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(54) **BOILER**

(57) The present invention provides a boiler. The boiler comprises: a main heat exchanger for heating return water, which is introduced water, by means of the combustion heat of a burner; a hot water supply heat exchanger which is supplied with heating water, which is water generated by heating the return water in the main heat exchanger, and which heats direct water by means of heat exchange with the heating water to generate warm water; and an indoor heating water storage tank which is provided on a return passage through which the heating water discharged from the hot water supply heat exchanger returns to the main heat exchanger as at least a portion of the return water, and which, in order to increase the temperature of the return water supplied to the main heat exchanger, stores therein high-temperature water having a higher temperature than the heating water discharged from the hot water supply heat exchanger when the warm water is generated by the hot water supply heat exchanger.

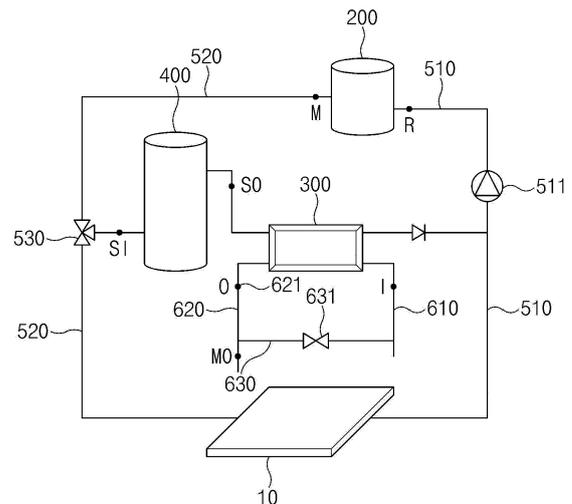


Fig. 5

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**Description**

[Technical Field]

5 **[0001]** The present disclosure relates to a boiler, and more particularly, relates to a boiler having an improved ability to supply hot-water.

[Background Art]

10 **[0002]** Boilers are used for heating or hot-water in general homes, public buildings, or the like. In general, a boiler combusts a fuel such as oil or gas through a burner, heats water using heat of combustion generated in the combustion process, and circulates the heated water indoors to perform heating or supply hot-water as needed.

15 **[0003]** FIG. 1 illustrates a conventional boiler 1. The conventional boiler 1 may include a main heat exchanger 2 for heating heating-water using heat of combustion of a burner, a three-way valve 4 for switching a flow path to a heating mode or a hot-water mode, a circulation pump 5 for circulating water, and a hot-water heat exchanger 3 for supplying hot-water by heat exchange of raw-water. The conventional boiler including the aforementioned components simultaneously performs a heating function and a hot-water function.

20 **[0004]** However, because the maximum amount of heat of combustion of the burner is limited based on heating, the conventional boiler has a limitation in an ability to supply hot-water in a raw-water type when a larger amount of heat than the limited amount of heat is required. Specifically, in a case where generation of hot-water is requested when the boiler is not used, a larger amount of heat than the maximum amount of heat of the burner in the boiler may be required to generate hot-water at a temperature requested by a user.

[Disclosure]

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[Technical Problem]

30 **[0005]** The present disclosure has been made to solve the aforementioned problems. An aspect of the present disclosure provides a boiler for improving an ability to supply hot-water and increasing the time during which hot-water at a set temperature or more is supplied, by raising the temperature of circulated-water supplied to a main heat exchanger.

**[0006]** Another aspect of the present disclosure provides a boiler for supplying hot-water at an accurate temperature and improving the durability of a burner by using an electronic mixing valve.

[Technical Solution]

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40 **[0007]** A boiler according to the present disclosure includes a main heat exchanger that heats circulated-water, which is introduced-water, by heat of combustion of a burner, a hot-water supply heat exchanger that is supplied with heated-water generated by heating the circulated-water in the main heat exchanger and that generates hot-water by heating raw-water by heat exchange with the heated water, and a heating-water storage tank that stores high-temperature water to raise temperature of the circulated-water supplied to the main heat exchanger and that is provided on a return flow path along which the heated-water released from the hot-water supply heat exchanger returns as at least part of the circulated-water to the main heat exchanger, the high-temperature water having a higher temperature than the heated-water released from the hot-water supply heat exchanger when the hot-water is generated by the hot-water supply heat exchanger.

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[Advantageous Effects]

50 **[0008]** As described above, the boiler according to the embodiment of the present disclosure may raise the temperature of circulated-water supplied to the main heat exchanger, thereby improving an ability to supply hot-water and increasing the time during which hot-water at a set temperature or more is supplied.

**[0009]** In addition, according to the present disclosure, the electronic mixing valve may enable the supply of hot-water at an accurate temperature and may improve the durability of the burner.

[Description of Drawings]

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**[0010]**

FIG. 1 is a schematic view illustrating a configuration of a conventional boiler.

FIG. 2 is a view illustrating a configuration of a boiler according to an embodiment of the present disclosure.

FIG. 3 is a graph depicting temperature changes over time at points R, M, and SI illustrated in FIG. 2.

FIG. 4 is a graph depicting temperature changes over time at points I and O illustrated in FIG. 2.

FIG. 5 is a view illustrating a configuration of a boiler according to a comparative example.

5 FIG. 6 is a graph depicting temperature changes over time at points R, M, and SO illustrated in FIG. 5.

FIG. 7 is a graph depicting temperature changes over time at points I and O illustrated in FIG. 5.

[Mode for Invention]

10 **[0011]** Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

**[0012]** First, the embodiments to be described below are embodiments appropriate for the understanding of technical features of a boiler according to the present disclosure. However, the present disclosure is not restrictively applied to the embodiments to be described below, and technical features of the present disclosure are not limited by the embodi-  
15 ments to be described. Furthermore, various changes and modifications can be made without departing from the spirit and scope of the present disclosure.

**[0013]** Referring to FIG. 2, a boiler 100 according to an embodiment of the present disclosure includes a main heat exchanger 200, a hot-water supply heat exchanger 300, and a heating-water storage tank 400.

**[0014]** The main heat exchanger 200 heats circulated-water, which is introduced-water, by heat of combustion of a burner. The circulated-water supplied to the main heat exchanger 200 may be circulated from an object 10 being heated or the hot-water supply heat exchanger 300. The introduced circulated-water may be heated by the heat of combustion of the burner of the main heat exchanger 200, and the heated-water may be released from the main heat exchanger 200. Here, no limitation applies to the type of the main heat exchanger 200, and for example, a shell-and-tube type heat exchanger may be applied.  
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**[0015]** The hot-water supply heat exchanger 300 is supplied with the heated-water generated by heating the circulated-water in the main heat exchanger 200 and generates hot-water by heating raw-water by heat exchange with the heated-water. At this time, the temperature of the heated-water supplied to the hot-water supply heat exchanger 300 is lowered after the heated-water indirectly exchanges heat with the raw-water.  
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**[0016]** The heating-water storage tank 400 is provided on a return flow path along which the heated-water released from the hot-water supply heat exchanger 300 returns as at least part of the circulated-water to the main heat exchanger 200. Furthermore, to raise the temperature of the circulated-water supplied to the main heat exchanger 200, the heating-water storage tank 400 stores high-temperature water having a higher temperature than the heated-water released from the hot-water supply heat exchanger 300 when the hot-water is generated by the hot-water supply heat exchanger 300.  
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**[0017]** Specifically, the heated-water released from the hot-water supply heat exchanger 300 may be circulated as the circulated-water to the main heat exchanger 200. Here, the heating-water storage tank 400 may be provided on the return flow path along which the heated-water released from the hot-water supply heat exchanger 300 returns to the main heat exchanger 200. That is, the heating-water storage tank 400 may be provided behind (downstream of) the hot-water supply heat exchanger 300 with respect to the flow of the heated-water. Accordingly, the heated-water heat-exchanged in the hot-water supply heat exchanger 300 may pass through the heating-water storage tank 400 and may return to the main heat exchanger 200.  
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**[0018]** Furthermore, the heating-water storage tank 400 may store the high-temperature water inside. The high-temperature water in the heating-water storage tank 400 may have a higher temperature than the heated-water released from the hot-water supply heat exchanger 300 when the hot-water is generated. Accordingly, the heated-water, the temperature of which is lowered by the heat exchange in the hot-water supply heat exchanger 300, may return to the main heat exchanger 200 after the temperature of the heated-water is raised by the high-temperature water while the heated-water passes through the heating-water storage tank 400. That is, the temperature of the circulated-water returning from the hot-water supply heat exchanger 300 to the main heat exchanger 200 may be raised by the high-temperature water in the heating-water storage tank 400.  
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**[0019]** As described above, according to the present disclosure, the high-temperature circulated-water may be supplied to the main heat exchanger 200 by the heating-water storage tank 400 disposed behind the hot-water supply heat exchanger 300, and thus the temperature of the heated-water flowing from the main heat exchanger 200 to the hot-water supply heat exchanger 300 may also be raised. Accordingly, the boiler 100 according to the present disclosure may increase the time during which the hot-water at a set temperature or more is supplied. That is, according to the present disclosure, the ability of the boiler 100 to supply the hot-water may be improved.  
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**[0020]** Furthermore, according to the present disclosure, the boiler 100 including the heating-water storage tank 400 may accumulate energy by heating water in the heating-water storage tank 400 through preheating when a user does not use hot-water and may use the accumulated energy as auxiliary heat when the user uses hot-water, thereby supplementing a deficient portion due to the limited combustion supply heat of the burner.  
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[0021] More specifically, the heating-water storage tank 400 may raise the temperature of the circulated-water, which is supplied to the main heat exchanger 200, to reduce the amount of heat applied by the burner to generate the heated-water having a preset target temperature.

5 [0022] Specifically, the heated-water supplied from the main heat exchanger 200 to the hot-water supply heat exchanger 300 has the preset target temperature so as to generate the hot-water. The burner supplies heat of combustion to heat the circulated-water supplied to the main heat exchanger 200 above the target temperature. The heating-water storage tank 400 may lower the load of the burner by raising the temperature of the circulated-water by the high-temperature water stored in the heating-water storage tank 400. That is, the heating-water storage tank 400 may reduce the amount of heat applied by the burner to generate the heated-water having the preset target temperature. Accordingly,

10 [0023] When the hot-water is generated by the hot-water supply heat exchanger 300, the heating-water storage tank 400 may be supplied with the heated-water released from the hot-water supply heat exchanger 300 and may supply the high-temperature water or a mixture of the high-temperature water and the heated-water to the main heat exchanger 200 as at least part of the circulated-water.

15 [0024] Furthermore, when the hot-water is not generated by the hot-water supply heat exchanger 300, the heating-water storage tank 400 may be supplied with the heated-water as the high-temperature water.

[0025] Specifically, when the boiler 100 does not generate the hot-water, the heating-water storage tank 400 is supplied with the heated-water from the main heat exchanger 200. At this time, the supplied heated-water is not heat-exchanged in the hot-water supply heat exchanger 300. The heated-water in the heating-water storage tank 400 may be supplied to the main heat exchanger 200. The heating-water storage tank 400 may store the high-temperature water therein while the heated-water is circulated between the main heat exchanger 200 and the heating-water storage tank 400.

20 [0026] Thereafter, when the boiler 100 generates the hot-water, the high-temperature water stored in the heating-water storage tank 400 may be supplied to the main heat exchanger 200 as the circulated-water. Alternatively, a mixture of the heated-water introduced into the heating-water storage tank 400 through the hot-water supply heat exchanger 300 and the high-temperature water may be supplied to the main heat exchanger 200 as the circulated-water.

25 [0027] Through this process, in the hot-water generating operation of the boiler 100, the heating-water storage tank 400 may raise the temperature of the circulated-water supplied to the main heat exchanger 200.

[0028] More specifically, the boiler 100 according to the present disclosure may further include a circulated-water line 510, a supply line 520, a first connecting line 540, and a three-way valve 530. In addition, the present disclosure may further include a second connecting line 550 and a third connecting line 560.

30 [0029] The circulated-water line 510 may connect the object 10 being heated and the main heat exchanger 200 and may introduce the circulated-water into the main heat exchanger 200 from the object 10 being heated. The supply line 520 may supply the heated-water from the main heat exchanger 200 to the object 10 being heated.

[0030] The first connecting line 540 may connect the supply line 520 and the hot-water supply heat exchanger 300 to supply the heated-water from the main heat exchanger 200 to the hot-water supply heat exchanger 300.

35 [0031] The three-way valve 530 may be provided at a connection point between the supply line 520 and the first connecting line 540 and may switch a flow path such that the heated-water supplied from the main heat exchanger 200 is supplied to at least one of the object 10 being heated or the hot-water supply heat exchanger 300. Specifically, when the hot-water is generated, the three-way valve 530 may switch the flow path such that the main heat exchanger 200 and the hot-water supply heat exchanger 300 are connected. Furthermore, when heating is performed, the three-way valve 530 may switch the flow path such that the main heat exchanger 200 and the object 10 being heated are connected.

40 [0032] The second connecting line 550 may connect the hot-water supply heat exchanger 300 and the heating-water storage tank 400, and the third connecting line 560 may connect the heating-water storage tank 400 and the circulated-water line 510. The above-described return flow path may be implemented by the second connecting line 550, the third connecting line 560, and the circulated-water line 510.

45 [0033] Specifically, the heated-water passing through the hot-water supply heat exchanger 300 may be introduced into the heating-water storage tank 400 through the second connecting line 550, and the heated-water introduced into the heating-water storage tank 400 may be mixed with the high-temperature water and may be supplied to the main heat exchanger 200 through the third connecting line 560 and the circulated-water line 510. In an initial hot-water generating operation (immediately after the user operates a hot-water mode), part of the high-temperature water in the heating-water storage tank 400 may be introduced into the main heat exchanger 200.

50 [0034] As described above, the heating-water storage tank 400 applied to the present disclosure may be located on the return flow path, that is, behind the hot-water supply heat exchanger 300 with respect to the flow of the heated-water. Accordingly, the heating-water storage tank 400 may be more effective than when the heating-water storage tank 400 is located in front of the hot-water supply heat exchanger 300.

55 [0035] Meanwhile, referring to FIG. 2, the boiler 100 may include a circulation pump 511 and an expansion tank 513 on the circulated-water line 510.

[0036] The circulation pump 511 may be provided on the circulated-water line 510 to introduce the circulated-water.

The expansion tank 513 may be provided on the circulated-water line 510 upstream of the circulation pump 511 to absorb a volume change caused by a change in the temperature of the circulated-water.

**[0037]** More specifically, the circulation pump 511 may be provided on the circulated-water line 510 downstream of a connection point between the third connecting line 560 and the circulated-water line 510 to supply the circulated-water. The expansion tank 513 may be provided on the circulated-water line 510 between the circulation pump 511 and the connection point between the third connecting line 560 and the circulated-water line 510 to absorb a volume change caused by a change in the temperature of the circulated-water.

**[0038]** According to the present disclosure, the temperature of the circulated-water supplied to the main heat exchanger 200 may be raised by the heating-water storage tank 400, and therefore the expansion tank 513 applied to the present disclosure may not include a separate heater for preheating. That is, hot-water performance is improved by the high-temperature heating water stored in the heating-water storage tank 400, and therefore the expansion tank 513 does not require a separate heater.

**[0039]** Hereinafter, effects of the position of the heating-water storage tank 400 according to the present disclosure will be described by comparing the embodiment of the present disclosure illustrated in FIGS. 2 to 4 and a comparative example illustrated in FIGS. 5 to 7. The comparative example illustrated in FIGS. 5 to 7 differs from the embodiment of the present disclosure in that the heating-water storage tank 400 is installed in front of the hot-water supply heat exchanger 300. For convenience of description, reference numerals identical to those in the present disclosure are used in FIGS. 5 to 7 and the following description.

**[0040]** First, referring to FIGS. 5 to 7, the heating-water storage tank 400 according to the comparative example may be installed in front of the hot-water supply heat exchanger 300, that is, between the main heat exchanger 200 and the hot-water supply heat exchanger 300. FIGS. 6 and 7 are graphs depicting temperatures over time at points illustrated in FIG. 5. For example, in FIGS. 6 and 7, "R" is a graph depicting the temperature of circulated-water supplied to the main heat exchanger 200, "M" is a graph depicting the temperature of heated-water released from the main heat exchanger 200, "SI" is a graph depicting the temperature of the heated-water supplied to the heating-water storage tank 400, and "SO" is a graph depicting the temperature of the heated-water released from the heating-water storage tank 400. Furthermore, "I" is a graph depicting the temperature of raw-water, and "O" is a graph depicting the temperature of hot-water generated by heat exchange in the hot-water supply heat exchanger 300.

**[0041]** According to the comparative example, when the hot-water is generated, high-temperature water stored in the heating-water storage tank 400 is supplied to the hot-water supply heat exchanger 300 and performs indirect heat exchange with the raw-water. Accordingly, even before the heated-water at the target temperature or more is generated in the main heat exchanger 200, the hot-water may be supplied immediately from the time when the generation of the hot-water is requested.

**[0042]** The high-temperature water, or a mixture of the high-temperature water and the heated-water, which is supplied to the hot-water supply heat exchanger 300 via the heating-water storage tank 400 may experience a temperature drop while being heat-exchanged in the hot-water supply heat exchanger 300 and may be supplied as the circulated-water to the main heat exchanger 200 in the low-temperature state. Accordingly, after some time point, the amount of heat required to heat the circulated-water above a temperature for the generation of the hot-water may exceed the maximum amount of heat of combustion of the burner. At this time, the temperature of the heated-water supplied from the main heat exchanger 200 to the hot-water supply heat exchanger 300 is lowered, and therefore the amount of heat required for the supply of the hot-water is not satisfied.

**[0043]** In experimental examples according to the comparative example illustrated in FIGS. 6 and 7, the main heat exchanger 200 is implemented with a shell-and-tube type heat exchanger. Furthermore, when the hot-water is not used, water in the main heat exchanger 200 and water in the heating-water storage tank 400 are in a state of being pre-heated to 80 degrees Celsius. The maximum amount of heat of the burner is 22,360kcal/h, and considering an internal circulation flow rate, the temperature that can be raised in the main heat exchanger 200 is 22.5 degrees Celsius when the maximum amount of heat of the burner is supplied. Furthermore, when the temperature of the hot-water requested by a user is 40 degrees Celsius, the amount of heat required for the supply of the hot-water is 36,000kcal/h.

**[0044]** When the user requests the hot-water in this condition, the hot-water at a preset hot-water temperature may be supplied until predetermined initial time by using the amount of heat accumulated in the heating-water storage tank 400. Referring to FIG. 7, it can be seen that in the case of the comparative example, hot-water at more than 40 degrees Celsius that is a hot-water temperature requested by the user is able to be supplied until about 240 seconds.

**[0045]** However, referring to FIG. 6, the maximum value of the temperature of the circulated-water is small because the heated-water passing through the hot-water supply heat exchanger 300 experiences a temperature drop due to heat exchange. That is, at the time point when about 26 seconds have elapsed, the temperature of the circulated-water supplied to the main heat exchanger 200 reaches a maximum value of about 42.8 degrees Celsius. It can be seen that when the main heat exchanger 200 supplies the maximum amount of heat to the circulated-water at the maximum temperature (about 42.8 degrees Celsius), the temperature of the heated-water supplied by the main heat exchanger 200 is about 65.3 degrees Celsius even though the maximum temperature (about 22.5 degrees Celsius) that can be

raised is added. That is, it can be seen that the temperature of the heated-water supplied by the main heat exchanger 200 fails to rise above 80 degrees Celsius that is the initial temperature of the high-temperature water stored in the heating-water storage tank 400 and the same is true of the temperature of water supplied to the hot-water supply heat exchanger 300.

5 [0046] Accordingly, referring to FIG. 7, it can be seen that the released-water temperature is maintained above 40 degrees Celsius, which is the preset hot-water temperature requested by the user, for a short time of about 240 seconds. Here, the released-water temperature is the temperature of water released after generated by mixing the raw-water with the hot-water generated by being heat-exchanged in the hot-water supply heat exchanger 300.

10 [0047] In contrast, in experimental examples of the present disclosure illustrated in FIGS. 2 to 4, conditions other than the position of the heating-water storage tank 400 are the same. FIGS. 3 and 4 are graphs depicting temperatures over time at points illustrated in FIG. 2. For example, in FIGS. 3 and 4, "R" is a graph depicting the temperature of circulated-water supplied to the main heat exchanger 200, "M" is a graph depicting the temperature of heated-water released from the main heat exchanger 200, "SI" is a graph depicting the temperature of the heated-water supplied to the heating-water storage tank 400, and "SO" is a graph depicting the temperature of the heated-water released from the heating-water storage tank 400. Furthermore, "I" is a graph depicting the temperature of raw-water, and "O" is a graph depicting the temperature of hot-water generated by heat exchange in the hot-water supply heat exchanger 300.

15 [0048] Referring to FIG. 3, when a user requests the hot-water under the above conditions, the temperature of the high-temperature water in the heating-water storage tank 400 is equal to the temperature of the circulated-water at the start of hot-water supply. The temperature of the heated-water released after heat-exchanged in the hot-water supply heat exchanger 300 is raised by the heating-water storage tank 400, and therefore the temperature of the circulated-water returning to the main heat exchanger 200 may be raised.

20 [0049] For example, the temperature of the circulated-water of the present disclosure is about 70.7 degrees Celsius at 26 seconds at which the temperature of the circulated-water in the comparative example has a maximum value (about 42.8 degrees Celsius). The temperature of the circulated-water plus the temperature (about 22.5 degrees Celsius) that can be raised when the main heat exchanger 200 supplies the maximum amount of heat equals about 93.2 degrees Celsius. That is, as the temperature of the circulated-water is raised, the temperature of the heated-water supplied by the main heat exchanger 200 may rise above 80 degrees Celsius that is the initial temperature of the high-temperature water stored in the heating-water storage tank 400, and the same is true of the temperature of the heated-water introduced into the hot-water supply heat exchanger 300. That is, as the temperature of the heated-water introduced into the hot-water supply heat exchanger 300 rises above 80 degrees of Celsius and then drops, the amount of heat that enables the supply of the hot-water at the preset hot-water temperature for a long time corresponding to the temperature rise and drop may be supplied.

25 [0050] Accordingly, referring to FIG. 4, it can be seen that the time during which the released-water temperature is maintained above 40 degrees Celsius, which is the preset hot-water temperature requested by the user, is about 434 seconds that is longer than that in the comparative example of FIG. 7. According to the present disclosure, it can be seen that the hot-water at the preset hot-water temperature is able to be supplied for a longer period of time.

30 [0051] Furthermore, when the heating-water storage tank 400 is installed behind the hot-water supply heat exchanger 300 as in the present disclosure (refer to FIG. 2), the heating-water storage tank 400 may have a similar ability to supply hot-water even though having a small tank capacity, as compared with when the heating-water storage tank 400 is installed in front of the hot-water supply heat exchanger 300 as in the comparative example (refer to FIG. 5). That is, according to the present disclosure, the heating-water storage tank 400 may have a high ability to supply hot-water despite a small tank capacity.

35 [0052] Table 1 below shows the time (seconds) during which the hot-water at the preset hot-water temperature or more is able to be supplied, depending on a tank capacity L according to the comparative example and the embodiment of the present disclosure. The time during which the hot-water is able to be supplied was tested for ignition delay time of 10 seconds and ignition delay time of 30 seconds.

40 [0053] In table 1 below, A-1, A-2, and A-3 are experimental examples according to the comparative example illustrated in FIG. 5, and B-1, B-2, and B-3 are experimental examples according to the embodiment of the present disclosure illustrated in FIG. 2. For example, it can be seen that when the ignition delay time is 10 seconds, the time (189 seconds) during which the hot-water at the preset hot-water temperature or more is able to be supplied in the case where the heating-water storage tank 400 has a capacity of 10 L is similar to the time (181 seconds) during which the hot-water at the preset hot-water temperature or more is able to be supplied in the case where the heating-water storage tank 400 has a capacity of 20 L. Accordingly, according to the present disclosure, a high ability to supply hot-water may be achieved with a small tank capacity.

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[Table 1]

Experimental example	Capacity (L) of heating-water storage tank	Time (seconds) during which hot-water at preset hot-water temperature or more is able to be supplied (ignition delay time of 10 seconds)	Time (seconds) during which hot-water at preset hot-water temperature or more is able to be supplied (ignition delay time of 30 seconds)
A-1	10	125	89
A-2	20	181	145
A-3	30	233	197
B-1	10	189	153
B-2	20	281	274
B-3	30	371	363

**[0054]** Meanwhile, the boiler 100 may further include a raw-water line 610, a hot-water line 620, a mixing line 630, and a mixing valve 631.

**[0055]** The raw-water to be heat-exchanged in the hot-water supply heat exchanger 300 may be supplied through the raw-water line 610, and the hot-water generated by heat exchange in the hot-water supply heat exchanger 300 may be released through the hot-water line 620.

**[0056]** Furthermore, the mixing line 630 may be connected between the raw-water line 610 and the hot-water line 620, and the mixing valve 631 may be installed on the mixing line 630 and may open and close the mixing line 630 to supply the raw-water to the hot-water line 620.

**[0057]** Accordingly, in a case where the high-temperature heated-water is supplied from the main heat exchanger 200 to the hot-water supply heat exchanger 300, the raw-water may be mixed with the hot-water by the mixing line 630 and the mixing valve 631, and a problem that the temperature of the hot-water is raised may be solved. In particular, as the heating-water storage tank 400 is provided, the released-water temperature may be adjusted to a temperature set by the user in a case where the temperature of initial hot-water is raised by the high-temperature water stored in the heating-water storage tank 400.

**[0058]** More preferably, to detect the temperature of the hot-water, the boiler 100 may further include a hot-water temperature sensor 621 provided on the hot-water line 620 upstream of a connection point between the hot-water line 620 and the mixing line 630. The mixing valve 631 may be an electronic valve that is automatically controlled depending on the preset hot-water temperature and the temperature measured by the hot-water temperature sensor 621.

**[0059]** Specifically, the mixing valve 631 may be an electronic valve rather than a mechanical valve, and the hot-water temperature sensor 621 may be mounted at an exit side of the hot-water generated through heat exchange in the hot-water supply heat exchanger 300. When the hot-water is generated, the mixing valve 631 may be continually automatically controlled to mix the raw-water depending on the preset hot-water temperature set by the user.

**[0060]** For example, in many cases, a mechanical valve is manufactured such that it is difficult or impossible for the user to randomly adjust the mechanical valve. Therefore, in a case where a mechanical valve is used as the mixing valve 631, the temperature of the heated-water flowing into the hot-water supply heat exchanger 300 is controlled by shortening the combustion ON/OFF cycle of the burner based on the target temperature of the heated-water because a heating-value controller (not illustrated) provided in the boiler 100 cannot recognize the set temperature of the mixing valve 631. That is, in this case, due to the use of the mechanical mixing valve 631, the mixing opening degree of which is fixed, the combustion ON/OFF of the burner is performed in consideration of the temperature of the heated-water to meet the released-water temperature, and therefore the combustion cycle of the burner may be shortened. Due to the frequent combustion ON/OFF cycle, the durability of the burner may be degraded.

**[0061]** In contrast, according to the present disclosure, the hot-water temperature sensor 621 may consistently measure the temperature of the hot-water, and the opening/closing or the opening degree of the electronic mixing valve 631 may be automatically controlled depending on the temperature of the hot-water measured by the hot-water temperature sensor 621. That is, in the case of the present disclosure, as the mixing valve 631 is electronically adjusted, the released-water temperature may be adjusted.

**[0062]** Accordingly, according to the present disclosure, due to the electronic mixing valve 631, hot-water at an accurate temperature may be supplied, the combustion ON/OFF cycle may be lengthened, and the durability of the burner may be improved.

**[0063]** Meanwhile, the heating-water storage tank 400 of the present disclosure may be provided on a flow path along which the heated-water released from the hot-water supply heat exchanger 300 or the heated-water returning from the object 10 being heated returns to the main heat exchanger 200 as the circulated-water. To raise the temperature of the

circulated-water supplied to the main heat exchanger 200, the heating-water storage tank 400 may store the high-temperature water having a higher temperature than the heated-water released from the hot-water supply heat exchanger 300 when the hot-water is generated by the hot-water supply heat exchanger 300.

**[0064]** Specifically, as in the illustrated embodiment, the heating-water storage tank 400 may be installed on the flow path connecting the hot-water supply heat exchanger 300 and the circulated-water line 510. At this time, the heating-water storage tank 400 is provided on the flow path along which the heated-water released from the hot-water supply heat exchanger 300 returns to the main heat exchanger 200 as the circulated-water.

**[0065]** Furthermore, the position of the heating-water storage tank 400 applied to the present disclosure is not limited to the aforementioned position, and the heating-water storage tank 400 may be installed on the circulated-water line 510. Specifically, in the case where the heating-water storage tank 400 is installed on the circulated-water line 510, the heated-water returning to the main heat exchanger 200 may be heated-water passing through the hot-water supply heat exchanger 300 or heated-water returning from the object 10 being heated.

**[0066]** When the above-described boiler according to the embodiment of the present disclosure is used, the temperature of the circulated-water supplied to the main heat exchanger may be raised, which results in an improvement in an ability to supply hot-water and an increase in the time during which hot-water at a set temperature or more is supplied.

**[0067]** In addition, according to the present disclosure, the electronic mixing valve may enable the supply of hot-water at an accurate temperature and may improve the durability of the burner.

**[0068]** Hereinabove, although the present disclosure has been described with reference to exemplary embodiments and the accompanying drawings, the present disclosure is not limited thereto, but may be variously modified and altered by those skilled in the art to which the present disclosure pertains without departing from the spirit and scope of the present disclosure claimed in the following claims.

## Claims

### 1. A boiler comprising:

a main heat exchanger configured to heat circulated-water, which is introduced-water, by heat of combustion of a burner;

a hot-water supply heat exchanger supplied with heated-water generated by heating the circulated-water in the main heat exchanger and configured to generate hot-water by heating raw-water by heat exchange with the heated water; and

a heating-water storage tank provided on a return flow path along which the heated-water released from the hot-water supply heat exchanger returns as at least part of the circulated-water to the main heat exchanger, the heating-water storage tank being configured to store high-temperature water to raise temperature of the circulated-water supplied to the main heat exchanger, wherein the high-temperature water has a higher temperature than the heated-water released from the hot-water supply heat exchanger when the hot-water is generated by the hot-water supply heat exchanger.

2. The boiler of claim 1, wherein the heating-water storage tank is configured to raise the temperature of the circulated-water, which is supplied to the main heat exchanger, to reduce an amount of heat applied by the burner to generate the heated-water having a preset target temperature.

3. The boiler of claim 1, wherein when the hot-water is generated by the hot-water supply heat exchanger, the heating-water storage tank is supplied with the heated-water released from the hot-water supply heat exchanger and the heating-water storage tank supplies the high-temperature water or a mixture of the high-temperature water and the heated-water to the main heat exchanger as at least part of the circulated-water.

4. The boiler of claim 1, wherein when the hot-water is not generated by the hot-water supply heat exchanger, the heating-water storage tank is supplied with the heated-water as the high-temperature water.

### 5. The boiler of claim 1, further comprising:

a circulated-water line configured to introduce the circulated-water into the main heat exchanger from an object to be heated;

a supply line configured to supply the heated-water from the main heat exchanger to the object to be heated;

a first connecting line configured to connect the supply line and the hot-water supply heat exchanger to supply the heated-water from the main heat exchanger to the hot-water supply heat exchanger; and

a three-way valve provided at a connection point between the supply line and the first connecting line and configured to switch a flow path to supply the heated-water supplied from the main heat exchanger to at least one of the object to be heated and the hot-water supply heat exchanger.

5 6. The boiler of claim 5, further comprising:

a second connecting line configured to connect the hot-water supply heat exchanger and the heating-water storage tank; and

10 a third connecting line configured to connect the heating-water storage tank and the circulated-water line, wherein the return flow path is implemented by the second connecting line, the third connecting line, and the circulated-water line.

7. The boiler of claim 5, further comprising:

15 a circulation pump provided on the circulated-water line to introduce the circulated-water; and an expansion tank provided on the circulated-water line upstream of the circulation pump to absorb a volume change caused by a change in the temperature of the circulated-water.

8. The boiler of claim 6, further comprising:

20 a circulation pump provided on the circulated-water line downstream of a connection point between the third connecting line and the circulated-water line to supply the circulated-water; and an expansion tank provided on the circulated-water line between the circulation pump and the connection point between the third connecting line and the circulated-water line to absorb a volume change caused by a change in the temperature of the circulated-water.

9. The boiler of claim 1, further comprising:

30 a raw-water line through which the raw-water to be heat-exchanged in the hot-water supply heat exchanger is supplied;

a hot-water line through which the hot-water generated by heat exchange in the hot-water supply heat exchanger is released;

a mixing line connected between the raw-water line and the hot-water line; and

35 a mixing valve installed on the mixing line and configured to open and close the mixing line to supply the raw-water to the hot-water line.

10. The boiler of claim 9, further comprising:

40 a hot-water temperature sensor provided on the hot-water line upstream of a connection point between the hot-water line and the mixing line to measure temperature of the hot-water, wherein the mixing valve is an electronic valve automatically controlled based on a preset hot-water temperature and the temperature measured by the hot-water temperature sensor.

11. The boiler of claim 1, wherein the main heat exchanger is implemented with a shell-and-tube type heat exchanger.

45 12. A boiler comprising:

a main heat exchanger configured to heat circulated-water, which is introduced-water, by heat of combustion of a burner to generate heated-water for supplying heating to an object to be heated;

50 a hot-water supply heat exchanger configured to generate hot-water by heating raw-water by heat exchange with the heated-water supplied from the main heat exchanger; and

55 a heating-water storage tank provided on a flow path along which the heated-water released from the hot-water supply heat exchanger or the heated-water returning from the object to be heated returns to the main heat exchanger as the circulated-water, wherein to raise temperature of the circulated-water supplied to the main heat exchanger, the heating-water storage tank is configured to store high-temperature water having a higher temperature than the heated-water released from the hot-water supply heat exchanger when the hot-water is generated by the hot-water supply heat exchanger.

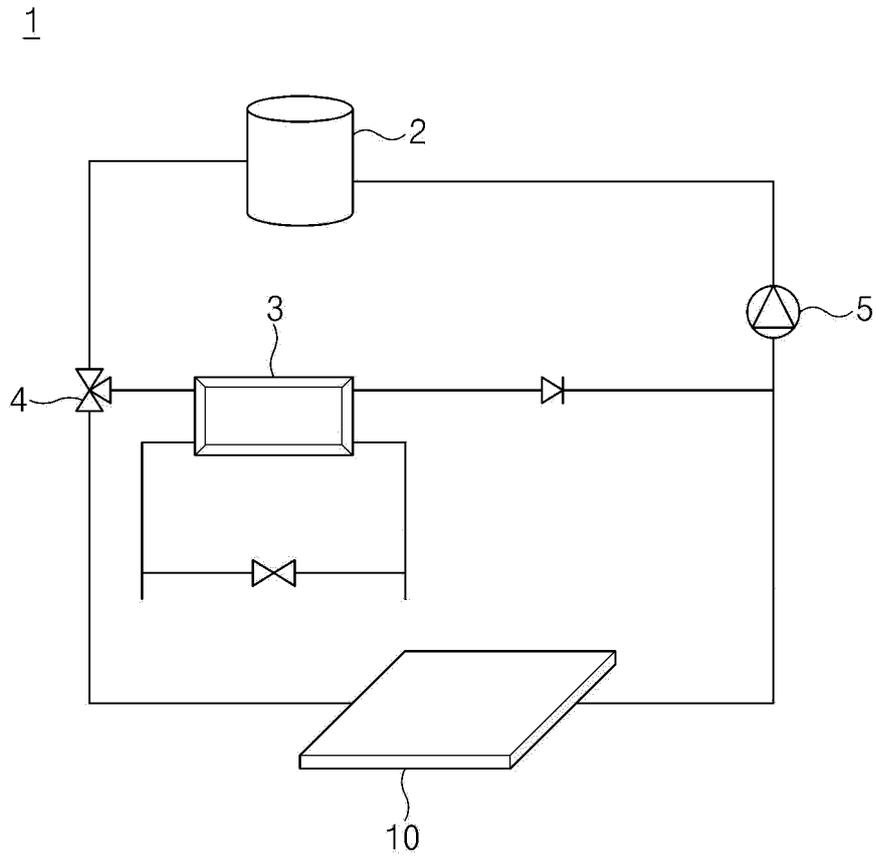


Fig.1

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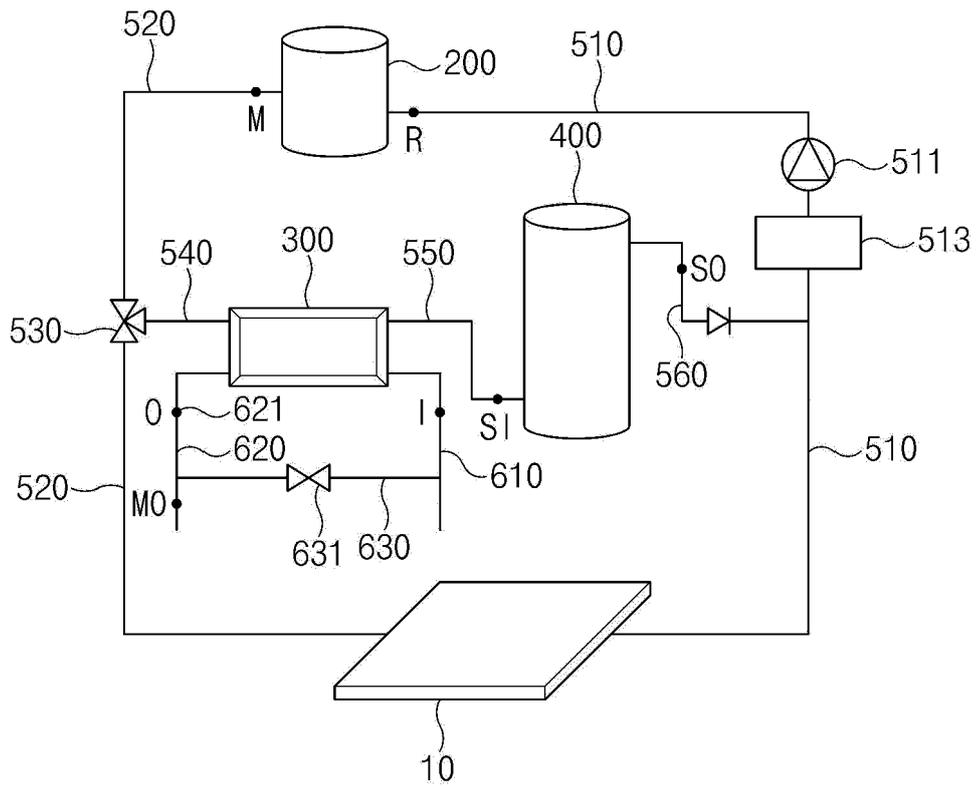


Fig.2

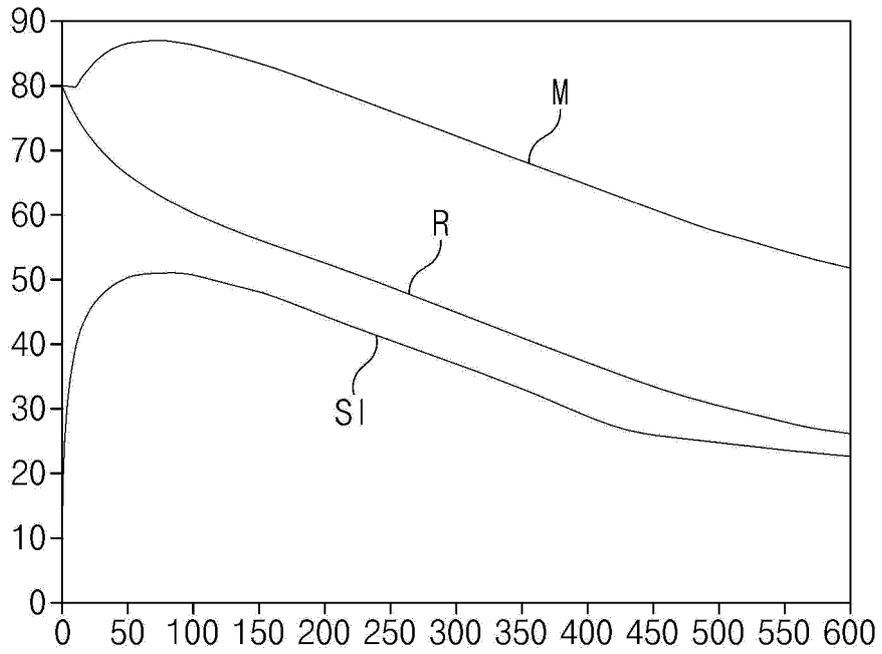


Fig.3

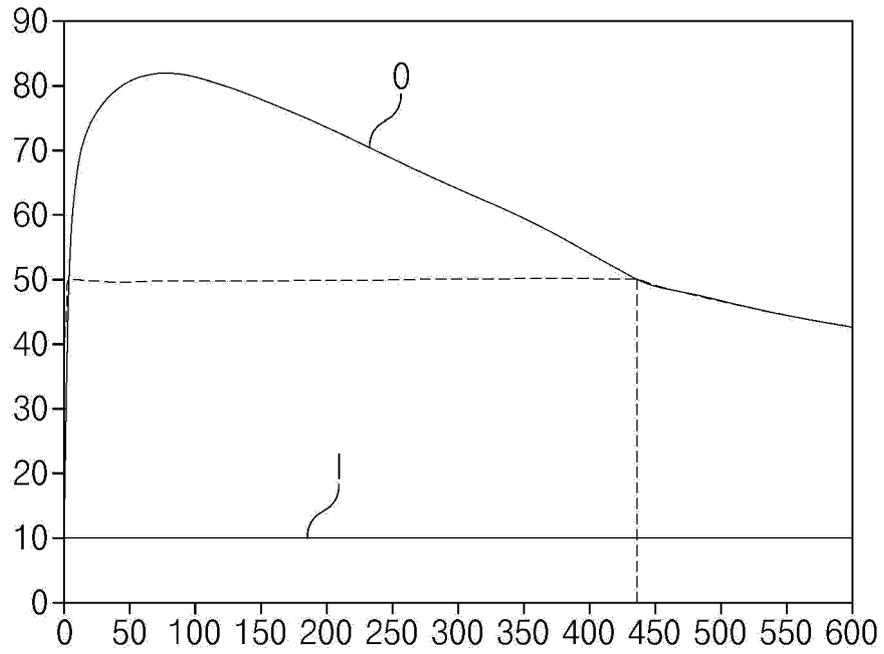


Fig.4

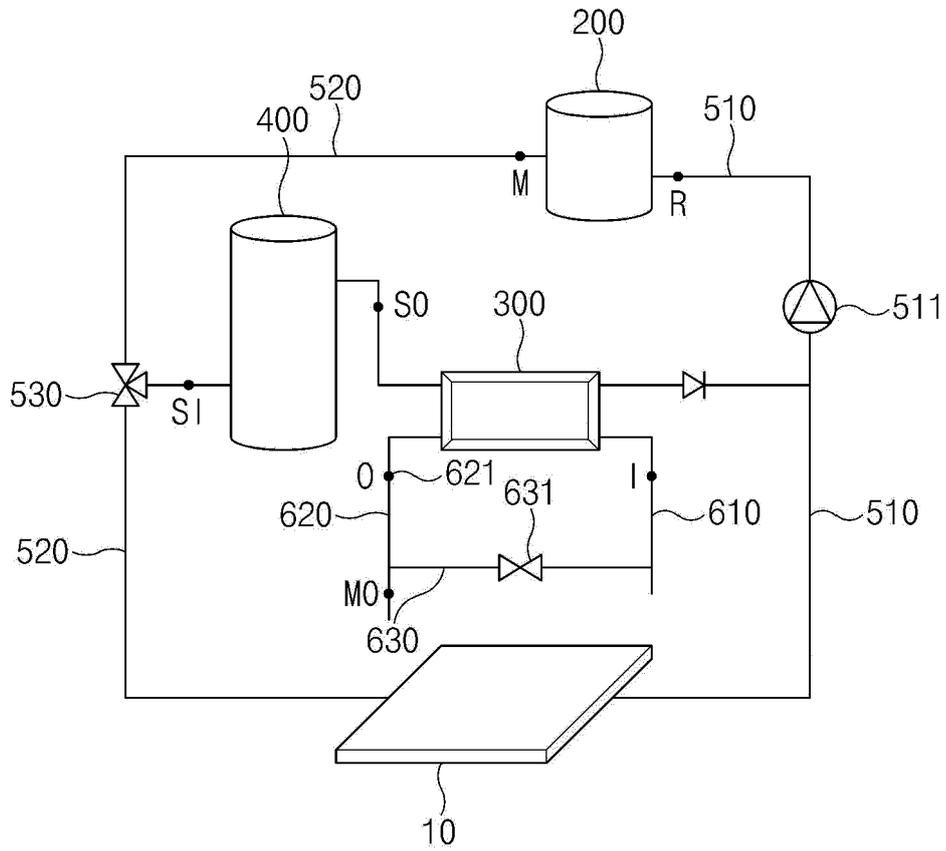


Fig.5

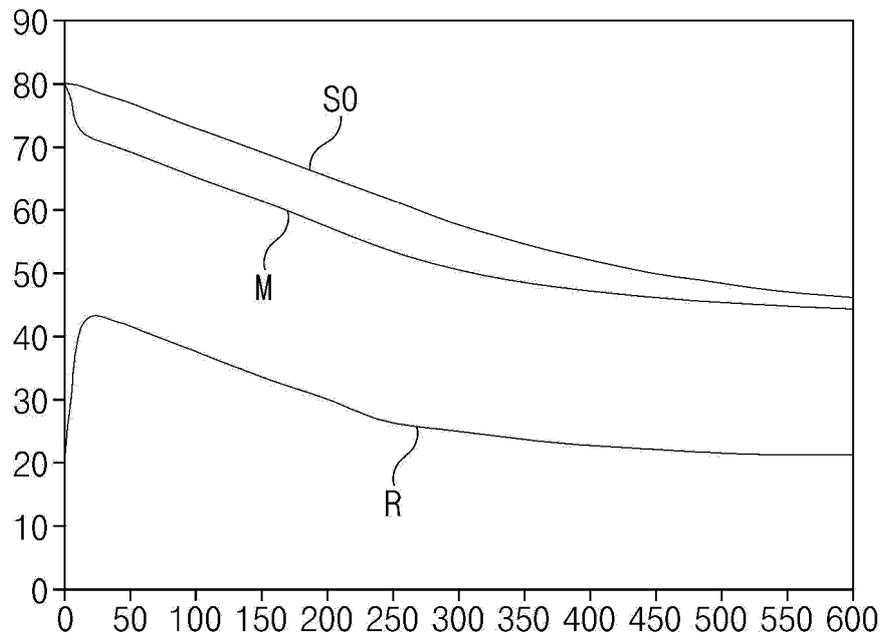


Fig.6

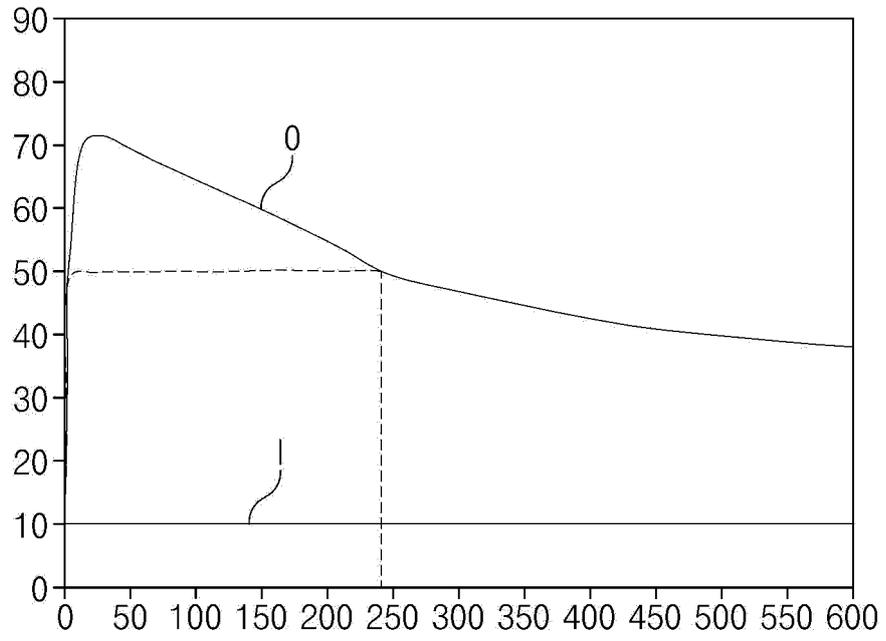


Fig.7

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2019/005331

5	A. CLASSIFICATION OF SUBJECT MATTER <i>F24H 1/52(2006.01)i, F24H 1/50(2006.01)i, F24H 9/14(2006.01)i, F24H 9/20(2006.01)i, F24D 19/10(2006.01)i</i> According to International Patent Classification (IPC) or to both national classification and IPC	
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F24H 1/52; F24D 19/00; F24D 19/08; F24D 19/10; F24D 3/08; F24D 3/10; F24H 1/00; F24H 1/40; F24H 9/20; F24H 1/50; F24H 9/14 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	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS (KIPO internal) & Keywords: boiler, hot-water, heating, supply, heat-exchanger, pump, line, combustion, storage, tank, temperature, flowpath, mixing, valve	
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
25	Category*	Citation of document, with indication, where appropriate, of the relevant passages
30	X	KR 10-2013-0123531 A (KYUNG DONG NAVIEN CO., LTD.) 13 November 2013 See paragraphs [0027]-[0032]; claim 1; and figure 2.
35	A	7-10
40	A	KR 10-0755646 B1 (KYUNG DONG NAVIEN CO., LTD.) 04 September 2007 See paragraphs [0026]-[0030]; and figure 2.
45	A	KR 10-1488472 B1 (KYUNG DONG NAVIEN CO., LTD.) 03 February 2015 See paragraphs [0028]-[0032]; and figure 2.
50	A	KR 10-2010-0037308 A (KYUNG DONG NETWORK CO., LTD.) 09 April 2010 See paragraphs [0003]-[0012]; and figure 1.
55	A	JP 2011-515647 A (KYUNG DONG NAVIEN CO., LTD.) 19 May 2011 See paragraphs [0019]-[0040]; and figures 3-8.
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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 06 AUGUST 2019 (06.08.2019)		Date of mailing of the international search report 07 AUGUST 2019 (07.08.2019)
Name and mailing address of the ISA/KR  Korean Intellectual Property Office Government Complex Daejeon Building 4, 189, Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578		Authorized officer  Telephone No.

INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.

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