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(72) Inventors:
• **KIM, Young Bum**
Incheon 406-110 (KR)
• **PARK, Su Dae**
Gwangmyeong-si
Gyeonggi-do 423-721 (KR)

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(74) Representative: **Witzany, Manfred**
Patentanwalt
Falkenstrasse 4
85049 Ingolstadt (DE)

(71) Applicant: **Kyungdong Navien Co., Ltd.**
Gyeonggi-do 450-818 (KR)

(54) **FREEZE PROTECTION METHOD FOR HEATING PIPE AND HOT WATER PIPE OF BOILER**

(57) The present invention relates to a freeze protection method of a gas boiler, which can prevent a heating pipe from freezing by using a heating water temperature sensor that is disposed in the boiler and can prevent a hot water pipe from freezing through the control of a three-way valve. The freeze protection method for a heating pipe and a hot water pipe of a boiler comprises the steps of: (a) converting the three-way valve (120) into a hot water mode and carrying out a combustion operation of the boiler, if the temperature of heating water falls below a preset freeze protection set temperature, and circulating the heating water through a closed loop including a circulation pump (140), a heating heat exchanger (110), the three-way valve (120) and a hot-water supply heat exchanger (130) by driving the circulation pump (140); and (b) converting the three-way valve (120) into a heating mode and performing an extinguishing operation of the boiler, if the temperature of the heating water is higher than a preset constant temperature, and circulating the heating water to the heating pipe (200) by the driving of the circulation pump (140). Accordingly, in addition to a freeze protection function for the heating pipe, freezing of the hot water pipe can be prevented, thereby overcoming the inconvenience of using hot water due to the freezing of the hot water pipe during winter. Also, since it is unnecessary to continuously carry out the combustion operation of the boiler in order to prevent the heating pipe and the hot water pipe from freezing, there is no significant difference in the amount of gas used when compared with existing freeze protection functions.

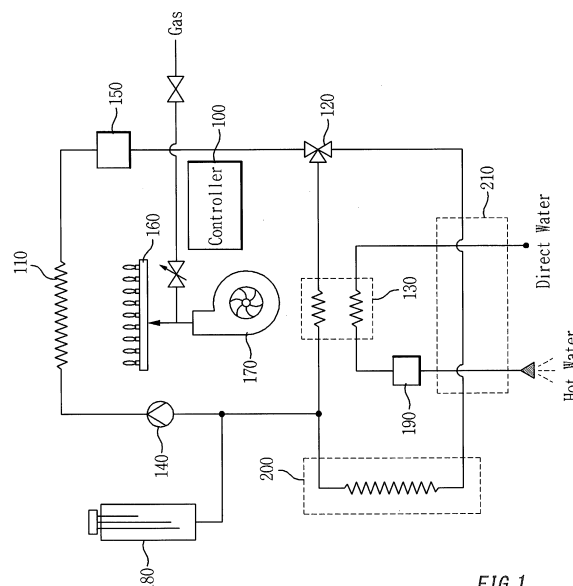


FIG. 1

Description

[Prior Art]

[TECHNICAL FIELD]

[Patent Literature]

[0001] The present invention relates to a freeze protection method for heating pipe and hot water pipe of a boiler, and, specifically, to a freeze protection method for heating pipe and hot water pipe of a boiler which can prevent a heating pipe from freezing by using a heating water temperature sensor that is disposed in the boiler and can also prevent a hot water pipe from freezing through the control of a three-way valve.

5 **[0005]** (Patent Literature 1) Korean Patent Application No. 10-2004-0037899

[DISCLOSURE OF INVENTION]10 **[TECHNICAL PROBLEM]**

[0006] The present invention has been made in view of the above information, and it is directed to a freeze protection method for heating pipe and hot water pipe of a boiler, which can prevent heating pipe from freezing by using a heating water temperature sensor that is disposed in the boiler and also prevent a hot water pipe from freezing through the control of a three-way valve.

20 **[TECHNICAL SOLUTION]**

[0007] The present invention, which aims to solve the above-described technical problem comprises, a controller comprising a single-chip microcomputer to control overall operation of the boiler, a heating water temperature sensor detecting temperature of the heating water within the boiler and inputting the information into the controller, a heating heat exchanger where heat exchange between heat energy supplied from the burner and the heating water occurs, a hot water supply heat exchanger where heat exchange between heating water and direct water occurs during operation of the hot water mode, a circulation pump accelerating heat exchange by circulating the heating water, and a three-way valve switching the boiler to a heating mode or a hot water mode according to the controller's control, characterized in that the controller switches the three-way valve to a hot water mode to prevent freezing of the hot water pipe if the temperature of the heating water detected by the heating water temperature sensor falls below the preset freeze protection temperature, and switches the three-way valve to a heating mode to prevent freezing of the heating pipe if the temperature of the heating water reaches the preset combustion stop temperature.

35 **[0008]** The freeze protection method for heating pipe and hot water pipe of a boiler comprises the steps of: (a) converting the three-way valve into a hot water mode and carrying out a combustion operation of the boiler via a controller's control, if the temperature of heating water falls below a preset freeze protection temperature, and circulating the heating water through a closed loop including a circulation pump, a heating heat exchanger, a three-way valve and a hot water supply heat exchanger by driving the circulation pump; and (b) switching the three-way valve into a heating mode and performing an extinguishing operation of the boiler via the controller's control, if the temperature of the heating water is higher than a preset combustion stop temperature, and circu-

[BACKGROUND OF THE INVENTION]

[0002] Referring to Figure 1 of a typical gas boiler, during heating, water flowing through the inner pipe is forcibly circulated by a circulation pump (140) and absorbs combustion heat of a burner (160) at a heating heat exchanger (110) such that its temperature increases and then it is supplied to a heating pipe (200) by the operation of a three-way valve (120) to be used for internal heating, while during hot water use the circulation pump (140) circulates the water flowing through the inner pipe in order to supply heat absorbed at the heating heat exchanger (110) to a hot water supply heat exchanger (130) such that direct water flowing into the direct water inlet absorbs the heat retained by the hot water supply heat exchanger (130), thereby supplying hot water through the hot water outlet.

[0003] Such a boiler has a freeze protection function in which the temperature of the internal pipe water is detected through a heating water temperature sensor (150) when one is away, and if temperature of the water flowing through the inner pipe drops below the freeze protection set temperature, that is, the set temperature at which the boiler automatically operates in order to prevent freezing of the boiler when temperature of the water in the pipe drops below a certain temperature, the controller (100) operates the boiler to increase temperature of the internal pipe water as well as to circulate this water through the heating pipe (200), and the boiler is stopped if the detected temperature is above the specific set temperature.

[0004] This conventional freeze protection function aims only at freeze protection of the heating pipe in consideration of the low insulation effect of the existing buildings, however recent buildings have improved external insulation effect which reduces risk of the heating pipe freezing. In contrast, freezing of the hot water pipe frequently occurs during cold weather in winter even when lagging material is applied thereon, which increases inconveniences in using hot water. Thus, there is an emerging need to prevent freezing of the hot water pipe.

lating the heating water through the heating pipe by the driving of the circulation pump.

[0009] In addition, preferably, it may include a further step of stopping operations of the circulation pump and the boiler if a preset certain amount of time has passed after the extinguishing operation.

[0010] It is preferable to set the preset combustion stop temperature for switching the three-way valve to the heating mode at a maximum temperature that can be raised in the closed loop including the circulation pump, the heating heat exchanger, the three-way valve and the hot water supply heat exchanger.

[ADVANTAGEOUS EFFECTS]

[0011] Using the freeze protection method for heating pipe and hot water pipe of a boiler according to the present invention, freezing of the heating pipe as well as freezing of the hot water pipe can be prevented in advance, and the inconvenience of using hot water during winter due to the freezing of the hot water pipe can be overcome.

[0012] In addition, since it is unnecessary to continuously carry out the combustion operation of the boiler in order to prevent the heating pipe and the hot water pipe from freezing, there is no significant difference in the amount of gas used when compared with existing freeze protection functions.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0013]

FIG. 1 is a schematic diagram showing the operation of a typical gas boiler.

FIG. 2 is a flow diagram showing the freeze protection method for heating pipe and hot water pipe of a boiler according to the present invention.

[DESCRIPTION OF THE PREFERRED EMBODIMENTS]

[0014] Hereinafter, preferred embodiment of the present invention will be described with reference to the accompanying drawings. The embodiment of the present invention can be modified into various forms, and it should be understood that the scope of present invention is not limited to the embodiments whose detailed description is provided below. The following embodiments are given to provide a more detailed description of the preset invention to those skilled in the art. Therefore, shapes of the elements, etc. may be exaggerated in the drawings for a clearer understanding of the description. Identical or corresponding elements in each drawing may be designated with same reference signs. In addition, description of known functions or configurations determined to hinder understanding of the present invention are omitted.

[0015] Hereafter, an exemplary embodiment of the freeze protection method for heating pipe and hot water pipe of a boiler of the present invention will be described in detail with reference to the accompanying drawings.

[0016] FIG. 1 is a schematic diagram showing the operation of a typical gas boiler.

[0017] First, configuration of a boiler where the freeze protection method for heating pipe and hot water pipe of a boiler of the present invention can be used will be described with reference to FIG. 1.

[0018] The controller (100), which comprises a single-chip microcomputer to control overall operation of the boiler, not only controls the ignition device to allow operation of the boiler and detects ignition state of the flame detection sensor to carry out safety control such as stopping gas supply during non-ignition, but also receives boiler state information from various sensors through the sensor input unit for optimal control of the boiler in order to carry out optimal control in consideration of the operation state of the boiler and the external environment. In particular, according to the present invention, the heating pipe and the hot water pipe can be prevented from freezing by receiving the heating water temperature detected at the heating water temperature sensor (150) and comparing this with the preset temperature to control the three-way valve (120).

[0019] In the heating heat exchanger (110) heat energy received from the burner, which is at ignition state, is used to carry out heat exchange with the heating water, and in the hot water supply heat exchanger (130) heat exchange occurs between the heating water and the direct water when heating mode is operated for the boiler.

[0020] The three-way valve (120) is controlled by the controller (100) so that the boiler can be operated in heating mode or hot water mode. When the boiler operates in heating mode, the heating water heated at the heating heat exchanger (110) is supplied to the heating pipe (200) through the three-way valve (120) by the operation of the circulation pump (140), returned again, and recirculates by passing through the expansion tank (180). On the other hand, when the boiler operates in hot water mode, heating water circulates through a closed loop including the heating heat exchanger (110), the three-way valve (120), the hot water supply heat exchanger (130), and the circulation pump (140).

[0021] FIG. 2 is a flow diagram showing the freeze protection method for heating pipe and hot water pipe of a boiler according to the present invention. Hereafter, the freeze protection method for heating pipe and hot water pipe of a boiler of the present invention will be described in detail with reference to FIG. 2.

[0022] In case the boiler is set to Away Mode by the user, the controller (100) first stops the boiler. That is, the fuel supplied to the burner (160) is blocked to stop combustion, and operation of the circulation pump (140) is stopped to stop circulation of the water in both the boiler and the heating pipe (200).

[0023] In this state, the controller (100) regularly

checks the temperature detected by the heating water temperature sensor (150) to compare it with the preset freeze protection temperature. Here, it is generally preferable to set the preset freeze protection temperature to a temperature at which the water in the pipe can freeze.

[0024] After comparing the above temperatures, if temperature of the heating water is higher than the freeze protection set temperature, temperature of the heating water is continuously checked, and if the temperature of the heating water is lower than the freeze protection set temperature, the controller (100) switches the three-way valve (120) to a hot water mode and supplies fuel to the burner (160) for combustion in order to create heat and also operates the circulation pump (140) so that the heating water absorbs heat at the heating heat exchanger (110) thereby increasing temperature of the heating water, and the heated heating water circulates through a closed loop including the circulation pump (140), the heating heat exchanger (110), the three-way valve (120), and the hot water supply heat exchanger (130).

[0025] At this time, in the hot water supply heat exchanger (130) heat is transferred from the heated heating water to the heating pipe (210), thereby preventing freezing of the heating pipe (210).

[0026] Afterwards, when temperature of the heating water reaches the preset combustion stop temperature via the combustion operation of the boiler, the controller (100) blocks the fuel to carry out extinguishing operation and switches the three-way valve (120) to heating mode again.

[0027] Here, it is preferable to set the preset combustion stop temperature for switching the three-way valve to a heating mode at a maximum temperature that can be reached in the closed loop including the circulation pump (140), the heating heat exchanger (110), the three-way valve (120) and the hot water supply heat exchanger (130).

[0028] The boiler does not carry out the combustion operation after the extinguishing operation and the three-way valve (120) are switched to the heating mode. Only the circulation pump (140) is operated to circulate the heated heating water through the heating pipe (200), thereby preventing freezing of the heating pipe (200).

[0029] Therefore, when compared with existing freeze protection functions, by using similar amounts of fuel the above method allows freeze protection of not only the heating pipe but also the hot water pipe.

[0030] Also, it is possible to include a step of returning the boiler to a stopped state by stopping operation of the circulation pump (140) after some time has passed, preferably some time after the extinguishing operation, that is, the time taken to sufficiently circulate the heating water for freeze protection of the heating pipe.

[0031] The above description relating to a preferred embodiment of a freeze protection method for heating pipe and hot water pipe of a boiler according to the present invention is merely an example. It will be understood by the skilled person in the art that various modi-

fications and other similar embodiments based on the description provided can be made. Therefore, it is clear that the present invention is not limited to the preferred embodiment described above. Accordingly, the scope of the invention to be protected must be based on the technical principles of the accompanying claims. Further, it must be understood that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

[REFERENCE SIGNS]

[0032]

100: Controller **110:** Heating Heat Exchanger
120: Three-Way Valve **130:** Hot Water Heat Exchanger
140: Circulation Pump **150:** Heating Water Temperature Sensor
160: Burner **170:** Fan
180: Expansion Tank **190:** Hot Water Temperature Sensor
200: Heating Pipe **210:** Hot Water Pipe

Claims

1. A freeze protection method for heating pipe and hot water pipe of a boiler, comprising the steps of:
 - (a) converting a three-way valve into a hot water mode and carrying out a combustion operation of the boiler via a controller's control, if temperature of heating water falls below a preset freeze protection temperature, and circulating the heating water through a closed loop including a circulation pump, a heating heat exchanger, the three-way valve and a hot water supply heat exchanger by driving the circulation pump; and
 - (b) converting the three-way valve to a heating mode and performing an extinguishing operation of the boiler via the controller's control, if temperature of the heating water is higher than a preset constant temperature, and circulating the heating water to the heating pipe by driving the circulation pump.
2. The freeze protection method for heating pipe and hot water pipe of a boiler as claimed in claim 1, further comprising the step of stopping operations of the circulation pump and the boiler if a preset certain amount of time has passed after the extinguishing operation.
3. The freeze protection method for heating pipe and hot water pipe of a boiler as claimed in claim 1 or 2, wherein temperature of the heating water is detected

by a heating water temperature sensor disposed in the boiler.

4. The freeze protection method for heating pipe and hot water pipe of a boiler as claimed in claim 1 or 2, wherein the preset constant temperature for switching the three-way valve to the heating mode is a maximum temperature that can be reached in the closed loop including the circulation pump, the heating heat exchanger, the three-way valve, and the hot water supply heat exchanger.

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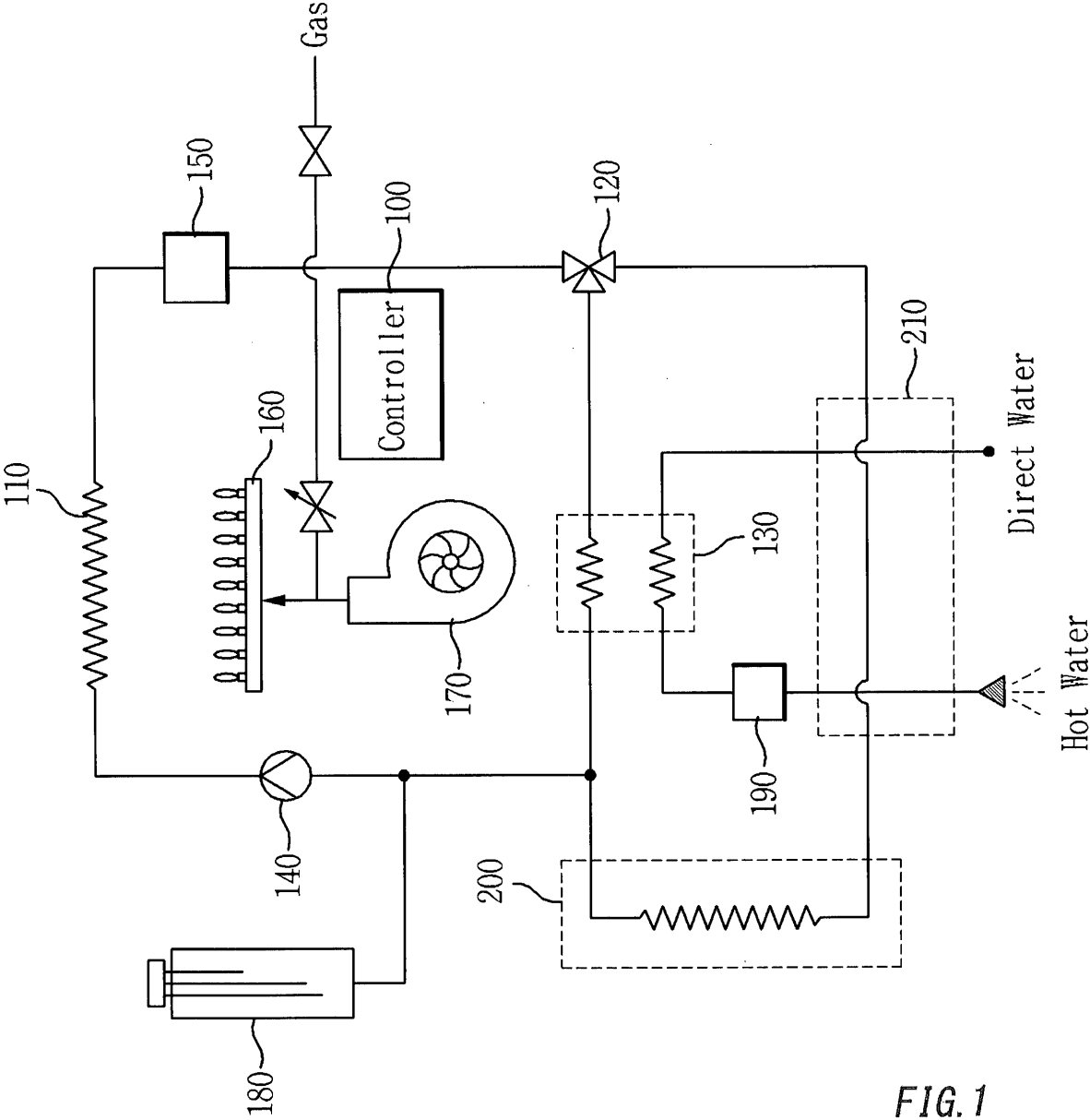


FIG. 1

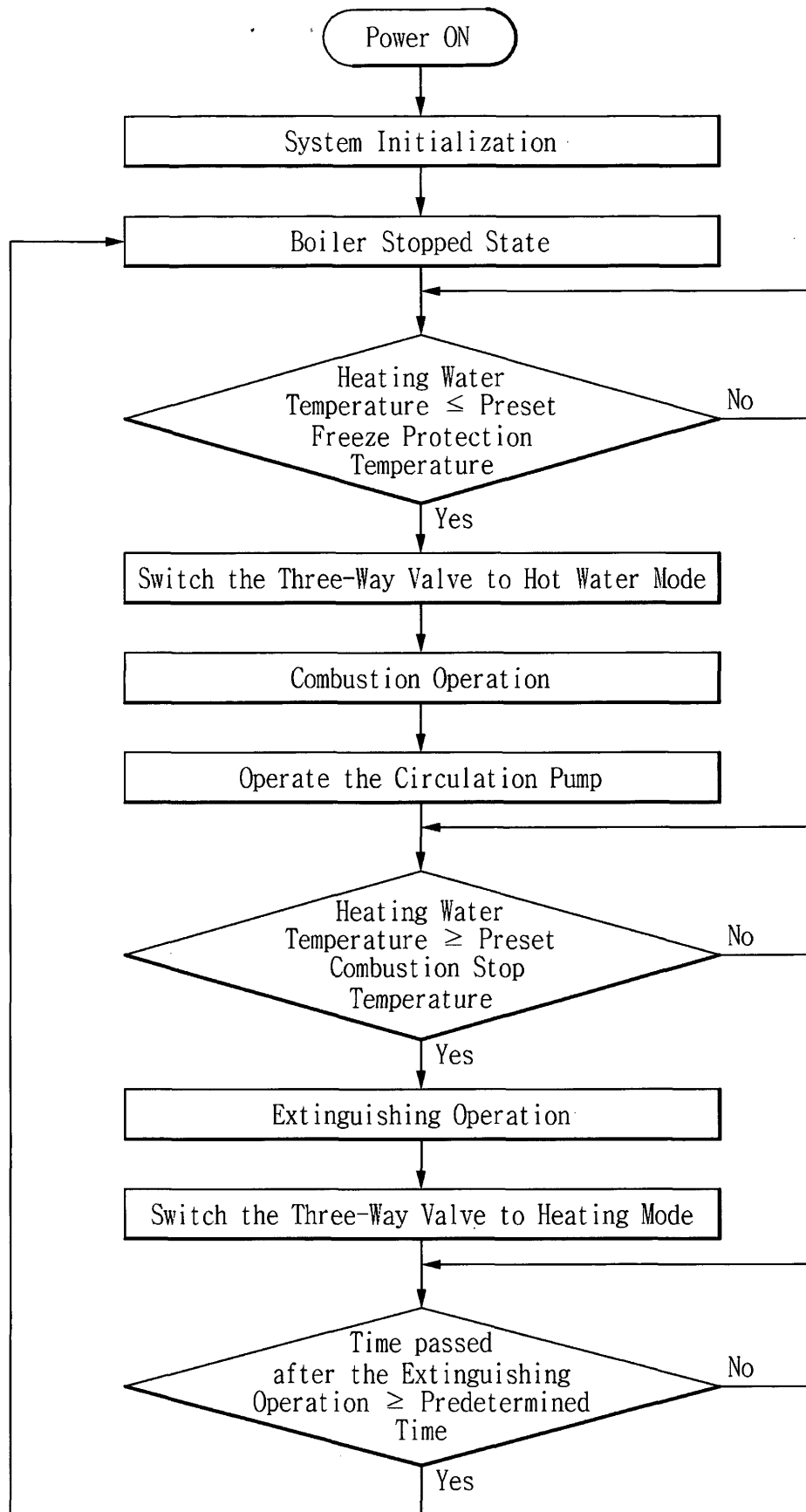


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2013/008315

A. CLASSIFICATION OF SUBJECT MATTER

F24D 19/10(2006.01)i, F24H 9/20(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)

F24D 19/10; F24H 9/00; F24H 9/20; F24D 10/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 Korean Utility models and applications for Utility models: IPC as above
 Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: hot water, heating, valve, pump, heat exchange, control and freeze and burst

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2001-0003836 A (DAEWOO ELECTRONICS CO.,LTD) 15 January 2001 See abstract; page 3 lines 14-17; claims 1, 2 and figure 1.	1-4
A	KR 10-1199687 B1 (KYUNG DONG NAVIEN CO., LTD.) 08 November 2012 See abstract; claim 1 and figure 2.	1-4
A	KR 10-0756910 B1 (CHOI, Jin Min) 07 September 2007 See abstract; claim 3 and figure 2.	1-4
A	KR 20-1990-0010444 U (GOLD STAR CO., LTD.) 02 June 1990 See claim 1 and figure 1.	1-4
A	KR 10-2007-0033682 A (KYUNG DONG NAVIEN CO., LTD.) 27 March 2007 See abstract; claim 1 and figure 2.	1-4

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"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

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Date of the actual completion of the international search

04 NOVEMBER 2013 (04.11.2013)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2013/008315

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KR 10-2001-0003836 A	15/01/2001	NONE	
KR 10-1199687 B1	08/11/2012	EP 2484983 A2	08/08/2012
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KR 10-2007-0033682 A	27/03/2007	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 1020040037899 B [0005]