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(54) Instant boiler for heating water

(57) Instant boiler (10) for heating water, comprising a first closed hydraulic circuit (11), in which a heat carrier fluid circulates, associated by means of a heat exchanger (12) with a second hydraulic circuit (13) connected to a user apparatus (15), and in which the water to be heated circulates. The first hydraulic circuit (11) comprises a pipe (16), burners (19) to heat the heat carrier fluid, an accumulation member (21) connected to the pipe (16) to contain and maintain at temperature a determinate quantity of heat carrier fluid, and valve members (20) associated with the pipe (16), in order to selectively divert the heat carrier fluid towards the accumulation members (21) or towards the heat exchanger (12).

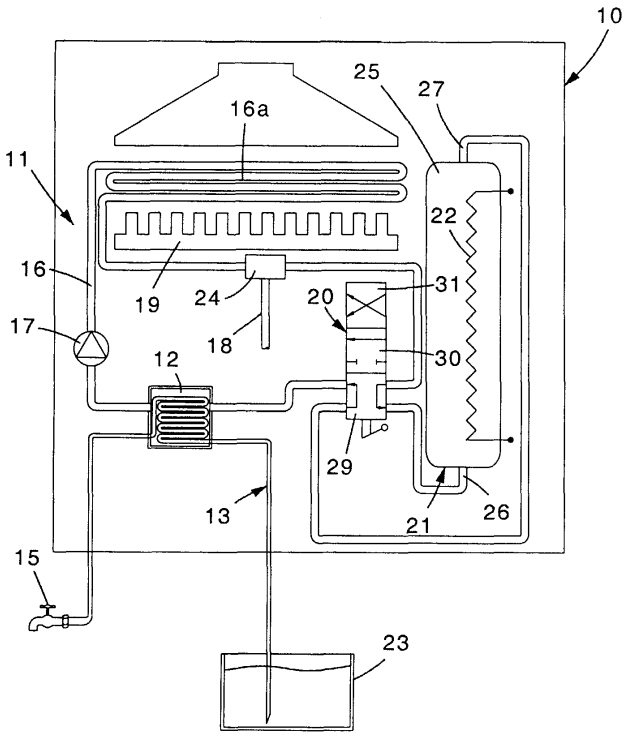

fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns an instant boiler for heating water, comprising a first closed hydraulic circuit in which a heat carrier fluid circulates, which, by means of a heat exchanger, heats a secondary hydraulic circuit connected to the user apparatus, and in which the water flows. To be more exact, the boiler according to the present invention comprises, apart from a gas burner to heat the heat carrier fluid, an accumulation tank to reduce the waiting times of the hot water to the user apparatus.

BACKGROUND OF THE INVENTION

[0002] Instant boilers for heating water are known, comprising a closed primary hydraulic circuit, provided with a pipe in which a heat carrier fluid circulates, and with which a gas burner and possibly an accumulation tank are associated, and a secondary hydraulic circuit connected to the user apparatus, in which the water circulates.

[0003] The secondary hydraulic circuit, by means of a heat exchanger, acquires heat from the primary hydraulic circuit, to supply the user apparatus with heated water at a desired temperature.

[0004] Conventional instant boilers have the disadvantage, however, that once the accumulation tank has been emptied, the cold fluid which when the cycle is started is found in the pipe, flows into the heat exchanger. Therefore, at the moment when the hot water is required, firstly water at a high temperature is supplied to the user apparatus, heated by the fluid arriving directly from the accumulation tank, then water at a lower temperature is supplied, cooled by the fluid in the pipe, and finally water at the desired temperature is supplied, which acquires heat from the fluid heated by the gas burner.

[0005] One purpose of the present invention is to achieve an instant boiler for heating water which will allow to deliver to the user apparatus hot water having a desired and substantially constant temperature at least during the first steps of delivery, that is, from the moment the request for hot water is made, to the moment when the heat exchange occurs directly with the fluid heated by the gas burner.

[0006] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0007] The present invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0008] In accordance with the above purpose, an instant boiler according to the present invention is able to heat water for sanitary use and comprises a first closed hydraulic circuit, in which a heat carrier fluid circulates, associated by means of heat exchange means with a second hydraulic circuit connected to a user apparatus, and in which the water flows.

[0009] The first hydraulic circuit comprises a pipe and burner means able to heat the heat carrier fluid.

[0010] According to a characteristic feature of the present invention, the first hydraulic circuit also comprises accumulation means connected to the pipe and able to contain and maintain at temperature a determinate quantity of heat carrier fluid, and valve means associated with the pipe, and able to selectively divert the heat carrier fluid towards the exchange means or towards the accumulation means, according to whether the fluid has or has not been subjected to heating by the burner means.

[0011] When hot water is required by the user apparatus, the valve means are disposed so as to direct the heat carrier fluid, which initially is stationary in the pipe and has rather a low temperature, around 15°C, into the accumulation means, so that the heated heat carrier fluid present in the latter, is thrust towards the heat exchange means, following a determinate path. At the moment when the heat carrier fluid is heated by the burner means, the valve means divert the heat carrier fluid arriving from the pipe directly towards the heat exchange means.

[0012] In this way, the cold fluid present initially in the pipes, which is normally the cause of the initial variations in the temperature of the water delivered, is conveyed into the accumulation means, without participating in the heat exchange with the second hydraulic circuit.

[0013] In this way, a substantially constant temperature of the water delivered to the user apparatus is guaranteed, from the moment it is requested to the moment when the heat exchange occurs directly with the fluid heated by the burner means.

[0014] In a preferential form of embodiment of the present invention, the boiler comprises a command and control unit, for example manually settable, able to coordinate the activation of the valve means both according to the temperature of the heat carrier fluid and also according to the manually set values.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic view of an instant boiler for heating water according to the present invention in a first operating condition;
- fig. 2 is a schematic view of the instant boiler in fig. 1 in a second operating condition;

- fig. 3 is a schematic view of the instant boiler in fig. 1 in a third operating condition;
- fig. 4 shows a graph comparing the theoretical curves of temperature/time of a traditional boiler and the boiler in fig. 1.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0016] With reference to figs. 1, 2 and 3, an instant boiler 10 according to the present invention comprises a closed primary circuit 11, with which a secondary circuit 13 is associated, by means of a heat exchanger 12 of a substantially conventional type; the secondary circuit 13 is connected to a user apparatus 15.

[0017] The primary circuit 11 comprises a pipe 16, in which a desired quantity of heat carrier fluid, such as water, anti-freeze or other, flows cyclically, and to which are connected a pump 17, a gas burner 19, a preheating valve 20, an accumulation tank 21 and the heat exchanger 12.

[0018] Moreover, the primary circuit 11 comprises a diversion valve 24 that selectively diverts the flow of heat carrier fluid towards a pipe 18 connected to a heating plant of a conventional type, not shown in the drawings.

[0019] The secondary circuit 13, on the contrary, is of the open type and water for sanitary use arriving for example from a water system 23 flows inside it.

[0020] To be more exact, the secondary circuit 13 is partly disposed inside the heat exchanger 12, so that the water for sanitary use acquires, through convection, a temperature near that of the heat carrier fluid that flows in the primary circuit 11 in correspondence with the heat exchanger 12, and thus delivers to the user apparatus 15 water with the desired temperature.

[0021] The pump 17 to make the heat carrier fluid flow inside the primary circuit 11, and the gas burner 19 to heat the heat carrier fluid, can be of any known type and will not be described in detail here.

[0022] The accumulation tank 21 is connected to the tube 16 and comprises a container 25, advantageously with stratifications, in which a desired quantity of heat carrier fluid is contained, an electric resistance 22 disposed inside the container 25 to compensate the normal heat losses of the heat carrier fluid contained, a lower pipe 26 and an upper pipe 27, the latter both able to allow the introduction and exit of the heat carrier fluid from the container 25.

[0023] The preheating valve 20 comprises inside a plurality of components selectively driven by means of mechanical or electric actuators, not shown here, to create three different conditions of fluid-dynamic connection between the gas burner 19, the accumulation tank 21 and the heat exchanger 12, according to the various steps to be performed during the delivery cycle of the water.

[0024] To be more exact, the preheating valve 20 is shown in the figures with a fluid-dynamic symbol, and comprises a first sector 29 used during the start-up step of the cycle, a second sector 30 used during the normal delivery of the water, and a third sector 31 used during the steps of reloading the accumulation tank 21.

[0025] The instant boiler 10 according to the present invention functions as follows.

[0026] In the inactive condition, that is, when no delivery of hot water is required by the user apparatus 15, inside the pipe 16 the heat carrier fluid is stationary and has a relatively low temperature, that is, about 15°C, while inside the container 25 the fluid is normally kept at a temperature that varies from about 40°C to about 90°C, by means of the electric resistance 22.

[0027] When the user apparatus 15 requires hot water, the pump 17 puts the heat carrier fluid into circulation inside the primary circuit 11, the gas burner 19 heats a first segment 16a of the pipe 16 adjacent thereto, and the heat carrier fluid contained in the accumulation tank 21 exits therefrom through the upper pipe 27.

[0028] In this first operative step, as shown in fig. 1, the components of the preheating valve 20 are activated to connect the gas burner 19, the accumulation tank 21 and the heat exchanger 12, in order to simulate the connection condition of the first sector 29.

[0029] In this way, the cold fluid initially present in the pipe 16, is diverted towards the lower pipe 26 of the accumulation tank 21, while the hot fluid contained in the latter is sent directly to the heat exchanger 12, in order to heat the water flowing in the secondary circuit 13.

[0030] In a second operative step, in which all the cold fluid arriving initially from the pipe 16 has been conveyed inside the accumulation tank 21, the various components of the preheating valve 20 are actuated to simulate the connection condition of the second sector 30 (fig. 2).

[0031] In this way, the fluid heated by the gas burner 19 arrives directly to the heat exchanger 12, temporarily excluding the accumulation tank 21 from the primary circuit 11.

[0032] In this way, the cold fluid initially present inside the pipe 16, and now contained in the accumulation tank 21, does not participate in the heat exchange, so as not to affect the temperature of the water delivered to the user apparatus 15.

[0033] Fig. 4 shows schematically, with a line of dashes, a theoretical curve made from the relation between the temperature of the water and its delivery time in an instant boiler of a conventional type. In the curve it can be seen that, after a sudden heating, determined by the heated fluid arriving from the accumulation tank, a flexion of the temperature occurs, due to the heat exchange with the cold fluid initially present in the pipe. Only after a few seconds does the water regain temperature due to the effect of the heat exchange with the heat carrier fluid heated by the gas burner.

[0034] On the contrary a continuous line shows schematically the same type of theoretical curve, but this time referring to the instant boiler 10 according to the present invention.

[0035] As can be seen, after the initial sudden heating

of the water, there is a substantially constant temperature of the latter. This is possible because, due to the effect of the preheating valve 20 that selectively connects the gas burner 19, accumulation tank 21 and heat exchanger 12, by means of the connection conditions shown in the first sector 29 or the second sector 30, the cold fluid is conveyed into the accumulation tank 21, without being able to intervene in the heat exchange with the water.

[0036] Fig. 3 on the contrary shows a third operating step in which the accumulation tank 21 is filled when the user apparatus 15 no longer requires hot water.

[0037] To be more exact, the components of the preheating valve 20 are actuated to connect the gas burner 19, which in this step is off, the accumulation tank 21, whose electric resistance 22 maintains at temperature the fluid contained therein, and the heat exchanger 12, so as to simulate the connection condition of the third sector 31.

[0038] In this case, the heat carrier fluid, still hot after the heating cycle of the water, is put into circulation by the pump 17 in the pipe 16, and is sent directly to the upper pipe 27 of the container 25, so as to enter inside the accumulation tank 21. At the same time, the cold fluid present inside the container 25 exits from the lower pipe 26 and is sent directly to the heat exchanger 12 and returned into circulation in the pipe 16.

[0039] Once the accumulation tank 21 is full, the pump 17 is stopped, so that the heat carrier fluid contained therein is maintained at temperature by means of the electric resistance 22.

[0040] This solution allows to introduce inside the accumulation tank 21 a heat carrier fluid already heated by the gas burner 19 during the delivery of the hot water, restoring to the pipe 16 the cold fluid contained therein.

[0041] In this way, at the end of the heating cycle it is possible to re-use the hot fluid present in the pipe 16, without its heat being dispersed, and use it to fill the accumulation tank 21. Therefore, with the instant boiler 10 according to the invention, it is possible to considerably reduce the consumption of gas necessary for heating the heat carrier fluid.

[0042] It is clear, however, that modifications and/or additions of parts may be made to the instant boiler 10 as described heretofore, without departing from the field and scope of the present invention.

[0043] For example, it comes within the field of the present invention to provide that one or more sensor devices can be associated with the pipe 16, which detect the temperature of the water in desired sections of the pipe 16 and, according to the temperatures detected, command the preheating valve 20 to simulate the conditions of the sectors 29, 30 or 31.

[0044] It also comes within the field of the present invention to provide that instead of said sensor device a timer can be provided which commands the preheating valve 20.

[0045] According to a variant, a control and command unit can also be provided, even of the type that can be selectively set by the operator, which manages the electronic and fluid-dynamic part of the instant boiler 10.

[0046] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of instant boiler for heating water, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Instant boiler for heating water, comprising a first closed hydraulic circuit (11), in which a heat carrier fluid circulates, associated by means of heat exchange means (12) with a second hydraulic circuit (13) connected to a user apparatus (15), and in which said water to be heated circulates, said first hydraulic circuit (11) comprising a pipe (16) and burner means (19) able to heat said heat carrier fluid, **characterized in that** it also comprises accumulation means (21) connected to said pipe (16) and able to contain and maintain at temperature a determinate quantity of said heat carrier fluid, and valve means (20) associated with said pipe (16), and able to selectively divert said heat carrier fluid towards said accumulation means (21) or towards said heat exchange means (12).

2. Instant boiler as in claim 1, **characterized in that** said valve means (20) comprise inside a plurality of components able to be selectively actuated so as to define at least a first condition of fluid-dynamic connection (29), wherein they connect said burner means (19) with a lower part (26) of said accumulation means (21) and an upper part (27) of said accumulation means (21) with said heat exchange means (12), a second condition of fluid-dynamic connection (30), wherein they connect said burner means (19) with said heat exchange means (12) isolating said accumulation means (21), and a third condition of fluid-dynamic connection (31), wherein they connect said burner means (19) with said upper part (27) of said accumulation means (21) and said lower part (26) of said accumulation means (21) with said heat exchange means (12).

3. Instant boiler as in any claim hereinbefore, **characterized in that** it comprises a command and control unit able to coordinate the drive of said valve means (20), both according to the temperature of said heat carrier fluid and also according to parameters set manually.

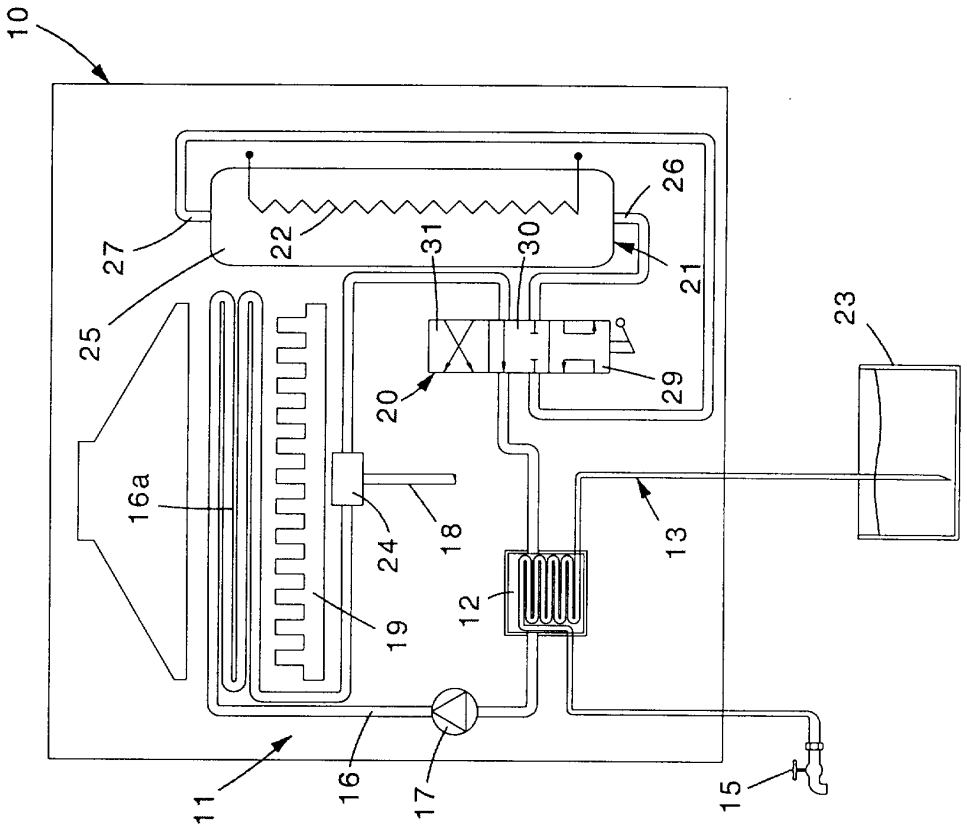
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fig. 2

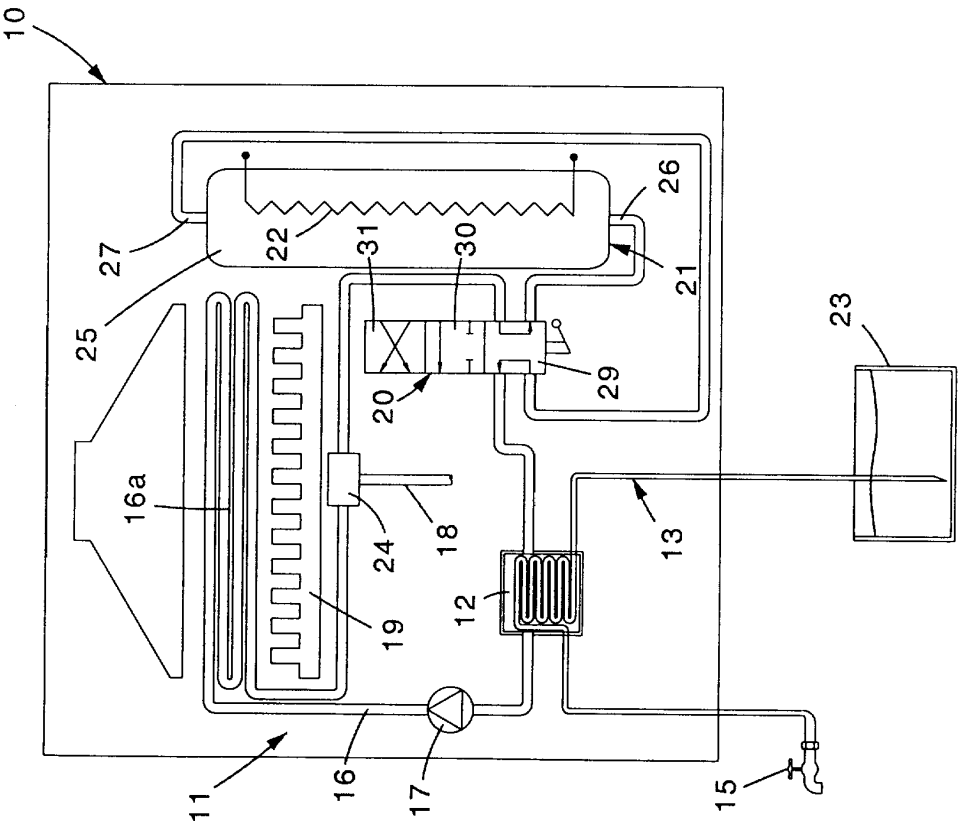
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fig. 1

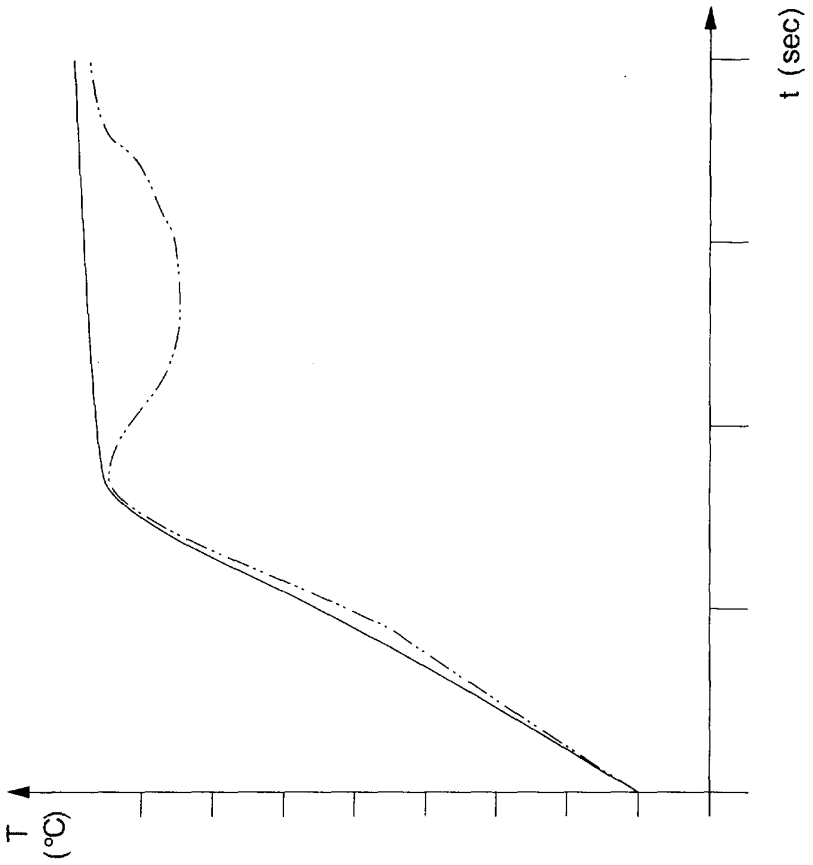

fig. 4

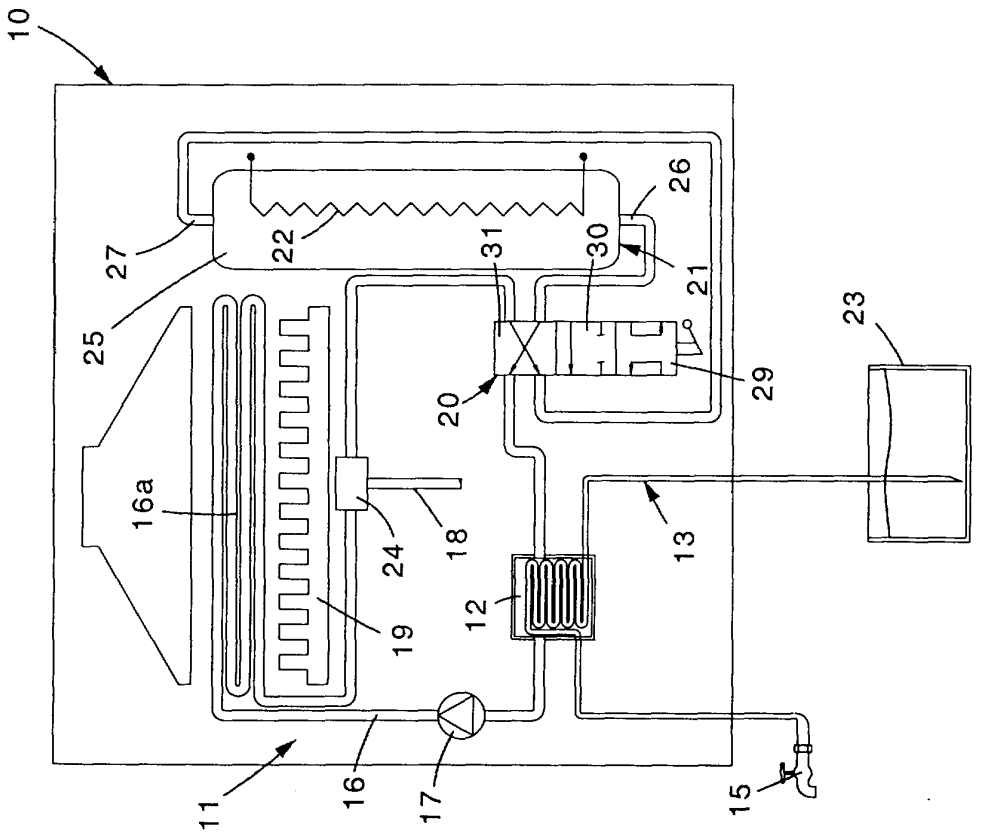

fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 10 6424

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	FR 2 817 610 A (DE DIETRICH THERMIQUE) 7 June 2002 (2002-06-07) * page 3 - page 9; figures 1-5 *	1,3	F24D3/08
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A	DE 199 48 703 A1 (BUDERUS HEIZTECHNIK GMBH) 12 April 2001 (2001-04-12) * the whole document *	2	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 October 2005	Arndt, M

CATEGORY OF CITED DOCUMENTS

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