(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 680 589 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.07.2020 Bulletin 2020/29

(51) Int Cl.:
F25D 17/06 *(2006.01)*

(21) Application number: **20150245.7**

(22) Date of filing: **03.01.2020**

(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
Designated Validation States:
KH MA MD TN

(30) Priority: **10.01.2019 KR 20190003588**

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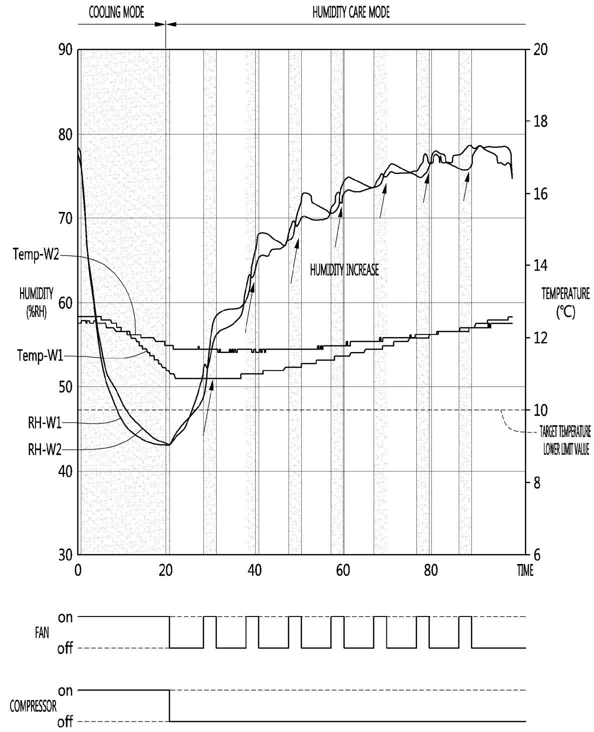
(54) **REFRIGERATOR**

(57) A refrigerator includes a cabinet configured to form a storage space, a temperature adjusting device configured to cool the storage space, a fan configured to blow air heat-exchanged with the temperature adjusting device to the storage space, a heating device configured to heat the storage space, and a controller configured to control the fan and the heating device, in which the controller starts a humidity care mode which drives the fan if a door that opens and closes the storage space is in a closed state, the temperature adjusting device is not operated, and the heating device is off.

FIG. 18



EP 3 680 589 A1

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND

1. Field

[0001] The present disclosure relates to a refrigerator.

2. Background

[0002] In general, a refrigerator is an appliance that allows food or other items to be stored at a relatively low temperature in an internal storage space that is accessed by a door. The refrigerator may cool the inside of the storage space by using air heat exchanged with the refrigerant circulating in a refrigeration cycle such that stored food, cosmetics, or the like (hereinafter, referred to as goods) may be in an optimal state. For example, the refrigerator may condense moisture in the air in the storage chamber by a heat exchanging device such as an evaporator such that the storage chamber may have relatively lower humidity than the outside of the refrigerator. Some of the goods stored in a refrigerator may be optimally stored at an appropriate humidity, and for this purpose, a refrigerator may include a component to adjust the humidity of the storage chamber.

[0003] An example of a refrigerator having a humidity adjuster is a temperature and humidity adjusted wine refrigerator discussed in Korean Utility Model Publication No. 20-0380906 Y1 (published March 29, 2005). The refrigerator in this reference has a humidity adjuster that includes a humidification device with a vapor discharge port, and the humidification device is operated to increase the humidity of the refrigerator. However, installing a humidity adjuster with a humidification device in the refrigerator may complicate the structure of the refrigerator and increase costs of the refrigerator. Furthermore,

[0004] In another example, a refrigerator may be formed to include a separate outside air suction passage such that the air outside the refrigerator can flow into the storage chamber to provide additional humidity to the storage chamber. However, the cooled air in the storage chamber may be exhausted through the outside air suction passage, causing a potentially large heat loss, and potentially allowing foreign matter, such as dust, to penetrate the storage chamber through the outside air suction passage.

[0005] The above reference is incorporated by reference herein where appropriate for appropriate teachings of additional or alternative details, features and/or technical background.

SUMMARY

[0006] An object of the present invention is to provide a refrigerator having an improved humidity control.

[0007] The object is solved by the features of the independent claims. Preferred embodiments are given in the dependent claims.

[0008] According to one aspect a refrigerator is provided comprising: a cabinet configured to form a storage space; a door that opens and closes the storage space; a refrigeration system to cool the storage space, the refrigeration system including a fan that blows air between the refrigeration system and the storage space; and a controller configured to control the fan, wherein the controller drives the fan to increase humidity in the storage space when the door is closed and the refrigeration system is not operated to cool the storage space.

[0009] Preferably, the refrigerator may further comprise a heater to heat the storage space.

[0010] Preferably, the refrigerator may further comprise a damper that is configured to be opened and closed to adjust air flowing into the storage space.

[0011] Preferably, the controller may drive the fan to increase humidity in the storage space when the door is closed, the refrigeration system is not operated to cool the storage space, and the heater is in a power off state.

[0012] Preferably, the controller may drive the fan for a predetermined time and may open the damper to increase humidity in the storage space when the door is closed and the refrigeration system is not operated to cool the storage space.

[0013] Preferably, the controller may pause driving the fan to increase humidity in the storage space when the door is opened or the refrigeration system is operated to cool the storage space, or a heater is in a power-on state to heat the storage space.

[0014] Preferably, the controller may, after pausing the driving of the fan to increase humidity in the storage space, resume driving the fan to increase humidity in the storage space when the door is closed, the refrigeration system is not operated to cool the storage space, and the heating device is in a power-off state.

[0015] Preferably, the storage space may include a first storage space and second storage space.

[0016] Preferably, the first storage space may have a first fan and the second storage space may have the second fan.

[0017] Preferably, the refrigeration system may include a first refrigeration system for controlling temperature of the first storage space having a first target temperature and a second refrigeration system for controlling temperature of the second storage space.

[0018] Preferably, the second storage space may be partitioned from the first storage space.

[0019] Preferably, the second storage space may be associated with a second target temperature that is lower than the first target temperature.

[0020] Preferably, the refrigerator may further comprise a second refrigeration system which cools the second storage space, the second refrigeration system including a second fan that blows air between the second refrigeration system and the second storage space.

[0021] Preferably, the controller may delay driving the first fan to increase humidity in the first storage space when the second refrigeration system is being defrosted.

[0022] Preferably, the controller may delay driving the fan to increase humidity in the storage space when the humidity of the refrigeration space is equal to or greater than a set humidity level.

[0023] Preferably, the controller may stop driving the fan to increase humidity in the storage space when the humidity of the refrigeration space is equal to or greater than a set humidity level.

[0024] Preferably, the storage space may be a refrigeration space which is partitioned into a first space and a second space, wherein the fan blows air into the first space and the second space.

[0025] Preferably, the refrigerator may further comprises a first damper that can be opened and can be closed to adjust a flow of air from the refrigeration system into the first space.

[0026] Preferably, the refrigerator may further comprises a second damper that can be opened and closed to adjust a flow of air from the refrigeration system into the second space.

[0027] Preferably, the controller may open the first damper and close the second damper during a first portion of a time period when driving the fan to increase humidity in the storage space.

[0028] Preferably, the controller may close the first damper and open the second damper during a second portion of the time period when driving the fan to increase humidity in the storage space.

[0029] Preferably, a target temperature of the first space may be higher than a target temperature of the second space.

[0030] Preferably, the controller may close the first damper and open the second damper during the second portion of the time period when driving the fan to increase humidity in the storage space even when a temperature in the first space is outside at a target range associated with the target temperature of the first space.

[0031] Preferably, the controller may determine that the refrigeration system is not operated to cool the storage chamber when refrigerant stops flowing to an evaporator of the refrigeration system.

[0032] Preferably, the controller may delay driving the fan to increase humidity in the storage space after a set time has elapsed after refrigerant stops flowing to the evaporator of the refrigeration system.

[0033] Preferably, the controller may, when controlling the fan, drive the fan to blow a first volume of air when the refrigeration system is operated to cool the refrigeration space.

[0034] Preferably, the controller may drive, when the door is closed and the refrigeration system is not operated to cool the refrigeration space, the fan to blow a second volume of air to increase humidity in the refrigeration space.

[0035] Preferably, the first air volume is greater than the second air volume.

[0036] Preferably, the controller may pause driving the fan to blow the second volume of air when the door is opened or the refrigeration system is operated to cool the refrigeration space.

[0037] Preferably, the controller may resume driving the fan to blow the second volume of air when the door is closed and the refrigeration system is not operated to cool the refrigeration space.

[0038] Preferably, the refrigerator may further comprise a heater configured to heat the refrigeration space.

[0039] Preferably, the controller may not drive the fan when the heater is operated to heat the refrigeration space.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, and wherein:

Fig. 1 is a sectional view illustrating an example of a refrigerator according to an embodiment of the present disclosure;

Fig. 2 is a sectional view illustrating another example of a refrigerator according to an embodiment of the present disclosure;

Fig. 3 is a front view when a refrigerator according to an embodiment of the present disclosure is disposed adjacent to another refrigerator;

Fig. 4 is a view illustrating on and off of cooling device(s) and on and off of heating device(s) according to the temperature change of the storage chamber according to an embodiment of the present disclosure;

Figs. 5 to 8 are views illustrating examples of a refrigeration cycle of a refrigerator according to an embodiment of the present disclosure;

Fig. 9 is a control block diagram of a refrigerator of an embodiment of the present disclosure;

Fig. 10 is a perspective view illustrating a see-through door of a refrigerator according to an embodiment of the present disclosure;

Fig. 11 is a plan view when an example of a door according to an embodiment of the present disclosure is opened in a door opening module;

Fig. 12 is a cross-sectional view when another example of a door according to an embodiment of the present disclosure is opened by the door opening module;

Fig. 13 is a sectional view when a holder illustrated in Fig. 12 is lifted;

Fig. 14 is a front view illustrating a storage chamber of a refrigerator according to an embodiment of the present disclosure;

Fig. 15 is a rear view illustrating an inner portion of the inner guide according to an embodiment of the present disclosure;

Fig. 16 is a view showing a change in storage chamber temperature and storage chamber humidity in the cooling mode of the storage chamber according to an embodiment of the present disclosure;

Fig. 17 is a view illustrating a compressor operation and a fan operation when repeating the operation in which the second storage chamber is cooled after the first storage chamber is cooled according to an embodiment of the present disclosure;

Fig. 18 is a view illustrating a change in relative humidity of the storage space while the fan is periodically turned on/off after the first storage chamber is cooled according to the present embodiment;

Fig. 19 is a flowchart illustrating a humidity care mode of a refrigerator according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0041] Hereinafter, specific embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. For example, FIG. 1 is a sectional view illustrating an example of a refrigerator according to an embodiment of the present disclosure.

[0042] The refrigerator may have a storage chamber (or refrigeration chamber) W in which goods and the like may be stored. The refrigerator may include a cabinet 1 in which a storage chamber W is formed. The refrigerator may further include a door 50 that opens and closes the storage chamber W. The door 50 may include at least one of a rotatable door 5 (e.g., a swinging door) or an advancing and retracting type door 6 (e.g., a drawer). The cabinet 1 may include an outer case 7 forming an outer appearance and an inner case 8 forming at least one surface for forming the storage chamber W therein.

[0043] The storage chamber W may be a storage chamber to receive mainly certain kinds of goods which are preferably stored at a specific temperature range. For example, the storage chamber W may be a dedicated storage chamber for storing certain goods that need to be kept warm or cold, for example, alcoholic liquors such as wine and beer, fermented foods, cosmetics, or medical supplies. As one example, the storage chamber for receiving wine may be maintained at a temperature range of 3°C to 20°C, and this temperature range is relatively higher than temperatures for the refrigerating chamber of a conventional refrigerator to receive food items, and is preferable not to exceed 20°C. More specifically, the temperature of the storage chamber for red wine can be adjusted to 12°C to 18°C, and the temperature of the storage chamber for white wine can be adjusted to 6°C to 11°C. In another example, the temperature of the storage chamber for champagne can be adjusted to about 5°C.

[0044] The temperature of the storage chamber W can be adjusted such that the storage chamber temperature fluctuates between a target temperature upper limit value and a target temperature lower limit value of the storage chamber W. The quality or freshness of the goods stored in the storage chamber W may be reduced by the difference between the target temperature upper limit value and the target temperature lower limit value (hereinafter, referred to as storage chamber temperature difference). The refrigerator may be manufactured with a small storage chamber temperature difference according to the type of the goods and may minimize the reduction of the quality of the goods. The storage chamber W of the refrigerator of the present embodiment may be a storage chamber having a smaller storage chamber temperature difference than that of a general refrigerator. For example, the storage chamber temperature difference of the storage chamber W may be less than 3°C and may be 2°C, as an example. Of course, in a case of considering certain types of goods that are very sensitive to temperature changes, the storage chamber temperature difference may be less than 1°C.

[0045] The refrigerator may include a device capable of adjusting the temperature of the storage chamber W (hereinafter, referred to as a "temperature adjusting device" or "temperature adjusting module"). The temperature adjusting device may include at least one of a cooling device or a heating device. The temperature adjusting device may cool or heat the storage chamber W by at least one of conduction, convection, and radiation. For example, a cooling device, such as an evaporator 150 or a heat absorbing body of a thermoelectric element, may be attached to the inner case 8 to cool the storage chamber W by conduction. By adding an airflow forming mechanism such as a fan, the air may be heat-exchanged with the cooling device by convection and supplied to the storage chamber W. In another example, a heating device, such as a heater or a heat generating body of the thermoelectric element, may be attached to the inner case 8 to heat the storage chamber W by conduction. An airflow forming mechanism, such as a fan, can supply a flow of air that is heated by convection and provided to the storage chamber W by convection.

[0046] In the present specification, the cooling device may be defined as a device capable of cooling the storage chamber W, including at least one of the evaporator 150, the heat absorbing body of the thermoelectric element, or the fan. In addition, the heating device may be defined as a device capable of heating the storage chamber W, including at least one of a heater, a heat generating body of the thermoelectric element, or a fan.

[0047] The refrigerator may further include an inner guide 200. The inner guide 200 may partition an inner portion of the inner case 8 into a first space in which goods are stored and a second space in which a temperature adjusting device is located (the second space hereinafter being referred to as a "temperature adjusting device chamber"). The temperature adjusting device chamber may include a cooling device chamber and a heating device chamber. For example, the temperature adjusting device chamber can be located between the inner guide 200 and the inner case 8, between the inner guide 200 and the outer case 7, or inside the inner guide

200, such as in the storage chamber W.

[0048] The inner guide 200 may be disposed to partition a cold air flow path P for supplying cold air to the space where goods are stored and the storage chamber W, and at least one cooling device may be disposed in the cold air flow path P. The inner guide 200 may be further disposed to partition a space in which goods are stored and a hot air flow path P for supplying heat to the storage chamber W, and at least one heating device may be disposed in the hot air flow path P. The inner guide for the cooling device and the inner guide for the heating device may be designed in common or may be manufactured separately. The inner guide 200 may form a storage space (or refrigeration space) together with the inner case 8. The inner guide 200 may be disposed in front of the rear body of the inner case.

[0049] The refrigerator may have one space having the same storage chamber temperature range of the storage chamber W or may have two or more spaces having different storage temperature ranges from each other (such as freezer/refrigerator combination. The refrigerator may further include a partition member 3 disposed vertically or horizontally in order to divide the storage chambers W into two or more spaces (for example, a first space W1 and a second space W2) which have different storage chamber temperatures range from each other.

[0050] The refrigerator may further include the partition member 10 disposed vertically or horizontally in order to divide the storage chambers W into two or more spaces (for example, a second space W2, a third space W3) which have different storage chamber temperatures range from each other. The partition member 10 may be separately manufactured and then mounted in the inner case 8. The partition member 10 may be manufactured as a heat insulating material disposed between the outer case 7 and the inner cases 8 and 9.

[0051] The two or more spaces may be different in size and locations. For example, the first space W1 may be located at the upper side, the second space W2 may be located at the lower side, and the partition member 3 may be disposed so that the size of the first space W1 is larger than the size of the second space W2. In one example, the first storage chamber temperature for the first space W may be higher than the second storage chamber temperature for the second space W2.

[0052] In the present specification, it can be defined that a meaning of the first storage chamber temperature being higher than the second storage chamber temperature corresponds to at least one case of a case where the maximum value of the first storage chamber temperature is greater than the maximum value of the second storage chamber temperature, a case where the average value of the first storage chamber temperature is greater than the average value of the second storage chamber temperature, a case where the minimum value of the first storage chamber temperature is greater than the minimum value of the second storage chamber temperature, or a case where a current detected value of the first storage chamber temperature is greater than a current detected value of the second storage chamber temperature..

[0053] The refrigerator may further include a door (hereinafter, a see-through door) through which the user can see the storage chamber through a see-through window without opening the door 50 from the outside of the refrigerator, and the see-through door will be described later. In addition, the refrigerator may further include a transparent gasket 24 disposed on at least one of the see-through door or the partition members 3 and 10. When the see-through door closes the storage chamber W, the transparent gasket 24 may combine with the partition members 3 and 10 to partition the storage chamber W into two or more spaces having different storage temperature ranges from each other together.

[0054] The refrigerator may further include door opening modules (or door motors) 11 and 11' for guiding an opening motion of the door 50. The door opening modules 11 and 11' may be a rotatable door opening module 11 which can allow the door 5 to be rotated more than a predetermined angle without the user holding the door 5, or an advancing and retracting type door opening module 11' which can allow the door (e.g., a drawer) 6 to be advanced and retracted in a front and rear direction. The door opening modules 11 and 11' will be described later.

[0055] The refrigerator may further include a lifting module (or lifting mechanism) 13 capable of lifting or lowering the holder (or bin) 12, and although not illustrated in FIG. 1, the lifting module may be located in at least one of the storage chamber or the door.

[0056] As previously described, the refrigerator may include a plurality of doors for opening and closing two or more spaces having different storage temperature ranges from each other. At least one of the plurality of doors may be a see-through door having a region that is formed of a transparent or translucent material, such as glass. At least one of the cabinet 1 or the plurality of doors may include door opening modules 11 and 11'. The lifting module 13 for lifting and lowering the holder located in the storage chamber to open and close may be disposed on at least one of the plurality of doors. For example, the door for the storage chamber located at the top may be a see-through door, and a lifting module 13 for lifting and lowering a holder 12 of a storage chamber located at the lower portion may be disposed.

[0057] FIG. 2 is a sectional view illustrating an example of another type of refrigerator according to an embodiment of the present disclosure. Hereinafter, the storage chamber W illustrated in FIG. 1 will be described as a first storage chamber W. The refrigerator may further include at least one of the first storage chamber W (e.g., first chambers W1 and W2) and at least one second storage chamber C that may be temperature-controlled independently of the first storage chamber W. Hereinafter, a detailed description of the same configuration and operation as those of the storage chamber W illustrated in FIG. 1 will be omitted for the first storage chamber W, and a different configuration and operation from the storage chamber W illustrated in FIG. 1 will be described.

[0058] The second storage chamber C may be a storage chamber having a temperature range lower than the temperature range of the first storage chamber W and, for example, may be a storage chamber having a temperature range of -24°C to 7°C. The second storage chamber C may be a storage chamber which is temperature-controlled based on a target temperature, which is a temperature selected by a user in this lower temperature range (e.g., between -24°C to 7°C). The second storage chamber C may be composed of a switching chamber (or a temperature changing chamber) in which any one of a plurality of temperature ranges may be selected, or may be configured as a non-switching chamber having one temperature range.

[0059] The switching chamber is a storage chamber which can be temperature-controlled to a selected temperature range among a plurality of temperature ranges, and the plurality of temperature ranges may include, for example, a first temperature range above zero, a second temperature range below zero, and a third temperature range between the first temperature range and the second temperature range. For example, the user may provide an input to control the second storage chamber C to operate in a mode (for example, a refrigerating chamber mode) associated with a temperature range above zero, and accordingly, the temperature range of the second storage chamber C may be selected a temperature range above zero (for example, 1°C to 7°C). For example, the user may further input a desired temperature in the temperature range above zero, and the target temperature of the second storage chamber C may be a specific temperature (for example, 4°C) entered by a user in the temperature range (for example, 1°C to 7°C) above zero.

[0060] In another example, the user can provide an input to select an operating mode in which the second storage chamber C is maintained in the temperature range below zero (for example, freezing chamber mode) or a special mode (for example, a mode for maintaining an optimal temperature range for storing certain kind of goods, such as a kimchi storage mode). For example, the user may further input a desired temperature in the temperature range below zero or a desired temperature for the certain type of goods, and the second storage chamber C may be maintained within a temperature range that is centered at or otherwise includes the specific inputted temperature.

[0061] As previously described, the first storage chamber W may be a specific goods storage chamber in a specific temperature range or other environmental conditions (e.g., humidity, light levels, etc.) are maintained to optimally store a particular kind of goods or to mainly store a certain kind of goods, or the second storage chamber C may be a non-specific goods storage chamber in which a various kinds of goods may be stored in addition to a specific kind of goods. Examples of specific goods may include alcoholic beverages such as wine, fermented foods, cosmetics, and medical supplies. For example, the first storage chamber W may be a storage chamber in which wine is stored or a wine chamber in which wine is mainly stored, and the second storage chamber C may be a nonwine chamber in which goods other than wine are stored or goods other than wine are mainly stored.

[0062] A storage chamber having a relatively small storage chamber temperature difference among the first storage chamber W and the second storage chamber C may be defined as a constant temperature chamber, and a storage chamber having a relatively large storage chamber temperature difference among the first storage chamber W and the second storage chamber C may be defined as a non-constant temperature chamber.

[0063] Any one of the first storage chamber W and the second storage chamber C may be a priority storage chamber which is controlled in priority, and the other may be a subordinate storage chamber which is controlled in relatively subordinate. A first goods having a large or expensive quality change according to the temperature change may be stored in the priority storage chamber, and A second goods having a small or low quality change according to the temperature change may be stored in the subordinate storage chamber.

[0064] The refrigerator may perform a specific operation for the priority storage chamber and a specific operation for the subordinate storage chamber. The specific operation includes a general operation and a special operation for the storage chamber. A general operation may include, for example, a conventional cooling operation for the storage chamber cooling. The special operation may include, for example, a defrost operation for defrosting the cooling device, a door load response operation that can be performed when one or more predetermined conditions are satisfied after the door is opened, or an initial power supply operation, which is an operation when the power is first supplied to the refrigerator.

[0065] The refrigerator may be controlled such that a specific operation for the priority storage chamber is performed first when two operations collide with each other. Here, the collision of the two operations may be occur, for example, as a case where the start condition of the first operation and the start condition of the second operation are satisfied at the same time; as a case where the start condition of the first operation is satisfied and thus the start condition of the second operation is satisfied while the first operation is in progress; or as a case where the start condition of the second operation is satisfied and thus the start condition of the first operation is satisfied while the second operation is in progress.

[0066] For example, in the refrigerator, the priority storage chamber may be cooled or heated prior to the subordinate storage chamber when the temperature of the priority storage chamber is not satisfied and the temperature of the subordinate storage chamber is not satisfied. In another example, while the cooling device for cooling the subordinate storage chamber is being defrosted, if the temperature of the priority storage chamber is not satisfied, the priority storage chamber may be cooled or heated while the cooling device of the subordinate storage chamber is being defrosted (even if this cooling or heating of the priority chamber may interfere with defrosting the cooling device of the subordinate storage chamber).

[0067] In another example, if the temperature of the priority storage chamber is not satisfied (e.g., outside of a desired temperature range) while the subordinate storage chamber is in progress of the door load response operation, the priority storage chamber may be cooled or heated during the door load response operation of the subordinate storage chamber such that the temperature of the priority storage chamber is adjusted to be within the desired temperature range.

[0068] In certain configurations, any one of the first storage chamber W and the second storage chamber C may be a storage chamber in which the temperature is adjusted by the first cooling device and the heating device, and the other is a storage chamber in which the temperature is adjusted by a second cooling mechanism or device.

[0069] In the refrigerator, a separate receiving member (or storage drawer) 4 may be additionally disposed in at least one of the first space W1 or the second space W2. In the receiving member 4, a separate space S (hereinafter, referred to as a receiving space) may be formed separately from the first space W1 and the second space W2 to accommodate goods. The refrigerator may adjust the receiving space S of the receiving member 4 to a temperature range different from that of the first space W1 and the second space W2.

[0070] The receiving member 4 may be disposed to be located in the second space W2 provided below the first space W1. The receiving space S of the receiving member 4 may be smaller than the second space W2. In one example, the storage chamber temperature of the receiving space S may be equal to or less than the storage chamber temperature of the second space W2.

[0071] In the refrigerator, in order to dispose as many shelves 2 as possible in the first storage chamber W, the length of the refrigerator itself in the vertical direction may be longer than the width in the horizontal direction, and in this case, the length of the refrigerator in the vertical direction may be more than twice the width in the horizontal direction. Meanwhile, since the refrigerator may be unstable and tip over if the length in the vertical direction is too long relative to the width in the horizontal direction, it may be preferable that the length in the vertical direction is less than three times the width in the horizontal direction. Certain examples of the length in the vertical direction that can store a plurality of the specific goods may be 2.3 to 3 times the width in a left and right direction, and a particular example may be 2.4 to 3 times the width in the left and right direction.

[0072] Meanwhile, even if the length of the refrigerator in the vertical direction is longer than the width in the left and right direction, when the length of the storage chamber in which the specific goods are substantially stored (for example, the first storage chamber W) is relatively short in a vertical direction, the number of specific goods that may be received in the storage chamber may not be high. In the refrigerator, preferably, the length of the first storage chamber W in the vertical direction is longer than the length of the second storage chamber C in the vertical direction so that the specific goods can be stored as much as possible. For example, the length of the first storage chamber W in the vertical direction may be 1.1 times to 1.5 times the length of the second storage chamber C in the vertical direction.

[0073] As previously described, at least one of the first door 5 and the second door 6 may be a see-through door, and the see-through door will be described later. Additionally, the refrigerator may further include door opening modules 11 and 11' for guiding the opening of at least one of the first door 5 or the second door 6, and the door opening modules 11 and 11' will be described later. In at least one of the first storage chamber W, the second storage chamber C, the first door 5, or the second door 6, a lifting module 13 capable of lifting a holder 12 may be disposed, and the lifting module 13 will be described later.

[0074] FIG. 3 is a front view when a refrigerator according to an embodiment of the present disclosure is positioned adjacent to another refrigerator. The refrigerator described in the present disclosure may be disposed adjacent to one or more other refrigerators, and a pair of adjacent refrigerators may be disposed, for example, in the left and right direction. Hereinafter, for convenience of description, the first refrigerator Q1 and the second refrigerator Q2 will be referred for description thereof, and the same configuration of the first refrigerator Q1 and the second refrigerator Q2 as each other will be described using the same reference numerals for convenience of description. In one example, a refrigerator may include a plurality of storage chambers that may be located in the left and right direction and the vertical direction in one outer case, such as a side by side type refrigerator or a French door type refrigerator.

[0075] At least one of the first refrigerator Q1 and the second refrigerator Q2 may be a refrigerator to which an embodiment of the present disclosure is applied. Although the first refrigerator Q1 and the second refrigerator Q2 may have some functions that different from each other, the lengths (or heights) of the first and second refrigerators Q1 and Q2 in the vertical direction be the same or almost similar so that the overall appearance may give the same or similar feeling when disposed adjacent to each other in the left and right direction.

[0076] Each of the first refrigerator Q1 and the second refrigerator Q2 may include each of a first storage chamber and a second storage chamber, and the first storage chamber and the second storage chamber may include a partition member 10 partitioning in the vertical direction, respectively, and the partition member 10 of the first refrigerator Q1 and the partition member 10 of the second refrigerator Q2 may overlap in the horizontal direction.

[0077] The upper end 6A of the second door 6 opening and closing the second storage chamber of the first refrigerator Q1 and the upper end 6A of the second door 6 opening and closing the second storage chamber of the second refrigerator Q2 can coincide with each other in the horizontal direction. Similarly, the lower end 6B of the second door 6 opening and closing the second storage chamber of the first refrigerator Q1 and the lower end 6B of the second door 6 opening and closing the second storage chamber of the second refrigerator Q2 can coincide with each other in the horizontal direction.

[0078] FIG. 4 is a view illustrating on and off of a cooling device and on and off of heating device according to the temperature change of the storage chamber according to an embodiment of the present disclosure. As previously described, the refrigerator may be provided with cooling device and heating device that can be independently controlled to control the temperature of the storage chamber W.

[0079] The refrigerator may include cooling device and heating device for controlling the temperature of at least one storage chamber among a specific goods storage chamber, a constant temperature chamber, and a priority storage chamber. The refrigerator may perform a cooling operation E in which the storage chamber W is cooled by the cooling device(s) or a heating operation H in which the storage chamber W is heated by the heating device(s), for temperature control of the storage chamber W. The refrigerator may implement a standby mode D that maintains the storage chamber W in a current state without cooling or heating. The refrigerator may include a temperature sensor for sensing a temperature of the storage chamber W and may perform the cooling operation E, the heating operation H, and the standby mode D according to the storage chamber temperature sensed by the temperature sensor.

[0080] The cooling operation E is not limited to that the storage chamber W is continuously cooled by the cooling device(s) and may include a case where the storage chamber is cooled by the cooling device(s) as a whole, but the storage chamber W is temporarily not cooled by the cooling device(s) and a case where the storage chamber W is cooled by the cooling device(s) as a whole, but the storage chamber is temporarily heated by the heating device(s). The cooling operation E may include a case where the time when the storage chamber is cooled by the cooling device(s) is longer than the time when the storage chamber W is not cooled by the cooling device(s).

[0081] The heating operation H is not limited to the storage chamber W being continuously heated by the heating device(s) and include a case where the storage chamber W is heated by the heating device(s) as a whole, but the storage chamber W is temporarily not heated by the heating device(s) and a case where the storage chamber W is heated by the heating device(s) as a whole, the storage chamber W is temporarily cooled by the cooling device(s). The heating operation H may include a case where the time when the storage chamber W is heated by the heating device(s) is longer than the time when the storage chamber W is not heated by the heating device(s).

[0082] In one example, the temperature of the storage chamber W, which has been temperature-controlled by the cooling operation E, may be kept below a target temperature lower limit value without lifting above the target temperature lower limit value for a long time in a state of being lowered below the target temperature lower limit value. In this example, the refrigerator may start the heating operation H so that the storage chamber W is not overcooled when the storage chamber temperature falls below the lower limit temperature, and the heating device(s) can be turned on. As used herein, the lower limit temperature may be a temperature set to be lower than the target temperature lower limit value by the predetermined temperature.

[0083] In certain examples, the refrigerator may start the heating operation H so that the storage chamber temperature is not maintained in a low state for a long time when the storage chamber temperature is maintained between the target temperature lower limit value and the lower limit temperature during the setting time. For example, the heating operation H may be started when the storage chamber temperature is less than the lower limit temperature, and the lower limit temperature may be the heating operation start temperature.

[0084] One example of the standby mode D may be a mode in which the storage chamber temperature is maintained between the target lower limit value and the lower limit temperature, the refrigerator is not immediately switched to the heating operation H during the cooling operation E, and the cooling operation E, the standby mode D, and the heating operation H in the order can be controlled.

[0085] Additionally, the temperature of the storage chamber W, which has been temperature-controlled by the heating operation H, may be kept above the target temperature upper limit value without being lowered below the target temperature upper limit value for a long time in a state of lifting above the target temperature upper limit value. For example, when the storage chamber temperature exceeds the upper limit temperature, the refrigerator can start the cooling operation E so that the storage chamber W is not overheated, and the cooling device(s) can be turned on. The upper limit temperature may be a temperature set to be higher than a target temperature upper limit value.

[0086] The refrigerator may start the cooling operation E so that the storage chamber temperature does not remain high (e.g., above a high temperature limit) for a long time when the storage chamber temperature is maintained between the target temperature upper limit value and the upper limit temperature during the setting time. The cooling operation E may be started when the storage chamber temperature exceeds the upper limit temperature, and the upper limit temperature may be a cooling operation start temperature.

[0087] Another example of the standby mode D may be a mode in which the storage chamber temperature is maintained between the target temperature upper limit value and the upper limit temperature, and the refrigerator does not immediately switch to the cooling operation E during the heating operation H, but the heating operation H, the standby mode D, and the cooling operation E in the order can be controlled.

[0088] For example, the cooling operation E may be a mode in which the refrigerant passes through the evaporator, the air in the storage chamber W is cooled by the evaporator, and then flows into the storage chamber W. In the cooling operation E, the compressor may be turned on or off according to the temperature of the storage chamber W. In the cooling operation E, the compressor may be turned on or off such that the storage chamber temperature is maintained between the target temperature upper limit value and the target temperature lower limit value. Specifically, the compressor may be turned on because the cooling is not satisfied when the storage chamber temperature reaches the target temperature upper limit value and may be turned off when cooling is satisfied when the storage chamber temperature reaches the target temperature lower limit value.

[0089] The cooling operation E may include a cooling mode in which the refrigerant passes through the evaporator and the fan supplies heat exchanged air with the evaporator to the storage space, and a non-cooling mode in which the refrigerant does not pass through the evaporator, and when the storage chamber temperature lifts and lowers repeatedly between the upper limit temperature and the lower limit temperature in the cooling operation E, the cooling mode and the non-cooling mode may be alternately performed.

[0090] For example, in the heating operation H, the heater may be turned on or off so that the storage chamber temperature is maintained between the target temperature upper limit value and the target temperature lower limit value. Specifically, the heater may be turned off because heating is satisfied when the storage chamber temperature reaches the target temperature upper limit value and may be turned on because heating is not satisfied when the storage chamber temperature reaches the target temperature lower limit value.

[0091] The heating operation H may include a heating mode in which the refrigerant does not pass through the evaporator and the heater is turned on, and a non-heating mode in which the refrigerant does not pass through the evaporator and the heater is turned off, and in the heating operation H, when the storage chamber temperature repeats the lifting and lowering between the upper limit temperature and the lower limit temperature, the heating mode and the non-heating mode can be performed alternately.

[0092] For example, the standby mode D may be a mode in which the refrigerant does not pass through the evaporator and the heater maintains the off state. The standby mode D may be a mode in which air in the storage chamber W is not forced to flow by the storage chamber fan. The standby mode D may be a mode in which the heater also maintains the off state while the compressor maintains the off state.

[0093] FIG. 5 is a view illustrating a first example of a refrigeration cycle of a refrigerator according to an embodiment of the present disclosure, FIG. 6 is a view illustrating a second example of a refrigeration cycle of a refrigerator according to an embodiment of the present disclosure, FIG. 7 is a view illustrating a third example of a refrigeration cycle of a refrigerator according to an embodiment of the present disclosure, and FIG. 8 is a diagram illustrating a fourth example of a refrigeration cycle of a refrigerator according to an embodiment of the present disclosure.

[0094] The refrigeration cycles illustrated in FIGs. 5 to 8 may be applied to a refrigerator having three spaces (hereinafter, referred to as first, second, and third spaces) that may have different storage temperature ranges from each other. For example, the refrigeration cycles may be applied to at least one of i) a refrigerator having a first space W1, a separate second space W2, and a separate third space W3, ii) a refrigerator having a first storage chamber W having the first space W1 and the second space W2, and a second storage chamber C partitioned from the first storage chamber W, or iii) a refrigerator having a first storage chamber W and second and third storage chambers partitioned from the first storage chamber W.

[0095] The refrigeration cycle illustrated in FIGs. 5 to 7 may include a compressor 100, a condenser 110, a plurality of expansion mechanisms (or valves) 130', 130, 140, and a plurality of evaporators 150', 150, 160 and may further include a flow path switching mechanism (or refrigerant valves) 120'. A case where the first region is the first space W1, the second region is the second space W2, and the third region is the second storage chamber C will be described below. The first, second, and third regions are also applicable to cases ii) and iii) described above.

[0096] The plurality of evaporators 150', 150, 160 may include a pair of first evaporators 150', 150 capable of independently cooling the first space W1 and the second space W2, respectively, and a second evaporator 160 that can cool a second storage chamber C. One of the pair of first evaporators 150' and 150 may be an evaporator 150' cooling the first space W1, and the other of the pair of first evaporators 150' and 150 may be an evaporator 150 cooling the second space W2.

[0097] The plurality of expansion mechanisms 130', 130, and 140 may include a pair of first expansion mechanisms 130' and 130 connected to a pair of first evaporators 150' and 150, and a second expansion mechanism 140 connected to a second evaporator 160. Any one of the pair of first expansion mechanisms 130' and 130 may be an expansion mechanism 130' connected to any one 150' of the pair of first evaporators 150' and 150, and the other of the pair of first expansion mechanisms 130' and 130 may be an expansion mechanism 130 connected to the other one 150 of the pair of first evaporators 150' and 150.

[0098] The flow path switching mechanism 120' may include a first valve 121 capable of controlling a refrigerant flowing into the pair of first expansion mechanisms 130' and 130, and a second valve 122 capable of controlling a refrigerant flowing into the first valve 121 and the second expansion mechanism 140.

[0099] The refrigerator having the refrigeration cycle illustrated in FIGs. 5 to 7 may include a pair of first fans 181' and 181, and a second fan 182 for circulating cold air in the space of the second storage chamber C to the space of the second evaporator 160 and the second storage chamber C and may further include a condensation fan 114 for blowing outside air to the condenser 110. Any one 181' of the pair of first fans 181' and 181 may be a fan for the first space in which cold air in the first space W1 can be circulated into any one 150' of the pair of first evaporators 150' and 150 and the first space W1. In addition, the other one 181 of the pair of fans 181' and 181 may be a fan the second space in which cold air in the second space W2 can be circulated into any one 150 of the pair of first evaporators 150' and 150 and the second space W2.

[0100] The refrigeration cycle illustrated in FIG. 5 may include a first parallel flow path in which a pair of first evaporators 150' and 150 are connected in parallel and a second parallel flow path in which a pair of first evaporators 150' and 150 are connected to the second evaporator 160 in parallel. In this case, a one-way valve 168 may be installed at an outlet side of the second evaporator 160 to prevent the refrigerant at the outlet side of the second evaporator 160 from flowing back to the second evaporator 160.

[0101] The refrigeration cycle illustrated in FIG. 6 may include a parallel flow path in which a pair of first evaporators 150' and 150 are connected in parallel and a serial flow path 123 in which the pair of first evaporators 150' and 150 are connected to a second evaporator 160 in series. One end of the serial flow path 123 may be connected to a parallel flow path in which a pair of first evaporators 150' and 150 are connected in parallel. The other end of the serial flow path 123 may be connected between the second expansion mechanism 140 and the inlet of the second evaporator 160. In this case, a one-way valve 168 may be installed at the outlet side of the second evaporator 150 to prevent the refrigerant at the outlet side of the second evaporator 160 from flowing back to the second evaporator 160.

[0102] The refrigeration cycle illustrated in FIG. 7 may include a serial flow path 125 in which a pair of first evaporators 150' and 150 are connected in series, and, a parallel flow path in which the pair of first evaporators 150' and 150 are connected to the second evaporator 160 in parallel. One end of the serial flow path 125 may be connected to the outlet side of any one 150 of the pair of first evaporators 150' and 150. The other end of the serial flow path 125 may be connected to an inlet side of the other 150' of the pair of first evaporators 150' and 150'. In this case, a one-way valve 168 may be installed at the outlet side of the second evaporator 160 to prevent the refrigerant at the outlet side of the second evaporator 160 from flowing back to the second evaporator 160.

[0103] The refrigeration cycle illustrated in FIG. 8 may include one first evaporator 150 instead of the pair of first evaporators 150' and 150 illustrated in FIGs. 5 to 7, and one first expansion mechanism 130 instead of the pair of expansion mechanism 130' and 130. In addition, the refrigeration cycle illustrated in FIG. 8 may include a flow path switching mechanism (or valve) 120 for controlling the refrigerant flowing into the first expansion mechanism 130 and the second expansion mechanism 140, and the flow path switching mechanism 120 may include a refrigerant valve that can be switched so that the refrigerant flowing from the condenser 110 flows to the first expansion mechanism 130 or the second expansion mechanism 140. In addition, a one-way valve 168 may be installed at the outlet side of the second evaporator 160 to prevent the refrigerant at the outlet side of the second evaporator 160 from flowing back to the second evaporator 160.

[0104] Since other configurations and actions other than one first evaporator 150, one first expansion mechanism 130, a flow path switching mechanism 120, and a one-way valve 168 of the refrigeration cycle illustrated in FIG. 8 are the same as or similar to those of the refrigeration cycle illustrated in FIGs. 5 to 7, a detailed description with respect to those will be omitted.

[0105] In addition, the refrigerator having a refrigeration cycle illustrated in FIG. 8 may include a first fan 181 circulating cold air of the first storage chamber W into the first evaporator 150 and the first storage chamber W instead of the pair of first fans 181' and 181 illustrated in FIGs. 5 to 7. In addition, the refrigerator having the refrigeration cycle illustrated in FIG. 8 may include a first damper 191 for controlling cold air flowing into the first space W1 after being cooled by the first evaporator 150 and a second damper 192 for controlling the cold air flowing into the second space W2 after being cooled by the first evaporator 150. Only one of the first damper 191 and the second damper 192 may be provided. Meanwhile, in the refrigerator, one damper may selectively supply air cooled by the evaporator 150 to at least one of the first space W1 and the second space W2.

[0106] Modification of the examples of the refrigeration cycle illustrated in FIGs. 5 to 8 may be applied to a refrigerator having two spaces having different storage temperature ranges from each other. In other words, the modification examples of the refrigeration cycle may be applied to a refrigerator having a first space W1 and a second space W2 or a refrigerator having a first storage chamber W and a second storage chamber C. In certain examples, the refrigeration cycle can be configured with a cycle which does not include the flow path switching mechanisms 120 and 122, the second expansion mechanism 140, the second evaporator 160, the second fan 182, and the one-way valve 168.

[0107] Fig. 9 is a control block diagram illustrating a refrigerator according to an embodiment of the present disclosure. The refrigerator may include a controller 30 that controls various electronic devices such as a motor provided in the refrigerator. The controller 30 may control the refrigerator according to an input value of the input device, such as a user command, or an input value that is generated by the refrigerator, such as an input value generated based on sensor reading related to stored objects, ambient conditions, a location of the refrigerator, a sensed attribute of the user, etc.

[0108] The input device may include at least one of a communication device 31 which receives a signal from an external device such as a remote controller such as a remote controller or a mobile terminal such as a mobile phone, a microphone 32 that changes a user's voice to a sound signal, a sensing unit 33 which can sense a user's motion, a proximity sensor 34 (or a distance sensor) which can sense the user's proximity, a touch sensor 35 which can sense the user's touch, a door switch 36 which can detect the opening and closing of the door, and a timer 37 which can measure the lapse of time, and a control panel 39 capable of inputting a target temperature.

[0109] As previously described, the refrigerator may include a see-through door. The see-through door may be a door that can selectively switched between a first state in which the door is at least partially transparent and a user can see through the door (a see-through activation state), and a second state in which the door is at least partially opaque and a user cannot see through the door (a see-through deactivation state). The see-through door may be a door that is changed from a see-through deactivation state to a see-through activation state or is changed from a see-through activation state to a see-through deactivation state according to an input value provided to the controller 30 through the input device. In another example, the see-through door may be a door in which the see-through door is changed from see-through deactivation state to see-through activation state when the see-through door is closed and according to an input value provided to the controller 30 through the input device.

[0110] An example of an operation method according to the input device is now described. The sensing unit 33 may include a vibration sensor. For example, the vibration sensor may be disposed on the rear surface of the front panel, and the vibration sensor may be formed in black such that visible exposure of the vibration sensor may be minimized. For example, the sensing unit 33 may include a microphone or other audio sensor disposed, for example, on the rear surface of the front panel, and the microphone may sense sound waves of vibration applied to the front panel. When a user provides a particular input, such as tapping the panel assembly 23 a plurality of times at a predetermined time interval, the specific input may be detected through the sensing unit 33, and the controller 30 may change the see-through door to be activated or deactivated based on the detected input. Additionally or alternatively, the sensing unit 33 may be a device for imaging a user's motion, such as a camera. It may be determined whether the image photographed by the sensing unit 33 is similar or identical to a specific motion input in advance, and may be changed to activate or deactivate the see-through door according to the determination result.

[0111] Similarly, if it is determined that the user or a part of the user (e.g., the user's hand) is positioned within a predetermined distance or less (e.g., 30 cm or less) of a portion of the refrigerator according to the value detected by the proximity sensor 34, the see-through door may be changed between the activated or deactivated states. In another example, the see-through door may be changed between the activated or deactivated states when it is determined that the user positioned with a predetermined distance or less and is moving toward the refrigerator according to the value detected by the proximity sensor 34.

[0112] In another example, when the controller 30 determines that the door is closed according to the value detected by the door switch 36, the see-through door may be activated, and when it is determined that the door is open, the see-through door may be changed to be inactivated. For example, the see-through door may be in the deactivated state when opened and may remain in the deactivated state when closed, until a particular input is received that prompts the see-through door to be switched to the activated state.

[0113] The see-through door may be controlled to be deactivated after a certain time elapses after being activated according to the value input through the timer 37. For example, the see-through door may be controlled to be deactivated after a certain time elapses after an input to activate the see-through door is received. In another example, according to the value input through the timer 37, the see-through door may be controlled to be activated when a predetermined time elapses after being deactivated.

[0114] If the mechanisms for activating or deactivating the see-through door (e.g., a transparency control module) may include, for example, the panel assembly 23 and the light source 38. As an example in which the see-through door is activated or deactivated, there may be a case where the transparency of the see-through door itself may vary. For example, the see-through door may maintain in an opaque state when no current is applied to the panel assembly 23 and may be changed to be transparent when current is applied to the panel assembly 23. In another example, it can be a case that, when the light source 38 installed inside the see-through door is turned on, the user may see the storage chamber through the see-through door by the light emitted from the light source 38. The light source 38 may make the panel assembly 23 appear transparent or translucent so that an inside of the refrigerator (a side of the storage chamber relative to the panel assembly) looks brighter than outside of the refrigerator (outside relative to the panel assembly). The light source 38 may be mounted on the light source mounting portion formed on the cabinet 1 or the light source mounting portion formed on the door and may be disposed to emit light toward the panel assembly 23.

[0115] The controller 30 may control the door opening module 11 according to the input value of the input device. The controller 30 may control the lifting module 13 according to the input value of the input device.

[0116] FIG. 10 is a perspective view illustrating a see-through door of a refrigerator according to an embodiment of the present disclosure. The refrigerator may include a door (hereinafter, a see-through door) through which a user may view the storage chamber through a see-through window without opening the door 50 from the outside of the refrigerator. The see-through door may include an outer door 22 and a panel assembly 23.

[0117] The outer door 22 may be opaque, and an opening portion 21 may be formed in (e.g., in a central region) of the outer door 22. The outer door 22 may form an outer appearance of the see-through door. The outer door 22 may be rotatably connected to or connected to the cabinet 1 to be capable of being advanced and retracted to open storage chamber W. The panel assembly 23 may be disposed in the opening portion 21. The panel assembly 23 may be disposed to shield the opening portion 21. The panel assembly 23 can form the same outer appearance as the front surface of the outer door 22.

[0118] The see-through door may be provided to open and close the storage chamber which mainly stores goods (for example, wine) having a large quality change according to the temperature change (e.g., the goods are preferable stored in a narrow temperature range to preserve a quality of the goods). In a case where goods having a large quality change due to temperature change are mainly stored in the storage chamber W, the storage chamber W is preferably opened and closed as short as possible, the number of opening and closing is preferably minimized, and the see-through door is preferably installed to open and close the storage chamber W so that a user may view goods within the storage chamber without opening the door and disturbing the temperature within the storage chamber. For example, the see-through door may be provided in the door for opening and closing at least one of a specific goods storage chamber, a constant temperature chamber, or a priority storage chamber.

[0119] FIG. 11 is a plan view when an example of a swinging-type door according to an embodiment of the present disclosure is opened in a door opening module. In the refrigerator, a door opening and closing the storage chamber may be an automatic door, and the door for opening and closing the specific goods storage chamber, the constant temperature chamber, and a priority storage chamber may be an automatic door. The refrigerator may include a door opening module 11 that provides a force for automatically opening the door 5. For example, the automatic door may be controlled to be opened or closed according to an input value provided to the controller 30 through the input device. For this purpose, the controller 30 may control the door opening module 11.

[0120] The cabinet 1 may be coupled to a hinge mechanism 40 in which the hinge shaft 42 is connected to the door 5. The refrigerator may further include a module cover 70 that may cover the hinge mechanism 40 and the door opening module 11 together. In addition, the door opening module 11 may include a drive motor 72, a power transmission unit 74, and a push member 76.

[0121] When the power of the refrigerator is turned on, the controller 30 may wait to receive an open command of the door 5. When the door opening command is input through the input device, the controller 30 may transmit an opening signal to the drive motor 72 included in the door opening module 11.

[0122] When the controller 30 transmits an opening signal to the drive motor 72, the drive motor 72 may be rotated in a first direction to move the push member 76 from the initial position to the door opening position. When the drive motor 72 rotates in the first direction, the power transmission unit 74 may transmit a first direction rotational force of the drive motor 72 to the push member 76, and the push member 76 may push the door while protruding forward, and the door 5 may be rotated in the forward direction with respect to the cabinet 1.

[0123] The controller 30 may determine whether the push member 76 has reached the door opening position in a process of rotating in the first direction of the drive motor 72. For example, the controller may determine that the push member 76 has reached the door opening position when the cumulative rotational speed of the drive motor 72 reaches the reference rotational speed. The controller 30 may stop the rotation of the drive motor 72 when it is determined that the push member 76 has moved to the door opening position.

[0124] In a state where the door 5 is rotated by a predetermined angle, the user can manually increase the opening angle of the door 5. When the user increases the opening angle of the door in a state where the push member 76 moves the door 5 to the door opening position, the door sensor including a magnet 46 and a reed switch 48 can sense the manual opening of the door 5, and if the manual opening of the door 5 is sensed by the door sensor, the controller 300 can output a return signal to the drive motor 72.

[0125] The controller 30 may transmit the return signal to the drive motor 72 so that the push member 76 returns to the initial position and the drive motor 72 may be reversely rotated in a second direction opposite to the first direction. If it is determined that the push member 76 has returned to the initial position, the controller 30 may stop the drive motor 72.

[0126] FIG. 12 is a sectional view when another example of a door according to an embodiment of the present disclosure is opened by a door opening module 11'. In the example shown in FIG. 12, the door is drawer that may be automatically opened by the door opening module 11' that applies an outward force.

[0127] The door opening module 11' illustrated in FIG. 12 may automatically open the door (or drawer) 6 disposed in the cabinet 1 to be capable of being advanced and retracted. The refrigerator may include a first door provided at a relatively higher at a greater height and a second door that is relatively lower and having a smaller height, and the door opening module 11' may be installed to automatically open a door having a lower height than other doors. Such a door may be a retractable automatic door which is automatically opened by the door opening module 11'. The door 6 advanced and retracted by the door opening module 11' may include a drawer body (or bin) 6A and a door body (or drawer front) 6B disposed at the drawer body 6A to open and close the storage chamber.

[0128] The door opening module 11' may include a drive motor 80, a pinion 82, and a rack 84. The pinion 82 may be connected to the rotation shaft of the drive motor 80. The rack 84 may extend from the door 6, in particular, the drawer body 6A. The refrigerator may further include a door sensor that senses a position of the door 6, and the door sensor may sense a pair of magnets 46' spaced apart from the door 6 and a reed switch (or Hall sensor) 48' sensing the magnet 46'.

[0129] When the power of the refrigerator is turned on, the controller 30 may wait to receive an opening command of the door 6. When the door opening command is input through the input device, the controller 30 may transmit an opening signal to the drive motor 80.

[0130] The drive motor 80 may be activated to rotate in the first direction by the controller 30 when an opening signal is input, and the pinion 82 and the rack 84 may transmit the rotational force of the drive motor 80 to the drawer body 82. The drawer body 6A may advance the door body 6B while advancing forward in the storage chamber, and the door body 6B can be advanced to be spaced apart from the cabinet 1 toward the front of the cabinet 1. The controller 30 may sense that the door 6 has reached the opening position by the door sensor, and when the door 6 has reached the opening position, the controller 30 may stop the rotation of the drive motor 80.

[0131] When the drawer body 6A is advanced as described above, the upper surface of the drawer body 6A may be exposed. In a state where the drawer body 6A is advanced to the opening position, the user can enter a door closing command such that the drawer body 6A retracts to the closing position via the input device. For example, if the motion sensed by the sensing unit 33 coincides with a specific motion, the controller 30 may transmit a close signal to the drive motor 80. In another example, the controller 30 may sense the proximity of the user by the proximity sensor 34 and transmit a closing signal to the drive motor 80 when the proximity sensor 34 detects that the user has moved more than a predetermined distance (e.g., toward the proximity sensor 34).

[0132] When the close signal is input, the drive motor 80 may be reversely rotated in a second direction opposite to the first direction. In reverse rotation of the drive motor 80, the pinion 82 and the rack 84 can transmit the rotational force of the drive motor 80 to the drawer body 6A, and while the drawer body 6A retracts into the storage chamber, the door body 6B can be retracted and the door body 6B can be retracted in close contact with the cabinet 1 toward the front of the cabinet 1. The controller 30 may sense that the door 6 has reached the closing position by the door sensor, and if the door 6 has reached the closing position, the controller 30 may stop the reverse rotation of the drive motor 80.

[0133] FIG. 13 is a sectional view illustrating when the holder 12 lifts while the door is opened according to the embodiment of the present disclosure. As previously described, the refrigerator may further include a lifting module (also referred to as a lift or elevator) 13 which allows the holder 12 to be automatically lifted and lowered after the holder 12 is moved forward in a state where the door 50 is opened. The holder 12 may be a shelf, a drawer, a basket, or the like on which goods can be placed. The lifting module 13 may be disposed in the storage chamber or at least one of the rotatable door 5 and the advancing and retracting type door 6 for opening and closing the storage chamber. The refrigerator may have both a first holder provided higher at a greater height and a second holder provided lower at a smaller lower height.

[0134] The lifting module 13 may be disposed in a low storage chamber associated with a holder 12 having a lower height than other holders 12. In another example, the lifting module 13 may function for lowering a holder and may be arranged in a storage chamber in which a holder having a relatively greater height than other holders is located.

[0135] An example of the lifting module 13 will be described. An example of the lifting module 13 may include a lower frame 93, an upper frame 94, a lifting and lowering mechanism 92 having at least one link 95, and a drive mechanism 90 capable of lifting and lowering the upper frame 94. The drive mechanism 90 may include a lifting and lowering motor 91 and a power transmission member connected to the lifting and lowering motor 91 to transfer the drive force of the lifting and lowering motor 91 to the upper frame 94.

[0136] When the refrigerator is turned on, the controller 30 may wait for a lifting command of the holder 12 to be input. When the lifting command is input through the input device, the controller 30 may transmit a lifting signal to the lifting and lowering motor 91 included in the lifting module 13. In another example, the controller 30 may automatically generate the lifting command when a drawer is fully opened and other, higher drawers are closed. When the controller 30 transmits an opening signal to the lifting and lowering motor 91, the lifting and lowering motor 91 may rotate in a first direction and the upper frame 94 may lift the holder 12 to the upper side of the drawer body 6B.

[0137] The user may input a lowering command through the input device, and the controller 30 may transmit a lowering signal to the lifting and lowering motor 91 when the lowering command is input through the input device. In another example, the controller 30 may automatically generate the lowering command when a lifted drawer is being closed or other, higher drawers start to be closed. For example, the lifting and lowering motor 91 may be reversely rotated in a second direction opposite to the first direction. Upon reverse rotation of the lifting and elevating motor 91, the upper frame 94 may be lowered to the inner lower portion of the drawer body 82, and the holder 12 may be inserted into the drawer body 6B together with the upper frame 94. In another example, the lifting and lowering motor 91 may be rotating in a same direction when lowering or lifting the holder 12, and a vertical movement direction may be adjusted by a power transmission member, such as to adjust a quantity and/or position of gears to receive a rotational force of the lifting and lowering motor 91.

[0138] Fig. 14 is a front view illustrating a storage chamber of a refrigerator according to an embodiment of the present disclosure, and Fig. 15 is a rear view illustrating an inside of the inner guide 200 according to an embodiment of the present disclosure. The inner guide 200 may be disposed in the cabinet 1 in which the first storage chamber W is formed, and may be disposed in the inner case 8 to partition the storage space and the air flow path P. The air flow path P may be formed between the inner guide 200 and the inner case 8 of the inner space of the inner case 8 or may be formed in the inner guide 200.

[0139] One example of the temperature adjusting device disposed in the air flow path P may be cooling device(s) capable of cooling the air passing through the air flow path P, and may cool the storage chamber. The cooling device(s) may be a heat absorbing body of the thermoelectric element, an evaporator 150 through which the refrigerant passes, or the like.

[0140] Hereinafter, the temperature adjusting device disposed in the refrigerant flow path P will be described as an example of cooling device(s), but the temperature adjusting device disposed in the air flow path P is not limited to being a cooling device(s), but may be a heating device such as a heater. For convenience, it will be described with reference to the same reference numeral 150 as the evaporator which can be an example for the temperature adjusting device disposed in the air flow path P.

[0141] At least one fan 181, 186 may be disposed in the inner case 8 or the inner guide 200. The fan 181 may be disposed in the inner guide 200 to circulate air in the storage space to the air flow path P and the storage space. The circulation fan 186 may circulate air in the storage space and may be an HG fan. The circulation fan 186 may be disposed in the circulation flow path P4, and the air of the storage space can flow into the circulation flow path P4 other than the air flow path P, and blow the air of the circulation flow path P4 into the storage space. The circulation flow path P4 may be formed to be partitioned from the air flow path P in the inner guide 200 and may be formed to communicate with the first space W1.

[0142] The inner guide 200 may form a storage space together with the inner case 8. The inner guide 200 may cover the temperature adjusting device 150 and the fan 181. When the inner guide 200 is disposed in front of the rear body of the inner case 8, the storage space may be a space in front of the inner guide 200 among the interior of the inner case 8, and the air flow path P may be formed between the inner guide 200 and the rear body of the inner case 8 or may be formed inside the inner guide 200.

[0143] When the refrigerator further includes a partition member 3, the partition member 3 may be closer to a lower end of the storage chamber.

[0144] The inner guide 200 may have a discharge port 204 and a suction port 205 spaced apart from each other, and the discharge port 204 and the suction port 205 may be formed to face the first space W1. The inner guide 200 may have a heat exchange flow path P1 in which the first cooling device(s) 150 and the fan 181 are received. The inner guide 200 may have a discharge flow path P2 through which air blown by the fan 181 is guided to the discharge port 204. The inner guide 200 may be provided with an additional discharge flow path P3 for guiding the air blown by the fan 181 to be discharged to the additional discharge port 321.

[0145] The heat exchange flow path P1, the discharge flow path P2, and the additional discharge flow path P3 may constitute an air flow path P for guiding air to circulate through the temperature adjusting device 150 and the storage space, and the temperature adjusting device 150 and the fan 181 may adjust the temperature of the first space W1 and the second space W2 in a state of being accommodated in the air flow path P.

[0146] The air guide 400 may include a front housing 410 and a rear housing 420 in which the fan 181 is received. The air guide 400 may have an outlet 412 communicating with the additional discharge port 321. The outlet 412 may be formed to face the additional discharge port 321 to discharge air to the additional discharge port 321 or may be in communication with the additional discharge port 321 through a discharge duct.

[0147] The refrigerator may include a guide 234 for guiding air forced by the fan 181 inside the air guide 400 to the outlet 412. The guide 234 may be formed in the discharge guide 202 to guide the air blown from the fan 181 to the outlet 412. The air guide 400 may be provided with a scroll 413 and an opening portion 414 for guiding air to the discharge flow path P2. The scroll 413 may guide the air blown from the fan 181 to the opening portion 414. The opening portion 414 may communicate with the lower end of the discharge flow path P2.

[0148] The first damper 191 may be disposed in the air flow path P and may adjust the air supplied to the first space W1. The second damper 192 may be disposed in the air flow path P and may adjust the air supplied to the second space W2.

[0149] The circulation fan 186 may be disposed in the inner guide 200. In the inner guide 200, when the circulation fan 186 is operated, a circulation flow path P4 through which air passes may be formed. The inner guide 200 may be formed with an inlet 188 through which air in the storage space flows into the circulation flow path P4 when the circulation fan 186 is driven. The inner guide 200 may have an outlet 189 through which air from the circulation flow path P4 is discharged into the storage space.

[0150] The inlet 188 and the outlet 189 may communicate with the first space W1. The circulation fan 186 may circulate air in the first space W1 into the circulation flow path P4 and the first space W1. A purifying unit 185 such as an air purifying filter may be disposed in the circulation flow path P4, and the air passing through the circulation flow path P4 may be purified by the purification unit 185. The inner guide 200 may further include an inlet body 187 forming the discharge guide 202 and the inlet 188.

[0151] The inner guide 200 may be provided with a first temperature sensor 190 for sensing the temperature of the first space W1 and a second temperature sensor 390 for sensing the temperature of the second space W2.

[0152] The inner guide 200 may include a discharge guide 202 and an inner cover 300. The discharge guide 202 may be disposed higher than the inner cover 300. The discharge guide 202 may include a discharge body 210 in which the discharge port 204 and the suction port 205 are formed, and a flow path body 230 disposed in the discharge body 210 and forming the discharge flow path P2.

[0153] The temperature adjusting device 150 and the fan 181 can supply air to the first space W1 and the second space W2 through the air flow path P formed by at least one of the discharge guide 202 and the inner cover 300. The temperature adjusting device 150 may be received in the inner cover 300.

[0154] The discharge guide 202 and the inner cover 300 are configured to be received inside the inner case 8 together with the temperature adjusting device 150 and the fan 181, and the volume occupied by the discharge guide 202, the inner cover 300, the temperature adjusting device 150, and the fan 181 may be minimized. The fan 181 is to forcedly flow the air heat exchanged with the temperature adjusting device 150, and the air flowing by the fan 181 can be discharged and guided to the first space W1 and the second space W2 by the discharge guide 202 and the inner cover 300.

[0155] The discharge guide 202 may face the first space W1, and the discharge hole 204 and the suction hole 205 may be formed in the discharge guide 202. The inner cover 300 may be connected to the discharge guide 202. The inner cover 300 may face the second space W2, and the additional discharge port 321 and the additional suction port 341 may be formed in the inner cover 300.

[0156] A portion of the discharge guide 202 facing the first space W1 may be provided with a heating air generation module (HG) module 184 and a first temperature sensor 190. The HG module 184 may include a circulation fan 186. The HG module 184 may include a purifying unit 185 such as an air purifying filter and purify the air in the first space W1.

[0157] The height of the additional discharge port 321 may be higher than the height of the additional suction port 341. The additional discharge ports 321 may be formed on the inner cover 300, and the air blown by the fan 181 may be discharged into the second space W2 through the additional discharge ports 321. The additional suction port 341 may be formed at the lower portion of the inner cover 300, and the air suctioned into the additional suction port 341 may flow to the temperature adjusting device 150. The second temperature sensor 390 may be disposed in the inner cover 300 to sense the temperature of the second space W2.

[0158] As previously described, the refrigerator may include at least one heating device for heating the storage space, and the refrigerator may perform a heating operation H (see Fig. 4) using the heating device. At least one heating device may be operated independently from the temperature adjusting device (or refrigeration system) 150 disposed in the air flow path P.

[0159] The refrigerator may perform the cooling operation E (see Fig. 4) by the temperature adjusting device 150 disposed in the air flow path P and may perform the heating operation H by the at least one heating device. The heating device may be disposed to heat only one of the first space W1 and the second space W2 and may be provided for each of the first space W1 and the second space W2. The heating device is preferably installed at a position thermally separated from the temperature adjusting device disposed in the air flow path P.

[0160] The heating device may include a first heating device 171 for heating the first space W1. The first heating device 171 may include a pair of first side heating devices 173 and 174 disposed in the first body 8C facing the first space W1. The first heating device 171 may include an inner heating device 175 disposed on the partition member 3 or the shelf 2. The inner heating device 175 is disposed to be exposed to the partition member 3, the shelf 3, or the outer surface of the heating body to directly heat the air in the storage space.

[0161] The heating device may further comprise a second heating device 172 for heating the second space W2. A second heating device 172 may include a pair of second side heating devices 176 and 177 disposed on the second body 8D towards the second space. A second heating device 172 may further include a lower heating device 178 disposed in the lower body of the inner case 8.

[0162] The controller 30 may control the fan 181 and the heating device. The controller 30 may drive or stop the fan 181. Driving the fan 181 may mean that the fan 181 is on, and stopping of the fan 181 may mean that the fan 181 is off.

[0163] The controller 30 may operate or stop the heating device. When the heating device is a heater, the operation of the heating device may mean that the temperature of the heater is increased, and for example, it may be the case that the heater is on. Stopping the heating device may mean that the temperature of the heater is not increased, and for example, it may be the case that the heater is off.

[0164] The controller 30 may operate or stop the temperature adjusting device 150. When the temperature adjusting device 150 is an evaporator, the operation of the temperature adjusting device 150 may mean that the refrigerant flows to the temperature adjusting device 150, and for example, may be a case where the compressor 100 is on and the refrigerant valve is in the evaporator mode which supplies refrigerant to the evaporator. The stop of the temperature adjusting device 150 may mean that the refrigerant does not flow to the temperature adjusting device 150, and for example, a mode in which the refrigerant valve does not supply the refrigerant to the evaporator (for example, a mode for supplying a refrigerant to a second evaporator, or the like).

[0165] During the cooling operation of the first space W1, the cooling device(s) and the fan 181 may be operated, and the first heating device 171 may be stopped. In this case, the cooling device(s) may control the flow path switching mechanism 120, 120', the compressor 100, or the like so that the refrigerant is supplied to the temperature adjusting device 150, and the first damper 191 may be opened.

[0166] During the heating operation of the first space W1, the first heating device 171 may be operated. In this case, at least one of the fan 181 and the circulation fan 186 may be operated. During the heating operation of the first space W1, the circulation fan 186 may be driven so that the air in the first space W1 circulates through the first heating device 171 and the circulation flow path P4, and thus the first space W1 may be heated by convection. In this case, the cooling device(s) may be controlled so that the air of the air flow path P is not discharged into the first space W1, and, to this end, the first damper 191 may be closed or the fan 181 may be stopped.

[0167] In the heating operation of the first space W1, the fan 181 may be operated so that the air in the first space W1 circulates through the first heating device 171 and the air flow path P, so that the first space W1 may be heated by convection. In this case, the cooling device(s) may control the flow path switching mechanisms 120 and 120', the compressor 100, and the like such that the refrigerant is not supplied to the temperature adjusting device 150.

[0168] In the cooling operation of the second space W2, the cooling device(s) and the fan 181 may be operated, and the second heating device 172 may be stopped. In this case, the cooling device(s) may control the flow path switching mechanism 120, 120', the compressor 100, and the like, such that the refrigerant is supplied to the temperature adjusting device 150, and the second damper 192 may be opened.

[0169] In the heating operation of the second space W2, the second heating device 172 may be operated. In this case, the fan 181 may be operated or stopped. In the heating operation of the second space W2, the fan 181 is operated so that the air in the second space W2 circulates through the second heating device 172 and the air flow path P, and thus the second space W2 may be heated by convection. In this case, the cooling device(s) may control the flow path switching mechanism 120, 120' and the compressor 100 such that the refrigerant is not supplied to the temperature adjusting device 150. Additionally, in the heating operation of the second space W2, the fan 181 may be stopped, and in this case, the second heating device 172 may heat the second space W2 by conduction.

[0170] Fig. 16 is a view illustrating a change in the storage chamber temperature and storage chamber humidity in the cooling mode of the storage chamber according to an embodiment of the present disclosure. Curve J of Fig. 16 is a temperature of storage space, and curve K of Fig. 16 is a relative humidity of storage space.

[0171] Region L in Fig. 16 corresponds to a process in which the temperature adjusting device 150 and the fan 181 are operated, and the air in the storage space may circulate through the storage space and the temperature adjusting device 150, and the temperature and relative humidity of the storage space can be gradually lowered, respectively.

[0172] Region M in Fig. 16 may correspond to a process in which some of the moisture in the temperature adjusting device 150 is moved to the storage space while the temperature adjusting device 150 is naturally defrosted by the air flowed from the storage space while the temperature adjusting device 150 is stopped and the fan 181 is driven such that temperature and relative humidity of the storage space may be increased together.

[0173] Region N in Fig. 16 may correspond to a process in which the temperature of the storage space is increased while the temperature adjusting device 150 is stopped and the fan 181 is driven, and the relative humidity of the storage space may be lowered again by the temperature rise of the storage space.

[0174] The relative humidity of the storage space can be increased or decreased by various factors, as illustrated in Fig. 16. These factors may include, for example, be the size of the temperature adjusting device 150, the time for which the fan 181 is operated while the temperature adjusting device 150 is stopped, the flow rate of the fan, and the temperature of the storage space.

[0175] As the humidity inside the storage chamber changes, the quality of goods stored in the storage chamber may be reduced. For example, when the humidity inside the storage chamber is low, the cork of the wine bottle stored in the storage chamber dries up, and oxygen may flow into the wine bottle, potentially causing the wine to oxidize, mold to form around the cork, and the quality of the wine to be drastically degraded. For this reason, in certain countries, the specification of the relative humidity range within a storage chamber may be specified for the storage chamber which stores particular goods.

[0176] Providing a separate humidifier for adjusting the humidity inside the storage chamber may cause the structure of the refrigerator to be more complicated and to include costs. As another example, an opening may be installed to allow air flow between the inside of the storage chamber and the outside of the storage chamber, but this opening would not allow the humidity in the storage chamber to be actively controlled. Meanwhile, since the ice is gradually formed into the cooling device(s) and its surroundings when the cooling device(s) starts the cooling operation, a separate defrost heater may be provided at a position adjacent to the cooling device(s) in order to remove ice formed on the cooling device(s), but, in this case, since heating device(s) operates near the cooling device(s), there is a disadvantage in terms of power consumption, and there is a problem that the quality of the stored goods may be degraded because the storage chamber is not cooled during defrosting.

[0177] In certain examples described herein, if a predetermined operation start condition is satisfied while the operation of the cooling device(s) is ended, the fan for the cooling device(s) may be driven to supply moisture to the storage chamber. By supplying moisture provided by the cooling device(s) and the ice formed around the storage chamber, the humidity inside the storage chamber can be maintained, and the amount of ice formed on the cooling device(s) and the surroundings can be gradually reduced. For this reason, a defrost heater can be can be minimized or avoided, and it is not necessary to provide a separate humidifier.

[0178] The humidity care (or humidifying) mode of driving the fan for the cooling device(s) to supply moisture to the storage chamber may be started with at least one of the cooling mode or the heating mode is ended. The humidity care mode can start at least in standby mode. The humidity care mode may be started when at least one of the cooling device(s) and at least one of the heating device(s) are deactivated.

[0179] In order to reduce the overcooling of the storage chamber, the air volume of the fan for the cooling device(s) during the humidity care mode driving may be controlled to be smaller than the air volume of the fan for the cooling device(s) during the cooling mode. Furthermore, when the refrigerator is partitioned into a first space W1 to which a first target temperature is set and a second space W2 to which a second target temperature lower than the first target temperature) is set, and when the humidity care operation for the first space W1 and the humidity care operation for the second space (W2) conflict, the performing of the humidity care operation for the first space can be prioritized since a storage space having a higher target temperature tends to have a larger deterioration in storage goods quality due to a decrease in storage chamber humidity.

[0180] The number of rotations or on-time period (duty cycle) of the fan for the cooling device(s) during the humidity care mode driving may be controlled so that the relative humidity (RH) average of the storage chamber is over 50% RH. In another example, the fan speed or on-time period (duty cycle) for cooling device(s) during humidity care mode driving is controlled so that the relative humidity average of the storage chamber is 50% to 75% (European standard).

[0181] The humidity care mode may be particularly performed to control the humidity of at least one of the expensive specific goods storage chambers, the constant temperature chamber, or the priority storage chamber of the refrigerator. The humidity care mode may be implemented to control the humidity of the storage chamber whose temperature is controlled by the cooling device(s) and the heating device(s).

[0182] The refrigerator may perform a humidity care mode to control the humidity of the storage space. As previously described the humidity care mode may be a kind of humidification mode in which moisture of the cooling device(s), for example, moisture on the surface of the evaporator is moved to the storage space. In the humidity care mode, the fan can be driven to move the accumulated moisture from the cooling device.

[0183] Thus, the humidity care mode may be defined as a mode in which the fan is driven and which supplies air to the storage space. For example, the humidity care mode may be a mode in which the air in the storage space W may flow into the cooling device(s) chamber by the fan and be humidified, and the humidified air in the cooling device(s) chamber may flow into the storage space to humidify the storage space, in a state where at least some of the cooling device(s) are in an off state (for example, the supply of refrigerant to the evaporator is interrupted, the thermoelectric element is off), and at least some of the heating device(s) are maintained in the off state (for example, the heater is turned off, the off of the thermoelectric element). For example, the humidity care mode may be a mode in which the air in the storage space flows to the evaporator by the fan to humidify, the humidified air flows into the storage space and humidifies the storage space, in a state where the refrigerant does not pass through the evaporator and the heater maintains the off state.

[0184] In one example, the humidity care mode may be performed while the storage space is closed by the door, the cooling device(s) are stopped (e.g., no refrigerant flows to the evaporator for cooling the storage space), and the heating device(s) are stopped (for example, the heater is turned off). Accordingly, the humidity care mode may be started when a first condition in which the door to open and close the storage space is closed, and when both second condition in which the cooling device(s) is stopped and the third condition in which the heating device(s) is stopped are satisfied.

[0185] For example, when the refrigerator repeats the cooling operation, the standby mode, and the cooling operation, the humidity care mode may be started when all of the first, second, and third conditions are satisfied in the non-cooling mode or the standby mode. Similarly, when the refrigerator repeats the heating operation, the standby mode and the heating operation, the humidity care mode may be started when all of the first, second, and third conditions are satisfied in the non-heating mode or the standby mode.

[0186] When the refrigerator may be operated in the order of the cooling operation, the standby mode, and the heating operation, or in the order of the heating operation, the standby mode and the cooling operation, the humidity care mode may be performed, for example, in the non-cooling mode, the standby mode, or the non-heating mode.

[0187] When the door to access the storage space is closed, and the temperature adjusting device 150 is not operated, and the heating device is off, the controller 30 may perform a humidity care mode and drive the fan 181 in the humidity care mode. For example, the door switch 36 may transmit a signal to the controller 30 when the door is opened or closed, and the controller 30 may determine whether the door is closed according to the signal of the door switch 36. The controller 30 may then operate or stop of the temperature adjusting device 150 and turn on or off of the heating device according the storage chamber temperature sensed by the temperature sensor and the storage chamber target temperature, and start the humidity care mode when door is closed, the temperature adjusting device 150 is stopped, and the heating device is turned off.

[0188] In certain examples, in the humidity care mode, the controller 30 may control a damper that controls air flowing into the storage space, and controls the damper in an open mode for a set time (for example, 2 minutes or 4 minutes) and may drive the fan 181.

[0189] The controller 30 may end the humidity care mode, for example, when the door is open, the temperature adjusting device 150 is operated, and/or the heating device is turned on. In one example, the controller 30 may end the humidity care mode (e.g., to deactivate fan 181) when a desired level of humidity is achieved. When ending the humidity care mode, the controller 30 may continue to activate fan 181 but close a damper to the storage space such that defrosting of the temperature adjusting device 150 continues without further providing humidity to the storage chamber.

[0190] When the door is opened, the outside air may flow into the storage space, and the humidity of the storage space may be increased by the inflow of the outside air. The controller 30 may not implement the humidity care mode in order to minimize the power consumption and wear of the fan 181 since moisture is received from outside the storage (that is, due to the opening of the door).

[0191] The operation of the temperature adjusting device (or cooler) 150 may relate to controlling the cooling the storage space, and the operation of the heating device (or heater) may relate to controlling the heating the storage space. In the refrigerator, the humidity management of the storage space may be important for the previously described reasons, but in order to ensure constant temperature properties, the temperature management of the storage chamber may be more important, and the controller 30 may perform the humidity care mode in a lower order of importance than controlling the cooling of the storage space (that is, the cooling operation) or the controlling the heating of the storage space (that is, heating operation).

[0192] The controller 30 may resume the humidity care mode (e.g., resume activating the fan 181) when the door is closed, the temperature adjusting device 150 is not operated, and the heating device is turned off after the humidity care mode is ended. For example, as previously described, the humidity care mode may stop when the door is opened, and the controller 30 may resume the humidity care mode (e.g., resume activating the fan 181) based on determining that the door is closed while the temperature adjusting device 150 remain not operated, and the heating device remains turned off.

[0193] Meanwhile, the low temperature storage chamber partitioned from the storage space may be further formed in the cabinet 1. Here, the low temperature storage chamber may include a space having a target temperature range lower than that of the storage space. For example, when the storage space is provided in the first storage chamber W, the low temperature storage chamber may be the second storage chamber C.

[0194] A low-temperature temperature adjusting device for cooling the low temperature storage chamber may be disposed in the low temperature storage chamber. When the temperature adjusting device 150 is the first evaporator 150 for cooling the first storage chamber W, the low-temperature temperature adjusting device may be the second evaporator 160 for cooling the second storage chamber C, as shown in FIGs. 6-9. In the following discussion, the low-temperature temperature adjusting device will be described with reference to the second evaporator 160 for the low-temperature temperature adjusting device.

[0195] In addition, the refrigerator may further include a low temperature fan for supplying air heat exchanged with the low-temperature temperature adjusting device 160 to the low temperature storage chamber. In a case where the fan 181 is the first fan 181 disposed in the first storage chamber W, the low temperature fan may be the second fan 182 disposed in the second storage chamber C, as shown in FIGs. 6-9.

[0196] Furthermore, a defrost heater for defrosting the low-temperature temperature adjusting device 160 may be disposed in the low temperature storage chamber. The controller 30 may separately perform a defrost mode for defrosting the low-temperature temperature adjusting device.

[0197] In some examples, the controller 30 may wait or omit starting the humidity care mode while the refrigerator performs the defrost mode. For example, the refrigerator may further include a humidity sensor for sensing the humidity of the storage chamber W, and the controller 30 may perform the defrost mode (e.g., not operate the low-temperature temperature adjusting device 160) without starting the humidity care mode when the humidity of the storage space is equal to or greater than the set humidity. In addition, the controller 30 may end the humidity care mode when the humidity of the storage space is equal to or greater than the set humidity during the humidity care mode.

[0198] If the humidity of the storage space is equal to or greater than an appropriate level, such as during a time period after the opening of the door, the power consumption of the fan 181 may be reduced by waiting to start the humidity care mode. Similarly, the power consumption of the fan 181 may be reduced by ending the humidity care mode if the humidity of the storage space is equal to or greater than the set humidity during the humidity care mode.

[0199] The refrigerator may perform a humidity care mode for each of the first space W1 and the second space W2. For example, the humidity care mode may include a first humidification mode in which the fan 181 is driven, the first damper 191 is open, and the second damper 192 is closed (such that moist air is provided to the first space W1), and a second humidification mode in which the fan 181 is driven, the first damper 191 is closed, and the second damper 192 is open (such that moist air is provided to the second space W2). Thus, the first humidification mode may be a mode for supplying the moisture of the temperature adjusting device 150 to the first space W1 without supplying the moisture to the second space W2, and the second humidification mode may be a mode for supplying the moisture of the temperature adjusting device 150 to the second space W2 without supplying the moisture to the first space W1.

[0200] The controller 30 may selectively perform one of the first humidification mode or the second humidification mode or may simultaneously perform both the first humidification mode and the second humidification mode (e.g., by opening both the first and second dampeners 191, 192).

[0201] The first humidification mode may be performed when the first heating device 171 is off, and during a set time (for example, 2 minutes), the fan 181 may be driven, the first damper 191 may be opened, and the second damper 192 may be closed. The second humidification mode may be performed when the second heating device 172 is off, and during a set time (for example, 2 minutes), the fan 181 may be driven, and the second damper 192 may be opened, and the second damper 191 may be closed. As previously described, the controller 30 may alternate between the first humidification mode and the second humidification mode, such as to sequentially perform the second humidification mode and the first humidification mode.

[0202] The target temperature of the first space W1 may be higher than the target temperature of the second space W2, such that the temperature at the temperature adjusting device 150 may be lower than the temperature of the second space W2, and the temperature of the second space W2 may be lower than the temperature of the first space W1. In the humidification care mode, the refrigerator may first perform the first humidification mode and then perform the second humidification mode. However, the humidification care mode may cause, when the temperature of the first space W1 is satisfied, low-temperature air from the at the temperature adjusting device 150 to flow into the first space W1 such that the first space W1 may be supercooled (e.g., cooled to be below a desired temperature range).

[0203] Accordingly, when the conditions of initiating the humidification care mode are satisfied, the controller 30 may perform the second humidification mode in preference to the first humidification mode. For example, in the situation where the condition of the humidification care mode is satisfied and the second heating device 172 is off, the controller 30 can drive the fan 181 during the setting time (for example, 2 minutes) to perform the second humidification mode by opening the second damper 192 while closing first damper 191. However, in the situation where the condition of the humidification care mode is satisfied while the second heating device 172 is turned on, the controller 30 may perform the first humidification mode or wait without performing the second humidification mode.

[0204] The humidification care mode may be performed in a situation where the humidity of the storage space is significantly lowered, and if a set (or delay) time (for example, 8 minutes) has not elapsed after the fan 181 is turned off, the humidification care mode may be performed after the set time has elapsed. Thus, if the door is closed, no refrigerant flows to the temperature adjusting device 150, a heating device is turned off, and the set time (for example, 8 minutes) has elapsed after the fan 181 is stopped, the controller 30 can perform the humidification care mode. The refrigerator may minimize the unnecessary humidification care mode and minimize the power consumption of the fan 181 by preventing the humidification care mode from being performed so frequently.

[0205] Fig. 17 is a view illustrating a compressor operation and a fan operation when the first storage chamber is cooled and then the second storage chamber is cooled according to an embodiment of the present disclosure. For example, region (a) of Fig. 17 is a view illustrating a compressor operation when repeating the operation in which the second storage chamber C is cooled after the first storage chamber W is cooled, the compressor 100 may be operated at a first capacity when the first storage chamber W is cooled and may be operated at a second capacity when the second storage chamber C is cooled and can maintain the off state after the second storage chamber C is cooled. The compressor 100 may be operated in the order of the operation of the first capability, the operation of the second capability, and the off state as time passes.

[0206] Region (b) of Fig. 17 illustrates an example in which the fan 181 is turned on when the first storage chamber W is cooled, the fan 181 is turned off when the second storage chamber C is cooled, and the fan 181 is turned off when the compressor 100 is turned off.

[0207] In contrast, region (c) of Fig. 17 illustrates an example in which the fan 181 is turned on when the first storage chamber W is cooled, and the fan 181 is intermittently turned on when the second storage chamber C is cooled and the compressor 100 is turned off. In this case, the speed of the fan 181 when the second storage chamber C is cooled and/or when the compressor 100 is turned off may be slower than or equal to the speed of the fan 181 when the first storage chamber W is cooled.

[0208] Additionally, the first fan 181 may be repeatedly turned on and off at least twice while the second storage chamber C is cooled and the compressor 100 is off, and at this time, the on time of the fan 181 may be shorter than the off time of fan 181. In this case, when the on time of the fan 181 is shorter than the off time of the fan 181, the power consumption of the fan 181 may be reduced.

[0209] Region (d) of Fig. 17 illustrates an example in which a fan 181 for flowing air in the first storage chamber W is turned on all when the first storage chamber W is cooled, when the second storage chamber C is cooled, and when the compressor 100 is turned off. In this case, the speed of the fan 181 when the second storage chamber C is cooled or the speed of the fan 181 when the compressor 100 is turned off may be slower than the speed of fan 181 when the first storage chamber C is cooled. When the fan 181 is controlled as illustrated in Fig. 17(d), the effect of increasing the humidity of the storage space by turning on the fan 181 may be high, and the refrigerator may maintain the storage space at a high relative humidity as a whole.

[0210] As illustrated in Fig. 17(c), when the fan 181 is intermittently turned on or off after cooling of the storage space, it may be an example of the humidity care mode or the first humidity care mode. As illustrated in Fig. 17(d), a case where the on state of the fan 181 is continuously maintained after cooling of the storage space may be another example of the humidity care mode and may be the second humidity care mode.

[0211] The user may select one or more of the first humidity care mode or the second humidity care mode through an input device. For example, if the user enters the second humidity care mode, the controller 30 executes the second humidity care mode, and if the user does not enter the second humidity care mode, the controller 30 can perform the first humidity care mode.

[0212] The user may input the second humidity care mode for each of the first space W1 and the second space W2. When the user inputs each of the first space W1 and the second space W2 in the second humidity care mode, the controller 30 can perform the humidity care mode in the second space W2 in preference to the first space W1. Meanwhile, when the user inputs only one of the first space (W1) and the second space (W2) in the second humidity care mode, the controller 30 can perform the second humidity care mode of the space in which the second humidity care mode is input in preference to the first humidity care mode of the space in which the second humidity care mode is not input.

[0213] Fig. 18 is a view illustrating a change in relative humidity (RH) of the storage space while the fan is periodically turned on/off after the first storage chamber is cooled according to the present embodiment. Fig. 18 illustrates an example in which temperature change and relative humidity change is indicated when the humidity care mode of each of the first space W1 and the second space W2 is performed.

[0214] Line RH-W1 of Fig. 18 is a relative humidity of the first space, line RH-W2 of Fig. 18 is a relative humidity of the second space, line Temp_W1 of Fig. 18 is a temperature of the first space, and line Temp-W2 of Fig 18 is a temperature of the second space. Referring to Fig. 18, while the fan 181 is repeatedly turned on and off periodically, each of the relative humidity of the first space (RH-W1) and the relative humidity of the second space (RH-W2) may be greatly increased when the fan 181 is on, and as the on and off of the fan 181 is repeated, each of the relative humidity and the second relative humidity of the first space may be increased.

[0215] Special goods such as wine that is sealed by a stopper such as cork may be stored in the storage chamber W. When the humidity of the storage chamber W is excessively low, the stopper of cork or the like may be excessively dried and deformed shape and oxygen in the storage chamber W may penetrate into the bottle through the inlet to reduce the quality of the special goods.

[0216] The controller 30 may perform a cooling operation for cooling the storage space by the temperature adjusting device 150. During the cooling operation, the controller 30 may perform a cooling mode in which the temperature adjusting device 150 is operated and the fan 181 is driven. In addition, if a door to access the storage space after the cooling mode is closed, and the temperature adjusting device 150 is not operated, the controller 30 can perform the humidity care mode in which the fan 181 is driven (for example, the first humidity care mode), as previously described. When the refrigerator performs the humidity care mode as described above, the moisture of the temperature adjusting device 150 may be moved into the storage space, and special goods such as wine may be maintained in an optimal state in the storage space.

[0217] The controller 30 may control the fan 181 such that the fan air volume in the cooling mode is greater than the fan air volume in the humidity care mode. In addition, the controller 50 may continuously drive the fan in the cooling mode and intermittently drive the fan in the humidity care mode, and in this case, the fan air volume per unit time may be more in the cooling mode. The controller 50 may control the fan 181 such that the fan speed in the cooling mode is faster than the fan speed in the humidity care mode.

[0218] The controller 30 may end the humidity care mode when the cooling operation is ended or the storage space is open during the humidity care mode. The controller 30 may resume the humidity care mode after the humidity care mode is ended, if it is in the cooling operation, a door that opens and closes the storage space is closed, and it is not in the cooling mode.

[0219] Fig. 19 is a flowchart illustrating process to manage humidity in storage chambers of refrigerator according to an embodiment of the present disclosure. For example, the controller 30 may perform a humidity care mode when the door 5 to access the storage space is closed, the low temperature storage chamber C is not in the defrost mode, and the refrigerant valve is not in the evaporator mode. The controller 30 may not perform the humidity care mode if, for example, the door is open or the low-temperature temperature adjusting device 160 is in the defrost mode that cools the low temperature storage chamber C.

[0220] Even if the door is closed and the low-temperature temperature adjusting device 160 is not in the defrost mode, the controller 30 does not perform the humidity care mode and can control the fan 181 to continue the cooling mode of the cooling operation E. For example, the controller 30 may wait for a delay time period before starting the humidity care mode and may turn on the fan 181 for the cooling mode in connection with the cooling operation E (S1)(S2)(S3)(S4). For example, the cooling device may remain relatively cool even when initially deactivated, and activation of fan 181 may cause the storage chamber to continue to be cooled.

[0221] If a door is closed and the low-temperature temperature adjusting device 160 is not in the defrost mode, the refrigerant valve is not in the evaporator mode, the controller 30 can compare the elapsed time with a first set time (for example, 8 minutes) after the fan 181 is off, and if the time elapsed is equal to or less than the first set time after the fan 181 is off, the controller 30 can maintain the off state of the fan 181 for a second set time (for example, 2 minutes), and may wait without controlling each of the first and second dampers 191 and 192 in the open mode (S1)(S2)(S3)(S5)(S6).

[0222] The controller 30 can drive the fan 181 during a third set time (for example, 2 minutes), close the first damper 191, and open the second damper 192 if the door is closed, the defrost mode of the low-temperature temperature adjusting device 160 is not performed, the refrigerant valve is not in the evaporator mode, the time elapsed after the fan 181 is turned off is greater than the first set time (for example, 8 minutes), and the second heating device 171 is off (S1)(S2)(S3)(S5)(S7)(S9).

[0223] Meanwhile, the controller 30 can maintain the off state of the fan 181 during the second set time (for example, 2 minutes), and wait for each of the first and second dampers 191 and 192 without controlling the first and second dampers 191 and 192 in an open mode, if the door is closed, the defrost mode of the low-temperature temperature adjusting device 160 is not performed, the refrigerant valve is not in the evaporator mode, and although the time elapsed after the fan 181 is turned off is greater than the first set time (for example, 8 minutes), the second heating device 171 is on (S7)(S8). In this case, the controller 30 may not perform the second humidification mode (S8)(S10).

[0224] If the first heating device 171 is off, the controller 30 can drive the fan 181 during a set time (for example, 2 minutes), open the first damper 191, and close the second damper 192 (S10) (S12). If the first heating device 171 is on, the controller 30 can maintain the off of the fan 181 for a set time (for example, 2 minutes), and wait without controlling each of the first and second dampers 191 and 192 in the open mode (S10) (S11).

[0225] Aspects of the present disclosure provide a refrigerator capable of managing the storage chamber at an appropriate humidity while minimizing the number of components or heat loss by increasing the humidity of the storage chamber using moisture of the heat exchanger.

[0226] A refrigerator according to an embodiment of the present disclosure includes a cabinet configured to forms a storage space, a temperature adjusting device configured to cool the storage space, a fan configured to blow air heat-exchanged with the temperature adjusting device to the storage space, a heating device configured to heat the storage space, and a controller configured to control the fan and the heating device, in which the controller may start a humidity care mode which drives the fan if a door that opens and closes the storage space is closed, the temperature adjusting device is not operated, and the heating device is off.

[0227] The refrigerator may further include a damper configured to adjust air flowing into the storage space. The controller may drive the fan for a predetermined time and open the damper in the humidity care mode. The controller may end the humidity care mode if the door is in an opened, the temperature adjusting device is operated, or the heating device is on. After the humidity care mode is ended, the controller may resume the humidity care mode if the door is closed, the temperature adjusting device is not operated, and the heating device is off.

[0228] The cabinet may further include a low temperature storage chamber partitioned with the storage space. A low-temperature temperature adjusting device which cools the low temperature storage chamber may be further disposed. A low temperature fan which supplies air heat-exchanged with the low-temperature temperature adjusting device to the low temperature storage chamber may further disposed. The controller may wait without starting the humidity care mode if a defrost mode in which the low-temperature temperature adjusting device is defrosted is performed.

[0229] The controller may wait without starting the humidity care mode if the humidity of the storage space is equal to or greater than a set humidity. The controller may end the humidity care mode if the humidity of the storage space is equal to or greater than a set humidity during the humidity care mode.

[0230] The storage space may be partitioned into a first space and a second space. The fan may blow air into the first space and the second space. The heating device may include a first heating device for heating the first space and a second heating device for heating the second space. A first damper for adjusting the air flowing into the first space may be disposed. A second damper for adjusting the air flowing into the second space may be disposed.

[0231] The humidity care mode may include a first humidification mode in which the fan is driven, the first damper is opened, and the second damper is closed, and a second humidification mode in which the fan is driven, the first damper is closed, and the second damper is opened. The controller may selectively perform the first humidification mode and the second humidification mode.

[0232] The target temperature of the first space may be higher than the target temperature of the second space. The controller may perform the second humidification mode in preference to the first gas mode.

[0233] The controller may start the humidity care mode if a door that opens and closes the storage space is closed, the refrigerant does not flow to the temperature adjusting device, the heating device is off, and a set time has elapsed after the fan is stopped.

[0234] The controller may be configured to perform a cooling operation for cooling the storage space by the temperature adjusting device, and the controller is configured to perform, in the cooling operation, a cooling mode in which the temperature adjusting device is operated and the fan is driven, and a humidity care mode in which the fan is operated if a door that opens and closes the storage space is closed and the temperature adjusting device is not operated. A fan air volume in the cooling mode may be greater than a fan air volume in the humidity care mode.

[0235] The controller may end the humidity care mode if the cooling operation is ended or the storage space is opened during the humidity care mode. The controller may resume the humidity care mode if the cooling operation is performed, the door that opens and closes the storage space is closed, and the cold mode is not performed after the humidity care mode is ended.

[0236] The refrigerator may further include a heating device configured to heat the storage space. The controller may not perform the humidity care mode if the heating operation for heating the storage space by the heating device is performed.

[0237] According to an embodiment of the present disclosure, the storage space can be maintained at an appropriate humidity by using the humidity and the fan of the temperature adjusting device without a separate humidity adjusting device such as a steam supply device. In addition, the supercooling of the storage space can be minimized, and the power consumption of the fan can be minimized.

[0238] The above description is merely illustrative of the technical idea of the present disclosure, and a person skilled in the art to which the present disclosure pertains may make various modifications and changes without departing from the essential characteristics of the present disclosure.

[0239] Therefore, the embodiments disclosed in the present disclosure are not intended to limit the technical idea of the present disclosure but to describe the present disclosure, and the scope of the technical idea of the present disclosure is not limited by these embodiments.

[0240] The protection scope of the present disclosure should be interpreted by the following claims, and all technical ideas within the scope equivalent thereto should be construed as being included in the scope of the present disclosure.

[0241] It will be understood that when an element or layer is referred to as being "on" another element or layer, the element or layer can be directly on another element or layer or intervening elements or layers. In contrast, when an element is referred to as being "directly on" another element or layer, there are no intervening elements or layers present. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0242] It will be understood that, although the terms first, second, third, etc., may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

[0243] Spatially relative terms, such as "lower", "upper" and the like, may be used herein for ease of description to describe the relationship of one element or feature to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation, in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "lower" relative to other elements or features would then be oriented "upper" relative to the other elements or features. Thus, the exemplary term "lower" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0244] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0245] Embodiments of the disclosure are described herein with reference to cross-section illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the disclosure. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the disclosure should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0246] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0247] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0248] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. A refrigerator comprising:

a cabinet (1) configured to form a storage space (W);
a door (50) for opening and closing the storage space (W);
a refrigeration system (150) to cool the storage space, the refrigeration system including a fan (181, 182) for blowing air between the refrigeration system (150) and the storage space (W); and
a controller (30) configured to control the fan (181, 182), wherein the controller (30) is configured to drive the fan (181, 182) to increase humidity in the storage space (W) when the door (50) is closed and the refrigeration system (150) is not operated to cool the storage space (W).

2. The refrigerator of claim 1, further comprising at least one of:

a heater (171, 172) to heat the storage space (W),
a damper (192) configured to be opened and closed to adjust air flowing into the storage space (W).

3. The refrigerator of claim 2, wherein the controller (30) is configured to drive the fan (181, 182) to increase humidity in the storage space (W) when the door (50) is closed, the refrigeration system (150) is not operated to cool the storage space (W), and the heater (171, 172) is in a power off state and/or the controller (30) is configured to drive the fan (181, 182) for a predetermined time and to open the damper (192) to increase humidity in the storage space (W) when the door (50) is closed and the refrigeration system (150) is not operated to cool the storage space (W).

4. The refrigerator of claim 1, 2 or 3, wherein the controller (30) is configured to pause driving the fan (181, 182) to increase humidity in the storage space (W) when the door (50) is opened or when the refrigeration system (150) is operated to cool the storage space (W), or when the heater (171, 172) is in a power-on state to heat the storage space (W).

5. The refrigerator of claim 4, wherein the controller (30), after pausing the driving of the fan to increase humidity in the storage space, is configured to resume driving the fan (181, 182) to increase humidity in the storage space (W) when the door (50) is closed, the refrigeration system is (150) not operated to cool the storage space (W), and the heater (171. 172) is in a power-off state.

6. The refrigerator of any one of claims 1 to 5, wherein the storage space (W) is a first storage space (W1), the refrigeration system (150) is a first refrigeration system (150'), and the fan (181) is a first fan (181'), wherein the first storage space (W1) is associated with a first target temperature, wherein the cabinet (1) further includes a second storage space (W2) that is partitioned from the first storage space (W1) and associated with a second target temperature that is lower than the first target temperature, wherein the refrigerator further comprises a second refrigeration system (150) which cools the second storage space (W2), the second refrigeration system (150) including a second fan (181) for blowing air between the second refrigeration system (150) and the second storage space (W2), and wherein the controller (30) is configured to delay driving the first fan (181') to increase humidity in the first storage space (W1) when the second refrigeration system (150) is being defrosted.

7. The refrigerator of any one of claims 1 to 6, wherein the controller (30) is configured to delay driving the fan (181) to increase humidity in the storage space (W) when the humidity of the storage space (W) is equal to or greater than a set humidity level.

8. The refrigerator of any one of claims 1 to 7, wherein the controller (30) is configured to stop driving the fan (181) to increase humidity in the storage space (181) when the humidity of the storage space is equal to or greater than a set humidity level.

9. The refrigerator of any one of claims 1 to 8, wherein the storage space (W) is partitioned into a first space (W1) and a second space (W2), wherein the fan (181) is configured to blow air into the first space (W1) and/or the second space (W2), and/or wherein the refrigerator further comprises:

a first damper (191) which could be opened or closed for adjusting a flow of air from the refrigeration system (150) into the first space (W1); and
a second damper (192) which could be opened or closed for adjusting a flow of air from the refrigeration system (150) into the second space (W2).

10. The refrigerator of claim 9, wherein the controller (30) is further configured to:

open the first damper (191) and to close the second damper (192) during a first portion of a time period when driving the fan (181) to increase humidity in the storage space (W), and
close the first damper (191) and to open the second damper (192) during a second portion of the time period when driving the fan (181) to increase humidity in the storage space (W),
wherein a target temperature of the first space (W1) is higher than a target temperature of the second space (W2), and/or
wherein the controller (30) is further configured to close the first damper (191) and to open the second damper (192) during the second portion of the time period when driving the fan (181) to increase humidity in the storage space (W) even when a temperature in the first space (W1) is outside at a target range associated with the target temperature of the first space (W1).

11. The refrigerator of any one of claims 1 to 10, wherein the controller (30) is further configured to:

determine that the refrigeration system (150) is not operated to cool the storage chamber (W) when refrigerant stops flowing to an evaporator (150) of the refrigeration system (150), and
delay driving the fan (181) to increase humidity in the storage space (W) until after a set time has elapsed after refrigerant stops flowing to the evaporator (150) of the refrigeration system (150).

12. The refrigerator of any one of claims 1 to 11, wherein the controller (30), when controlling the fan (181), is configured to:

drive the fan (181) to blow a first volume of air when the refrigeration system (150) is operated to cool the storage space (W), and
drive, when the door (50) is closed and the refrigeration system (150) is not operated to cool the storage space (W), the fan (181) to blow a second volume of air to increase humidity in the storage space (W), wherein the first air volume is greater than the second air volume.

13. The refrigerator of claim 12, wherein the controller (30) is configured to pause driving the fan (181) to blow the second volume of air when the door (50) is opened or the refrigeration system (150) is operated to cool the storage space (W).

14. The refrigerator of claim 13, wherein the controller (30) is configured to resume driving the fan (181) to blow the second volume of air when the door (50) is closed and the refrigeration system (150) is not operated to cool the storage space (W).

15. The refrigerator of any one of the preceding claims, further comprising a heater (171, 172) configured to heat the storage space (W), wherein the controller

(30) is configured not to drive the fan (181) when the heater (171, 172) is operated to heat the storage space (W).

FIG. 1

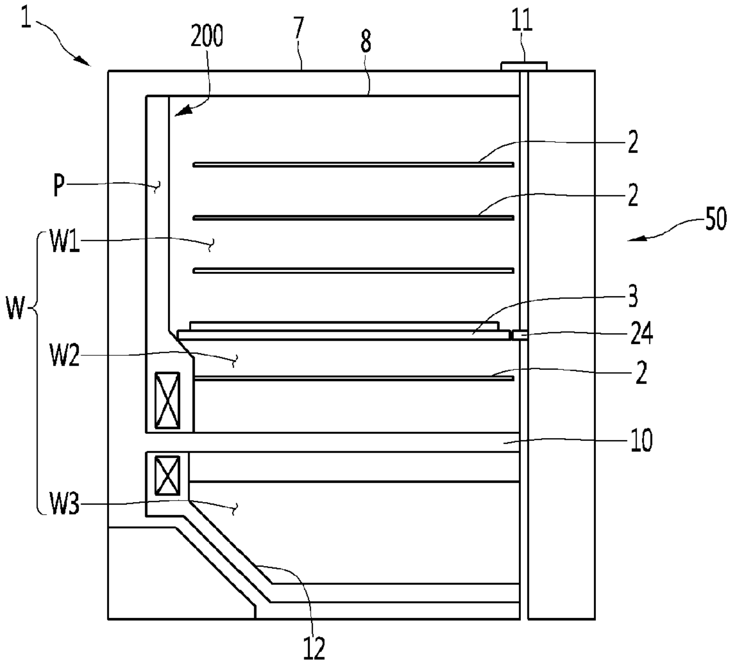

1
200
7
8
11
2
P
2
50
W1
W
3
24
W2
2
10
W3
12

FIG. 2

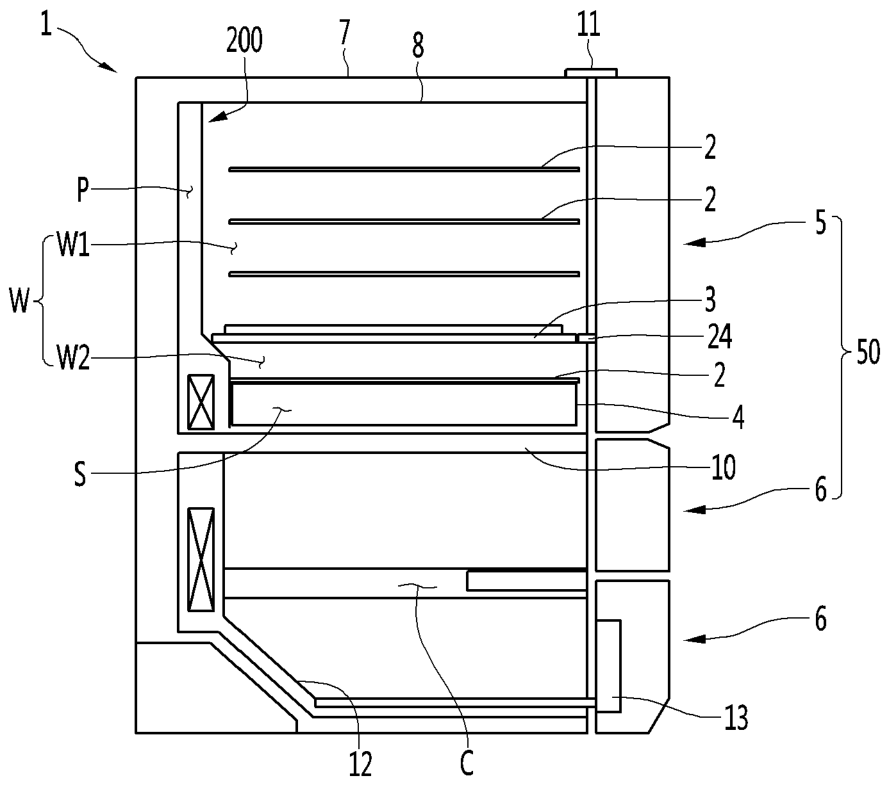

1
200
7
8
11
2
P
2
5
W1
W
3
24
50
W2
2
4
S
10
6
6
13
12
C

FIG. 3

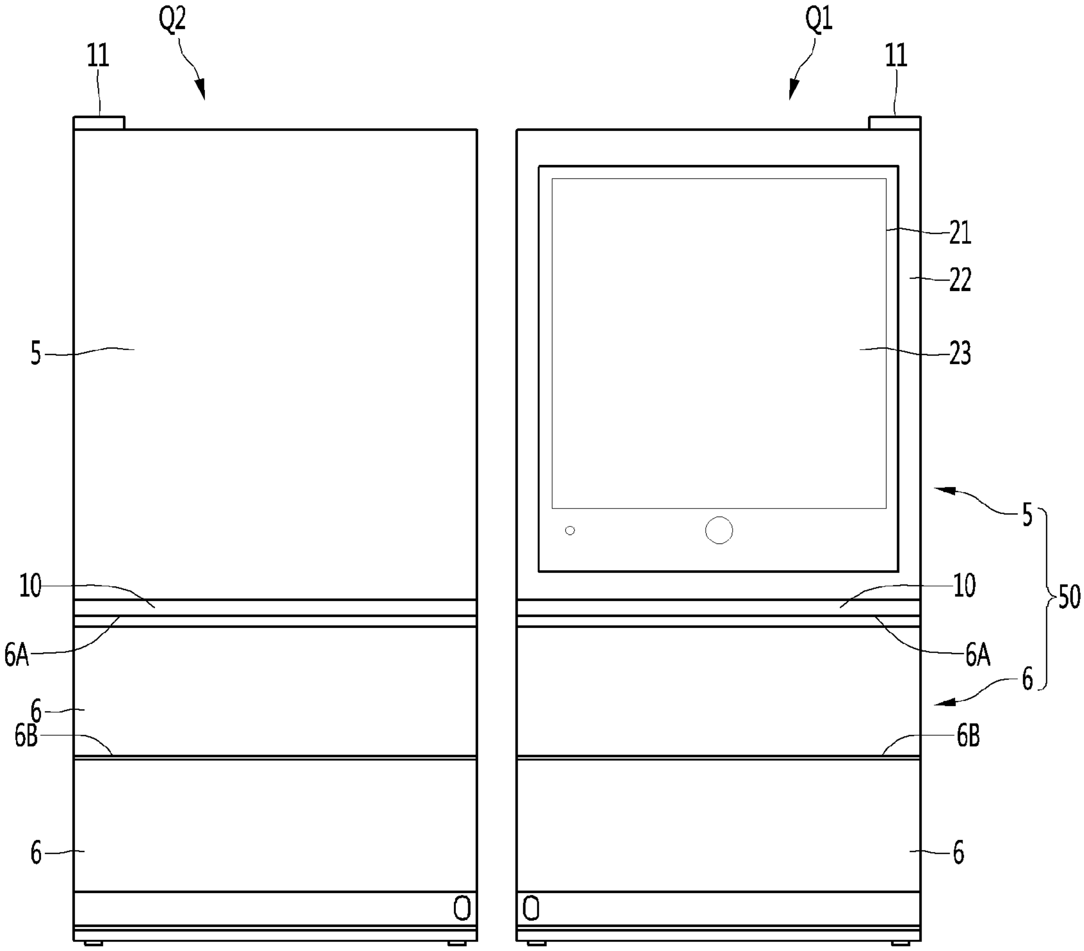

Q2
Q1
11
11
21
22
5
23
5
50
10
10
6A
6A
6
6
6B
6B
6
6

FIG. 4

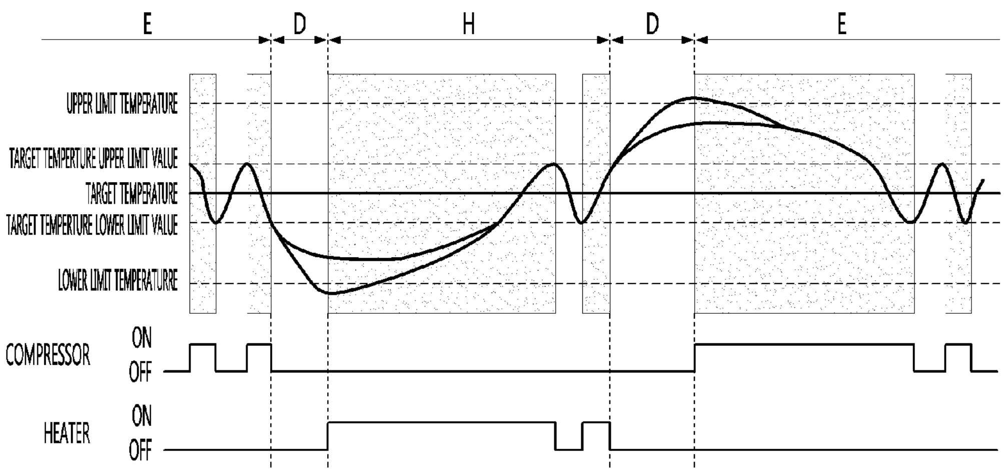

E
D
H
D
E
UPPER LIMIT TEMPERATURE
TARGET TEMPERTURE UPPER LIMIT VALUE
TARGET TEMPERATURE
TARGET TEMPERTURE LOWER LIMIT VALUE
LOWER LIMIT TEMPERATURRE
COMPRESSOR
ON
OFF
HEATER
ON
OFF

FIG. 5

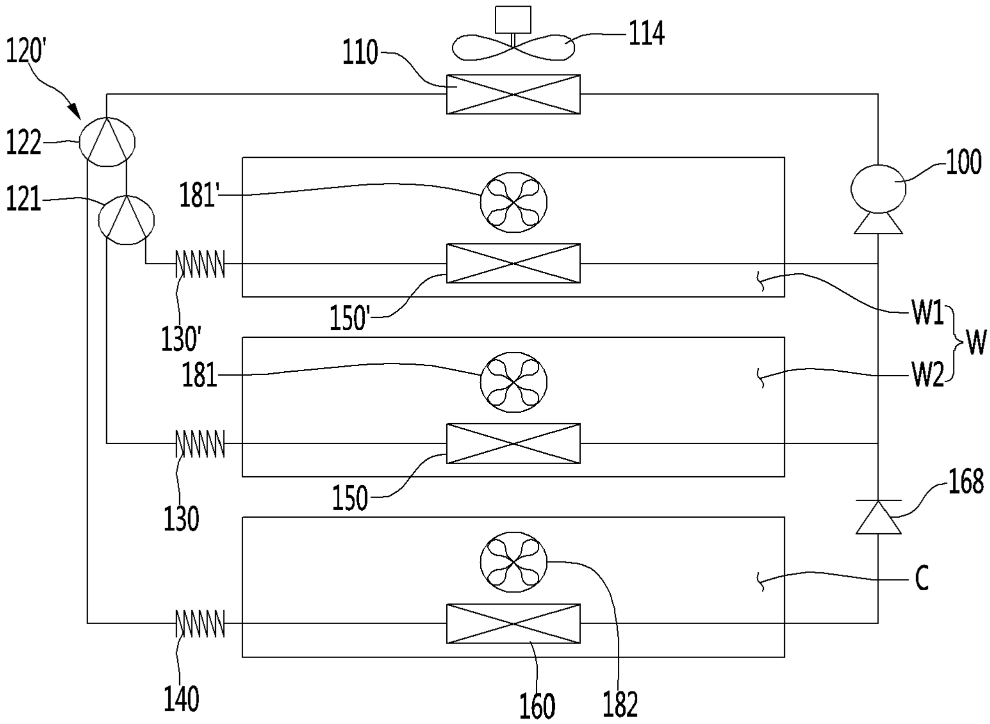

114
110
120'
122
121
100
181'
130'
150'
W1
W
W2
181
130
150
168
C
140
160
182

FIG. 6

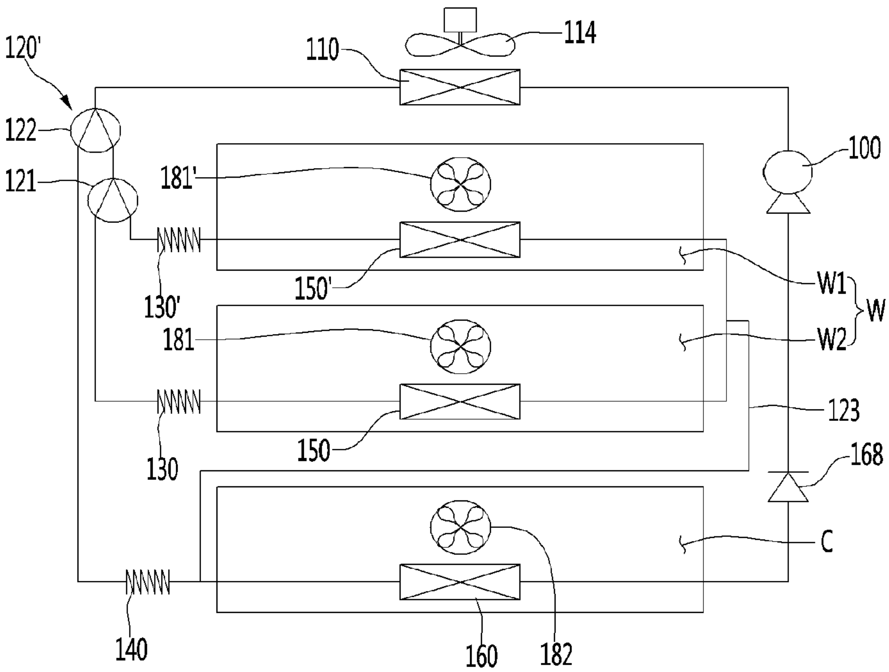

114
110
120'
122
121
100
181'
130'
150'
W1
W
W2
181
123
130
150
168
C
140
160
182

FIG. 7

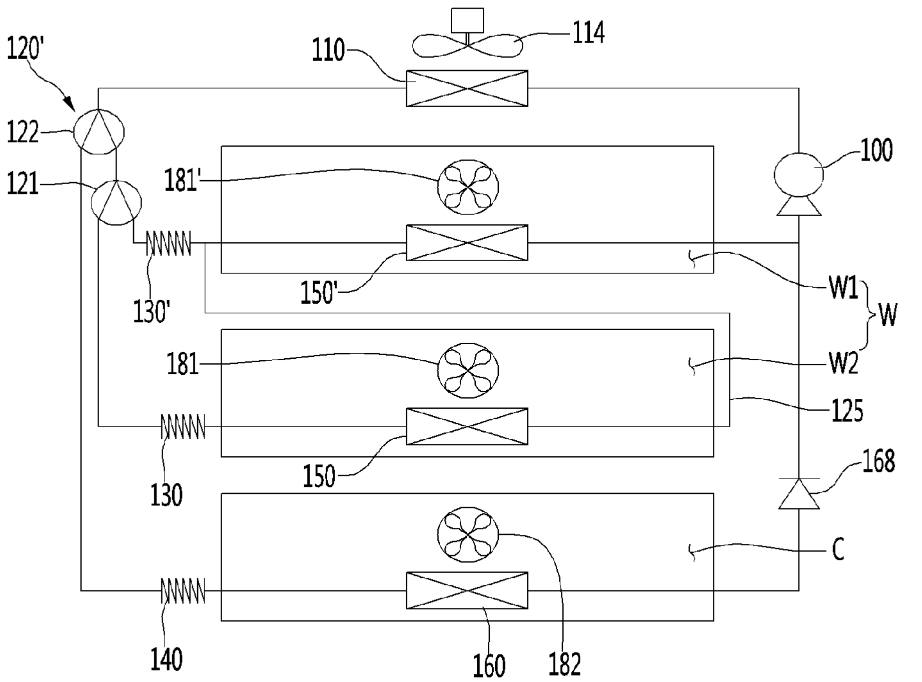

120'
110
114
122
121
181'
100
130'
150'
W1
W
181
W2
125
130
150
168
C
140
160
182

FIG. 8

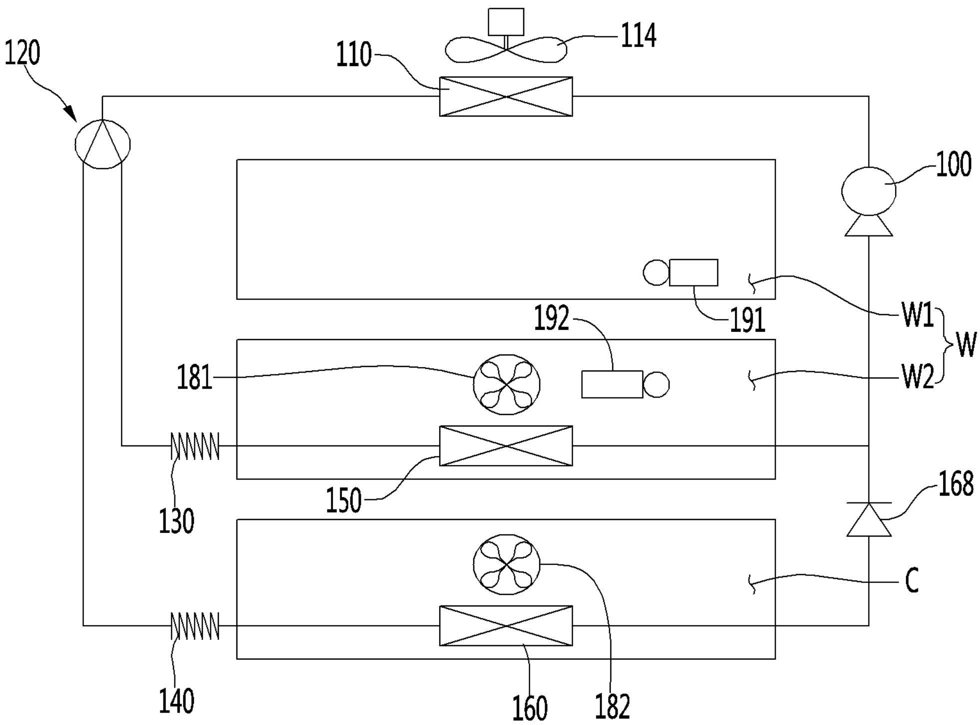

120
110
114
100
191
192
W1
W
181
W2
130
150
168
C
140
160
182

FIG. 9

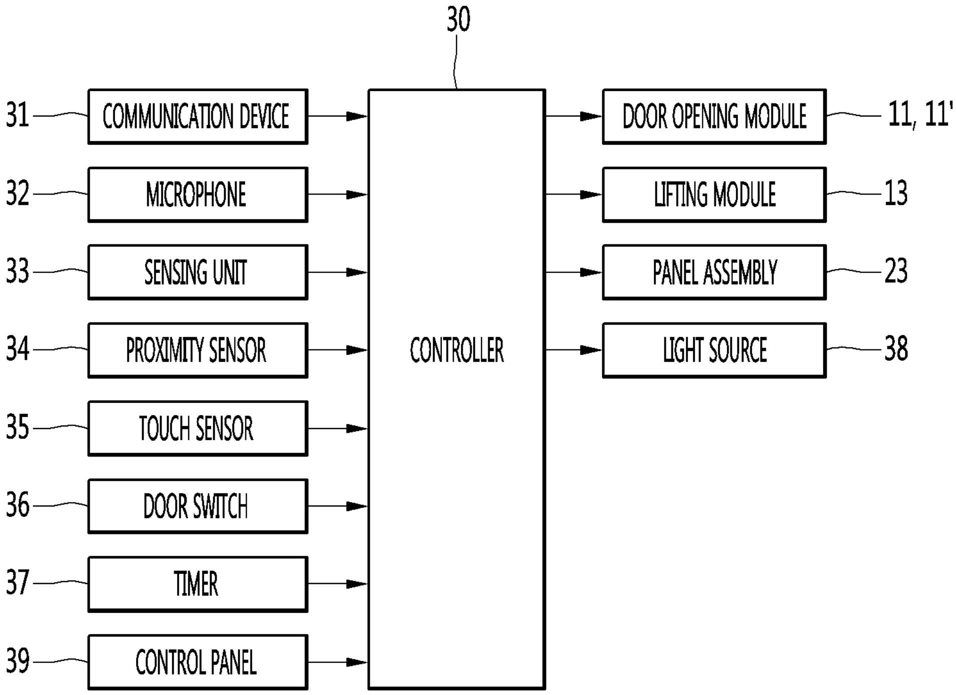

30
31
COMMUNICATION DEVICE
32
MICROPHONE
33
SENSING UNIT
34
PROXIMITY SENSOR
35
TOUCH SENSOR
36
DOOR SWITCH
37
TIMER
39
CONTROL PANEL
CONTROLLER
DOOR OPENING MODULE
11, 11'
LIFTING MODULE
13
PANEL ASSEMBLY
23
LIGHT SOURCE
38

FIG. 10

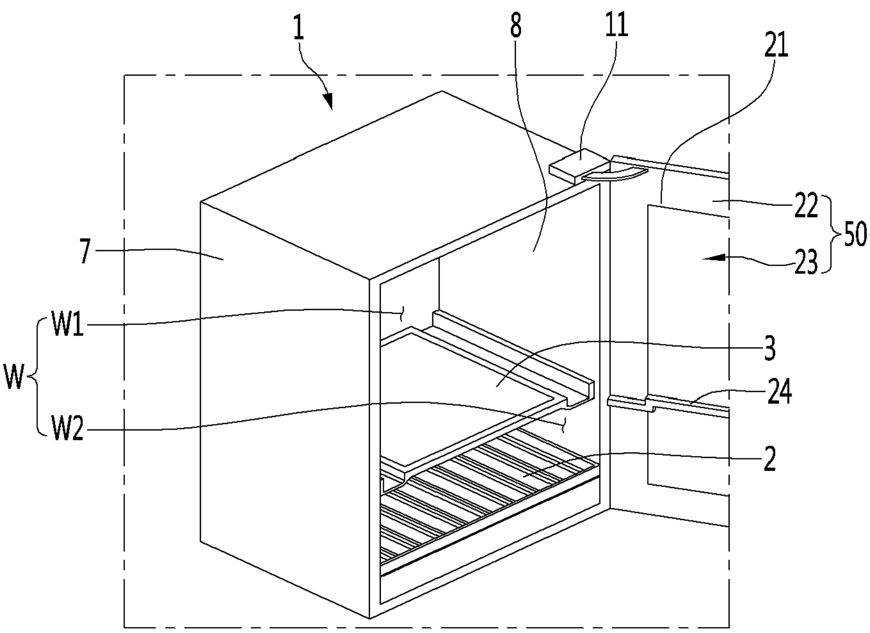

1
8
11
21
22
50
23
7
W1
W
W2
3
24
2

FIG. 11

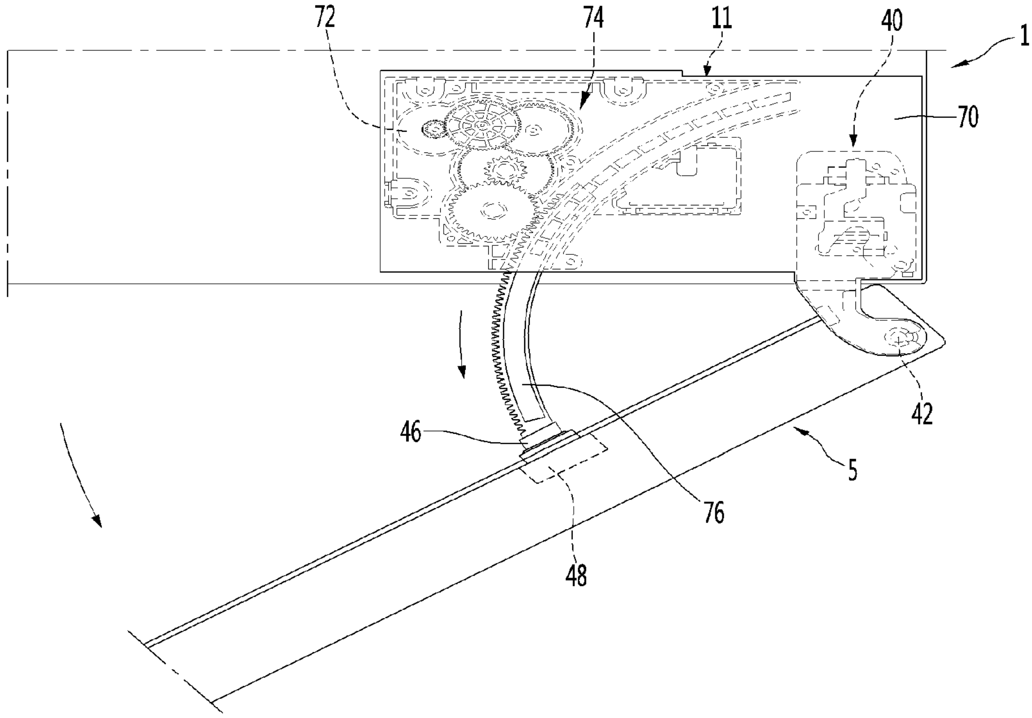


FIG. 12

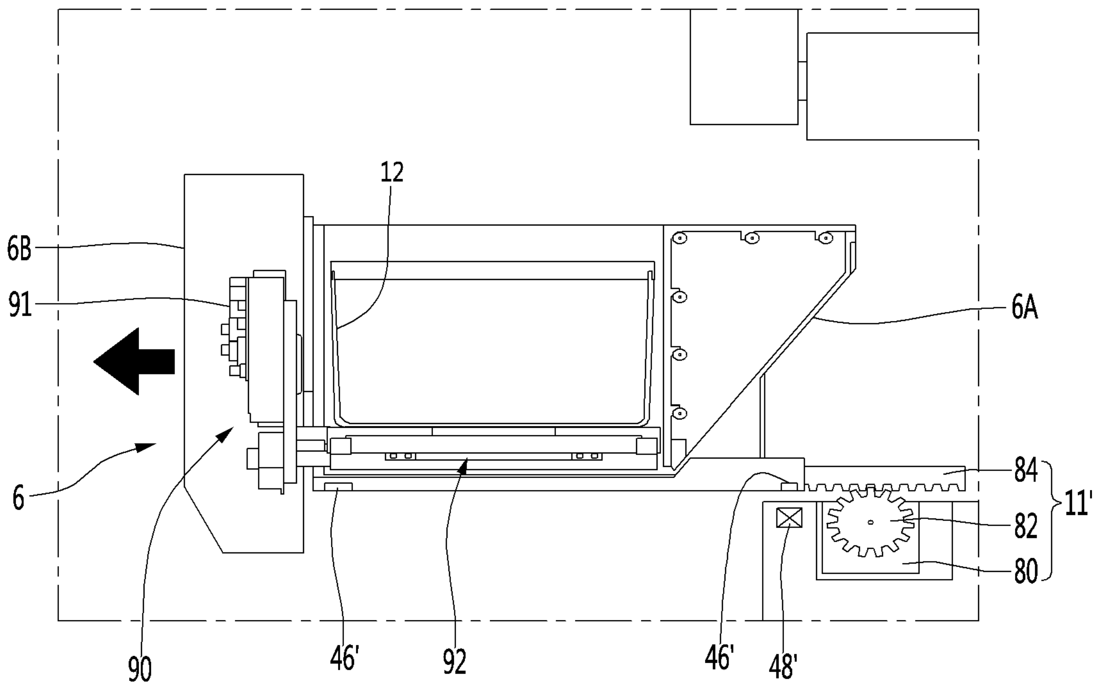


FIG. 13

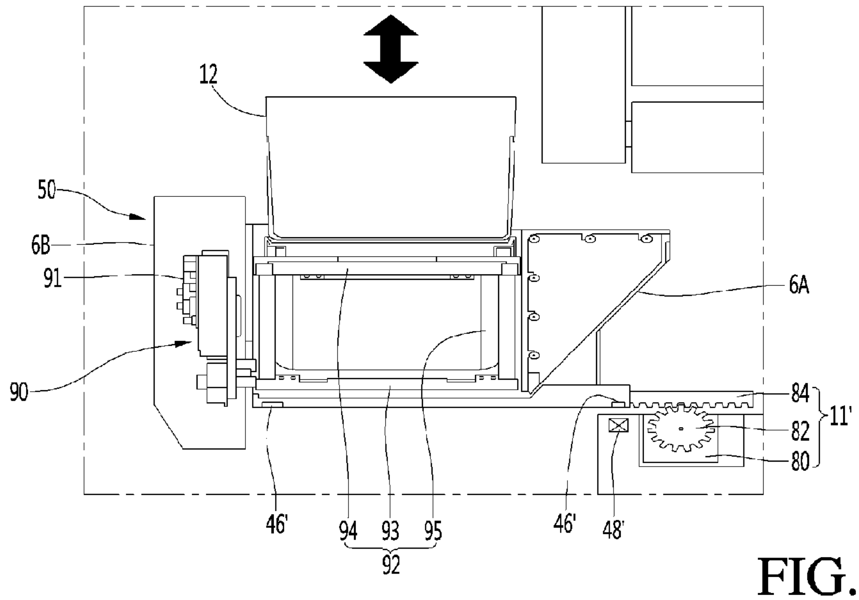

12
50
6B
91
90
6A
84
82
80
11'
46'
94
93
95
92
46'
48'

FIG. 14

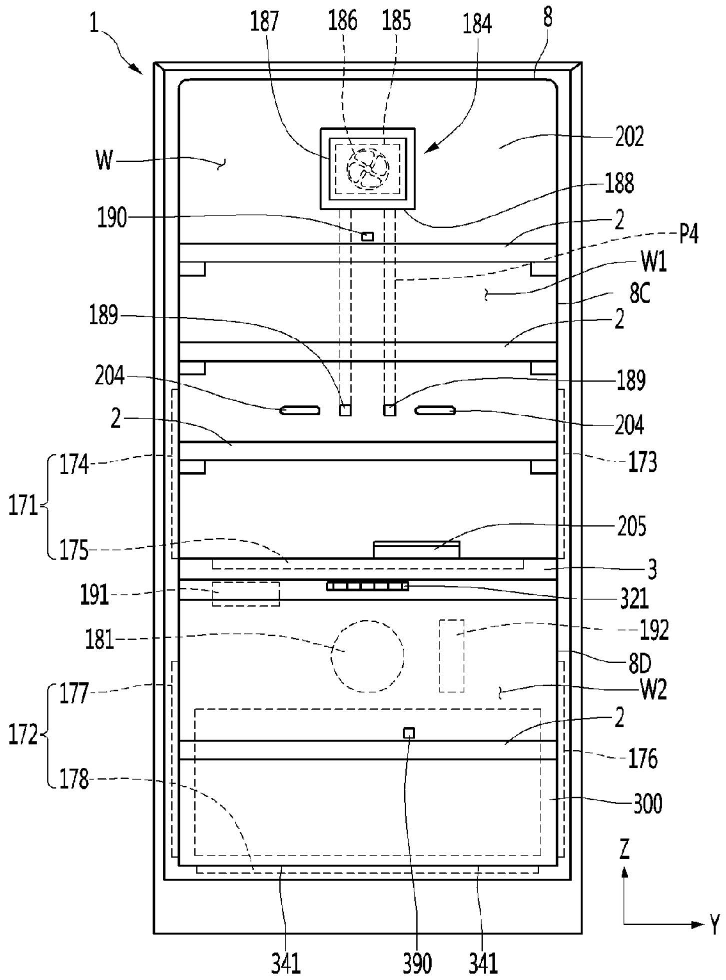

1
187
186
185
184
8
W
202
188
190
2
P4
W1
8C
189
2
204
189
2
204
174
173
171
205
175
3
191
321
181
192
8D
W2
177
2
172
176
178
300
341
390
341
Z
Y

FIG. 15

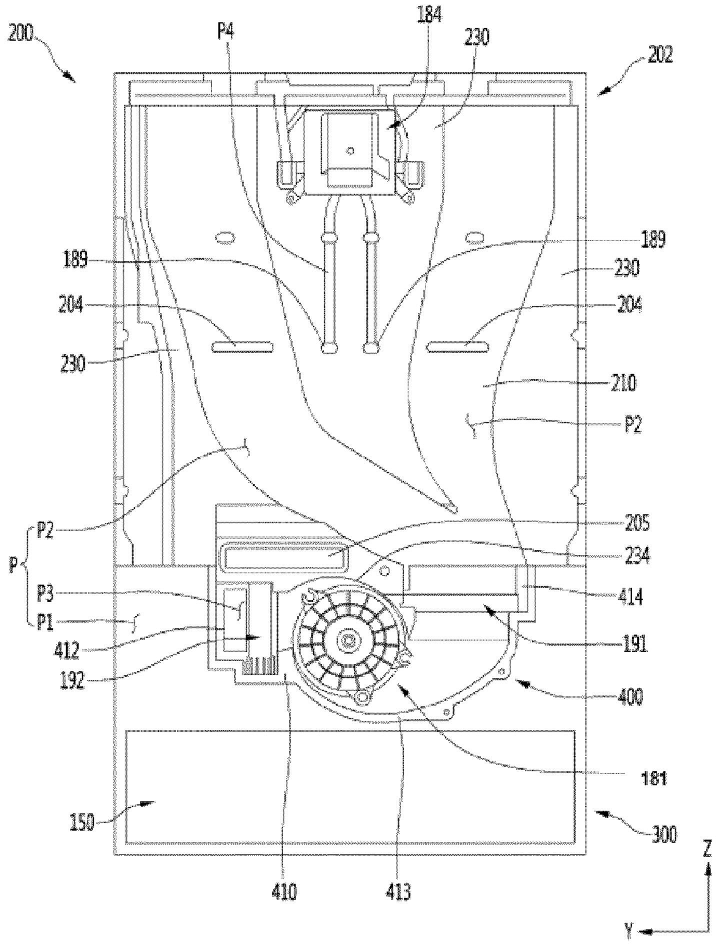

200
P4
184
230
202
189
189
230
204
204
230
210
P2
P2
P
P3
P1
412
192
205
234
414
191
400
181
150
300
410
413
Z
Y

FIG. 16

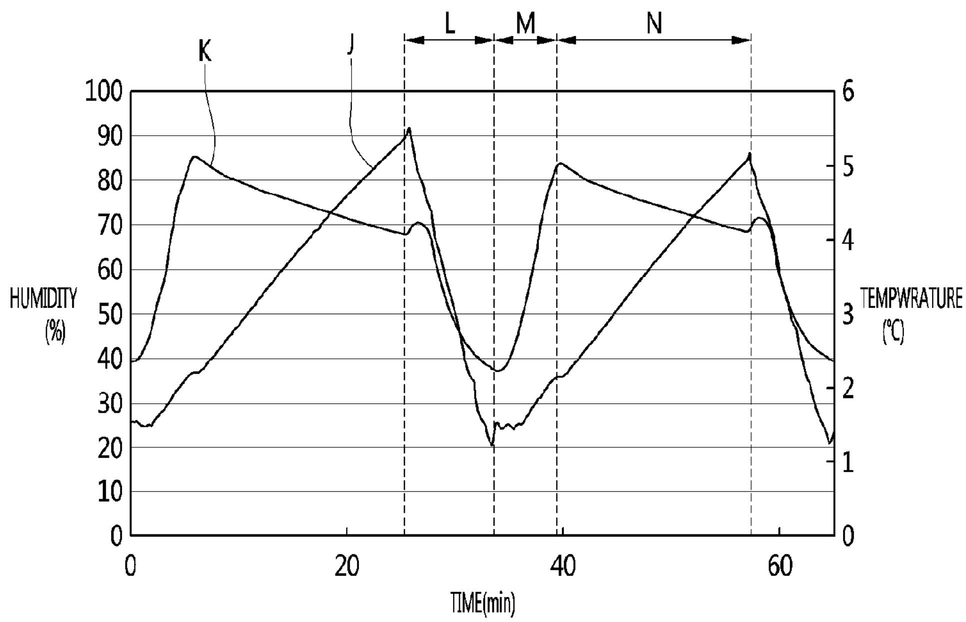

L
M
N
K
J
HUMIDITY (%)
TEMPWRATURE (℃)
100
90
80
70
60
50
40
30
20
10
0
6
5
4
3
2
1
0
0
20
40
60
TIME(min)

FIG. 17

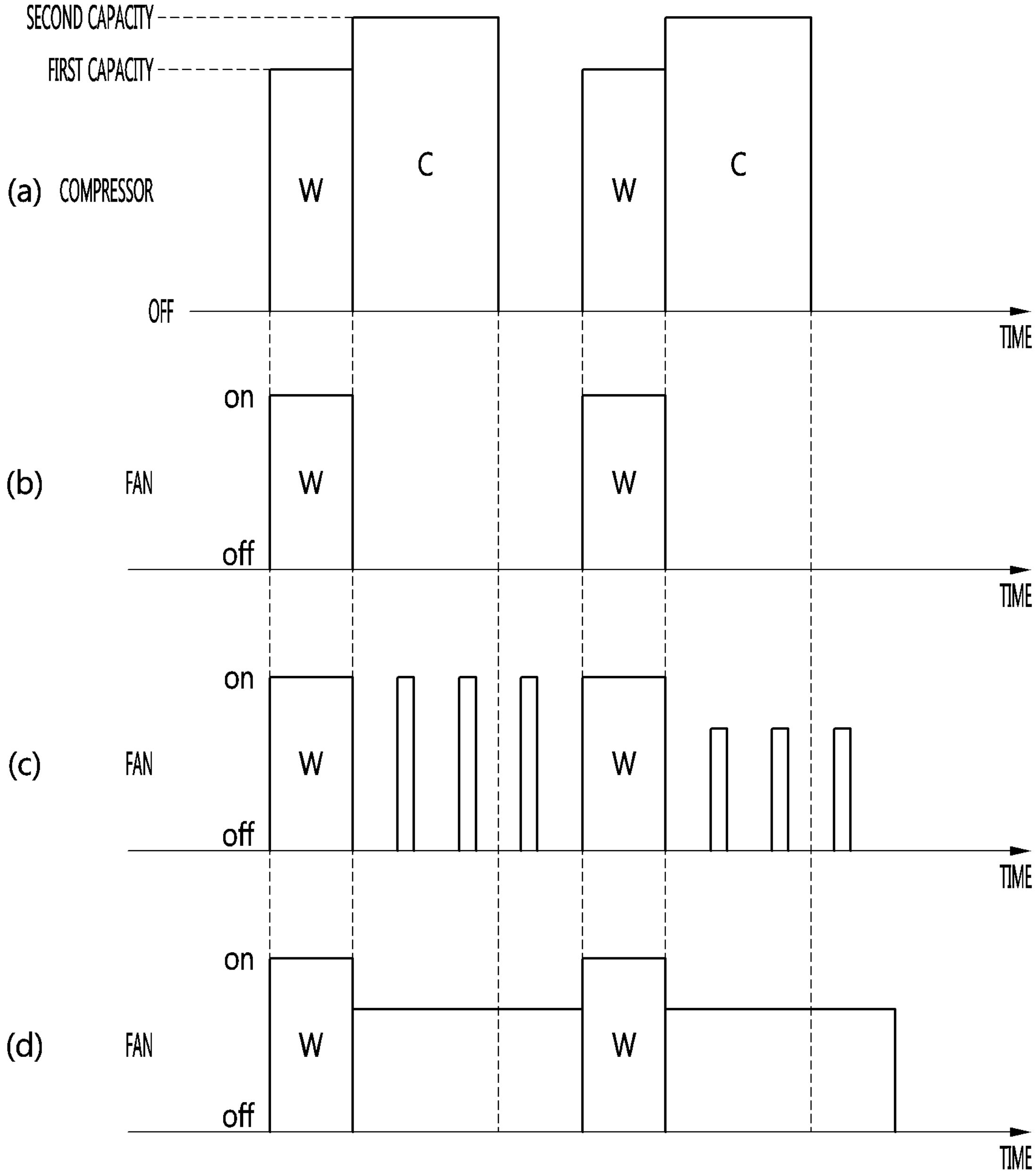

SECOND CAPACITY
FIRST CAPACITY
(a) COMPRESSOR
W
C
W
C
OFF
TIME
(b) FAN
on
off
W
W
TIME
(c) FAN
on
off
W
W
TIME
(d) FAN
on
off
W
W
TIME

FIG. 18

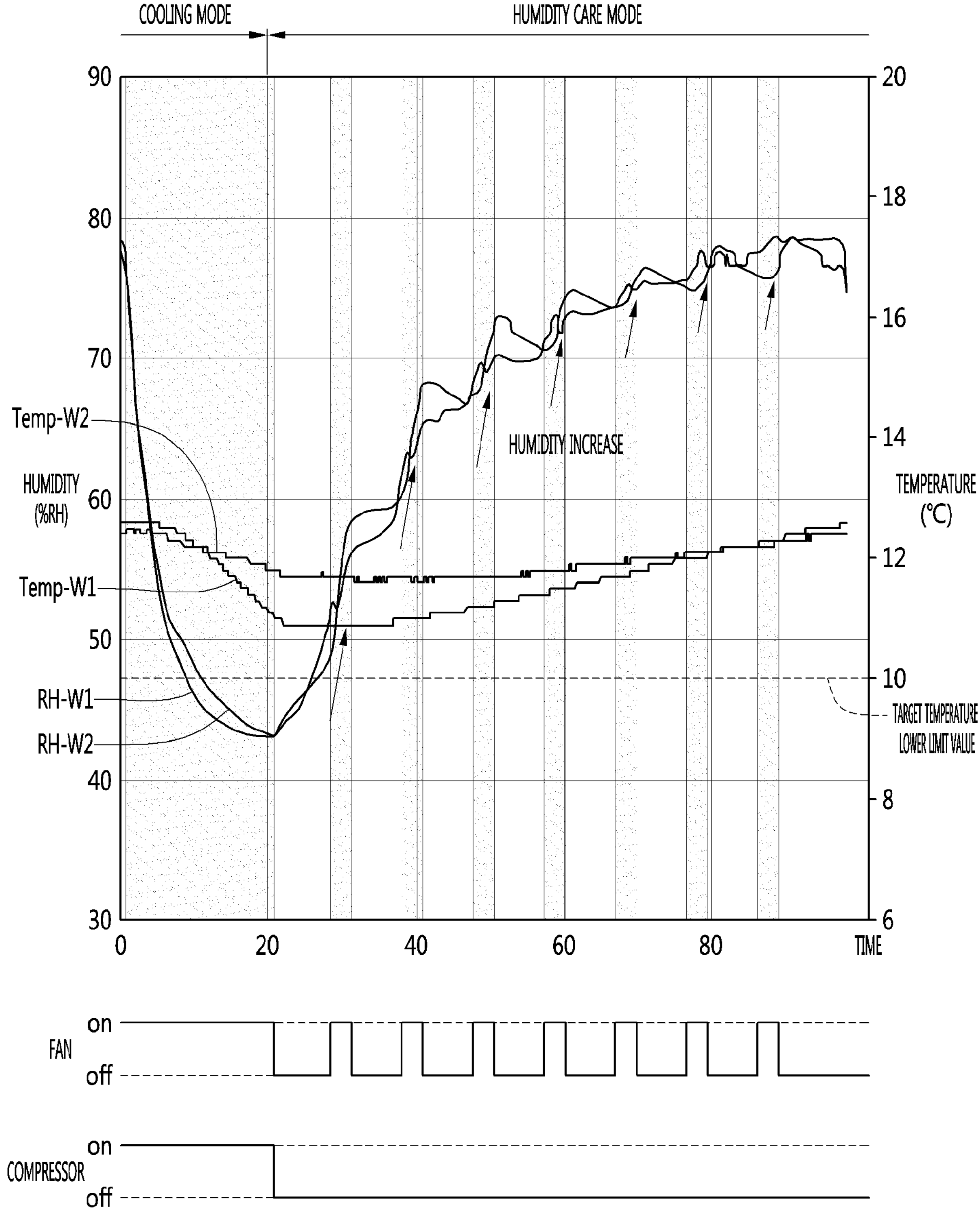
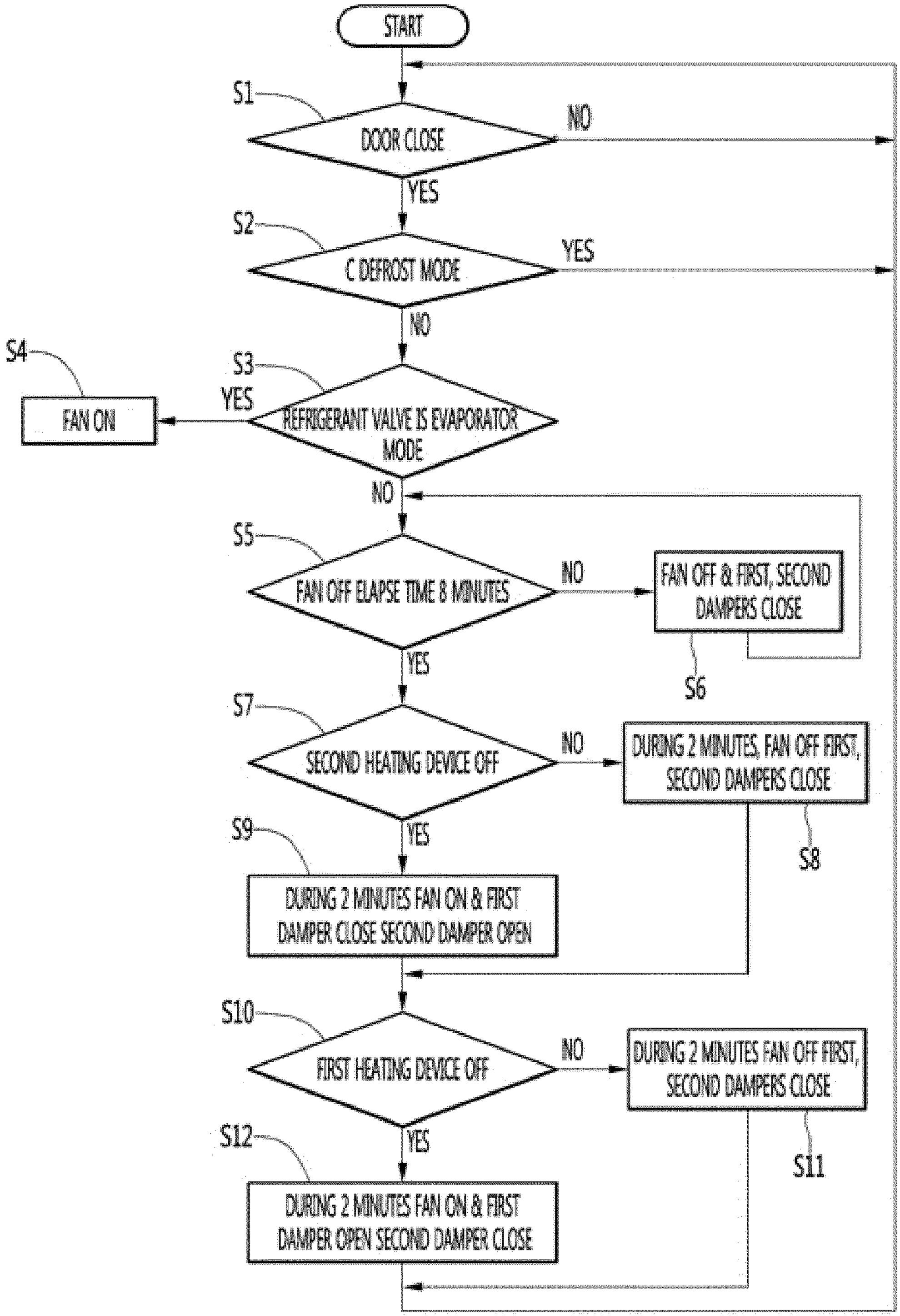

COOLING MODE
HUMIDITY CARE MODE
90
80
70
60
50
40
30
20
18
16
14
12
10
8
6
0
20
40
60
80
TIME
Temp-W2
Temp-W1
RH-W1
RH-W2
HUMIDITY (%RH)
TEMPERATURE (℃)
HUMIDITY INCREASE
TARGET TEMPERATURE LOWER LIMIT VALUE
FAN
on
off
COMPRESSOR
on
off

FIG. 19


START
S1
DOOR CLOSE
NO
YES
S2
C DEFROST MODE
YES
NO
S4
S3
YES
FAN ON
REFRIGERANT VALVE IS EVAPORATOR MODE
NO
S5
FAN OFF ELAPSE TIME 8 MINUTES
NO
FAN OFF & FIRST, SECOND DAMPERS CLOSE
YES
S6
S7
SECOND HEATING DEVICE OFF
NO
DURING 2 MINUTES, FAN OFF FIRST, SECOND DAMPERS CLOSE
S9
YES
S8
DURING 2 MINUTES FAN ON & FIRST DAMPER CLOSE SECOND DAMPER OPEN
S10
FIRST HEATING DEVICE OFF
NO
DURING 2 MINUTES FAN OFF FIRST, SECOND DAMPERS CLOSE
S12
YES
S11
DURING 2 MINUTES FAN ON & FIRST DAMPER OPEN SECOND DAMPER CLOSE

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 0245

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Place of search	Date of completion of the search	Examiner
The Hague	11 May 2020	Bejaoui, Amin

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