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

(11) EP 1 094 279 A2

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.04.2001 Bulletin 2001/17

(51) Int. Cl.[7]: **F24D 17/00**, F24D 3/08

(21) Application number: **00203601.0**

(22) Date of filing: **17.10.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **19.10.1999 NL 1013341**

(71) Applicant: **Heatex B.V.**
9482 TW Tynaarlo (NL)

(72) Inventor:
Willemsen, Johannes Albertus Hendrikus
9482 RZ Tynaarlo (NL)

(74) Representative:
Prins, Adrianus Willem et al
Vereenigde,
Nieuwe Parklaan 97
2587 BN Den Haag (NL)

(54) **Management of heated water in a storage boiler with anti-Legionella provisions**

(57) A storage boiler having a hot water reservoir (1, 101), a tap water supply (6, 106), communicating with the reservoir (1, 101), for supplying tap water, and a tap water discharge (7, 107), communicating with the reservoir (1, 101), for delivering heated tap water from the reservoir (1, 101), further comprising water displacement provisions (10-15, 106, 107, 110, 111, 115, 116, 120-123, 130) (9, 109) for displacing water present in the reservoir (1, 101) within the reservoir (1, 101). By displacing water from one place to another place in the reservoir, Legionella growth in water that is relatively cool for a long time in the reservoir is controlled. Also described is a method utilizing this principle.

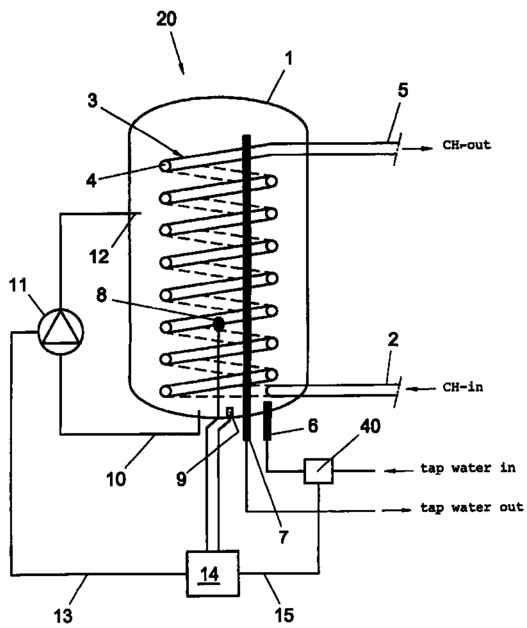

FIG. 1

Printed by Xerox (UK) Business Services
2.16.7 (HRS)/3.6

Description

[0001] This invention relates to a storage boiler system according to the preamble of claim 1, and to a method for managing a supply of heated water according to the preamble of claim 10.

[0002] Such boiler systems and methods have become known from practice and can be fired, for instance, by an external central heating boiler which also serves for heating a medium for transferring heat for the purpose of space heating. As a fluid for the heat transfer, generally water is used, but in principle other heat transferring media, such as oil or steam, can also be used. It is also known, however, to fire boilers directly or to heat tap water in a location outside the water reservoir and to supply it to the reservoir after its being heated.

[0003] Water that is heated in the storage boiler is stored in the storage boiler until use. A problem in the storage of hot water is that in water having a temperature between 25°C and 55°C after a longer time health-threatening growth of Legionella bacteria can arise. To control such growth, the water stored is held at a high temperature, preferably higher than 60°C.

[0004] The problem exists, however, that despite the measures taken, yet bacterial growth arises in the known storage boilers, and water contaminated with Legionella bacteria leaves the boiler.

[0005] It is an object of the invention to control health-threatening growth of Legionella bacteria in hot water in storage boilers.

[0006] To that end, the invention provides a storage boiler system according to claim 1, and a method according to claim 10.

[0007] Displacing water from at least a lower area of the reservoir to another area of the hot water reservoir prevents the temperature at the bottom of the reservoir remaining below a limit value for a longer time, which can give rise to health-threatening growth of Legionella bacteria. The colder water at the bottom of the hot water reservoir is at least partly displaced to hotter portions within the reservoir, where it is heated by the hotter water to a temperature at which Legionella growth is controlled. This prevents the temperature in portions of the water in the reservoir from remaining protractedly below a temperature at which health-threatening growth of Legionella bacteria can arise.

[0008] Particularly advantageous embodiments of the invention are set forth in the dependent claims.

[0009] The invention will be elucidated in the following on the basis of a description of a number of exemplary embodiments of the invention and with reference to the drawing, in which:

Fig. 1 is a schematic side elevation in cross section of a storage boiler system according to a first exemplary embodiment of the invention, and

Fig. 2 is a schematic side elevation in cross section of a storage boiler system according to a second exemplary embodiment of the invention.

[0010] The invention will first be described and elucidated with reference to the embodiment shown in Fig. 1 which constitutes the embodiment of the invention that is presently preferred most.

[0011] The storage boiler system 20 shown in Fig. 1 has a hot water reservoir 1. For heating tap water in the reservoir 1, there are provided a CH inlet 2 for supply of hot CH water, a heating element 3 connected to the CH inlet, through which extends a channel 4 for guiding CH water, and a CH outlet 5 for discharging CH water that has passed through the heating structure 3 and is to be returned to the CH boiler.

[0012] In the following, the assumption is that the heat-transferring medium used is water which also circulates in a central heating system. The heat-transferring fluid will therefore be designated hereinafter as CH water for short. It will be clear to one skilled in the art that other heat transferring fluids can be used, such as oil, steam or water that circulates exclusively between the CH boiler and the storage boiler.

[0013] For supplying tap water, there is provided a cold tap water supply 6, communicating with the reservoir 1. For discharging heated tap water, there is provided a tap water discharge 7 communicating with the reservoir 1. Further, a main temperature sensor 8 projects from below into the reservoir, such that the main sensor 8 is located in a central portion of the reservoir 1, surrounded by the heating structure 3. The temperature in the reservoir detected by the main sensor 8 is used, as is known per se, for controlling the supply of CH water to the heating element 3. In principle, it is also possible to fire the hot water reservoir directly or to feed tap water to it that has been heated outside the reservoir.

[0014] In the bottom portion of the reservoir, a second temperature sensor 9 is located. The sensor 9 is located under the heating structure 3, and preferably adjacent the extreme lower end of the reservoir 1.

[0015] Further, the reservoir 1 is provided with a circulation system with an inlet 10, located in the area of a lower end of the reservoir 1. Through a pump 11, the inlet 10 is in communication with a return channel 12 which terminates in an upper part of the reservoir 1.

[0016] The pump 11 is coupled via a connection 13 to a control unit 14. The control unit 14 is further connected with the temperature sensor 9 through a connection 15. The control unit 14 is arranged for activating the pump 11 depending on the temperature measured by the temperature sensor 9.

[0017] In operation, tap water present in the reservoir 1 is heated by means of the heating structure 3 in a manner known as such. Water at the top of the reservoir is then tendentially hotter than water at the bottom of the reservoir. The thus formed temperature gradient of the water present in the reservoir is as such desired; in fact, the inlet of the tap water discharge 7 is located in an upper portion of the reservoir 1, so that at all times the hottest water is tapped from the reservoir 1 and supply of cold water still to be heated does not result in any essential decrease of the delivery temperature.

[0018] In the bottom portion of the reservoir 1, therefore, relatively cold water is present. Colder water that is present in the area located under the heating structure 3 can dwell there for a longer time in that circulation caused by the heating structure 3 when heating the water does not carry along the water under the heating structure 3.

[0019] In this example, the pump 11 is arranged for drawing in relatively cold water, via a delivery channel 10, from the portion of the reservoir 1 located under the heating structure 3 and carrying the drawn-in water via the return channel 12 into the reservoir 1. As a result, the colder water from the lower area of the reservoir is heated by the hot water in the upper part of the reservoir, such that the temperature rises above a value at which health-threatening growth of Legionella threatens.

[0020] The temperature sensor 9 measures the temperature of the water located under the heating structure 3 and passes a signal which indicates the measured temperature to the control unit 14. The control unit 14 is arranged to determine, on the basis of the temperature measured by sensor 9 and a time interval, whether water in the area under the heating element needs to be treated.

[0021] The control unit 14 can be arranged, for instance, for activating the pump if the measured temperature has a value between 25°C and 55°C for four hours. If this is the case, the control unit 14 switches the pump 11 on, via connection 13.

[0022] To wait, before switching on the pump, until the temperature in the lower area of the storage boiler has been in the critical range for a longer time provides the advantage that the pump is activated exclusively if there is a risk of health-threatening bacterial growth. Any undesired effects on the delivery temperature that are entailed in the mixing are thus controlled, and so are heat losses and wear of the pump 11. Incidentally, it is also possible to have the control unit respond exclusively to a time delay or a critical temperature. Exclusive response to the elapse of a time interval provides the advantage that no temperature sensor is needed. Exclusive response to the attainment of a critical temperature provides the advantage that danger of health-threatening bacterial growth is further controlled. Optionally, the temperature sensor may then be mounted slightly higher, so that the pump is not activated until the temperature in a relatively large area has fallen below a limit value, which will generally occur only some time after the pump 11 has stopped.

[0023] In the cold tap water supply 6, a flow switch 40 is included, which is likewise connected with the control unit 14. The control unit is further arranged for suppressing activation of the pump 11 in response to a particular duration of signals from the flow switch 40 which signals flow of water through the cold tap water supply 6. Supply of cold tap water causes refreshment of water in the bottom area of the hot water reservoir 1, so that Legionella growth is already controlled. As long as sufficient refreshment is involved, it is therefore possible, despite low temperatures in the lower area of the boiler, to refrain from activation of the pump 11 and the associated mixing, undesirable as such, of colder and hotter water in the hot water reservoir 1.

[0024] Incidentally, the opposite pumping direction can be used, whereby hot water is carried from the top of the reservoir 1 to the bottom of the reservoir 1, whereby the colder water is heated by the hotter water supplied, and convection flow is stimulated which has as a consequence that through mixing the temperature in the bottom area of the reservoir 1 rises sufficiently.

[0025] In the example represented in Fig. 1, the return channel 12 is located remote from the lower area of the reservoir 1, but also remote from the upper area of the reservoir, preferably between half and three quarters of the height of the water in the reservoir 1. This provides the advantage that upon activation of the pump 11, water is carried from the bottom area of the reservoir to hotter parts, but the hottest water in the upper area (at the least about the top one-third to one-fourth of the reservoir and preferably above the inlet of the tap water discharge 7) remains unaffected, so that the delivery temperature of tap water is not essentially influenced by activation of the pump 11.

[0026] It is preferred to switch on the pump 11 for a particular fixed period of time, so that on the one hand all the water too cold for too long is removed from the bottom area of the reservoir 1 and, on the other, the layered temperature structure, desired as such, of the water in the reservoir 1 is not disturbed more than is necessary. To that end, the control unit 14 is arranged to be switched on, after activation, for so long that a volume of water is drawn in that substantially corresponds to the volume of the portion of the reservoir 1 located under the heating structure 3.

[0027] In Fig. 2 a second exemplary embodiment according to the invention is shown. The storage boiler 100 has a hot water reservoir 101. For heating water in the reservoir 101, there are provided a CH inlet 102 for supply of CH water, a heating element 103 connected to the CH inlet, through which extends a channel 104 for guiding CH water, and a CH outlet 105 for the discharge of CH water that has passed through the heating structure 103 and is returned to the heat source. For supplying tap water, there is provided a tap water supply 106 communicating with the reservoir 101. For discharging tap water, there is provided a tap water discharge 107 communicating with the reservoir 1. Further, a main temperature sensor 108 extends from below into the reservoir, such that the main sensor 108 is located in a central portion of the reservoir 101, surrounded by the heating structure 103. The temperature in the reservoir as detected by the main sensor 108 is used, as is known per se, for controlling the CH boiler for controlling the throughput of CH water through the heating element 103.

[0028] In the bottom portion of the reservoir, a temperature sensor 109 is located.

[0029] The storage boiler 100 differs from the storage boiler 20 according to the first exemplary embodiment in the construction of the water displacement means. The tap water discharge 107 is provided with a valve 110 which is arranged to switch the flow between a bypass position (as shown in Fig. 2) and a normal position (designated by the arrow A in Fig. 2). In the normal position, the tap water discharge 107 extends uninterruptedly. In the bypass position, the tap water discharge 107 is connected with a pump 130 via a line 115.

[0030] The tap water supply 106 is likewise provided with a valve 111 which is arranged to switch the flow between a bypass position (as shown in Fig. 2) and a normal position (designated by the arrow A in Fig. 2). In the normal position the tap water supply 106 extends uninterruptedly. In the bypass position, the tap water supply 106 is connected with the pump 130 via a line 116.

[0031] The storage boiler 100 is provided with a control unit 120 which can operate the valve 110 via a connection 121 and can operate the valve 111 via a connection 123. Further, the control unit 120 can control the pump 130 via the connection 122. The control unit 120 is further connected with the temperature sensor 109.

[0032] Like the control unit 14 from the first exemplary embodiment, the control unit 120 is arranged to determine on the basis of the temperature measured by the sensor 109 whether water in the reservoir 101 is to be displaced to control Legionella.

[0033] If water displacement is desired, the control unit 120 controls the valves 110, 111, so that they switch from the normal position (designated by the arrows A in Fig. 2) to the bypass position (as shown in Fig. 2). Thereupon the control unit 120 controls the pump 130. Via the tap water discharge 107, hot water is then tapped from the upper portion of the reservoir 101 and carried via line 115 and 116 to the tap water supply 106 at the bottom of the reservoir. As a result, the too cold bottom water at the bottom of the reservoir 101 is partly displaced to an area where it can be heated by the heating element and be partly heated by mixing with the hot water from the hottest portion of the reservoir 101. Health-threatening bacterial growth is thus prevented.

[0034] That the direction of the water displacement with respect to the exemplary embodiment represented in Fig. 1 is reversed provides the advantage that after water displacement the tap water discharge 107 has just been filled with hot water from the top of the reservoir 101. As a consequence, upon subsequent tapping of hot tap water, hot water is rapidly available.

[0035] As the tap water supply 106 and the tap water discharge 107 at the same time form the delivery and return channels for recirculating water to be displaced, it is not necessary to use additional ducts communicating with the reservoir. This is of particular advantage if the proposed method of Legionella control is applied to an existing, already installed storage boiler.

[0036] It will be clear to one skilled in the art that within the scope of the invention many other embodiments than those shown are possible. For displacing water, for instance, a propeller or other stirring instrument may be provided.

Claims

1. A storage boiler system comprising:

a hot water reservoir (1, 101),
a heating structure (3, 103) for heating water,
a cold tap water supply (6, 106) communicating with the reservoir (1, 101), for supplying cold tap water, and
a tap water discharge (7, 107) communicating with the reservoir (1, 101) for delivering heated tap water from the hot water reservoir (1, 101), **characterized by** water displacement means (10-15, 106, 107, 110, 111, 115, 116, 120-123, 130) for displacing water from at least a lower area of the reservoir (1, 101) to another area of the hot water reservoir (1, 101).

2. A storage boiler system according to claim 1, further comprising a temperature sensor (9, 109) in said lower area of the hot water reservoir (1, 101) and an operating structure coupled with said water displacement means for activating said water displacement means in response to a signal from said temperature sensor (9, 109) which represents a temperature below a particular limit value.

3. A storage boiler system according to claim 1 or 2, wherein the operating structure comprises a delay for activating said water displacement means in response to the elapse of a delay interval.

4. A storage boiler system according to claim 3, wherein the operating structure is arranged for activating said water displacement means in response to the elapse of said delay interval after said signal from said temperature sensor (9, 109) which represents a temperature below said limit value.

5. A storage boiler system according to claim 4, further comprising a flow switch for switching in response to tap water flow in said tap water supply or tap water discharge, and connected with said operating structure for activating said water displacement means in response to a combination, during a minimum time interval, of the occurrence of said signal from said temperature sensor (9, 109) which represents a temperature below a particular value and the non-occurrence of switching due to water flow in said tap water supply or discharge.

6. A storage boiler system according to any one of the preceding claims, wherein said heating structure (3, 103) is located in said hot water reservoir (1, 101) and wherein said lower area is located under the heating structure (3, 103).

7. A storage boiler system according to any one of the preceding claims, wherein the water displacement means (10-15, 106, 107, 110, 111, 115, 116, 120-123, 130) are arranged for displacing in each case a particular water volume.

8. A storage boiler system according to any one of the preceding claims, wherein the water displacement means (10-15, 106, 107, 110, 111, 115, 116, 120-123, 130) comprise a delivery passage (10, 107) and a return channel (12, 106) terminating in the reservoir (1, 101), the water displacement means (10-15, 106, 107, 110, 111, 115, 116, 120-123, 130) being further arranged for displacing water from the reservoir (1, 101) via the delivery passage (10, 107) and the return channel (12, 106) back into the reservoir (1, 101).

9. A storage boiler system according to any one of the preceding claims, wherein said delivery passage and said termination are formed by the tap water supply (106) and the tap water discharge (107), further comprising a bypass (115, 116) between said tap water supply (106) and said tap water discharge (107) as well as at least one valve (110, 111) for closing and opening said bypass (115, 116).

10. A method for managing a supply of heated tap water in a hot water reservoir (1, 101), comprising:

supplying cold tap water,
heating cold tap water to heated tap water,
holding the heated tap water in the hot water reservoir (1, 101), and
according to need, delivering heated tap water from the hot water reservoir (1, 101),
characterized by displacing water from at least a lower area of the reservoir (1, 101) to another area of the hot water reservoir (1, 101).

11. A method according to claim 10, wherein a signal is generated that forms an indication of the temperature in said lower area of the reservoir (1, 101) and wherein said displacement of water occurs in response to said signal indicating a temperature below a particular limit value.

12. A method according to claim 10 or 11, wherein said displacement of water occurs in response to the elapse of a delay interval.

13. A method according to claim 12, wherein said displacement of water occurs in response to the elapse of said delay interval after said signal from said temperature sensor (9, 109) which indicates a temperature below a particular value.

14. A method according to any one of claims 10-13, wherein said displacement of water occurs in response to the non-occurrence of tap water supply or discharge during a minimum time interval.

15. A method according to claim 14, wherein said displacement of water occurs in response to the combination, during a minimum time interval, of the occurrence of said signal that indicates a temperature below a particular value and the non-occurrence of tap water supply or discharge.

16. A method according to any one of claims 10-15, wherein said displacement of water in each case involves displacement of a defined water volume.

17. A method according to any one of claims 10-16, wherein said displacement of water in each case involves water being discharged from the reservoir (1, 101) and, bypassing the reservoir, being carried back to the reservoir (1, 101).

18. A method according to any one of the preceding claims, wherein said displacement of water in each case involves water in an upper area of the reservoir being left undisturbed.

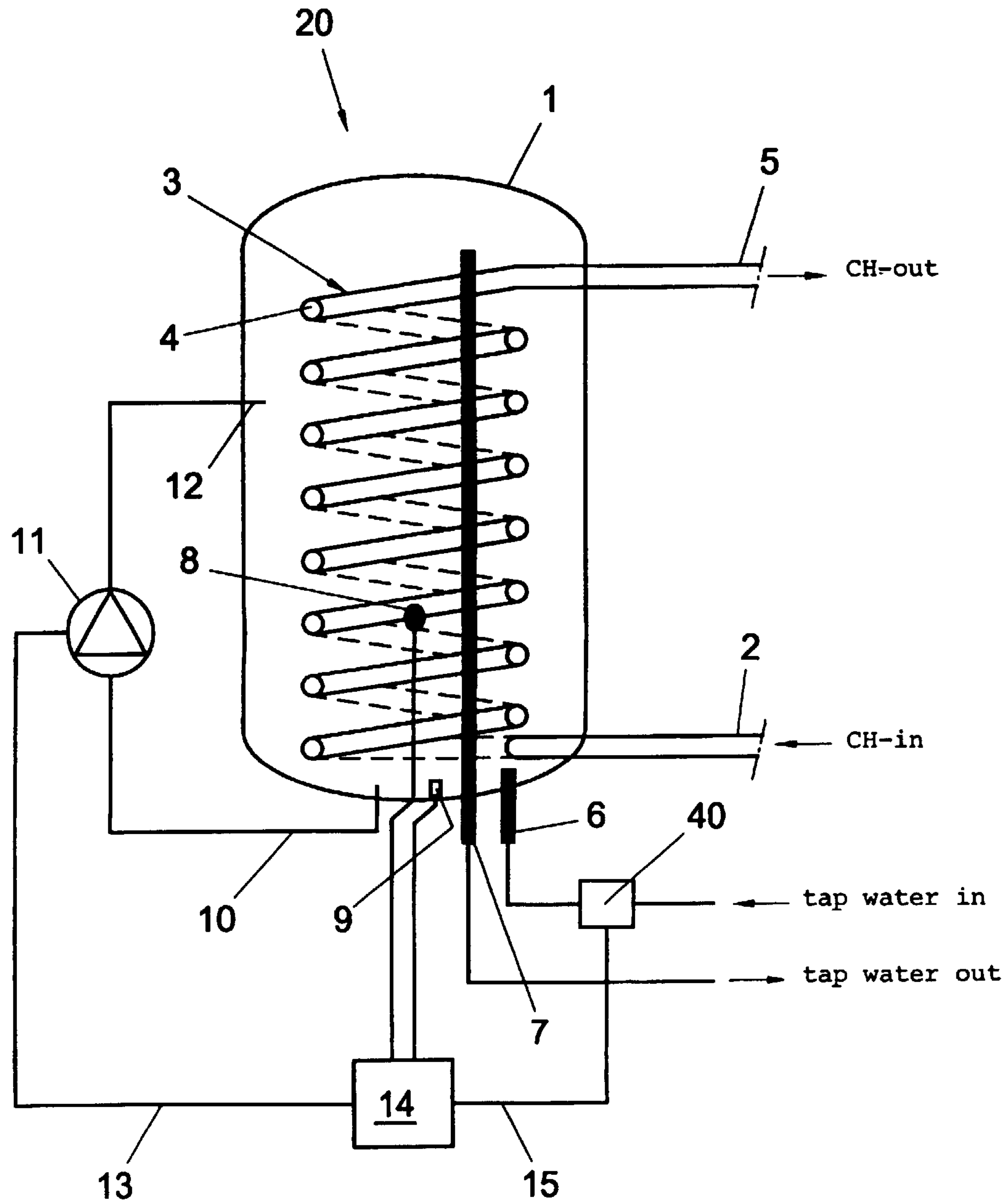
20
1
5
3
CH-out
4
12
11
8
2
CH-in
6
40
tap water in
10
9
tap water out
7
14
13
15

FIG. 1

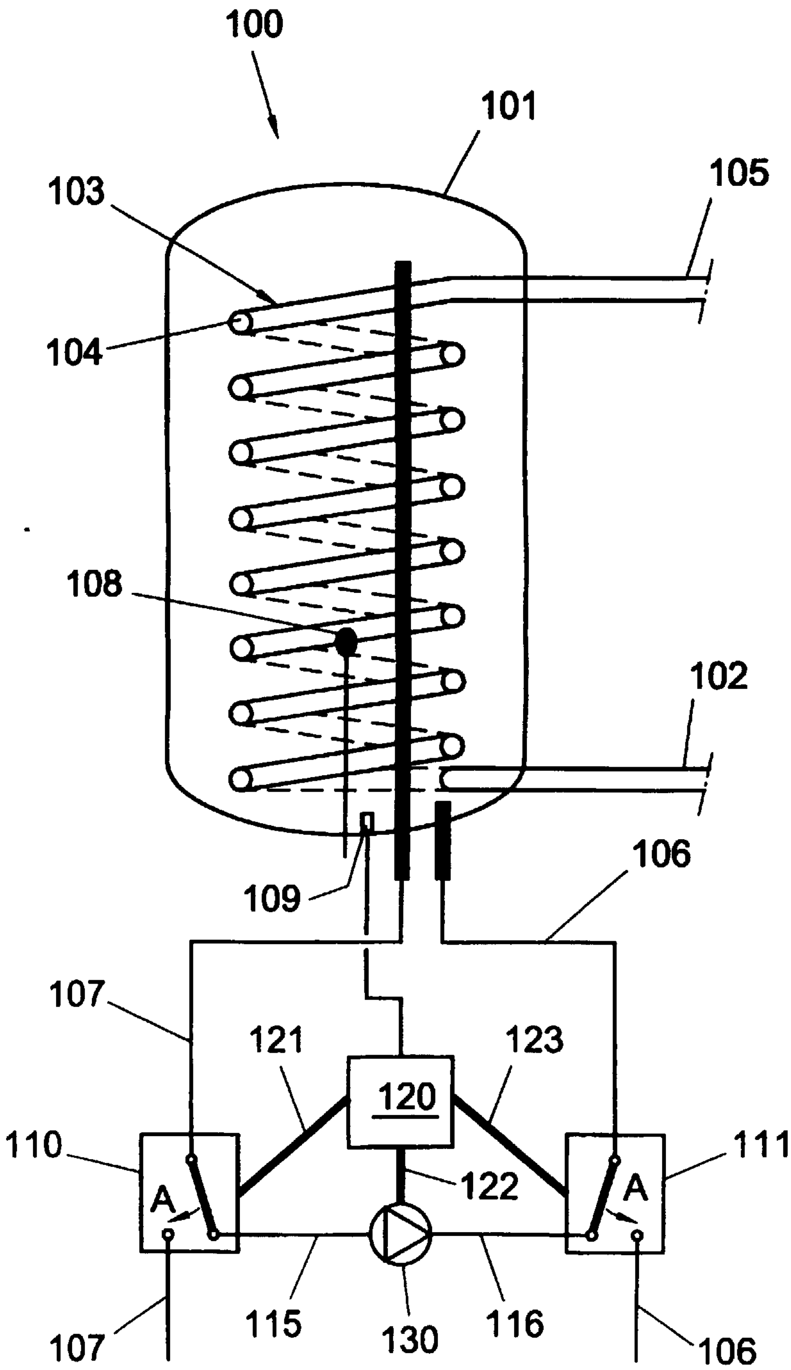
100
101
105
103
104
108
102
106
109
107
121
123
120
110
111
A
A
122
115
130
116
107
106

FIG. 2