



(11)

EP 3 832 236 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

09.06.2021 Bulletin 2021/23

(51) Int Cl.:

F25D 29/00 ^(2006.01) **F25B 41/04** ^(2006.01)
F16K 31/06 ^(2006.01)

(21) Application number: **18945188.3**

(86) International application number:

PCT/CN2018/124968

(22) Date of filing: **28.12.2018**

(87) International publication number:

WO 2020/133244 (02.07.2020 Gazette 2020/27)

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

KH MA MD TN

• **Hefei Hualing Co., Ltd.**

Hefei, Anhui 230601 (CN)

• **Midea Group Co., Ltd.**

Foshan, Guangdong 528311 (CN)

(72) Inventor: **TANG, Xueqiang**

Hefei, Anhui 230601 (CN)

(71) Applicants:

- **Hefei Midea Refrigerator Co., Ltd.**
Hefei, Anhui 230601 (CN)

(74) Representative: **Lam, Alvin et al**

Maucher Jenkins

26 Caxton Street

London SW1H 0RJ (GB)

(54) **CONTROL METHOD AND DEVICE FOR REFRIGERATOR, AND REFRIGERATOR**

(57) A control method and device for a refrigerator (30), and the refrigerator (30). The refrigerator (30) comprises at least two compartments. The control method comprises: acquiring a compartment currently requesting cooling; after detecting and confirming a first set time, the compartment currently requesting cooling not being cooled, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting

cooling and the currently cooled compartment requesting cooling. The present invention may solve the problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator, and reduces the refrigerator repair rate, improves the refrigerator production efficiency, and reduces fabrication costs.

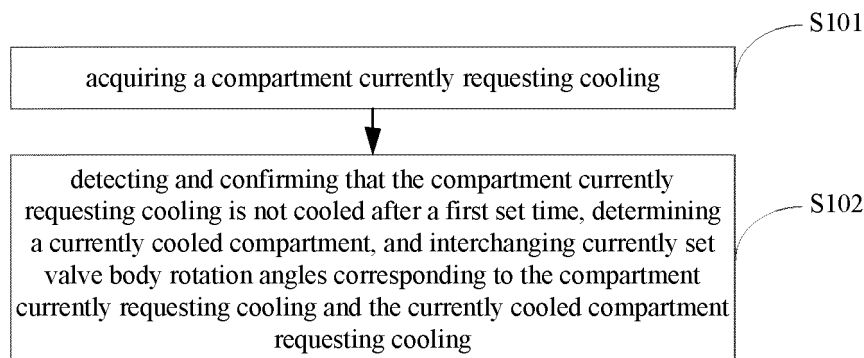


Figure 2

EP 3 832 236 A1

Description

CROSS-REFERENCE TO RELATED PRESENT APPLICATIONS

[0001] The present application claims the priority of a Chinese Patent Application No. _ entitled "Control Method and Device for Refrigerator, and Refrigerator" filed on December 28, 2018 by Hefei Midea Refrigerator Co., Ltd., Hefei Hualing Co., Ltd., and Midea Group Co., Ltd.

FIELD OF THE INVENTION

[0002] The present disclosure relates to the technical field of electrical appliances, in particular to a control method and device for a refrigerator, and the refrigerator.

BACKGROUND OF THE INVENTION

[0003] With the development of economy and technology and the upgrading of consumer demands of a wide range of customers, refrigerators are developing towards large volume and multi-function. As the basic technology of refrigerators, refrigerating systems have also developed from single systems to multiple systems. Multi-system refrigerators are featured with multiple capillary tubes and one solenoid valve with "one-in-multiple-out". After multiple outlet tubes of the solenoid valve are mutually connected with multiple capillary tubes, the corresponding relationship between the rotation angle of the valve body of the solenoid valve and the capillary tubes connected with the solenoid valve is preset by a program. When cooling is requested, the valve body of the solenoid valve operates according to a preset control rule, and the purpose of cooling each compartment can be achieved.

[0004] In the related art, when a refrigerator is designed, multiple outlet tubes of the solenoid valve and multiple capillary tubes corresponding to the outlet tubes are identically marked according to a set rule such that only the outlet tubes of the solenoid valve with identical marks are needed to be connected with the capillary tubes and welded well during the production. However, because the label falls off during the transportation or the operation of workers is not careful and like circumstances, error connections between the outlet tube of the solenoid valve and the capillary tube may still occur such that the refrigerator cannot be cooled normally, and the refrigerator can only be found abnormally operating and repaired after being subjected to commercial inspections, causing the production efficiency of the refrigerator to be low and fabrication costs to be high.

SUMMARY OF THE INVENTION

[0005] The present disclosure is intended to solve, at least to some extent, one of the technical problems in the related art.

[0006] Therefore, the first object of the present disclosure

is to propose a control method for a refrigerator. It is detected and confirmed that the compartment currently requesting cooling is not cooled after a first set time; a currently cooled compartment is determined; and currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling are interchanged so that the compartment currently requesting cooling is cooled. So, the problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, and fabrication costs are reduced.

[0007] The second object of the present disclosure is to propose a control device for a refrigerator.

[0008] The third object of the present disclosure is to propose a refrigerator.

[0009] The fourth object of the present disclosure is to propose an electronic apparatus.

[0010] The fifth object of the present disclosure is to propose a non-temporary computer-readable storage medium.

[0011] To achieve the above objects, an embodiment of the first aspect of the present disclosure proposes a control method for a refrigerator. The refrigerator includes at least two compartments, and the control method includes:

acquiring a compartment currently requesting cooling; and
detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling.

[0012] According to the control method for a refrigerator provided by the embodiment of the present disclosure, the refrigerator includes at least two compartments. The control method for a refrigerator includes: firstly, acquiring a compartment currently requesting cooling; then detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. By determining the currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the compartment currently requesting cooling is cooled such that the problem in which a refrigerator cannot be cooled normally due to a connection

tion error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, and fabrication costs are reduced.

[0013] According to one embodiment of the present disclosure, the control method for a refrigerator further includes: detecting and confirming that the compartment currently requesting cooling is cooled after the first set time, and keeping the currently set valve body rotation angles corresponding to the at least two compartments requesting cooling unchanged.

[0014] According to one embodiment of the present disclosure, the refrigerator includes two compartments. After the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the control method for a refrigerator further includes: controlling a set compartment to request cooling, wherein the set compartment is any one of the two compartments; detecting and confirming that the set compartment is cooled after a second set time, and keeping currently set valve body rotation angles corresponding to the two compartments requesting cooling unchanged; and detecting and confirming that the set compartment is not cooled after the second set time, and sending out a refrigerator fault alerting signal.

[0015] According to one embodiment of the present disclosure, the refrigerator includes at least three compartments. After the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the control method for a refrigerator further includes: accumulating a number of the interchanging for 1 time; and detecting and confirming that the number of interchanging is smaller than the interchanging number threshold value, controlling the currently cooled compartment to request cooling, and returning to a step of acquiring a compartment currently requesting cooling, wherein a difference between the number of the at least three compartments and the interchanging number threshold value is 1.

[0016] According to one embodiment of the present disclosure, the control method for a refrigerator further includes: detecting and confirming that the number of interchanging is equal to the interchanging number threshold value, and controlling the currently cooled compartment to request cooling; reacquiring a compartment currently requesting cooling; detecting and confirming that the compartment currently requesting cooling is cooled after a third set time, and keeping currently set valve body rotation angles corresponding to the at least three compartments requesting cooling unchanged; and detecting and confirming that the compartment currently requesting cooling is not cooled after the third set time, and sending out a refrigerator fault alerting signal.

[0017] According to one embodiment of the present disclosure, the acquiring a compartment currently re-

questing cooling includes: each time after a compressor is started or each time after defrosting is finished, acquiring the compartment currently requesting cooling.

[0018] To achieve the above objects, an embodiment of the second aspect of the present disclosure proposes a control device for a refrigerator. The refrigerator includes at least two compartments, and the control device includes:

an acquisition module configured to acquire a compartment currently requesting cooling; and
an execution module configured to detect and confirm that the compartment currently requesting cooling is not cooled after a first set time, determine a currently cooled compartment, and interchange currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling.

[0019] According to the control device for a refrigerator proposed by the embodiment of the present disclosure, the refrigerator includes at least two compartments. The control device for a refrigerator includes: firstly, acquiring a compartment currently requesting cooling, then detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. By determining the currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the compartment currently requesting cooling is cooled such that the problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, and fabrication costs are reduced.

[0020] According to one embodiment of the present disclosure, the execution module is further configured to: detecting and confirming that the compartment currently requesting cooling is cooled after the first set time, keep the currently set valve body rotation angles corresponding to the at least two compartments requesting cooling unchanged.

[0021] According to one embodiment of the present disclosure, the refrigerator includes two compartments, and the execution module is further configured to: after interchanging the currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, control a set compartment to request cooling, the set compartment being any one of the two compart-

ments; detect and confirm that the set compartment is cooled after the second set time, keep the currently set valve body rotation angles corresponding to the two compartments requesting cooling unchanged; and detect and confirm that the set compartment is not cooled after the second set time, send out a refrigerator fault alerting signal.

[0022] According to one embodiment of the present disclosure, the refrigerator includes at least three compartments, and the execution module is further configured to: after the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, accumulate a number of the interchanging for 1 time; and detect and confirm that the number of interchanging is smaller than an interchanging number threshold value, control the currently cooled compartment to request cooling, and trigger the acquisition module to re-execute the step of acquiring a compartment currently requesting cooling, wherein a difference between the number of the at least three compartments and the interchanging number threshold value is 1.

[0023] According to one embodiment of the present disclosure, the execution module is further configured to: detect and confirm that the number of interchanging is equal to the interchanging number threshold value, and control the currently cooled compartment to request cooling; reacquire a compartment currently requesting cooling; detect and confirm that the compartment currently requesting cooling is cooled after a third set time, and keep currently set valve body rotation angles corresponding to the at least three compartments requesting cooling unchanged; and detect and confirm that the compartment currently requesting cooling is not cooled after the third set time, and send out a refrigerator fault alerting signal.

[0024] According to one embodiment of the present disclosure, the acquisition module is specifically configured to: acquire a compartment currently requesting cooling each time after a compressor is started or each time after defrosting is finished.

[0025] To achieve the above objects, an embodiment of the third aspect of the present disclosure proposes a refrigerator, including: the control device for a refrigerator according to the embodiment of the second aspect of the present disclosure.

[0026] To achieve the above objects, an embodiment of the fourth aspect of the present disclosure proposes an electronic apparatus, including: a memory, a processor, and a computer program stored on the memory and executable on the processor, the processor implementing the control method for a refrigerator according to the embodiment of the first aspect of the present disclosure when executing the program.

[0027] To achieve the above objects, an embodiment of the fifth aspect of the present disclosure proposes a non-temporary computer-readable storage medium storing thereon a computer program which, when executed

by the processor, implements the control method for a refrigerator according to the embodiment of the first aspect of the present disclosure.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0028]

Fig. 1 is a working principle diagram of a solenoid valve of a three-system refrigerator;

Fig. 2 is a flowchart of a control method for a refrigerator according to one embodiment of the present disclosure;

Fig. 3 is a flowchart of a control method for a refrigerator according to another embodiment of the present disclosure;

Fig. 4 is a detailed flowchart of a control method for a refrigerator according to another embodiment of the present disclosure;

Fig. 5 is a flowchart of a control method for a refrigerator according to another embodiment of the present disclosure;

Fig. 6 is a detailed flowchart of a control method for a refrigerator according to another embodiment of the present disclosure;

Fig. 7 is a structural view of a control device for a refrigerator according to one embodiment of the present disclosure;

Fig. 8 is a structural view of a refrigerator according to one embodiment of the present disclosure;

Fig. 9 is a structural view of an electronic apparatus according to one embodiment of the present disclosure.

35 DETAILED DESCRIPTION OF THE INVENTION

[0029] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. Like or similar reference numerals refer to the same or similar elements or have elements with the same or similar function throughout the text. The embodiments described below by reference to the drawings are exemplary and are intended to be illustrative of the present disclosure and are not to be construed as limiting the present disclosure.

[0030] The control method and device of a refrigerator, and the refrigerator in the embodiments of the present disclosure are described below with reference to the drawings.

[0031] Firstly, the working principle of a solenoid valve of a multi-system refrigerator is introduced by taking a three-system refrigerator including refrigerating, freezing, and temperature changing compartment as an example. Fig. 1 is a working principle diagram of a solenoid valve of a three-system refrigerator. As shown in Fig. 1, the solenoid valve of the three-system refrigerator is a "one-in-three-out" solenoid valve which includes three outlet tubes A, B, and C, and has three connection

modes. Three outlet tubes A, B, and C of the solenoid valve respectively correspond to three specific rotation angles of the solenoid valve; after the valve body of the solenoid valve rotates by a rotation angle corresponding to the A outlet tube, the A outlet tube is connected; after the solenoid valve body rotates by a rotation angle corresponding to the B outlet tube, the B outlet tube is connected; after the solenoid valve body rotates by a rotation angle corresponding to the C outlet tube, the C outlet tube is connected. The capillary tubes corresponding to refrigerating, freezing and temperature changing are respectively connected with the three outlet tubes of the solenoid valve, then the connection mode and the rotation angles of the corresponding solenoid valves are written into a program. When the refrigerating, freezing, and temperature changing compartments request cooling, the program drives the valve body of the solenoid valve to rotate a corresponding rotation angle such that the capillary tubes corresponding to the compartment requesting cooling can be connected and cooling is realized.

[0032] Fig. 2 is a flowchart of a control method for a refrigerator according to one embodiment of the present disclosure, and as shown in Fig. 2, the control method for a refrigerator includes the following steps.

[0033] S101, acquiring a compartment currently requesting cooling.

[0034] According to the embodiment of the present disclosure, the refrigerator includes at least two compartments, in which a compartment currently requesting cooling is acquired. Specifically, every time after a compressor is started or every time after defrosting is finished, the compartment currently requesting cooling is acquired such that the out-of-step of the solenoid valve caused by the loss of a control signal in the control process is avoided, and the abnormal cooling of the refrigerator is prevented.

[0035] S102, detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling.

[0036] In the embodiment of the present disclosure, the first set time can be preset, the first set time can be specifically 5 minutes (min), and after the first set time passes, whether the compartment currently requesting cooling is cooled or not is detected. Specifically, compartment temperature sensors can be respectively arranged in at least two compartments of the refrigerator, defrosting temperature sensors are respectively arranged at evaporator outlets of the at least two compartments of the refrigerator, the compartment temperature sensors and the defrosting temperature sensors can be connected with a refrigerator control system, and the refrigerator control system can acquire the compartment interior temperature collected by the compartment tem-

perature sensors and the evaporator outlet temperature collected by the defrosting temperature sensors in real time. In step S101, after acquiring the compartment currently requesting cooling, an initial compartment interior temperature T_j and an initial evaporator outlet temperature Th of the compartment currently requesting cooling are collected through a refrigerator control system. After the first set time, compartment interior temperature T_{j1} and evaporator outlet temperature $Th1$ currently requesting cooling after the first set time are collected through the refrigerator control system, and T_j is compared with T_{j1} , and Th is compared with $Th1$ to determine whether the compartment currently requesting cooling is cooled or not. If $T_j \leq T_{j1}$ and $Th \leq Th1$, that is, the compartment interior temperature is equal to or greater than the initial compartment interior temperature after the first set time and the evaporator outlet temperature is equal to or greater than the initial evaporator outlet temperature after the first set time, it can be judged that the compartment currently requesting cooling is not cooled; if $T_j > T_{j1}$ or $Th > Th1$, that is, the compartment interior temperature is less than the initial compartment interior temperature after the first set time and the evaporator outlet temperature is less than the initial evaporator outlet temperature after the first set time, it can be judged that the compartment currently requesting cooling is cooled.

[0037] It is detected and confirmed that the compartment currently requesting cooling is not cooled after the first set time, suggesting that the connection between the capillary tube and the outlet tube of the solenoid valve at the moment may be wrong; a currently cooled compartment is determined; and currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling are interchanged, so that the compartment currently requesting cooling is cooled. Specifically, if the refrigerator includes two compartments, namely the refrigerator is a double-system refrigerator, the compartment which does not request cooling in the two compartments is currently cooled compartment; if the refrigerator includes at least three compartments, that is, the refrigerator is a three-system or more-system refrigerator, it may be necessary to judge successively whether a compartment which does not request cooling among the at least three compartments is cooled in order to determine the currently cooled compartment. The mode of detecting whether the compartment is cooled can specifically refer to the above description, which will not be described in detail herein.

[0038] Further, the control method for a refrigerator further includes: detecting and confirming that the compartment currently requesting cooling is cooled after the first set time, and keeping the currently set valve body rotation angles corresponding to the at least two compartments requesting cooling unchanged.

[0039] According to the embodiment of the present disclosure, if it is detected and confirmed that the compartment currently requesting cooling is cooled after the first

set time, it indicates that the capillary tube is correctly connected with the outlet tube of the solenoid valve at the moment, no adjustment is needed and the valve body rotation angles corresponding to the currently set at least two compartments requesting cooling are kept unchanged.

[0040] According to the control method for a refrigerator provided by the embodiment of the present disclosure, the refrigerator includes at least two compartments. The control method for a refrigerator includes: firstly, acquiring a compartment currently requesting cooling; then detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. By determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the compartment currently requesting cooling is cooled such that the problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, and fabrication costs are reduced.

[0041] Fig. 3 is a flowchart of a control method for a refrigerator according to another embodiment of the present disclosure. When the refrigerator includes two compartments, that is, the refrigerator is a double-system refrigerator, after step S102 of the embodiment shown in Fig. 2, as shown in Fig. 3, the control method for a refrigerator may further include steps as follows.

[0042] S201, controlling a set compartment to request cooling, wherein the set compartment is any one of two compartments.

[0043] In the embodiment of the present disclosure, the set compartment can be controlled by the refrigerator control system to request cooling, wherein the set compartment is any one of two compartments, that is, the set compartment can be a compartment currently requesting cooling or a compartment not currently requesting cooling.

[0044] S202, detecting and confirming that set compartment is cooled after a second set time, and keeping the currently set valve body rotation angles corresponding to the two compartments requesting cooling unchanged.

[0045] In the embodiment of the present disclosure, the second set time can be preset, and the second set time can be specifically 5 min. After the second set time, whether the set compartment is cooled or not is detected, and the mode of detecting whether the compartment is cooled or not can specifically refer to the detailed description of step S102 of the embodiment shown in Fig.

2, which will not be described in detail herein.

[0046] If detecting and confirming the set compartment to be cooled after the second set time, it is judged that both the compartment currently requesting cooling and the currently cooled compartment are cooled, and the currently set (that is, after the rotation angles are interchanged) valve body rotation angles corresponding to the two compartments requesting cooling are kept unchanged.

[0047] S203, detecting and confirming that the set compartment is not cooled after the second set time, and sending out a refrigerator fault alerting signal.

[0048] In the embodiment of the present disclosure, if detecting and confirming that the set compartment is not cooled after the second set time, it can be judged that at least one of the compartment currently requesting cooling and the currently cooled compartment is not cooled, the refrigerator is abnormally cooled, and a refrigerator failure alerting signal is sent out.

[0049] In order to clearly illustrate the above-mentioned embodiments, embodiments of the present disclosure will be described in detail by taking a dual-system refrigerator including two compartments of freezing and refrigerating as an example. Fig. 4 is a specific flowchart of a control method for a refrigerator according to another embodiment of the present disclosure, and as shown in Fig. 4, the control method for a refrigerator may specifically include:

S301, acquiring a compartment currently requesting cooling;
S302, judging whether the compartment currently requesting cooling is a refrigerating compartment;
if so, entering step S303; if not, entering step S306;
S303, acquiring the compartment interior temperature T_{cj} and the evaporator outlet temperature T_{ch} of the refrigerating compartment;
S304, after a first set time, acquiring the compartment interior temperature T_{cj1} and the evaporator outlet temperature T_{ch1} of the refrigerating compartment;
S305, judging whether $T_{cj} > T_{cj1}$ or $T_{ch} > T_{ch1}$;
if so, entering step S312; if not, entering step S310;
S306, acquiring the compartment interior temperature T_{dj} and the evaporator outlet temperature T_{dh} of the freezing compartment;
S307, acquiring compartment interior temperature T_{dj1} and the evaporator outlet temperature T_{dh1} of the freezing compartment after the first set time;
S308, judging whether $T_{dj} > T_{dj1}$ or $T_{dh} > T_{dh1}$;
if so, entering step S312; if not, entering step S309;
S309, interchanging the currently set valve body rotation angles corresponding to the refrigerating compartment and the freezing compartment requesting cooling;
S310, determining any one of the refrigerating compartment and the freezing compartment as a set compartment, and controlling the set compartment to request cooling;

S311, judging whether the set compartment is cooled after a second set time;
 if so, entering step S312; if not, entering step S313;
 S312, keeping the currently set valve body rotation angles corresponding to the refrigerating compartment and the freezing compartment requesting cooling unchanged; and
 S313, sending out a refrigerator fault alerting signal.

[0050] According to the control method for a refrigerator provided by the embodiments of the present disclosure, the refrigerator includes two compartments. Firstly, a set compartment is controlled to request cooling and the set compartment is any one of the two compartments. Then, after a second set time, detecting and confirming that the set compartment is cooled after the second set time, the currently set valve body rotation angles corresponding to the two compartments requesting cooling are kept unchanged; if detecting and confirming that the set compartment is not cooled after the second set time, a refrigerator fault alerting signal is sent out. The problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a double-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, fabrication costs are reduced and an alerting signal can be sent out when the refrigerator fails.

[0051] Fig. 5 is a flowchart of a control method for a refrigerator according to another embodiment of the present disclosure. When the refrigerator includes at least three compartments, that is, the refrigerator is a three-system or a more-system refrigerator, after step S102 of the embodiment shown in Fig. 2, as shown in Fig. 5, the control method for a refrigerator may further include steps as follows.

[0052] S401, accumulating a number of the interchanging for 1 time.

[0053] In the embodiment of the present disclosure, after the valve body rotation angles interchange in the step S103, the number of interchanging is accumulated 1 time, and the initial value of the number of interchanging is 0.

[0054] S402, detecting and confirming that the number of interchanging is smaller than the interchanging number threshold value, controlling the currently cooled compartment to request cooling, and returning to the step of acquiring the compartment currently requesting cooling.

[0055] In the embodiment of the present disclosure, the interchanging number threshold value can be preset with the difference between the number of at least three compartments and the interchanging number threshold value being possible to be 1. If detecting and confirming that the number of interchanging is smaller than the interchanging number threshold value, the currently cooled compartment requesting cooling can be controlled by a refrigerator control system, and step S101 of the embod-

iment shown in fig.2 is returned to to enter a cycle. Until the currently cooled compartment is cooled, that is, the compartment currently requesting cooling and the currently cooled compartment are both cooled, the cycle is withdrawn from, and the currently set valve body rotation angles corresponding to the at least three compartments requesting cooling are kept unchanged.

[0056] Further, as shown in Fig. 5, the control method for a refrigerator may further include steps as follows.

[0057] S403, detecting and confirming that the number of interchanging is equal to the interchanging number threshold value, and controlling the currently cooled compartment to request cooling.

[0058] In the embodiment of the present disclosure, if detecting and confirming that the number of interchanging is equal to the interchanging number threshold value, the currently cooled compartment can be controlled by the refrigerator control system to request cooling.

[0059] S404, reacquiring a compartment currently requesting cooling.

[0060] In the embodiment of the present disclosure, the compartment currently requesting cooling is reacquired.

[0061] S405, detecting and confirming that the compartment currently requesting cooling is cooled after a third set time, and keeping the currently set valve body rotation angles corresponding to at least three compartments requesting cooling unchanged.

[0062] In the embodiment of the present disclosure, the third set time can be preset, and the third set time can be specifically 5 min. After the third set time, whether the compartment currently requesting cooling, which is reacquired in step S404, is cooled or not is detected, and the mode of detecting whether the compartment is cooled or not can specifically refer to the detailed description of S102 of the embodiment shown in Fig. 2, which will not be described in detail herein. If detecting and confirming that the compartment currently requesting cooling after the third set time is cooled, it can be judged that the two compartments interchanging the valve body rotation angles are both cooled, and the currently set valve body rotation angles corresponding to at least three compartments requesting cooling are kept unchanged.

[0063] S406, detecting and confirming that the compartment currently requesting cooling is not cooled after the third set time, and sending out a refrigerator fault alerting signal.

[0064] In the embodiment of the present disclosure, if detecting and confirming that the compartment currently requesting cooling is not cooled after the third set time, it is suggested that the refrigerator may have a fault, and a refrigerator fault alerting signal is sent out.

[0065] In order to clearly illustrate the above-mentioned embodiments, embodiments of the present disclosure will be described in detail by taking a multiple-system refrigerator including three compartments of freezing, refrigerating and temperature changing as an example. Fig. 6 is a specific flowchart of a control method

for a refrigerator according to another embodiment of the present disclosure, and as shown in Fig. 6, the control method for a refrigerator may specifically include:

S501, acquiring a compartment currently requesting cooling; 5
 S502, judging whether the compartment currently requesting cooling is a refrigerating compartment;
 if so, entering step S503; if not, entering step S507;
 S503, acquiring the compartment interior temperature Tcj and the evaporator outlet temperature Tch of the refrigerating compartment; 10
 S504, after a first set time, acquiring the compartment interior temperature Tcj1 and the evaporator outlet temperature Tch1 of the refrigerating compartment; 15
 S505, judging whether $T_{cj} > T_{cj1}$ or $T_{ch} > T_{ch1}$;
 if so, entering step S520; if not, entering step S506;
 S506, determining the currently cooled compartment, interchanging the currently set valve body rotation angles corresponding to the refrigerating compartment and the currently cooled compartment requesting cooling, and entering step S516.
 S507, judging whether the compartment currently requesting cooling is a freezing compartment; 25
 if so, entering step S508; if not, entering step S512;
 S508, acquiring the compartment interior temperature Tdj and the evaporator outlet temperature Tdh of the freezing compartment;
 S509, acquiring compartment interior temperature Tdj1 and the evaporator outlet temperature Tdh1 of the freezing compartment after the first set time; 30
 S510, judging whether $T_{dj} > T_{dj1}$ or $T_{dh} > T_{dh1}$;
 if so, entering step S520; if not, entering step S511;
 S511, determining the currently cooled compartment, interchanging the currently set valve body rotation angles corresponding to the freezing compartment and the currently cooled compartment requesting cooling, and entering step S516.
 S512, acquiring the compartment interior temperature Tbj and the evaporator outlet temperature Tbh of the temperature changing compartment; 35
 S513, after a first set time, acquiring the compartment interior temperature Tbj1 and the evaporator outlet temperature Tbh1 of the temperature changing compartment;
 S514, judging whether $T_{bj} > T_{bj1}$ or $T_{bh} > T_{bh1}$;
 if so, entering step S520; if not, entering step S515;
 S515, determining the currently cooled compartment, interchanging the currently set valve body rotation angles corresponding to the temperature changing compartment and the currently cooled compartment requesting cooling, and entering step S516;
 S516, accumulating a number of the interchanging for 1 time; 40
 S517, controlling the currently cooled compartment to request cooling;

if the number of interchanging is smaller than the interchanging number threshold value, returning to step S501; if the interchange number is equal to the interchanging number threshold value, entering step S518;
 S518, reacquiring a compartment currently requesting cooling;
 S519, judging whether the compartment currently requesting cooling is cooled after a third set time;
 if so, entering step S520; if not, entering step S521;
 S520, keeping the currently set valve body rotation angles corresponding to the freezing compartment, refrigerating compartment, and the temperature changing compartment requesting cooling unchanged; and
 S521, sending out a refrigerator fault alerting signal.

[0066] According to the control method for a refrigerator provided by the embodiment of the present disclosure, the refrigerator includes at least three compartments. The control method for a refrigerator includes: firstly, controlling a set compartment to request cooling; then detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. The problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a three-system or more-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, fabrication costs are reduced and an alerting signal can be sent out when the refrigerator fails.

[0067] Fig. 7 is a structural view of a control device for a refrigerator according to one embodiment of the present disclosure, the refrigerator including at least two compartments, and as shown in Fig. 7, the control device includes:

an acquisition module 21 configured to acquire a compartment currently requesting cooling; and
 an execution module 22 configured to detect and confirm that the compartment currently requesting cooling is not cooled after a first set time, determine the currently cooled compartment, and interchange the currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling.

[0068] It should be noted that the foregoing explanation of the embodiments of the control method for a refrigerator is also applicable to the control device for a refrigerator of the embodiment and will not be described in detail herein.

[0069] According to the control device for a refrigerator provided by the embodiment of the present disclosure, the refrigerator includes at least two compartments, the control device includes: firstly, acquiring a compartment currently requesting cooling, detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. By determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the compartment currently requesting cooling is cooled such that the problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, and fabrication costs are reduced.

[0070] Further, in a possible implementation of an embodiment of the present disclosure, the execution module 22 is further configured to: detect and confirm that the compartment currently requesting cooling is cooled after the first set time, and keep the currently set valve body rotation angles corresponding to the at least two compartments requesting cooling unchanged.

[0071] Further, in one possible implementation of an embodiment of the present disclosure, the refrigerator includes two compartments, and the execution module 22 is further configured to: after interchanging the currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, control a set compartment to request cooling, the set compartment being any one of two compartments; detect and confirm that the set compartment is cooled after the second set time, keep the currently set valve body rotation angles corresponding to the two compartments requesting cooling unchanged; and detect and confirm that the set compartment is not cooled after the second set time, send out a refrigerator fault alerting signal.

[0072] Further, in one possible implementation of an embodiment of the present disclosure, the refrigerator includes at least three compartments, and the execution module 22 is further configured to: after interchanging the currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, accumulate a number of interchanging for 1 time; detecting and confirming that the number of interchanging is smaller than the interchanging number threshold value, control the currently cooled compartment to request cooling, and trigger the acquisition module 21 to re-execute the step of acquiring the compartment currently requesting cooling, the difference between the number of at least three

compartments and the interchanging number threshold value being 1.

[0073] Further, in one possible implementation of an embodiment of the present disclosure, the execution module 22 is further configured to: detect and confirm that the number of interchanging is equal to the interchanging number threshold value, control the currently cooled compartment to request cooling; reacquire a compartment currently requesting cooling; detect and confirm that the compartment currently requesting cooling is cooled after a third set time, keep the currently set valve body rotation angles corresponding to the at least three compartments requesting cooling unchanged; and detect and confirm that the compartment currently requesting cooling is not cooled after the third set time, send out a refrigerator fault alerting signal.

[0074] Further, in one possible implementation of an embodiment of the present disclosure, the acquisition module 21 is specifically configured to: each time after the compressor is started or each time after defrosting is finished, acquire a compartment currently requesting cooling.

[0075] It should be noted that the foregoing explanation of the embodiments of the control method for a refrigerator is also applicable to the control device for a refrigerator of the embodiment and will not be described in detail herein.

[0076] According to the control device for a refrigerator provided by the embodiment of the present disclosure, the refrigerator includes at least two compartments. The control device for a refrigerator includes: an acquisition module 21 configured to acquire a compartment currently requesting cooling, and an execution module 22 configured to detect and confirm that the compartment currently requesting cooling is not cooled after a first set time, determine a currently cooled compartment, and interchange currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. By determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the compartment currently requesting cooling is cooled such that the problem in which a refrigerator cannot be cooled normally due to a connection error between the capillary tube and a solenoid valve during the production of a multi-system refrigerator may be solved, the refrigerator repair rate is reduced, the refrigerator production efficiency is improved, and fabrication costs are reduced.

[0077] In order to realize the above embodiment, the embodiment of the present disclosure also provides a refrigerator 30, which is shown in Fig.8 and includes: a control device 31 of the refrigerator shown in the above embodiment.

[0078] To implement the above-described embodiment, the embodiment of the present disclosure also pro-

poses an electronic apparatus 40, as shown in Fig. 9, including a memory 41 and a processor 42. The memory 41 stores thereon a computer program executable on the processor 42. The processor 42 executes the program to implement the control method for a refrigerator as shown in the above-described embodiment.

[0079] To implement the above-described embodiment, the embodiment of the present disclosure also proposes a non-temporary computer-readable storage medium storing thereon a computer program which, when executed by the processor, implements the control method for a refrigerator as shown in the above-described embodiment.

[0080] In the description of the present specification, descriptions with reference to terms of "one embodiment", "some embodiments", "examples", "specific examples", or "some examples" etc. mean that specific features, structures, materials, or characteristics described in conjunction with the embodiment or example are included in at least one embodiment or example of the present disclosure. In the present specification, schematic representations of the above terms do not necessarily refer to the same embodiments or examples. Furthermore, the specific features, structures, materials, or characteristics described may be combined in a suitable mode in any one or more embodiments or examples. Moreover, various embodiments or examples and features of various embodiments or examples described in the present specification may be incorporated and combined by those skilled in the art without mutual contradiction.

[0081] While embodiments of the present disclosure have been shown and described above, it is appreciated that the above-described embodiments are exemplary and should not be construed as restrictive of the present disclosure, and that changes, modifications, substitutions, and variations of the above-described embodiments may be made within the scope of the present disclosure by those of ordinary skills in the art.

Claims

1. A control method for a refrigerator comprising at least two compartments, the control method comprising:

acquiring a compartment currently requesting cooling; and
detecting and confirming that the compartment currently requesting cooling is not cooled after a first set time, determining a currently cooled compartment, and interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling.

2. The control method of claim 1, further comprising:

detecting and confirming that the compartment currently requesting cooling is cooled after the first set time, and keeping currently set valve body rotation angles corresponding to the at least two compartments requesting cooling unchanged.

3. The control method of claim 1, wherein the refrigerator comprises two compartments, and after the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the control method further comprises:

controlling a set compartment to request cooling, wherein the set compartment is any one of the two compartments;
detecting and confirming that the set compartment is cooled after a second set time, and keeping currently set valve body rotation angles corresponding to the two compartments requesting cooling unchanged; and
detecting and confirming that the set compartment is not cooled after the second set time, and sending out a refrigerator fault alerting signal.

4. The control method of claim 1, wherein the refrigerator comprises at least three compartments, and after the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, the control method further comprises:

accumulating a number of the interchanging for 1 time; and
detecting and confirming that the number of interchanging is smaller than an interchanging number threshold value, controlling the currently cooled compartment to request cooling, and returning to a step of acquiring a compartment currently requesting cooling, wherein a difference between the number of the at least three compartments and the interchanging number threshold value is 1.

5. The control method of claim 4, further comprising:

detecting and confirming that the number of interchanging is equal to the interchanging number threshold value, and controlling the currently cooled compartment to request cooling; reacquiring a compartment currently requesting cooling;
detecting and confirming that the compartment currently requesting cooling is cooled after a third set time, and keeping currently set valve body rotation angles corresponding to the at

- least three compartments requesting cooling unchanged; and
 detecting and confirming that the compartment currently requesting cooling is not cooled after the third set time, and sending out a refrigerator fault alerting signal. 5
6. The control method of claim 1, wherein the acquiring a compartment currently requesting cooling comprises: 10
 each time after a compressor is started or each time after defrosting is finished, acquiring the compartment currently requesting cooling.
7. A control device for a refrigerator comprising at least two compartments, the control device comprising: 15
 an acquisition module configured to acquire a compartment currently requesting cooling; and
 an execution module configured to detect and confirm that the compartment currently requesting cooling is not cooled after a first set time, determine a currently cooled compartment, and interchange currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling. 20 25
8. The control device of claim 7, wherein the execution module is further configured to: 30
 detect and confirm that the compartment currently requesting cooling is cooled after the first set time, and keep currently set valve body rotation angles corresponding to the at least two compartments requesting cooling unchanged. 35
9. The control device of claim 7, wherein the refrigerator comprises two compartments, and the execution module is further configured to: 40
 after the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, control a set compartment to request cooling, wherein the set compartment is any one of the two compartments; 45
 detect and confirm that the set compartment is cooled after a second set time, and keep currently set valve body rotation angles corresponding to the two compartments requesting cooling unchanged; and 50
 detect and confirm that the set compartment is not cooled after the second set time, and send out a refrigerator fault alerting signal. 55
10. The control device of claim 7, wherein the refrigerator comprises at least three compartments, and the execution module is further configured to: 5
 after the interchanging currently set valve body rotation angles corresponding to the compartment currently requesting cooling and the currently cooled compartment requesting cooling, accumulate a number of interchanging for 1 time; and
 detect and confirm that the number of interchanging is smaller than an interchanging number threshold value, control the currently cooled compartment to request cooling, and trigger the acquisition module to re-execute the step of acquiring a compartment currently requesting cooling, wherein a difference between the number of the at least three compartments and the interchanging number threshold value is 1.
11. The control device of claim 10, wherein the execution module is further configured to:
 detect and confirm that the number of interchanging is equal to the interchanging number threshold value, and control the currently cooled compartment to request cooling;
 reacquire a compartment currently requesting cooling;
 detect and confirm that the compartment currently requesting cooling is cooled after a third set time, and keep currently set valve body rotation angles corresponding to the at least three compartments requesting cooling unchanged; and
 detect and confirm that the compartment currently requesting cooling is not cooled after the third set time, and send out a refrigerator fault alerting signal.
12. The control device of claim 7, wherein the acquisition module is specifically configured to:
 acquire the compartment currently requesting cooling each time after a compressor is started or each time after defrosting is finished.
13. A refrigerator, comprising: the control device for a refrigerator of any one of claims 7 to 12.
14. An electronic apparatus, comprising: a memory, a processor, and a computer program stored on the memory and executable on the processor, the processor implementing the control method for a refrigerator of any one of claims 1 to 6 when executing the program.
15. A non-temporary computer-readable storage medium storing thereon a computer program, wherein the program, when executed by a processor, implements the control method for a refrigerator of any

one of claims 1 to 6.

5

10

15

20

25

30

35

40

45

50

55

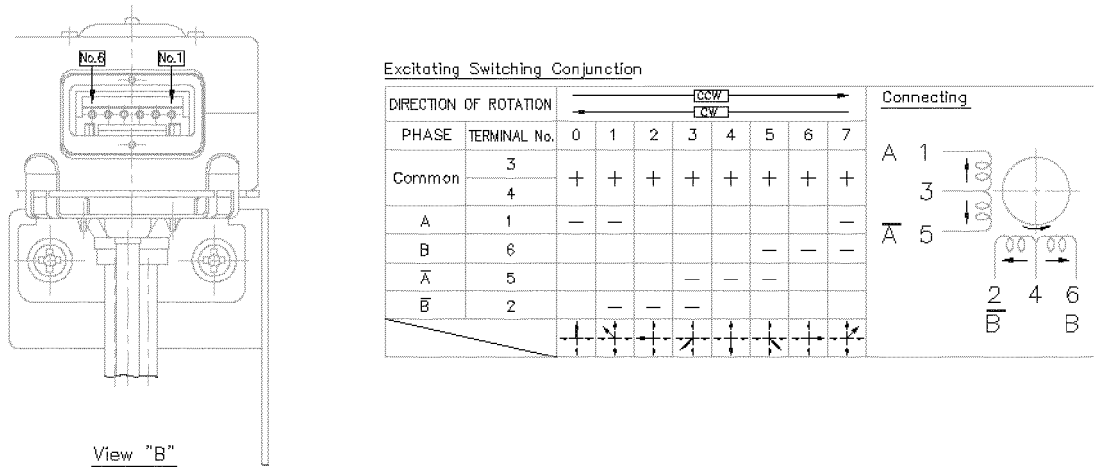


Figure 1

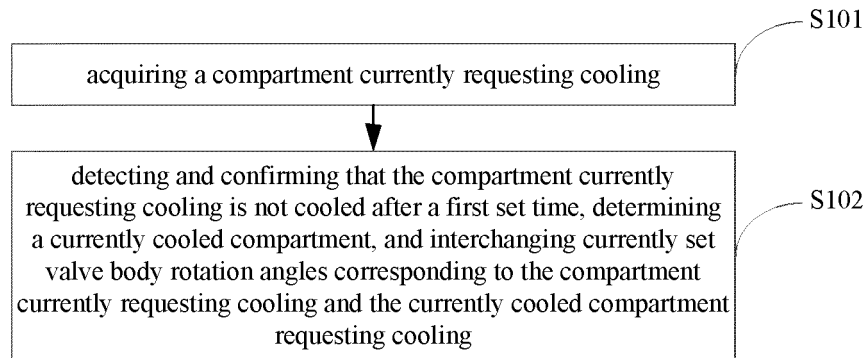


Figure 2

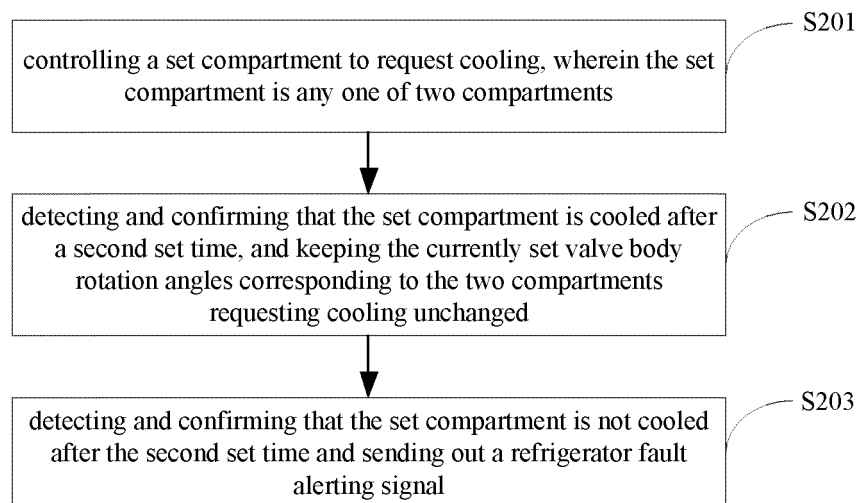


Figure 3

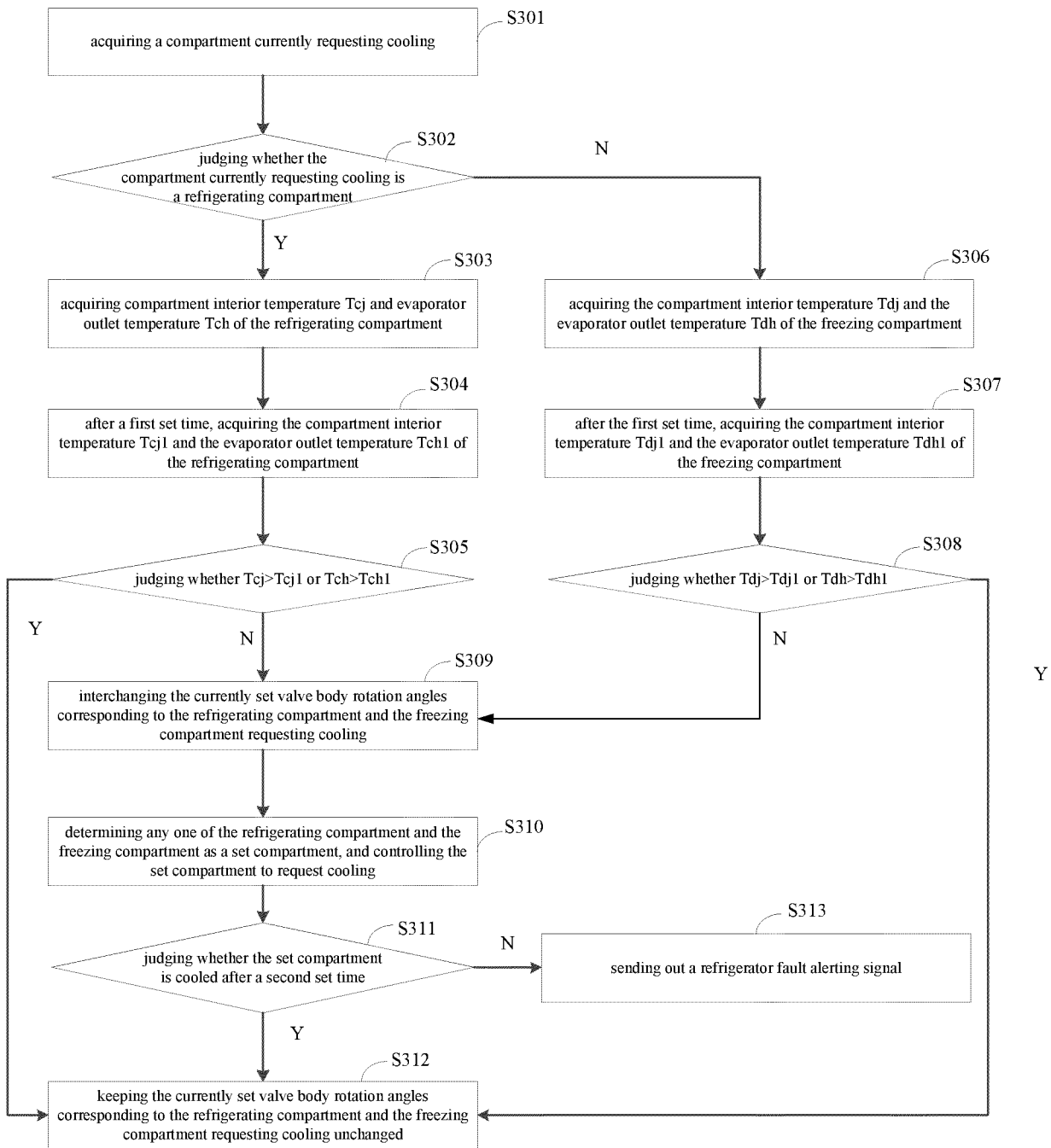


Figure 4

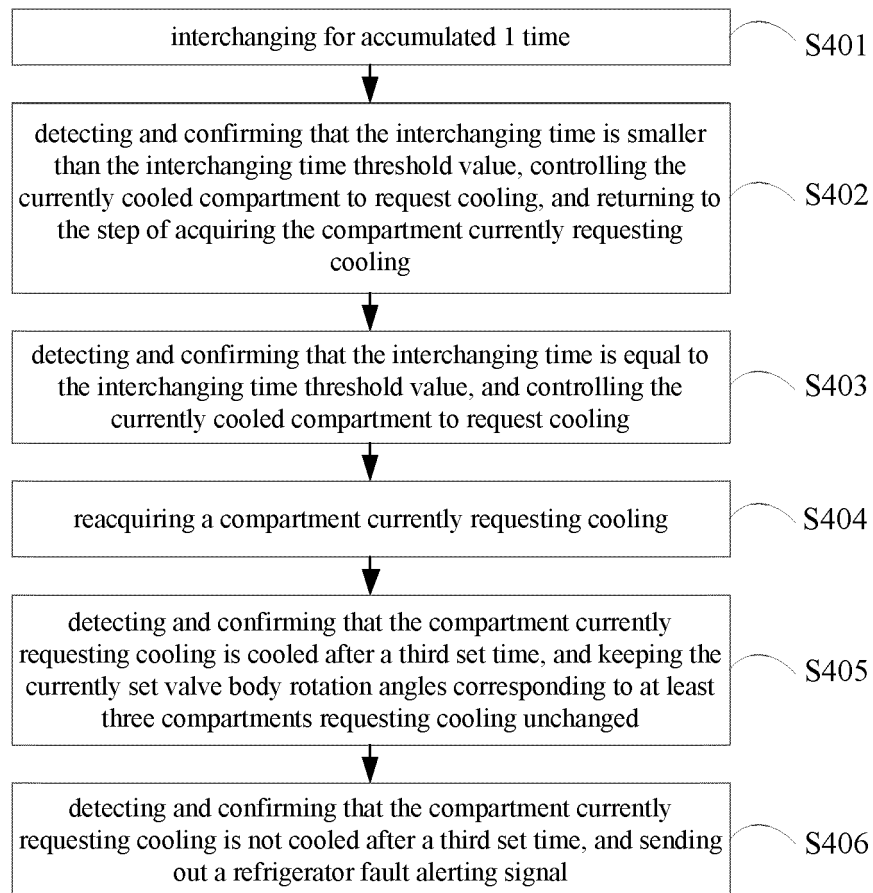


Figure 5

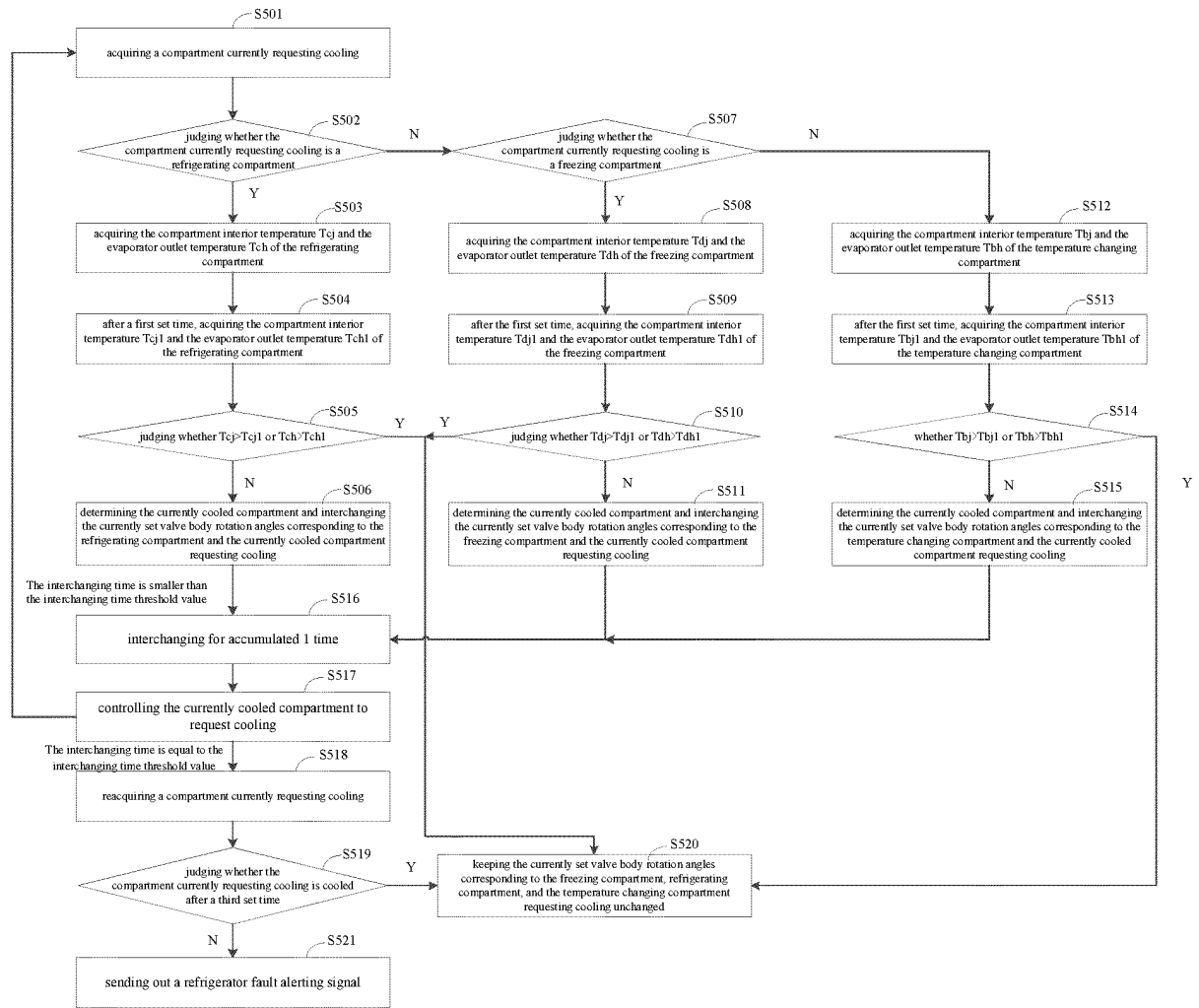


Figure 6

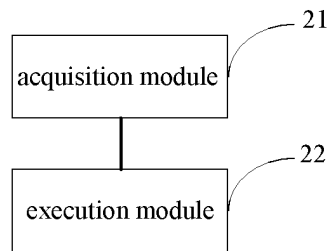


Figure 7

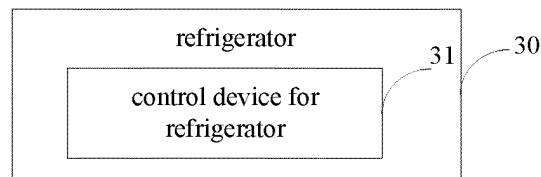


Figure 8

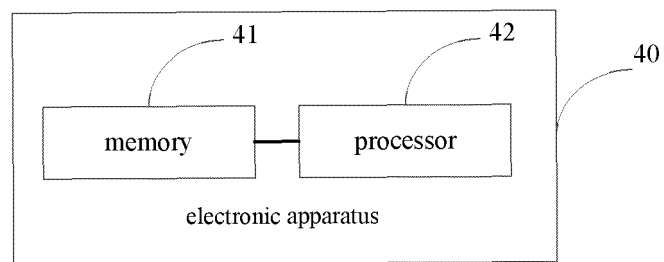


Figure 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/124968

A. CLASSIFICATION OF SUBJECT MATTER F25D 29/00(2006.01)i; F25B 41/04(2006.01)i; F16K 31/06(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; F25B; F16K 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) VEN; CNABS; CNTXT; 中国期刊网全文数据库, CHINA JOURNAL FULL-TEXT DATABASE: 间室, 阀体, 接反, 步进电机, 电磁阀, 运动, 步数, 故障, 转动, 角度, 错误, 冰箱, 连接, 阀值, 毛细管, 电机, 一进多出, 接错, 时间, 次数, 数量, valve, electromagnet+, time, conneting, motor, steps, walk?, refrigerator, error, malfunction																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT																					
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>CN 108302863 A (HISENSE (SHANDONG) REFRIGERATOR CO., LTD.) 20 July 2018 (2018-07-20) description, paragraphs 12-29, and figures 1-6</td> <td>1-15</td> </tr> <tr> <td>Y</td> <td>CN 201053790 Y (HISENSE (BEIJING) ELECTRICAL APPLIANCE CO., LTD.) 30 April 2008 (2008-04-30) particular embodiments, and figure 1</td> <td>1-15</td> </tr> <tr> <td>Y</td> <td>CN 108458523 A (LIAONING INSTITUTE OF SCIENCE AND TECHNOLOGY) 28 August 2018 (2018-08-28) description, paragraphs 13-39, and figures 1-3</td> <td>1-15</td> </tr> <tr> <td>A</td> <td>CN 1548867 A (HENAN XINFEI ELECTRIC CO., LTD.) 24 November 2004 (2004-11-24) entire document</td> <td>1-15</td> </tr> <tr> <td>A</td> <td>CN 104565501 A (CHONGQING UNIVERSITY OF SCIENCE & TECHNOLOGY) 29 April 2015 (2015-04-29) entire document</td> <td>1-15</td> </tr> <tr> <td>A</td> <td>SU 603816 A1 (DIDINEV, V.S. et al.) 29 March 1978 (1978-03-29) entire document</td> <td>1-15</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	CN 108302863 A (HISENSE (SHANDONG) REFRIGERATOR CO., LTD.) 20 July 2018 (2018-07-20) description, paragraphs 12-29, and figures 1-6	1-15	Y	CN 201053790 Y (HISENSE (BEIJING) ELECTRICAL APPLIANCE CO., LTD.) 30 April 2008 (2008-04-30) particular embodiments, and figure 1	1-15	Y	CN 108458523 A (LIAONING INSTITUTE OF SCIENCE AND TECHNOLOGY) 28 August 2018 (2018-08-28) description, paragraphs 13-39, and figures 1-3	1-15	A	CN 1548867 A (HENAN XINFEI ELECTRIC CO., LTD.) 24 November 2004 (2004-11-24) entire document	1-15	A	CN 104565501 A (CHONGQING UNIVERSITY OF SCIENCE & TECHNOLOGY) 29 April 2015 (2015-04-29) entire document	1-15	A	SU 603816 A1 (DIDINEV, V.S. et al.) 29 March 1978 (1978-03-29) entire document	1-15
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																			
Y	CN 108302863 A (HISENSE (SHANDONG) REFRIGERATOR CO., LTD.) 20 July 2018 (2018-07-20) description, paragraphs 12-29, and figures 1-6	1-15																			
Y	CN 201053790 Y (HISENSE (BEIJING) ELECTRICAL APPLIANCE CO., LTD.) 30 April 2008 (2008-04-30) particular embodiments, and figure 1	1-15																			
Y	CN 108458523 A (LIAONING INSTITUTE OF SCIENCE AND TECHNOLOGY) 28 August 2018 (2018-08-28) description, paragraphs 13-39, and figures 1-3	1-15																			
A	CN 1548867 A (HENAN XINFEI ELECTRIC CO., LTD.) 24 November 2004 (2004-11-24) entire document	1-15																			
A	CN 104565501 A (CHONGQING UNIVERSITY OF SCIENCE & TECHNOLOGY) 29 April 2015 (2015-04-29) entire document	1-15																			
A	SU 603816 A1 (DIDINEV, V.S. et al.) 29 March 1978 (1978-03-29) entire document	1-15																			
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																					
<table border="0"> <tr> <td style="vertical-align: top;"> * Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “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 </td> <td style="vertical-align: top;"> “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 </td> </tr> </table>	* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “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																			
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “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 06 September 2019	Date of mailing of the international search report 18 September 2019																				
Name and mailing address of the ISA/CN State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/124968

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report			Publication date (day/month/year)		Patent family member(s)			Publication date (day/month/year)	
CN	108302863	A	20 July 2018		None				
CN	201053790	Y	30 April 2008		None				
CN	108458523	A	28 August 2018		None				
CN	1548867	A	24 November 2004		None				
CN	104565501	A	29 April 2015		CN	104565501	B	07 December 2016	
SU	603816	A1	29 March 1978		None				