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(54) **FIRE GRATE AND GAS DEVICE**

(57) Disclosed are a fire grate and a gas device. The fire grate includes a casing, a combustion cover and a metal mesh. An airflow channel is formed inside the casing. The combustion cover is provided at the top portion of the casing, and is provided with a plurality of first fire apertures communicating with the airflow channel. A plurality of first rivet parts are provided at the top surface of the combustion cover. The metal mesh is provided at the upper surface of the combustion cover, and covers the plurality of first fire apertures. The plurality of first rivet parts press and fix the metal mesh to the upper surface of the combustion cover.

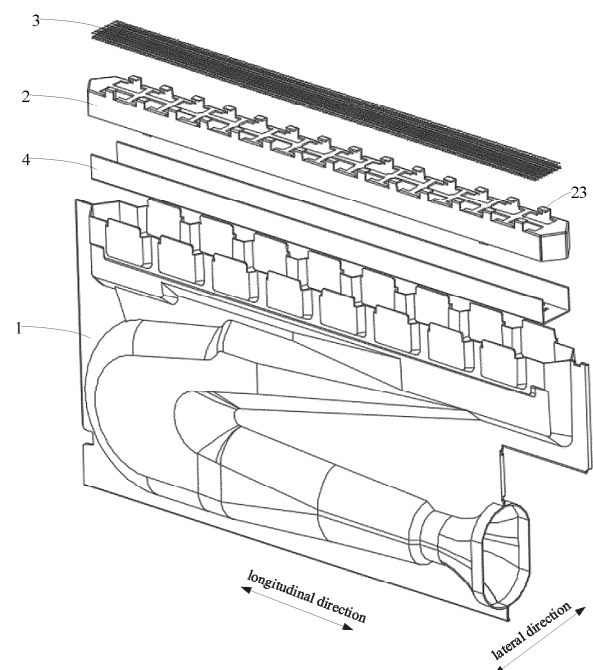


FIG. 2

**EP 4 741 710 A1**

## Description

### TECHNICAL FIELD

5 [0001] The present invention relates to the technical field of combustion, and in particular to a fire grate and a gas device.

### BACKGROUND

[0002] A burner is the core component of a gas device.

10 [0003] In the related art, the flame intensity of the burner is high, and the flue gas emitted by instantaneous combustion is poor, resulting in high nitrogen oxides and failing to meet the requirements of low nitrogen emission performance.

### SUMMARY

15 [0004] The main purpose of the present invention is to propose a fire grate, which aims to reduce the flame height and make the flame uniform, to achieve full combustion and reduce nitrogen oxide emissions.

[0005] To achieve the above purpose, the fire grate proposed in the present invention includes: a casing, an airflow channel is formed inside the casing, a combustion cover and a metal mesh.

20 [0006] In an embodiment of the present invention, the combustion cover is provided at a top portion of the casing and provided with a plurality of first fire apertures communicating with the airflow channel.

[0007] In an embodiment of the present invention, a plurality of first rivet parts are provided at a top surface of the combustion cover.

[0008] In an embodiment of the present invention, the metal mesh is provided at an upper surface of the combustion cover and covering the plurality of first fire apertures.

25 [0009] In an embodiment of the present invention, the plurality of first rivet parts press and fix the metal mesh to the upper surface of the combustion cover.

[0010] In an embodiment of the present invention, the combustion cover includes a panel extending from one end of the casing to the other end in a longitudinal direction of the casing.

30 [0011] In an embodiment of the present invention, the plurality of first fire apertures are spaced apart in a longitudinal direction of the panel.

[0012] In an embodiment of the present invention, the panel has an upper surface and a lower surface opposite to the upper surface.

[0013] In an embodiment of the present invention, the metal mesh is provided at the upper surface of the panel.

35 [0014] In an embodiment of the present invention, the plurality of first rivet parts are respectively located on both lateral sides of the panel to respectively clamp two side edges, away from the panel, of a surface of the metal mesh.

[0015] In an embodiment of the present invention, the combustion cover further includes two edge plates respectively provided on both lateral sides of the panel.

[0016] In an embodiment of the present invention, the two edge plates are bent with respect to the panel in a direction from the upper surface to the lower surface of the panel to be inserted into the airflow channel.

40 [0017] In an embodiment of the present invention, the plurality of first rivet parts on the both sides are respectively connected to the two edge plates.

[0018] In an embodiment of the present invention, each of the plurality of first rivet parts includes a connection portion and a clamping portion.

45 [0019] In an embodiment of the present invention, one end of the connection portion is coupled to an upper edge of each edge plate and the other end of the connection portion is extending upward in a direction away from the edge plates.

[0020] In an embodiment of the present invention, a clamping portion is coupled to an end, away from the two side plates, of the connection portion and opposite to the panel to form a clamping space for fixing the metal mesh.

[0021] In an embodiment of the present invention, the metal mesh is welded to portions at both ends of the panel in the longitudinal direction where no first fire aperture is provided.

50 [0022] In an embodiment of the present invention, the plurality of first rivet parts and the combustion cover are integrally formed.

[0023] In an embodiment of the present invention, the panel has a hollow area, and the panel is provided with a plurality of first dividing ribs extending in a width direction of the panel in the hollow area.

55 [0024] In an embodiment of the present invention, the plurality of first dividing ribs being arranged at intervals in the longitudinal direction of the panel to divide the hollow area into the plurality of first fire apertures arranged at intervals along the longitudinal direction of the panel.

[0025] In an embodiment of the present invention, the panel is provided with a second dividing rib extending along the longitudinal direction of the panel at each of the plurality of first fire apertures.

[0026] In an embodiment of the present invention, the second dividing rib divides each of the plurality of first fire apertures into two first sub-fire apertures, and two adjacent second dividing ribs are staggered in the width direction of the panel.

[0027] In an embodiment of the present invention, the fire grate further includes a rectifying plate located below the panel.

[0028] In an embodiment of the present invention, the rectifying plate is provided with two side plates on both sides of in a width direction of the rectifying plate, and the two side plates are inserted between the two edge plates.

[0029] In an embodiment of the present invention, the rectifying plate is provided with a plurality of rectifying apertures.

[0030] In an embodiment of the present invention, an end of the edge plate away from the panel is provided with a plurality of second riveted parts.

[0031] In an embodiment of the present invention, the plurality of second riveted parts clamps the rectifying plate and the two side plates in the combustion cover.

[0032] In an embodiment of the present invention, the casing includes two side casing walls respectively located outside the two edge plates.

[0033] In an embodiment of the present invention, each of the two side casing walls is provided with a plurality of convex humps protruding outward.

[0034] In an embodiment of the present invention, the plurality of convex humps are arranged at intervals along the longitudinal direction of the casing.

[0035] In an embodiment of the present invention, a cavity communicating with the airflow channel is formed between each of the plurality of convex humps and an adjacent edge plate, and the cavity are open at a top to form a second fire aperture.

[0036] In an embodiment of the present invention, a total area of the rectifying apertures is defined as  $S_1$ , and a total area of the plurality of first fire apertures and the second fire aperture as  $S$ , then  $0.3 \leq S_1/S \leq 0.45$ .

[0037] In order to achieve the above purpose, the present invention further provides a gas device, including the fire grate as described above.

[0038] In the fire grate of the present invention, the airflow channel is formed in the casing, and the combustion cover with the plurality of first fire apertures is provided on the top portion of the casing, so that the air flow can be ejected from the plurality of first fire apertures for combustion. The metal mesh is provided at the upper surface of the combustion cover, and covers the plurality of first fire apertures. The plurality of first rivet parts are provided at the upper surface of the combustion cover, and the metal mesh is pressed and fixed to the upper surface of the combustion cover through the plurality of first rivet parts, to increase the combustion area, break up the air flow, make the combustion more uniform and stable, and prevent backfire, thereby achieving the purpose of sufficient combustion and reduce nitrogen oxide emissions. In addition, the metal mesh is fixed by riveting, which can reduce the welding position between the metal mesh and the combustion cover and improve the thermal deformation problem of the metal mesh and the combustion cover during the welding process.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0039] In order to more clearly illustrate the technical solutions in the embodiments of the present invention or in the related art, accompanying drawings required for description of the embodiments or the related art will be briefly introduced below. Obviously, the accompanying drawings described below are only some embodiments of the present invention. For those skilled in the art, other drawings can be obtained based on the structures shown in these drawings without creative efforts.

FIG. 1 is a schematic structural view of a fire grate according to an embodiment of the present invention.

FIG. 2 is an exploded structural view of the fire grate according to an embodiment of the present invention.

FIG. 3 is an exploded structural view of a metal mesh, a combustion cover and a rectifying plate according to an embodiment of the present invention.

FIG. 4 is a top view of the embodiment of FIG. 1.

FIG. 5 is a cross-sectional view of the embodiment of FIG. 1.

FIG. 6 is a schematic structural view of assembly of the metal mesh, the combustion cover and the rectifying plate according to an embodiment of the present invention.

FIG. 7 is a bottom view of FIG. 6.

FIG. 8 is a bottom view of the combustion cover according to an embodiment of the present invention.

Description of reference signs:

[0040]

| reference sign | name                    | reference sign | name                |
|----------------|-------------------------|----------------|---------------------|
| 1              | casing                  | 212            | second dividing rib |
| 11             | casing wall             | 22             | edge plate          |
| 111            | convex bump             | 23             | first rivet part    |
| 101            | air inlet               | 231            | connection portion  |
| 102            | second fire aperture    | 232            | clamping portion    |
| 2              | combustion cover        | 24             | second rivet part   |
| 201            | first fire aperture     | 3              | metal mesh          |
| 201a           | first sub-fire aperture | 4              | rectifying plate    |
| 21             | panel                   | 401            | rectifying aperture |
| 211            | first dividing rib      | 41             | side plate          |

**[0041]** The realization of the purpose, functional features and advantages of the present invention will be further explained in conjunction with embodiments and with reference to the accompanying drawings.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

**[0042]** The technical solutions in the embodiments of the present invention will be described clearly and completely below in conjunction with the accompanying drawings in the embodiments. Obviously, the described embodiments are only some rather than all of the embodiments of the present invention. Based on the embodiments of the present invention, all other embodiments obtained by those skilled in the art without creative efforts are within the scope of the present invention.

**[0043]** It should be noted that if there are directional indications (such as up, down, left, right, front, back, etc.) in the embodiments of the present invention, the directional indications are only used to explain the relative position relationship and movement of the components under a certain posture (as shown in the figures). If the certain posture changes, the directional indication will also change accordingly.

**[0044]** At the same time, the meaning of "and/or" in the full text includes three solutions. Taking "A and/or B" as an example, it includes solution A, solution B, or a solution that both A and B satisfy.

**[0045]** In addition, if there are descriptions involving "first", "second", etc. in the embodiments of the present invention, the descriptions of "first", "second", etc. are only used for descriptive purposes and cannot be understood as indicating or suggesting their relative importance or implicitly indicating the number of the indicated technical features. Therefore, the features defined as "first" and "second" may explicitly or implicitly include at least one of the features. In addition, the technical solutions of the various embodiments can be combined with each other, but they must be based on the fact that it can be implemented by those skilled in the art. When the combination of technical solutions is contradictory or cannot be implemented, it should be deemed that such a combination of technical solutions does not exist and is not within the scope of the present invention.

**[0046]** The burner is the core component of the gas device, and a fire grate is provided inside the burner. In the traditional burner structure, the flame stabilization is usually achieved by changing the shape structure of the fire outlet, but the gas outlet speed is fast, which easily leads to the problem of too high combustion flame, incomplete combustion, and large nitrogen oxide emissions.

**[0047]** To this end, the present invention proposes a fire grate, which aims to reduce the flame intensity and stabilize the flame by covering the metal mesh above the fire aperture, and fix the metal mesh by riveting, reduce the welding process, and avoid thermal deformation problems.

**[0048]** In the embodiment of the present invention, as shown in FIG. 1 to FIG. 5, the fire grate includes a casing 1, a combustion cover 2 and a metal mesh 3.

**[0049]** An airflow channel is formed inside the casing 1. The combustion cover 2 is provided at the top portion of the casing 1 and is provided with a plurality of first fire apertures 201 communicating with the airflow channel. A plurality of first rivet parts 23 are provided at the top surface of the combustion cover 2. The metal mesh 3 is provided at the upper surface of the combustion cover 2 and covers the plurality of first fire apertures 201. The plurality of first rivet parts 23 press and fix the metal mesh 3 to the upper surface of the combustion cover 2.

**[0050]** It can be understood that the combustion cover 2 is provided at the top portion of the casing 1 of the fire grate, and the air inlet 101 of the airflow channel in the casing 1 is connected to the air flow source. The air flow source includes air and gas. The gas and air enter the airflow channel from the air inlet 101, and are ejected through the plurality of first fire

apertures 201 at the combustion cover 2 and ignited to form a combustion flame after being pre-mixed in the airflow channel. In an embodiment, the specific structure of the combustion cover 2 can be determined according to actual conditions, for example, it can be a plate structure, a U-shaped structure or other shape structures. The combustion cover 2 can be made of high temperature resistant sheet metal. The plurality of first fire apertures 201 are distributed at intervals, which can achieve flow balancing, making the airflow more uniform when ejected. In an embodiment, the plurality of first fire apertures 201 can be circular apertures, square apertures, triangular apertures, strip apertures or other irregularly shaped apertures.

**[0051]** The metal mesh 3 is provided at the upper surface of the combustion cover 2 and covers the plurality of first fire apertures 201, playing the role of breaking up the airflow, so that the mixed gas can be fully burned after being ignited, forming a stable and uniform flame. In an embodiment, the metal mesh 3 is made of a high temperature resistant material, such as an iron-chromium-aluminum material. In an embodiment, the multiple layers of the metal mesh 3 can be provided. The multiple layers of the metal mesh 3 can further break up the air and the gas, so that the gas and the air can be mixed evenly. In addition, the multiple layers of the metal mesh 3 can increase the resistance, and play a better anti-backfire effect. In practical applications, the number of layers of the metal mesh 3 is related to the mesh number of the metal mesh 3. The metal mesh 3 with a large mesh number has a small number of layers, and the metal mesh 3 with a small mesh number has a large number of layers. For example, the number of layers of the metal mesh 3 can be 2 to 10, specifically 2, 3, 4, 5, 6, 7, 8, 9 or 10. The mesh number of the metal mesh 3 can be 20 to 100, specifically 20, 40, 50, 60, 80 or 100, etc.

**[0052]** It should be noted that the metal mesh 3 in the related art is provided below the combustion cover 2, and usually the upper surface of the metal mesh 3 has some rib structures. When the fire grate is working, the rib structure above the metal mesh 3 will directly contact the flame, which is prone to burnout of the ribs and causes some problems such as backfire. The metal mesh 3 of this embodiment is provided at the upper surface of the combustion cover 2, so when the fire grate is working, the flame burns directly on the surface of the metal mesh 3. Compared with the related art in which the metal mesh 3 is provided below the combustion cover 2, it is possible to prevent safety accidents such as explosion caused by backfire.

**[0053]** In this embodiment, the top surface of the combustion cover 2 is provided with a plurality of first rivet parts 23. When assembling, the metal mesh 3 can be first stacked on the upper surface of the combustion cover 2 to cover the plurality of first fire apertures 201, and then the metal mesh 3 is pressed and fixed to the upper surface of the combustion cover 2 through the plurality of first rivet parts 23 to achieve the assembly of the metal mesh 3 and the combustion cover 2. Such a design can reduce the welding position between the metal mesh 3 and the combustion cover 2 and improve the thermal deformation problem of the metal mesh 3 and the combustion cover 2 during the welding process.

**[0054]** It can be understood that the metal mesh 3 can be consistent with the extension direction of the top surface of the combustion cover 2, and the specific positions of the plurality of first rivet parts 23 can be determined according to actual conditions. For example, the plurality of first rivet parts 23 can be provided on one side or two opposite sides of the combustion cover 2. When provided on one side, the plurality of first rivet parts 23 can be provided at intervals on the long side of the combustion cover 2 to limit and fix the long side of the metal mesh 3. When provided on the opposite sides of the combustion cover 2, the plurality of first rivet parts 23 can be provided on the two long sides of the combustion cover 2 respectively to limit and fix the two long sides of the metal mesh 3. In some embodiments, the plurality of first rivet parts 23 can also be provided on the short side of the combustion cover 2 to limit and fix the short side of the metal mesh 3.

**[0055]** In an embodiment, the specific structure of the plurality of first rivet parts 23 can be a rivet buckle structure, a flange structure, a claw structure or some other structure, as long as the metal mesh 3 can be riveted toward the upper surface of the combustion cover 2.

**[0056]** In an embodiment, the plurality of first rivet parts 23 can be an integrally formed structure with the combustion cover 2, or can be a separately formed structure.

**[0057]** In summary, in the fire grate of the technical solution of the present invention, the airflow channel is formed inside the casing 1, and the combustion cover 2 with the plurality of first fire apertures 201 is provided at the top portion of the casing 1, so that the air flow can be ejected from the plurality of first fire apertures 201 for combustion. The metal mesh 3 is provided at the upper surface of the combustion cover 2. The metal mesh 3 can cover the plurality of first fire apertures 201, and the plurality of first rivet parts 23 are provided at the upper surface of the combustion cover 2. The metal mesh 3 is pressed and fixed to the upper surface of the combustion cover 2 through the plurality of first rivet parts 23, to increase the combustion area, break up the air flow, make the combustion more uniform and stable, and prevent backfire, thereby achieving the purpose of sufficient combustion and reducing nitrogen oxide emissions. In addition, the metal mesh 3 is fixed by riveting, which can reduce the welding position between the metal mesh 3 and the combustion cover 2 and improve the thermal deformation problem of the metal mesh 3 and the combustion cover 2 during the welding process.

**[0058]** In an embodiment of the present invention, as shown in FIG. 1 to FIG. 4, the combustion cover 2 includes a panel 21 extending from one end to the other end in the longitudinal direction of the casing 1. The plurality of first fire apertures 201 are spaced apart in the longitudinal direction of the panel 21. The panel 21 has an upper surface and a lower surface opposite to the upper surface. The metal mesh 3 is provided at the upper surface of the panel 21. The lower surface faces the airflow channel. The plurality of first rivet parts 23 are respectively located on both lateral sides of the panel 21 to

respectively clamp the two side edges, away from the panel, of the surface of the metal mesh 3.

**[0059]** In this embodiment, the panel 21 is located in the casing 1 and extends from one end to the other end in the longitudinal direction of the casing 1. The plurality of first fire apertures 201 are spaced apart in the longitudinal direction of the panel 21, which can increase the air outlet area of the airflow and reduce the flame intensity. It can be understood that the panel 21 can also play a role in supporting the metal mesh 3, so that the metal mesh 3 can be placed at the upper surface of the panel 21, and limited and fixed through the plurality of first rivet parts 23 on both sides of the width of the panel 21, thereby improving the assembly reliability of the metal mesh 3.

**[0060]** In addition, the plurality of first rivet parts 23 are provided on both lateral sides of the panel 21 to respectively clamp the two side edges, away from the panel 21, of the surface of the metal mesh 3. That is, the plurality of first rivet parts 23 respectively limit the two opposite long side edges of the metal mesh 3. Such a design, on the one hand, can make the force on both sides of the width of the metal mesh 3 balanced, not easy to warp, thereby ensuring the flatness of the metal mesh 3; on the other hand, it can avoid the plurality of first rivet parts 23 blocking the main air outlet area in the middle of the metal mesh 3 to ensure the air outlet area.

**[0061]** To further enhance the flame stabilizing effect of the metal mesh 3, the metal mesh 3 may cover as much of the upper surface of the panel 21 as possible to ensure that all of the plurality of first fire apertures 201 are covered. In this way, in addition to covering the plurality of first fire apertures 201, the metal mesh 3 may also cover the areas at both ends of the panel 21 in the longitudinal direction except where the plurality of first fire apertures 201 are provided. At this time, the metal mesh 3 and the two ends of the panel 21 may be fixed by welding to limit of the two ends of the longitudinal direction of the metal mesh 3, thereby further enhancing the assembly reliability of the metal mesh 3 and preventing the two ends of the longitudinal direction of the metal mesh 3 from warping.

**[0062]** Further, as shown in FIG. 2 to FIG. 5, the combustion cover 2 also includes two edge plates 22 respectively provided on both lateral sides of the panel 21. The two edge plates 22 are bent with respect to the panel 21 in a direction from the upper surface to the lower surface of the panel 21 to be inserted into the airflow channel. The plurality of first rivet parts 23 on both sides are respectively connected to the two edge plates 22.

**[0063]** The metal mesh is installed at the upper surface of the panel 21, and the lower surface of the panel 21 faces the airflow channel. The direction from the upper surface to the lower surface of the panel 21 can be understood as the direction from top to bottom, that is, the two edge panels 22 are bent with respect to the panel 21 in the direction from top to bottom. The two edge plates 22 and the panel 21 roughly form a "∩"-shaped structure. When applied to the fire grate, the panel 21 is provided at the top portion of the casing 1, and the two edge plates 22 are inserted in the airflow channel and are respectively fixed to the walls 11 on both sides of the casing 1. In practical applications, the panel 21 and the two edge plates 22 can be formed separately and then welded and fixed, or they can be formed by bending the sheet metal as a whole. The metal mesh 3 is stacked on the upper surface of the panel 21, and the two side edges of the metal mesh 3 are limited by the plurality of first rivet parts 23 provided at the two edge plates 22, which is beneficial to the stability and overall consistency of the assembly of the metal mesh 3 and the combustion cover 2, and is beneficial to improving the combustion stability.

**[0064]** It should be noted that the plurality of first rivet parts 23 and the two edge plates 22 can be integrally formed, or the plurality of first rivet parts 23 can be connected and fixed to the two edge plates 22 after the metal mesh 3 is stacked on the front of the panel 21, as long as it is ensured that the plurality of first rivet parts 23 can finally abut against the side edge of the metal mesh 3 away from the panel 21.

**[0065]** In an embodiment, as shown in FIG. 3 to FIG. 5, each of the plurality of first rivet parts 23 includes a connection portion 231 and a clamping portion 232, one end of the connection portion 231 is coupled to the upper edge of each of the two edge plates 22, and the other end of the connection portion 231 extends upward in a direction away from the two edge plates 22. The clamping portion 232 is coupled to the end, away from the two side plates, of the connection portion 231 and is opposite to the panel 21 to form a clamping space for fixing the metal mesh 3.

**[0066]** This embodiment illustrates the structure of the plurality of first rivet parts 23 by way of example. The connection portion 231 serves to connect the supporting panel 21 and the clamping portion 232, so that the clamping portion 232 can be spaced apart from the panel 21 to form the clamping space. In this way, the metal mesh 3 can be clamped between the clamping portion 232 and the panel 21 to achieve assembly and fixation. In an embodiment, the connection portion 231 can be an integrally formed structure with the side panel 22, and the connection portion 231 extends upward from the upper edge of the side panel 22. The clamping portion 232 can also be formed by integrally bending the upper edge of the connection portion 231, so that the forming process can be simplified and the production efficiency can be improved.

**[0067]** In an embodiment, the connection portion 231 and the clamping portion 232 are in a right-angle structure, so that the structural strength of the first rivet parts 23 is stronger, to further improve the limiting strength of the metal mesh 3.

**[0068]** To further enhance the flame stabilizing effect of the fire grate, as shown in FIG. 2, FIG. 3 and FIG. 8, in an embodiment of the present invention, the panel 21 has a hollow area, and the panel 21 is provided with a plurality of first dividing ribs 211 extending in the width direction of the panel 21 in the hollow area. The plurality of first dividing ribs 211 are arranged at intervals in the longitudinal direction of the panel 21 to divide the hollow area into a plurality of first fire apertures 201 arranged at intervals in the longitudinal direction of the panel 21.

**[0069]** In this embodiment, the hollow area of the panel 21 is communicated with the airflow channel of the casing 1, and a plurality of first dividing ribs 211 extending along the width are provided at the hollow area. The plurality of first dividing ribs 211 are spaced apart in the longitudinal direction of the panel 21 to divide the hollow area into the plurality of first fire apertures 201. It can be understood that the first dividing ribs 211 play a role in strengthening the structure on the one hand, and on the other hand, play a role in separating the plurality of first fire apertures 201 and breaking up the air flow. The plurality of first fire apertures 201 are spaced apart in the longitudinal direction of the panel 21 to achieve uniform gas discharge, thereby making the flame burn more stably.

**[0070]** Further, as shown in FIG. 8, the panel 21 is provided with a second dividing rib 212 extending in the longitudinal direction of the panel 21 at the first fire aperture 201, and the second dividing rib 212 divides the first fire aperture 201 into two first sub-fire apertures 201a.

**[0071]** By providing the second dividing rib 212 at the first fire aperture 201, the second dividing rib 212 further divides the first fire aperture 201 into two first sub-fire apertures 201a with smaller areas, thereby further breaking up the airflow, making the airflow distribution more uniform and the combustion more complete.

**[0072]** Further, as shown in FIG. 8, two adjacent second dividing ribs 212 are staggered in the width direction of the panel 21.

**[0073]** This arrangement makes the two first sub-fire apertures 201a in the same first fire aperture 201 have different areas, and the first sub-fire apertures 201a of different areas are alternately arranged in the longitudinal direction of the panel 21. On the one hand, the overall fire area can be increased, and on the other hand, the air flow velocity can be reduced through the first sub-fire aperture 201a with a smaller area to lower the flame height, thereby playing a role in stabilizing the flame, making the combustion more complete and reducing the emission of nitrogen oxides. At the same time, the combustion noise can be reduced.

**[0074]** On this basis, the metal mesh 3 is provided above the plurality of first dividing ribs 211 and the second dividing ribs 212, and is limited and fixed by the plurality of first rivet parts 23 above.

**[0075]** In an embodiment of the present invention, as shown in FIG. 2, FIG. 3, and FIG. 5 to FIG. 7, the fire grate also includes a rectifying plate 4 located below the panel 21, and two side plates 41 are respectively provided on both sides of the rectifying plate 4 in the width direction. The two side plates 41 are inserted between the two edge plates 22. A plurality of rectifying apertures 401 are provided at the rectifying plate 4. A plurality of second rivet parts 24 are provided at one end of the two edge plates 22 away from the panel 21, and the plurality of second rivet parts 24 clamp the rectifying plate 4 and the two side plates 41 in the combustion cover 2.

**[0076]** The rectifying plate 4 is provided below the panel 21 so that the airflow first passes through the rectifying plate 4 and then enters the first fire aperture 201 of the combustion cover 2. It can be understood that a mixing chamber is formed between the rectifying plate 4 and the combustion cover 2. After the airflow is dispersed and split by the plurality of rectifying apertures 401 of the rectifying plate 4, it is mixed and decelerated in the mixing chamber, thereby reducing the speed of the airflow out of the first fire aperture 201 to avoid flame failure.

**[0077]** The two sides of the rectifying plate 4 are respectively provided with two side plates 41, and the two side plates 41 can play the role of installing and fixing the rectifying plate 4 and increasing the structural strength of the rectifying plate 4. By providing the plurality of second rivet parts 24 at the ends of the two edge plates 22 away from the panel 21, the plurality of second rivet parts 24 can clamp the rectifying plate 4 and the two side plates 41 in the combustion cover 2, thereby realizing the assembly function of the rectifying plate 4 and the combustion cover 2. In actual application, the two side plates 41 of the rectifying plate 4 can be inserted between the two edge plates 22 first, and then the lower surface of the rectifying plate 4 is clamped through the plurality of second rivet parts 24, so that the rectifying plate 4 and the two side plates 41 are fixed in the combustion cover 2. Such a design can reduce the welding position between the rectifying plate 4 and the combustion cover 2, and improve the thermal deformation problem of the rectifying plate 4 and the combustion cover 2 during the welding process.

**[0078]** In an embodiment, the specific structure of the plurality of second rivet parts 24 can be a rivet structure, a flange structure, a claw structure or some other structure. In this embodiment, the structure of the plurality of second rivet parts 24 are the same as those of the plurality of first rivet parts 23, which is more convenient for molding. In an embodiment, the plurality of second rivet parts 24 and the two edge plates 22 are integrally formed, and the plurality of second rivet parts 24 can be formed by bending the lower edges of the two edge plates 22.

**[0079]** In an embodiment, the plurality of second rivet part 24 can be arranged at intervals in the longitudinal direction of the two edge plates 22, so that the rectifying plate 4 is subjected to uniform force, thereby improving the installation reliability of the rectifying plate 4.

**[0080]** In this embodiment, during assembly, the rectifying plate 4 can be first installed at the combustion cover 2, and then the whole can be inserted into the casing 1, which simplifies the assembly structure and improves the installation efficiency.

**[0081]** Further, as shown in FIG. 1, FIG. 2, FIG. 4 and FIG. 5, the casing 1 includes two side casing walls 11 respectively located on the outside of the two edge plates 22, each side casing wall 11 is provided with a plurality of convex bumps 111 protruding outward, and the plurality of convex bumps 111 are arranged at intervals in the longitudinal direction of the

casing 1. A cavity communicating with the airflow channel is formed between each of the plurality of convex bumps 111 and the adjacent edge plates 22, and the top of the cavity is open to form a second fire aperture 102.

**[0082]** In this embodiment, the casing 1 includes two opposite side casing walls 11, which are pressed to enclose an air inlet 101, an air outlet, and an airflow channel communicating the air inlet 101 with the air outlet. The air inlet 101 is generally located at the side of the bottom of the casing 1, and the air outlet is generally located on the top surface of the casing 1. During assembly, the combustion cover 2 is inserted into the air outlet, the panel 21 and the metal mesh 3 are opposite to the air outlet, and the two edge plates 22 are respectively located on the inner sides of the two side casing walls 11. Each of the two side casing walls 11 and the adjacent edge plate 22 can be fixed by welding. In an embodiment, the two side casing walls 11 can be sheet metal parts.

**[0083]** Each side casing wall 11 is provided with a plurality of convex bumps 111 protruding outwards, the cavity communicating with the airflow channel is formed between each convex bump 111 and the adjacent edge plate 22, and the top of the cavity is opened to form the second fire aperture 102. When the fire grate burns, part of the mixed gas in the airflow channel flows to the metal mesh 3 for combustion, and part of the mixed gas burns at the second fire aperture 102 through the cavity of the convex bump 111. By providing the second fire apertures 102 on both sides, the space on both sides can be used more efficiently, and the combustion area can be increased. At the same time, the flow rate of the second fire apertures 102 on both sides is relatively large, and the flame stabilization effect of the middle metal mesh 3 can be used to further reduce the emission of nitrogen oxides.

**[0084]** Furthermore, the total area of the rectifying apertures 401 is defined as  $S_1$ , and the total area of the plurality of first fire apertures 201 and the second fire apertures 102 is defined as  $S$ , then  $0.3 \leq S_1/S \leq 0.45$ .

**[0085]** It can be understood that the airflow in the airflow channel first passes through a plurality of rectifying apertures 401 before being discharged from the first fire aperture 201 and the second fire aperture 102. The rectifying apertures 401 can play a role in diverting and reducing the speed of the airflow, and the total area  $S_1$  of the rectifying apertures 401 will be smaller than the total area  $S$  of all the first fire apertures 201 and the second fire apertures 102. In practical applications, the ratio of the total area  $S_1$  of the rectifying apertures 401 to the total area  $S$  of the plurality of first fire apertures 201 and the second fire aperture 102 should not be too small or too large. If it is too small, it may lead to excessive resistance in the flow channel and too small air output, which may easily cause flame extinguishing; if it is too large, the air output velocity may be too fast, resulting in flame failure and flame separation. Based on this, in this embodiment, a ratio  $S_1/S$  of the total area  $S_1$  of the rectifying apertures 401 to the total area  $S$  of the plurality of first fire apertures 201 and the second fire apertures 102 is in a range of 0.3 to 0.45, ensuring a balance between the flow channel resistance and the rectifying uniformity effect, thereby achieving better flame stabilization and reducing nitrogen oxide emissions.

**[0086]** In an embodiment, the number of the rectifying apertures 401 can be determined according to actual conditions, for example, it can be a dozen, twenty or other numbers; the shape of the rectifying apertures 401 can be determined according to actual conditions, for example, it can be a strip hole, a circular hole, a triangular hole or a hole structure of other shapes.

**[0087]** The present invention also proposes a gas device, which includes a fire grate. The specific structure of the fire grate refers to the above embodiment. Since the gas device adopts all the technical solutions of the above embodiments, it at least has all the beneficial effects brought by the technical solutions of the above embodiments, which will not be repeated here.

**[0088]** As an example, the gas device can be a burner, such as a premix burner, a thick-lean burner, a water-cooled burner, etc.

**[0089]** As an example, the gas device can also be a gas water heater, a boiler and other device.

## Claims

### 1. A fire grate, comprising:

a casing (1), wherein an airflow channel is formed inside the casing (1);  
 a combustion cover (2) provided at a top portion of the casing (1) and provided with a plurality of first fire apertures (201) communicating with the airflow channel, wherein a plurality of first rivet parts (23) are provided at a top surface of the combustion cover (2); and  
 a metal mesh (3) provided at an upper surface of the combustion cover (2) and covering the plurality of first fire apertures (201), wherein the plurality of first rivet parts (23) press and fix the metal mesh (3) to the upper surface of the combustion cover (2).

### 2. The fire grate according to claim 1, wherein:

the combustion cover (2) comprises a panel (21) extending from one end of the casing (1) to the other end in a

longitudinal direction of the casing (1), the plurality of first fire apertures (201) being spaced apart in a longitudinal direction of the panel (21);  
the panel (21) has an upper surface and a lower surface opposite to the upper surface, and the metal mesh (3) is provided at the upper surface of the panel (21); and  
the plurality of first rivet parts (23) are respectively located on both lateral sides of the panel (21) to respectively clamp two side edges, away from the panel (21), of a surface of the metal mesh (3).

3. The fire grate according to claim 2, wherein:

the combustion cover (2) further comprises two edge plates (22) respectively provided on both lateral sides of the panel (21), the two edge plates (22) being bent with respect to the panel (21) in a direction from the upper surface to the lower surface of the panel (21) to be inserted into the airflow channel; and  
the plurality of first rivet parts (23) on the both sides are respectively connected to the two edge plates (22).

4. The fire grate according to claim 3, wherein each of the plurality of first rivet parts (23) comprises:

a connection portion (231) with one end coupled to an upper edge of each edge plate (22) and the other end extending upward in a direction away from the two edge plates (22); and  
a clamping portion (232) coupled to an end, away from the two edge plates (22), of the connection portion (231) and opposite to the panel (21) to form a clamping space for fixing the metal mesh (3).

5. The fire grate according to any one of claims 2 to 4, wherein the metal mesh (3) is welded to portions at both ends of the panel (21) in the longitudinal direction where no first fire aperture (201) is provided.

6. The fire grate according to any one of claims 1 to 5, wherein the plurality of first rivet parts (23) and the combustion cover (2) are integrally formed.

7. The fire grate according to any one of claims 2 to 6, wherein:

the panel (21) has a hollow area;  
the panel (21) is provided with a plurality of first dividing ribs (211) extending in a width direction of the panel (21) in the hollow area, the plurality of first dividing ribs (211) being arranged at intervals in the longitudinal direction of the panel (21) to divide the hollow area into the plurality of first fire apertures (201) arranged at intervals along the longitudinal direction of the panel (21);  
the panel (21) is provided with a second dividing rib (212) extending along the longitudinal direction of the panel (21) at each of the plurality of first fire apertures (201), the second dividing rib (212) dividing each of the plurality of first fire apertures (201) into two first sub-fire apertures; and  
two adjacent second dividing ribs (212) are staggered in the width direction of the panel (21).

8. The fire grate according to any one of claims 3 to 7, further comprising a rectifying plate (4) located below the panel (21), the rectifying plate (4) being provided with two side plates on both sides in a width direction of the rectifying plate (4), the two side plates being inserted between the two edge plates (22), wherein:

the rectifying plate (4) is provided with a plurality of rectifying apertures (401); and  
an end of the edge plate (22) away from the panel (21) is provided with a plurality of second rivet parts (24), the plurality of second rivet parts (24) clamping the rectifying plate (4) and the two side plates in the combustion cover (2).

9. The fire grate according to claim 8, wherein:

the casing (1) comprises two side casing walls (11) respectively located outside the two edge plates (22), each of the two side casing walls (11) being provided with a plurality of convex humps protruding outward, the plurality of convex humps being arranged at intervals along the longitudinal direction of the casing (1);  
a cavity communicating with the airflow channel is formed between each of the plurality of convex humps and an adjacent edge plate (22), the cavity being open at a top to form a second fire aperture; and  
a total area of the rectifying apertures (401) is defined as  $S_1$ , and a total area of the plurality of first fire apertures (201) and the second fire aperture as  $S$ , then  $0.3 \leq S_1/S \leq 0.45$ .

**10.** A gas device, comprising the fire grate according to any one of claims 1 to 9.

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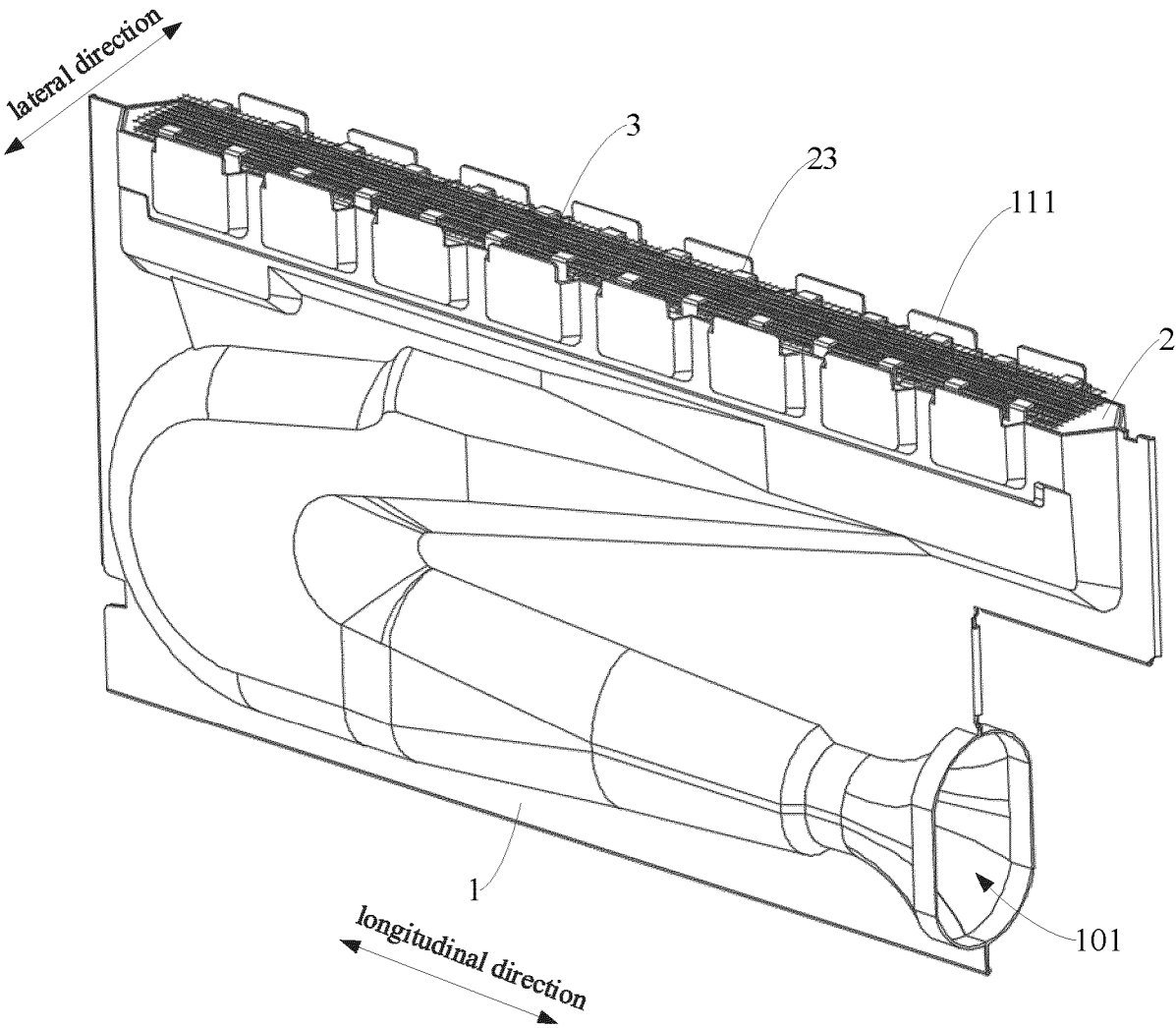


FIG. 1

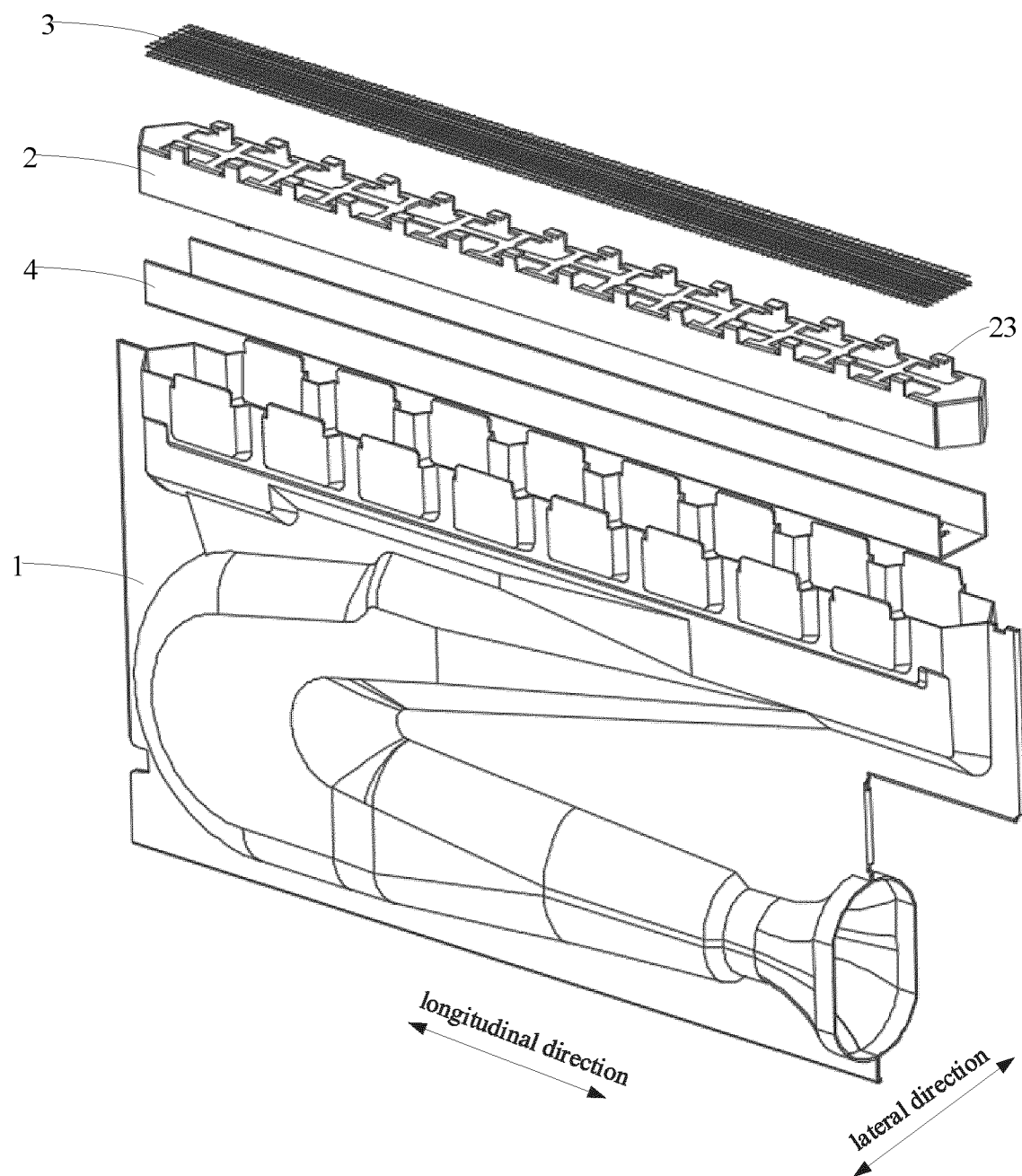


FIG. 2

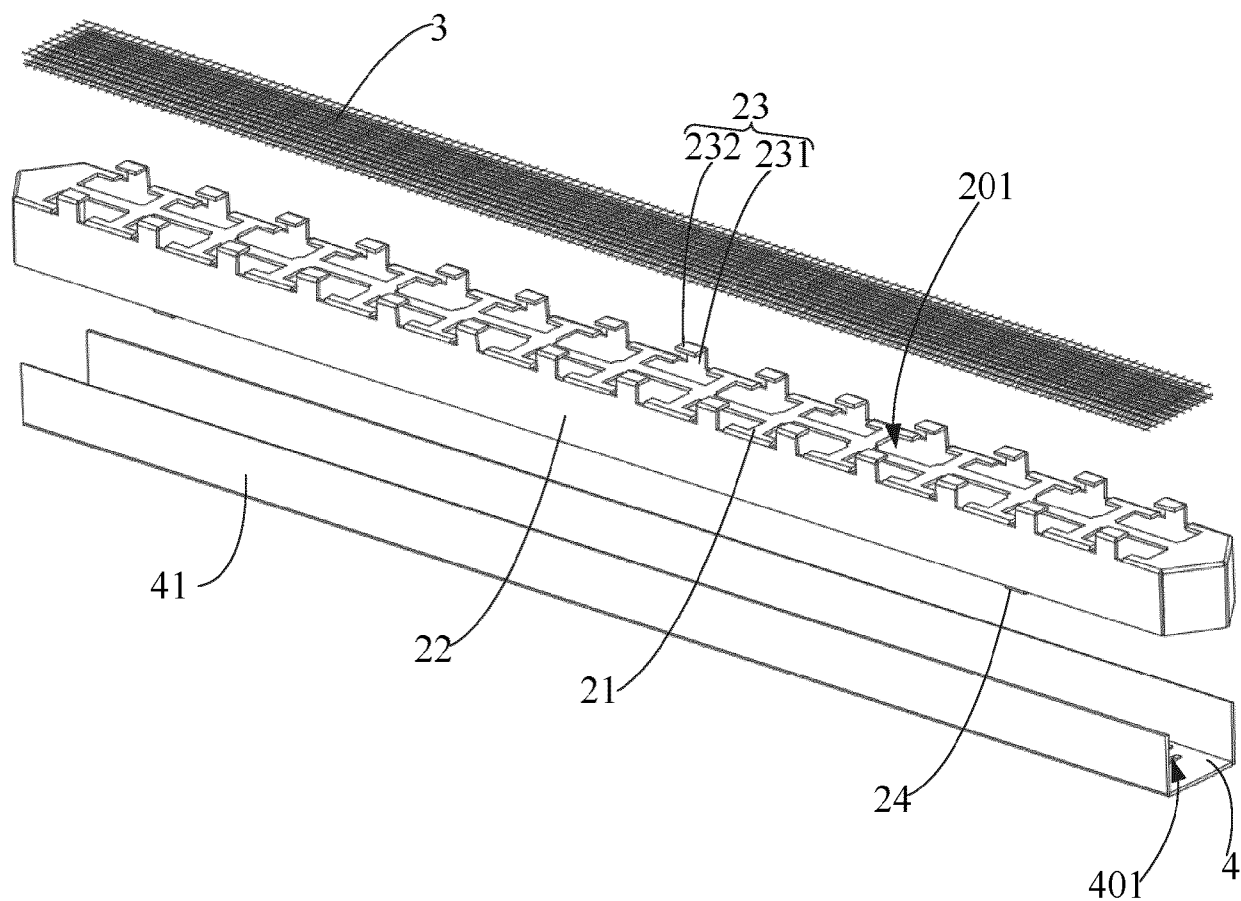


FIG. 3

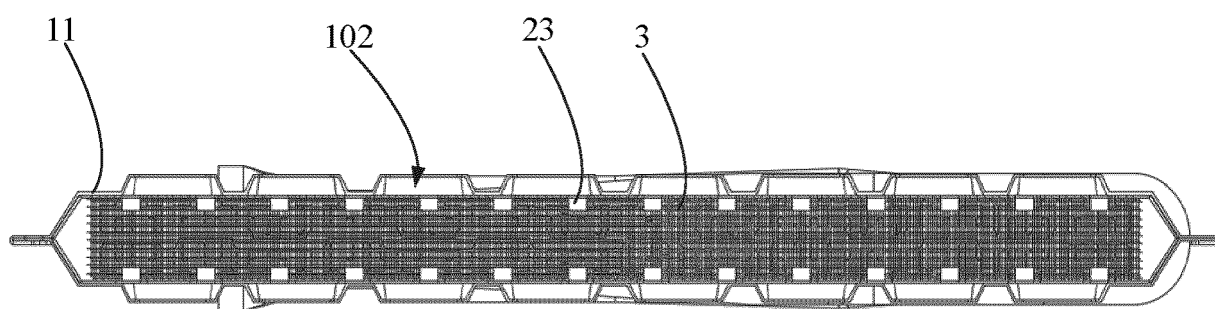


FIG. 4

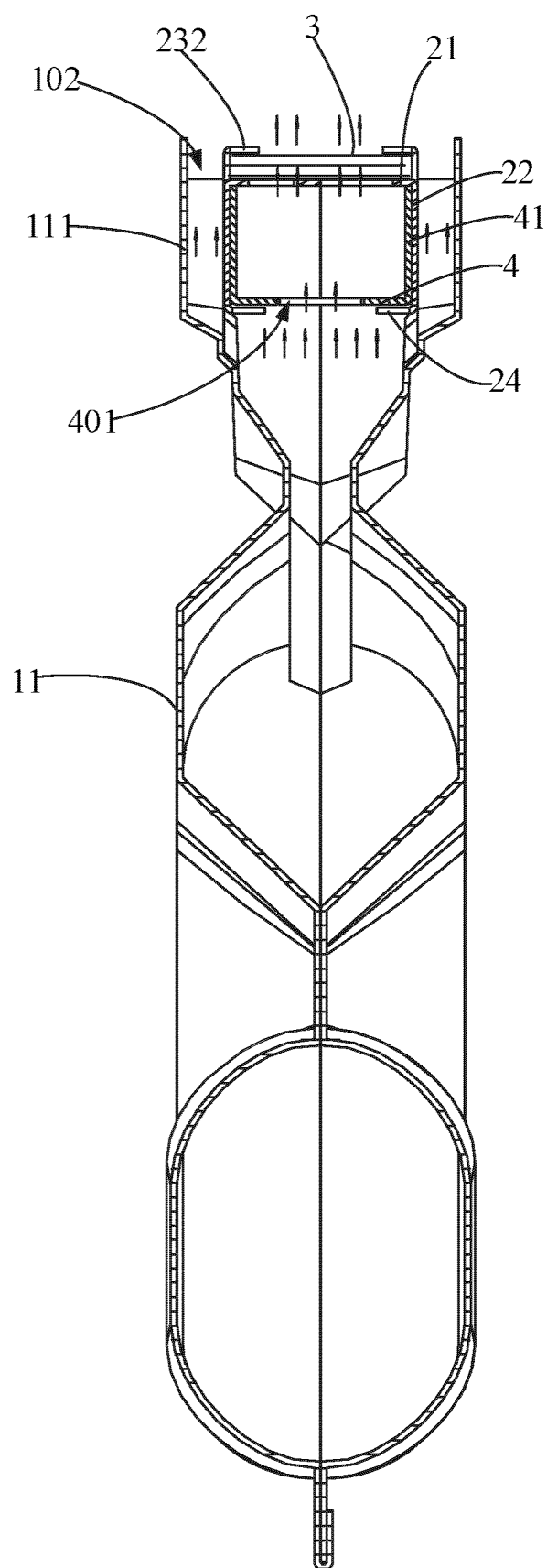


FIG. 5

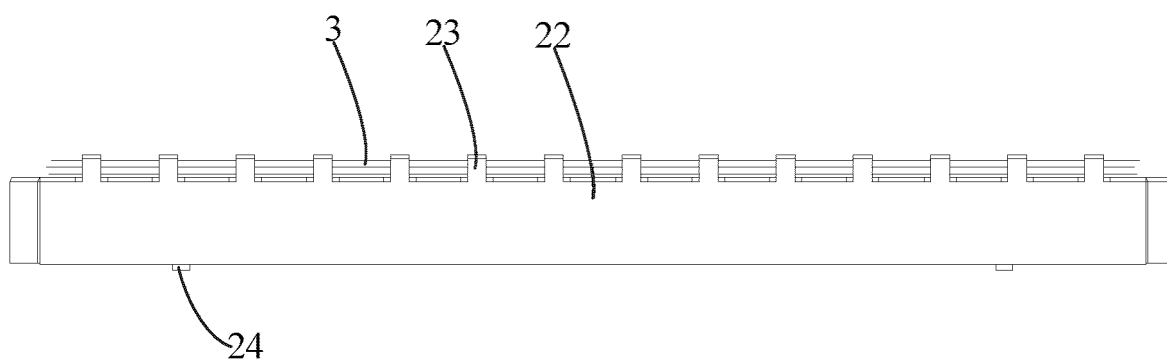


FIG. 6

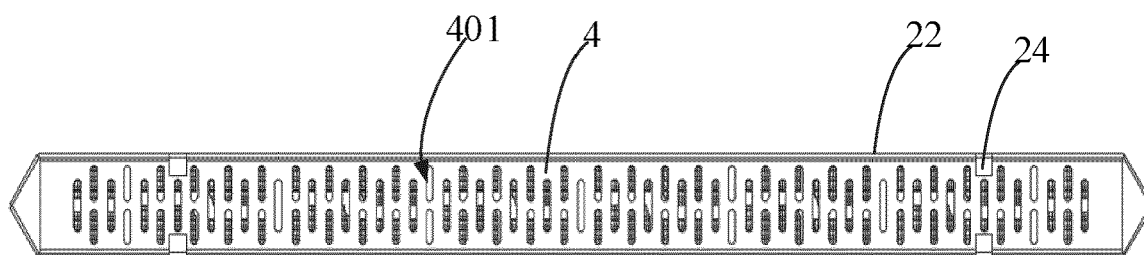


FIG. 7

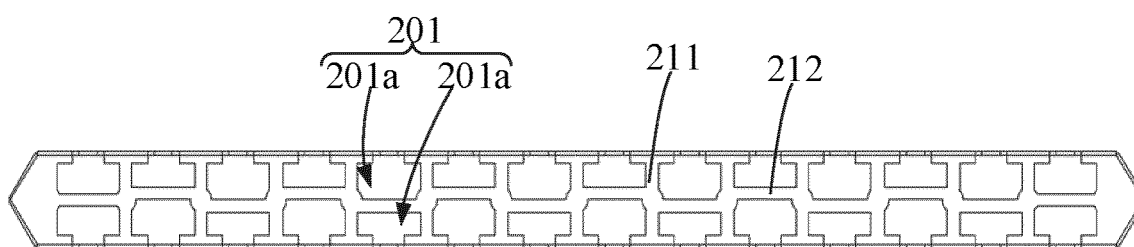


FIG. 8



## EUROPEAN SEARCH REPORT

Application Number

EP 25 20 5620

## 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                                                                                                                                                                                                                                                                                     | CN 220 229 169 U (WUHU MIDEA SMART KITCHEN APPLIANCE MFG CO LTD)<br>22 December 2023 (2023-12-22)                                                                                                               | 1-6,10                           | INV.<br>F23D14/04<br>F23D14/10<br>F23D14/14<br>F23D14/58 |
| Y                                                                                                                                                                                                                                                                                     | * translation 22.12.2023 *                                                                                                                                                                                      | 7                                |                                                          |
| A                                                                                                                                                                                                                                                                                     | * paragraph [0038] - paragraph [0061] *<br>* claim 12 *<br>* figures 2-8 *                                                                                                                                      | 8,9                              |                                                          |
| Y                                                                                                                                                                                                                                                                                     | -----<br>CN 220 229 168 U (WUHU MIDEA SMART KITCHEN APPLIANCE MFG CO LTD)<br>22 December 2023 (2023-12-22)<br>* translation 22.12.2023 *<br>* paragraph [0041] - paragraph [0073] *<br>* figures 1-8 *<br>----- | 7                                |                                                          |
|                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                 |                                  | TECHNICAL FIELDS SEARCHED (IPC)                          |
|                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                 |                                  | F23D                                                     |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                            |                                                                                                                                                                                                                 |                                  |                                                          |
| Place of search                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                 | Date of completion of the search | Examiner                                                 |
| Munich                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                 | 2 February 2026                  | Gavriliu, Costin                                         |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                 |                                  |                                                          |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document                                                               |                                                                                                                                                                                                                 |                                  |                                                          |
| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                                                 |                                  |                                                          |

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ON EUROPEAN PATENT APPLICATION NO.

EP 25 20 5620

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02-02-2026

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