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

(11) EP 0 692 682 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.01.1996 Bulletin 1996/03

(51) Int. Cl.[6]: **F24D 3/08**, F24D 3/10

(21) Application number: **95201798.6**

(22) Date of filing: **01.07.1995**

(84) Designated Contracting States:
DE ES FR GB IT NL

(30) Priority: **15.07.1994 IT MI941487**

(71) Applicant: **INTEGRA S.r.l.**
I-35010 Limena (PD) (IT)

(72) Inventor: **Scanferla, Giorgio**
I-36061 Bassano del Grappa (Vicenza) (IT)

(74) Representative: **Bottero, Claudio**
I-20135 Milano (IT)

(54) Boiler in particular of the so-called combined type with prompt delivery of hot sanitary water

(57) A boiler, in particular of the so-called combined type, comprises a first gas-water heat exchanger (4) for producing hot water for space heating in heat exchange relationship, by means of a primary piping system (5), with a second water-water heat exchanger (7) for producing hot sanitary water, as well as a storage and expansion unit (8) for the hot primary water in fluid communication with the second water-water heat exchanger (7). Advantageously, the boiler allows a prompt delivery of hot sanitary water although having limited weight and size.

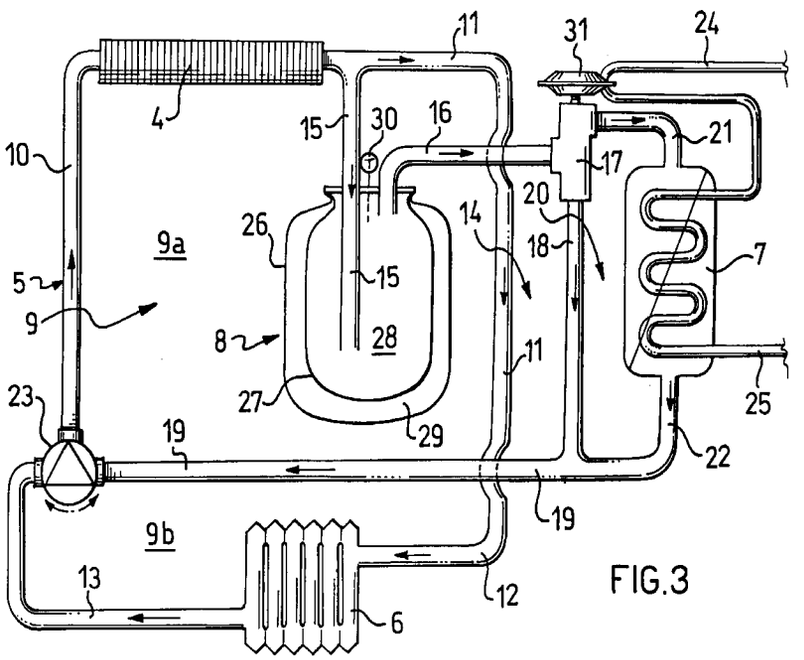

FIG.3

EP 0 692 682 A1

Description

The present invention relates to a boiler, preferably but not exclusively of the so-called combined type, comprising a first gas-water heat exchanger for producing primary hot water for space heating in heat exchange relationship with a second water-water heat exchanger for producing hot sanitary water through a primary piping system.

In the following description and the appended claims, the term: boiler of the so-called combined type, indicates a boiler capable of delivering both hot water for space heating or primary water and hot water for sanitary use.

As is known, in the field of domestic boilers for home use and in particular those of the so-called combined type, the need of ensuring a prompt delivery of sanitary water at the desired temperature and producing ever more compact and lightweight boilers continues to rise.

To meet this need, so-called accumulation boilers in which a certain quantity of hot water ready for use, sanitary or for space heating, is stored in a tank provided in the primary piping system of the boiler and employed to supply in relatively short time hot water for sanitary use, have become more widely used in the art.

Although essentially meeting the purpose, however, accumulation boilers do not allow to fully achieve the desired structural simplification of the boiler and to attain the features of high compactness and small size ever more sought after by the market.

The technical problem underlying the present invention is accordingly that of conceiving and making available a boiler, in particular but not exclusively of the so-called combined type, which allows to fulfill in all its aspects the above mentioned need to ensure a prompt delivery of hot sanitary water and to have at the same time a minimum size and the minimum weight compatible with the services required to the boiler.

In accordance with the present invention, this problem is solved by a boiler of the above mentioned type, which is characterized in that it comprises in said primary piping system a storage and expansion unit for said hot water for space heating, means being provided for putting said unit in fluid communication with the second water-water heat exchanger.

In accordance with the present invention, the desired reduction in size and weight of the boiler is achieved by providing in the primary piping system of the boiler a combined unit wherein the reservoirs necessary to accumulate hot water and to compensate the thermal expansion of the water circulating in the primary piping system (expansion chamber) are combined in a single and common body.

In accordance with a preferred embodiment, the storage and expansion unit comprises a single tank having appropriate means allowing both accumulation of primary hot water and compensation of the thermal expansion which said water undergoes during the operation of the boiler.

Advantageously, the above mentioned means comprises a bag membrane in which is defined a hot water storage zone supported within the tank wherein it is free to expand or shrink depending on the temperature of the accumulated hot water.

In accordance with a preferred embodiment, furthermore, the storage and expansion unit is installed between the above mentioned primary and secondary heat exchangers and inside the boiler body.

In this manner, it is possible to achieve optimal characteristics of compactness and structural simplification of the boiler, while keeping essentially unchanged the storage capacity of hot water ready to use.

Further characteristics and advantages of the present invention will be more readily apparent by the detailed description of an embodiment thereof given below by way of non-limiting example with reference to the annexed drawings. In the drawings:

Figure 1 shows a perspective view of a preferred embodiment of a boiler in accordance with the present invention;

Figure 2 shows a perspective view of a second embodiment of the boiler of FIG. 1; and

Figure 3 shows a simplified piping diagram of the boiler in accordance with the present invention.

With reference to the above mentioned drawing figures, reference number 1 indicates a boiler, in particular a wall boiler of the so-called combined type, in accordance with a preferred embodiment of the present invention.

The boiler 1 comprises a vessel 2 essentially parallelepipedic in shape and having at the front a control panel 3 comprising an electronic control unit, control panel 3 comprising an electronic control unit, known per se, for controlling and regulating the boiler.

In the vessel 2, the various components of the boiler 1 - shown schematically in FIG. 3 - are conventionally supported in a manner known per se.

More specifically, the boiler 1 comprises a gas-water heat exchanger 4 for producing primary hot water for space heating (indicated hereinafter by the term: primary exchanger), in fluid communication - through a primary piping system globally indicated by reference 5 - with a plurality of radiant elements 6 and with a second water-water heat exchanger 7 for producing hot sanitary water (indicated hereinafter by the term: secondary exchanger).

In the primary piping system 5 three fluid paths, closed in a loop and in mutual parallel relationship, are defined to connect the primary heat exchanger 4 respectively with the radiant elements 6, with a primary water storage and expansion unit 8 and with the secondary heat exchanger 7.

A first path, indicated by 9 in figure 2, comprises a first branch 9a defined within the boiler 1 and including ducts 10, 11 respectively for water delivery to and return from the primary heat exchanger 4 and a second branch

9b located outside the boiler 1 and including deliver and return ducts 12, 13 connected to the radiant elements 6.

The above mentioned inner branch 9a and external branch 9b of the fluid path 9 are mutually connected by means of a pair of fittings of conventional type not shown in the figures.

A second fluid path is indicated by 14 and comprises exchanger 4, a pair of ducts 15, 16 respectively for feeding to and withdrawing primary water from the storage and expansion unit 8, a hydraulically controlled 3-way valve 17 and a pair of ducts 18, 19 for returning the primary water to the heat exchanger 4.

A third fluid path 20 comprises the duct 10 for water delivery to the primary heat exchanger 4, the ducts 15, 16 for feeding to and withdrawing primary water from the storage and expansion unit 8, the 3-way valve 17 and a pair of delivery and return ducts 21, 22 connected to the secondary heat exchanger 7.

In accordance with the present invention, the above mentioned duct 22 is connected in a known manner to the duct 19 for returning the primary water to the heat exchanger 4.

In a preferred embodiment of the boiler, illustrated in figure 1, the fluid paths 14 and 20 are entirely supported within the vessel 2.

In accordance with a feature of the present invention, the primary water flow in each of the fluid paths 9, 14 and 20 is promoted by a variable-speed pump 23 of known type and incorporating a 3-way valve.

The primary water flow is also directed towards one or the other of the parallel fluid paths 14 and 20 provided inside the boiler by means of the 3-way valve 17 as will be clarified in more detail hereinbelow.

More specifically, the 3-way valve 17 is driven in a known manner by an actuator 31, incorporating a flow sensor, mounted on a duct 24 provided for feeding cold sanitary water taken from the water mains to the secondary heat exchanger 7.

Reference numeral 25 indicates a duct extending from the secondary heat exchanger 7 and designed for delivering hot sanitary water to the users.

In a manner equivalent to that set forth for the ducts 12 and 13, the above mentioned ducts 24 and 25 are also equipped with fittings of conventional type - not shown - for connection with an external system for distribution of the hot sanitary water to the users which system is in turn equipped with corresponding fittings, also not shown, designed to be inserted in a water-tight manner thereon.

In accordance with a preferred embodiment, the storage and expansion unit 8 for hot primary water comprises a tank 26 in which is conventionally supported a membrane 27 of the so-called bag type.

In accordance with the present invention, in the membrane 27, provided for compensating the thermal expansion of the primary water, a zone 28 is defined for storing a predetermined quantity of hot primary water temperature of which is constantly measured and controlled by a thermostat 30 of conventional type.

Between the membrane 27 and the tank 26 is also defined a variable-volume airspace 29 including air, optionally under pressure, or another appropriate gas.

The operation of the boiler 1 described above is as follows.

In the absence of any sanitary water withdrawal and in space heating mode, the pump 23 promotes circulation of the fluid from the duct 13 to the duct 10 for water delivery to the primary heat exchanger 4 and cuts off the duct 19 while the 3-way valve 17 closes the duct 16.

In accordance with this operating mode, the hot primary water circulates exclusively in the fluid path 9 so as to give away to the radiant elements 6 part of the heat supplied thereto by the primary heat exchanger 4.

In the absence of any sanitary water withdrawal, furthermore, the temperature of the hot primary water accumulated in the unit 8 is kept at a constant value thanks to the intervention of the thermostat 30.

Whenever the temperature of the stored water falls below a preset thresold value, this thermostat drives the burner of the boiler so as to deliver the maximum thermal power to the primary heat exchanger 4, stops any fluid flow in the path 9 by means of the pump 23 and switches the 3-way valve 17 on so as to allow a primary water flow from the duct 16 to the duct 18.

In this way, the primary water flows only in the fluid path 14 and by-passes both the radiant elements 6 and the secondary heat exchanger 7.

As soon as hot water for sanitary use is drawn, the actuator 31 incorporating the flow sensor drives the pump 23 and the 3-way valve 17 so as to allow a primary water flow from the duct 16 to the duct 21, i.e. from the storage and expansion unit 8 to the secondary heat exchanger 7 and therefrom to the primary heat exchanger 4.

In this operating mode, therefore, the primary water flows exclusively in the fluid path 20 while by-passing the radiant elements 6.

In this way, the hot primary water stored in the unit 8 is immediately sent to the secondary heat exchanger 7 where it releases its heat to the cold water drawn from the water mains and thus allows quick delivery of hot water from the boiler 1.

In accordance with the present invention, the primary water heated by the primary heat exchanger 4 is fed by the pump 23 to the unit 8 in order to replace the stored hot water delivered to the secondary heat exchanger 7.

In accordance with an advantageous feature of the present invention, by adjusting the flow rate delivered by the pump 23 it is possible to withdraw from the unit 8 the minimum quantity of hot primary water necessary to reach the desired temperature level of the sanitary water.

Advantageously, this adjustment may be performed by means of a thermostat, not shown, provided on the duct 25 and which regulates the flow rate delivered by the pump 23 and, optionally, also the thermal power delivered by the burner to the primary heat exchanger 4.

When the sanitary water witdrawal is terminated and depending upon the temperature detected by the thermostat 30, the boiler returns to the pre-existing operating conditions or accumulates new hot primary water in the unit 8 as disclosed hereinabove.

Understandably, in all the operating modes described the unit 8, in addition to fulfilling the important function of heat accumulator able to supply ready-to-use hot water to the secondary heat exchanger 7, compensates all the thermal expansions/contractions of the primary water thus ensuring a correct operation of the boiler 1.

In each of the above mentioned operating modes the burner of the primary heat exchanger 4 and/or the pump 23 are started - by known procedures - if and when they are in stand-by status.

In accordance with a second embodiment of the invention, shown in figure 2, the boiler 1 allows a prompt delivery of hot sanitary water with spaces reduced to a minimum even when the storage and expansion unit 8 is installed outside of the vessel 2.

In another embodiment of the boiler 1, not shown, both the storage and expansion unit 8 and the secondary heat exchanger 7 with associated inlet and outlet ducts may be installed outside of the vessel 2.

These additional variants allow - where required - installation in separate rooms of the boiler vessel and the unit 8 and, optionally, of the secondary heat exchanger 7 and achieve, even if to a lesser degree, the desired reduction of the overall size of the boiler.

From the above description and discussion the several advantages achieved by the present invention are evident.

From a functional viewpoint, the boiler of the present invention allows to achieve, in addition to a prompt delivery of hot sanitary water with waiting times reduced to a minimum, a gradual and in any case reduced use of the primary water stored in the storage and expansion unit 8.

The boiler of the present invention thus allows an optimal use of the accumulated heat which can be metered to face in an extremely flexible and durable manner the most varied requirements of hot sanitary water withdrawals.

Integrating the storage and expansion functions in the same unit also allows to obtain the desired prompt delivery of hot sanitary water while using a boiler of extremely small size and weight.

In a preferred embodiment, the size of the boiler is reduced to a minimum by incorporating the storage and expansion unit 8 inside the boiler vessel.

Advantageously, furthermore, the airspace 29 between the bag membrane 27 and the tank 26 contributes to the thermal insulation of the membrane 27, thus allowing to reduce and in some cases to eliminate the insulation layers normally provided on the outer surface of the accumulation tanks of the prior art.

By integrating the storage and expansion functions in a single structure, the unit 8, the further considerable advantage of a "self-regulation" of the primary water storing capacity in the membrane 27 is achieved.

In winter, when the primary water reaches its maximum temperature and hence also its maximum volumetric expansion, the storage capacity in the zone 28 is at its highest level and thus allows ample compensation for the heat loss in the various ducts.

Conversely, in summer when the boiler 1 operates in the mode of hot sanitary water delivery and the primary water falls to the lowest degree of volumetric expansion, the storage capacity in the zone 28 is at its lowest level and in perfect alignment with the lesser thermal inertia of the secondary heat exchanger 7 and the lesser heat loss due to the various ducts.

Claims

1. Boiler, in particular of the so-called combined type, comprising a first gas-water heat exchanger (4) for producing hot primary water for space heating, said heat exchanger (4) being in heat exchange relationship, through a primary piping system (5), with a second water-water heat exchanger (7) for producing hot sanitary water,
characterized in that it comprises in said primary piping system (5) a storage and expansion unit (8) for said hot water for space heating, means being provided for putting said unit (8) in fluid communication with said second water-water heat exchanger (7).

2. Boiler according to claim 1, characterized in that said storage and expansion unit (8) for hot primary water is placed between said first gas-water heat exchanger (4) and said second water-water heat exchanger (7).

3. Boiler according to claim 1, characterized in that said unit (8) comprises a tank (26) for storage and expansion of said hot primary water.

4. Boiler according to claim 3, characterized in that said tank (26) comprises a bag membrane (27) in which a storage zone (28) for said hot primary water is defined.

5. Boiler according to claim 1, characterized in that said means for putting said storage and expansion unit (8) for the hot primary water in fluid communication with said second water-water heat exchanger (7), comprises at least one duct (16, 21) having respective valve means (17).

6. Boiler according to claim 5, characterized in that said valve means (17) are driven by an actuator (31), incorporating a flow detector, mounted on a duct (24) for feeding cold sanitary water to said second water-water heat exchanger (7).

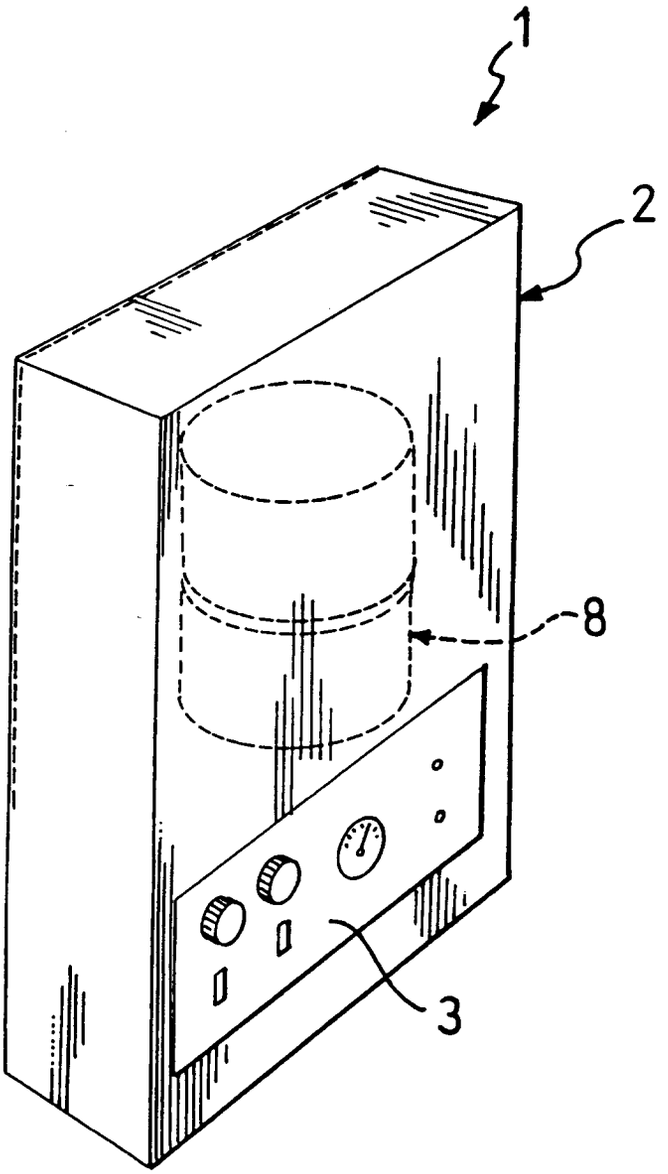

FIG.1

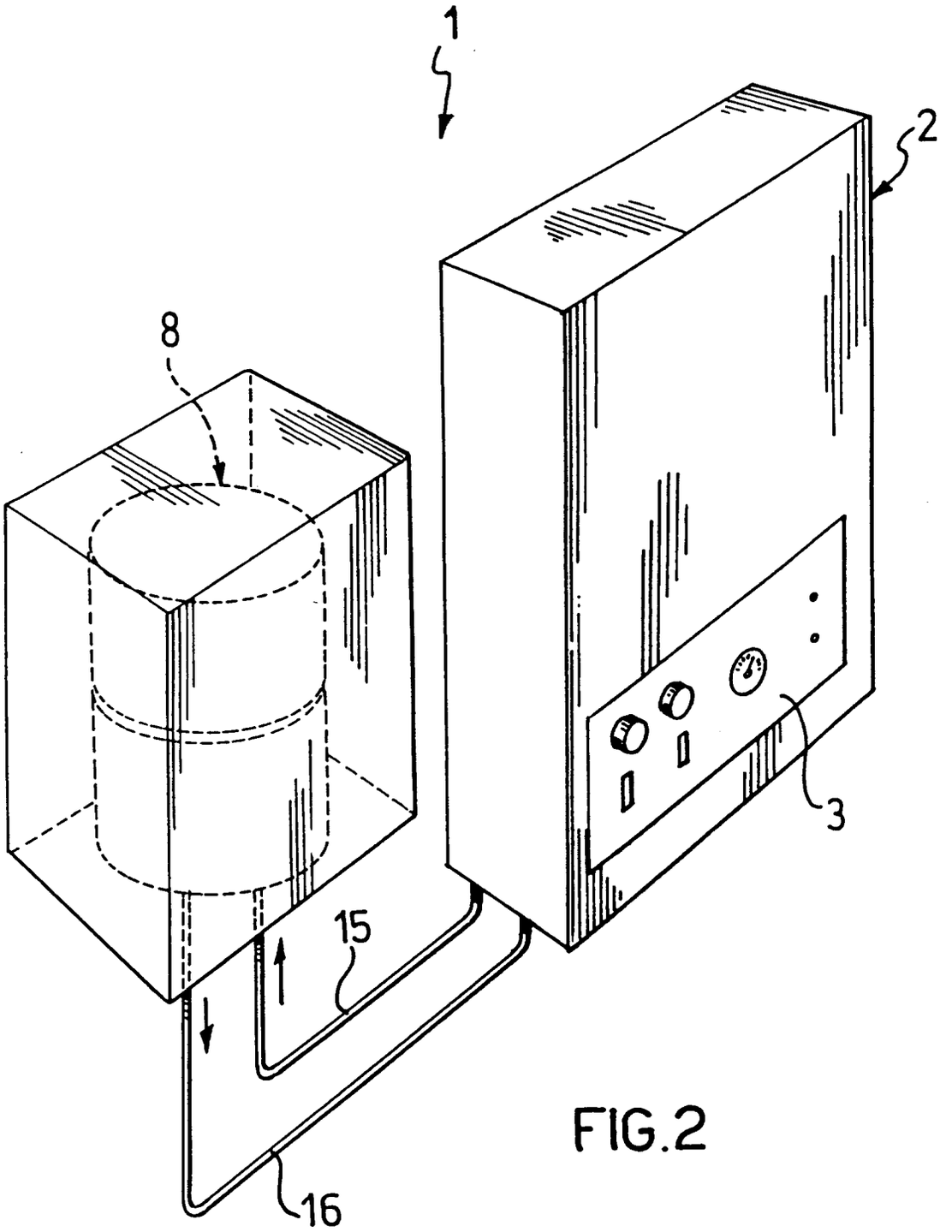

FIG.2

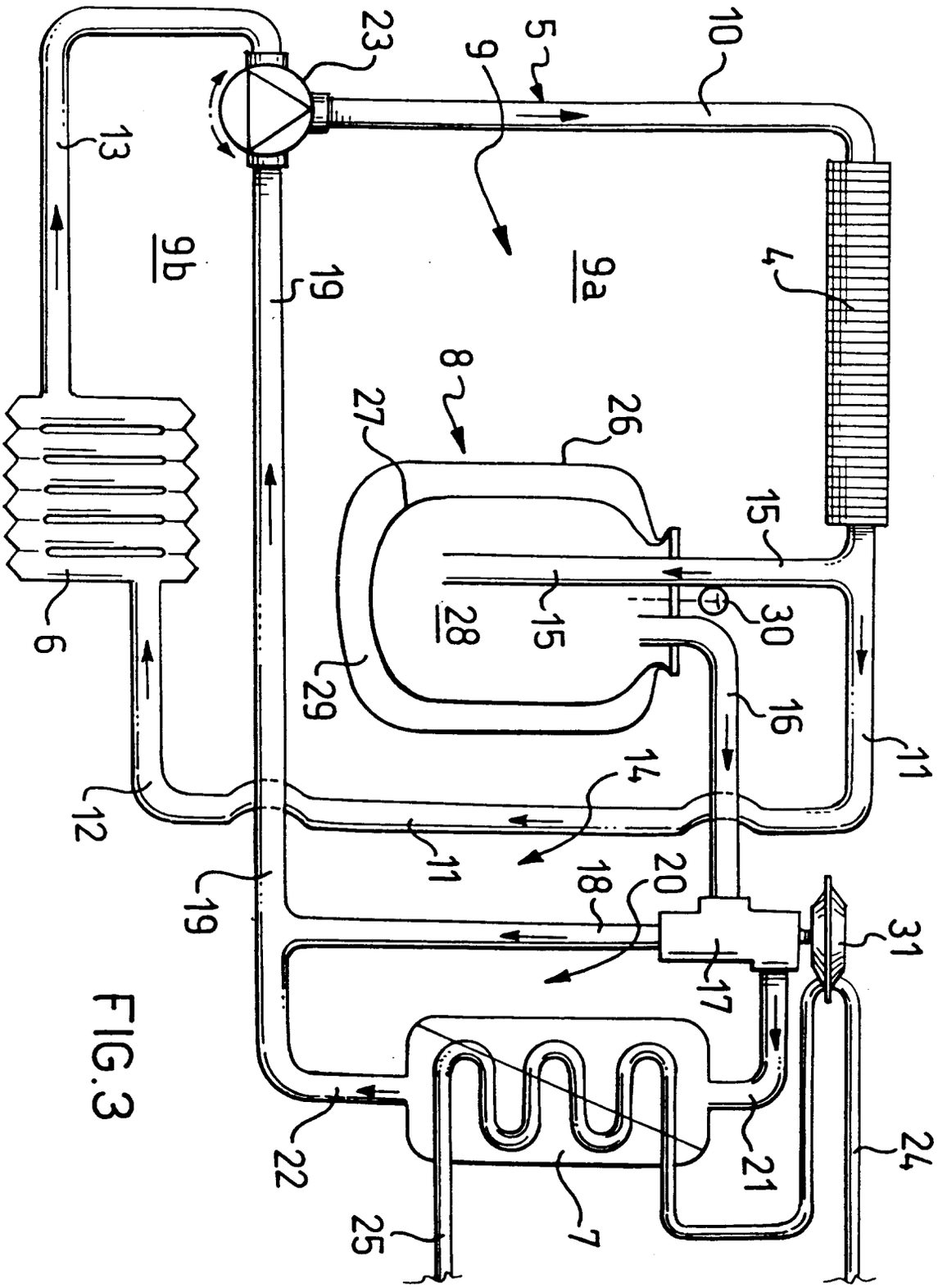
23
5
9
10
13
9b
9a
4
19
8
27
26
15
28
15
30
6
29
16
11
14
12
11
20
18
19
31
17
22
21
24
25
7

FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 1798

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.6)
X	DE-U-91 15 237 (JOH. VAILLANT GMBH U. CO.) 6 February 1992 * the whole document *	1-5	F24D3/08 F24D3/10
Y	---	6	
Y	GB-A-2 262 593 (INTER ALBION LIMITED) 23 June 1993 * abstract *	6	
A	---	1-5	
A	DE-A-42 36 967 (JOH. VAILLANT GMBH U. CO.) 6 May 1993	1-6	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F24D
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 October 1995	Van Gestel, H

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)