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

(11) **EP 4 534 902 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
09.04.2025 Bulletin 2025/15

(21) Application number: **24828006.7**

(22) Date of filing: **01.07.2024**

(51) International Patent Classification (IPC):
F23D 14/04 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F23D 14/04; F23D 14/46; F23D 14/58; F23D 14/64; F24H 9/1836

(86) International application number:
PCT/CN2024/102949

(87) International publication number:
WO 2025/025948 (06.02.2025 Gazette 2025/06)

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

(30) Priority: **28.07.2023 CN 202322018587 U**

(71) Applicant: **Wuhu Midea Smart Kitchen Appliance Manufacturing Co., Ltd.**
Wuhu, Anhui 241000 (CN)

(72) Inventor: **LI, Maozhao**
Anhui 241000 (CN)

(74) Representative: **RGTH**
Patentanwälte PartGmbB
Neuer Wall 10
20354 Hamburg (DE)

(54) **BURNER ROW, BURNER, AND GAS DEVICE**

(57) The present application discloses a combustion grate, a burner, and a gas appliance. The combustion grate is provided with a gas inlet, combustion fire ports, and an injection channel communicating the gas inlet with the combustion fire ports. The injection channel comprises a contraction section, a mixing section, and a diffuse section in communication with one another in a gas intake direction, and the mixing section abruptly expands in the gas intake direction.

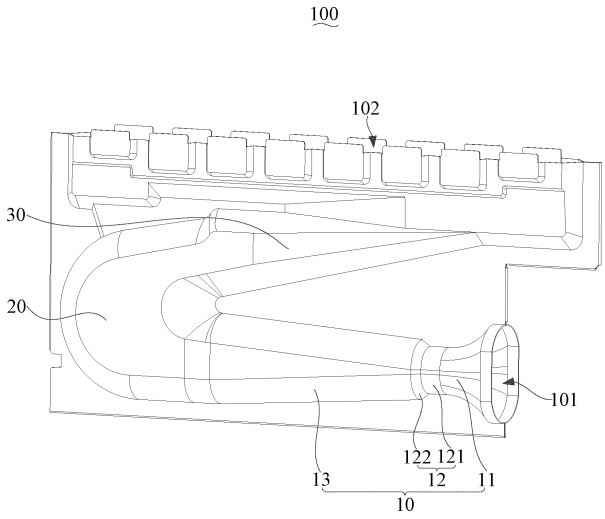

FIG. 1

EP 4 534 902 A1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims benefit of Chinese Patent Application No. 202322018587.6 filed on July 28, 2023, the contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of gas appliance, and particularly to a combustion grate, a burner and a gas appliance.

BACKGROUND

[0003] Gas appliances (such as gas water heaters, wall-mounted boilers, etc.) are devices that heat media (such as water) by the heat released by combustion of a fuel gas. The burner, as the place of fuel combustion, has the functions of mixing gas (mixing the fuel gas and air), evenly distributing the gas mixture, and ensuring the complete and stable combustion of the fuel. The burner generally consists of several individual combustion grates.

[0004] The main purpose of the present application is to propose a combustion grate to improve the mixing uniformity of the fuel gas and air, ensure the complete combustion, and improve the thermal efficiency.

[0005] In order to achieve the above purpose, the present application proposes a combustion grate provided with a gas inlet, combustion fire ports, and an injection channel communicating the gas inlet with the combustion fire ports.

[0006] In one embodiment, the injection channel comprises a contraction section, a mixing section, and a diffuse section in communication with one another in a gas intake direction, and the mixing section abruptly expands in the gas intake direction.

[0007] In one embodiment, the mixing section comprises a throat pipe section and abrupt section, the contraction section, the throat pipe section, the abrupt section and the diffuse section are in communication with one another in the gas intake direction.

[0008] In one embodiment, the throat pipe section is the narrowest portion of the injection channel, and the abrupt section expands from the throat pipe section toward the diffuse section.

[0009] In one embodiment, both the abrupt section and the diffuse section gradually expand in the gas intake direction, an expanding angle of the abrupt section is greater than an expanding angle of the diffuse section.

[0010] In one embodiment, in a cross-section perpendicular to the gas intake direction, a maximum radial dimension of the gas inlet is a, and a maximum radial dimension of the throat pipe section is b, a value of b/a is greater than or equal to 0.4 and less than or equal to 0.6.

[0011] In one embodiment, the value of b/a is 0.5.

[0012] In one embodiment, a peripheral wall of the abrupt section is inclined, with respect to a peripheral wall of the throat pipe section, towards a side away from a center line of the injection channel.

[0013] In one embodiment, an angle α is formed between the peripheral wall of the abrupt section and the peripheral wall of the throat pipe section, the angle α is greater than or equal to 120 ° and less than or equal to 170 °.

[0014] In one embodiment, a distance between the gas inlet and an outlet of the mixing section is L1, and a distance between the gas inlet and an outlet of the diffuse section is L2, a value of L1/L2 is greater than or equal to 0.2 and less than or equal to 0.5.

[0015] In one embodiment, the combustion grate comprises a panel having a hollowed-out area, and a metal mesh stacked above or below the panel.

[0016] In one embodiment, portions of the metal mesh covering the hollowed-out area form the combustion fire ports.

[0017] In one embodiment, limiting members are provided on opposite sides of the combustion grate, the limiting members located on the opposite sides abut respectively against edge portions of two sides of a surface of the metal mesh facing away from the panel.

[0018] The present application also proposes a burner comprising the combustion grate as described above.

[0019] The present application also proposes a gas appliance comprising the burner as described above.

[0020] In the present application, the combustion grate is provided with the gas inlet, the combustion fire ports, and the injection channel that communicates the gas inlet with the combustion fire ports. The injection channel comprises the contraction section, the mixing section, and the diffuse section in communication with one another in the gas intake direction, and the mixing section abruptly expands in the gas intake direction. In this way, the gaseous mixture of the fuel gas and air enters the contraction section from the gas inlet and rapidly contracts in the contraction section. The gaseous mixture entering the mixing section at a high flow speed, and the high-speed gaseous mixture will abruptly expand when it flows to a position of the mixing section adjacent to the diffuse section, and then enters the diffuse section for further mixing.

As such, the injection channel can changes at multiple positions in the gas intake direction, and the gaseous mixture can quickly contract and expand, thereby increasing the turbulence effect, and improving the mixing uniformity of fuel gas and air. As such, the complete combustion is achieved, and the utilization rate of fuel and the thermal efficiency are improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In order to explain more clearly technical solutions of the embodiments of the present application or the related technology, the drawings for the description of the embodiments and the related technology will be introduced below. Apparently, the drawings in the below description are only for some embodiments of the present application, and other drawings may be acquired based on the structure shown in these drawings by those skilled in the art without creative efforts.

FIG. 1 is a schematic view of a combustion grate according to an embodiment of the present application.
FIG. 2 is a front view of the combustion grate of FIG. 1.
FIG. 3 is a schematic cross-sectional view of the combustion grate of FIG. 1 taken at an abrupt section.
FIG. 4 is a partial cross-sectional view of the combustion grate of FIG. 1.
FIG. 5 is an enlarged partial cross-sectional view of the combustion grate of FIG. 4.
FIG. 6 is another schematic view showing the combustion grate in FIG. 1 from another viewpoint.

Reference Numerals:

[0022]

Reference Numeral	Element	Reference Numeral	Element
100	Combustion Grate	122	Abrupt Section
101	Gas Inlet	13	Diffuse Section
102	Combustion Fire Port	20	Curved Channel
10	Injection Channel	30	Flow Splitter Channel
11	Contraction Section	40	Panel
12	Mixing Section	50	Metal Mesh
121	Throat Pipe Section		

[0023] The implementation of objectives, functional characteristics and advantages of the present application will be further described with reference to accompanying drawings in combination with embodiments.

DETAILED DESCRIPTION

[0024] Hereinafter a clear and complete description will be given for explaining the technical solution in the embodiments of the present application with reference to the drawings of the embodiments of the present application. It should be noted that the described embodiments are only part of and not all of the embodiments of the present application. All other embodiments obtained by those of ordinary skill in the art based on the embodiments in the present application without creative efforts fall within the scope of protection of the present application.

[0025] It should be noted that directional and positional terms in the embodiments of the present application, such as "upper", "lower", "left", "right", "front" and "rear", are used to explain the relative position relationship and movement of the elements in a specific attitude. It should be understood that these directional terms may correspondingly change when the specific attitude is changed.

[0026] In the embodiments of the present application, the terms "first" and "second" are used merely for descriptive purposes, and are not to be construed as indicating or implying relative importance or implicitly specifying the quantity of indicated technical features. Thus, the features defined as "first", "second" may explicitly or implicitly means that there is at least one said features. In addition, the meaning of the term "and/or" comprises any and all combinations of one or more of the associated listed items. For example, "A and/or B" comprises scheme A, scheme B, or a scheme comprising both A and B. In addition, the technical solutions of the various embodiments may be combined with each other as long as the person of ordinary skill in the art can realize it. If the combination of the technical solutions results in a contradictory or the combination of the technical solutions is impossible to realize, it should be considered that the combination of the technical

solutions does not exist and is not within the scope of protection of the present application.

[0027] In the related art, the combustion grate of the burner has an injection channel for introducing mixed gas. The injection channel generally contracts from a gas inlet toward the interior of the channel and then gradually expands. The whole channel varies smoothly, and the uniformity of mixing of the fuel gas and air is poor, which is not conducive to the complete combustion of the fuel gas, and thus the thermal efficiency is low.

[0028] The present application proposes a combustion grate 100.

[0029] Referring to FIGS. 1 to 3, in an embodiment of the present application, the combustion grate 100 is provided with a gas inlet 101, combustion fire ports 102, and an injection channel 10 that communicates the gas inlet 101 with the combustion fire ports 102. The injection channel 10 comprises a contraction section 11, a mixing section 12, and a diffuse section 13 in communication with one another in a gas intake direction, and the mixing section 12 abruptly expands in the gas intake direction.

[0030] Specifically, the combustion grate 100 comprises the gas inlet 101, the combustion fire ports 102, and the injection channel 10. A fuel gas and air enter the injection channel 10 from the gas inlet 101, then are fully mixed in the injection channel 10, and then transported to the combustion fire ports 102. The gaseous mixture is ignited at the combustion fire 102 to achieve combustion. The injection channel 10 comprises the contraction section 11, the mixing section 12, and the diffuse section 13 in communication with one another in the gas intake direction. The contraction section 11 gradually contracts in the gas intake direction, the diffuse section 13 gradually expands in the gas intake direction, and the mixing section 12 connects a narrow opening end of the contraction section 11 with a narrow opening end of the diffuse section 13. The mixing section 12 abruptly expands in the gas intake direction, that is, the cross-sectional dimension of an end of the mixing section 12 adjacent to the contraction section is smaller, while the cross-sectional dimension of an end of the mixing section 12 adjacent to the diffuse section 13 is larger, and the change in the cross-sectional dimension of the mixing section 12 in the gas intake direction is not a continuous linear change, but has a distinct gradient. In this way, the gaseous mixture of the fuel gas and air enters the contraction section 11 from the gas inlet 101 and rapidly contracts in the contraction section 11. The gaseous mixture entering the mixing section 12 is at a high flow speed, and the high-speed gaseous mixture will abruptly expand when it flows to a position of the mixing section 12 adjacent to the diffuse section 13, and then enters the diffuse section 13 for further mixing. Thus, the injection channel 10 changes at multiple positions in the gas intake direction, and the gaseous mixture can rapidly contract and expand, thereby increasing the turbulence effect and improving the mixing uniformity.

[0031] Specifically, in the present embodiment, as shown in FIGS. 1 and 2, the combustion grate 100 comprises a body and a combustion head provided on a top of the body. The body is provided with the gas inlet 101 and the injection channel 10, and the combustion head is provided with a plurality of combustion fire ports 102. The gas inlet 101 is in communication with the combustion fire ports 102 via the injection channel 10. The gas inlet 101 is located on the first side of the body, and the injection channel 10 extends from the first side of body to a second side of body. For example, as shown in FIG. 2, the gas inlet 101 is located on the left side of the body, and the injection channel extends from the left to the right. In this case, the gaseous mixture enters the injection channel 10 in the horizontal direction from the first side of the body and is transported toward the second side. In one embodiment, as shown in FIG. 1, the body is further provided with a curved channel 20 and a flow splitter channel 30. One end of the curved channel 20 is in communication with an outlet end of the injection channel 10, and the other end of the curved channel 20 is located above the injection channel 10 and is in communication with an inlet end of the shunt channel 30. The flow splitter channel 30 extends from the second side of the body toward the first side of the body, and the flow splitter channel 30 is in communication with the plurality of combustion fire ports 102. In one embodiment, the body comprises two half-shells spliced together, and the two half-shells together define the gas inlet 101, the injection channel 10, the curved channel 20 and the flow splitter channel 30. The half shells can be made of a sheet metal, and be punched to form the corresponding cavity channel, and then the two half shells can be welded and fixed with each other.

[0032] In the present application, the combustion grate 100 is provided with the gas inlet 101, the combustion fire ports 102, and the injection channel 10 that communicates the gas inlet 101 with the combustion fire ports 102. The injection channel 10 comprises the contraction section 11, the mixing section 12, and the diffuse section 13 in communication with one another in the gas intake direction, and the mixing section 12 abruptly expands in the gas intake direction. In this way, the gaseous mixture of the fuel gas and air enters the contraction section 11 from the gas inlet 101 and rapidly contracts in the contraction section 11. The gaseous mixture entering the mixing section 12 is at a high flow speed, and the high-speed gaseous mixture will abruptly expand when it flows to a position of the mixing section 12 adjacent to the diffuse section 13, and then enters the diffuse section 13 for further mixing. In this way, the injection channel 10 can changes at multiple positions in the gas intake direction, and the gaseous mixture can quickly contract and expand, thereby increasing the turbulence effect, and improving the mixing uniformity of the fuel gas and air. As such, the complete combustion is achieved, and the utilization rate of fuel and the thermal efficiency are improved.

[0033] As shown in FIGS. 4 and 5, in one embodiment, the mixing section 12 comprises a throat pipe section 121 and an abrupt section 122. The contraction section 11, the throat pipe section 121, the abrupt section 122, and the diffuse section 13 are in communication with one another in the gas intake direction. The throat pipe section 121 is the narrowest portion of

the injection channel 10, and the abrupt section 122 expands from the throat pipe section 121 towards the diffuse section 13.

[0034] In one embodiment, the mixing section 12 comprises a throat pipe section 121 and an abrupt section 122. The throat pipe section 121 has a substantially cylindrical shape extending straight in the gas intake direction, and the abrupt section 122 has a substantially frustum cone shape gradually expanding in the gas intake direction. The cross-sectional dimension of throat pipe section 121 is smaller, while the cross-sectional dimension of abrupt section 122 is larger, that is, the portion of mixing section 12 adjacent to the diffuse section 13 forms an obvious sudden step (that is, the abrupt section 122), which makes mixing section 12 abruptly expanding towards the gradually expanding section. The throat pipe section 121 is the narrowest part of the injection channel 10. After rapidly contracting in the contraction section 11, the gaseous mixture enters the throat pipe section 121 in which the gaseous mixture reaches its maximum speed. The high-speed gaseous mixture in the throat pipe section 121 enters the abrupt section 122, rapidly expands in the abrupt section 122, then the gaseous mixture enters the diffuse section 13. In this way, the turbulence effect is strengthened.

[0035] In order to further improve the mixing uniformity of the fuel gas and air, as shown in FIG. 5, in one embodiment, both the abrupt section 122 and the diffuse section 13 gradually expand in the gas intake direction, and the expanding angle of the abrupt section 122 is larger than that of the diffuse section 13.

[0036] In one embodiment, both the abrupt section 122 and the diffuse section 13 gradually expand in the gas intake direction, and the expanding angle of the abrupt section 122 is greater than the expanding angle of the diffuse section 13, that is, in the axial cross-section of the injection channel 10, the angle between two side edges of the abrupt section 122 is greater than the angle between two side edges of the diffuse section 13. In this way, after gaseous mixture is rapidly contracted in the contraction section 11 and enters the throat pipe section 121, it rapidly expanded in the abrupt section 122, and then enters the diffuse section 122. In this process, a radially outward portion of the gaseous mixture in the throat pipe section 121 enters the abrupt section 122 and has a large expanding angle. When entering the diffuse section 13, the outward portion of the gaseous mixture is expanded and collided with a wall of a flow channel of the diffuse section 13 since the expanding angle of diffuse section 13 is relatively small, then bounced back to the middle of the flow channel and collided with a inward portion of the gaseous mixture, which greatly increases the turbulence effect and makes the gas mixing more uniform. It is more conducive to achieve the complete combustion, and fully release the combustion heat, and improve the thermal efficiency.

[0037] In the traditional technology, the ratio of a dimension of the narrowest section of the injection channel 10 in the combustion grate 100 to a dimension of the gas inlet 101 is large. When the wind speed of the fan in the gas appliance fluctuates, the air volume fluctuates, and the air volume entering the flow channel changes obviously, resulting in that the fuel gas volume does not match the air volume, which in turn leads to the unstable combustion.

[0038] In order to further improve the combustion stability, as shown in FIG. 4, in one embodiment, in a cross-section perpendicular to the gas intake direction, the maximum radial dimension of the gas inlet 101 is a, and the maximum radial dimension of the throat pipe section 121 is b, and the value of b/a is greater than or equal to 0.4 and less than or equal to 0.6.

[0039] In one embodiment, the gas inlet 101 is generally an oblong hole extending in a vertical direction, and the cross-section of the throat pipe section 121 is generally an ellipse extending in the vertical direction. The dimension of the gas inlet 101 in the vertical direction is the maximum radial dimension a of the gas inlet 101, and the dimension of the cross-section of the throat pipe section 121 in the vertical direction is the maximum radial dimension b of the throat pipe section 121. Of course, the cross-sections of the gas inlet 101 and the throat pipe section 121 may be designed in other shapes, which are not particularly limited herein. Since the value of b/a is less than or equal to 0.6, the dimensional ratio of the narrowest section of the injection channel 10 (that is, the throat pipe section 121) to the gas inlet 101 is controlled to be a small ratio, so that the resistance in the flow path can be appropriately increased. When the wind speed of the fan of the gas appliance fluctuates, the air volume entering the flow channel decreases, but the ratio of the fuel gas to air is hardly affected, making the combustion more stable. By limiting the value of b/a to be greater than or equal to 0.4, an excessive increase in resistance can be avoided, to ensure that the gaseous mixture can flow smoothly along the injection channel 10. Specifically, $0.4 \leq b/a \leq 0.6$. For example, the value of b/a may be 0.4, 0.45, 0.5, 0.55, 0.6, etc.

[0040] In one embodiment, the value of b/a is 0.5, so that the resistance in the flow passage is moderate, and the ratio of the fuel gas to the air is hardly affected by the fluctuation of the wind speed, thereby further improving the combustion stability.

[0041] As shown in FIG. 2, in one embodiment, the peripheral wall of the abrupt section 122 is inclined, with respect to the peripheral wall of the throat pipe section 121, towards a side away from the center line of the injection channel 10. An angle α is formed between the peripheral wall of the abrupt section 122 and the peripheral wall of the throat pipe section 121, the angle α is greater than or equal to 120° and less than or equal to 170°.

[0042] In one embodiment, the angle α is comprised between 120° and 170°, and the inclination angle of the peripheral wall of the abrupt section 122 with respect to the peripheral wall of the throat pipe section 121 is moderate, which is beneficial to guiding the peripheral flow in the throat pipe section 121 to abruptly expand outward, rebound after colliding with the side wall of the flow channel, and then collide with the inner gaseous mixture, thereby increasing the turbulence effect. Specifically, $120° \leq a \leq 170°$. For example, the angle α may be 120°, 130°, 140°, 150°, 160°, 170° , etc.

[0043] As shown in FIG. 2, in one of the embodiments, a distance between the gas inlet 101 and an outlet of the mixing section 12 is L1, and a distance between the gas inlet 101 and an outlet of the diffuse section 13 is L2, the value of L1/L2 is greater than or equal to 0.2 and less than or equal to 0.5. In this way, it is possible to ensure a diffuse section 13 distance sufficient to achieve the thorough mixing of the fuel gas and the air. Specifically, $0.2 \leq L1/L2 \leq 0.5$. For example, the value of L1/L2 may be 0.2, 0.3, 0.4, 0.5, etc.

[0044] In one embodiment, an inner peripheral face of the contraction section 11 is a smooth curved surface. In this way, the resistance in the contraction section 11 can be reduced, and it is beneficial to quickly flow and contract of the gaseous mixture in the contraction section 11.

[0045] In addition to the above embodiment, as shown in FIG. 6, in one embodiment, the combustion grate 100 comprises a panel 40 having a hollowed-out area, and a metal mesh 50 stacked above or below the panel 40. The portions of the metal mesh 50 covering the hollowed-out area form the combustion fire ports 102. Limiting members are provided on opposite sides of the combustion grate 100 respectively, and the limiting members located on the opposite sides abut respectively against edge portions of two sides of the surface of the metal mesh 50 facing away from the panel 40.

[0046] In one embodiment, the metal mesh 50 may be stacked on the back side or the front side of the panel 40, and in one embodiment, the metal mesh 50 may be stacked on the back side of the panel 40. Two side edges of the metal mesh 50 are respectively limited by the limiting members on both sides of the combustion grate 100, so that the side edges of the metal mesh 50 are sandwiched between the panel 40 and the limiting members. In this way, the two side edges of the metal mesh 50 are not easily warped, and the flatness of the metal mesh 50 is ensured. Compared with the traditional method in which the metal mesh is welding to the panel, the solution of the present application does not have problems such as large resistance at solder joint positions of the metal mesh 50 and small resistance at warping positions, so that the resistance at a combustion surface of the combustion grate 100 is uniform. It is conducive to improving uniform and stable combustion, and it is less likely to occur backfire, flame-out and lift-off phenomenon, and combustion noise and resonance caused by flame oscillation can be avoided. With the structural design of the injection channel 10 in the above embodiment, the gaseous mixture of the air and the fuel gas can be fully and evenly mixed after entering the injection channel 101 from the gas inlet 10, and then flow to the combustion fire port 102 for combustion. In addition, due to the mesh structure of the metal mesh 50 and the installation flatness of the metal mesh 50, the combustion at the metal mesh 50 is more uniform and stable, which is conducive to achieving a better low-nitrogen combustion effect.

[0047] The present application also proposes a burner comprising the combustion grate 100 of the embodiment described above. Since the burner adopts all the technical solutions of all the above embodiments, it has at least all the effects brought by the technical solutions of the above embodiments, which will not be repeatedly described here.

[0048] The present application also proposes a gas appliance comprising a burner of the embodiment described above. Since the gas appliance adopts all the technical solutions of all the above embodiments, it has at least all the effects brought by the technical solutions of the above embodiments, which will not be repeatedly described here.

[0049] What described are merely preferable embodiments of the present application, and are not intended to limit the scope of protection of the present application. All equivalent structures made using the specification and accompanying drawings of the present application, or direct or indirect applications of the application to other related technical fields should be comprised within the scope of protection of the present application.

Claims

1. A combustion grate **characterized in that** the combustion grate is provided with a gas inlet, combustion fire ports, and an injection channel communicating the gas inlet with the combustion fire ports, the injection channel comprising a contraction section, a mixing section, and a diffuse section in communication with one another in a gas intake direction, the mixing section being abruptly expanding in the gas intake direction.

2. The combustion grate according to claim 1, wherein the mixing section comprises a throat pipe section and an abrupt section, the contraction section, the throat pipe section, the abrupt section and the diffuse section being in communication with one another in the gas intake direction, the throat pipe section being the narrowest portion of the injection channel, and the abrupt section expanding from the throat pipe section towards the diffuse section.

3. The combustion grate according to claim 2, wherein both the abrupt section and the diffuse section gradually expand in the gas intake direction, an expanding angle of the abrupt section being greater than an expanding angle of the diffuse section.

4. The combustion grate according to claim 2 or 3, wherein in a cross-section perpendicular to the gas intake direction, a maximum radial dimension of the gas inlet is a, and a maximum radial dimension of the throat pipe section is b, wherein a value of b/a is greater than or equal to 0.4 and less than or equal to 0.6.

5. The combustion grate according to claim 4, wherein the value of b/a is 0.5.

6. The combustion grate according to any one of claims 2 to 5, wherein a peripheral wall of the abrupt section is inclined, with respect to a peripheral wall of the throat pipe section, towards a side away from a center line of the injection channel, an angle α being formed between the peripheral wall of the abrupt section and the peripheral wall of the throat pipe section, the angle α being greater than or equal to 120 ° and less than or equal to 170°.

7. The combustion grate according to any one of claims 1 to 6, wherein a distance between the gas inlet and an outlet of the mixing section is L1, and a distance between the gas inlet and an outlet of the diffuse section is L2, wherein a value of L1/L2 is greater than or equal to 0.2 and less than or equal to 0.5.

8. The combustion grate according to any one of claims 1 to 7, wherein the combustion grate comprises a panel having a hollowed-out area, and the combustion grate comprises a metal mesh stacked above or below the panel, portions of the metal mesh covering the hollowed-out area forming the combustion fire ports, limiting members being provided on opposite sides of the combustion grate, the limiting members located on the opposite sides abutting respectively against edge portions of two sides of a surface of the metal mesh facing away from the panel.

9. A burner, comprising a combustion grate according to any one of claims 1 to 8.

10. A gas appliance, comprising a burner according to claim 9.

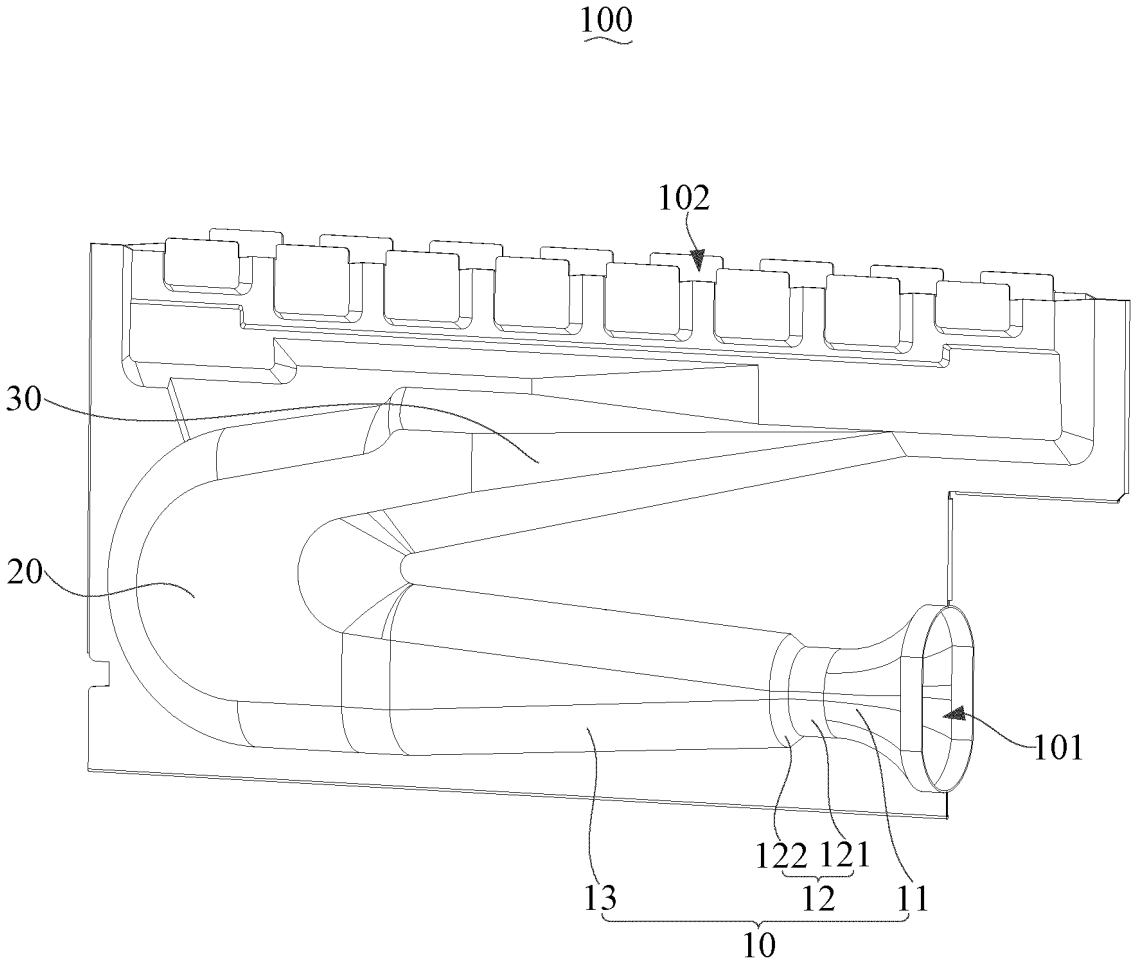

FIG. 1

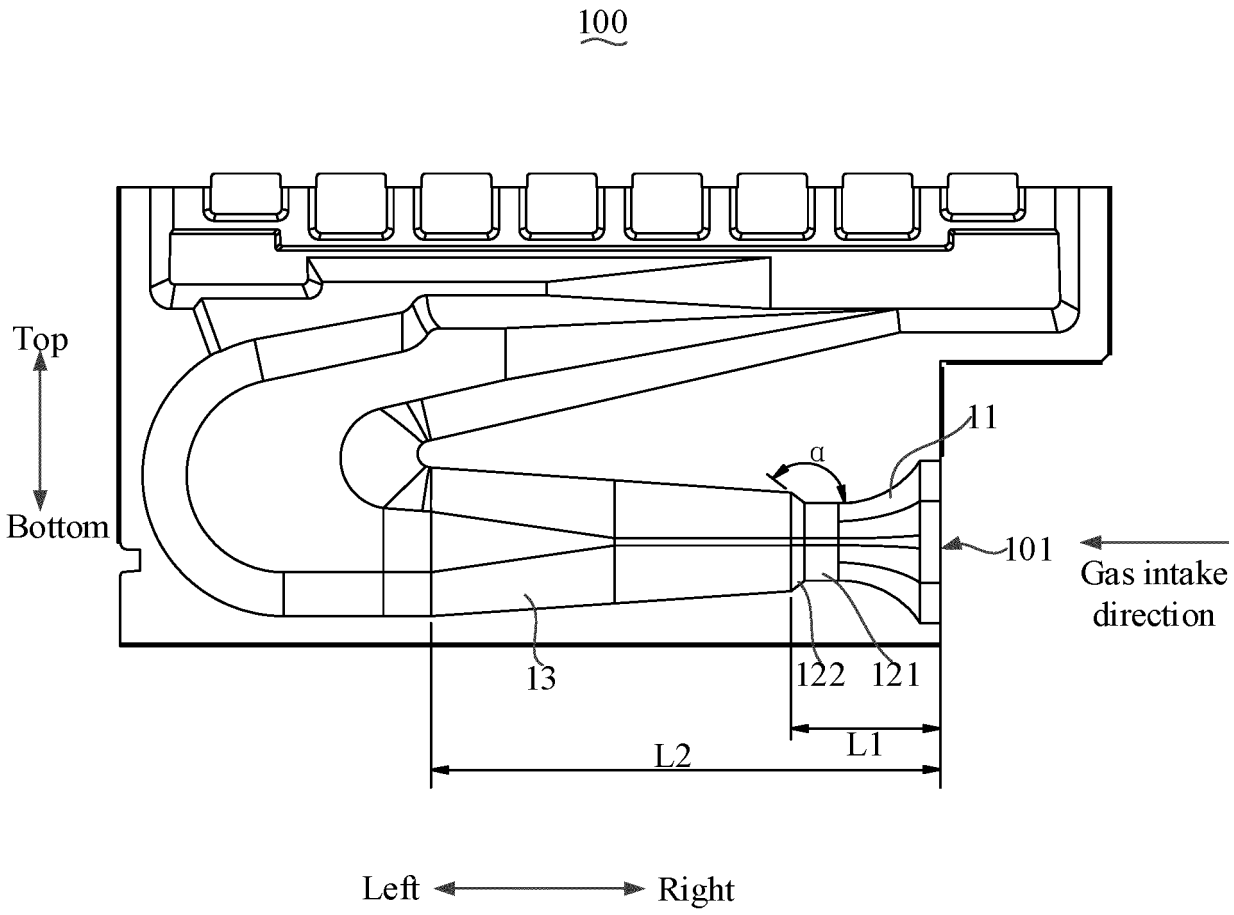
100
Top
Bottom
11
α
101
Gas intake direction
13
122
121
L2
L1
Left
Right

FIG. 2

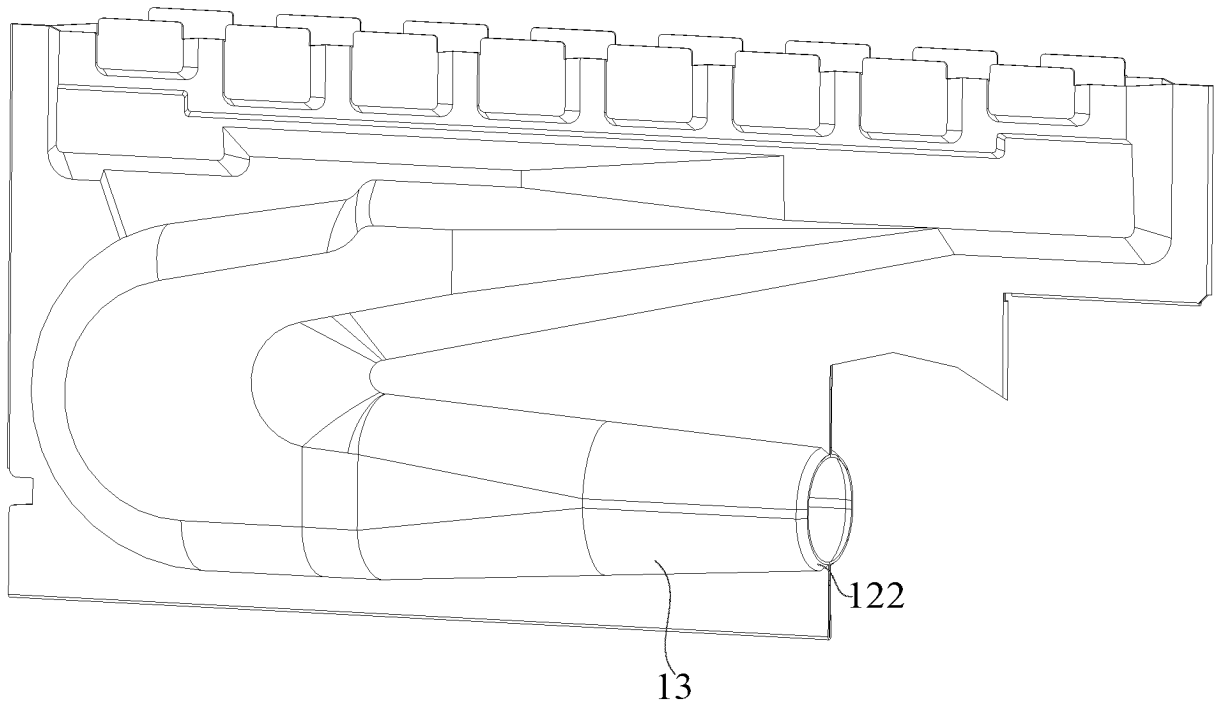

FIG. 3

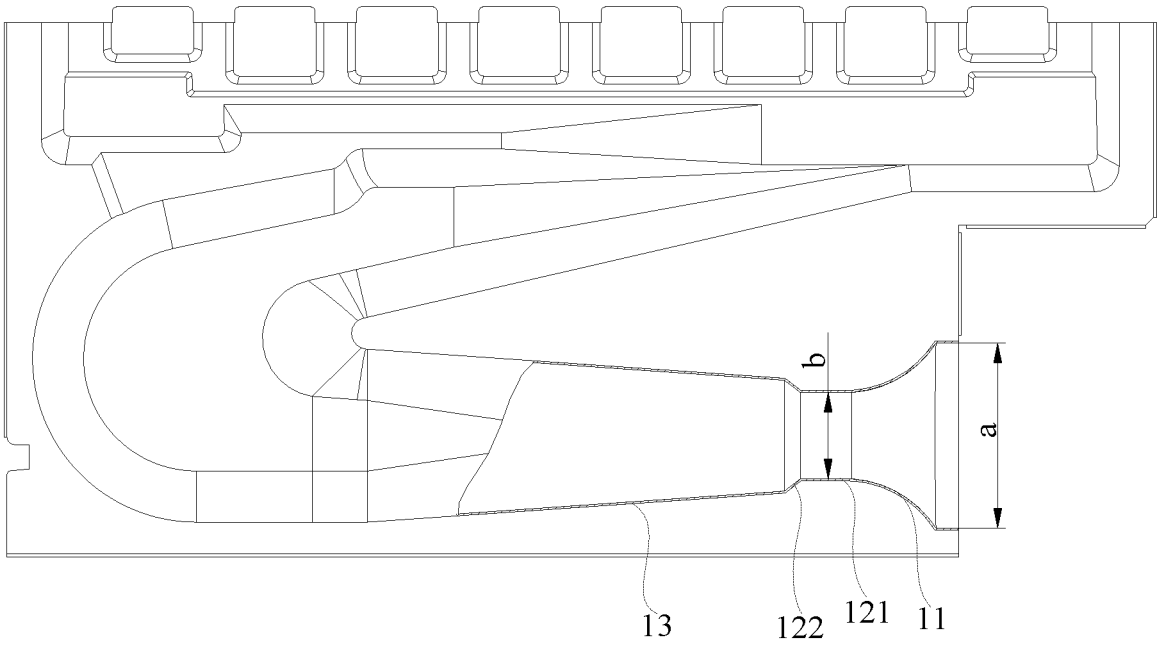

FIG. 4

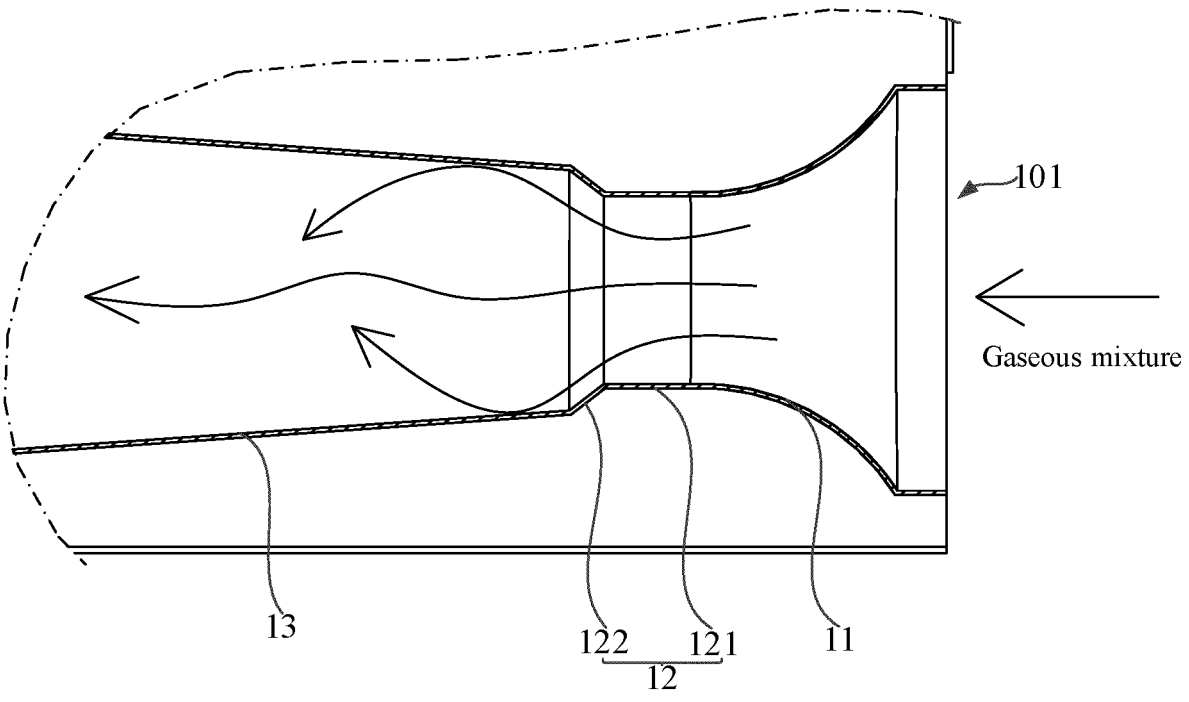

FIG. 5

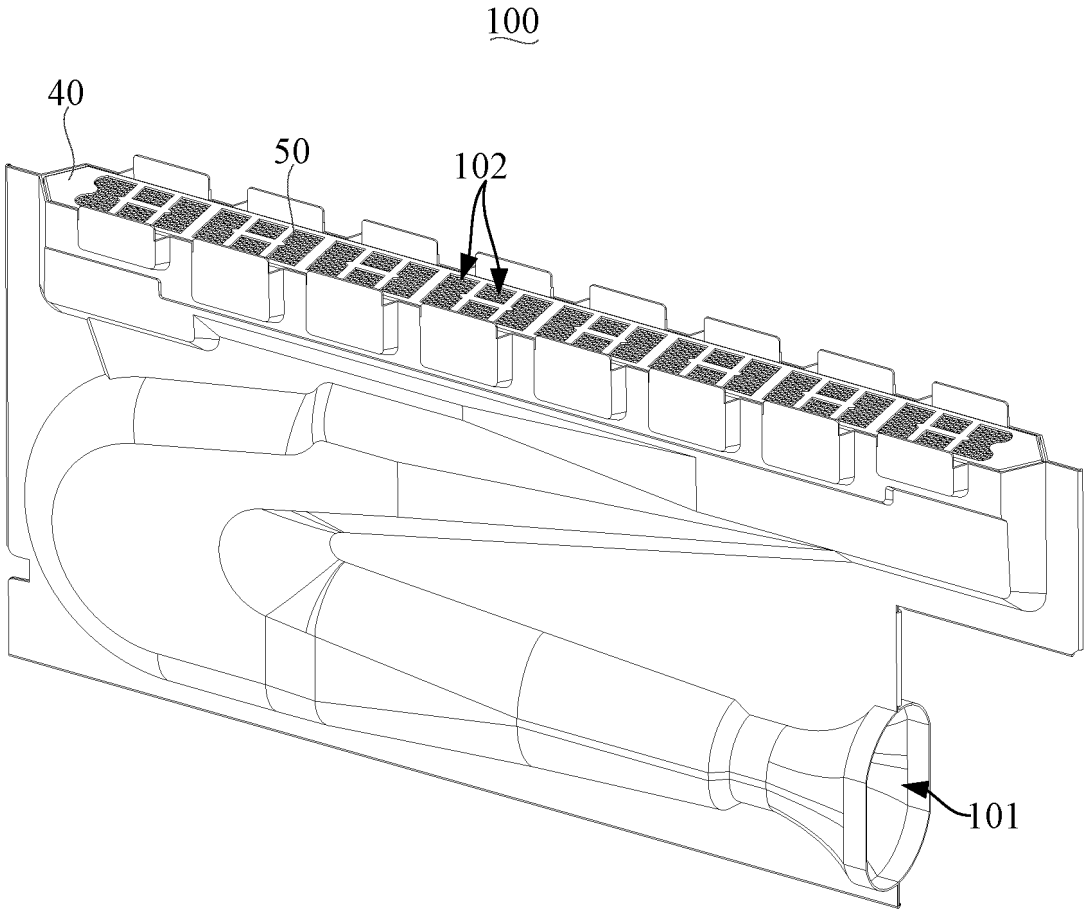

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/102949

A. CLASSIFICATION OF SUBJECT MATTER

F23D14/04(2006.01)i; F23D14/58(2006.01)i; F23D14/64(2006.01)i; F23D14/46(2006.01)i; F24H9/1836(2022.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F23D14, F24H9

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, CNKI, ENTXTC, VEN: 火排, 燃气, 引射, 收缩, 混合, 扩, 突, 喉, fire, grate, gas, inject, shrink, mix, diffusion, expansion, suddenly, throat

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 220229167 U (WUHU MIDEA INTELLIGENT KITCHEN APPLIANCE MANUFACTURING CO., LTD.) 22 December 2023 (2023-12-22) specific embodiments, and the drawings	1-10
PX	CN 220229168 U (WUHU MIDEA INTELLIGENT KITCHEN APPLIANCE MANUFACTURING CO., LTD.) 22 December 2023 (2023-12-22) claims 12-14, and figure 8	1-3, 8-10
Y	CN 208779447 U (SHENZHEN LYUYANG THERMAL ENERGY CO., LTD.) 23 April 2019 (2019-04-23) description, paragraphs [0022]-[0029], and figure 1	1-10
Y	CN 218781284 U (JIANGSU YALANTE ENVIRONMENTAL PROTECTION TECHNOLOGY CO., LTD.) 31 March 2023 (2023-03-31) description, paragraphs [0019]-[0024], and figure 1	1-10
Y	CN 115479273 A (WUHU MIDEA KITCHEN & BATH APPLIANCES MANUFACTURING CO., LTD. et al.) 16 December 2022 (2022-12-16) description, paragraphs [0093]-[0094], and figures 16-17	8

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"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	Date of mailing of the international search report
10 September 2024	**19 September 2024**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/102949

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 218672171 U (QINGDAO HAIER INTELLIGENT TECH RESEARCH AND DEVELOPMENT CO., LTD. et al.) 21 March 2023 (2023-03-21) description, paragraphs [0042]-[0052], and figures 1-3	1-10
Y	CN 202647761 U (VAILLANT (WUXI) HEATING EQUIPMENT CO., LTD.) 02 January 2013 (2013-01-02) abstract, and figure 2	1-10
Y	US 2018087772 A1 (GRAND MATE CO., LTD.) 29 March 2018 (2018-03-29) abstract, and figures 4-5	1-10
A	CN 109140494 A (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG CO., LTD.) 04 January 2019 (2019-01-04) entire document	1-10

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2024/102949

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 220229167 U	22 December 2023	None	
CN 220229168 U	22 December 2023	None	
CN 208779447 U	23 April 2019	None	
CN 218781284 U	31 March 2023	None	
CN 115479273 A	16 December 2022	None	
CN 218672171 U	21 March 2023	None	
CN 202647761 U	02 January 2013	None	
US 2018087772 A1	29 March 2018	TWI 611146 B	11 January 2018
		TW 201814214 A	16 April 2018
		US 10495302 B2	03 December 2019
CN 109140494 A	04 January 2019	None	

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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.

Patent documents cited in the description

- CN 202322018587 **[0001]**