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(71) Applicant: **Altrason Inc.**
Taipei City 11492 (TW)

(72) Inventor: **JAN, Po-Sheng**
114 Taipei City (TW)

(74) Representative: **Morris, Jonathan Paul**
Urquhart-Dykes & Lord LLP
Altius House
1 North Fourth Street
Milton Keynes MK9 1NE (GB)

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(54) TEMPERATURE-BASED ADAPTIVE DEHUMIDIFICATION SYSTEM

(57) Disclosed is a temperature-based adaptive dehumidification system (100) for an air-conditioning environment, comprising: a temperature sensing device (1) provided to sense temperature of the air-conditioning environment to obtain environmental temperature information (S1); a humidity sensing device (2) provided to sense humidity of the air-conditioning environment to obtain environmental humidity information (S2); and a dehumidifying device (3) which obtains a referenced humidity range which corresponds to the obtained environmental temperature information (S1) by means of a calculation in reference to a predetermined reference relationship of temperature-humidity, and then the controller (33) performs a comparison between the obtained environmental humidity information (S2) and the referenced humidity range thereby, when the obtained environmental humidity information (S2) is not within the referenced humidity range, enabling dehumidifying device (3) to perform a dehumidifying process for the air-conditioning environment so as to automatically regulate humidity to the most appropriate degree for the user according to environment temperature.

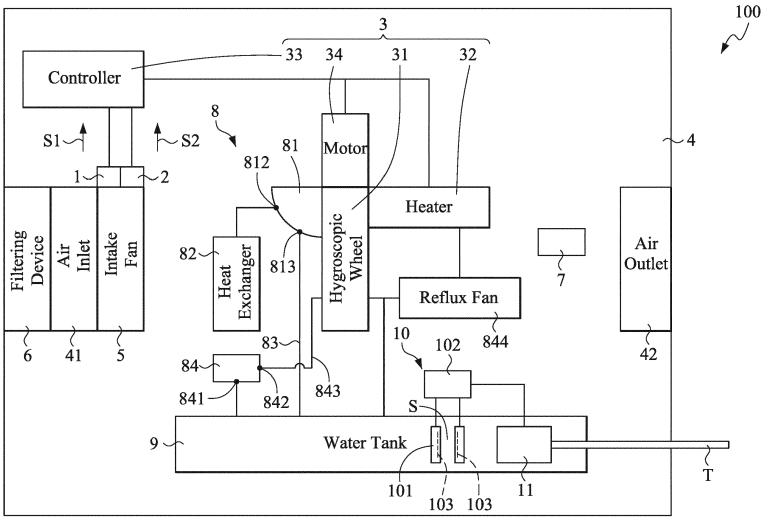


FIG.2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a dehumidifier, and more particularly relates to a temperature-based adaptive dehumidification system that regulates humidity based on temperature.

BACKGROUND OF THE INVENTION

[0002] The higher the temperature is, the greater amount of water vapor in the air will be. In medicine, respiration is closely related to humidity. A relative humidity in a range from 40 to 60% will help oxygen to be easier to enter the human blood through alveoli, and thus it makes people feel most comfortable. On the contrary, when temperature and humidity of the environment become higher, the perspiration system of human being, which regulates human's temperature, becomes affected to thus make people feel muggy and uncomfortable. Therefore, a dehumidifier is widely used by people to regulate the humidity.

[0003] A conventional dehumidifier is configured to perform a dehumidifying process according to a preset value of target humidity. The conventional dehumidifier stops the dehumidifying process when the relative humidity reaches the preset value of target humidity. However, since the preset value of target humidity in the conventional dehumidifier is always a constant value which can not be auto-adjusted corresponding to the current environment temperature, the conventional dehumidifier is not an ideal device to provide people with the most appropriate humidity.

SUMMARY OF THE INVENTION

[0004] Accordingly, one of the objects of the present invention is to provide a temperature-based adaptive dehumidification system that automatically modifies the target humidity depending on environment's current temperature, thereby regulating humidity to the most appropriate degree for the user.

[0005] In order to overcome the technical problems in prior art, the present invention provides a temperature-based adaptive dehumidification system for an air-conditioning environment, comprising: a temperature sensing device provided to sense temperature of the air-conditioning environment to obtain environmental temperature information; a humidity sensing device provided to sense humidity of the air-conditioning environment to obtain environmental humidity information; and a dehumidifying device including a hygroscopic wheel, a heater and a controller, wherein the hygroscopic wheel is in air communication with the air-conditioning environment to absorb moisture therefrom, the heater is in thermal connection with the hygroscopic wheel to heat moisture absorbed by the hygroscopic wheel so as to evaporate moisture from the hygroscopic wheel, and the controller is electrically connected to the temperature sensing device, the humidity sensing device and the heater in such a manner that the controller obtains a referenced humidity range which corresponds to the obtained environmental temperature information by means of a calculation in reference to a predetermined reference relationship of temperature-humidity, and then the controller performs a comparison between the obtained environmental humidity information and the referenced humidity range thereby, when the obtained environmental humidity information is not within the referenced humidity range, enabling dehumidifying device to perform a dehumidifying process for the air-conditioning environment.

[0006] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, wherein when the temperature of the air-conditioning environment is in a range between 15.5°C and 24°C, the predetermined reference relationship of temperature-humidity is a function of: $Y \leq (-20/8.5)\ X + (1640/17) \pm 5$, wherein X (°C) is the temperature of the air-conditioning environment and Y (%) is the humidity of the air-conditioning environment, and wherein the controller is configured to: substitute the obtained environmental temperature information for the X and substitute the obtained environmental humidity information for the Y, and perform the dehumidifying process for the air-conditioning environment when the obtained environmental humidity information is not within the referenced humidity range.

[0007] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the controller is configured to, when the obtained environmental humidity information is within the referenced humidity range, not perform the dehumidifying process.

[0008] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, in the predetermined reference relationship of temperature-humidity, the controller is configured to perform the dehumidifying process for the air-conditioning environment when the temperature of the air-conditioning environment is higher than 24°C, the referenced humidity range is less than or equal to 40%, and the obtained environmental humidity information is not within the referenced humidity range.

[0009] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, in the predetermined reference relationship of temperature-humidity, the controller is configured to perform the dehumidifying process for the air-conditioning environment when the temperature of the air-conditioning environment is lower than 15.5°C, the referenced humidity range is greater than or equal to 60%, and the obtained environmental humidity information is not within the referenced humidity range.

[0010] In a temperature-based adaptive dehumidification system according to one embodiment of the present

invention, the controller is configured to, when the obtained environmental humidity information is within the referenced humidity range, not perform the dehumidifying process.

[0011] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the controller is configured to activate the hygroscopic wheel when the heater is performing a heating operation.

[0012] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the heater is disposed in a position corresponding to a wind outflow side of the hygroscopic wheel.

[0013] According to one embodiment of the present invention, the temperature-based adaptive dehumidification system further comprises a filtering device and an air velocity sensing device, wherein the filtering device is disposed in a position corresponding to a wind inflow side of the hygroscopic wheel and disposed between the hygroscopic wheel and the air-conditioning environment so as to filter airflow which flows from the air-conditioning environment to the hygroscopic wheel, and wherein the air velocity sensing device is disposed in a position between the filtering device and the hygroscopic wheel so as to sense an air velocity of the airflow which flows from the air-conditioning environment through the filtering device.

[0014] According to one embodiment of the present invention, the temperature-based adaptive dehumidification system further comprises a condensing device, wherein the condensing device and the heater are disposed at opposite sides of the hygroscopic wheel, and the condensing device is provided to condense the moisture which is evaporated by the heater and then flows through a condensation inlet of condensing device from the hygroscopic wheel to the condensing device.

[0015] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the condensing device is provided with a cooling passage which is connected to an air inlet provided between the hygroscopic wheel and the air-conditioning environment.

[0016] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the condensing device includes a steam guiding hood, a heat exchanger and a drainage member, wherein the steam guiding hood, connected to the hygroscopic wheel, forms a steam guiding passage in such a manner that an upper portion of the steam guiding passage is connected with the heat exchanger to guide the moisture evaporated by the heater to the heat exchanger, and a lower portion of the steam guiding passage is in air communication with the drainage member to drain condensation inside the steam guiding hood.

[0017] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the condensing device includes a steam-water splitting member connected to a lower portion of the heat exchanger, the steam-water splitting member is provided with a water outlet and a reflux outlet located at a height level higher than that of the water outlet.

[0018] According to one embodiment of the present invention, the temperature-based adaptive dehumidification system further comprises a water tank connected to a drainage portion of the condensing device.

[0019] In a temperature-based adaptive dehumidification system according to one embodiment of the present invention, the steam-water splitting member further includes a reflux channel and a reflux fan, wherein the reflux channel is in air communication with the reflux outlet and is connected to the heater, and the reflux fan is disposed at the reflux channel to draw airflow from the reflux outlet into the heater.

[0020] According to one embodiment of the present invention, the temperature-based adaptive dehumidification system further comprises a water level detecting device including two electrodes and a determining unit, wherein the two electrodes are provided in the water tank and each electrode has a dielectric constant detecting surface in such a manner that the dielectric constant detecting surfaces of one electrode faces forward the dielectric constant detecting surfaces of another electrode, a water level detecting space is formed between the two dielectric constant detecting surfaces, and the determining unit is connected to the two electrodes to determine a water level of the water tank according to a dielectric constant detected in the water level detecting space.

[0021] According to one embodiment of the present invention, the temperature-based adaptive dehumidification system further comprises a pump, which is electrically connected to the determining unit to pump out water from the water tank when the water level of the water tank exceeds a predetermined water level threshold.

[0022] The temperature-based adaptive dehumidification system of the present invention has possessed with the following technical effects: the controller of the temperature-based adaptive dehumidification system of the present invention provides with a predetermined reference relationship of temperature-humidity on a basis of the most appropriate relative humidity degree for the user under a specific temperature, obtains a referenced humidity range which corresponds to the obtained environmental temperature information by means of a calculation in reference to a predetermined reference relationship of temperature-humidity, and performs the dehumidifying process when the environmental humidity information is not within the referenced humidity range, thereby regulating humidity to the most appropriate degree for the human body.

[0023] Furthermore, a replacement of filter in a prior art is usually determined by a visual inspection which inspects dirtiness degree of the filter. However, a result of visual inspection always different for users time to time without consistency criterion. Therefore, the temperature-based adaptive dehumidification system of the present invention is provided with an air velocity sensing

device for sensing an air velocity of the airflow flowing through the filtering device, thereby measuring the dirtiness degree of the filtering device to facilitate determination of the timing for replacing a filter.

[0024] In a prior art, a conventional water level sensor includes a float attached to the water tank via a swing arm and a magnetic component mounted at an upper surface of the float. When the water level in the water tank is beyond a predetermined degree, the float is lifted up to change the position of the magnetic component. However, because there is a risk that the float of the conventional water level sensor may fail to change position in response to changes of the water level, the water level detecting device adopted by the temperature-based adaptive dehumidification system of the present invention is provided to determine a water level of the water tank according to a detected dielectric constant between the two electrodes, thereby removing the risk of failure detection of water level.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a schematic stereogram illustrating a temperature-based adaptive dehumidification system according to one embodiment of the present invention;

FIG. 2 is a schematic block diagram illustrating the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 3 is a schematic graph of a reference relationship of temperature-humidity of the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 4 is a schematic cross-section view of the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 5 is a schematic cross-section view of the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 6 is a schematic top view of the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 7 is a schematic cross-section view of the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 8 is a schematic stereogram illustrating a condensing device of the temperature-based adaptive dehumidification system according to the embodiment of the present invention;

FIG. 9 is a schematic cross-section view of the temperature-based adaptive dehumidification system according to the embodiment of the present invention; and

FIG. 10 is a schematic stereogram illustrating a temperature-based adaptive dehumidification system according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] The preferred embodiments of the present invention are described in detail below with reference to FIG. 1 to FIG. 10. The description is used for explaining the embodiments of the present invention only, but not for limiting the scope of the claims.

[0027] As shown in FIG. 1 to FIG. 3, a temperature-based adaptive dehumidification system 100 according to one embodiment of the present invention is disposed in an air-conditioning environment (not shown), such as a bedroom, a bathroom, a living room, an office or other environment. The temperature-based adaptive dehumidification system 100 includes a temperature sensing device 1, a humidity sensing device 2 and a dehumidifying device 3.

[0028] The temperature sensing device 1 is provided to sense temperature of the air-conditioning environment to obtain environmental temperature information S1. The humidity sensing device 2 is provided to sense humidity of the air-conditioning environment to obtain environmental humidity information S2. The dehumidifying device 3 includes a hygroscopic wheel 31, a heater 32 and a controller 33. The hygroscopic wheel 31 is in air communication with the air-conditioning environment to absorb moisture therefrom. The heater 32 is in thermal connection with the hygroscopic wheel 31 to heat moisture absorbed by the hygroscopic wheel 31 so as to evaporate moisture from the hygroscopic wheel 31. The controller 33 is electrically connected to the temperature sensing device 1, the humidity sensing device 1 and the heater 32 in such a manner that the controller 33 obtains a referenced humidity range which corresponds to the obtained environmental temperature information S1 by means of a calculation in reference to a predetermined reference relationship of temperature-humidity (as shown in FIG. 3), and then the controller 33 performs a comparison between the obtained environmental humidity information S2 and the referenced humidity range thereby, when the obtained environmental humidity information S2 is not within the referenced humidity range, enabling dehumidifying device 3 to perform a dehumidifying process for the air-conditioning environment. Preferably, the hygroscopic wheel 31 is porous and can achieve a good moisture absorption result. For example, the hygroscopic wheel 31 is made of a moisture absorbing material such as zeolite, silica gel, activated alumina or activated carbon. Specifically, the dehumidifying device 3 further includes a motor 34 electrically connected to the controller 33. The motor 34 drives the hygroscopic wheel 31 to rotate when the heater 32 is performing a

heating operation. Preferably, the dehumidifying device 3 includes a heating temperature sensing unit (not shown) electrically connected to the heater 32 to sense heating temperature of the heater 32, and stops the operation of the heater 32 when the heating temperature of the heater 32 exceeds a standard value. Alternatively, the dehumidifying device 3 is provided with a fuse (not shown), which is electrically connected to the heater 32 and breaks when the heating temperature of the heater 32 exceeds the standard value, in order to prevent the heating temperature of the heater 32 from being too high. By means of a double security protection mechanism of the heating temperature sensing unit and the fuse according to the present invention, an accident due to an excessive heating temperature of the heater 32 can be avoided.

[0029] As shown in FIG. 3, the temperature-based adaptive dehumidification system 100 according to the present invention, when the temperature of the air-conditioning environment is in a range between 15.5°C and 24°C, the predetermined reference relationship of temperature-humidity is a function of: $Y \leq (-20/8.5) X + (1640/17) \pm 5$, wherein X (°C) is the temperature of the air-conditioning environment and Y (%) is the humidity of the air-conditioning environment, and wherein the controller 33 is configured to: substitute the obtained environmental temperature information for the X and substitute the obtained environmental humidity information for the Y, and perform the dehumidifying process for the air-conditioning environment when the obtained environmental humidity information is not within the referenced humidity range. When the temperature of the air-conditioning environment is in a range between 15.5°C and 24°C and the obtained environmental humidity information is not within the referenced humidity range, e.g., the temperature of the air-conditioning environment is 21°C and the humidity of the air-conditioning environment is 60%, the controller 33 obtains a referenced humidity range of 0% to 47% according to the reference relationship of temperature-humidity and accordingly activates the heater 32 to heat the hygroscopic wheel 31 so as to evaporate moisture absorbed by the hygroscopic wheel 31 in such a manner that moisture of an airflow flowing from the air-conditioning environment is removed by the hygroscopic wheel 31 when the airflow flows through the hygroscopic wheel 31, and then the airflow in which the moisture has been removed is discharged back into the air-conditioning environment to dehumidify the air-conditioning environment.

[0030] As shown in FIG. 3, in the temperature-based adaptive dehumidification system according to the embodiment of the present invention, in the predetermined reference relationship of temperature-humidity, when the temperature of the air-conditioning environment is higher than 24°C, the referenced humidity range is less than or equal to 40%, and the controller 33 is configured to perform the dehumidifying process for the air-conditioning environment when the obtained environmental humidity information is not within the referenced humidity range. When the temperature of the air-conditioning environment is higher than 24°C and the obtained environmental humidity information is not within the referenced humidity range, e.g., the temperature of the air-conditioning environment is 24.5°C and the humidity of the air-conditioning environment is 60%, the controller 33 obtains a referenced humidity range of 0% to 40% according the reference relationship of temperature-humidity and accordingly activates the heater 32 to heat the hygroscopic wheel 31 so as to evaporate moisture absorbed by the hygroscopic wheel 31 in such a manner that moisture of an airflow flowing from the air-conditioning environment is removed by the hygroscopic wheel 31 when the airflow flows through the hygroscopic wheel 31, and then the airflow in which the moisture has been removed is discharged back into the air-conditioning environment to dehumidify the air-conditioning environment.

[0031] As shown in FIG. 3, in the temperature-based adaptive dehumidification system according to the embodiment of the present invention, in the predetermined reference relationship of temperature-humidity, when the temperature of the air-conditioning environment is lower than 15.5°C, the referenced humidity range is greater than or equal to 60%, and the controller 33 is configured to perform the dehumidifying process for the air-conditioning environment when the obtained environmental humidity information is not within the referenced humidity range. When the temperature of the air-conditioning environment is lower than 15.5°C and the obtained environmental humidity information is not within the referenced humidity range, e.g., the temperature of the air-conditioning environment is 15°C and the humidity of the air-conditioning environment is 70%, the controller 33 obtains a referenced humidity range of 0% to 60% according the reference relationship of temperature-humidity and accordingly activates the heater 32 to heat the hygroscopic wheel 31 so as to evaporate moisture absorbed by the hygroscopic wheel 31 in such a manner that moisture of an airflow flowing from the air-conditioning environment is removed by the hygroscopic wheel 31 when the airflow flows through the hygroscopic wheel 31, and then the airflow in which the moisture has been removed is discharged back into the air-conditioning environment to dehumidify the air-conditioning environment.

[0032] As shown in FIG. 3, in the temperature-based adaptive dehumidification system 100 according to the embodiment of the present invention, the controller 33 is configured to, when the obtained environmental humidity information is within the referenced humidity range, not perform the dehumidifying process. For example, when the temperature of the air-conditioning environment is 21°C and the humidity of the air-conditioning environment is 45%, the controller 33 obtains a referenced humidity range of 0% to 47% according to the reference relationship of temperature-humidity and thereby determines that the environmental humidity information is within the referenced humidity range, and accordingly

does not activate the motor 34 so as to stop the rotation of the hygroscopic wheel 31 and does not activate the heater 31 so as not to heat the hygroscopic wheel 31.

[0033] As shown in FIG. 3, the controller 33 is configured to, when the obtained environmental humidity information is within the referenced humidity range, not perform the dehumidifying process. For example, when the temperature of the air-conditioning environment is 24.5°C and the humidity of the air-conditioning environment is 35%, the controller 33 obtains a referenced humidity range of 0% to 40% according to the reference relationship of temperature-humidity and thereby determines that the environmental humidity information is within the referenced humidity range, and accordingly does not activate the motor 34 so as to stop the rotation of the hygroscopic wheel 31 and does not activate the heater 31 so as not to heat the hygroscopic wheel 31. When the temperature of the air-conditioning environment is 15°C and the humidity of the air-conditioning environment is 55%, the controller 33 obtains a referenced humidity range of 0% to 60% according to the reference relationship of temperature-humidity and thereby determines that the environmental humidity information is within the referenced humidity range, and accordingly does not activate the motor 34 so as to stop the rotation of the hygroscopic wheel 31 and does not activate the heater 31 so as not to heat the hygroscopic wheel 31.

[0034] As shown in FIG. 1, FIG. 2 and FIG. 4, specifically, the temperature-based adaptive dehumidification system 100 includes a housing 4 and an intake fan 5. The temperature sensing device 1, the humidity sensing device 2, the dehumidifying device 3 and the intake fan 5 are disposed within the housing 4. The housing 4 is provided with an air inlet 41 and an air outlet 42, in which the intake fan 5 is provided between the air inlet 41 and the hygroscopic wheel 31 to draw the airflow of the air-conditioning environment from the air inlet 41 to the air outlet 42.

[0035] As shown in FIG. 2, FIG. 4 and FIG. 5, preferably, the temperature-based adaptive dehumidification system 100 further includes a filtering device 6 and an air velocity sensing device 7, wherein the filtering device 6 is disposed in a position corresponding to a wind inflow side 311 of the hygroscopic wheel 31 and disposed between the hygroscopic wheel 31 and the air-conditioning environment so as to filter airflow which flows from the air-conditioning environment to the hygroscopic wheel 31. In this embodiment, the filtering device 6 is disposed at the air inlet 41 to filter pollen, dust, dust mites and other air pollution sources. Specifically, the filtering device 6 is a particulate filter. The air velocity sensing device 7 is disposed in a side of the filtering device 6 opposite to the air-conditioning environment so as to sense an air velocity of the airflow which flows from the air-conditioning environment through the filtering device 6. In this embodiment, the air velocity sensing device 7 includes a cleaning/replacement reminding member (not shown) which is provided with a predetermined minimum threshold air velocity and is configured to provide a reminder of cleaning or replacing the filtering device 6 when the air velocity of the airflow flowing through the filtering device is less than the minimum threshold air velocity.

[0036] As shown in FIG. 2 and FIG. 6 to FIG. 8, the temperature-based adaptive dehumidification system 100 further includes a condensing device 8, wherein the condensing device 8 and the heater 32 are disposed at opposite sides of the hygroscopic wheel 31, that is, the condensing device 8 is disposed in a position corresponding to the wind inflow side 311 of the hygroscopic wheel 31 and the heater 32 is disposed in a position corresponding to a wind outflow side 312 of the hygroscopic wheel 31 in such a manner that the moisture which is evaporated by the heater and then flows through the hygroscopic wheel 31 to the condensing device 8 will be condensed in the condensing device.

[0037] As shown in FIG. 2 and FIG. 6 to FIG. 8, in the temperature-based adaptive dehumidification system 100 according to the embodiment of the present invention, the condensing device 8 includes a steam guiding hood 81, a heat exchanger 82 and a drainage member 83. The steam guiding hood 81 forms a steam guiding passage 811 and is connected to the wind inflow side 311 of the hygroscopic wheel 31, which is opposite to the side where the heater 32 disposed, in such a manner that the moisture evaporated by the heater 32 will flow into the steam guiding hood 81 through the hygroscopic wheel 31. An upper portion 812 of the steam guiding passage 811 is connected with the heat exchanger 82 to guide the moisture evaporated by the heater 32 to the heat exchanger 82, and a lower portion 813 of the steam guiding passage 811 is in air communication with the drainage member 83 to drain condensation inside the steam guiding hood 81. Specifically, the heat exchanger 82 is provided a plurality of hollow plates 821 and each hollow plate 821 has a side thereof in air communication with the steam guiding hood 81 in such a manner that the moisture evaporated by the heater 32 will flow into the hollow plates 821 and then be condensed in the hollow plates 821.

[0038] As shown in FIG. 2 and FIG. 6 to FIG. 9, in the temperature-based adaptive dehumidification system 100 according to the embodiment of the present invention, the condensing device 8 includes a steam-water splitting member 84 connected to a lower portion of the heat exchanger 82. The steam-water splitting member 84 is provided with a water outlet 841 and a reflux outlet 842 located at a height level higher than that of the water outlet 841. Preferably, the steam-water splitting member 84 further including a reflux channel 843 and a reflux fan 844, wherein the reflux channel 843 is in air communication with the reflux outlet 842 and is connected to the heater 32, and the reflux fan 844 is disposed at the reflux channel 843 to draw airflow from the reflux outlet 842 into the heater 32.

[0039] As shown in FIG. 8, the condensing device 8 is provided at the heat exchanger 82 with a cooling passage

85 which is connected between the air outlet 42 and the air inlet 41 provided between the hygroscopic wheel 31 and the air-conditioning environment in such a manner that the airflow which flows from the air-conditioning environment into the housing 4 will flow through the cooling passage 85 to enhance condensation of moisture in the heat exchanger 82.

[0040] As shown in FIG. 2 and FIG. 6 to FIG. 8, the temperature-based adaptive dehumidification system 100 further includes a water tank 9 connected to a drainage portion of the condensing device 8 so as to collect water condensed by the condensing device 8. Specifically, the drainage portion of the condensing device 8 includes the drainage member 83, the water outlet 841 and the reflux channel 843.

[0041] As shown in FIG 2 and FIG. 7, preferably, the temperature-based adaptive dehumidification system 100 further includes a water level detecting device 10 including two electrodes 101 and a determining unit 102, wherein the two electrodes 101 are provided in the water tank 9 and each electrode 101 has a dielectric constant detecting surface 103 in such a manner that the dielectric constant detecting surface 103 of one electrode 101 faces forward the dielectric constant detecting surface 103 of the other electrode 101, a water level detecting space S is formed between the two dielectric constant detecting surfaces 101, and the determining unit 102 is connected to the two electrodes 101 to determine a water level of the water tank 9 according to a dielectric constant detected in the water level detecting space S.

[0042] As shown in FIG. 2, the temperature-based adaptive dehumidification system 100 further includes a pump 11, which is electrically connected to the determining unit 102 to pump out water from the water tank 9 through a drainage pipe T when the water level of the water tank 9 exceeds a predetermined water level threshold.

[0043] Alternatively, the temperature-based adaptive dehumidification system 100 further includes a operating state indicating device (not shown) including a detector, a transmitter and an indicator, wherein the detector is electrically connected to the motor 34, the intake fan 5, the reflux fan 844 and/or the pump 11 to detect an operating state of the motor 34, the intake fan 5, the reflux fan 844 and/or the pump 11 and generates an operating state signal accordingly. The transmitter is electrically connected to the detector and the indicator so as to receive the operating state signal generated from the detector and transmit to the indicator for indicating information according to the generated operating state signal. It is noted that the indicator is disposed in a remote controller and is network-connected to the transmitter so as to wirelessly receive the operating state signal. In addition, it should be understood by one having ordinary skill in the art that the temperature-based adaptive dehumidification system of the present invention can be paired with the remote controller in various conventional ways so as to control the temperature-based adaptive dehumidification system to perform the dehumidifying function or other function.

[0044] In this embodiment, the air inlet 41 and the air outlet 42 are provided at the same side of the housing 4, and the housing 4 is further provided with an air baffle 43 to guide the airflow which flows through the hygroscopic wheel 31 and the heat exchanger 82 to the air outlet 42.

[0045] According to another embodiment of the present invention, a temperature-based adaptive dehumidification system 100a is generally the same as the temperature-based adaptive dehumidification system 100 and the description of the corresponding parts will be omitted. The difference is that an air inlet 41a and an air outlet 42a of a housing 4a are disposed in different sides of the housing 4a. However, the present invention is not limited to this, and one having ordinary skill in the art can modify the position of the air inlet 41a and the air outlet 42a of the housing 4a for different configurations.

[0046] The above description is only an explanation of the preferred embodiments of the present invention. One having ordinary skill in the art can make various modifications according to the above description and the claims defined below. However, those modifications shall still fall within the scope of the present invention.

Claims

1. A temperature-based adaptive dehumidification system (100) for an air-conditioning environment, **characterised in that** the temperature-based adaptive dehumidification system (100) comprises:

   a temperature sensing device (1) provided to sense temperature of the air-conditioning environment to obtain environmental temperature information (S1);
   a humidity sensing device (2) provided to sense humidity of the air-conditioning environment to obtain environmental humidity information (S2); and
   a dehumidifying device (3) including a hygroscopic wheel (31), a heater (32) and a controller (33), wherein the hygroscopic wheel (31) is in air communication with the air-conditioning environment to absorb moisture therefrom, the heater (32) is in thermal connection with the hygroscopic wheel (31) to heat moisture absorbed by the hygroscopic wheel (31) so as to evaporate moisture from the hygroscopic wheel (31), and the controller (33) is electrically connected to the temperature sensing device (1), the humidity sensing device (2) and the heater (32) in such a manner that the controller (33) obtains a referenced humidity range which corresponds to the obtained environmental temperature information (S1) by means of a calculation in ref-

erence to a predetermined reference relationship of temperature-humidity, and then the controller (33) performs a comparison between the obtained environmental humidity information (S2) and the referenced humidity range thereby, when the obtained environmental humidity information (S2) is not within the referenced humidity range, enabling dehumidifying device (3) to perform a dehumidifying process for the air-conditioning environment.

2. The temperature-based adaptive dehumidification system (100) as claimed in claim 1, wherein when the temperature of the air-conditioning environment is in a range between 15.5°C and 24°C, the predetermined reference relationship of temperature-humidity is a function of:

$$Y \leq (-20/8.5)\ X + (1640/17) \pm 5,$$

wherein X (°C) is the temperature of the air-conditioning environment and Y (%) is the humidity of the air-conditioning environment, and
wherein the controller (33) is configured to:

substitute the obtained environmental temperature information (S1) for the X and substitute the obtained environmental humidity information (S2) for the Y, and
perform the dehumidifying process for the air-conditioning environment when the obtained environmental humidity information (S2) is not within the referenced humidity range.

3. The temperature-based adaptive dehumidification system (100) as claimed in claim 2, wherein the controller (33) is configured to, when the obtained environmental humidity information (S2) is within the referenced humidity range, not perform the dehumidifying process.

4. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein, in the predetermined reference relationship of temperature-humidity, the controller (33) is configured to perform the dehumidifying process for the air-conditioning environment when the temperature of the air-conditioning environment is higher than 24°C, the referenced humidity range is less than or equal to 40%, and the obtained environmental humidity information (S2) is not within the referenced humidity range.

5. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein, in the predetermined reference relationship of temperature-humidity, the controller (33) is configured to perform the dehumidifying process for the air-conditioning environment when the temperature of the air-conditioning environment is lower than 15.5°C, the referenced humidity range is greater than or equal to 60%, and the obtained environmental humidity information (S2) is not within the referenced humidity range.

6. The temperature-based adaptive dehumidification system (100) as claimed in any one of claims 4 and 5, wherein the controller (33) is configured to, when the obtained environmental humidity information (S2) is within the referenced humidity range, not perform the dehumidifying process.

7. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein the controller (33) is configured to activate the hygroscopic wheel (31) when the heater (32) is performing a heating operation.

8. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein the heater (32) is disposed in a position corresponding to a wind outflow side (312) of the hygroscopic wheel (31).

9. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, further comprising a filtering device (6) and an air velocity sensing device (7),
wherein the filtering device (6) is disposed in a position corresponding to a wind inflow side (311) of the hygroscopic wheel (31) and disposed between the hygroscopic wheel (31) and the air-conditioning environment so as to filter airflow which flows from the air-conditioning environment to the hygroscopic wheel (31), and
wherein the air velocity sensing device (7) is disposed in a position between the filtering device (6) and the hygroscopic wheel (31) so as to sense an air velocity of the airflow which flows from the air-conditioning environment through the filtering device (6).

10. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, further comprising a condensing device (8), wherein the condensing device (8) and the heater (32) are disposed at opposite sides of the hygroscopic wheel (31), and the condensing device (8) is provided to condense the moisture which is evaporated by the heater (32) and then flows through a condensation inlet of condensing device (8) from the hygroscopic wheel (31) to the condensing device (8).

11. The temperature-based adaptive dehumidification

system (100) as claimed in claim 10, wherein the condensing device (8) is provided with a cooling passage (85) which is connected to an air inlet (11) provided between the hygroscopic wheel (31) and the air-conditioning environment.

12. The temperature-based adaptive dehumidification system (100) as claimed in claim 10, wherein the condensing device (8) includes a steam guiding hood (81), a heat exchanger (82) and a drainage member (83),
wherein the steam guiding hood (81), connected to the hygroscopic wheel (31), forms a steam guiding passage (811) in such a manner that an upper portion (812) of the steam guiding passage (811) is connected with the heat exchanger (82) to guide the moisture evaporated by the heater (32) to the heat exchanger (82), and a lower portion (813) of the steam guiding passage (811) is in air communication with the drainage member (83) to drain condensation inside the steam guiding hood (81).

13. The temperature-based adaptive dehumidification system (100) as claimed in claim 10, wherein the condensing device (8) includes a steam-water splitting member (84) connected to a lower portion of the heat exchanger (82), the steam-water splitting member (84) is provided with a water outlet (841) and a reflux outlet (842) located at a height level higher than that of the water outlet (841).

14. The temperature-based adaptive dehumidification system (100) as claimed in any one of claims 10, 12 and 13, further comprising a water tank (9) connected to a drainage portion of the condensing device (8).

15. The temperature-based adaptive dehumidification system (100) as claimed in claim 13, the steam-water splitting member (84) further including a reflux channel (843) and a reflux fan (844), wherein the reflux channel (843) is in air communication with the reflux outlet (842) and is connected to the heater (32), and the reflux fan (844) is disposed at the reflux channel (843) to draw airflow from the reflux outlet (842) into the heater (32).

16. The temperature-based adaptive dehumidification system (100) as claimed in claim 14, further comprising a water level detecting device (10) including two electrodes (101) and a determining unit (102), wherein the two electrodes (101) are provided in the water tank (9) and each electrode has a dielectric constant detecting surface (103) in such a manner that the dielectric constant detecting surface (103) of one electrode faces forward the dielectric constant detecting surface (103) of another electrode, a water level detecting space (S) is formed between the two dielectric constant detecting surfaces (103), and the determining unit (102) is connected to the two electrodes (101) to determine a water level of the water tank (9) according to a dielectric constant detected in the water level detecting space (S).

17. The temperature-based adaptive dehumidification system (100) as claimed in claim 16, further comprising a pump (11), which is electrically connected to the determining unit (102) to pump (11) out water from the water tank (9) when the water level of the water tank (9) exceeds a predetermined water level threshold.

Amended claims in accordance with Rule 137(2) EPC.

1. A temperature-based adaptive dehumidification system (100) for an air-conditioning environment, **characterised in that** the temperature-based adaptive dehumidification system (100) comprises:

a temperature sensing device (1) provided to sense temperature of the air-conditioning environment to obtain environmental temperature information (S1);
a humidity sensing device (2) provided to sense humidity of the air-conditioning environment to obtain environmental humidity information (S2); and
a dehumidifying device (3) including a hygroscopic wheel (31), a heater (32) and a controller (33), wherein the hygroscopic wheel (31) is in air communication with the air-conditioning environment to absorb moisture therefrom, the heater (32) is in thermal connection with the hygroscopic wheel (31) to heat moisture absorbed by the hygroscopic wheel (31) so as to evaporate moisture from the hygroscopic wheel (31), and the controller (33) is electrically connected to the temperature sensing device (1), the humidity sensing device (2) and the heater (32) in such a manner that the controller (33) obtains a referenced humidity range which corresponds to the obtained environmental temperature information (S1) by means of a calculation in reference to a predetermined reference relationship of temperature-humidity, and then the controller (33) performs a comparison between the obtained environmental humidity information (S2) and the referenced humidity range such that when the obtained environmental humidity information (S2) is not within the referenced humidity range, dehumidifying device (3) is enabled to perform a dehumidifying process for the air-conditioning environment, wherein the referenced humidity range is varied according to the temperature of the air-conditioning environ-

ment.

2. The temperature-based adaptive dehumidification system (100) as claimed in claim 1, wherein when the temperature of the air-conditioning environment is in a range between 15.5°C and 24°C, the predetermined reference relationship of temperature-humidity is a function of:

$Y \leq (-20/8.5)\ X + (1640/17) \pm 5$, wherein X (°C) is the temperature of the air-conditioning environment and Y (%) is the humidity of the air-conditioning environment, and
wherein the controller (33) is configured to:

substitute the obtained environmental temperature information (S1) for the X and substitute the obtained environmental humidity information (S2) for the Y, and
perform the dehumidifying process for the air-conditioning environment when the obtained environmental humidity information (S2) is not within the referenced humidity range.

3. The temperature-based adaptive dehumidification system (100) as claimed in claim 2, wherein the controller (33) is configured to, when the obtained environmental humidity information (S2) is within the referenced humidity range, not perform the dehumidifying process.

4. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein, in the predetermined reference relationship of temperature-humidity, the controller (33) is configured to perform the dehumidifying process for the air-conditioning environment when the temperature of the air-conditioning environment is higher than 24°C, the referenced humidity range is less than or equal to 40%, and the obtained environmental humidity information (S2) is not within the referenced humidity range.

5. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein, in the predetermined reference relationship of temperature-humidity, the controller (33) is configured to perform the dehumidifying process for the air-conditioning environment when the temperature of the air-conditioning environment is lower than 15.5°C, the referenced humidity range is greater than or equal to 60%, and the obtained environmental humidity information (S2) is not within the referenced humidity range.

6. The temperature-based adaptive dehumidification system (100) as claimed in any one of claims 4 and 5, wherein the controller (33) is configured to, when the obtained environmental humidity information (S2) is within the referenced humidity range, not perform the dehumidifying process.

7. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein the controller (33) is configured to activate the hygroscopic wheel (31) when the heater (32) is performing a heating operation.

8. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, wherein the heater (32) is disposed in a position corresponding to a wind outflow side (312) of the hygroscopic wheel (31).

9. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, further comprising a filtering device (6) and an air velocity sensing device (7),
wherein the filtering device (6) is disposed in a position corresponding to a wind inflow side (311) of the hygroscopic wheel (31) and disposed between the hygroscopic wheel (31) and the air-conditioning environment so as to filter airflow which flows from the air-conditioning environment to the hygroscopic wheel (31), and
wherein the air velocity sensing device (7) is disposed in a position between the filtering device (6) and the hygroscopic wheel (31) so as to sense an air velocity of the airflow which flows from the air-conditioning environment through the filtering device (6).

10. The temperature-based adaptive dehumidification system (100) as claimed in any one of the preceding claims, further comprising a condensing device (8), wherein the condensing device (8) and the heater (32) are disposed at opposite sides of the hygroscopic wheel (31), and the condensing device (8) is provided to condense the moisture which is evaporated by the heater (32) and then flows through a condensation inlet of condensing device (8) from the hygroscopic wheel (31) to the condensing device (8).

11. The temperature-based adaptive dehumidification system (100) as claimed in claim 10, wherein the condensing device (8) is provided with a cooling passage (85) which is connected to an air inlet (11) provided between the hygroscopic wheel (31) and the air-conditioning environment.

12. The temperature-based adaptive dehumidification system (100) as claimed in claim 10, wherein the condensing device (8) includes a steam guiding hood (81), a heat exchanger (82) and a drainage member (83),

wherein the steam guiding hood (81), connected to the hygroscopic wheel (31), forms a steam guiding passage (811) in such a manner that an upper portion (812) of the steam guiding passage (811) is connected with the heat exchanger (82) to guide the moisture evaporated by the heater (32) to the heat exchanger (82), and a lower portion (813) of the steam guiding passage (811) is in air communication with the drainage member (83) to drain condensation inside the steam guiding hood (81).

13. The temperature-based adaptive dehumidification system (100) as claimed in claim 10, wherein the condensing device (8) includes a steam-water splitting member (84) connected to a lower portion of the heat exchanger (82), the steam-water splitting member (84) is provided with a water outlet (841) and a reflux outlet (842) located at a height level higher than that of the water outlet (841).

14. The temperature-based adaptive dehumidification system (100) as claimed in any one of claims 10, 12 and 13, further comprising a water tank (9) connected to a drainage portion of the condensing device (8).

15. The temperature-based adaptive dehumidification system (100) as claimed in claim 13, the steam-water splitting member (84) further including a reflux channel (843) and a reflux fan (844), wherein the reflux channel (843) is in air communication with the reflux outlet (842) and is connected to the heater (32), and the reflux fan (844) is disposed at the reflux channel (843) to draw airflow from the reflux outlet (842) into the heater (32).

16. The temperature-based adaptive dehumidification system (100) as claimed in claim 14, further comprising a water level detecting device (10) including two electrodes (101) and a determining unit (102), wherein the two electrodes (101) are provided in the water tank (9) and each electrode has a dielectric constant detecting surface (103) in such a manner that the dielectric constant detecting surface (103) of one electrode faces forward the dielectric constant detecting surface (103) of another electrode, a water level detecting space (S) is formed between the two dielectric constant detecting surfaces (103), and the determining unit (102) is connected to the two electrodes (101) to determine a water level of the water tank (9) according to a dielectric constant detected in the water level detecting space (S).

17. The temperature-based adaptive dehumidification system (100) as claimed in claim 16, further comprising a pump (11), which is electrically connected to the determining unit (102) to pump (11) out water from the water tank (9) when the water level of the water tank (9) exceeds a predetermined water level threshold.

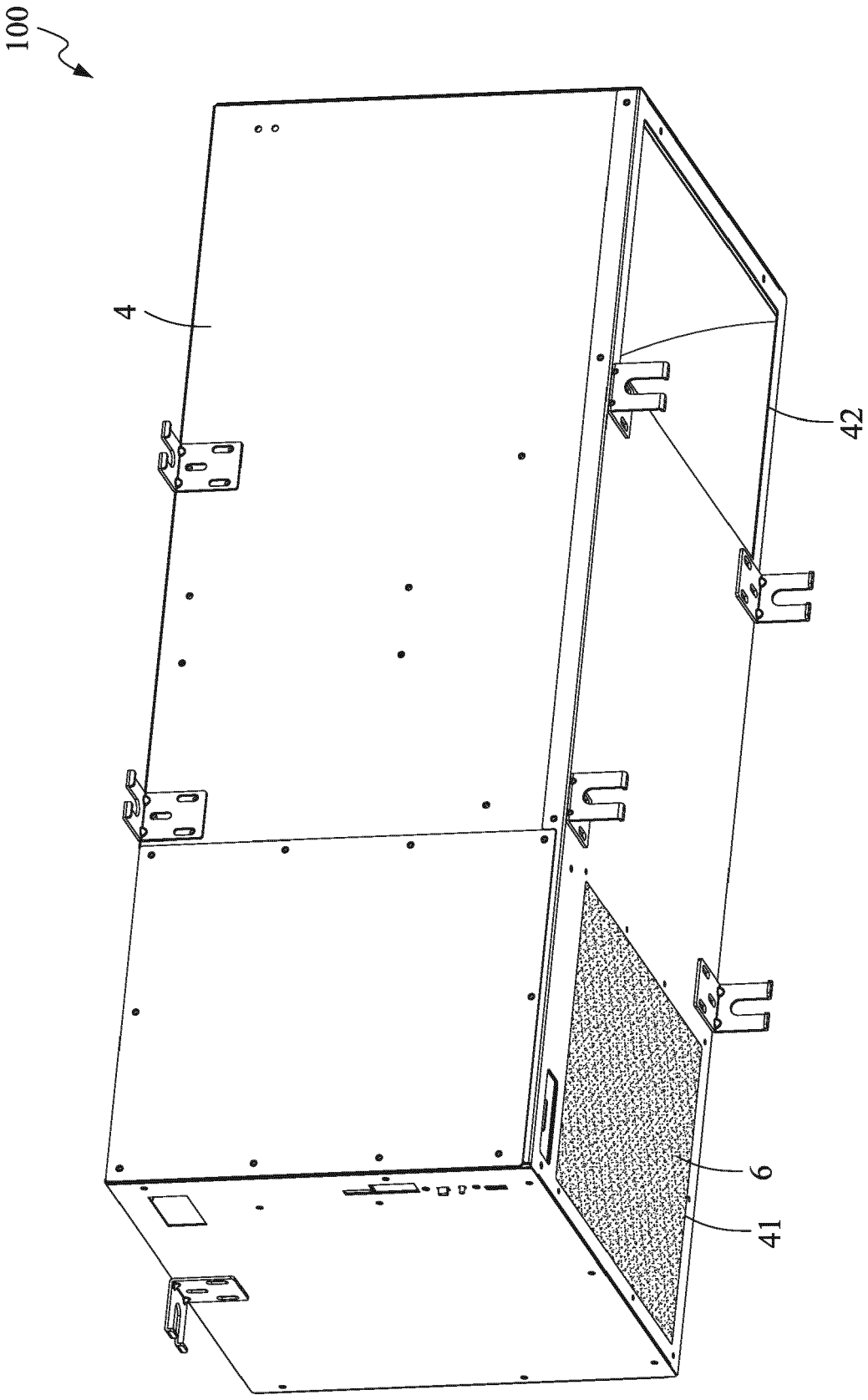


FIG.1

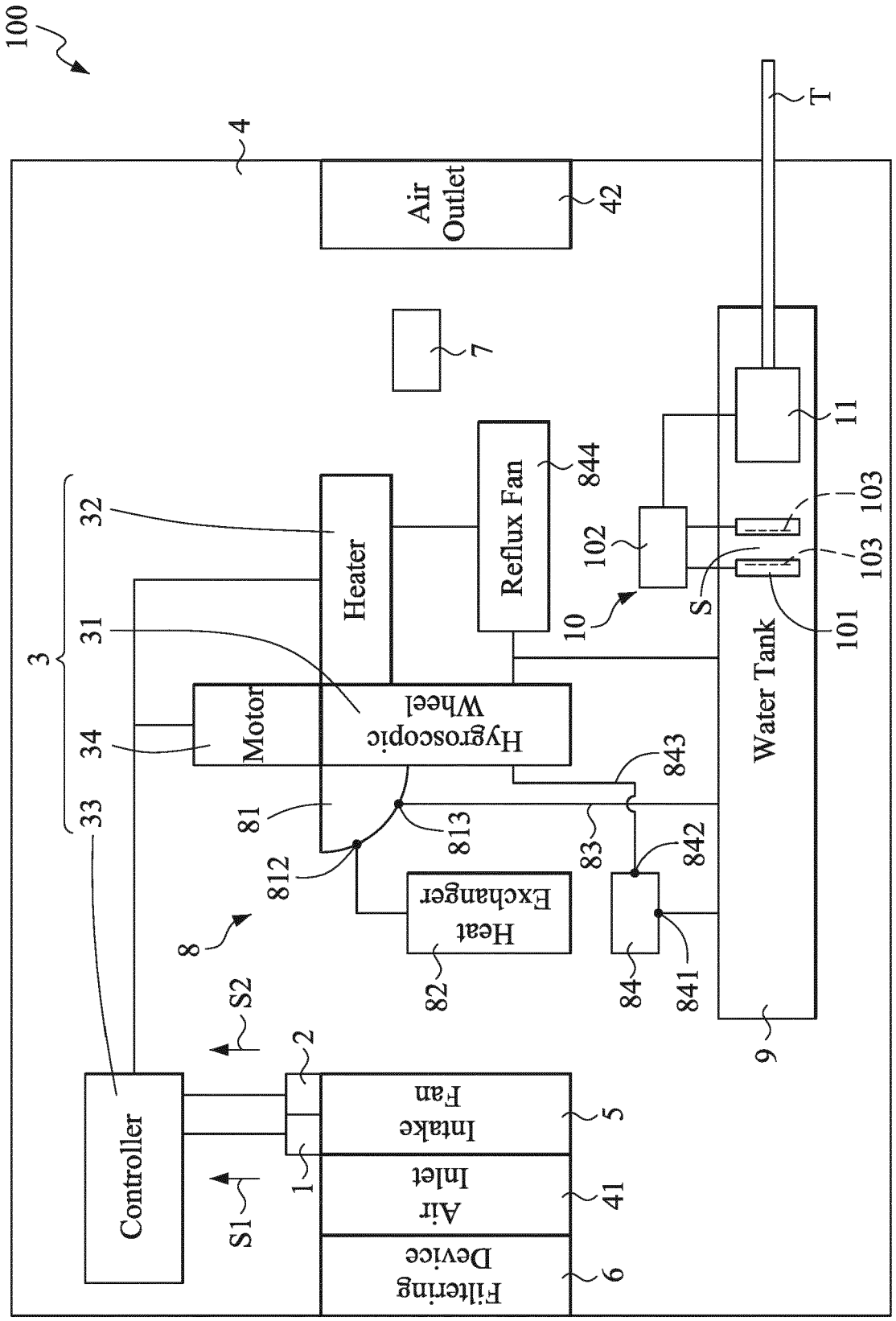

100
4
Air Outlet
42
T
7
11
Reflux Fan
844
Heater
32
102
103
103
10
S
101
Water Tank
3
31
Motor
Hygroscopic Wheel
34
843
33
81
813
812
83
842
Heat Exchanger
8
82
84
841
9
S2
2
Controller
Intake Fan
5
1
Air Inlet
41
S1
Filtering Device
6

FIG.2

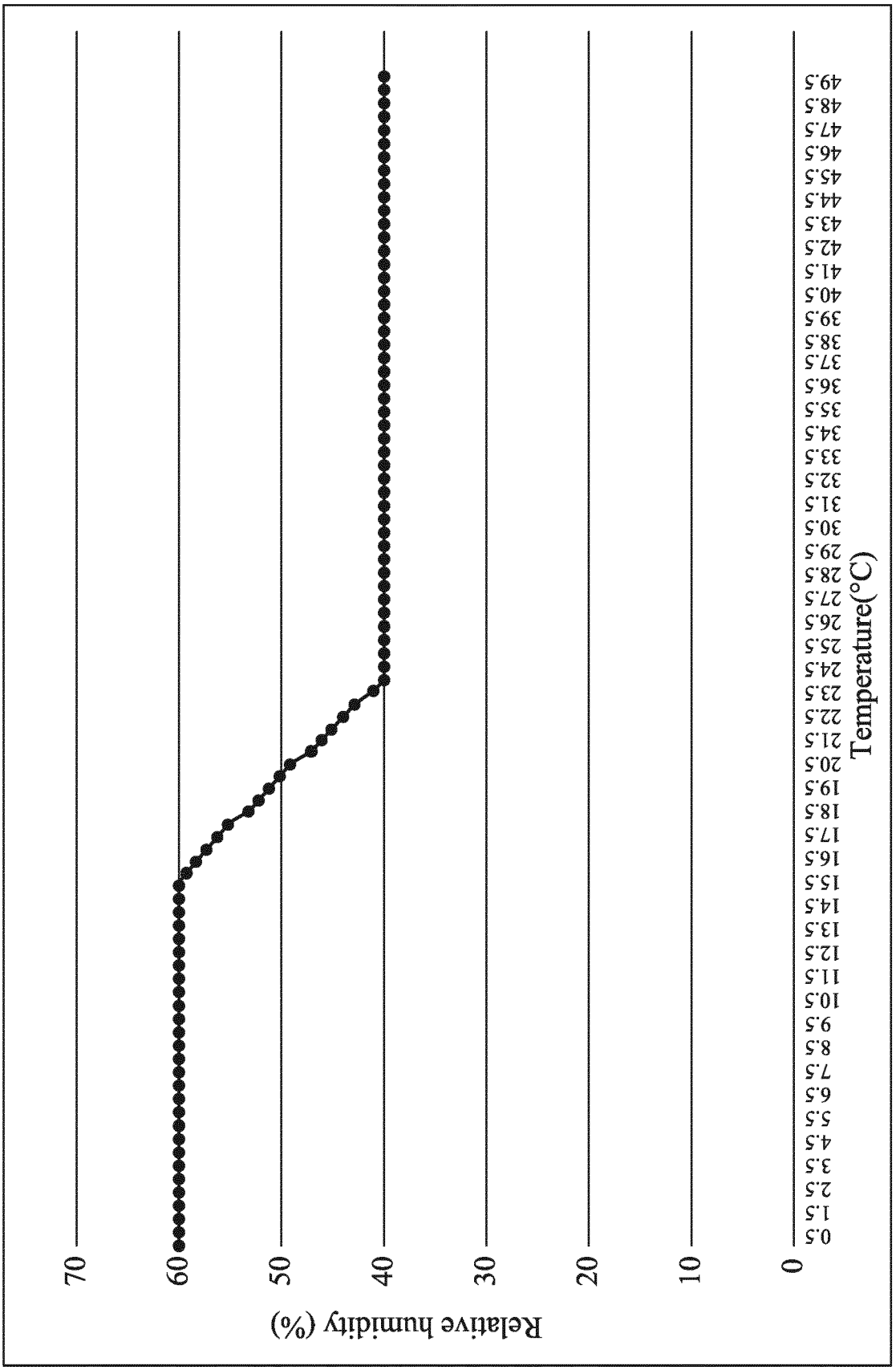

Relative humidity (%)
70
60
50
40
30
20
10
0
Temperature(°C)
0.5
1.5
2.5
3.5
4.5
5.5
6.5
7.5
8.5
9.5
10.5
11.5
12.5
13.5
14.5
15.5
16.5
17.5
18.5
19.5
20.5
21.5
22.5
23.5
24.5
25.5
26.5
27.5
28.5
29.5
30.5
31.5
32.5
33.5
34.5
35.5
36.5
37.5
38.5
39.5
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47.5
48.5
49.5

FIG.3

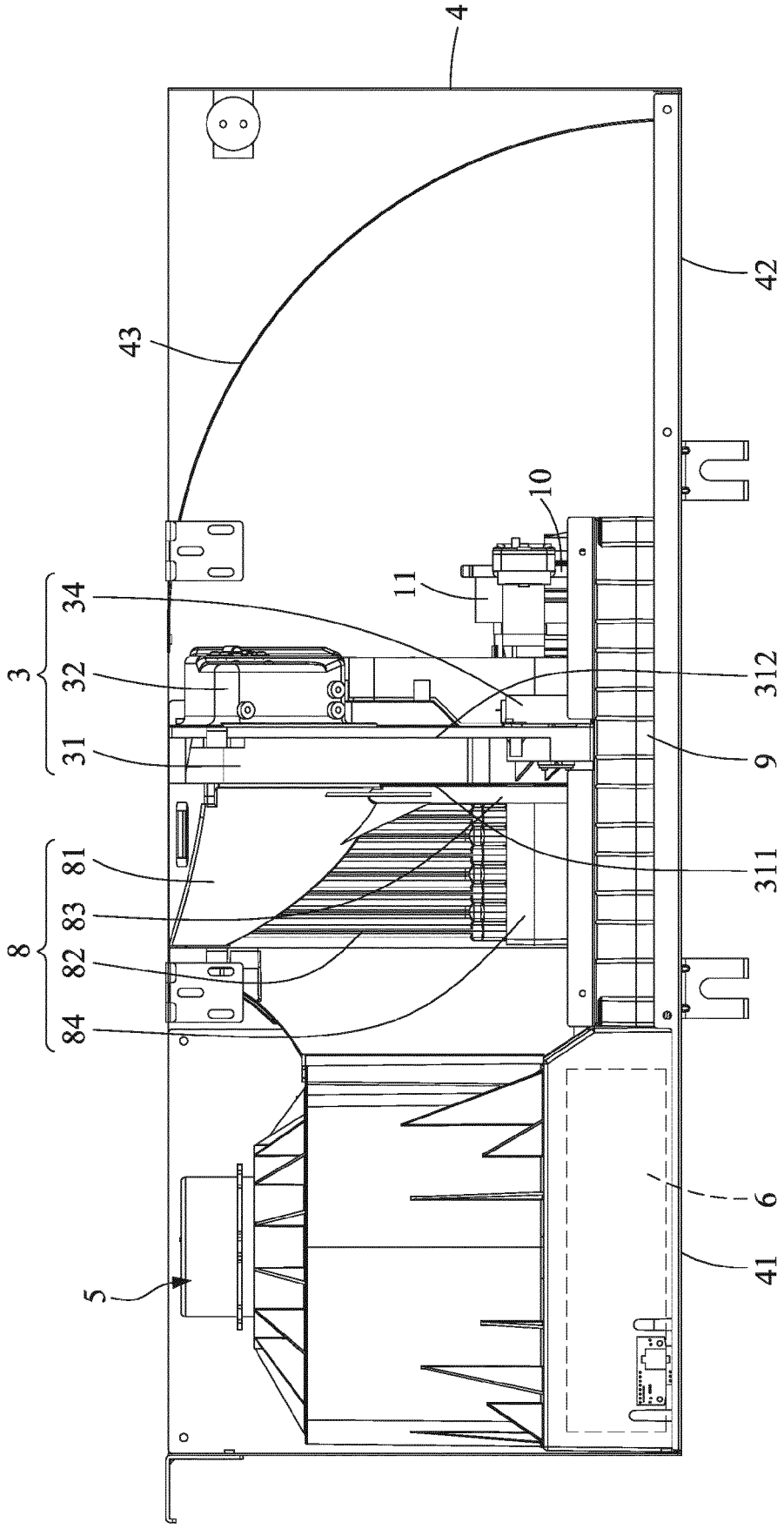


FIG.4

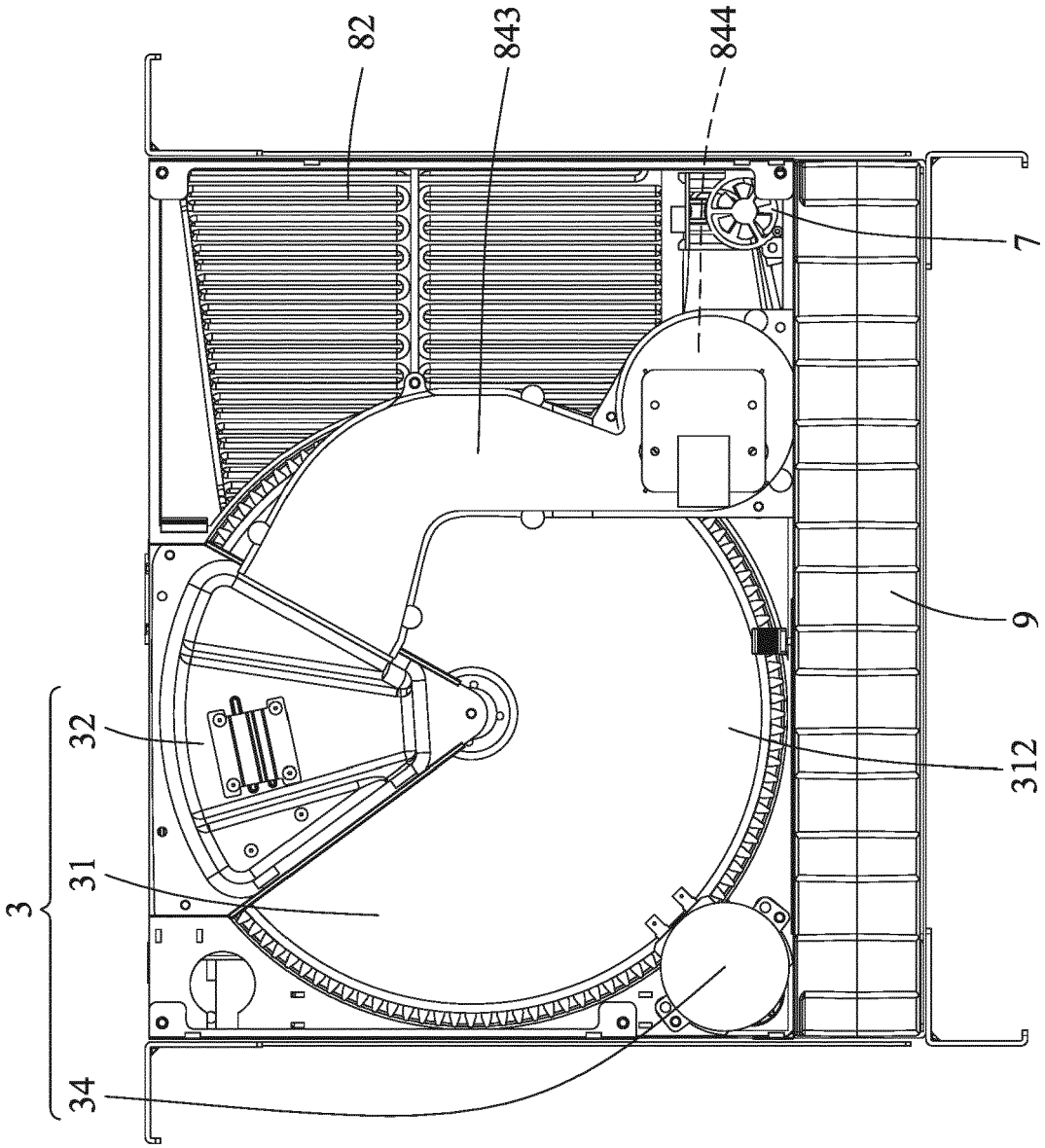


FIG.5

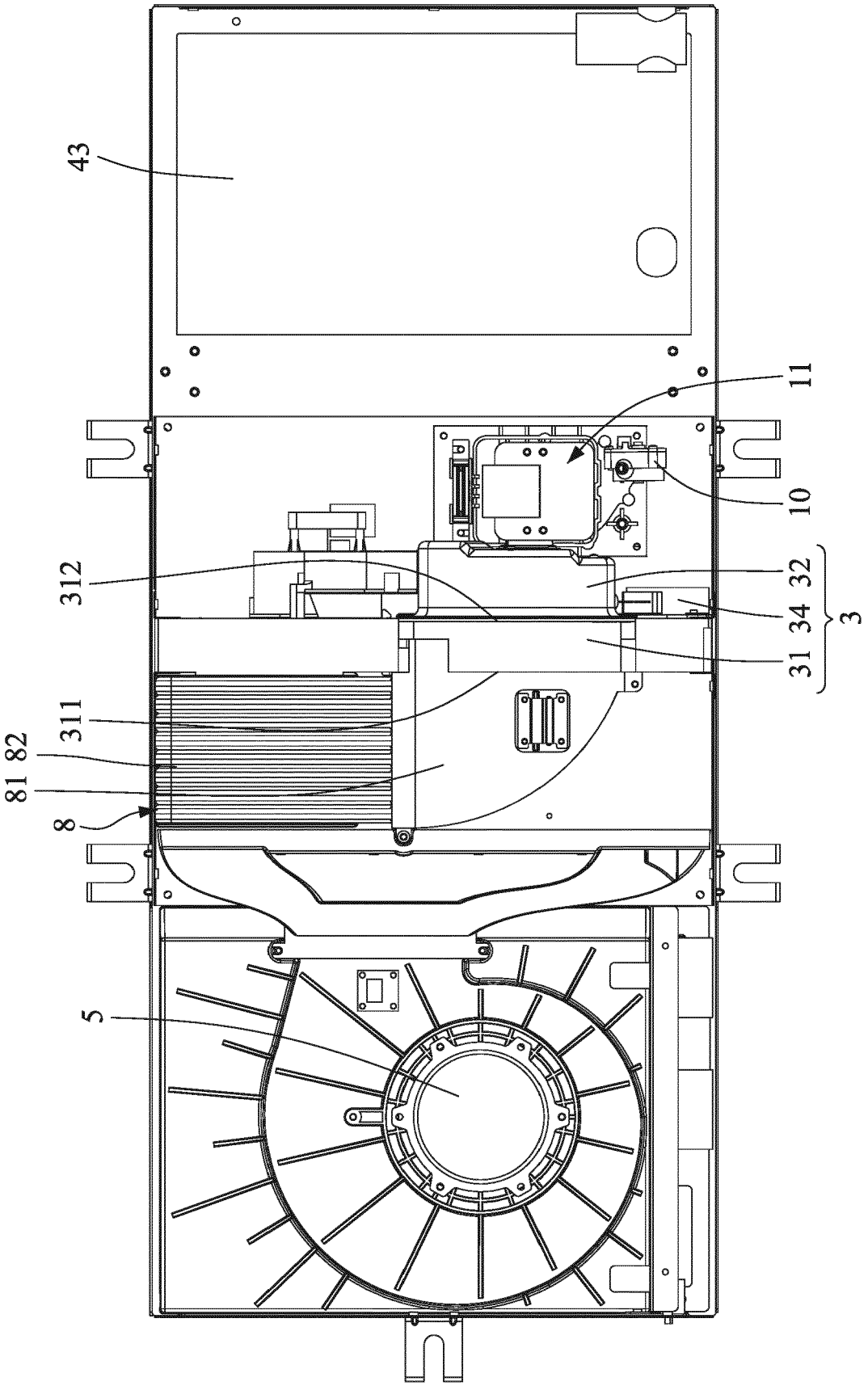


FIG.6

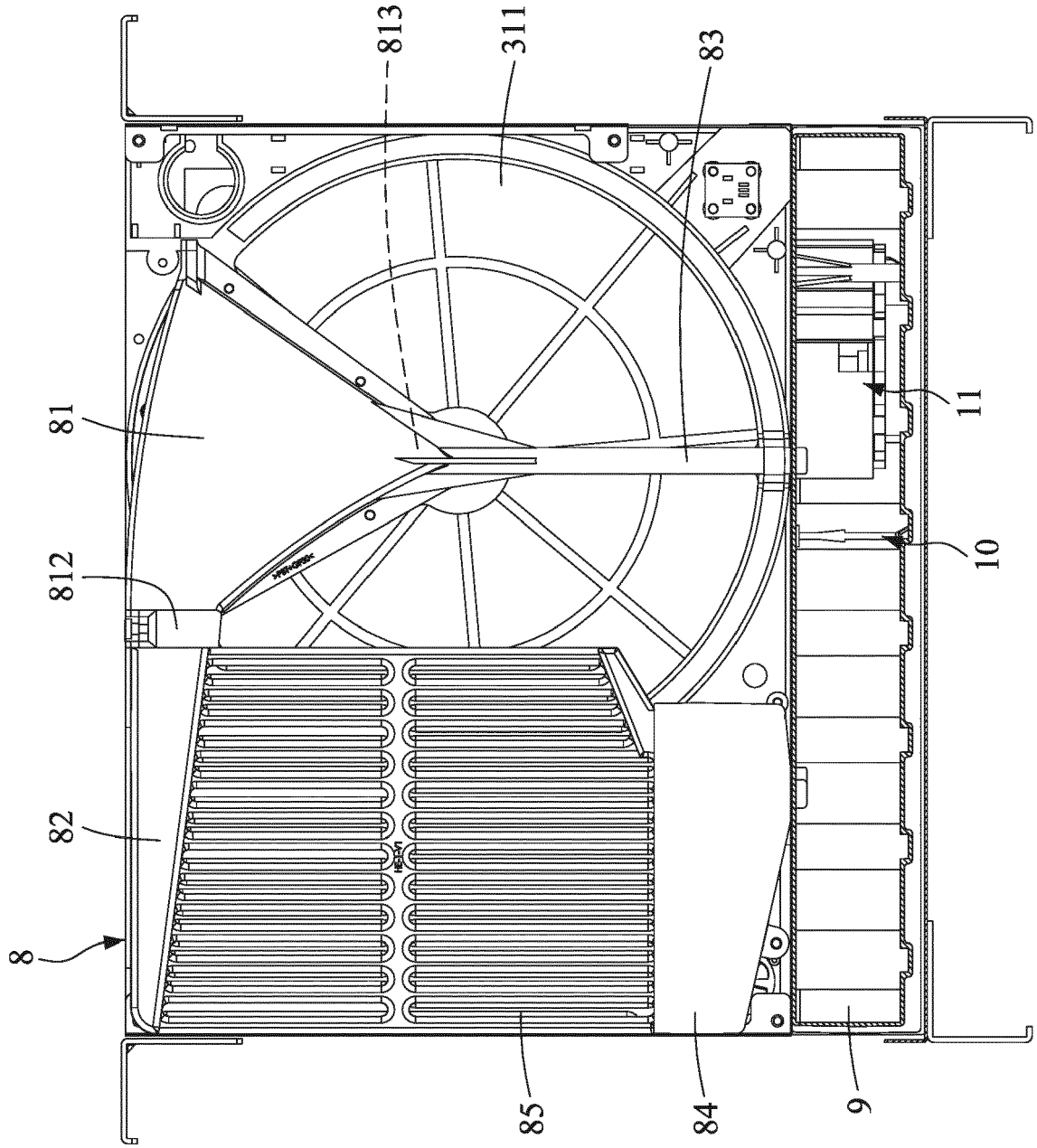


FIG.7

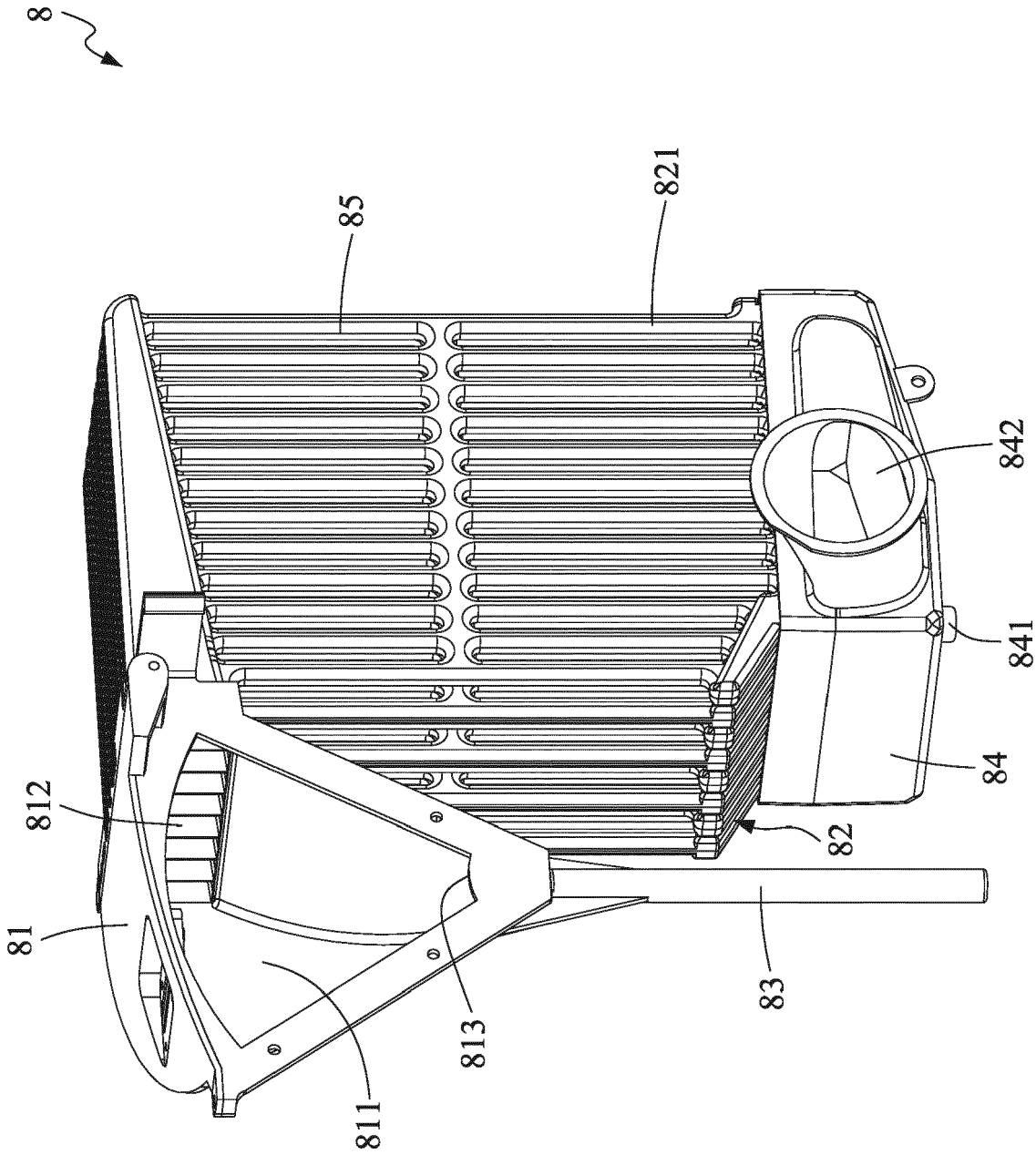


FIG.8

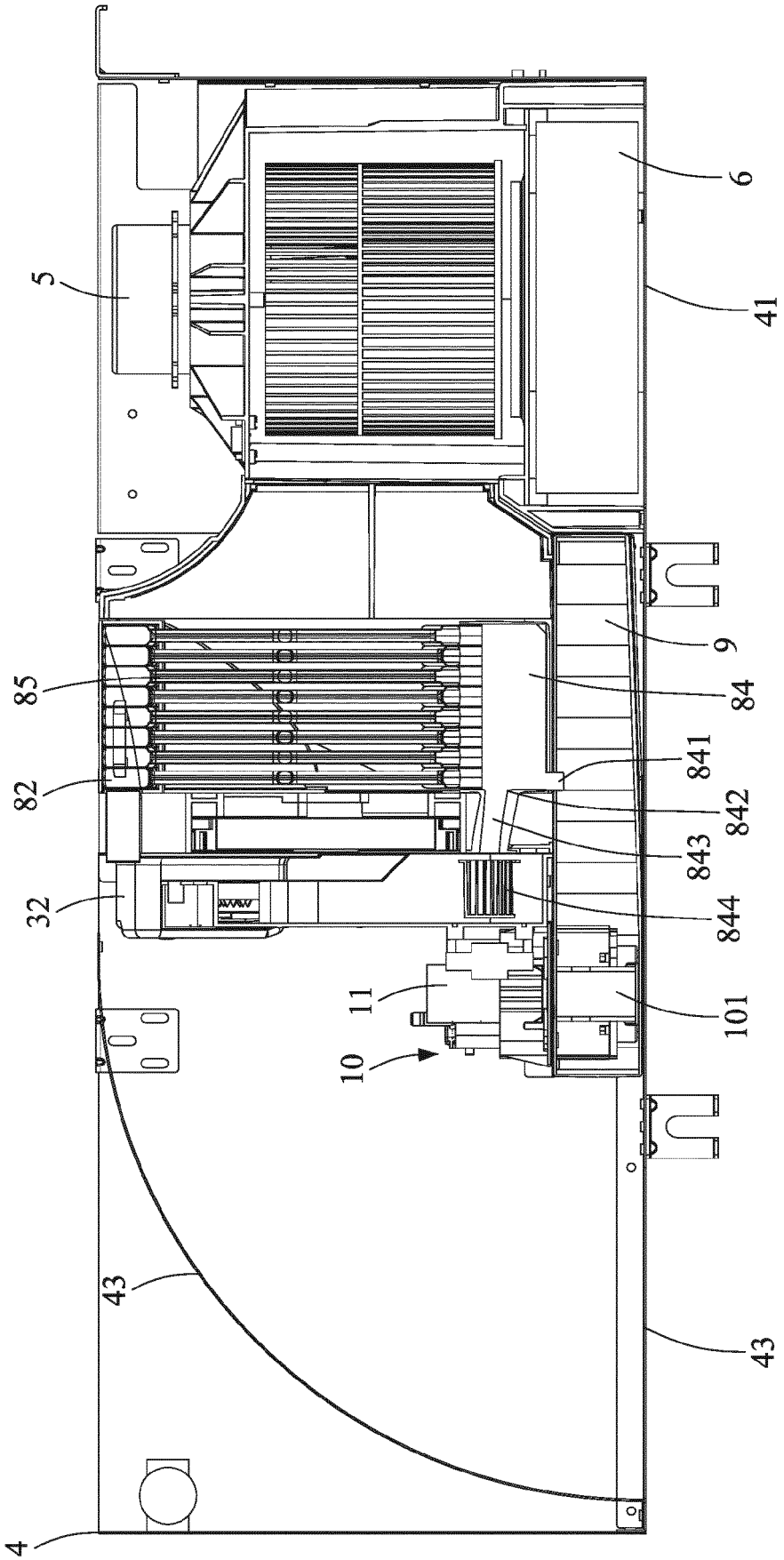


FIG.9

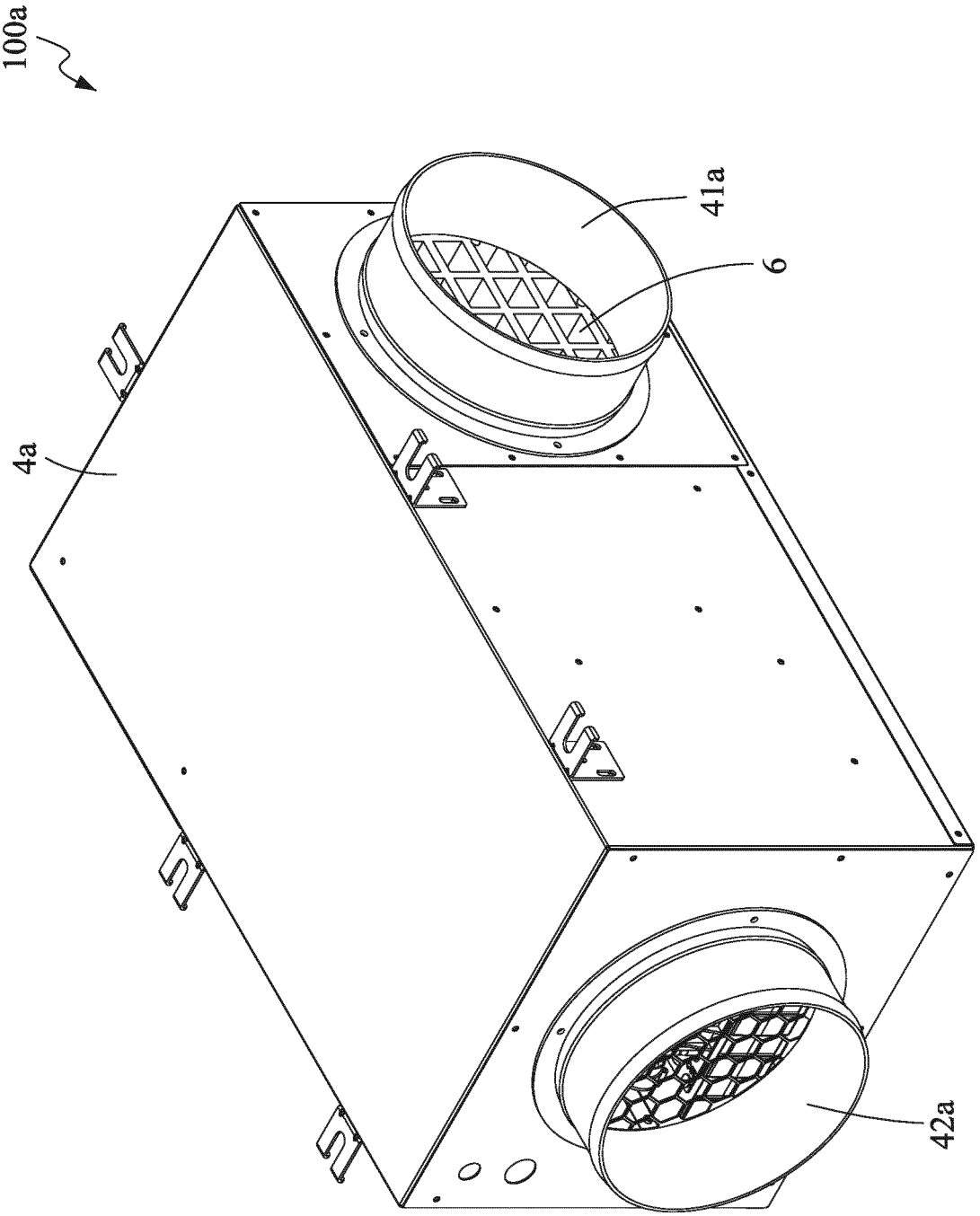


FIG.10

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 9757

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y A	WO 2015/045609 A1 (HITACHI LTD [JP]) 2 April 2015 (2015-04-02) * the whole document *	1-11,14, 16,17 12,13,15	INV. F24F3/14 F24F11/00
Y	US 4 869 073 A (KAWAI NOBUO [JP] ET AL) 26 September 1989 (1989-09-26) * columns 3-5; figure 1 *	1-11,14, 16,17	

TECHNICAL FIELDS SEARCHED (IPC)

F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 May 2017	Blot, Pierre-Edouard

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 19 9757

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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05-05-2017

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