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(54) CONTROL METHOD FOR REFRIGERATING AND FREEZING APPARATUS, AND REFRIGERATING AND FREEZING APPARATUS

(57) The present invention relates to a control method for a Refrigerator-freezer unit device, Refrigerator-freezer unit device comprising a case and a refrigeration system, the case defining a freezing compartment and at least one non-freezing compartment, and at least one non-freezing branch connected in parallel to both ends of a freezing capillary tube. The control method comprises: when the refrigerator-freezer unit device is in a state of refrigeration of either of the non-refrigerated compartments, decreasing the frequency of operation of the compressor so as to cause the evaporator temperature of the refrigerated evaporator to be higher than an inter-compartmental temperature within the refrigerated compartments, and thereby increasing the humidity of the refrigerated compartments.

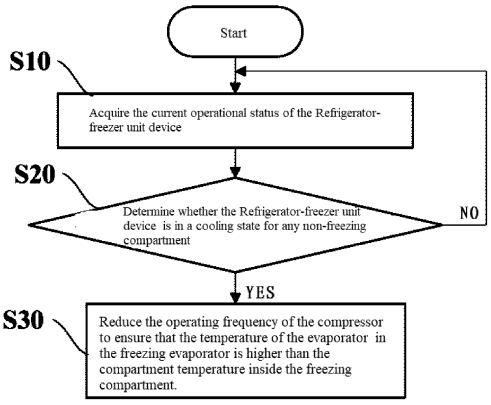

FIG. 3

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Description

TECHNICAL FIELD

[0001] This invention relates to Refrigerator-freezer unit technology, specifically to a control method and device for Refrigerator-freezer unit.

BACKGROUND

[0002] The humidity level inside a Refrigerator-freezer unit device impacts the rate of moisture evaporation from food items, thus affecting their quality. When humidity is too low, food items lose moisture more rapidly, leading to weight loss and, consequently, poor storage efficiency and shorter freshness duration. Therefore, maintaining humidity in Refrigerator-freezer unit devices is a critical research topic. However, most current devices focus on humidifying the refrigeration compartment, with little attention to the freezing compartment.

[0003] In reality, the low humidity in the freezing compartment results in significant moisture loss in stored items like meat, affecting their taste and nutritional value, and thus the user experience. Existing solutions for increasing humidity in the freezing compartment involve complex humidifying devices, which are prone to frosting and blockage due to low temperatures, and occupy space in air ducts or compartments, making them impractical and costly, thus failing to effectively address the issue of low humidity.

SUMMARY

[0004] The purpose of this invention is to provide a new control method for a Refrigerator-freezer unit device, which can effectively avoids low humidity in the freezer room.

[0005] In order to fulfill the above-mentioned objective, the technical solutions provided by the present invention are described as below.The present invention:

[0006] Control Method and Device for Refrigerator-freezer unit comprising a casing and a refrigeration system. The casing defines a freezing compartment and at least one non-freezing compartment. The refrigeration system includes a compressor, a condenser, a solenoid valve, a freezing capillary tube, and a freezing evaporator, connected in sequence to form a circuit. The freezing capillary tube has parallel branches for providing cooling to the at least one non-freezing compartment, each comprising a non-freezing capillary tube and a non-freezing evaporator in series. The control method comprises:

[0007] When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, reducing the operating frequency of the compressor such that the temperature of the freezing evaporator is higher than the compartment temperature inside the freezing compartment, thereby retaining moisture inside the freezing compartment and allowing moisture at the freezing evaporator to enter the freezing compartment, thereby increasing the humidity of the freezing compartment.

[0008] As a further improvement of the present invention, the Refrigerator-freezer unit device further includes a freezing fan for directing the cooling airflow generated by the freezing evaporator into the freezing compartment during cooling. The control method also comprises:

[0009] When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, controlling the freezing fan to continuously operate until the temperature in the cooling non-freezing compartment reaches the set temperature of that compartment.

[0010] As a further improvement of the present invention, When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the rotational speed of the freezing fan is less than its set speed when the Refrigerator-freezer unit device is in a cooling state for the freezing compartment.

[0011] As a further improvement of the present invention, When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the operating frequency of the compressor is between its lowest operating frequency and the set operating frequency when the Refrigerator-freezer unit device is in a cooling state for the freezing compartment.

[0012] As a further improvement of the present invention, When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the operating frequency of the compressor is 3 to 17 hertz lower than the set operating frequency.

[0013] As a further improvement of the present invention, When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the operating frequency of the compressor is 8 to 12 hertz lower than the set operating frequency.

[0014] As a further improvement of the present invention, When the temperature in the cooling non-freezing compartment reaches its set temperature, if the temperature inside the freezing compartment is higher than its set temperature, controlling the solenoid valve to switch to the cooling state for the freezing compartment and increasing the operating frequency of the compressor.

[0015] As a further improvement of the present invention, The at least one non-freezing compartment includes a refrigeration compartment, and the at least one non-freezing branch includes a refrigeration branch; and/or The at least one non-freezing compartment includes a variable temperature compartment, and the at least one non-freezing branch includes a variable temperature branch.

[0016] As a further improvement of the present invention, A casing, defining a freezing compartment and at least one non-freezing compartment. A refrigeration system, including a compressor, a condenser, a solenoid valve, a freezing capillary tube, and a freezing evaporator connected in sequence to form a circuit, with the freezing capillary tube having parallel branches for providing cooling to the at least one non-freezing compartment, each

comprising a non-freezing capillary tube and a non-freezing evaporator in series. A control device, including a processor and memory, the memory storing machine-executable instructions, which when executed by the processor implement the control method according to any one of claims 1-8.

[0017] As a further improvement of the present invention, A freezing fan, for directing the cooling airflow generated by the freezing evaporator into the freezing compartment during cooling, and configured to maintain continuous operation until the temperature in the cooling non-freezing compartment reaches its set temperature when the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment.

[0018] The beneficial effects of this invention are as follows: The refrigerating and freezing device of the present invention raises the evaporator temperature of the refrigerating evaporator by decreasing the operating frequency of the compressor during refrigeration of the non-refrigerating compartment, so that the evaporator temperature of the refrigerating evaporator is higher than the compartment temperature inside the refrigerating compartment while satisfying the refrigeration demand of the non-refrigerating compartment. At this time, the outside water vapor entering the freezing compartment through the door seal and the moisture (e.g., moisture volatilized from the ingredients) in the freezing compartment will condense in the freezing compartment at the lower temperature instead of condensing at the freezing evaporator, thereby effectively increasing the moisture content in the freezing compartment, increasing the humidity in the freezing compartment, and avoiding that the preservation effect of the ingredients will be affected by the lower humidity in the freezing compartment.

[0019] Moreover, the present invention realizes the effect of humidifying and moisturizing the freezer room by controlling the operating frequency of the compressor on the basis of the original structure of the refrigerating and freezing device, and does not require the addition of any auxiliary structure, and thus does not have any effect on the original structure of the refrigerating and freezing device and the capacity of storage, and is convenient for application in practice.

[0020] Further, the refrigerating and freezing device further comprises a refrigerating fan for inducing a cooling airflow generated by the refrigerating evaporator to flow to the refrigerating compartment when the refrigerating compartment is refrigerated. In the prior art, the refrigeration fan is usually stopped when the non-refrigerated compartment is being cooled. The present invention sets the refrigeration fan to operate continuously during non-freezer room cooling, when water vapor formed by sublimation of a portion of the frost on the surface of the refrigeration evaporator is induced by the refrigeration fan to enter the lower temperature freezer room, further increasing the rate of increase of the moisture in the freezer room, and thereby increasing the rate of humidification of the freezer room.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Figure 1: Schematic structural diagram of a Refrigerator-freezer unit device according to an embodiment of this invention.

Figure 2: Schematic structural diagram of the refrigeration system of a Refrigerator-freezer unit device according to an embodiment of this invention.

Figure 3: Schematic flowchart of the control method for a Refrigerator-freezer unit device according to a specific embodiment of this invention.

Figure 4: Schematic flowchart of the control method for a Refrigerator-freezer unit device according to another specific embodiment of this invention.

Figure 5: Schematic structural diagram of the refrigeration system according to another embodiment of this invention.

Figure 6: Schematic structural diagram of the refrigeration system according to yet another embodiment of this invention.

Figure 7: Schematic structural diagram of a Refrigerator-freezer unit device according to an embodiment of this invention.

DETAILED DESCRIPTION

[0022] This invention initially provides a control method for a Refrigerator-freezer unit device. Refer to Figures 1 and 2, the Refrigerator-freezer unit device (1) comprises a casing (10) and a refrigeration system (20). The casing (10) defines a freezing compartment (11) and at least one non-freezing compartment. It is understood that the freezing compartment (11) is used as a storage compartment for freezing purposes, while the non-freezing compartment is used for non-freezing storage, such as for refrigeration or variable temperature storage. Typically, the temperature inside the non-freezing compartment is higher than that in the freezing compartment (11).

[0023] The refrigeration system (20) includes, connected in sequence to form a circuit, a compressor (21), a condenser (22), a solenoid valve (23), a freezing capillary tube (24), and a freezing evaporator (25). The freezing capillary tube (24) has parallel branches to provide cooling for the above-mentioned at least one non-freezing compartment, each comprising a non-freezing capillary tube and a non-freezing evaporator connected in series. It should be noted that the terms "series" and "parallel" used in this invention refer to the physical series and parallel connections in the refrigerant flow path, not to the series and parallel in the electrical circuit structure.

[0024] When the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment, the solenoid valve (23) is set to connect the condenser (22) and the non-freezing branch corresponding to that non-freezing compartment. At this time, the refrigerant flowing out of the compressor (21) passes sequentially through

the condenser (22), the solenoid valve (23), the non-freezing evaporator and capillary tube of the non-freezing branch, and the freezing evaporator (25), before returning to the compressor (21). When the Refrigerator-freezer unit device (1) is in a cooling state for the freezing compartment, the solenoid valve (23) connects the condenser (22) and the freezing capillary tube (24), and the refrigerant from the compressor (21) flows through the condenser (22), the solenoid valve (23), the freezing capillary tube (24), and the freezing evaporator (25), before returning to the compressor (21).

[0025] The applicant recognizes that the freezing compartment (11) is not an absolutely sealed compartment. The outside air carrying moisture enters the freezing compartment (11) through the door seal; moisture evaporates from food items inside the freezing compartment (11); after the food items in the freezing compartment (11) are frozen, a small amount of moisture on the surface of the food items sublimates; and a small amount of frost formed on the surface of the freezing evaporator (25) also sublimates. In other words, the Refrigerator-freezer unit device (1) inherently has various moisture sources that can be used for moisturizing or humidifying the freezing compartment (11). If these moisture sources can be effectively used for moisturizing or humidifying the freezing compartment (11), then there is no need to set up any other humidifying devices.

[0026] The applicant further recognizes that for air-cooled Refrigerator-freezer unit devices, frost rarely forms inside the storage compartments but mainly on the evaporators. This is due to the temperature of the evaporators being generally lower than that of the storage compartments. That is to say, water vapor typically accumulates and condenses at the lower temperature locations. Therefore, if the compartment temperature inside the freezing compartment is lower than the temperature of the evaporator at the freezing evaporator, water vapor will gather inside the freezing compartment. This can effectively moisturize or increase the humidity of the freezing compartment.

[0027] To achieve this, the invention specifically proposes a control method for a Refrigerator-freezer unit device, which includes the following steps:

[0028] When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, reduce the operating frequency of the compressor. This action raises the temperature of the freezing evaporator above the compartment temperature inside the freezing compartment. Consequently, the moisture inside the freezing compartment is retained, and moisture at the freezing evaporator enters the freezing compartment, thereby increasing its humidity.

[0029] During the cooling period of the non-freezing compartment of the Refrigerator-freezer unit device, the operating frequency of the compressor is lowered to increase the temperature of the freezing evaporator. While satisfying the cooling needs of the non-freezing compartment, this ensures that the temperature of the freezing evaporator is higher than the compartment temperature inside the freezing compartment. At this time, external water vapor entering the freezing compartment through the door seal and moisture inside the freezing compartment (such as vapor from unfrozen food items, sublimated moisture from frozen food surfaces, etc.) will condense inside the colder freezing compartment rather than at the freezing evaporator. Thus, effectively increasing the moisture content inside the freezing compartment and improving its humidity. This avoids the issue of low humidity inside the freezing compartment affecting the preservation of food items.

[0030] Moreover, this invention improves the humidity of the freezing compartment by controlling the operating frequency of the compressor based on the existing structure of the Refrigerator-freezer unit device, without the need for any auxiliary structures. Therefore, it does not impact the original structure and storage capacity of the device and is easy to apply in practice. The approach to moisturizing and humidifying the freezing compartment proposed by this invention is completely different from the existing techniques, featuring an innovative design and significant effectiveness, with a promising practical application prospect.

[0031] Figure 3 presents a schematic flowchart of the control method for a Refrigerator-freezer unit device according to a specific embodiment of this invention. Referring to Figure 3, the control method includes the following steps:

Step S10: Acquire the current operational status of the Refrigerator-freezer unit device (1).

Step S20: Determine whether the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment. If yes, proceed to Step S30; if no, return to Step S10.

Step S30: Reduce the operating frequency of the compressor (21) to ensure that the temperature of the evaporator (25) in the freezing evaporator is higher than the compartment temperature inside the freezing compartment (11).

[0032] It should be noted that throughout the entire cooling period of the non-freezing compartment, the compressor (21) consistently operates at the reduced operating frequency to continuously moisturize or humidify the freezing compartment (11).

[0033] In some embodiments, the Refrigerator-freezer unit device (1) includes a freezing fan (30) used to direct the cooling airflow generated by the freezing evaporator (25) into the freezing compartment (11) during cooling. In these embodiments, the control method further includes:

[0034] Controlling the freezing fan (30) to operate continuously until the temperature in the cooling non-freezing compartment reaches the set temperature for that compartment.

[0035] According to existing technology, the freezing

fan (30) is usually stopped during the cooling of the non-freezing compartment. In this invention, the freezing fan (30) is set to continuously operate during the cooling period of the non-freezing compartment. At this time, some of the frost sublimating from the surface of the freezing evaporator (25) quickly enters the colder freezing compartment (11) under the action of the freezing fan (30), thereby increasing the rate of moisture addition and humidification in the freezing compartment (11).

[0036] Figure 4 illustrates another specific embodiment of the control method for a Refrigerator-freezer unit device, referring to Figure 4. The control method includes:

Steps S10, S20 as described earlier.

Step S30: Reduce the operating frequency of the compressor (21) to ensure that the temperature of the freezing evaporator (25) is higher than the compartment temperature inside the freezing compartment (11).

Step S40: Control the freezing fan (30) to operate continuously until the temperature in the cooling non-freezing compartment reaches its set temperature. The term "continuous operation" here means that the freezing fan (30) remains operational throughout the entire cooling period of the non-freezing compartment.

[0037] In the embodiment illustrated in Figure 4, the freezing fan (30) is activated after the operating frequency of the compressor (21) is reduced. It should be understood that in some alternative embodiments, the activation of the freezing fan (30) may occur simultaneously with the reduction of the operating frequency of the compressor (21).

[0038] Since the purpose of the freezing fan (30) operating during the cooling period of the non-freezing compartment is to expedite the transfer of sublimated frost from the freezing evaporator (25) into the freezing compartment (11), and not to convey airflow to the freezing compartment (11), the rotational speed of the freezing fan (30) does not need to be high. Accordingly, in some embodiments, when the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment, the rotational speed of the freezing fan (30) is lower than its set speed when the Refrigerator-freezer unit device (1) is in a cooling state for the freezing compartment. This configuration facilitates the quick transfer of sublimated frost from the freezing evaporator (25) into the freezing compartment (11) while preventing excessive airflow, which could raise the temperature inside the freezing compartment (11) too much.

[0039] Due to the need to satisfy the cooling requirements of the non-freezing compartment and because a too-high temperature of the freezing evaporator (25) could affect the temperature of the freezing compartment (11), the operating frequency of the compressor (21) cannot be too low. Therefore, in some embodiments, when the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment, the operating frequency of the compressor (21) is set between its lowest operating frequency and the set operating frequency when the Refrigerator-freezer unit device (1) is in a cooling state for the freezing compartment. This ensures that while the non-freezing compartment's cooling requirements are met, the temperature of the freezing evaporator (25) is higher than the compartment temperature inside the freezing compartment (11), thereby achieving the goal of moisturizing or humidifying the freezing compartment (11).

[0040] In some embodiments, when the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment, the operating frequency of the compressor (21) is 3 to 17 hertz lower than the aforementioned set operating frequency. In other words, by appropriately reducing the operating frequency of the compressor (21), the evaporator temperature of the freezing evaporator (25) can be slightly higher than the temperature inside the freezing compartment (11). This ensures maximum cooling efficiency and effectiveness for the non-freezing compartments while minimizing the possibility of excessive temperature rise within the freezing compartment (11).

[0041] For example, during the cooling period of the non-freezing compartment, the operating frequency of the compressor (21) can be 3, 5, 7, 9, 11, 13, 15, or 17 hertz lower than the operating frequency of the compressor (21) during the cooling period of the freezing compartment.

[0042] Preferably, when the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment, the operating frequency of the compressor (21) is 8 to 12 hertz lower than the above-mentioned set operating frequency. As a result, this achieves better cooling efficiency and effectiveness for the non-freezing compartments and improves the moisturizing and humidifying effect inside the freezing compartment (11).

[0043] In some embodiments, the control method of this invention also includes:

When the temperature inside the non-freezing compartment, which is in a cooling state, reaches its set temperature, and if the temperature inside the freezing compartment (11) is higher than its set temperature, control the solenoid valve (23) to switch to the cooling state for the freezing compartment (11) and increase the operating frequency of the compressor (21) to enable the freezing compartment (11) to reach its set temperature more rapidly.

[0044] Specifically, during the cooling period of the freezing compartment (11), the operating frequency of the compressor (21) can be increased to the aforementioned set operating frequency.

[0045] In some embodiments, at least one non-freezing compartment may include a refrigeration compartment (12), and at least one non-freezing branch may include a refrigeration branch (201). The non-freezing cap-

illary tube may include a refrigeration capillary tube (26), and the non-freezing evaporator may include a refrigeration evaporator (27). During the cooling period of the refrigeration compartment (12), the freezing compartment (11) is moisturized or humidified by reducing the operating frequency of the compressor (21).

[0046] Figure 5 shows a schematic structural diagram of the refrigeration system according to another embodiment of this invention. In other embodiments, at least one non-freezing compartment may include a variable temperature compartment (13), and at least one non-freezing branch may include a variable temperature branch (202). The non-freezing capillary tube may include a variable temperature capillary tube (28), and the non-freezing evaporator may include a variable temperature evaporator (29). During the cooling period of the variable temperature compartment (13), the freezing compartment (11) is moisturized or humidified by reducing the operating frequency of the compressor (21).

[0047] Figure 6 shows a schematic structural diagram of the refrigeration system according to yet another embodiment of this invention. In yet other embodiments, the number of non-freezing compartments can be two, namely a refrigeration compartment (12) and a variable temperature compartment (13). The number of non-freezing branches is two, namely a refrigeration branch (201) and a variable temperature branch (202). The number of non-freezing capillary tubes is two, namely a refrigeration capillary tube (26) and a variable temperature capillary tube (28). The number of non-freezing evaporators is two, namely a refrigeration evaporator (27) and a variable temperature evaporator (29). During the cooling period of either the refrigeration compartment (12) or the variable temperature compartment (13), the freezing compartment (11) is moisturized or humidified by reducing the operating frequency of the compressor (21).

[0048] This invention also provides a Refrigerator-freezer unit device, as shown in Figures 1, 2, and 7. The Refrigerator-freezer unit device (1) of this invention includes a casing (10), a refrigeration system (20), and a control device (40).

[0049] The casing (10) of the Refrigerator-freezer unit device defines a freezing compartment (11) and at least one non-freezing compartment. The refrigeration system (20) includes a compressor (21), a condenser (22), a solenoid valve (23), a freezing capillary tube (24), and a freezing evaporator (25), connected in sequence to form a circuit. The freezing capillary tube (24) has parallel branches for providing cooling to the at least one non-freezing compartment, each comprising a non-freezing capillary tube and a non-freezing evaporator connected in series.

[0050] The control device (40) includes a processor (41) and a memory (42). The memory stores machine-executable instructions that, when executed by the processor, implement the control method described in the embodiments. Specifically, the processor (41) can be a central processing unit (CPU) or a digital processing unit, etc. The processor (41) communicates data through a communication interface. The memory (44) stores programs executed by the processor (41). The memory (44) can be any medium capable of carrying or storing desired program codes in the form of instructions or data structures and accessible by a computer, and it can also be a combination of multiple memories. The machine-executable program (43) can be downloaded to the corresponding computing/processing device from a computer-readable storage medium or via a network (such as the Internet, LAN, WAN, and/or wireless network).

[0051] In some embodiments, the Refrigerator-freezer unit device (1) also includes a freezing fan (30). The freezing fan (30) is used to direct the cooling airflow generated by the freezing evaporator (25) into the freezing compartment (11) during cooling. It is configured to maintain continuous operation until the temperature in the cooling non-freezing compartment reaches its set temperature when the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment. This allows the moisture from the freezing evaporator (25) to enter the freezing compartment (11) more quickly, improving the humidification efficiency of the freezing compartment (11). The freezing fan (30) is electrically connected to the control device (40) and operates under its control.

[0052] This section of the document also acknowledges that the invention's Refrigerator-freezer unit device (1) encompasses not only refrigerators but also freezers, ice chests, or other devices with at least freezing capabilities.

[0053] In some embodiments, the Refrigerator-freezer unit device (1) also includes a freezing fan (30). The freezing fan (30) is used to direct the cooling airflow generated by the freezing evaporator (25) into the freezing compartment (11) during cooling. It is configured to maintain continuous operation until the temperature in the cooling non-freezing compartment reaches its set temperature when the Refrigerator-freezer unit device (1) is in a cooling state for any non-freezing compartment. This configuration facilitates the quicker entry of moisture from the freezing evaporator (25) into the freezing compartment (11), thereby enhancing the humidification efficiency of the freezing compartment (11).

[0054] Specifically, the freezing fan (30) is electrically connected to the control device (40) and operates under its control.

[0055] It should be understood by those skilled in the art that the Refrigerator-freezer unit device (1) of this invention encompasses not only refrigerators but also freezers, ice chests, or other devices that at least have freezing capabilities.

[0056] To summarize, skilled persons in the relevant field should recognize that, although this document has thoroughly demonstrated and described multiple exemplary embodiments of the invention, many other variations or modifications that are in line with the principles

of this invention can be directly determined or derived based on the content disclosed by this invention. Therefore, the scope of the invention should be understood and recognized to cover all these other variations or modifications.

Claims

1. The Control Method for Refrigerator-freezer unit, comprising a casing and a refrigeration system. The casing defines a freezing compartment and at least one non-freezing compartment. The refrigeration system includes a compressor, a condenser, a solenoid valve, a freezing capillary tube, and a freezing evaporator, connected in sequence to form a circuit. The freezing capillary tube has parallel branches for providing cooling to the at least one non-freezing compartment, each comprising a non-freezing capillary tube and a non-freezing evaporator in series. The control method comprises:
   When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, reducing the operating frequency of the compressor such that the temperature of the freezing evaporator is higher than the compartment temperature inside the freezing compartment, thereby retaining moisture inside the freezing compartment and allowing moisture at the freezing evaporator to enter the freezing compartment, thereby increasing the humidity of the freezing compartment.

2. The control method of claim 1, wherein the Refrigerator-freezer unit device further includes a freezing fan for directing the cooling airflow generated by the freezing evaporator into the freezing compartment during cooling. The control method also comprises:
   When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, controlling the freezing fan to continuously operate until the temperature in the cooling non-freezing compartment reaches the set temperature of that compartment.

3. The control method according to claim 2, wherein:
   When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the rotational speed of the freezing fan is less than its set speed when the Refrigerator-freezer unit device is in a cooling state for the freezing compartment.

4. The control method of claim 1, wherein: When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the operating frequency of the compressor is between its lowest operating frequency and the set operating frequency when the Refrigerator-freezer unit device is in a cooling state for the freezing compartment.

5. The control method of claim 4, wherein: When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the operating frequency of the compressor is 3 to 17 hertz lower than the set operating frequency.

6. The control method of claim 5, wherein: When the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment, the operating frequency of the compressor is 8 to 12 hertz lower than the set operating frequency.

7. The control method of claim 1, further comprising:
   When the temperature in the cooling non-freezing compartment reaches its set temperature, if the temperature inside the freezing compartment is higher than its set temperature, controlling the solenoid valve to switch to the cooling state for the freezing compartment and increasing the operating frequency of the compressor.

8. The control method according to claim 1, wherein:
   The at least one non-freezing compartment includes a refrigeration compartment, and the at least one non-freezing branch includes a refrigeration branch; and/or The at least one non-freezing compartment includes a variable temperature compartment, and the at least one non-freezing branch includes a variable temperature branch.

9. A Device for Refrigerator-freezer unit, comprising: A casing, defining a freezing compartment and at least one non-freezing compartment. A refrigeration system, including a compressor, a condenser, a solenoid valve, a freezing capillary tube, and a freezing evaporator connected in sequence to form a circuit, with the freezing capillary tube having parallel branches for providing cooling to the at least one non-freezing compartment, each comprising a non-freezing capillary tube and a non-freezing evaporator in series. A control device, including a processor and memory, the memory storing machine-executable instructions, which when executed by the processor implement the control method according to any one of claims 1-8.

10. The Device for Refrigerator-freezer unit of claim 9, further comprising: A freezing fan, for directing the cooling airflow generated by the freezing evaporator into the freezing compartment during cooling, and configured to maintain continuous operation until the temperature in the cooling non-freezing compartment reaches its set temperature when the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment.

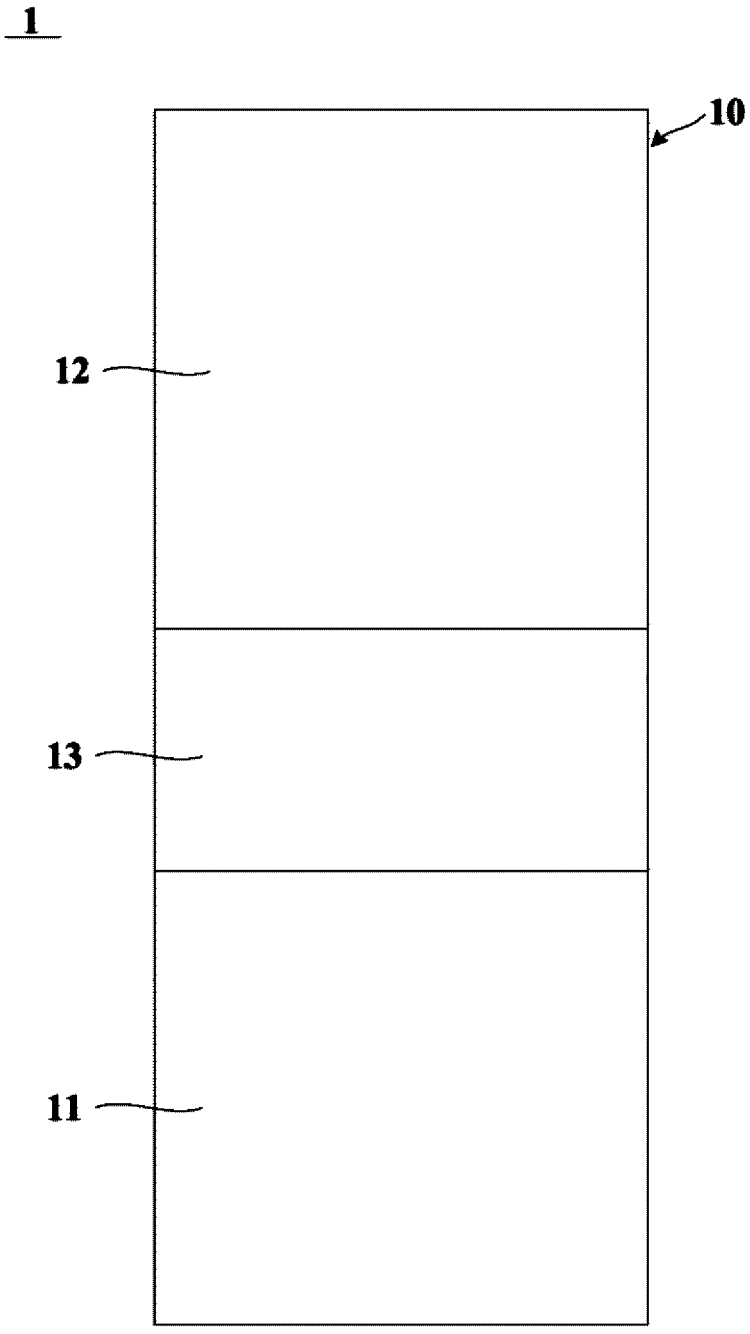

FIG. 1

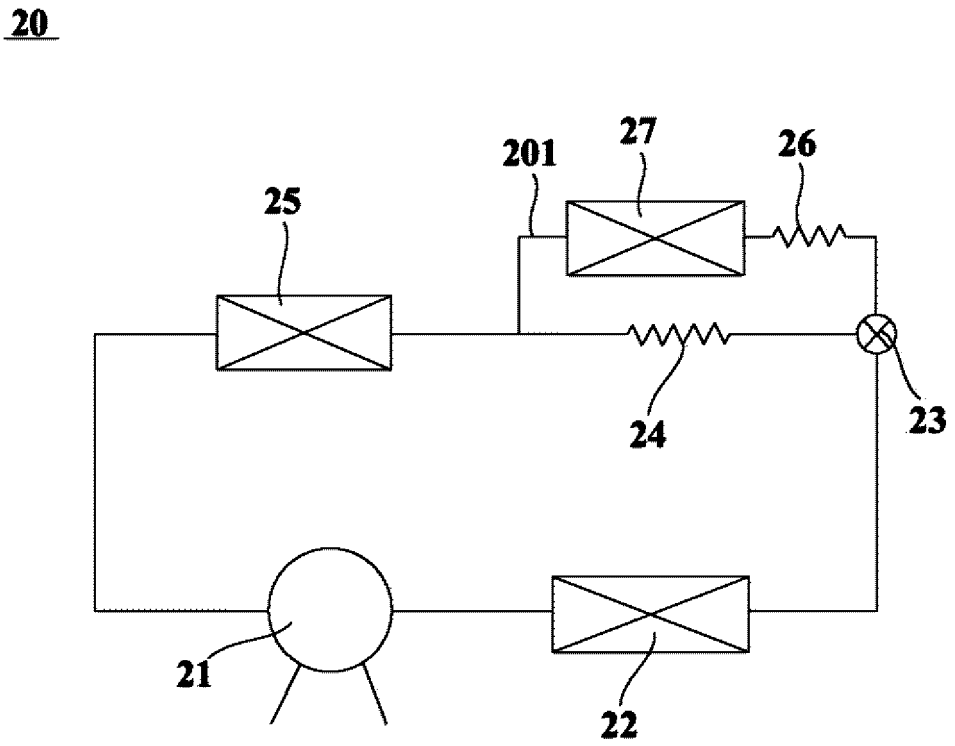

FIG. 2

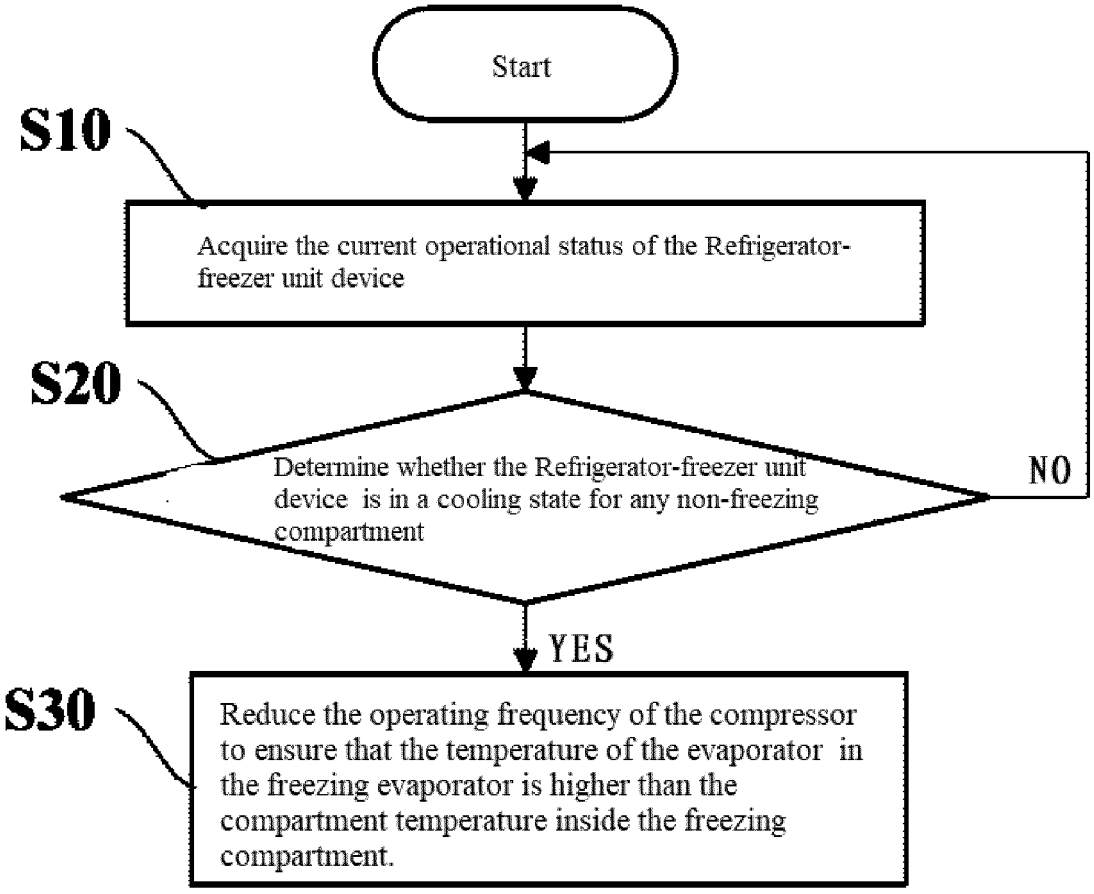
Start
S10
Acquire the current operational status of the Refrigerator-freezer unit device
S20
Determine whether the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment
NO
YES
S30
Reduce the operating frequency of the compressor to ensure that the temperature of the evaporator in the freezing evaporator is higher than the compartment temperature inside the freezing compartment.

FIG. 3

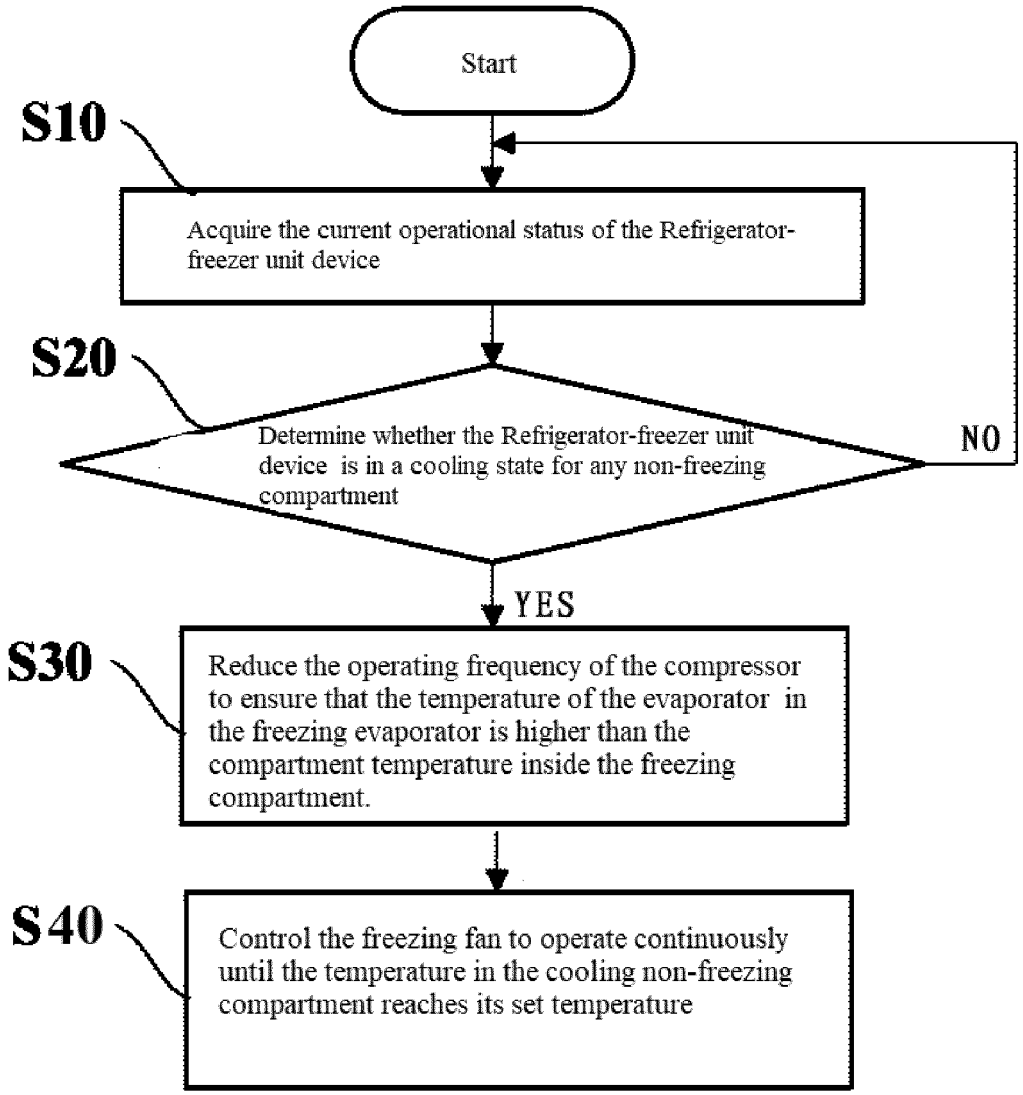
Start
S10
Acquire the current operational status of the Refrigerator-freezer unit device
S20
Determine whether the Refrigerator-freezer unit device is in a cooling state for any non-freezing compartment
NO
YES
S30
Reduce the operating frequency of the compressor to ensure that the temperature of the evaporator in the freezing evaporator is higher than the compartment temperature inside the freezing compartment.
S40
Control the freezing fan to operate continuously until the temperature in the cooling non-freezing compartment reaches its set temperature

FIG. 4

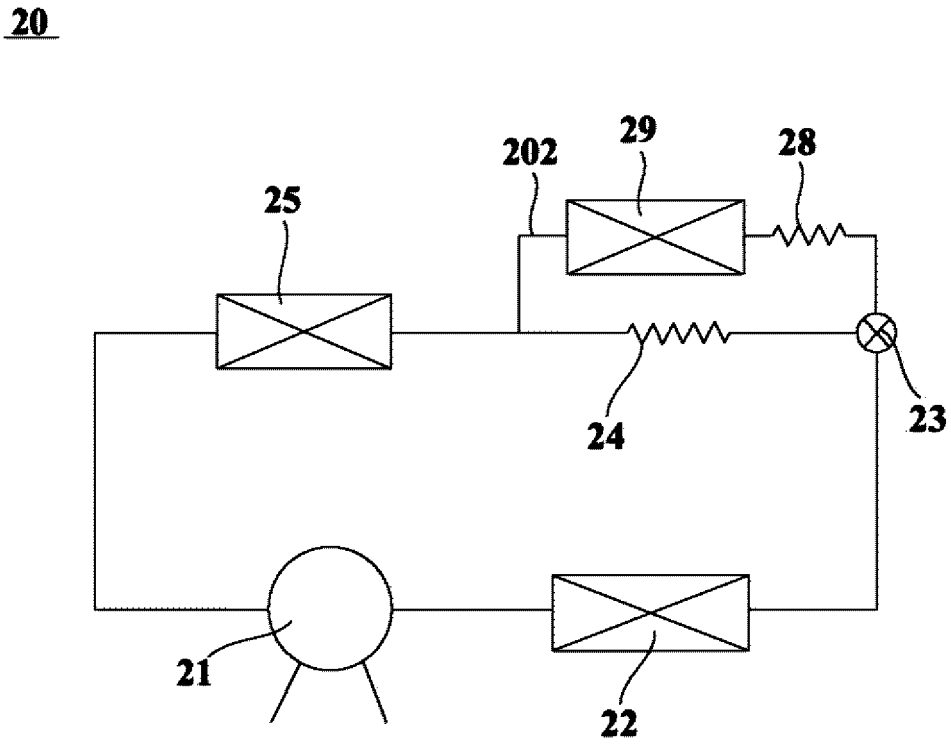

FIG. 5

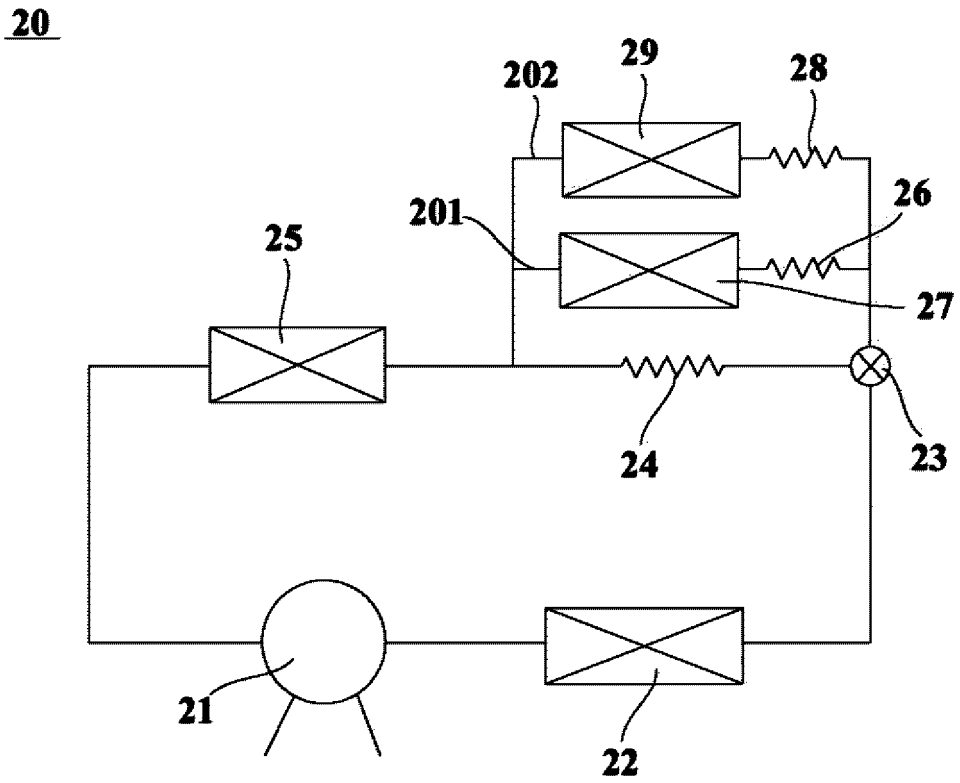
20
202
29
28
201
26
25
27
24
23
21
22

FIG. 6

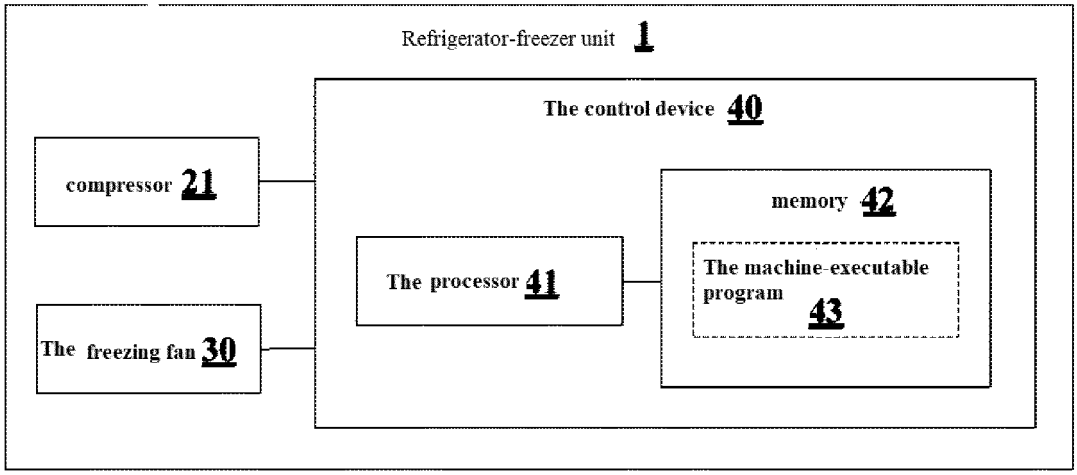
Refrigerator-freezer unit 1
The control device 40
compressor 21
memory 42
The processor 41
The machine-executable program 43
The freezing fan 30

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/093876

A. CLASSIFICATION OF SUBJECT MATTER

F25D 29/00(2006.01)i; F25D 11/02(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)

F25D11; F25D29; F25D21

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)

CNKI, CNTXT, CNABS, ENTXT, ENTXTC, DWPI, VEN: 冷冻室, 冷冻间室, 保湿, 增湿, 加湿, 湿度, 增加, 保持, 提高, 压缩机, 频率, 蒸发器, 温度, freez+, humidif+, humidity, increas+, enhanc+, improv+, keep, retain, compressor, frequency, evaporator, temperature

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 207113362 U (HEFEI HUALING CO., LTD. et al.) 16 March 2018 (2018-03-16) description, paragraphs [0029]-[0041], and figure 1	1-10
A	CN 207113361 U (HEFEI HUALING CO., LTD. et al.) 16 March 2018 (2018-03-16) entire document	1-10
A	CN 207515321 U (HEFEI HUALING CO., LTD. et al.) 19 June 2018 (2018-06-19) entire document	1-10
A	CN 103673483 A (AUCMA CO., LTD.) 26 March 2014 (2014-03-26) entire document	1-10
A	CN 106871539 A (HEFEI HUALING CO., LTD. et al.) 20 June 2017 (2017-06-20) entire document	1-10
A	CN 105972905 A (HEFEI MEILING CO., LTD.) 28 September 2016 (2016-09-28) entire document	1-10
A	JP 2001272147 A (HOSHIZAKI ELECTRIC CO., LTD.) 05 October 2001 (2001-10-05) entire document	1-10

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

* Special categories of cited documents:
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 July 2022	**05 August 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/093876

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2008057904 A (HITACHI APPLIANCES INC.) 13 March 2008 (2008-03-13) entire document	1-10
A	KR 100661836 B1 (SAMSUNG ELECTRONICS CO., LTD.) 28 December 2006 (2006-12-28) entire document	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/093876

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 207113362 U	16 March 2018	None	
CN 207113361 U	16 March 2018	None	
CN 207515321 U	19 June 2018	None	
CN 103673483 A	26 March 2014	None	
CN 106871539 A	20 June 2017	None	
CN 105972905 A	28 September 2016	None	
JP 2001272147 A	05 October 2001	None	
JP 2008057904 A	13 March 2008	CN 101135532 A	05 March 2008
KR 100661836 B1	28 December 2006	None	

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