor 22 and the actual value of the cold water temperature T2 measured by the temperature sensor 23. In addition, the controller 29 receives the actual value of at least one mixed water temperature, preferably the actual value of the mixed water temperature T4 measured by the temperature sensor 24 and the actual value of the mixed water temperature T1 measured by the temperature sensor 25. Further on, the controller 29 receives the actual value of the past mixed water consumption volume measured by the flow sensor 28.

[0026] The controller 29 generates for each water consumer 12 at least one individual control signal for preventing and/or counteracting microbiological growth within the potable water system, namely for preventing and/or counteracting microbiological growth downstream of the mixing valve 13 of the respective water consumer 12.

[0027] The controller 29 generates the or each control signal on basis of the actual value of the hot water temperature T3 and/or on basis of the actual value of the cold water temperature T2. The controller 29 generates the or each control signal further on basis of the actual value of the mixed water temperature T4 and/or on basis of the actual value of the mixed water temperature T1. Preferably, the or each control signal for respective water consumer 12 is in addition generated by the controller

29 on basis of the actual value of the past mixed water consumption volume V.

[0028] If the controller 29 determines that in case of a closed mixing valve 13 the actual value of the cold water temperature T2 is greater than a first threshold, the controller 29 generates automatically a control signal for the mixing valve 13 and a control signal for a withdrawal valve 19 of the water consumer 12 in order to flush the second inlet 15 of the respective mixing valve 13 and the withdrawal line 17 of the respective water consumer 12 with cold water. Also the outlet 16 of the respective mixing valve 13 becomes flushed with cold water. For this flushing the second inlet 15 of the respective mixing valve 13 and the withdrawal valve 19 become automatically opened. If the cold water temperature T2 is individually measured for each water consumer 12, the above flushing is water consumer individual. If the cold water temperature T2 is commonly measured for all water consumers 12 branching off from the cold water supply line 11, each water consumer 12 connected to the cold water supply line 11 will be flushed. The above flushing is performed for a defined time period or for a defined flow volume through the withdrawal line 17 or until the actual value of the cold water temperature T2 is lower than a second threshold. The second threshold is preferably lower than the first threshold. However, the second threshold and the first threshold can also be the same. This allows an effective prevention against microbiological growth downstream of the mixing valve 23 for water consumer 12 connected to the cold water supply line 11. The flushed cold water flows into a sewage 30 of the respective water consumer 12.

[0029] If the controller 29 determines that in case of a closed mixing valve 13 the actual value of at least one mixing water temperature T1 and/or T4 is greater than a third threshold, the controller 29 generates automatically a control signal for the mixing valve 13 and a control signal for a withdrawal valve 19 of the respective water consumer 12 in order to flush and disinfect the withdrawal line 17 of the respective water consumer 12 with hot water. Also the outlet 16 of the respective mixing valve 13 becomes flushed and disinfected with hot water. For this flushing and disinfection the first inlet 14 of the respective mixing valve 13 and the withdrawal valve 19 become automatically opened.

[0030] The above flushing and disinfection of the withdrawal line 17 of the respective water consumer 12 is performed for a defined time period or for a defined flow volume through the withdrawal line 17. The above flushing and disinfection is preferably performed for a defined time period in such a way that the hot water temperature T3 and/or the or each mixing water temperature T1 and T4 must be for the defined time period larger than a fourth threshold. This allows an effective disinfection against microbiological growth downstream of the mixing valve 23 for each water consumer 12 individually. The flushed hot water flows into the sewage 30 of the respective water consumer 12.

[0031] This flushing and disinfection cycle with hot water is followed by a cold water flushing cycle to prevent scalding from the hot water stored downstream of mixing valve 13 in withdrawal line 17 up to the withdrawal point 18. It shall also cause sudden temperature variation to help disinfection against microbiological growth.

[0032] The cold water flushing cycle subsequent to the flushing and disinfection cycle with hot water is performed for a defined time period or for a defined flow volume through the withdrawal line 17 or until the actual value of the or each mixing water temperature T1 and T4 is lower than a threshold.

[0033] If the controller 29 determines that in case of a closed mixing valve 13 the actual value of the past mixed water consumption volume V is smaller than a threshold, the controller 29 generates automatically a control signal for the mixing valve 13 and a control signal for a withdrawal valve 19 of the respective water consumer 12 in order to flush and disinfect the withdrawal line of the respective water consumer 12 with hot water. The flushing and disinfection on basis of the past mixed water consumption volume V is performed for a defined time period or for a defined flow volume through the withdrawal line 17 or until the actual value of the hot water temperature T3 and/or of the or each mixing water temperature T1, T4 is higher than a threshold analogous to the above flushing and disinfection on basis of the mixing water temperature T1 and/or T4. Preferably, the flushing and disinfection cycle with hot water is followed by a cold water flushing cycle.

[0034] Flushing and disinfection can in also be performed in defined time intervals analogous to the above flushing and disinfection on basis of the mixing water temperature T1 and/or T4. If the controller 29 determines that the actual value of the hot water temperature T3 is lower than a threshold, the controller 29 generates automatically a control signal for the valve 27 in order to flush the hot water supply line 10 through the by-pass line 26.

[0035] The potable water system according to the present application allows an effective prevention and disinfection against microbiological growth downstream of the mixing valve 13 for each water consumers 12 individually.

[0036] If the controller 29 determines on basis of the signal provided by the proximity sensor 20 and/or on basis of the signal provided the hand lever 21 that regular water consumption takes place at water consumer 12, the controller 29 automatically stops the automatic flushing or the automatic flushing and disinfection of the withdrawal line 17 of the respective consumer 12. This increases acceptance and safety of the potable water system. This prevents scalding or thermal shock during regular operation.

[0037] Preferably, another proximity sensor 31 monitors if a person is in the vicinity while an automatic flushing cycle or flushing and disinfection cycle is performed. If the controller 29 determines on basis of the signal provided by this proximity sensor 31 that a person is in the

vicinity, the controller 29 automatically stops the automatic flushing or the automatic flushing and disinfection of the withdrawal line 17 of the respective consumer 12. Cold water flushing is carried out to remove scalding hot water downstream of mixing valve 13 and withdrawal point 18 if a disinfection cycle was going on and if this disinfection cycle is interrupted by the proximity sensor 31. However, cold water flushing is carried out to remove scalding hot water downstream of the mixing valve 13 and the withdrawal point 18 if a disinfection cycle was going on and is interrupted by the proximity sensor 31. This make the system more safe and provides have higher level of prevention against scalding if someone comes into the vicinity.

[0038] Preferably, the controller 29 initiates the automatic flushing or the automatic flushing and disinfection only at defined daytimes when regular water consumption does usually not take place. This further increases acceptance and safety of the potable water system. This prevents scalding or thermal shock during operation.

[0039] Preferably, the controller 29 of the potable water system provides a fail safe mode. Such a fail safe mode shuts down the flow through the mixing valve 13 using a normally closed mixing valve 13.

[0040] The fail safe mode can be activated during and including the following scenarios but not limited them: in case of a failure of any sensor 22, 23, 24, 25, 28 and/or actuator and/or controller 29; in case of a power failure; in case that a pressure difference between the hot water supply line 10 and cold water supply line 11 is outside a defined range; in case that the mixing water temperature T4 and/or mixing water temperature T1 is above or below a defined usage temperature. The potable water system according to the present application provides optimum performance and safety for applications at medical facilities and similar premises.

[0041] The potable water system according to the present application provides automatic flushing of hot water supply lines 10 and/or cold water supply lines 12 both running upstream of the mixing valves 13 and automatic flushing and disinfection of the mixing water withdrawal lines 17 running downstream of the mixing valves 13.

[0042] The present application is also directed to the controller 29 for operating such a potable water system. In addition, the present application is directed to a method for operating such a potable water system. The details of the controller 29 and of the method have been described above in connection with the potable water system as such.

List of reference signs

[0043]

10 hot water supply line
11 cold water supply line
12 water consumer
13 mixing valve
14 inlet
15 inlet
16 outlet
17 withdrawal line
18 point of withdrawal
19 withdrawal valve
20 proximity sensor
21 hand lever
22 temperature sensor
23 temperature sensor
24 temperature sensor
25 temperature sensor
26 by-pass line
27 valve
28 flow sensor
29 controller
30 sewage
31 proximity sensor

Claims

1. Potable water system for a building, comprising a hot water supply line (10), a cold water supply line (11) and a plurality of water consumers (12) branching of from the hot water supply line (10) and the cold water supply line (11), wherein each water consumer (12) has a mixing valve (13) having a first inlet (14) connected to the hot water supply line (10), a second inlet (15) connected to the cold water supply line (11) and an outlet (16) connected to a withdrawal line (17) conducting mixed water to a point of withdrawal (18) of the respective water consumer (12), and further comprising a controller (29) receiving an actual value of the hot water temperature (T3) and an actual value of the cold water temperature (T2), wherein the controller (29) generates at least one control signal for preventing and/or counteracting microbiological growth within the potable water system, **characterized in that** the controller (29) receives in addition to the hot water temperature (T3) and the cold water temperature (T2) an actual value of at least one mixed water temperature (T1, T4) of each water consumer (12), wherein the controller (29) generates for each water consumer (12) at least one water consumer individual control signal for preventing and/or counteracting microbiological growth within the potable water system.

2. Potable water system as claimed in claim 1, **characterized in that** the controller (29) receives actual values of two mixed water temperatures of each water consumer (12), namely an actual value of the mixed water temperature (T4) immediately downstream of the mixing valve (13) or at the outlet (16) of the mixing valve (13) and an actual value of the mixed water temperature (T1) immediately upstream

of the point of withdrawal (18) of the respective water consumer (12).

3. Potable water system as claimed in claim 1 or 2, **characterized in that** the controller (29) receives in addition an actual value of the past mixed water consumption volume (V) of each water consumer (12).

4. Potable water system as claimed in one of claims 1 or 3, **characterized in that** at least the actual value of the or each mixed water temperature (T1, T4) and the actual value of the mixed water consumption volume (V) are individual for each water consumer (12).

5. Potable water system as claimed in claim 4, **characterized in that** also the actual values of the hot water temperature (T3) and the cold water temperature (T2) are individual for each water consumer (12), wherein the hot water temperature (T3) of each water consumer (12) is measured at the first inlet (14) of the respective mixing valve (13), and wherein the cold water temperature (T2) of each water consumer (12) is measured at the second inlet (15) of the respective mixing valve (13).

6. Potable water system as claimed in one of claims 1 or 5, **characterized in that** if the controller (29) determines that in case of a closed mixing valve (13) the actual value of the cold water temperature (T2) is greater than a threshold, the controller (29) generates automatically a control signal for the mixing valve (13) and a control signal for a withdrawal valve (19) of the respective water consumer (12) in order to flush the second inlet (15) of the respective mixing valve (13) and the withdrawal line (17) of the respective water consumer (12) with cold water.

7. Potable water system as claimed in claim 6, **characterized in that** the flushing of the second inlet (15) of the respective mixing valve (13) and of the withdrawal line (17) of the respective water consumer (12) is performed for a defined time period or for a defined flow volume through the withdrawal line (17) or until the actual value of the cold water temperature (T2) is lower than a threshold.

8. Potable water system as claimed in one of claims 1 to 7, **characterized in that** if the controller (29) determines that in case of a closed mixing valve (13) the actual value of at least one mixing water temperature (T1, T4) is greater than a threshold, the controller (29) generates automatically a control signal for the mixing valve (13) and a control signal for a withdrawal valve (19) of the respective water consumer (12) in order to flush and disinfect the withdrawal line (17) of the respective water consumer (12) with hot water.

9. Potable water system as claimed in claim 8, **characterized in that** the flushing and disinfection of the withdrawal line (17) is performed for a defined time period or for a defined flow volume through the withdrawal line (17) or until the actual value of the hot water temperature (T3) and/or of the or each mixing water temperature (T1, T4) is higher than a threshold.

10. Potable water system as claimed in one of claims 1 to 9, **characterized in that** if the controller (29) determines that in case of a closed mixing valve (13) the actual value of the past mixed water consumption volume (V) is smaller than a threshold, the controller (29) generates automatically a control signal for the mixing valve (13) and a control signal for a withdrawal valve (19) of the respective water consumer (12) in order to flush and disinfect the withdrawal line of the respective water consumer (12) with hot water.

11. Potable water system as claimed in claim 10, **characterized in that** the flushing and disinfection of the withdrawal line (17) is performed for a defined time period or for a defined flow volume through the withdrawal line (17) or until the actual value of the hot water temperature (T3) and/or of the or each mixing water temperature (T1, T4) is higher than a threshold.

12. Potable water system as claimed in one of claims 8 to 11, **characterized in that** the flushing and disinfection with hot water is followed by cold water flushing.

13. Potable water system as claimed in one of claims 1 to 12, **characterized in that** if the controller (29) determines regular water consumption at a water consumer (12), the controller (29) stops or inhibits the flushing of the withdrawal line (17) of the respective water consumer (12).

14. Potable water system as claimed in one of claims 1 to 13, **characterized in that** the controller (29) initiates the flushing only at defined daytimes.

15. Controller for operating a potable water system, **characterized by** means for operating the potable water system according to one of claims 1 to 14.

16. Method for operating a potable water system using a controller of claim 15.

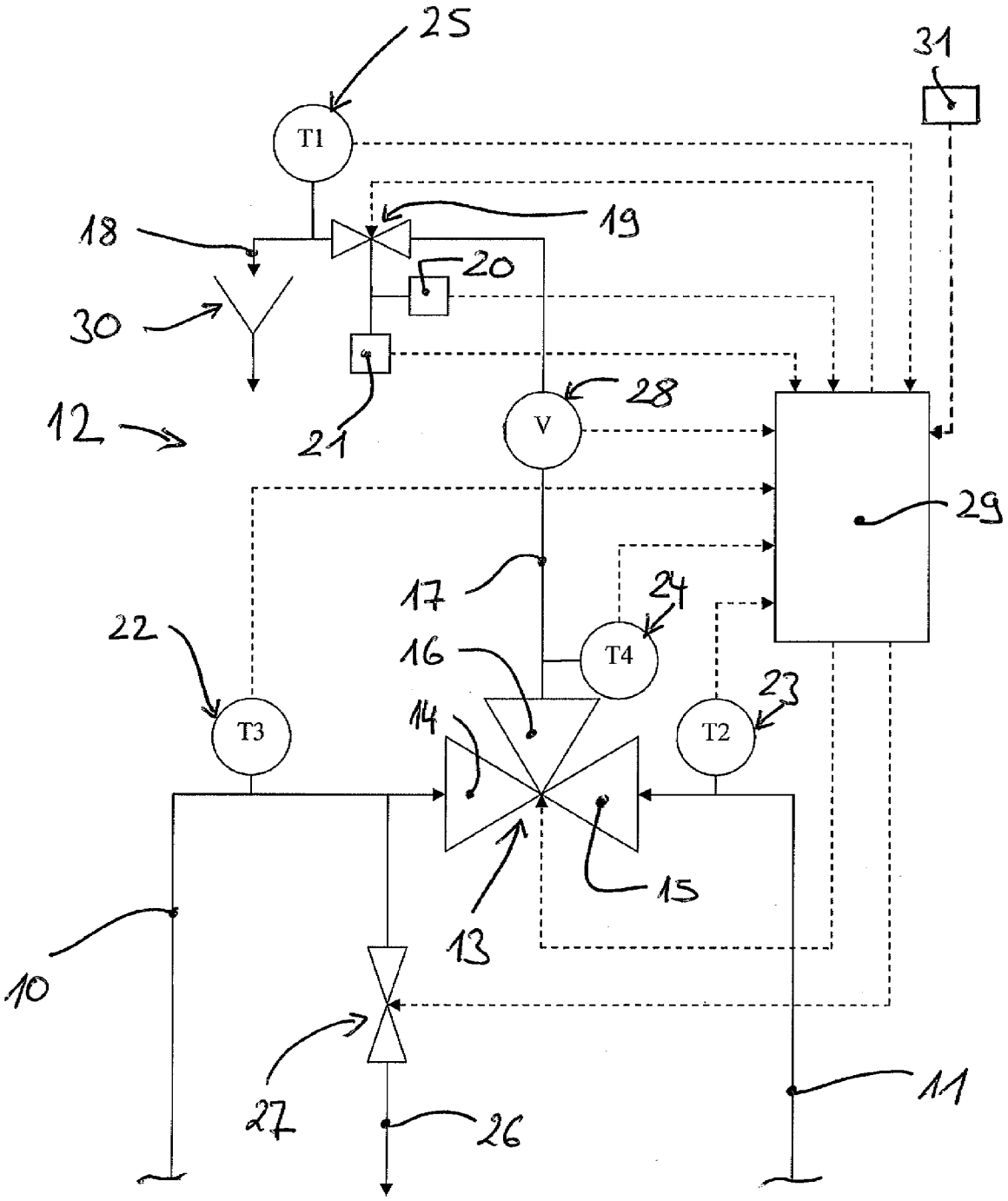
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Fig 1

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 9268

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E03B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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