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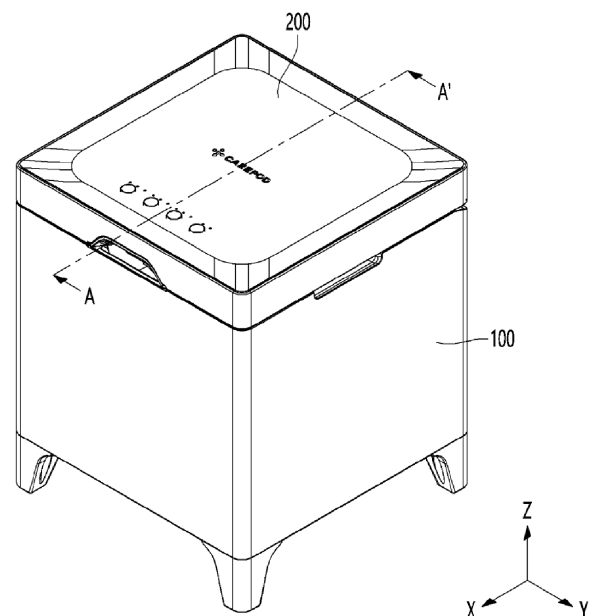
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(54) **HUMIDIFIER WITH STERILIZING FUNCTION**

(57) According to one aspect of the present invention, provided is a humidifier comprising: a main body; a water tank that provides an accommodating space; an atomizing module that includes an atomizing unit; a heater that is installed inside the main body and is located between the main body and the water tank; and a processor that controls the heater to heat the water tank, wherein the processor heats the heater to a first temperature while the atomizing unit operates, or heats the heater to a second temperature higher than the first temperature so as to heat or maintain the temperature of water inside the water tank within a predetermined temperature range.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a humidifier having a sterilizing function.

BACKGROUND ART

[0002] A humidifier is available in various types based on the humidification principle, including a heating type humidifier, an ultrasonic type humidifier, and a hybrid humidifier. Among these, the hybrid humidifier employs the principle of heating water using a heating plate (or heater) and then atomizing the heated water using an ultrasonic vibrator to form mist.

[0003] Typically, such a hybrid humidifier has a configuration in which an accommodating unit for storing water is formed separately from the main body, and a heating plate is formed at a place where the lower part of the accommodating unit abuts on the main body to heat the water stored in the accommodating unit.

[0004] It is important that the hybrid humidifier configured as described above is managed hygienically. However, a conventional humidifier has the problem of being difficult to clean and sterilize. Many of the internal components of the humidifier are not properly disassembled, and even when they are disassembled, it is necessary to go through a separate sterilization process, which is cumbersome.

DETAILED DESCRIPTION OF THE INVENTION

Technical Problem

[0005] The present invention aims to solve the above-described problems.

[0006] An object of the present invention is to provide a humidifier that can simultaneously sterilize internal components of the humidifier, such as an atomizing module, a water tank, and a cover.

[0007] Another object of the present invention is to provide a humidifier that can sterilize the interior of the humidifier.

[0008] Yet another object of the present invention is to provide a humidifier that automatically performs sterilization when atomization is completed during humidifier operation.

Technical Solution

[0009] A representative configuration of the present invention for achieving the above object is as follows.

[0010] According to one aspect of the present invention, provided is a humidifier comprising: a main body; a water tank that provides an accommodating space; an atomizing module that includes an atomizing unit; a heater that is installed inside the main body and is located

between the main body and the water tank; and a processor that controls the heater to heat the water tank, wherein the processor heats the heater to a first temperature while the atomizing unit operates, or heats the heater to a second temperature higher than the first temperature so as to heat or maintain the temperature of water inside the water tank within a predetermined temperature range.

Advantageous Effects

[0011] According to the present invention, it is possible to simultaneously sterilize an atomizing module, a water tank and a cover, which are internal components of the humidifier.

[0012] Also, according to the present invention, it is possible to sterilize the interior of the humidifier.

[0013] In addition, according to the present invention, it is possible to automatically perform sterilization when atomization is completed during humidifier operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a diagram showing a humidifier according to an embodiment of the present invention.

FIG. 2 is a diagram showing a state in which partial components of the humidifier of FIG. 1 are disassembled.

FIG. 3 is a diagram showing a state in which an atomizing module, a hinge assembly, and a sensor of the humidifier of FIG. 1 are disassembled.

FIG. 4 is a diagram showing a state in which an atomizing module, a hinge assembly, and a sensor of the humidifier of FIG. 1 are assembled.

FIG. 5 is a diagram showing the pivoting of the atomizing module of the humidifier of FIG. 1.

FIG. 6 is a schematic diagram showing a cross-sectional configuration taken along the cutting line A-A' of FIG. 1.

FIG. 7 is a flowchart showing the operating process of the humidifier of FIG. 1.

FIG. 8 is an image showing a sterilization test of the humidifier of FIG. 1.

FIG. 9 is an image showing the culture medium before and after the sterilization test of test bacterial strains inoculated into water inside the water tank according to the sterilization test of FIG. 8.

FIG. 10 is an image showing the culture medium before and after the sterilization test of test bacterial strains inoculated onto the inner surface and cover of the water tank according to the sterilization test of FIG. 8.

FIG. 11 is an image showing the results of the sterilization tests of FIGS. 9 and 10 in a table.

<Description of Symbols>

[0015]

100: main body
 110: heater
 120: heating plate
 200: upper body
 210: hinge assembly
 211: identifier
 220: sensor
 310: water tank
 320: cover
 400: atomizing module
 410: atomizing unit
 411: vibrator
 420: arm

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0016] In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, specific embodiments. These embodiments are described in sufficient detail to enable those skilled in the art to practice the claimed invention. It is to be understood that various embodiments of the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described herein in connection with one embodiment may be implemented within other embodiments without departing from the spirit and scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the spirit and scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims, appropriately interpreted, along with the full range of equivalents to which the claims are entitled. In the drawings, like numerals refer to the same or similar functionality throughout the several views.

[0017] Hereinafter, with reference to the accompanying drawings, various preferred embodiments of the present disclosure will be described in detail to the extent that one of ordinary skill in the art can easily practice the claimed invention.

Configuration of Humidifier

[0018] FIG. 1 is a diagram showing a humidifier according to an embodiment of the present invention. FIG. 2 is a diagram showing a state in which partial components of the humidifier of FIG. 1 are disassembled.

[0019] Referring to FIGS. 1 and 2, a humidifier 10 according to an embodiment of the present invention may include a main body 100 and an upper body 200.

[0020] Referring to FIGS. 1 and 2, the main body 100

may form an outside appearance of the humidifier. The main body 100 may have a rectangular parallelepiped shape. The main body 100 may provide a space inside. The main body 100 may have a shape whose upper surface is opened.

[0021] Referring to FIG. 1, the upper body 200 may form an outside appearance of the humidifier. The upper body 200 may be coupled to the main body 100 in an openable and closable manner. For example, the upper body 200 may be pivotally coupled or connected to the main body 100. The upper body 200 may open and close the interior space of the main body 100. In addition, the upper body 200 may be provided with a plurality of buttons (physical buttons or touch buttons) for operating the humidifier.

[0022] Referring to FIG. 2, the water tank 310 may be detachably accommodated, coupled, or mounted in the interior space of the main body 100. The water tank 310 may have a cylindrical shape. The water tank 310 may provide a space inside. The water tank 310 may have a shape whose upper surface is opened. The water tank 310 may be formed of a material with high thermal conductivity. The water tank 310 may be formed of a material with high thermal conductivity, such as a metal, alloy, graphite, or silicon carbide. For example, the water tank 310 may be formed of a stainless steel.

[0023] Referring to FIG. 2, the heater 110 may be installed on the inner side surface of the main body 100. The heater 110 may be located on the lower surface of the inner side surface of the main body 100. The heater 110 may be located between the water tank 310 and the main body 100. For example, the heater 110 may be a PTC heater 110.

[0024] Referring to FIG. 2, the heating plate 120 may be installed on the inner side surface of the main body 100. The heating plate 120 may be located on a lower surface of the inner side surface of the main body 100. The heating plate 120 may cover the upper surface of the heater 110. The heating plate 120 may be located between the water tank 310 and the main body 100. The heating plate 120 may come into contact with at least one of the heater 110 and the water tank 310. The heating plate 120 may be formed of a material with high thermal conductivity. The heating plate 120 may be formed of the same material as the water tank 310. For example, the heating plate 120 may be formed of a stainless steel. The heating plate 120 may rapidly diffuse and transfer heat of the heater 110 to the water tank 310.

[0025] Referring to FIG. 2, the cover 320 may be detachably accommodated, coupled, or mounted to the inner side surface of the upper body 200. The cover 320 may have a disc shape. The cover 320 may cover the upper surface of the water tank 310. The cover 320 may be formed of a material with high thermal conductivity. In addition, the cover 320 may be formed of the same material as the water tank 310. For example, the cover 320 may be formed of a stainless steel.

[0026] Referring to FIG. 2, the atomizing module 400

may have an elongated shape. At least a part of the atomizing module 400 may be accommodated in the water tank 310. An upper side of the atomizing module 400 may be pivotally connected, coupled, or mounted to the inner surface of the upper body 200.

[0027] The humidifier may include a processor (not shown). The processor may be electrically connected to the electronic components of the humidifier and control operation of the humidifier.

[0028] FIG. 3 is a diagram showing a state in which an atomizing module 400, a hinge assembly 210, and a sensor 220 of the humidifier of FIG. 1 are disassembled. FIG. 4 is a diagram showing a state in which an atomizing module 400, a hinge assembly 210, and a sensor 220 of the humidifier of FIG. 1 are assembled.

[0029] Referring to FIGS. 3 and 4, the atomizing module 400 may include an atomizing unit 410 and an arm 420. The arm 420 may have an elongated shape. The atomizing unit 410 may be provided at the lower end of the arm 420. The upper end of the arm 420 may be detachably connected, coupled, or mounted to the hinge assembly 210. The atomizing unit 410 may include a vibrator 411. The vibrator 411 may be exposed to the outside. For example, the vibrator 411 may be an ultrasonic vibrator 411. The vibrator 411 may generate mist through atomization.

[0030] Referring to FIGS. 3 and 4, the hinge assembly 210 may be provided on the upper body 200. The hinge assembly 210 may be rotatably installed based on a rotation axis r . In addition, the hinge assembly 210 may further include an identifier 211. The identifier 211 may be formed integrally with the hinge assembly 210. The identifier 211 may rotate together with the hinge assembly 210.

[0031] Referring to FIGS. 3 and 4, a sensor 220 may be provided on the upper body 200. The sensor 220 may detect rotation of the hinge assembly 210 or the identifier 211. The sensor 220 may detect at least one of the rotation amount, phase, rotation direction, and position of the identifier 211. For example, the sensor 220 may be a photo sensor 220. When the atomizing module 400 is coupled to the hinge assembly 210, the sensor 220 may detect at least one of the pivot amount, pivot angle, pivoting direction, and position of the atomizing module 400.

[0032] FIG. 5 is a diagram showing the pivoting of the atomizing module 400 of the humidifier of FIG. 1. Referring to FIG. 5, the atomizing module 400 is connected to the upper body 200 and can pivot and move within the water tank 310.

[0033] Referring to FIG. 5, when water W is accommodated in the water tank 310, the atomizing module 400 may be pivoted in response to the water level. The atomizing unit 410 may be made of a structure (e.g., a hollow structure) or material (e.g., a material with a lower specific gravity than water) that may exert a predetermined degree of buoyancy in water. The atomizing module 400 may float to the extent that only the atomizing unit

410 or the vibrator 411 is submerged in water due to the buoyancy that the atomizing unit 410 receives from the water. In addition, the atomizing module 400 may pivot by means of the hinge assembly 210 while floating to the extent that only the atomizing unit 410 or the vibrator 411 is submerged in the water, even if the water level changes.

[0034] For example, if the water level is at a first height h_2 , the angle formed by the upper body 200 and the atomizing module 400 may be B . At this time, the atomizing unit 410 or the vibrator 411 may be located below the water surface. Furthermore, the processor may detect the angle or water level formed by the upper body 200 and the atomizing module 400 through the sensor 220.

[0035] In addition, when the water level decreases to a second height h_1 due to the operation of the humidifier, the atomizing module 400 may pivot around the axis of the hinge assembly 210, and the angle formed by the upper body 200 and the atomizing module 400 may be C . Angle C may be greater than angle B . At this time, the atomizing unit 410 or the vibrator 411 may be located below the water surface. Furthermore, the processor may detect the angle formed by the upper body 200 and the atomizing module 400 or the water level through the sensor 220.

Sterilizing Function

[0036] FIG. 6 is a schematic diagram showing a cross-sectional configuration taken along the cutting line A-A' of FIG. 1. Referring to FIG. 6, the processor may heat the heater 110 to reach a first temperature while the atomization module 400 is performing atomization. At this time, the first temperature may be a temperature that can heat or maintain the water temperature at approximately 30 to 50°C. The first temperature may also be a temperature higher than the water temperature. For example, when the heater 110 is heated to the first temperature, the water temperature may be approximately 40°C. The processor may control the heater 110 so that the water temperature remains constant while the atomization module 400 is performing atomization.

[0037] In addition, if the atomizing module 400 is stopped during atomization, the processor may heat the heater 110 to reach a second temperature higher than the first temperature. At this time, the second temperature may be a temperature that can heat or maintain the water temperature at approximately 60 to 100°C. The second temperature may also be a temperature higher than the water temperature. For example, if the heater 110 is heated to the second temperature, the water temperature may be approximately 70°C. Furthermore, the processor can stop the operation of the heater 110 when the water temperature reaches a specific temperature. At this time, the specific temperature may be 60 to 80°C. In addition, the processor may operate a fan (not shown) installed inside the main body 100 to cool the water tank 310, thereby lowering the water temperature.

When the water temperature drops to approximately 30 to 50°C, the fan can be stopped.

[0038] Furthermore, the processor may sterilize at least one of the water tank 310, the water W inside the water tank, the atomizing module 400 and the cover 320 through the above-mentioned heater controlling method. Specifically, the processor may control the heater 110 to heat the water tank 310, and the heat from the heated water tank is transferred to the water inside the water tank, thereby raising the temperature of the water inside the water tank. At this time, the heat from the water inside the water tank is transferred to the atomizing unit 410 or the vibrator 411 of the atomizing module 400 which is submerged in water, so that the atomizing unit 410 or the vibrator 411 is sterilized. Furthermore, since the water tank 310 may be made of a material with high thermal conductivity, all portions of the water tank 310 are heated, so that sterilization occurs on all surfaces of the water tank 310. Additionally, heat generated inside the water tank 310 (the water tank interior surface or the water inside the water tank) is transferred to the arm 420 and the cover 320, so that sterilization occurs even in the arm 420 and the cover 320. Consequently, the humidifier may be managed hygienically even without the user having to disassemble and clean its internal components.

[0039] Referring to FIG. 6, the processor may control the heater 110 based on the pivoting of the atomizing module 400. The processor may sterilize at least one of the water tank 310, the water W inside the water tank, the atomizing module 400, and the cover 320 by controlling the heater 110 based on the pivoting of the atomizing module 400.

[0040] For example, the processor may detect the rotation of the identifier 211 or the pivoting of the atomizing module 400 through the sensor 220. The processor may detect the rotation amount or position of the identifier 211 through the sensor 220 to acquire the water level. Alternatively, the processor may detect the pivoting amount or position of the atomizing module 400 through the sensor 220 to acquire the water level. Alternatively, the processor may detect the angle formed by the upper body 200 and the atomizing module 400 through the sensor 220 to acquire the water level. Further, the processor may stop the operation of the vibrator 411 when the water level becomes sufficiently low, thereby allowing sterilization to proceed.

[0041] Referring to FIG. 6, the processor may control the heater 110 based on the angle formed by the upper body 200 and the atomizing module 400. For example, the processor may detect the angle formed by the upper body 200 and the atomizing module 400 through the sensor 220, and obtain the water level based on this.

[0042] If the angle formed by the upper body 200 and the atomizing module 400 becomes equal to or greater than a first value, the processor determines that the water level has sufficiently dropped, and stops the operation of the vibrator 411 to allow sterilization to proceed. For example, the first value may refer to the angle formed

by the upper body 200 and the atomizing module 400 when the water level from the bottom of the water tank 310 is approximately 40 mm to 60 mm. When the angle between the upper body 200 and the atomizing module 400 is equal to or greater than the first value, the atomizing unit 410 or the vibrator 411 may be in a state of being submerged in water.

[0043] Referring to FIG. 6, if the angle formed by the atomizing module 400 and the upper body 200 is less than a first value, the processor may heat the heater 110 to reach a first temperature. At this time, the first temperature may be a temperature that can heat or maintain the water temperature at approximately 30 to 50°C. And the first temperature may be a temperature higher than the water temperature.

[0044] In addition, if the angle formed by the atomizing module 400 and the upper body 200 is equal to or greater than the first value, the processor can heat the heater 110 to a second temperature higher than the first temperature. At this time, the second temperature may be a temperature that can heat or maintain the water temperature at approximately 60 to 100°C. And the second temperature may be a temperature higher than the water temperature.

[0045] FIG. 7 is a flowchart showing the operating process of the humidifier of FIG. 1. Referring to FIG. 7, the processor may determine whether the atomization mode is On (S710). If the atomization mode is On, the processor can operate the vibrator 411 (S710). The vibrator 411 can generate mist through atomization. The processor may then determine whether the sterilization reservation mode is On (S720). The sterilization reservation mode can refer to generating mist through atomization in a state where the water temperature is maintained at approximately 30 to 50°C. If the sterilization reservation mode is On, the processor may heat the heater 110 to reach a first temperature (S730). At this time, the first temperature may refer to a temperature that can heat or maintain the water temperature at approximately 30 to 50°C. And the first temperature may be a temperature higher than the water temperature.

[0046] The processor may determine whether the angle formed by the atomizing module 400 and the upper body 200 is equal to or greater than a first value (S740). At this time, the first value may refer to an angle formed by the atomizing module 400 and the upper body 200 when the water level from the bottom of the water tank 310 is approximately 40 mm to 60 mm. When the angle between the upper body 200 and the atomizing module 400 is equal to or greater than the first value, the atomizing unit 410 or the vibrator 411 may be in a state of being submerged in water.

[0047] If the angle formed by the atomizing module 400 and the upper body 200 is equal to or greater than a first value, the processor may turn Off the atomization mode and turn Off the sterilization reservation mode. Furthermore, the processor may heat the heater 110 to reach a second temperature (S750). The heater 110 being

heated to reach the second temperature may be referred to as a sterilization mode. At this time, the second temperature may refer to a temperature that can heat or maintain the water temperature at approximately 60 to 100°C. The second temperature may be a temperature higher than the water temperature. When the water temperature reaches a specific temperature, the processor may stop heating the heater 110 and operate a fan installed within the main body 100 to lower the water temperature. At this time, the specific temperature may be 60 to 80°C. When the water temperature drops to approximately 30 to 50°C, the processor may stop the fan and terminate the sterilization mode. For example, the processor may output a notification indicating that the sterilization mode has ended when the water temperature reaches 40°C.

[0048] On the other hand, the processor may perform sterilization regardless of the atomization mode. The processor can terminate the operation of the humidifier after performing the sterilization mode. For example, after the sterilization mode is completed, the processor may terminate the operation of the heater 110 and not operate the atomizing unit 410. At this time, the processor can turn On the sterilization mode regardless of the water level in the water tank 310. Alternatively, the processor may turn On the sterilization mode without detecting the angle formed by the atomizing module 400 and the upper body 200.

[0049] In addition, the processor may turn On the atomization mode after performing the sterilization mode. At this time, the processor can maintain a standby state until the water temperature inside the water tank 310 reaches an appropriate temperature for the atomization mode, or operate a fan installed inside the main body 100 to lower the water temperature. The processor may also operate the vibrator 411 if the water temperature inside the water tank 310 drops to an appropriate level.

Humidifier Sterilization Test

[0050] To verify the sterilizing performance of a humidifier according to an embodiment of the present invention, a sterilization test was conducted, and the test conditions are as follows:

- Test bacterial strains: *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Listeria monocytogenes*
- Test bacterial strain inoculation location: Humidifier cover, inner surface of the water tank, and water inside the water tank
- Surface test bacterial strain inoculation amount: 10 μ l
- Humidifier sterilization course operation time: 2 hours

[0051] The sterilization test procedure is as follows: Water was filled into a humidifier water tank to a height of

50 to 75 mm to operate the humidifier. At the same time, a sterilization reservation button was pressed to reserve and activate sterilization function (when the humidifier is turned On, atomization starts, and when the water level in the tank reaches approximately 50 mm, the sterilization function automatically starts).

[0052] The upper body of the humidifier was opened before starting sterilization, and the precultured test bacterial strain was inoculated at the locations for conducting sterilization test (humidifier cover, inner surface of the water tank, and water inside the water tank) (see FIG. 8).

[0053] The upper body of the humidifier was closed, and waited until the sterilization course (approximately 2 hours) was completed.

[0054] After the sterilization course was completed, test bacterial stains were collected again from the locations where they were inoculated, and the colony-forming units (CFU) were compared with the previously cultured medium to measure the bacterial reduction rate.

[0055] FIGS. 9 and 10 are images showing the culture medium before and after the sterilization test of test bacterial strain inoculated into water inside the water tank according to the sterilization test of FIG. 8. Referring to FIGS. 9 and 10, it may be visually confirmed that all test bacterial strains collected after the sterilization test were almost completely sterilized and disappeared at all test locations.

[0056] FIG. 11 is an image showing the results of the sterilization tests of FIGS. 9 and 10 in a table. Referring to FIG. 11, it may be seen that the reduction rate of all test bacterial stains used in the test was measured to be 99.9% or more.

[0057] As can be seen from the sterilization test results, the humidifier according to an embodiment of the present invention may also perform sterilization using a heater for heat retention and humidification, so that the structure is simple and can be managed hygienically. In addition, the humidifier according to an embodiment of the present invention can effectively reduce most bacteria throughout the humidifier's internal components (cover, water tank, and atomizing module) through sterilization, thereby exhibiting excellent sterilization effects.

[0058] Although the present invention has been described above in terms of specific items such as detailed elements as well as the limited embodiments and the drawings, they are only provided to help more general understanding of the invention, and the present invention is not limited to the above embodiments. It will be appreciated by those skilled in the art to which the present invention pertains that various modifications and changes may be made from the above description.

[0059] Therefore, the idea or spirit of the present invention shall not be limited to the above-described embodiments, and the entire scope of the appended claims and their equivalents will fall within the scope and spirit of the invention.

Claims**1.** A humidifier comprising:

a main body; 5
 a water tank that provides an accommodating space;
 an atomizing module that includes an atomizing unit;
 a heater that is installed inside the main body and is located between the main body and the water tank; and 10
 a processor that controls the heater to heat the water tank,
 wherein the processor heats the heater to a first temperature while the atomizing unit operates, or heats the heater to a second temperature higher than the first temperature so as to heat or maintain the temperature of water inside the water tank within a predetermined temperature range. 20

2. The humidifier according to claim 1, wherein the temperature range is 60 to 100°C. 25

3. The humidifier according to claim 1 or 2, wherein the water tank is detachably mounted inside the main body.

4. The humidifier according to claim 1 or 2, wherein when liquid is accommodated inside the water tank, the atomizing module is configured to float on the liquid while being at least partially submerged in the liquid. 30
 35

5. The humidifier according to claim 4, wherein the main body and the water tank have upper surfaces opened, and the humidifier further comprises an upper body that covers the main body and an upper surface of the water tank. 40

6. The humidifier according to claim 5, wherein the upper body further comprises a hinge assembly provided on its inner surface, and the atomizing module is detachably mounted to the hinge assembly via an arm. 45
 50

7. The humidifier according to claim 1, wherein the water tank is formed of a material with high thermal conductivity. 55

8. The humidifier according to claim 1, wherein the water tank is formed of a stainless steel.

9. The humidifier according to claim 6, wherein the atomizing module is pivotally mounted on the hinge assembly on the inner surface of the upper body, and the upper body comprises a sensor that detects the pivoting of the atomizing module.

10. The humidifier according to claim 9, wherein the sensor detects the rotation of the hinge assembly.

11. The humidifier according to claim 9, wherein the processor controls the atomizing unit and the heater based on the pivoting of the atomizing module.

12. The humidifier according to claim 11, wherein the processor controls operation of the atomizing unit when the angle formed by the atomizing module and the upper body is less than a first value, and stops operation of the atomizing unit when the angle is equal to or greater than the first value.

FIG. 1

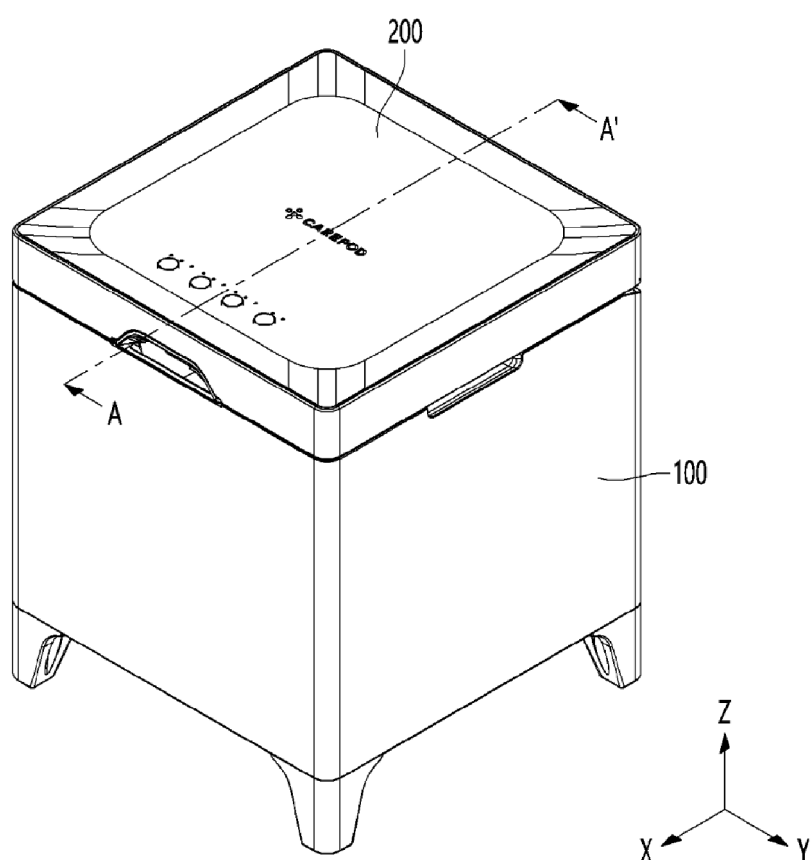


FIG. 2

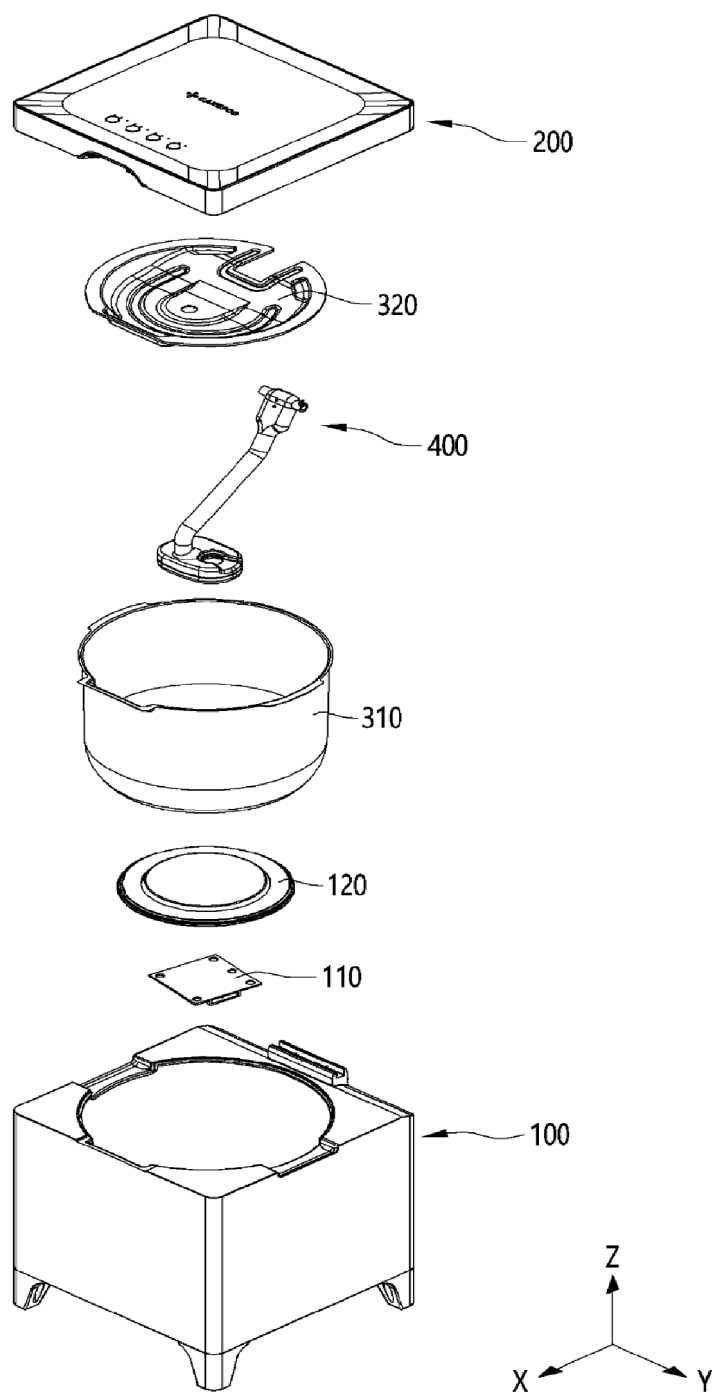


FIG. 3

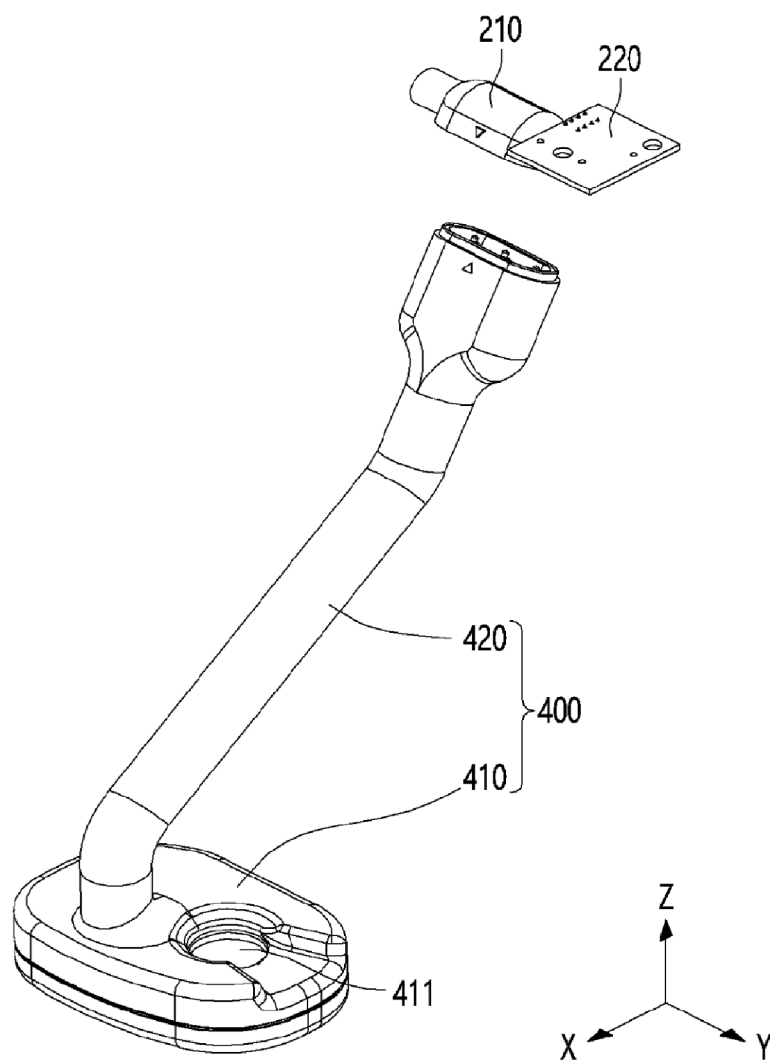


FIG. 4

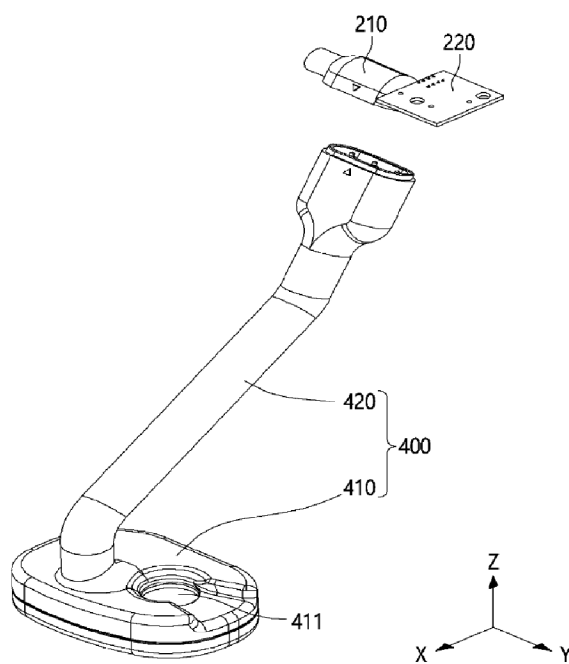


FIG. 5

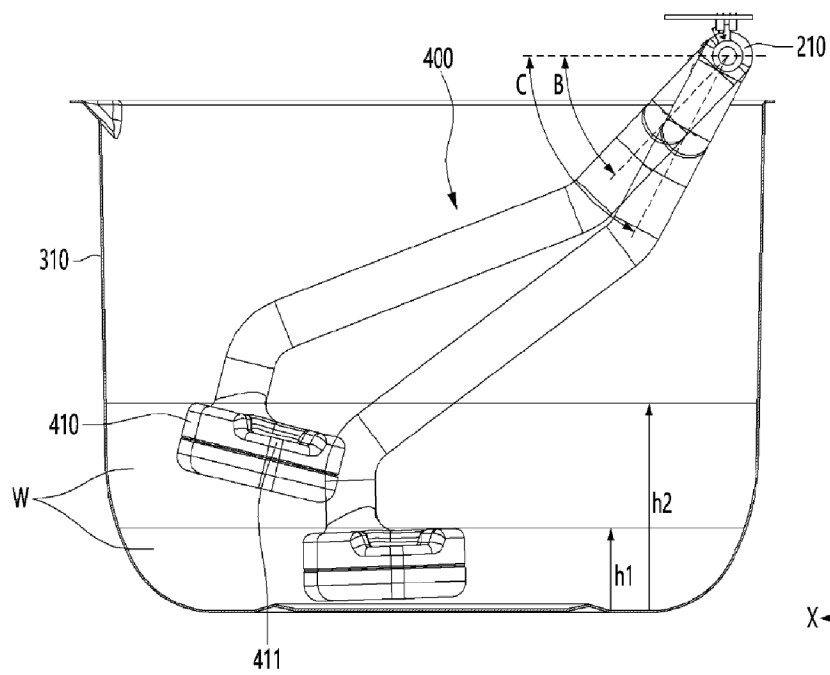


FIG. 6

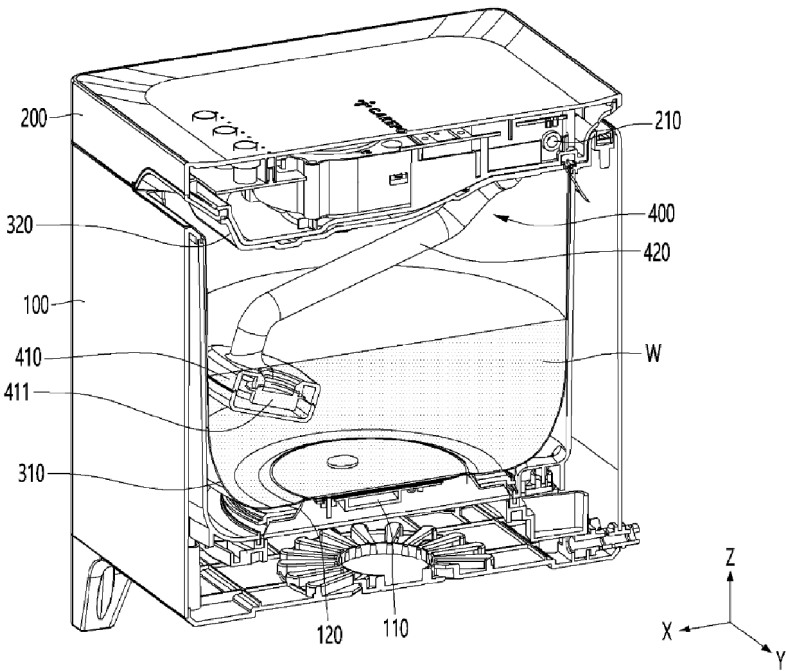


FIG. 7

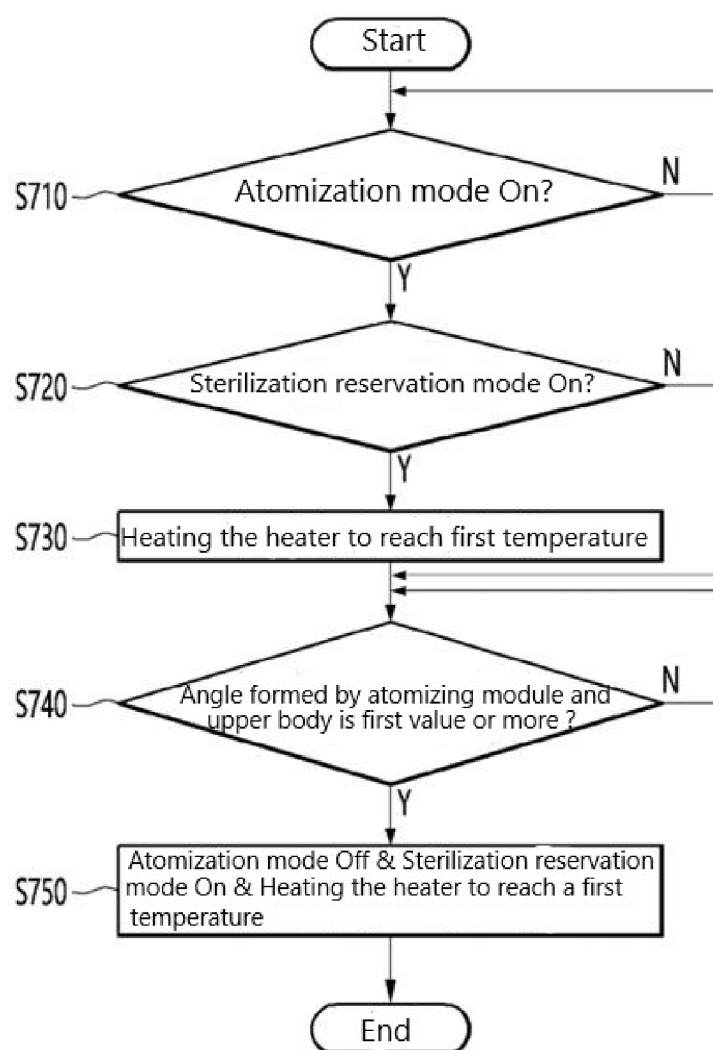


FIG. 8

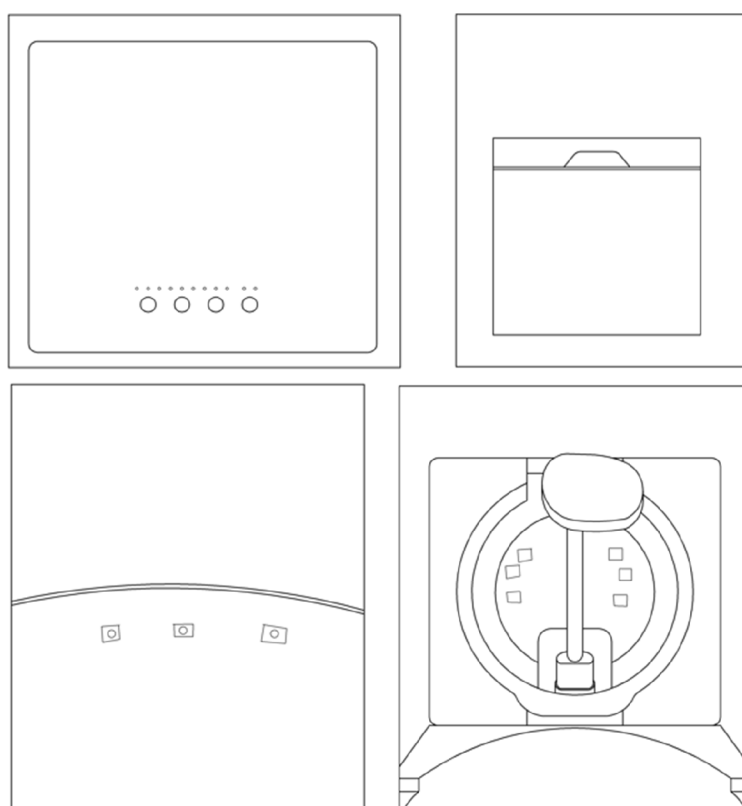
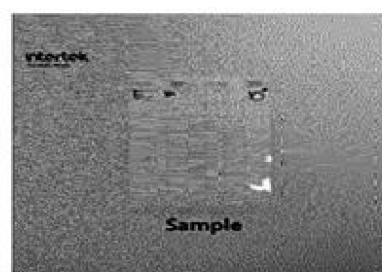
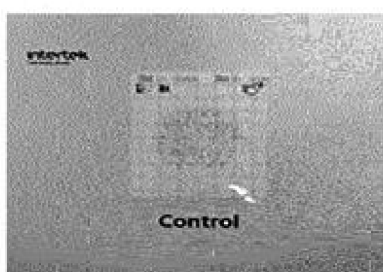
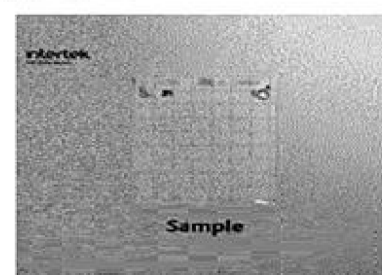


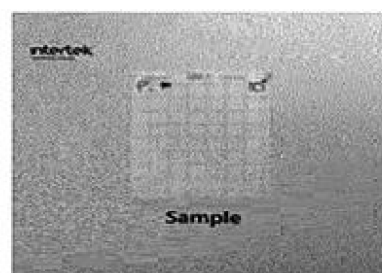
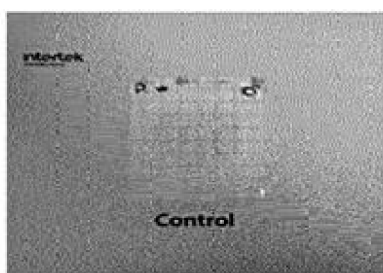
FIG. 9



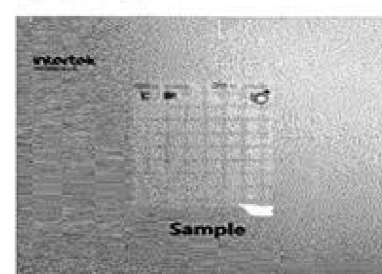
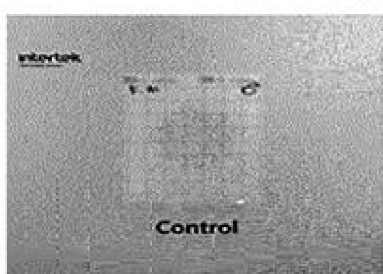
<Before and after treatment with *E. coli*>



<Before and after treatment with *Staphylococcus aureus*>



<Before and after treatment with *Pseudomonas aeruginosa*>



<Before and after treatment with *Klebsiella pneumoniae*>

FIG. 10

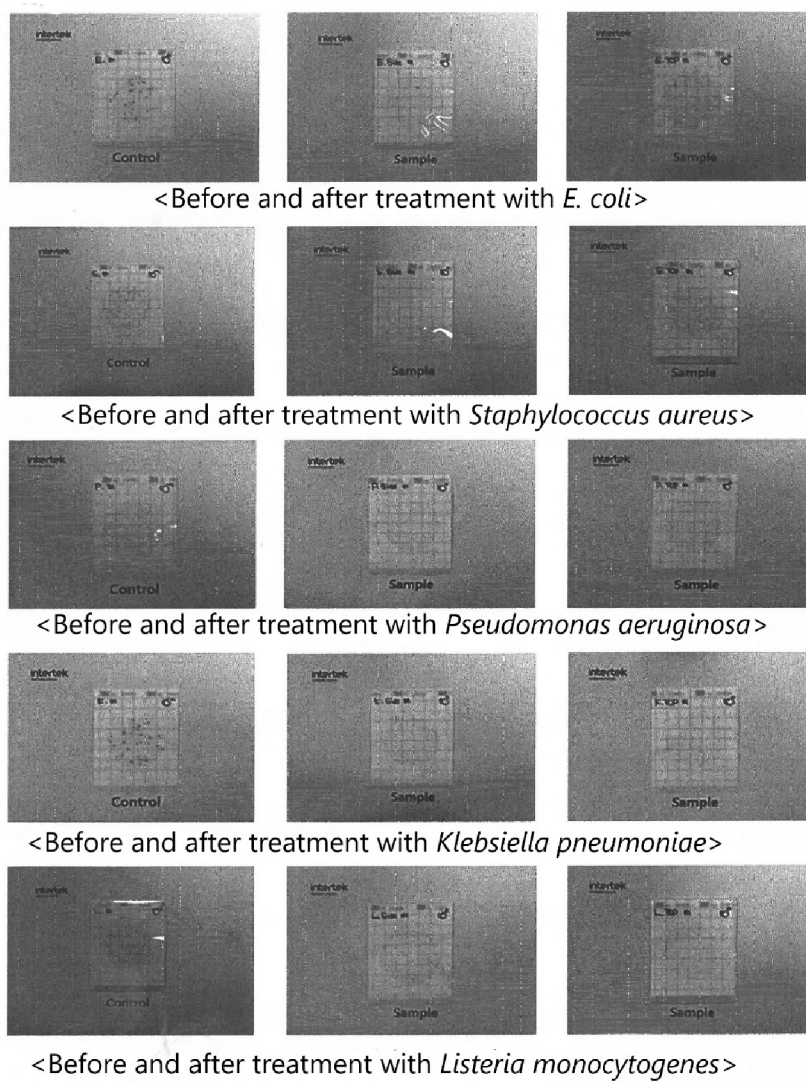


FIG. 11

Category	Test bacterial strain	Test results (CFU/mL)		Bacteria reduction rate (%)
		Before treatment	After treatment	
Water inside water tank	<i>Escherichia coli</i>	8.4×10^4	0	> 99.9
	<i>Staphylococcus aureus</i>	1.3×10^5	0	> 99.9
	<i>Pseudomonas aeruginosa</i>	2.2×10^3	0	> 99.9
	<i>Klebsiella pneumoniae</i>	1.4×10^4	0	> 99.9
	<i>Listeria monocytogenes</i>	1.2×10^4	0	> 99.9
Water tank interior surface	<i>Escherichia coli</i>	3.7×10^4	2	> 99.9
	<i>Staphylococcus aureus</i>	7.7×10^5	0	> 99.9
	<i>Pseudomonas aeruginosa</i>	4.4×10^5	0	> 99.9
	<i>Klebsiella pneumoniae</i>	3.9×10^3	0	> 99.9
	<i>Listeria monocytogenes</i>	1.2×10^4	2	99.9
Water tank lid surface	<i>Escherichia coli</i>	3.7×10^4	0	> 99.9
	<i>Staphylococcus aureus</i>	7.7×10^5	39	> 99.9
	<i>Pseudomonas aeruginosa</i>	4.4×10^5	0	> 99.9
	<i>Klebsiella pneumoniae</i>	3.9×10^3	0	> 99.9
	<i>Listeria monocytogenes</i>	1.2×10^4	0	> 99.9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/013337

A. CLASSIFICATION OF SUBJECT MATTER**F24F 6/12**(2006.01)i; **F24F 13/20**(2006.01)i; **F24F 6/00**(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F 6/12(2006.01); B05B 17/06(2006.01); F24F 6/02(2006.01); F24F 6/14(2006.01)

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

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 가습기(humidifier), 살균 기능(sterilizing function), 히터(heater), 힌지(hinge), 센서(sensor), 피봇(pivot)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 20-2021-0000607 U (BACK, Kyo Ki) 12 March 2021 (2021-03-12) See paragraphs [0029]-[0033], [0035], [0039], [0040], [0045] and [0046] and figures 2-4.	1-3,7,8
Y		4-6,9-12
Y	KR 10-2017-0046634 A (KIM, Hyung Joo) 02 May 2017 (2017-05-02) See paragraphs [0025], [0031], [0032], [0058], [0060] and [0061] and figures 2-4.	4-6,9-12
Y	JP 2010-249337 A (SANYO ELECTRIC CO., LTD. et al.) 04 November 2010 (2010-11-04) See paragraphs [0047]-[0052] and figures 12-15.	11,12
A	US 2016-0123613 A1 (KIM, Joo Hyung) 05 May 2016 (2016-05-05) See claim 8 and figures 1-6.	1-12
A	KR 10-1997-0047340 A (DAEWOO ELECTRONICS CO., LTD.) 26 July 1997 (1997-07-26) See claims 1 and 2 and figures 1 and 2.	1-12

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

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Date of the actual completion of the international search

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/013337

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		WO 2015-012662 A1	29 January 2015
KR 10-1997-0047340 A	26 July 1997	None	

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