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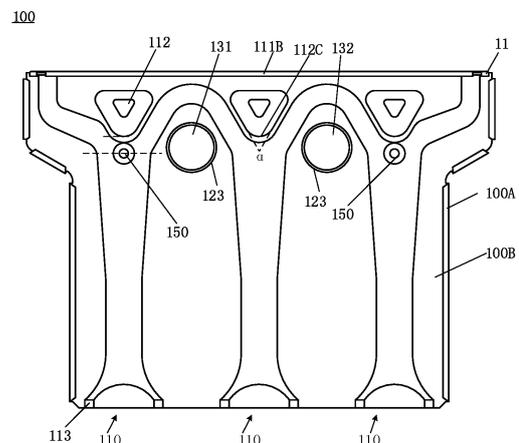
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(54) **DISTRIBUTOR AND COMBUSTOR AND WATER HEATER HAVING SAME**

(57) A distributor (100), and a combustor (10) and a water heater having same, the distributor (100) comprising: a first housing (100A) and a second housing (100B) symmetrically provided; ejection tubes (110), each comprising the first housing (100A), the second housing (100B) and an inlet end (113), the ejection tubes (110) ejecting gas upward from the inlet ends (113); and pitch positioning structures (150) provided outside the ejection tubes (110), each pitch positioning structure comprising a first protrusion (151) and a second protrusion (152) provided symmetrically, the first protrusion (151) being formed by the portion of the first housing (100A) protruding toward the outside of the ejection tube (110), and the second protrusion (152) being formed by the portion of the second housing (100B) protruding toward the outside of the ejection tube (110), side walls of the inlet ends (113) of the two adjacent distributors (100) abutting, and the pitch positioning structures (150) of the two adjacent distributors (100) abutting. The combustor (10) can better secure the fixation between the distributors (100) and reduce shaking or vibration, thereby reducing the working noise of the combustor (10).

FIG. 1



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## Description

### CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** The present application claims the priority of Chinese patent application No. 201820732279.6 entitled "Combustor and Water Heater Using the same" filed in the Chinese Patent Office on May 15, 2018; Chinese patent application No. 201820720485.5 entitled "Flame distributor and Combustor and Water Heater Having Same" filed in the Chinese Patent Office on May 15, 2018; Chinese patent application No. 201820720484.0 entitled "Flame distributor and Combustor and Water Heater Having Same" filed in the Chinese Patent Office on May 15, 2018, the entire contents of which are incorporated herein by reference.

### TECHNICAL FIELD

**[0002]** The application relates to the field of water heater equipment or wall-mounted furnaces, in particular to the technical field of combustors, especially in particular to a flame distributor and a combustor and a water heater having same.

### BACKGROUND

**[0003]** A water heater or a wall-mounted furnace is household equipment which takes fuel gas as a main energy source and provides domestic hot water or household heating. Combustors are important components of gas water heaters and wall-mounted furnaces, and are a general term for devices that cause fuel and air to be ejected in a certain manner and then mixed for combustion. The combustors are divided into industrial combustors, burning mechanism, civil combustors and special combustors according to types and application fields.

**[0004]** In the prior art, combustors generally comprise a plurality of flame distributors arranged side by side, and the flame distributors are provided with ejection tubes for ejecting gas in a direction. Due to the fact that the inner diameters of the ejection tubes are inconsistent in the direction, the plurality of flame distributors combined together tend to shake, so that the working noise of the combustor is high.

### SUMMARY

**[0005]** In order to solve or alleviate the technical problems existing in the prior art and provide at least one beneficial option, the embodiment of the application provides a flame distributor and a combustor and a water heater having same.

**[0006]** The present application provides a flame distributor, comprising: a first housing; a second housing symmetrically arranged with the first housing; an ejection tube comprising the first housing, the second housing and an inlet end, and ejecting gas upwards from the inlet

end; and an interval positioning structure arranged outside of the ejection tube and comprising a first protrusion and a second protrusion which are symmetrically arranged with each other, the first protrusion being formed by protruding the first housing toward the outside of the ejection tube, and the second protrusion being formed by protruding the second housing toward the outside of the ejection tube, wherein side walls of two adjacent flame distributors at the inlet ends abut against each other, and the interval positioning structures of the two adjacent flame distributors abut against each other.

**[0007]** In some embodiments, the distance between a surface of the first protrusion and a surface of the second protrusion is equal to the width of the inlet end.

**[0008]** In some embodiments, the ejection tube further comprises a diverter arranged above the interval positioning structure and comprising a first recess and a second recess which are symmetrically arranged with respect to each other, the first recess being formed by recessing the first housing toward a cavity of the ejection tube, the second recess being formed by recessing the second housing toward the cavity of the ejection tube.

**[0009]** In some embodiments, a gas passage is provided between the first recess and the second recess.

**[0010]** In some embodiments, the flame distributor further comprises a top plate, the cavity of the ejection tube is enclosed by the first housing, the second housing and the top plate, and the top plate is provided with a plurality of fire holes.

**[0011]** In some embodiments, a first flange is provided at top of the first housing; a second flange is provided at top of the second housing; a first connecting portion is provided at an edge of the top plate, and the first connecting portion is riveted to the first housing and the second housing, so that the first connecting portion wraps and compresses the first flange and the second flange; wherein the first flange and the second flange are oppositely arranged.

**[0012]** In some embodiments, a second connecting portion is provided on a side of the first housing, and the second connecting portion is riveted to the second housing so that the second connecting portion wraps and compresses a side of the second housing.

**[0013]** In some embodiments, two ends of the top plate are arc-shaped and provided with a third connecting portion, joints of the first housing and the second housing to two ends of the top are arc-shaped, and the third connecting portion wraps and compresses the first housing and the second housing.

**[0014]** In some embodiments, the flame distributor comprises a water inlet pipe through hole and a water outlet pipe through hole for a cooling water pipe to pass therethrough, the water inlet pipe through hole and the water outlet pipe through hole passing through the first housing and the second housing, the water inlet pipe through hole and the water outlet pipe through hole extending outwardly along their peripheries to form a third flange so that the cooling water pipe is in close contact

with the first housing and the second housing.

**[0015]** In some embodiments, a plurality of first connecting holes are provided on the first housing, a plurality of second connecting holes are provided on the second housing, the plurality of first connecting holes extend outwardly along the periphery thereof to form a fourth flange, and the fourth flange wraps and compresses the second connecting hole.

**[0016]** In some embodiments, multiple groups of fire outlets are provided on the top plate, each group of the fire outlets includes a plurality of fire holes, and fire holes at both ends of each group of the fire outlets have a minimum length.

**[0017]** In some embodiments, the length of the fire holes between the fire holes at both ends is the same.

**[0018]** In some embodiments, lengths of the fire holes are gradually shortened from center to both ends of the fire outlets.

**[0019]** In some embodiments, the fire outlets are symmetrically arranged about an axis along the length of the top plate, and the fire outlets are flush at one end near the axis.

**[0020]** In some embodiments, a density of the fire holes arranged adjacent to a gas outlet of the ejection tube is less than a density of the fire holes arranged at both sides of the gas outlet of the ejection tube.

**[0021]** In some embodiments, the distance between two adjacent groups of fire outlets is greater than the distance between two adjacent fire holes in the fire outlets.

**[0022]** In some embodiments, the fire holes have bulges, and the bulges of adjacent fire holes are staggered.

**[0023]** The application also provides a flame distributor, which comprises a fire outlet provided with a plurality of fire holes; a plurality of ejection tubes, each ejection tube comprising an inlet end and ejecting gas from the inlet end to the fire holes of the fire outlet for combustion; an interval positioning structure arranged on the ejection tube and used for defining a mounting position of the flame distributor; and a diverter arranged above the interval positioning structure and used for diverting and guiding the gas ejected from the inlet end of the ejection tube to the fire outlet.

**[0024]** In some embodiments, the interval positioning structure comprises a first protrusion and a second protrusion symmetrically arranged on a front side and a rear side of the ejection tube, the first protrusion and the second protrusion being formed by protruding a housing of the flame distributor toward the outside.

**[0025]** In some embodiments, a maximum distance between a surface of the first protrusion and a surface of the second protrusion is equal to a width of the inlet end.

**[0026]** In some embodiments, the diverter comprises a first recess and a second recess symmetrically arranged and formed by recessing a housing of the flame distributor toward a cavity of the flame distributor, and a gas passage is provided between the first recess and the

second recess.

**[0027]** In some embodiments, the flame distributor comprises a water pipe through hole for a cooling water pipe to pass therethrough, the water pipe through hole passing through a housing of the flame distributor.

**[0028]** In some embodiments, a water pipe through hole is provided in a housing between at least two adjacent ones of the plurality of ejection tubes.

**[0029]** The application also provides a flame distributor, which comprises a top plate arranged on top of the flame distributor and provided with multiple groups of fire outlets; and a plurality of ejection tubes, each ejection tube comprising an inlet end and ejecting gas from the inlet end to fire holes of the fire outlet for combustion, a water pipe through hole being provided in a housing between at least one pair of adjacent ejection tubes in the plurality of ejection tubes.

**[0030]** In some embodiments, the multiple groups of fire outlets comprise a plurality of strip-shaped fire holes arranged along a length direction of the top plate.

**[0031]** In some embodiments, at least the plurality of strip-shaped fire holes have at least one bulge, and the bulges between adjacent ones of the plurality of strip-shaped fire holes are staggered.

**[0032]** In some embodiments, an interval between the fire holes in the fire outlets on the top plate corresponding to positions above the gas outlets of the ejection tubes is larger than an interval between the fire holes in the fire outlets on the top plate corresponding to positions at both sides of the gas outlets of the ejection tubes.

**[0033]** The application also provides a combustor comprising a plurality of flame distributors according to the above embodiments, wherein the plurality of flame distributors are arranged side by side along a width direction, side walls of two adjacent flame distributors abut at the inlet ends against each other, and the interval positioning structures of the two adjacent flame distributors abut against each other.

**[0034]** In some embodiments, the combustor further comprises a first pressing plate and a second pressing plate, the first pressing plate and the second pressing plate are respectively arranged at an outside of the flame distributors which are arranged at both ends, and the first pressing plate and the second pressing plate are respectively fixedly connected to the corresponding flame distributors.

**[0035]** In some embodiments, the combustor further comprises a cooling water pipe passing through the plurality of the flame distributors, which comprises at least one U-shaped section.

**[0036]** The application also provides a water heater which comprises a plurality of combustors according to the above embodiments.

## 55 BRIEF DESCRIPTION OF THE DRAWINGS

**[0037]** In the drawings, like reference numerals refer to the same or similar components or elements through-

out the several drawings unless otherwise specified. The drawings are not necessarily to scale. It is to be understood that these drawings depict only some embodiments in accordance with the present disclosure and are not to be considered limiting the scope of the present application.

FIG. 1 is a front view of a flame distributor of an embodiment of the present application;  
 FIG. 2 is a left side view of two flame distributors of a combustor of an embodiment of the present application;  
 FIG. 3 is a front view of a flame distributor of another embodiment of the present application;  
 FIG. 4 is a cross-sectional view of the flame distributor taken along the line B-B of FIG. 3;  
 FIG. 5 is a top view of the flame distributor of FIG. 3;  
 FIG. 6 is an enlarged partial cross-sectional view of the flame distributor taken along the line A-A of FIG. 3;  
 FIG. 7 is a top view of a top plate of a flame distributor of an embodiment of the present application;  
 FIG. 8 is a top view of a top plate of a flame distributor of another embodiment of the present application;  
 FIG. 9 is a top view of a top plate of a flame distributor of yet another embodiment of the present application;  
 FIG. 10 is a top view of a top plate of a flame distributor of still another embodiment of the present application;  
 FIG. 11 is a top view of a combustor of an embodiment of the present application;  
 FIG. 12 is a front view of a combustor of an embodiment of the present application; and  
 FIG. 13 is an exploded view of a combustor of an embodiment of the present application.

## DETAILED DESCRIPTION

**[0038]** In the following, only certain exemplary embodiments are briefly described. As will be appreciated by those skilled in the art, the described embodiments may be modified in various ways without departing from the spirit or scope of the present application. Accordingly, the drawings and description are to be regarded as illustrative in nature and not as restrictive.

**[0039]** As shown in FIG. 1, which is a front view of a flame distributor 100. The flame distributor 100 of the present embodiment comprises three ejection tubes 110 and two through holes (a water inlet pipe through hole 131 and a water outlet pipe through hole 132), wherein the water inlet pipe through hole 131 is used for a water inlet pipe (to be described in detail below) to pass therethrough and is in close contact with the water inlet pipe, and the water outlet pipe through hole 132 is used for a water outlet pipe (to be described in detail below) to pass therethrough and is in close contact with the water outlet pipe.

**[0040]** Preferably, the width of the ejection tube 110 at a gas outlet end is larger than the width of the ejection tube 110 at an inlet end 113, so that the outlet end of the ejection tube 110 formed by a first housing 100A and a second housing 100B is inclined to both sides to form flow guide inclined planes. Therefore, the ejection pressure of the gas at the outlet end is reduced, and the gas from the ejection tube 110 is more uniformly dispersed when it flows out.

**[0041]** As shown in FIG. 2, which is a left side view of two adjacent flame distributors 103 and 104. Referring to FIG. 2 in combination with FIG. 1, in the present embodiment the flame distributor 100 may be formed by the first housing 100A and the second housing 100B in a snap-fit relationship, that is, a cavity of the ejection tube 110 is enclosed by the first housing 100A and the second housing 100B. The water inlet pipe through hole 131 and the water outlet pipe through hole 132 pass through the first housing 100A and the second housing 100B. The flame distributor 100 further comprises a top plate 11 which covers the three ejection tubes 110 on the top and is provided with a plurality of fire holes 111B. Each ejection tube 110 has the inlet end 113 for ejecting gas upward from the inlet end 113, and then the gas is discharged from the fire holes 111B and ignited by an igniter 160 (see FIG. 12) to form a flame.

**[0042]** Further, the flame distributor 100 further comprises interval positioning structures 150 arranged outside the ejection tube 110, each interval positioning structure 150 including a first protrusion 151 and a second protrusion 152 symmetrically arranged, wherein the first protrusion 151 is formed by protruding the first housing 100A toward the outside of the ejection tube 110, and the second protrusion 152 is formed by protruding the second housing 100B toward the outside of the ejection tube 110.

**[0043]** As shown in FIG. 2, the distance between a surface of the first protrusion 151 (convex surface) and a surface of the second protrusion 152 (convex surface) is D1, and the width of the inlet end 113 of the ejection tube 110 is D2, wherein D1 is equal to D2, so that side walls of the two adjacent flame distributors 103 and 104 at the inlet ends 113 can abut against each other, and the interval positioning structures 150 of the two adjacent flame distributors 103 and 104 can abut against each other, namely, the first protrusion 151 of the flame distributor 103 and the second protrusion 152 of the flame distributor 104 abut against each other.

**[0044]** It should be noted that the number of interval positioning structures 150 is not limited by this embodiment. For example, one interval positioning structure 150 may be provided outside one of the ejection tubes 110, or respective interval positioning structure 150 may be provided outside each ejection tube 110, as long as the side walls of the two adjacent flame distributors 100 at the inlet ends can abut against each other, and the interval positioning structures 150 of the two adjacent flame distributors can abut against each other.

**[0045]** In the present embodiment, the interval positioning structures 150 makes it possible to secure the plurality of flame distributors 100 more firmly and reduce shaking or vibration, thereby reducing noise generated by the combustor 10 (see FIGS. 11 to 13) during operation.

**[0046]** Preferably, as shown in FIGS. 1 and 2, the ejection tube 110 further comprises a diverter 112 arranged above the interval positioning structure 150, including a first recess 112A formed by recessing the first housing 100A toward a cavity of the ejection tube 110 and a second recess 112B formed by recessing the second housing 100B toward the cavity of the ejection tube 110. The diverter 112 is used for diverting gas, that is to say, a part of the gas influenced by the resistance of the diverter 112 is diverted to two sides of the ejection tube 110, ejected from fire holes 111B corresponding to two sides of the ejection tube 110, and then burned to form a flame; and the other part of the gas travels upward from a gas passage between the first recess 112A and the second recess 112B, is ejected from the fire holes 111B corresponding to a center of the ejection tube 110, and then burned to form a flame.

**[0047]** The angle  $\alpha$  of a apex corner 112C of the diverter 112 is preferably  $45^\circ$  to  $85^\circ$ , that is, the diverting angle of the apex corner 112C for diverting the gas to two sides thereof is preferably  $45^\circ$  to  $85^\circ$ , so as to reduce the diverting resistance.

**[0048]** As shown in FIGS. 3 and 4, a first flange 121 is provided at top of the first housing 100A, and a second flange 122 is provided at top of the second housing 100B. A top plate 11 is provided on the first housing 100A and the second housing 100B, and includes a first connecting portion 11A at an edge thereof. The first connecting portion 11A is riveted to the first housing 100A and the second housing 100B so that the first connecting portion 11A wraps and compresses the first flange 121 and the second flange 122. The first flange 121 and the second flange 122 are oppositely arranged (i.e. the fold direction of the first flange 121 is opposite to the fold direction of the second flange 122). According to the embodiment, the top plate 11 is connected to the first housing 100A and the second housing 100B in a wrapping and riveting mode, so that air tightness of the flame distributor is increased, and combustion effect of the flame distributor is improved.

**[0049]** Here, the edge of the top plate 11 can be understood as the entire outer edge of the top plate 11, and can also be understood as two sides of the top plate 11 parallel to a length direction. Ends of the top plate 11 can be understood as both ends of the top plate 11 in the width direction.

**[0050]** Further, the first flange 121 of the first housing 100A and the second flange 122 of the second housing 100B are wrapped by and riveted to the top plate 11.

**[0051]** It should be noted that the riveting depicted in the embodiments may be understood as riveting with rivets or riveting without rivets. Among them, rivet-free riv-

eting (riveting without rivets) utilizes plastic deformation of the plate material itself to join the plates. The rivet-free connection can adopt a wrapping and riveting mode or a flanging and riveting mode, and the specific connection mode is selected according to the working requirement and the interference condition of each connecting piece. Rivet-free riveting does not damage a plating layer or a paint layer on the surface of the workpiece, and the original corrosion resistance of the plate is maintained. The wrapping and riveting mode is achieved by deforming and folding a plate inwardly to wrap the edge of the other plate. The flanging and riveting mode is achieved by deforming and folding a plate outwardly to reversely wrap the edge of the other plate.

**[0052]** In some embodiments, as shown in FIGS. 3 and 5, second connecting portions 11B are provided at both sides of the first housing 100A, and the second connecting portions 11B are connected to the second housing 100B in the wrapping and riveting mode so that the second connecting portions 11B wrap and compress both sides of the second housing 100B.

**[0053]** In a variable embodiment, the second connecting portions may be provided at both sides of the second housing 100B, and the second connecting portions are connected to the first housing 100A in the wrapping and riveting mode so that the second connecting portions wrap and compress both sides of the first housing 100A. In this embodiment, the first housing 100A and the second housing 100B can be fastened and sealed better by connecting the side edges of the first housing 100A and the second housing 100B in the wrapping and riveting mode.

**[0054]** In order to achieve a better seal between the first connecting portion 11A of the top plate 11 and the first housing 100A and the second housing 100B in the wrapping and riveting mode better, joints of the first connecting portion 11A to the first flange 121 and the second flange 122 can be further riveted. The sides of the first housing 100A and the sides of the second housing 100B may be further riveted during connection with the second connecting portions 11B.

**[0055]** In an embodiment, as shown in FIG. 5, two ends of the top plate 11 are arc-shaped, and two ends of the top plate 11 are provided with a third connecting portion 11C. Also, the joints of the first housing 100A and the second housing 100B to two ends of the top 11 are arc-shaped structures. The joints of the first housing 100A and the second housing 100B are wrapped and compressed by the third connecting portion 11C so that joints of the top plate 11 to the top of the first housing 100A and the second housing 100B is connected in a wrapping and riveting mode. When the joints of the first housing 100A and the second housing 100B are arc-shaped structures, the top plate 11 also adopts a corresponding arc-shaped structure. Compared with other shapes, it provides better seal performance, heat conduction and cooling when the both ends of the top plate 11 are arc-shaped.

**[0056]** With reference to FIGS. 1, 3 and 6, according to one aspect of the embodiment of the present application, the water inlet pipe through hole 131 and the water outlet pipe through hole 132 of the present embodiment extend outwardly along their peripheries to form a third flange 123, so that a cooling water pipe 200 is in close contact with the flame distributor 100 (see FIGS. 11 to 13).

**[0057]** In an embodiment, as shown in FIGS. 3 and 6, a plurality of first through holes 18 are provided between adjacent ejection tubes 110, and include a plurality of first connecting holes 181 formed in the first housing 100A and a plurality of second connecting holes 182 formed in the second housing 100B. The first connecting hole 181 and the second connecting hole 182 are combined to form the first through hole 18. The first connecting hole 181 extends outwardly along the periphery thereof to form a fourth flange 183, which wraps and compresses the second connecting hole 182. Therefore, the first connecting hole 181 is connected to the second connecting hole 182 in the flanging and riveting mode.

**[0058]** In a variable embodiment, the second housing 100B may extend outwardly along its periphery to form a fourth flange 183 for wrapping and compressing the first connecting hole 181. Therefore, the second connecting hole 182 is connected to the first connecting hole 181 in the flanging and riveting mode.

**[0059]** The provision of the first through hole 18 can be used, on the one hand, for the mounting of the flame distributor (to be described below in connection with Figs. 11 to 13) and, on the other hand, for the placement of the cooling water pipe. The combination of the first connecting hole 181 and the second connecting hole 182 also enables the connection of the first housing 100A and the second housing 100B to be sealed better, and increases the mounting reliability and operability of the flame distributor.

**[0060]** Preferably, the materials of the first housing 100A, the second housing 100B, and the top plate 11 are aluminum alloys, which have good plasticity, corrosion resistance, and thermal conductivity. Meanwhile, the first housing 100A, the second housing 100B and the top plate 11 are riveted together with each other, so that the aluminum alloy structure will not be damaged, and the air tightness, the heat conductivity and other properties of the flame distributor structure are better.

**[0061]** As shown in FIG. 7, multiple groups of fire outlets 111A are provided on the top plate 11, the fire outlets 111A include a plurality of fire holes 111B, and the fire holes 111B at both ends of each group of fire outlets 111A have a minimum length.

**[0062]** It should be noted that the fire holes 111B at both ends of the fire outlets 111A defined in this embodiment may be understood as at least one fire hole 111B at each end of the fire outlets 111A, and may be also understood as a plurality of fire holes 111B at each end of the fire outlets 111A. For example, two fire holes 111B located at each end of the fire outlets 111A are shortest

in length, i.e., a total of four fire holes 111B located at both ends of each fire outlet 111A are shortest in length.

**[0063]** In a specific embodiment, as shown in FIG. 7, the plurality of fire holes 111B are divided into multiple groups of fire outlets 111A, and the fire outlets 111A are arranged at intervals along the length direction of the top plate 11, and the fire holes 111B at both ends have a minimum length, so that the flame generated by each group of the fire outlets 111A has a distinct boundary, and each group of the fire outlets 111A can form a plurality of group flames. The overall height of the flame and the temperature of the flame are reduced, so that the adaptability of the flame distributor is improved, and nitrogen oxides generated by burning the flame are discharged.

**[0064]** In a variable embodiment, the fire holes 111B at both ends are the same and shortest in length, and the remaining fire holes 111B (other than the fire holes at both ends) are the same in length (as shown in FIGS. 7 and 8), which reduces the flame height and emission of nitrogen oxides while reducing manufacturing costs.

**[0065]** In another variable embodiment, as shown in FIG. 9, the length of the fire holes 111B near center of the fire outlets 111A is longer, and the length of the fire holes 111B near both ends is shorter, so that the boundary of the generated flame becomes more obvious and the group flame is better formed, thereby reducing the height of the generated flame to a greater extent.

**[0066]** The shape of the fire holes 111B in the top plate 11 in the present application comprises, but is not limited to, the above-mentioned shape and length, and the fire holes 111B in the present application enable the flame boundary generated by each group of the fire outlets 111A more obvious by changing the lengths thereof. Other configurations that reduce the flame height by varying the length and arrangement of the fire holes 111B to vary the boundary of flame generated by each group of fire outlets 111A or fire holes 111B should also be included within the scope of this application.

**[0067]** In an embodiment, as shown in FIGS. 7-10, the fire outlets 111A are symmetrically arranged in at least two rows about an axis in the length direction of the top plate 11. Also, the fire outlets 111A of each row are flush at one end near the symmetry line so that the generated flame is more uniform and closer to center of the top plate 11 to provide sufficient flame temperature.

**[0068]** In an embodiment, as shown in FIG. 8, the fire holes 111B in each of the fire outlets 111A on the top plate 11 corresponding to positions above a gas outlet 114 of the ejection tube 110 are arranged sparsely, and the fire holes 111B in the fire outlets 111A on the top plate 11 corresponding to positions at both sides of the gas outlet 114 of the ejection tube 110 are arranged densely. That is, a density of the fire holes 111B arranged adjacent to the gas outlet 114 of the ejection tube 110 is smaller than a density of the fire holes 111B arranged at two sides of the gas outlet 114 of the ejection tube 110. Thus, more gas can flow to the densely arranged fire holes 111B at both sides to generate a flame, so that

uniform flames are generated on the top plate 11.

**[0069]** In a variable embodiment, as shown in FIG. 8, an interval between the fire holes 111B in the fire outlets 111A on the top plate 11 corresponding to positions above the gas outlets 114 of the ejection tubes 110 is large so that the fire holes are arranged sparsely. An interval between fire holes 111B in the fire outlets 111A on the top plate 11 at positions corresponding to positions at both sides of the gas outlets 114 of the ejection tube 110 is small so that the fire holes are arranged densely.

**[0070]** Preferably, as shown in FIGS. 7 to 11, in order to set the intervals between each group of the fire outlets 111A so that the generated flame has a boundary, the intervals between each group of the fire outlets 111A may be larger than the intervals between the fire holes 111B in each group of the fire outlets 111A.

**[0071]** In an embodiment, as shown in FIG. 9, two sides of the fire holes 111B bulge outwardly. The ejecting strength is increased by bulging two sides of the fire holes outwardly so that the fire holes 111B forms an elliptical structure to increase the area of the fire holes 111B. Two sides of the fire holes 111B can be understood to correspond to the positions of both ends of the top plate 11 in the length direction.

**[0072]** In a variable embodiment, as shown in FIG. 10, the fire holes 111B have bulges, and the bulges of adjacent fire holes 111B are staggered. The fire holes 111B are provided with a plurality of bulges at the middle portion, so that the fire holes 111B are increased by area of the bulges compared to those without bulges, thereby the overall area of the fire holes 111B is increased and the ejecting strength is increased. The bulges of two adjacent fire holes 111B are staggered to increase the number and density of the fire holes 111B.

**[0073]** With reference to FIGS. 1-10, the present application also provides a flame distributor 100 including a fire outlet 111A, a plurality of ejection tubes 110, an interval positioning structure 150, and a diverter 112. A plurality of fire holes 111B are formed in the fire outlet 111A. Each ejection tube 110 comprises an inlet end 113, and the ejection tube 110 ejects gas from the inlet end 113 to the fire holes 111B for combustion. Further, an interval positioning structure 150 is provided on the ejection tube 110 to define a mounting position for the flame distributor 100. The diverter 112 is arranged above the interval positioning structure 150 to divert and direct the gas ejected from the inlet end 113 of the ejection tube 110 to the fire outlets 111A.

**[0074]** The specific structure of the fire outlet 111A, the plurality of ejection tubes 110, the interval positioning structure 150, and the diverter 112 have been described above and will not be described in detail herein.

**[0075]** Further, the interval positioning structure 150 may include a first protrusion 151 and a second protrusion 152 symmetrically arranged on a front side and a rear side of the ejection tube 110. Also, the first protrusion 151 and the second protrusion 152 are formed by protruding the housing of the flame distributor 100 outwardly.

Also, as shown in FIG. 2, the distance between the surface of the first protrusion 151 (convex surface) and the surface of the second protrusion 152 (convex surface) is  $D1$ , the width of the inlet end 113 of the ejection tube 110 is  $D2$ , and  $D1$  is equal to  $D2$ .

**[0076]** Preferably, as shown in FIGS. 1 and 2, the diverter 112 comprises a first recess 112A and a second recess 112B symmetrically arranged and formed by recessing the housing of the flame distributor 100 (e.g., the first housing 100A in a snap fit relationship with the second housing 100B) toward a cavity of the flame distributor 100. Also, a gas passage is provided between the first recess 112A and the second recess 112B.

**[0077]** With reference to FIGS. 1, 3 and 6, the flame distributor 100 further comprises a water pipe through hole for the cooling water pipe 200 to pass therethrough, such as the water pipe through hole 131 and the water outlet pipe through hole 132, and the water pipe through hole passes through the housing of the flame distributor 100.

**[0078]** With reference to FIGS. 1 and 3, a water pipe through hole is formed in the housing between two adjacent ejection tubes 110.

**[0079]** With reference to FIGS. 1 to 10, the present application also provides a flame distributor 100 including: a top plate 11 and a plurality of ejection tubes 110. Here, the top plate 11 is provided on top of the flame distributor 100, and multiple groups of fire outlets 111A are provided on the top plate 11. Each ejection tube 110 comprises an inlet end 113, and the ejection tube 110 ejects gas from the inlet end 113 to the fire holes 111B for combustion.

**[0080]** Further, as shown in FIGS. 1 and 3, a water pipe through hole such as the water pipe through hole 131 and the water outlet pipe through hole 132 is formed in the housing between at least one pair of adjacent ejection tubes 100 of the plurality of ejection tubes 110.

**[0081]** With reference to FIGS. 2 to 10, the multiple groups of fire outlets 111A include a plurality of strip-shaped fire holes 111B, wherein the plurality of strip-shaped fire holes 111B are arranged along the length direction of the top plate 11.

**[0082]** With reference to FIG. 10, at least the plurality of strip-shaped fire holes 111B have at least one bulge, and bulges between adjacent strip-shaped fire holes 111B are staggered to increase the number and density of fire holes 111B.

**[0083]** Further, as shown in FIG. 8, the interval between the fire holes 111B in the fire outlets 111A on the top plate 11 corresponding to positions above the gas outlets 114 of the ejection tubes 110 is larger than the interval between the fire holes 111B in the fire outlets 111A on the top plate 111 corresponding to positions at both sides of the gas outlets 114 of the ejection tubes 110.

**[0084]** With reference to FIGS. 11-13, according to another aspect of an embodiment of the present application, the present embodiment also provides a combustor 10 including a flame distributor 100 according to the above-

described embodiments. Here, a plurality of flame distributors 100 are arranged side by side in the width direction, and include a first flame distributor 101 and a second flame distributor 102 arranged at an end of the combustor 10.

**[0085]** Further, the combustor 10 further comprises a first pressing plate 171, a second pressing plate 172, a connecting piece 180, a first fastener 191, and a second fastener 192. Here, the first pressing plate 171 is located outside the first distributor 101, and the second pressing plate 172 is located outside the second distributor 102. The connecting piece 180 passes through the first pressing plate 171, various distributors 100 (wherein the connecting piece 180 can pass through the first through hole 18 when passing through the flame distributor 100 as shown in connection with the first through hole 18 in FIG. 3) and the second pressing plate 172 in sequence. Also, the connecting piece 180 is fixedly connected to the first pressing plate 171 through a first fastener 191, and the connecting piece 180 is fixedly connected to the second pressing plate 172 through a second fastener 192, so that the first pressing plate 171 and the second pressing plate 172 press the respective flame distributors 100 from both ends of the combustor 10. Preferably, in this embodiment, the connecting piece 180 may be a threaded stud, and the first fastener 191 and the second fastener 192 may be bolts.

**[0086]** With reference to FIG. 2, the interval positioning structures 150 of the two adjacent flame distributors 103 and 104 may abut against each other, i.e., a first protrusion 151 of the flame distributor 103 and a second protrusion 152 of the flame distributor 104 may abut against each other.

**[0087]** Further, the combustor 10 of the present embodiment comprises a cooling water pipe 200 passing through the plurality of flame distributors 100, the cooling water pipe 200 including at least one U-shaped section. For example, the cooling water pipe 200 may be a U-shaped pipe (i.e., including one U-shaped section) or an S-shaped pipe (i.e., including two U-shaped sections). With reference to FIG. 13, the cooling water pipe may pass between adjacent ejection tubes 110 so that each ejection tube 110 may be cooled. When the cooling water pipe 200 comprises a plurality of U-shaped sections, it is possible to pass between adjacent ejection tubes 110 in a serpentine roundabout manner.

**[0088]** Preferably, as shown in combination with FIGS. 1 and 3, the cooling water pipe 200 is arranged close to the top plate 11, so that the temperature of the fire outlets 111A can be lowered.

**[0089]** With reference to FIG. 11, the cooling water pipe 200 comprises a water inlet pipe 210 and a water outlet pipe 220 for water inflow and outflow at the same side of the combustor 10. Preferably, the cooling water pipe 200 is integrally formed. The water inlet pipe 210 passes through the water inlet pipe through hole 131 (see FIG. 1), and the water outlet pipe 220 passes through the water outlet pipe through hole 132 (see FIG. 1).

**[0090]** With reference to FIGS. 11 to 13, the present application further improves a combustor 10 including a plurality of the flame distributors 100 according to the embodiment described above, and a cooling water pipe 200 passing through a water pipe through hole of the flame distributor 100, the cooling water pipe 200 including a water inlet end and a water outlet end (for example, a water inlet pipe 210 and a water outlet pipe 220).

**[0091]** Other configurations of the combustor of the present embodiment may employ various technical solutions known to those of ordinary skill in the art now and in the future, and will not be described in detail herein.

**[0092]** As a further aspect of an embodiment of the present application, this embodiment also proposes a water heater or wall-mounted furnace comprising a combustor 10 according to the embodiment described above. Other configurations of the water heater or the wall-mounted furnace of the present embodiment may employ various technical solutions known to those of ordinary skill in the art now and in the future, and will not be described in detail herein.

**[0093]** In the description of the present application, it is to be understood that the orientations or position relationships indicated by terms "center", "longitudinal", "transverse", "length", "width", "thickness", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", "clockwise", "counterclockwise", "axial", "radial", "circumferential" and the like are based on the orientations or position relationships shown in the drawings for ease of description and simplicity of description only, and are not intended to indicate or imply that the device or assembly referred to must have a particular orientation, or be constructed and operated in a particular orientation. It is therefore not to be construed as limiting the present application.

**[0094]** Furthermore, the terms "first" and "second" are used for descriptive purposes only and are not to be construed as indicating or implying relative importance or implicitly indicating the number of technical features indicated. Thus, features defined with "first" and "second" may explicitly or implicitly include one or more such features. In the description of the present application, "a plurality of" means two or more, unless specifically defined otherwise.

**[0095]** In this application, the terms "mounted", "coupled", "connected", "fixed", and the like are to be construed broadly, for example, as fixed or detachable connections, or as a single unit, unless expressly stated and defined otherwise. It can be a mechanical connection, an electrical connection, or a communication. It may be a direct connection or an indirect connection through an intermediary, or two components may be interconnected inside or in an interactive relationship with each other. The specific meaning of the terms in this application will be understood by those of ordinary skill in the art, as the case may be.

**[0096]** In this application, unless expressly stated and defined otherwise, reference to a first feature as being

"above" or "below" a second feature may include reference to the first and second features being in direct contact, and reference to the first and second features not being in direct contact but being in contact by additional features therebetween. Furthermore, the first feature being "above", "over" and "on" the second feature comprises the first feature being directly above and obliquely above the second feature, or merely indicates that the first feature has a higher horizontal height than the second feature. The first feature being "below", "underneath" and "under" the second feature comprises the first feature being directly above and obliquely above the second feature, or merely indicates that the first feature has a lower horizontal height than the second feature.

**[0097]** The following disclosure provides many different embodiments or examples for implementing different structures of the present application. To simplify the disclosure of this application, components and arrangements of specific examples are described below. They are, of course, merely exemplary and are not intended to limit the present application. In addition, the present application may have repeated reference numerals and/or reference letters in various examples for purposes of simplicity and clarity, which does not inherently indicate a relationship between the various implementations and/or arrangements discussed. In addition, examples of various specific processes and materials are provided herein, but one of ordinary skill in the art may recognize the application of other processes and/or the use of other materials.

**[0098]** The above-mentioned content is only preferred embodiments of the present application, and it should be noted that the above-mentioned preferred embodiment should not be considered as limiting the present application, and the scope of protection of the present application should be based on the scope defined by the claims. It will be apparent to those skilled in the art that various modifications and variations can be made in the present application without departing from the spirit or scope of the application, and such modifications and variations are considered to be within the scope of the application.

## Claims

1. A flame distributor, wherein comprising:

a first housing;  
 a second housing symmetrically arranged with respect to the first housing;  
 an ejection tube comprising the first housing, the second housing and an inlet end, and the ejection tube ejecting gas upwards from the inlet end; and  
 an interval positioning structure arranged at an outside of the ejection tube and comprising a first protrusion and a second protrusion which are symmetrically arranged with respect to each

other, the first protrusion being formed by protruding the first housing toward the outside of the ejection tube, and the second protrusion being formed by protruding the second housing toward the outside of the ejection tube.

2. The flame distributor according to claim 1, wherein a maximum distance between a surface of the first protrusion and a surface of the second protrusion is equal to a width of the inlet end.

3. The flame distributor according to claim 1, wherein the ejection tube further comprises a diverter arranged above the interval positioning structure, and the diverter comprises a first recess and a second recess which are symmetrically arranged with respect to each other, the first recess being formed by recessing the first housing toward a cavity of the ejection tube, the second recess being formed by recessing the second housing toward the cavity of the ejection tube, and a gas passage is provided between the first recess and the second recess, a gas passage being defined between the first recess and the second recess.

4. The flame distributor according to any one of claims 1 to 3, wherein the flame distributor further comprises a top plate; a first flange is provided at a top of the first housing, a second flange is provided at a top of the second housing; a first connecting portion is provided at an edge of the top plate, and the first connecting portion is riveted to the first housing and the second housing, so that the first connecting portion wraps and compresses the first flange and the second flange; wherein the first flange and the second flange are oppositely arranged with respect to each other.

5. The flame distributor according to claim 4, wherein a second connecting portion is provided on a side of the first housing, and the second connecting portion is riveted to the second housing so that the second connecting portion wraps and compresses a side of the second housing; and wherein two ends of the top plate are arc-shaped and are provided with a third connecting portion, joints of the first housing and the second housing to the two ends of the top are arc-shaped, and the third connecting portion wraps and compresses the first housing and the second housing.

6. The flame distributor according to any one of claims 1 to 3, wherein comprising a water inlet pipe through hole and a water outlet pipe through hole for a cooling water pipe to pass through, the water inlet pipe through hole and the water outlet pipe through hole

passing through the first housing and the second housing, the water inlet pipe through hole and the water outlet pipe through hole extending outwardly along their peripheries to form a third flange so that the cooling water pipe is in close contact with the first housing and the second housing.

7. The flame distributor according to claim 4, wherein multiple groups of fire outlets are provided on the top plate, each group of the fire outlets includes a plurality of fire holes, and fire holes at both ends of each group of the fire outlets have a minimum length.
8. The flame distributor according to claim 7, wherein lengths of the fire holes are gradually shortened from center to both ends of the fire outlets.
9. The flame distributor according to claim 7, wherein a density of the fire holes arranged adjacent to a gas outlet of the ejection tube is less than a density of the fire holes arranged at both sides of the gas outlet of the ejection tube.
10. A flame distributor, wherein comprising:
  - a fire outlet provided with a plurality of fire holes; a plurality of ejection tubes, each ejection tube comprising an inlet end, and the ejection tube ejecting gas from the inlet end to the fire holes of the fire outlet for combustion;
  - an interval positioning structure arranged on the ejection tube and used for defining a mounting position of the flame distributor; and
  - a diverter arranged above the interval positioning structure and used for diverting and guiding the gas ejected from the inlet end of the ejection tube to the fire outlet.
11. The flame distributor according to claim 10, wherein the interval positioning structure comprises a first protrusion and a second protrusion symmetrically arranged with respect to each other on a front side and a rear side of the ejection tube, and the first protrusion and the second protrusion are formed by protruding a housing of the flame distributor toward outside.
12. The flame distributor according to claim 11, wherein a maximum distance between a surface of the first protrusion and a surface of the second protrusion is equal to a width of the inlet end.
13. The flame distributor according to claim 10, wherein the diverter comprises a first recess and a second recess symmetrically arranged with respect to each other, and the first recess and the second recess are formed by recessing a housing of the flame distributor toward a cavity of the flame distributor, and a

gas passage is provided between the first recess and the second recess.

14. The flame distributor according to claim 10, wherein comprising a water pipe through hole for a cooling water pipe to pass through, the water pipe through hole passing through a housing of the flame distributor.
15. The flame distributor according to claim 14, wherein a water pipe through hole is provided in the housing between at least two adjacent ejection tubes among the plurality of ejection tubes.
16. A flame distributor, wherein comprising:
  - a top plate arranged on a top of the flame distributor and the top plate provided with multiple groups of fire outlets;
  - a plurality of ejection tubes, each ejection tube comprising an inlet end and the ejection tube ejecting gas from the inlet end to fire holes of the fire outlets for combustion, and
  - a water pipe through hole provided in a housing between at least a pair of adjacent ejection tubes among the plurality of ejection tubes.
17. The flame distributor according to claim 16, wherein the multiple groups of fire outlets comprise a plurality of strip-shaped fire holes the strip-shaped fire holes are arranged along a length direction of the top plate.
18. The flame distributor according to claim 16, wherein at least a plurality of strip-shaped fire holes have at least a bulge, and the bulges between adjacent strip-shaped fire holes among the plurality of strip-shaped fire holes are staggeredly arranged.
19. The flame distributor according to claim 16, wherein an interval between the fire holes in the fire outlets on the top plate corresponding to a position above the gas outlets of the ejection tubes is larger than an interval between the fire holes in the fire outlets on the top plate corresponding to positions at both sides of the gas outlets of the ejection tubes.
20. A combustor, wherein comprising a plurality of flame distributors according to any one of claims 1 to 19, the plurality of flame distributors are arranged side by side along a width direction, wherein, side walls of two adjacent flame distributors at the inlet ends abut against each other, and the interval positioning structures of the two adjacent flame distributors abut against each other.
21. The combustor according to claim 20, wherein the combustor further comprises a first pressing plate and a second pressing plate, the first pressing plate

and the second pressing plate are respectively arranged at an outside of the flame distributors which are arranged at both ends, and the first pressing plate and the second pressing plate are respectively fixedly connected to the corresponding flame distributors. 5

**22.** The combustor according to claim 20, wherein the combustor further comprises a cooling water pipe passing through the plurality of the flame distributors, and the cooling water pipe which comprises at least one U-shaped section. 10

**23.** A water heater comprising the combustor according to any one of claims 20 to 22. 15

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FIG. 1

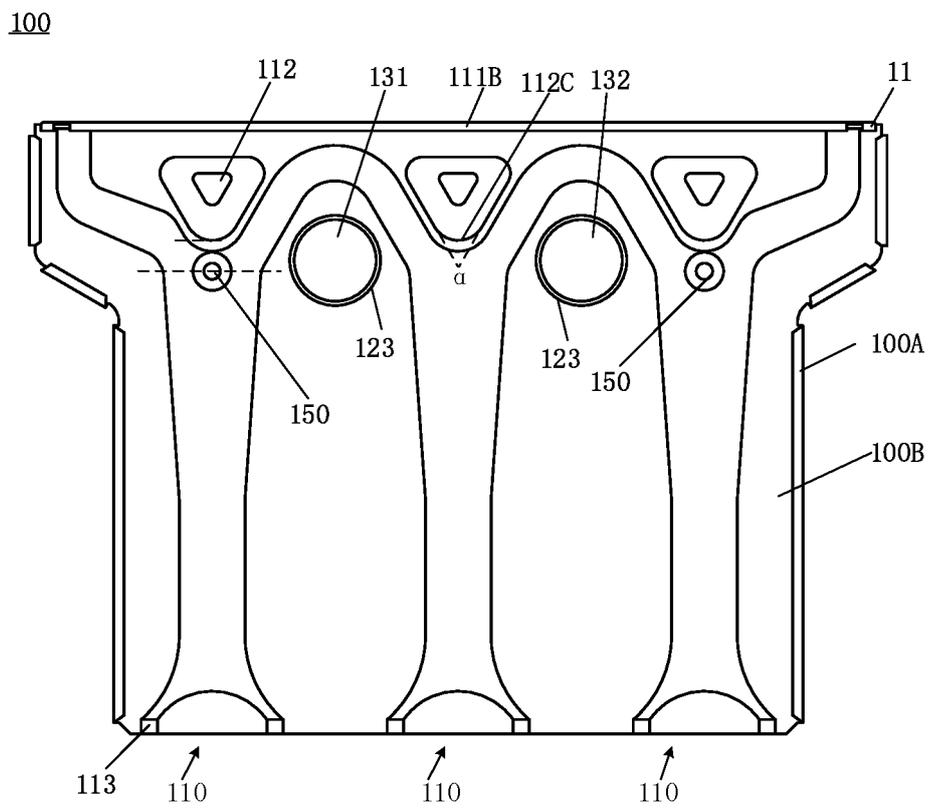


FIG. 2

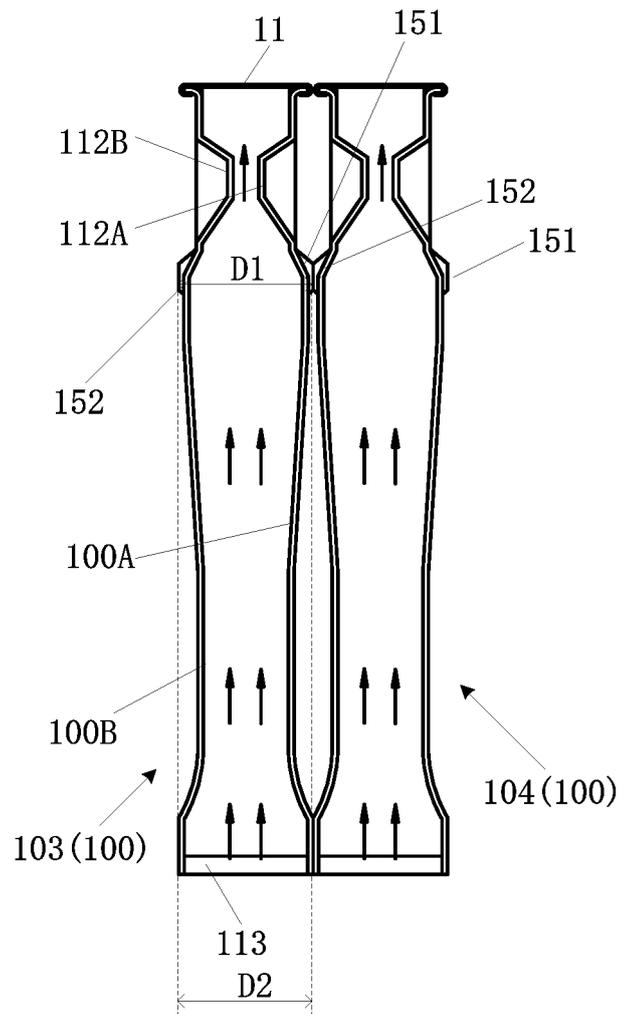


FIG. 3

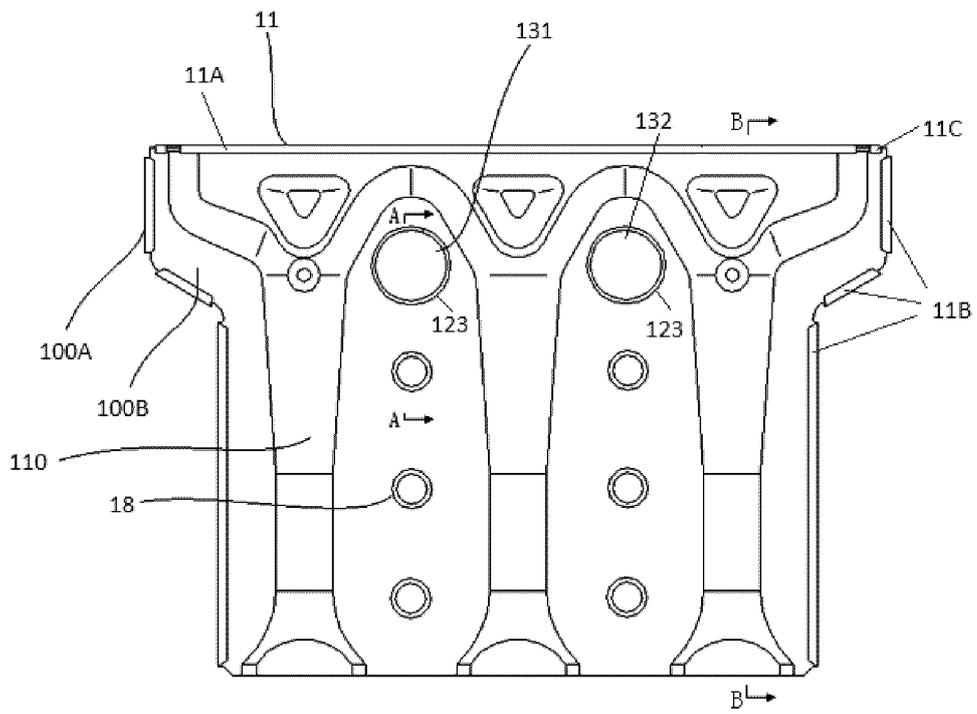
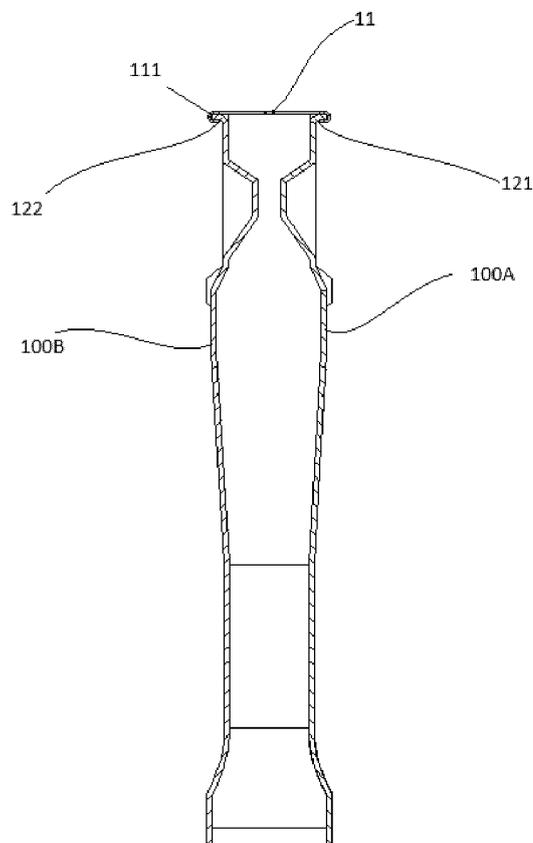


FIG. 4



M20024W02P045

FIG. 5

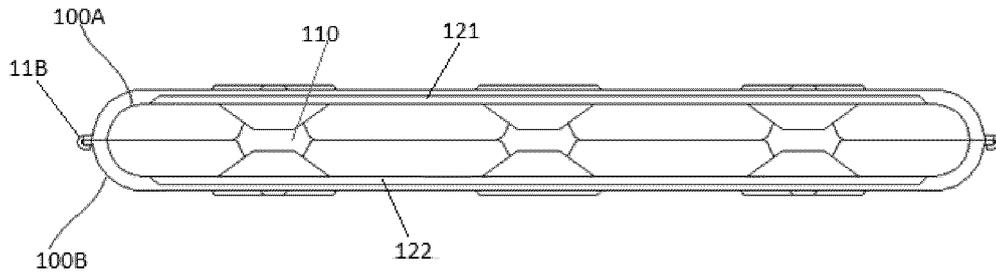


FIG. 6

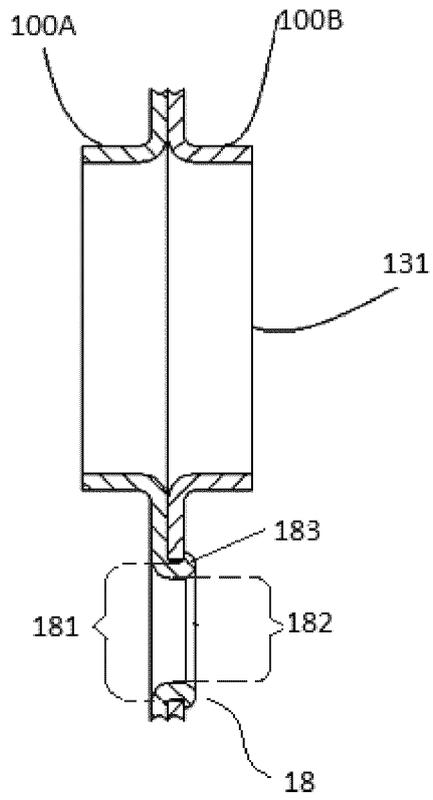


FIG. 7

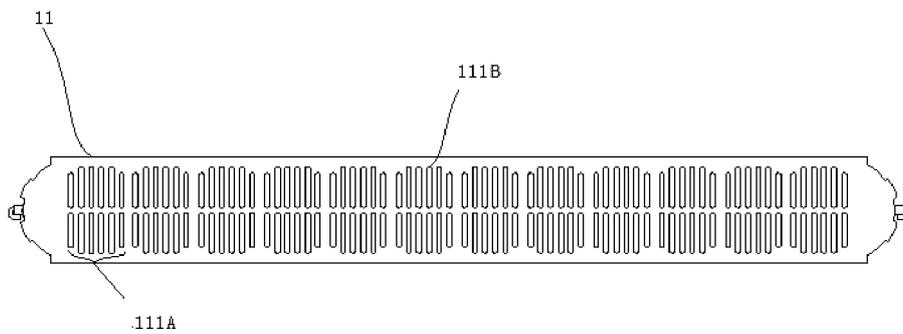


FIG. 8

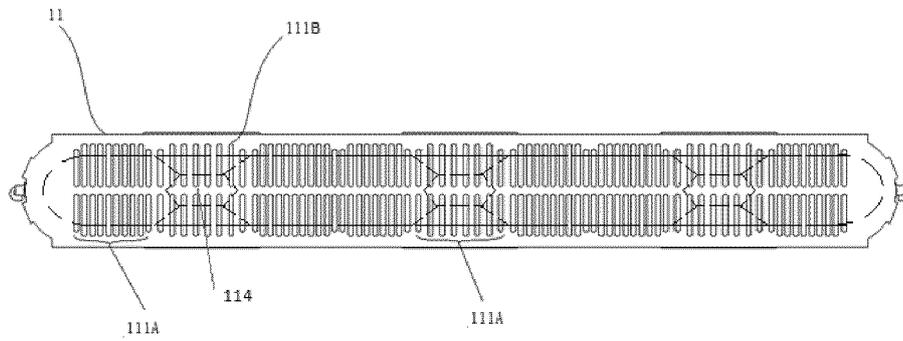


FIG. 9

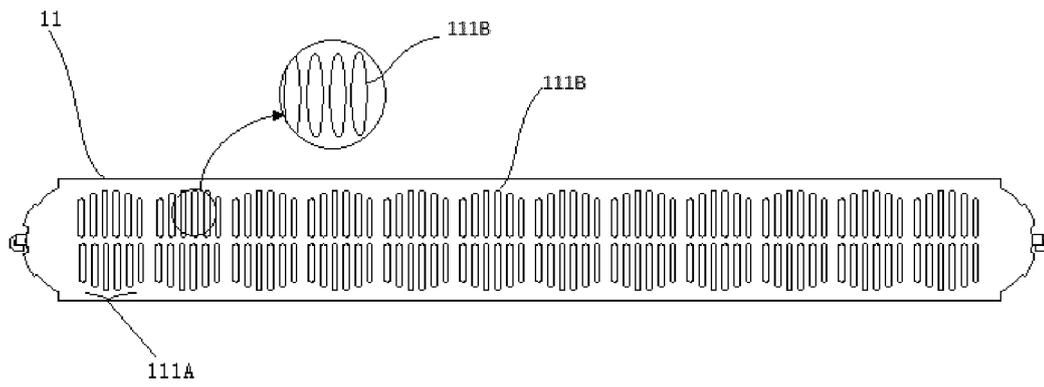


FIG. 10

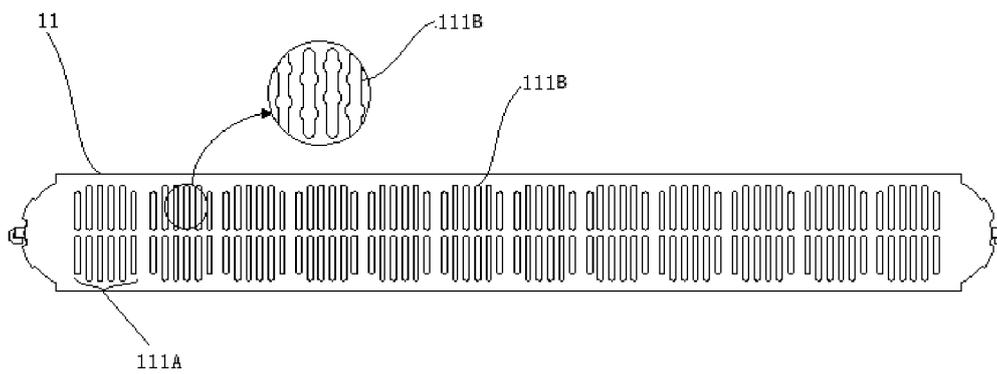


FIG. 11

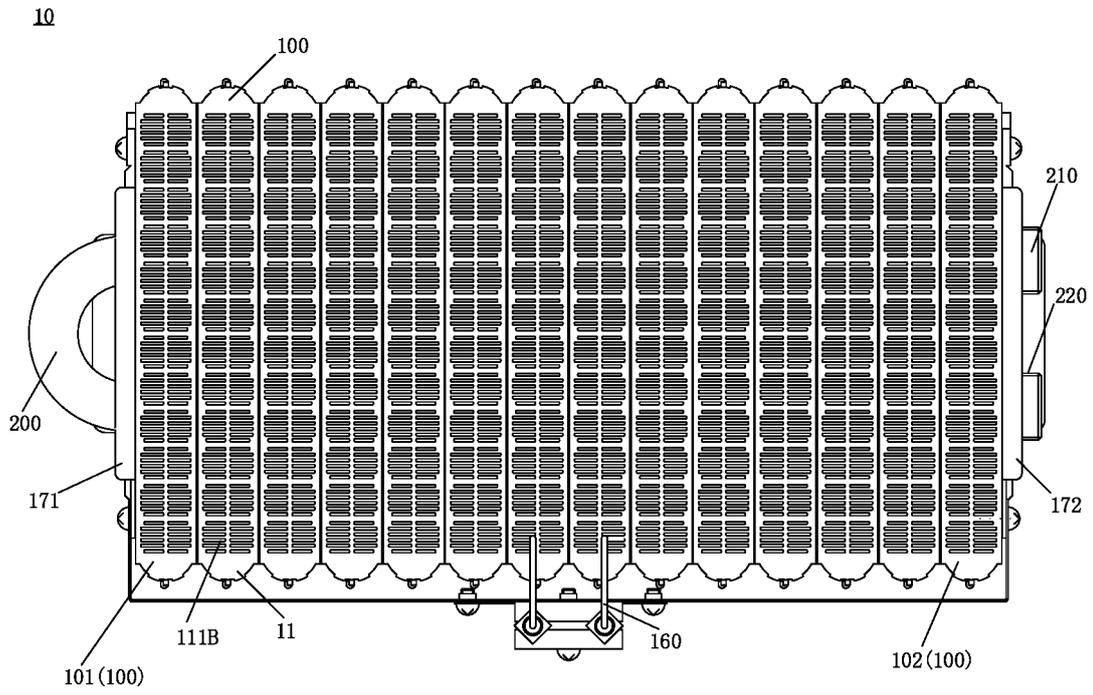


FIG. 12

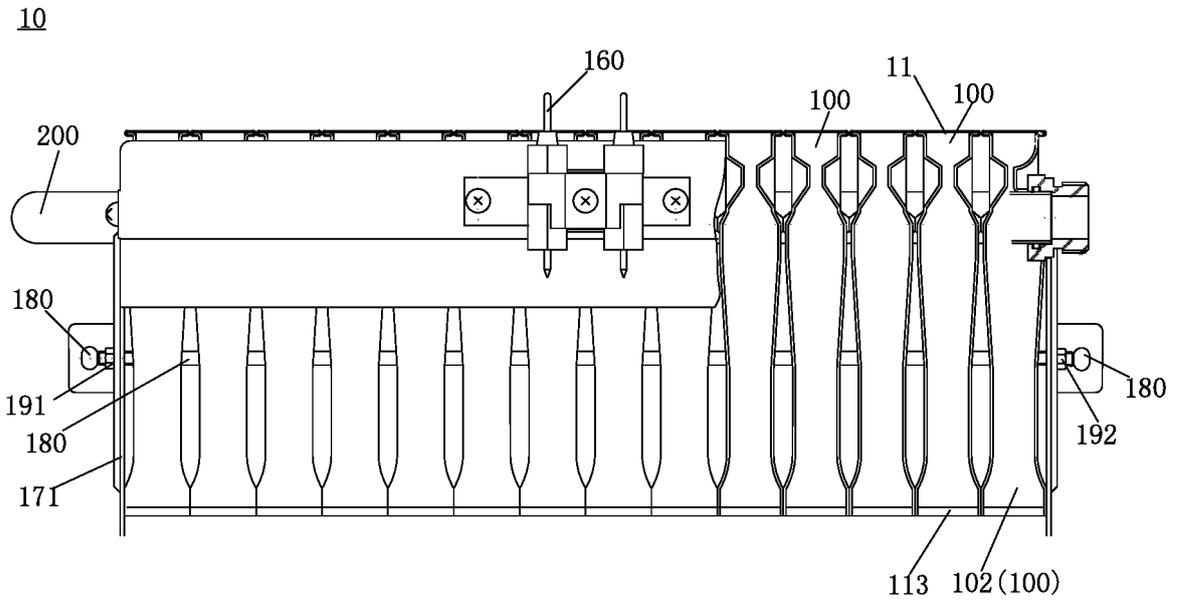
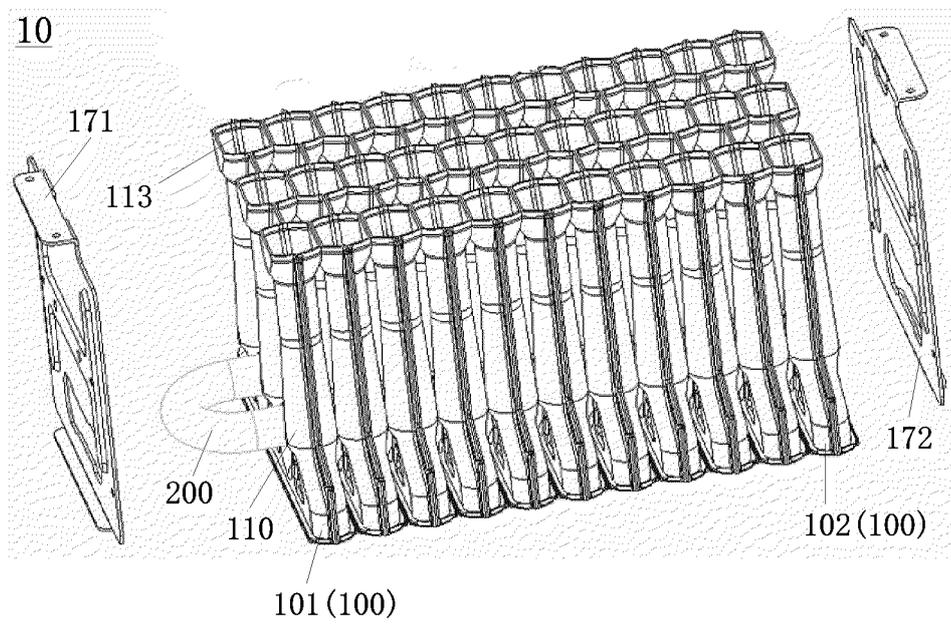


FIG. 13



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/087112

5	<b>A. CLASSIFICATION OF SUBJECT MATTER</b> F24H 9/18(2006.01)i; F23D 14/58(2006.01)i; F23D 14/46(2006.01)i  According to International Patent Classification (IPC) or to both national classification and IPC	
10	<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) F24H; F23D  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) VEN: CNABS; CNTXT; DWPI; CNKI: 分火, 燃烧器, 壳体, 引射, 定位, 间距, 凸, 分流, 翻边, 火孔, 出火, 水管, burner, distributor, shell, induct+, distance, locat+, inject+, convex, flange+, hole+, water, tunnel, pipe, tube	
20	<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>	
25	Category*	Citation of document, with indication, where appropriate, of the relevant passages
30	PX	CN 208186343 U (WUHU MIDEA KITCHEN & BATH APPLIANCES MANUFACTURE CO., LTD. ET AL.) 04 December 2018 (2018-12-04) claims 1-10, description, paragraphs [0003]-[0049], and figures 1-6
35	PX	CN 208205437 U (WUHU MIDEA KITCHEN & BATH APPLIANCES MANUFACTURE CO., LTD. ET AL.) 07 December 2018 (2018-12-07) claims 1-10, description, paragraphs [0004]-[0058], and figures 1-5
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55	X	CN 206582843 U (HUANG, WANPING) 24 October 2017 (2017-10-24) description, paragraphs [0003]-[0048], and figures 1-17
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search <b>15 July 2019</b>		Date of mailing of the international search report <b>29 July 2019</b>
Name and mailing address of the ISA/CN <b>National Intellectual Property Administration, PRC (ISA/ CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088 China</b>		Authorized officer
Facsimile No. (86-10)62019451		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/087112

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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**INTERNATIONAL SEARCH REPORT**  
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*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

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- CN 201820720484 [0001]