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(54) REFRIGERATOR AND CONTROL METHOD THEREFOR

(57) Provided are a refrigerator and a control method therefor. The refrigerator comprises a constant-temperature chamber, a cooling unit used for cooling the constant-temperature chamber, at least one tray located within the constant-temperature chamber, a room temperature sensor used for measuring a temperature within the constant-temperature chamber, a tray temperature sensor for measuring the temperature of the tray, and a controller, wherein the cooling unit, the room temperature sensor and the tray temperature sensor are all in communication connection with the controller.

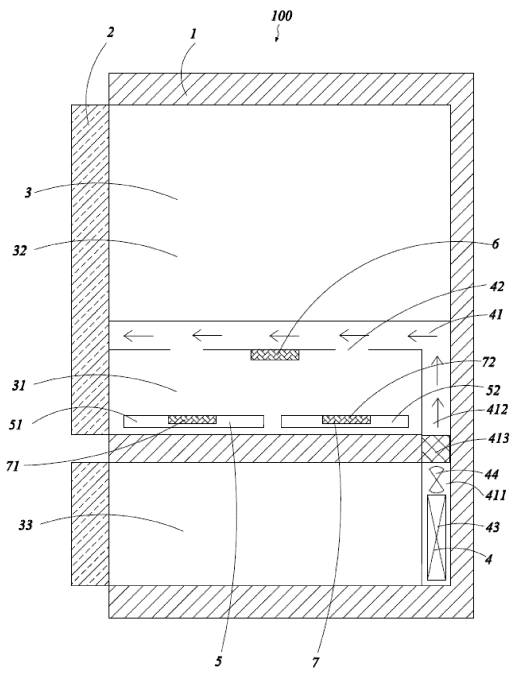

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a refrigerator, and in particular, to a refrigerator and a control method thereof.

BACKGROUND

[0002] In order to adapt to refrigerated items with high temperature precision requirements, a compartment in a refrigerator is usually expected to be in a constant temperature state, such that use is not influenced, bacteria are not prone to breeding, and the use is convenient.

[0003] In the current refrigerator, temperatures of a refrigerating compartment and a freezing compartment cannot achieve the purpose. Although some refrigerators have chill compartments, a temperature fluctuation is often large, such that food materials are repeatedly frozen and slowly thawed, thus affecting quality of the food materials.

[0004] In view of this, it is necessary to provide a new refrigerator and a control method thereof to solve the above problems.

SUMMARY

[0005] The present invention is intended to solve at least one of technical problems in the prior art, and thus provides a refrigerator and a control method thereof.

[0006] A refrigerator, comprising a constant temperature compartment and a cooling unit for cooling the constant temperature compartment, wherein the refrigerator further comprises at least one tray located in the constant temperature compartment, a compartment temperature sensor for detecting a temperature in the constant temperature compartment, a tray temperature sensor for detecting a temperature of the tray, and a controller, and the cooling unit, the compartment temperature sensor and the tray temperature sensor are all communicatively connected with the controller.

[0007] Further, wherein the tray at least comprises a first tray and a second tray which are arranged at intervals, and the tray temperature sensor at least comprises a first tray temperature sensor and a second tray temperature sensor which are configured to detect temperatures of the first tray and the second tray respectively.

[0008] Further, wherein the refrigerator further comprises a door for opening or closing the constant temperature compartment, and the second tray is located on a side of the first tray away from the door; a starting point temperature of the first tray temperature sensor is higher than a starting point temperature of the second tray temperature sensor, and a stopping point temperature of the first tray temperature sensor is higher than a stopping point temperature of the second tray temperature sensor; or, the refrigerator further comprises a door for opening or closing the constant temperature compartment, the first tray and the second tray are arranged side by side along a width direction of the door of the refrigerator, and the starting point temperatures and the stopping point temperatures of the first tray temperature sensor and the second tray temperature sensor are the same.

[0009] Further, wherein the cooling unit comprises an air duct communicated with the constant temperature compartment, at least one air inlet for allowing cold air in the air duct to enter the constant temperature compartment, a cold source located in the air duct, and a fan for driving the cold air to enter the constant temperature compartment from the air duct; the cold source is configured as an evaporator of a refrigerant refrigeration cycle unit, or a cold end of a semiconductor refrigeration unit, or a cold accumulation module.

[0010] Further, wherein the tray is provided at a bottom of the constant temperature compartment, the at least one air inlet is provided at a top of the constant temperature compartment, and the compartment temperature sensor is also provided at the top of the constant temperature compartment.

[0011] A control method of a refrigerator, comprising:

acquiring a compartment temperature in a constant temperature compartment, and acquiring a tray temperature;
when the compartment temperature reaches a starting point temperature of a compartment temperature sensor and the tray temperature reaches a starting point temperature of a tray temperature sensor, starting a cooling unit; and
when the compartment temperature reaches a stopping point temperature of the compartment temperature sensor and the tray temperature reaches a stopping point temperature of the tray temperature sensor, stopping the cooling unit.

[0012] Further, wherein before the cooling unit is started, when only the compartment temperature reaches the starting point temperature of the compartment temperature sensor, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and the cooling unit is stopped after the compartment temperature is lower than the starting point temperature of the compartment temperature sensor; or, before the cooling unit is started, when only the

tray temperature reaches the starting point temperature of the tray temperature sensor, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and the cooling unit is stopped after the tray temperature is lower than the starting point temperature of the tray temperature sensor.

[0013] Further, wherein during starting of the cooling unit, when the compartment temperature decreases to the stopping point temperature of the compartment temperature sensor, the cooling unit is started and stopped at the period of a starting time t1 and a stopping time t2.

[0014] Further, wherein the tray temperature sensor comprises a first tray temperature sensor for detecting a first tray and a second tray temperature sensor for detecting a second tray; the first tray and the second tray are arranged side by side along a width direction of a door of the refrigerator, and starting point temperatures and stopping point temperatures of the first tray temperature sensor and the second tray temperature sensor are the same; or, the tray temperature sensor comprises a first tray temperature sensor for detecting a first tray and a second tray temperature sensor for detecting a second tray; the second tray is located on a side of the first tray away from a door of the refrigerator, the starting point temperature of the first tray temperature sensor is higher than the starting point temperature of the second tray temperature sensor, and the stopping point temperature of the first tray temperature sensor is higher than the stopping point temperature of the second tray temperature sensor.

[0015] A control method of a refrigerator, comprising:

acquiring load information of a tray in the refrigerator;
acquiring a compartment temperature in a constant temperature compartment, and acquiring a tray temperature; and
controlling a cooling unit to be started and stopped according to starting point temperatures and stopping point temperatures of a compartment temperature sensor for detecting the compartment temperature and a tray temperature sensor for detecting the tray temperature under a current load condition.

[0016] Further, wherein when the tray is unloaded, the cooling unit is started, and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when the tray is unloaded or the tray temperature reaches the stopping point temperature of the tray temperature sensor when the tray is unloaded, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and when both the compartment temperature and the tray temperature are reduced to the stopping point temperatures, the cooling unit is stopped; or, when the tray is loaded, the cooling unit is started, and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when the tray is loaded or the tray temperature reaches the stopping point temperature of the tray temperature sensor when the tray is loaded, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and when both the compartment temperature and the tray temperature are reduced to the stopping point temperatures when the tray is loaded, the cooling unit is stopped; or, when some trays in the refrigerator are loaded and other trays are unloaded, the cooling unit is started; when the compartment temperature reaches a preset temperature T0, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2; the cooling unit is stopped when the temperature of the unloaded tray reaches the stopping point temperature of the tray temperature sensor for detecting the tray when some trays are loaded and other trays are unloaded; the preset temperature T0 is lower than the stopping point temperature of the compartment temperature sensor under the condition that some trays are loaded and other trays are unloaded; when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when some trays are loaded and other trays are unloaded, the cooling unit is started and stopped at the period of a starting time t1 and a stopping time t2; when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when some trays are loaded and other trays are unloaded, and the temperature of the unloaded tray reaches the stopping point temperature of the tray temperature sensor for detecting the tray when some trays are loaded and other trays are unloaded, the cooling unit is stopped.

[0017] Further, wherein when a first tray and a second tray located on a side of the first tray away from a door of the refrigerator are unloaded, a starting point temperature of a second tray temperature sensor for detecting the second tray is less than the starting point temperature of the compartment temperature sensor less than a starting point temperature of a first tray temperature sensor for detecting the first tray, and the stopping point temperature of the compartment temperature sensor is less than a stopping point temperature of the second tray temperature sensor for detecting the second tray less than a stopping point temperature of the first tray temperature sensor for detecting the first tray.

[0018] Further, wherein when the first tray and the second tray located on the side of the first tray away from the door of the refrigerator are both loaded, the starting point temperature of the second tray temperature sensor for detecting the second tray is less than the starting point temperature of the first tray temperature sensor for detecting the first tray less than the starting point temperature of the compartment temperature sensor, and the stopping point temperature of the compartment temperature sensor is less than the stopping point temperature of the second tray temperature sensor for detecting the second tray less than the stopping point temperature of the first tray temperature sensor for detecting the first tray.

[0019] Further, wherein when the first tray is loaded, and the second tray located on the side of the first tray away from the door of the refrigerator is unloaded, the starting point temperature of the second tray temperature sensor for detecting the second tray is less than the starting point temperature of the first tray temperature sensor for detecting the first tray less than the starting point temperature of the compartment temperature sensor, and the stopping point temperature of the compartment temperature sensor is less than the stopping point temperature of the second tray temperature sensor for detecting the second tray less than the stopping point temperature of the first tray temperature sensor for detecting the first tray; or, when the first tray is unloaded and the second tray located on the side of the first tray away from the door of the refrigerator is loaded, the starting point temperature of the second tray temperature sensor for detecting the second tray is less than the starting point temperature of the compartment temperature sensor less than the starting point temperature of the first tray temperature sensor for detecting the first tray, and the stopping point temperature of the compartment temperature sensor is less than the stopping point temperature of the second tray temperature sensor for detecting the second tray less than the stopping point temperature of the first tray temperature sensor for detecting the first tray.

[0020] Further, wherein after the cooling unit is stopped, the compartment temperature in the constant temperature compartment is acquired, and the tray temperature is acquired; when the compartment temperature reaches the starting point temperature of the compartment temperature sensor under the current load condition and the tray temperature reaches the starting point temperature of the tray temperature sensor under the current load condition, the cooling unit is started; and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor under the current load condition and the tray temperature reaches the stopping point temperature of the tray temperature sensor under the current load condition, the cooling unit is stopped.

[0021] The present invention has the following beneficial effects: in the refrigerator according to the present invention, the cooling unit is controlled according to the compartment temperature and the tray temperature to supply cold energy to the constant temperature compartment, and the temperature of the constant temperature compartment and a temperature of food in the constant temperature compartment are taken into consideration, such that a temperature fluctuation in the constant temperature compartment is small.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] To describe the technical solutions in the embodiments of the present invention or the prior art more clearly, the following briefly describes the accompanying drawings required for describing the embodiments or the prior art. Apparently, the accompanying drawings in the following description only show the embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from the provided accompanying drawings without creative efforts.

FIG. 1 is a schematic structural diagram of a refrigerator according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION

[0023] The technical solutions in the embodiments of the present invention are clearly and completely described with reference to the accompanying drawings in the embodiments of the present invention, and apparently, the described embodiments are not all but only a part of the embodiments of the present invention. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

[0024] FIG. 1 shows a refrigerator 100 according to a preferred embodiment of the present invention, including a cabinet 1, a door 2, and a plurality of compartments 3 defined by the cabinet 1 and the door 2. One of the compartments 3 is configured as a constant temperature compartment 32 for storing items or food with high temperature requirements.

[0025] In a specific embodiment, the compartments 3 further include a refrigerating compartment 31 and a freezing compartment 32, and the constant temperature compartment 32 is located in the refrigerating compartment 31 and is in a refrigerating environment with a relatively stable temperature, such that a temperature fluctuation in the constant temperature compartment 32 is relatively less influenced by an ambient temperature.

[0026] Further, the refrigerator 100 further includes a cooling unit 4 for cooling the constant temperature compartment 32, at least one tray 5 located in the constant temperature compartment 32, a compartment temperature sensor 6 for detecting a temperature in the constant temperature compartment 32, a tray temperature sensor 7 for detecting a temperature of the tray 5, and a controller for controlling operation of the refrigerator 100.

[0027] The tray temperature sensor 7 may be configured as any sensor which can detect the temperature of the tray 4, and a providing position thereof is not limited. Preferably, the tray temperature sensor 7 is provided on the tray 5 and is close to or located on an upper surface of the tray 5, so as to take account of the temperature of the tray 5 and a temperature of the food on the tray 5.

[0028] When the food is placed on the tray 5, the food is in direct contact with the tray 5 to rapidly transfer heat, and

the temperatures of the food and the tray 5 rapidly get consistent, such that the temperature of the tray 5 is close to the temperature of the food, which can also mean that the tray temperature sensor 7 indirectly measures the temperature of the food by detecting the temperature of the tray 5.

[0029] The cooling unit 4, the compartment temperature sensor 6 and the tray temperature sensor 7 are all communicatively connected with the controller, the controller controls the cooling unit 4 to be started and stopped according to the temperature of the compartment and the temperature of the tray, and the temperature of the constant temperature compartment 32 and the temperature of the food in the constant temperature compartment are taken into consideration, such that the temperature fluctuation in the constant temperature compartment 32 is small.

[0030] The tray 5 at least includes a first tray 51 and a second tray 52 which are arranged at intervals, and the tray temperature sensor 7 at least includes a first tray temperature sensor 71 and a second tray temperature sensor 72 which are configured to detect temperatures of the first tray 51 and the second tray 52 respectively. The plurality of trays 5 are located at different positions in the constant temperature compartment 32, and temperature distribution at different positions in the constant temperature compartment 32 may be known by measuring the temperatures of the trays 5, which has a quite good effect on adjustment and maintenance of a constant temperature.

[0031] In a specific embodiment, the second tray 52 is located on a side of the first tray 51 away from the door 2; that is, the first tray 51 is close to the door 2, and the second tray 52 is apart from the door 2. Since a joint of the door 2 and the cabinet 1 inevitably has a cold leakage phenomenon, a temperature close to the door 2 is usually slightly higher than an internal temperature; in the present invention, a starting point temperature of the first tray temperature sensor 71 is higher than a starting point temperature of the second tray temperature sensor 72, and a stopping point temperature of the first tray temperature sensor 71 is higher than a stopping point temperature of the second tray temperature sensor 72; therefore, frequent starting of the cooling unit 4 caused by a fluctuation of the temperature near the door 2 can be avoided, and an excessively low internal temperature can also be avoided.

[0032] The cooling unit 4 includes an air duct 41 communicated with the constant temperature compartment 32, at least one air inlet 42 for allowing cold air in the air duct 41 to enter the constant temperature compartment 32, a cold source 43 located in the air duct 41, and a fan 44 for driving the cold air to enter the constant temperature compartment 32 from the air duct 41; the cold source 43 is configured as an evaporator of a refrigerant refrigeration cycle unit, or a cold end of a semiconductor refrigeration unit, or a cold accumulation module. The constant temperature compartment 32 is cooled by the cold air, such that the whole compartment 3 has good air fluidity and a uniform temperature.

[0033] Further, the tray 5 is provided at a bottom of the constant temperature compartment 32, the at least one air inlet 42 is provided at a top of the constant temperature compartment 32, and the compartment temperature sensor 6 is also provided at the top of the constant temperature compartment 32. On the one hand, cold air sinks, and hot air rises, such that the whole constant temperature compartment 32 has a relatively uniform temperature; on the other hand, the compartment temperature sensor 6 is relatively close to the top of the constant temperature compartment 32, and the tray 5 and the tray temperature sensor 7 are relatively close to the bottom of the constant temperature compartment 32, such that the temperature of the whole compartment 3 can be detected effectively.

[0034] In a preferred embodiment, the compartment temperature sensor 6 is located at a middle position of the top of the constant temperature compartment 32, and the at least one air inlet 42 is uniformly distributed around the compartment temperature sensor 6, such that measurement of the compartment temperature is more precise.

[0035] As shown in FIG. 1, in a specific embodiment, the cooling unit 4 cools the freezing compartment 32 at the same time, the air duct 41 includes a freezing air duct 411 for supplying cold energy to the freezing compartment 32, a constant temperature air duct 412 communicated with the freezing air duct 411, and a damper 413 for communicating or disconnecting the freezing air duct 411 and the air duct 41, and the fan 44 is provided in the freezing air duct 411. As mentioned herein, when the cooling unit 4 is started, the damper 413 is opened, and at this point, when the fan 44 is not started, the fan 44 may be started at the same time; when the cooling unit 4 is stopped, the damper 413 is closed, and at this point, when the fan 44 is in an operating state due to a cooling demand of the freezing compartment 32, the fan 44 is not required to be stopped.

[0036] The present invention further provides a control method of a refrigerator, including the following steps: acquiring a compartment temperature in a constant temperature compartment 32, and acquiring a tray temperature; when the compartment temperature reaches a starting point temperature of a compartment temperature sensor 6 and the tray temperature reaches a starting point temperature of a tray temperature sensor 7, starting a cooling unit 4; and when the compartment temperature reaches a stopping point temperature of the compartment temperature sensor 6 and the tray temperature reaches a stopping point temperature of the tray temperature sensor 7, stopping the cooling unit 4.

[0037] According to the control method of a refrigerator, the cooling unit 4 is controlled to supply cold energy to the constant temperature compartment 32 according to the compartment temperature and the tray temperature, and the temperature of the constant temperature compartment 32 and a temperature of food in the constant temperature compartment 32 are taken into consideration, such that the temperature in the constant temperature compartment 32 is constant.

[0038] Before the cooling unit 4 is started, when only the compartment temperature reaches the starting point tem-

perature of the compartment temperature sensor 6, and the tray temperature does not reach the starting point temperature of the tray temperature sensor 7, the cooling unit 4 is started and stopped at a period of a starting time t1 and a stopping time t2, and the cooling unit 4 is stopped after the compartment temperature is lower than the starting point temperature of the compartment temperature sensor 6.

[0039] Or, before the cooling unit 4 is started, when only the tray temperature reaches the starting point temperature of the tray temperature sensor 7, and the compartment temperature does not reach the starting point temperature of the compartment temperature sensor 6, the cooling unit 4 is started and stopped at a period of a starting time t1 and a stopping time t2, and the cooling unit 4 is stopped after the tray temperature is lower than the starting point temperature of the tray temperature sensor 7.

[0040] In a specific embodiment, t1 is 80s and t2 is 170s.

[0041] When one of the compartment temperature and the tray temperature reaches the corresponding starting point temperature, the cooling unit 4 is intermittently started to slowly perform cooling; on the one hand, an over-high local temperature can be effectively avoided, and on the other hand, a phenomenon that since the cooling unit 4 is started due to the over-high local temperature, temperatures at other positions are excessively low can be avoided.

[0042] A cooling speed of the food is usually lower than a cooling speed of air in the constant temperature compartment 32, and during starting of the cooling unit 4, after the compartment temperature is reduced to the stopping point temperature of the compartment temperature sensor 6, a temperature in the food may not be reduced to a rational temperature, and the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2; intermittent slow cooling is carried out, and when the temperature of the food is slowly reduced to the stopping point temperature, the cooling unit 4 is stopped; compared with direct stopping of the cooling unit 4, a rapid rise of the compartment temperature can be avoided.

[0043] Specifically, the tray temperature sensor 7 includes a first tray 51 sensor for detecting a first tray 51 and a second tray 52 sensor for detecting a second tray 52. The plurality of trays 5 are located at different positions in the constant temperature compartment 32, such that the temperature of the food at different positions can be detected, which has a quite good effect on adjustment and maintenance of a constant temperature.

[0044] When the first tray 51 and the second tray 52 are arranged side by side along a width direction of a door 2 of the refrigerator 100, distances between the two trays 5 and the door 2 and an air inlet 42 are substantially the same or similar, and starting point temperatures and stopping point temperatures of the first tray temperature sensor 71 and the second tray 52 sensor are the same.

[0045] When the second tray 52 is located on a side of the first tray 51 away from the door 2 of the refrigerator 100, the starting point temperature of the first tray temperature sensor 71 is higher than the starting point temperature of the second tray temperature sensor 72, the stopping point temperature of the first tray temperature sensor 71 is higher than the stopping point temperature of the second tray temperature sensor 72, and the cooling unit 4 is controlled based on temperature distribution in the constant temperature compartment 32, such that the temperature is more uniform.

[0046] In addition, in consideration of a difference between a heat exchange speed of the food and a heat exchange speed of the air in the refrigerator 100, the control method of a refrigerator according to the present invention further includes: adjusting the starting point temperatures and the stopping point temperatures of the temperature sensors, such as the compartment temperature sensor 6 and the tray temperature sensor 7, according to a load condition of the tray 5.

[0047] The control method of a refrigerator includes the following steps: acquiring load information of the tray 5 in the refrigerator 100; acquiring the compartment temperature in the constant temperature compartment 32, and acquiring the tray temperature; and controlling the cooling unit 4 to be started and stopped according to the starting point temperatures and the stopping point temperatures of the compartment temperature sensor 6 and the tray temperature sensor 7 under the current load condition.

[0048] The control method takes the compartment temperature, a food storage space and the temperature of the food into consideration, such that the temperature in the constant temperature compartment 32 is more uniform; these steps can be used independently or based on the above-mentioned control method of a refrigerator 100.

[0049] In the present invention, a camera is provided in the refrigerator for photographing or video recording, and the load condition of the tray is obtained using pictures or videos, or a scale is provided on or below the tray for weighing, so as to obtain the load condition of the tray.

[0050] After a constant temperature function is started, when the tray 5 is unloaded, the cooling unit 4 is started, and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor 6 when the tray 5 is unloaded or the tray temperature reaches the stopping point temperature of the tray temperature sensor 7 when the tray 5 is unloaded, the local temperature in the constant temperature compartment 32 meets a set requirement, and the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2, so as to slowly perform cooling and avoid a rise of the temperature in the constant temperature compartment 32 caused by a sudden stop; when both the compartment temperature and the tray temperature are reduced to the stopping point temperatures, the cooling unit 4 is stopped.

[0051] In a preferred embodiment, when the first tray 51 and the second tray 52 located on the side of the first tray 51 away from the door 2 of the refrigerator are unloaded, the starting point temperature of the second tray temperature sensor 72 for detecting the second tray 52 is less than the starting point temperature of the compartment temperature sensor 6 less than the starting point temperature of the first tray temperature sensor 71 for detecting the first tray 51, the stopping point temperature of the compartment temperature sensor 6 is less than the stopping point temperature of the second tray temperature sensor 72 for detecting the second tray 52 less than the stopping point temperature of the first tray temperature sensor 71 for detecting the first tray 51, and the second tray 52 is located on the side of the first tray 51 away from the door 2 of the refrigerator 100.

[0052] After the cooling unit 4 is stopped, when the refrigerator 100 is in a normal started state, the cooling unit 4 is controlled to be started and stopped using the control method of a refrigerator, and the temperature sensors have the starting point temperatures and the stopping point temperatures under the unloaded condition.

[0053] Specifically, the control method of a refrigerator further includes: acquiring the compartment temperature in the constant temperature compartment 32, and acquiring the tray temperature; when the compartment temperature reaches the starting point temperature of the compartment temperature sensor 6 under the current load condition and the tray temperature reaches the starting point temperature of the tray temperature sensor 7 under the current load condition, starting the cooling unit 4; and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor 6 under the current load condition and the tray temperature reaches the stopping point temperature of the tray temperature sensor 7 under the current load condition, stopping the cooling unit 4.

[0054] Before the cooling unit 4 is started, when only the compartment temperature reaches the starting point temperature of the compartment temperature sensor 6 under the current load condition, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2, and the cooling unit 4 is stopped after the compartment temperature is lower than the starting point temperature of the compartment temperature sensor 6 under the current load condition; or, before the cooling unit 4 is started, when only the tray temperature reaches the starting point temperature of the tray temperature sensor 7 under the current load condition, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2, and the cooling unit 4 is stopped after the tray temperature is lower than the starting point temperature of the tray temperature sensor 7 under the current load condition.

[0055] After the cooling unit 4 is started, when the compartment temperature decreases to the stopping point temperature of the compartment temperature sensor 6 under the current load condition, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2.

[0056] After the constant temperature function is started, when the tray is loaded, the control method of a refrigerator is different from the control method when the tray 5 is unloaded only in that: when the tray 5 is loaded, the cooling unit 4 is started, and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor 6 when the tray 5 is loaded or the tray temperature reaches the stopping point temperature of the tray temperature sensor 7 when the tray 5 is loaded, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2, so as to slowly perform cooling; when both the compartment temperature and the tray temperature are reduced to the stopping point temperatures when the tray 5 is loaded, the cooling unit 4 is stopped. After the cooling unit 4 is stopped, the cooling unit 4 is controlled to be started and stopped using the control method of a refrigerator, and the temperature sensors have the starting point temperatures and the stopping point temperatures under the loaded condition.

[0057] Specifically, when the first tray 51 and the second tray 52 are both loaded, and when the first tray 51 and the second tray 52 located on the side of the first tray 51 away from the door 2 of the refrigerator 100 are both loaded, the starting point temperature of the second tray temperature sensor 72 for detecting the second tray 52 is less than the starting point temperature of the first tray temperature sensor 71 for detecting the first tray 51 less than the starting point temperature of the compartment temperature sensor 6, and the stopping point temperature of the compartment temperature sensor 6 is less than the stopping point temperature of the second tray temperature sensor 72 for detecting the second tray 52 less than the stopping point temperature of the first tray temperature sensor 71 for detecting the first tray 51.

[0058] After the constant temperature function is started, when some trays 5 in the refrigerator 100 are loaded and other trays 5 are unloaded, the control method of a refrigerator is different from the control method when the trays 5 are unloaded only in that: when some trays 5 are loaded and other trays 5 are unloaded, the cooling unit 4 is started. When the compartment temperature reaches a preset temperature T0, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2, so as to slowly perform cooling; the cooling unit 4 is stopped when the temperature of the unloaded tray 5 reaches the stopping point temperature of the tray temperature sensor 7 for detecting the tray 5 when some trays 5 are loaded and other trays 5 are unloaded, and a supercooling phenomenon of the constant temperature compartment 32 is avoided; when the compartment temperature slowly rises to the stopping point temperature of the compartment temperature sensor 6 when some trays 5 are loaded and other trays 5 are unloaded, which indicates that the temperature in the constant temperature compartment 32 is relatively uniform, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2, so as to slowly perform cooling; when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor 6 when some

trays 5 are loaded and other trays 5 are unloaded, and the temperature of the unloaded tray 5 reaches the stopping point temperature of the tray temperature sensor 7 for detecting the tray 5 when some trays 5 are loaded and other trays 5 are unloaded, the cooling unit 4 is stopped, such that the temperature in the constant temperature compartment 32 can be prevented from being too low.

[0059] The preset temperature T0 is lower than the stopping point temperature of the compartment temperature sensor 6 under the condition that some trays 5 are loaded and other trays 5 are unloaded.

[0060] After the cooling unit 4 is stopped, the cooling unit 4 is controlled to be started and stopped using the control method of a refrigerator, and the temperature sensors have the starting point temperatures and the stopping point temperatures under the condition that some trays 5 are loaded and other trays 5 are unloaded.

[0061] In a preferred embodiment, when the first tray 51 is loaded, and the second tray 52 located on the side of the first tray 51 away from the door 2 of the refrigerator 100 is unloaded, the starting point temperature of the second tray temperature sensor 72 for detecting the second tray 52 is less than the starting point temperature of the first tray temperature sensor 71 for detecting the first tray 51 less than the starting point temperature of the compartment temperature sensor 6, and the stopping point temperature of the compartment temperature sensor 6 is less than the stopping point temperature of the second tray temperature sensor 72 for detecting the second tray 52 less than the stopping point temperature of the first tray temperature sensor 71 for detecting the first tray 51. The starting point temperatures and the stopping point temperatures of the plurality of temperature sensors are adjusted in conjunction with the positions of the two trays 5 and the temperature distribution in the constant temperature compartment 32, such that the temperature fluctuation in the constant temperature compartment 32 can be small.

[0062] Specifically, for the starting point temperatures and the stopping point temperatures of the temperature sensors, reference is made to table 1. When the refrigerator is started, the cooling unit 4 is started; when the compartment temperature reaches a preset temperature of -6.5°C, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2; the cooling unit 4 is stopped when the temperature of the second tray 52 reaches the stopping point temperature under the current condition. When the compartment temperature reaches the starting point temperature under the current condition, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2; the cooling unit 4 is stopped when both the compartment temperature and the temperature of the second tray 52 reach the stopping point temperature under the current condition; and then, control is performed according to the starting point temperature and the stopping point temperature under the current condition.

[0063] In another preferred embodiment, when the first tray 51 is unloaded and the second tray 52 located on the side of the first tray 51 away from the door 2 of the refrigerator 100 is loaded, the starting point temperature of the second tray temperature sensor 72 for detecting the second tray 52 is less than the starting point temperature of the compartment temperature sensor 6 less than the starting point temperature of the first tray temperature sensor 71 for detecting the first tray 51, and the stopping point temperature of the compartment temperature sensor 6 is less than the stopping point temperature of the second tray temperature sensor 72 for detecting the second tray 52 less than the stopping point temperature of the first tray temperature sensor 71 for detecting the first tray 51. The starting point temperatures and the stopping point temperatures of the plurality of temperature sensors are adjusted in conjunction with the positions of the two trays 5 and the temperature distribution in the constant temperature compartment 32, such that the temperature fluctuation in the constant temperature compartment 32 can be small.

[0064] Specifically, for the starting point temperatures and the stopping point temperatures of the temperature sensors, reference is made to table 1. When the refrigerator is started, after the compartment temperature reaches a preset temperature of -6.5°C, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2; the cooling unit 4 is stopped when the temperature of the first tray 51 reaches the stopping point temperature under the current condition. When the compartment temperature reaches the starting point temperature under the current condition, the cooling unit 4 is started and stopped at the period of a starting time t1 and a stopping time t2; the cooling unit 4 is stopped when both the compartment temperature and the temperature of the first tray 51 reach the stopping point temperature under the condition that the first tray 51 is unloaded and the second tray 52 is loaded; and then, control is performed according to the starting point temperature and the stopping point temperature under the current condition.

Table 1. Starting point temperatures and stopping point temperatures of the temperature sensors in the refrigerator under different load conditions

Sensor	Starting-stopping point temperature (°C)	The first tray is unloaded The second tray is unloaded	The first tray is loaded The second tray is loaded	The first tray is loaded The second tray is unloaded	The first tray is unloaded The second tray is loaded
Compartment temperature sensor	Starting point temperature	0	1.5	1.5	1.5
	Stopping point temperature	-5	-5	-5	-5
First tray temperature sensor	Starting point temperature	0.5	0.5	1	2.5
	Stopping point	-1.5	-0.5	0	-0.5
	temperature				
Second tray temperature sensor	Starting point temperature	-0.5	0	0.5	0
	Stopping point temperature	-3.5	-2	-2	-1

[0065] In addition, when defrosting is performed in the refrigerator 100 during stopping, whether the starting point temperature is reached is judged after the defrosting is finished, and when the starting point temperature is reached, the cooling unit 4 is started; when the starting point temperature is not reached, the starting point temperature is awaited.

[0066] In addition, the constant temperature compartment 32 in the present invention can also be used as the ordinary compartment 3. When the constant temperature function is started, the control method is adopted for control; when the constant temperature function is stopped and the constant temperature compartment is used as the ordinary compartment 3, control is performed based on the starting point temperature and the stopping point temperature of the temperature sensor in the compartment 3, and the starting point temperature ranges from 1°C to 9°C; the stopping point temperature is at least 1°C less than the starting point temperature. When the compartment temperature reaches the starting point temperature, the cooling unit 4 is started; when the compartment temperature decreases to the stopping point temperature, the cooling unit 4 is stopped. Preferably, when cooling is required, the cooling unit 4 is started and stopped at a period of a starting time t3 and a stopping time t4. In a specific embodiment, t3 is 90s and t2 is 10s.

[0067] In conclusion, in the refrigerator 100 according to the present invention, the cooling unit 4 is controlled according to the compartment temperature and the tray temperature to supply cold energy to the constant temperature compartment 32, and the temperature of the constant temperature compartment 32 and the temperature of the food in the constant temperature compartment are taken into consideration, such that the temperature fluctuation in the constant temperature compartment 32 is small.

[0068] It should be understood that although the present specification is described based on embodiments, not every embodiment contains only one independent technical solution. Such a narration way of the present specification is only for the sake of clarity. Those skilled in the art should take the present specification as an entirety. The technical solutions in the respective embodiments may be combined properly to form other embodiments which may be understood by those skilled in the art.

[0069] A series of the detailed descriptions set forth above is merely specific description of feasible embodiments of the present invention, and is not intended to limit the protection scope of the present invention. Equivalent embodiments or modifications made within the spirit of the present invention shall fall within the protection scope of the present invention.

Claims

1. A refrigerator, comprising a constant temperature compartment and a cooling unit for cooling the constant temperature compartment, wherein the refrigerator further comprises at least one tray located in the constant temperature compartment, a compartment temperature sensor for detecting a temperature in the constant temperature compartment, a tray temperature sensor for detecting a temperature of the tray, and a controller, and the cooling unit, the compartment temperature sensor and the tray temperature sensor are all communicatively connected with the controller.

2. The refrigerator according to claim 1, wherein the tray at least comprises a first tray and a second tray which are arranged at intervals, and the tray temperature sensor at least comprises a first tray temperature sensor and a second tray temperature sensor which are configured to detect temperatures of the first tray and the second tray respectively.

3. The refrigerator according to claim 2, wherein the refrigerator further comprises a door for opening or closing the constant temperature compartment, and the second tray is located on a side of the first tray away from the door; a starting point temperature of the first tray temperature sensor is higher than a starting point temperature of the second tray temperature sensor, and a stopping point temperature of the first tray temperature sensor is higher than a stopping point temperature of the second tray temperature sensor;
or, the refrigerator further comprises a door for opening or closing the constant temperature compartment, the first tray and the second tray are arranged side by side along a width direction of the door of the refrigerator, and the starting point temperatures and the stopping point temperatures of the first tray sensor and the second tray sensor are the same.

4. The refrigerator according to claim 1, wherein the cooling unit comprises an air duct communicated with the constant temperature compartment, at least one air inlet for allowing cold air in the air duct to enter the constant temperature compartment, a cold source located in the air duct, and a fan for driving the cold air to enter the constant temperature compartment from the air duct; the cold source is configured as an evaporator of a refrigerant refrigeration cycle unit, or a cold end of a semiconductor refrigeration unit, or a cold accumulation module.

5. The refrigerator according to claim 4, wherein the tray is provided at a bottom of the constant temperature compartment, the at least one air inlet is provided at a top of the constant temperature compartment, and the compartment temperature sensor is also provided at the top of the constant temperature compartment.

6. A control method of a refrigerator, comprising:

acquiring a compartment temperature in a constant temperature compartment, and acquiring a tray temperature;
when the compartment temperature reaches a starting point temperature of a compartment temperature sensor and the tray temperature reaches a starting point temperature of a tray temperature sensor, starting a cooling unit; and
when the compartment temperature reaches a stopping point temperature of the compartment temperature sensor and the tray temperature reaches a stopping point temperature of the tray temperature sensor, stopping the cooling unit.

7. The control method of a refrigerator according to claim 6, wherein before the cooling unit is started, when only the compartment temperature reaches the starting point temperature of the compartment temperature sensor, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and the cooling unit is stopped after the compartment temperature is lower than the starting point temperature of the compartment temperature sensor;
or, before the cooling unit is started, when only the tray temperature reaches the starting point temperature of the tray temperature sensor, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and the cooling unit is stopped after the tray temperature is lower than the starting point temperature of the tray temperature sensor.

8. The control method of a refrigerator according to claim 6, wherein during starting of the cooling unit, when the compartment temperature decreases to the stopping point temperature of the compartment temperature sensor, the cooling unit is started and stopped at the period of a starting time t1 and a stopping time t2.

9. The control method of a refrigerator according to claim 6, wherein the tray temperature sensor comprises a first tray sensor for detecting a first tray and a second tray sensor for detecting a second tray; the first tray and the second tray are arranged side by side along a width direction of a door of the refrigerator, and starting point temperatures and stopping point temperatures of the first tray temperature sensor and the second tray sensor are the same;
or, the tray temperature sensor comprises a first tray sensor for detecting a first tray and a second tray sensor for detecting a second tray; the second tray is located on a side of the first tray away from a door of the refrigerator, the starting point temperature of the first tray temperature sensor is higher than the starting point temperature of the second tray temperature sensor, and the stopping point temperature of the first tray temperature sensor is higher than the stopping point temperature of the second tray temperature sensor.

10. A control method of a refrigerator, comprising:

acquiring load information of a tray in the refrigerator;
acquiring a compartment temperature in a constant temperature compartment, and acquiring a tray temperature; and
controlling a cooling unit to be started and stopped according to starting point temperatures and stopping point temperatures of a compartment temperature sensor for detecting the compartment temperature and a tray temperature sensor for detecting the tray temperature under a current load condition.

11. The control method of a refrigerator according to claim 10, wherein when the tray is unloaded, the cooling unit is started, and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when the tray is unloaded or the tray temperature reaches the stopping point temperature of the tray temperature sensor when the tray is unloaded, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and when both the compartment temperature and the tray temperature are reduced to the stopping point temperatures, the cooling unit is stopped;

or, when the tray is loaded, the cooling unit is started, and when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when the tray is loaded or the tray temperature reaches the stopping point temperature of the tray temperature sensor when the tray is loaded, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2, and when both the compartment temperature and the tray temperature are reduced to the stopping point temperatures when the tray is loaded, the cooling unit is stopped;
or, when some trays in the refrigerator are loaded and other trays are unloaded, the cooling unit is started; when the compartment temperature reaches a preset temperature T0, the cooling unit is started and stopped at a period of a starting time t1 and a stopping time t2; the cooling unit is stopped when the temperature of the unloaded tray reaches the stopping point temperature of the tray temperature sensor for detecting the tray when some trays are loaded and other trays are unloaded; the preset temperature T0 is lower than the stopping point temperature of the compartment temperature sensor under the condition that some trays are loaded and other trays are unloaded; when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when some trays are loaded and other trays are unloaded, the cooling unit is started and stopped at the period of a starting time t1 and a stopping time t2; when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor when some trays are loaded and other trays are unloaded, and the temperature of the unloaded tray reaches the stopping point temperature of the tray temperature sensor for detecting the tray when some trays are loaded and other trays are unloaded, the cooling unit is stopped.

12. The control method of a refrigerator according to claim 11, wherein when a first tray and a second tray located on a side of the first tray away from a door of the refrigerator are unloaded, a starting point temperature of a second tray temperature sensor for detecting the second tray is less than the starting point temperature of the compartment temperature sensor less than a starting point temperature of a first tray temperature sensor for detecting the first tray, and the stopping point temperature of the compartment temperature sensor is less than a stopping point temperature of the second tray temperature sensor for detecting the second tray less than a stopping point temperature of the first tray temperature sensor for detecting the first tray.

13. The control method of a refrigerator according to claim 11, wherein when the first tray and the second tray located on the side of the first tray away from the door of the refrigerator are both loaded, the starting point temperature of the second tray temperature sensor for detecting the second tray is less than the starting point temperature of the first tray temperature sensor for detecting the first tray less than the starting point temperature of the compartment temperature sensor, and the stopping point temperature of the compartment temperature sensor is less than the stopping point temperature of the second tray temperature sensor for detecting the second tray less than the stopping point temperature of the first tray temperature sensor for detecting the first tray.

14. The control method of a refrigerator according to claim 11, wherein when the first tray is loaded, and the second tray located on the side of the first tray away from the door of the refrigerator is unloaded, the starting point temperature of the second tray temperature sensor for detecting the second tray is less than the starting point temperature of the first tray temperature sensor for detecting the first tray less than the starting point temperature of the compartment temperature sensor, and the stopping point temperature of the compartment temperature sensor is less than the stopping point temperature of the second tray temperature sensor for detecting the second tray less than the stopping

point temperature of the first tray temperature sensor for detecting the first tray;
or, when the first tray is unloaded and the second tray located on the side of the first tray away from the door of the refrigerator is loaded, the starting point temperature of the second tray temperature sensor for detecting the second tray is less than the starting point temperature of the compartment temperature sensor less than the starting point temperature of the first tray temperature sensor for detecting the first tray, and the stopping point temperature of the compartment temperature sensor is less than the stopping point temperature of the second tray temperature sensor for detecting the second tray less than the stopping point temperature of the first tray temperature sensor for detecting the first tray.

15. The control method of a refrigerator according to claim 11, wherein after the cooling unit is stopped, the compartment temperature in the constant temperature compartment is acquired, and the tray temperature is acquired;

when the compartment temperature reaches the starting point temperature of the compartment temperature sensor under the current load condition and the tray temperature reaches the starting point temperature of the tray temperature sensor under the current load condition, the cooling unit is started; and
when the compartment temperature reaches the stopping point temperature of the compartment temperature sensor under the current load condition and the tray temperature reaches the stopping point temperature of the tray temperature sensor under the current load condition, the cooling unit is stopped.

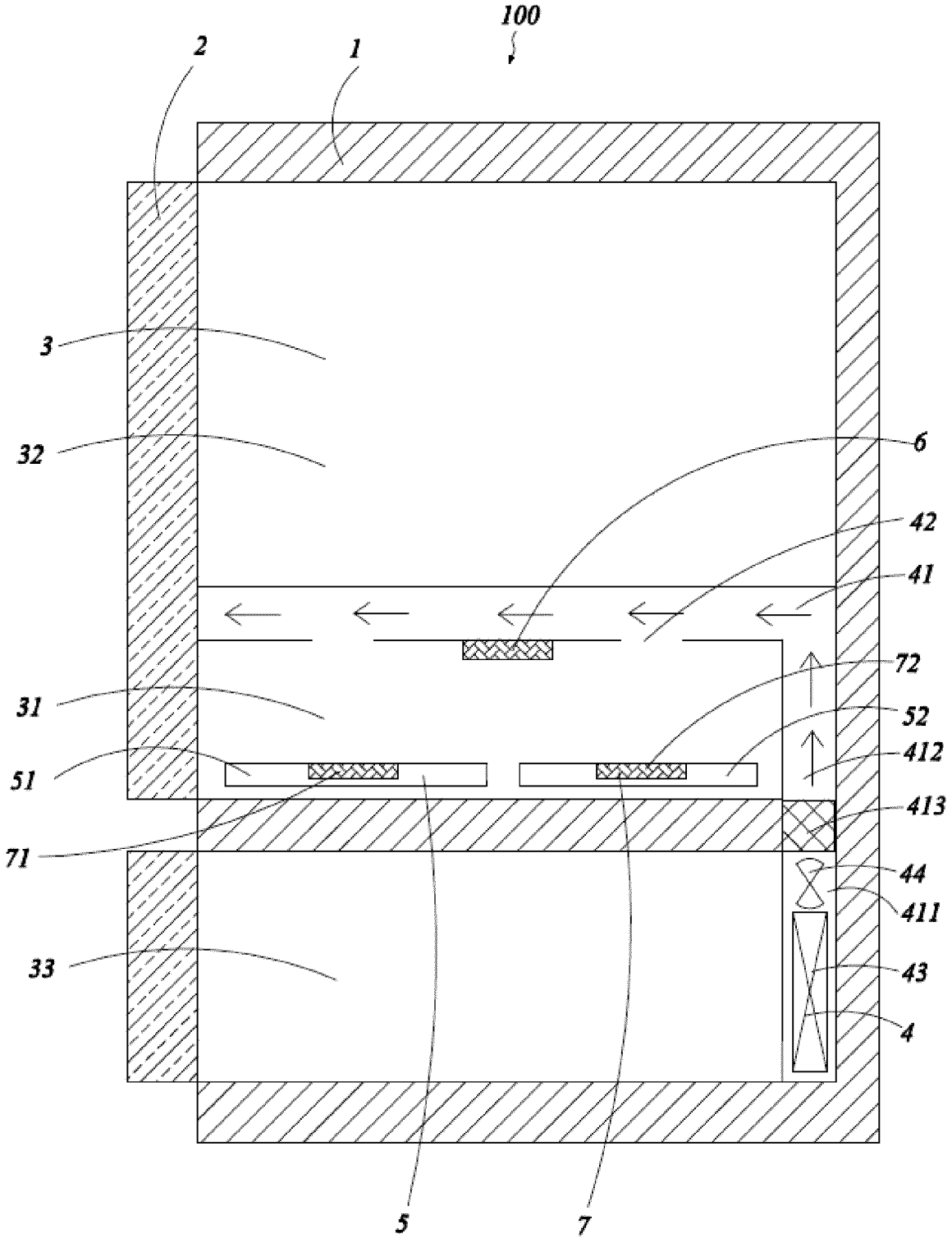

FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/093199

A. CLASSIFICATION OF SUBJECT MATTER

F25D 29/00(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)

F25D

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)

CNTXT, CNABS, CNKI, SIPOABS, DWPI: 恒温, 温度, 波动, 托盘, 传感器, 室温, 控制器, 风道, 周期, 负载, constant, temperature, fluctuation, tray, sensor, inner, controller, duct, cycle, load

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 105698460 A (QINGDAO HAIER INTELLIGENT TECHNOLOGY RESEARCH AND DEVELOPMENT CO., LTD.) 22 June 2016 (2016-06-22) description, paragraphs [0018]-[0030], and figure 1	1, 4-5
Y	CN 105698460 A (QINGDAO HAIER INTELLIGENT TECHNOLOGY RESEARCH AND DEVELOPMENT CO., LTD.) 22 June 2016 (2016-06-22) description, paragraphs [0018]-[0030], and figure 1	2-3, 6-10
Y	CN 103940195 A (HEFEI HUALING CO., LTD.) 23 July 2014 (2014-07-23) description, paragraphs [0026]-[0066], and figures 1-4	2-3, 6-10
X	CN 105758109 A (HEFEI HAIER REFRIGERATOR CO., LTD.) 13 July 2016 (2016-07-13) description, paragraphs [0026]-[0075], and figures 1-4	1, 4-5
A	CN 105222508 A (QINGDAO HAIER INTELLIGENT HOME APPLIANCE TECHNOLOGY CO., LTD.) 06 January 2016 (2016-01-06) entire document	1-15
A	US 2016162715 A1 (EBAY INC.) 09 June 2016 (2016-06-09) entire document	1-15

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 July 2021	**05 August 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/093199

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CN 103940195 A	23 July 2014	CN 103940195 B	24 August 2016
CN 105758109 A	13 July 2016	None	
CN 105222508 A	06 January 2016	CN 105222508 B	02 April 2021
US 2016162715 A1	09 June 2016	WO 2016089440 A1	09 June 2016
		US 9449208 B2	20 September 2016

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