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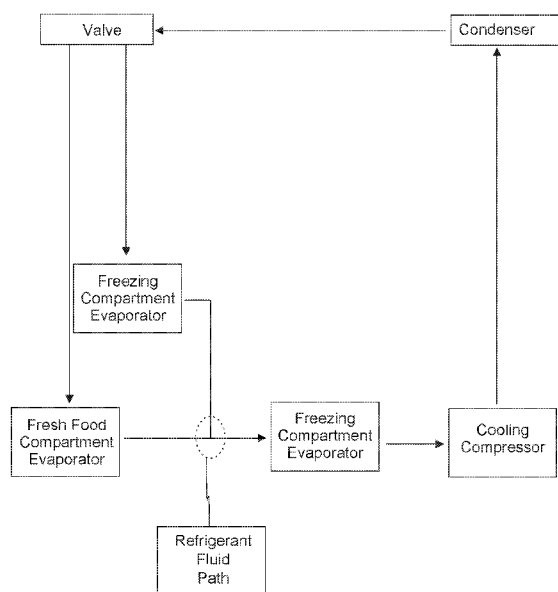
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(54) Title: A COOLING DEVICE COMPRISING A ICE MAKING UNIT

Figure 1



(57) Abstract: The present invention relates to a cooling device comprising a body having a fresh food compartment, a freezing compartment and an ice compartment; a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice compartment evaporator, a valve for directing a refrigerant fluid to the fresh food compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator; an ice making unit and an ice storage unit provided in the ice compartment, and a fresh food compartment fan; a freezing compartment fan; an ice compartment fan; a fresh food compartment temperature sensor; a freezing compartment temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor.

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A COOLING DEVICE COMPRISING A ICE MAKING UNIT

The present invention relates to a cooling device comprising an ice making unit with improved energy efficiency and an ice storage unit.

5 Cooling devices, especially refrigerators, comprise a fresh food compartment, a freezing compartment, an ice compartment and a refrigerant fluid cycle. A refrigerant fluid cycle in the cooling device is directed to the relevant compartment evaporators according to the cooling needs of the compartments. This direction is performed by means of a valve in the cooling devices with a fully parallel cooling cycle. In a fully parallel cooling cycle, the
10 fresh food compartment evaporator and the freezing compartment evaporator are connected to each other in parallel. Thus, the valve directs the refrigerant fluid to the evaporators of the compartment which needs cooling at that time. The ice compartment evaporator is connected in series to the fresh food compartment evaporator and the freezing compartment evaporator. In other words, before reaching the ice compartment evaporator, the refrigerant
15 fluid must pass through the fresh food compartment evaporator or the freezing compartment evaporator. In the prior art, especially when there is no cooling need for the fresh food compartment and the freezing compartment and there is a need to make ice pieces or cool the existing ice pieces, the cooling of the fresh food compartment or the freezing compartment should also continue. Cooling the fresh food compartment or the
20 freezing compartment when there is no need for cooling dramatically reduces the energy efficiency and economic life of the cooling device. There is a need for cooling devices with a fully parallel cooling cycle wherein the ice pieces are made or the existing ice pieces are cooled in a highly energy efficient manner. Especially when there is no cooling requirement for the fresh food compartment and the freezing compartment and there is a need to make
25 ice pieces or cool the existing ice pieces, a cooling device is needed wherein the operation of the components of the cooling device is determined.

In the state of the art American Patent Document No. US10982892B2, a refrigerator is disclosed, comprising a fresh food compartment, a freezing compartment and an ice compartment. Here, the refrigerant fluid valve directs the refrigerant fluid to one of a first
30 path or a second path of the refrigeration cycle. The first path enables the ice maker

evaporator to be operated in series with the freezing compartment evaporator. The second path enables the refrigerant fluid to bypass the ice compartment evaporator and pass into the freezing compartment evaporator.

5 The aim of the present invention is the realization of a cooling device with a fully parallel cooling cycle wherein it is determined how the ice pieces are made or how the existing ice pieces are cooled. A cooling device with high energy efficiency wherein the operation of the components of the cooling device is determined is realized especially when there is no cooling requirement for the fresh food compartment and the freezing compartment and there is a need to make ice pieces or cool the existing ice pieces.

10 The cooling device of the present invention comprises a body having a fresh food compartment, a freezing compartment and an ice compartment. The cooling device further comprises a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice compartment evaporator, a valve for directing a refrigerant fluid to the fresh food
15 compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator. The cooling device further comprises an ice making unit and an ice storage unit provided in the ice compartment; a fresh food compartment fan; a freezing compartment fan; an ice
20 compartment fan; a fresh food compartment temperature sensor; a freezing compartment temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor. The cooling device comprises a processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is not triggered, to operate the ice compartment fan when the ice
25 storage unit temperature sensor detects a temperature above a selected ice storage starting temperature, and configured to stop the ice compartment fan upon detecting a temperature below a selected ice storage stopping temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is
30 not triggered. Here, the refrigerant fluid leaving the fresh food compartment evaporator or

the freezing compartment evaporator reaches the ice compartment evaporator. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature. Since the fresh food compartment or the freezing compartment is already actively cooled in this condition, the ice compartment is cooled in an energy-saving manner by means of the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator, and the ready-made ice pieces in the ice storage unit are enabled to maintain their ice form, in other words, the ice pieces are preventing from melting.

In an embodiment of the present invention, the cooling device comprises the processing unit which is configured, when the fresh food compartment fan and the freezing compartment fan are not in operation and the ice making unit is not triggered, to operate the cooling compressor when the ice storage unit temperature sensor detects a temperature above the selected ice storage starting temperature, to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and to operate the ice compartment fan, and configured to stop the cooling compressor and the ice compartment fan upon detecting a temperature below the selected ice storage stopping temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is not triggered. In this case, in order to ensure that the ready-made ice pieces in the ice storage unit maintain their ice form, in other words, to prevent the ice pieces from melting, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. Here, it is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the user), and thus the energy efficiency is improved. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature.

In an embodiment of the present invention, the cooling device comprises the processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered, when it is requested to make ice pieces and the ice storage unit is not full, to operate the ice compartment fan when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, and configured to stop the ice compartment fan when the ice making unit temperature sensor detects a temperature below a selected ice making stopping temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered. Here, the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice compartment evaporator. The temperature of the ice making unit is enabled to remain within the range of the selected ice making starting temperature and the selected ice making stopping temperature. Since the fresh food compartment or the freezing compartment is already actively cooled in this condition, the ice compartment is cooled in an energy-saving manner by means of the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator, and the ice making unit is enabled to remain within the range of temperatures suitable for making ice pieces.

In an embodiment of the present invention, the cooling device comprises the processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered, when it is requested to make ice pieces and the ice storage unit is not full, to operate the cooling compressor when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the ice compartment fan; also configured to stop the freezing compartment fan when the freezing compartment temperature sensor detects a temperature below a decreased freezing compartment stopping temperature which is lower than a predetermined freezing compartment stopping temperature; and also configured to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the freezing compartment fan when the freezing compartment temperature sensor detects a temperature above a decreased freezing compartment starting temperature which

is lower than a predetermined freezing compartment starting temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is triggered. In this case, in order to enable the ice making unit to
5 make ice pieces, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. Here, it is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food
10 compartment (the frequency of opening of the compartment door by the user), and thus the energy efficiency is improved. Here, the freezing compartment temperature is enabled to remain within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Since the decreased freezing compartment starting/stopping temperatures are lower than the predetermined freezing
15 compartment starting/stopping temperatures, the refrigerant fluid cycle started for the ice making unit is also used to keep the freezing compartment temperature within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Thus, energy efficiency is improved.

In an embodiment of the cooling device of the present invention, the decreased freezing
20 compartment starting temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment starting temperature and the decreased freezing compartment stopping temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment stopping temperature.

In an embodiment of the present invention, the cooling device comprises the ice making
25 unit having an ice making cartridge and an ice piece dispensing unit, and a processing unit which is configured, when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, to operate the ice compartment fan to make ice pieces in the ice making cartridge, and configured, after the ice pieces are made, to enable the ice dispensing unit to dispense the ice pieces into the ice storage unit.

The cooling device operating method of the present invention is suitable for cooling devices comprising a body having a fresh food compartment, a freezing compartment and an ice compartment; a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice compartment evaporator, a valve for directing a refrigerant fluid to the fresh food compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator; an ice making unit and an ice storage unit provided in the ice compartment; a fresh food compartment fan; a freezing compartment fan; an ice compartment fan; a fresh food compartment temperature sensor; a freezing compartment temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor. The cooling device operating method comprises the steps, when a fresh food compartment fan or a freezing compartment fan is in operation and an ice making unit is not triggered, of operating an ice compartment fan when an ice storage unit temperature sensor detects a temperature above a selected ice storage starting temperature, and of stopping the ice compartment fan when the ice storage unit temperature sensor detects a temperature below a selected ice storage stopping temperature. In this embodiment of the cooling device operating method, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is not triggered. Here, the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice compartment evaporator. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature. Since the fresh food compartment or the freezing compartment is already actively cooled in this condition, the ice compartment is cooled in an energy-saving manner by means of the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator, and the ready-made ice pieces in the ice storage unit are enabled to maintain their ice form, in other words, the ice pieces are preventing from melting.

In an embodiment of the present invention, the cooling device operating method comprises the steps, when the fresh food compartment fan and the freezing compartment fan are not in

operation and the ice making unit is not triggered, of operating the cooling compressor when the ice storage unit temperature sensor detects a temperature above the selected ice storage starting temperature, enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operating the ice compartment fan, and of stopping the cooling compressor and the ice compartment fan when the ice storage unit temperature sensor detects a temperature below the selected ice storage stopping temperature. In this embodiment of the cooling device operating method, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is not triggered. In this case, in order to ensure that the ready-made ice pieces in the ice storage unit maintain their ice form, in other words, to prevent the ice pieces from melting, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. Here, it is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the user), and thus the energy efficiency is improved. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature.

In an embodiment of the present invention, the cooling device operating method comprises the steps, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered, of operating the ice compartment fan when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, and of stopping the ice compartment fan when the ice making unit temperature sensor detects a temperature below a selected ice making stopping temperature. In this embodiment of the cooling device operating method, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered. Here, the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice compartment evaporator. The temperature of the ice making unit is enabled to remain within the range of the selected ice making starting temperature and

the selected ice making stopping temperature. Since the fresh food compartment or the freezing compartment is already actively cooled in this condition, the ice compartment is cooled in an energy-saving manner by means of the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator, and the ice making unit is enabled to remain within the range of temperatures suitable for making ice pieces.

In an embodiment of the present invention, the cooling device operating method comprises the steps, when the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is triggered, of operating the cooling compressor when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operating the ice compartment fan; stopping the freezing compartment fan when the freezing compartment temperature sensor detects a temperature below a decreased freezing compartment stopping temperature which is lower than a predetermined freezing compartment stopping temperature; and enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operating the freezing compartment fan when the freezing compartment temperature sensor detects a temperature above a decreased freezing compartment starting temperature which is lower than a predetermined freezing compartment starting temperature. In this embodiment of the cooling device operating method, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is triggered. In this case, in order to enable the ice making unit to make ice pieces, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. Here, it is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the user), and thus the energy efficiency is improved. Here, the freezing compartment temperature is enabled to remain within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Since the decreased freezing compartment starting/stopping temperatures are lower than the predetermined freezing

compartment starting/stopping temperatures, the refrigerant fluid cycle started for the ice making unit is also used to keep the freezing compartment temperature within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Thus, energy efficiency is improved.

- 5 In an embodiment of the cooling device operating method of the present invention, the decreased freezing compartment starting temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment starting temperature and the decreased freezing compartment stopping temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment stopping temperature.
- 10 In an embodiment of the present invention, the cooling device operating method is suitable for cooling devices which further comprise an ice making cartridge and an ice dispensing unit. In this embodiment of the present invention, the cooling device operating method comprises steps, when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, of operating the ice compartment fan to make ice
- 15 pieces in the ice making cartridge, and, after the ice pieces are made, enabling the ice dispensing unit to dispense the ice pieces into the ice storage unit.

The cooling device realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

- Figure 1 - is the flow diagram showing the refrigerant fluid cycle structure of the cooling device of the present invention.
- 20

- The cooling device of the present invention comprises a body having a fresh food compartment, a freezing compartment and an ice compartment. The cooling device further comprises a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice
- 25 compartment evaporator, a valve for directing a refrigerant fluid to the fresh food compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator. The cooling device further comprises an ice making unit and an ice storage unit provided in the ice
- 30 compartment; a fresh food compartment fan; a freezing compartment fan; an ice

compartment fan; a fresh food compartment temperature sensor; a freezing compartment temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor.

- 5 The cooling device comprises a processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is not triggered, to operate the ice compartment fan when the ice storage unit temperature sensor detects a temperature above a selected ice storage starting temperature, and configured to stop the ice compartment fan upon detecting a temperature below a selected ice storage stopping temperature.
- 10 The refrigerant fluid cycle structure is in the form of a closed loop circulating the refrigerant fluid, and the compressor circulates the refrigerant fluid in the closed loop. The heat of the refrigerant fluid in the vapor phase converted by the compressor is discharged to the external environment by means of the condenser. The refrigerant fluid, which changes phase as the pressure thereof is decreased, is directed to the fresh food compartment
- 15 evaporator, the freezing compartment evaporator or the ice compartment evaporator. The compartment fans enable the air in the relevant compartment to be directed the relevant evaporator surface, thus decreasing the relevant compartment temperature. In more specific terms, the fresh food compartment fan enables the air in the fresh food compartment to be directed to the fresh food compartment evaporator. The freezing compartment fan enables
- 20 the air in the freezing compartment to be directed to the freezing compartment evaporator. The ice compartment fan enables the air in the ice compartment to be directed to the ice compartment evaporator. The fresh food compartment evaporator and the freezing compartment evaporator are connected parallel to each other in fluid communication. In other words, the valve separates the refrigerant fluid into one of two paths. The refrigerant
- 25 fluid is directed to the fresh food compartment evaporator in a path directed by the valve. In another path directed by the valve, the refrigerant fluid is directed to the freezing compartment evaporator. The ice compartment evaporator is connected in series to the fresh food compartment evaporator and the freezing compartment evaporator. By means of the refrigerant fluid path, the refrigerant fluid coming from both the fresh food

compartment evaporator and the freezing compartment evaporator is directed to the ice compartment evaporator (Figure 1).

In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in
5 operation and the ice making unit is not triggered. Here, the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice compartment evaporator. The operation of the fresh food compartment fan means that the fresh food compartment is actively cooled. When the fresh food compartment is actively cooled, the cooling compressor is in operation and the valve directs the refrigerant
10 fluid to the fresh food compartment evaporator. Upon leaving the fresh food compartment evaporator, the refrigerant fluid reaches the ice compartment evaporator. The operation of the freezing compartment fan means that the freezing compartment is actively cooled. When the freezing compartment is actively cooled, the cooling compressor is in operation and the valve directs the refrigerant fluid to the freezing compartment evaporator. Upon
15 leaving the freezing compartment evaporator, the refrigerant fluid reaches the ice compartment evaporator. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature. For this purpose, the processing unit is configured to operate the ice compartment fan when the ice storage unit temperature sensor detects a temperature above
20 a selected ice storage starting temperature, and configured to stop the ice compartment fan when the ice storage unit temperature sensor detects a temperature below a selected ice storage stopping temperature. The operation of the ice compartment fan means that the ice compartment is actively cooled. When the ice compartment is actively cooled, the cooling compressor is in operation and the refrigerant fluid is passing through the ice compartment
25 evaporator. The selected ice storage starting temperature may be at or below the melting temperature of ice.

The situation where the ice making unit used in the description is not triggered discloses the situation wherein there is no ice making request or even if there is an ice making request, the ice storage unit is full. When there is no ice making request, in other words, when ice
30 making is not desired, the ice making unit is not triggered/does not operate. When there is a

ice making request, in other words, when ice making is desired but the ice storage unit is full, the ice making unit is not triggered/does not operate since the ice pieces to be made cannot be stored. Whether the ice storage unit is full or not can be determined by means of an ice fullness sensor. The ice fullness sensor may include a weight meter which measures the weight of the ice storage unit. When the sensor measures that the ice storage unit is over a selected weight, the ice storage unit is assumed to be full. Another ice fullness sensor may include a level sensing probe and an actuator. The actuator moves the probe into the ice storage unit. If the probe can penetrate less than a selected distance into the ice storage unit, the ice storage unit is assumed to be full.

10 In an embodiment of the present invention, the cooling device comprises the processing unit which is configured, when the fresh food compartment fan and the freezing compartment fan are not in operation and the ice making unit is not triggered, to operate the cooling compressor when the ice storage unit temperature sensor detects a temperature above the selected ice storage starting temperature, to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and to operate the ice compartment fan, and configured to stop the cooling compressor and the ice compartment fan upon detecting a temperature below the selected ice storage stopping temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is not triggered. When the fresh food compartment fan and the freezing compartment fan are not in operation, the cooling compressor is not in operation. In this case, in order to ensure that the ready-made ice pieces in the ice storage unit maintain their ice form, in other words, to prevent the ice pieces from melting, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. For this purpose, first the cooling compressor is operated, the valve is enabled to direct the refrigerant fluid to the freezing compartment evaporator and the ice compartment fan is operated. It is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the user), and thus the

energy efficiency is improved. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature.

In an embodiment of the present invention, the cooling device comprises the processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered, when it is requested to make ice pieces and the ice storage unit is not full, to operate the ice compartment fan when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, and configured to stop the ice compartment fan when the ice making unit temperature sensor detects a temperature below a selected ice making stopping temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered. Here, the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice compartment evaporator. The temperature of the ice making unit is enabled to remain within the range of the selected ice making starting temperature and the selected ice making stopping temperature. The selected ice making starting temperature may be at or below the temperature at which water turns into ice.

In an embodiment of the present invention, the cooling device comprises the processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered, to operate the cooling compressor when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the ice compartment fan; also configured to stop the freezing compartment fan when the freezing compartment temperature sensor detects a temperature below a decreased freezing compartment stopping temperature which is lower than a predetermined freezing compartment stopping temperature; and also configured to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the freezing compartment fan when the freezing compartment temperature sensor detects a temperature above a decreased freezing

compartment starting temperature which is lower than a predetermined freezing compartment starting temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is triggered. When the

5 fresh food compartment fan and the freezing compartment fan are not in operation, the cooling compressor is not in operation. In this case, in order to enable the ice making unit to make ice pieces, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. For this purpose, first the cooling

10 compressor is operated, the valve is enabled to direct the refrigerant fluid to the freezing compartment evaporator and the ice compartment fan is operated. It is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the

15 user), and thus the energy efficiency is improved. The ice making process is a relatively long process. Here, the temperature setting value of the freezing compartment temperature (for example, the temperature value selected by the user for the freezing compartment) is reduced for energy efficiency. Thus, the refrigerant fluid cycle started to enable the ice making unit to make ice pieces is also used to bring the freezing compartment temperature

20 to lower temperatures. Thus, the energy efficiency is increased. In order to maintain the temperature setting value, the cooling process must be performed by taking the predetermined freezing compartment starting temperature and the predetermined freezing compartment stopping temperature as reference. For example, the freezing compartment fan should be stopped when the freezing compartment temperature sensor detects a

25 temperature below the predetermined freezing compartment stopping temperature. Similarly, the freezing compartment fan should be operated when the freezing compartment temperature sensor detects a temperature above the predetermined freezing compartment starting temperature. However, here, instead, the freezing compartment fan is stopped when the freezing compartment temperature sensor detects a temperature below the decreased

30 freezing compartment stopping temperature which is lower than the predetermined freezing compartment stopping temperature. Moreover, the freezing compartment fan is operated

when the freezing compartment temperature sensor detects a temperature above the decreased freezing compartment stopping temperature which is lower than the predetermined freezing compartment stopping temperature. Thus, the freezing compartment temperature is enabled to remain within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Since the decreased freezing compartment starting/stopping temperatures are lower than the predetermined freezing compartment starting/stopping temperatures, the refrigerant fluid cycle started for the ice making unit is also used to keep the freezing compartment temperature within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Thus, energy efficiency is improved. In this embodiment of the present invention, the direction of the refrigerant fluid to the freezing compartment evaporator by the valve is not a choice, but a necessity. If the valve directs the refrigerant fluid to the fresh food compartment evaporator, the decreased fresh food compartment starting temperature and the decreased fresh food compartment stopping temperature may cause the food in the fresh food compartment to freeze. An exemplary embodiment is described to clarify the present invention. The user sets the temperature value as -18°C . For this -18°C temperature setting, the predetermined freezing compartment starting temperature is predetermined as -17.5°C and the predetermined freezing compartment stopping temperature is predetermined as -18.5°C . Here the decreased freezing compartment starting temperature is a temperature lower than -17.5°C , for example -19.5°C . The decreased freezing compartment stopping temperature is a temperature lower than -18.5°C , for example -20.5°C . The decreased freezing compartment stopping temperature is lower than the decreased freezing compartment starting temperature.

In an embodiment of the cooling device of the present invention, the decreased freezing compartment starting temperature is 0.5°C to 6°C lower than the predetermined freezing compartment starting temperature and the decreased freezing compartment stopping temperature is 0.5°C to 6°C lower than the predetermined freezing compartment stopping temperature. When this embodiment is adapted according to the exemplary embodiment of the present invention, the decreased freezing compartment starting temperature is between -

18.0 °C and -23.5 °C. The decreased freezing compartment stopping temperature is between -19.0 °C and -24.5 °C.

In an embodiment of the present invention, the cooling device comprises the ice making unit having an ice making cartridge and an ice piece dispensing unit, and a processing unit
5 which is configured, when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, to operate the ice compartment fan to make ice pieces in the ice making cartridge, and configured, after the ice pieces are made, to enable the ice dispensing unit to dispense the ice pieces into the ice storage unit. In this embodiment, the cooling device further comprises the processing unit which is configured
10 to fill the ice making cartridge with water.

The cooling device operating method of the present invention is suitable for cooling devices comprising a body having a fresh food compartment, a freezing compartment and an ice compartment; a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice
15 compartment evaporator, a valve for directing a refrigerant fluid to the fresh food compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator; an ice making unit and an ice storage unit provided in the ice compartment; a fresh food compartment fan; a
20 freezing compartment fan; an ice compartment fan; a fresh food compartment temperature sensor; a freezing compartment temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor. The cooling device operating method comprises the steps, when a fresh food compartment fan or a freezing compartment fan is in operation and an ice making unit is not triggered, of operating an ice compartment fan when an ice
25 storage unit temperature sensor detects a temperature above a selected ice storage starting temperature, and of stopping the ice compartment fan when the ice storage unit temperature sensor detects a temperature below a selected ice storage stopping temperature.

In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in
30 operation and the ice making unit is not triggered. Here, the refrigerant fluid coming from

the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice compartment evaporator. The operation of the fresh food compartment fan means that the fresh food compartment is actively cooled. When the fresh food compartment is actively cooled, the cooling compressor is in operation and the valve directs the refrigerant fluid to the fresh food compartment evaporator. Upon leaving the fresh food compartment evaporator, the refrigerant fluid reaches the ice compartment evaporator. The operation of the freezing compartment fan means that the freezing compartment is actively cooled. When the freezing compartment is actively cooled, the cooling compressor is in operation and the valve directs the refrigerant fluid to the freezing compartment evaporator. Upon leaving the freezing compartment evaporator, the refrigerant fluid reaches the ice compartment evaporator. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature. For this purpose, the ice compartment fan is operated when the ice storage unit temperature sensor detects a temperature above a selected ice storage starting temperature, and the ice compartment fan is stopping when the ice storage unit temperature sensor detects a temperature below a selected ice storage stopping temperature. The operation of the ice compartment fan means that the ice compartment is actively cooled. When the ice compartment is actively cooled, the cooling compressor is in operation and the refrigerant fluid is passing through the ice compartment evaporator. The selected ice storage starting temperature may be at or below the melting temperature of ice.

In an embodiment of the present invention, the cooling device operating method comprises the steps, when the fresh food compartment fan and the freezing compartment fan are not in operation and the ice making unit is not triggered, of operating the cooling compressor when the ice storage unit temperature sensor detects a temperature above the selected ice storage starting temperature, enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operating the ice compartment fan, and of stopping the cooling compressor and the ice compartment fan when the ice storage unit temperature sensor detects a temperature below the selected ice storage stopping temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is not triggered. When the fresh food compartment fan and the

freezing compartment fan are not in operation, the cooling compressor is not in operation.

In this case, in order to ensure that the ready-made ice pieces in the ice storage unit maintain their ice form, in other words, to prevent the ice pieces from melting, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice

5 compartment evaporator. For this purpose, first the cooling compressor is operated, the valve is enabled to direct the refrigerant fluid to the freezing compartment evaporator and the ice compartment fan is operated. It is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold
10 insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the user), and thus the energy efficiency is improved. The temperature of the ice storage unit is enabled to remain within the range of the selected ice storage starting temperature and the selected ice storage stopping temperature.

15 In an embodiment of the present invention, the cooling device operating method comprises the steps, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered, of operating the ice compartment fan when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, and of stopping the ice compartment fan when the ice making unit
20 temperature sensor detects a temperature below a selected ice making stopping temperature.

In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered. Here, the refrigerant fluid coming from the fresh food compartment evaporator or the freezing compartment evaporator reaches the ice
25 compartment evaporator. The temperature of the ice making unit is enabled to remain within the range of the selected ice making starting temperature and the selected ice making stopping temperature. The selected ice making starting temperature may be at or below the temperature at which water turns into ice.

In an embodiment of the present invention, the cooling device operating method comprises
30 the steps, when the fresh food compartment fan or the freezing compartment fan is not in

operation and the ice making unit is triggered, of operating the cooling compressor when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operating the ice compartment fan; stopping the freezing compartment fan when the freezing compartment temperature sensor detects a temperature below a decreased freezing compartment stopping temperature which is lower than a predetermined freezing compartment stopping temperature; and enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operating the freezing compartment fan when the freezing compartment temperature sensor detects a temperature above a decreased freezing compartment starting temperature which is lower than a predetermined freezing compartment starting temperature. In this embodiment of the cooling device, the operation principle of the cooling device is defined wherein the fresh food compartment fan or the freezing compartment fan is not in operation and the ice making unit is triggered. When the fresh food compartment fan and the freezing compartment fan are not in operation, the cooling compressor is not in operation. In this case, in order to enable the ice making unit to make ice pieces, the refrigerant fluid cycle must be started and the refrigerant fluid must be delivered to the ice compartment evaporator. For this purpose, first the cooling compressor is operated, the valve is enabled to direct the refrigerant fluid to the freezing compartment evaporator and the ice compartment fan is operated. It is preferred that the valve directs the refrigerant fluid to the freezing compartment evaporator. This choice is made since the freezing compartment operates at lower temperatures than the fresh food compartment and the cold insulation of the freezing compartment is generally broken less than the fresh food compartment (the frequency of opening of the compartment door by the user), and thus the energy efficiency is improved. The ice making process is a relatively long process. Here, the temperature setting value of the freezing compartment temperature (for example, the temperature value selected by the user for the freezing compartment) is reduced for energy efficiency. Thus, the refrigerant fluid cycle started to enable the ice making unit to make ice pieces is also used to bring the freezing compartment temperature to lower temperatures. Thus, the energy efficiency is increased. In order to maintain the temperature setting value, the cooling process must be performed by taking the predetermined freezing compartment

starting temperature and the predetermined freezing compartment stopping temperature as reference. For example, the freezing compartment fan must be stopped when the freezing compartment temperature sensor detects a temperature below the predetermined freezing compartment stopping temperature. Similarly, the freezing compartment fan must be operated when the freezing compartment temperature sensor detects a temperature above the predetermined freezing compartment starting temperature. However, here, instead, the freezing compartment fan is stopped when the freezing compartment temperature sensor detects a temperature below the decreased freezing compartment stopping temperature which is lower than the predetermined freezing compartment stopping temperature.

Moreover, the freezing compartment fan is operated when the freezing compartment temperature sensor detects a temperature above the decreased freezing compartment stopping temperature which is lower than the predetermined freezing compartment stopping temperature. Thus, the freezing compartment temperature is enabled to remain within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Since the decreased freezing compartment starting/stopping temperatures are lower than the predetermined freezing compartment starting/stopping temperatures, the refrigerant fluid cycle started for the ice making unit is also used to keep the freezing compartment temperature within the range of the decreased freezing compartment starting temperature and the decreased freezing compartment stopping temperature. Thus, energy efficiency is improved. In this embodiment of the present invention, the direction of the refrigerant fluid to the freezing compartment evaporator by the valve is not a choice, but a necessity. If the valve directs the refrigerant fluid to the fresh food compartment evaporator, the decreased fresh food compartment starting temperature and the decreased fresh food compartment stopping temperature may cause the food in the fresh food compartment to freeze. An exemplary embodiment is described to clarify the present invention. The user sets the temperature value as -18°C . For this -18°C temperature setting, the predetermined freezing compartment starting temperature is predetermined as -17.5°C and the predetermined freezing compartment stopping temperature is predetermined as -18.5°C . Here the decreased freezing compartment starting temperature is a temperature lower than -17.5°C , for example -19.5°C . The decreased freezing compartment stopping temperature is a

temperature lower than -18.5°C , for example -20.5°C . The decreased freezing compartment stopping temperature is lower than the decreased freezing compartment starting temperature.

5 In an embodiment of the cooling device operating method of the present invention, the decreased freezing compartment starting temperature is 0.5°C to 6°C lower than the predetermined freezing compartment starting temperature and the decreased freezing compartment stopping temperature is 0.5°C to 6°C lower than the predetermined freezing compartment stopping temperature.

10 In an embodiment of the present invention, the cooling device operating method is suitable for cooling devices which further comprise an ice making cartridge and an ice dispensing unit. In this embodiment of the present invention, the cooling device operating method comprises steps, when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, operating the ice compartment fan to make ice pieces in the ice making cartridge, and, after the ice pieces are made, enabling the ice
15 dispensing unit to dispense the ice pieces into the ice storage unit. In this embodiment, the cooling device operating method further comprises the step of filling the ice making cartridge with water.

CLAIMS

1. A cooling device **comprising**

- a body having a fresh food compartment, a freezing compartment and an ice compartment;
- 5 – a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice compartment evaporator, a valve for directing a refrigerant fluid to the fresh food compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food
10 compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator;
- an ice making unit and an ice storage unit provided in the ice compartment, and
- a fresh food compartment fan; a freezing compartment fan; an ice compartment fan; a fresh food compartment temperature sensor; a freezing compartment
15 temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor,
- **characterized by** a processing unit which is configured to operate the ice compartment fan and stop the ice compartment fan upon detecting a temperature below a selected ice storage stopping temperature when the fresh food
20 compartment fan or the freezing compartment fan is in operation and the ice making unit is not triggered and the ice storage unit temperature sensor detects a temperature above a selected ice storage starting temperature.

2. A cooling device as in Claim 1, **characterized by** the processing unit which is configured, when the fresh food compartment fan and the freezing compartment fan 25 are not in operation and the ice making unit is not triggered,

- to operate the cooling compressor when the ice storage unit temperature sensor detects a temperature above the selected ice storage starting temperature, to

enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and to operate the ice compartment fan, and

- to stop the cooling compressor and the ice compartment fan upon detecting a temperature below the selected ice storage stopping temperature.

5 3. A cooling device as in Claim 1, **characterized by** the processing unit which is configured, when the fresh food compartment fan or the freezing compartment fan is in operation and the ice making unit is triggered,

- to operate the ice compartment fan when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature,
10 and

- to stop the ice compartment fan when the ice making unit temperature sensor detects a temperature below a selected ice making stopping temperature.

15 4. A cooling device as in as in any of the above claims, **characterized by** the processing unit which is configured, when the fresh food compartment fan and the freezing compartment fan are not in operation and the ice making unit is triggered,

- to operate the cooling compressor when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the ice compartment fan;

- to stop the freezing compartment fan when the freezing compartment temperature sensor detects a temperature below a decreased freezing compartment stopping temperature which is lower than a predetermined freezing compartment stopping temperature; and

- to enable the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the freezing compartment fan when the freezing compartment temperature sensor detects a temperature above a decreased freezing compartment starting temperature which is lower than a predetermined freezing compartment starting temperature.
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5. A cooling device as in Claim 4, **characterized in that** the decreased freezing compartment starting temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment starting temperature and the decreased freezing compartment stopping temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment stopping temperature.
6. A cooling device as in any one of Claims 3 to 5, **characterized by**
- the ice making unit having an ice making cartridge and an ice piece dispensing unit, and
 - a processing unit which is configured, when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, to operate the ice compartment fan to make ice pieces in the ice making cartridge, and configured, after the ice pieces are made, to enable the ice dispensing unit to dispense the ice pieces into the ice storage unit.
7. A cooling device operating method, **characterized by** the steps, when a fresh food compartment fan or a freezing compartment fan is in operation and an ice making unit is not triggered, of
- operating an ice compartment fan when an ice storage unit temperature sensor detects a temperature above a selected ice storage starting temperature, and
 - stopping the ice compartment fan when the ice storage unit temperature sensor detects a temperature below a selected ice storage stopping temperature,
- which is suitable for a cooling device comprising
- a body having a fresh food compartment, a freezing compartment and an ice compartment;
 - a refrigerant fluid cycle structure having a cooling compressor, a condenser, a fresh food compartment evaporator, a freezing compartment evaporator, an ice compartment evaporator, a valve for directing a refrigerant fluid to the fresh food compartment evaporator or the freezing compartment evaporator, and a refrigerant fluid path for directing the refrigerant fluid leaving the fresh food

compartment evaporator and the freezing compartment evaporator to the ice compartment evaporator;

- an ice making unit and an ice storage unit provided in the ice compartment, and
- a fresh food compartment fan; a freezing compartment fan; an ice compartment fan; a fresh food compartment temperature sensor; a freezing compartment temperature sensor; an ice making unit temperature sensor; and an ice storage unit temperature sensor.

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8. A cooling device operating method as in Claim 7, **characterized by** the steps, when the fresh food compartment fan and the freezing compartment fan are not in operation and the ice making unit is not triggered, of

- operating the cooling compressor,
- enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and
- operating the ice compartment fan when the ice storage unit temperature sensor detects a temperature above the selected ice storage starting temperature, and
- stopping the cooling compressor and the ice compartment fan when the ice storage unit temperature sensor detects a temperature below the selected ice storage stopping temperature.

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9. A cooling device operating method as in Claim 7 or 8, **characterized by** the steps, when the fresh food compartment fan and the freezing compartment fan are in operation and the ice making unit is triggered, of

- operating the ice compartment fan when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, and
- stopping the ice compartment fan when the ice making unit temperature sensor detects a temperature below a selected ice making stopping temperature.

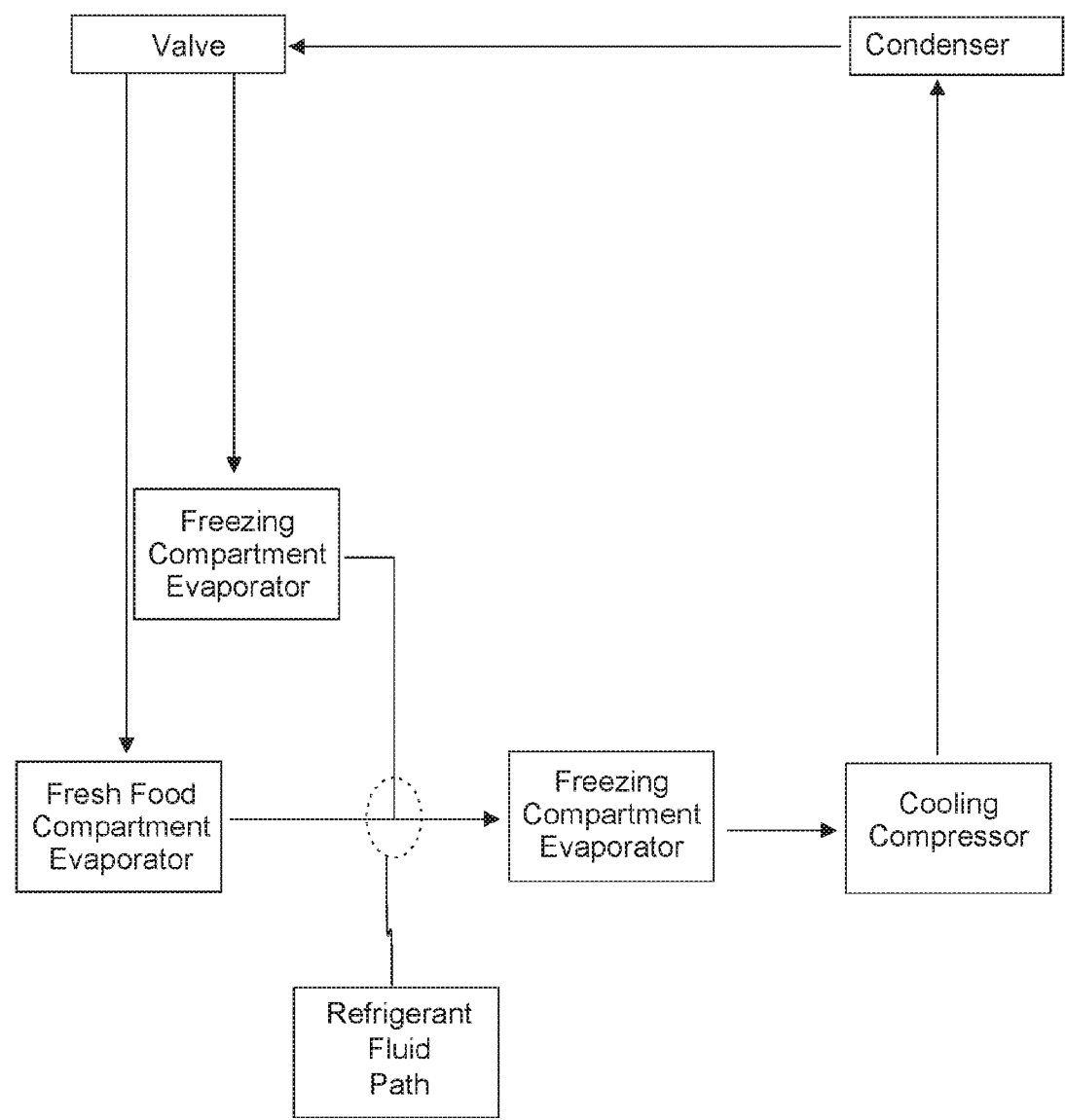
25

10. A cooling device operating method as in any one of Claims 7 to 9, **characterized by** the steps, when the fresh food compartment fan and the freezing compartment fan are not in operation and the ice making unit is triggered, of
- operating the cooling compressor when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature;
 - enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator;
 - operating the ice compartment fan;
 - stopping the freezing compartment fan when the freezing compartment temperature sensor detects a temperature below a decreased freezing compartment stopping temperature which is lower than a predetermined freezing compartment stopping temperature; and
 - enabling the valve to direct the refrigerant fluid to the freezing compartment evaporator and operate the freezing compartment fan when the freezing compartment temperature sensor detects a temperature above a decreased freezing compartment starting temperature which is lower than a predetermined freezing compartment starting temperature.
11. A cooling device operating method as in Claim 10, **characterized in that** the decreased freezing compartment starting temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment starting temperature and the decreased freezing compartment stopping temperature is 0.5 °C to 6 °C lower than the predetermined freezing compartment stopping temperature.
12. A cooling device operating method as in any one of Claims 9 to 11, **characterized by** the steps, when the ice making unit temperature sensor detects a temperature above a selected ice making starting temperature, of
- operating the ice compartment fan to make ice pieces in the ice making cartridge, and

- after the ice pieces are made, enabling the ice dispensing unit to dispense the ice pieces into the ice storage unit,

which is suitable for a cooling device comprising an ice making cartridge and an ice dispensing unit.

Figure 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/TR2024/050843

A. CLASSIFICATION OF SUBJECT MATTER**F25C 5/20**(2018.01)i; **F25C 1/00**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25C 5/20; F25C 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

TURKPATENT Patent Database

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO Abstract & Fulltext Databases & Keywords: process,unit,ice,fan,stop,making,logic,control,on,off,sense,detect,temperature, trigger,spark,stimulate,induce,cool,compress,dispense,cartridge,valve,fresh,compartment,liquid,refrigerant,evaporate,unload, release,harvest,discharge

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 3517864 A1 (LG ELECTRONICS INC [KR]) 31 July 2019 (2019-07-31) Paragraphs 10, 14-18, 257-263, 272-284, 308	1-12
A	US 2007157645 A1 (MAYTAG CORP) 12 July 2007 (2007-07-12) Whole document	1-12
A	US 2018313593 A1 (ELECTROLUX HOME PROD INC [US]) 01 November 2018 (2018-11-01) Paragraph 39	1-12

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

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

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“E” earlier application or patent but published on or after the international filing date

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

24 October 2024

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/TR2024/050843

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EP	3517864	A1	31 July 2019	EP	3517864	B1	09 December 2020
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