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(54) **STORAGE TYPE HOT WATER SUPPLY DEVICE**

(57) To provide a hot water storage type hot water supply device that is capable of controlling a drop in energy efficiency even while activating a relief valve in the same manner as conventionally.

A heat exchange component (3) for a tub and pump (12) are installed in a bypass path (41). A relief valve (43) is connected to the bypass path (41), and energy loss is controlled by releasing cold water and not high-temperature hot water. A communication path (46) that bypasses a narrow component (44) and an air reservoir component (45) and allows an upper portion of a hot water storage tank (2) and the bypass path (41) to be communicated with each other is disposed, and a check valve (47) is installed in the communication path (46). The check valve (47) is configured such that it is not opened by differential pressure stemming from convection leading from the upper portion of the hot water storage tank (2) through the bypass path (41) to a bottom portion of the hot water storage tank (2) and such that it is opened by differential pressure generated by the driving of the pump (12), so that convection loss is prevented.

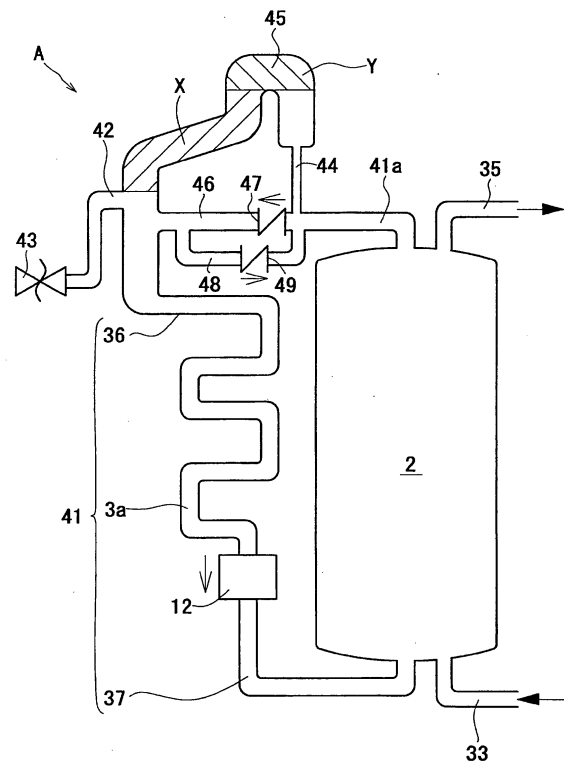


FIG. 1

Description

TECHNICAL FIELD

[0001] This invention relates to a hot water storage type hot water supply device.

BACKGROUND ART

[0002] FIG. 5 is a configural diagram showing embodiments of a hot water storage type hot water supply device of this invention, but the prior art will be described with reference to this diagram. The hot water storage type hot water supply device is, as shown in the same diagram, equipped with a heat pump unit 1 that serves as one example of a heating component, a hot water storage tank 2 that stores warm water that has been heated by the heat pump unit 1, a heat exchange component 3 for reheating that exchanges heat between the warm water that has been supplied from the hot water storage tank 2 and hot water inside a tub 4, and a control device 10.

[0003] One end of a pipe 31 is connected to an input side of the heat pump unit 1, and the other end of the pipe 31 is connected to a lower side of the hot water storage tank 2. Meanwhile, one end of a pipe 32 is connected to an output side of the heat pump unit 1, and the other end of the pipe 32 is connected to an upper side of the hot water storage tank 2. A pump 11 is installed in the pipe 31, and the warm water (or water) inside the hot water storage tank 2 is circulated by the pump 11 via the pipe 31, the heat pump unit 1 and the pipe 32.

[0004] Further, a water supply pipe 33 is connected to the lower side of the hot water storage tank 2, and one end of a water supply pipe 34 is connected to that water supply pipe 33. The other end of this water supply pipe 34 is connected to one input of a mixing valve 25, and the other input of the mixing valve 25 is connected to the upper side of the hot water storage tank 2 via a hot water supply pipe 35.

[0005] Further, the upper side of the hot water storage tank 2 and a primary upper side connection port on an upper side of the heat exchange component 3 are interconnected via a pipe 36, and the lower side of the hot water storage tank 2 and a primary lower side connection port on a lower side of the heat exchange component 3 are interconnected via a pipe 37. The primary upper side connection port and the primary lower side connection port are communicated with a primary flow path in the heat exchange component 3. A pump 12 is installed in the pipe 37, and the warm water inside the hot water storage tank 2 is circulated by the pump 12 via the pipe 36, the heat exchange component 3 and the pipe 37.

[0006] Further, a secondary lower side connection port on the lower side of the heat exchange component 3 and a circulation opening 20 in the tub 4 are interconnected via a pipe 38, and a secondary upper side connection port on the upper side of the heat exchange component 3 and the circulation opening 20 in the tub 4 are inter-

connected via a pipe 39. The secondary lower side connection port and the secondary upper side connection port are communicated with a secondary flow path in the heat exchange component 3. A pump 13 is installed in the pipe 38, and the hot water inside the tub 4 is circulated by the pump 13 via the pipe 38, the heat exchange component 3 and the pipe 39. Because the hot water inside the tub 4 circulates via the secondary side of the heat exchange component 3, the hot water inside the tub 4 is heated by heat exchange with the warm water that is supplied from the inside of the hot water storage tank 2.

[0007] In the pipe 38, there are disposed a water level sensor 21 that serves as one example of a hot water quantity sensor that detects the water level inside the tub 4 and a temperature sensor 22 for detecting the temperature of the hot water inside the tub 4.

[0008] Further, one end of a hot water supply pipe 40 is connected to an outlet of the mixing valve 25, and the other end of that hot water supply pipe 40 is connected to the pipe 39. In the hot water supply pipe 40, there are disposed a flow rate sensor 23 for detecting the quantity of the hot water supply and a temperature sensor 24 for detecting the temperature of the hot water supply. A warm water supply component is configured by the water supply pipes 33 and 34, the mixing valve 25 and the hot water supply pipes 35 and 40. The warm water inside the hot water storage tank 2 is pushed up by the water supply from the water supply pipe 33, and high-temperature water in the upper portion inside the hot water storage tank 2 is pushed out and supplied from the hot water supply pipe 35.

[0009] Although it is not shown, the heat pump unit 1 is equipped with a refrigerant circuit in which a compressor, a condenser (water heater), expansion means and an evaporator are annularly connected, and the warm water that has been circulated by the pump 11 is heated utilizing heat that is generated by the condenser. In this embodiment, the temperature of the high-temperature water that is supplied to the upper portion inside the hot water storage tank 2 by the heat pump unit 1 is set to 80°C.

[0010] Additionally, in this hot water supply device, a relief valve is disposed in the top portion of the hot water storage tank 2 in order to prevent the warm water from expanding at the time of boiling operation and the internal pressure of the hot water storage tank 2 from rising. Further, an air purge valve for purging stored air is attached in the vicinity of the top portion of the hot water storage tank 2 (e.g., see patent documents 1 and 2).

Patent Document 1: JP-A No. 2001-263791

Patent Document 2: JP-A No. 08-219555

DISCLOSURE OF THE INVENTION

<Technical Problem>

[0011] Incidentally, when a relief valve is attached to

the top portion of the hot water storage tank 2 as in the above-described hot water supply device, the high-temperature hot water that is stored in the upper portion of the hot water storage tank 2 becomes sprayed out to the outside by activation of the relief valve. Additionally, because the high-temperature hot water is sprayed out to the outside and lost in this manner, there is needless energy expenditure in the hot water storage tank 2, which resultingly leads to a drop in energy efficiency at the time of hot water boiling.

[0012] This invention has been made in order to solve this conventional defect, and it is an object thereof to provide a hot water storage type hot water supply device that is capable of controlling a drop in energy efficiency even while activating a relief valve in the same manner as conventionally.

<Solution to the Problem>

[0013] Thus, a hot water storage type hot water supply device of claim 1 is a hot water storage type hot water supply device that heats and stores, as high-temperature hot water, low-temperature water inside a hot water storage tank 2, wherein a bypass path 41 that interconnects an upper portion and a lower portion of the hot water storage tank 2 is configured, and pressure relieving means 43 is connected to this bypass path 41.

[0014] Further, in a hot water storage type hot water supply device of claim 2, a high component positioned in a higher position than a top portion of the hot water storage tank 2 is disposed in the bypass path 41, the high component is configured by an air reservoir component 45, and a valve attachment opening 42 communicated with the pressure relieving means 43 is disposed in the high component or in the vicinity thereof. In this case, it is preferable, like in claim 3, for the valve attachment opening 42 communicated with the pressure relieving means 43 to be disposed in a higher position than the top portion of the hot water storage tank 2.

[0015] In a hot water storage type hot water supply device of claim 4, a narrow component 44 whose flow path area is smaller than the flow path area of the other portions of the bypass path 41 is formed in the bypass path 41 between the air reservoir component 45 and the upper portion of the hot water storage tank 2.

[0016] In a hot water storage type hot water supply device of claim 5, a heat exchange component 3 for heating hot water inside a tub 4 and a pump 12 are installed in the bypass path 41, a communication path 46 that bypasses the narrow component 44 and the air reservoir component 45 and allows the upper portion of the hot water storage tank 2 and the bypass path 41 to be communicated with each other is disposed in the bypass path 41, backflow preventing means 47 is installed in this communication path 46, and this backflow preventing means 47 is configured such that it is not opened by differential pressure stemming from convection leading from the upper portion of the hot water storage tank 2 through the

bypass path 41 to a bottom portion of the hot water storage tank 2 and such that it is opened by differential pressure generated by the driving of the pump 12.

[0017] In a hot water storage type hot water supply device of claim 6, a second communication path 48 that bypasses the front and back of the backflow preventing means 47 is disposed, and second backflow preventing means 49 that allows air to flow from the pressure relieving means 43 to the upper portion of the hot water storage tank 2 is installed in this second communication path 48.

[0018] In a hot water storage type hot water supply device of claim 7, a heat exchange component 3 for heating hot water inside a tub 4 and a pump 12 are installed in the bypass path 41, backflow preventing means 47 is installed in the bypass path 41 in a position closer to the upper portion of the hot water storage tank 2 than the heat exchange component 3, and this backflow preventing means 47 is configured such that it is not opened by differential pressure stemming from convection leading from the upper portion of the hot water storage tank 2 through the bypass path 41 to a bottom portion of the hot water storage tank 2 and such that it is opened by differential pressure generated by the driving of the pump 12.

<Advantageous Effects of the Invention>

[0019] In the hot water storage type hot water supply device of claim 1, when the pressure inside the hot water storage tank 2 rises at the time of operation for boiling the hot water inside the hot water storage tank 2 and the pressure relieving means 43 is activated, low-temperature water inside the bypass path 41 is released to the outside. In this manner, high-temperature water is not released as has conventionally been the case, but rather low-temperature water is released, so heat release can be controlled and heat storage loss can be reduced.

[0020] According to the hot water storage type hot water supply device of claims 2 and 3, retained air is also released to the outside together with the low-temperature water, so it is not necessary to install an air purge device as has conventionally been the case, and device costs can be reduced.

[0021] In the hot water storage type hot water supply device of claim 4, release of the high-temperature hot water can be reliably controlled because the narrow component 44 is disposed, so device efficiency can be even more reliably improved.

[0022] In the hot water storage type hot water supply device of claim 5, the bypass path 41 also doubles as a configuration that is indispensable to the hot water storage type hot water supply device, so it becomes possible to significantly reduce device costs in comparison to when the bypass path 41 is configured completely separately. Further, natural convection traveling through the bypass path 41 of the high-temperature hot water inside the hot water storage tank 2 is prevented by the backflow preventing means 47 that is needed at that time, so in this respect also, it is possible to control the occurrence

of energy loss.

[0023] Further, in the hot water storage type hot water supply device of claim 6, air from the opposite side of the backflow preventing means 47—that is, from the pressure relieving means 43—is allowed to flow to the hot water storage tank 2, so when negative pressure arises inside the hot water storage tank 2, it becomes possible to improve air intake performance.

[0024] In the hot water storage type hot water supply device of claim 7, the bypass path 41 also doubles as a configuration that is indispensable to the hot water storage type hot water supply device, so it becomes possible to significantly reduce device costs in comparison to when the bypass path 41 is configured completely separately. Further, natural convection traveling through the bypass path 41 of the high-temperature hot water inside the hot water storage tank 2 is prevented by the backflow preventing means 47 that is needed at that time, so in this respect also, it is possible to control the occurrence of energy loss.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is an enlarged circuit diagram showing a relevant portion of a first embodiment of a hot water storage type hot water supply device of this invention;

FIG. 2 is an enlarged circuit diagram showing a relevant portion of a second embodiment of the hot water storage type hot water supply device of this invention;

FIG. 3 is an enlarged circuit diagram showing a relevant portion of a third embodiment of the hot water storage type hot water supply device of this invention;

FIG. 4 is an enlarged circuit diagram showing a relevant portion of a fourth embodiment of the hot water storage type hot water supply device of this invention; and

FIG. 5 is a total circuit diagram in the first, second and fourth embodiments of the hot water storage type hot water supply device of this invention.

EXPLANATION OF THE REFERENCE NUMERALS

[0026]

- 2 Hot Water Storage Tank
- 3 Heat Exchange Component
- 4 Tub
- 12 Pump
- 41 Bypass Path
- 42 Valve Attachment Opening
- 43 Relief Valve (Pressure Relieving Means)
- 44 Narrow Component
- 45 Air Reservoir Component

- 46 First Communication Path
- 47 First Check Valve (First Backflow Preventing Means)
- 48 Second Communication Path
- 49 Second Check Valve (Second Backflow Preventing Means)

BEST MODES FOR CARRYING OUT THE INVENTION

[0027] Next, specific embodiments of a hot water storage type hot water supply device of this invention will be described in detail with reference to the drawings. First, FIG. 1 is an enlarged water circuit diagram showing relevant portion A in FIG. 5. As shown in the same diagram, a bypass path 41 that interconnects the upper portion and the lower portion of the storage tank 2 is configured, and a valve attachment opening 42 is disposed in and a relief valve 43 is connected to this bypass path 41. Here, the relief valve 43 configures pressure relieving means, but the relief valve 43 should be understood as configuring part of the valve attachment opening 42. Additionally, in this case, the bypass path 41 is configured by the pipes 36 and 37 that are connected to the heat exchange component 3 and by an internal passage 3a in the heat exchange component 3. More specifically, the bypass path 41 is configured by an upper bypass path 41a that is connected to the upper portion (top portion) of the hot water storage tank 2, a narrow component 44, an air reservoir component 45, the pipe 36, the internal passage 3a in the heat exchange component 3, and the pipe 37 that is connected to the lower portion (bottom portion) of the hot water storage tank 2. That is, a high component positioned in a higher position than the top portion of the hot water storage tank 2 is disposed in the bypass path 41, this high component is configured by the air reservoir component 45, and the valve attachment opening 42 is disposed in the vicinity thereof (somewhat lower than the air reservoir component). In this case, the valve attachment opening 42 is disposed in a higher position than the top portion of the hot water storage tank 2. Further, the narrow component 44, whose flow path area is smaller than the flow path area of the other portions of the bypass path 41, is formed between the air reservoir component 45 and the upper bypass path 41a.

[0028] Here, to further describe the air reservoir component 45, in the air reservoir component 45, at the time of initial tank water supply, the inside of the pipe is close to atmospheric pressure, but air inside the pipe exists in portion X and moves to portion Y at the time of water supply completion because of flowing water pressure. At this time, the pressure is increased to the pressure of the relief valve 43 at a maximum, so the air volume is compressed, but it is necessary to retain air in portion Y in this state. For this reason, it is preferable to make the volume of portion X into a volume that is equal to or greater than 3 times the volume of portion Y in consideration of the ratio between atmospheric pressure and the set pressure of the relief valve 43.

[0029] A first communication path 46 that bypasses the narrow component 44 and the air reservoir component 45 and allows the upper bypass path 41a and the bypass path 41 (the passage 36) to be communicated is disposed in the bypass path 41, and a first check valve (first backflow preventing means) 47 is installed in this first communication path 46. This first check valve 47 is configured such that it is not opened by differential pressure stemming from convection leading from the upper portion of the hot water storage tank 2 through the upper bypass path 41 a and the bypass path 41 to the hot water storage tank 2 and such that it is opened by differential pressure generated by the driving of the pump 12. Here, "differential pressure stemming from convection" is a pressure difference arising because of a density difference between the inside of the hot water storage tank 2 and the inside of the bypass path 41, and the water density difference is a maximum of 3.6% in the range of 0 to 90°C, so when the height of the hot water storage tank 2 is set to about 2 m, the hydraulic head becomes about 72 mm (0.72 kPa).

[0030] Further, a second communication path 48 that bypasses the front and back of the first check valve 47 is disposed, and a second check valve (second backflow preventing means) 49 that allows air to flow from the pressure relieving means 43 to the upper portion of the hot water storage tank 2 is installed in this second communication path 48.

[0031] In the hot water storage type hot water supply device of the above-described embodiment, when the pressure inside the hot water storage tank 2 rises at the time of operation for boiling the hot water inside the hot water storage tank 2 and the relief valve 43 is activated, low-temperature water inside the bypass path 41 is released to the outside. In this manner, high-temperature water is not released as has conventionally been the case, but rather low-temperature water is released, so heat release can be controlled and heat storage loss can be reduced. As a result, device efficiency can specifically be raised about 3% (specific gravity reduction of from 15°C to 85°C). Further, retained air is also released to the outside together with the low-temperature water, so it is not necessary to install an air purge device as has conventionally been the case, and device costs can be reduced. Further, release of the high-temperature hot water can be reliably controlled because the narrow component 44 is disposed, so device efficiency can be even more reliably improved.

[0032] Further, the bypass path 41 is configured by the pipes 36 and 37 that are connected to the heat exchange component 3 and by the internal passage 3a in the heat exchange component 3, and the bypass path 41 also doubles as a configuration that is indispensable to the hot water storage type hot water supply device, so it becomes possible to significantly reduce device costs in comparison to when the bypass path 41 is configured completely separately. Further, natural convection traveling through the bypass path 41 of the high-temper-

ature hot water inside the hot water storage tank 2 is prevented by the first check valve 47 that is needed at that time. Consequently, in this respect also, it is possible to control the occurrence of energy loss. Moreover, air from the opposite side of the first check valve 47—that is, from the pressure relieving means 43—is allowed to flow to the hot water storage tank 2, so when negative pressure arises inside the hot water storage tank 2 (e.g., in the case of hot water supply from downstairs), air intake performance can be improved and damage to the tank 2 can be prevented.

[0033] FIG 2 shows a second embodiment. This is an embodiment where installation of the second communication path 48 and the second check valve 49 in the first embodiment are omitted. In this second embodiment, action and effects that are substantially the same as those in the first embodiment are obtained, with the exception of the item associated with negative pressure.

[0034] FIG. 3 shows a third embodiment. This is an embodiment where the bypass path 41 is disposed separately and completely independently of the bathtub heating circuit. In this case also, the action and effects of an improvement in energy efficiency resulting from outside release of low-temperature water and omission of installation of an air purge device become obtained.

[0035] FIG. 4 shows a fourth embodiment. This is an embodiment where, in the second embodiment, installation of the narrow component 44 and the air reservoir component 45 is omitted and part of the bypass path 41 is configured by the first communication path 46. In this embodiment, an air purge device 50 is needed, but action and effects that are substantially the same as those in the second embodiment are obtained, with the exception of the action and effects stemming from the air reservoir component 45. It will be noted that, in the second to fourth embodiments, components having the same functions as those in the first embodiment are represented by reference numerals that are the same as those in the first embodiment and description thereof is omitted.

Claims

1. A hot water storage type hot water supply device that heats and stores, as high-temperature hot water, low-temperature water inside a hot water storage tank (2), wherein a bypass path (41) that interconnects an upper portion and a lower portion of the hot water storage tank (2) is configured, and pressure relieving means (43) is connected to this bypass path (41).
2. The hot water storage type hot water supply device according to claim 1, wherein a high component positioned in a higher position than a top portion of the hot water storage tank (2) is disposed in the bypass path (41), the high component is configured by an air reservoir component (45), and a valve attachment

opening (42) communicated with the pressure relieving means (43) is disposed in the high component or in the vicinity thereof.

a bottom portion of the hot water storage tank (2) and such that it is opened by differential pressure generated by the driving of the pump (12).

3. The hot water storage type hot water supply device according to claim 2, wherein the valve attachment opening (42) communicated with the pressure relieving means (43) is disposed in a higher position than the top portion of the hot water storage tank (2). 5
10
4. The hot water storage type hot water supply device according to claim 2 or claim 3, wherein a narrow component (44) whose flow path area is smaller than the flow path area of the other portions of the bypass path (41) is formed in the bypass path (41) between the air reservoir component (45) and the upper portion of the hot water storage tank (2). 15
5. The hot water storage type hot water supply device according to claim 4, wherein a heat exchange component (3) for heating hot water inside a tub (4) and a pump (12) are installed in the bypass path (41), a communication path (46) that bypasses the narrow component (44) and the air reservoir component (45) and allows the upper portion of the hot water storage tank (2) and the bypass path (41) to be communicated with each other is disposed in the bypass path (41), backflow preventing means (47) is installed in this communication path (46), and this backflow preventing means (47) is configured such that it is not opened by differential pressure stemming from convection leading from the upper portion of the hot water storage tank (2) through the bypass path (41) to a bottom portion of the hot water storage tank (2) and such that it is opened by differential pressure generated by the driving of the pump (12). 20
25
30
35
6. The hot water storage type hot water supply device according to claim 5, wherein a second communication path (48) that bypasses the front and back of the backflow preventing means (47) is disposed, and second backflow preventing means (49) that allows air to flow from the pressure relieving means (43) to the upper portion of the hot water storage tank (2) is installed in this second communication path (48). 40
45
7. The hot water storage type hot water supply device according to claim 1, wherein a heat exchange component (3) for heating hot water inside a tub (4) and a pump (12) are installed in the bypass path (41), backflow preventing means (47) is installed in the bypass path (41) in a position closer to the upper portion of the hot water storage tank (2) than the heat exchange component (3), and this backflow preventing means (47) is configured such that it is not opened by differential pressure stemming from convection leading from the upper portion of the hot water storage tank (2) through the bypass path (41) to 50
55

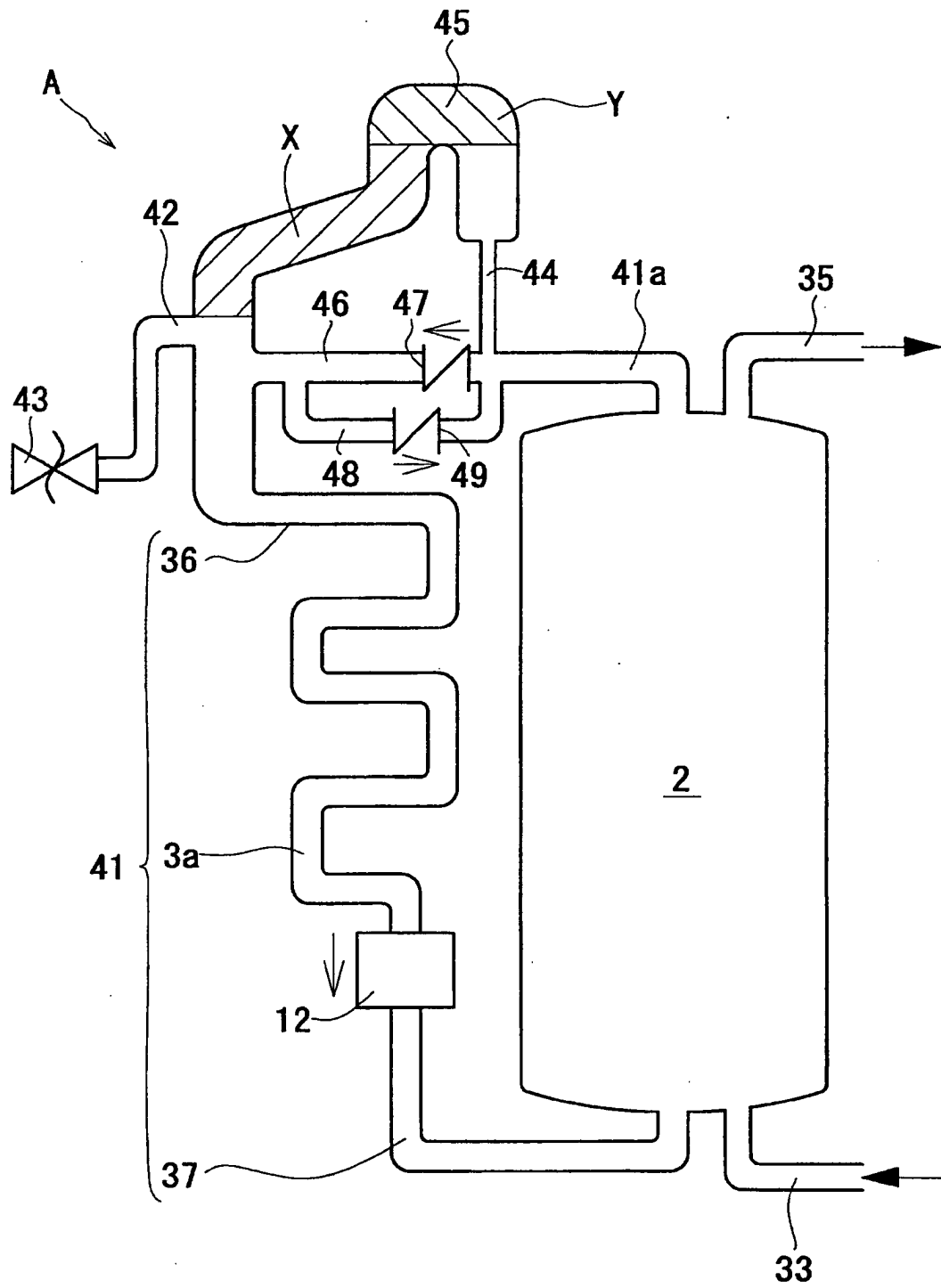


FIG. 1

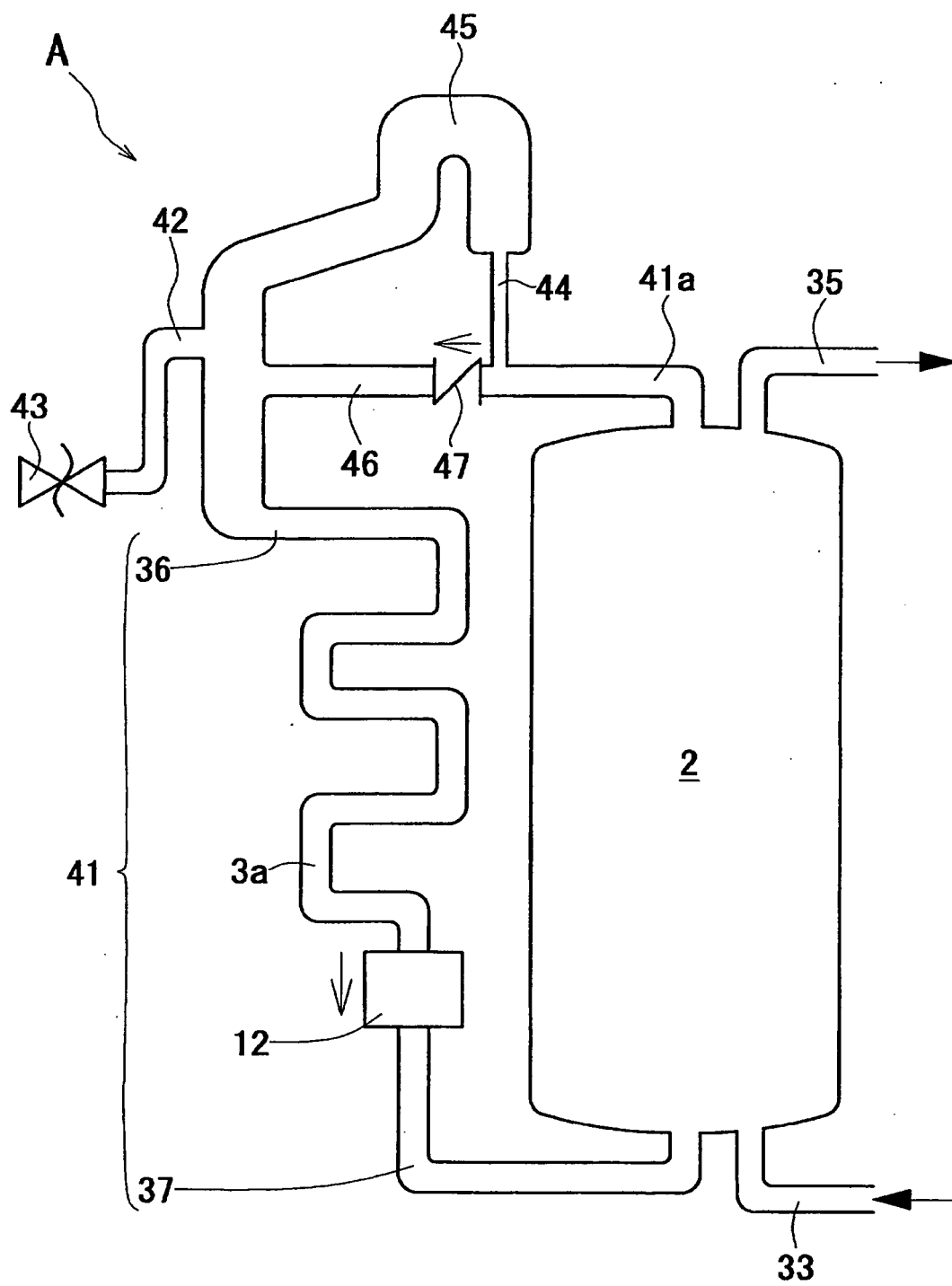


FIG. 2

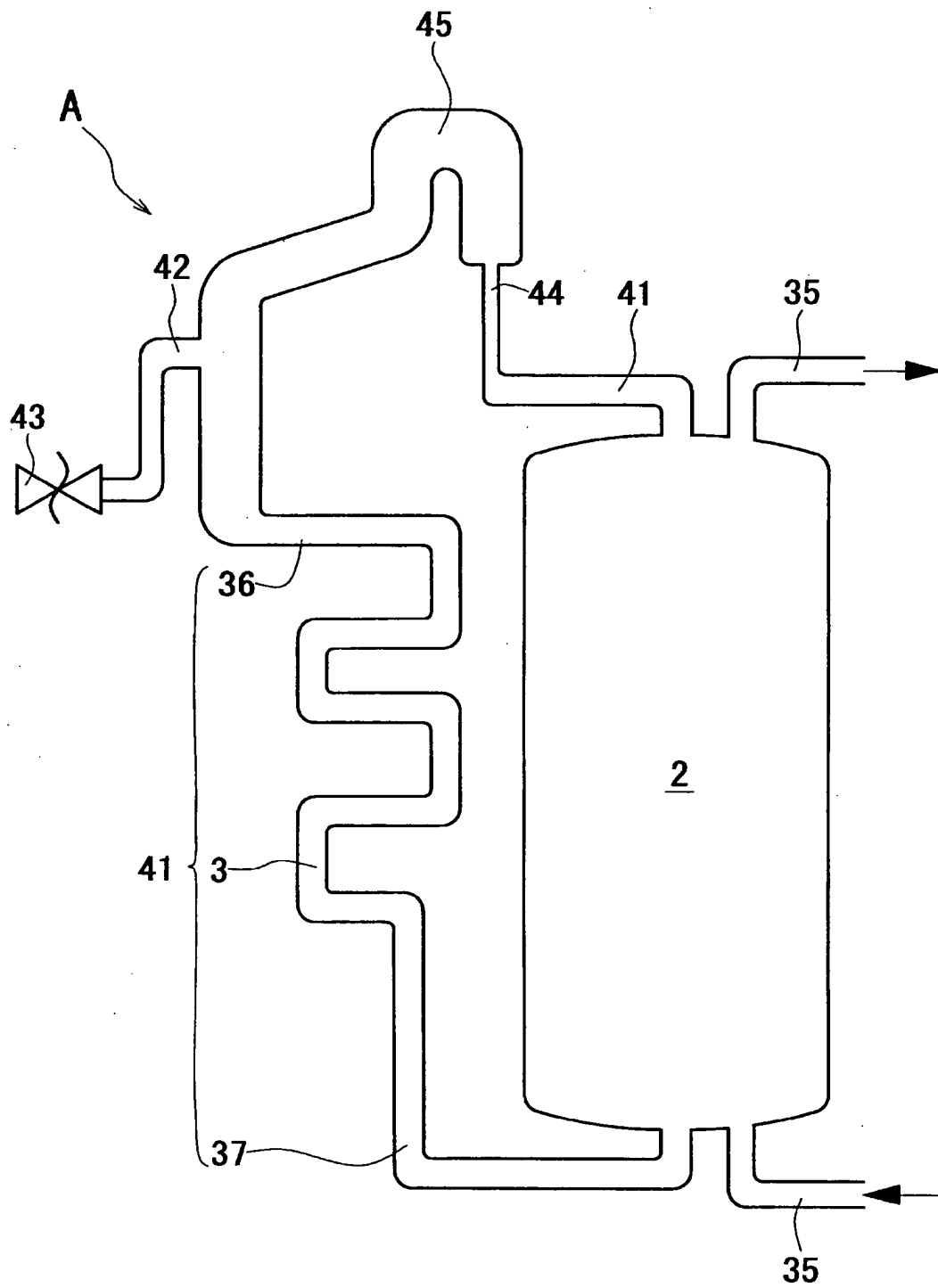


FIG. 3

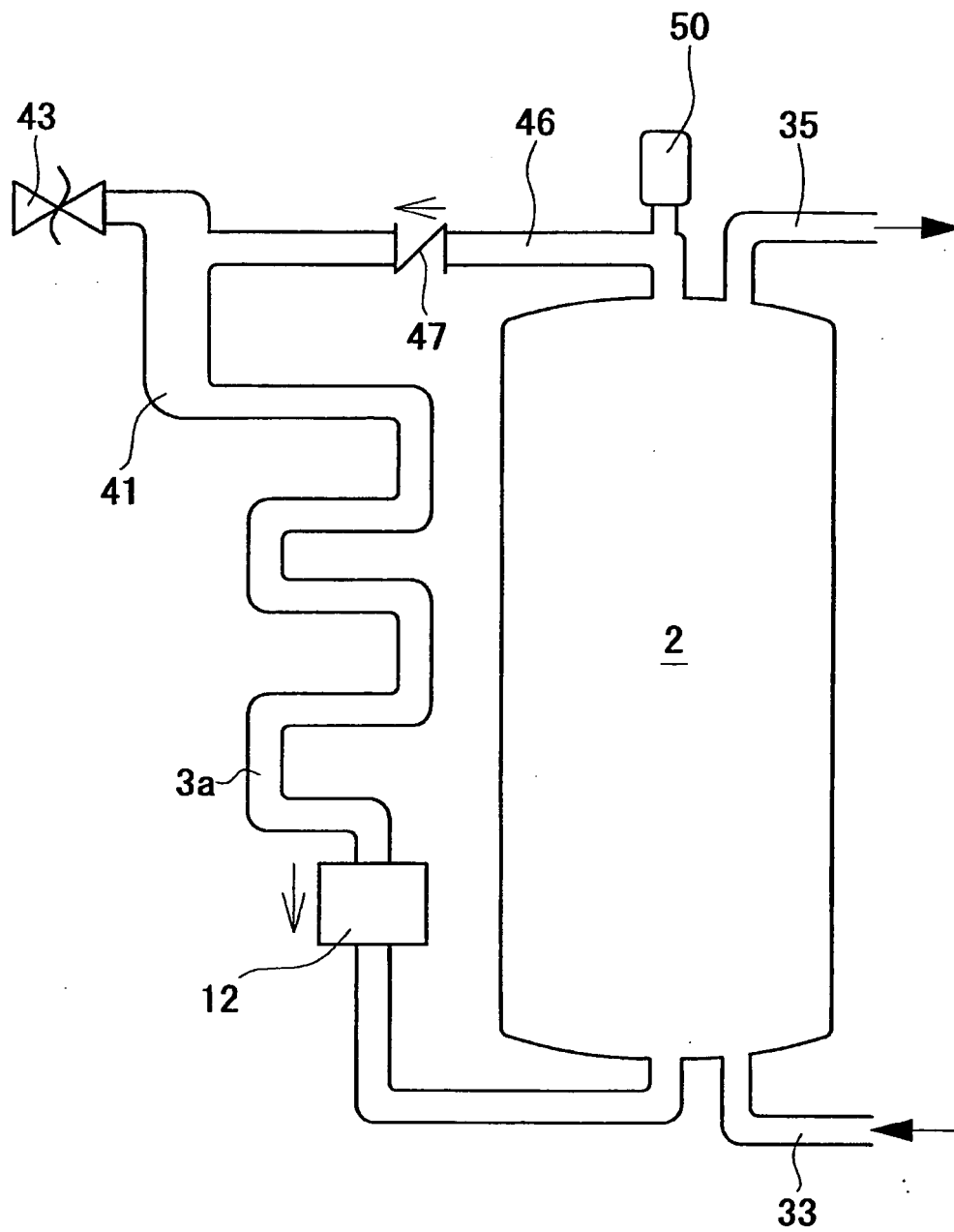
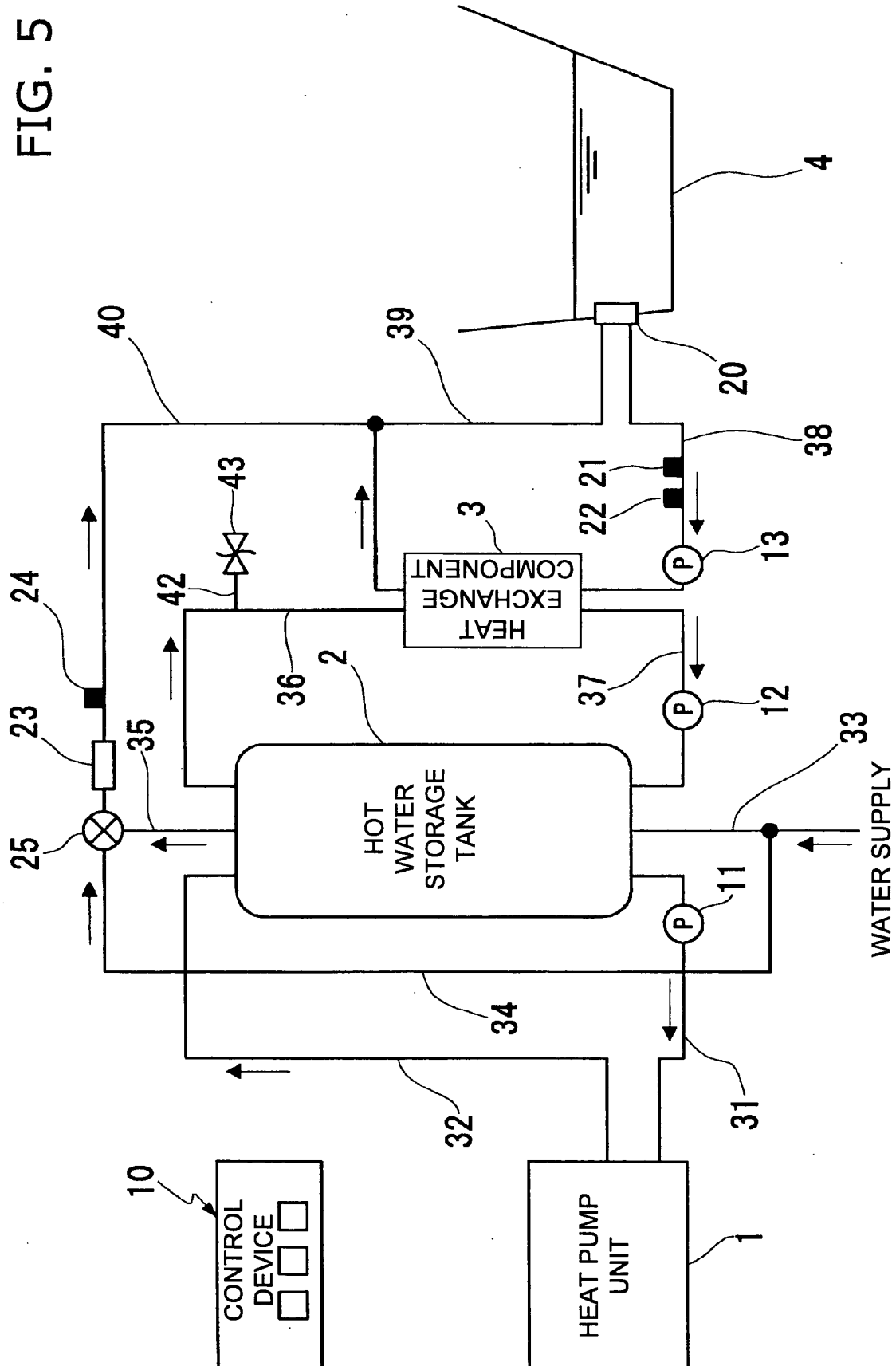


FIG. 4

FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/064857

A. CLASSIFICATION OF SUBJECT MATTER F24H1/18 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) F24H1/00, 1/18		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2008 Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 55-137448 A (Hashimoto Sangyo Co., Ltd.), 27 October, 1980 (27.10.80), Full text; Figs. 1 to 3 (Family: none)	1-4 5-7
Y A	JP 58-140552 A (Matsushita Electric Industrial Co., Ltd.), 20 August, 1983 (20.08.83), Page 2, lower left column, line 4 to lower right column, line 9; page 3, upper left column, lines 3 to 7; page 3, upper right column, lines 2 to 5; Fig. 1 (Family: none)	1-4 5-7
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 10 November, 2008 (10.11.08)		Date of mailing of the international search report 18 November, 2008 (18.11.08)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/064857

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 156326/1979 (Laid-open No. 74255/1981)	1-4
A	(Mitsubishi Electric Corp.), 17 June, 1981 (17.06.81), Description, page 3, lines 2 to 4; page 7, line 19 to page 8, line 2; Fig. 3 (Family: none)	5-7
A	JP 8-219555 A (Shiroki Corp.), 30 August, 1996 (30.08.96), Par. No. [0023]; Fig. 1 (Family: none)	1-7
A	JP 2002-195664 A (Nippon Electric Glass Co., Ltd.), 10 July, 2002 (10.07.02), Par. No. [0002]; Fig. 2 (Family: none)	1-7
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 142803/1975 (Laid-open No. 54948/1977) (Mitsubishi Electric Corp.), 20 April, 1977 (20.04.77), Full text; drawings (Family: none)	1-7

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REFERENCES CITED IN THE DESCRIPTION

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