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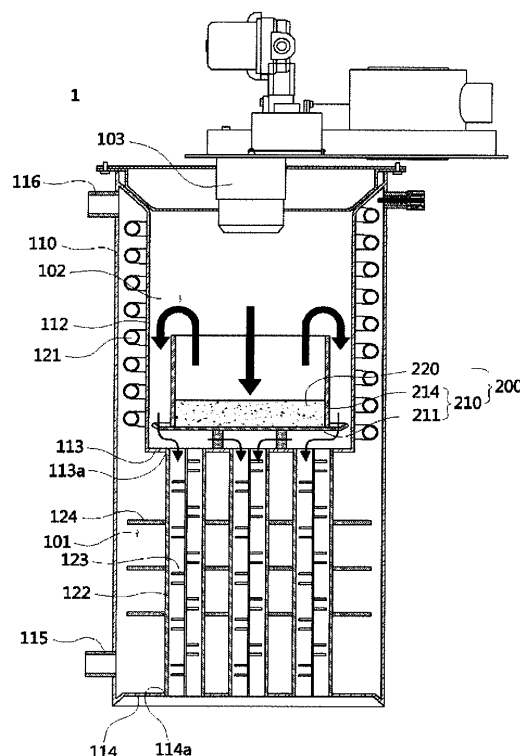
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(54) **OIL-FIRED BOILER HAVING COMBUSTION GAS PATH GUIDE**

(57) The present invention relates to an oil-fired boiler having a combustion gas path guide, the oil-fired boiler comprising: a combustion chamber wall body configured to enclose a combustion chamber in which combustion is performed by a burner; a plurality of fire tubes installed to face the burner with the combustion chamber interposed therebetween, wherein a combustion gas generated by the combustion of the burner passes through the plurality of fire tubes; a first fire tube support plate configured to fixedly support one end of each of the plurality of fire tubes, which is close to the burner; a boiler body configured to form a water tank accommodating heating water which is filled in a space between the combustion chamber wall body and the boiler body and a space between the fire tube and the boiler body; and combustion gas path guides provided between the burner and the first fire tube support plate and configured to block the combustion gas generated by the combustion of the burner from flowing through a central portion of the combustion chamber and at the same time to allow the combustion gas to flow through a space formed between an edge portion of the combustion chamber and an inner side surface of the combustion chamber wall body.

FIG. 2



Description

[Technical Field]

5 **[0001]** The present invention relates to an oil-fired boiler having a combustion gas path guide, and more particularly, to an oil-fired boiler having a combustion gas path guide capable of preventing generation of bubbles and improving efficiency by preventing a combustion gas generated in a burner from being concentrated on a fire tube support plate to which a fire tube is coupled.

10 [Background Art]

15 **[0002]** Boilers that are widely used as a heating and hot water installation in a general household are classified according to various criteria such as fuel used to heat heating water, positions of a heat source and a burner, and the like. That is, boilers are classified into oil-fired boilers and gas boilers according to fuel for use, and the oil-fired boilers use diesel or kerosene as fuel, and the gas boilers use liquefied petroleum gas (LPG) or liquefied natural gas (LNG) as fuel. Also, boilers are classified into general boilers that perform heat exchange by only a heat source (sensible heat) generated from fuel combustion, and condensing boilers that additionally perform heat exchange by latent heat of condensation generated from a sensible heat exchanger. In addition, according to a position of a burner that combusts fuel, boilers are classified into upward combustion type boilers in which a burner is positioned at a lower portion of the boiler and downward combustion type boilers in which a burner is positioned at an upper portion of the boiler.

20 **[0003]** Among the types of boilers described above, FIG. 1 illustrates a typical downward combustion type general oil-fired boiler.

25 **[0004]** A burner 15 is provided at an upper portion of a boiler, and a combustion chamber 10 is formed below the burner 15. Combustion is performed inside the combustion chamber 10 by a flame generated in the burner 15.

30 **[0005]** A plurality of fire tubes 12 are provided below the combustion chamber 10 and form a heat exchanger, wherein a combustion gas passes inside the plurality of fire tubes 12. Upper end portions of the fire tubes 12 are fixedly installed at a first fire tube support plate 13, and lower end portions thereof are fixedly installed at a second fire tube support plate 14.

35 **[0006]** A boiler body 11 configured to form an outer body of the boiler is provided outside each of the combustion chamber 10 and the fire tube 12. A space between the boiler body 11 and the combustion chamber 10 and a space between the boiler body 11 and the fire tube 12 become a water tank 30 in which heating water is filled.

40 **[0007]** In the space between the boiler body 11 and the combustion chamber 10, a hot water coil 20 is provided so that the hot water coil 20 is wound around a circumference of the combustion chamber 10. When water to be supplied to a user is supplied inside the hot water coil 20, the water is heated through heat exchange with the heating water filled in the water tank 30 and supplied to the user as hot water.

45 **[0008]** The water filled in the water tank 30 is heated through heat exchange with the fire tube 12 and then is supplied to a place to be heated.

50 **[0009]** In the case of a typical downward combustion chamber oil-fired boiler configured as described above, the flame generated in the burner 15 is formed downward, and bubbles are generated in region A under the first fire tube support plate 13 due to effervescence resulting from the high temperature flame. There are problems in that these bubbles decrease thermal efficiency by hindering heat exchange and, when overheated, generate noise by popping.

55 **[0010]** As prior art for solving such problems, Korean Patent Registration No. 10-1504394 is disclosed. In Korean Patent Registration No. 10-1504394, upper and lower end plates are provided, each configured in a multistage form and having a height that increases toward an outside portion farthest from the flame. However, there are problems in that the upper and lower end plates are complicated in form and are difficult to manufacture, and even though the manufacturing is possible, manufacturing costs are high.

[Disclosure]

[Technical Problem]

60 **[0011]** The present invention is directed to providing an oil-fired boiler having a combustion gas path guide capable of improving thermal efficiency and reducing generation of noise by preventing generation of effervescence due to a flame of a burner.

[Technical Solution]

65 **[0012]** One aspect of the present invention provides an oil-fired boiler, which is configured with a combustion chamber wall body (112) configured to enclose a combustion chamber (102) in which combustion is performed by a burner (103);

a plurality of fire tubes (122) installed to face the burner (103) with the combustion chamber (102) interposed therebetween, wherein a combustion gas generated by the combustion of the burner (103) passes through the plurality of fire tubes (122); a first fire tube support plate (113) configured to fixedly support one end of each of the plurality of fire tubes (122), which is close to the burner (103); a boiler body (110) configured to form a water tank (101) accommodating heating water which is filled in a space between the combustion chamber wall body (112) and the boiler body (110) and a space between the fire tube (122) and the boiler body (110); and combustion gas path guides (200, 200-1, 200-2, and 200-3) provided between the burner (103) and the first fire tube support plate (113) and configured to block the combustion gas generated by the combustion of the burner (103) from flowing through a central portion of the combustion chamber (102) and at the same time to allow the combustion gas to flow through a space formed between an edge portion of the combustion chamber (102) and an inner side surface of the combustion chamber wall body (112).

[0013] The combustion gas path guide (200) may include a guide plate (211) separated from the first fire tube support plate (113) .

[0014] The oil-fired boiler may further include a guide sidewall (214) extending from an edge of the guide plate (211) toward the burner (103).

[0015] An insulating material (220) may be provided on the guide plate (211) to block heat of the combustion gas generated in the burner (103) from being transmitted to the guide plate (211) .

[0016] The combustion gas path guide (200-1) may be configured with a guide plate (211-1) separated from the first fire tube support plate (113); and an insulating material (220-1) provided on the guide plate (211-1) to block the heat of the combustion gas generated in the burner (103) from being transmitted to the guide plate (211-1).

[0017] The combustion gas path guide (200-2) may be configured with a first guide plate (211-2) separated from the first fire tube support plate (113); a second guide plate (212-2) provided to form a space (213-2) between the first guide plate (211-2) and the second guide plate (212-2); and a guide sidewall (214-2) extending from an edge of each of the first guide plate (211-2) and the second guide plate (212-2) toward the burner (103) to seal an inside of the space (213-2).

[0018] The combustion gas path guide (200-3) may be configured with a first guide plate (211-3) separated from the first fire tube support plate (113); a second guide plate (212-3) provided to form a space (213-3) between the first guide plate (211-3) and the second guide plate (212-3); and a guide sidewall (214-3) configured to connect edges of the first guide plate (211-3) and the second guide plate (212-3) to each other and seal an inside of the space (213-3).

[0019] A portion in contact with the combustion gas of each of the combustion gas path guides (200, 200-1, 200-2, and 200-3) may be configured with a ferritic stainless steel for high-temperature oxidation resistance.

[0020] An end portion of the edge of the guide plate (211) may be configured to protrude outward more than an outside surface of the guide sidewall (214).

[0021] Another aspect of the present invention provides an oil-fired boiler, which is configured with a combustion chamber wall body (112) configured to enclose a combustion chamber (102) in which combustion is performed by a burner (103); a plurality of fire tubes (122) installed to face the burner (103) with the combustion chamber (102) interposed therebetween, wherein a combustion gas generated by the combustion of the burner (103) passes through the plurality of fire tubes (122); a first fire tube support plate (113) configured to fixedly support one end of each of the plurality of fire tubes (122), which is close to the burner (103); a combustion gas path guide (200-4) configured to cover an upper portion of the first fire tube support plate (113) to block the combustion gas from being in direct contact with the first fire tube support plate (113), and having a through-hole (215-4) formed at a position corresponding to each of the plurality of fire tubes (122) to allow the combustion gas to flow through the plurality of fire tubes (122).

[0022] The combustion gas path guide (200-4) may be formed of an insulating material having a predetermined thickness.

[Advantageous Effects]

[0023] In accordance with the oil-fired boiler of the present invention, since the combustion gas path guide configured to guide the combustion gas to an edge thereof is provided, the combustion gas can be prevented from being in direct contact with the fire tube support plate to suppress generation of bubbles, improve thermal efficiency, and reduce generation of noise.

[Description of Drawings]

[0024]

FIG. 1 is a cross-sectional view illustrating a typical downward combustion type general oil-fired boiler.

FIG. 2 is a cross-sectional view illustrating an oil-fired boiler according to a first embodiment of the present invention.

FIG. 3 is a diagram illustrating a combustion gas path guide according to the first embodiment.

FIG. 4 is a cross-sectional view illustrating an oil-fired boiler according to a second embodiment of the present invention.

FIG. 5 is a cross-sectional view illustrating an oil-fired boiler according to a third embodiment of the present invention.

FIG. 6 is a cross-sectional view illustrating an oil-fired boiler according to a fourth embodiment of the present invention.

FIG. 7 is a cross-sectional view illustrating an oil-fired boiler according to a fifth embodiment of the present invention.

FIG. 8 is a diagram illustrating an insulating material of FIG. 7.

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

1: oil-fired boiler	101: water tank
102: combustion chamber	103: burner
110: boiler body	112: combustion chamber wall body
113: first fire tube support plate	114: second fire tube support plate
121: hot water coil	122: fire tube
123: baffle plate membrane	124: heating water partition
200, 200-1, 200-2, 200-3, and guides 200-4: combustion gas path guide	
210: path guide	211, 211-1, and 211-2: guide plates
212-2 and 212-3: second guide plates	
214, 214-2, and 214-3: guide sidewalls	
220 and 220-1: insulating materials	
215-4: through-hole	

[Modes of the Invention]

[0025] Hereinafter, preferred embodiments according to the present invention will be described in detail with reference to the accompanying drawings.

<First Embodiment>

[0026] FIG. 2 is a cross-sectional view illustrating an oil-fired boiler according to a first embodiment of the present invention, and FIG. 3 is a diagram illustrating a combustion gas path guide according to the first embodiment.

[0027] The oil-fired boiler 1 of the present invention is configured with a burner 103 configured to generate a flame, a combustion chamber wall body 112 configured to enclose a combustion chamber 102 in which combustion is performed by the burner 103, a plurality of fire tubes 122 through which a combustion gas generated from the combustion of the burner 103 passes inside the plurality of fire tubes 122, a first fire tube support plate 113 and a second fire tube support plate 114 by which an upper end portion and a lower end portion of each of the plurality of fire tubes 122 are fixedly supported, and a combustion gas path guide 200 provided between the burner 103 and the first fire tube support plate 113 and configured to block the combustion gas from flowing through a central portion of the combustion chamber 102 and at the same time guide the combustion gas to flow to an edge portion of the combustion chamber 102.

[0028] The burner 103 is provided above the combustion chamber 102, and a flame generated in the burner 103 is formed downward.

[0029] A boiler body 110 encloses the combustion chamber wall body 112 with a separate space interposed therebetween.

[0030] A hot water coil 121 is provided to enclose the outside of the combustion chamber wall body 112 in the space between the combustion chamber wall body 112 and the boiler body 110. Direct water supplied through a hot water demand of a user flows inside the hot water coil 121. The direct water flowing inside the hot water coil 121 is heat-exchanged with heating water filled in a water tank 101 which is an outside space of the hot water coil 121, and then is supplied to the user as hot water.

[0031] A heating water partition membrane 124 is provided in a space between the fire tube 122 and the boiler body 110. The heating water partition membrane 124 prevents a sudden flow of the heating water inside the water tank 101,

thereby the heating water is sufficiently heat-exchanged with the combustion gas which flows inside the fire tube 122.

[0032] The fire tube 122 has a cylindrical shape having a predetermined length in a vertical direction and is configured with open upper and lower portions such that the combustion gas flows inside an inner space thereof through the open upper portion and is discharged through the open lower portion after flowing inside the inner space.

[0033] Baffle plates 123 are provided inside the fire tube 122 to increase a time during which the combustion gas stays in the inner space of the fire tube 122. The baffle plates 123 are provided such that a plurality of pieces are disposed to be staggered in a longitudinal direction of the fire tube 122 to retard a passage time of the combustion gas, thereby improving efficiency of heat exchange.

[0034] A first fire tube support plate 113 is coupled to the upper end portion of the fire tube 122. An edge of the first fire tube support plate 113 is coupled to a lower end of the combustion chamber wall body 112, and a first fire tube insertion hole 113a is formed in a body of the first fire tube support plate 113 to insert the upper end portion of the fire tube 12 into the body.

[0035] The second fire tube support plate 114 is coupled to the lower end portion of the fire tube 122. An edge of the second fire tube support plate 114 is coupled to a lower end of the boiler body 110, and a second fire tube insertion hole 114a is formed in a body of the second fire tube support plate 114 to insert the lower end portion of the fire tube 122 into the body.

[0036] The upper end portion and the lower end portion of the fire tube 122 are respectively inserted into the first fire tube insertion hole 113a and the second fire tube insertion hole 114a, and the contact portions are coupled by welding.

[0037] The combustion gas path guide 200 is configured with a path guide 210 and an insulating material 220, and is installed to face the burner 103 with the combustion chamber 102 interposed therebetween.

[0038] The path guide 210 is configured with a guide plate 211 separated upward from the first fire tube support plate 113, and a guide sidewall 214 extending upward from an edge of the guide plate 211 toward the burner 103.

[0039] The insulating material 220 is configured to block heat of the combustion gas from being transferred above the first fire tube support plate 113, and heat blocking may vary according to a thickness or a material of the insulating material 220. The insulating material 220 may be configured with an insulating refractory material having both fire resistance and heat insulation so as to withstand high temperature heat.

[0040] A separate space is formed between the guide sidewall 214 and the combustion chamber wall body 112 to form a flow path for the combustion gas.

[0041] A guide support leg 213 having a predetermined height is formed on a lower surface of the guide plate 211 to support the path guide 210 which is in a state separated from an upper surface of the first fire tube support plate 113.

[0042] An end portion of the edge of the guide plate 211 is configured to protrude outward more than an outside surface of the guide sidewall 214, and thus the space between the guide sidewall 214 and the combustion chamber wall body 112 is further narrowed so that the heat exchange between the combustion gas and the heating water is more easily accomplished.

[0043] A heating water inlet 115 and a heating water outlet 116 are provided to allow the heating water to flow into and out of the water tank 101. Further, although not shown in the drawing, an inlet end and an outlet end of the hot water coil 121 are respectively connected to a direct water pipe (not shown) and a warm water pipe (not shown) which pass through the boiler body 110 and are provided outside the boiler body 110.

[0044] A flow of the combustion gas in the oil-fired boiler configured as described above is as follows. That is, when combustion is performed in the burner 103, a combustion gas flows downward, and the flowing combustion gas is blocked by the insulating material 220, and thus an upward flow is generated along an inner wall of the guide sidewall 214. Thereafter, the combustion gas flows downward along the space between the guide sidewall 214 and the combustion chamber wall body 112, and, while flowing downward, the combustion gas undergoes a first heat-exchange with the heating water of the water tank 101.

[0045] The combustion gas, which has undergone the first heat-exchange, flows downward and then flows inside the fire tube 122, and, while flowing along the inner space of the fire tube 122, undergoes a second heat-exchange with the heating water of the water tank 101 provided outside the fire tube 122.

[0046] As described above, thermal efficiency is improved due to heat exchange occurring as the combustion gas flows downward along the space between the guide sidewall 214 and the combustion chamber wall body 112.

[0047] Also, while the combustion gas flows through the separate space between the guide sidewall 214 and the combustion chamber wall body 112, a temperature of the combustion gas first drops and then the combustion gas comes into contact with the first fire tube support plate 113, such that effervescence does not occur.

[0048] In addition, the insulating material 220 blocks the flow of the combustion gas, and thus heat is blocked from being transferred to the first fire tube support plate 113 such that effervescence is effectively prevented.

[0049] In the above-described first embodiment, a configuration provided with the path guide 210, which is configured with the guide plate 211 and the guide sidewall 214, and the insulating material 220 has been described, but a configuration without the guide sidewall 214 and the insulating material 220 may be configured.

[0050] That is, when the guide plate 211 is configured with a thick thickness, the combustion gas flows to the edge of

the guide plate 211 and then a downward flow of the combustion gas is generated, and thus heat of the combustion gas is blocked from being directly transmitted to the first fire tube support plate 113 such that generation of effervescence may be prevented. In this case, since the surface of the guide plate 211 may be oxidized, the guide plate 211 is preferably configured to be a heat resistant steel plate of a ferritic stainless steel with high-temperature oxidation resistance.

<Second Embodiment>

[0051] FIG. 4 is a cross-sectional view illustrating an oil-fired boiler according to a second embodiment of the present invention.

[0052] A combustion gas path guide 200-1 of the second embodiment is configured with a guide plate 211-1 separated upward from the first fire tube support plate 113, and an insulating material 220-1 provided on the guide plate 211-1 and configured to block heat of a combustion gas generated in the burner 103 from being transmitted to the guide plate 211-1.

[0053] Even in the above configuration, a downward flow of the combustion gas is blocked at an upper surface of the insulating material 220-1, thus the combustion gas flows in a lateral direction and then flows downward, and in the course of such a process, the combustion gas undergoes a first heat-exchange with the heating water of the water tank 101.

[0054] Thereafter, in a state in which a temperature of the combustion gas has dropped, the combustion gas flows to the upper surface of the first fire tube support plate 113 and undergoes heat exchange such that effervescence is prevented.

<Third Embodiment>

[0055] FIG. 5 is a cross-sectional view illustrating an oil-fired boiler according to a third embodiment of the present invention.

[0056] A combustion gas path guide 200-2 of the third embodiment is configured with a first guide plate 211-2 separated upward from the first fire tube support plate 113, a second guide plate 212-2 provided to form a space 213-2 between the first guide plate 211-2 and the second guide plate 212-2, and a guide sidewall 214-2 extending from an edge of each of the first guide plate 211-2 and the second guide plate 212-2 toward the burner 103 and configured to seal an inside of the space 213-2.

[0057] The combustion gas path guide 200-2 has a configuration nearly identical to that of the combustion gas path guide 200 of the first embodiment, but, there is a difference in that the second guide plate 212-2 and the space 213-2 are provided instead of the insulating material 220.

[0058] Owing to such a configuration, thermal efficiency can be improved due to a first heat exchange occurring as combustion gas flows downward along a space between the guide sidewall 214-2 and the combustion chamber wall body 112.

[0059] Further, heat of the combustion gas is blocked from being directly transmitted to the first fire tube support plate 113 such that generation of effervescence may be prevented.

[0060] In this case, the inside of the space 213-2 may be formed as a hollow space, or may be filled with a material for blocking heat transfer.

[0061] The first guide plate 211-2 and the second guide plate 212-2 may be configured with a ferritic stainless steel for high-temperature oxidation resistance so as to prevent oxidation resulting from a high temperature.

<Fourth Embodiment>

[0062] FIG. 6 is a cross-sectional view illustrating an oil-fired boiler according to a fourth embodiment of the present invention.

[0063] A combustion gas path guide 200-3 of the fourth embodiment is configured with a first guide plate 211-3 separated upward from the first fire tube support plate 113, a second guide plate 212-3 provided to form a space 213-3 between the first guide plate 211-3 and the second guide plate 212-3, and a guide sidewall 214-3 configured to connect edges of the first guide plate 211-3 and the second guide plate 212-3 and configured to seal an inside of the space 213-3.

[0064] The fourth embodiment is different from the third embodiment in that the guide sidewall 214-3 does not protrude above the second guide plate 212-3.

[0065] Even in this case, heat insulation is performed by the space 213-3, and thus heat of a combustion gas is blocked from being directly transmitted to the first fire tube support plate 113 such that generation of effervescence may be prevented.

[0066] Also, thermal efficiency can be improved due to heat exchange occurring as the combustion gas flows downward along a space between the guide sidewall 214-3 and the combustion chamber wall body 112.

<Fifth Embodiment>

[0067] FIG. 7 is a cross-sectional view illustrating an oil-fired boiler according to a fifth embodiment of the present invention, and FIG. 8 is a diagram illustrating an insulating material of FIG. 7.

[0068] A combustion gas path guide 200-4 of the fifth embodiment covers an upper portion of the first fire tube support plate 113 to block the combustion gas from being in direct contact with the first fire tube support plate 113, and is configured such that a through-hole 215-4 is formed at a position corresponding to the fire tube 122 to allow the combustion gas to flow through the fire tube 122.

[0069] In this case, the combustion gas path guide 200-4 is preferably formed of an insulating material having a predetermined thickness.

[0070] In accordance with such a configuration, the combustion gas path guide 200-4 prevents combustion gas from being in direct contact with the upper surface of the first fire tube support plate 113 such that generation of effervescence may be prevented.

[0071] As described above, the present invention is not limited to the above described embodiments, and modified implementations may be devised by those skilled in the art without departing from the technical spirit of the present invention as defined in the appended claims, and therefore, such modified implementations should be construed to fall within the scope of the present invention.

Claims**1.** An oil-fired boiler comprising:

a combustion chamber wall body (112) configured to enclose a combustion chamber (102) in which combustion is performed by a burner (103);

a plurality of fire tubes (122) installed to face the burner (103) with the combustion chamber (102) interposed therebetween, wherein a combustion gas generated by the combustion of the burner (103) passes through the plurality of fire tubes (122);

a first fire tube support plate (113) configured to fixedly support one end of each of the plurality of fire tubes (122), which is close to the burner (103);

a boiler body (110) configured to form a water tank (101) accommodating heating water which is filled in a space between the combustion chamber wall body (112) and the boiler body (110) and a space between the fire tube (122) and the boiler body (110); and

combustion gas path guides (200, 200-1, 200-2, and 200-3) provided between the burner (103) and the first fire tube support plate (113) and configured to block the combustion gas generated by the combustion of the burner (103) from flowing through a central portion of the combustion chamber (102) and at the same time to allow the combustion gas to flow through a space formed between an edge portion of the combustion chamber (102) and an inner side surface of the combustion chamber wall body (112).

2. The oil-fired boiler of claim 1, wherein the combustion gas path guide (200) includes a guide plate (211) separated from the first fire tube support plate (113).

3. The oil-fired boiler of claim 2, further comprising a guide sidewall (214) configured to extend from an edge of the guide plate (211) toward the burner (103).

4. The oil-fired boiler of claim 2, wherein an insulating material (220) is provided on the guide plate (211) to block heat of the combustion gas generated in the burner (103) from being transmitted to the guide plate (211).

5. The oil-fired boiler of claim 1, wherein the combustion gas path guide (200-1) is configured with:

a guide plate (211-1) separated from the first fire tube support plate (113); and
an insulating material (220-1) provided on the guide plate (211-1) to block the heat of the combustion gas generated in the burner (103) from being transmitted to the guide plate (211-1).

6. The oil-fired boiler of claim 1, wherein the combustion gas path guide (200-2) is configured with:

a first guide plate (211-2) separated from the first fire tube support plate (113);
a second guide plate (212-2) provided to form a space (213-2) between the first guide plate (211-2) and the

second guide plate (212-2); and
a guide sidewall (214-2) extending from an edge of each of the first guide plate (211-2) and the second guide plate (212-2) toward the burner (103) to seal an inside of the space (213-2).

- 5 **7.** The oil-fired boiler of claim 1, wherein the combustion gas path guide (200-3) is configured with:

a first guide plate (211-3) separated from the first fire tube support plate (113);
a second guide plate (212-3) provided to form a space (213-3) between the first guide plate (211-3) and the
10 second guide plate (212-3); and
a guide sidewall (214-3) configured to connect edges of the first guide plate (211-3) and the second guide plate
(212-3) to each other and seal an inside of the space (213-3) .
-
- 15 **8.** The oil-fired boiler of claim 1, wherein a portion in contact with the combustion gas of each of the combustion gas path guides (200, 200-1, 200-2, and 200-3) is configured with a ferritic stainless steel for high-temperature oxidation resistance.
-
-
-
-
- 20 **10.** An oil-fired boiler comprising:

a combustion chamber wall body (112) configured to enclose a combustion chamber (102) in which combustion is performed by a burner (103);
a plurality of fire tubes (122) installed to face the burner (103) with the combustion chamber (102) therebetween,
25 wherein a combustion gas generated by the combustion of the burner (103) passes through the plurality of fire tubes (122);
a first fire tube support plate (113) configured to fixedly support one end of each of the plurality of fire tubes (122), which is close to the burner (103); and
a combustion gas path guide (200-4) configured to cover an upper portion of the first fire tube support plate (113) to block the combustion gas from being in direct contact with the first fire tube support plate (113), and
30 having a through-hole (215-4) formed at a position corresponding to each of the plurality of fire tubes (122) to allow the combustion gas to flow through the plurality of fire tubes (122) .
-
- 35 **11.** The oil-fired boiler of claim 10, wherein the combustion gas path guide (200-4) is formed of an insulating material having a predetermined thickness.

FIG. 1

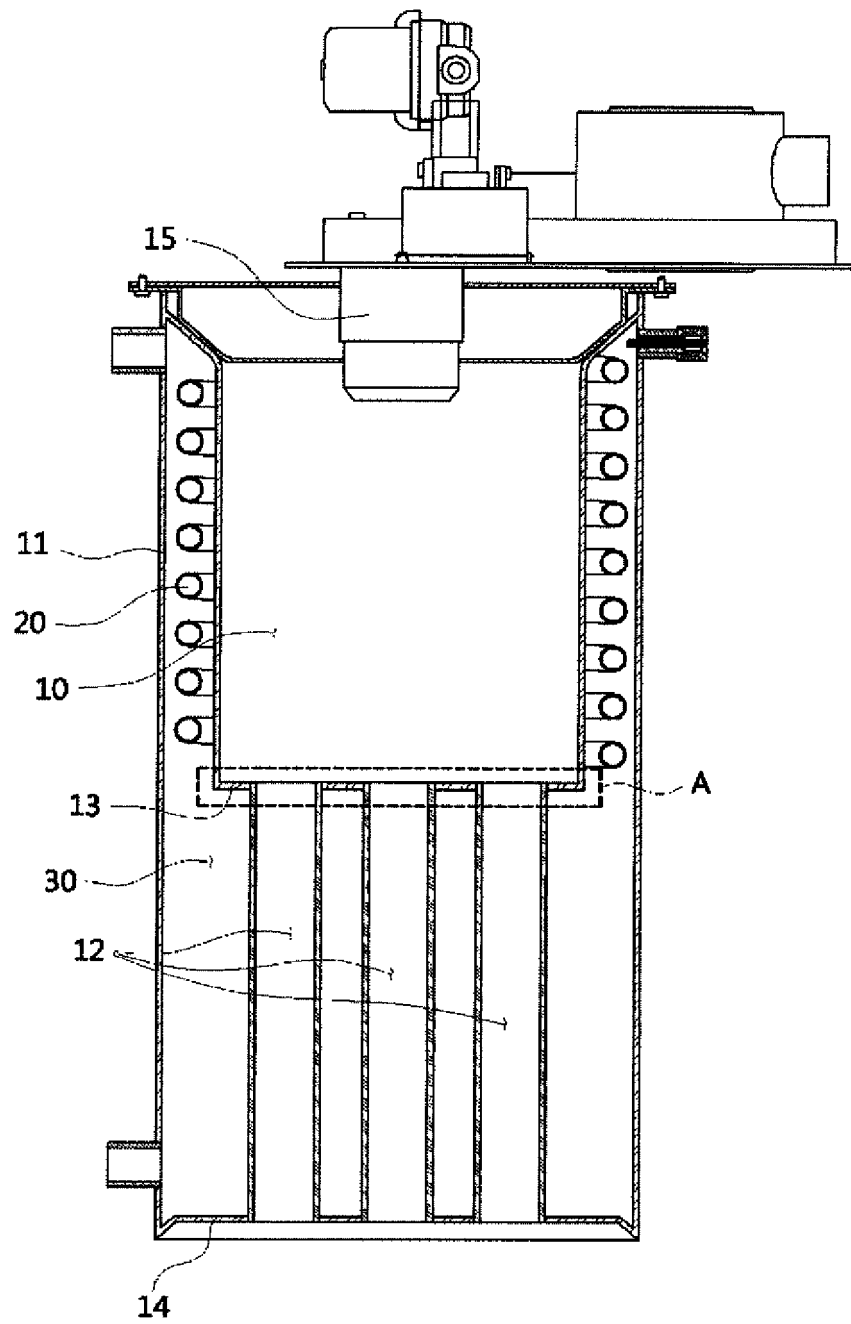


FIG. 2

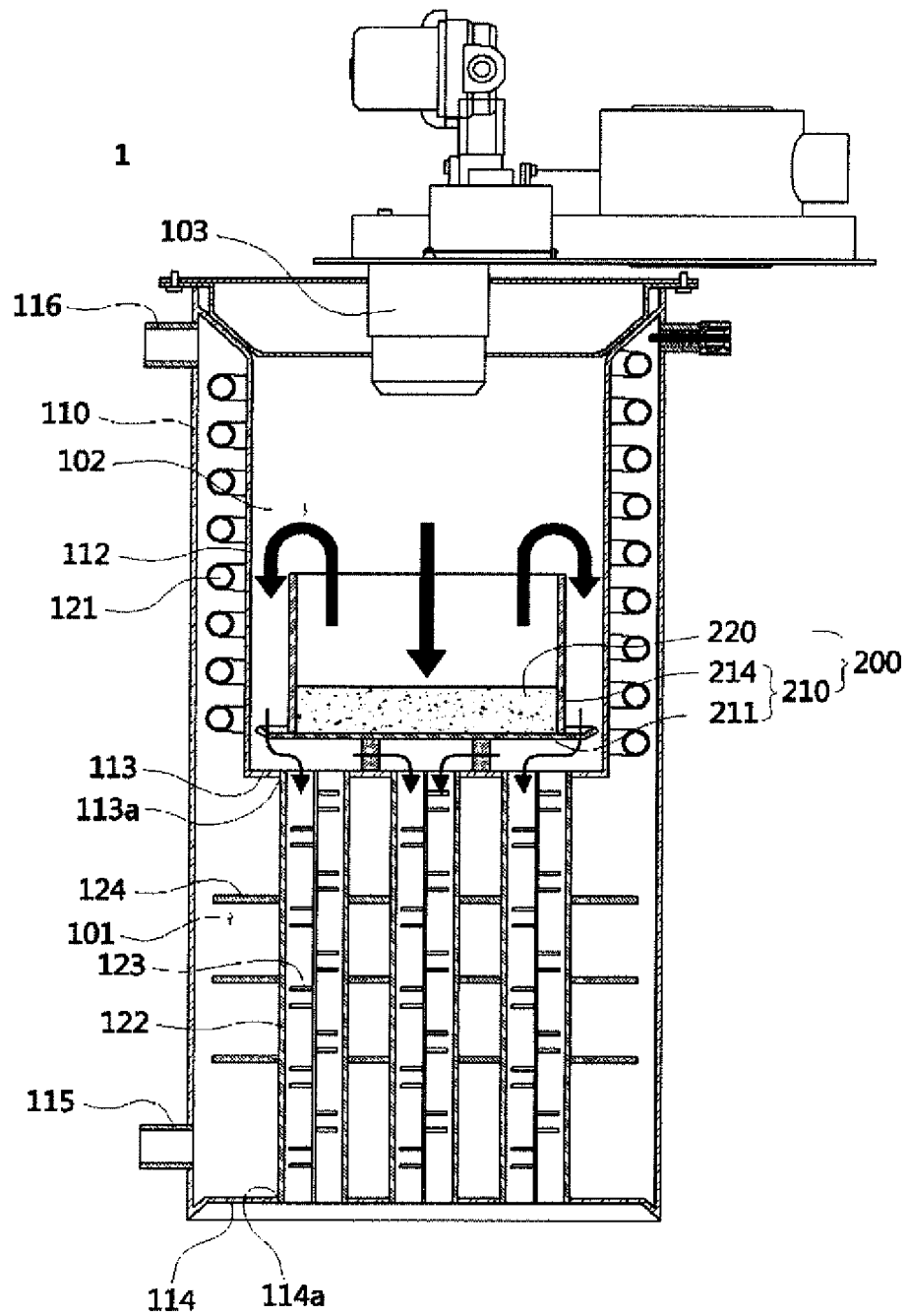


FIG. 3

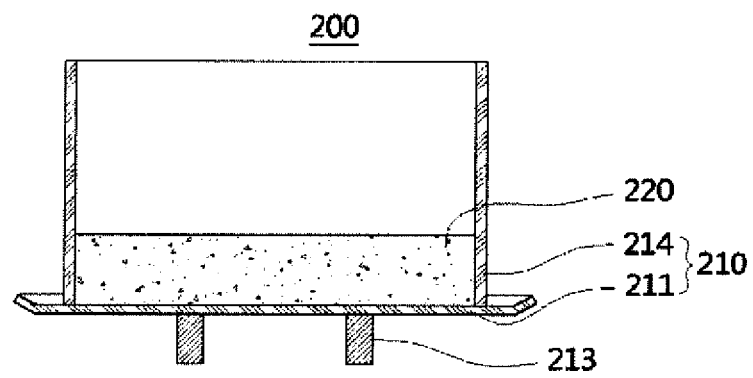


FIG. 4

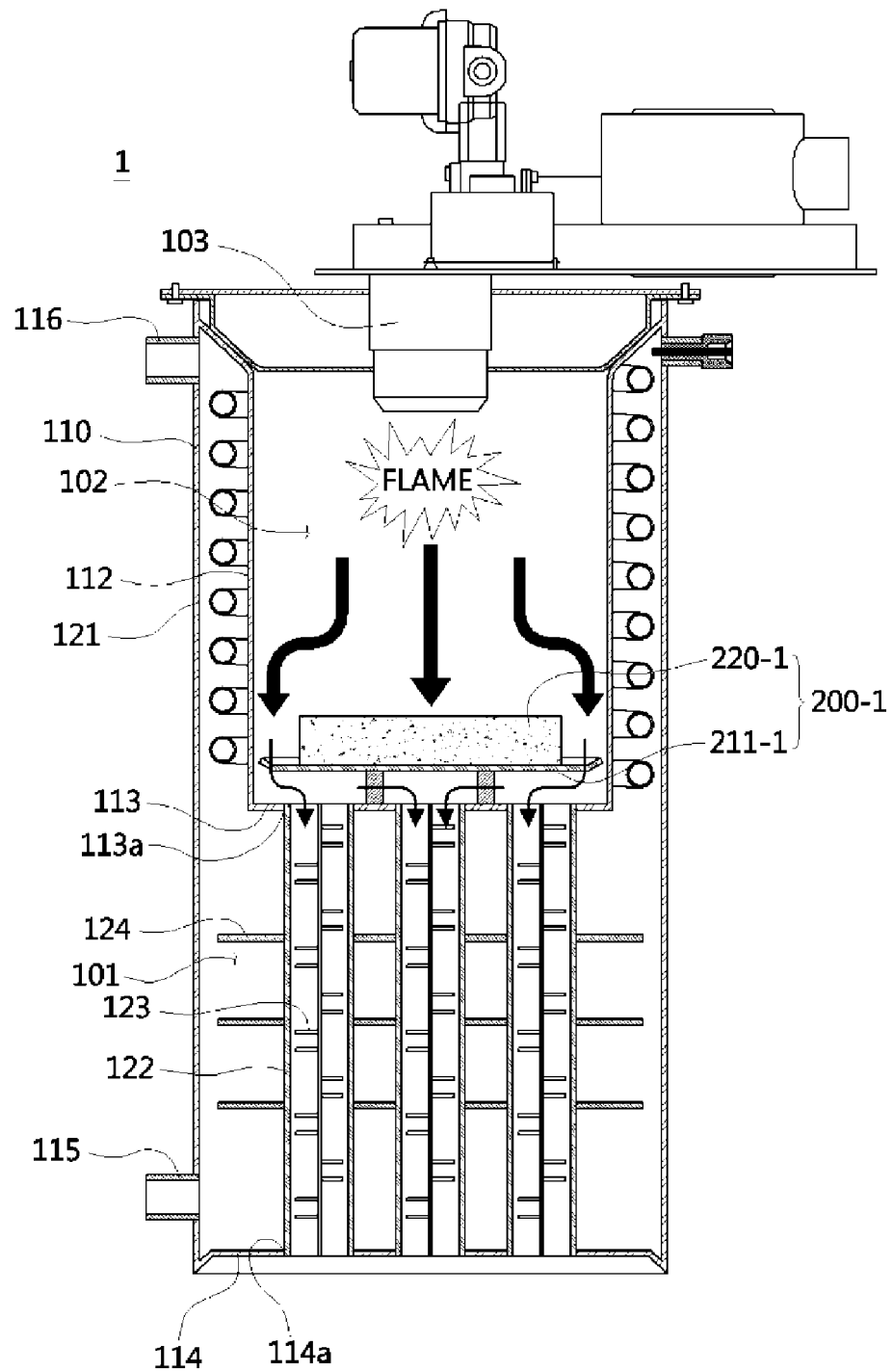


FIG. 5

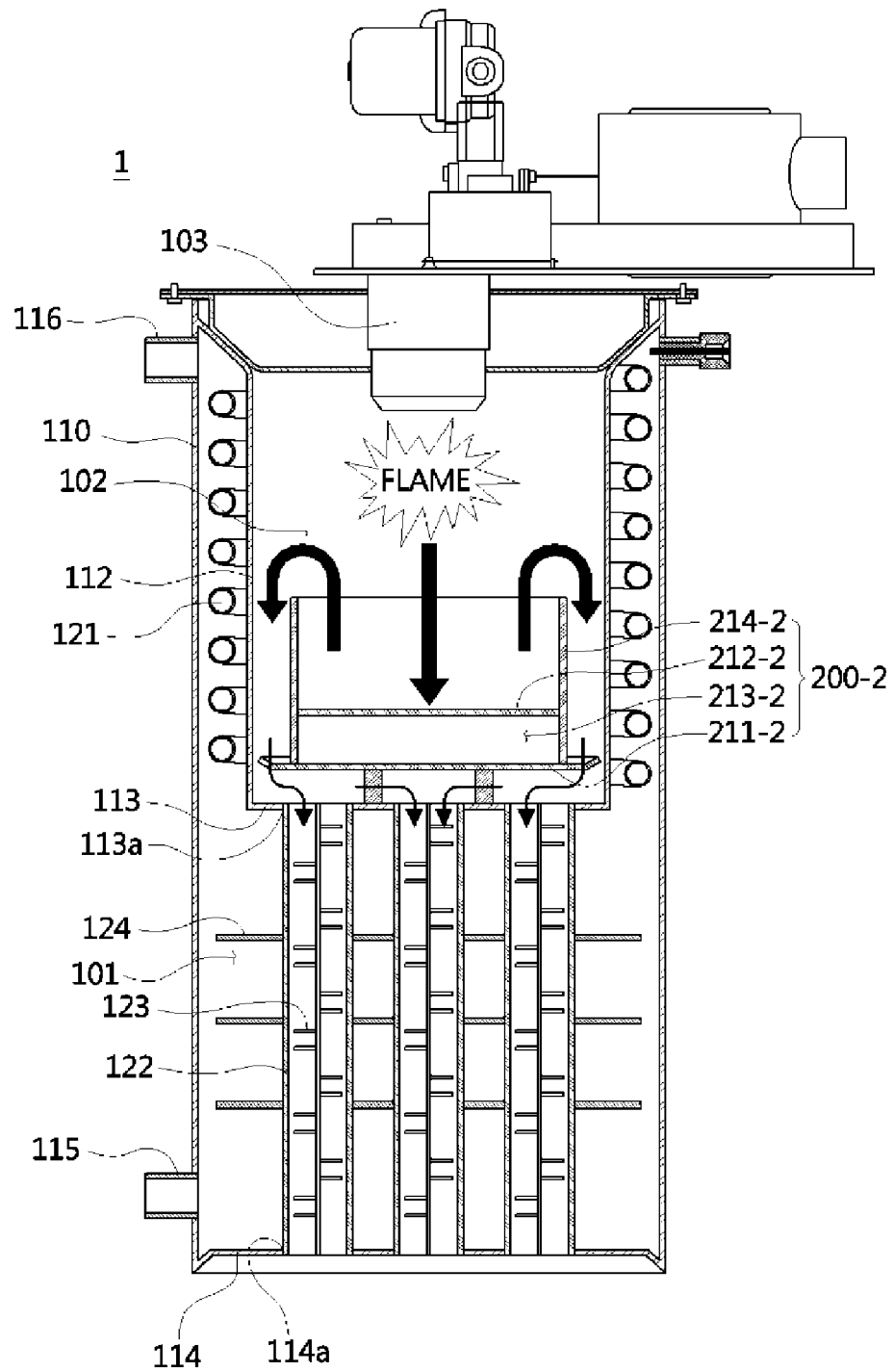


FIG. 6

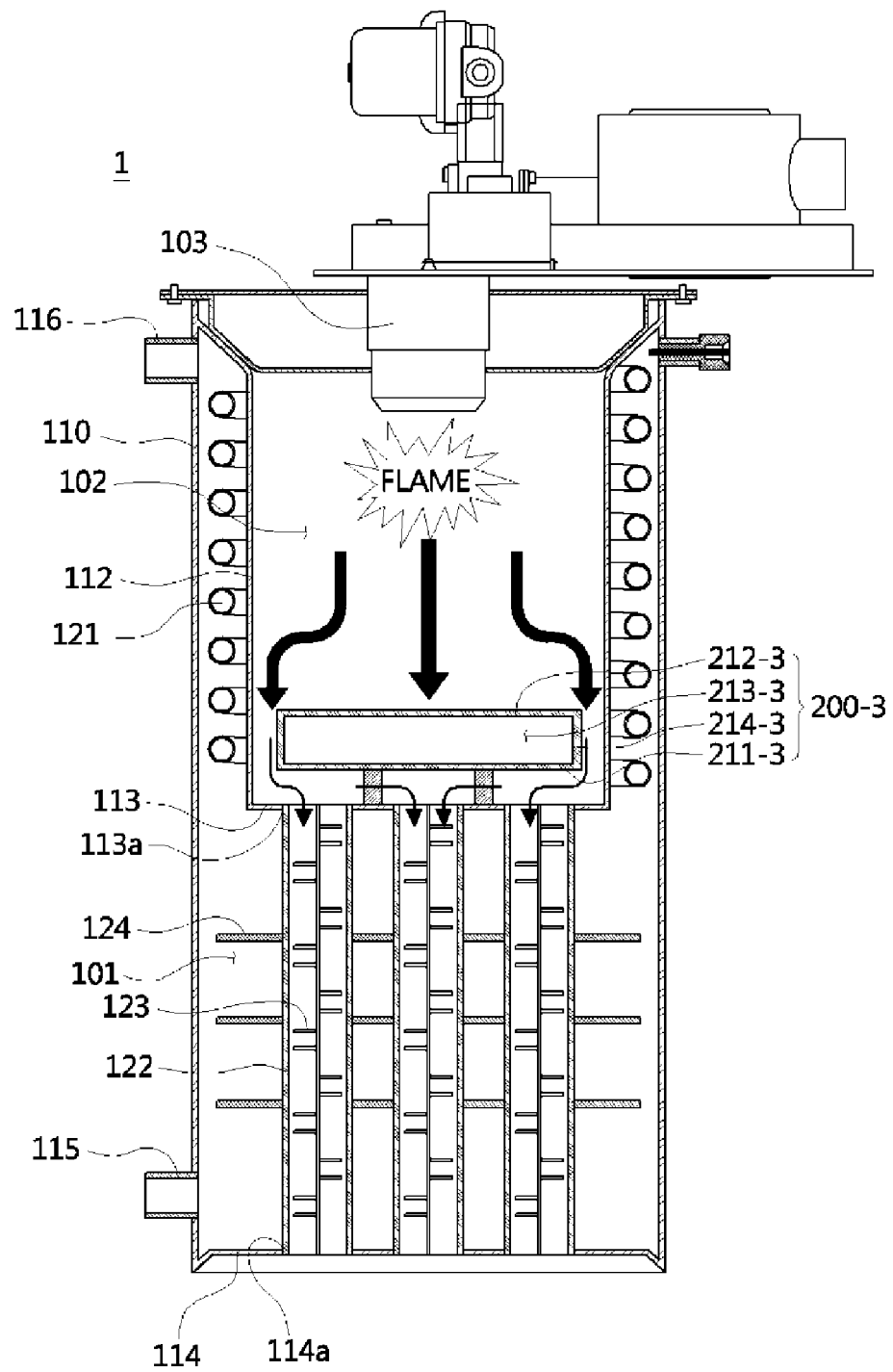


FIG. 7

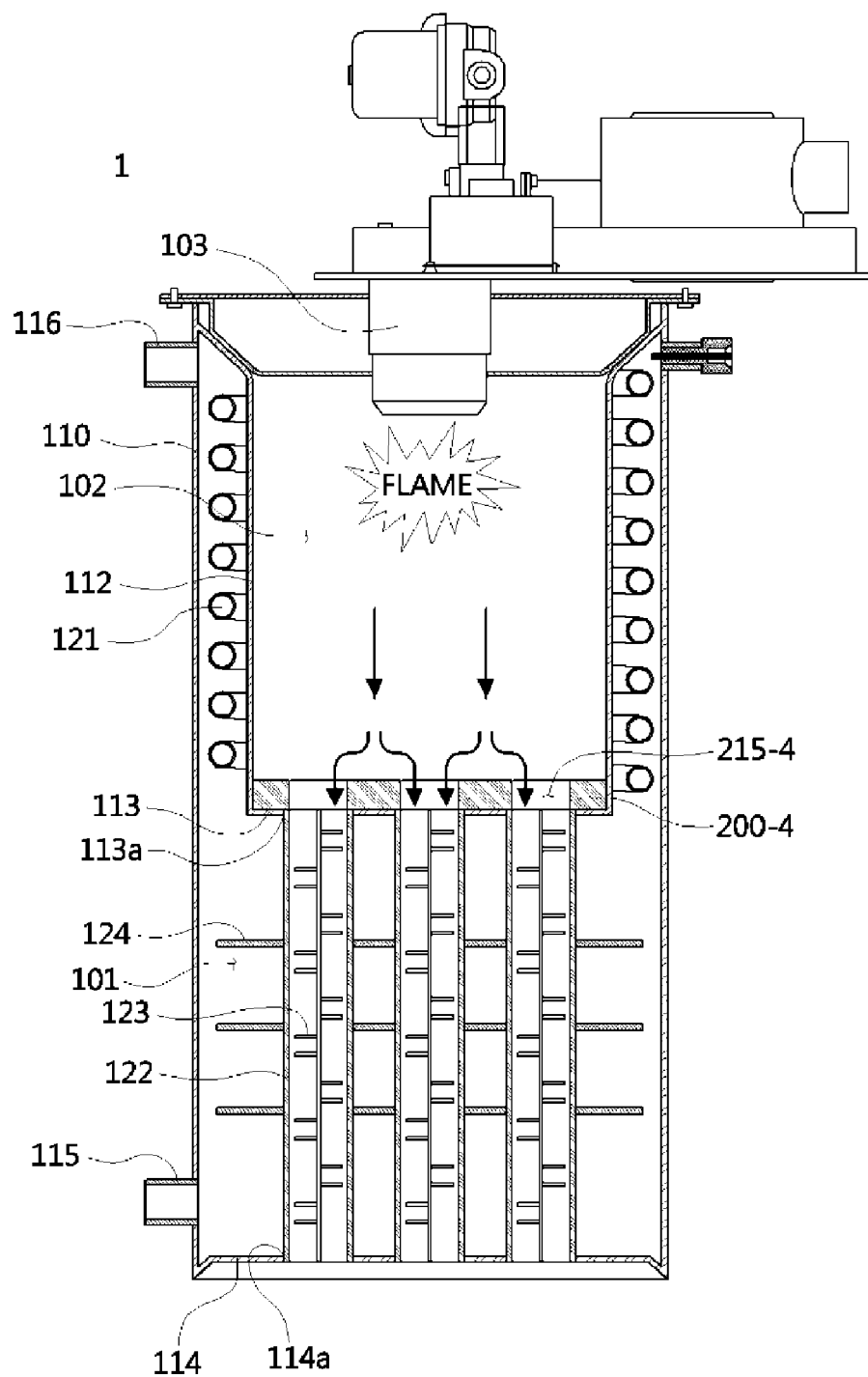
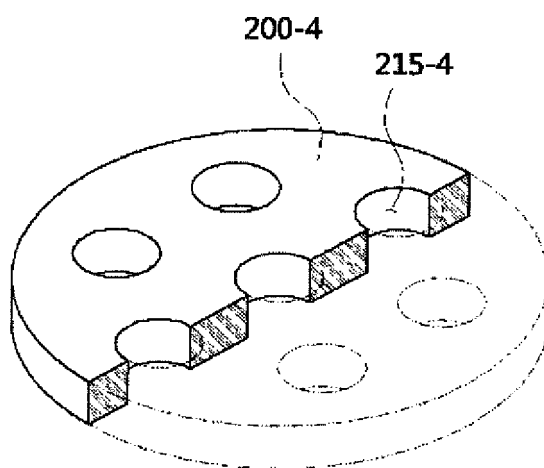


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2016/003393

A. CLASSIFICATION OF SUBJECT MATTER

F23D 11/36(2006.01)i, F24H 1/34(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)

F23D 11/36; F24H 1/00; F24H 1/40; F24H 1/34; F24H 1/16; F23J 11/00; F24H 1/28; F24H 9/00; F24H 8/00

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: boiler, burner, relation, relation support plate, water tank, combustion gas flow guide, guide plate, insulation panel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2004-0082591 A (KYUNG DONG BOILER CO., LTD.) 30 September 2004 See pages 2-3 and figures 1-2.	1-5,8-11
A		6-7
Y	JP 2007-046794 A (NORITZ CORP.) 22 February 2007 See paragraphs [0030]-[0041] and figures 1-11.	1-5,8-11
A	KR 20-2010-0006985 U (KIM, Byung Kuk et al.) 08 July 2010 See paragraph [0017] and figure 2.	1-11
A	KR 10-0747000 B1 (KITURAMI BOILER) 07 August 2007 See claims 1-3 and figure 3.	1-11
A	KR 10-2011-0084725 A (RINNAI KOREA CO., LTD. et al.) 26 July 2011 See paragraphs [0024]-[0036] and figures 3-5.	1-11

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" 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

12 JULY 2016 (12.07.2016)

Date of mailing of the international search report

12 JULY 2016 (12.07.2016)

Name and mailing address of the ISA/KR


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 Republic of Korea

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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2016/003393

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2004-0082591 A	30/09/2004	KR 10-0484123 B1	20/04/2005
JP 2007-046794 A	22/02/2007	NONE	
KR 20-2010-0006985 U	08/07/2010	NONE	
KR 10-0747000 B1	07/08/2007	NONE	
KR 10-2011-0084725 A	26/07/2011	NONE	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 101504394 [0010]