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(54) **CONDENSED WATER TREATMENT DEVICE AND AIR CONDITIONING SYSTEM FREE OF
CONDENSED WATER**

(57) A condensate water treatment apparatus (2) includes a water receiving tray (20) and an evaporator (21) disposed on the water receiving tray (20). The water receiving tray (20) is configured to store condensate water generated by an air conditioner. The evaporator (21) is configured to draw the condensate water in the water

receiving tray (20) upward to a surface of the evaporator (21), so that the condensate water evaporates. An air conditioning system free from condensate water that includes a condensate water treatment apparatus is further disclosed.

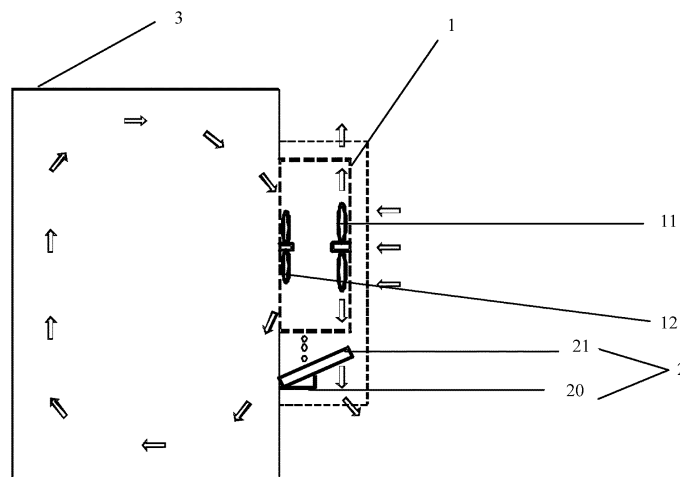


FIG. 1

Description

[0001] This application claims priority to Chinese Patent Application No. 201610863850.3, filed with the Chinese Patent Office on September 29, 2016 and entitled "CONDENSATE WATER TREATMENT APPARATUS AND AIR CONDITIONING SYSTEM FREE FROM CONDENSATE WATER", which is incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of this application relate to air conditioning technologies, and in particular, to a condensate water treatment apparatus and an air conditioning system free from condensate water.

BACKGROUND

[0003] Currently, various industrial devices are disposed in a cabinet in an equipment room. Precise temperature control is performed on the devices in the cabinet by installing a cabinet air conditioner on the cabinet and operating the cabinet air conditioner.

[0004] In an operation process of the cabinet air conditioner, condensate water is inevitably generated. The devices in the cabinet corrode if the condensate water is not properly collected and discharged, affecting service lives, performance, and the like of the devices. To collect and discharge the condensate water, a water storage vessel is disposed on the cabinet, and a drainage pipe is installed below the floor of the equipment room. The condensate water is collected by using the water storage vessel, and the condensate water collected by using the water storage vessel is discharged to the outside of the equipment room by using the drainage pipe.

[0005] However, not all equipment rooms can be disposed with drainage pipes, and a relatively high capital investment is required even though a drainage pipe can be installed. Therefore, how to treat condensate water in an equipment room is actually a problem to be resolved urgently in the industry.

SUMMARY

[0006] This application provides a condensate water treatment apparatus and an air conditioning system free from condensate water. Condensate water evaporates by using an evaporator disposed on a water receiving tray, so that an air conditioner has no condensate water discharged.

[0007] According to a first aspect, an embodiment of this application provides a condensate water treatment apparatus. The apparatus includes a water receiving tray and an evaporator. The evaporator is disposed on the water receiving tray, and condensate water generated by an air conditioner drops onto the evaporator. The water receiving tray is configured to receive condensate wa-

ter penetrating through the evaporator. The evaporator is configured to draw the condensate water to a surface of the evaporator, so that the condensate water evaporates naturally when the air conditioner does not operate or the condensate water evaporates under action of the air conditioner when the air conditioner operates.

[0008] According to the condensate water treatment apparatus provided in this embodiment of this application, the condensate water evaporates naturally when the air conditioner does not operate or the condensate water evaporates under action of the air conditioner in an operation process of the air conditioner, so that the air conditioner has no condensate water discharged. Therefore, there is no need to install a drainage pipe, reducing a construction difficulty. In an evaporation process of the condensate water, no extra energy consumption is caused. Therefore, energy consumption is low.

[0009] In a feasible implementation, there is an included angle between the evaporator and the water receiving tray, so that a part of an orthographic projection of the evaporator extends beyond the water receiving tray, thereby increasing a contact area of hot air and the evaporator, and speeding up evaporation of the condensate water on the evaporator.

[0010] In a feasible implementation, the condensate water treatment apparatus further includes a liquid level sensor and a heater. The heater is embedded in the evaporator. The liquid level sensor is disposed on the water receiving tray, and is configured to trigger the heater to heat the evaporator when detecting that condensate water in the water receiving tray reaches a warning water level, or configured to trigger the heater to stop heating the evaporator when detecting that condensate water in the water receiving tray drops below a warning water level.

[0011] According to the condensate water treatment apparatus provided in the foregoing implementation, when an evaporation rate of the condensate water is less than a production rate of the condensate water, the evaporator is heated by using the heater, thereby speeding up evaporation of the condensate water and preventing the condensate water from overflowing from the water receiving tray.

[0012] In a feasible implementation, the water receiving tray, the evaporator, the heater, and the liquid level sensor are detachable structures, facilitating maintenance and reuse of the condensate water treatment apparatus and reducing costs.

[0013] In a feasible implementation, the evaporator is made of a porous material, and a surface of the porous material is coated with a water absorbing material. The condensate water in the water receiving tray is drawn upward along the surface of the porous material, so that an evaporation area of the condensate water increases in a multiplying way, and an evaporation rate is improved.

[0014] In a feasible implementation, the condensate water treatment apparatus further includes an evaporator mounting bracket. The evaporator is fastened to the wa-

ter receiving tray by using the evaporator mounting bracket, facilitating mounting and dismounting of the evaporator.

[0015] In a feasible implementation, the evaporator is further configured to diffuse, to the surface of the evaporator, the condensate water dropping onto the evaporator.

[0016] According to a second aspect, an embodiment of this application provides an air conditioning system free from condensate water. The air conditioning system free from condensate water includes the condensate water treatment apparatus according to the first aspect or any possible implementation of the first aspect, an air conditioner, and a cabinet.

[0017] According to the condensate water treatment apparatus and the air conditioning system free from condensate water provided in the embodiments of this application, the condensate water treatment apparatus includes the water receiving tray and the evaporator disposed on the water receiving tray. The water receiving tray is configured to store the condensate water generated by the air conditioner. The evaporator is configured to draw the condensate water in the water receiving tray upward to the surface of the evaporator. In this way, the condensate water evaporates naturally when the air conditioner does not operate or the condensate water evaporates under action of the air conditioner in an operation process of the air conditioner, so that the air conditioner has no condensate water discharged. Therefore, there is no need to install a drainage pipe, reducing a construction difficulty. In an evaporation process of the condensate water, no extra energy consumption is caused. Therefore, energy consumption is low.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

FIG. 1 is a schematic structural diagram of an air conditioning system free from condensate water according to this application;

FIG. 2 is a schematic diagram of an example of a condensate water treatment apparatus according to this application;

FIG. 3 is a schematic diagram of another example of a condensate water treatment apparatus according to this application; and

FIG. 4 is a flowchart of treating condensate water by a condensate water treatment apparatus according to this application.

DESCRIPTION OF EMBODIMENTS

[0019] FIG. 1 is a schematic structural diagram of an air conditioning system free from condensate water according to this application. As shown in FIG. 1, the air conditioning system free from condensate water provided in an embodiment includes an air conditioner 1, a con-

densate water treatment apparatus 2, and a cabinet 3. The air conditioner 1 is disposed on the cabinet 3, and the condensate water treatment apparatus 2 is also disposed on the cabinet and is located under the air conditioner 1. An air vent is disposed on the cabinet 3, and is configured to exchange air with the air conditioner 1.

[0020] As shown in FIG. 1, the air conditioner 1 includes an external circulating fan 11 and an internal circulating fan 12. The internal circulating fan 12 facilitates air flow inside the cabinet 3, carries off heat in the cabinet 3 to the air conditioner 1. The external circulating fan 11 takes heat away, so as to form hot air. When the hot air blows downward, condensate water on a surface of an evaporator 21 is taken away.

[0021] The condensate water treatment apparatus 2 includes a water receiving tray 20 and the evaporator 21. The evaporator 21 is disposed on the water receiving tray 20. The water receiving tray 20 is configured to store condensate water generated by the air conditioner. The evaporator 21 is configured to draw the condensate water in the water receiving tray 20 upward to the surface of the evaporator 21, causing evaporation of the condensate water.

[0022] Specifically, the condensate water is generated in an operation process of the air conditioner 1, and the condensate water drops onto the evaporator 21. When an amount of the condensate water is relatively small, the condensate water is directly and rapidly diffused on the surface of the evaporator 21. The condensate water evaporates naturally when the air conditioner 1 stops working. When the air conditioner 1 is in an operation state, and the hot air blows downward through the evaporator 21, the condensate water rapidly evaporates into water vapor and the external circulating fan 11 carries the water vapor out. When an amount of the condensate water is relatively large, condensate water that has not evaporated on the evaporator 21 is stored in the water receiving tray 20. When the air conditioner 1 stops working, the evaporator 21 draws the condensate water upward, so that the condensate water reaches a top surface of the evaporator 21 and evaporates naturally. When the air conditioner 1 is in an operation state, the evaporator also draws the condensate water upward, so that the condensate water reaches the top surface of the evaporator 21. When the hot air goes through the evaporator 21, the condensate water rapidly evaporates into water vapor and the external circulating fan 11 carries the water vapor out.

[0023] The air conditioning system free from condensate water provided in this embodiment of this application includes the condensate water treatment apparatus, the air conditioner, and the cabinet. The condensate water treatment apparatus includes the water receiving tray and the evaporator disposed on the water receiving tray. The water receiving tray is configured to store the condensate water generated by the air conditioner. The evaporator is configured to draw the condensate water in the water receiving tray upward to the surface of the

evaporator, so that the condensate water evaporates naturally when the air conditioner does not operate or the condensate water evaporates under action of the air conditioner when the air conditioner operates. In the air conditioning system free from condensate water, the condensate water treatment apparatus treats the condensate water, so that the air conditioner has no condensate water discharged. Therefore, there is no need to install a drainage pipe, reducing a construction difficulty. In addition, in the condensate water treatment apparatus, the condensate water evaporates naturally or evaporates under action of the air conditioner. In an evaporation process of the condensate water, no extra energy consumption is caused. Therefore, energy consumption is low.

[0024] Optionally, still referring to FIG. 1, in an embodiment of this application, the air conditioning system free from condensate water further includes an air conditioner exterior cover 13, configured to enclose the air conditioner 1 and the condensate water treatment apparatus 2. The air conditioner exterior cover 13 is disposed with a simple cover plate, facilitating maintenance of the condensate water treatment apparatus.

[0025] Next, the condensate water treatment apparatus in this embodiment of this application is described in detail.

[0026] Specifically, the water receiving tray 20 is made of a metal material, for example, stainless steel, or is made of a plastic material, a foam material, or the like. The evaporator 21 is made of a porous material, and a surface of the porous material is coated with a water absorbing material. The condensate water in the water receiving tray 20 can be drawn upward along the surface of the porous material, so that an evaporation area of the condensate water increases in a multiplying way. The material of the evaporator 21 is not limited in this embodiment of this application, and the evaporator 21 may alternatively be made of an aluminum foil material, a copper material, an aluminum material, or the like.

[0027] In this embodiment of this application, the evaporator 21 is fastened in the water receiving tray 20. The evaporator 21 and the water receiving tray 20 may be absolutely parallel to each other, and there is no included angle between the evaporator 21 and the water receiving tray 20. Alternatively, there is an included angle between the evaporator 21 and the water receiving tray 20, and a part of an orthographic projection of the evaporator 21 may extend beyond the water receiving tray 20 or may not exceed the water receiving tray 20. For example, referring to FIG. 1, a small triangle in the figure represents the water receiving tray 20, and a rectangle disposed obliquely on the water receiving tray is the evaporator 21 fastened to the water receiving tray 20. Because the part of the orthographic projection of the evaporator 21 extends beyond the water receiving tray 20, the hot air of the air conditioner can reach a part of a bottom surface of the evaporator 21, thereby increasing a contact area of the hot air and the evaporator 21, and speeding up evaporation of the condensate water on the evaporator

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[0028] Optionally, in an embodiment of this application, the condensate water treatment apparatus further includes an evaporator mounting bracket 22. The evaporator 21 is fastened to the water receiving tray 20 by using the evaporator mounting bracket 22. Specifically, referring to FIG. 2 and FIG. 3, FIG. 2 is a schematic diagram of an example of the condensate water treatment apparatus according to this application, and FIG. 3 is a schematic diagram of another example of the condensate water treatment apparatus according to this application.

[0029] In the foregoing embodiment, when a cabinet device in the cabinet 3 is in a relatively suitable environment or operates in a hostile environment for a short time, there is a small amount of condensate water generated during operation of the air conditioner 2. The evaporator 21 diffuses the condensate water to the top surface of the evaporator 21. If the air conditioner 2 is in an operation state, the external circulating fan 11 accelerates air flow, and takes away heat in the cabinet 3 through heat exchange, thereby lowering an environment temperature of the cabinet device. The heat that is taken away forms hot air. When the hot air goes through the evaporator 21, the condensate water on the surface of the evaporator 21 evaporates and is discharged rapidly. In this way, heat in the ambient air is taken away, further lowering the environment temperature of the cabinet device. When the air conditioner 1 stops operating, if the water receiving tray 20 still stores condensate water, the evaporator 21 may continue to draw the condensate water upward, so that the condensate water evaporates naturally.

[0030] However, when the cabinet device in the cabinet 3 operates in a hostile environment for a long time, for example, operates in an environment with a temperature higher than 45°C and a humidity higher than 95% for a long time, there is an excessive amount of condensate water generated during operation of the air conditioner 2. An evaporation rate of the condensate water is less than a production rate of the condensate water. Consequently, condensate water that has not evaporated even overflows from the water receiving tray 20. To prevent excessive condensate water from overflowing from the water receiving tray 20, in an embodiment of this application, still referring to FIG. 2 and FIG. 3, the condensate water treatment apparatus 2 further includes a liquid level sensor 23 and a heater 24. The heater 24 is embedded in the evaporator 21. The liquid level sensor 23 is disposed on the water receiving tray 20, and is configured to trigger the heater 24 to heat the evaporator 21 when detecting that condensate water in the water receiving tray 20 reaches a warning water level, or configured to trigger the heater 24 to stop heating the evaporator 21 when detecting that condensate water in the water receiving tray 20 drops below a warning water level. The liquid level sensor 23 is mounted in the water receiving tray 20 by using a liquid level sensor mounting bracket 25. The heater 24 is embedded in the evaporator 21.

[0031] In a condensate water treatment process, the

heater 24 of the condensate water treatment apparatus 2 is connected to a power supply of the cabinet device in the cabinet 3. The liquid level sensor 23 of the condensate water treatment apparatus 2 is connected to a control board of the cabinet device in the cabinet 3. When the liquid level sensor 23 detects that the condensate water in the water receiving tray 20 reaches the warning water mark, the control board of the cabinet device is triggered to turn on the heater 24, so that the heater 24 heats the evaporator 21, speeding up evaporation of the condensate water. When the liquid level sensor 23 detects that the condensate water in the water receiving tray 20 drops below the warning water mark, the control board is triggered to turn off the heater 24, so that the heater 24 stops heating the evaporator 21. Afterward, the condensate water evaporates naturally or evaporates under action of the air conditioner. Then, when the liquid level sensor 23 detects again that the condensate water in the water receiving tray 20 reaches the warning water mark, the control board of the cabinet device is triggered to turn on the heater 24. An operation cycle continues in this way. Specifically, referring to FIG. 4, FIG. 4 is a flow-chart of treating condensate water by a condensate water treatment apparatus according to this application. The following steps are included:

101. An air conditioner operates to generate condensate water.

102. A liquid level sensor detects whether condensate water in a water receiving tray reaches a warning water mark. If yes, step 103 is performed. If no, step 107 is performed.

103. A control board turns on a heater.

104. The heater heats an evaporator, to speed up evaporation of the condensate water.

105. The liquid level sensor detects whether condensate water in the water receiving tray drops below the warning water mark. If yes, step 106 is performed. If no, step 104 is returned to.

106. The control board turns off the heater.

107. The condensate water evaporates naturally or evaporates under action of the air conditioner, and step 102 is returned to.

[0032] In this embodiment, the heater is embedded in the evaporator. The heater does not operate under a normal condition. Only in an extreme operation condition, when the condensate water reaches the warning water mark, the liquid level sensor triggers the heater to operate, thereby speeding up evaporation of the condensate water. In addition, power of the heater is relatively small.

[0033] In the foregoing embodiment, the water receiving tray 20, the evaporator 21, the heater 24, and the liquid level sensor 23 in the condensate water treatment apparatus 2 are detachable structure, facilitating maintenance and reuse of the condensate water treatment apparatus and reducing costs.

[0034] In addition, in the foregoing embodiment, in ad-

dition to supplying power to the heater 24 of the condensate water treatment apparatus 2, the power supply disposed on the cabinet device may also supply power to the air conditioner or another device. In addition to controlling the heater 24, the control board disposed on the cabinet device may also control the air conditioner or another device.

Claims

1. A condensate water treatment apparatus, comprising a water receiving tray and an evaporator, wherein the evaporator is disposed on the water receiving tray, and condensate water generated by an air conditioner drops onto the evaporator, wherein the water receiving tray is configured to receive condensate water penetrating through the evaporator; and the evaporator is configured to draw the condensate water to a surface of the evaporator, so that the condensate water evaporates naturally when the air conditioner does not operate or the condensate water evaporates under action of the air conditioner when the air conditioner operates.
2. The apparatus according to claim 1, wherein there is an included angle between the evaporator and the water receiving tray, so that a part of an orthographic projection of the evaporator extends beyond the water receiving tray.
3. The apparatus according to claim 1 or 2, further comprising a liquid level sensor and a heater, wherein the heater is embedded in the evaporator; and the liquid level sensor is disposed on the water receiving tray, and is configured to trigger the heater to heat the evaporator when detecting that condensate water in the water receiving tray reaches a warning water level, or configured to trigger the heater to stop heating the evaporator when detecting that condensate water in the water receiving tray drops below a warning water level.
4. The apparatus according to claim 3, wherein the water receiving tray, the evaporator, the heater, and the liquid level sensor are detachable structures.
5. The apparatus according to any one of claims 1 to 4, wherein the evaporator is made of a porous material, and a surface of the porous material is coated with a water absorbing material.
6. The apparatus according to any one of claims 1 to 5, further comprising: an evaporator mounting bracket, wherein the evaporator is fastened to the water receiving tray by using

the evaporator mounting bracket.

7. The apparatus according to any one of claims 1 to 6, wherein the evaporator is further configured to diffuse, to the surface of the evaporator, the condensate water dropping onto the evaporator. 5
8. An air conditioning system free from condensate water, comprising the condensate water treatment apparatus according to any one of claims 1 to 7, an air conditioner, and a cabinet. 10
9. The system according to claim 8, wherein the cabinet is configured to accommodate a cabinet device, and the cabinet device is disposed with a control board and a power supply; 15
the control board is configured to control the condensate water treatment apparatus; and
the power supply is configured to supply power to the air conditioner and the condensate water treatment apparatus. 20

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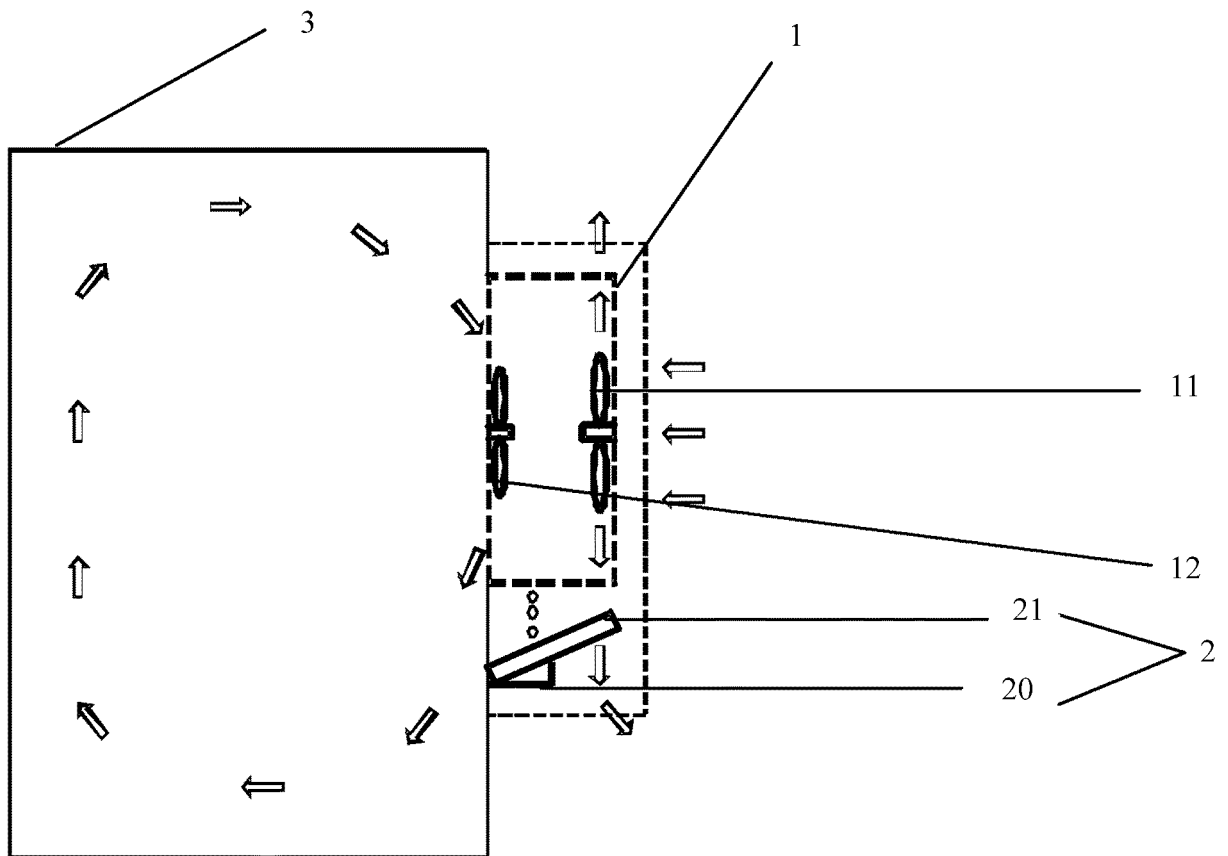


FIG. 1

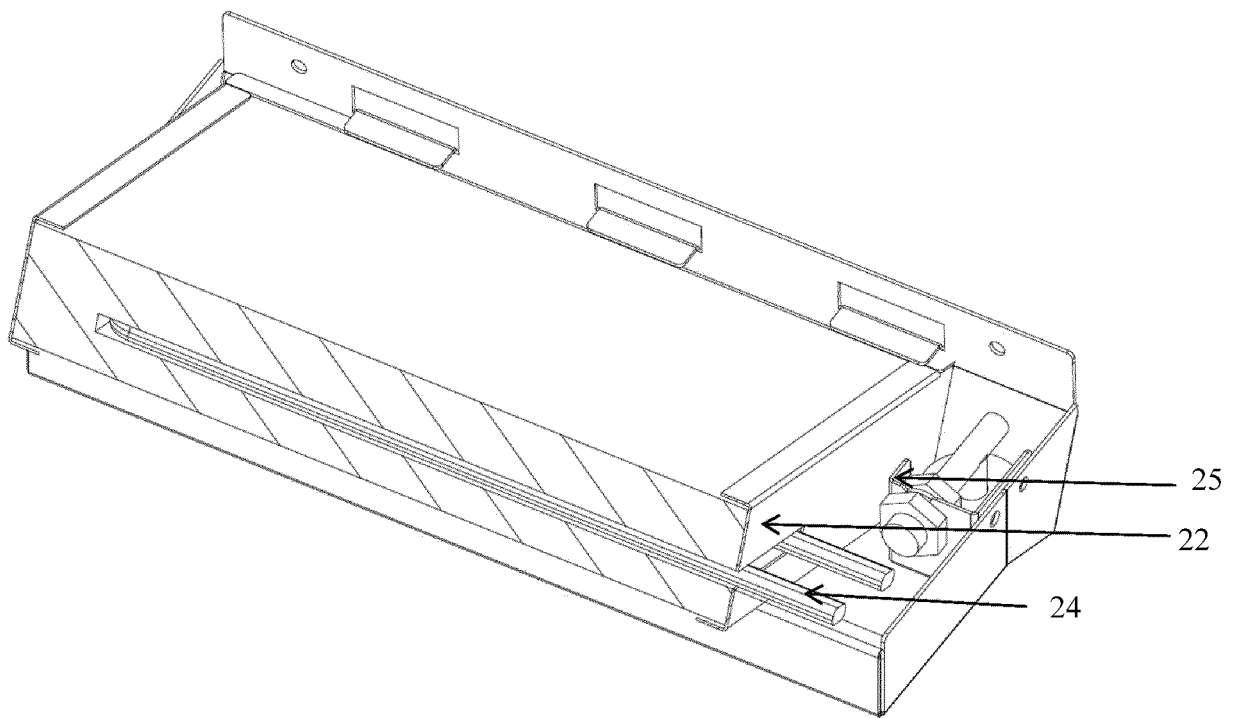


FIG. 2

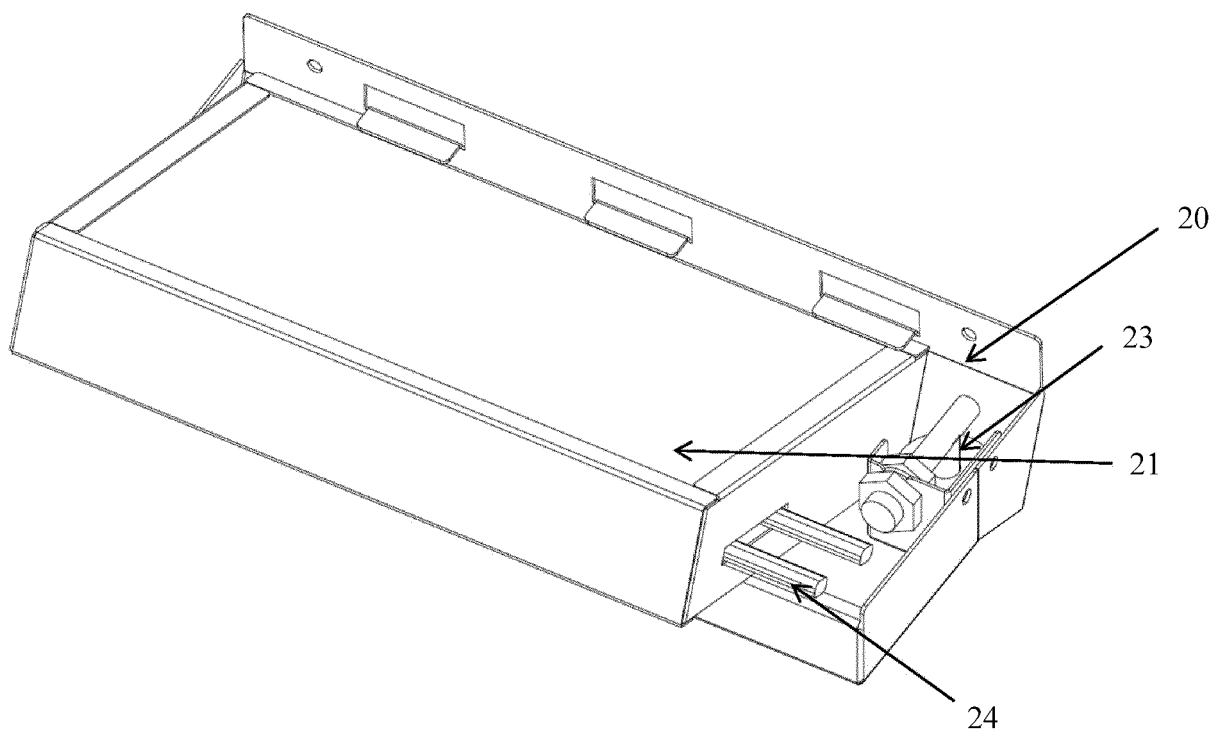


FIG. 3

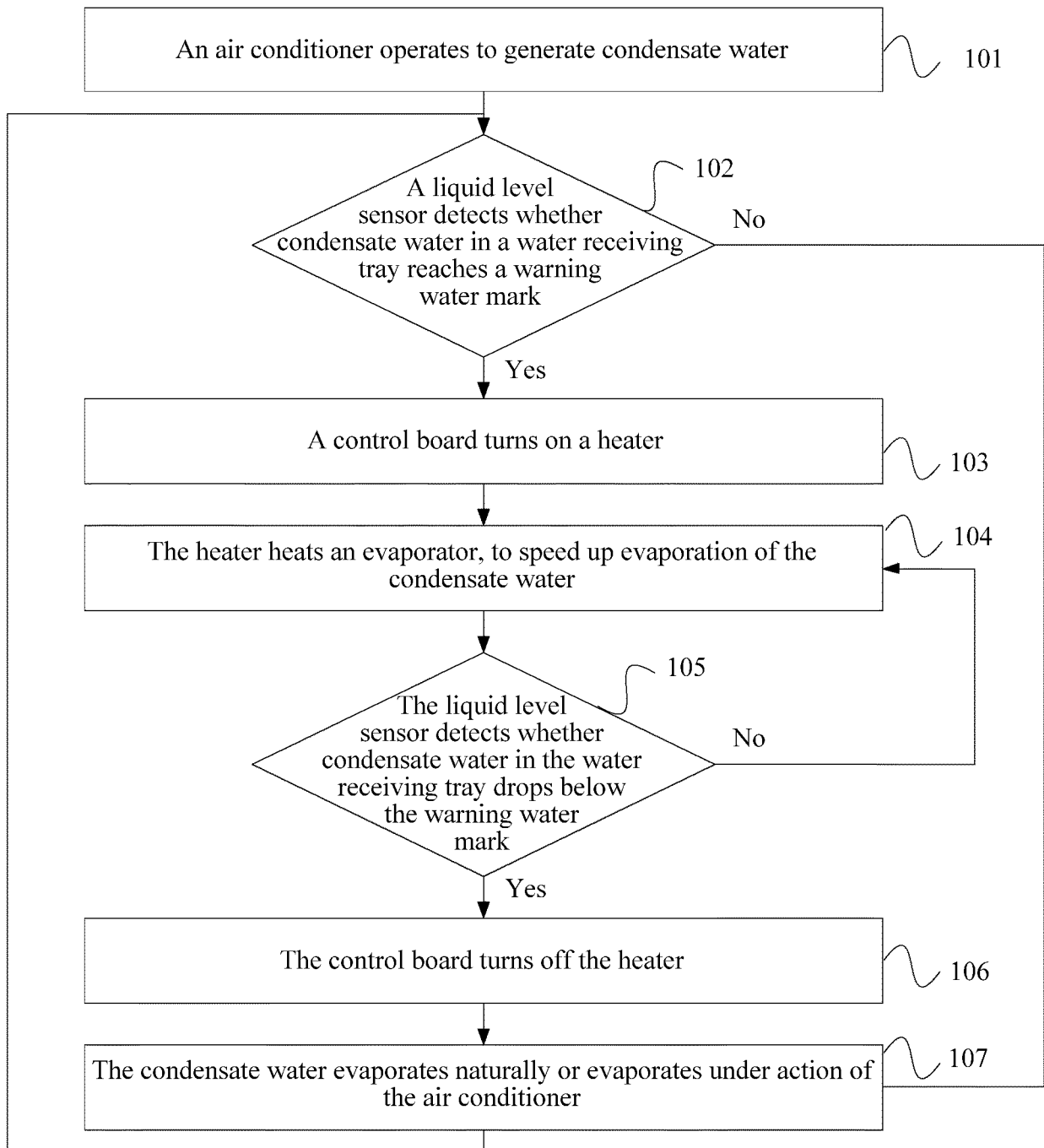


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/104215

A. CLASSIFICATION OF SUBJECT MATTER

F24F 13/22 (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

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

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

CNABS; DWPI; SIPOABS; CNKI: 冷凝水 蒸发 加热器 吸水 亲水 CONDENSATE CONDENSING WATER EVAPORAT???

HEATER HYDROPHILIC ABSORPTION SUCTION

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 105115137 A (XIE, Wei) 02 December 2015 (02.12.2015), description, paragraphs [0005]-[0028], and figures 1 and 2	1-9
Y	JP 2002022203 A (OHM DENKI K.K.) 23 January 2002 (23.01.2002), description, paragraphs [0030]-[0058], and figures 1-4	1-9
A	CN 105180409 A (GUANGZHOU LEIZIG ELECTRIC MACHINERY CO., LTD.) 23 December 2015 (23.12.2015), entire document	1-9
A	CN 1407289 A (GAO, Zhen'ou) 02 April 2003 (02.04.2003), entire document	1-9
A	CN 105605861 A (JIANGSU BAIXUE ELECTRIC APPLIANCES CO., LTD.) 25 May 2016 (25.05.2016) entire document	1-9
A	JP S58145868 A (TORAY IND INC.) 31 August 1983 (31.08.1983), entire document	1-9

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
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"O" document referring to an oral disclosure, use, exhibition or other means	
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Date of the actual completion of the international search
27 November 2017

Date of mailing of the international search report
10 January 2018

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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/104215

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 106403246 A (XI'AN HUAWEI TECHNOLOGY CO., LTD.) 15 February 2017 (15.02.2017), claims 1-9	1-9

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/104215

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 105115137 A	02 December 2015	None	
JP 2002022203 A	23 January 2002	None	
CN 105180409 A	23 December 2015	None	
CN 1407289 A	02 April 2003	None	
CN 105605861 A	25 May 2016	None	
JP S58145868 A	31 August 1983	None	
CN 106403246 A	15 February 2017	None	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201610863850 [0001]