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

(11) **EP 1 767 881 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.03.2007 Bulletin 2007/13

(51) Int Cl.:
F24H 1/52 *(2006.01)* ***F24D 17/00*** *(2006.01)*

(21) Application number: **06025994.2**

(22) Date of filing: **19.06.2002**

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

(30) Priority: **28.06.2001 DK 200101012**
18.03.2002 DK 200200419

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
02388042.0 / 1 271 068

(71) Applicant: **ApsH af 1. maj 2000 ApS**
8660 Skanderborg (DK)

(72) Inventor: **Faurschou, Jens**
8660 Skanderborg (DK)

(74) Representative: **Larsen, Hans Ole et al**
Larsen & Birkeholm A/S
Skandinavisk Patentbureau
Banegaardspladsen 1
P.O. Box 362
1570 Copenhagen V (DK)

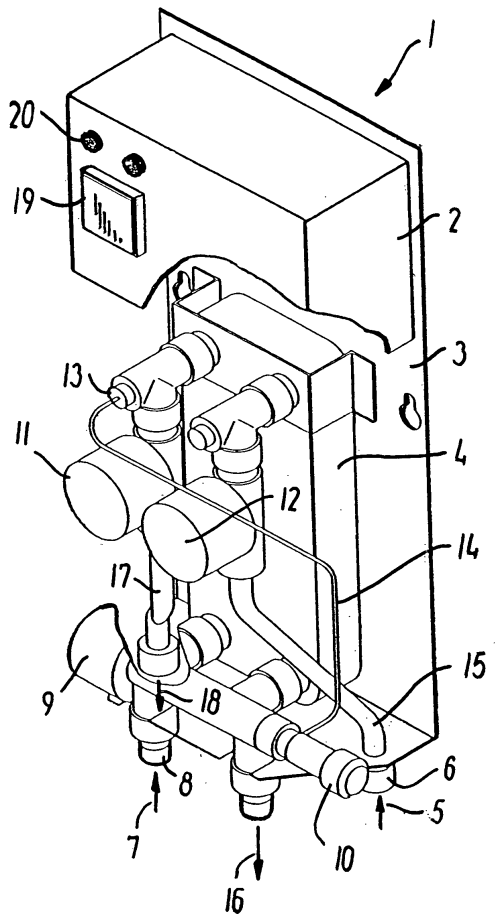
Remarks:
This application was filed on 19 - 06 - 2002 as a divisional application to the application mentioned under INID code 62.

(54) A method of heating domestic water in a water heater

(57) In order to tap bacteria-free hot domestic water at a tapping point, such as a wash basin, shower and similar point of use, in a simple manner, use is made of a method according to the invention which incorporates a heat exchanger (4), from whose secondary side the hot domestic water (18) is tapped directly and without being mixed with domestic water already heated.

The risk of bacteria, including the feared legionella bacteria, is eliminated hereby, since no hot water is left between the tappings, as the heating takes place only in connection with the tapping.

The heat exchanger (4) may be included in a water heater (1) which may be installed directly at the tapping point, thereby making the installation very compact and direct such that a high water rate and a low consumption of energy are ensured.



EP 1 767 881 A1

Description

State of the art

[0001] The invention relates to a method of heating domestic water in a water heater having a heat exchanger whose primary side is supplied with hot water, and whose secondary side is supplied with colder water.

[0002] Hot domestic water, particularly in major systems, is frequently of a poor quality, as bacterial growth and formation of slime occur because of physical/bacterial conditions.

[0003] The bacterial growth may cause diseases, and where legionella occurs, there is a risk of legionnaire's disease.

[0004] This disease is a bronchial infection, which may be lethal when it occurs at hospitals, etc. with immunocompromised patients.

[0005] The factors having the greatest influence on the bacterial growth in the water are the temperature, the residence time of the water in the piping and the area of the internal surfaces. The bacterial growth takes place particularly at temperatures between 20° and 50°C, with long residence times and large surfaces.

[0006] The traditional way of obviating the risk of bacterial growth is to maintain a relatively high water temperature, or discharging all the heated water in the container and optionally flushing out formations of slime, as needed. However, it is a problem that the heated water from the container and in the piping to the tapping point frequently stands still between the tappings and thereby loses temperature, thus involving the risk of bacterial growth.

[0007] To remedy this drawback it is known from Japanese Patent Application 101 959 45 to sterilize the hot water in a heat exchanger, an electric water heater, in a container, from which a limited amount of sterile water may be tapped.

[0008] The drawback of this is that, outside the tapping periods, the stagnant water constitutes a relatively large amount of water corresponding to the volume of the container, and this water has to be sterilized before it can be tapped. This requires both time and energy, to which should be added the risk of scalding injuries.

[0009] Furthermore, EP 621 450 A2 discloses a water heating system for heating domestic water through a heat exchanger having a water supply via a buffer container.

[0010] This buffer container is necessary where the source of heating is limited such as in solar heating systems. To ensure a suitable domestic water temperature from the beginning of the tapping at the tapping point, circulation for the domestic water is provided for. As a result, in the circulation line there will always be a temperature of about 40°C , precisely the temperature which is the optimum temperature for the multiplication of legionella bacteria. Since the circulation line has a length at least corresponding to twice the distance between the exchanger and the tapping point, this means that a relatively large amount of water, which must constantly be kept heated to about 40°C , will constitute a considerable danger of infection. It should be recalled in this connection that the bacterial growth is at least doubled every two hours under these conditions.

Object of the invention

[0011] It is an object of the invention to remedy these defects and drawbacks, and this is achieved accordingly to the invention by a method wherein, as stated in claim 1, the water on the secondary side is tapped directly from the heat exchanger without being mixed with water already heated, and that the secondary side of the heat exchanger is frequently flushed with domestic water in order to keep the temperature of the secondary side of the heat exchanger below a desired temperature, e.g. 20°C.

[0012] The risk of bacteria in the tapped hot domestic water is reduced in this simple manner for the simple reason that the multiplication of the legionella bacteria in the periods between the tappings cannot take place, since the heating and the tapping take place at the same time, and thus no water is left standing in which the bacteria can thrive.

[0013] The installation may therefore be made so compact and the piping so direct that a high water rate, low supply pipe temperature and return pipe temperature as well as minimum storage of stagnant water may be achieved. In addition to low costs of installation, this also results in a low consumption of energy.

[0014] The heating takes place when the tapping is initiated, and it takes place right up at the actual tapping point. This provides the greatest possible certainty that the water does not contain the feared legionella bacteria.

[0015] When, as stated in claim 2, the secondary side of the heat exchanger is flushed with the cool domestic water immediately after the tapping is terminated, a particularly efficient cooling of the secondary side and a further reducing of the possibility of growing of legionella bacteria is achieved.

[0016] As stated in claim 3, the flushing water is preferably led out directly to the sewers through an extra magnet valve, which is open during flushing and closed during normal tapping. The normal tapping valve is closed during flushing and only opens during tapping.

[0017] It is also possible to heat the secondary side of the heat exchanger to a desired temperature, e.g. 60 - 70°C by letting the hot water flow through the primary side in a period after terminating the tapping, as stated in claim 4, whereby the possibility of growing legionella bacteria is further reduced.

[0018] By controlling these operations, such as opening and closing of the magnet valves in the system by a microprocessor, as stated in claim 5, it is made possible to automatize and optimize the tapping and flushing processes.

The drawing:

[0019] An example of an embodiment of an installation for use in the method according to the invention will be described more fully below with reference to the drawing, which shows a water heater in perspective and with a cabinet partially cut away.

Description of the embodiment:

[0020] According to the invention, the example of an embodiment of a water heater 1 shown in the drawing is constructed on a rear plate 3, which may be secured to the wall right above the tapping point so that the tapped water 18 leaves the water heater through the outlet line 17 directly and not through valves, outlet spouts and the like.

[0021] The hot medium 5, which may either be district heating system water or an existing hot water supply, is fed to the primary side of the heat exchanger 4 through a stub 6, a pipe 15 and a magnet valve 12.

[0022] Fresh domestic water 7 is fed to the secondary side of the exchanger 4 through a stub 8 and a regulator 9.

[0023] The regulator 9 is preferably of the type which is described in Danish Utility Model Registration No. 2000 00320.

[0024] The tapping of the heated domestic water 18 from the secondary side of the exchanger 4 takes place via a temperature sensor 13, which is connected with the regulator 9 via a capillary pipe 14 and with a magnet valve 11 inserted in the outline line 17.

[0025] The heated and now cooled medium is discharged from the primary side of the exchanger 4 through the regulator 9 to an outlet line, as illustrated by the arrow 16.

[0026] A switch 19 switches on the current to the water heater, including the magnet valves 11, 12, and a microprocessor (not shown) and various control lamps 20 on the front of the cabinet 2. Finally, a water temperature regulator 10 is provided on the regulator 9 for determining the temperature of the hot domestic water 18.

[0027] The regulator 9 and the valves 11, 12 are made of materials approved for drinking water. The exchanger 4 is preferably soldered of pure copper or silver, and the exchanger is preferably made of acid-proof stainless steel AISI 316. The exchanger and the pipes may be cleaned and be supplied with chlorine in a reasonably high concentration without corrosion and are made with a minimum pipe dimension and exchanger size, such that, at each tapping, there is a strong flow and great replacement of the water with a predetermined quantity, temperature and time, which in turn results in a less favourable environment for the formation of bio films, protozoans and thereby multiplication of the legionella bacteria.

[0028] Outside the tapping periods, about 3 dl of stagnant water remains in the exchanger 4. In contrast to containers and/or long pipes of larger diameter with many times greater amounts of stagnant water and thereby a potential, much greater risk of legionella problems. If necessary, the exchanger 4 may be flushed automatically solely as far as the domestic water is concerned x-number of times/time/days, so that the limited amount of stagnant domestic water in the exchanger is replaced according to the concrete need, which depends on concrete multiplication conditions for the legionella bacteria.

[0029] The temperature of the stagnant domestic water must be lower than 20 °C or higher than 50-60 °C to prevent multiplication of the legionella bacteria. The exchanger 4, which, as mentioned, is soldered with pure copper or silver, releases copper or silver ions to the stagnant water in the exchanger 4 to a minimum extent, which can also contribute to restricting the multiplication environment of the bacterium and reducing the number of bacteria.

[0030] District heating system water 5 is usually used for heating the primary side of the exchanger, but, according to the invention, it is also possible to use the domestic water on the secondary side, which has already been heated to 50 °C, and which is present in the existing hot water piping, as the heating medium. This heating method may provide domestic water of 40-45 °C°. Precipitation of lime and scalding, e.g., are avoided hereby.

[0031] To use the already heated domestic water as a heating medium, which frequently contains an undesirable amount of legionella bacteria, may be of extreme practical importance in case of repair and not least where old, long pipe installations are involved, as the water heater 1 may merely be mounted directly above - and still use - e.g. the existing wash basin and be connected with the existing hot water tap as a heating medium source irrespective of the content of legionella bacteria. This simplifies and reduces the costs of the installation.

[0032] There is no need for a mixer tap or other facility for mixing the domestic water with "old", possibly legionella-infected, heated domestic water - only a tapping pipe.

[0033] In the water heater 1, there is just one tapping point for cold and/or hot domestic water that comes directly from the exchanger 4 to the point of use. A tap/water valve is not needed. The heated domestic water must be fed to the area of use as rapidly and directly as possible. The system may thus replace previously used fittings.

[0034] One, two or more magnet valves 11, 12 are mounted on the system. Basically, one on the secondary side and one on the primary side, which are controlled by a microprocessor separately and independently.

[0035] On the domestic water side, the magnet valve 11 is provided with a pressure-controlled regulator 9 - also for reasons of safety. In those cases where just a magnet valve is mounted, and the magnet valve perhaps fails e.g. because of impurities or other faults, the domestic water will undesirably continue to flow in such cases. Here, however, the pressure-controlled regulator 9 becomes operative, as the pressure-controlled regula-

tor will always operate with an on/off function when starting and terminating the tapping.

[0036] Further, it is possible to supplement with a magnet valve (not shown) in those cases where it is desired that part of the domestic water on the primary side and/or the secondary side should be fed e.g. to the sewer system for a shorter or longer period of time or after terminated tapping, cf. the following.

[0037] For example, the system may optionally be set for activation with simultaneous opening of the primary and the secondary side. Here, however, there may be a short waiting period, e.g. if the domestic water is heated to 40 °C, because the heating medium must heat the piping and the exchanger and/or be set for activation of first the secondary side x-number of units of time and/or quantity and/or temperature-dependent such that fresh water is fed to the exchanger until the "old" stagnant water has been flushed away, before the primary side is connected. With an extra magnet valve, the secondary side may optionally convey directly to the sewers instead of to the basin until the primary side becomes operative, and/or until the desired domestic water temperature has been achieved, and/or is set for activation of first the primary side x-number of units of time and/or quantity and/or temperature-dependent such that the heated domestic water in the exchanger has the desired temperature before opening the tapping point or starting the primary and the secondary side simultaneously, and such that the secondary side first conveys directly to the sewers until the desired domestic water temperature has been reached, and then directly to e.g. the basin.

[0038] This ensures that the secondary side is flushed with/for pure, cold domestic water, and also that the domestic water temperature has the desired temperature when the tapping point becomes operative and/or is set for activation solely on the secondary side with a predetermined interval of time for x-number of units of time or quantity per time, irrespective of whether the water heater 1 has been affected by an operator for use or not in the short or long term, or correspondingly automatically activated x-number of time units after the latest tapping so that the secondary side always contains domestic water of an optimum quality irrespective of whether the system has been activated by an operator or not in the short or long term and/or is set for activation such that when the desired tapping is terminated, the primary side stops immediately, while the secondary side continues the flow in the exchanger for x-number of units of time and/or quantity and/or temperature-dependent optionally to the sewers to thereby cool the exchanger 4 immediately and thus also the "stagnant" water in the exchanger 4 to the desired temperature below 20 °C e.g. to prevent legionella bacteria from multiplying.

[0039] The process may also be reversed so that, after terminated tapping, the primary side is activated solely for x-number of units of time/quantity and/or temperature-dependent, whereby the temperature of the domestic water, the "stagnant" water in the exchanger of 3 dl, is raised to the desired temperature of e.g. 60-70 °C to thereby destroy any legionella or other bacteria. This, however, involves a waste of water and may cause scalding and/or scaling of the exchanger. The latter, however, is a minor problem, as the exchanger may be descaled like a coffee machine and/or be set for activation such that, irrespective of activation of the tapping point, the temperature range in the exchanger on both the primary side and the secondary side is always e.g. min. 50 °C and optionally below 50 °C after commenced tapping because of e.g. the scalding risk, so that the multiplication capacity of the legionella bacteria is restricted or eliminated also in the standstill period of the water heater.

[0040] According to the combination of components used, including the microprocessor, there are numerous alternative possibilities of combination and security which may be set for activation such that the domestic water in e.g. a buffer container is given an optimum temperature and/or time horizon for e.g. killing bacteria and the like, which is placed directly in front of the water heater 1, and then the domestic water from the buffer container is subsequently cooled, if the exchanger 4 - instead of being supplied with e.g. district heating system water 5 on the primary side like before - in this case is supplied with cold/cooled water that may be recirculated and thereby bring the container domestic water first optimally heated and stored down to the desired tapping temperature.

[0041] The temperature of the domestic water is generally controlled by a thermostat 10, which may be connected with a pressure-controlled domestic water part to achieve an optimum solution in terms of security as well as temperature. The thermostat 10 may readily be adjusted to the desired approximate temperature.

Claims

1. A method of heating domestic water in a water heater (1) having a heat exchanger (8) whose primary side is supplied with hot water (5), and whose secondary side is supplied with colder domestic water (7), **characterized in that** the water (18) on the secondary side is tapped directly from the heat exchanger (4) without being mixed with water already heated, and that the secondary side of the heat exchanger is frequently flushed with domestic water in order to keep the temperature of the second side of the heat exchanger below a desired temperature, e.g. 20°C.

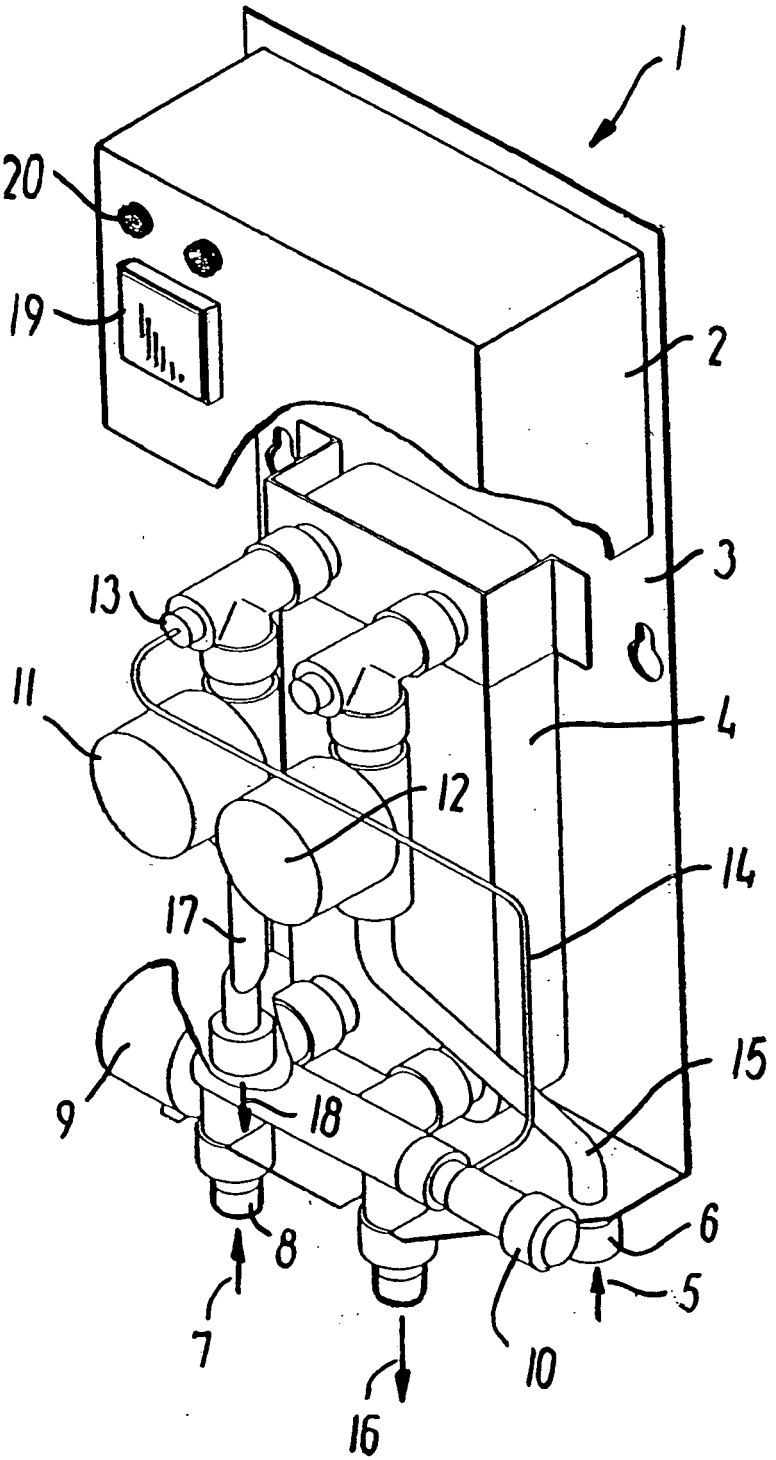
2. A method according to claim 1, **characterized in that** the secondary side of the heat exchanger is flushed with domestic water immediately after a tapping is terminated.

3. A method accordingly to claims 1 or 2, **characterized in that** the domestic water used for flushing is led directly to the sewers through an extra magnet

valve, which is open during flushing and closed during tapping.

4. A method accordingly to claims 1 - 3, **characterized in** the further feature that the primary side of the heat exchanger is flushed with hot water in a period after terminating tapping in order to heat the water, reminding in the secondary side of the water exchanger to a desired temperature of e.g. 60 - 70°C.

5. A method accordingly to claims 1 - 4, **characterized in that** the various operations of the valves are controlled by a microprocessor in accordance with signals from temperature- and/or pressure transducers in the system.


1
20
19
2
3
13
11
4
12
14
17
9
15
18
6
8
5
7
10
16

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 02 5994

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 199 60 527 C (SAMSON AG) 31 May 2001 (2001-05-31) * column 1, line 1 - line 12 * * column 3, line 37 - column 4, line 65 * * figure 1 *	1	INV. F24H1/52 F24D17/00
P,A	WO 01/63182 A (DANTAET ELECTRONICS AS [DK]; NIELSEN ERIK [DK]) 30 August 2001 (2001-08-30) * page 6, line 25 - page 7, line 24 *	1	
P,A	WO 01/61224 A (MATTSSON AB F M [SE]; ANDERSSON SVEN [SE]; ERICSSON STEFAN [SE]) 23 August 2001 (2001-08-23) * page 3, line 20 - page 4, line 2 *	1	
A	DE 39 28 074 A1 (C T C WAERMETAUSCHER GMBH [DE]) 28 February 1991 (1991-02-28) * the whole document *	4	
A	DE 196 33 574 A1 (FROELING KESSEL APP [DE] FROELING HEIZ UND TRINKWASSERS [DE]) 16 October 1997 (1997-10-16) * the whole document *	4	TECHNICAL FIELDS SEARCHED (IPC) F24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 February 2007	Arndt, Markus

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 02 5994

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-02-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19960527 C	31-05-2001	NONE	
WO 0163182 A	30-08-2001	AU 3362401 A	03-09-2001
		DE 1285201 T1	14-08-2003
		DK 200000773 A	22-08-2001
		EP 1285201 A1	26-02-2003
WO 0161224 A	23-08-2001	AT 294348 T	15-05-2005
		AU 3627201 A	27-08-2001
		DE 60110400 D1	02-06-2005
		DE 60110400 T2	16-02-2006
		EP 1266161 A1	18-12-2002
		SE 518769 C2	19-11-2002
		SE 0000515 A	18-08-2001
DE 3928074 A1	28-02-1991	NONE	
DE 19633574 A1	16-10-1997	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 10195945 B **[0007]**
- EP 621450 A2 **[0009]**
- DK 200000320 **[0023]**