(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 470 750 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.04.2019 Bulletin 2019/16

(21) Application number: **18199343.7**

(22) Date of filing: **09.10.2018**

(51) Int Cl.:
F24H 1/00 *(2006.01)* ***F23D 14/04*** *(2006.01)*
F23D 23/00 *(2006.01)* ***F23C 5/02*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **11.10.2017 JP 2017197338**

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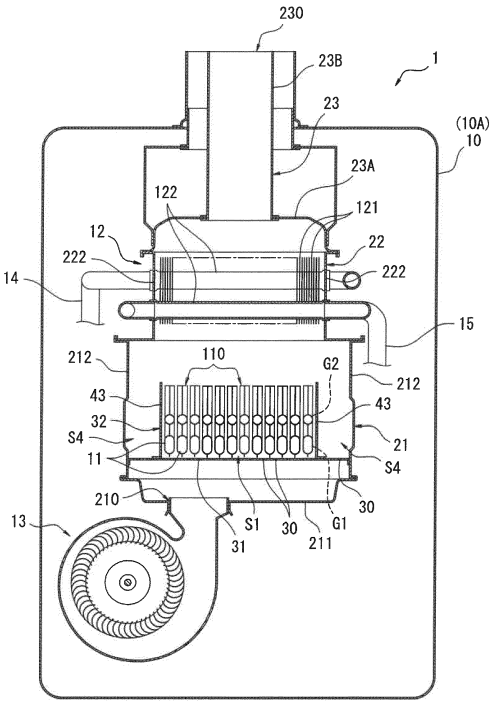
(54) COMBUSTION DEVICE

(57) A combustion device includes a combustion housing (21), a heat exchanger (12), and a burner support frame (32) for supporting a plurality of burners (11), wherein a side plate-inner gap (S3) through which air flows is defined between an outermost burner (11E) and a support frame side plate (43), a side plate-outer gap (S4) through which air flows is defined between the support frame side plate (43) and a side wall (212), the side plate-outer gap (S4) has a width wider than the side plate-inner gap (S3), and the support frame side plate (43) extends further upward than an upper end portion of the outermost burner (11E).

FIG. 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a combustion device such as a water heater or a heat source device for a room heater. Especially, the present invention relates to a combustion device configured to heat a heat medium flowing through a heat exchanger by combustion exhaust gas generated by a burner.

DESCRIPTION OF THE RELATED ART

[0002] Conventionally, there has been known a combustion device such as a water heater or a heat source device for a room heater having a plurality of burners for combusting a mixture gas of fuel gas and air to generate combustion exhaust gas and a heat exchanger for heating a heat medium flowing therethrough by the combustion exhaust gas. In this type of combustion device, in order to reduce size and cost, it is desirable to make a combustion housing for housing the burners and a heat exchanger as small as possible.

[0003] However, if a volume of the combustion housing is too small, pressure fluctuation around flame ports increases in an intensive combustion mode of the burner. As a result, combustion balance is disturbed and vibration combustion is caused, thereby generating resonance noise. Therefore, it has been proposed to arrange a partition plate having a substantially L-shape or a substantially U-shape on an inner side or an outer side of a side wall of the combustion housing (for example, Japanese Unexamined Utility Model Publication No. H05-96739 U) . According to this combustion device, in order to suppress pressure fluctuation around flame ports, a semi-sealed space serving as a pressure absorbing chamber is formed on a side of a burner arrangement portion for housing burners.

[0004] However, in the above combustion device, it is necessary to provide the partition plate for forming the pressure absorbing chamber defined by the burner arrangement portion on the inner side or the outer side of the side wall of the combustion housing. Therefore, the number of parts and assembling steps are increased. Also, work of incorporating the partition plate and the burners in the combustion housing becomes complicated. As a result, manufacturing cost increases. Moreover, when the relatively large space defined by the burner arrangement portion is provided on the side of the burner arrangement portion as described in the above-mentioned combustion device, combustion flame of the burner disposed on an outermost side tends to spread to a space side depending on a flow of air in the combustion housing. As a result, flicker of the combustion flame is promoted, and combustion noise increases.

SUMMARY OF THE INVENTION

[0005] The present invention has been achieved under the above circumstances, and an object of the present invention is to reduce manufacturing cost and combustion noise during combustion operation of a combustion device such as a water heater or a heat source device for a room heater.

[0006] According to the present invention, there is provided a combustion device comprising:

a plurality of burners each having a flame port at an upper end portion;
a combustion housing for housing the plurality of burners;
a heat exchanger for recovering heat in combustion exhaust gas generated by the plurality of burners to heat a heat medium, the heat exchanger being provided continuously to an upper portion of the combustion housing; and
a burner support frame for supporting the plurality of burners laterally arranged side by side in the combustion housing, the burner support frame having a support frame side plate facing an outer surface of an outermost burner disposed on an outermost side among the plurality of burners,
wherein a side plate-inner gap through which air flows is defined between the outermost burner and the support frame side plate,
a side plate-outer gap through which the air flows is defined between the support frame side plate and a side wall of the combustion housing,
the side plate-outer gap has a width wider than a width of the side plate-inner gap, and
the support frame side plate extends further upward than the upper end portion of the outermost burner.

[0007] According to the present invention, it is possible to not only simplify an entire structure and assembling work of the device but also reduce resonance noise and flicker of combustion flame. Accordingly, the combustion device having low combustion noise can be provided cost-effectively.

[0008] Other objects, features and advantages of the present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not to be considered as limiting the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic vertical sectional view showing a combustion device according to an embodiment of the present invention;
FIG. 2 is a schematic perspective view showing an

area around burners of the combustion device according to the embodiment of the present invention; and

FIG. 3 is a schematic vertical sectional view showing an area around a support frame side plate of the combustion device according to the embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

[0010] Hereinafter, referring to drawings, an embodiment of the present invention will be described in detail.

[0011] As shown in FIG. 1, a combustion device 1 according to the embodiment of the present invention is a water heater including a plurality of burners 11 for generating combustion exhaust gas, a heat exchanger 12 for recovering heat in the combustion exhaust gas, and a combustion fan 13 for supplying combustion air to the burners 11. The combustion exhaust gas is generated by combusting a mixture gas of fuel gas and air jetted from a flame port 110 provided at an upper end of the burner 11. Although not shown, water (a heat medium) supplied into the heat exchanger 12 from a water supply pipe through an inlet pipe 14 is heated by the combustion exhaust gas, and hot water is supplied to a hot-water supplying terminal such as a faucet or a shower from an outlet pipe 15 through a hot-water supply pipe.

[0012] An outer casing 10 includes a substantially rectangular box shaped casing main body 10A whose front surface is open, and a front panel (not shown) closing a front opening of the casing main body 10A. In this specification, when the outer casing 10 is viewed from a front surface side of the front panel, a depth direction, a width direction, and a height direction of the casing main body 10A respectively correspond to a front-and-back direction, a left-and-right direction, and an up-and-down direction.

[0013] A substantially rectangular box shaped combustion housing 21 having an upper end opened is provided inside the casing main body 10A. The plurality of burners 11 elongated in the front-and-back direction is laterally arranged side by side at predetermined intervals at a substantially central position in the left-and-right direction in the combustion housing 21. A can body 22 constituting an outer shell of the heat exchanger 12 is formed in a substantially rectangular tubular shape having upper and lower ends opened. A lower end opening of the can body 22 is continuously connected to an upper end opening of the combustion housing 21. An upper end opening of the can body 22 is continuously connected to an exhaust duct 22 for discharging the combustion exhaust gas and the combustion air introduced into the can body 22 to the exterior of the outer casing 10. In this embodiment, a left-right width of the combustion housing 21 in the left-and-right direction is provided so as to be larger than that of the can body 22.

[0014] The exhaust duct 23 has an upper cover 23A covering the upper end opening of the can body 22 from above and a cylindrical body 23B extending upward from a center of an upper wall of the upper cover 23A. A space inside the upper cover 23A communicates with the exterior of the outer casing 10 through an exhaust port 230 at an upper end of a cylindrical body 23B.

[0015] An air inlet port 210 for introducing the combustion air of the burners 11 into the combustion housing 21 is opened on a bottom wall 211 of the combustion housing 21. The combustion fan 13 is connected to the air inlet port 210.

[0016] As described above, an air supply-discharge path that connects from the air inlet port 210 to the combustion housing 21 and the can body 22, and further reaches the exhaust port 230 through the exhaust duct 22, is formed in the outer casing 10. Accordingly, when the combustion fan 13 is activated, as the combustion air of the burners 11, the air outside the device is forcibly taken into the combustion housing 21 from the air inlet port 210. The taken air is then fed into the can body 22 together with the combustion exhaust gas generated by the burners 11, and further discharged outside the device from the exhaust port 230 through the exhaust duct 23.

[0017] The heat exchanger 12 includes a plurality of plate shaped heat transfer fins 121 disposed in a vertical posture and arranged side by side in the left-and-right direction at predetermined intervals in the can body 22, and a plurality of circularly shaped straight heat transfer tubes 122 disposed so as to extend between left and right side walls 222 of the can body 22 and penetrate to the heat transfer fins 121 in a direction perpendicular to each of the heat transfer fins 121. The heat in the combustion exhaust gas introduced into the can body 22 is recovered by the heat transfer fins 121 and the heat transfer tubes 122, whereby the water flowing through the heat transfer tubes 122 is heated.

[0018] Tube ends of the heat transfer tubes 122 are connected to each other in series outside the side walls of the can body 22. Accordingly, the plurality of heat transfer tubes 122 forms one heat exchange tube path meandering between the left and right side walls 222. The inlet pipe 14 is connected to an upstream end of the heat exchange tube path and the outlet pipe 15 is connected to a downstream end of the heat exchange tube path.

[0019] Each of the burners 11 has a flat plate shaped cylindrical body formed by superimposing a plurality of metal plates press-formed into a predetermined shape. Two independent gas conduction paths G1 and G2 are defined in each burner 11.

[0020] As shown in FIG. 2, a gas inlet port for lean flame (hereinafter referred to as "lean gas inlet port") 111 facing a gas jet nozzle for lean flame (not shown), and a gas inlet port for rich flame (hereinafter referred to as "rich gas inlet port") 112 facing a gas jet nozzle for rich flame (not shown) are provided at a front end portion of the burner 11.

[0021] As shown in FIGs. 2 and 3, a flame port 110 includes a flame port for lean flame (hereinafter referred to as "lean flame port") 113 connected to the lean gas

inlet port 111 through the gas conduction path G1 for the lean flame and a flame port for rich flame (hereinafter referred to as "rich flame port") 114 connected to the rich gas inlet port 112 through the gas conduction path G2 for the rich flame. Therefore, the fuel gas jetted from the gas jet nozzle for the lean flame toward the lean gas inlet port 111 is introduced into the gas conduction path G1 for the lean flame together with the air around the lean gas inlet port 111. Then, lean mixture gas having a fuel gas concentration lower than a theoretical air-fuel ratio is jetted out from the lean flame port 113. On the other hand, the fuel gas jetted from the gas jet nozzle for the rich flame toward the rich gas inlet port 112 is introduced into the gas conduction path G2 for the rich flame together with the air around the rich gas inlet port 112. Then, rich mixture gas having a fuel gas concentration higher than the lean mixture gas is jetted out from the rich flame port 114.

[0022] As shown in FIGs. 1 to 3, a distribution plate 31 is provided between the burners 11 and the bottom wall 211 in the combustion housing 21. The distribution plate 31 has a plurality of distribution holes 30. Accordingly, the air introduced into the combustion housing 21 from the air inlet port 210 is distributed as secondary combustion air to an arrangement portion of the burners 11 (hereinafter referred to as "burner arrangement portion") S1 and a side plate-outer gap S4 described later through the distribution plate 31.

[0023] The distribution plate 31 is supported by left and right side walls 212 of the combustion housing 21. Therefore, the distribution plate 31 extends between the pair of left and right side walls 212 opposed to each other, and an internal space of the combustion housing 21 is divided up and down by the distribution plate 31. A substantially rectangular tubular burner support frame 32 having four front, rear, left, and right plate bodies is provided on an upper surface of the distribution plate 31. The burners 11 are disposed in a space inside the burner support frame 32. In other words, the space inside the burner support frame 32 forms the burner arrangement portion S1.

[0024] As shown in FIG. 2, the front end portion and a rear end portion of the burner 11 are respectively supported and fixed to a front plate (hereinafter referred to as "support frame front plate") 41 and a rear plate (hereinafter referred to as "support frame rear plate") 42 of the burner support frame 32.

[0025] The support frame front plate 41 and the support frame rear plate 42 are each connected to left and right side plates (hereinafter referred to as "support frame side plates") 43 of the burner support frame 32 at both left and right end portions. Further, each lower end portion of the pair of left and right support frame side plates 43 is supported and fixed to the upper surface of the distribution plate 31. Accordingly, the burner 11 is supported and fixed to the upper surface of the distribution plate 31 with the burner support frame 32.

[0026] As shown in FIGs. 2 and 3, between side surfaces of the two adjacent burners 11, a gap having a predetermined left-right width (for example, 2 mm) (hereinafter referred to as "burner gap") S2 is provided so that air introduced from the distribution holes 30 into the burner arrangement portion S1 is appropriately guided to a periphery of the flame port 110 of each burner 11.

[0027] Each of the pair of support frame side plates 43 is disposed adjacently to an outer surface of a burner disposed on an outermost side (hereinafter referred to as "outermost burner") 11E in a parallel direction of the burners 11 among the plurality of burners 11. Between the support frame side plate 43 and the outer surface of the outermost burner 11E, a gap having substantially the same left-right width as the burner gap S2 (for example, 2 mm) (hereinafter referred to as "side plate-inner gap") S3 is provided so that the air introduced from the distribution holes 30 into the burner arrangement portion S1 is appropriately guided to the periphery of the flame port 110 of the outermost burner 11E.

[0028] The side plate-outer gap S4 is provided between the support frame side plate 43 and the side wall 212, that is, on both left and right sides of the burner arrangement portion S1. Therefore, pressure fluctuation around the flame port 110 during combustion operation is absorbed by the side plate-outer gap S4. The side plate-outer gap S4 has a left-right width (for example, 25 mm) wider than that of the side plate-inner gap S3. As a result, a flow speed of the air flowing upward in the side plate-inner gap S3 is faster than that of the air flowing upward in the side plate-outer gap S4.

[0029] As shown in FIG. 3, each distribution hole 30 is a small circular hole having a diameter substantially equal to the left-right width of the burner gap S2. The distribution holes 30 are opened at predetermined intervals in the front-and-back direction in each region below the burner gap S2, the side plate-inner gap S3, and the side plate-outer gap S4 in the distribution plate 31. Accordingly, the air passing through the distribution holes 30 is smoothly guided to the burner gap S2, the side plate-inner gap S3, and the side plate-outer gap S4, each of which corresponds to the region where the distribution holes 30 are opened.

[0030] The distribution holes 30 in the region below the side plate-outer gap S4 and the distribution holes 30 in the region below the side plate-inner gap S3 are formed so that a ratio of a total opening area of the distribution holes 30 to an area of the region below the side plate-outer gap S4 is smaller than a ratio of a total opening area of the distribution holes 30 to an area of the region below the side plate-inner gap S3 . In other words, the distribution holes 30 are opened in the distribution plate 30 in such a manner that the ratio of the total opening area of the distribution holes 30 in the region below the side plate-outer gap S4 is smaller than that in the region below the side plate-inner gap S3. Therefore, an inflow amount of air per unit time into the side plate-outer gap S4 is lower than that per unit time into the side plate-inner gap S3.

[0031] The support frame side plate 43 is supported and fixed to the distribution plate 31 while substantially the entire lower end portion is in contact with the upper surface of the distribution plate 31. Further, the support frame side plate 43 stands substantially vertically upward from the upper surface of the distribution plate 31. Therefore, a space above the upper surface of the distribution plate 31 up to a predetermined height in the combustion housing 21 is divided by the support frame side plate 43 into the burner arrangement portion S1 and the side plate-outer gap S4 in the left-and right direction. As a result, the air flowing into the burner arrangement portion S1 from the distribution holes 30 linearly flows upward through the burner arrangement portion S1 until exceeding a height of an upper end of the support frame side plate 43. Also, the air flowing into the side plate-outer gap S4 from the distribution holes 30 linearly flows upward through the side plate-outer gap S4 until exceeding the height of the upper end of the support frame side plate 43.

[0032] The support frame side plate 43 extends upward so that the upper end is located above a predetermined height (for example, 2 mm) from an upper end edge of an outer shell (hereinafter referred to as "burner cap") 115 of the outermost burner 11E. Accordingly, the air flowing upward in the side plate-inner gap S3 passes through a side of the upper end edge of the burner cap 115, and thereafter, is guided upward along the support frame side plate 43 as it is. Thus, spread of combustion flame formed above the flame port 110 of the outermost burner 11E toward a side plate-outer gap S4 side is suppressed during the combustion operation.

[0033] In the above combustion device 1, the side plate-outer gap S4 is defined inside the side wall 212 by the support frame side plate 43 of the burner support frame 32. Therefore, unlike the conventional combustion device, the pressure fluctuation around the flame port 110 is suppressed without separately providing a partition plate for defining a space inside the side wall 212. Accordingly, it is possible to simplify a structure and assembling work of the device. In addition, it is possible to reduce resonance noise caused by vibration combustion. With this configuration, it is possible to reduce combustion noise generated during the combustion operation, while reducing cost of the combustion device 1.

[0034] Further, since the support frame side plate 43 extends upward beyond the upper end (a flame port forming portion) of the outermost burner 11E, the combustion flame of the outermost burner 11E hardly spreads to the side plate-outer gap S4 side during the combustion operation. In addition, since the air passing through the side plate-outer gap S4 hardly flows from the side plate-outer gap S4 side to an outermost burner 11E side, the combustion flame of the outermost burner 11E is hardly affected by the air passing through the side plate-outer gap S4 and a combustion state hardly becomes unstable. Therefore, it is possible to reduce the combustion noise caused by flicker of the combustion flame.

[0035] Furthermore, since the gap (side plate-inner gap) S3 having substantially the same left-right width as the burner gap S2 is defined between the outer surface of the outermost burner 11E and the support frame side plate 43, the secondary combustion air having substantially the same amount as that around the flame ports 110 of the other burners 11 is supplied to the periphery of the flame port 110 of the outermost burner 11E. As a result, variation in the combustion state hardly occurs between the central burner 11 and the burners 11 at both ends in the left-and-right direction. Accordingly, it is possible to further reduce the combustion noise caused by the flicker of the combustion flame.

[0036] Further, during the combustion operation, the flow speed of the air flowing through the side plate-inner gap S3 is faster than that of the air flowing through the side plate-outer gap S4. As a result, the air flowing through the side plate-inner gap S3 is smoothly guided above the flame port 110 of the outermost burner 11E. Accordingly, the combustion flame of the outermost burner 11E hardly spreads to the side plate-outer gap S4 side. Furthermore, since the air passing through the side plate-outer gap S4 hardly flows from the side plate-outer gap S4 side to the outermost burner 11E side, the combustion flame of the outermost burner 11E is hardly affected by the air passing through the side plate-outer gap S4 and the combustion state hardly becomes unstable. Therefore, it is possible to further reduce the combustion noise caused by the flicker of the combustion flame.

[0037] Moreover, since the ratio of the total opening area of the distribution holes 30 in the region below the side plate-outer gap S4 is smaller than the ratio of the total opening area of the distribution holes 30 in the region below the side plate-inner gap S3, the inflow amount of the air per unit time into the side plate-outer gap S4 is lower than that per unit time into the side plate-inner gap S3. Accordingly, the combustion flame of the outermost burner 11E hardly spreads to the side plate-outer gap S4 side. Further, since the air passing through the side plate-outer gap S4 hardly flows from the side plate-outer gap S4 side to the outermost burner 11E side, the combustion flame of the outermost burner 11E is hardly affected by the air passing through the side plate-outer gap S4 and the combustion state hardly becomes unstable. Therefore, it is possible to further reduce the combustion noise caused by the flicker of the combustion flame.

[0038] In the embodiment described above, the distribution holes 30 are opened in the region below the side plate-outer gap S4 in such a manner that the air flows through the side plate-outer gap S4. However, if the spread of the combustion flame of the outermost burner 11E toward the side plate-outer gap S4 side is suppressed, no distribution hole 30 may be opened in the region below the side plate-outer gap S4 in such a manner that the air is not introduced into the side plate-outer gap S4.

[0039] In the above embodiment, the distribution holes 30 are the small circular holes opened in the distribution

plate 31 at the predetermined intervals in the front-and-back direction. However, if the air is appropriately introduced into the burner gap S2, the side plate-inner gap S3, and the side plate-outer gap S4, the distribution hole 30 may be constituted by one or a plurality of slits long in the front-and-back direction.

[0040] Further, the present invention is not limited to a combustion device only having a hot-water supply function. The present invention can be applied to a combustion device having a bathwater reheating function. Moreover, the present invention can be applied to a heat source device for a room heater supplying hot water to a hot water heating terminal, a heat source device of a storage type water heater, or a heat source device only having a sensible heat exchanger.

[0041] In the above embodiment, the side plate-inner gap S3 and the side plate-outer gap S4 are formed at both left and right ends of the combustion housing 21. However, in accordance with a structure of the combustion device 1, the side plate-inner gap S3 and the side plate-outer gap S4 may be formed at either the left end or the right end of the combustion housing 21.

[0042] As described in detail, the present invention is summarized as follows.

[0043] According to the present invention, there is provided a combustion device comprising:

a plurality of burners each having a flame port at an upper end portion;
a combustion housing for housing the plurality of burners;
a heat exchanger for recovering heat in combustion exhaust gas generated by the plurality of burners to heat a heat medium, the heat exchanger being provided continuously to an upper portion of the combustion housing; and
a burner support frame for supporting the plurality of burners laterally arranged side by side in the combustion housing, the burner support frame having a support frame side plate facing an outer surface of an outermost burner disposed on an outermost side among the plurality of burners,
wherein a side plate-inner gap through which air flows is defined between the outermost burner and the support frame side plate,
a side plate-outer gap through which the air flows is defined between the support frame side plate and a side wall of the combustion housing,
the side plate-outer gap has a width wider than a width of the side plate-inner gap, and
the support frame side plate extends further upward than the upper end portion of the outermost burner.

[0044] According to the combustion device described above, a space (the side plate-outer gap) inside the side wall of the combustion housing is defined by the support frame side plate supporting the burners. Therefore, unlike the conventional combustion device, pressure fluctuation around the flame port can be suppressed without separately providing a partition plate for defining a space inside the side wall. Accordingly, it is possible to not only simplify a structure and assembling work of the device but also reduce resonance noise caused by vibration combustion.

[0045] Further, according to the combustion device described above, since the support frame side plate extends further upward than the upper end portion (i.e., a flame port forming portion) of the outermost burner, combustion flame of the outermost burner hardly spreads to a side plate-outer gap side during combustion operation. Furthermore, since the air passing through the side plate-outer gap hardly flows from the side plate-outer gap side to an outermost burner side, the combustion flame of the outermost burner is hardly affected by the air passing through the side plate-outer gap and a combustion state hardly becomes unstable. Accordingly, it is possible to reduce the combustion noise caused by flicker of the combustion flame.

[0046] Preferably, in the combustion device described above, the combustion housing is configured in such a manner that during combustion operation a flow speed of the air flowing upward in the side plate-inner gap is faster than that of the air flowing upward in the side plate-outer gap.

[0047] According to the combustion device described above, during the combustion operation, the air flowing through the side plate-inner gap between the outermost burner and the support frame side plate is guided above the flame port of the outermost burner with the flow speed faster than that of the air flowing through the side plate-outer gap outside the support frame side plate. Therefore, the combustion flame of the outermost burner hardly spreads to the side plate-outer gap side. Further, since the air passing through the side plate-outer gap hardly flows from the side plate-outer gap side to the outermost burner side, the combustion flame of the outermost burner is hardly affected by the air passing through the side plate-outer gap and a combustion state hardly becomes unstable. Accordingly, it is possible to further reduce the combustion noise caused by the flicker of the combustion flame.

[0048] Preferably, the combustion device described above further comprises, a distribution plate having a plurality of distribution holes, the distribution plate being provided below the plurality of burners and extending between a pair of opposed side walls of the combustion housing,
wherein the distribution plate is configured in such a manner that a ratio of a total opening area of the distribution holes in a region below the side plate-outer gap is smaller than that of the distribution holes in a region below the side plate-inner gap.

[0049] According to the combustion device described above, an inflow amount of the air per unit time into the side plate-outer gap through the distribution holes becomes lower than that per unit time into the side plate-

inner gap through the distribution holes. Therefore, the air flowing upward from the side plate-outer gap hardly spreads to the outermost burner side, whereby the combustion state of the outermost burner hardly becomes unstable. Therefore, it is possible to further reduce the combustion noise caused by the flicker of the combustion flame.

[0050] Although the present invention has been described in detail, the foregoing descriptions are merely exemplary at all aspects, and do not limit the present invention thereto. It should be understood that an enormous number of unillustrated modifications may be assumed without departing from the scope of the present invention.

Claims

1. A combustion device comprising:

a plurality of burners each having a flame port at an upper end portion;
a combustion housing for housing the plurality of burners;
a heat exchanger for recovering heat in combustion exhaust gas generated by the plurality of burners to heat a heat medium, the heat exchanger being provided continuously to an upper portion of the combustion housing; and
a burner support frame for supporting the plurality of burners laterally arranged side by side in the combustion housing, the burner support frame having a support frame side plate facing an outer surface of an outermost burner disposed on an outermost side among the plurality of burners,
wherein a side plate-inner gap through which air flows is defined between the outermost burner and the support frame side plate,
a side plate-outer gap through which the air flows is defined between the support frame side plate and a side wall of the combustion housing, the side plate-outer gap has a width wider than a width of the side plate-inner gap, and
the support frame side plate extends further upward than the upper end portion of the outermost burner.

2. The combustion device according to claim 1,
wherein the combustion housing is configured in such a manner that during combustion operation a flow speed of the air flowing upward in the side plate-inner gap is faster than that of the air flowing upward in the side plate-outer gap.

3. The combustion device according to claim 1 or 2 further comprising,
a distribution plate having a plurality of distribution holes, the distribution plate being provided below the plurality of burners and extending between a pair of opposed side walls of the combustion housing,
wherein the distribution plate is configured in such a manner that a ratio of a total opening area of the distribution holes in a region below the side plate-outer gap is smaller than that of the distribution holes in a region below the side plate-inner gap.

FIG. 1

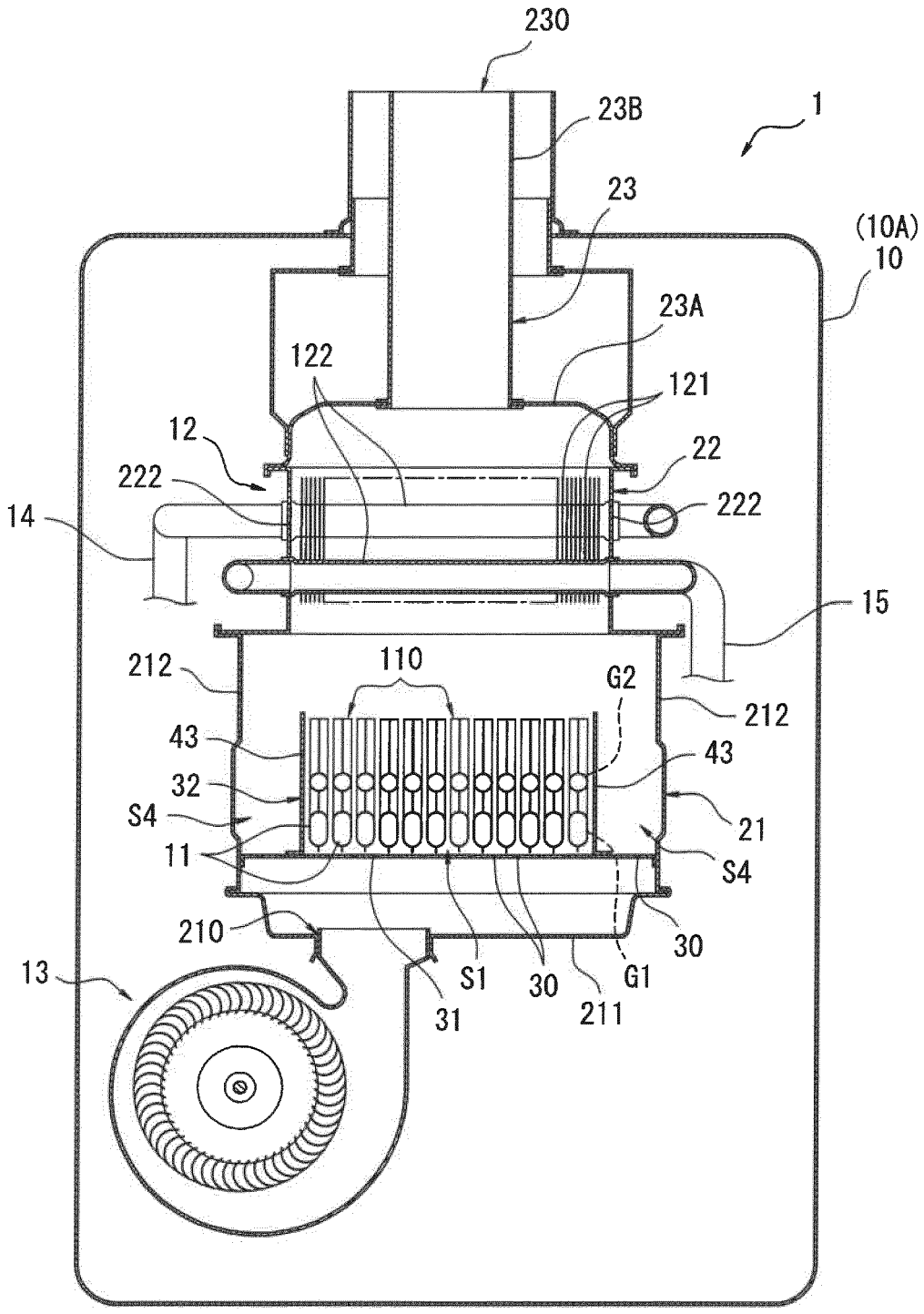
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FIG. 2

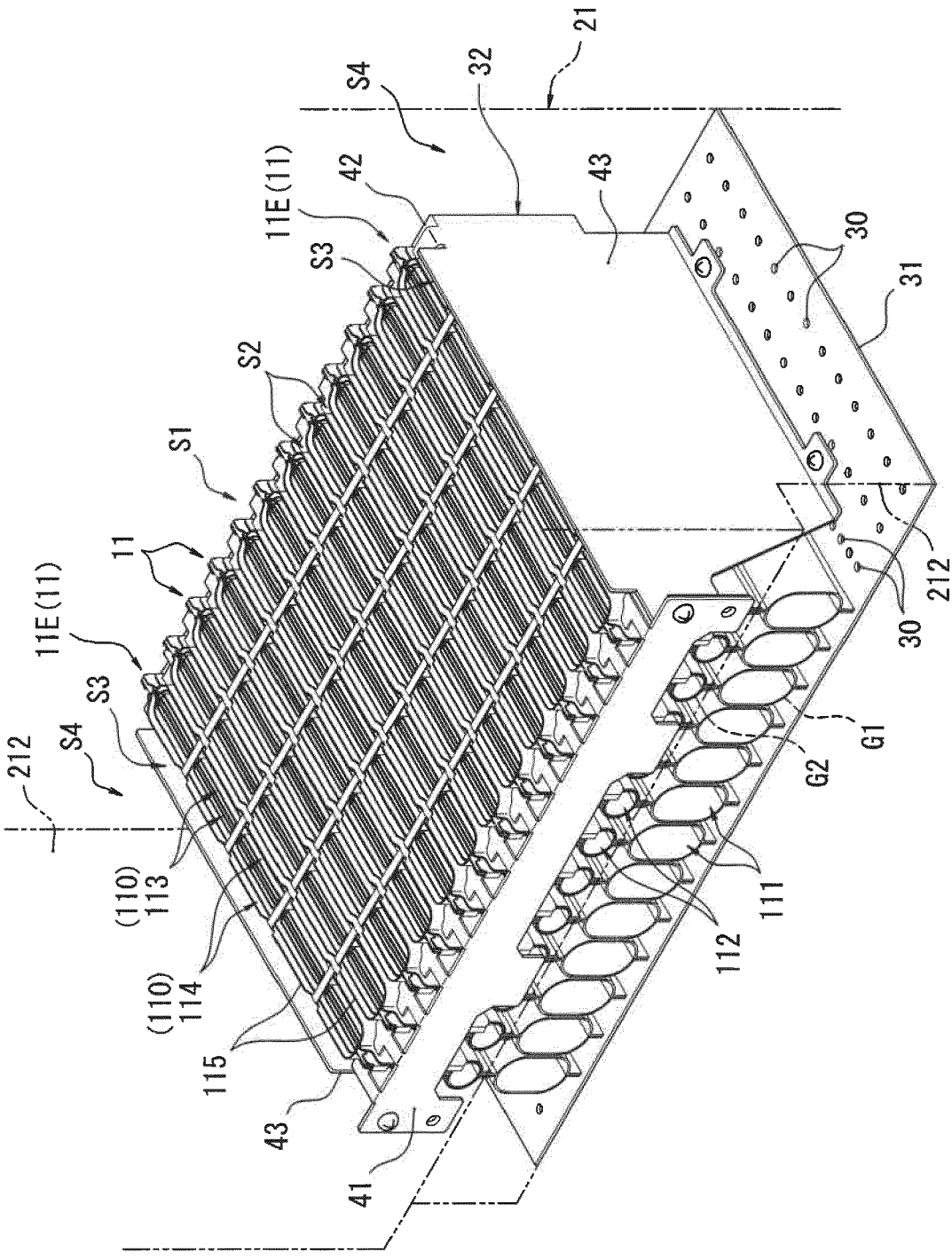
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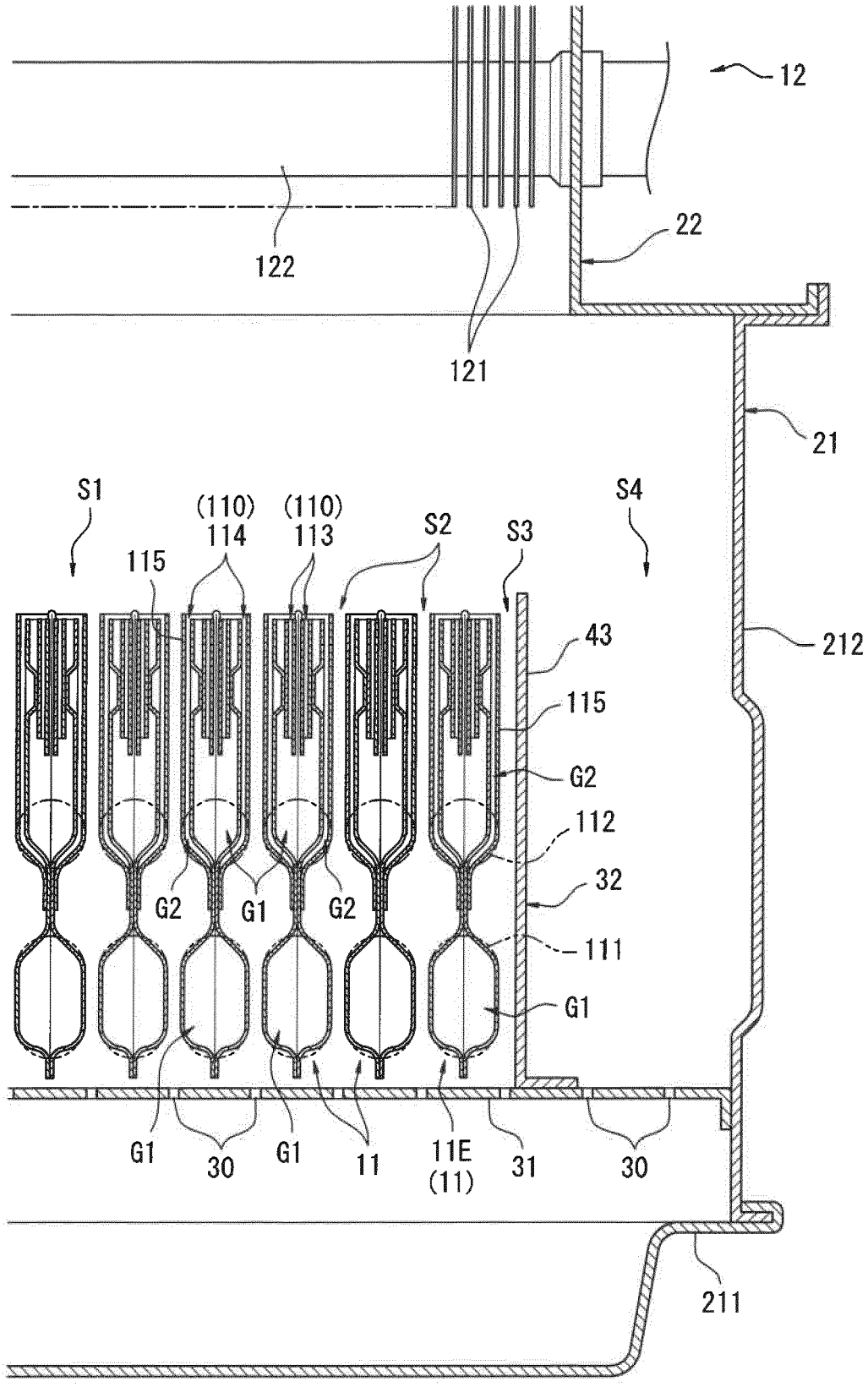
FIG. 3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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 9343

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2016/282011 A1 (UMAKOSHI RYOSUKE [JP]) 29 September 2016 (2016-09-29) * page 2, paragraph 33 - page 4, paragraph 51 * * figures 1, 3, 6, 7 *	1-3	INV. F24H1/00 F23D14/04 F23D23/00 F23C5/02
A	CN 1 847 729 A (RINNAI KK [JP]) 18 October 2006 (2006-10-18) * figures 1, 4-6, 8, 9, 11 and the appurtenant description *	1-3	
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TECHNICAL FIELDS SEARCHED (IPC)

F24H
F23D
F23C
F23L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 February 2019	Rudolf, Andreas

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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