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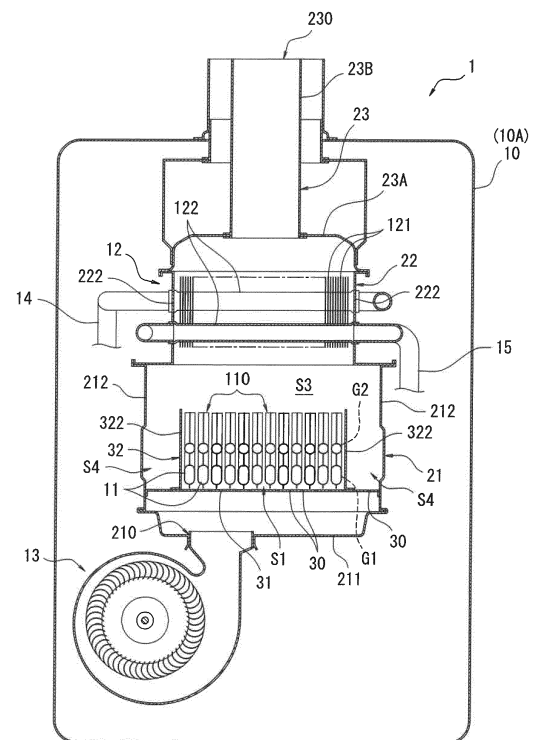
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(54) **COMBUSTION APPARATUS**

(57) A combustion apparatus includes burners, a burner chamber that houses the burners, and a heat exchanger that collects heat emitted from the burner to heat a heating medium. A side space connected to an upper space of a burner port is provided between a burner arrangement section and a burner chamber side wall. A partition wall having suction holes communicating with gas introduction ports of the burners is provided in front of the burner arrangement section. A front space guiding air introduced into the burner chamber to the suction holes is provided between the partition wall and a burner chamber front wall. A flow controller that restricts air in the front space from forming a turbulent flow and flowing from a no suction hole area to a suction hole area side, is provided at the front of the side of the suction hole area of the partition wall.

Fig. 1



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a combustion apparatus such as a water heater and a heat source device for heating, and more particularly to a combustion apparatus for heating a heating medium supplied into a heat exchanger, by exhaust gas generated in a burner.

Description of the Related Art

[0002] Heretofore, in a combustion apparatus such as a water heater and a heat source device for heating in which a mixed gas of fuel gas and air discharged from a burner is burned, and a heating medium supplied into a heat exchanger is heated by the exhaust gas, from the viewpoint of reduction in size and cost, the heat exchanger and a burner chamber housing the burner should preferably be configured as small as possible.

[0003] However, an excessively small volume of the burner chamber increases pressure fluctuation around the burner port when the burner is strongly burned, which disturbs the combustion balance to cause oscillating combustion, and may cause resonance. For example, JP H5-96739 Y discloses that a partition wall having a substantial L shape or U shape is provided on the inner side of a burner chamber side wall, to form a semi-closed space as a pressure absorption chamber on the side of a burner arrangement section. This aims to suppress pressure fluctuation around a burner port.

[0004] In this type of combustion apparatus, as shown in FIG. 9, multiple burners 61 are arranged side by side in a substantially central position in the horizontal direction in a burner chamber 71. A partition wall 83 having multiple suction holes 831 is erected to extend between the right and left burner chamber side walls 712, in front of a burner arrangement section S1 in the burner chamber 71. A gap S5 connected to a front space S6 in front of the partition wall 83, is provided between a lower edge portion of the partition wall 83 and a burner chamber bottom wall 711. During combustion operation, a part of air introduced into the burner chamber 71 from an air introduction port 710 of the burner chamber bottom wall 711 is guided to the front space S6 through the gap S5, and is introduced into each burner 61 from the suction hole 831 as primary air for combustion.

[0005] However, as in the aforementioned conventional combustion apparatus, when the lateral width dimension of the burner chamber 71 is increased to form a predetermined space S4 on the side of the burner arrangement section S1, a relatively large no suction hole area A2 in which the suction hole 831 is not formed is formed on the side of a suction hole area A1 on a front face of the partition wall 83.

[0006] For this reason, a part of the air introduced into

the front space S6 from the gap S5 during combustion operation forms a turbulent flow in a space in front of the no suction hole area A2. This causes instability in the flow of air particularly around the suction holes 831 on the outer side, and may cause variation in the combustion state of the burners 61.

SUMMARY OF THE INVENTION

[0007] The present invention has been made in view of the above problem, and aims to provide a combustion apparatus such as a water heater and a heat source device for heating that can improve combustion stability while reducing noise generated during combustion operation.

[0008] The present invention is a combustion apparatus including: multiple burners each having a burner port in an upper end portion of the burner; a burner chamber that houses the burners side by side in the horizontal direction; and a heat exchanger that is connected to an upper portion of the burner chamber, and collects heat in exhaust gas generated in the burner to heat a heating medium, in which: a side space connected to an upper space of the burner port is provided between a burner arrangement section and a burner chamber side wall; a partition wall that has multiple suction holes opposite to and communicating with gas introduction ports of the burners is provided in front of the burner arrangement section; a front space that guides combustion air introduced into the burner chamber to the suction holes is provided between the partition wall and a burner chamber front wall; and a flow controller that restricts air introduced into the front space from forming a turbulent flow and flowing from the front of the side of a suction hole area of the partition wall to the suction hole area side, is provided at the front of the side of the suction hole area.

[0009] With this configuration, even if the lateral width dimension of the burner chamber is increased by providing the side space on the side of the burner arrangement section, the flow controller provided at the front of the side of the suction hole area of the partition wall can restrict air introduced into the burner chamber from forming a turbulent flow at the front of the side of the suction hole area, that is, in the no suction hole area, and flowing to the suction hole area side. Accordingly, primary air is uniformly introduced into the suction holes from the front space. Hence, the combustion state is less likely to vary among the burners.

[0010] Moreover, since the side space is formed on the side of the burner arrangement section, pressure fluctuation around the burner port is suppressed. Hence, resonance due to oscillating combustion is less likely to occur. In addition, since the flow controller is provided at the front of the side of the suction hole area of the partition wall, disturbance of air flow around each suction hole is suppressed. Hence, wind noise due to the disturbance of air flow is also less likely to occur.

[0011] Preferably, in the above combustion apparatus,

a damper plate is provided on a front face of the partition wall along a peripheral edge portion of the suction holes, and the flow controller is formed integrally with a side end portion of the damper plate.

[0012] With this configuration, since the flow controller is formed integrally with the damper plate provided along the peripheral edge portion of the suction holes, the flow controller is less likely to be misaligned with respect to the suction hole area. Hence, it is possible to more appropriately restrict the flow of air from the no suction hole area to the suction hole area side. Moreover, since the damper plate and the flow control portion are integrally formed, there is no need to dispose the flow controller on the front face of the partition wall separately from the other members. Hence, it is also possible to reduce the number of parts of the whole apparatus and the number of assembly steps.

[0013] As described above, according to the present invention, primary air is uniformly introduced into the suction holes. Hence, the combustion state is less likely to vary among the burners, and combustion stability is improved. In addition, it is possible to reduce noise generated during combustion operation, such as resonance due to oscillating combustion and wind noise due to disturbance of airflow around the suction holes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

[Fig. 1]

FIG. 1 is a schematic front longitudinal cross-sectional view of a combustion apparatus according to an embodiment of the present invention;

[Fig. 2]

FIG. 2 is a schematic side longitudinal cross-sectional view of the periphery of a burner of the combustion apparatus according to the embodiment of the present invention;

[Fig. 3]

FIG. 3 is a schematic perspective lateral cross-sectional view of the periphery of the burner of the combustion apparatus according to the embodiment of the present invention;

[Fig. 4]

FIG. 4 is a schematic perspective view of the periphery of the burner of the combustion apparatus according to the embodiment of the present invention;

[Fig. 5]

FIG. 5 is a schematic front view of the periphery of suction holes of the combustion apparatus according to the embodiment of the present invention;

[Fig. 6]

FIG. 6 is a schematic front view of the periphery of suction holes, showing Modification 1 of the combustion apparatus according to the embodiment of the present invention;

[Fig. 7]

FIG. 7 is a schematic front view of the periphery of suction holes, showing Modification 2 of the combustion apparatus according to the embodiment of the present invention;

[Fig. 8]

FIG. 8 is a schematic perspective cross-sectional view of the periphery of a burner, showing Modification 3 of the combustion apparatus according to the embodiment of the present invention; and

[Fig. 9]

FIG. 9 is a schematic perspective cross-sectional view, showing a configuration of the periphery of a burner of a conventional combustion apparatus.

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Next, an embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0016] As shown in FIG. 1, a combustion apparatus 1 according to the embodiment of the present invention is a water heater including: multiple burners 11 that emit a mixed gas of fuel gas and air from a burner port 110 provided in an upper end portion of the burner 11 and burn it to generate exhaust gas; a heat exchanger 12 that collects heat in the exhaust gas; and a combustion fan 13 that supplies combustion air to the burner 11. The combustion apparatus 1 is configured to heat, with the exhaust gas, a heating medium (e.g., water) supplied to the heat exchanger 12 from a water supply pipe (not shown) through a water inlet pipe 14, and supply the heating medium from a tap pipe 15 to a tapping destination such as a faucet and a shower, through a hot water supply pipe (not shown).

[0017] An exterior case 10 of the combustion apparatus 1 is configured by a case main body 10A having a substantially rectangular box shape open toward the front, and a front panel (not shown) covering the front opening of the case main body 10A. Note that in the specification, when the exterior case 10 is viewed from the front panel side, the depth direction of the case main body 10A is defined as the longitudinal direction, the width direction of the case main body 10A is defined as the horizontal direction, and the height direction of the case main body 10A is defined as the vertical direction.

[0018] Inside the case main body 10A, a substantially rectangular box-like burner chamber 21 having an open upper end is provided, and the burners 11 are arranged side by side in a substantially central position in the horizontal direction in the burner chamber 21. A can body 22 that forms the outer shell of the heat exchanger 12 has a substantially rectangular tubular shape having open upper and lower ends, and a lower end opening thereof is connected to an upper end opening of the burner chamber 21. An exhaust duct 23 that leads exhaust gas and combustion air introduced into the can body 22 to the outside of the exterior case 10, is connected to the

upper end opening of the can body 22. Note that the lateral width dimension of the burner chamber 21 of the embodiment is set larger than the lateral width dimension of the can body 22.

[0019] The exhaust duct 23 is configured by an upper cover 23A covering the upper end opening of the can body 22 from above, and a cylinder 23B extending upward from the center of an upper wall of the upper cover 23A. A space inside the upper cover 23A is connected to the outside of the exterior case 10, through an exhaust port 230 at the upper end of the cylinder 23B.

[0020] An air introduction port 210 for introducing the combustion air of the burner 11 into the burner chamber 21, is formed in a bottom wall (hereinafter referred to as "burner chamber bottom wall") 211 of the burner chamber 21. The combustion fan 13 is connected to the air introduction port 210.

[0021] As described above, the exterior case 10 includes therein an air supply and exhaust path that extends from the air introduction port 210, passes through the burner chamber 21, connects into the can body 22, also passes through the exhaust duct 23, and reaches the exhaust port 230. By actuating the combustion fan 13, air outside the apparatus is forcibly introduced into the burner chamber 21 from the air introduction port 210 as combustion air of the burner 11, is sent into the can body 22 together with exhaust gas generated in the burner 11, and is led to the outside of the apparatus from the exhaust port 230 through the exhaust duct 23.

[0022] The heat exchanger 12 is configured by: multiple plate-like heat transfer fins 121 arranged side by side in the horizontal direction in the can body 22; and multiple circular straight heat absorbing tubes 122 that extend between right and left side walls 222 of the can body 22 and penetrate the heat transfer fins 121 from directions perpendicular to the heat transfer fins 121. The heat exchanger 12 collects heat in exhaust gas introduced into the can body 22 by the heat transfer fins 121 and the heat absorbing tubes 122, and heats water supplied to the heat absorbing tubes 122.

[0023] The heat absorbing tubes 122 are connected in series outside the side wall 222 of the can body 22, and form a single heat exchange pipeline meandering between the side walls 222. The water inlet pipe 14 is connected to the upstream end of the heat exchange pipeline, and the tap pipe 15 is connected to the downstream end of the heat exchange pipeline.

[0024] As shown in FIGS. 2 and 3, a nozzle manifold 16 that distributes and injects fuel gas supplied from gas piping (not shown) into the burners 11, is disposed on a front face of a front wall (hereinafter referred to as "burner chamber front wall") 213 of the burner chamber 21.

[0025] The nozzle manifold 16 is a flat plate-like hollow body formed of a metal block and a metal plate, for example, which are cast in a predetermined shape. The nozzle manifold 16 has, on a rear face portion 164 thereof, a gas jet nozzle (hereinafter referred to as "light nozzle") 161 for light flame, which injects fuel gas supplied

from the gas piping toward a gas introduction port 111 for light flame of the burner 11, and a gas jet nozzle (hereinafter referred to as "dense nozzle") 162 for dense flame, which injects the fuel gas toward a gas introduction port 112 for dense flame.

[0026] As shown in FIGS. 2 and 4, the burner 11 is a flat plate-like cylinder in which multiple metal plates press-formed in a predetermined shape are superimposed on top of one another. Two independent gas guide passages G1 and G2 are formed inside the burner 11.

[0027] The gas introduction port (hereinafter referred to as "light gas introduction port") 111 for light flame disposed opposite to the light nozzle 161 of the nozzle manifold 16, and the gas introduction port (hereinafter referred to as "dense gas introduction port") 112 for dense flame disposed opposite to the dense nozzle 162 of the nozzle manifold 16 are provided in a front end portion of the burner 11.

[0028] The burner port 110 is configured by a burner port (hereinafter referred to as "light burner port") 113 for light flame connected to the light gas introduction port 111 through the gas guide passage G1 for light flame, and a burner port (hereinafter referred to as "dense burner port") 114 for dense flame connected to the dense gas introduction port 112 through the gas guide passage G2 for dense flame. Fuel gas injected from the light nozzle 161 toward the light gas introduction port 111 is introduced into the gas guide passage G1 for light flame, together with air around the light gas introduction port 111. The fuel gas and air are mixed into light mixed gas having a lower fuel gas concentration than the theoretical air fuel ratio, and the light mixed gas is injected from the light burner port 113. Meanwhile, fuel gas injected from the dense nozzle 162 toward the dense gas introduction port 112 is introduced into the gas guide passage G2 for dense flame, together with air around the dense gas introduction port 112. The fuel gas and air are mixed into dense mixed gas having a higher fuel gas concentration than the light mixed gas, and the dense mixed gas is injected from the dense burner port 114.

[0029] As shown in FIGS. 1, 2 and 4, a distribution plate 31 having multiple vent holes 30, and configured to distribute air introduced into the burner chamber 21 from the air introduction port 210 to an arrangement section (hereinafter referred to as "burner arrangement section") S1 of the burners 11 and a side space S4 to be described later, is provided between the burners 11 and the burner chamber bottom wall 211 in the burner chamber 21.

[0030] The distribution plate 31 is supported by both the right and left side walls (hereinafter referred to as "burner chamber side walls") 212 of the burner chamber 21, and divides the internal space of the burner chamber 21 into upper and lower sections. A substantially rectangular and tubular burner support frame 32 formed of four front, rear, right, and left plate bodies is provided on an upper face of the distribution plate 31. The burners 11 are supported and fixed in a space inside the burner sup-

port frame 32. That is, the space inside the burner support frame 32 is the burner arrangement section S1.

[0031] As shown in FIGS. 2 and 4, a 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") 323 and rear plate (hereinafter referred to as "support frame rear plate") 324 of the burner support frame 32.

[0032] Each of the support frame front plate 323 and the support frame rear plate 324 is connected and supported to the right and left side plates (hereinafter referred to as "support frame side plates") 322 of the burner support frame 32 at right and left end portions thereof. Each of the right and left support frame side plates 322 is supported and fixed on the upper face of the distribution plate 31 at a lower end portion thereof. Thus, the burner 11 is supported and fixed to the upper face of the distribution plate 31 by the burner support frame 32.

[0033] As shown in FIGS. 1 and 3, the side space S4 connected to an upper space (hereinafter referred to as "combustion section") S3 of the burner port 110 in the burner chamber 21, and configured to absorb pressure fluctuation around the burner port 110 during combustion operation, is provided between the support frame side plate 322 and the burner chamber side wall 212, that is, on the right and left sides of the burner arrangement section S1.

[0034] As shown in FIGS. 1 and 4, the vent holes 30 are opened in rows formed along the longitudinal direction in lower relative areas of the burner arrangement section S1 and the side space S4 in the distribution plate 31. During combustion operation, a part of air introduced into the burner chamber 21 from the air introduction port 210 by the combustion fan 13, is sent into the burner arrangement section S1 and the side space S4 through the vent holes 30 as secondary air for combustion.

[0035] As shown in FIGS. 2 and 3, a lower half face 33 of the burner chamber front wall 213 is recessed one step rearward toward the inside of the burner chamber 21, from an upper half face 34. The nozzle manifold 16 is screwed and fixed to a front peripheral edge 35 of the lower half face 33, and forms a predetermined space (hereinafter referred to as "front space") S6 between the rear face portion 164 of the nozzle manifold 16 and the lower half face 33 of the burner chamber front wall 213. Specifically, the lower half face (hereinafter referred to as "partition wall") 33 of the burner chamber front wall 213 is erected to extend between the right and left burner chamber side walls 212 in front of the burner arrangement section S1 in the burner chamber 21, and divides the internal space of the burner chamber 21 into front and rear sections. Accordingly, during combustion operation, a part of the air introduced into the burner chamber 21 from the air introduction port 210 by the combustion fan 13, is guided to the front space S6 through the gap S5 between a lower edge portion of the partition wall 33 and the burner chamber bottom wall 211.

[0036] The partition wall 33 is provided with multiple

suction holes 331 for light flame and suction holes 332 for dense flame which are opposite to and communicate with the gas introduction ports 111 and 112 of the burners 11. During combustion operation, air introduced into the front space S6 of the partition wall 33 is sent to the burner 11 through the suction holes 331, 332 together with fuel gas injected from the light nozzle 161 and the dense nozzle 162, as primary air for combustion.

[0037] As shown in FIGS. 2, 3, and 5, a damper plate 17 is provided on a front face of the partition wall 33 along peripheral edge portions of the suction holes 331 for light flame and the suction holes 332 for dense flame. The damper plate 17 is a metal plate formed in a substantial U shape when viewed from above. A damper main body 170 in the center has substantially rectangular first communication holes 171 corresponding to the suction holes 331 for light flame, and substantially circular second communication holes 172 corresponding to the suction holes 332 for dense flame.

[0038] A frontward extending flow control plate 37 is formed on right and left side end portions of the damper main body 170. The flow control plate 37 is a flow controller that restricts air introduced into the burner chamber 21 from forming a turbulent flow and flowing from the front of the side of the area (hereinafter referred to as "suction hole area") A1 where the suction holes 331, 332 are formed on the front face of the partition wall 33, that is, from the no suction hole area A2 side, to the suction hole area A1 side.

[0039] The flow control plate 37 is bent toward the front from the right and left side end portions of the damper main body 170. The flow control plate 37 extends substantially vertically from an upper edge portion to a lower edge portion of the partition wall 33, and divides the front space S6 into a space in front of the suction hole area A1 and a space in front of the no suction hole area A2. Accordingly, air introduced into the front space S6 from the gap S5 on the lower edge portion side of the partition wall 33 is smoothly guided from the lower side to the upper side toward the suction hole area A1, and no air flows toward the center (suction hole area A1 side) from the right and left outer sides (no suction hole area A2 side).

[0040] As described above, according to the combustion apparatus 1, even if the lateral width dimension of the burner chamber 21 is increased by providing the space (side space) S4 on the side of the burner arrangement section S1, the flow control plate 37 provided at the front of the side of the suction hole area A1 of the partition wall 33 can restrict air introduced into the burner chamber 21 from forming a turbulent flow in the space in front of the no suction hole area A2 and flowing to the suction hole area A1 side. Accordingly, primary air is uniformly introduced into the suction holes 331, 332 from the front space S6. Hence, the combustion state is less likely to vary among the burners 11, and combustion stability is improved.

[0041] In addition, in the combustion apparatus 1,

since the side space S4 is formed on the side of the burner arrangement section S1 to increase the volume of the burner chamber 21, oscillating combustion of the burner 11 is suppressed, so that resonance is less likely to occur. In addition, since the flow control plate 37 is provided at the front of the side of the suction hole area A1 of the partition wall 33, disturbance of airflow around each of the suction holes 331, 332 is suppressed, so that wind noise due to the disturbance of airflow is also less likely to occur.

[0042] Also, if the flow control plate 37 is formed separately from the other members, the flow control plate 37 may be incapable of appropriately restricting the flow of air from the no suction hole area A2 side to the suction hole area A1 side, due to variation in attachment precision or attachment failure of the flow control plate 37. However, in the combustion apparatus 1, since the flow control plate 37 is formed integrally with the damper plate 17 provided along peripheral edge portions of the suction holes 331, 332, the flow control plate 37 is less likely to be misaligned with respect to the suction hole area A1. This makes it possible to more appropriately restrict the air introduced into the burner chamber 21 from flowing to the suction hole area A1 side from the no suction hole area A2. Hence, the combustion state is less likely to vary among the burners 11, and combustion stability is improved even more.

[0043] In addition, since the damper plate 17 and the flow control plate 37 are integrally formed, there is no need to dispose the flow control plate 37 on the front face of the partition wall 33 separately from the other members. Hence, it is also possible to reduce the number of parts of the whole apparatus and the number of assembly steps. Accordingly, it is also possible to reduce the cost of the combustion apparatus 1.

[0044] Note that in the above embodiment, the flow control plate 37 has a flat plate shape and protrudes frontward on the side end portion of the damper main body 170. However, as shown in FIG. 6, the flow control plate 37 may have a lower plate 371, and the substantially L-shaped plate in front view may protrude frontward on a side end portion of the damper main body 170. In the flow control plate 37 of FIG. 6, since air introduced into the burner chamber 21 can be restricted from flowing into the space in front of the no suction hole area A2 by the lower plate 371, it is possible to intensively and uniformly guide primary air into the suction holes 331, 332.

[0045] In the above embodiment, the flat plate-shaped flow control plate 37 extends substantially vertically from the upper edge portion to the lower edge portion of the partition wall 33. However, as shown in FIG. 7, the flat plate-shaped flow control plate 37 may extend diagonally outward from the upper edge portion toward the lower edge portion of the partition wall 33. In the flow control plate 37 of FIG. 7, air introduced into the front space S6 is smoothly guided to the suction hole area A1 side along a tilted lower face of the flow control plate 37, and is less likely to form a turbulent flow in the space in front of the

no suction hole area A2. Hence, it is possible to intensively and uniformly guide primary air into to the suction holes 331, 332.

[0046] Further, in the above-described embodiment, the flow controller is configured by the flow control plate 37 provided at the side end portion of the damper main body 170. However, as shown in FIG. 8, instead of the flow control plate 37, the flow controller may be configured by a protrusion 38 that protrudes to a position substantially flush with the upper half face 34 of the burner chamber front wall 213 on the outer side of the front surface of the partition wall 33. According to the protrusion 38, it is possible to restrict the air introduced into the burner chamber 21 from flowing to the suction hole area A1 side from the no suction hole area A2. Hence, it is possible to intensively and uniformly guide primary air to the suction holes 331, 332.

[0047] In the above embodiment, the damper plate 17 is provided with the flow control plate 37. However, the rear face portion 164 of the nozzle manifold 16 may be provided with a plate piece or protrusion having a flow restriction effect similar to that of the flow control plate 37, as the flow controller.

[0048] Note that the present invention is not limited to the above-described embodiments, and may be changed as required within the scope of claims and the equivalent thereof. For example, the present invention is applicable not only to a water heater having only a hot water supply function, but also to a water heater having a bath reheating function, a heat source device for heating that circulates and supplies hot water to a hot water heating terminal, a heat source device of a storage type hot water supply system, and a heat source device having only a sensible heat exchanger.

Claims

1. A combustion apparatus (1) comprising:

multiple burners (11) each having a burner port (110) in an upper end portion of the burner (11); a burner chamber (21) that houses the burners (11) side by side in a horizontal direction; and a heat exchanger (12) that is connected to an upper portion of the burner chamber (21), and collects heat in exhaust gas generated in the burner (11) to heat a heating medium, wherein:

a side space (S4) connected to an upper space (S3) of the burner port (110) is provided between a burner arrangement section (S1) and a burner chamber side wall (212);

a partition wall (33) that has multiple suction holes (331, 332) opposite to and communicating with gas introduction ports (111, 112) of the burners (11) is provided in front of the

burner arrangement section (S1);
a front space (S6) that guides combustion
air introduced into the burner chamber (21)
to the suction holes (331, 332) is provided
between the partition wall (33) and a burner 5
chamber front wall (213); and
a flow controller (37) that restricts air intro-
duced into the front space (S6) from forming
a turbulent flow and flowing from the front 10
of the side of a suction hole area (A1) of the
partition wall (33) to the suction hole area
(A1) side, is provided at the front of the side
of the suction hole area (A1).

2. The combustion apparatus (1) according to claim 1, 15
wherein:

a damper plate (17) is provided on a front face
of the partition wall (33) along a peripheral edge
portion of the suction holes (331, 332); and 20
the flow controller (37) is formed integrally with
a side end portion of the damper plate (17).

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Fig. 1

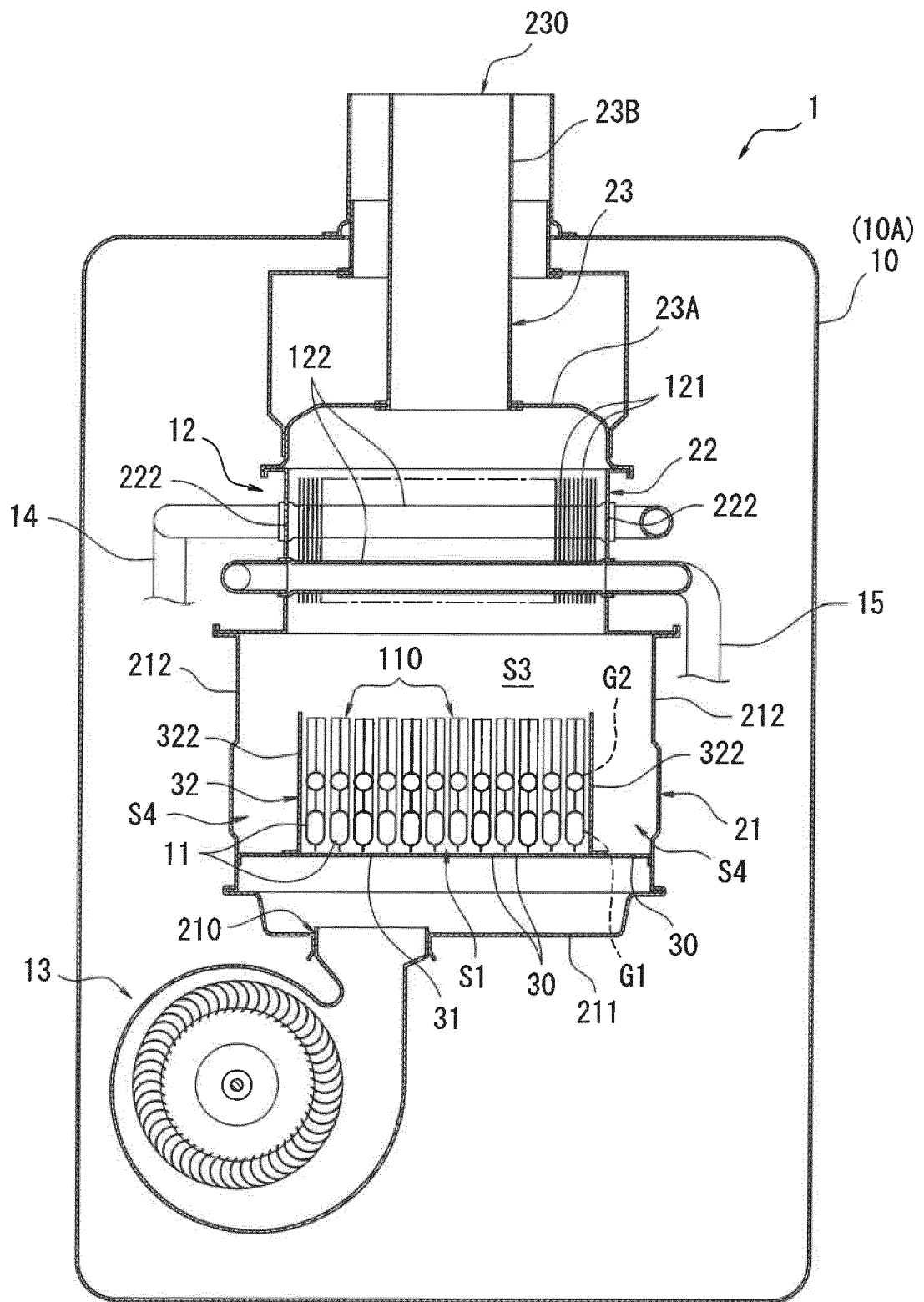


Fig. 2

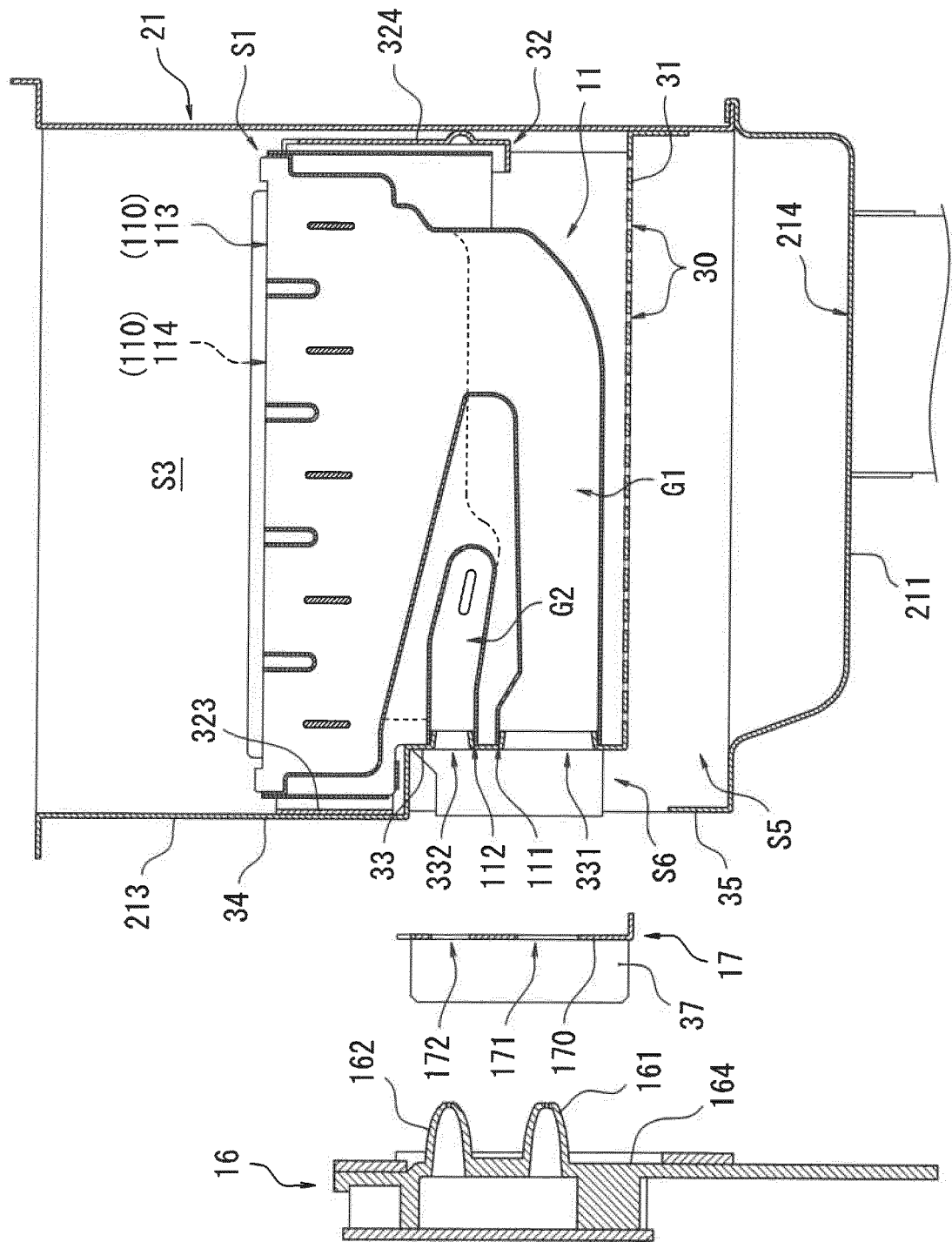


Fig. 3

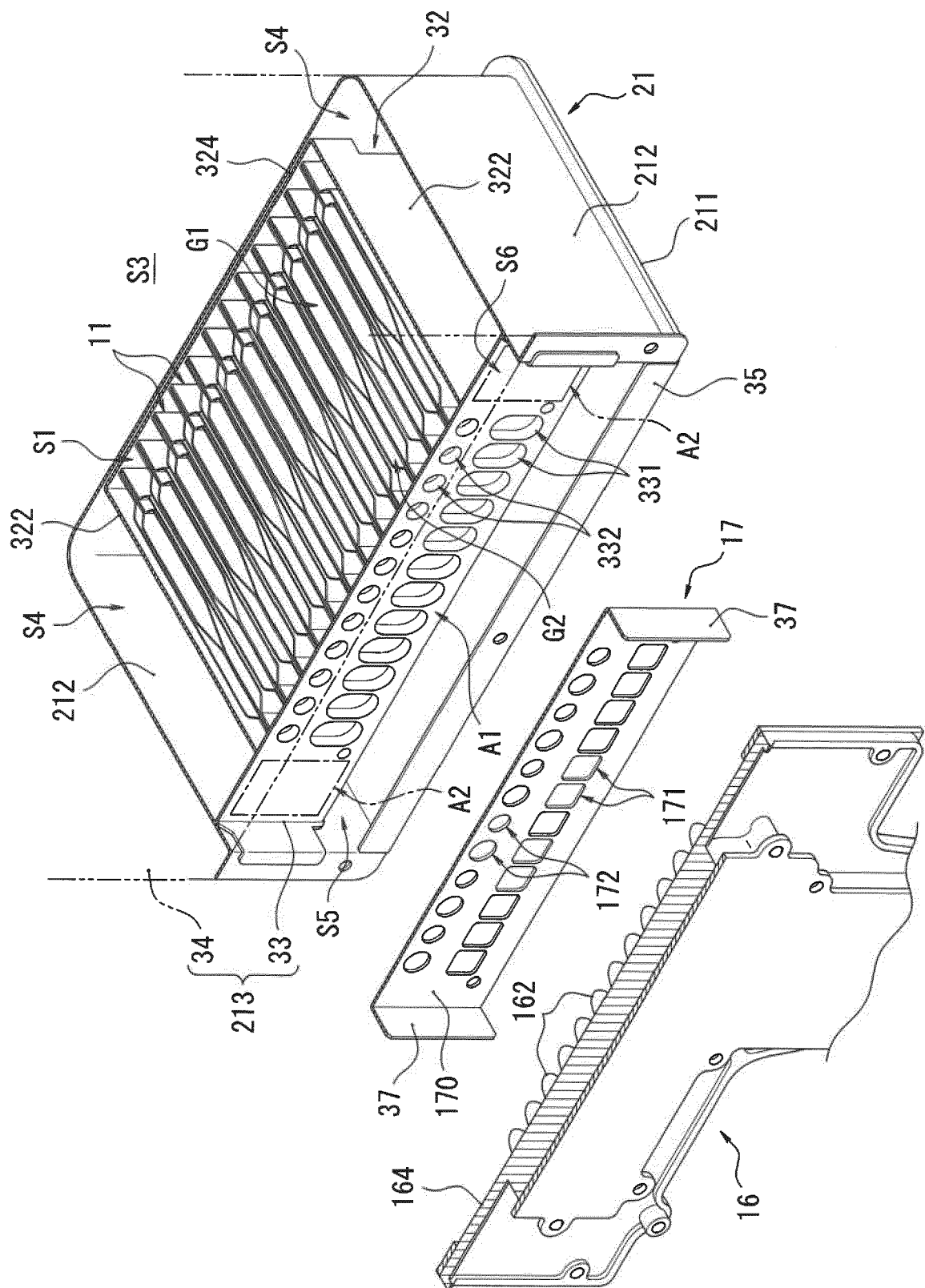


Fig. 4

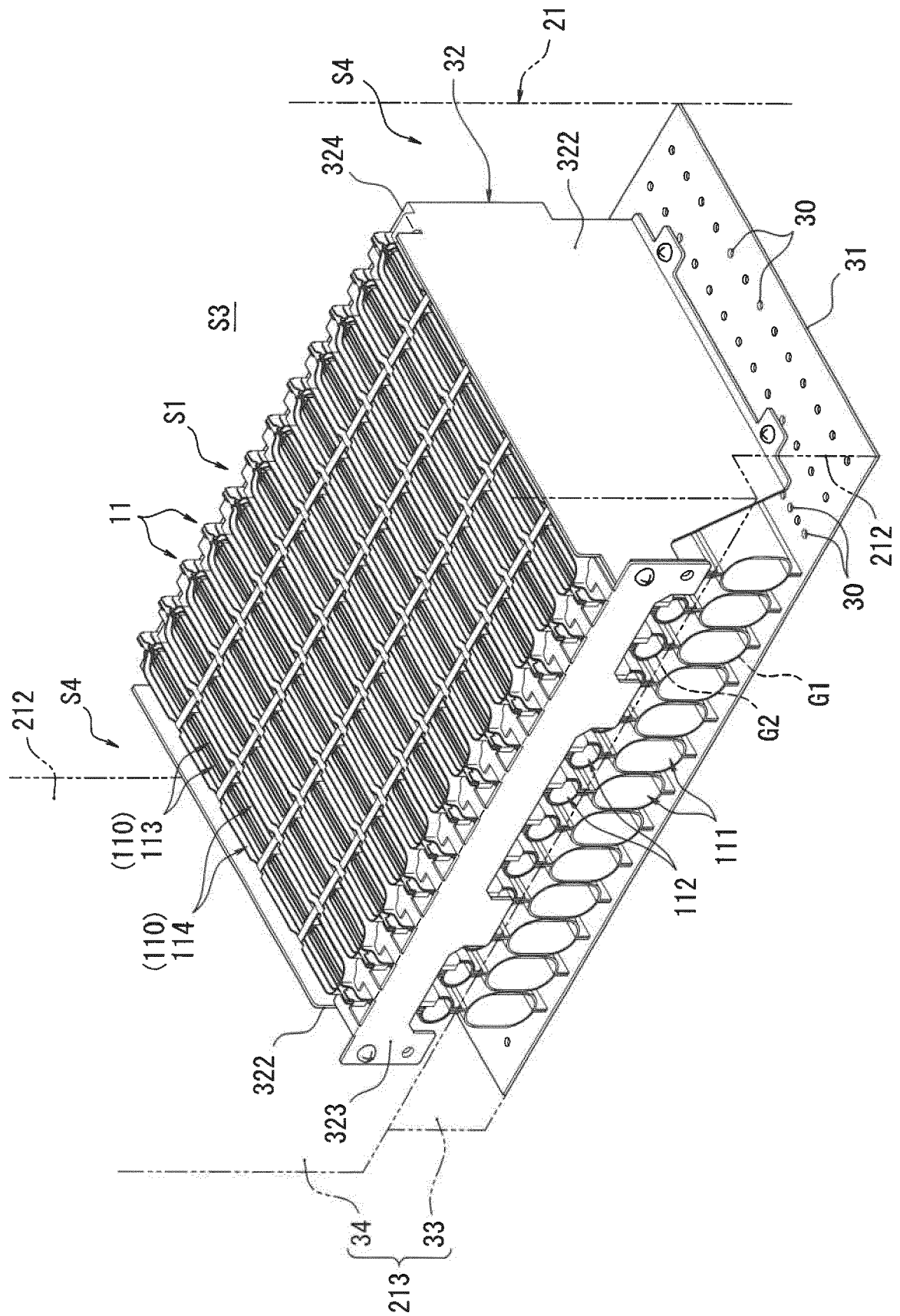


Fig. 5

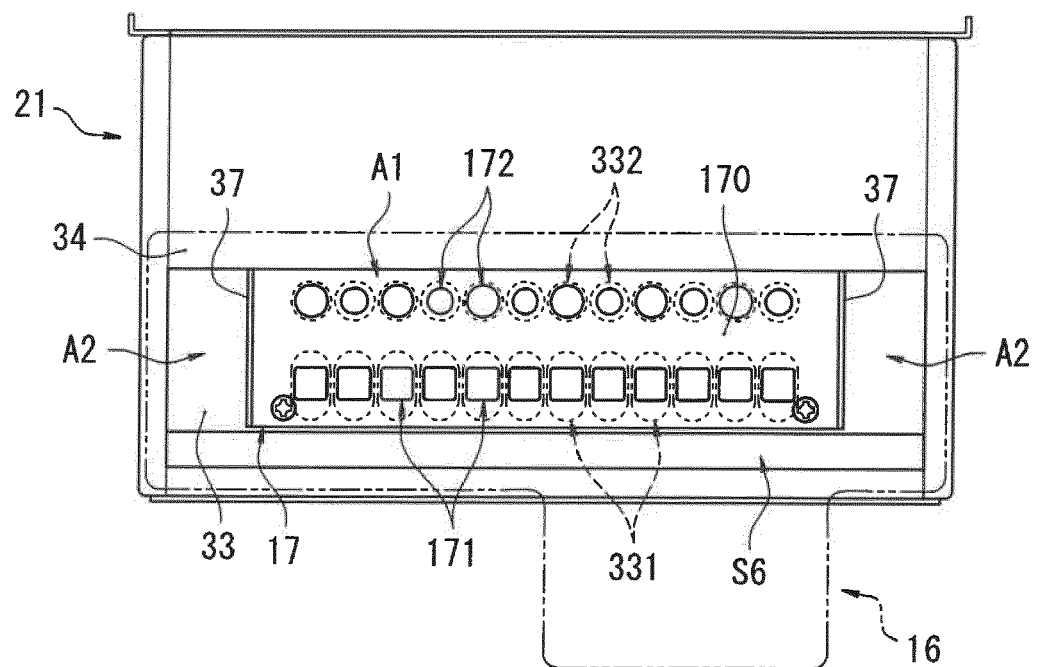


Fig. 6

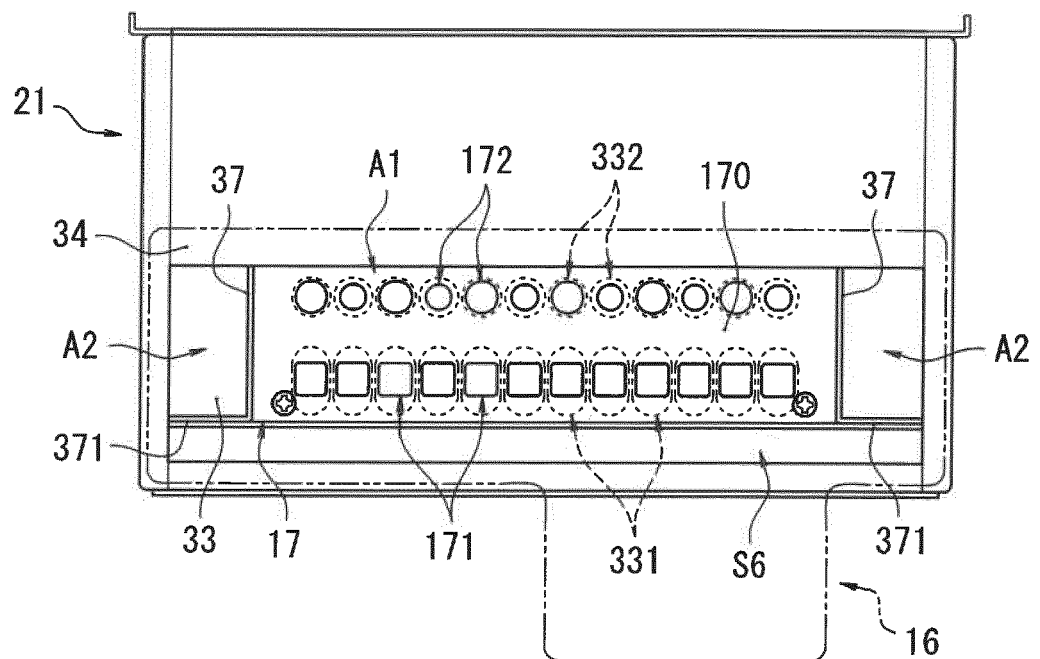
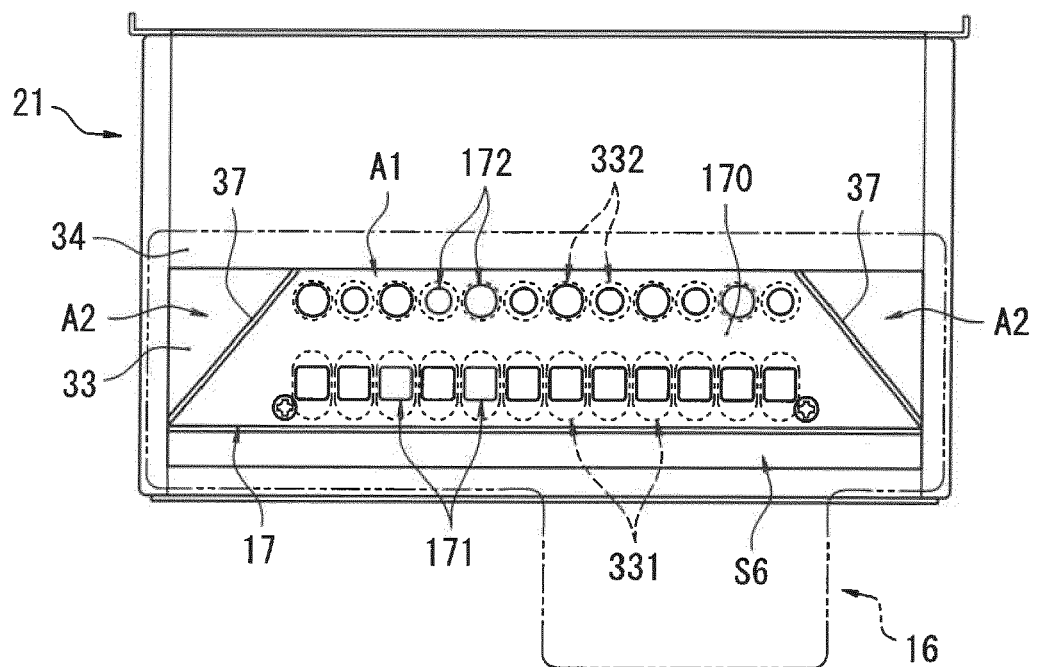
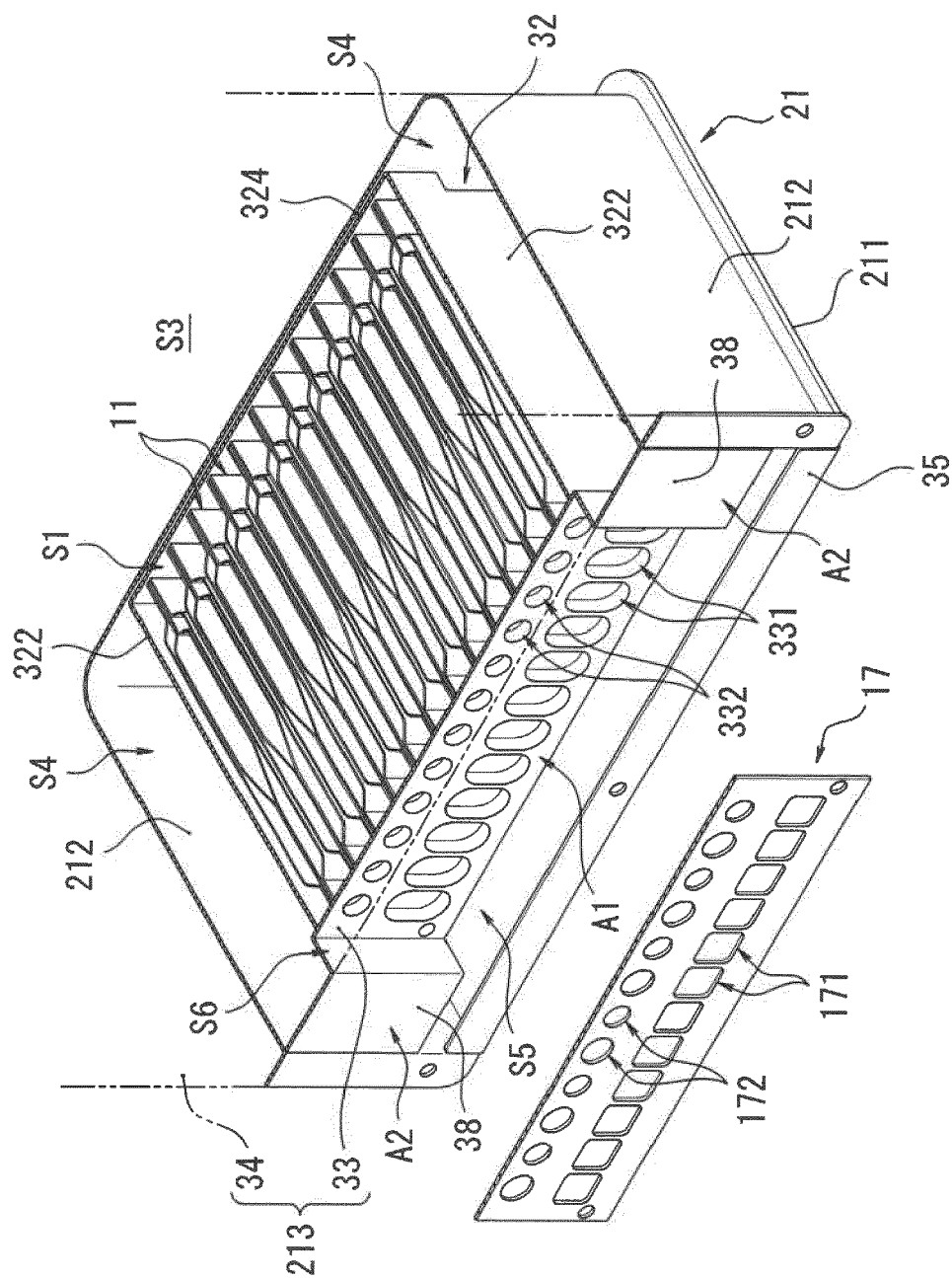


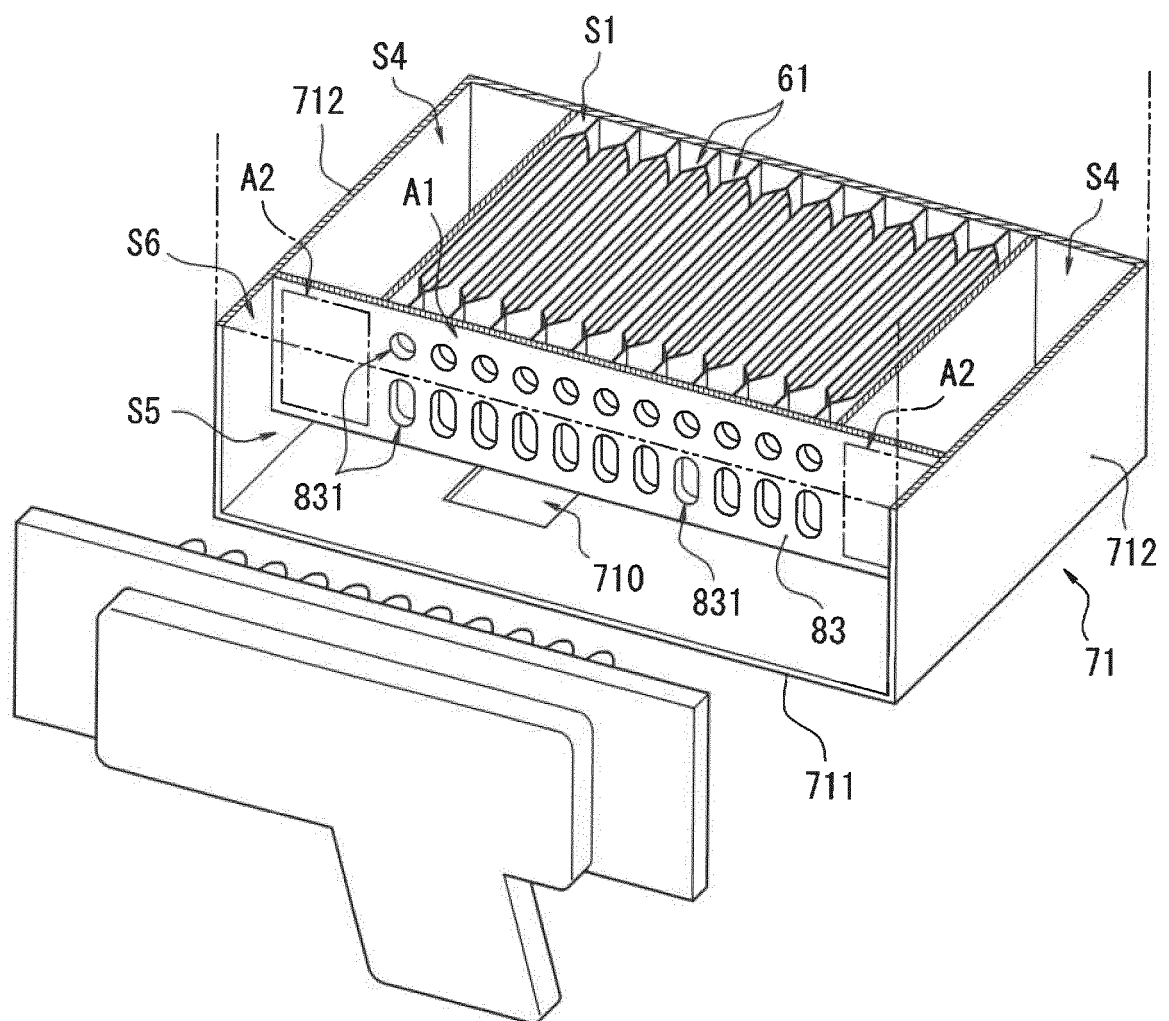
Fig. 7





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Fig. 9





EUROPEAN SEARCH REPORT

Application Number
EP 18 19 4220

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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	JP H10 115407 A (MATSUSHITA ELECTRIC IND CO LTD) 6 May 1998 (1998-05-06) * figures 1-6 *	1,2	INV. F23L1/00 F23D14/04 F23D14/70
A	US 2016/377282 A1 (SUGIOKA SHINGO [JP] ET AL) 29 December 2016 (2016-12-29) * paragraph [0019] - paragraph [0034]; figures 1-3 *	1	
A	US 2014/000534 A1 (NAITOH KATSUMI [JP] ET AL) 2 January 2014 (2014-01-02) * the whole document *	1	
A	US 2016/305654 A1 (KIM SUNG KI [KR] ET AL) 20 October 2016 (2016-10-20) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			F23L F23D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 February 2019	Examiner Theis, Gilbert
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 19 4220

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-02-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP H10115407 A	06-05-1998	JP 3713838 B2 JP H10115407 A	09-11-2005 06-05-1998
US 2016377282 A1	29-12-2016	CN 106287671 A JP 2017015283 A KR 20170002295 A US 2016377282 A1	04-01-2017 19-01-2017 06-01-2017 29-12-2016
US 2014000534 A1	02-01-2014	US 2014000534 A1 US 2018135888 A1	02-01-2014 17-05-2018
US 2016305654 A1	20-10-2016	AU 2014349389 A1 CN 105765303 A EP 3070404 A1 JP 6207740 B2 JP 2016536553 A KR 101468940 B1 RU 2628249 C1 US 2016305654 A1 WO 2015072759 A1	02-06-2016 13-07-2016 21-09-2016 04-10-2017 24-11-2016 04-12-2014 15-08-2017 20-10-2016 21-05-2015

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H596739 Y [0003]