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(54) Vehicle and method for cleaning water supply systems

(57) A mobile cleaning installation for water supply systems is designed as a vehicle (20) having a fixed installation therein which contains a series circuit of, successively, a heating unit (12), a storage tank (13), a hydrophore (14) and a chemical injection unit (15). Parallel thereto are provided selectively activated air supply means (16a,16b,16c). Further are provided series circuit selectively activated bypass circuits around the heating unit (12), the storage tank (13) and the chemical injection unit (15), respectively. A series of different steps for treating the water supply system is realized by selectively activating the bypass circuits.

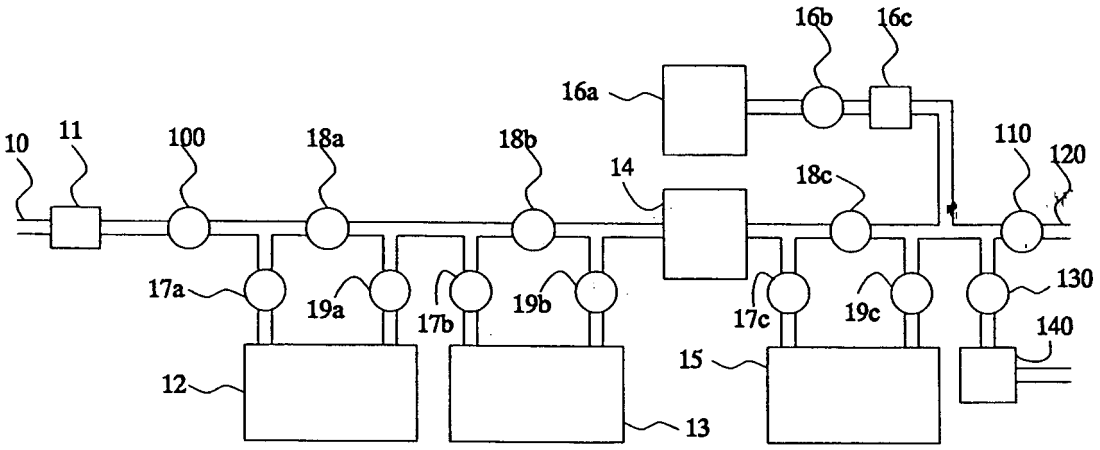

Fig.1

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Description

[0001] The invention relates to a vehicle and method for cleaning water supply systems, especially for the control of legionella contamination, in particular in water supply systems of buildings.

[0002] For the control of legionella contamination in water supply systems, different techniques are known, requiring different types of equipment. A chemical bactericide can for instance be supplied to the water supply system, or the system can be rinsed. After contamination has been established, generally, a plan is drawn up with which a particular manner of control is chosen, whereupon a treatment is carried out during which the required equipment is connected to the contaminated water supply system. When, thereupon, a different form of control still proves necessary, control has to be started all over again. Furthermore, when exchanging connections to different apparatus, inadvertently, contamination can still subsist.

[0003] It is, inter alia, an object of the invention to solve at least one of these problems.

[0004] The invention provides a vehicle for cleaning water supply systems according to claim 1, and a method for cleaning a water supply system according to claim 6.

[0005] Further objectives and advantageous aspects of the invention will be further illustrated with reference to the following Figures.

Fig. 1 shows a diagram of an installation in a cleaning vehicle.
Fig. 2 illustrates the operation of a cleaning vehicle.

[0006] Fig. 1 shows a diagram of an installation in a cleaning vehicle. The installation has a supply coupling 10 for tap water and a dispensing coupling 120 for dispensing processed water to a water supply system to be treated. The installation further comprises a heating unit 12, a storage tank 13, a hydrophore 14, a chemical injection unit 15, a compressed air pump 16a and a discharge pump 140. The heating unit is, for instance, a diesel-fired "hotbox" with a power to heat 25 liter of water per minute to a temperature of 125°C. Storage tank 13 has, for instance, a capacity of 300 litres. Discharge pump 140 may be a membrane pump which is preferably driven by compressed air from compressed air pump 16a (via a further duct not shown).

[0007] The installation is arranged in a series of bypass groups, containing the heating unit, the storage tank 13, and the chemical injection unit 15, respectively. The installation contains a pipe system connecting supply coupling 10 to the dispensing coupling 120 via, successively, coupled in series, a non-return valve 11, an entrance valve 100, the bypass group with the heating unit 12, the bypass group with the storage tank 13, hydrophore 14, the bypass group with chemical injection unit 15 and an exit valve.

[0008] Each bypass group contains an entrance valve 17a-c, an exit valve 19a-c, and a bypass valve 18a-c. In the bypass group with heating unit 12, entrance valve 17a is coupled between an entrance of the bypass group and an entrance of heating unit 12. Exit valve 19a is coupled between an exit of heating unit 12 and an exit of this bypass group. Bypass valve 18a is coupled between the entrance and the exit of this bypass group. In the bypass group with storage tank 13, entrance valve 17b is coupled between an entrance of the bypass group and an entrance of storage tank 13b. Exit valve 19b is coupled between an exit of storage tank 13 and an exit of this bypass group. Bypass valve 18b is coupled between the entrance and the exit of this bypass group. In the bypass group with chemical injection unit 15, entrance valve 17c is coupled between an entrance of the bypass group and an entrance of chemical injection unit 15. Exit valve 19c is coupled between an exit of chemical injection unit 15 and an exit of this bypass group. Bypass valve 18c is coupled between the entrance and the exit of this bypass group.

[0009] Compressed air pump 16a is coupled, via an air valve 16b and a non-return valve 16c, to a point in the pipe system between exit valve 110 and the bypass group with chemical injection unit 15. Discharge pump 140 has an entrance which is coupled, via a discharge valve 130, to a further point between exit valve 110 and the bypass group with chemical injection unit 15. Discharge pump 140 has an exit which is coupled to a discharge of the vehicle.

[0010] Fig. 2 illustrates the operation of the vehicle 20, when cleaning a water supply system to be treated in a building 22. The vehicle (preferably a trailer) is driven to the building. There, supply coupling 10 is connected to an exit 24 of the public water system 24. The water supply system to be treated is uncoupled from the public water system, for instance with a mains 26. Dispensing coupling 120 is connected to a central connection 28 on the water supply system to be treated (that is to say to a connection from whence the entire water supply system can be reached, for instance from a branch directly behind the mains).

[0011] The valves of the bypass groups enable switching between a number of different configurations without needing, to that end, to couple or uncouple hoses. The following table gives an overview of the function of a number of possible configurations.

1	Thermal disinfection using storage tank

(continued)

2	Thermal disinfection without using storage tank
3	Thermal disinfection using storage tank and air
4	Cold rinsing using storage tank
5	Cold rinsing without using storage tank
6	Cold rinsing using storage tank and air
7	Chemical cleaning using storage tank
8	Chemical cleaning without using storage tank
9	Chemical cleaning using storage tank and air
10	Thermal plus chemical cleaning with storage tank and air
11	Thermal plus chemical cleaning without storage tank/with air
12	Thermal plus chemical cleaning without storage tank or air
13	Thermal plus chemical cleaning with storage tank/without air
14	Draining the pipe system to be treated
15	Draining installation in vehicle

[0012] The different configurations are obtained by selectively opening and closing valves. When the heating unit 12, the storage tank 13 or the chemical injection unit in a particular bypass group is active, then, the entrance valve 17a-c and the exit valve 19a-c of the bypass group are opened and the bypass valve 18a-c is closed. When a particular bypass group is not active, then, the bypass valve 18a-c is opened and the entrance valve 17a-c and the exit valve 19a-c of the bypass group are closed.

[0013] Supply of air is preferably carried out in bursts, by each time opening air valve 16a. Draining is carried out by opening discharge valve 130 and activating discharge pump 140.

[0014] In one embodiment, all valves concerned are hand-operable, so that they can be put in the position required for the desired configuration. In an alternative embodiment, use is made, at least partly, of electrically controlled valves. In that case, for instance a circuit can be provided, constructed such that by pressing buttons for the different configurations, the corresponding combinations of open and closed valves is realized. Here, furthermore, a circuit can be used for automatically supplying air, in bursts, in the configurations where air is supplied. As alternative, the valves can be computer-controlled. It will, for that matter, be clear that not all valves need to be operable, a part of the valves in the bypass groups can also be designed as non-return valve, which automatically slam shut when other valves are closed.

[0015] After the supply coupling has been coupled to the public water system, and the dispensing valve to the water supply system to be treated, a preferred embodiment for controlling legionella in a water supply system comprises, successively, the following steps, to which end the installation in the vehicle is, successively, switched to different configurations:

(a) dispensing water with a temperature of at least sixty degrees Centigrade, via dispensing coupling 120, to the water supply system to be treated, until, at a number of tapping points of the water supply system to be treated, a water temperature of at least sixty degrees Centigrade is measured;
(b) draining the water supply system via dispensing coupling 120;
(c) dispensing water with added chemical bactericide via dispensing coupling 120 to the water supply system to be treated;
(d) allowing the bactericide to act for a pre-selected period of time
(e) dispensing water with a temperature of at least sixty degrees Centigrade, via dispensing coupling 120, to the water supply system to be treated, with periodical air bursts, whereby the water supply system to be treated is rinsed;
(f) (optionally) measuring, at a number of measured tapping points, whether the water has reached at least sixty degrees Centigrade and then switch to rinsing with unheated water and added air bursts via dispensing valve 120;
(g) (optionally) testing whether the water at tapping points contains virtually no more bactericides and, when more bactericide is measured, repeating the previous step;
(h) dispensing water with a temperature of at least sixty degrees Centigrade, via dispensing valve 120, to the water supply system to be treated.

[0016] As the installation is fixedly mounted in a vehicle, and designed with valves, it is, in this treatment, not necessary to couple and uncouple connections between different steps. This decreases the risk that by doing so, accidentally, contamination occurs.

[0017] After these steps, the water supply system to be treated is held in a position of standstill for preferably 48 hours and thereafter it is measured whether the control has had the desired effect.

[0018] Hydrophore 14 is preferably set such that water is guided through the water supply system at a highest possible water pressure. A hydrophore can set the pressure, typically, to 10 atmospheres, but in practice the pressure is limited to what the water supply system to be treated can handle. This is preferably determined in advance. Mostly, a pressure of about 3.2 atmospheres is adequate/works well.

[0019] Step (a) serves for killing or detaching the largest possible part of the bacteria and their nutrient soil. The supplied water preferably has a temperature of between sixty and eighty degrees Centigrade. When warmer water is used, the supply is, for instance, temporarily interrupted when the water temperature at a tapping point exceeds eighty degrees Centigrade. The draining step (b) serves for removing the soaked material. Then, also, amoebas are removed (they can ingest legionella bacteria and protect them from chemical cleaning; when, thereafter, upon rinsing, amoebas burst open, the water supply system to be treated can become contaminated again).

[0020] As bactericide, for instance, CTB can be used. The time allowed for acting depends on the selected agent and the local circumstances, but is, for instance, between three and six hours. The bactericide is added to the water by chemical injection unit 15, while a desired average dose is set by injecting, with an adjustable frequency, standard doses in the water flow by chemical injection unit 15. In steps wherein no bactericide is dispensed, the bypass group with chemical injection unit 15 is bypassed to prevent remainders of bactericide from contaminating the dispensed water.

[0021] When rinsing after chemical control, again, use is made of thermal disinfection, at least temporarily. It has appeared that in this manner, last remainders of bacteria and/or nutrient soil can be removed. Generally, this will take up less time than rinsing out the chemical bactericide and that is why it is preferred to switch to unheated water when the thermal disinfection is finished.

[0022] Finally, a last thermal disinfection step is carried out to remove the last remainders (for instance bacteria from amoebas having burst upon rinsing). Thereupon, after a few days, it is measured whether the treatment has had effect. If necessary, the treatment needs then be repeated, but this proves to be necessary only seldom.

[0023] The use of the storage tank 13 depends on the size of the water supply system to be treated. With small systems, the capacity of heating unit 12 can be sufficient to directly provide the required water flow at the desired temperature. In that case, storage tank 13 is preferably bypassed, unless sufficient heated water is present in storage tank 13 for other reasons. With larger systems, for dispensing heated water, first, a buffer stock of heated water is build up in storage tank 13, whereupon the water is dispensed.

[0024] Although one embodiment for control of legionella bacteria has been described, it will be clear that the vehicle can also be used for other cleaning operations, such as the removal of material (for instance sand) having remained behind at the construction of a water supply system

[0025] Also, in particular cases, a simplified treatment of legionella control can be chosen when it appears, for instance, that dispensing heated water for the water supply system involved is impossible or undesired. In that case, heating unit 12 can be bypassed and use can be made of intensive chemical treatment. On the other hand, it may appear, under simple circumstances, that chemical treatment is not necessary so that thermal treatment suffices. Under more complicated circumstanoes, more steps, in particular repetitions of the steps mentioned, can be required.

Claims

1. A cleaning vehicle for cleaning water supply systems, which cleaning vehicle is provided with a supply coupling for supplying water to the vehicle and a dispensing coupling for dispensing water from the vehicle to a water supply system to be treated, wherein the vehicle contains, from the supply coupling to the dispensing coupling, a series circuit of, successively, a heating unit, a storage tank, a hydrophore and a chemical injection unit, and selectively activated air supply means which are coupled in parallel to this series circuit to the dispensing coupling, while in the series circuit selectively activated bypass circuits are provided around the heating unit, the storage tank and the chemical injection unit, respectively.

2. A cleaning vehicle according to claim 1, wherein each of the bypass circuits is provided with a first and second valve between, respectively, an entrance and an exit of the bypass circuit in the series circuit, and an entrance and an exit of either the heating unit, the storage tank and the chemical injection unit involved, and the bypass circuit is provided with a third valve in a bypass connection between the entrance and the exit of the bypass circuit.

3. A cleaning vehicle according to any one of the preceding claims and further provided with a discharge pump which

is coupled in parallel to said series circuit and the air supply means to the dispensing coupling.

4. A cleaning vehicle according to claim 3, wherein the discharge pump is an air driven membrane pump which is driven from the air supply means.

5. A cleaning vehicle according to claim 3, wherein the vehicle is designed as a trailer.

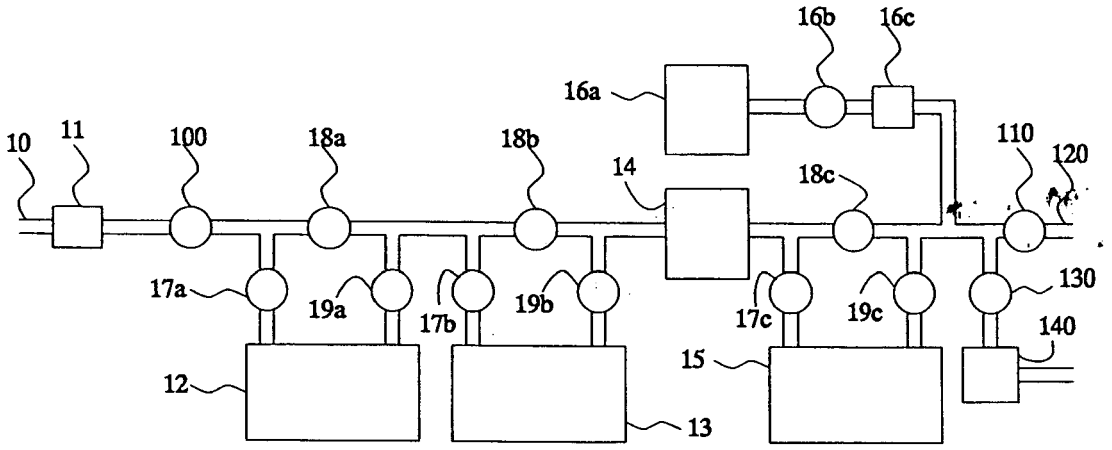
6. A method for treating a water supply system, wherein a vehicle according to any one of the preceding claims is driven to a location of the water supply system, the water supply system is uncoupled from the public water system, the supply coupling is coupled to the public water system and the dispensing coupling is coupled to the water supply system, whereupon a series of different steps for treating the water supply system is realized by selectively activating the bypass circuits.

7. A method according to claim 6, wherein a treatment of the water supply system comprises the steps, realized by selectively activating the bypass circuits, of:

(a) dispensing water with a temperature of at least sixty degrees Centigrade via the dispensing coupling to the water supply system to be treated;
(b) draining the water supply system to be treated via the dispensing coupling;
(c) dispensing water with added chemical bactericide via the dispensing coupling to the water supply system to be treated;
(d) allowing the bactericide to act for a pre-selected period of time;
(e) dispensing water with a temperature of at least sixty degrees Centigrade via the dispensing coupling to the water supply system to be treated, with periodical air bursts, whereby the water supply system to be treated is rinsed.

8. A method according to claim 7, further comprising the steps of

- measuring, during step (e) the temperature of the water at at least one tapping point; and
- then, when the temperature has reached a value of at least sixty degrees Centigrade, switching to rinsing with unheated water and added air bursts via the dispensing coupling;
- after virtually all chemical bactericide has been rinsed from the water supply system to be treated, dispensing water with a temperature of at least sixty degrees Centigrade via dispensing coupling to the water supply system to be treated.


16b
16c
16a
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11
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130
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Fig.1

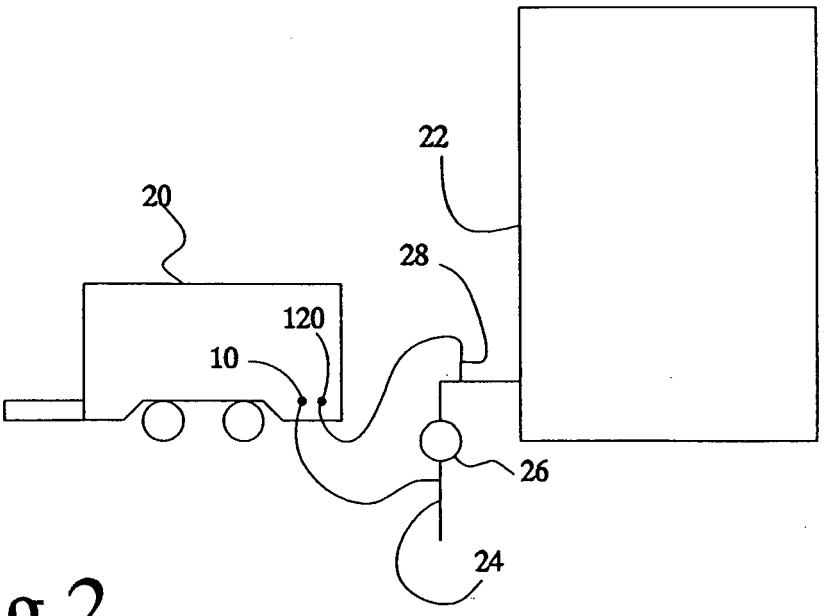
22
20
28
120
10
26
24

Fig.2

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EUROPEAN SEARCH REPORT

Application Number
EP 06 07 5085

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 April 2006	van der Zee, W

CATEGORY OF CITED DOCUMENTS

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