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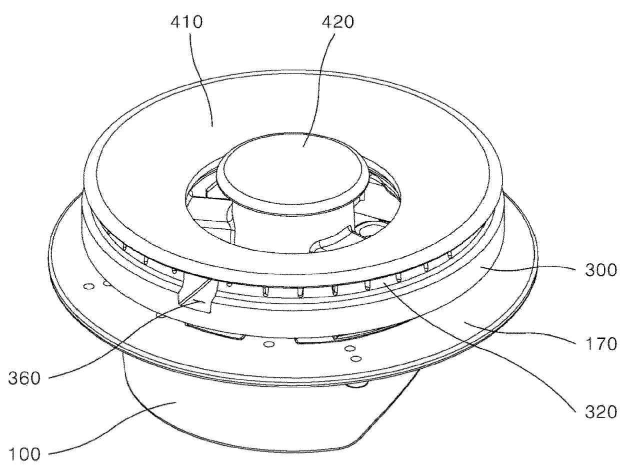
(54) BURNER WITH TWO FLAME RINGS FOR A COOKING RANGE

(57) A burner includes a body; a cover disposed on top of the body and coupled to the body to define a mixing tube in which gas and air flow and are mixed with each other; and a head disposed on top of the cover and configured to generate a flame, wherein the head includes: a first flame generation portion disposed in a central area of the head and a second flame generation portion disposed in an outer area of the head. The body, the cover, and the head are configured such that: the gas discharged from the mixing tube is divided into two portions flowing (in opposite directions) in an outer area of the body, then, the two portions of the gas flow through the cover, and then, a portion of each of the two portions flows into the second flame generation portion, while a remaining portion of each of the two portions flows from the outer area of the head to the central area thereof and flows into the first flame generation portion.

FIG. 1



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Description

[0001] The present disclosure relates to a burner, and more specifically, a burner with a simplified flow channel structure for flow of gas.

[0002] The contents as described in this Background Section simply provides background information on the present disclosure and does not constitute a prior art.

[0003] A burner emits a flame and generally receives gas from an external source and ignites the gas to generate a flame. The burner may be installed in a cooking appliance.

[0004] The burner may be used in a gas range or a cooktop of a combined cooking appliance that uses both gas and electricity, and may receive gas from an external source and combust the gas to generate a flame.

[0005] The burner may be composed of two flame generation portions, and each of the two flame generation portions generally generates a flame having a ring shape. The two flame generation portions may generate an inner flame in a small ring shape and an outer flame in a large ring shape surrounding the small ring shape, respectively.

[0006] In this structure, it is common that separate gas flow paths are respectively formed for the two flame generation portions to deliver combusted gas between the two flame generation portions spaced apart from each other. In this general structure, a plurality of gas flow paths independent of each other should be provided in the burner.

[0007] Furthermore, since the burner is provided with multiple gas injection holes, a plurality of pipes connecting the external source and the gas injection holes of the burner to each other should be provided.

[0008] The burner of the above-described structure has a complicated structure to form a gas flow path, making the overall structure of the burner complicated. Therefore, due to the complicated structure, the gas does not flow smoothly, burner performance deteriorates, and a manufacturing cost increases.

[0009] To solve this problem, it is necessary to manufacture a burner that has a single gas injection hole and a gas flow path connected to the hole and divided into to a plurality of flame generation portions spaced apart from each other.

[0010] A burner may generally be provided with a plurality of flame generation portions. Ring-shaped flame generation portions may be arranged to be spaced apart from each other in a radial direction of the burner.

[0011] In the burner of this structure, a structure is needed to propagate the flame from one flame generation portion to another flame generation portion. For example, during initial ignition, a flame may be first generated in one flame generation portion among the plurality of flame generation portions, and then may propagate therefrom to another flame generation portion to generate a flame.

[0012] Furthermore, when the fire is extinguished in any one flame generation portion of the plurality of flame generation portions due to disturbance such as wind, the flame of another flame generation portion that is being burned may propagate to the extinguished flame generation portion, thereby generating a flame again in the extinguished flame generation portion.

[0013] Accordingly, a propagating structure that may propagate the flame between adjacent ones of the plurality of flame generation portions is needed. This flame propagating structure needs to have a structure that allows the flame to propagate smoothly between the flame generation portions. Furthermore, the propagating structure needs to have a structure that suppresses the increase in incomplete combustion.

[0014] A purpose of the present disclosure is to provide a burner with a structure that improves performance and saves a production cost.

[0015] Furthermore, a purpose of the present disclosure is to provide a burner with a structure that simplifies a path through which gas flows.

[0016] Furthermore, a purpose of the present disclosure is to provide a burner with a structure that smoothly guides the flow of gas.

[0017] Furthermore, a purpose of the present disclosure is to provide a burner with a structure capable of propagating a flame between adjacent ones of a plurality of flame generating portions spaced apart from each other.

[0018] Furthermore, a purpose of the present disclosure is to provide a burner with a structure that smoothly re-ignites the flame in an extinguished flame generation portion of the plurality of flame generation portions.

[0019] Purposes according to the present disclosure are not limited to the above-mentioned purpose. Other purposes and advantages according to the present disclosure that are not mentioned may be understood based on following descriptions, and may be more clearly understood based on embodiments according to the present disclosure. Further, it will be easily understood that the purposes and advantages according to the present disclosure may be realized using means shown in the claims or combinations thereof.

[0020] The invention is specified by the independent claim. Preferred embodiments are defined in the dependent claims. A burner according to one embodiment may include a body; a cover disposed on top of the body and coupled to the body to define a mixing tube in which gas and air flow and are mixed with each other; and a head disposed on top of the cover and configured to generate a flame, wherein the head includes: a first flame generation portion disposed in a central area of the head and a second flame generation portion disposed in an outer area of the head.

[0021] The body, the cover, and the head are configured such that: the gas discharged from the mixing tube is divided into two portions flowing (preferably in opposite directions) in an outer area of the body, then, the two portions of the gas flow through the cover, and then, a portion of each of the two portions flows into the second flame generation portion, while a remaining portion of each of the two portions flows from the outer area of the head to the central area thereof and flows into the first flame generation portion. Accordingly, the burner may be configured such that the gas discharged from the single mixing tube may be supplied into the first flame generation portion and the second flame generation portion in a divided manner.

[0022] The body may include a first guide tube connected to an outlet of the mixing tube in the outer area of the body, wherein the first guide tube has two divided portions connected to the outlet of the mixing tube and extending in a circumferential direction of the body and respectively in opposite directions, wherein a portion of the first guide tube is closed with the cover, and the gas flows in the first guide tube.

[0023] The first guide tube has an inclined guide surface formed on each of a distal end of the two divided portions thereof configured to change a flow direction of the gas so that the gas gradually rises upwardly. The inclined guide surface may induce a smooth flow of gas by gently changing the flow direction of the gas.

[0024] A through-hole through which the gas flows is formed in the cover in an area at least partially overlapping the inclined guide surface. The through-hole includes a pair of through-holes disposed in an outer area of the cover and spaced apart from each other along a circumferential direction of the cover. The pair of through-holes may facilitate the flow of gas.

[0025] The burner may include a flame propagation portion as a space in which the flame propagates between the first flame generation portion and the second flame generation portion.

[0026] The head includes a propagation portion-defining protrusion protruding upwardly from the upper surface of the head, wherein the propagation portion-defining protrusion includes a pair of propagation portion-defining protrusions disposed on both opposing sides of the flame propagation portion, respectively so as to define the flame propagation portion therebetween. The propagation portion-defining protrusion may include a propagation hole that discharges gas into the flame propagation portion.

[0027] The propagation portion-defining protrusion may include a first protrusion, and a second protrusion spaced apart from the first protrusion in a circumferential direction, wherein the first and second protrusions define the flame propagation portion.

[0028] The propagation hole may include a plurality of first propagation holes formed in the first protrusion, and a second propagation hole formed in the second protrusion. The first propagation holes may be provided so that a spacing in a radial direction of the head between gas outlets of the first propagation holes in which the flame may be generated is larger than a spacing in a radial direction of the head between gas inlets of the first propagation holes. Accordingly, the merging between the flames in the gas outlets may be suppressed.

[0029] The first propagation hole may include a pair of first propagation holes spaced apart from each other in the radial direction, while the second propagation hole may be positioned between the pair of first propagation holes in the radial direction. Therefore, the plurality of first propagation holes and the second propagation hole may be arranged alternately with each other in the longitudinal direction of the flame propagation portion, and accordingly, the plurality of flames may be generated so as to be spaced from each other by a small spacing. This structure may facilitate the propagation of the flame.

[0030] A burner according to another embodiment may include a body; a cover disposed on top of the body and coupled to the body to define a mixing tube in which gas and air flow and are mixed with each other; and a head disposed on top of the cover and configured to generate a flame, wherein the head includes: a first flame generation portion disposed in a central area of the head and a second flame generation portion disposed in an outer area of the head.

[0031] The body, the cover, and the head are configured such that: the gas discharged from the mixing tube flows through the cover and flows to the central area of the cover, and then is divided into portions in the central area of the cover, and then one thereof flows into the first flame generation portion, and the other thereof flows to the outer area of the cover and flows into the second flame generation portion.

[0032] Accordingly, the burner may be configured such that the gas discharged from the single mixing tube may be supplied into the first flame generation portion and the second flame generation portion in a divided manner.

[0033] The head may include a spreading hole which connected to the second guide tube, wherein the gas may flow through the spreading hole.

[0034] The head may include a gas spreading portion through which the gas having flowed through the spreading hole spreads, wherein the gas spreading portion is a space surrounded with the upper surface of the head and the second flame generation portion, and the gas spreading portion extends along a circumference of the head.

[0035] The upper surface of the head has an inclined spreading surface disposed at a position where the spreading hole and the gas spreading portion are connected to each other, wherein the inclined spreading surface contacts each of both opposing ends of the spreading hole, and is inclined in a circumferential or radial direction of the head. The gas flowing along the inclined spreading surface may be spread uniformly throughout the gas spreading portion.

[0036] The gas that has flowed through the through-hole may flow from the outer area of the head to the central area of the head through the second guide tube and then may be divided into the portions.

[0037] One of the portions thereof reaches the first flame generation portion and is injected through the first flame hole, and is burned. The other of the portions of the gas flows from the central area of the head to the outer area of the head again through the second guide tube and flows through the spreading hole, and then, reaches the second flame generation portion, and is injected through the second flame hole and is burned.

[0038] In the burner according to the present disclosure, compared to a structure in which the external source is connected to a plurality of pipes, and a plurality of gas flow paths respectively connected to the plurality of pipes and the flame generation portions are provided independently of each other, an overall structure of the burner according to an embodiment of the present disclosure may be simplified. Furthermore, the burner according to an embodiment of the present disclosure may be connected to an external source through a single pipe. This simple structure allows for smooth flow of the gas inside the burner, improves burner performance, and saves a manufacturing cost of the burner.

[0039] Furthermore, in the burner according to the present disclosure, the first guide tube has the inclined guide surface formed on each of a distal end of the two divided portions thereof configured to change a flow direction of the gas so that the gas gradually rises upwardly. This structure may induce smooth flow of the gas. That is, the gas flowing through the first guide tube may be guided along the inclined guide surface so as to rises gradually, thereby allowing smooth flow of the gas.

[0040] Furthermore, in the burner according to the present disclosure, the through-hole may include the pair of the through-holes arranged circumferentially spaced apart from each other and disposed in the outer area of the cover. Therefore, compared to the case where gas flows into the head at one location, the gas flowing through the pair of through-holes spaced apart from each other may flow smoothly into the second flame generation portion or the central area of the head.

[0041] Furthermore, in the burner according to the present disclosure, the first propagation holes may be provided so that a spacing in a radial direction of the head between gas outlets of the first propagation holes in which the flame may be generated is larger than a spacing in a radial direction of the head between gas inlets of the first propagation holes. Due to this structure, the merging between the flames respectively generated in the first propagation holes adjacent to each other may be effectively suppressed.

[0042] Furthermore, in the burner according to the present disclosure, the plurality of first propagation holes and the second propagation hole may be arranged alternately with each other in the longitudinal direction of the flame propagation portion, and accordingly, the plurality of flames may be generated so as be spaced from each other by a small spacing. Therefore, the flame propagation portion may have a plurality of locations which are arranged in the longitudinal direction of the flame propagation portion and at which the flames are generated, and thus the flame may easily propagate along the flame propagation portion. Therefore, initial ignition or re-ignition of the first flame generation portion and the second flame generation portion may be facilitated.

[0043] Furthermore, in the burner according to the present disclosure, due to the gas discharge hole, the propagation hole, and the flame guiding portion arranged to be spaced apart from each other in the radial direction of the head, the flame may smoothly propagate from the first flame generation portion to the second flame generation portion or vice versa.

[0044] Due to smooth flame propagation between the first flame generation portion and the second flame generation portion, any extinguished flame generation portion may be immediately re-ignited. Thus, the performance of the burner may be improved.

[0045] Furthermore, in the burner according to the present disclosure, while the gas flowing into the gas spreading portion through the spreading hole flows further upwardly, the gas may be guided along the inclined spreading surface so as to smoothly spread into the gas spreading portion and then be uniformly distributed throughout the gas spreading portion. As a result, the second flame generation portion may receive a uniform supply of the gas in its circumferential direction and thus generate a uniform flame in its circumferential direction.

[0046] Furthermore, in the burner according to the present disclosure, the gas discharged from the single mixing tube may be divided into the portions which may be respectively supplied to the plurality of flame generation portions radially spaced apart from each other in the burner. Due to this structure, the flow channels for gas supply to the flame generation portions may be integrated with each other. The gas may be fed to the burner using a single supply pipe, and the flow channel structure in the burner may be simplified.

[0047] In addition to the above-mentioned effects, the specific effects of the present disclosure are described below along with the description of the specific details for carrying out the present disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0048]

FIG. 1 is a perspective view showing a burner according to one embodiment.

FIG. 2 is a side view of FIG. 1.

FIG. 3 is a rear view of FIG. 1.

FIG. 4 is an exploded top perspective view of FIG. 1.

FIG. 5 is an exploded bottom perspective view of FIG. 1.

FIG. 6 is a side cross-sectional view of a burner.

FIG. 7 is a perspective view showing a body and a cover of a burner.

FIG. 8 is an exploded view of FIG. 7.

FIG. 9 is a top view of FIG. 7.

FIG. 10 is a bottom view of FIG. 7.

FIG. 11 is a perspective view of a body.

FIG. 12 is a top view of FIG. 11.

FIG. 13 is a perspective view of a cover.

FIG. 14 is a bottom view of FIG. 13.

FIG. 15 is a top view of FIG. 13.

FIG. 16 is a perspective view showing a cover and a head.

FIG. 17 is an exploded top perspective view of FIG. 16.

FIG. 18 is a bottom perspective view of FIG. 16.

FIG. 19 is a top view of FIG. 16.

FIG. 20 is a perspective view of a head.

FIG. 21 is a bottom view of FIG. 20.

FIG. 22 is a top view of FIG. 20.

FIG. 23 is a view of FIG. 20 in a different direction.

FIG. 24 is an enlarged view of a portion 24 of FIG. 23.

FIG. 25 is an enlarged view of a portion 25 of FIG. 23.

FIG. 26 is a perspective view showing a state in which an outer cap and an inner cap are installed on a head.

FIG. 27 is a cross-sectional view of FIG. 26.

FIG. 28 is an enlarged view of a portion 28 of FIG. 27.

FIG. 29 is a perspective view showing an inner cap.

FIG. 30 is a diagram for illustrating flow of gas in a burner according to one embodiment.

FIG. 31 is an enlarged top view of a flame propagation portion of a head.

FIG. 32 is a diagram showing a state in which an outer cap and an inner cap are installed on the head in FIG. 31.

FIG. 33 is an enlarged perspective view of a flame propagation portion in a head.

FIG. 34 is a diagram for illustrating flow of gas in the flame propagation portion of the head.

FIG. 35 is a perspective view showing a burner according to another embodiment.

FIG. 36 is a side view of FIG. 35.

FIG. 37 is a rear view of FIG. 35.

FIG. 38 is an exploded top perspective view of FIG. 35.

FIG. 39 is an exploded bottom perspective view of FIG. 35.

FIG. 40 is a side cross-sectional view of a burner.

FIG. 41 is a perspective view showing a body and a cover of a burner.

FIG. 42 is an exploded view of FIG. 41.

FIG. 43 is a top view of FIG. 41.

FIG. 44 is a bottom view of FIG. 41.

FIG. 45 is a perspective view of a body.

FIG. 46 is a top view of FIG. 45.

FIG. 47 is a perspective view of a cover.

FIG. 48 is a bottom view of FIG. 47.

FIG. 49 is a top view of FIG. 47.

FIG. 50 is a perspective view showing a cover and a head.

FIG. 51 is an exploded top perspective view of FIG. 50.

FIG. 52 is a bottom perspective view of FIG. 50.

FIG. 53 is a top view of FIG. 50.

FIG. 54 is a perspective view of a head.

FIG. 55 is a bottom view of FIG. 54.

FIG. 56 is a top view of FIG. 54.

FIG. 57 is a view of FIG. 54 in a different direction.

FIG. 58 is an enlarged view of a portion 58 of FIG. 57.

FIG. 59 is an enlarged view of a portion 59 of FIG. 57.

FIG. 60 is a perspective view showing a state in which an outer cap and an inner cap are installed on a head.

FIG. 61 is a cross-sectional view of FIG. 60.

FIG. 62 is an enlarged view of a portion 62 of FIG. 61.

FIG. 63 is a perspective view showing an inner cap.

FIG. 64 is a diagram for illustrating flow of gas in a burner according to one embodiment.

DETAILED DESCRIPTIONS

[0049] The above-mentioned purposes, features, and advantages will be described in detail later with reference to the attached drawings. In describing the present disclosure, when it is determined that a detailed description of the publicly known technology related to the present disclosure may unnecessarily obscure the gist of the present disclosure, the detailed description thereof will be omitted. Hereinafter, a preferred embodiment according to the present disclosure will be described in detail with reference to the attached drawings. In the drawings, identical reference numerals are used to indicate identical or similar components.

[0050] It will be understood that, although the terms "first", "second", "third", and so on may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, a first element, component, region, layer or section described under could be termed a second element, component, region, layer or section.

[0051] As used herein, the singular constitutes "a" and "an" are intended to include the plural constitutes as well, unless the context clearly indicates otherwise.

[0052] It will be further understood that the terms "comprise", "comprising", "include", and "including" when used in this specification, specify the presence of the stated features, integers, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, operations, elements, components, and/or portions thereof.

[0053] Throughout the present disclosure, "A and/or B" means A, B, or A and B, unless otherwise specified, and "C to D" means C inclusive to D inclusive unless otherwise specified.

[0054] A burner according to an embodiment may be used in a gas range or a cooktop of a combined cooking appliance that uses both gas and electricity, and may receive gas from an external source and combust the gas to generate a flame.

[0055] The burner may be composed of two flame generation portions, and each of the two flame generation portions generally generates a flame having a ring shape. The two flame generation portions may generate an inner flame in a small ring shape and an outer flame in a large ring shape surrounding the small ring shape, respectively.

[0056] In this structure, it is common that separate gas flow paths are respectively formed for the two flame generation portions to deliver combusted gas between the two flame generation portions spaced apart from each other. In this general structure, a plurality of gas flow paths independent of each other should be provided in the burner.

[0057] Furthermore, since the burner is provided with multiple gas injection holes, a plurality of pipes connecting the external source and the gas injection holes of the burner to each other should be provided.

[0058] The burner of the above-described structure has a complicated structure to form a gas flow path, making the overall structure of the burner complicated. Therefore, due to the complicated structure, the gas does not flow smoothly, burner performance deteriorates, and a manufacturing cost increases.

[0059] To solve this problem, it is necessary to manufacture a burner that has a single gas injection hole and a gas flow path connected to the hole and divided into to a plurality of flame generation portions spaced apart from each other.

[0060] The burner according to an embodiment has a structure to solve the above-mentioned problems, and the burner according to an embodiment is described in detail below.

[First embodiment]

[0061] FIG. 1 is a perspective view showing a burner according to one embodiment. FIG. 2 is a side view of FIG. 1. FIG. 3 is a rear view of FIG. 1. The burner according to an embodiment may include a body 100, a cover 200, a head 300, an inner cap 420, and an outer cap 410.

[0062] The body 100 may constitute a lower portion of the burner and may be connected to an external source through a pipe so that the body may receive gas required for combustion from the external source. The cover 200 may be disposed on top of the body 100 and may be coupled to the body 100 to define a mixing tube 101 in which gas and air flow and are mixed with each other.

[0063] In the illustrated embodiment, the cover 200 and the body 100 are manufactured separately from each other. However, in another embodiment, the cover 200 and the body 100 may be integrated into a single body.

[0064] The mixing tube 101 may be a space in the burner. The gas flowing thereto from the external source and the air flowing into the burner from a surrounding around the burner may meet and be mixed with each other in the mixing tube 101. The gas may be mixed with air and thus may receive oxygen from the air necessary for combustion and thus may be burned in the head 300.

[0065] The mixing tube 101 may be formed by combining the body 100 and the cover 200 with each other. The body 100 may constitute approximately a lower half of the mixing tube 101, while the cover 200 may constitute approximately an upper half of the mixing tube 101.

[0066] The head 300 may be disposed on top of the cover 200, and the flame may be generated in the head 300. The head 300 may be coupled to the cover 200 to form a path through which gas flowing into the head 300 and the cover 200 through the body 100 flows. The gas flow path formed by combining the header and the cover 200 with each other may distribute the gas to a first flame generation portion 310 and a second flame generation portion 320, which are described in detail below.

[0067] The inner cap 420 may cover a top of the first flame generation portion 310 where the flame may be generated, and may control a spread direction of the flame so that the flame is directed outwardly in the radial direction of the head 300. The outer cap 410 may cover a top of the second flame generation portion 320 where the flame may be generated, and may control the spread direction of the flame so that the flame is directed outwardly in the radial direction of the head 300.

[0068] FIG. 4 is an exploded top perspective view of FIG. 1. FIG. 5 is an exploded bottom perspective view of FIG. 1. The head 300 may include a flame generation portion. In the flame generation portion, while gas is discharged outwardly of the burner, the gas is ignited by a spark plug (not shown), thereby generating a flame.

[0069] The head 300 may include the first flame generation portion 310 and the second flame generation portion 320 where the flame may be generated. The first flame generation portion 310 may be disposed in the central area of the head 300, and a plurality of first flame holes 311 may be defined in the first flame generation portion 310 and may be arranged along a circumference thereof.

[0070] The second flame generation portion 320 may be disposed in the outer area of the head 300 and may be disposed to surround the first flame generation portion 310. A plurality of second flame holes 321 may be defined in the second flame generation portion 320 and may be arranged along a circumference thereof. Therefore, when the flame may be generated in the burner, inner and outer ring-shaped flames may be generated in a double manner.

[0071] The gas flowing inside the burner may be discharged through the first flame hole 311 and the second flame hole 321. When the gas is ignited, a flame may be generated at the outlet of each of the first flame hole 311 and the second flame hole 321, such that the flame may be maintained while the gas is discharged.

[0072] The first flame generation portion 310 and the second flame generation portion 320 may be separate components and may be spaced apart from each other. Therefore, gas needs to be individually supplied to each of the first flame generation portion 310 and the second flame generation portion 320. In an embodiment, one mixing tube 101 may be used, and gas flowing thereto from one pipe may flow through the single mixing tube 101.

[0073] Therefore, the gas discharged from one mixing tube 101 should flow into the first flame generation portion 310 and the second flame generation portion 320, which are spaced apart from each other. For this reason, inside the burner, a flow channel needs to be formed to distribute the gas discharged from the mixing tube 101 to each of the first flame generation portion 310 in the central area and the second flame generation portion 320 in the outer area.

[0074] In the burner according to an embodiment, the body 100, the cover 200, and the head 300 are configured such that: the gas discharged from the mixing tube 101 is divided into two portions flowing (preferably in opposite directions) in an outer area of the body, then, the two portions of the gas flow through the cover 200, and then, a portion of each of the two portions flows into the second flame generation portion 320, while a remaining portion of each of the two portions flows from the outer area of the head 300 to the central area thereof and flows into the first flame generation portion 310.

[0075] In other words, the gas discharged from the mixing tube 101 may flow through the cover 200 and reach an outer area of a top of the cover 200. One portion of the gas may flow from the top of the cover 200 to the outer area of the head 300, flow through the head 300, reach a top of the head 300, and flow into the second flame generation portion 320 in the outer area of the head 300.

[0076] The other portion of the gas may flow from the outer area to the central area of the top of the cover 200, flow through the head 300, reach the top of the head 300, and flow into the first flame generation portion 310 in the central area of the head 300.

[0077] Due to this structure, the gas flowing into one common mixing tube 101 may be divided into the two portions inside the burner while flowing through the flow channel formed in the burner, and then the two portions may flow into the first flame generation portion 310 and the second flame generation portion 320, respectively.

[0078] Therefore, compared to a structure in which the external source is connected to a plurality of pipes, and a plurality of gas flow paths respectively connected to the plurality of pipes and the flame generation portions are provided independently of each other, an overall structure of the burner according to an embodiment of the present disclosure may be simplified. Furthermore, the burner according to an embodiment of the present disclosure may be connected to an external source through a single pipe. This simple structure allows for smooth flow of the gas inside the burner, improves burner performance, and saves a manufacturing cost of the burner.

[0079] FIG. 6 is a side cross-sectional view of the burner. In drawings as described below, flow of the gas is indicated using a solid arrow. Furthermore, in FIG. 6, the flow of air flowing into the burner from the surroundings is indicated using a hidden line arrow.

[0080] The body 100 may include an injection portion 130 and an air receiving portion 140. The injection portion 130 may be formed on one side of the body 100, and a gas injection hole 131 may be defined in the injection portion 130. The gas injection hole 131 may be formed to extend through the injection portion 130, and may have an inlet connected to a pipe connected to the external source that supplies gas.

[0081] The injection portion 130, the air receiving portion 140 and the mixing tube 101 may be arranged in a straight line. Due to this structure, the gas having flowed through the injection portion 130 may smoothly flow through the air receiving portion 140 and the mixing tube 101.

[0082] The gas injection hole 131 may be formed in the injection portion 130 so as to extend through the injection portion 130.

[0083] The air receiving portion 140 may be disposed between an inlet of the mixing tube 101 and an outlet of the injection portion 130. A space into which air is introduced and stored may be formed in the air receiving portion 140. In one example, an air guide 301 may protrude downwardly from the head 300 and may cover the space of the air receiving portion 140. The air guide 301 may be formed in a generally "U" shape so as to be combined with the air receiving portion 140 to form a space into which air flows.

[0084] The air guide 301 may cover the space of the air receiving portion 140, but may be coupled to the air receiving portion 140 to form a hole into which surrounding air flows in a rear side of the burner. Through the hole, air around the burner may flow into the space of the air receiving portion 140.

[0085] An inlet of the gas injection hole 131 may be relatively wide and an outlet thereof may be relatively narrow. For example, the outlet of the gas injection hole 131 may be provided with an orifice, so that the gas flowing into the body 100 through the gas injection hole 131 may be injected at a rapid speed from the outlet of the gas injection hole 131.

[0086] The gas injected from the outlet of the gas injection hole 131 may flow into the mixing tube 101 without being dispersed due to its rapid flow speed. At this time, the gas may meet the air flowing into the air receiving portion 140 while flowing through the air receiving portion 140, and, at the same time, the air may flow into the mixing tube 101.

[0087] While the gas flows through the mixing tube 101, the gas may be mixed with air which has been introduced into the air receiving portion 140, and then the mixture of the gas and the air may be discharged from the mixing tube 101. In this way, the gas may be mixed with the air in the mixing tube 101 and may be mixed with oxygen in the air. Thus, when the mixture is ignited by the spark plug, the mixture may be combusted.

[0088] The mixing tube 101 may be , for example, a Venturi tube. The Venturi tube may be formed so that a cross-sectional area of each of the inlet and the outlet thereof is relatively large, and a cross-sectional area of a central area thereof is relatively narrow.

[0089] Therefore, in a neck area as a narrow cross-sectional area of the central area of the mixing tube 101, the gas flow speed is the fastest in the mixing tube 101, such that the pressure may be lowered in the central area.

[0090] The mixing tube 101 may be the Venturi tube. Thus, the pressure in the neck area is lower than that of an area adjacent thereto. Thus, the air in the space of the air receiving portion 140 which has a relatively high pressure may smoothly flow into the mixing tube 101 due to the pressure difference and thus may be mixed with the gas in the mixing tube.

[0091] FIG. 7 is a perspective view showing the body 100 and the cover 200 of the burner. FIG. 8 is an exploded view of FIG. 7. FIG. 9 is a top view of FIG. 7. FIG. 10 is a bottom view of FIG. 7. FIG. 11 is a perspective view of the body 100. FIG. 12 is a top view of FIG. 11.

[0092] The body 100 may include a lower cell 110 and a first guide tube 120. The lower cell 110 may be depressed from an upper surface of the body 100 into the body 100 and may constitute a lower portion of the mixing tube 101. The lower cell 110 may constitute approximately the half of the mixing tube 101.

[0093] However, since at least a portion of an upper cell 220 formed on the cover 200 is received in a depressed space of the lower cell 110, the depressed space of the lower cell 110 constituting the mixing tube 101 may be deeper than a depth of the half of the mixing tube 101.

[0094] The first guide tube 120 may be connected to the outlet of the mixing tube 101 and may have two portions be connected to the outlet of the mixing tube 101 and extending in the circumferential direction of the body 100 and respectively in opposite directions. A portion of the first guide tube 120 may be closed with the cover 200, and the gas may flow in the first guide tube 120. A top of the first guide tube 120 may be closed with the cover 200 to form a gas flow path.

[0095] The first guide tube 120 may be connected to the outlet of the mixing tube 101 and may branch from a distal end of the mixing tube 101 into the two portions extending in the circumferential direction of the body 100. Therefore, as shown by the solid arrow in FIG. 12, the gas discharged from the mixing tube 101 and may be divided into two portions corresponding to the two portions of the first guide tube 120. Thus, the gas may flow in both opposing directions and in the circumferential direction of the body 100 along the two portions of the first guide tube 120 and may flow through a through-hole 210 of the cover 200 at the two portions of the first guide tube 120.

[0096] The gas is divided into the two portions flowing in both opposing directions and in the circumferential direction of the body 100 such that the portions of the gas may be respectively supplied to the first flame generation portion 310 and the second flame generation portion 320 which are spaced apart from each other, using one gas injection hole 131 equipped with the orifice and one mixing tube 101.

[0097] The body 100 may include a cover receiving groove 150, a first spark plug receiving hole 160, and an extension panel 170. The cover receiving groove 150 may be depressed from the upper surface of the body 100 into the body, and may have a shape corresponding to that of the cover 200 so that the cover 200 is received therein.

[0098] A hole into which fastening means such as a bolt is fastened may be formed in a bottom surface defining the cover receiving groove 150, and a corresponding hole thereto may be formed in the cover 200 so that the cover 200 may be coupled to the body 100 using the fastening means. Since the cover 200 is seated in the cover receiving groove 150, the cover 200 may be accurately positioned at a designated position of the body 100.

[0099] The first spark plug receiving hole 160 may be formed at a position overlapping with the cover 200, and the spark plug may be inserted and mounted in the first spark plug receiving hole 160. In one example, the cover 200 may have a second spark plug receiving hole 250 defined therein into which the spark plug is inserted at a position corresponding to the first spark plug receiving hole 160.

[0100] In the illustrated embodiment, the first spark plug receiving hole 160 may be disposed adjacent to the first flame generating portion 310 disposed in the central area of the burner. In this structure, the first flame generation portion 310 may be ignited first and the second flame generation portion 320 may be ignited later.

[0101] In another embodiment, the first spark plug receiving hole 160 may be disposed adjacent to the second flame generation portion 320 disposed in the outer area of the burner. In this structure, the second flame generation portion 320 may be ignited first and the first flame generation portion 310 may be ignited later.

[0102] The extension panel 170 may surround the cover receiving groove 150 and extend in a circumferential direction of the body 100. The extension panel 170 may generally be provided in a disk form. Holes into which the fastening means are inserted may be formed in the extension panel 170.

[0103] Accordingly, the burner may be mounted on a gas range or a combined cooking appliance by coupling the extension panel 170 to the gas range or the cooktop of the combined cooking appliance using the fastening means.

[0104] An inclined guide surface 121 may be formed on each of the two portions of the first guide tube 120 to change the flow direction of the gas so that the gas gradually rises. The gas flowing through the first guide tube 120 may rise along the two portions of the first guide tube 120 extending in the circumferential direction of the body 100 and in the opposite directions, and then may flow through the through-hole 210 of the cover 200.

[0105] When the flow direction of the gas in the first guide tube 120 suddenly changes from the circumferential direction of the body 100 to the upward direction, the gas may not flow smoothly. Therefore, in accordance with an embodiment, the inclined guide surfaces 121 may be respectively formed on the two portions of the first guide tube 120 extending in the circumferential direction of the body 100 and in the opposite directions to induce smooth flow of gas.

[0106] The inclined guide surface 121 is preferably formed as a flat surface. However, in another embodiment, the inclined guide surface 121 may be formed in a step-wise manner with a plurality of steps. Even when the inclined guide surface 121 is formed in the step-wise manner, the gas may gradually rise along the plurality of steps.

[0107] The gas flowing through the first guide tube 120 may be guided along the inclined guide surfaces 121 respectively formed on the two portions of the first guide tube 120 extending in the circumferential direction of the body 100 and in the opposite directions so as to gradually rise. Thus, the gas flow may be smooth.

[0108] The inclined guide surface 121 may have a constant width in a longitudinal direction. In another embodiment, the inclined guide surface 121 may become narrower as the inclined guide surface 121 extends in an upward direction. Conversely, the inclined guide surface 121 may become wider as the inclined guide surface 121 extends in an upward direction.

[0109] FIG. 13 is a perspective view of the cover 200. FIG. 14 is a bottom view of FIG. 13. FIG. 15 is a top view of FIG. 13. The cover 200 may have a smaller planar area than that of the body 100. As described above, the cover 200 may be seated in the cover receiving groove 150 of the body 100 and may be coupled to the cover 200 using the fastening means.

[0110] The cover 200 may include the through-hole 210 formed at a position that overlaps at least a portion of the first guide tube 120. The gas may flow through the through-hole 210. For example, a through-hole 210 through which gas passes may be formed in the cover 200 at a portion overlapping at least the inclined guide surface 121.

[0111] The gas gradually rising along the inclined guide surface 121 may flow through the cover 200 through the through-hole 210 and may flow into a top of the cover 200.

[0112] A width of the through-hole 210 may be equal to or larger than a width of the inclined guide surface 121.

[0113] Furthermore, the cover 200 may include the upper cell 220 constituting the mixing tube 101. The upper cell 220 may be formed to protrude downwardly toward the body 100, and may have an inner space defined therein so as to be depressed upwardly from a lower surface thereof into the upper cell 220. The inner space may constitute an upper portion of the mixing tube 101.

[0114] The upper cell 220 may constitute approximately a half of the mixing tube 101. However, the upper cell 220 may be inserted into a groove defined in the lower cell 110 of the body 100 to define the mixing tube 101.

[0115] In the illustrated embodiment, the upper cell 220 may be formed integrally with the cover 200. However, in another embodiment, the upper cell 220 may be formed as a separate structure from the cover 200. Furthermore, in still another embodiment, the upper cell 220 may be formed integrally with the lower cell 110.

[0116] In one example, the burner may include a second guide tube 230. The second guide tube 230 may be formed by combining the cover 200 and the head 300 with each other and may provide a space in which the gas flowing to the space from the body 100 may flow from the outer area of the head 300 to the central area thereof.

[0117] A portion of the gas discharged from the first guide tube 120 may flow to the central area of the head 300 through the second guide tube 230 and may be discharged through the first flame generation portion 310 and may be burned.

[0118] The cover 200 may include the through-hole 210 and a lower part 240. In addition to the above description, the through-hole 210 may be connected to the first guide tube 120 and allows gas to flow through therein. The gas may flow through the through-hole 210, and then, a portion thereof may flow into the second guide tube 230, and a remaining portion thereof may flow into the second flame generation portion 320.

[0119] The through-hole 210 may include a pair of through-hole spaced apart from each other and extending in the circumferential direction and in the outer area of the cover 200. Therefore, compared to the case where gas flows into the head 300 at one location, the gas flowing through the pair of through-holes 210 spaced apart from each other may flow smoothly into the second flame generation portion 320 or the central area of the head 300.

[0120] The lower part 240 may be formed so that a portion thereof surrounds the through-hole 210, and may protrude upwardly from the upper surface of the cover 200, and may constitute a lower portion of the second guide tube 230. The lower part 240 and an upper part 340 formed on the head 300 may be combined to each other to define the second guide tube 230.

[0121] The lower part 240 may include a first outer part 241, a first central part 242, and a first connection part 243. The first outer part 241 may be disposed in the outer area of the cover 200 so as to surround the through-hole 210, and may define a flow channel connected to the second flame generation portion 320, and may include a pair of first outer parts 241 arranged to be spaced apart from each other in the circumferential direction.

[0122] A portion of the gas flowing into the first outer part 241 may rise upward and flow into the second flame generation portion 320, and a remaining portion thereof may flow into the first connection part 243.

[0123] The first central part 242 may be formed in the central area of the cover 200 and may define a flow channel connected to the first flame generation portion 310.

[0124] The first connection part 243 may define a flow channel connecting an inner space of the first outer part 241 and an inner space of the first central part 242 to each other. Since the first outer part 241 includes a pair of first outer parts, the first connection part 243 may include a pair of first connection parts respectively connected to the pair of first outer parts 241.

[0125] Therefore, a portion of gas flowing into the first outer part 241 may flow to the first central part 242 through the first connection part 243. In this way, a portion of the gas flowing into the second guide tube through the through-hole 210 may flow from the outer area of the cover 200 to the central area thereof.

[0126] The gas flowing into the first connection part 243 may rise in the first central part 242. To ensure that gas flows smoothly, a bottom surface of the first connection part 243 and a bottom surface of the first central part 242 may constitute a continuous plane without formation of a step.

[0127] In one example, the pair of first outer parts 241 may be formed and arranged symmetrically with each other around a center of the cover 200. The pair of first connection parts 243 may be formed and arranged symmetrically with each other around a center of the cover 200.

[0128] The first central part 242 may be formed at a position that overlaps a core 370 of the head 300 in a vertical direction. Due to this structure, the gas that reaches the first central part 242 may flow smoothly to the core 370 and reach the first flame generation portion 310.

[0129] The lower part 240 may include a lower partitioning wall protruding upwardly from the upper surface of the cover 200, and the lower partitioning wall may surround the through-hole. The gas flowing through the through-hole may be guided along the lower partitioning wall so as to flow to the first connection part 243 and the first central part 242.

[0130] The lower partitioning wall may constitute walls of the first outer part 241, the first connection part 243 and the first central part 242. That is, the first outer part 241, the first connection part 243, and the first central part 242 may be constituted with the lower partitioning wall protruding upwardly from the upper surface of the cover 200.

[0131] In one example, the cover 200 may include a second spark plug receiving hole 250 into which the spark plug is inserted and mounted. The second spark plug receiving hole 250 may be positioned in a position corresponding to the first spark plug receiving hole 160 of the body 100. Therefore, depending on a location of the first spark plug receiving hole 160, the second spark plug receiving hole 250 may be disposed adjacent to the first flame generation portion 310 or adjacent to the second flame generation portion 320.

[0132] FIG. 16 is a perspective view showing a cover and a head. FIG. 17 is an exploded top perspective view of FIG. 16. FIG. 18 is a bottom perspective view of FIG. 16. FIG. 19 is a top view of FIG. 16.

[0133] Foreign substances may remain on the head 300 due to the use of the burner. Therefore, cleaning of the head 300 is necessary for hygiene purposes. To clean the head 300, the head 300 may be easily removed from the burner.

[0134] Therefore, for example, it is necessary to couple the head 300 and the cover 200 or the body 100 using the fastening means so that the user may easily remove the head 300 from the burner using the fastening means when necessary.

[0135] A structure is needed to guide a position of the head 300 so that the head 300 may be disposed in a correct position on the cover 200. For this guide, an insert protrusion 372 may be formed on the head 300, and a protrusion receiving groove 260 may be formed in the cover 200.

[0136] When the protrusion 372 of the head 300 is inserted into the protrusion receiving groove 260 of the cover 200, the head 300 may be disposed in the correct position on the cover 200. The insert protrusion 372 and the protrusion receiving groove 260 are additionally described below. Hereinafter, the head 300 is described in detail.

[0137] FIG. 20 is a perspective view of the head 300. FIG. 21 is a bottom view of FIG. 20. FIG. 22 is a top view of FIG. 20. FIG. 23 is a view of FIG. 20 in a different direction.

[0138] The head 300 may include a spreading hole 330 and the upper part 340. The spreading hole 330 may be connected to the through-hole 210 and may allow gas to flow therein. The gas flowing into the spreading hole 330 may flow into the second flame generation portion 320 and be burned therein.

[0139] The spreading hole 330 may include a pair of spreading holes disposed in the outer area of the head 300 at positions corresponding to the pair of through-holes 210, respectively. Since the spreading hole 330 and the through-hole 210 overlap each other vertically, a portion of the gas that has flowed through the through-hole 210 may flow through the spreading hole 330 and may spread in the circumferential direction of the upper surface of the head 300 and may flow into the second flame generation portion 320.

[0140] The upper part 340 may be formed so that a portion thereof surrounds the spreading hole 330, and may protrude downwardly from a lower surface of the head 300, and may be coupled to the lower part 240 to define an upper portion of the second guide tube 230. The lower part 240 of the cover 200 and the upper part 340 of the head 300 may be combined with each other to define the second guide tube 230.

[0141] The upper part 340 may include a second outer part 341, a second central part 342, and a second connection part 343. The second outer part 341 may surround the spreading hole 330 and may be disposed in the outer area of the head 300, and may define a flow channel connected to the second flame generation portion 320, and may include a pair of second outer parts spaced apart from each other in the circumferential direction.

[0142] A portion of the gas flowing into the second outer part 341 may rise upwardly and may flow into the second flame generation portion 320, and a remaining portion thereof may flow into the second connection part 343.

[0143] The second central part 342 may be formed in the central area of the head 300 and may define a flow channel connected to the first flame generation portion 310.

[0144] The second connection part 343 may define a flow channel connecting the inner space of the second outer part 341 and the inner space of the second central part 342. Since the second outer part 341 includes the pair of second outer parts, the second connection part 343 may include a pair of second connection parts respectively connected to the pair of second outer parts 341.

[0145] An opening may be formed in a side surface of the second central part 342, and this opening may be connected to the second outer part 341 through the second connection part 343.

[0146] In one example, the pair of second outer parts 341 may be formed and arranged symmetrically with each other around a center of the head 300. The pair of second connection parts 343 may be formed and arranged symmetrically with each other around a center of the head 300.

[0147] The upper part 340 may include an upper partitioning wall protruding downwardly from the lower surface of the head 300, and the upper partitioning wall may surround the through-hole 210 formed in the outer area of the cover 200. The gas flowing through through-hole 210 may be guided along the upper partitioning wall so as to flow to the second connection part 343 and the second central part 342.

[0148] The upper partitioning wall may constitute walls of the second outer part 341, the second connection part 343 and the second central part 342. That is, the second outer part 341, the second connection part 343, and the second central part 342 may be constituted by the upper partitioning wall protruding downwardly from the lower surface of the head 300.

[0149] To prevent the gas flowing into the second guide tube 230 from leaking out through a gap between the upper part 340 and the lower part 240, contact surfaces of the partitioning walls respectively constituting the upper part 340 and the lower part 240 contacting each other may have the same shape.

[0150] Accordingly, a portion of the gas flowing into the second outer part 341 may flow to the second central part 342 through the second connection part 343. In this way, the portion of the gas flowing into the second guide tube 230 through the through-hole 210 may flow from the outer area of the cover 200 or the head 300 to the central area thereof.

[0151] The gas that has flowed through the through-hole 210 may be divided into two portions which may flow to the first flame generation portion 310 and the second flame generation portion 320, respectively, and may be injected through the first flame hole 311 and the second flame hole 321, respectively and finally, may be burned.

[0152] More specifically, the gas that has flowed through the through-hole 210 may be divided into two portions. One portion thereof may flow through the spreading hole 330, may reach the second flame generation portion 320, and may be injected through the second flame hole 321 and may be finally burned. Since the through-hole 210 and the spreading hole 330 overlap each other in the vertical direction of the burner, the portion of the gas may continue to rise up through the through-hole 210 and then the spreading hole 330 and then may flow into the second flame generation portion 320 on top of the spreading hole 330.

[0153] Furthermore, the remaining portion of the gas that has flowed through the through-hole 210 may flow from the outer area of the head 300 to the central area of the head 300 along the second guide tube 230 and may reach the first flame generation portion 310, and may be injected thorough the first flame hole 311.

[0154] The second guide tube 230 may include a first space defined by combining the first outer part 241 and the second outer part 341 with each other, a second space defined by combining the first connection part 243 and the second connection part 343 with each other, and a third space defined by combining the first central part 242 and the second central part 342 with each other.

[0155] The gas flows into the first space from an outside out of the second guide tube 230, and a portion of the gas flowing into the first space may flow through the second space and into the third space in the central area of the head 300. The gas merged in the central area of the head 300 rises up and flows through a hole defined in the central area of the head 300, and may reach the first flame generation portion 310 connected to the hole.

[0156] In this way, the gas that has flowed through the through-hole 210 may be divided into the two portions in the second guide tube 230. One thereof may reach the first flame generation portion 310 while the other one thereof may reach the second flame generation portion 320.

[0157] The first flame generation portion 310 may be disposed in the central area of the head 300 and may protrude upwardly from the upper surface of the head 300. Furthermore, the second flame generation portion 320 may protrude upwardly from the upper surface of the head 300 in the outer area of the head 300. Accordingly, the second flame generation portion 320 may surround the first flame generation portion 310.

[0158] The head 300 may include a gas spreading portion 350 and a flame propagation portion 360. The gas spreading portion 350 may be a space in which the gas flowing through the spreading hole 330 spreads and which is surrounded with the upper surface of the head 300 and the second flame generation portion 320, and may extend along the circumference of the head 300.

[0159] The gas spreading portion 350 may be a space connected to the second flame generation portion 320, and may extend in a ring shape with a constant width and may be positioned inwardly of the second flame generation portion 320. Accordingly, the gas that has flowed through the spreading hole 330 may spread along the gas spreading portion 350 and on the upper surface of the head 300 and flow into the second flame generation portion 320 uniformly in the circumferential direction of the second flame generation portion 320.

[0160] An inclined spreading surface 361 may be disposed at a location adjacent to the spreading hole 330 to facilitate the flow and spread of gas. That is, the inclined spreading surface 361 may be defined on the upper surface of the head 300 and at an area where the spreading hole 330 and the gas spreading portion 350 are connected to each other, and may constitute each of both opposing ends of the spreading hole 330. The inclined spreading surface 361 may be inclined in the circumferential or radial direction.

[0161] The inclined spreading surface 361 may be formed on the upper surface of the head 300 so as to be inclined in the circumferential or radial direction. Due to the inclined spreading surface 361, a planar area size of the spreading hole 330 may increases as the spreading hole 330 extends upwardly.

[0162] Accordingly, while the gas flowing into the gas spreading portion 350 through the spreading hole 330 may flow further upwardly, the gas may be guided along the inclined spreading surface 361 so as to smoothly spread into the gas spreading portion 350 and then be uniformly distributed throughout the gas spreading portion 350. As a result, the second flame generation portion 320 may receive a uniform supply of the gas in its circumferential direction and thus generate a uniform flame in its circumferential direction.

[0163] The flame propagation portion 360 may occupy a partial area of the gas spreading portion 350 such that the gas spreading portion 350 may be discontinuous at the flame propagation portion 360. The flame propagation portion 360 may be a space in which the flame propagates between the first flame generation portion 310 and the second flame generation portion 320.

[0164] The flame propagation portion 360 may serve as a passage supplying secondary air (outside air) to the first flame generation portion 310. The flame propagation portion 360 may be a space extending through the second flame generation portion 320. Therefore, the secondary air outside the second flame generation portion 320 may be smoothly introduced into the first flame generation portion 310 through the flame propagation portion 360.

[0165] In one example, the secondary air may flow directly into the first flame generation portion 310 even in the vicinity of the first flame generation portion 310.

[0166] Furthermore, the flame may be generated in the flame propagation portion 360, and the flame may flow from the first flame generation portion 310 to the second flame generation portion 320 or from the second flame generation portion 320 to the first flame generation portion 310 through the flame propagation portion 360.

[0167] Therefore, the flame generated in the first flame generation portion 310 may flow to the second flame generation portion 320, or conversely, the flame generated in the second flame generation portion 320 may flow to the first flame generation portion 310. Accordingly, the flame may always exist in the first flame generation portion 310 and the second flame generation portion 320 while the gas is supplied thereto.

[0168] When a flame is not ignited or is extinguished in one flame generation portion, the flame of another flame generation portion may flow through the propagation portion, thereby generating a flame in the flame generation portion where there is no flame.

[0169] The head 300 may include a spreading portion-defining protrusion 362 and a propagation portion-defining protrusion 363. The spreading portion-defining protrusion 362 may be disposed between the first flame generation portion 310 and the second flame generation portion 320, protrude upwardly from the upper surface of the head 300, extend in the circumferential direction of the head 300, and surround the gas spreading portion 350.

[0170] The gas spreading portion 350 may be a space surrounded with the second flame generation portion 320, the upper surface of the head 300, the spreading portion-defining protrusion 362, and the outer cap 410.

[0171] The propagation portion-defining protrusion 363 may protrude upwardly from the upper surface of the head 300 and may include a pair of propagation portion-defining protrusions respectively disposed on both opposing sides of the flame propagation portion 360 to define the flame propagation portion 360. The propagation portion-defining protrusion 363 may isolate the gas spreading portion 350 and the flame propagation portion 360 from each other.

[0172] Referring to FIG. 23, the propagation portion-defining protrusion 363 may be formed to be inclined in the radial direction of the head 300. For example, a height in the vertical direction of the propagation portion-defining protrusion 363 may become smaller as the propagation portion-defining protrusion 363 extends inwardly in the radial direction of the head 300. In other words, a depth of the flame propagation portion 360 defined by the propagation portion-defining protrusions 363 may become smaller than as the flame propagation portion 360 extends inwardly in the radial direction of the head 300.

[0173] The propagation portion-defining protrusion 363 may have a through-hole extending therethrough, so that the gas in the gas spreading portion 350 is discharged to the flame propagation portion 360 through this through-hole. The flame may be generated at an outlet of the through-hole, and then, this flame may propagate from the first flame generation portion 310 to the second flame generation portion 320 through the flame propagation portion 360 or vice versa.

[0174] FIG. 24 is an enlarged view of a portion 24 of FIG. 23. FIG. 24 shows the first flame generation portion 310. FIG. 25 is an enlarged view of a portion 25 of FIG. 23. FIG. 25 shows the second flame generation portion 320.

[0175] The flame generation portion may include the flame hole through which gas is sprayed. A flame may be generated at an outlet of the flame hole. The first flame generation portion 310 may include the first flame hole 311, and the second flame generation portion 320 may include the second flame hole 321.

[0176] The first flame hole 311 or the second flame hole 321 may be depressed into the upper end of the first flame generation portion 310 or the second flame generation portion 320. The first flame hole 311 may be covered with the inner cap 420, and the second flame hole 321 may be covered with the outer cap 410 so that a top of each of the first and second flame holes may be blocked.

[0177] Depression depths of neighboring flame holes in the first flame generation portion 310 or the second flame generation portion 320 may be different from each other. For example, the first flame generation portion 310 may have deep first flame holes 311a and shallow first flame holes 311b arranged alternately with each other along the circumference. The deep second flame holes 321a and the shallow second flame hole s321b may be alternately arranged each other along the circumference of the second flame generation portion 320.

[0178] The depression depth of the flame hole may be proportional to an amount of gas discharged to the outside through the flame hole. Furthermore, a size and a length of the flame may be proportional to the discharged gas amount through the flame hole.

[0179] Therefore, the deeper the depression depth of the flame hole, the larger the size of the flame generated at the outlet of the flame hole. As the size of the flame increases, a likelihood at which adjacent flames merge with each other increases.

[0180] When the size of the flame becomes larger due to the merging, the gas inside the flame may not contact the air, which may lead to incomplete combustion of the gas. Therefore, it is necessary to suppress the merging to suppress incomplete combustion.

[0181] In an embodiment, a relatively deep flame hole may be disposed between relatively shallow flame holes. Due to this structure, a spacing between large flames highly likely to merge with each other may be increased, and the relatively small flame may be placed therebetween, such that the merging between neighboring flames may be effectively suppressed.

[0182] Further, when the flame generation portion is formed only to have relatively shallow flame holes, the gas amount discharged from the flame generation portion is small, so that the burner cannot generate sufficient fire power. In an embodiment, a plurality of relatively deep flame holes may be arranged such that the gas may be sufficiently discharged to the outside through the flame holes.

[0183] FIG. 26 is a perspective view showing a state in which the outer cap 410 and the inner cap 420 are installed on the head 300. FIG. 27 is a cross-sectional view of FIG. 26. FIG. 28 is an enlarged view of a portion 28 of FIG. 27. FIG. 29 is a perspective view showing the inner cap 420.

[0184] The burner may include the outer cap 410 and the inner cap 420 that cover the flame generation portion. The outer cap 410 may be disposed on an upper end of each of the second flame generation portion 320 and the spreading portion-defining protrusion 362 and may cover the gas spreading portion 350. The outer cap 410 may be disposed on the head 300 and cover an upper end of the gas spreading portion 350.

[0185] Referring to FIG. 27, the outer cap 410 may have an inclined cross sectional shape. For example, the outer cap 410 may be formed so that its cross-sectional shape is gradually inclined upwardly as the outer cap extends outwardly in the radial direction.

[0186] The inner cap 420 may be disposed on an upper end of the first flame generation portion 310 and may cover the upper end of the first flame generation portion 310 and the upper end of the space where the gas is merged and flows to the first flame generation portion 310.

[0187] The head 300 may include the core 370, a side portion 380, and a support 390. The core 370 may be disposed in the central area of the head 300, and the first flame generation portion 310 may be formed at an upper end of the core. The inner cap 420 may be disposed on the upper end of the core 370.

[0188] The side portion 380 occupies the outer area of the head 300 and the gas spreading portion 350 may be defined in the side portion 380. The core 370 and the side portion 380 may be arranged to be spaced apart from each other, and may be connected to each other via the support 390 and the pair of second connection parts 343.

[0189] The support 390 may connect the core 370 and the side portion 380 to each other and may support the core 370. The pair of second connection parts 343 and the support 390 may connect the core 370 and the side portion 380 to each other, and may be spaced apart from each other in the circumferential direction. A space may be defined between each of the pair of second connection parts 343 and the support 390.

[0190] The first flame generation portion 310 may be formed to protrude from an outer area of the core 370. In the core 370 and in an area inwardly of the first flame generation portion 310, a space may be defined where portions of the gas flowing into the core 370 through the second guide tube 230 are merged with each other.

[0191] The core 370 may include a plurality of guide protrusions 371 that protrude upward and are spaced apart from each other in the circumferential direction, and guides a mounting position of the inner cap 420. The inner cap 420 may include a guide ring 421 which protrudes downwardly and is formed to surround the guide protrusions 371 and contacts the guide protrusions 371.

[0192] In order for the inner cap 420 to be stably disposed on the upper end of the core 370, the guide protrusions 371 may be formed on the core 370, and the guide ring 421 may be formed on the inner cap 420.

[0193] The guide protrusion 371 may include a plurality of guide protrusions spaced apart from each other in the circumferential direction. When the inner cap 420 is placed on the core 370, the guide protrusions 371 may be located inwardly of the guide ring 421 so as to contact the guide ring. The position of the inner cap 420 may be guided along the guide protrusions 371, and thus may not deviate laterally from the core 370.

[0194] Due to this structure, the inner cap 420 may be stably disposed in the designed position on the upper end of core 370 and may maintain its position.

[0195] The core 370 may include a supporter 373 that contacts a lower surface of the inner cap 420 and supports the inner cap 420. The supporter 373 may be formed to be inclined gradually upwardly as the support extends inwardly of the core 370. The inner cap 420 may be disposed on an upper surface of the supporter 373.

[0196] The guide protrusion 371 may be formed to protrude from an upper end of the supporter 373. Each of the lower surface and the upper surface of the supporter 373 may extend in a generally straight line.

[0197] The gas discharged from the flame holes of the first flame generation portion 310 or the second flame generation portion 320 may be mixed with the secondary air around the flame generation portion to increase combustion efficiency. Since the second flame generation portion 320 is disposed in the outer area of the burner, the gas discharged from the second flame hole 321 may actively contact the surrounding secondary air.

[0198] However, since the first flame generation portion 310 may be disposed on the core 370 disposed in the central area of the burner, a contact area thereof in contact with the surrounding air may be reduced due to the outer cap 410 and other structures.

[0199] Considering this problem, in accordance with an embodiment, a vertical level of the first flame generation portion 310 may be higher than that of the spreading portion-defining protrusion 362. Due to this structure, a vertical level of the first flame generation portion 310 may be higher than that of the outer cap 410. Thus, a contact area of the first flame generation portion 310 with the surrounding air may be increased.

[0200] Therefore, the first flame generation portion 310 smoothly contacts the surrounding air, such that the gas discharged from the first flame generation portion 310 smoothly receives the surrounding secondary air, and thus incomplete combustion due to insufficient supply of the secondary air may be suppressed.

[0201] The core 370 may include the insert protrusion 372 protruding downwardly and inserted into the groove defined in the cover 200. The cover 200 may include the protrusion receiving groove 260 depressed from the upper surface of the cover into the cover, and formed in an area corresponding to the insertion protrusion 372. The insert protrusion 372 may be inserted into the protrusion receiving groove 260. The insert protrusion 372 may include at least one insert protrusion 372. The protrusion receiving groove 260 may include at least one protrusion receiving groove 260.

[0202] In order that the head 300 is easily attached to and detached from the cover 200 and, at the same time, the head and the cover are coupled to each other at a designed position, a structure is needed to guide the positions thereof. Therefore, the core 370 may be provided with the insert protrusion 372, and the cover 200 may be provided with the protrusion receiving groove 260.

[0203] Due to this structure, the head 300 may be stably disposed at the designed position on an upper end of the cover 200 and may maintain its position.

[0204] FIG. 30 is a diagram for illustrating flow of gas in a burner according to one embodiment. In an embodiment, the gas discharged from one mixing tube 101 may flow into the first guide tube 120 and the second guide tube 230. In the first guide tube 120, the gas may be divided into the two portions flowing in the opposite directions and in the circumferential direction. Then, the two portions may flow through the cover. Then, a portion of each of the two portions may flow to the second flame generation portion 320 disposed in the outer area of the burner, and a remaining portion thereof may flow to the first flame generation portion 310 disposed in the central area of the burner.

[0205] Specifically, while the gas flows through the mixing tube 101, the gas may be mixed with primary air. Then, the mixture of the gas and the air may be discharged from the mixing tube 101, and then flow into the first guide tube 120. In the first guide tube 120, the gas may be divided into the two portions flowing in the opposite directions and in the circumferential direction of the body.

[0206] A location where the first guide tube 120 and the mixing tube 101 meet each other may be a position at which the two portions of the first guide tube 120 extending in the opposite directions and in the circumferential direction of the body meet each other. Thus, the gas may be divided into the two portions in a corresponding manner to the two portions of the first guide tube 120 and may flow in the circumferential direction. The two portions of the gas flowing in the opposite directions and in the circumferential direction may flow through the pair of through-holes 210 spaced from each other, respectively and may flow into the second guide tube 230.

[0207] The gas flowing into the second guide tube 230 may be divided into two portions which may be fed to the first flame generation portion 310 and the second flame generation portion 320, respectively.

[0208] A portion of the gas flowing into the second guide tube 230 may flow through the spreading hole 330 and may spread in the gas spreading portion 350 on the upper surface of the head 300, and may flow uniformly into the second flame generation portion 320 along the circumference of the second flame generation portion 320 disposed in the outer area of the head 300, and then may be discharged through the second flame hole 321 and may be burned to generate the outer flame.

[0209] A remaining portion of the gas flowing into the second guide tube 230 may flow to the central area of the head 300 through the space defined by the first connection part 243 and the second connection part 343, and may flow upwardly in the central area of the head 300, and may flow into the first flame generation portion 310, and may be discharged through the first flame hole 311 and may be burned to generate the inner flame.

[0210] In an embodiment, the gas discharged from the single mixing tube 101 may be divided into the portions which may be respectively supplied to the plurality of flame generation portions radially spaced apart from each other in the burner. Due to this structure, the flow channels for gas supply to the flame generation portions may be integrated with each other. The gas may be fed to the burner using a single supply pipe, and the flow channel structure in the burner may be simplified.

[0211] The burner may generally be provided with the plurality of flame generation portions. The ring-shaped flame generation portions may be arranged to be spaced apart from each other in the radial direction of the burner.

[0212] In this structure, a structure is needed to propagate the flame from one flame generation portion to another flame generation portion. For example, at the time of initial ignition, the flame may be first generated in one flame generation portion among the plurality of flame generation portions, and then, the generated flame may propagate therefrom to another flame generation portion to generate the flame.

[0213] Furthermore, when the fire is extinguished in any one flame generation portion of the plurality of flame generation portions due to disturbance such as wind, the flame of the flame generation portion of another flame generation portion that is being burned may propagate to the extinguished flame generation portion, thereby generating a flame again in the extinguished flame generation portion.

[0214] Accordingly, a propagating structure that may propagate the flame between adjacent ones of the plurality of flame generation portions is needed. This flame propagating structure allows the flame to propagate smoothly between the flame generation portions, and furthermore, the propagating structure needs to have a structure that suppresses increase in incomplete combustion.

[0215] To achieve the above purpose, the burner according to an embodiment may be provided with the flame propagation portion 360 for propagating a flame between adjacent ones of the plurality of flame generation portions. Hereinafter, the flame propagation portion 360 is described in detail.

[0216] FIG. 31 is an enlarged top view of the flame propagation portion 360 of the head 300. FIG. 32 is a diagram showing a state in which the outer cap 410 and the inner cap 420 are installed on the head 300 in FIG. 31.

[0217] The head 300 may include the first flame generation portion 310 disposed in the central area thereof, and having the plurality of first flame holes 311 arranged along the circumference thereof. Furthermore, the head 300 may include the second flame generation portion 320 which may be disposed in the outer area thereof and may be disposed to surround the first flame generation portion 310, and have the plurality of second flame holes 321 arranged along the circumference thereof.

[0218] The flame propagation portion 360 may be a space in which a flame propagates between the first flame generation portion 310 and the second flame generation portion 320. A flame may be generated in the flame propagation portion 360, and the generated flame may flow to the first flame generation portion 310 or the second flame generation portion 320.

[0219] When the burner is first ignited, the flame may propagate along the flame propagation portion 360, so that both the first flame generation portion 310 and the second flame generation portion 320 may be ignited.

[0220] For example, in an example in which the spark plug is located adjacent to the first flame generation portion 310, when the spark plug operates, the flame may be generated in the first flame generation portion 310, and then the flame generated in the first flame generation portion 310 may propagate along the flame propagation portion 360 to ignite the second flame generation portion 320.

[0221] Conversely, in another example in which the spark plug is located adjacent to the second flame generation portion 320, when the spark plug operates, the flame may be generated in the second flame generation portion 320, and then the flame generated in the second flame generation portion 320 may propagate along the flame propagation portion 360 to ignite the first flame generation portion 310.

[0222] Furthermore, for example, when the burner is operating in a simmer mode in which the burner generates a low-heat flame, the discharged gas amount is small and the size of the flame is small, so that the flame of any one flame generation portion among the plurality of flame generation portions may be extinguished due to disturbances such as wind.

[0223] When the fire of the first flame generation portion 310 is extinguished due to the disturbance, the flame generated in the second flame generation portion 320 may propagate along the flame propagation portion 360 to re-ignite the first flame generation portion 310. Conversely, when the flame in the second flame generation portion 320 is extinguished due to the disturbance, the flame generated in the first flame generation portion 310 may propagate along the flame propagation portion 360 to re-ignite the second flame generation portion 320.

[0224] The head 300 may include the propagation portion-defining protrusion 363 which protrudes upwardly from the upper surface of the head and includes a pair of propagation portion-defining protrusions respectively disposed on both opposing sides of the flame propagation portion 360 so as to define the flame propagation portion 360 therebetween. The propagation portion-defining protrusion 363 may include a propagation hole 3631 that discharges the gas to the flame propagation portion 360.

[0225] The propagation portion-defining protrusion 363 may have a longitudinal direction equal to the radial direction of the head 300. The pair of propagation portion-defining protrusions 363 may be arranged to be spaced apart from each other in the circumferential direction of the head 300. The propagation portion-defining protrusion 363 may spatially isolate the gas spreading portion 350 and the flame propagation portion 360 from each other.

[0226] The propagation hole 3631 may be formed to extend through the propagation portion-defining protrusion 363, and may be depressed from an upper surface of the propagation portion-defining protrusion 363 into the propagation portion-defining protrusion. The propagation portion-defining protrusion 363 may have an open upper end covered with the outer cap 410.

[0227] The gas spreading portion 350 and the flame propagation portion 360 may be connected to each other via the propagation hole 3631. Accordingly, the gas filling the gas spreading portion 350 may be discharged to the flame propagation portion 360 through the propagation hole 3631. The flame in the first flame generation portion 310 or the second flame generation portion 320 may propagate from the outlet of the propagation hole 3631 such that the gas may be ignited and burned.

[0228] The propagation portion-defining protrusion 363 may include a first protrusion 363a and a second protrusion 363b. The first protrusion 363a may be spaced apart from the second protrusion 363b in the circumferential direction and may define the flame propagation portion 360. The second protrusion 363b may be spaced apart from the first protrusion 363a in the circumferential direction. The flame propagation portion 360 may be defined between the first protrusion 363a and the second protrusion 363b.

[0229] The propagation portion-defining protrusion 363 may include a pair of protrusions, that is, the first protrusion 363a and the second protrusion 363b. The propagation hole 3631 may be defined in each of the first protrusion 363a and the second protrusion 363b. The propagation holes 3631 respectively defined in the first protrusion 363a and the second protrusion 363b may be positioned asymmetrically with each other.

[0230] The propagation hole 3631 may be depressed into an upper end of the propagation portion-defining protrusion 363 so as to extend through the propagation portion-defining protrusion 363. The number and the orientation of the propagation holes 3631 formed in the first protrusion 363a may be different from the number and the orientation of the propagation holes 3631 formed in the second protrusion 363b.

[0231] The propagation hole 3631 may include a plurality of first propagation holes 3631a formed in the first protrusion 363a, and a second propagation hole 3631b formed in the second protrusion 363b. However, in the drawing of an embodiment, a single second propagation hole 3631b is shown. However, in some further embodiments, the number of the second propagation holes 3631b may be at least two.

[0232] In a case in which the multiple propagation holes 3631 connected to the flame propagation portion 360 are formed, the flame may be easily propagated even when the burner operates at low heat, compared to a case where only one propagation hole 3631 connected to the flame propagation portion 360 is formed.

[0233] However, when the multiple propagation holes 3631 are formed, a distance between the propagation holes 3631 may become smaller such that a flame merging phenomenon may occur. For this reason, the plurality of first propagation holes 3631a may be formed so that the distance between adjacent ones thereof increases as each of the first propagation holes 3631a extends from an inlet to an outlet thereof, that is, extends toward the flame propagation portion 360.

[0234] Accordingly, a spacing between the flames at the outlets of the first propagation holes 3631a where the flames may be generated may be sufficiently larger, so that the occurrence of the merging between the flames may be suppressed.

[0235] Each of the plurality of first propagation holes 3631a may extend in a longitudinal direction thereof which may be inclined with respect to the circumferential direction. To the contrary, the second propagation hole 3631b may extend in a longitudinal direction thereof which may be parallel to the circumferential direction. Therefore, a length in the longitudinal direction of the first propagation hole 3631a may be larger than that of the second propagation hole 3631b.

[0236] The first propagation holes 3631a may be positioned to be symmetrical with each other around the circumferential direction of the head. The plurality of first propagation holes 3631a may connect the gas spreading portion 350 and the flame propagation portion 360 to each other. Based on a flow direction of the gas, a point of the first propagation hole 3631a connected to the gas spreading portion 350 may be the inlet of the first propagation hole 3631a, and a point thereof connected to the flame propagation portion 360 may be the outlet of the first propagation hole 3631a.

[0237] The plurality of first propagation holes 3631a may be positioned so that the distance between adjacent ones thereof may increase as each of the first propagation holes 3631a extends from the inlet to the outlet thereof.

[0238] That is, the spacing between the gas outlets of the first propagation holes 3631a from which the gas are discharged and at which the first propagation holes 3631a are connected to the flame propagation portion 360 may be larger than the spacing between the gas inlets of the first propagation holes 3631a into which the gas flow and at which the first propagation holes 3631a are connected to the gas spreading portion 350. This structure may suppress the merging between the flames discharged from neighboring first propagation holes 3631a.

[0239] The flame propagating from the first flame generation portion 310 or the second flame generation portion 320 may ignite the gas at the gas outlet of the first propagation hole 3631a to generate a flame. In this regard, when the spacing between the outlets of the first propagation holes 3631a is small, the merging between the flames generated at the outlets of the first propagation holes 3631a may occur.

[0240] When the merging occurs, a volume of the flame increases such that the air may not be fed into the flame, thereby increasing a probability of the incomplete combustion throughout the flame. Thus, emission of carbon monoxide as a product of the incomplete combustion of gas may increase. Carbon monoxide is a harmful substance. Thus, a production thereof needs to be suppressed.

[0241] Therefore, in order to reduce the occurrence of the incomplete combustion in the flame propagation portion 360, it is necessary to suppress the merging between the flames respectively generated in the gas outlets of the plurality of first propagation holes 3631a.

[0242] The first propagation holes 3631a according to an embodiment may be constructed such that the spacing in the radial direction of the head 300 between the gas outlets of the first propagation holes 3631a where the flame may be generated may be large, as described above. Due to this structure, the merging between the flames respectively generated in the adjacent first propagation hole 3631a may be effectively suppressed.

[0243] As described above, the first propagation hole 3631a may include a pair of first propagation holes 3631a spaced apart from each other in the radial direction of the head 300. In this regard, the second propagation hole 3631b may be disposed between the pair of first propagation holes 3631a in the radial direction of the head 300.

[0244] A point of the second propagation hole 3631b connected to the flame propagation portion 360 may become a gas outlet through which the gas input from the gas spreading portion 350 is discharged. The flame propagating from the first flame generation portion 310 or the second flame generation portion 320 may ignite the gas at the gas outlet to generate the flame.

[0245] Due to this structure, in the flame propagation portion 360, the plurality of first propagation holes 3631a and the second propagation holes 3631b may be alternately arranged with each other in a longitudinal direction of the flame propagation portion 360, that is, in the radial direction of the head 300. The flames may be generated at the outlets of the plurality of first propagation holes 3631a and the second propagation holes 3631b.

[0246] The flame may move in the longitudinal direction of the flame propagation portion 360 and thus may propagate between the first flame generation portion 310 and the second flame generation portion 320. Therefore, in accordance with an embodiment, the plurality of first propagation hole 3631a and the second propagation hole 3631b may be arranged alternately with each other in the longitudinal direction of the flame propagation portion 360, and thus the plurality of flames respectively generated at the outlets of the plurality of first propagation holes 3631a and the second propagation holes 3631b may be arranged to be spaced from each other by a small spacing.

[0247] Therefore, the flame propagation portion 360 may have a plurality of locations which are arranged in the longitudinal direction of the flame propagation portion 360 and at which the flames are generated, and thus the flame may easily propagate along the flame propagation portion 360. Therefore, initial ignition or re-ignition of the first flame generation portion 310 and the second flame generation portion 320 may be facilitated.

[0248] Furthermore, the first propagation holes 3631a and the second propagation hole 3631b may be alternately arranged with each other in the length direction of the flame propagation portion 360. In other words, the first propagation hole 3631a and the second propagation hole 3631b may not overlap each other in the circumferential direction of the head.

[0249] This structure may effectively suppress the merging between the flames respectively generated in the outlets of the first propagation hole 3631a and the second propagation hole 3631b, thereby reducing the occurrence of the incomplete combustion. However, when the first propagation hole 3631a and the second propagation hole 3631b overlap each other in the circumferential direction of the head, the merging between the flames respectively generated in the outlets of the first propagation hole 3631a and the second propagation hole 3631b may occur.

[0250] FIG. 33 is an enlarged perspective view of the flame propagation portion 360 of the head 300. The second flame generation portion 320 may protrude upwardly from the upper surface of the head 300 in the outer area of the head 300. The second flame generation portion 320 may be connected to the propagation portion-defining protrusion 363 at an end thereof.

[0251] The head 300 may include the gas spreading portion 350 and the spreading portion-defining protrusion 362. The gas spreading portion 350 may be a space surrounded with the upper surface of the head 300 and the second flame generation portion 320 and may extend along the circumference of the head 300. The gas spreading portion 350 may be isolated from the flame propagation portion 360 via the propagation portion-defining protrusion 363.

[0252] The spreading portion-defining protrusion 362 may be disposed between the first flame generation portion 310 and the second flame generation portion 320 and may protrude upwardly from the upper surface of the head 300. The spreading portion-defining protrusion 362 may extend in the circumferential direction of the head 300 and may surround the gas spreading portion 350.

[0253] The propagation portion-defining protrusion 363 may have one end connected to the second flame generation portion 320 and the other end connected to the spreading portion-defining protrusion 362. Due to this structure, the gas spreading portion 350 may be defined by the second flame generation portion 320, the propagation portion-defining protrusion 363, and the spreading portion-defining protrusion 362.

[0254] The propagation portion-defining protrusion 363 may be connected to the second flame generation portion 320 and the spreading portion-defining protrusion 362 which protrude from the upper surface of the head, and may spatially separate the gas spreading portion 350 and the flame propagation portion 360 from each other.

[0255] The spreading portion-defining protrusion 362 may include a gas discharge hole 3621 which may be depressed from an upper surface of the spreading portion-defining protrusion 362 into the spreading portion-defining protrusion 362 and may be defined at a position adjacent to the propagation portion-defining protrusion 363. The gas discharge hole 3621 may be connected to the gas spreading portion 350.

[0256] The gas discharge hole 3621 may having an inlet connected to the gas spreading portion 350 and an outlet directed toward the first flame generation portion 310. An upper end of the gas discharge hole 3621 may be covered with the outer cap 410.

[0257] The gas may be burned to generate a flame at the outlet of the gas discharge hole 3621. When the first flame generation portion 310 is not ignited, the flame generated in the gas discharge hole 3621 may propagate to the first flame hole 311 of the first flame generation portion 310 facing the gas discharge hole 3621, thereby igniting the gas discharged from the first flame hole 311.

[0258] A length in the circumferential direction of the gas discharge hole 3621 is preferably smaller than or equal to a radial width of the spreading portion-defining protrusion 362.

[0259] When the length in the circumferential direction of the gas discharge hole 3621 is larger than the radial width of the spreading portion-defining protrusion 362, the size of the flame generated at the outlet of the gas discharge hole 3621 increases. Thus, the flame of the gas discharge hole 3621 consumes a lot of air, so that an amount of the secondary air may be insufficient at the outlet of the first flame hole 311 of the first flame generation portion 310 facing the gas discharge hole 3621. Accordingly, a shape of the flame in the first flame generation portion 310 may become unstable.

[0260] Referring again to FIG. 31, the outer cap 410 may be disposed on the upper end of each of the second flame generation portion 320, the propagation portion-defining protrusion 363, and the spreading portion-defining protrusion 362 so as to cover the flame propagation portion 360 and the gas spreading portion 350.

[0261] Further, the inner cap 420 may be disposed on the upper end of the first flame generation portion 310 and may cover the first flame hole 311 and an inner space in the first flame generation portion 310 in which the gas flows.

[0262] Furthermore, the outer cap 410 may cover the upper end of each of the propagation hole 3631 and the gas discharge hole 3621 so that the portion of the gas in the gas spreading portion 350 may be discharged to the outlet of each of the propagation hole 3631 and the gas discharge hole 3621 and may be burned to generate the flame. The outer cap 410 may prevent this flame from propagating to the gas spreading portion 350.

[0263] Referring to FIG. 33, the propagation portion-defining protrusion 363 may include a flame guiding portion 3632. The flame guiding portion 3632 may be formed by cutting a portion of an outer end of the propagation portion-defining protrusion 363 connected to the second flame generation portion 320, and may guide the flame of the second flame generation portion 320 to the flame propagation portion 360.

[0264] The flame guiding portion 3632 may be formed by cutting a portion of an outer end of the propagation portion-defining protrusion 363 connected to the second flame generation portion 320 so that a step is formed in the outer end of the propagation portion-defining protrusion 363. The flame of the second flame hole 321 may travel through the flame guiding portion 3632 and then may flow into the flame propagation portion 360.

[0265] The flame generated at the outlet of the second flame hole 321 of the second flame generation portion 320 may flow into the flame propagation portion 360 through the flame guiding portion 3632. Therefore, when the flame may be generated in the second flame generation portion 320, the flame may flow into the flame propagation portion 360 through the flame guiding portion 3632, and thus, the flame may be generated at the outlet of the propagation hole 3631 and the outlet of the gas discharge hole 3621.

[0266] FIG. 34 is a diagram for illustrating flow of gas in the flame propagation portion 360 of the head 300. In FIG. 34, the solid arrow represents the flow of gas. The gas may flow from the gas spreading portion 350 to the flame propagation portion 360 through the propagation hole 3631. The gas may be discharged from the gas spreading portion 350 through the gas discharge hole 3621 toward the first flame generation portion 310.

[0267] Furthermore, the gas discharged from the second flame hole 321 may flow to the flame propagation portion 360 through the flame guiding portion 3632. Due to this structure, the gas may flow from the gas spreading portion 350 to the flame propagation portion 360. Furthermore, in the flame propagation portion 360, the gas may flow freely in both opposite directions, that is, an inward direction from the outer area of the head 300 to the central area thereof or an outward direction from the central area to the outer area thereof.

[0268] Therefore, when the flame is first generated in the second flame hole 321, the flame may flow into an outer end of the flame propagation portion 360 through the flame guiding portion 3632, and then may propagate to the central area of the head 300 along the flame propagation portion 360. In this process, the flame may be generated sequentially in the propagation hole 3631 and the gas discharge hole 3621.

[0269] Conversely, when the flame is first generated in the gas discharge hole 3621, the flame may propagate to the flame propagation portion 360 and may propagate to the outer area of the head 300 along the propagation portion 360. In this process, the flame may be generated in the propagation hole 3631. Further, the flame may propagate from the outer end of the flame propagation portion 360 to the second flame hole 321 through the flame guiding portion 3632, such that the flame may be generated in the second flame hole 321.

[0270] Hereinafter, the flame propagating process is described. First, in a situation in which the first flame generation portion 310 has been ignited and the second flame generation portion 320 has been extinguished, the flame propagating process is as follows. The flame of the first flame hole 311 may propagate to the gas discharge hole 3621, causing a flame to be generated in the gas discharge hole 3621.

[0271] Then, the flame may propagate to the flame propagation portion 360, such that the flames may be generated sequentially in the plurality of propagation holes 3631 in a direction from the central area of the head 300 to the outer area thereof. The flame in the outer area of the head 300 may propagate to the second flame hole 321 through the flame guiding portion 3632, thereby generating the flame in the second flame hole 321.

[0272] The flame of the second flame hole 321 adjacent to the flame propagation portion 360 may propagate along the circumference of the second flame propagation portion 360, and eventually, the flame may be generated throughout the plurality of second flame holes 321 arranged along the circumference of the second flame propagation portion 360.

[0273] Next, in a situation in which the second flame generation portion 320 has been ignited and the first flame generation portion 310 has been extinguished, the flame propagating process is as follows. The flame of the second flame hole 321 may propagate to the flame propagation portion 360 through the flame guiding portion 3632.

[0274] The flame in the flame propagation portion 360 may propagate from the outer area of the head 300 toward the central area thereof. Therefore, flames may be sequentially generated in the plurality of propagation holes 3631 in a direction from the outer area of the head 300 to the central area thereof. The flame may propagate to the gas discharge hole 3621, causing the flame to be generated in the gas discharge hole 3621.

[0275] The flame may propagate from gas discharge hole 3621 or the propagation hole 3631 to the first flame hole 311. Thus, the flame may be generated in the first flame hole 311 of the first flame generation portion 310 facing the gas discharge hole 3621 or the propagation hole 3631.

[0276] The flame of the first flame hole 311 may propagate along the circumference of the first flame propagation portion 310, and eventually, the flame may be generated throughout the plurality of first flame holes 311 arranged along the circumference of the first flame propagation portion 310.

[0277] In accordance with an embodiment, due to the gas discharge hole 3621, the propagation hole 3631, and the flame guiding portion 3632 arranged to be spaced apart from each other in the radial direction of the head 300, the flame may smoothly propagate from the first flame generation portion 310 to the second flame generation portion 320 or vice versa.

[0278] Due to smooth flame propagation between the first flame generation portion 310 and the second flame generation portion 320, any extinguished flame generation portion may be immediately re-ignited. Thus, the performance of the burner may be improved.

[Second embodiment]

[0279] FIG. 35 is a perspective view showing a burner according to another embodiment. FIG. 36 is a side view of FIG. 35. FIG. 37 is a rear view of FIG. 35. The burner according to an embodiment may include a body 500, a cover 600, head 700, an inner cap 820, and an outer cap 810.

[0280] The body 500 may constitute a lower portion of the burner and may be connected to an external source through a pipe so that the body may receive gas required for combustion from the external source. The cover 600 may be disposed on top of the body 500 and may be coupled to the body 500 to define a mixing tube 501 in which gas and air flow and are mixed with each other.

[0281] In the illustrated embodiment, the cover 600 and the body 500 are manufactured separately from each other. However, in another embodiment, the cover 600 and the body 500 may be integrated into a single body.

[0282] The mixing tube 501 may be a space in the burner. The gas flowing thereto from the external source and the air flowing into the burner from a surrounding around the burner may meet and be mixed with each other in the mixing tube 501. The gas may be mixed with air and thus may receive oxygen from the air necessary for combustion and thus may be burned in the head 700.

[0283] The mixing tube 501 may be formed by combining the body 500 and the cover 600 with each other. The body 500 may constitute approximately a lower half of the mixing tube 501, while the cover 600 may constitute approximately an upper half of the mixing tube 501.

[0284] The head 700 may be disposed on top of the cover 600, and the flame may be generated in the head 700. The head 700 may be coupled to the cover 600 to form a path through which gas flowing into the head 700 and the cover 600 through the body 500 flows. The gas flow path formed by combining the header and the cover 600 with each other may distribute the gas to a first flame generation portion 710 and a second flame generation portion 720, which are described in detail below.

[0285] The inner cap 820 may cover a top of the first flame generation portion 710 where the flame may be generated, and may control a spread direction of the flame so that the flame is directed outwardly in the radial direction of the head 700. The outer cap 810 may cover a top of the second flame generation portion 720 where the flame may be generated, and may control the spread direction of the flame so that the flame is directed outwardly in the radial direction of the head 700.

[0286] FIG. 38 is an exploded top perspective view of FIG. 35. FIG. 39 is an exploded bottom perspective view of FIG. 35. The head 700 may include a flame generation portion. In the flame generation portion, while gas is discharged outwardly of the burner, the gas is ignited by a spark plug (not shown), thereby generating a flame.

[0287] The head 700 may include the first flame generation portion 710 and the second flame generation portion 720 where the flame may be generated. The first flame generation portion 710 may be disposed in the central area of the head 700, and a plurality of first flame holes 711 may be defined in the first flame generation portion 710 and may be arranged along a circumference thereof.

[0288] The second flame generation portion 720 may be disposed in the outer area of the head 700 and may be disposed to surround the first flame generation portion 710. A plurality of second flame holes 721 may be defined in the second flame generation portion 720 and may be arranged along a circumference thereof. Therefore, when the flame may be generated in the burner, inner and outer ring-shaped flames may be generated in a double manner.

[0289] The gas flowing inside the burner may be discharged through the first flame hole 711 and the second flame hole 721. When the gas is ignited, a flame may be generated at the outlet of each of the first flame hole 711 and the second flame hole 721, such that the flame may be maintained while the gas is discharged.

[0290] The first flame generation portion 710 and the second flame generation portion 720 may be separate components and may be spaced apart from each other. Therefore, gas needs to be individually supplied to each of the first flame generation portion 710 and the second flame generation portion 720. In an embodiment, one mixing tube 501 may be used, and gas flowing thereto from one pipe may flow through the single mixing tube 501.

[0291] Therefore, the gas discharged from one mixing tube 501 should flow into the first flame generation portion 710 and the second flame generation portion 720, which are spaced apart from each other. For this reason, inside the burner, a flow channel needs to be formed to distribute the gas discharged from the mixing tube 501 to each of the first flame generation portion 710 in the central area and the second flame generation portion 720 in the outer area.

[0292] In the burner according to an embodiment of the present disclosure, the gas discharged from the mixing tube 501 may flow through the cover 600, and may flow to the central area of the cover 600, and may be divided into portions and then one thereof may flow into the first flame generation portion 710, and the other thereof may flow to the outer area of the cover 600 and may flow into the second flame generation portion 720.

[0293] In other words, the gas discharged from the mixing tube 501 may flow through cover 600 and reach an outer area of an upper surfaced of the cover 600. Then, the gas may flow from the outer area of the cover 600 to the central area of the cover 600 and may be divided into the portions. One thereof may flow from the central area of the cover 600 through the head 700 and may reach an upper surface of the head 700, and may flow into the first flame generation portion 710 in the central area of the head 700.

[0294] The other of the portions may flow from the central area to the outer area of a space on the upper surface of the cover 600, and may flow through the head 700, and may reach the upper surface of the head 700, and may flow into the second flame generation portion 720 in the outer area of the head 700.

[0295] Due to this structure, the gas flowing into one common mixing tube 501 may be divided into the two portions inside the burner while flowing through the flow channel formed in the burner, and then the two portions may flow into the first flame generation portion 710 and the second flame generation portion 720, respectively.

[0296] Therefore, compared to a structure in which the external source is connected to a plurality of pipes, and a plurality of gas flow paths respectively connected to the plurality of pipes and the flame generation portions are provided independently of each other, an overall structure of the burner according to an embodiment of the present disclosure may be simplified. Furthermore, the burner according to an embodiment of the present disclosure may be connected to an external source through a single pipe. This simple structure allows for smooth flow of the gas inside the burner, improves burner performance, and saves a manufacturing cost of the burner.

[0297] FIG. 40 is a side cross-sectional view of the burner. In drawings as described below, flow of the gas is indicated using a solid arrow. Furthermore, in FIG. 40, the flow of air flowing into the burner from the surroundings is indicated using a hidden line arrow.

[0298] The body 500 may include an injection portion 530 and an air receiving portion 540. The injection portion 530 may be formed on one side of the body 500, and a gas injection hole 531 may be defined in the injection portion 530. The gas injection hole 531 may be formed to extend through the injection portion 530, and may have an inlet connected to a pipe connected to the external source that supplies gas.

[0299] The injection portion 530, the air receiving portion 540 and the mixing tube 501 may be arranged in a straight line. Due to this structure, the gas having flowed through the injection portion 530 may smoothly flow through the air receiving portion 540 and the mixing tube 501.

[0300] The gas injection hole 531 may be formed in the injection portion 530 so as to extend through the injection portion 530.

[0301] The air receiving portion 540 may be disposed between an inlet of the mixing tube 501 and an outlet of the injection portion 530. A space into which air is introduced and stored may be formed in the air receiving portion 540. In one example, an air guide 701 may protrude downwardly from the head 700 and may cover the space of the air receiving portion 540. The air guide 701 may be formed in a generally "U" shape so as to be combined with the air receiving portion 540 to form a space into which air flows.

[0302] The air guide 701 may cover the space of the air receiving portion 540, but may be coupled to the air receiving portion 540 to form a hole into which surrounding air flows in a rear side of the burner. Through the hole, air around the burner may flow into the space of the air receiving portion 540.

[0303] An inlet of the gas injection hole 531 may be relatively wide and an outlet thereof may be relatively narrow. For example, the outlet of the gas injection hole 531 may be provided with an orifice, so that the gas flowing into the body 500 through the gas injection hole 531 may be injected at a rapid speed from the outlet of the gas injection hole 531.

[0304] The gas injected from the outlet of the gas injection hole 531 may flow into the mixing tube 501 without being dispersed due to its rapid flow speed. At this time, the gas may meet the air flowing into the air receiving portion 540 while flowing through the air receiving portion 540, and, at the same time, the air may flow into the mixing tube 501.

[0305] While the gas flows through the mixing tube 501, the gas may be mixed with air which has been introduced into the air receiving portion 540, and then the mixture of the gas and the air may be discharged from the mixing tube 501. In this way, the gas may be mixed with the air in the mixing tube 501 and may be mixed with oxygen in the air. Thus, when the mixture is ignited by the spark plug, the mixture may be combusted.

[0306] The mixing tube 501 may be , for example, a Venturi tube. The Venturi tube may be formed so that a cross-sectional area of each of the inlet and the outlet thereof is relatively large, and a cross-sectional area of a central area thereof is relatively narrow.

[0307] Therefore, in a neck area as a narrow cross-sectional area of the central area of the mixing tube 501, the gas flow speed is the fastest in the mixing tube 501, such that the pressure may be lowered in the central area.

[0308] The mixing tube 501 may be the Venturi tube. Thus, the pressure in the neck area is lower than that of an area adjacent thereto. Thus, the air in the space of the air receiving portion 540 which has a relatively high pressure may smoothly flow into the mixing tube 501 due to the pressure difference and thus may be mixed with the gas in the mixing tube.

[0309] FIG. 41 is a perspective view showing the body 500 and the cover 600 of the burner. FIG. 42 is an exploded view of FIG. 41. FIG. 43 is a top view of FIG. 41. FIG. 44 is a bottom view of FIG. 41. FIG. 45 is a perspective view of the body 500. FIG. 46 is a top view of FIG. 45.

[0310] The body 500 may include a lower cell 510 and a first guide tube 520. The lower cell 510 may be depressed from an upper surface of the body 500 into the body 500 and may constitute a lower portion of the mixing tube 501. The lower cell 510 may constitute approximately the half of the mixing tube 501.

[0311] However, since at least a portion of an upper cell 620 formed on the cover 600 is received in a depressed space of the lower cell 510, the depressed space of the lower cell 510 constituting the mixing tube 501 may be deeper than a depth of the half of the mixing tube 501.

[0312] The first guide tube 520 may be connected to the outlet of the mixing tube 501 and may have two portions be connected to the outlet of the mixing tube 501 and extending in the circumferential direction of the body 500 and respectively in opposite directions. A portion of the first guide tube 520 may be closed with the cover 600, and the gas may flow in the first guide tube 520. A top of the first guide tube 520 may be closed with the cover 600 to form a gas flow path.

[0313] The first guide tube 520 may be a space connected to the outlet of the mixing tube 501, and may change the flow direction of the gas discharged from the mixing tube 501 to an upward direction. The gas discharged from the mixing tube 501 may flow upward along the first guide tube 520 and may flow into the space on the upper surface of the cover 600.

[0314] The body 500 may include a cover receiving groove 550, a first spark plug receiving hole 560, and an extension panel 570. The cover receiving groove 550 may be depressed from the upper surface of the body 500 into the body, and may have a shape corresponding to that of the cover 600 so that the cover 600 is received therein.

[0315] A hole into which fastening means such as a bolt is fastened may be formed in a bottom surface defining the cover receiving groove 550, and a corresponding hole thereto may be formed in the cover 600 so that the cover 600 may be coupled to the body 500 using the fastening means. Since the cover 600 is seated in the cover receiving groove 550, the cover 600 may be accurately positioned at a designated position of the body 500.

[0316] The first spark plug receiving hole 560 may be formed at a position overlapping with the cover 600, and the spark plug may be inserted and mounted in the first spark plug receiving hole 560. In one example, the cover 600 may have a second spark plug receiving hole 650 defined therein into which the spark plug is inserted at a position corresponding to the first spark plug receiving hole 560.

[0317] In the illustrated embodiment, the first spark plug receiving hole 560 may be disposed adjacent to the first flame generating portion 710 disposed in the central area of the burner. In this structure, the first flame generation portion 710 may be ignited first and the second flame generation portion 720 may be ignited later.

[0318] In another embodiment, the first spark plug receiving hole 560 may be disposed adjacent to the second flame generation portion 720 disposed in the outer area of the burner. In this structure, the second flame generation portion 720 may be ignited first and the first flame generation portion 710 may be ignited later.

[0319] The extension panel 570 may surround the cover receiving groove 550 and extend in a circumferential direction of the body 500. The extension panel 570 may generally be provided in a disk form. Holes into which the fastening means are inserted may be formed in the extension panel 570.

[0320] Accordingly, the burner may be mounted on a gas range or a combined cooking appliance by coupling the extension panel 570 to the gas range or the cooktop of the combined cooking appliance using the fastening means.

[0321] FIG. 47 is a perspective view of the cover 600. FIG. 48 is a bottom view of FIG. 47. FIG. 49 is a top view of FIG. 47. The cover 600 may have a smaller planar area than that of the body 500. As described above, the cover 600 may be seated in the cover receiving groove 550 of the body 500 and may be coupled to the cover 600 using the fastening means.

[0322] The cover 600 may include a through-hole 610 formed at a position that overlaps at least a portion of the first guide tube 520. The gas may flow through the through-hole 610. The through-hole 610 through which the gas may flow may be formed in the cover 600 at a portion overlapping at least the inclined guide surface 121. The gas may flow upwardly along the first guide tube 520 and may flow through the cover 600 through the through-hole 610 and may flow into the space on the upper surface of the cover 600.

[0323] Furthermore, the cover 600 may include the upper cell 620 constituting the mixing tube 501. The upper cell 620 may be formed to protrude downwardly toward the body 500, and may have an inner space defined therein so as to be depressed upwardly from a lower surface thereof into the upper cell 620. The inner space may constitute an upper portion of the mixing tube 501.

[0324] The upper cell 620 may constitute approximately a half of the mixing tube 501. However, the upper cell 620 may be inserted into a groove defined in the lower cell 510 of the body 500 to define the mixing tube 501.

[0325] In the illustrated embodiment, the upper cell 620 may be formed integrally with the cover 600. However, in another embodiment, the upper cell 620 may be formed as a separate structure from the cover 600. Furthermore, in still another embodiment, the upper cell 620 may be formed integrally with the lower cell 510.

[0326] In one example, the burner may include a second guide tube 630. The second guide tube 630 may be formed by combining the cover 600 and the head 700 with each other and may provide a space in which the gas flowing to the space from the body 500 may flow from the outer area of the head 700 to the central area thereof.

[0327] The gas discharged from the first guide tube 520 may flow to the central area of the head 700 through the second guide tube 630 and may be divided into portions which may be fed to the first and second flame generation portion 710 and 720, respectively.

[0328] The gas may be divided into the portions such that the portions of the gas may be respectively supplied to the first flame generation portion 710 and the second flame generation portion 720 which are spaced apart from each other, using one gas injection hole 531 equipped with the orifice and one mixing tube 501.

[0329] The cover 600 may include the through-hole 610 and a lower part 640. In addition to the above description, the through-hole 610 may be connected to the first guide tube 520 and allows gas to flow through therein. The gas may flow through the through-hole 610, and then, a portion thereof may flow into the second guide tube 630, and a remaining portion thereof may flow into the second flame generation portion 720.

[0330] The through-hole 610 may include a pair of through-hole spaced apart from each other in the circumferential direction and extending in the circumferential direction and in the outer area of the cover 600. The through-hole 610 may be disposed on top of the first guide tube 520, and the flow direction of the gas in the first guide tube 520 may be changed rapidly in the through-hole 610.

[0331] Therefore, in order to allow the flow of the gas between the mixing tube 501 and the second guide tube 630 to be smooth, the first guide tube 520 may be formed as a relatively large space, and thus an area size of the through-hole 610 may be increased.

[0332] If a single through-hole 610 with a large area size is formed, the rigidity of the cover 600 may be weakened. Therefore, in accordance with an embodiment, the through-hole 610 may include a pair of through-holes spaced apart from each other in the circumferential direction, while a bridge portion may be disposed between the through-holes 610 to reinforce the rigidity of the cover 600.

[0333] Furthermore, fastening holes may be defined in the bridge portion between the through-holes 610 such that fastening means may be inserted and fastened to the fastening holes. Thus, the various holes may be efficiently arranged in an entire area of the cover 600. The coupling between the cover 600 and the body 500 may be strengthened using the fastening means inserted and fastened to the fastening holes.

[0334] The lower part 640 may be formed so that a portion thereof surrounds the through-hole 610, and may protrude upwardly from the upper surface of the cover 600, and may constitute a lower portion of the second guide tube 630. The lower part 640 and an upper part 740 formed on the head 700 may be combined to each other to define the second guide tube 630.

[0335] The lower part 640 may include a first flow channel-defining part 641, a first central part 642, a first outer part 643, and a first connection part 644. The first flow channel-defining part 641 may surround the through-hole 610 and may define a flow channel extending from the through-hole 610 to the central area of the cover 600.

[0336] The gas that has flowed through the through-hole 610 and has flowed into the space on the upper surface of the cover may flow from the outer area of the cover 600 to the central area thereof along the first flow channel-defining part 641.

[0337] The first central part 642 may be formed in the central area of the cover 600, may be connected to the first flow channel-defining part 641, and may define a flow channel connected to the first flame generation portion 710. In the first central part 642, the gas may be divided into the portions such that one portion may flow to the first flame generation portion 710 and the remaining portion may flow to the second flame generation portion 720.

[0338] The portion of the gas flowing into the first central part 642 may flow upwardly and may flow into the first flame generation portion 710, while the other portion thereof may flow back to the outer area of the cover 600 along the first connection part 644 and may reach the first outer part 643.

[0339] The first outer part 643 may be disposed in the outer area of the cover 600, may define a flow channel connected to the second flame generation portion 720, and may include a pair of the first outer parts spaced apart from each other in the circumferential direction. The gas flowing into the first outer part 643 may flow upwardly and may flow through the spreading hole 730 of the head 700 and to a space on the upper surface of the head and may reach the second flame generation portion 720.

[0340] The first connection part 644 may define a flow channel connecting an inner space of the first outer part 643 and an inner space of the first central part 642 to each other. Since the first outer part 643 includes the pair of first outer parts, the first connection part 644 may include a pair of first connection parts respectively connected to the pair of first outer parts 643.

[0341] The gas flowing into the first flow channel-defining part 641 may flow through the first central part 642 and the first connection part 644 and may flow upwardly in the first outer part 643. In order for gas to flow smoothly, bottom surfaces of the first flow channel-defining part 641, the first central part 642, and the first connection part 644 may constitute a continuous plane.

[0342] In one example, the pair of first outer parts 643 may be formed and arranged symmetrically with each around the center of the cover 600. The pair of first connection parts 644 may be formed and arranged symmetrically with each around the center of the cover 600.

[0343] The first outer part 643 may be formed at a position that overlaps a side portion 780 of the head 700 in the vertical direction. Due to this structure, the gas that has reached the first outer part 643 may flow smoothly to the side portion 780 and then reach the second flame generation portion.

[0344] The lower part may include a lower partitioning wall that protrudes upwardly from the upper surface of the cover 600, and the lower partitioning wall may surround the through-hole 610. The gas that has flowed through the through-hole 610 may be guided along the lower partitioning wall so as to flow to the first flow channel-defining part 641 and the first central part 642.

[0345] The lower partitioning wall may constitute walls of the first flow channel-defining part 641, the first central part 642, the first outer part 643 and the first connection part 644. That is, the first flow channel-defining part 641, the first central part 642, the first outer part 643, and the first connection part 644 may be constituted with the lower partitioning wall protruding upwardly from the upper surface of the cover 600.

[0346] In one example, the cover 600 may include a second spark plug receiving hole 650 into which the spark plug is inserted and mounted. The second spark plug receiving hole 650 may be positioned in a position corresponding to the first spark plug receiving hole 560 of the body 500. Therefore, depending on a location of the first spark plug receiving hole 560, the second spark plug receiving hole 650 may be disposed adjacent to the first flame generation portion 710 or adjacent to the second flame generation portion 720.

[0347] FIG. 50 is a perspective view showing the cover 600 and the head 700. FIG. 51 is an exploded top perspective view of FIG. 50. FIG. 52 is a bottom perspective view of FIG. 50. FIG. 53 is a top view of FIG. 50.

[0348] Foreign substances may remain on the head 700 due to the use of the burner. Therefore, cleaning of the head 700 is necessary for hygiene purposes. To clean the head 700, the head 700 may be easily removed from the burner.

[0349] Therefore, for example, it is necessary to couple the head 700 and the cover 600 or the body 500 using the fastening means so that the user may easily remove the head 700 from the burner using the fastening means when necessary.

[0350] A structure is needed to guide a position of the head 700 so that the head 700 may be disposed in a correct position on the cover 600. For this guide, an insert protrusion 772 may be formed on the head 700, and a protrusion receiving groove 660 may be formed in the cover 600.

[0351] When the protrusion 772 of the head 700 is inserted into the protrusion receiving groove 660 of the cover 600, the head 700 may be disposed in the correct position on the cover 600. The insert protrusion 772 and the protrusion receiving groove 660 are additionally described below. Hereinafter, the head 700 is described in detail.

[0352] FIG. 54 is a perspective view of the head 700. FIG. 55 is a bottom view of FIG. 54. FIG. 56 is a top view of FIG. 54. FIG. 27 is a view of FIG. 54 in a different direction.

[0353] The head 700 may include a spreading hole 730 and the upper part 740. The spreading hole 730 may be connected to the second guide tube 630 and may allow gas to flow therein. The gas flowing into the spreading hole 730 may flow into the second flame generation portion 720 and be burned therein.

[0354] The spreading hole 730 may include a pair of spreading holes disposed in the outer area of the head 700 and spaced from each other in the circumferential direction of the head. In the plan view, the spreading hole 730 may be spaced from the through-hole 610 in the circumferential direction of the head.

[0355] Therefore, the portion of the gas having flowed through the through-hole 610 may flow to the central area of the head 700 along the second guide tube 630. The other portion of the gas may flow back to the outer area of the head 700, and may flow through the spreading hole 730, and may spread in the circumferential direction in a space on the upper surface of the head 700, and then may flow into the second flame generation portion 720.

[0356] The upper part 740 may be formed so that a portion thereof surrounds the spreading hole 730, and may protrude downwardly from a lower surface of the head 700, and may be coupled to the lower part 640 to define an upper portion of the second guide tube 630. The lower part 640 of the cover 600 and the upper part 740 of the head 700 may be combined with each other to define the second guide tube 630.

[0357] The upper part 740 may include a second flow channel-defining part 741, a second central part 742, a second outer part 743, and a second connection part 744. The second flow channel-defining part 741 may cover the through-hole 610 and may define a flow channel extending from the through-hole 610 to the central area of the head 700.

[0358] The gas that has flowed through the through-hole 610 and has flowed into the second flow channel-defining part 741 may flow along the second flow channel-defining part 741 from the outer area of the head 700 to the central area thereof.

[0359] The second central part 742 may be formed in the central area of the head 700, may be connected to the second flow channel-defining part 741, and may define a flow channel connected to the first flame generation portion 710. In the second central part 742, the gas may be divided into the portions such that one portion may flow to the first flame generation portion 710 and a remaining portion may flow to the second flame generation portion 720.

[0360] The portion of the gas flowing into the second central part 742 may flow upwardly and may flow into the first flame generation portion 710. The other portion thereof may flow back to the outer area of the head 700 along the second connection part 744 and may reach the second outer part 743.

[0361] The second outer part 743 may surround the spreading hole 730 and may be disposed in the outer area of the head 700, and may define a flow channel connected to the second flame generation portion 720. The second outer part 743 may include a pair of second outer parts spaced apart from each other in the circumferential direction. The gas flowing into the second outer part 743 may flow upwardly and may flow through the spreading hole 730 of the head 700 and may flow along a space on the upper surface of the head 700 and may reach the second flame generation portion 720.

[0362] The second connection part 744 may define a flow channel connecting the inner space of the second outer part 743 and the inner space of the second central part 742. Since the second outer part 743 includes the pair of second outer parts, the second connection part 744 may include a pair of second connection parts respectively connected to the pair of second outer parts 743.

[0363] An opening may be formed in a side surface of the second central part 742, and this opening may be connected to the second outer part 743 through the second connection part 744.

[0364] In one example, the pair of second outer parts 743 may be arranged symmetrically around a center of the head 700. The pair of second connection parts 744 may be arranged symmetrically around a center of the head 700.

[0365] The upper part 740 may include an upper partitioning wall protruding downwardly from the lower surface of the head 700, and the upper partitioning wall may surround the through-hole 610 formed in the outer area of the cover 600. The gas flowing through through-hole 610 may be guided along the upper partitioning wall so as to flow to the second connection part 744 and the second central part 742.

[0366] The upper partitioning wall may constitute walls of the second flow channel-defining part 741, the second central part 742, the second outer part 743, and the second connection part 744. That is, the second flow channel-defining part 741, the second central part 742, the second outer part 743, and the second connection part 744 may be constituted with the upper partitioning wall protruding downwardly from the lower surface of the head 700.

[0367] To prevent the gas flowing into the second guide tube 630 from leaking out through a gap between the upper part 740 and the lower part 640, contact surfaces of the partitioning walls respectively constituting the upper part 740 and the lower part 640 contacting each other may have the same shape.

[0368] The gas that has flowed through the through-hole 610 may flow from the outer area of the head 700 to the central area of the head 700 through the second guide tube 630 and may be divided into the portions in the central area of the head 700. One of the portions into the gas has been divided into in the central area of the head 700 may reach the first flame generation portion 710 and may be injected through the first flame hole 711 and may be burned.

[0369] The other of the portions into the gas has been divided into in the central area of the head 700 may flow from the central area of the head 700 to the outer area of the head 700 through the second guide tube 630 and the may flow through spreading hole 730, and then, may reach the second flame generation portion 720, and may be injected through the second flame hole 721 and may be burned.

[0370] The second guide tube 630 may include a first space defined by combining the first flow channel-defining part 641 and the second flow channel-defining part 741 with each other, a second space defined by combining the first central part 642 and the second central part 742 with each other, a third space defined by combining the first connection part 644 and the second connection part 744 with each other, and a fourth space defined by combining the first outer part 643 and the second outer part 743 with each other.

[0371] The gas may flow into the first space in the outer area of the second guide tube 630 and may flow from the first space into the second space and reach the central area of the head 700. The gas may be divided into the portions in the second space. One of the portions may flow upwardly directly from the second space and may flow upwardly through a central hole disposed in an upper portion of the central area of the head 700, and may reach the first flame generation portion 710 connected to this central hole.

[0372] The other of the portions of the gas may flow through the third space, and flow into the fourth space in the outer area of the head 700, and may flow upwardly from the fourth space to reach the second flame generation portion 720 in the outer area of the head 700.

[0373] In this way, the gas that has flowed through the through-hole 610 may be divided into the two portions in the second guide tube 630. One thereof may reach the first flame generation portion 710 while the other there may reach the second flame generation portion 720.

[0374] The first flame generation portion 710 may be disposed in the central area of the head 700 and may protrude upwardly from the upper surface of the head 700. Furthermore, the second flame generation portion 720 may protrude upwardly from the upper surface of the head 700 in the outer area of the head 700. Accordingly, the second flame generation portion 720 may surround the first flame generation portion 710.

[0375] The head 700 may include a gas spreading portion 750 and a flame propagation portion 760. The gas spreading portion 750 may be a space in which the gas flowing through the spreading hole 730 spreads and which is surrounded with the upper surface of the head 700 and the second flame generation portion 720, and may extend along the circumference of the head 700.

[0376] The gas spreading portion 750 may be a space connected to the second flame generation portion 720, and may extend in a ring shape with a constant width and may be positioned inwardly of the second flame generation portion 720. Accordingly, the gas that has flowed through the spreading hole 730 may spread along the gas spreading portion 750 and on the upper surface of the head 700 and flow into the second flame generation portion 720 uniformly in the circumferential direction of the second flame generation portion 720.

[0377] An inclined spreading surface 761 may be disposed at a location adjacent to the spreading hole 730 to facilitate the flow and spread of gas. That is, the inclined spreading surface 761 may be defined on the upper surface of the head 700 and at an area where the spreading hole 730 and the gas spreading portion 750 are connected to each other, and may constitute each of both opposing ends of the spreading hole 730. The inclined spreading surface 761 may be inclined in the circumferential or radial direction.

[0378] The inclined spreading surface 761 may be formed on the upper surface of the head 700 so as to be inclined in the circumferential or radial direction. Due to the inclined spreading surface 761, a planar area size of the spreading hole 730 may increases as the spreading hole 730 extends upwardly.

[0379] Accordingly, while the gas flowing into the gas spreading portion 750 through the spreading hole 730 may flow further upwardly, the gas may be guided along the inclined spreading surface 761 so as to smoothly spread into the gas spreading portion 750 and then be uniformly distributed throughout the gas spreading portion 750. As a result, the second flame generation portion 720 may receive a uniform supply of the gas in its circumferential direction and thus generate a uniform flame in its circumferential direction.

[0380] The flame propagation portion 760 may occupy a partial area of the gas spreading portion 750 such that the gas spreading portion 750 may be discontinuous at the flame propagation portion 760. The flame propagation portion 760 may be a space in which the flame propagates between the first flame generation portion 710 and the second flame generation portion 720. The flame may be generated in the flame propagation portion 760, and the flame may flow from the first flame generation portion 710 to the second flame generation portion 720 or from the second flame generation portion 720 to the first flame generation portion 710 through the flame propagation portion 760.

[0381] Therefore, the flame generated in the first flame generation portion 710 may flow to the second flame generation portion 720, or conversely, the flame generated in the second flame generation portion 720 may flow to the first flame generation portion 710. Accordingly, the flame may always exist in the first flame generation portion 710 and the second flame generation portion 720 while the gas is supplied thereto.

[0382] When a flame is not ignited or is extinguished in one flame generation portion, the flame of another flame generation portion may flow through the propagation portion, thereby generating a flame in the flame generation portion where there is no flame.

[0383] The head 700 may include a spreading portion-defining protrusion 762 and a propagation portion-defining protrusion 763. The spreading portion-defining protrusion 762 may be disposed between the first flame generation portion 710 and the second flame generation portion 720, protrude upwardly from the upper surface of the head 700, extend in the circumferential direction of the head 700, and surround the gas spreading portion 750.

[0384] The gas spreading portion 750 may be a space surrounded with the second flame generation portion 720, the upper surface of the head 700, the spreading portion-defining protrusion 762, and the outer cap 810.

[0385] The propagation portion-defining protrusion 763 may protrude upwardly from the upper surface of the head 700 and may include a pair of propagation portion-defining protrusions respectively disposed on both opposing sides of the flame propagation portion 760 to define the flame propagation portion 760. The propagation portion-defining protrusion 763 may isolate the gas spreading portion 750 and the flame propagation portion 760 from each other.

[0386] The propagation portion-defining protrusion 763 may have a through-hole extending therethrough, so that the gas in the gas spreading portion 750 is discharged to the flame propagation portion 760 through this through-hole. The flame may be generated at an outlet of the through-hole, and then, this flame may propagate from the first flame generation portion 710 to the second flame generation portion 720 through the flame propagation portion 760 or vice versa.

[0387] FIG. 58 is an enlarged view of a portion 58 of FIG. 57. FIG. 58 shows a portion of the first flame generation portion 710. FIG. 59 is an enlarged view of a portion 59 of FIG. 57. FIG. 59 shows a portion of the second flame generation portion 720.

[0388] The flame generation portion may include the flame hole through which gas is sprayed. A flame may be generated at an outlet of the flame hole. The first flame generation portion 710 may include the first flame hole 711, and the second flame generation portion 720 may include the second flame hole 721.

[0389] The first flame hole 711 or the second flame hole 721 may be depressed into the upper end of the first flame generation portion 710 or the second flame generation portion 720. The first flame hole 711 may be covered with the inner cap 820, and the second flame hole 721 may be covered with the outer cap 810 so that a top of each of the first and second flame holes may be blocked.

[0390] Depression depths of neighboring flame holes in the first flame generation portion 710 or the second flame generation portion 720 may be different from each other. For example, the first flame generation portion 710 may have deep first flame holes 711a and shallow first flame holes 711b arranged alternately with each other along the circumference. The deep second flame holes 721a and the shallow second flame hole s721b may be alternately arranged each other along the circumference of the second flame generation portion 720.

[0391] The depression depth of the flame hole may be proportional to an amount of gas discharged to the outside through the flame hole. Furthermore, a size and a length of the flame may be proportional to the discharged gas amount through the flame hole.

[0392] Therefore, the deeper the depression depth of the flame hole, the larger the size of the flame generated at the outlet of the flame hole. As the size of the flame increases, a likelihood at which adjacent flames merge with each other increases.

[0393] When the size of the flame becomes larger due to the merging, the gas inside the flame may not contact the air, which may lead to incomplete combustion of the gas. Therefore, it is necessary to suppress the merging to suppress incomplete combustion.

[0394] In an embodiment, a relatively deep flame hole may be disposed between relatively shallow flame holes. Due to this structure, a spacing between large flames highly likely to merge with each other may be increased, and the relatively small flame may be placed therebetween, such that the merging between neighboring flames may be effectively suppressed.

[0395] Further, when the flame generation portion is formed only to have relatively shallow flame holes, the gas amount discharged from the flame generation portion is small, so that the burner cannot generate sufficient fire power. In an embodiment, a plurality of relatively deep flame holes may be arranged such that the gas may be sufficiently discharged to the outside through the flame holes.

[0396] FIG. 60 is a perspective view showing a state in which the outer cap 810 and the inner cap 820 are installed on the head 700. FIG. 61 is a cross-sectional view of FIG. 60. FIG. 62 is an enlarged view of a portion 62 of FIG. 61. FIG. 63 is a perspective view showing the inner cap 820.

[0397] The burner may include the outer cap 810 and the inner cap 820 that cover the flame generation portion. The outer cap 810 may be disposed on an upper end of each of the second flame generation portion 720 and the spreading portion-defining protrusion 762 and may cover the gas spreading portion 750. The outer cap 810 may be disposed on the head 700 and cover an upper end of the gas spreading portion 750.

[0398] Referring to FIG. 61, the outer cap 810 may have an inclined cross sectional shape. For example, the outer cap 810 may be formed so that its cross-sectional shape is gradually inclined upwardly as the outer cap extends outwardly in the radial direction.

[0399] The head 700 may include a core 770, the side portion 789, a first support 791 and a second support 792. The core 770 may be disposed in the central area of the head 700, and the first flame generation portion 710 may be formed at an upper end of the core. The inner cap 820 may be disposed on the upper end of the core 770.

[0400] The side portion 789 occupies the outer area of the head 700 and the gas spreading portion 750 may be defined in the side portion 789. The core 770 and the side portion 789 may be arranged to be spaced apart from each other, and may be connected to each other via the first and second supports 791 and 792 and the pair of second connection parts 744.

[0401] The first support 791 may connect the core 770 and the side portion 780 to each other and may meet the inner end of the flame propagation portion 760. The second support 792 may connect the core 770 and the side portion 780 to each other, and may be opposite to the first support 791 around the core 770.

[0402] The pair of second connection parts 744, the first support 791 and the second support 792 may connect the core 770 and the side portion 780 to each other and may be spaced from each other in the circumferential direction. A space may be defined between each of the pair of second connection parts 744 and each of the first and second supports 791 and 792.

[0403] The first flame generation portion 710 may be formed to protrude from an outer area of the core 770. In the core 770 and in an area inwardly of the first flame generation portion 710, a space may be defined where portions of the gas flowing into the core 770 through the second guide tube 630 are merged with each other.

[0404] The core 770 may include a plurality of guide protrusions 771 that protrude upward and are spaced apart from each other in the circumferential direction, and guides a mounting position of the inner cap 820. Each of the plurality of guide protrusions 771 may be disposed between adjacent ones of the plurality of first flame holes 711. The inner cap 820 may include a guide ring 821 which protrudes downwardly and is formed to surround the guide protrusions 771 and contacts the guide protrusions 771.

[0405] In order for the inner cap 820 to be stably disposed on the upper end of the core 770, the guide protrusions 771 may be formed on the core 770, and the guide ring 821 may be formed on the inner cap 820.

[0406] The guide protrusion 771 may include a plurality of guide protrusions spaced apart from each other in the circumferential direction. When the inner cap 820 is placed on the core 770, the guide protrusions 771 may be located inwardly of the guide ring 821 so as to contact the guide ring. The position of the inner cap 820 may be guided along the guide protrusions 771, and thus may not deviate laterally from the core 770.

[0407] Due to this structure, the inner cap 820 may be stably disposed in the designed position on the upper end of core 770 and may maintain its position.

[0408] The core 770 may include a supporter 773 that contacts a lower surface of the inner cap 820 and supports the inner cap 820. The supporter 773 may be formed to be inclined gradually upwardly as the support extends inwardly of the core 770. The inner cap 820 may be disposed on an upper surface of the supporter 773.

[0409] The supporter 773 may be disposed inwardly of the guide protrusion 771. The upper surface of the supporter 773 may extend in a generally straight line, while a lower surface of the supporter may be generally curved.

[0410] The gas discharged from the flame holes of the first flame generation portion 710 or the second flame generation portion 720 may be mixed with the secondary air around the flame generation portion to increase combustion efficiency. Since the second flame generation portion 720 is disposed in the outer area of the burner, the gas discharged from the second flame hole 721 may actively contact the surrounding secondary air.

[0411] However, since the first flame generation portion 710 may be disposed on the core 770 disposed in the central area of the burner, a contact area thereof in contact with the surrounding air may be reduced due to the outer cap 810 and other structures.

[0412] Considering this problem, in accordance with an embodiment, a vertical level of the first flame generation portion 710 may be higher than that of the spreading portion-defining protrusion 762. Due to this structure, a vertical level of the first flame generation portion 710 may be higher than that of the outer cap 810. Thus, a contact area of the first flame generation portion 710 with the surrounding air may be increased.

[0413] Therefore, the first flame generation portion 710 smoothly contacts the surrounding air, such that the gas discharged from the first flame generation portion 710 smoothly receives the surrounding secondary air, and thus incomplete combustion due to insufficient supply of the secondary air may be suppressed.

[0414] The core 770 may include the insert protrusion 772 protruding downwardly and inserted into the groove defined in the cover 600. The cover 600 may include the protrusion receiving groove 660 depressed from the upper surface of the cover into the cover, and formed in an area corresponding to the insertion protrusion 772. The insert protrusion 772 may be inserted into the protrusion receiving groove 660. The insert protrusion 772 may include at least one insert protrusion 772. The protrusion receiving groove 660 may include at least one protrusion receiving groove 660.

[0415] In order that the head 700 is easily attached to and detached from the cover 600 and, at the same time, the head and the cover are coupled to each other at a designed position, a structure is needed to guide the positions thereof. Therefore, the core 770 may be provided with the insert protrusion 772, and the cover 600 may be provided with the protrusion receiving groove 660.

[0416] Due to this structure, the head 700 may be stably disposed at the designed position on an upper end of the cover 600 and may maintain its position.

[0417] FIG. 64 is a diagram for illustrating flow of gas in a burner according to one embodiment. In an embodiment, the gas discharged from one mixing tube 501 may flow into the first guide tube 520 and the second guide tube 630. In the first guide tube 520, the gas may be divided into the two portions flowing in the opposite directions and in the circumferential direction. Then, the two portions may flow through the cover. Then, a portion of each of the two portions may flow to the second flame generation portion 720 disposed in the outer area of the burner, and a remaining portion thereof may flow to the first flame generation portion 710 disposed in the central area of the burner.

[0418] Specifically, while the gas flows through the mixing tube 501, the gas may be mixed with the primary air. Then, the mixture of the gas and the air may be discharged from the mixing tube 501, and then flow into the first guide tube 520. The gas flowing into the first guide tube 520 may flow into the second guide tube 630 through the through-hole 610. The gas flowing into the second guide tube 630 may flow to the central area of the head 700 and may be divided into the portions in the central area of the head 700.

[0419] One of the portions of the gas in the central area of the head 700 may flow upwardly immediately and may flow into the first flame generation portion 710, and may be discharged through the first flame hole 711 and may be burned to generate a flame.

[0420] The other of the portions of the gas in the central area of the head 700 may flow to the outer area of the head 700 through the space defined by the first connection part 644 and the second connection part 744 and may flow upwardly and flow through the spreading hole 730. Then, the gas may spread along the gas spreading portion 750 and may flow into the second flame generation portion 720 and may flow evenly along the circumference of the second flame generation portion 720 disposed in the outer area of the head 700, and may be discharged through the second flame hole 721 and may be burned to generate a flame.

[0421] In an embodiment, the gas discharged from the single mixing tube 501 may be divided into the portions which may be respectively supplied to the plurality of flame generation portions radially spaced apart from each other in the burner. Due to this structure, the flow channels for gas supply to the flame generation portions may be integrated with each other. The gas may be fed to the burner using a single supply pipe, and the flow channel structure in the burner may be simplified.

[0422] Although the present disclosure has been described with reference to the accompanying drawings, the present disclosure is not limited by the embodiments disclosed herein and drawings. In addition, although the effects based on the configuration of the present disclosure are not explicitly described and illustrated in the above description of the embodiment of the present disclosure, it is obvious that predictable effects of the corresponding configuration should also be recognized.

Claims

1. A burner comprising:

a body (100, 500);
a cover (200, 600) disposed on top of the body (100, 500) and coupled to the body (100, 500) to define a mixing tube (101, 501) in which gas and air flow and are mixed with each other; and
a head (300, 700) disposed on top of the cover (200, 600) and configured to generate a flame, wherein the head (300, 700) includes:

a first flame generation portion (310, 710) disposed in a central area of the head (300, 700) and having a plurality of first flame holes (311; 311a, 711; 711a) defined therein and arranged along a circumference thereof; and
a second flame generation portion (320, 720) disposed in an outer area of the head (300, 700) and surrounding the first flame generation portion (310, 710), wherein a plurality of second flame holes (321, 721) are defined in the second flame generation portion (320, 720) and area arranged along a circumference thereof,

wherein the body (100, 500), the cover (200, 600), and the head (300, 700) are configured such that:

the gas discharged from the mixing tube (101, 501) is divided into two portions in an outer area of the body (100, 500), then, the two portions of the gas flow through the cover (200, 600), and
then, a portion of each of the two portions flows into the second flame generation portion (320, 720), while a remaining portion of each of the two portions flows from the outer area of the head (100, 500) to the central area thereof and flows into the first flame generation portion (310, 710).

2. The burner of claim 1, wherein the gas discharged from the mixing tube (101, 501) is divided into two portions flowing supplied to the first flame generation portion (310, 710) and the second flame generation portion (320, 720) which are radially spaced apart from each other.

3. The burner of claim 1 or 2, wherein the gas discharged from the mixing tube (101, 501) is divided into two portions flowing in opposite directions.

4. The burner according to any one of claims 1 to 3, wherein the body (100, 500) includes:

a lower cell (110, 610) depressed from an upper surface of the body (100, 500) into the body (100, 500) and constituting a lower portion of the mixing tube (101, 501); and
a first guide tube (120, 520) connected to an outlet of the mixing tube (101, 501) in the outer area of the body (100, 500), wherein the first guide tube (120, 520) has two divided portions connected to the outlet of the mixing tube (101, 501) and extending in a circumferential direction of the body (100, 500) and respectively in opposite directions, wherein the first guide tube (120, 520) is partially closed with the cover (200, 600), and the gas flows in the first guide tube (120, 520).

5. The burner according to any one of claims 1 to 4, wherein the body (100, 500) includes:

an injection portion (130, 530) constituting one side of the body (100, 500) and having a gas injection hole (131, 531) defined therein; and
an air receiving portion (140, 540) disposed between an inlet of the mixing tube (101, 501) and an outlet of the injection portion (130, 530), wherein a space into which the air is introduced and stored is defined in the air receiving portion (140, 540).

6. The burner according to any one of claims 1 to 5, wherein the body (100, 500) includes:

a cover receiving groove (150, 550) depressed from an upper surface of the body (100, 500) into the body (100, 500) and having a shape corresponding to a shape of the cover (200, 600) so that the cover (200, 600) is seated in the cover receiving groove (150, 550);
a first spark plug receiving hole (160, 560) formed at a position overlapping with the cover (200, 600), wherein a spark plug is inserted and mounted into the first spark plug receiving hole (160, 560); and
an extension panel (170, 570) surrounding the cover receiving groove (150, 550) and extending laterally from the body (100, 500).

7. The burner according to any one of claims 4 to 6, wherein the first guide tube (120) has an inclined guide surface (121) formed on each of a distal end of the two divided portions thereof configured to change a flow direction of the gas so that the gas gradually rises upwardly, and wherein a through-hole (210) through which the gas flows is formed in the cover (200) in an area at least partially over-

lapping the inclined guide surface (121).

8. The burner according to any one of claims 4 to 7, wherein the cover (200) includes an upper cell (220, 620) protruding downwardly toward the body (100, 500), wherein the upper cell (220, 620) has an inner space upwardly depressed from a lower surface thereof into the upper cell (220, 620), wherein the inner space constitutes an upper portion of the mixing tube (101, 501).

9. The burner according to any one of claims 4 to 8, wherein the burner further comprises a second guide tube (230, 630) defined by a combination of the cover (200, 600) and the head (300, 700), wherein the second guide tube (230, 630) has a space in which the gas flowing into the space from the body (100, 500) flows from the outer area of the head (300, 700) to the central area thereof.

10. The burner of claim 9, wherein the cover (200, 600) includes:

a through-hole (210, 610) connected to the first guide tube (120, 520), wherein the gas flows through the through-hole (210, 610), preferably wherein the through-hole (210, 610) includes a pair of through-holes (210, 610) disposed in an outer area of the cover (200, 600) and spaced apart from each other along a circumferential direction of the cover (200, 600); and
a lower part (240, 640) having a portion surrounding the through-hole (210, 610), wherein the lower part (240, 640) protrudes upwardly from an upper surface of the cover (200, 600), and defines a lower portion of the second guide tube (230, 630).

11. The burner of claim 10, wherein the lower part (240, 640) includes:

a first outer part (241, 643) surrounding the through-hole (210, 610) and disposed in an outer area of the cover (200, 600), wherein the first outer part (241, 643) defines a flow channel connected to the second flame generation portion (320, 720), wherein the first outer part (241, 643) includes a pair of first outer parts (241, 643) spaced apart from each other in a circumferential direction of the cover (200, 600);
a first central part (242, 642) formed in a central area of the cover (200, 600) and defining a flow channel connected to the first flame generation portion (310, 710); and
a first connection part (243, 644) defining a flow channel connecting an inner space of the first outer part (241, 643) and an inner space of the first central part (242, 642) to each other.

12. The burner of claim 10 or 11, wherein the cover (200, 600) includes a second spark plug receiving hole (250, 650) defined therein, wherein a spark plug is inserted and mounted into the second spark plug receiving hole (250, 650).

13. The burner according to any one of claims 10 to 12, wherein the head (300, 700) includes:

a spreading hole (330, 730) connected to the through-hole (210, 610), wherein the gas flows through the spreading hole (330, 730); and
an upper part (340, 740) having a portion surrounding the spreading hole (330, 730), wherein the upper part (340, 740) protrudes downwardly from a lower surface of the head (300, 700) and is coupled to the lower part (240, 640) to define an upper portion of the second guide tube (230, 630).

14. The burner of claim 13, wherein the spreading hole (330, 730) includes a pair of spreading holes (330, 730) disposed in an outer area of the head (300, 700) and respectively at positions corresponding to the pair of through-holes (210, 610), preferably wherein the upper part (340, 740) includes:

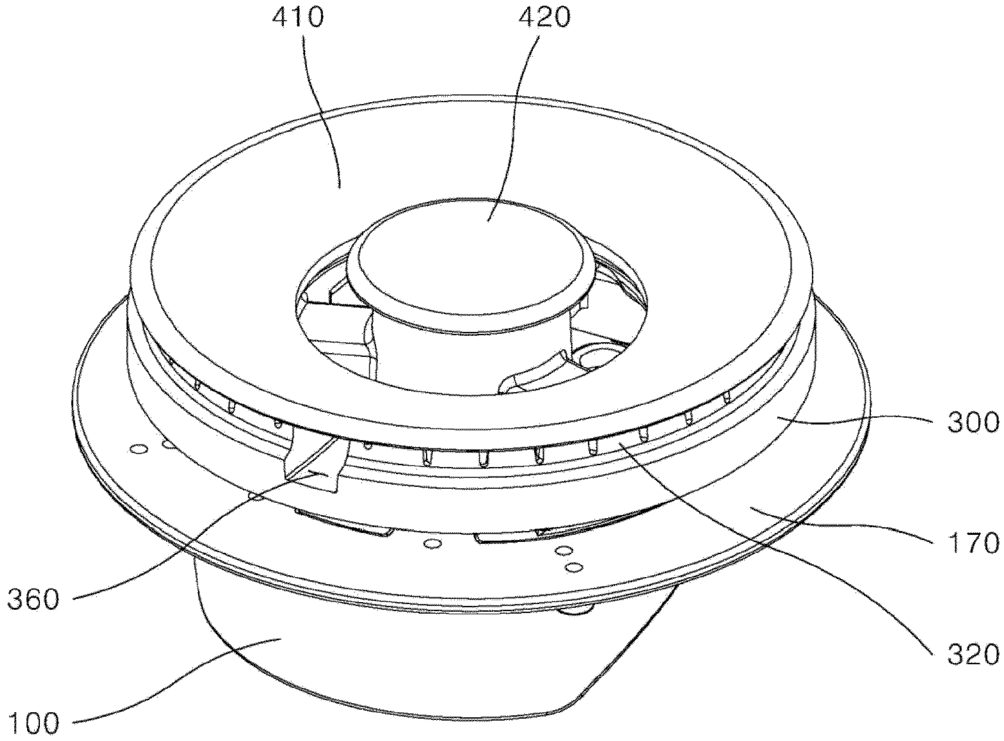
a second outer part (341, 743) surrounding the spreading hole (330, 730) and disposed in the outer area of the head (300, 700), wherein the second outer part (341, 743) defines a flow channel connected to the second flame generation portion (320, 720), and includes a pair of second outer parts (341, 743) spaced apart from each other in a circumferential direction of the head;
a second central part (342, 742) formed in a central area of the head (300, 700) and defining a flow channel connected to the first flame generation portion (310, 710); and
a second connection part (343, 744) defining a flow channel connecting an inner space of the second outer part (341, 743) and an inner space of the second central part (342, 742) to each other.

15. The burner of claim 13, wherein the burner is configured such that:

the portion of each of the two portions having flowed through the through-hole (210, 610) of the cover (200, 600) flows through the spreading hole (330, 730) reaches the second flame generation portion (320, 720), and is injected through the second flame hole (321, 721) and is burned; and
the remaining portion thereof flows from the outer area of the head (300, 700) to the central

area of the head (300, 700) along the second guide tube (230, 630), reaches the first flame generation portion (310, 710), and is injected through the first flame hole (311, 711) and is burned.

FIG. 1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100

FIG. 2

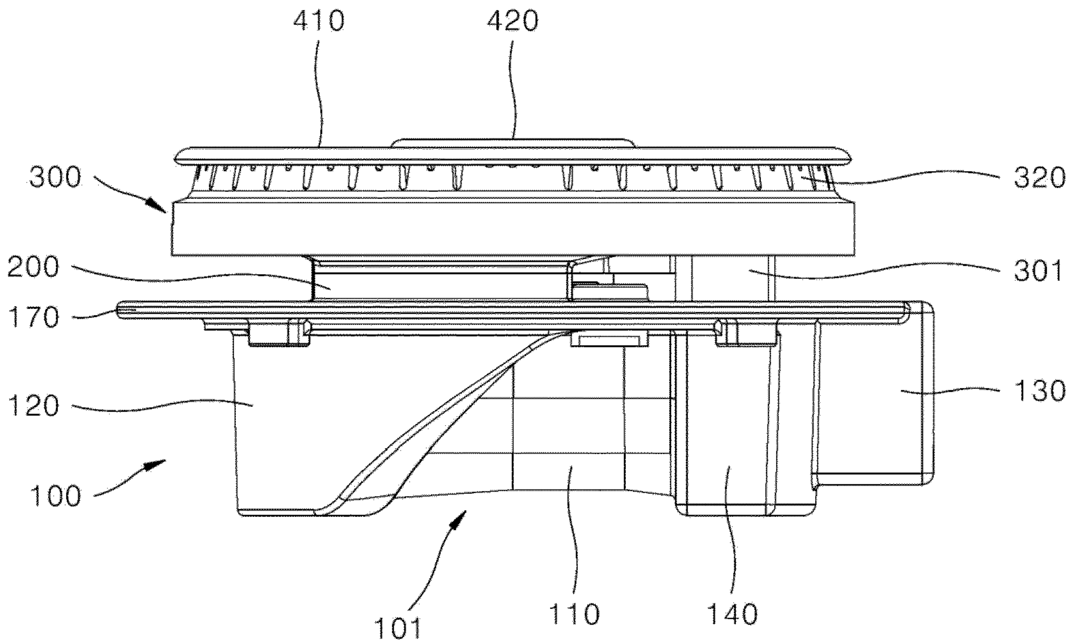
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FIG. 3

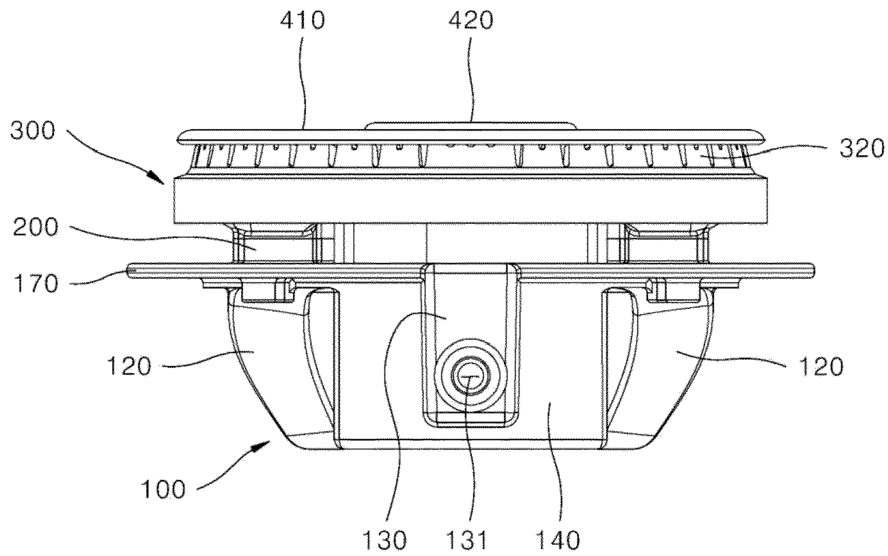
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FIG. 4

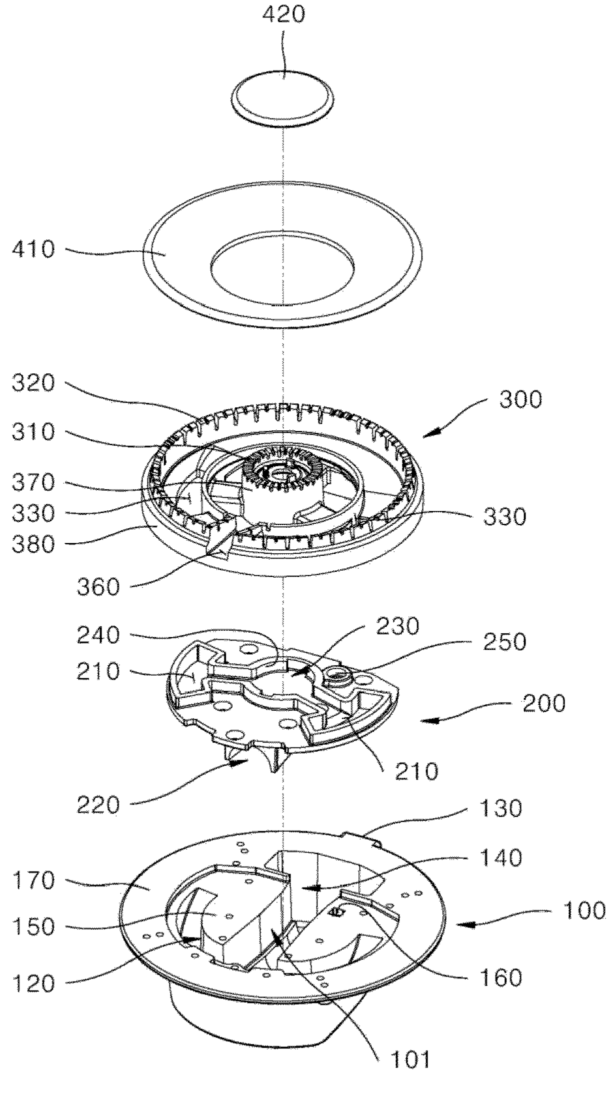
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FIG. 5

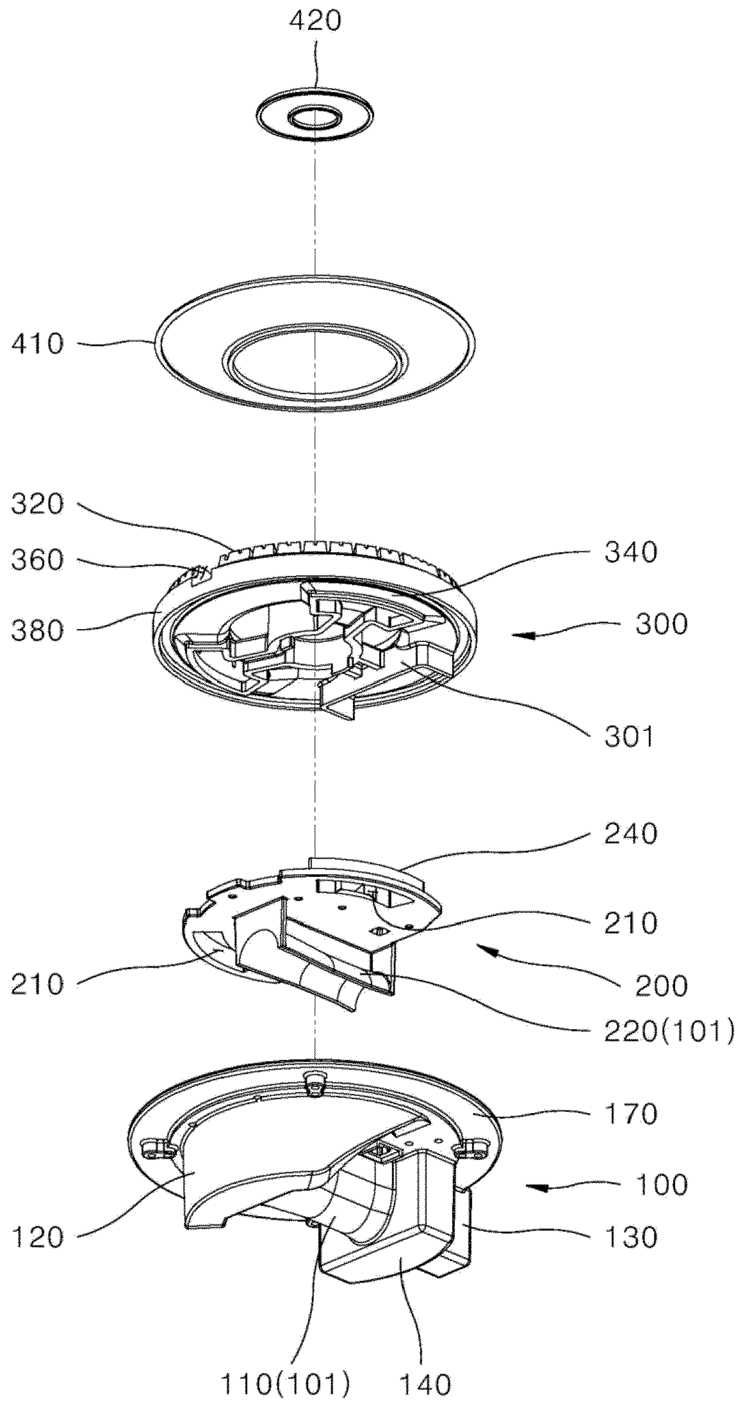
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FIG. 6

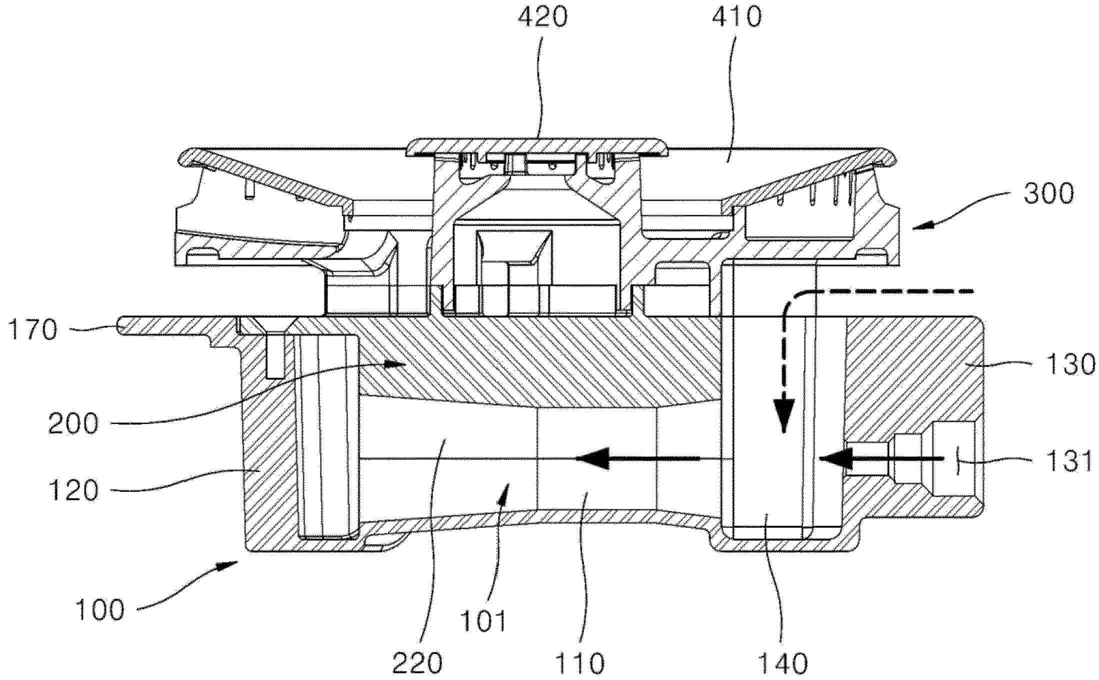
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FIG. 7

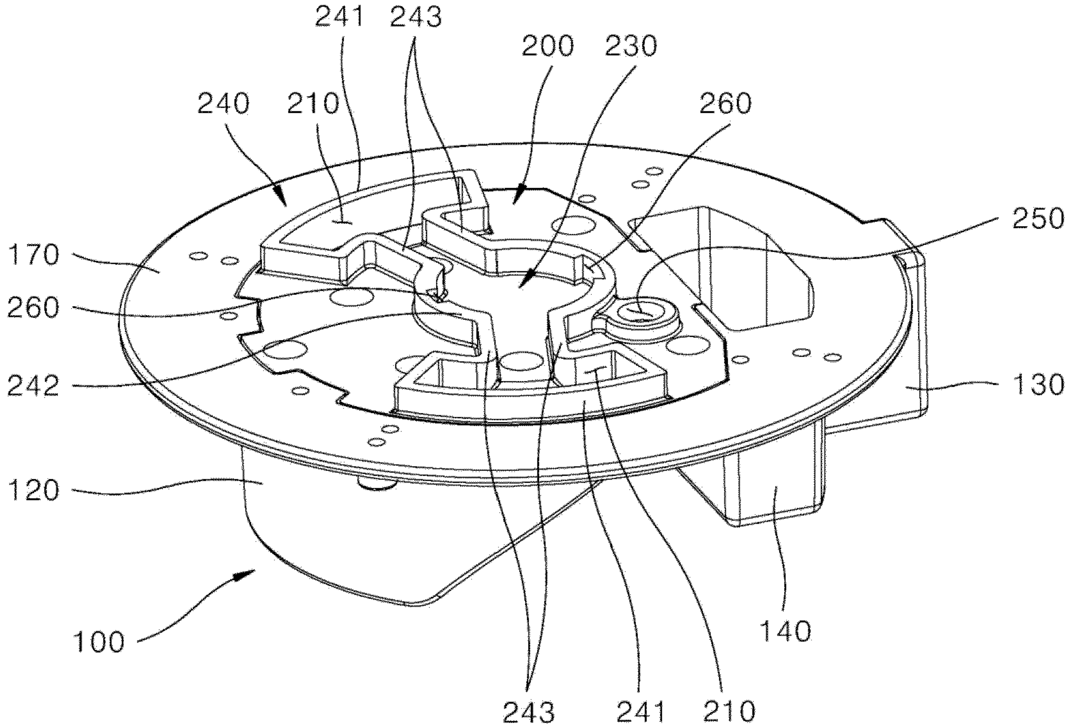
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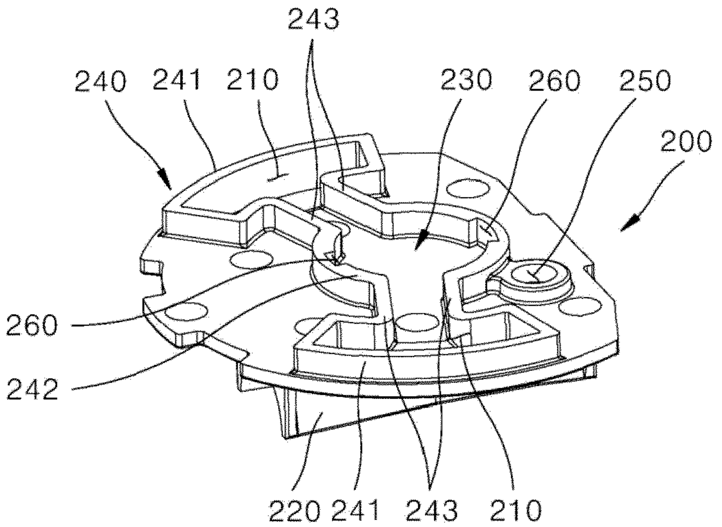
FIG. 8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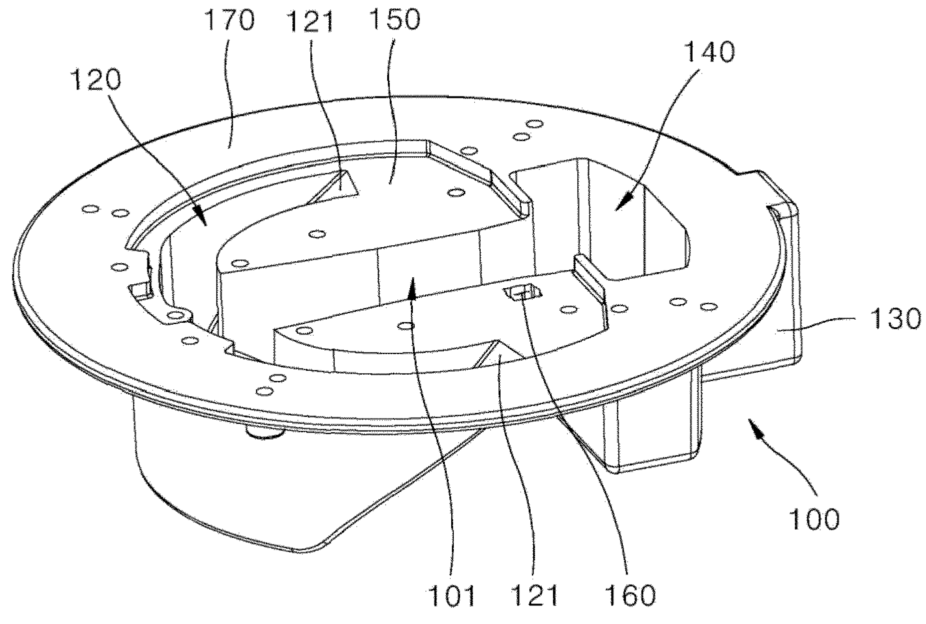
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FIG. 9

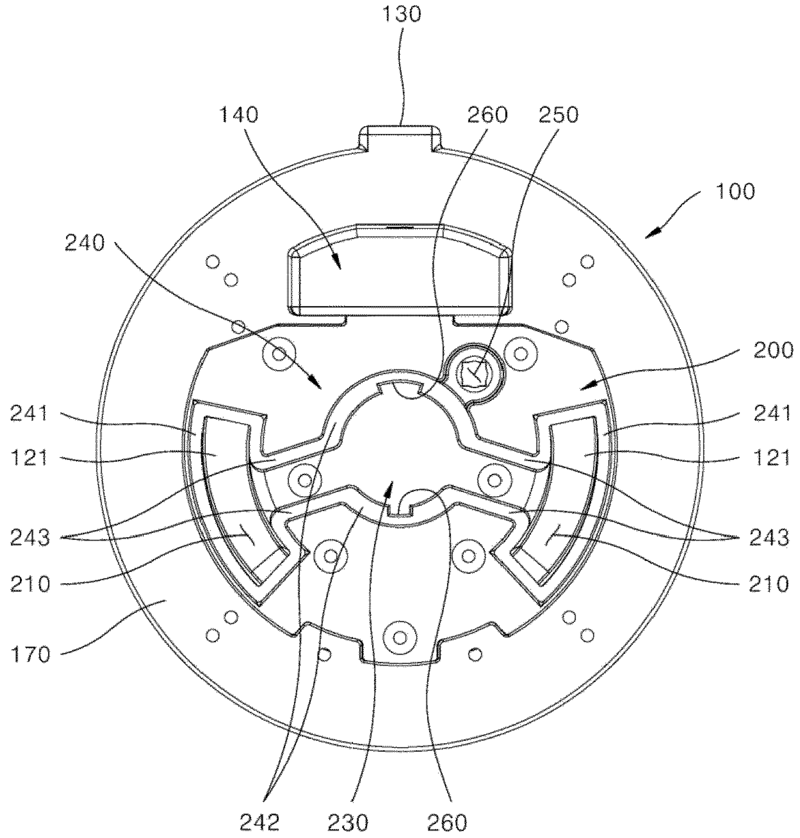
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FIG. 10

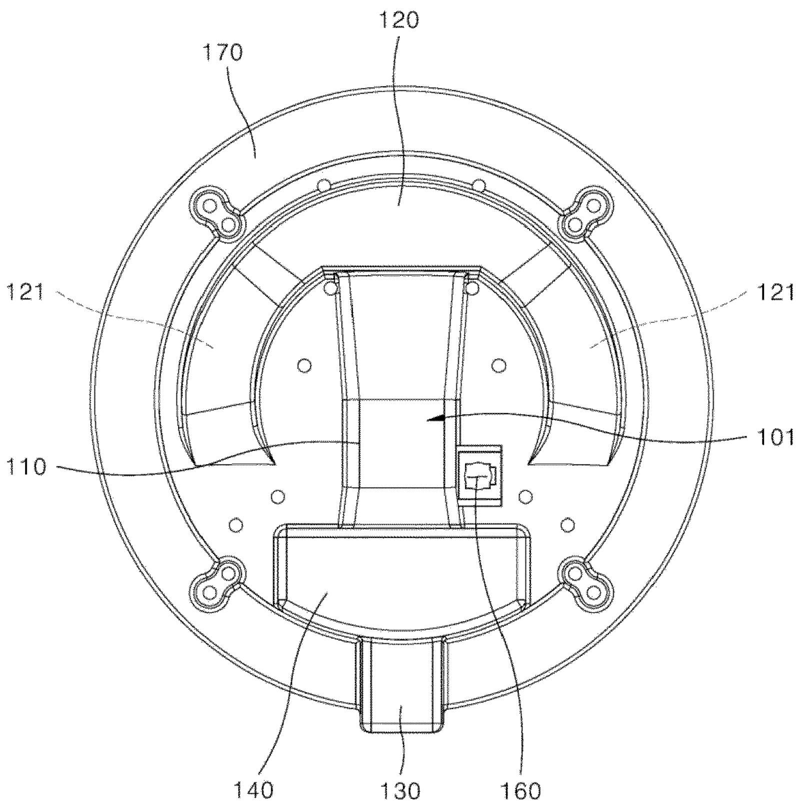
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FIG. 11

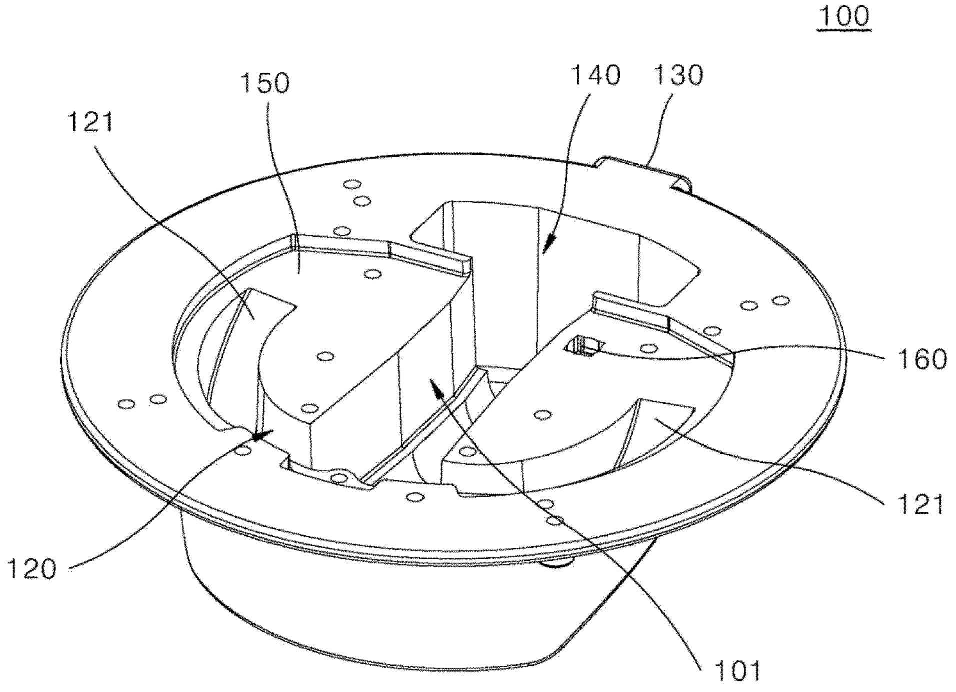
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FIG. 12

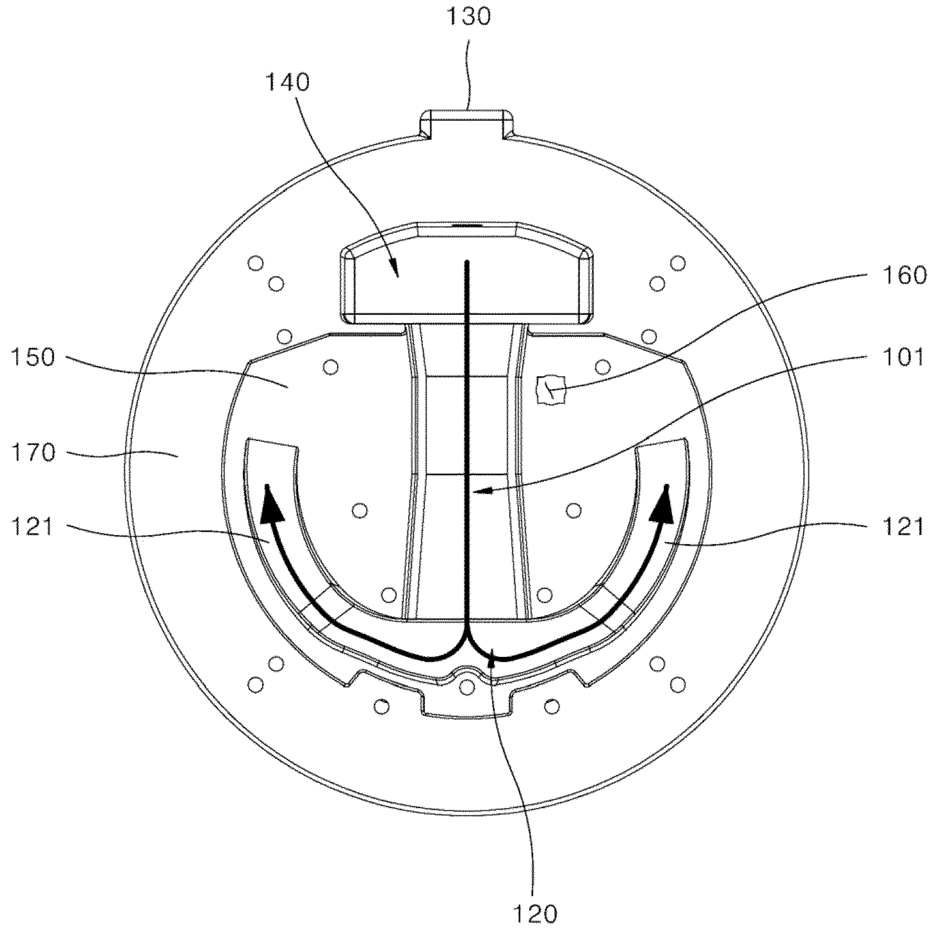
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FIG. 13

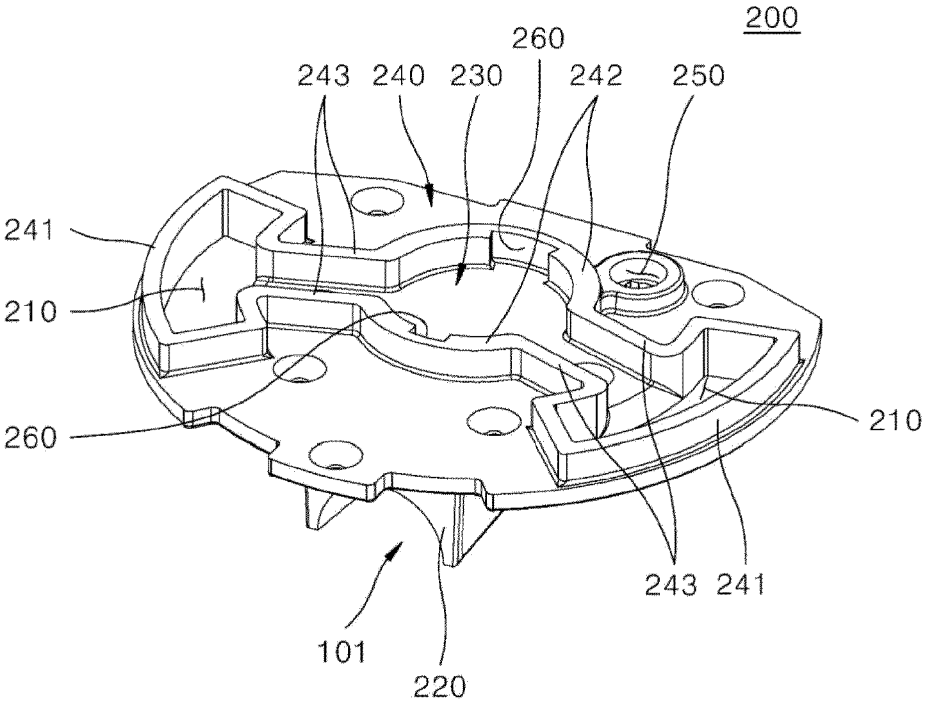
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FIG. 14

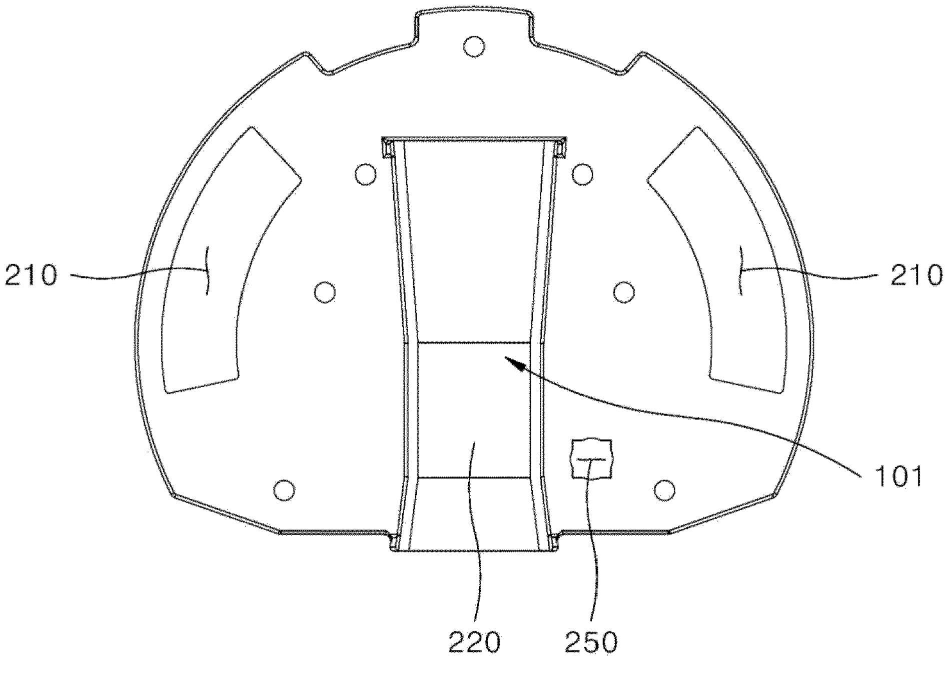
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FIG. 15

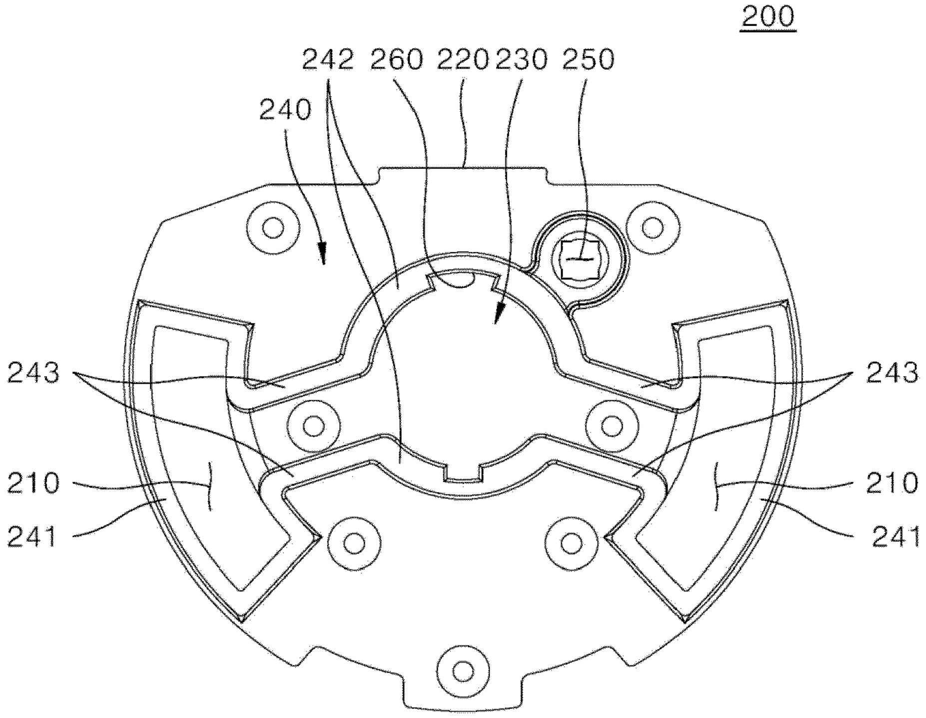
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FIG. 16

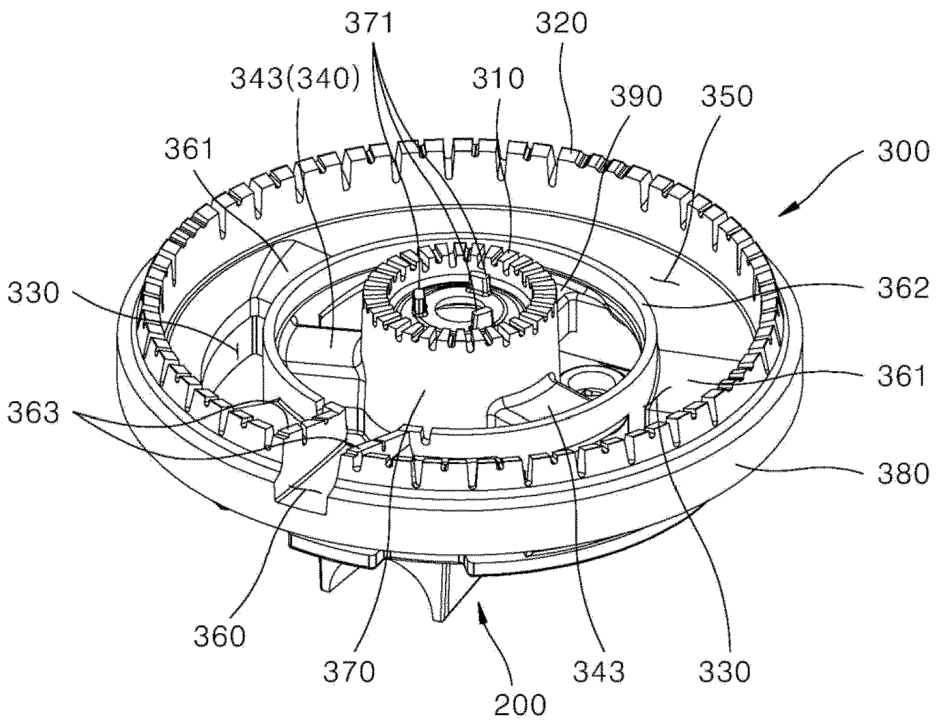
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FIG. 17

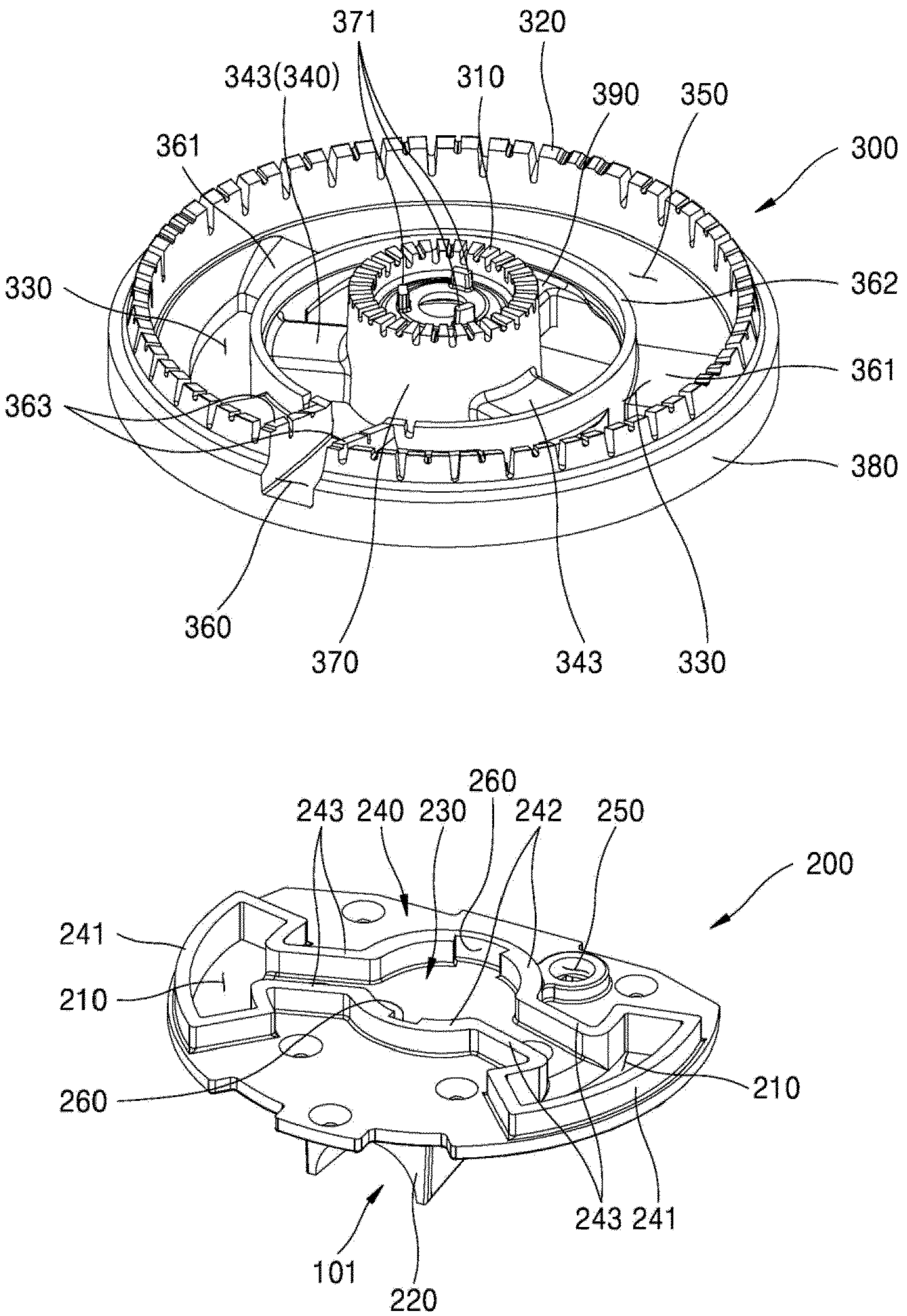
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FIG. 18

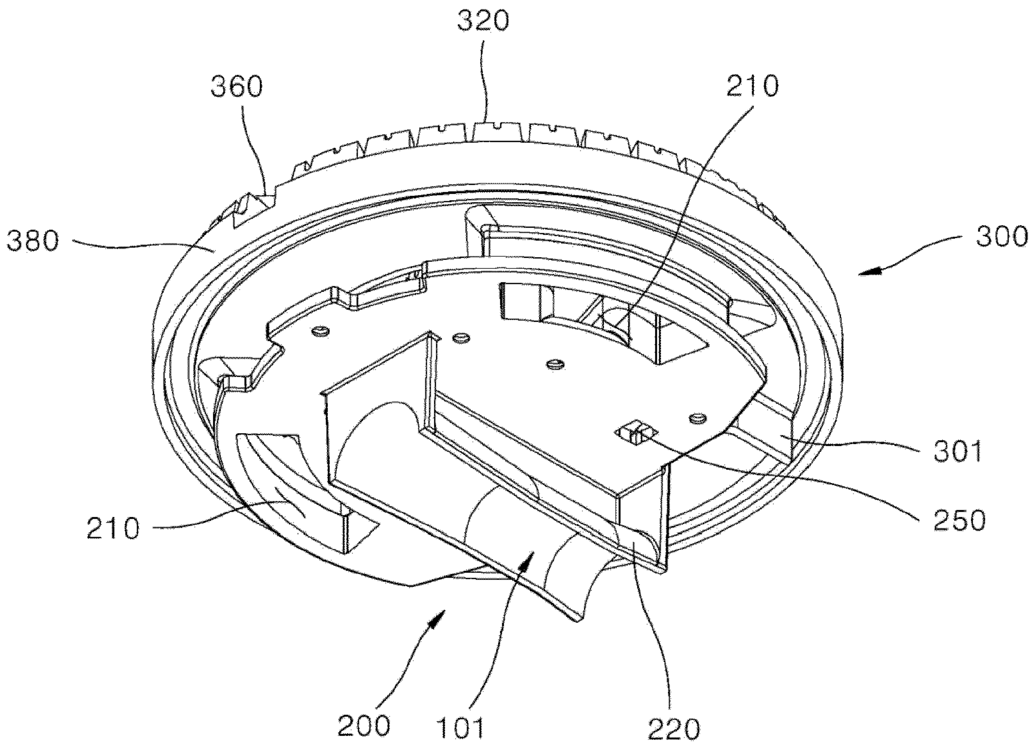
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FIG. 19

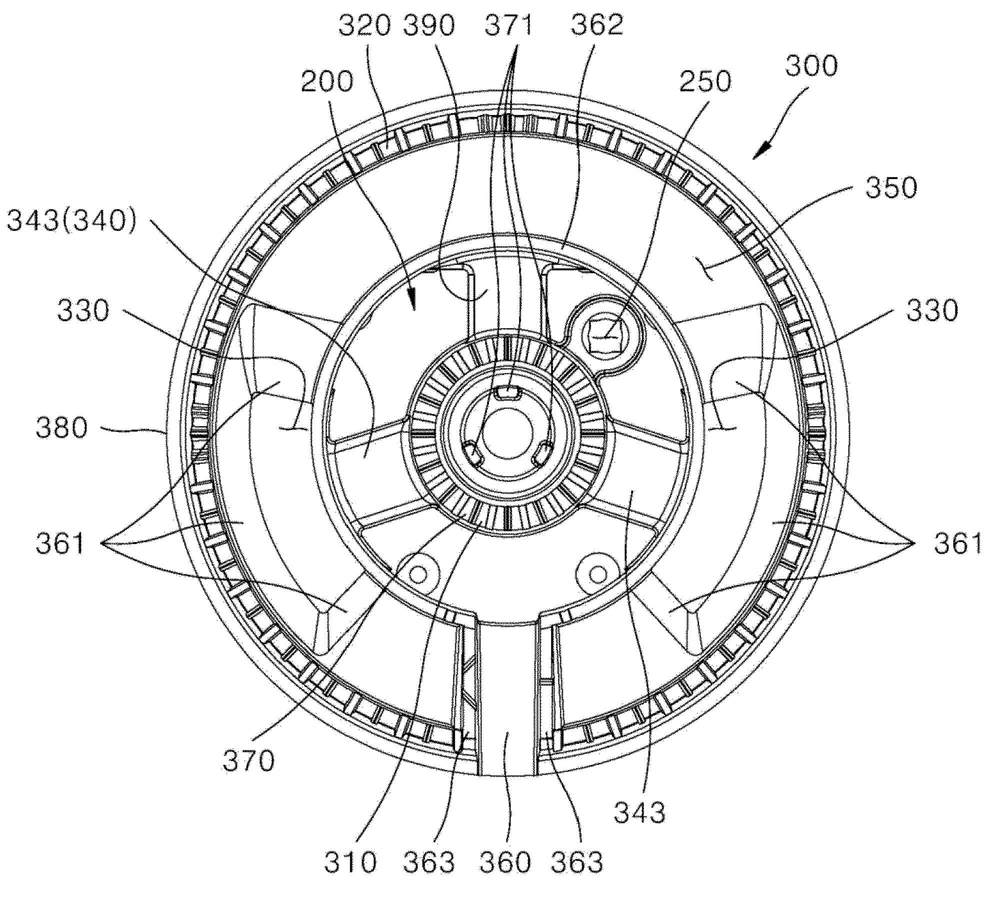
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FIG. 20

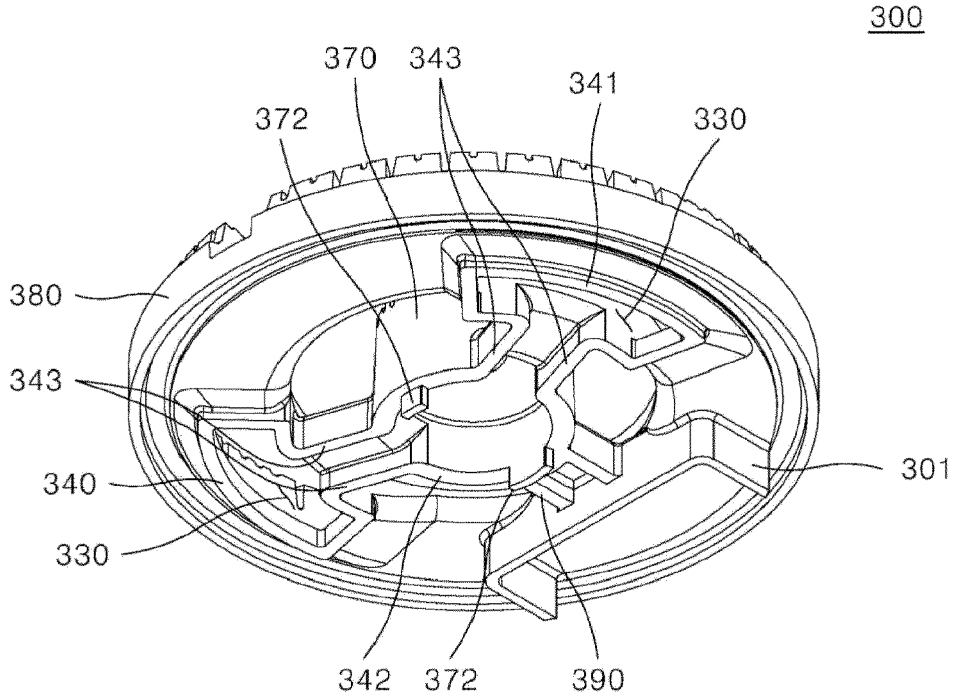
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FIG. 21

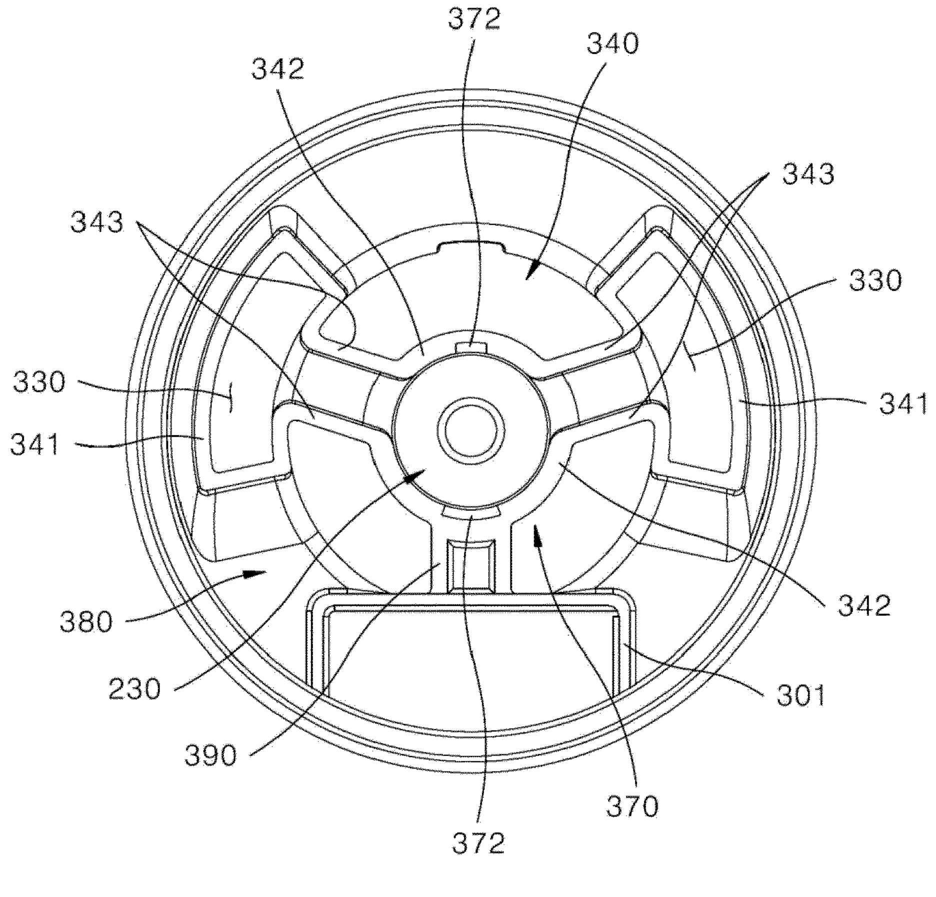
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FIG. 22

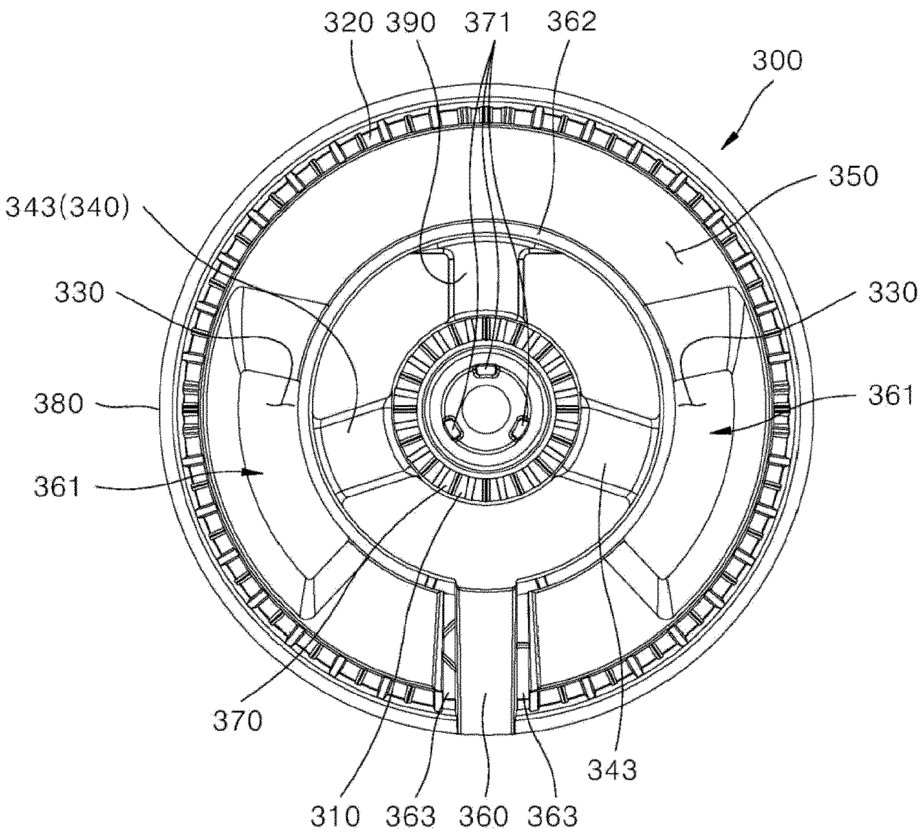
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FIG. 23

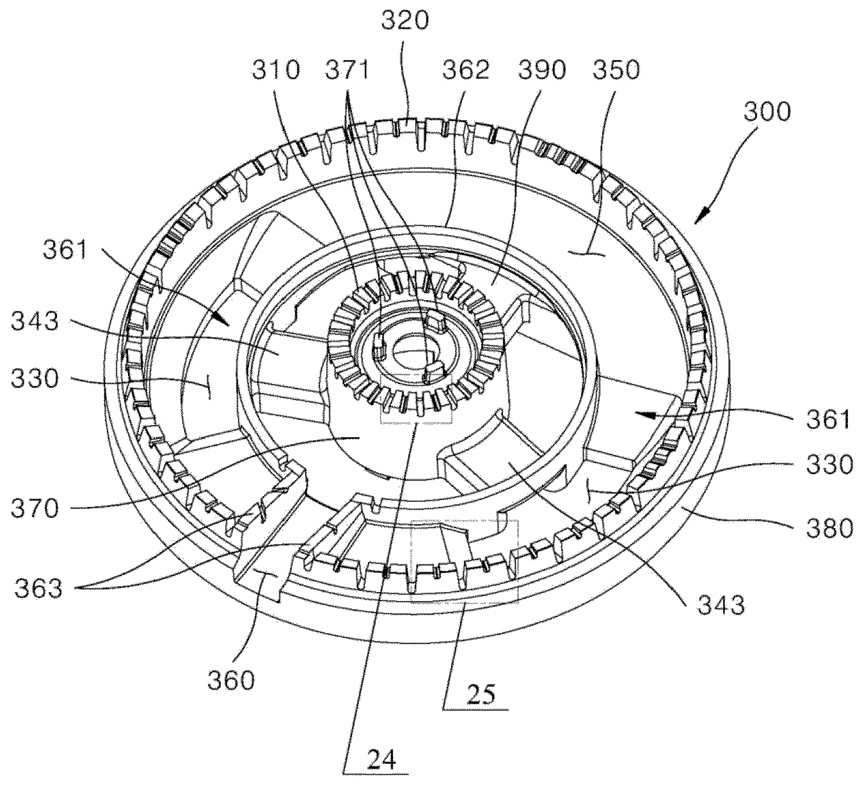
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FIG. 24

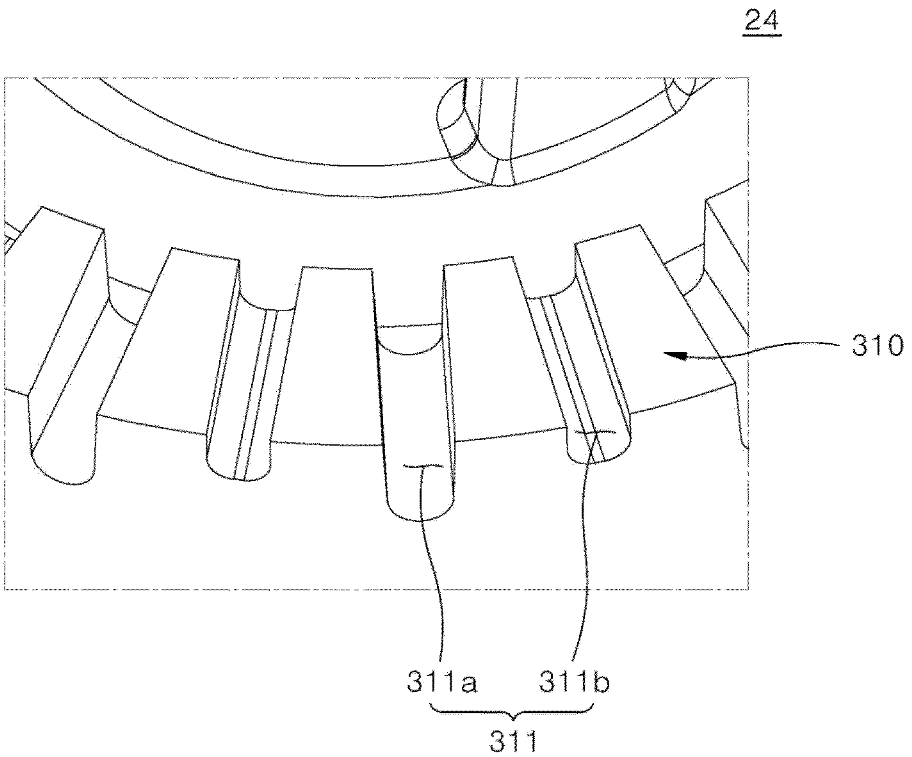


FIG. 25

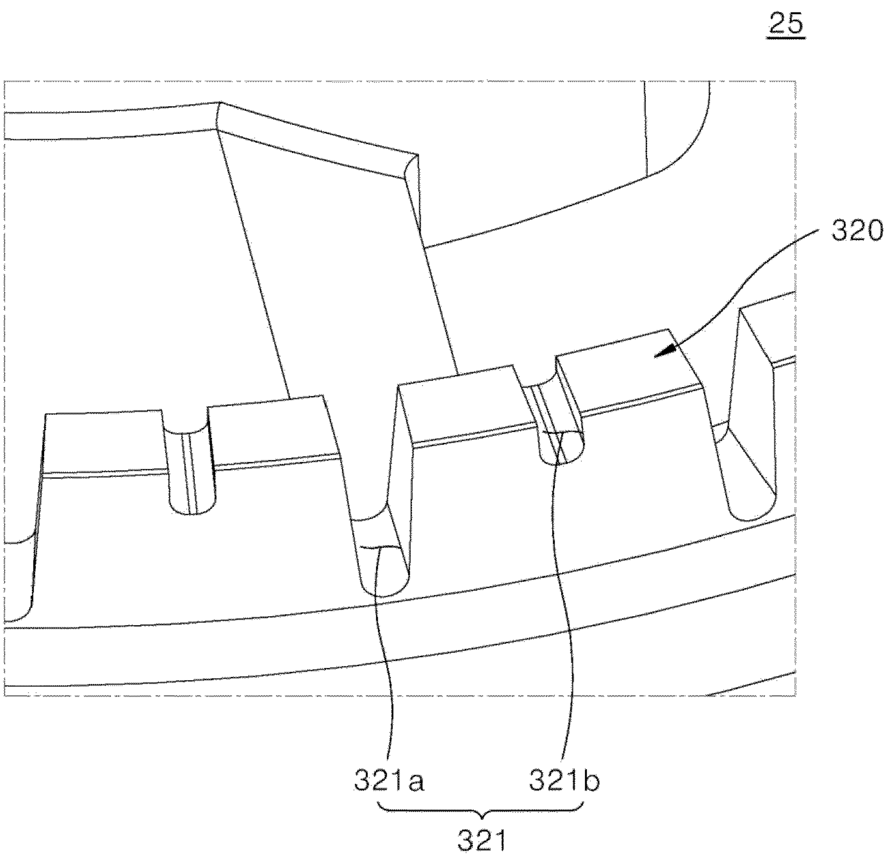


FIG. 26

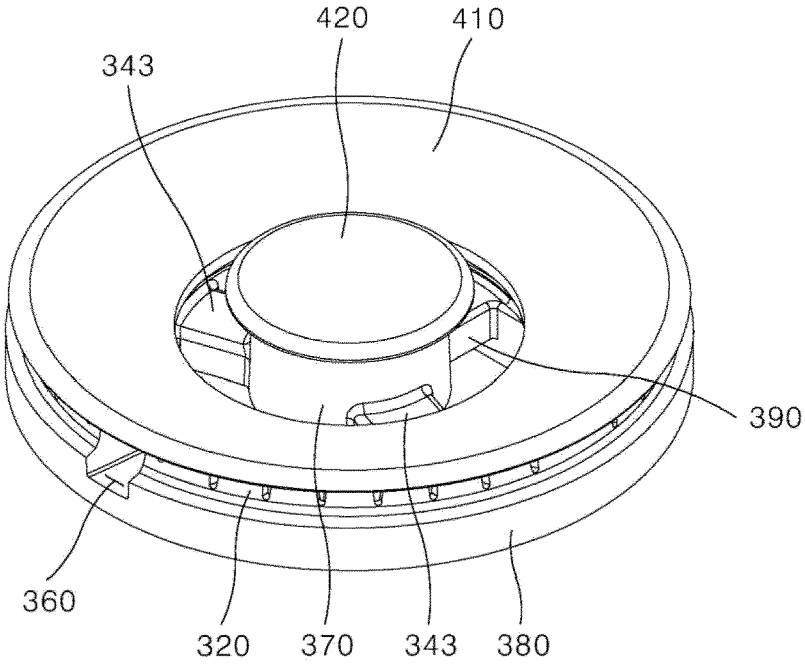


FIG. 27

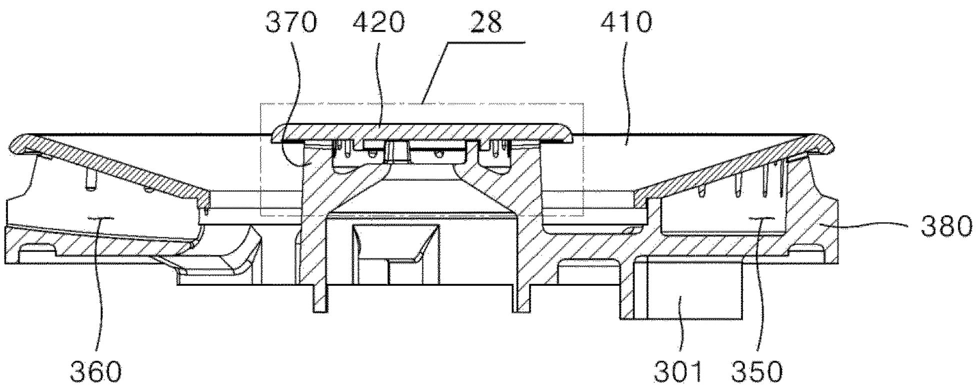


FIG. 28

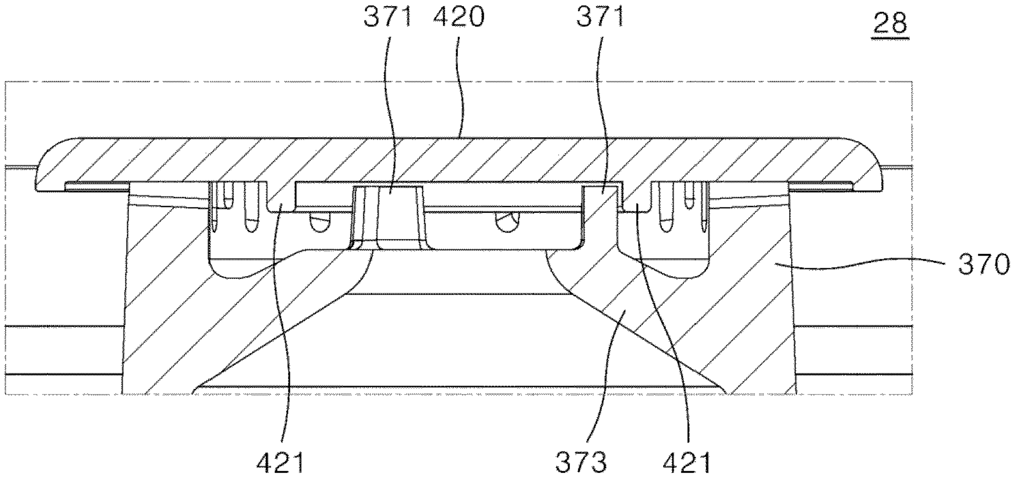


FIG. 29

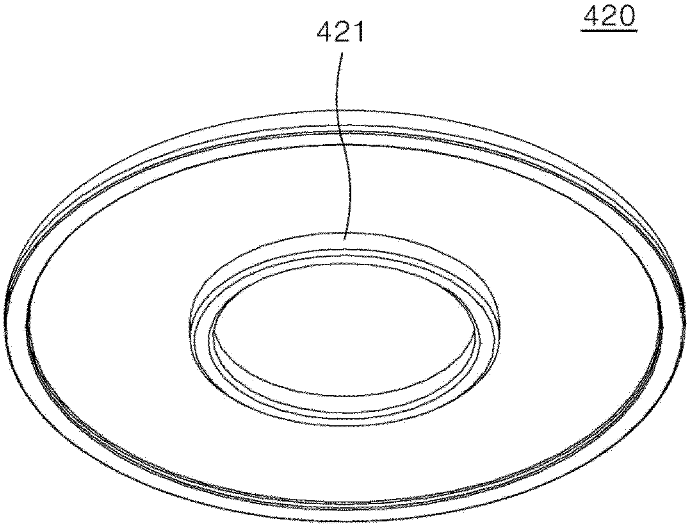
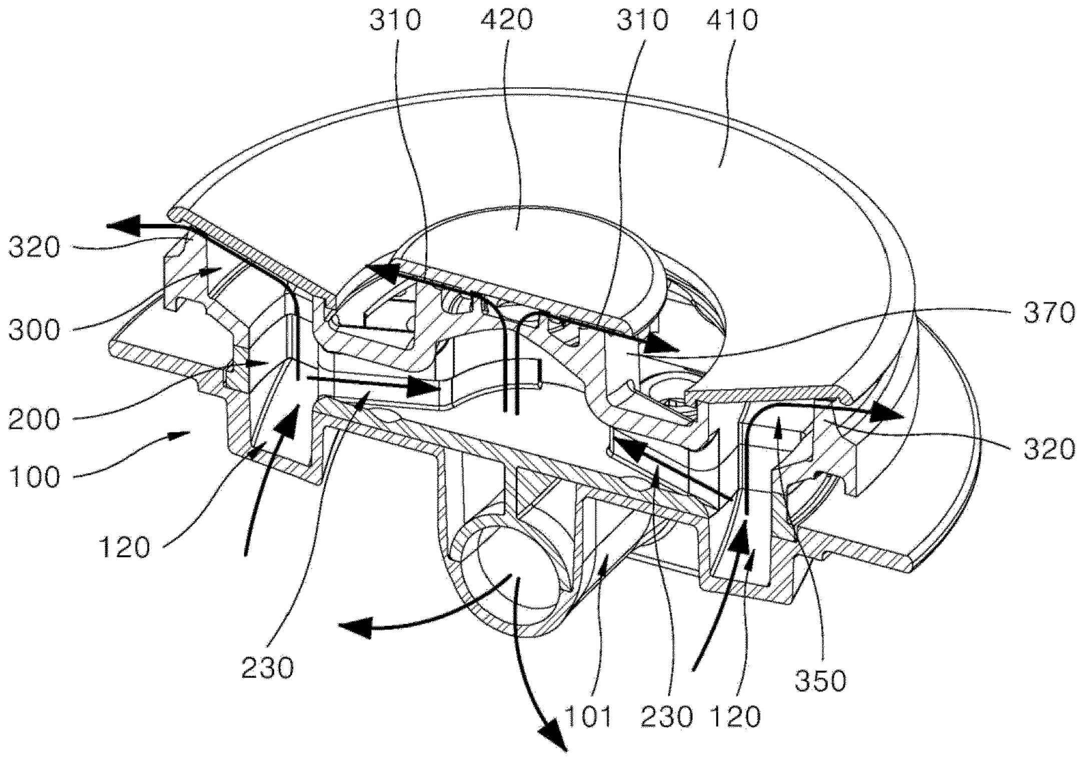

421
420

FIG. 30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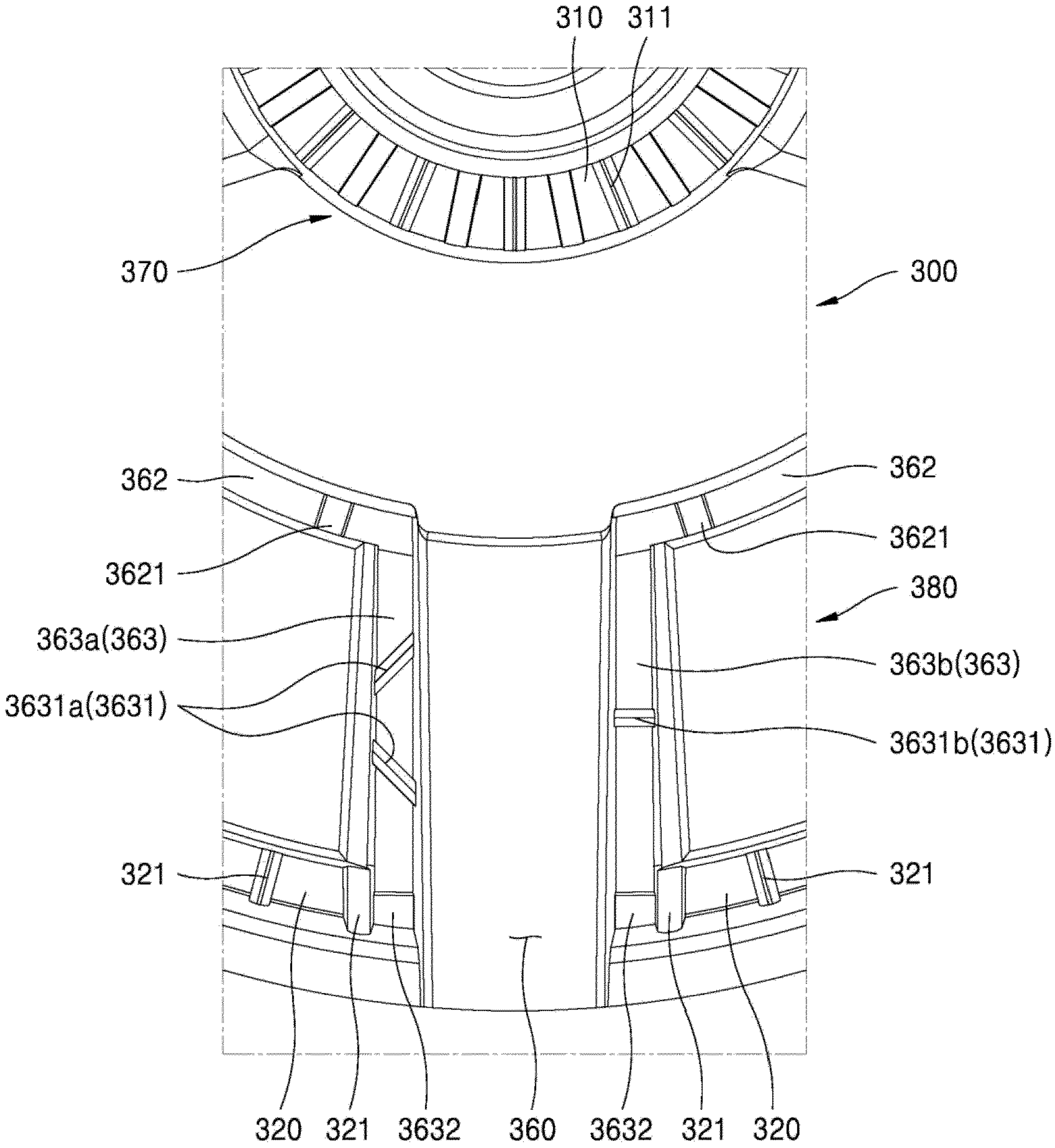
370
320
230
101
230
120
350

FIG. 31


310
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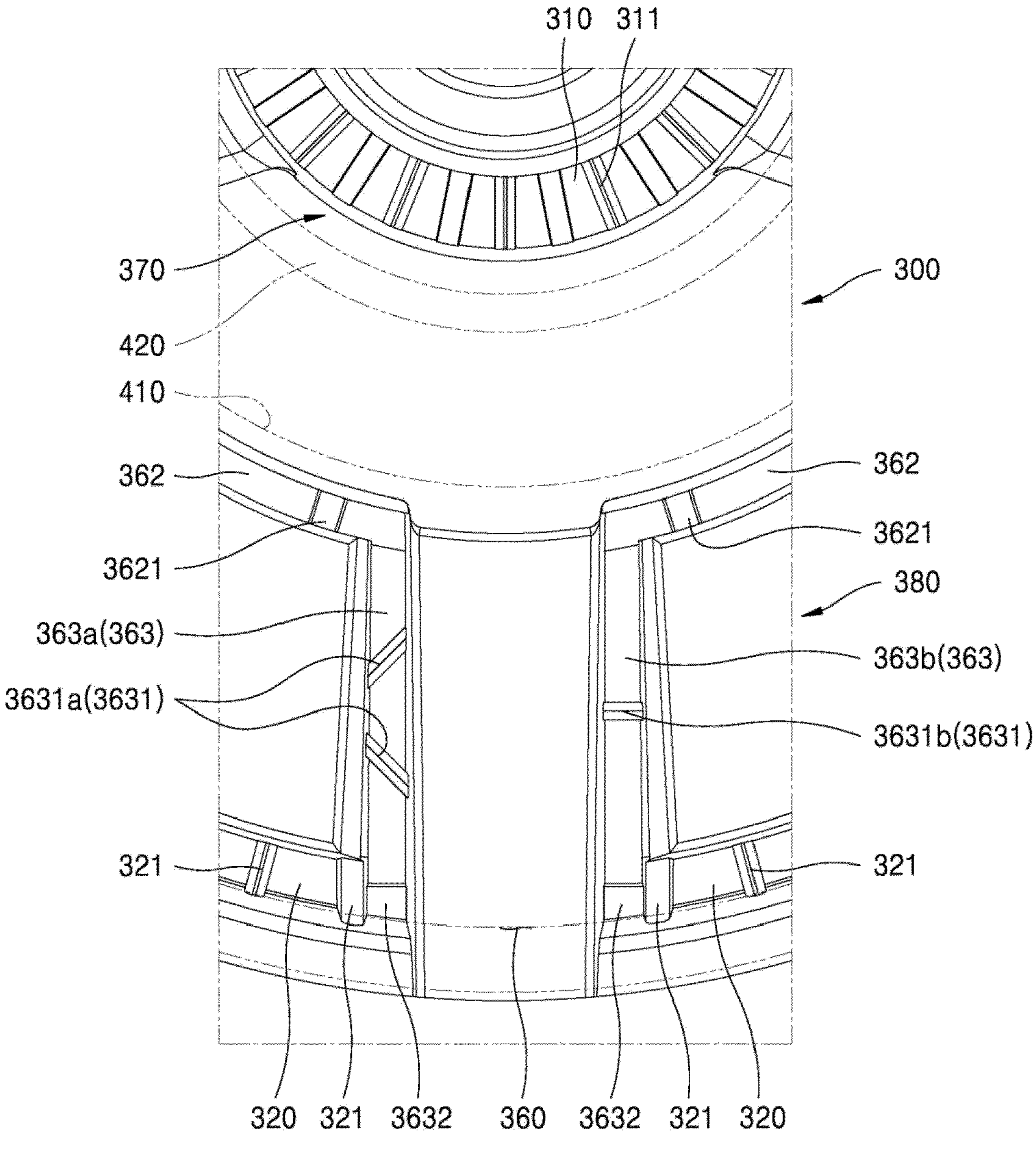
3621
3621
380
363a(363)
363b(363)
3631a(3631)
3631b(3631)
321
321
320
321
3632
360
3632
321
320

FIG. 32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3621
380
363a(363)
363b(363)
3631a(3631)
3631b(3631)
321
321
320
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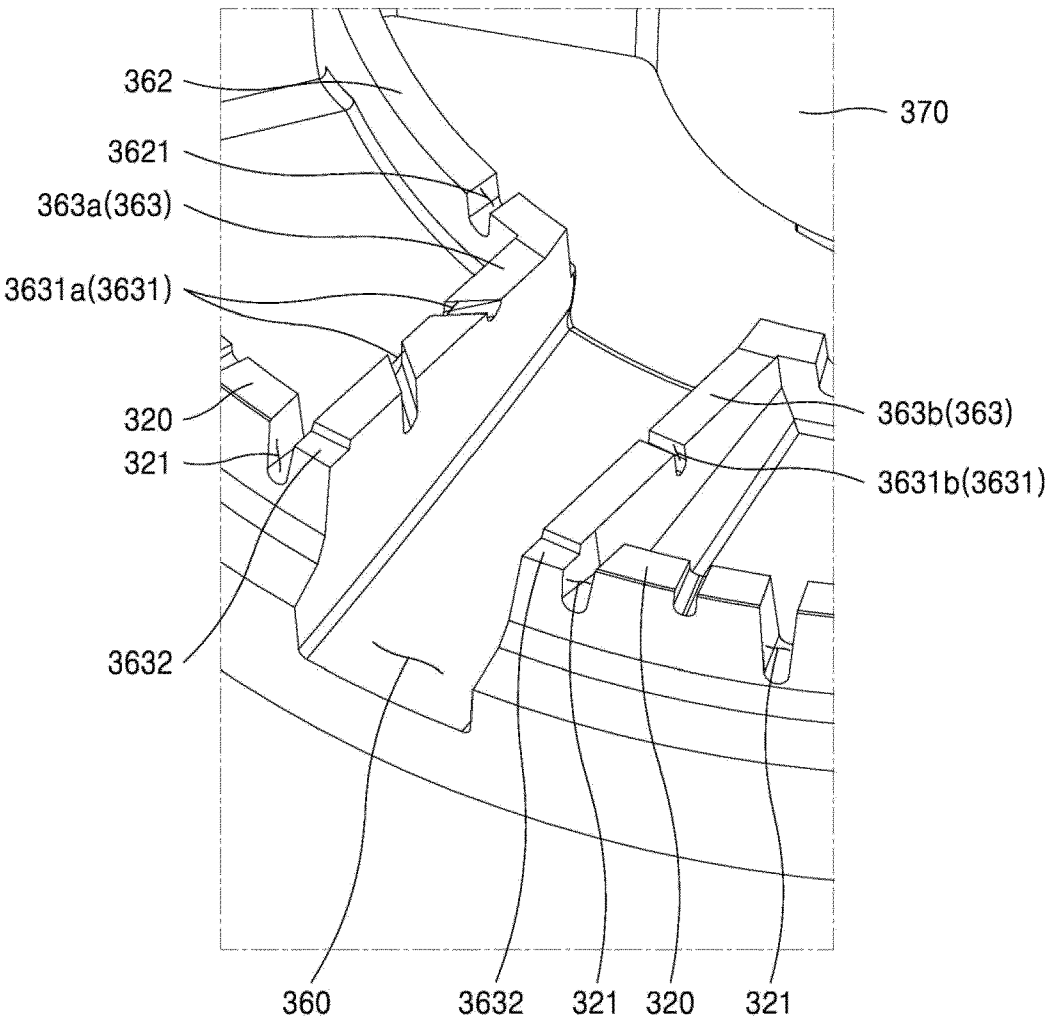
3632
360
3632
321
320

FIG. 33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363a(363)
3631a(3631)
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3632
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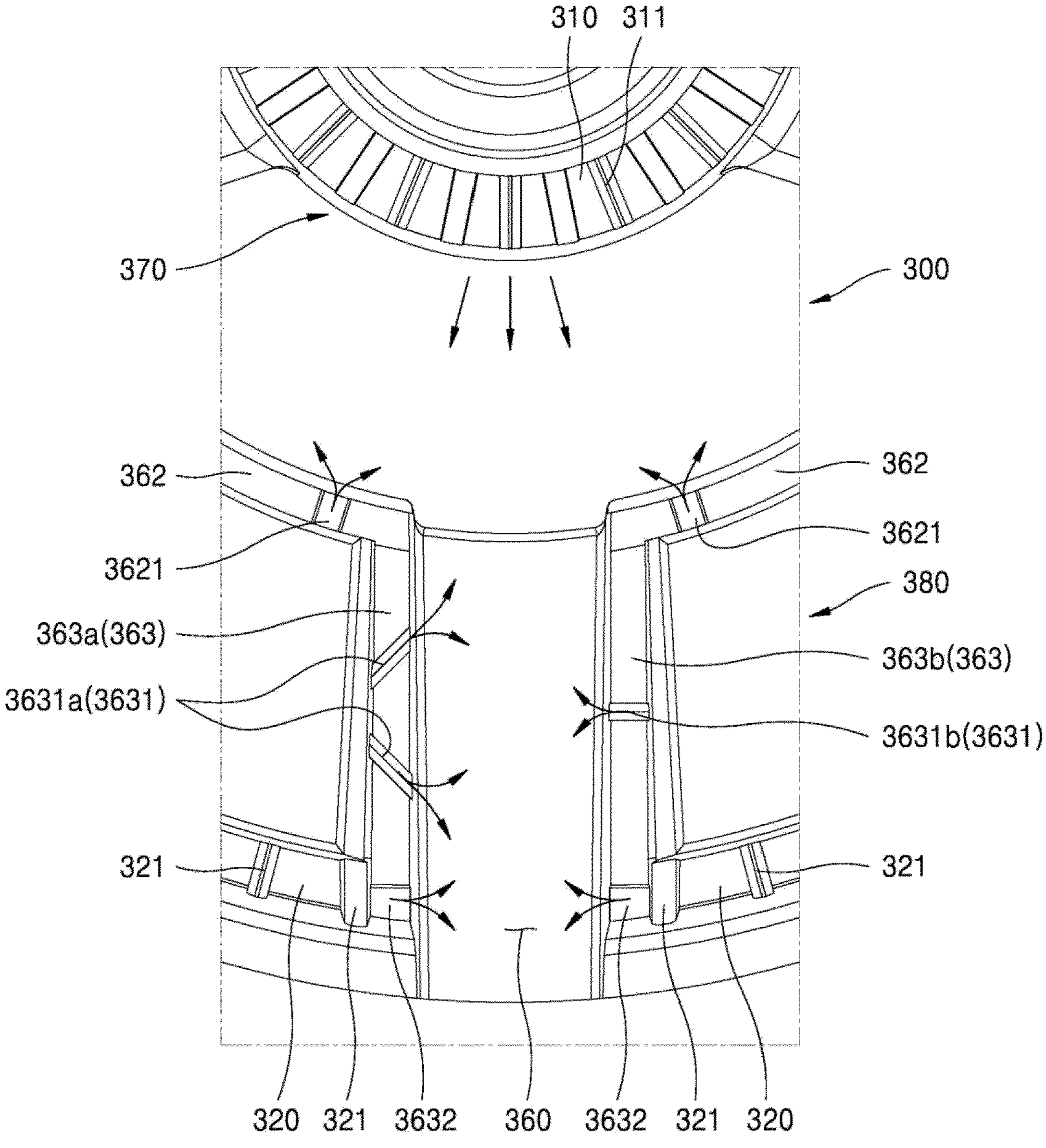
363b(363)
3631b(3631)
360
3632
321
320
321

FIG. 34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3621
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363a(363)
363b(363)
3631a(3631)
3631b(3631)
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3632
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3632
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320

FIG. 35

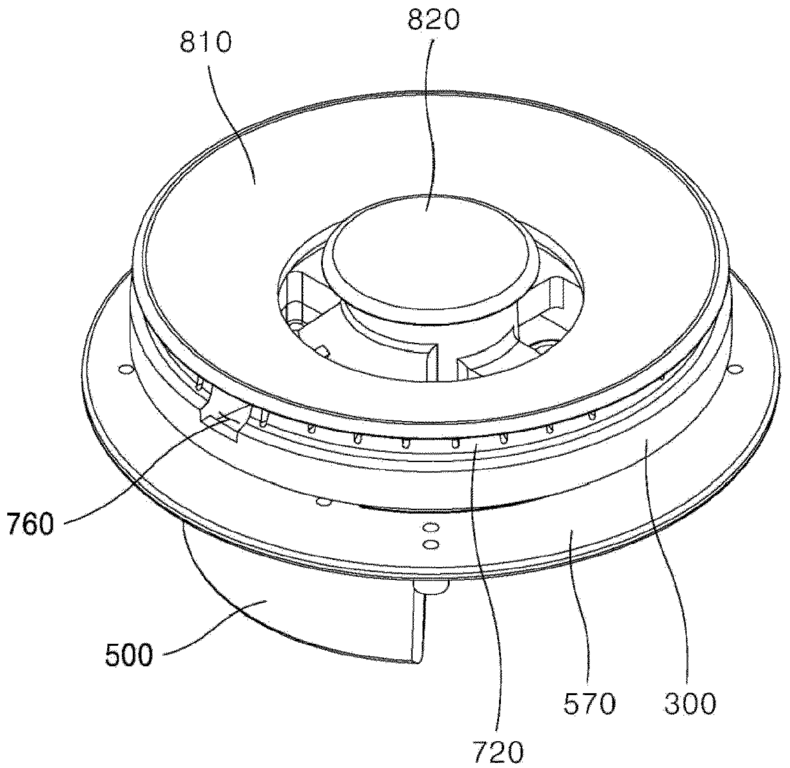
820
810
760
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FIG. 36

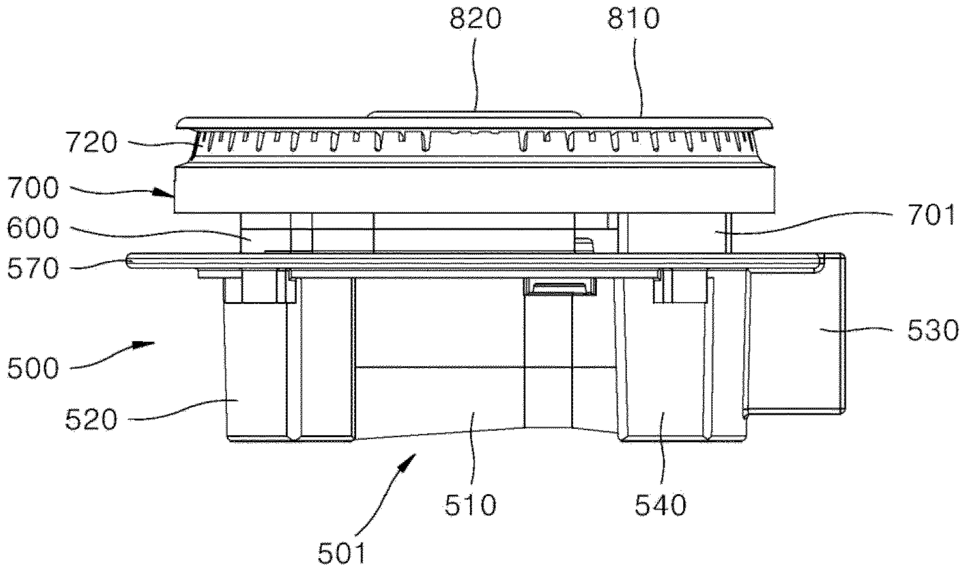
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FIG. 37

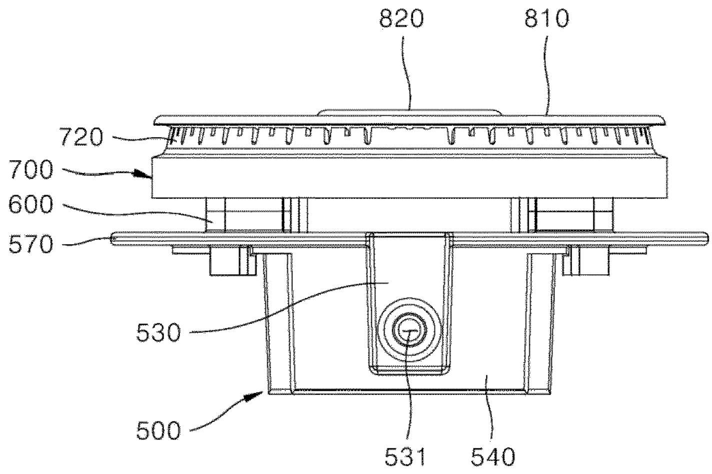
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FIG. 38

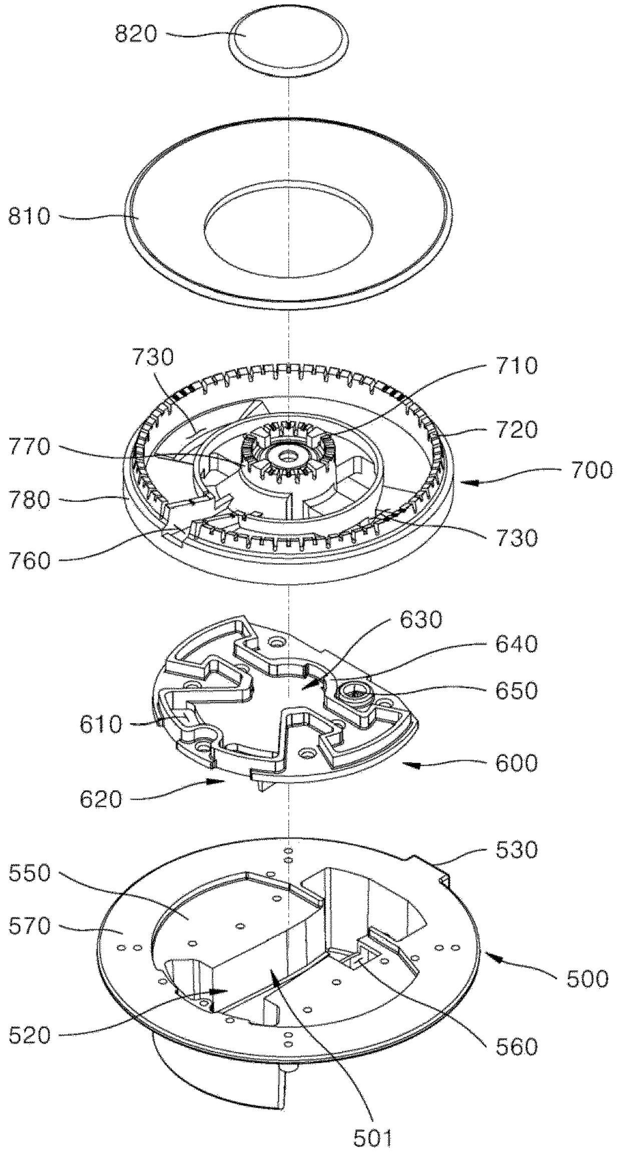
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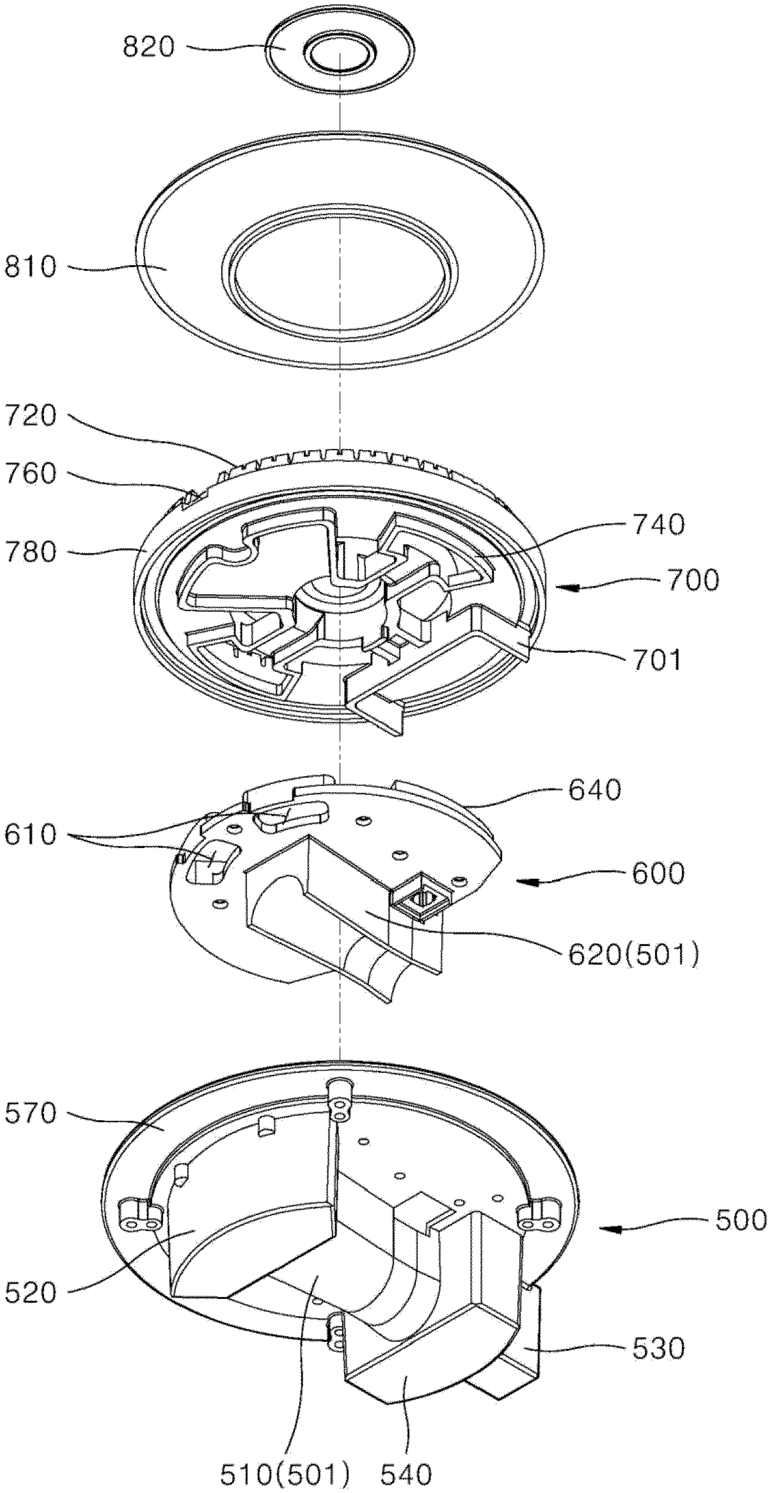
FIG. 39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620(501)
570
500
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510(501)
540

FIG. 40

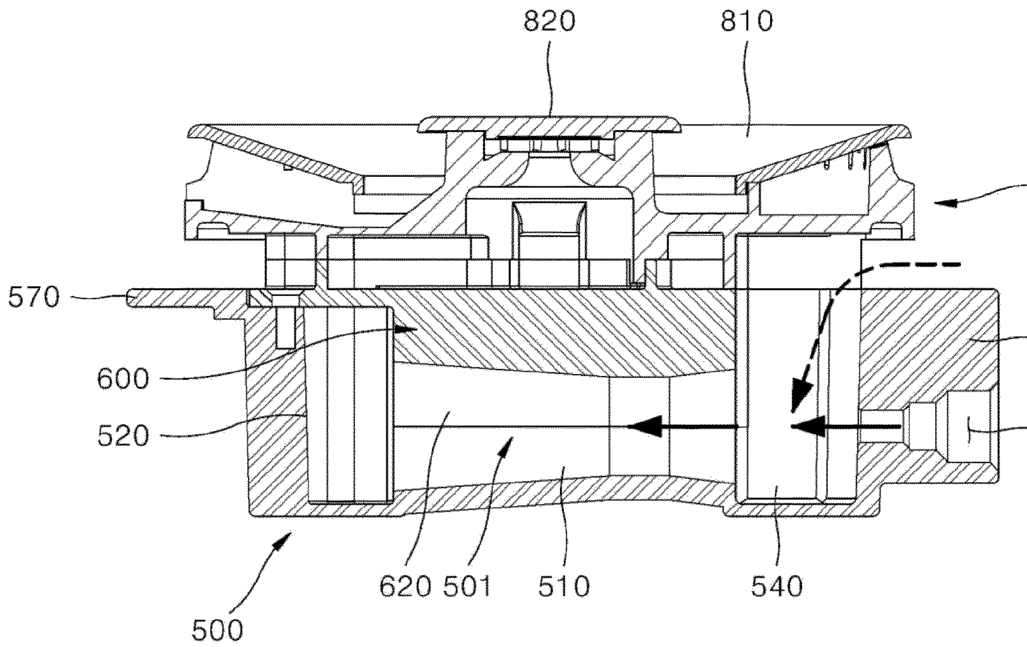
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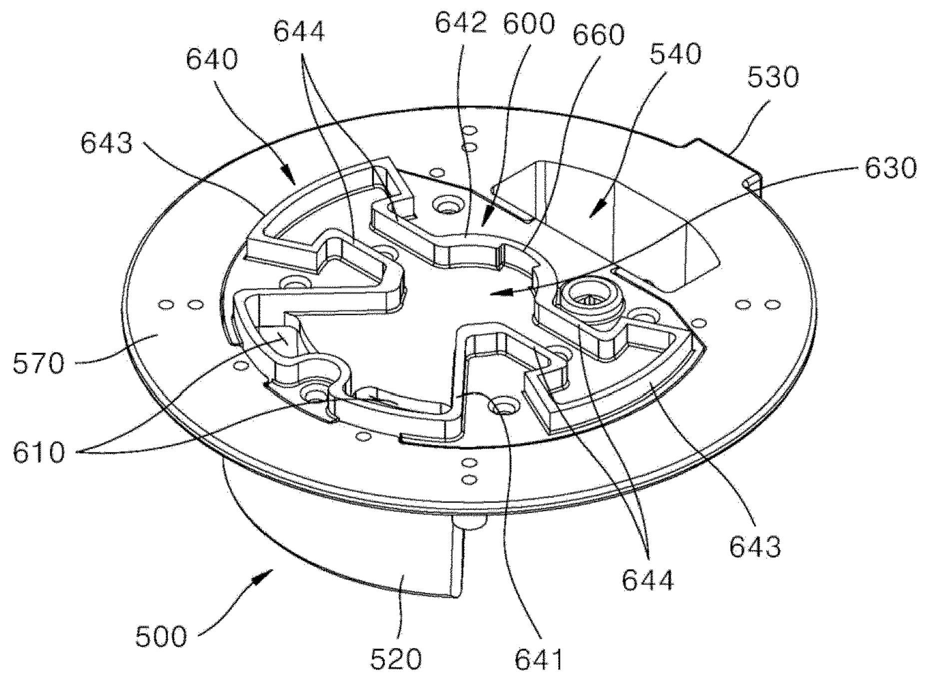
FIG. 41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641

FIG. 42

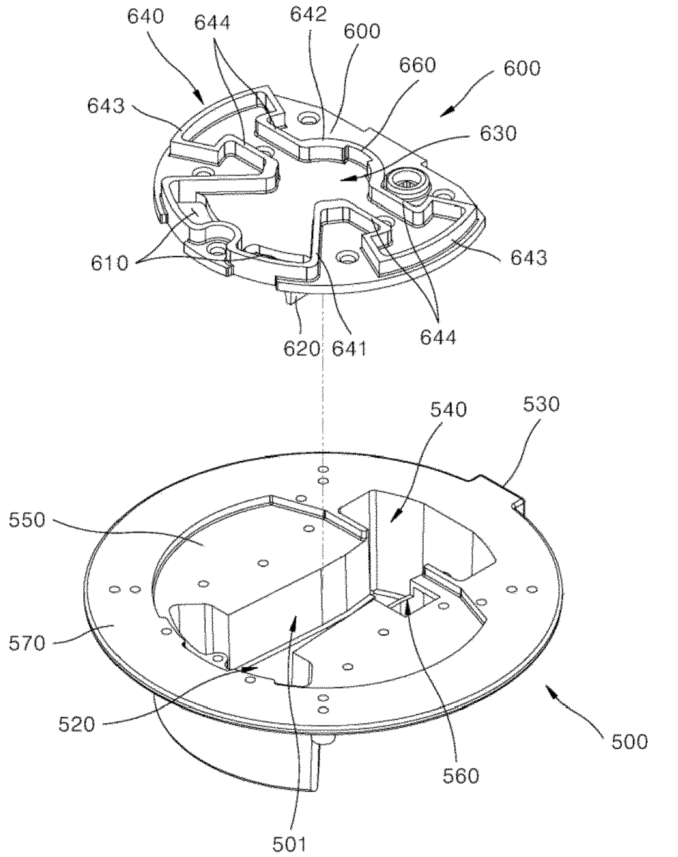
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FIG. 43

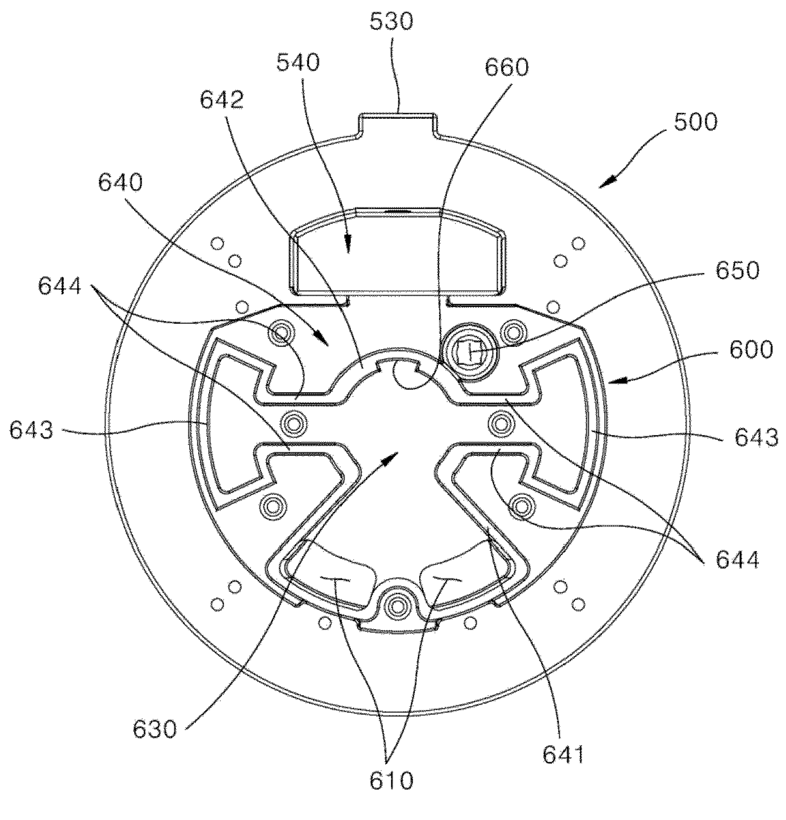
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FIG. 44

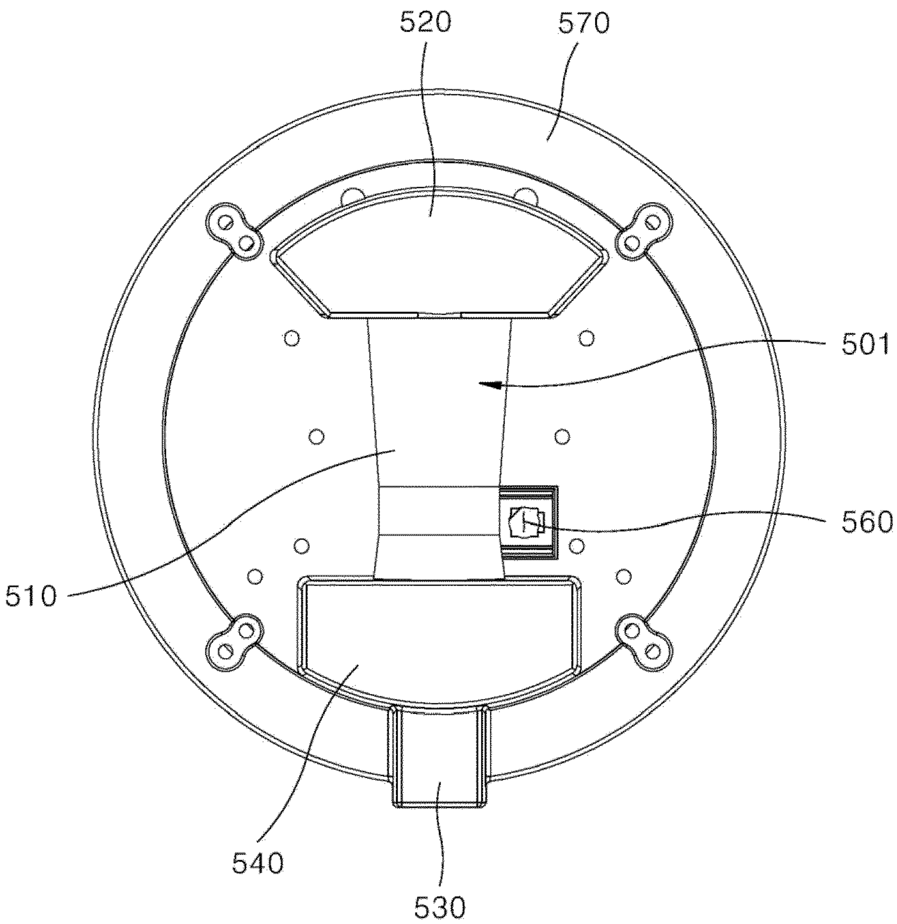

FIG. 45

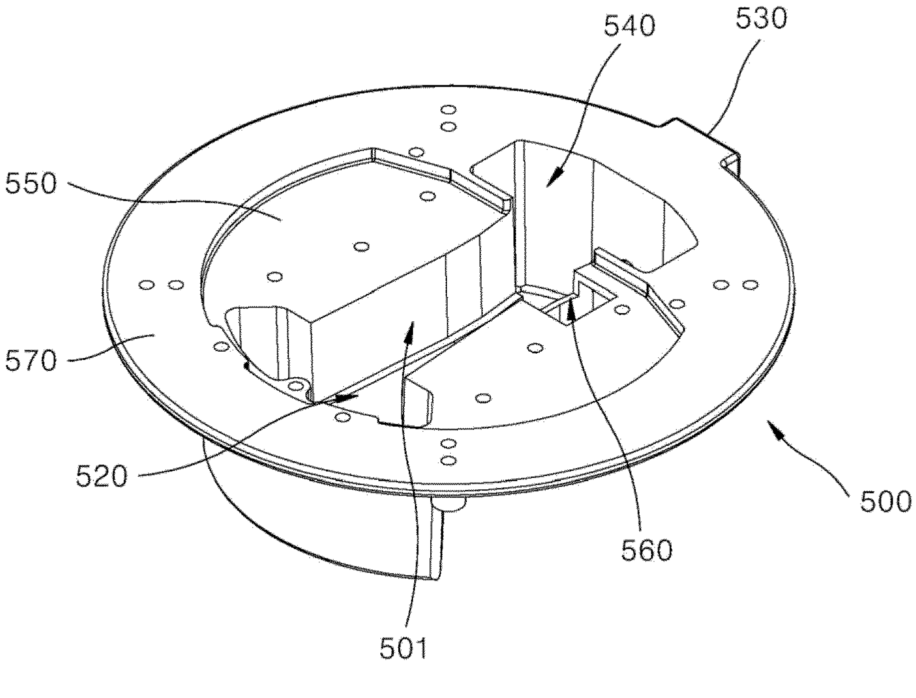

FIG. 46

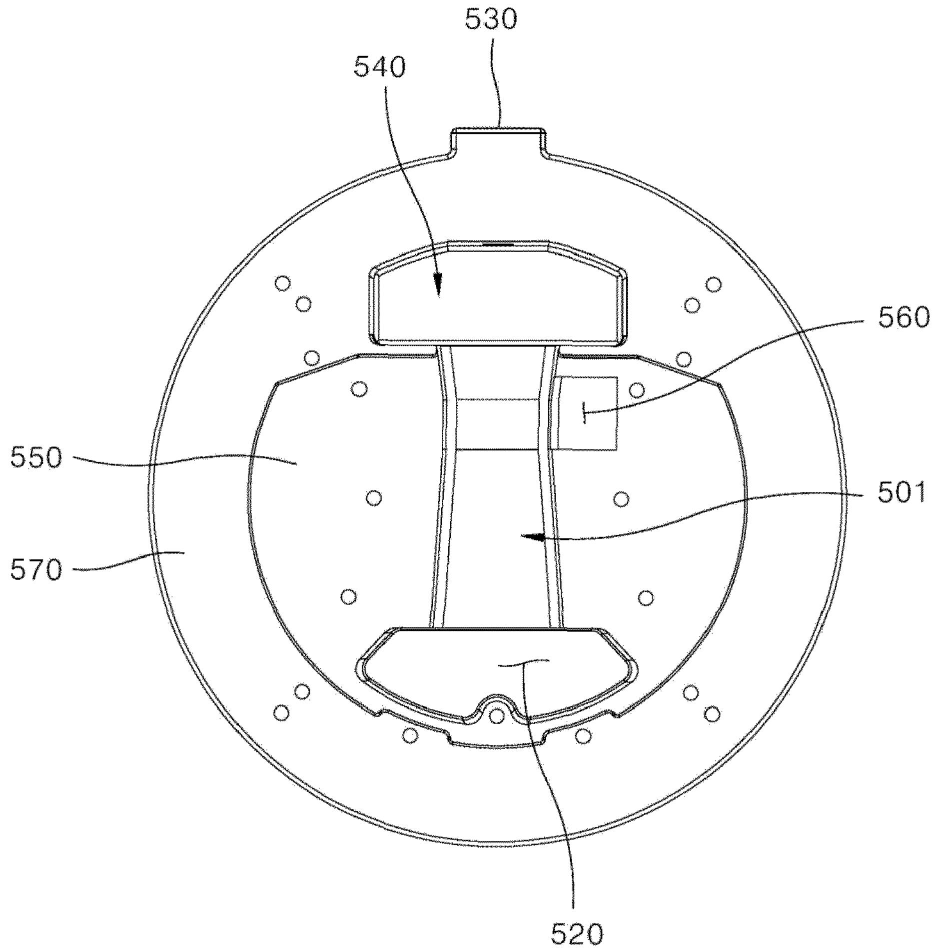
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FIG. 47

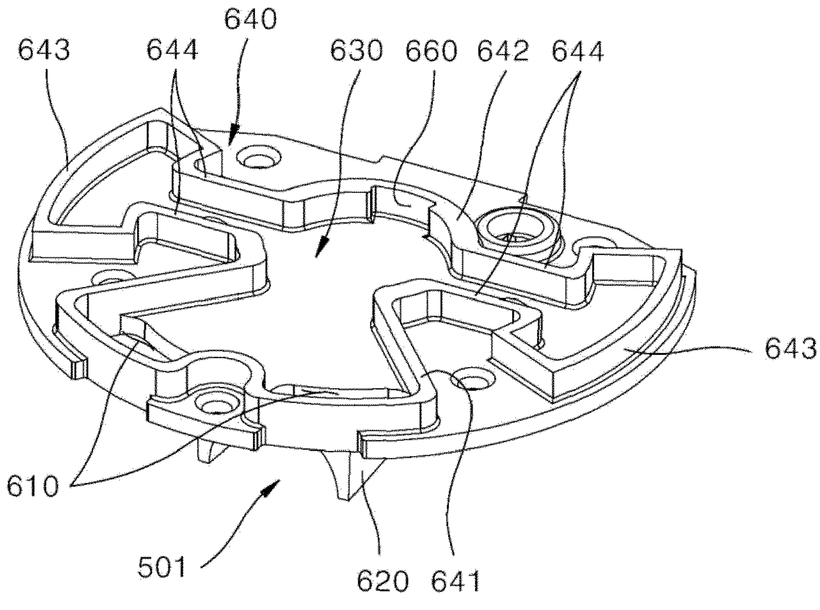
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FIG. 48

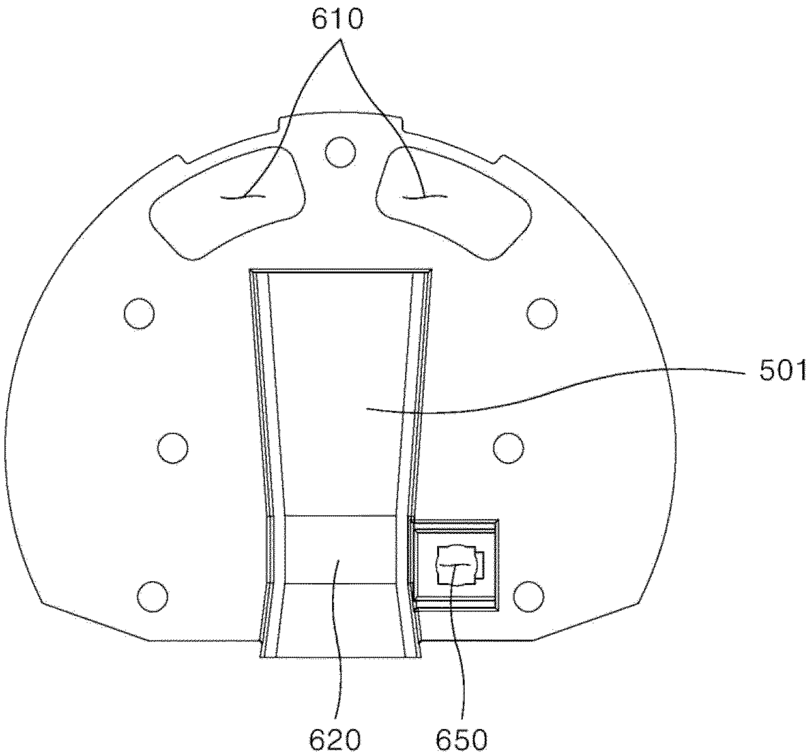

FIG. 49

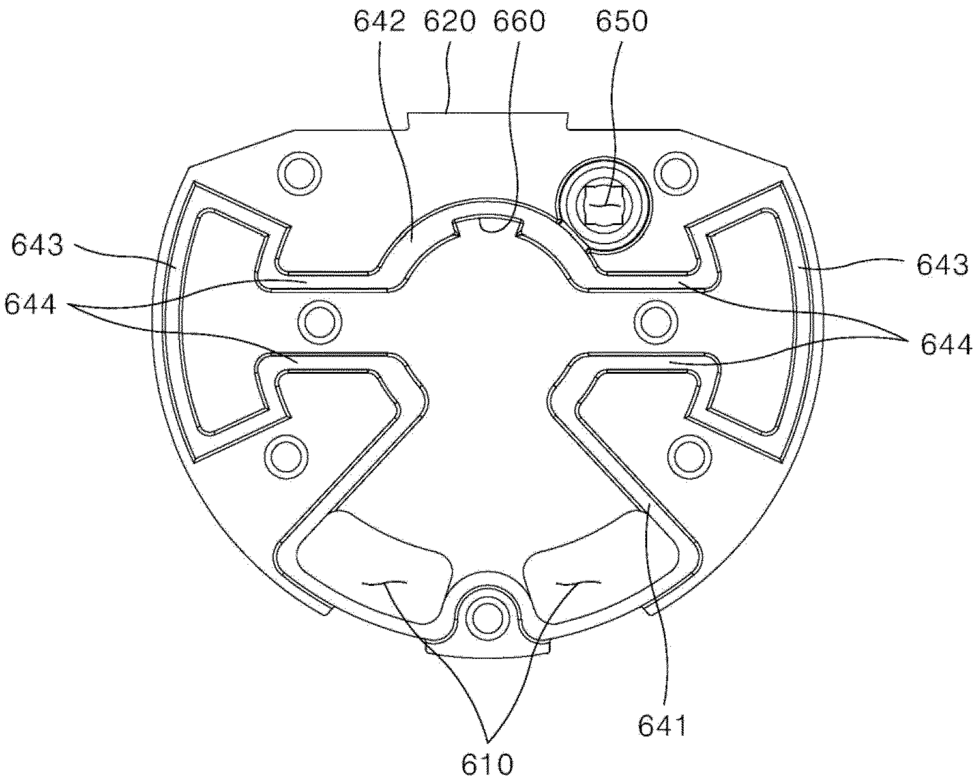

FIG. 50

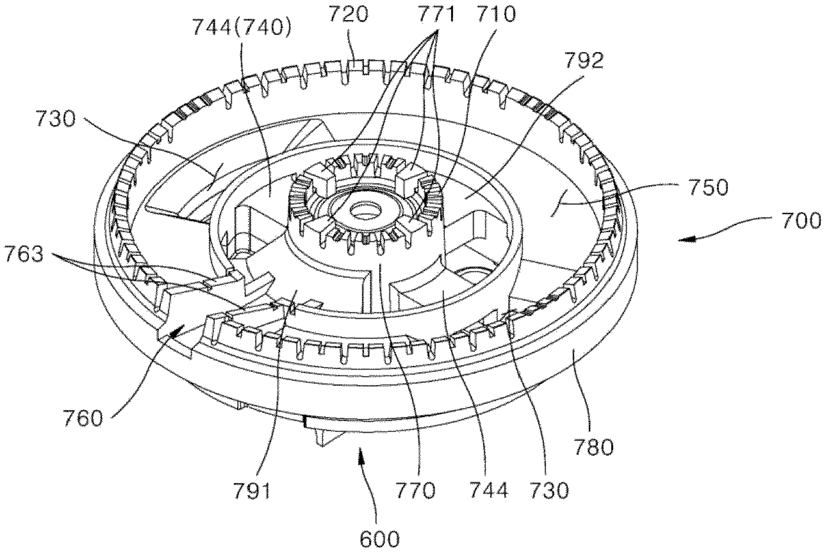
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FIG. 51

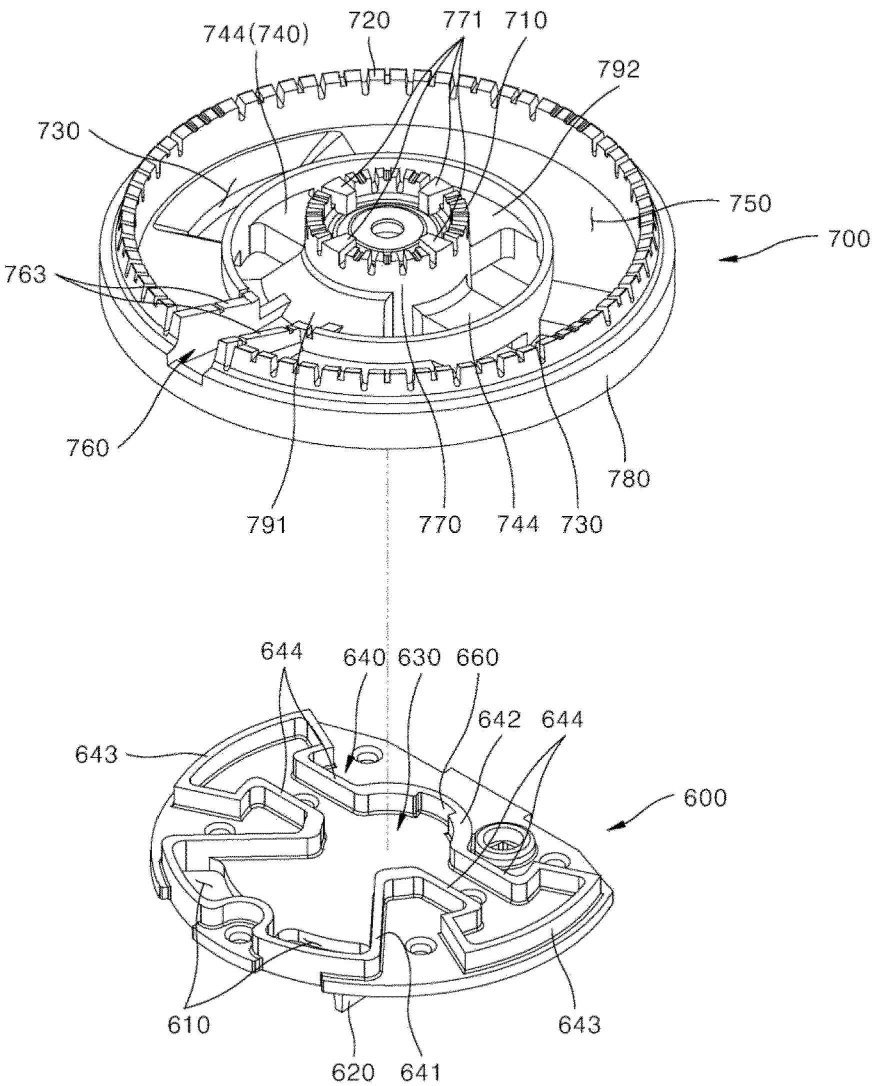
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FIG. 52

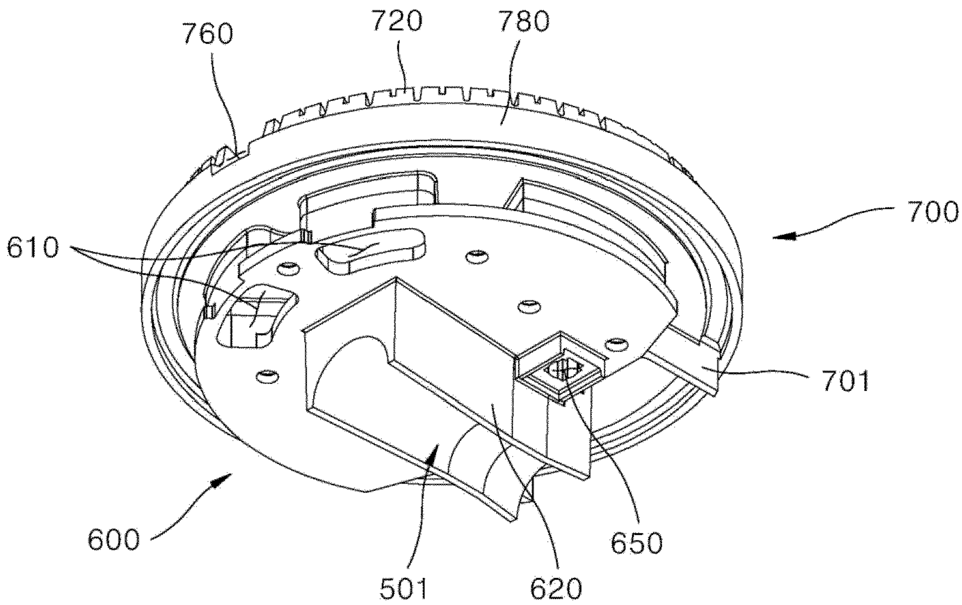
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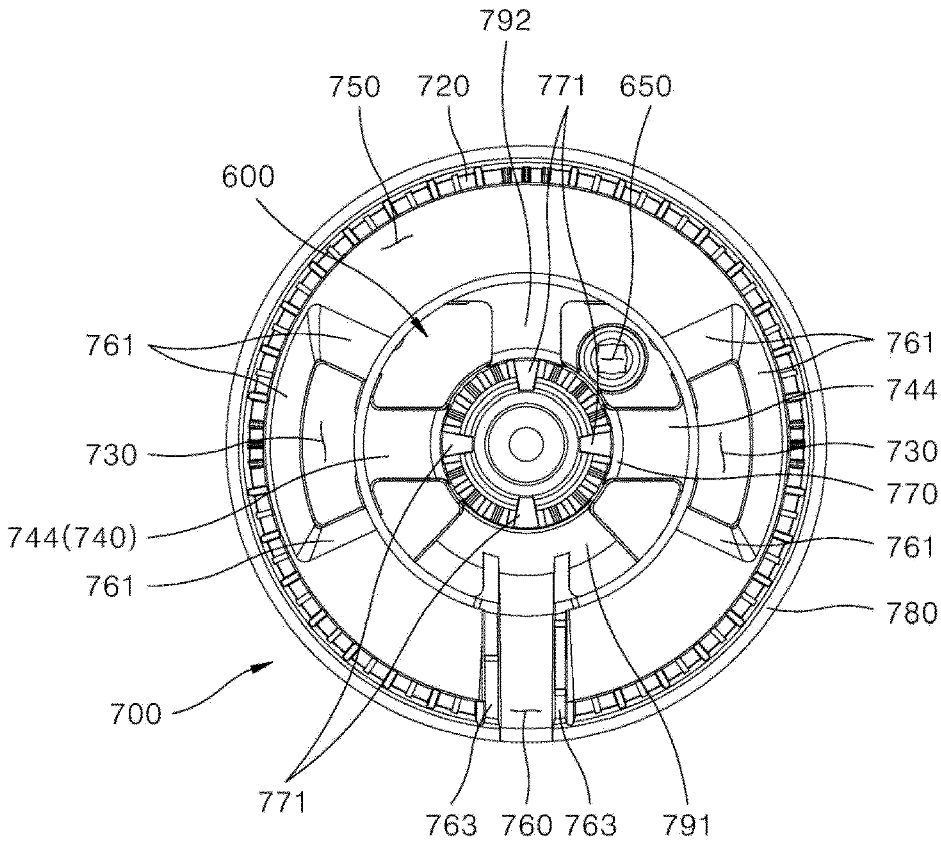
FIG. 53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744(740)
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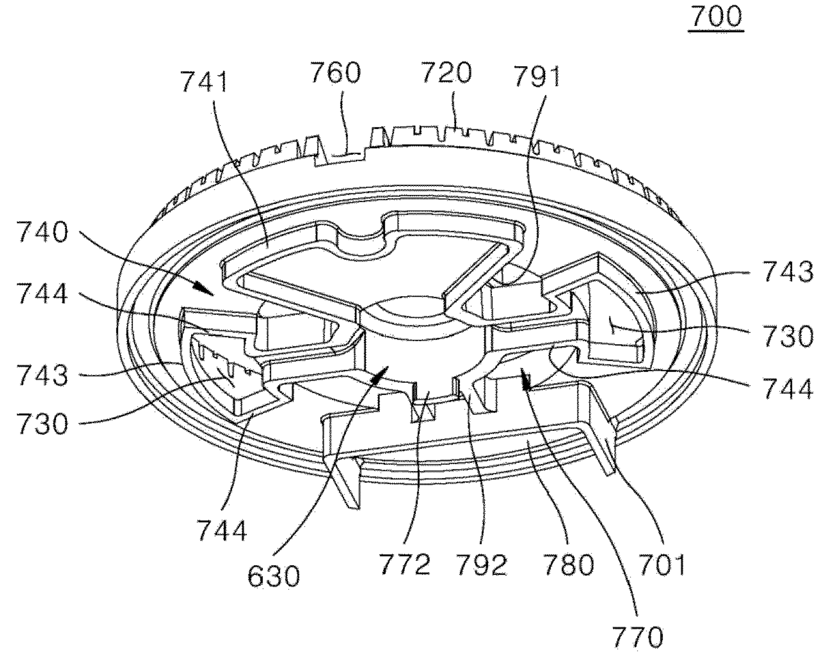
763
791

FIG. 54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744
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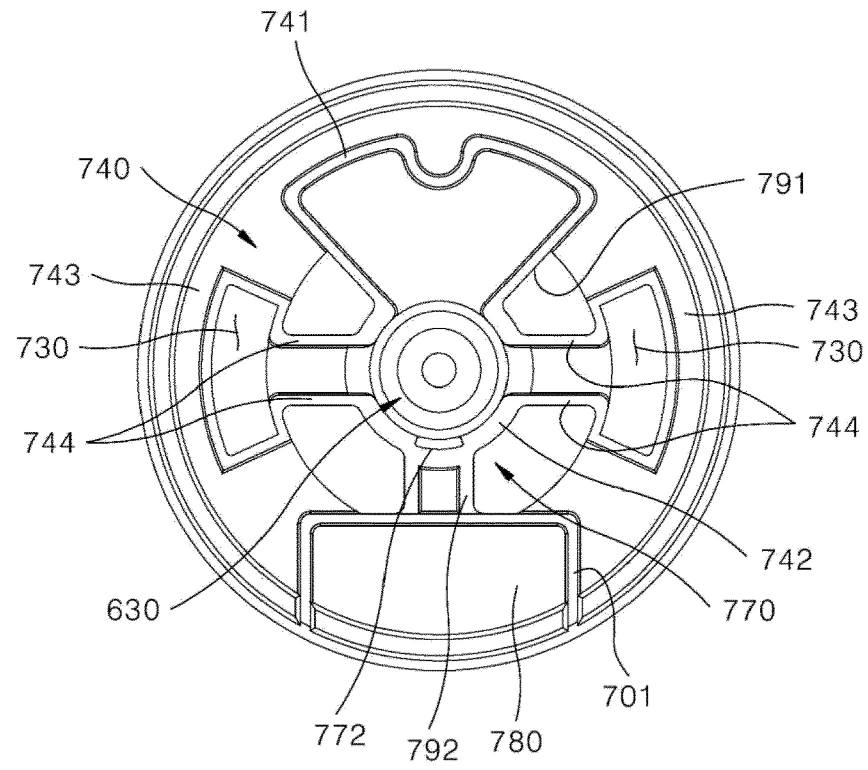
770

FIG. 55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770
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772
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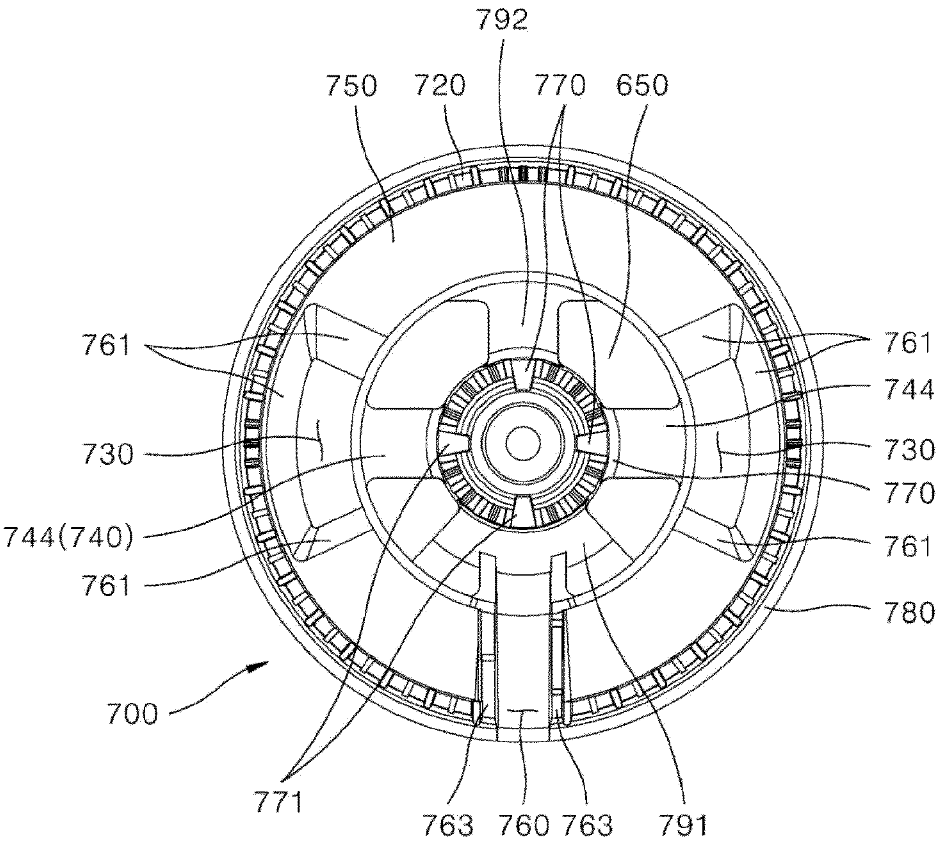
780

FIG. 56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744
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744(740)
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791

FIG. 57

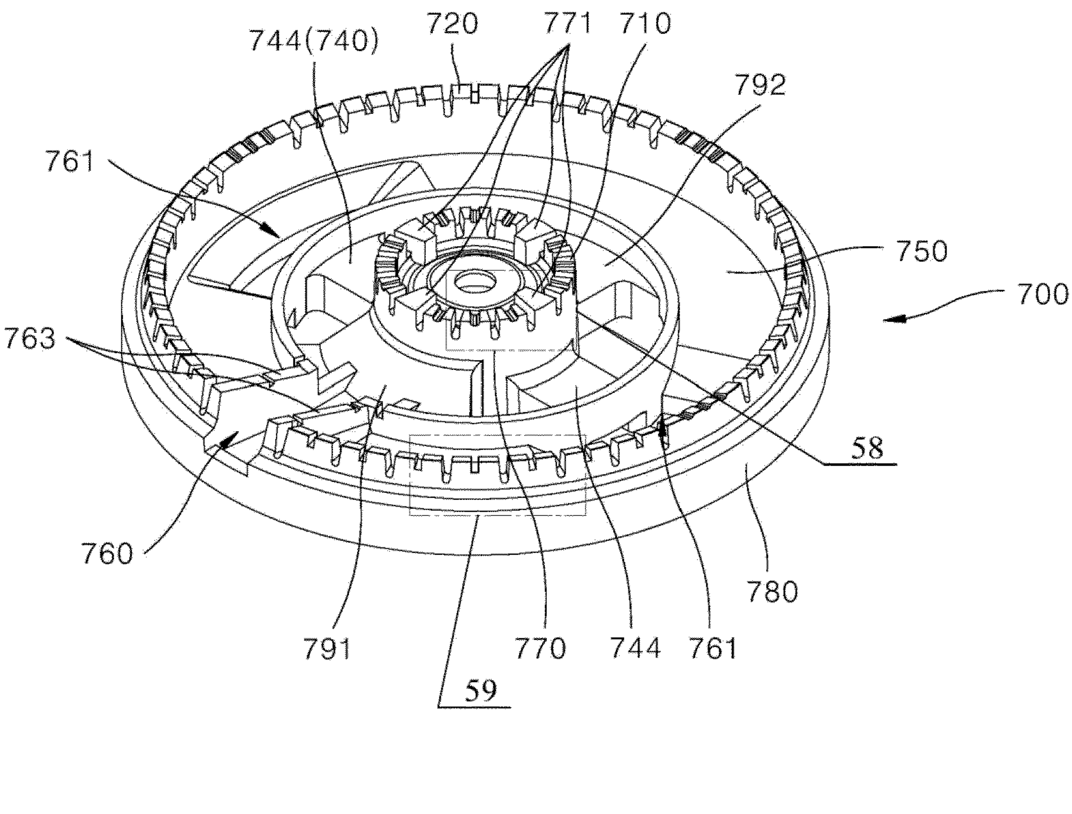
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FIG. 58

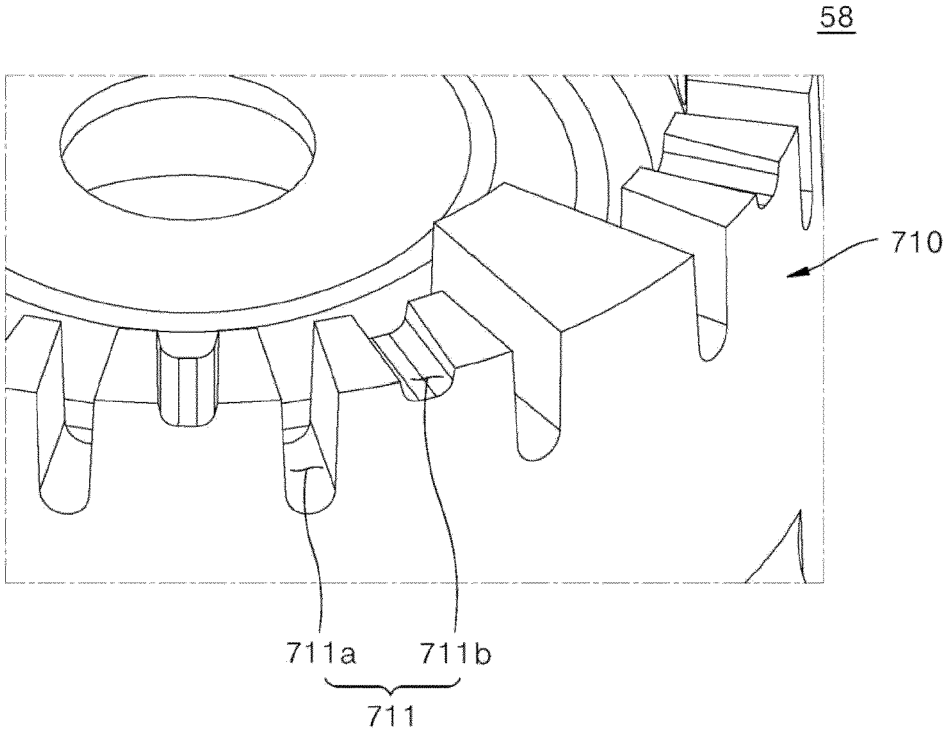


FIG. 59

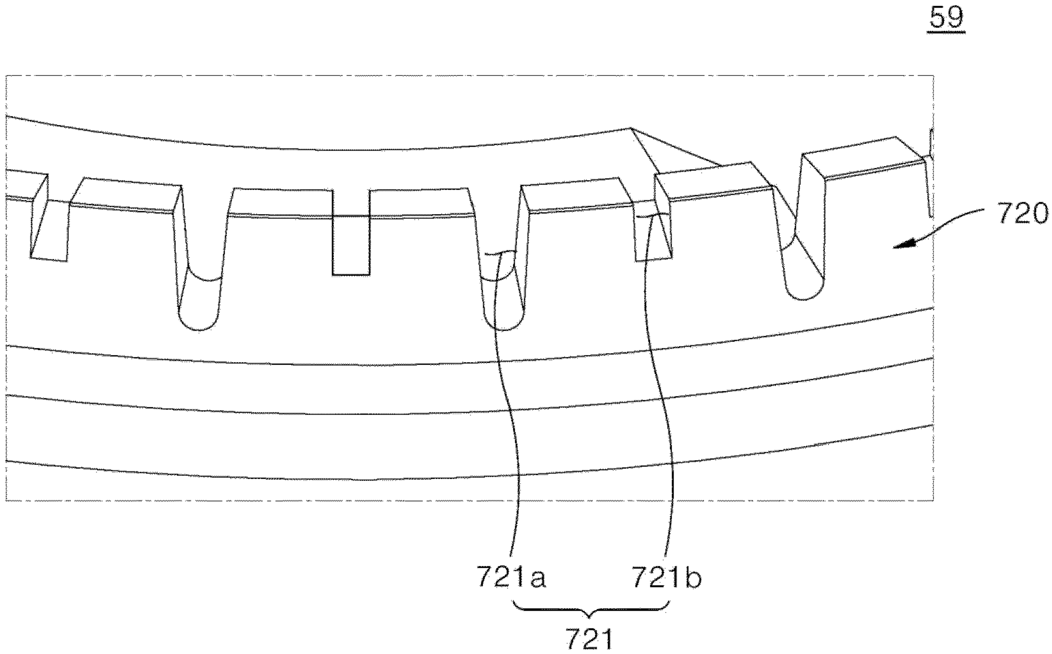


FIG. 60

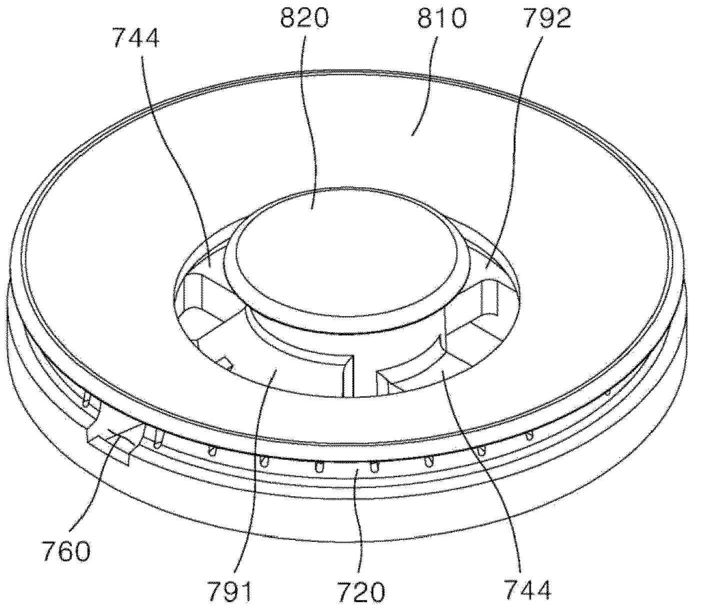


FIG. 61

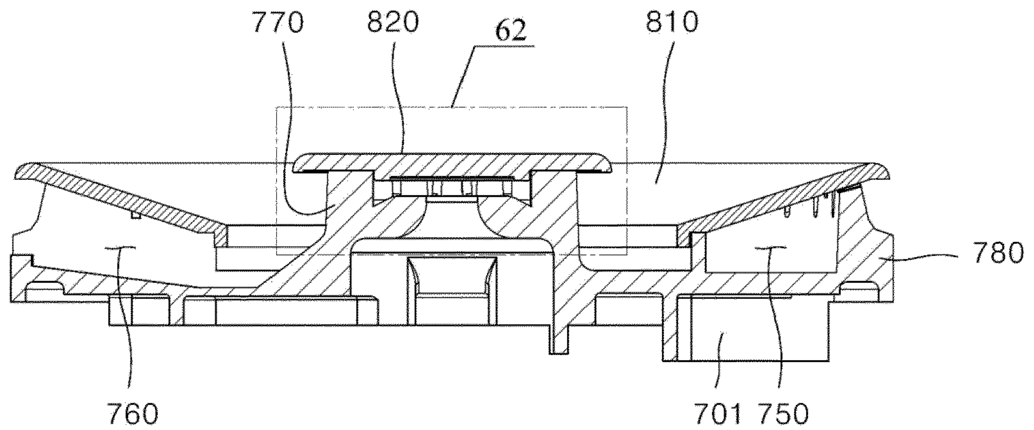


FIG. 62

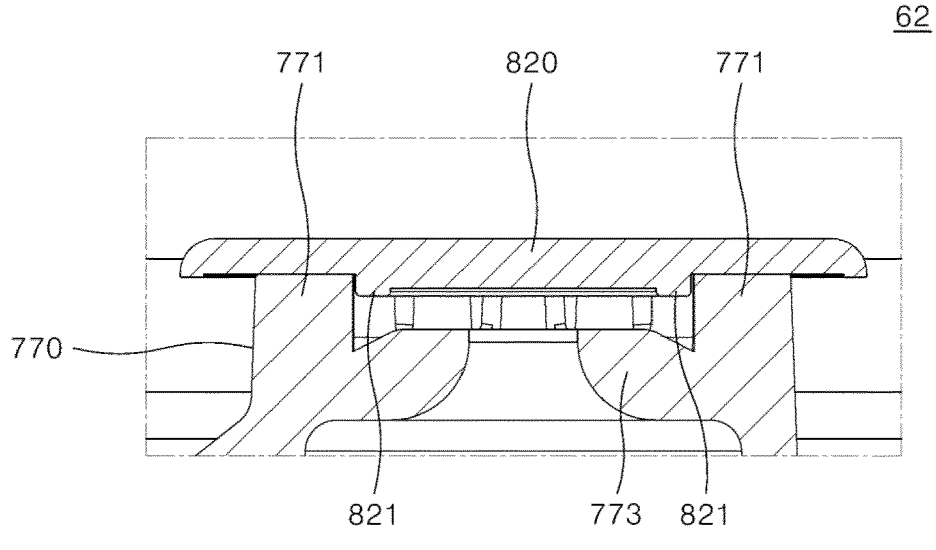


FIG. 63

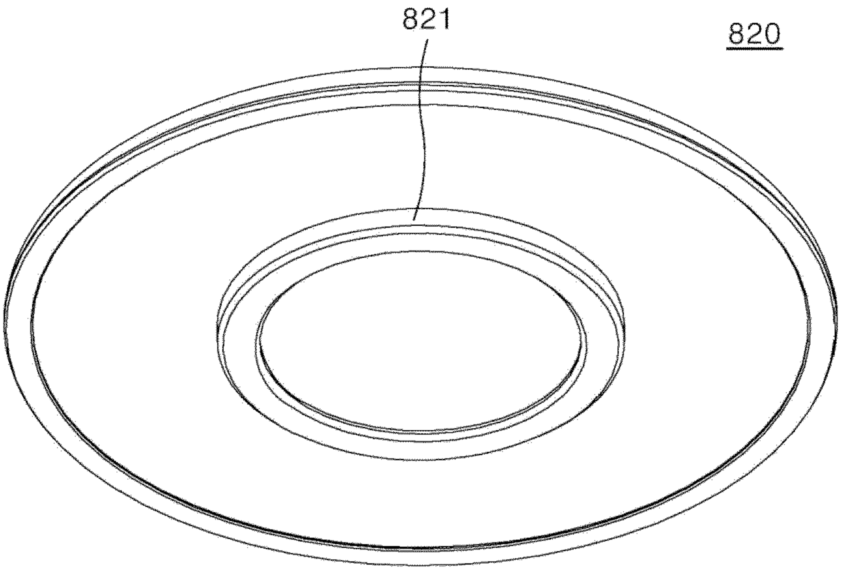
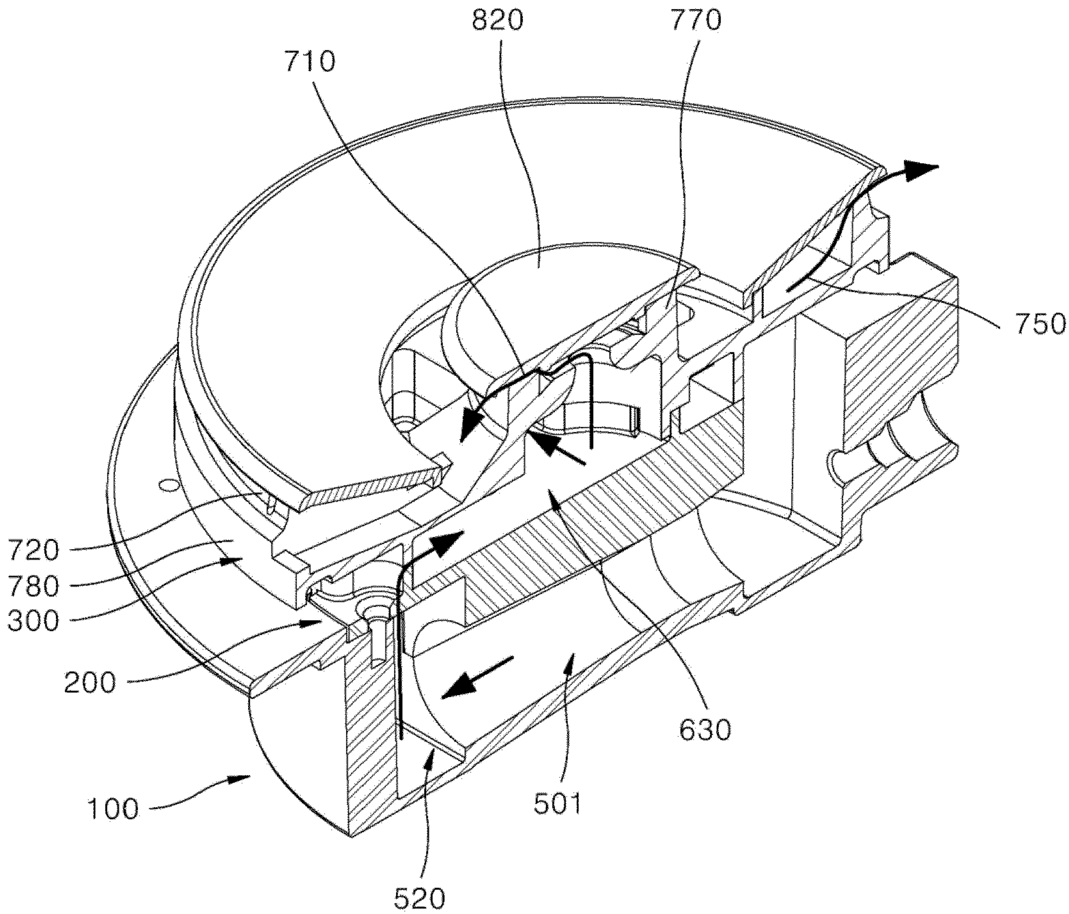


FIG. 64



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EUROPEAN SEARCH REPORT

Application Number
EP 24 18 9658

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	WO 2021/006832 A1 (FEMAS METAL SAN VE TIC A S [TR]) 14 January 2021 (2021-01-14) * the whole document * -----	1-5,7,8, 13-15	INV. F23D14/06 F23D14/64 F24C3/08
X	WO 2021/006829 A1 (FEMAS METAL SAN VE TIC A S [TR]) 14 January 2021 (2021-01-14) * the whole document * -----	1-8, 12-15	
X	WO 2018/207040 A1 (SABAF SPA [IT]) 15 November 2018 (2018-11-15) * figures 1-4 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			F23D F24C

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	15 January 2025	Vogl, Paul

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15-01-2025

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2021006832 A1	14-01-2021	EP 3980689 A1	13-04-2022
		WO 2021006832 A1	14-01-2021
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		WO 2018207040 A1	15-11-2018

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