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(54) **TEMPERATURE CONTROL METHOD, CONTROL DEVICE OF VARIABLE TEMPERATURE CHAMBER IN REFRIGERATOR, AND REFRIGERATOR**

(57) An embodiment of the present invention provides a temperature control method and control device of a variable-temperature compartment in a refrigerator, and a refrigerator. The refrigerator includes a variable-temperature compartment and a refrigeration system adapted to generate cold air to cool the variable-temperature compartment. The refrigeration system includes an evaporator configured corresponding to the variable-temperature compartment. The temperature control method of a variable-temperature compartment in a refrigerator includes: obtaining a set temperature of the variable-temperature compartment; determining whether the set temperature is greater than or equal to a first temperature threshold, if yes, executing a non-freezing temperature control mode on the variable-temperature compartment; and if no, executing a freezing temperature control mode on the variable-temperature compartment, where the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment and a temperature of the evaporator to cool the variable-temperature compartment, and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment to cool the variable-temperature compartment. In the technical solutions of the embodiments of the present invention, temperature control modes of the variable-temperature compartment can be flexibly changed, and it is conducive to saving energy and defrosting in the non-freezing temperature control mode and improving a cooling rate in the freezing temperature control mode.

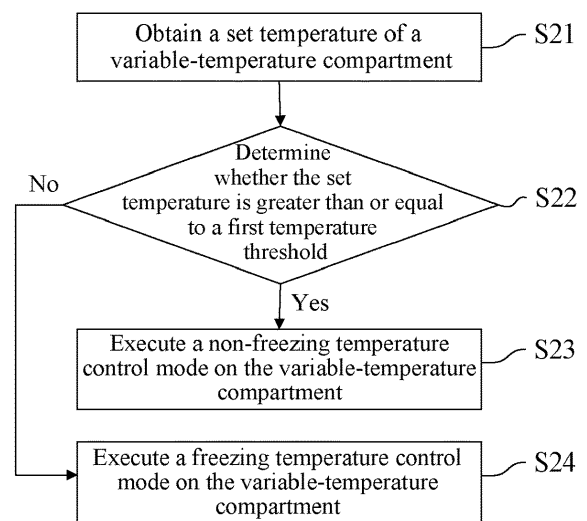


FIG. 2

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of household appliance technologies, and in particular, to a temperature control method and control device of a variable-temperature compartment in a refrigerator, and a refrigerator.

BACKGROUND

[0002] With continuous improvement of people's living standard and diversified development of item storage requirements, people's functional requirements for a refrigerator gradually increase. Currently, storage demands for the refrigerator are no longer limited to simple refrigerating and freezing modes, and more and more refrigerators are gradually provided with a variable-temperature compartment capable of being flexibly changed between non-freezing and freezing modes. However, how to flexibly control a temperature in the variable-temperature compartment is a problem urgently to be resolved.

SUMMARY

[0003] An objective of the present invention is to provide a temperature control method and control device of a variable-temperature compartment in a refrigerator, and a refrigerator.

[0004] The refrigerator provided in the embodiments of the present invention includes a variable-temperature compartment and a refrigeration system adapted to generate cold air to cool the variable-temperature compartment. The refrigeration system includes an evaporator configured corresponding to the variable-temperature compartment.

[0005] A temperature control method of a variable-temperature compartment in a refrigerator provided in the embodiments of the present invention includes: obtaining a set temperature of the variable-temperature compartment; determining whether the set temperature is greater than or equal to a first temperature threshold, if yes, executing a non-freezing temperature control mode on the variable-temperature compartment; and if no, executing a freezing temperature control mode on the variable-temperature compartment, where the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment and a temperature of the evaporator to cool the variable-temperature compartment, and the freezing temperature control mode is that the refrigeration system based on the temperature of the variable-temperature compartment to cool the variable-temperature compartment.

[0006] Optionally, the non-freezing temperature control mode includes: obtaining the temperature of the variable-temperature compartment and the temperature of

the evaporator; and determining whether the temperature of the variable-temperature compartment is greater than a second temperature threshold, and determining whether the temperature of the evaporator is greater than a third temperature threshold, if yes, operating the refrigeration system.

[0007] Optionally, the second temperature threshold is equal to the set temperature.

[0008] Optionally, the third temperature threshold is equal to the temperature of the variable-temperature compartment.

[0009] Optionally, the refrigeration system includes a fan adapted to introduce the cold air into the variable-temperature compartment. The non-freezing temperature control mode includes: operating the fan in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is less than the third temperature threshold.

[0010] Optionally, the refrigerator includes a closable drawer located in the variable-temperature compartment. The non-freezing temperature control mode includes: determining, before the refrigeration system is operated, whether the drawer is closed, if yes, operating the refrigeration system; and if no, closing the drawer and then operating the refrigeration system.

[0011] Optionally, the non-freezing temperature control mode includes: determining, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the second temperature threshold, if yes, stopping operating the refrigeration system.

[0012] Optionally, the freezing temperature control mode includes: obtaining the temperature of the variable-temperature compartment; and determining whether the temperature of the variable-temperature compartment is greater than a fourth temperature threshold, if yes, operating the refrigeration system.

[0013] Optionally, the fourth temperature threshold is equal to the set temperature.

[0014] Optionally, the refrigerator includes a closable drawer located in the variable-temperature compartment. The freezing temperature control mode includes: determining, before the refrigeration system is operated, whether the drawer is open, if yes, operating the refrigeration system; and if no, opening the drawer and then operating the refrigeration system.

[0015] Optionally, the freezing temperature control mode includes: determining, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the fourth temperature threshold, if yes, stopping operating the refrigeration system.

[0016] A control device of a variable-temperature compartment in a refrigerator provided in the embodiments of the present invention includes: an obtaining module, configured to obtain a set temperature of the variable-temperature compartment; a determining module, con-

figured to determine whether the set temperature is greater than or equal to a first temperature threshold; and a processing module, configured to execute a non-freezing temperature control mode on the variable-temperature compartment in a case that the set temperature is greater than or equal to the first temperature threshold, and execute a freezing temperature control mode on the variable-temperature compartment in a case that the set temperature is less than the first temperature threshold, where the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment and a temperature of the evaporator to cool the variable-temperature compartment, and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment to cool the variable-temperature compartment.

[0017] Optionally, the processing module includes: a first obtaining unit, configured to obtain the temperature of the variable-temperature compartment and the temperature of the evaporator; a first determining unit, configured to determine whether the temperature of the variable-temperature compartment is greater than a second temperature threshold, and determine whether the temperature of the evaporator is greater than a third temperature threshold; and a first processing unit, configured to operate the refrigeration system in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is greater than the third temperature threshold, to execute the non-freezing temperature control mode.

[0018] Optionally, the refrigeration system includes a fan adapted to introduce the cold air into the variable-temperature compartment. The first processing unit is configured to operate the fan in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is less than the third temperature threshold.

[0019] Optionally, the refrigerator includes a closable drawer located in the variable-temperature compartment. The first determining unit is configured to determine, before the refrigeration system is operated, whether the drawer is closed. The first processing unit is configured to operate the refrigeration system in a case that the drawer is closed, or close the drawer and then operate the refrigeration system in a case that the drawer is not closed.

[0020] Optionally, the first determining unit is configured to determine, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the second temperature threshold. The first processing unit is configured to stop operating the refrigeration system in a case that the temperature of the variable-temperature compartment is less than or equal to the second temper-

ature threshold, to stop executing the non-freezing temperature control mode.

[0021] Optionally, the processing module includes: a second obtaining unit, configured to obtain the temperature of the variable-temperature compartment; a second determining unit, configured to determine whether the temperature of the variable-temperature compartment is greater than a fourth temperature threshold; and a second processing unit, configured to operate the refrigeration system in a case that the temperature of the variable-temperature compartment is greater than the fourth temperature threshold, to execute the freezing temperature control mode.

[0022] Optionally, the refrigerator includes a closable drawer located in the variable-temperature compartment. The second determining unit is configured to determine, before the refrigeration system is operated, whether the drawer is open. The second processing unit is configured to operate the refrigeration system in a case that the drawer is open, or open the drawer and then operate the refrigeration system in a case that the drawer is not open.

[0023] Optionally, the second determining unit is configured to determine, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the fourth temperature threshold. The second processing unit is configured to stop operating the refrigeration system in a case that the temperature of the variable-temperature compartment is less than or equal to the fourth temperature threshold, to stop executing the freezing temperature control mode.

[0024] The refrigerator provided in this embodiment of the present invention further includes a control module.

The control module includes a processor and a memory, the memory stores a computer program executable by the processor, and the computer program, when executed by the processor, performing the temperature control method of a variable-temperature compartment in a refrigerator provided in the embodiments of the present invention.

[0025] Optionally, the refrigerator further includes a closable drawer located in the variable-temperature compartment and a cover adapted to open or close the drawer.

[0026] Optionally, the refrigeration system includes a fan adapted to introduce the cold air into the variable-temperature compartment.

[0027] Compared with the related art, the technical solutions of the embodiments of the present invention have the following beneficial effects.

[0028] For example, while determining, based on a set temperature, whether to execute a non-freezing temperature control mode or a freezing temperature control mode on a variable-temperature compartment, the non-freezing temperature control mode is executed based on a temperature of the variable-temperature compartment and a temperature of an evaporator, and the freezing

temperature control mode is executed based on the temperature of the variable-temperature compartment. In this way, temperature control modes of the variable-temperature compartment can be flexibly changed, and it is conducive to saving energy and defrosting in the non-freezing temperature control mode and improving a cooling rate in the freezing temperature control mode.

[0029] In another example, a drawer of the variable-temperature compartment is further configured to be closable, the drawer is closed in the non-freezing temperature control mode, and the drawer is open in the freezing temperature control mode, so that a fresh-keeping effect of items in the non-freezing temperature control mode may be improved, and freeze between the drawer and a cover in the freezing temperature control mode may be prevented, thereby improving user experience.

[0030] In another example, the technical solutions provided in the embodiments of the present invention may be implemented without considerable and complex reconstruction on the structure of existing refrigerators, which is simple and easy to implement, and is conducive to reducing costs.

[0031] Other features of the present invention are to be presented in the claims, accompanying drawings, and description of the accompanying drawings. Features and feature combinations described in the foregoing description and features and feature combinations described and/or simply shown in the accompanying drawings can not only be respectively presented in the described combinations, but also be presented in other combinations or separately presented without departing from the scope of the present invention. Embodiments that are not described in the present invention and not specifically shown in the accompanying drawings, but can be considered according to the detailed description of the embodiments and can be obtained according to combinations of various features shall be constructed to be included and disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032]

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

FIG. 2 is a schematic flowchart of a temperature control method of a variable-temperature compartment in a refrigerator according to an embodiment of the present invention; and

FIG. 3 is a principle block diagram of a control device of a variable-temperature compartment in a refrigerator according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0033] In the related art, more and more refrigerators

are gradually provided with a variable-temperature compartment capable of being flexibly changed between non-freezing and freezing modes. However, how to flexibly control a temperature in the variable-temperature compartment is a problem urgently to be resolved.

[0034] An embodiment of the present invention provides a temperature control method and control device of a variable-temperature compartment in a refrigerator, and a refrigerator. The refrigerator includes a variable-temperature compartment and a refrigeration system adapted to generate cold air to cool the variable-temperature compartment. The refrigeration system includes an evaporator configured corresponding to the variable-temperature compartment. The temperature control method of a variable-temperature compartment in a refrigerator includes: obtaining a set temperature of the variable-temperature compartment; determining whether the set temperature is greater than or equal to a first temperature threshold, if yes, executing a non-freezing temperature control mode on the variable-temperature compartment; and if no, executing a freezing temperature control mode on the variable-temperature compartment, where the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment and a temperature of the evaporator to cool the variable-temperature compartment, and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment to cool the variable-temperature compartment.

[0035] In the technical solutions of the embodiments of the present invention, while determining, based on a set temperature, whether to execute a non-freezing temperature control mode or a freezing temperature control mode on a variable-temperature compartment, the non-freezing temperature control mode is executed based on a temperature of the variable-temperature compartment and a temperature of an evaporator, and the freezing temperature control mode is executed based on the temperature of the variable-temperature compartment. In this way, temperature control modes of the variable-temperature compartment can be flexibly changed, and it is conducive to saving energy and defrosting in the non-freezing temperature control mode and improving a cooling rate in the freezing temperature control mode.

[0036] To make objectives, features, and beneficial effects of the embodiments of the present invention more comprehensible, the following describes specific embodiments of the present invention in detail with reference to the accompanying drawings. It may be understood that the specific embodiments to be described below are only used to explain the present invention, but not to intended to limit the present invention. In addition, for ease of description, some accompanying drawings of the embodiments of the present invention only show parts relevant to the present invention rather than the entire structure.

[0037] Referring to FIG. 1, an embodiment of the

present invention provides a refrigerator 10.

[0038] Specifically, the refrigerator 10 includes a variable-temperature compartment 11 adapted to store items at a relatively low temperature and a refrigeration system (not shown in FIG. 1) adapted to generate cold air to cool the variable-temperature compartment 11.

[0039] In a specific implementation, the refrigeration system includes a compressor, a condenser, an evaporator, and a dryer. The compressor, the condenser, the dryer, the evaporator, and the compressor are connected in sequence to form a refrigeration loop applicable to circulation of a refrigerant.

[0040] In the refrigeration loop, the compressor is adapted to compress a low-temperature and low-pressure gas refrigerant from the evaporator into a high-temperature and high-pressure gas refrigerant, the condenser is adapted to condense the high-temperature and high-pressure gas refrigerant from the compressor into a low-temperature and high-pressure liquid refrigerant, the dryer is adapted to remove moisture and impurities of the low-temperature and high-pressure liquid refrigerant from the condenser and throttle and depressurize the low-temperature and high-pressure liquid refrigerant to a low-temperature and low-pressure liquid refrigerant, and the evaporator is adapted to evaporate the low-temperature and low-pressure liquid refrigerant from the dryer into a low-temperature and low-pressure gas refrigerant. In the process of evaporating the low-temperature and low-pressure liquid refrigerant into the low-temperature and low-pressure gas refrigerant, heat inside the refrigerator 10 may be constantly absorbed to generate cold air, thereby implementing refrigeration inside refrigerator 10.

[0041] In this embodiment of the present invention, the refrigeration system includes an evaporator independently configured corresponding to the variable-temperature compartment 11. To be specific, one evaporator is only configured to cool one variable-temperature compartment 11.

[0042] In some embodiments, the refrigerator 10 may further include a refrigerating compartment 12 and/or a freezing compartment 13 that are also adapted to store items at a relatively low temperature. In this case, the refrigeration system further includes an evaporator configured corresponding to the refrigerating compartment 12 and/or the freezing compartment 13.

[0043] In an embodiment of the present invention, a corresponding temperature control method is provided only for the variable-temperature compartment 11 in the refrigerator 10. Referring to FIG. 2, the temperature control method of a variable-temperature compartment in a refrigerator provided in this embodiment of the present invention includes the following steps:

S21: Obtain a set temperature of a variable-temperature compartment.

S22: Determine whether the set temperature is greater than or equal to a first temperature threshold,

if yes, perform step S23; and if no, perform step S24.

S23: Execute a non-freezing temperature control mode on the variable-temperature compartment.

S24: Execute a freezing temperature control mode on the variable-temperature compartment.

[0044] In a specific implementation of step S21, the set temperature of the variable-temperature compartment is adjusted by a user based on current item storage requirements for the variable-temperature compartment.

[0045] In some embodiments, the set temperature of the variable-temperature compartment may be adjusted based on a specific temperature value.

[0046] When the user expects to store items under a freezing condition, the set temperature of the variable-temperature compartment may be adjusted to a temperature suitable for freeze, for example, -18°C .

[0047] When the user expects to store items under a non-freezing condition, the set temperature of the variable-temperature compartment may be adjusted to a temperature relatively higher than a temperature under the freezing condition. For example, when the user expects to store items under an ordinary refrigerating condition, the set temperature of the variable-temperature compartment may be adjusted to 5°C ; or when the user expects to store items under an ice-temperature condition (that is, under a condition between the freezing condition and the non-freezing condition), the set temperature of the variable-temperature compartment may be adjusted to 0°C .

[0048] In some other embodiments, the set temperature of the variable-temperature compartment may also be adjusted based on a temperature range.

[0049] When the user expects to store items under a freezing condition, the set temperature of the variable-temperature compartment may be adjusted to a first temperature range, where the first temperature range represents temperatures suitable for freeze, for example, $[-18^{\circ}\text{C}, -16^{\circ}\text{C}]$.

[0050] When the user expects to store items under a non-freezing condition, the set temperature of the variable-temperature compartment may be adjusted to a second temperature range or a third temperature range. For example, when the user expects to store items under an ordinary refrigerating condition, the set temperature of the variable-temperature compartment may be adjusted to the second temperature range, where the second temperature range represents temperatures suitable for ordinary refrigeration, for example, $[5^{\circ}\text{C}, 10^{\circ}\text{C}]$. Alternatively, when the user expects to store items under an ice-temperature condition (that is, under a condition between the freezing condition and the non-freezing condition), the set temperature of the variable-temperature compartment may be adjusted to the third temperature range, where the third temperature range represents temperatures suitable for ice-temperature storage, for example, $[-3^{\circ}\text{C}, 3^{\circ}\text{C}]$.

[0051] In a specific implementation, each temperature

range may be represented as a temperature interval rather than a temperature value. Two endpoint values of each temperature interval respectively represent a maximum value and a minimum value of the temperature range.

[0052] In this embodiment of the present invention, the ordinary refrigeration and the ice-temperature storage may be distinguished, or may not be distinguished. When the ordinary refrigeration and the ice-temperature storage are not distinguished, the third temperature range and the second temperature range may be integrated into one temperature range.

[0053] In this embodiment of the present invention, the ordinary refrigeration and the ice-temperature storage are collectively referred to as non-freeze regardless of whether the two are distinguished.

[0054] Referring to FIG. 1, the refrigerator 10 further includes a door 14 adapted to open or close the variable-temperature compartment 11 and an operation panel 15 disposed on an outer side surface of the door 14.

[0055] In a specific implementation, the operation panel 15 is adapted to be operated by the user to adjust the set temperature. Specifically, the operation panel 15 is adapted to be operated by the user to adjust a specific value or the temperature range of the set temperature.

[0056] In this embodiment of the present invention, which temperature control mode is to be executed on the variable-temperature compartment is determined based on the set temperature of the variable-temperature compartment.

[0057] In a specific implementation, the temperature control mode may include a non-freezing temperature control mode and a freezing temperature control mode.

[0058] Specifically, the non-freezing temperature control mode and the freezing temperature control mode may be distinguished based on the first temperature threshold. The non-freezing temperature control mode is adapted to be executed in a case that the set temperature of the variable-temperature compartment is greater than or equal to the first temperature threshold. The freezing temperature control mode is adapted to be executed in a case that the set temperature of the variable-temperature compartment is less than the first temperature threshold.

[0059] In this embodiment of the present invention, the first temperature threshold is mainly used for defining a non-freezing and freezing modes of the items stored in the refrigerator, and may be set based on a relevant country, industry, enterprise standard, and user's general cognition to which the refrigerator belongs. For example, the first temperature threshold may be set to -3°C.

[0060] In a specific implementation of step S22, whether the set temperature of the variable-temperature compartment is greater than or equal to the first temperature threshold is determined.

[0061] In a case that the set temperature of the variable-temperature compartment is greater than or equal to the first temperature threshold, step S23 is performed, and the non-freezing temperature control mode is exe-

cuted on the variable-temperature compartment.

[0062] In a case that the set temperature of the variable-temperature compartment is less than the first temperature threshold, step S24 is performed, and the freezing temperature control mode is executed on the variable-temperature compartment.

[0063] In this embodiment of the present invention, alternatively, the non-freezing temperature control mode may be executed in a case that the set temperature of the variable-temperature compartment is greater than the first temperature threshold, and the freezing temperature control mode is executed in a case that the set temperature of the variable-temperature compartment is less than or equal to the first temperature threshold.

[0064] In this embodiment of the present invention, the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment and a temperature of the evaporator to cool the variable-temperature compartment, and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment to cool the variable-temperature compartment.

[0065] Specifically, a specific implementation of the non-freezing temperature control mode may include the following steps:

S31: Obtain a temperature of a variable-temperature compartment and a temperature of an evaporator.

S32: Determine whether the temperature of the variable-temperature compartment is greater than a second temperature threshold, and determine whether the temperature of the evaporator is greater than a third temperature threshold, if yes, operate a refrigeration system.

[0066] In a specific implementation of step S31, the temperature of the variable-temperature compartment and the temperature of the evaporator may be obtained by using a temperature sensor. The evaporator may be an evaporator independently configured corresponding to the variable-temperature compartment.

[0067] In a specific implementation, the refrigerator provided in the embodiments of the present invention further includes a variable-temperature compartment temperature sensor and an evaporator temperature sensor that are configured respectively corresponding to the variable-temperature compartment and the evaporator, and are respectively configured to acquire the temperature of the variable-temperature compartment and the temperature of the evaporator.

[0068] In a specific implementation of step S32, whether to operate the refrigeration system to cool the variable-temperature compartment may be determined based on the temperature of the variable-temperature compartment and the temperature of the evaporator.

[0069] Specifically, whether the temperature of the variable-temperature compartment is greater than the sec-

ond temperature threshold may be determined, and whether the temperature of the evaporator is greater than the third temperature threshold may be determined. The refrigeration system is operated in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold and the temperature of the evaporator is greater than the third temperature threshold.

[0070] In this embodiment of the present invention, operating the refrigeration system includes: simultaneously operating the compressor, the condenser, the evaporator, and the dryer in the refrigeration system, and enabling the refrigerant to flow in the refrigeration loop.

[0071] In a specific implementation, the second temperature threshold refers to a temperature threshold at which the variable-temperature compartment cannot achieve a non-freezing cooling effect and needs to receive cold energy for cooling.

[0072] Specifically, the second temperature threshold may be determined based on the set temperature of the variable-temperature compartment.

[0073] The second temperature threshold may be equal to the set temperature in a case that the set temperature is adjusted based on a specific value.

[0074] The second temperature threshold may be equal to a startup temperature threshold of the refrigerator under an existing non-freezing mode in a case that the set temperature is adjusted based on the temperature range. The existing non-freezing mode refers to a non-freezing mode of the refrigerator in the related art. The "startup" in the startup temperature threshold refers to enabling the refrigeration system and causing the entire refrigeration loop to operate.

[0075] In this embodiment of the present invention, the second temperature threshold may alternatively be slightly higher than the set temperature, which is conducive to energy saving and environmental protection.

[0076] For example, in a case that the set temperature is adjusted based on a specific value, the second temperature threshold may be equal to the set temperature plus 0.5°C. In a case that the set temperature is adjusted based on the temperature range, the second temperature threshold may be equal to the startup temperature threshold of the refrigerator under the existing non-freezing mode plus 0.5°C.

[0077] Generally, in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, from the perspective of the variable-temperature compartment, the refrigeration system is expected to be operated immediately to cool the variable-temperature compartment. However, from the perspective of the evaporator, there may be excess cold energy for continuously cooling the variable-temperature compartment, and there is no need to immediately operate the refrigeration system, which is not conducive to defrosting the evaporator.

[0078] In this embodiment of the present invention, whether the temperature of the variable-temperature

compartment is greater than the second temperature threshold is to be determined, and whether the temperature of the evaporator is greater than the third temperature threshold is also to be determined.

5 **[0079]** Specifically, the third temperature threshold may be equal to the temperature of the variable-temperature compartment.

10 **[0080]** Determining whether the temperature of the evaporator is greater than the third temperature threshold is specifically refers to determining whether the temperature of the evaporator is greater than the temperature of the variable-temperature compartment.

15 **[0081]** In a case that the temperature of the evaporator is greater than the temperature of the variable-temperature compartment, the evaporator has no excess cold energy for cooling the variable-temperature compartment. In this case, from the perspective of evaporator, it is also necessary to operate the refrigeration system.

20 **[0082]** In a case that the temperature of the evaporator is less than the temperature of the variable-temperature compartment, the evaporator still has excess cold energy for cooling the variable-temperature compartment. In this case, from the perspective of evaporator, there is no need to operate the refrigeration system. In this way, it is not only conducive to energy saving and environmental protection, but also conducive to defrosting the evaporator.

25 **[0083]** In this embodiment of the present invention, from the perspectives of both the variable-temperature compartment and the evaporator, the refrigeration system is operated only when both the variable-temperature compartment and the evaporator refrigeration system require the refrigeration system to be operated. To be specific, the refrigeration system is operated only in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is greater than the third temperature threshold.

30 **[0084]** In this embodiment of the present invention, the refrigeration system may further include a fan adapted to introduce the cold air generated by the evaporator into the variable-temperature compartment.

35 **[0085]** Correspondingly, the non-freezing temperature control mode may further include: operating the fan in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is less than the third temperature threshold.

40 **[0086]** In this way, in a case that the evaporator still has excess cold energy, the excess cold energy may be introduced into the variable-temperature compartment for cooling by using the fan, which is not only conducive to energy saving and environmental protection, but also conducive to defrosting the evaporator.

45 **[0087]** Referring to FIG. 1, the refrigerator 10 provided in the embodiments of the present invention may further include a closable drawer 16 located in the variable-temperature compartment 11.

[0088] Correspondingly, the non-freezing temperature control mode may further include:

determining, before the refrigeration system is operated, whether the drawer is closed, if yes, operating the refrigeration system; and if no, closing the drawer and then operating the refrigeration system.

[0089] In the non-freezing mode, based on fresh-keeping requirements for storage items (especially for items such as fruit and vegetables), the drawer in the variable-temperature compartment may be closed, and the refrigeration system is operated only when the drawer is closed. In this way, the fresh-keeping effect of the items may be improved, frost damage of the items may be prevented, air-drying and dehydration of the items may be reduced, and it is conducive to energy saving and environmental protection.

[0090] Specifically, the refrigerator provided in the embodiments of the present invention may further include a cover adapted to open or close the drawer of the variable-temperature compartment, and a cover sensor adapted to detect whether the drawer is open or closed by the cover.

[0091] In a specific implementation, the cover may open or close the drawer by user's manual operation, or automatically open or close the drawer based on the set temperature. For example, in a case that it is determined based on the set temperature that the non-freezing temperature control mode needs to be executed, the cover may be controlled to automatically close the drawer.

[0092] In a specific implementation, conventional technical means in the art may be used for the cover to automatically close or open the drawer.

[0093] In a specific implementation, the cover sensor may be implemented by using an existing door sensor in the art for detecting whether the door is open or closed.

[0094] In some embodiments, the non-freezing temperature control mode may further include:

determining, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the second temperature threshold, if yes, stopping operating the refrigeration system.

[0095] In this way, the operation of the refrigeration system may be stopped in time in a case that a non-freezing cooling effect of the variable-temperature compartment is achieved, to save energy and protect environment.

[0096] In some other embodiments, the non-freezing temperature control mode may further include:

determining, after the refrigeration system is operated, whether the temperature of the evaporator is less than a stop temperature threshold under the non-freezing mode, if yes, stopping operating the refrigeration system.

[0097] The stop temperature threshold under the non-freezing mode refers to a stop temperature threshold of the refrigerator under the non-freezing mode in the related art. The "stop" in the stop temperature threshold refers to disabling the refrigeration system and causing the re-

frigeration loop to stop operating.

[0098] In this embodiment of the present invention, the freezing temperature control mode includes:

S41: Obtain a temperature of a variable-temperature compartment.

S42: Determine whether the temperature of the variable-temperature compartment is greater than a fourth temperature threshold, if yes, operate a refrigeration system. In a specific implementation of step S41, the temperature of the variable-temperature compartment may also be obtained by using a temperature sensor.

[0099] In a specific implementation of step S42, whether to operate the refrigeration system to cool the variable-temperature compartment may be determined only based on the temperature of the variable-temperature compartment.

[0100] Generally, more cold energy is required for the variable-temperature compartment in the freezing mode. In addition, in the freezing mode, there is no need to consider the defrosting of the evaporator. Therefore, in this embodiment of the present invention, when the freezing temperature control mode is executed, whether there is a need to operate the refrigeration system to cool the variable-temperature compartment is determined only based on the temperature of the variable-temperature compartment.

[0101] Specifically, whether the temperature of the variable-temperature compartment is greater than the fourth temperature threshold may be determined. The refrigeration system is operated in a case that the temperature of the variable-temperature compartment is greater than the fourth temperature threshold.

[0102] In a specific implementation, the fourth temperature threshold may be determined based on the set temperature of the variable-temperature compartment.

[0103] The fourth temperature threshold may be equal to the set temperature in a case that the set temperature is adjusted based on a specific value. The fourth temperature threshold may be equal to a startup temperature threshold of the refrigerator under an existing freezing mode in a case that the set temperature is adjusted based on the temperature range. The existing freezing mode refers to a freezing mode of the refrigerator in the related art. The "startup" in the startup temperature threshold refers to enabling the refrigeration system and causing the entire refrigeration loop to operate.

[0104] In this embodiment of the present invention, the fourth temperature threshold may alternatively be slightly higher than the set temperature, which is conducive to energy saving and environmental protection.

[0105] For example, in a case that the set temperature is adjusted based on a specific value, the fourth temperature threshold may be equal to the set temperature plus 0.5°C. In a case that the set temperature is adjusted based on the temperature range, the fourth temperature

threshold may be equal to the startup temperature threshold of the refrigerator under the existing freezing mode plus 0.5°C.

[0106] In this embodiment of the present invention, the freezing temperature control mode may further include: determining, before the refrigeration system is operated, whether the drawer in the variable-temperature compartment is open, if yes, operating the refrigeration system; and if no, opening the drawer and then operating the refrigeration system.

[0107] In the freezing mode, to prevent freeze between the drawer and the cover and improve a cooling rate of the drawer in the variable-temperature compartment, the drawer in the variable-temperature compartment may be opened by using the cover.

[0108] In a specific implementation, the cover may open the drawer by user's manual operation, or automatically open the drawer based on the set temperature. For example, in a case that it is determined based on the set temperature that the freezing temperature control mode needs to be executed, the cover may be controlled to automatically open the drawer.

[0109] In this embodiment of the present invention, the freezing temperature control mode may further include: determining, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the fourth temperature threshold, if yes, stopping operating the refrigeration system.

[0110] In this way, the operation of the refrigeration system may be stopped in time in a case that a freezing cooling effect of the variable-temperature compartment is achieved, to save energy and protect environment.

[0111] In some other embodiments, the freezing temperature control mode may further include: determining, after the refrigeration system is operated, whether the temperature of the evaporator is less than a stop temperature threshold under the freezing mode, if yes, stopping operating the refrigeration system.

[0112] The stop temperature threshold under the freezing mode refers to a stop temperature threshold of the refrigerator under the non-freezing mode in the related art. The "stop" in the stop temperature threshold refers to disabling compressor in the refrigeration system and causing the refrigeration loop to stop operating.

[0113] The refrigerator provided in this embodiment of the present invention may further include a control module.

[0114] In a specific implementation, the control module includes a processor and a memory, the memory stores a computer program executable by the processor, and the computer program, when executed by the processor, performs the temperature control method of a variable-temperature compartment in a refrigerator provided in the embodiments of the present invention.

[0115] Referring to FIG. 3, an embodiment of the present invention further provides a control device 50 of a variable-temperature compartment in a refrigerator.

[0116] The control device 50 includes an obtaining module 51, a determining module 52, and a processing module 53 that are sequentially connected. Specifically, the obtaining module 51 is configured to obtain a set temperature of the variable-temperature compartment; the determining module 52 is configured to determine whether the set temperature is greater than or equal to a first temperature threshold; and the processing module 53 is configured to execute a non-freezing temperature control mode on the variable-temperature compartment in a case that the set temperature is greater than or equal to the first temperature threshold, and execute a freezing temperature control mode on the variable-temperature compartment in a case that the set temperature is less than the first temperature threshold, where the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment and a temperature of the evaporator to cool the variable-temperature compartment, and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment to cool the variable-temperature compartment.

[0117] In a specific implementation, the processing module 53 includes:

a first obtaining unit, configured to obtain the temperature of the variable-temperature compartment and the temperature of the evaporator;

a first determining unit, configured to determine whether the temperature of the variable-temperature compartment is greater than a second temperature threshold, and determine whether the temperature of the evaporator is greater than a third temperature threshold; and

a first processing unit, configured to operate the refrigeration system to execute the non-freezing temperature control mode in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is greater than the third temperature threshold.

[0118] In a specific implementation, the first processing unit is further configured to operate the fan in a case that the temperature of the variable-temperature compartment is greater than the second temperature threshold, and the temperature of the evaporator is less than the third temperature threshold.

[0119] In a specific implementation, the first determining unit is further configured to determine, before the refrigeration system is operated, whether the drawer is closed. The first processing unit is further configured to operate the refrigeration system in a case that the drawer is closed, or close the drawer and then operate the refrigeration system in a case that the drawer is not closed.

[0120] In a specific implementation, the first determining unit is further configured to determine, after the re-

frigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the second temperature threshold. The first processing unit is further configured to stop operating the refrigeration system in a case that the temperature of the variable-temperature compartment is less than or equal to the second temperature threshold, to stop executing the non-freezing temperature control mode.

[0121] In a specific implementation, the processing module 53 further includes: a second obtaining unit, configured to obtain the temperature of the variable-temperature compartment;

a second determining unit, configured to determine whether the temperature of the variable-temperature compartment is greater than a fourth temperature threshold; and

a second processing unit, configured to operate the refrigeration system in a case that the temperature of the variable-temperature compartment is greater than the fourth temperature threshold, to execute the freezing temperature control mode.

[0122] In a specific implementation, the second determining unit is further configured to determine, before the refrigeration system is operated, whether the drawer is open. The second processing unit is further configured to operate the refrigeration system in a case that the drawer is open, or open the drawer and then operate the refrigeration system in a case that the drawer is not open.

[0123] In a specific implementation, the second determining unit is further configured to determine, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment is less than or equal to the fourth temperature threshold. The second processing unit is further configured to stop operating the refrigeration system in a case that the temperature of the variable-temperature compartment is less than or equal to the fourth temperature threshold, to stop executing the freezing temperature control mode.

[0124] Although specific implementations are described above, the implementations are not intended to limit the scope disclosed in the present invention, even if only a single implementation is described relative to a specific feature. The feature examples provided in the present invention are intended to be illustrative rather than limiting, unless different expressions are made. During specific implementation, according to an actual requirement, in a technically feasible case, the technical features of one or more dependent claims may be combined with the technical features of the independent claims, and the technical features from the corresponding independent claims may be combined in any appropriate way instead of using just specific combinations listed in the claims.

[0125] Although the present invention is disclosed above, the present invention is not limited thereto. Any person skilled in the art may make various changes and

modifications without departing from the spirit and the scope of the present invention. Therefore, the protection scope of the present invention should be subject to the scope defined by the claims.

Claims

1. A temperature control method of a variable-temperature compartment (11) in a refrigerator (10), the refrigerator (10) comprising a refrigeration system adapted to generate cold air to cool the variable-temperature compartment (11), the refrigeration system comprising an evaporator configured corresponding to the variable-temperature compartment (11), and **characterized by** comprising:

obtaining a set temperature of the variable-temperature compartment (11); and

determining whether the set temperature is greater than or equal to a first temperature threshold, if yes, executing a non-freezing temperature control mode on the variable-temperature compartment (11); and if no, executing a freezing temperature control mode on the variable-temperature compartment (11), wherein the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment (11) and a temperature of the evaporator to cool the variable-temperature compartment (11), and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment (11) to cool the variable-temperature compartment (11).

2. The temperature control method according to claim 1, **characterized in that** the non-freezing temperature control mode comprises: obtaining the temperature of the variable-temperature compartment (11) and the temperature of the evaporator; and determining whether the temperature of the variable-temperature compartment (11) is greater than a second temperature threshold, and determining whether the temperature of the evaporator is greater than a third temperature threshold, if yes, operating the refrigeration system.

3. The temperature control method according to claim 2, **characterized in that** the second temperature threshold is equal to the set temperature.

4. The temperature control method according to claim 2, **characterized in that** the third temperature threshold is equal to the temperature of the variable-temperature compartment (11).

5. The temperature control method according to claim 2, **characterized in that** the refrigeration system comprises a fan adapted to introduce the cold air into the variable-temperature compartment (11); and the non-freezing temperature control mode comprises operating the fan in a case that the temperature of the variable-temperature compartment (11) is greater than the second temperature threshold, and the temperature of the evaporator is less than the third temperature threshold. 5
6. The temperature control method according to claim 1, **characterized in that** the refrigerator (10) comprises a closable drawer (16) located in the variable-temperature compartment (11); and the non-freezing temperature control mode comprises: 10
determining, before the refrigeration system is operated, whether the drawer (16) is closed, if yes, operating the refrigeration system; and if no, closing the drawer (16) and then operating the refrigeration system. 15 20
7. The temperature control method according to claim 2 or 6, **characterized in that** the non-freezing temperature control mode comprises: 25
determining, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment (11) is less than or equal to the second temperature threshold, if yes, stopping operating the refrigeration system. 30
8. The temperature control method according to claim 1, **characterized in that** the freezing temperature control mode comprises: obtaining the temperature of the variable-temperature compartment (11); and determining whether the temperature of the variable-temperature compartment (11) is greater than a fourth temperature threshold, if yes, operating the refrigeration system. 35 40
9. The temperature control method according to claim 8, **characterized in that** the fourth temperature threshold is equal to the set temperature.
10. The temperature control method according to claim 1, **characterized in that** the refrigerator (10) comprises a closable drawer (16) located in the variable-temperature compartment (11); and the freezing temperature control mode comprises: 45
determining, before the refrigeration system is operated, whether the drawer (16) is open, if yes, operating the refrigeration system; and if no, opening the drawer (16) and then operating the refrigeration system. 50
11. The temperature control method according to claim 8 or 10, **characterized in that** the freezing temperature control mode comprises: 55

determining, after the refrigeration system is operated, whether the temperature of the variable-temperature compartment (11) is less than or equal to the fourth temperature threshold, if yes, stopping operating the refrigeration system.

12. A control device (50) of a variable-temperature compartment (11) in a refrigerator (10), **characterized in that** the refrigerator (10) comprises a refrigeration system adapted to generate cold air to cool the variable-temperature compartment (11), the refrigeration system comprises an evaporator configured corresponding to the variable-temperature compartment (11), and the device comprises:

an obtaining module (51), configured to obtain a set temperature of the variable-temperature compartment (11);
a determining module (52), configured to determine whether the set temperature is greater than or equal to a first temperature threshold; and
a processing module (53), configured to execute a non-freezing temperature control mode on the variable-temperature compartment (11) in a case that the set temperature is greater than or equal to the first temperature threshold, and execute a freezing temperature control mode on the variable-temperature compartment (11) in a case that the set temperature is less than the first temperature threshold, wherein
the non-freezing temperature control mode is that the refrigeration system is operated based on a temperature of the variable-temperature compartment (11) and a temperature of the evaporator to cool the variable-temperature compartment (11), and the freezing temperature control mode is that the refrigeration system is operated based on the temperature of the variable-temperature compartment (11) to cool the variable-temperature compartment (11).

13. The control device (50) according to claim 12, **characterized in that** the processing module (53) comprises:

a first obtaining unit, configured to obtain the temperature of the variable-temperature compartment (11) and the temperature of the evaporator;
a first determining unit, configured to determine whether the temperature of the variable-temperature compartment (11) is greater than a second temperature threshold, and determine whether the temperature of the evaporator is greater than a third temperature threshold; and
a first processing unit, configured to operate the refrigeration system in a case that the temperature of the variable-temperature compartment

(11) is greater than the second temperature threshold, and the temperature of the evaporator is greater than the third temperature threshold, to execute the non-freezing temperature control mode.

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14. The control device (50) according to claim 13, **characterized in that** the refrigeration system comprises a fan adapted to introduce the cold air into the variable-temperature compartment (11); and the first processing unit is configured to operate the fan in a case that the temperature of the variable-temperature compartment (11) is greater than the second temperature threshold, and the temperature of the evaporator is less than the third temperature threshold.
15. A refrigerator (10), comprising a variable-temperature compartment (11) and a refrigeration system adapted to generate cold air to cool the variable-temperature compartment (11), the refrigeration system comprising an evaporator configured corresponding to the variable-temperature compartment (11), and **characterized by** comprising: a control module comprising a processor and a memory, wherein the memory stores a computer program executable by the processor, and the computer program, when executed by the processor, performs the temperature control method according to any one of claims 1 to 11.

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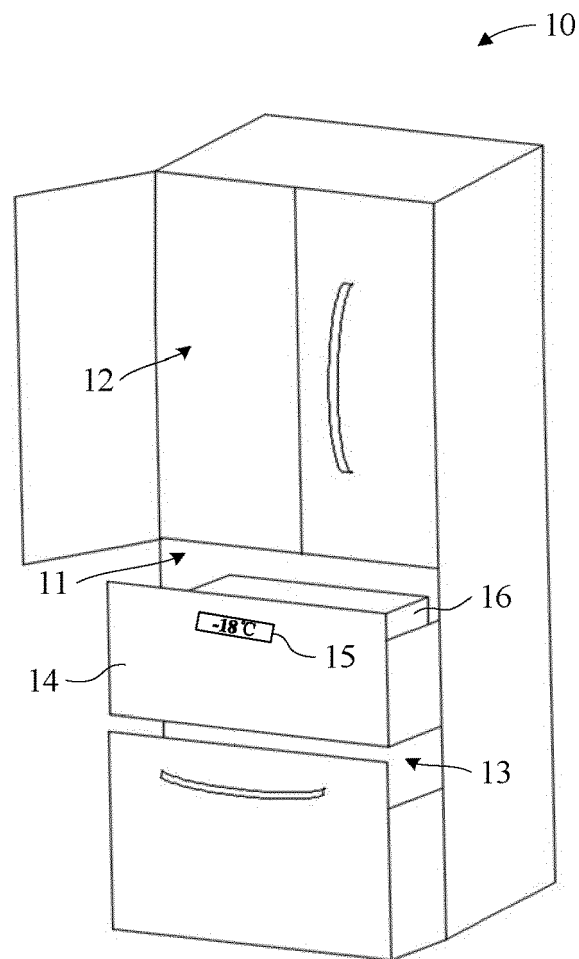


FIG. 1

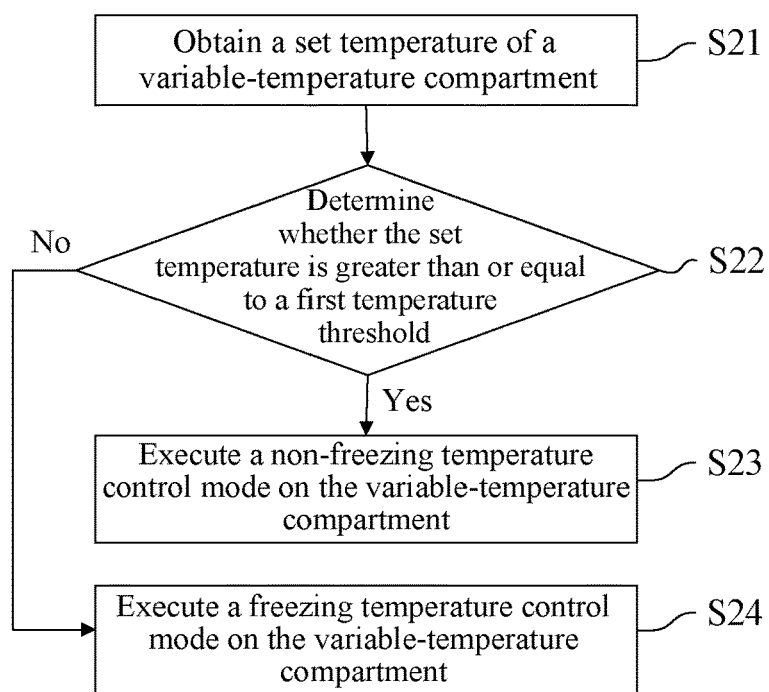


FIG. 2

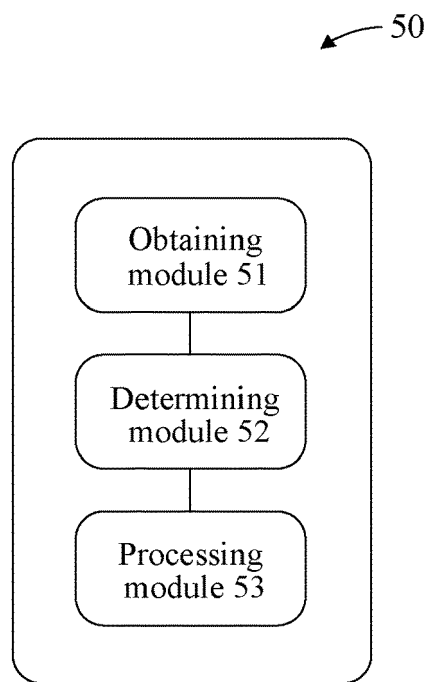


FIG. 3



EUROPEAN SEARCH REPORT

Application Number

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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