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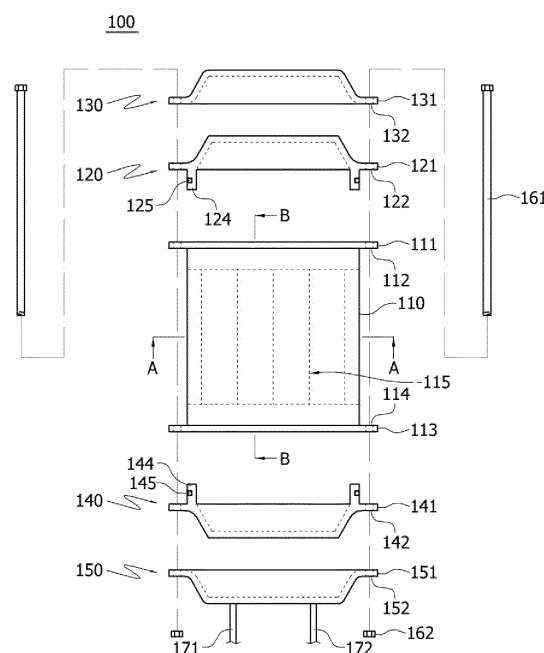
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(54) **EXPANSION TANK FOR A GAS BOILER**

(57) Provided is an expansion tank for a gas boiler which may be easily manufactured at a low cost due to its simple structure, and may have high pressure resistance and high corrosion resistance against heating water. To this end, the expansion tank includes: a body that has an upper portion and a lower portion that are opened,

includes a lattice heating water receiving unit that is divided into compartments by a plurality of diaphragms and in which heating water is received, and is integrally formed with the plurality of diaphragms; and an upper inner cover and a lower inner cover that are coupled to the body to cover the upper portion and the lower portion of the body.

[Fig. 4]



Description

[Technical Field]

[0001] The present invention relates to an expansion tank for a gas boiler, and more particularly, to an expansion tank for a gas boiler which may be easily manufactured at a low cost due to its simple internal structure, and may have high pressure resistance and high corrosion resistance against a change in pressure of heating water.

[Background Art]

[0002] In general, gas boilers are classified into opened type gas boilers and closed type gas boilers. Opened type gas boilers are structured such that heating water in an expansion tank is exposed to the atmosphere, and closed type gas boilers are structured such that heating water in an expansion tank is blocked from the atmosphere.

[0003] FIG. 1 is a schematic view illustrating a conventional gas boiler including an opened type expansion tank.

[0004] The conventional opened type gas boiler includes a circulation pump 10 that circulates heating water, a main heat exchanger 20 that transmits heat energy of a burner 21 to the heating water transferred by the circulation pump 10, a three-way valve 30 that supplies the heating water to a heating pipeline to be heated during a heating operation and supplies the heating water to a hot water heat exchanger 40 during a hot water supply operation, the hot water heat exchanger 40 that heats direct water and supplies hot water during the hot water supply operation, and an expansion tank 50 that stores heating return water therein and absorbs a change in pressure as a temperature of the heating water is changed.

[0005] Reference numeral 61 denotes a heating water supply pipe, 62 denotes a heating return water pipe, 63 denotes a direct water pipe, and 64 denotes a hot water pipe.

[0006] The expansion tank 50 which is structured such that heating water is exposed to the atmosphere includes a water level detection sensor 51 that detects whether heating water stored therein is within a predetermined water level range, and an overflow pipe 52 that is provided on a side of an upper portion of the expansion tank 50 and allows the heating water to overflow to the outside when the heating water exceeds a predetermined water level.

[0007] The conventional opened type gas boiler may be easily manufactured at a low cost due to its simple structure. However, since a heating water circulation system is exposed to the atmosphere and thus may not be able to be provided at a position lower than that of the heating pipeline to be heated, there is a limitation in an installation position of the heating water circulation system. Also, since heating water is exposed to the atmosphere and thus oxygen is introduced into the expansion tank 50, there is a risk of corrosion in the heating pipeline.

[0008] FIG. 2 is a schematic view illustrating a conventional gas boiler including a closed type expansion tank.

[0009] The conventional closed type gas boiler is the same as the conventional opened type gas boiler in that the conventional closed type gas boiler includes the circulation pump 10, the main heat exchanger 20, the burner 21, the three-way valve 30, and the hot water heat exchanger 40, and is different from the conventional opened type gas boiler in that the expansion tank 70 is blocked from the atmosphere and the conventional closed type gas boiler further includes a gas-water separator 71, an overpressure safety valve 72, and a pressure system 73.

[0010] The expansion tank 70 which is structured such that heating water is shielded from external air includes a rubber plate 70a, and a gas storage unit 70b in which gas (for example, nitrogen) is filled and a heating water storage unit 70c in which heating water is stored, wherein the gas storage unit 70b and the heating water storage unit 70c are formed with the rubber plate 70a therebetween. The rubber plate 70a absorbs a change in a pressure of the heating water by being deformed according to a pressure applied thereto.

[0011] The conventional closed type gas boiler has no limitation in its installation position, unlike the conventional opened type gas boiler, and may prevent oxygen from being introduced into heating water because a heating water circulation system is blocked from the atmosphere. However, since a change in a pressure of the heating water is absorbed using a gas pressure of a gas filled in the gas storage unit 70b, a function of the conventional closed type gas boiler may be degraded when it is used for a long time. Since the conventional closed type gas boiler has a complex structure of filling a gas therein, the conventional closed type gas boiler may not be easily manufactured at a low cost. Since the conventional closed type gas boiler is formed of a steel material, the conventional closed type gas boiler may have a risk of corrosion.

[0012] Since the opened type expansion tank 50 has disadvantages of a limitation of an installation position and a risk of corrosion of a heating water pipeline and the closed type expansion tank 70 has disadvantages of a complex structure, a difficult manufacturing process, and high manufacturing costs, there is a demand for an expansion tank that may overcome the disadvantages of the conventional expansion tanks 50 and 70.

[Disclosure]

[Technical Problem]

5 **[0013]** The present invention is directed to providing an expansion tank for a gas boiler which may be easily manufactured at a low cost due to its simple internal structure and may have high pressure resistance and high corrosion resistance to heating water.

[Technical Solution]

10 **[0014]** One aspect of the present invention provides an expansion tank for a gas boiler, the expansion tank including: a body that has an upper portion and a lower portion that are opened, includes a lattice heating water receiving unit that is divided into compartments by a plurality of diaphragms and in which heating water is received, and is integrally formed with the plurality of diaphragms; and an upper inner cover and a lower inner cover that are coupled to the body to cover
15 the upper portion and the lower portion of the body.

[0015] An upper outer cover may be attached to an upper portion of the upper inner cover, and a lower outer cover may be attached to a lower portion of the lower inner cover.

[0016] The lattice heating water receiving unit may be shaped such that an outer surface of a body portion divided into compartments by the plurality of diaphragms is curved outward.

20 **[0017]** Each of the body including the lattice heating water receiving unit, the upper inner cover, and the lower inner cover is formed of a plastic material, and each of the upper outer cover and the lower outer cover may be formed of a steel material.

[0018] Flanges that protrude outward may be vertically stacked on an edge portion of an upper end of the body, a lower end of the upper inner cover, and a lower end of the upper outer cover, flanges that protrude outward may be
25 vertically stacked on an edge portion of a lower end of the body, an upper end of the lower inner cover, and an upper end of the lower outer cover, and a plurality of bolts may pass at regular intervals through the flanges ranging from the flange formed on the upper outer cover to the lower outer cover, and end portions of the plurality of bolts may be screwed into nuts.

[0019] An upper support plate and a lower support plate may be horizontally provided respectively in the upper portion and the lower portion of the body, and flanges may be formed on an upper end and a lower end of the lattice heating
30 water receiving unit and may be fixedly inserted into holes formed in the upper support plate and the lower support plate.

[0020] Each of the upper support plate and the lower support plate may be formed of a plastic material.

[0021] The upper support plate may include an upper communication unit that is provided at a position spaced a predetermined interval downward from an upper end of the body and is disposed between the upper support plate and
35 the upper inner cover, and the lower support plate may include a lower communication unit that is provided at a position spaced a predetermined interval upward from a lower end of the body and is disposed between the lower support plate and the lower inner cover, wherein the compartments of the lattice heating water receiving unit communicate with one another through the upper communication unit and the lower communication unit.

[0022] Protrusion units that are closely attached to an inner circumferential surface of the body may be respectively
40 formed on a lower end of the upper inner cover and an upper end of the lower inner cover, and O-rings may be disposed between outer circumferential surfaces of the protrusion units and the inner circumferential surface of the body.

[0023] Each of the upper inner cover and the upper outer cover may be curved upward, and each of the lower inner cover and the lower outer cover may be curved downward.

45 **[0024]** The expansion tank may further include a gas-water separator, a water level detection sensor, and an over-pressure safety valve that are provided on the body.

[Advantageous Effects]

50 **[0025]** According to an expansion tank for a gas boiler of the present invention, since each of a body and upper and lower inner covers contacting heating water is formed of a plastic material, corrosion resistance may be improved. Since each of upper and lower outer covers is formed of a steel material, the body, the upper and lower inner covers, and the upper and lower outer covers are coupled to one another using bolts and nuts, and a lattice heating water receiving unit formed of a plastic material is provided in the body, a rapid change in a pressure of heating water may be supported and damage due to expansion may be prevented.

55 **[0026]** Also, when the expansion tank includes a gas-water separator, a water level detection sensor, and an over-pressure safety valve, since the expansion tank has an opened structure when a water level of heating water is equal to or less than a predetermined water level and is changed to a closed structure when the water level of the heating water exceeds the predetermined water level, a risk of corrosion of a heating pipeline which is caused when external

oxygen is introduced into the expansion tank may be avoided. Also, since a water level in the expansion tank is detected, whether to supplement heating water may be easily determined. Since the pressure is adjusted to an appropriate pressure using the overpressure safety valve when a pressure in the expansion tank rapidly increases, damage to the expansion tank may be prevented.

[Description of Drawings]

[0027]

FIG. 1 is a schematic view illustrating a conventional gas boiler including an opened type expansion tank.
 FIG. 2 is a schematic view illustrating a conventional gas boiler including a closed type expansion tank.
 FIG. 3 is a front view illustrating an expansion tank for a gas boiler according to an embodiment of the present invention.
 FIG. 4 is an exploded perspective view illustrating the expansion tank of FIG. 3.
 FIG. 5 is a perspective view illustrating a lattice heating water receiving unit provided in a body of the expansion tank of FIG. 4.
 FIG. 6 is a cross-sectional view taken along line A-A of the body of the expansion tank of FIG. 4.
 FIG. 7 is a cross-sectional view taken along line B-B of the body of the expansion tank of FIG. 4.
 FIG. 8 is a front view illustrating an expansion tank for a gas boiler according to another embodiment of the present invention.

**** Description of Reference Numerals ****

[0028]

10:	circulation pump
20:	main heat exchanger
21:	burner
30:	three-way valve
40:	hot water heat exchanger
50, 70, 100, 200:	expansion tank
51:	water level detection sensor
52:	overflow pipe
61:	heating water supply pipe
62:	heating return water pipe
63:	direct water pipe
64:	hot water pipe
70a:	rubber plate
70b:	gas storage unit
70c:	heating water storage unit
71:	gas-water separator
72:	overpressure safety valve
73:	pressure system
110:	body
111, 113, 121, 131, 141, 151:	flange
112, 114, 122, 132, 142, 152:	coupling hole
115:	lattice heating water receiving unit
115a:	body portion
115b, 115c:	flange
115d, 115e, 115f, 115g:	diaphragm
116:	upper support plate
117:	lower support plate
118:	upper communication unit
119:	lower communication unit
120:	upper inner cover
124, 144:	protrusion unit
125, 145:	O-ring
130:	upper outer cover

140:	lower inner cover
150:	lower outer cover
161:	bolt
162:	nut
210:	gas-water separator
220:	water level detection sensor
230:	overpressure safety valve

[Modes of the Invention]

[0029] The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown.

[0030] FIG. 3 is a front view illustrating an expansion tank 100 for a gas boiler according to an embodiment of the present invention. FIG. 4 is an exploded perspective view illustrating the expansion tank 100 of FIG. 3. FIG. 5 is a perspective view illustrating a lattice heating water receiving unit 115 provided in a body 110 of the expansion tank 100 of FIG. 4. FIG. 6 is a cross-sectional view taken along line A-A of the body 110 of the expansion tank 100 of FIG. 4. FIG. 7 is a cross-sectional view taken along line B-B of the body 110 of the expansion tank 100 of FIG. 4.

[0031] Referring to FIG. 3, the expansion tank 100 includes the body 110 that has a cylindrical shape and includes the lattice heating water receiving unit 115 therein, an upper inner cover 120 that is coupled to the body 110 to cover an upper portion of the body 110, an upper outer cover 130 that is coupled to the upper inner cover 120 to be closely attached to an upper portion of the upper inner cover 120, a lower inner cover 140 that is coupled to the body 110 to cover a lower portion of the body 110, and a lower outer cover 150 that is coupled to the lower inner cover 140 to be closely attached a lower portion of the lower inner cover 140 and includes a heating return water inlet pipe 171 and a heating return water outlet pipe 172. The elements are coupled to one another using bolts 161 and nuts 162.

[0032] Since each of the body 110 including the lattice heating water receiving unit 115, the upper inner cover 120, and the lower inner cover 140 is formed of a plastic material, even when the body 110, the upper inner cover 120, and the lower inner cover 140 contact heating water stored in the expansion tank 100, there is no risk of corrosion.

[0033] However, if all of the elements of the expansion tank 100 are formed of a plastic material, when a water pressure of the heating water stored in the expansion tank 100 increases, the expansion tank 100 may not withstand the water pressure and may be damaged. Accordingly, in order to increase water pressure resistance of the expansion tank 100, each of the upper outer cover 130 and the lower outer cover 150, which do not contact the heating water, is formed of a steel material.

[0034] A coupling structure of the expansion tank 100 will now be explained with reference to FIG. 4.

[0035] The body 110 has a cylindrical shape and the upper and lower portions of the body 110 are opened. As shown in FIGS. 5 through 7, the heating water receiving unit 115 having a lattice shape to withstand a pressure increase of the heating water by distributing a water pressure of the heating water is provided in the body 110, and flanges 111 and 113 that protrude outward are formed on edge portions of upper and lower ends of the body 110.

[0036] The upper inner cover 120 and the lower inner cover 140 have the same shape and are symmetrically coupled to the upper and lower portions of the body 110 respectively. The upper outer cover 130 and the lower outer cover 150 have the same shape and are symmetrically coupled to the upper portion of the upper inner cover 120 and the lower portion of the lower inner cover 140 respectively.

[0037] Each of the upper inner cover 120 and the upper outer cover 130 has a hat-like shape in which an empty space is formed and is curved upward. The lower inner cover 140 and the lower outer cover 150 are curved downward to be symmetrical to the upper inner cover 120 and the upper outer cover 130.

[0038] Flanges 121 and 131 which protrude outward are formed on an edge portion of a lower end of the upper inner cover 120 and a lower end of the upper outer cover 130. The flange 121 of the upper inner cover 120 and the flange 131 of the upper outer cover 130 are sequentially stacked on the flange 111 formed on the upper end of the body 110.

[0039] Likewise, flanges 141 and 151 which protrude outward are formed on an edge portion of an upper end of the lower inner cover 140 and an upper end of the lower outer cover 150. The flange 141 of the lower inner cover 140 and the flange 151 of the lower outer cover 150 are sequentially stacked under the flange 113 formed on the lower end of the body 110.

[0040] A protrusion unit 124 that protrudes downward is formed on the lower end of the upper inner cover 120 and is closely attached to an inner circumferential surface of the upper portion of the body 110. A protrusion unit 144 that protrudes upward is formed on the upper end of the lower inner cover 140 and is closely attached to an inner circumferential surface of the lower portion of the body 110.

[0041] O-rings 125 and 145 are provided on outer circumferential surfaces of the protrusion units 124 and 144 to maintain airtightness between the outer circumferential surfaces of the protrusion units 124 and 144 and an inner circumferential surface of the body 110.

[0042] A plurality of coupling holes 132, 122, 112, 114, 142, and 152 are respectively formed at regular intervals in the flanges 131, 121, 111, 113, 141, and 151, the bolts 161 are sequentially inserted into the coupling holes 132, 122, 112, 114, 142, and 152, and end portions of the bolts 161 are screwed into the nuts 162 so that the upper inner cover 120 and the upper outer cover 130 are coupled to the upper portion of the body 110 and the lower inner cover 140 and the lower outer cover 150 are coupled to the lower portion of the body 110.

[0043] An internal structure of the body 110 will now be explained with reference to FIGS. 5 through 7.

[0044] The lattice heating water receiving unit 115 in which an inner space of a body portion 115a is divided into compartments by a plurality of diaphragms 115d, 115e, 115f, and 115g to withstand a pressure increase of heating water by distributing a water pressure of the heating water is provided in the body 110. Flanges 115b and 115c which protrude outward are respectively formed on an upper end and a lower end of the body portion 115a.

[0045] Since the lattice heating water receiving unit 115 is formed of a plastic material and an outer surface of the body portion 115a has a shape that is curved outward, a pressure of the heating water received in the compartments divided by the diaphragms 115d, 115e, 115f, and 115g may be uniformly distributed outward.

[0046] An upper support plate 116 and a lower support plate 117 each formed of a plastic material are horizontally provided in the upper portion and the lower portion of the body 110, and side surfaces of the upper support plate 116 and the lower support plate 117 are fixed to the inner circumferential surface of the body 110. Holes having sizes corresponding to shapes of the flanges 115b and 115c formed on an upper end and a lower end of the lattice heating water receiving unit 115 are formed in the upper support plate 116 and the lower support plate 117, and the flanges 115b and 115c of the lattice heating water receiving unit 115 are fixedly inserted into the holes.

[0047] Since the upper support plate 116 and the lower support plate 117 are horizontally provided in the body 110 and the lattice heating water receiving unit 115 is vertically coupled between the upper support plate 116 and the lower support plate 117, and thus the body 110, the upper support plate 116, the lower support plate 117, and the lattice heating water receiving unit 115 provided in the body 110 which are each formed of a plastic material mutually support one another, a water pressure of the heating water stored in the body 110 may be withstood.

[0048] The upper support plate 116 is provided at a position spaced a predetermined interval downward from the upper end of the body 110, and the lower support plate 117 is provided at a position spaced a predetermined interval upward from the lower end of the body 110.

[0049] Accordingly, when the expansion tank 100 is assembled, an upper communication unit 118 is provided between the upper support plate 116 and the upper inner cover 120, a lower communication unit 119 is provided between the lower support plate 117 and the lower inner cover 140, and thus the lattice heating water receiving unit 115 communicates with the upper communication unit 118 and the lower communication unit 119 in the body 110.

[0050] Also, since the upper communication unit 118 and the lower communication unit 119 are formed, spaces into which the protrusion units 124 and 144 formed on the lower end of the upper inner cover 120 and the upper end of the lower inner cover 140 are inserted into the inner circumferential surface of the body 110 are secured.

[0051] Although the body portion 115a of the lattice heating water receiving unit 115 has the outer surface looking like partially overlapping convex cylindrical shapes, the present embodiment is not limited thereto. The body portion 115a may have any other shapes as long as the inner space may be divided by the diaphragms to support a water pressure and distribute the water pressure. Also, it would be understood that a number of the compartments is not limited to that in FIG. 5 and may also be changed.

[0052] FIG. 8 is a front view illustrating an expansion tank 200 for a gas boiler according to another embodiment of the present invention. The expansion tank 200 further includes a gas-water separator 210, a water level detection sensor 220, and an overpressure safety valve 230 in addition to the body 110 of the expansion tank 100.

[0053] The gas-water separator 210 for preventing a heating pipeline from being corroded by discharging air included in heating water to the outside of the expansion tank 200 is configured such that an air vent hole communicating with air is opened and closed according to a change in a water level in the expansion tank 200.

[0054] Accordingly, when a water level of the heating water stored in the expansion tank 200 is equal to or less than a predetermined water level, the expansion tank 200 has an opened structure, and when the water level of the heating water stored in the expansion tank 200 exceeds the predetermined water level, the expansion tank 200 is changed to a closed structure.

[0055] The water level detection sensor 220 provides a standard for determining whether to supplement the heating water by allowing a user to easily know a water level of the heating water stored in the expansion tank 200.

[0056] As a temperature of the heating water increases and thus a pressure in the expansion tank 200 rapidly increases, the overpressure safety valve 230 is automatically opened. The overpressure safety valve 230 may be provided at a side of the upper portion of the body 110 and may maintain a pressure in the expansion tank 200 at an appropriate level or less by discharging air compressed in the expansion tank 200 to the outside.

[0057] According to the present embodiment, a change in a pressure of the expansion tank 200 may be handled using the gas-water separator 210 and the overpressure safety valve 230, and whether to supplement heating water may be easily determined using the water level detection sensor 220.

Claims

1. An expansion tank for a gas boiler, the expansion tank comprising:

a body that has an upper portion and a lower portion that are opened,
comprises a lattice heating water receiving unit that is divided into compartments by a plurality of diaphragms
and in which heating water is received, and is integrally formed with the plurality of diaphragms; and
an upper inner cover and a lower inner cover that are coupled to the body to cover the upper portion and the
lower portion of the body.

2. The expansion tank of claim 1, wherein an upper outer cover is attached to an upper portion of the upper inner cover, and a lower outer cover is attached to a lower portion of the lower inner cover.

3. The expansion tank of claim 1, wherein the lattice heating water receiving unit is shaped such that an outer surface of a body portion divided into compartments by the plurality of diaphragms is curved outward.

4. The expansion tank of claim 2, wherein each of the body comprising the lattice heating water receiving unit, the upper inner cover, and the lower inner cover is formed of a plastic material, and each of the upper outer cover and the lower outer cover is formed of a steel material.

5. The expansion tank of claim 2, wherein flanges that protrude outward are vertically stacked on an edge portion of an upper end of the body, a lower end of the upper inner cover, and a lower end of the upper outer cover, flanges that protrude outward are vertically stacked on an edge portion of a lower end of the body, an upper end of the lower inner cover, and an upper end of the lower outer cover, and
a plurality of bolts pass through at regular intervals from the flanges formed on the upper outer cover to the flanges formed on the lower outer cover, and end portions of the plurality of bolts are screwed into nuts.

6. The expansion tank of claim 1, wherein an upper support plate and a lower support plate are horizontally provided respectively in the upper portion and the lower portion of the body, and flanges are formed on an upper end and a lower end of the lattice heating water receiving unit and are fixedly inserted into holes formed in the upper support plate and the lower support plate.

7. The expansion tank of claim 6, wherein each of the upper support plate and the lower support plate is formed of a plastic material.

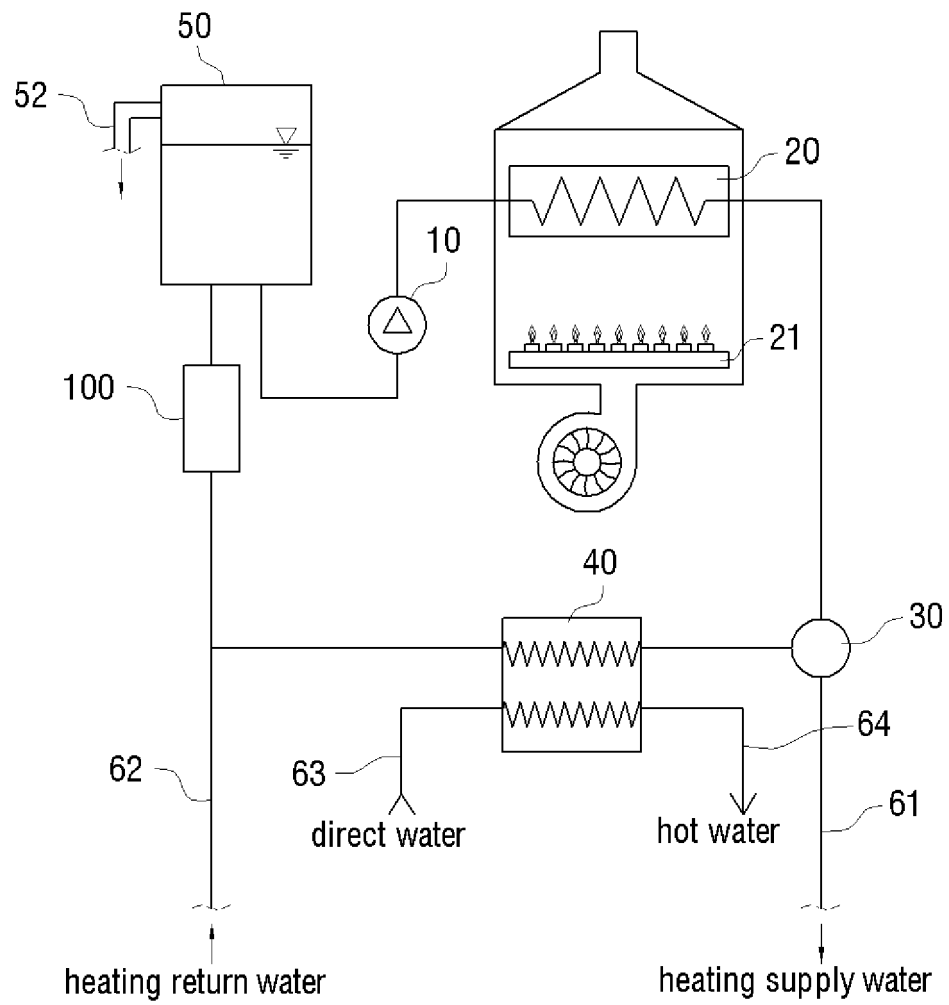
8. The expansion tank of claim 6, wherein the upper support plate comprises an upper communication unit that is provided at a position spaced a predetermined interval downward from an upper end of the body and is disposed between the upper support plate and the upper inner cover, and the lower support plate comprises a lower communication unit that is provided at a position spaced a predetermined interval upward from a lower end of the body and is disposed between the lower support plate and the lower inner cover, wherein the compartments of the lattice heating water receiving unit communicate with one another through the upper communication unit and the lower communication unit.

9. The expansion tank of claim 8, wherein protrusion units that are closely attached to an inner circumferential surface of the body are respectively formed on a lower end of the upper inner cover and an upper end of the lower inner cover, and O-rings are disposed between outer circumferential surfaces of the protrusion units and the inner circumferential surface of the body.

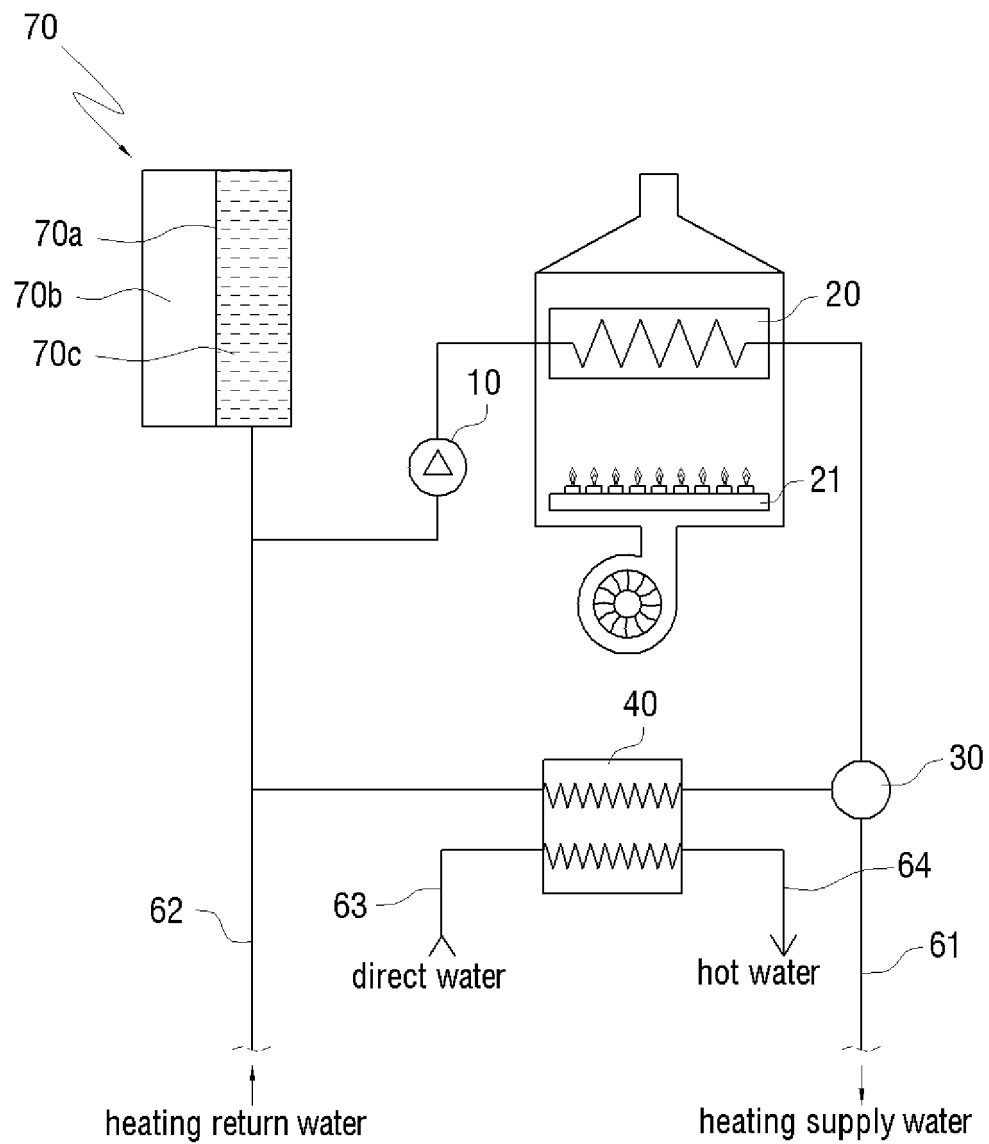
10. The expansion tank of claim 2, wherein each of the upper inner cover and the upper outer cover is curved upward, and each of the lower inner cover and the lower outer cover is curved downward.

11. The expansion tank of any one of claims 1 through 10, wherein a gas-water separator, a water level detection sensor, and an overpressure safety valve are further provided on the body.

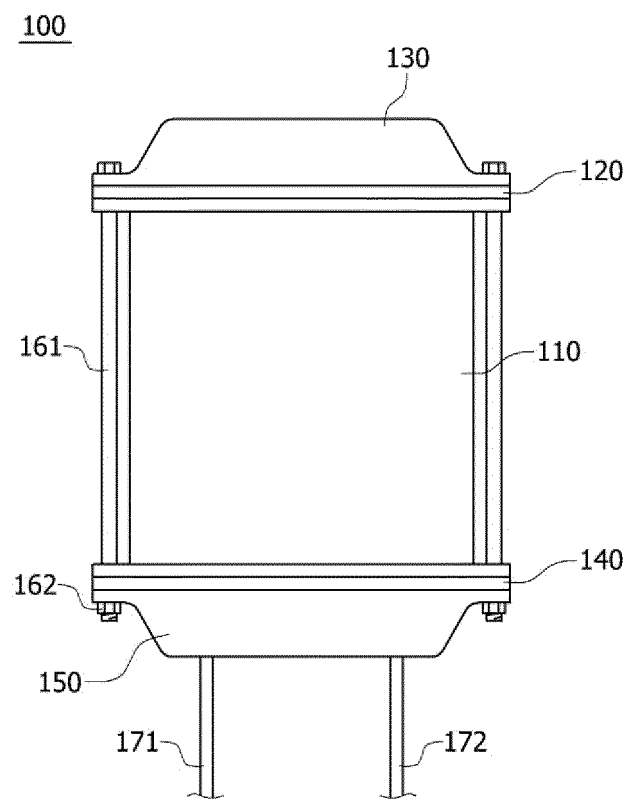
【Fig. 1】



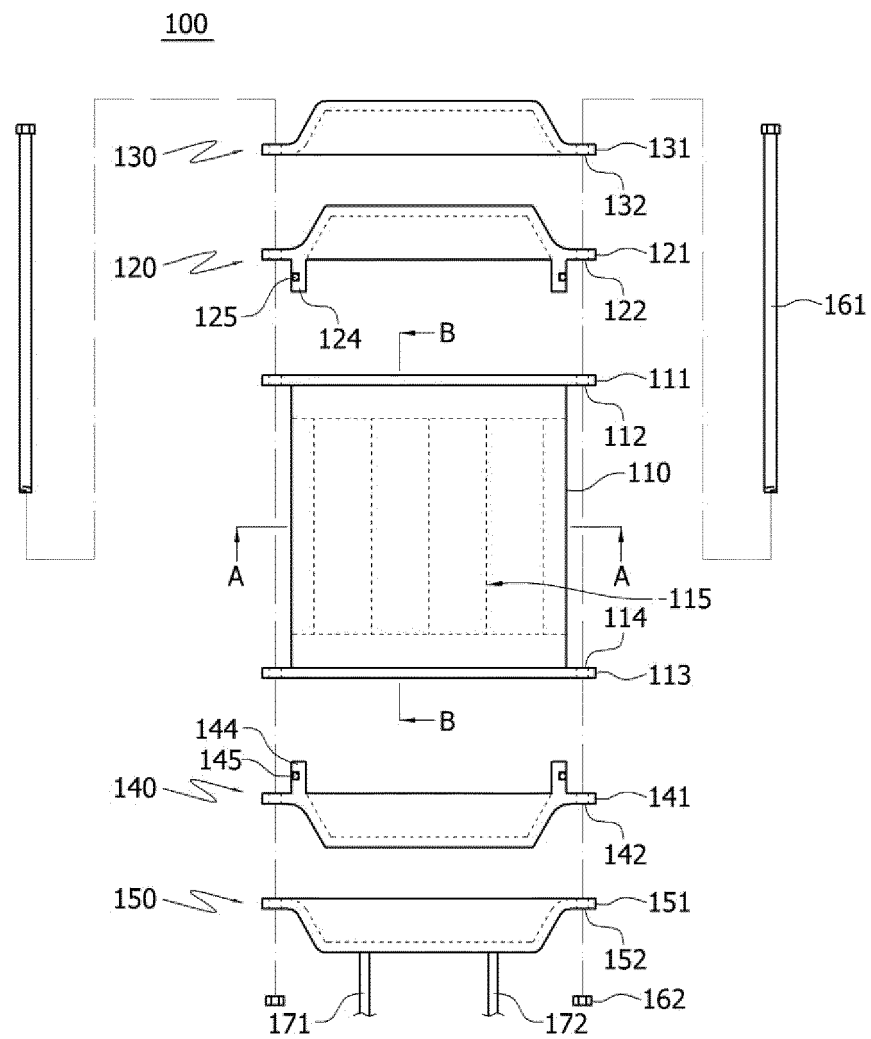
【 Fig. 2】



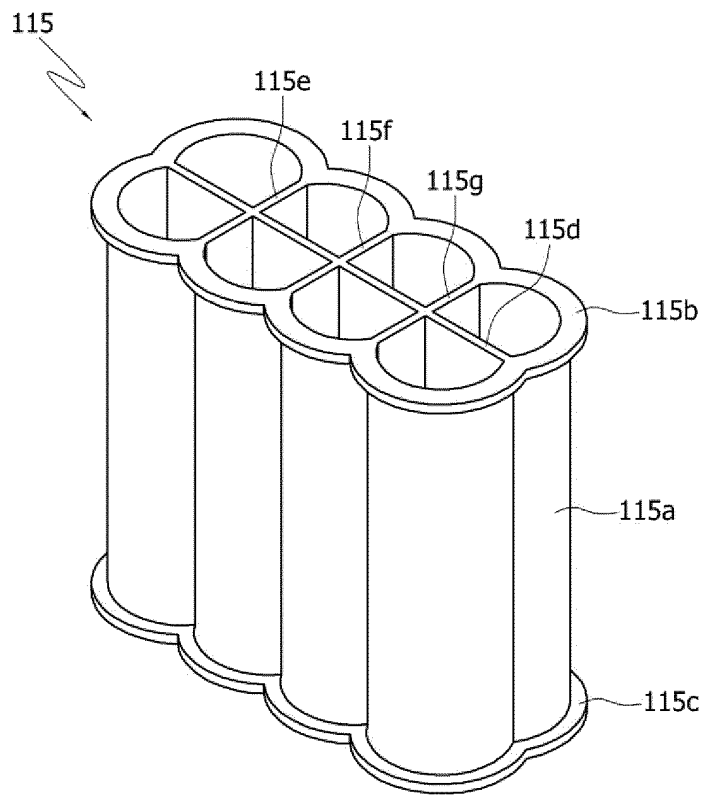
【 Fig. 3】



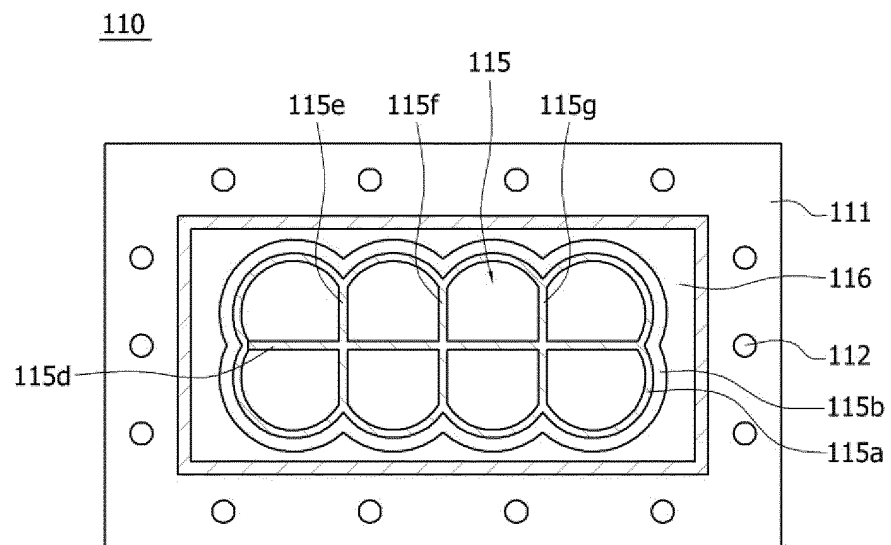
【Fig. 4】



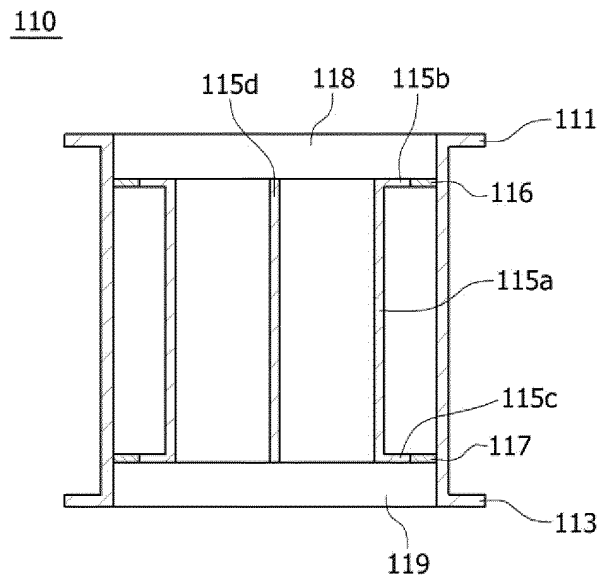
【 Fig. 5】



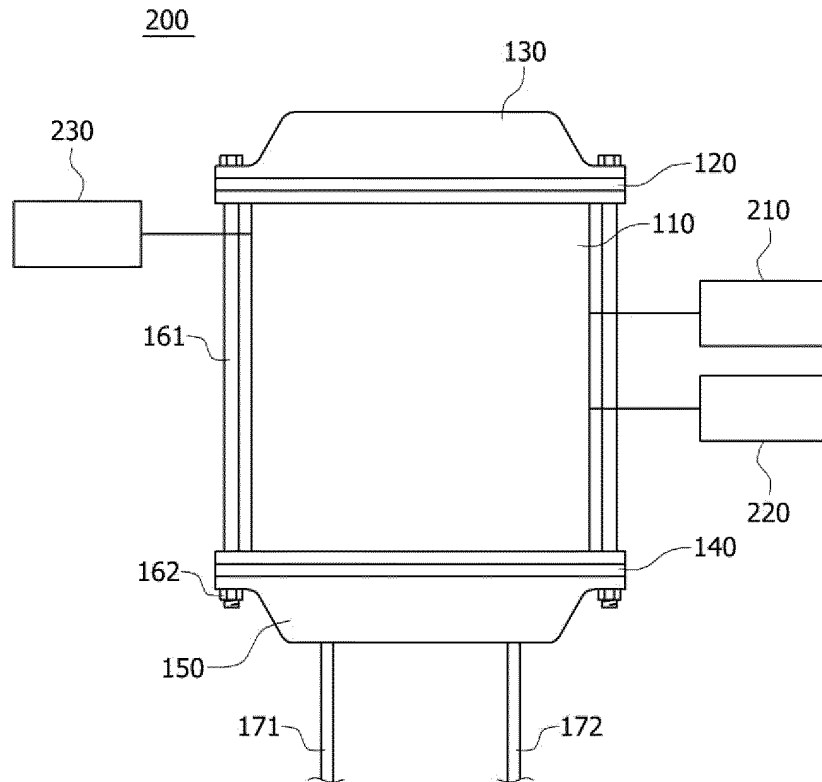
【 Fig. 6】



【 Fig. 7】



【 Fig. 8】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2011/002932

A. CLASSIFICATION OF SUBJECT MATTER		
F24H 9/00(2006.01)i, F24H 9/20(2006.01)j		
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) F24H 9/00; F24H 1/00; F24D 3/10; B65B 3/04; F24H 9/20		
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: expansion tnak, cover		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-505035 A (BASF SE) 05 February 2009 See figure 1.	1-11
A	KR 10-2009-0093341 A (KYUNG DONG NAVIEN CO., LTD.) 02 September 2009 See figures 1-8.	1-11
A	KR 10-2009-0078951 A (KYUNG DONG NAVIEN CO., LTD.) 21 July 2009 See figures 1-12.	1-11
A	KR 20-0253031 Y1 (BAE, KI MAN et al.) 23 November 2001 See figures 1-3.	1-11
A	KR 20-0139707 Y1 (DAEWOO ELECTRONICS CO., LTD) 20 March 1999 See figures 1-4.	1-11
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search 16 JANUARY 2012 (16.01.2012)		Date of mailing of the international search report 16 JANUARY 2012 (16.01.2012)
Name and mailing address of the ISA/KR  Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140		Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2011/002932

Patent document cited in search report	Publication date	Patent family member	Publication date
JP 2009-505035 A	05.02.2009	CN 101243289 A CN 101243289 B DE 102005039161 A1 EP 1917482 A1 JP 2009-505035 T KR 10-2008-0037090 A KR20080037090A US 2010-0140273 A1 WO 2007-020199 A1	13.08.2008 09.06.2010 22.02.2007 07.05.2008 05.02.2009 29.04.2008 29.04.2008 10.06.2010 22.02.2007
KR 10-2009-0093341 A	02.09.2009	AU 2008-351482 A1 CN 101960230 A EP 2250449 A1 US 2011-0000444 A1 WO 2009-107923 A1	03.09.2009 26.01.2011 17.11.2010 06.01.2011 03.09.2009
KR 10-2009-0078951 A	21.07.2009	NONE	
KR 20-0253031 Y1	23.11.2001	KR 10-0457641 B1	26.11.2004
KR 20-0139707 Y1	20.03.1999	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)