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(54) **WATER HEATING DEVICE WITH FLAME SENSOR**

(57) Disclosed is a water heating device including a combustion chamber provided with an interior space, in which a combustion reaction occurs, a burner that causes the combustion reaction in the interior space, a heat exchanger including a heat exchange pipeline, in which water flows along an interior thereof, and that heats the water by using heat generated by the combustion reaction, a flame detecting sensor that senses flames generated in the interior space, an upper housing covering an upper side of the interior space, and having a mounting hole such that the flame detecting sensor is mounted therein, a flame tube including a tube part that surrounds at least some of the flames on a lower side of the upper housing, and an extending part surrounding a sensing hole formed at a location corresponding to the mounting hole such that the flames are sensed by the flame detecting sensor, and extending from the tube part toward the mounting hole, and a tube packing disposed between an inner surface of the upper housing, which defines the mounting hole and the extending part.

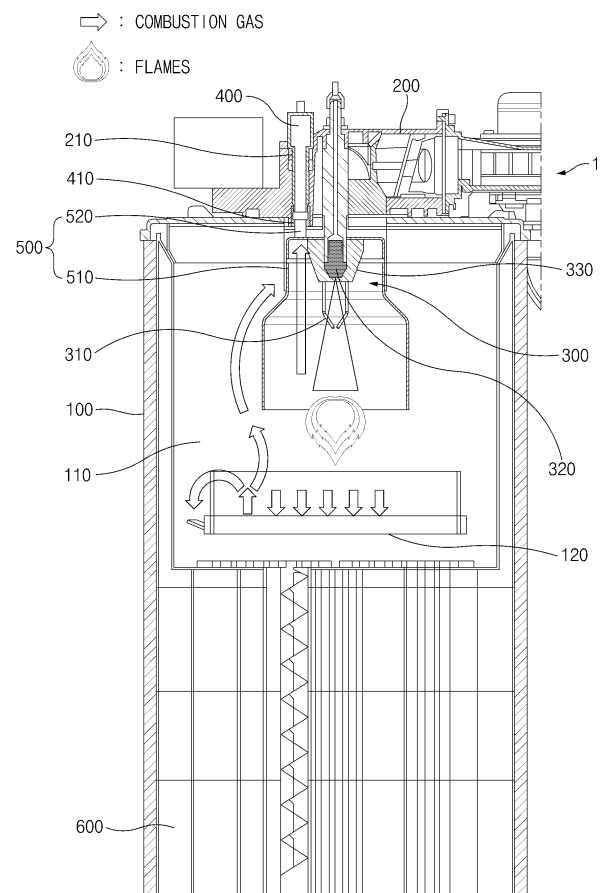


FIG. 1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority to Korean Patent Application No. 10-2022-0071768, filed in the Korean Intellectual Property Office on June 13, 2022, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a water heating device.

BACKGROUND

[0003] A water heating device, such as a boiler, heats water that flows in an interior thereof, and provides heating or hot water based on the heated water. A burner that induces a combustion reaction in an interior thereof to heat water that is introduced into the interior of the water heating device is provided, and heat generated in the interior of the water heating device may heat the water through the combustion reaction. Because the combustion reaction occurs in the interior of the water heating device, a flame detecting sensor that may sense the interior to monitor an emergency situation, such as a fire, may be provided.

[0004] According to a conventional technology, when excessive heat or the combustion gas due to the combustion reaction in the interior of the water heating device is delivered to the flame detecting sensor, the flame detecting sensor cannot be properly used, for example, soot may be generated or a board may be damaged.

SUMMARY

[0005] The present disclosure has been made to solve the above-mentioned problems occurring in the prior art while advantages achieved by the prior art are maintained intact.

[0006] An aspect of the present disclosure provides a water heating device that may minimize an influence of heat received by a flame detecting sensor or soot due to a combustion reaction in an interior of a water heating device.

[0007] The technical problems to be solved by the present disclosure are not limited to the aforementioned problems, and any other technical problems not mentioned herein will be clearly understood from the following description by those skilled in the art to which the present disclosure pertains.

[0008] According to an aspect of the present disclosure, a water heating device includes a combustion chamber provided with an interior space, in which a combustion reaction occurs, a burner that causes the combustion reaction in the interior space, a heat exchanger

including a heat exchange pipeline, in which water flows along an interior thereof, and that heats the water by using heat generated by the combustion reaction, a flame detecting sensor that senses flames generated in the interior space, an upper housing covering an upper side of the interior space, and having a mounting hole such that the flame detecting sensor is mounted therein, a flame tube including a tube part that surrounds at least some of the flames on a lower side of the upper housing, and an extending part surrounding a sensing hole formed at a location corresponding to the mounting hole such that the flames are sensed by the flame detecting sensor, and extending from the tube part toward the mounting hole, and a tube packing disposed between an inner surface of the upper housing, which defines the mounting hole and the extending part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above and other objects, features and advantages of the present disclosure will be more apparent from the following detailed description taken in conjunction with the accompanying drawings:

FIG. 1 is a longitudinal sectional view of a water heating device according to an embodiment of the present disclosure;

FIG. 2 is a perspective view illustrating an upper housing according to an embodiment of the present disclosure;

FIG. 3 is an enlarged longitudinal sectional view illustrating a part of a water heating device according to an embodiment of the present disclosure;

FIG. 4 is a perspective view illustrating a flame tube according to an embodiment of the present disclosure;

FIG. 5 is a longitudinal sectional view illustrating a mounting hole according to an embodiment of the present disclosure;

FIG. 6 is a side view illustrating a state, in which a sensor packing and a support member are mounted on a flame detecting sensor and a glass is mounted, according to an embodiment of the present disclosure; and

FIG. 7 is a side sectional view illustrating that a flame detecting sensor, a tube packing, a sensor packing, and a support member are disposed in a mounting hole, according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0010] Hereinafter, some embodiments of the present disclosure will be described in detail with reference to the exemplary drawings. Throughout the specification, it is noted that the same or like reference numerals denote the same or like components even though they are provided in different drawings. Further, in the following de-

scription of the present disclosure, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present disclosure rather unclear.

[0011] FIG. 1 is a longitudinal sectional view illustrating a water heating device 1 according to an embodiment of the present disclosure. FIG. 2 illustrates a perspective view of an upper housing 200 according to an embodiment of the present disclosure.

[0012] Referring to FIG. 1, the water heating device 1 may include a combustion chamber 100. For example, the combustion chamber 100 may include an interior space 110, in which a combustion reaction occurs. The interior space 110 may be a space, in which flames and a combustion gas are generated by the combustion reaction. The combustion chamber 100 may include a combustion guide 120. The combustion guide 120 may be configured to reverse a flow direction of the combustion gas that is generated by the combustion reaction and flows to a lower side, upwards. A flow direction of the combustion gas may be reversed upwards and thus the combustion gas may circulate. As the combustion gas circulates, distribution of temperatures may become uniform as a temperature of the interior space 110 becomes lower as compared with a case, in which ignition occurs in a situation, in which simply only air and a fuel are present. Furthermore, an amount of nitrogen oxides that may be generated at a high temperature may be reduced.

[0013] The water heating device 1 may include the upper housing 200. For example, the upper housing 200 may be disposed to cover an upper side of the interior space 110. The upper housing 200 may be configured such that at least a flame detecting sensor 400, which will be described below, is mounted thereon.

[0014] The water heating device 1 may include a burner 300. For example, the burner 300 may be configured to cause a combustion reaction in the interior space 110. The burner 300 may ignite a fuel (e.g., an oil type or a gas type) and air in the interior space 110 to cause a combustion reaction, and flames and the combustion gas may be formed in the interior space 110 by the combustion reaction.

[0015] The burner 300 may include an ignition plug 310. For example, the ignition plug 310 may ignite a mixture material, in which the ejected fuel and the ejected air are mixed. The ignition plug 310 may generate an electric spark, and a mixture material may be ignited by the electric spark. The ignition plug 310 may generate the electric spark in the interior space 110 through an ignition plug hole (e.g., an ignition plug hole 310-1 of FIG. 4). The burner 300 may include a fuel nozzle 320. For example, the fuel nozzle 320 may be a nozzle that may inject the fuel into the interior space 110. The fuel nozzle 320 may be disposed to pass through the upper housing 200. The burner 300 may include an air nozzle 330. For example, the air nozzle 330 may inject air into the interior space 110. The air nozzle 330 may be formed to surround the fuel nozzle 320. The air nozzle 330 may inject the air

through an air injection hole 330-1 formed between the air nozzle 330 and an outer surface of the fuel nozzle 320.

[0016] The water heating device 1 may include the flame detecting sensor 400. For example, the flame detecting sensor 400 may sense physical characteristics, such as a temperature of the flames that may be generated in the interior space 110. The flame detecting sensor 400 may be a UV sensor that detects physical characteristics of the flames by receiving ultraviolet rays generated in the interior space 110. The flame detecting sensor 400 may detect whether a combustion reaction occurs in the interior space 110, presence of flames, and physical characteristics of the flames.

[0017] Referring to FIG. 2, the upper housing 200 may include a mounting hole 210. For example, the mounting hole 210 may be a hole, into which the flame detecting sensor 400 is inserted to sense the flames in the interior space 110. The flame detecting sensor 400 may be disposed to be inserted into the mounting hole 210 to pass through the upper housing 200. The upper housing 200 may include a temperature sensor mounting part 201. For example, the temperature sensor mounting part 201 may be a hole that is configured such that at least a portion of the temperature sensor that may sense the temperature of the interior space 110 passes through the upper housing 200. The temperature sensor may be disposed such that at least a portion thereof is inserted into the temperature sensor mounting part 201 to pass through the upper housing 200. The upper housing 200 may include a fuel nozzle hole 320-1. For example, the fuel nozzle hole 320-1 may be a hole, into which the fuel nozzle 320 is inserted to inject the fuel into the interior space 110. The fuel nozzle hole 320-1 may be a hole that is configured such that the fuel nozzle 320 passes through the upper housing 200. However, the present disclosure is not limited to the above description.

[0018] Referring to FIG. 1, the water heating device 1 may include a flame tube 500. For example, the flame tube 500 may include a tube part 510 that is formed to surround at least some of the flames that may be generated in the interior space 110. The tube part 510 may surround at least a portion of an ignition space that is configured such that the mixture material of the fuel and the air are ignited, and may surround at least some of the flames that are generated through ignition. The ignition space may be a partial space included in the interior space 110, and may be a space that is defined while being surrounded by an inner space of the tube part 510.

[0019] The flame tube 500 may include an extending part 520 that extends from the tube part 510 toward the mounting hole 210. A sensing hole 521 may be formed in the extending part 520. The sensing hole 521 may be communicated with the ignition space that is defined while being surrounded by the inner surface of the tube part 510.

[0020] The water heating device 1 may include a heat exchanger 600. For example, the heat exchanger 600 may include a heat exchange pipeline, in which water

may flow along an interior thereof. The heat exchanger 600 may cause the combustion gas (or heat generated through the combustion reaction) and the water that flows in the heat exchange pipeline to exchange heat, and as illustrated, may be formed at a lower portion of the water heating device 1. However, this is an example, and the present disclosure may not be limited thereto.

[0021] FIG. 3 is an enlarged longitudinal sectional view of a portion of the water heating device 1 according to an embodiment of the present disclosure. FIG. 4 illustrates a perspective view of the flame tube 500 according to an embodiment of the present disclosure. The contents described in the above-described embodiment may be applied to the present embodiment in the same or similar way.

[0022] Referring to FIG. 3, the mounting hole 210 may be a hole that is provided in the upper housing 200 such that the flame detecting sensor 400 is mounted therein, and the flame detecting sensor 400 may be inserted into the mounting hole 210 to sense the interior space 110. The flame detecting sensor 400 may sense the interior space 110 through the sensing hole 521. For example, the sensing hole 521 (or the extending part 520) may be formed at a location corresponding to the mounting hole 210, in the extending part 520 of the flame tube 500, such that the flame detecting sensor 400 senses the interior space 110. In detail, for example, the sensing hole 521 and the mounting hole 210 may be formed on a sensing path (e.g., a direction, in which the mounting hole 210 extends) of the flame detecting sensor 400. The mounting hole 210 and the sensing hole 521 may be communicated with each other. For example, the extending part 520 may extend to be inserted into the mounting hole 210, and the sensing hole 521 may be communicated with the mounting hole 210. As the extending part 520 is inserted into the mounting hole 210, the combustion gas and the soot generated in the interior space 110 may be prevented from flowing to the mounting hole 210, through other parts than the extending part 520.

[0023] Referring to FIG. 4, the flame tube 500 may include the tube part 510 and the extending part 520. The extending part 520 may extend from the tube part 510 toward the mounting hole 210. The extending part 520 may extend toward the mounting hole 210 at a location corresponding to the mounting hole 210. The extending part 520 may include a discharge hole 522. For example, the discharge hole 522 may be formed to pass through a side part of the extending part 520. The discharge hole 522 may pass through the side part of the extending part 520 to be communicated with the sensing hole 521. The discharge hole 522 may be a hole that is provided in the extending part 520 such that the combustion gas that flows in the sensing hole 521 is discharged. The extending part 520 may include the discharge hole 522 and may prevent the combustion gas from being excessively introduced into the mounting hole 210 as a portion of the combustion gas may be discharged in a process of the combustion gas passing through the sensing hole 521.

According to the above description, thermal damage to the flame detecting sensor 400, which may occur due to the combustion gas, or generation of soot may be restrained.

[0024] The flame tube 500 may include a fuel nozzle mounting part 530. For example, the fuel nozzle mounting part 530 may be configured such that the fuel nozzle 320 is mounted thereon. As a detailed example, a fuel nozzle mounting hole 531 may be formed in the fuel nozzle mounting part 530, and at least a portion of the fuel nozzle 320 may be mounted to pass through the fuel nozzle mounting hole 531. The fuel nozzle 320 may be mounted on the fuel nozzle mounting part 530 to inject the fuel for generating the combustion reaction in the interior space 110 (or an ignition space that is a partial space of the interior space 110). As another example, the fuel nozzle 320 may pass through the fuel nozzle hole 320-1 of the upper housing 200 to be mounted on the fuel nozzle mounting part 530. The above description of the fuel nozzle mounting part 530 and the fuel nozzle mounting hole 531 are exemplary, and the present disclosure may not be limited thereto. Furthermore, locations or shapes of the fuel nozzle mounting part 530 and the fuel nozzle mounting hole 531 illustrated in FIG. 4 are exemplary, and may be differently implemented according to designs.

[0025] The water heating device 1 may include a tube packing 410. For example, the tube packing 410 may be disposed between the mounting hole 210 and the extending part 520. As a detailed example, the tube packing 410 may be disposed between an inner surface (e.g., a second opening inner-surface 121 that will be described below) of the upper housing 200, which defines the mounting hole 210, and the extending part 520. As another example, the tube packing 410 may be disposed between the extending part 520 and the flame detecting sensor 400. The tube packing 410 may define a flow path from the sensing hole 521 of the combustion gas generated by the combustion reaction to the mounting hole 210. For example, the tube packing 410 may be disposed between the inner surface (e.g., the second opening inner-surface 121 that will be described below) and the extending part 520 (or between the extending part 520 and the flame detecting sensor 400) to define a flow path, in which the combustion gas that flows along the extending part 520 in the interior space 110 (or the ignition space that is a partial space of the interior space 110) of the tube part 510 flows. Furthermore, the tube packing 410 may restrain the circulating combustion gas from flowing to the mounting hole 210. For example, the flow direction of the combustion gas may be reversed by the combustion guide 120, and thus the combustion gas may flow in a direction that faces the mounting hole 210. In this case, the tube packing 410 may prevent introduction of the combustion gas by restricting the flow path of the combustion gas to the mounting hole 210. Because the tube packing 410 prevents the introduction of the combustion gas, thermal damage to the flame detecting sensor 400,

which may occur due to the combustion gas, or generation of soot may be restrained.

[0026] FIG. 5 illustrates a longitudinal sectional view of the mounting hole 210 according to an embodiment of the present disclosure. The contents described in the above-described embodiment may be applied to the present embodiment in the same or similar way.

[0027] The mounting hole 210 may be formed in the upper housing 200 such that the flame detecting sensor 400 is mounted on the upper housing 200. For example, the mounting hole 210 may be formed to have a shape corresponding to an outskirt of the flame detecting sensor 400.

[0028] The mounting hole 210 may be defined by opening inner-surfaces 211 and 212 of the inner surface of the upper housing 200. For example, the first opening inner-surface 211 may define a first hole part 211-1 of the mounting hole 210, and the second opening inner-surface 212 may define a second hole part 212-1 of the mounting hole 210. The mounting hole 210 may include the first hole part 211-1 and the second hole part 212-1 defined by the opening inner-surfaces 211 and 212, and the first hole part 211-1 and the second hole part 212-1 may be communicated with each other. The second hole part 212-1 may extend from the first hole part 211-1 to the interior space 110.

[0029] The first hole part 211-1 and the second hole part 212-1 may have different cross-sectional areas. For example, the first hole part 211-1 may have a first cross-sectional area, and the second hole part 212-1 may have a second cross-sectional area that is smaller than the first cross-sectional area. The first hole part 211-1 and the second hole part 212-1 may have different cross-sectional areas with respect to a border that distinguishes them. For example, the first cross-sectional area of the first hole part 211-1 corresponding to a border of the first hole part 211-1 and the second hole part 212-1 may be larger than the second cross-sectional area of the second hole part 212-1 corresponding to the border. The first opening inner-surface 211 and the second opening inner-surface 212 may define a step. For example, when compared with the first opening inner-surface 211, the second opening inner-surface 212 may protrude toward the mounting hole 210 such that a step is formed on the first opening inner-surface 211 and the second opening inner-surface 212.

[0030] FIG. 6 is a side view illustrating a state, in which a sensor packing 420 and a support member 430 are mounted on the flame detecting sensor 400 and a glass 440 is mounted, according to an embodiment of the present disclosure. FIG. 7 is a side sectional view illustrating that the flame detecting sensor 400, the tube packing 410, the sensor packing 420, and the support member 430 are disposed in the mounting hole 210, according to an embodiment of the present disclosure. Hereinafter, a description will be made with reference to FIGS. 6 and 7.

[0031] The flame detecting sensor 400 may include a main part 401. For example, the main part 401 may in-

clude a main board 401-1. The main board 401-1 may be a printed circuit board. The flame detecting sensor 400 may include a sub part 402. For example, the sub part 402 may be a part that extends from the main part 401 toward the sensing hole 521. The sub part 402 may include a sub part end 402-1. The sub part end 402-1 may include a lens 435. A cross-sectional area of the main part 401 may be larger than a cross-sectional area of the sub part 402. The sub part 402 may extend from the main part 401 to include the sub part end 402-1 at an end thereof, and may include a sub board that electrically connects the main board 401-1 and the sub part end 402-1 (or the lens 435) in an interior thereof. In the flame detecting sensor 400, the sub part 402 including the sub part end 402-1 may extend toward the sensing hole 521 to minimize thermal damage to the main part 401 that senses the flames that may be generated in the interior space 110, due to heat or the combustion gas, or an influence of soot. The flame detecting sensor 400 may include a slide preventing pattern 403. For example, the slide preventing pattern 403 may be formed on the sub part 402, and the support member 430 described below may be disposed at a location corresponding to the slide preventing pattern 403.

[0032] The water heating device 1, as described above, may include the tube packing 410. The tube packing 410 may at least partially surround the extending part 520 and the flame detecting sensor 400. For example, the tube packing 410 may be disposed to surround at least a portion of an end of the extending part 520 and at least a portion of an end of the flame detecting sensor 400. A diameter of the tube packing 410 may be larger than a diameter of an end of the extending part 520 and a diameter of the flame detecting sensor 400 (or an end of the sub part 402). As a detailed example, an inner diameter of the tube packing 410 may be larger than an outer diameter of the end of the extending part 520 and an outer diameter of the end of the flame detecting sensor 400. Alternatively, the inner diameter of the tube packing 410 may be smaller than or equal to the outer diameter of the end of the extending part 520 and the outer diameter of the end of the flame detecting sensor 400 such that the tube packing 410 is elastically fixed. However, the present disclosure is not limited to the above description, and may be variously implemented according to designs.

[0033] The water heating device 1 may include the sensor packing 420. For example, the sensor packing 420 may be disposed between an outer surface of the flame detecting sensor 400 and the opening inner-surfaces 211 and 212. As a detailed example, the sensor packing 420 may be disposed between the first opening inner-surface 211 that defines the first hole part 211-1 and the sub part 402 of the flame detecting sensor 400. The sensor packing 420 may be disposed to surround at least a portion of the sub part 402. The sensor packing 420 may be disposed to contact the first opening inner-surface 211, and may be disposed to contact the sub part 402 while

contacting the first opening inner-surface 211. The sensor packing 420 may include an elastic member. The sensor packing 420 may be disposed as described above, and may restrain the combustion gas or the soot from passing through the mounting hole 210. Because the combustion gas or the soot may be restrained from passing through the mounting hole 210, thermal damage to the main board 401-1 of the flame detecting sensor 400 or diffusion of the soot also may be restrained.

[0034] The water heating device 1 may include the support member 430. For example, the support member 430 may be disposed between the sensor packing 420 and the main part 401. The support member 430 may be disposed between the first opening inner-surface 211 that defines the first hole part 211-1 and the sub part 402 of the flame detecting sensor 400. The support member 430 may be disposed to support the sensor packing 420 on an opposite side to the interior space 110 with respect to the sensor packing 420. In a different description, the support member 430 may be disposed on an opposite side to a side that faces the extending part 520 with respect to the sensor packing 420. The support member 430 may be disposed to at least partially surround the sub part 402. The support member 430 may support the sensor packing 420. The support member 430 may be configured to restrain movement of the sub part 402. For example, the support member 430 may surround the sub part 402, and may be disposed on the slide preventing pattern 403 such that movement thereof is restrained at a surrounded location. Because the support member 430 is disposed on the slide preventing pattern 403, a relative movement of the support member 430 to the sub part 402 may be restrained further when compared with the sensor packing 420. Furthermore, the support member 430 may have a groove 430-1 on an inner surface thereof such that movement thereof with respect to the sub part 402 is restrained. For example, the support member 430 may include the groove 430-1 formed on the inner surface thereof in a lengthwise direction of the flame detecting sensor 400, and a disposition form thereof is not particularly restricted. The groove 430-1 formed on an inner surface of the support member 430 may protrude from the sub part 402 of the flame detecting sensor 400 to an outside, and may be stopped by a protruding part 404 formed along a lengthwise direction thereof. Because the groove 430-1 of the support member 430 is stopped by the protruding part 404 of the sub part 402, the support member 430 may be prevented from being rotated about the sub part 402 whereby the support member 430 may be prevented from deviating from the flame detecting sensor 400 or an inner surface of the support member 430 may be prevented from being worn. Due to the above-described disposition, the support member 430 may prevent the flame detecting sensor 400 from being pushed out by elasticity of the sensor packing 420, or prevent the sensor packing 420 from being pushed out, or prevent damage to the sensor packing 420.

[0035] The water heating device 1 may include a soot

preventing glass 440. For example, the soot preventing glass 440 may be provided at the sub part end 402-1. The glass 440 may be disposed between the lens 435 provided at the sub part end 402-1 and the sensing hole 521. The glass 440 may have a size, by which the sub part end 402-1 (or the lens 435) is covered, and may be disposed to a side that is close to the sensing hole 521 of the sub part end 402-1. For example, the glass 440 may have a size of an outer diameter corresponding to an inner diameter of the sub part end 402-1. Furthermore, the outer diameter of the glass 440 may be formed to be larger than an outer diameter of the lens 435, but the present disclosure is not limited thereto. The glass 440 may be a quartz glass, by which diffusion or adsorption of the soot may be restrained, and may be a complex glass including the quartz glass. Because the glass 440 is disposed around the sub part end 402-1 (or the lens 435), diffusion or adsorption of the soot may be restrained whereby it may be more advantageous for the flame detecting sensor 400 to sense the flames.

[0036] According to the embodiments of the present disclosure, thermal damage to the flame detecting sensor or generation of soot due to the combustion gas may be restrained.

[0037] According to the embodiments of the present disclosure, a durability of the flame detecting sensor may be enhanced.

[0038] According to embodiments of the present disclosure, an emergency situation may be effectively monitored by restraining damage to the flame detecting sensor.

[0039] The above description is a simple exemplification of the technical spirits of the present disclosure, and the present disclosure may be variously corrected and modified by those skilled in the art to which the present disclosure pertains without departing from the essential features of the present disclosure. Accordingly, the embodiments disclosed in the present disclosure is not provided to limit the technical spirits of the present disclosure but provided to describe the present disclosure, and the scope of the technical spirits of the present disclosure is not limited by the embodiments. Accordingly, the technical scope of the present disclosure should be construed by the attached claims, and all the technical spirits within the equivalent ranges fall within the scope of the present disclosure.

Claims

1. A water heating device comprising:

a combustion chamber provided with an interior space, in which a combustion reaction occurs;
a burner configured to cause the combustion reaction in the interior space;
a heat exchanger including a heat exchange pipeline, in which water flows along an interior

- thereof, and configured to heat the water by using heat generated by the combustion reaction; a flame detecting sensor configured to sense flames generated in the interior space; an upper housing covering an upper side of the interior space, and having a mounting hole such that the flame detecting sensor is mounted therein; a flame tube including a tube part configured to surround at least some of the flames on a lower side of the upper housing, and an extending part surrounding a sensing hole formed at a location corresponding to the mounting hole such that the flames are sensed by the flame detecting sensor, and extending from the tube part toward the mounting hole; and a tube packing disposed between an inner surface of the upper housing, which defines the mounting hole and the extending part.
2. The water heating device of claim 1, wherein the extending part is inserted into the mounting hole such that the mounting hole and the sensing hole are communicated with each other.
 3. The water heating device of claim 2, wherein a side part of the extending part is through to define a discharge hole that communicates an outside and the sensing hole with each other.
 4. The water heating device of claim 2, wherein the tube packing defines a flow path of a combustion gas generated by the combustion reaction from the sensing hole to the mounting hole and is disposed between the extending part and the inner surface of the upper housing.
 5. The water heating device of claim 4, wherein the tube packing is disposed to surround at least a portion of an end of the extending part and at least a portion of an end of the flame detecting sensor.
 6. The water heating device of claim 4, wherein an inner diameter of the tube packing larger than an outer diameter of the end of the extending part and an outer diameter of the end of the flame detecting sensor.
 7. The water heating device of claim 1, further comprising: a sensor packing disposed between an opening inner-surface of the inner surface of the upper housing, which is a surface that defines the mounting hole, and an outer surface of the flame detecting sensor.
 8. The water heating device of claim 7, wherein the mounting hole includes:
 - a first hole part having a first cross-sectional area; and
 - a second hole part having a second cross-sectional area that is smaller than the first cross-sectional area, and extending from the first hole part toward the interior space, and wherein the sensor packing is disposed in the first hole part.
 9. The water heating device of claim 8, further comprising: a support member disposed in the first hole part to support the sensor packing on an opposite side to a side that faces the extending part with respect to the sensor packing.
 10. The water heating device of claim 1, wherein the flame detecting sensor further includes:
 - a main part including a main board; and
 - a sub part extending from the main part toward the sensing hole, and provided with a lens at an end thereof on a side that is close to the sensing hole.
 11. The water heating device of claim 10, wherein the flame detecting sensor further includes: a soot preventing glass disposed between the lens and the sensing hole.
 12. The water heating device of claim 10, further comprising: a sensor packing disposed between an opening inner-surface of the upper housing, which is a surface that defines the mounting hole, and an outer surface of the flame detecting sensor.
 13. The water heating device of claim 12, wherein a cross-sectional area of the main part is larger than a cross-sectional area of the sub part, and wherein the sensor packing surrounds the sub part.
 14. The water heating device of claim 12, further comprising: a support member disposed between the sensor packing and the main part, and configured to support the sensor packing while surrounding the sub part, wherein the flame detecting sensor further includes a slide preventing pattern in at least a partial area of an outer surface of the sub part, and wherein the support member is disposed to surround the slide preventing pattern.
 15. A water heating device comprising:

a combustion chamber provided with an interior space, in which a combustion reaction occurs;
a burner configured to cause the combustion reaction in the interior space;
a heat exchanger including a heat exchange pipeline, in which water flows along an interior thereof, and configured to heat the water by using heat generated by the combustion reaction;
a flame detecting sensor configured to sense flames generated in the interior space;
an upper housing covering an upper side of the interior space, and having a mounting hole such that the flame detecting sensor is mounted therein;
a flame tube formed on a lower side of the upper housing to surround at least some of the flames, and in which a location thereof corresponding to the mounting hole is through such that a sensing hole is formed whereby the flame detecting sensor senses the flames; and
a sensor packing disposed between an inner surface of the upper housing and the flame detecting sensor, in the mounting hole.

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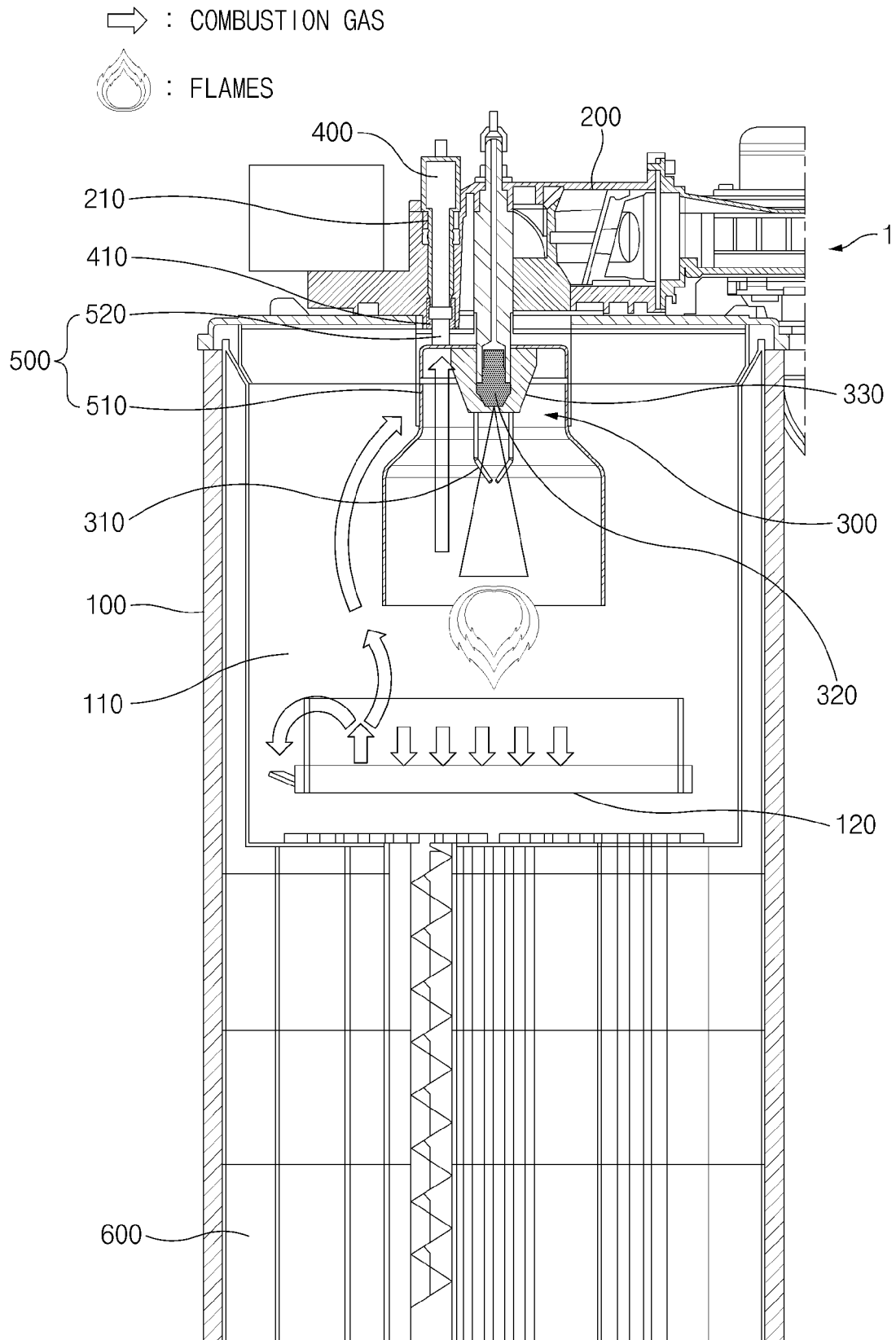


FIG.1

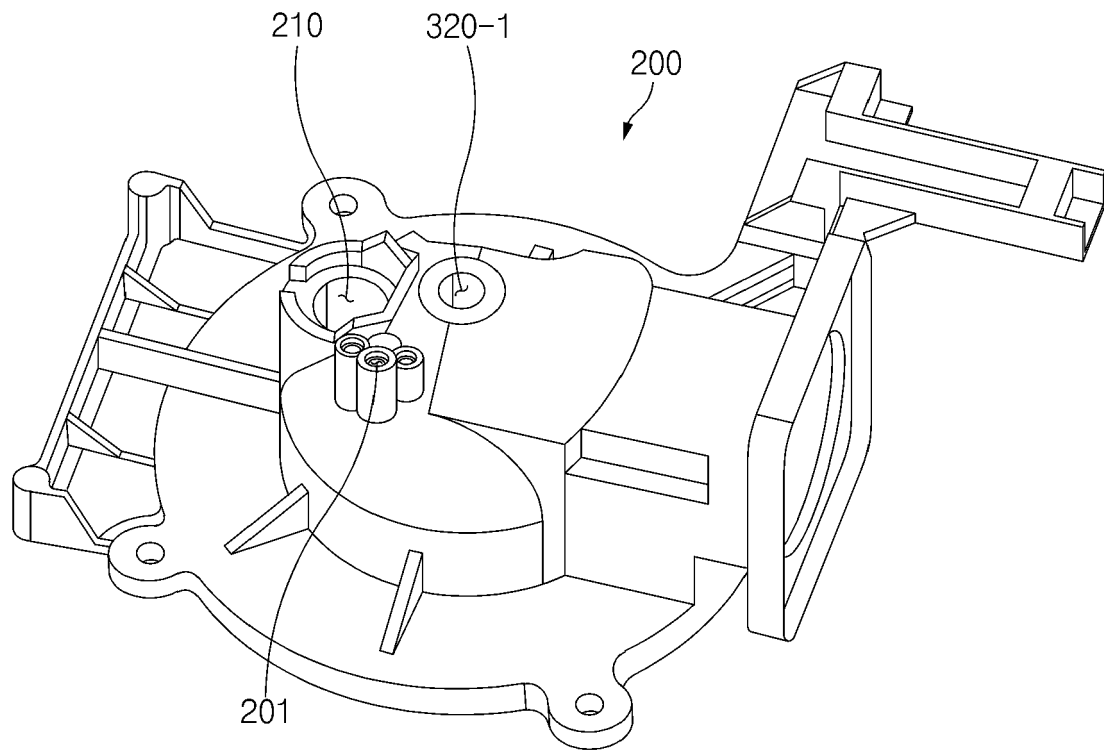


FIG.2

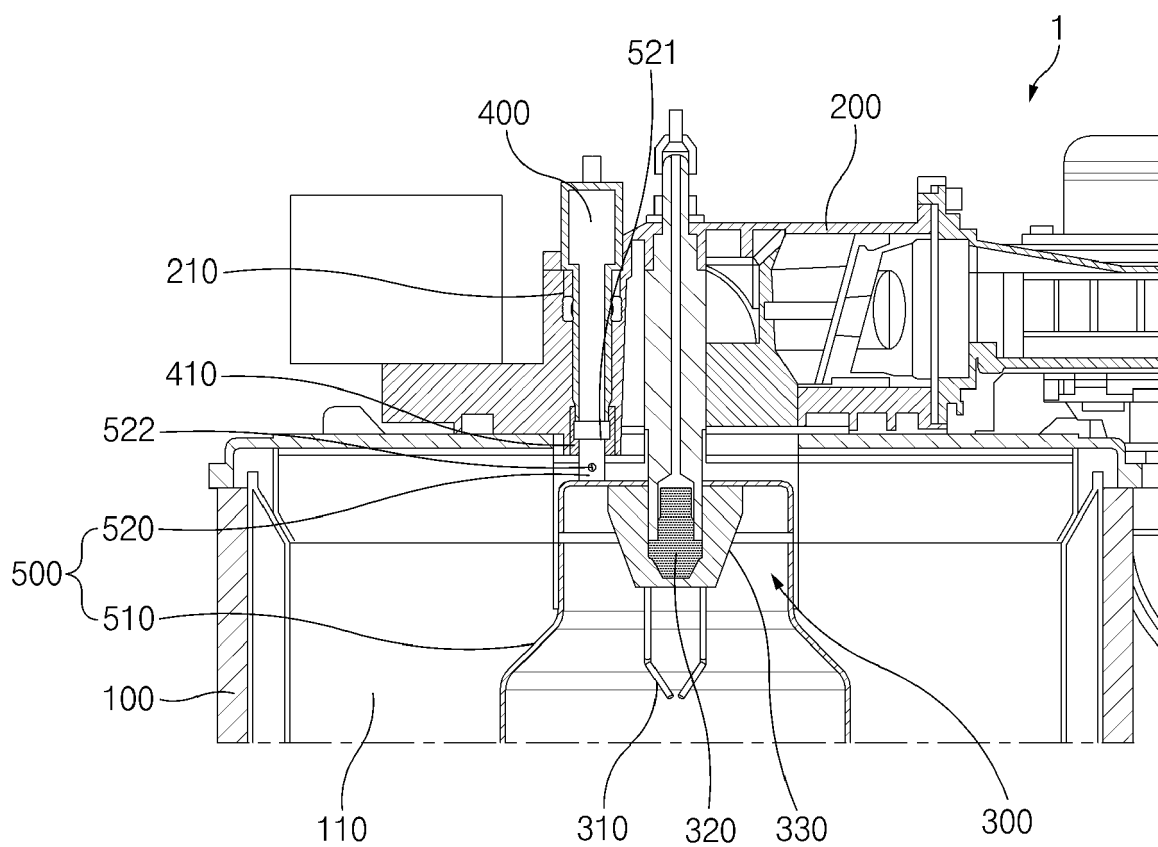


FIG. 3

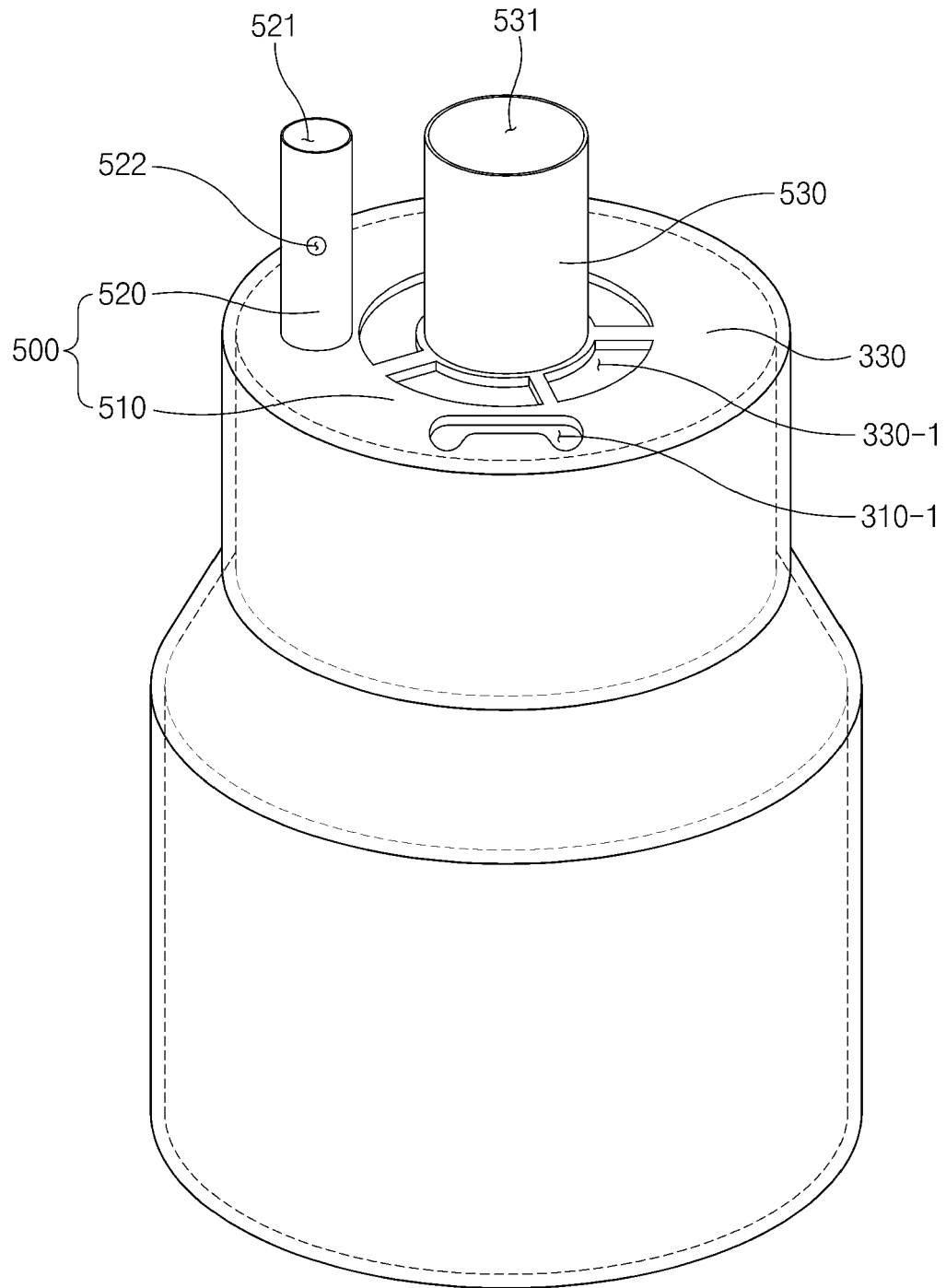


FIG. 4

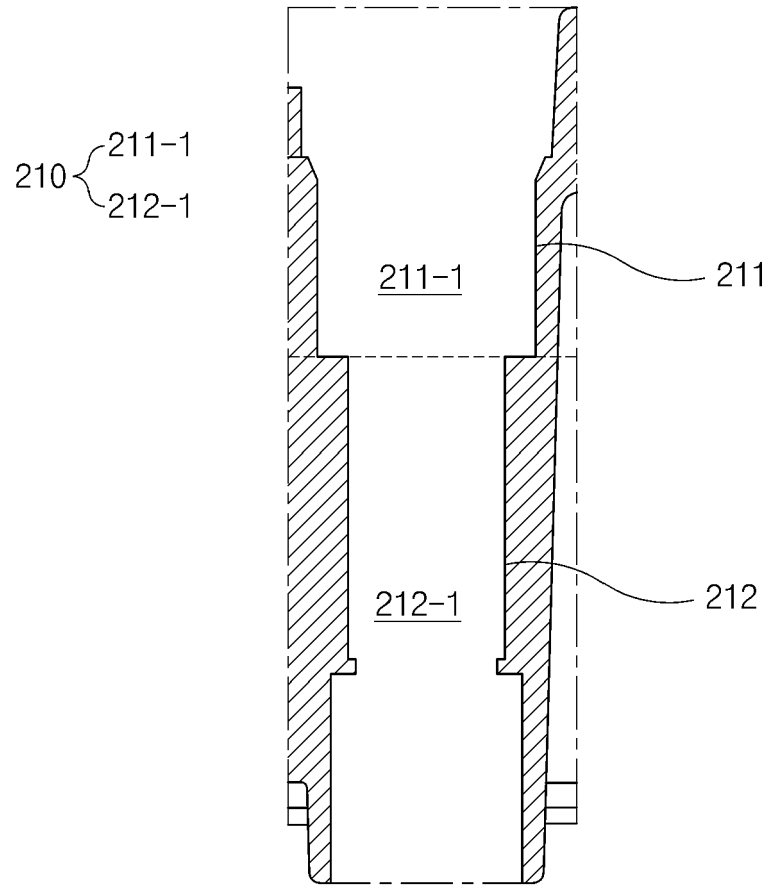


FIG.5

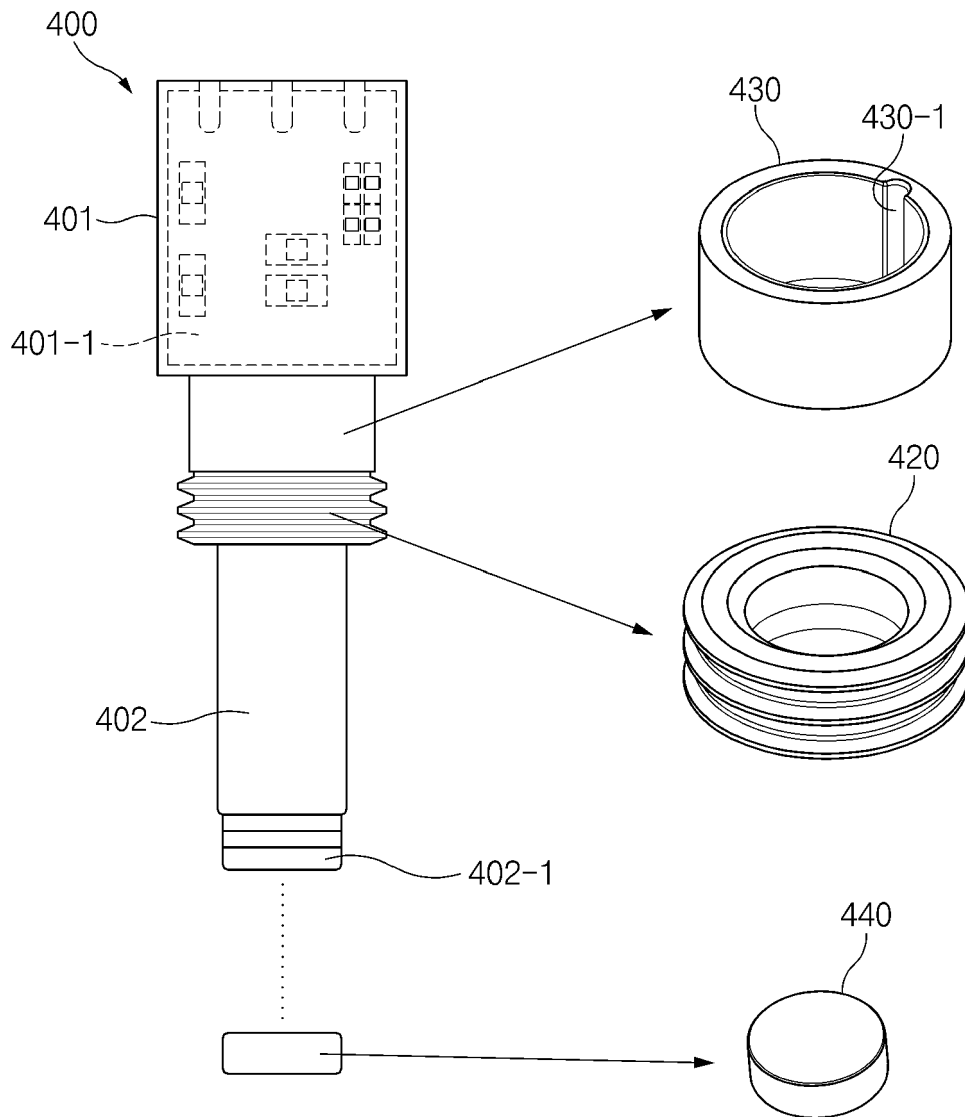


FIG. 6

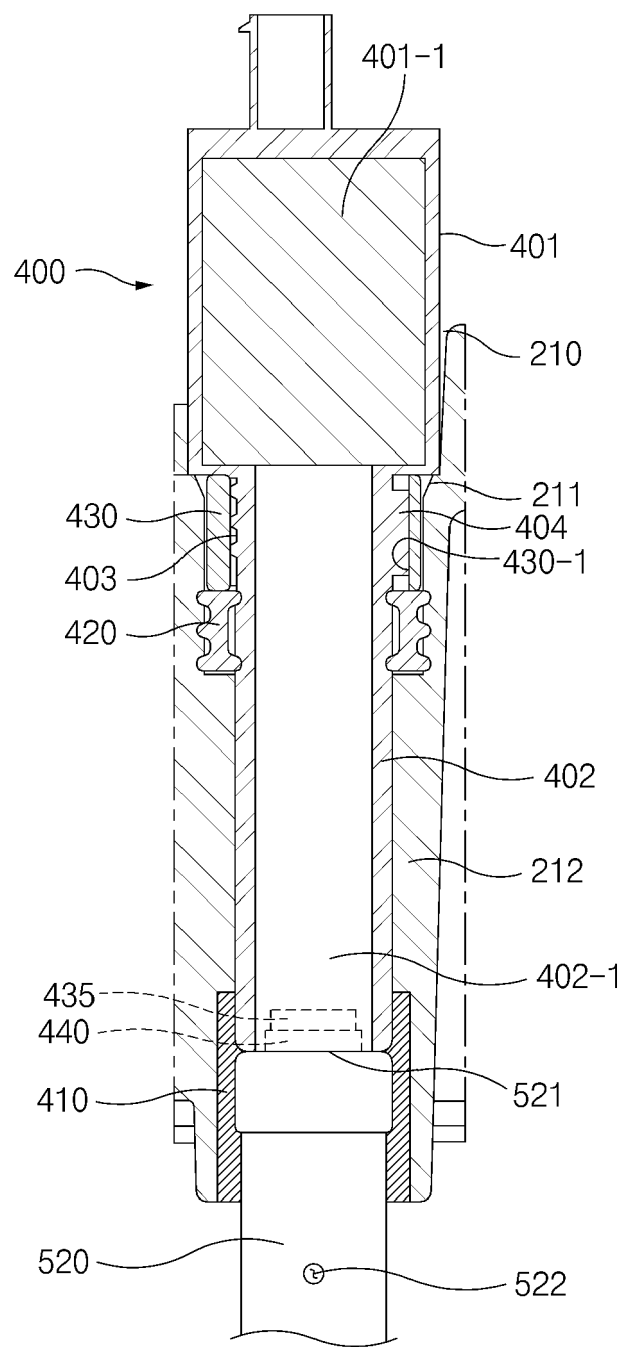


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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