



(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:  
08.03.2017 Bulletin 2017/10

(51) Int Cl.:

F25D 11/02 (2006.01)

F25B 5/04 (2006.01)

F25B 5/02 (2006.01)

(21) Application number: 16184776.9

(22) Date of filing: 18.08.2016

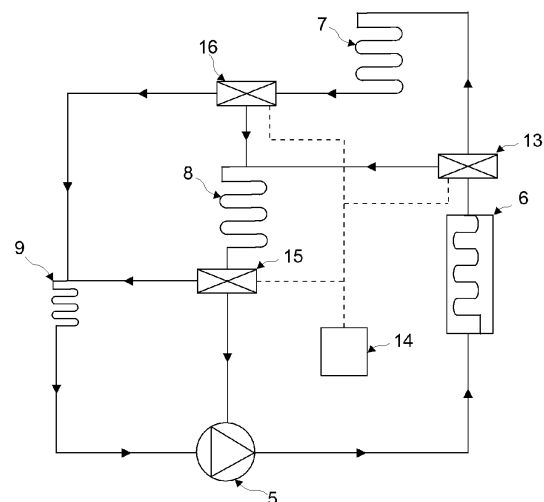
|                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>(84) Designated Contracting States:<br/>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<br/>Designated Extension States:<br/>BA ME<br/>Designated Validation States:<br/>MA MD</div> <div>(30) Priority: 07.09.2015 TR 201511066</div> <div>(71) Applicant: Arçelik Anonim Sirketi<br/>34950 Istanbul (TR)</div> | <div>(72) Inventors:</div> <ul style="list-style-type: none"> <li>SAHNALI, KAA<br/>34950 ISTANBUL (TR)</li> <li>AYNUR, TOLGA NURETTIN<br/>34950 ISTANBUL (TR)</li> <li>PEKER, GOKMEN<br/>34950 ISTANBUL (TR)</li> <li>KAYA, UNSAL<br/>34950 ISTANBUL (TR)</li> <li>KARAKAYA, ERKAN<br/>34950 ISTANBUL (TR)</li> </ul> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

(54)

A COOLING DEVICE COMPRISING A TEMPERATURE CONTROLLED SPECIAL COMPARTMENT

(57) The present invention relates to a cooling device (1) comprising a fresh food compartment (2) wherein the foods are placed to be cooled; a freezing compartment (3) that is kept at lower temperatures than the fresh food compartment (2) and wherein the foods are placed to be frozen; a special compartment (4) that is disposed inside the fresh food compartment (2) and that is kept at a temperature between the fresh food compartment (2) temperature and the freezing compartment (3) temperature; a compressor (5) providing the compression of the refrigerant fluid; a condenser (6) that enables the refrigerant fluid leaving the compressor (5) to change to the liquid phase by being condensed; at least one fresh food compartment evaporator (7) providing the cooling of the fresh food compartment (2); at least one freezing compartment evaporator (8) providing the cooling of the freezing compartment (3); a first temperature sensor (10) that measures the temperature of the fresh food compartment (2) for controlling the cooling process; a second temperature sensor (11) that measures the temperature of the freezing compartment (3) for controlling the freezing process; a first valve (13) that is disposed at the outlet of the condenser (6), and a control unit (14) that enables the refrigerant fluid leaving the condenser (6) to be directed to the fresh food compartment evaporator (7) or the freezing compartment evaporator (8) by passing through the first valve (13) by evaluating the data received from the first temperature sensor (10) and the second temperature sensor (11).

Figure 2



## Description

**[0001]** The present invention relates to a cooling device that comprises a temperature controlled special compartment.

**[0002]** In cooling devices, the circulation of the refrigerant fluid through the units composed of the compressor, the condenser, the capillary tube and the evaporator constitutes the refrigeration cycle. In cooling devices composed of fresh food and freezing compartments, wherein serially connected evaporators are provided in both compartments, the refrigerant fluid alternately circulates the evaporators in both compartments according to the order of connection in the refrigeration cycle. In cooling devices wherein evaporators connected in parallel are provided in both compartments, the refrigerant fluid is directed to one of the compartments by means of a valve. In cooling devices comprising a special compartment, also referred to as the 0°C compartment, that is kept approximately between -2°C and +3°C degrees and wherein foodstuffs like cheese, meat etc. are placed, the temperature of the special compartment is controlled by the heat transfer between the special compartment and the fresh food or the freezing compartments, independently from the refrigeration cycle. In this case, in particular in the case the cooling device is used in different ambient temperatures, the temperature of the special compartment cannot be kept within the desired interval.

**[0003]** In the state of the art United States of America Patent Application No. US6073458, a refrigerator is disclosed, comprising a plate having outlet openings that are opened controllably by means of the panel that moves by sliding, whereon the plate is disposed.

**[0004]** The aim of the present invention is the realization of a cooling device that comprises a controllably cooled special compartment together with the fresh food compartment and the freezing compartment.

**[0005]** The cooling device realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a fresh food compartment; a freezing compartment; a special compartment; a compressor providing the realization of the refrigeration cycle; a condenser that is formed by bending a tube in serpentine form and that enables the refrigerant fluid leaving the compressor as hot vapor to be condensed so as to change into liquid phase; at least one fresh food compartment evaporator that provides the cooling of the fresh food compartment; at least one freezing compartment evaporator that provides the cooling of the freezing compartment; a first temperature sensor that measures the interior temperature of the fresh food compartment; a second temperature sensor that measures the interior temperature of the freezing compartment; a first valve disposed at the condenser outlet, and a control unit that evaluates the data received from the first temperature sensor and the second temperature sensor so as to enable the refrigerant fluid leaving the condenser and passing through the first valve to be directed to the

fresh food compartment evaporator or to the freezing compartment evaporator.+ The special compartment is a storage compartment suitable to place foodstuffs like cheese, meat etc. therein and which is kept at approximately 0 °C degrees.

**[0006]** The cooling device of the present invention comprises

- at least one special compartment evaporator providing the cooling of the special compartment and
- a third temperature sensor that measures the temperature of the special compartment.

**[0007]** The refrigerant fluid used in the refrigeration cycle performed for the aim of cooling the fresh food compartment and the freezing compartment is delivered to the special compartment for cooling the special compartment controllably and to keep the special compartment temperature at the desired level.

**[0008]** In an embodiment of the present invention, the control unit enables the refrigerant fluid leaving the fresh food compartment evaporator to be delivered to the special compartment evaporator by evaluating the data received from the third temperature sensor. The refrigerant fluid used in the refrigeration cycle performed for the aim of cooling the fresh food compartment and the freezing compartment is delivered to the special compartment from the outlet of the fresh food compartment evaporator in order to cool the special compartment controllably and to keep the special compartment temperature at the desired level.

**[0009]** In another embodiment of the present invention, the control unit enables the refrigerant fluid leaving the freezing compartment evaporator to be delivered to the special compartment evaporator by evaluating the data received from the third temperature sensor. The refrigerant fluid used in the refrigeration cycle performed for the aim of cooling the fresh food compartment and the freezing compartment is delivered to the special compartment from the outlet of the freezing compartment evaporator to cool the special compartment controllably and to keep the special compartment temperature at the desired level.

**[0010]** In an embodiment of the present invention, the cooling device comprises a second valve disposed at the outlet of the freezing compartment evaporator and the control unit that enables the refrigerant fluid leaving the freezing compartment evaporator to be delivered to the special compartment evaporator or the compressor depending on the data received from the third temperature sensor. The refrigerant fluid leaving the freezing compartment evaporator is carried to the special compartment evaporator by means of the second valve in the case the thermal load of the special compartment increases.

**[0011]** In another embodiment of the present invention, the control unit

- compares the special compartment temperature detected by the third temperature sensor with the special compartment limit temperature predetermined by the producer,
- enables the refrigerant fluid to be passed through the second valve and delivered to the compressor if the temperature of the special compartment is lower than the special compartment limit temperature, and
- enables the refrigerant fluid to be passed through the second valve and delivered to the special compartment evaporator if the temperature of the special compartment is higher than the special compartment limit temperature. If the temperature of the special compartment is higher than the special compartment limit temperature, the control unit decides that the thermal load of the special compartment has increased and provides the cooling of the special compartment by directing the refrigerant fluid to the special compartment evaporator. After being passed through the special compartment evaporator, the refrigerant fluid is delivered to the compressor. In the case the special compartment is not required to be cooled, the refrigerant fluid leaving the freezing compartment evaporator is delivered directly to the compressor.

**[0012]** In another embodiment of the present invention, the cooling device comprises a third valve disposed at the outlet of the fresh food compartment evaporator and the control unit that enables the refrigerant fluid leaving the fresh food compartment evaporator to be delivered to the freezing compartment evaporator or the special compartment evaporator by passing through the third valve depending on the data received from the second temperature sensor and the third temperature sensor. In the situation the special compartment is required to be cooled but the freezing compartment not required to be cooled, the refrigerant fluid leaving the fresh food compartment evaporator is delivered to the special compartment evaporator by means of the third valve. In the situation the thermal load increases both in the fresh food compartment and the freezing compartment, the control unit enables the refrigerant fluid to be delivered to the fresh food compartment evaporator through the first valve so that the fresh food compartment is cooled first. The refrigerant fluid leaving the fresh food compartment evaporator is carried to the freezing compartment evaporator by passing through the third valve.

**[0013]** In another embodiment of the present invention, the control unit

- compares the freezing compartment temperature detected by the second temperature sensor with the freezing compartment limit temperature predetermined by the producer,
- compares the special compartment temperature detected by the third temperature sensor with the special compartment limit temperature predetermined

by the producer,

- enables the refrigerant fluid to be delivered to the special compartment evaporator by passing through the third valve if the freezing compartment temperature is lower than the freezing compartment limit temperature and the special compartment temperature is higher than the special compartment limit temperature, and
- enables the refrigerant fluid to be delivered to the freezing compartment evaporator by passing through the third valve if the freezing compartment temperature is lower than the freezing compartment limit temperature and the special compartment temperature is lower than the special compartment limit temperature. In this embodiment, after the refrigerant fluid exits the fresh food compartment evaporator, the control unit checks the temperatures of the freezing compartment and the special compartment and if the freezing compartment is required to be cooled, enables the refrigerant fluid to be delivered to the freezing compartment evaporator. Upon detecting that both the freezing compartment and the special compartment need to be cooled, the control unit enables the refrigerant fluid to be delivered to the freezing compartment evaporator so that the freezing compartment is cooled first and enables the refrigerant fluid leaving the freezing compartment evaporator to be carried to the compressor after passing through the special compartment evaporator. Thus, the freezing compartment and the special compartment are enabled to be cooled in this order.

**[0014]** In another embodiment of the present invention, the control unit enables the delivery of the refrigerant fluid to be stopped by stopping the compressor if the fresh food compartment temperature is lower than the fresh food compartment limit temperature and the freezing compartment temperature is lower than the freezing compartment limit temperature, and the special compartment temperature is lower than the special compartment limit temperature. In the case the fresh food compartment, the freezing compartment and the special compartment are sufficiently cooled, the control unit prevents energy consumption by terminating the refrigeration cycle.

**[0015]** By means of the present invention, a cooling device is realized, wherein the refrigeration cycle performance is improved by delivering the refrigerant fluid to the fresh food compartment evaporator, the freezing compartment evaporator and the special compartment evaporator by evaluating the temperatures measured in each compartment. The temperature of the special compartment is prevented from exceeding a limit temperature predetermined by the producer by delivering the refrigerant fluid leaving the fresh food compartment and/or the freezing compartment to the special compartment evaporator.

**[0016]** The cooling device realized in order to attain the aim of the present invention is illustrated in the at-

tached figures, where:

Figure 1 - is the schematic view of a cooling device.  
Figure 2 - is the schematic view of a refrigeration cycle.

**[0017]** The elements illustrated in the figures are numbered as follows:

1. Cooling device
2. Fresh food compartment
3. Freezing compartment
4. Special compartment
5. Compressor
6. Condenser
7. Fresh food compartment evaporator
8. Freezing compartment evaporator
9. Special compartment evaporator
10. First temperature sensor
11. Second temperature sensor
12. Third temperature sensor
13. First valve
14. Control unit
15. Second valve
16. Third valve

**[0018]** The cooling device (1) comprises a fresh food compartment (2) wherein the foods are placed to be cooled; a freezing compartment (3) that is kept at lower temperatures than the fresh food compartment (2) and wherein the foods are placed to be frozen; a special compartment (4) that is disposed inside the fresh food compartment (2) and that is kept at a temperature between the fresh food compartment (2) temperature and the freezing compartment (3) temperature; a compressor (5) providing the compression of the refrigerant fluid; a condenser (6) that enables the refrigerant fluid leaving the compressor (5) to change to the liquid phase by being condensed; at least one fresh food compartment evaporator (7) providing the cooling of the fresh food compartment (2); at least one freezing compartment evaporator (8) providing the cooling of the freezing compartment (3); a first temperature sensor (10) that measures the temperature of the fresh food compartment (2) for controlling the cooling process; a second temperature sensor (11) that measures the temperature of the freezing compartment (3) for controlling the freezing process; a first valve (13) that is disposed at the outlet of the condenser (6), and a control unit (14) that enables the refrigerant fluid leaving the condenser (6) to be directed to the fresh food compartment evaporator (7) or the freezing compartment evaporator (8) by passing through the first valve (13) by evaluating the data received from the first temperature sensor (10) and the second temperature sensor (11).

**[0019]** The cooling device (1) of the present invention comprises

- at least one special compartment evaporator (9) pro-

viding the cooling of the special compartment (4), and

- a third temperature sensor (12) that measures the temperature of the special compartment (4) Figure 1 and Figure 2).

**[0020]** In an embodiment of the present invention, the control unit (14) enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the special compartment evaporator (9) by evaluating the data received from the third temperature sensor (12). The control unit (14) controls the temperature of the special compartment (4) and when the special compartment (4) needs to be cooled, directs the refrigerant fluid leaving the fresh food compartment evaporator (7) to the special compartment evaporator (9).

**[0021]** In another embodiment of the present invention, the control unit (14) enables the refrigerant fluid leaving the freezing compartment evaporator (8) to be delivered to the special compartment evaporator (9) by evaluating the data received from the third temperature sensor (12). The control unit (14) controls the temperature of the special compartment (4) and when the special compartment (4) needs to be cooled, directs the refrigerant fluid leaving the freezing compartment evaporator (8) to the special compartment evaporator (9).

**[0022]** The control unit (14) determines the compartment the thermal load of which has increased by evaluating the data received from the first temperature sensor (10) and the second temperature sensor (11) and provides the delivery of the refrigerant fluid leaving the condenser (6) to be directed to the fresh food compartment evaporator (7) or the freezing compartment evaporator (8) by passing through the first valve (13) so as to be directed to the detected compartment. In the case the thermal load of the special compartment (4) increases, the refrigerant fluid leaving the fresh food compartment evaporator (7) and/or the freezing compartment evaporator (8) is delivered to the special compartment evaporator (9).

**[0023]** In another embodiment of the present invention, the cooling device (1) comprises

- a second valve (15) disposed at the outlet of the freezing compartment evaporator (8), and
- the control unit (14) that enables the refrigerant fluid leaving the freezing compartment evaporator (8) to be delivered to the special compartment evaporator (9) or the compressor (5) depending on the data received from the third temperature sensor (12). The control unit (14) enables the refrigerant fluid after leaving the freezing compartment evaporator (8) to be delivered directly to the compressor (5) by passing or without passing through the special compartment evaporator (8) depending on the thermal load of the special compartment (4).

**[0024]** In another embodiment of the present invention,

the control unit (14)

- compares the special compartment (4) temperature ( $T_{SC}$ ) detected by the third temperature sensor (12) with the special compartment (4) limit temperature ( $T_{SClim}$ ) predetermined by the producer,
- enables the refrigerant fluid to be passed through the second valve (15) and delivered to the compressor (5) if the special compartment (4) temperature ( $T_{SC}$ ) is lower than the special compartment (4) limit temperature ( $T_{SClim}$ ), and
- enables the refrigerant fluid to be passed through the second valve (15) and delivered to the special compartment evaporator (9) if the special compartment (4) temperature ( $T_{SC}$ ) is higher than the special compartment (4) limit temperature ( $T_{SClim}$ ). If the special compartment (4) temperature ( $T_{SC}$ ) is higher than the special compartment (4) limit temperature ( $T_{SClim}$ ), the control unit (14) decides that the thermal load of the special compartment (4) has increased and provides the cooling of the special compartment (4) by directing the refrigerant fluid to the special compartment evaporator (9). If the special compartment (4) temperature ( $T_{SC}$ ) is lower than the special compartment (4) limit temperature ( $T_{SClim}$ ), the control unit (14) decides that the special compartment (4) is not required to be cooled and enables the refrigerant fluid to be delivered to the compressor (5). When the special compartment (4) temperature ( $T_{SC}$ ) reaches the special compartment (4) limit temperature ( $T_{SClim}$ ) while the refrigerant fluid is being delivered to the compressor (5), the control unit (14) enables the refrigerant fluid to be delivered to the special compartment evaporator (9) again.

**[0025]** In another embodiment of the present invention, the cooling device (1) comprises

- a third valve (16) disposed at the outlet of the fresh food compartment evaporator (7), and
- the control unit (14) that enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the freezing compartment evaporator (8) or the special compartment evaporator (9) by passing through the third valve (16) depending on the data received from the second temperature sensor (11) and the third temperature sensor (12). In the case the thermal load increases in the fresh food compartment (2), the control unit (14) enables the refrigerant fluid to be first delivered to the fresh food compartment evaporator (7) through the first valve (13) and the refrigerant fluid leaving the fresh food compartment evaporator (7) to be carried to the freezing compartment evaporator (8). In the case the thermal load increases in the special compartment (4), the control unit (14) enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the special compartment evapo-

rator (9).

**[0026]** In another embodiment of the present invention, the control unit (14)

- compares the freezing compartment (3) temperature ( $T_{FRZ}$ ) detected by the second temperature sensor (11) with the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) predetermined by the producer,
- compares the special compartment (4) temperature ( $T_{SC}$ ) detected by the third temperature sensor (12) with the special compartment (4) limit temperature ( $T_{SClim}$ ) predetermined by the producer,
- enables the refrigerant fluid to be delivered to the special compartment evaporator (9) by passing through the third valve (16) if the freezing compartment (3) temperature ( $T_{FRZ}$ ) is lower than the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) and the special compartment (4) temperature ( $T_{SC}$ ) is higher than the special compartment (4) limit temperature ( $T_{SClim}$ ), and
- enables the refrigerant fluid to be delivered to the freezing compartment evaporator (8) by passing through the third valve (16) if the freezing compartment (3) temperature ( $T_{FRZ}$ ) is lower than the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) and the special compartment (4) temperature ( $T_{SC}$ ) is lower than the special compartment (4) limit temperature ( $T_{SClim}$ ). The control unit (14), after cooling the fresh food compartment (2), enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the freezing compartment evaporator (8) in order to cool the freezing compartment (3). In the case the freezing compartment (3) is not required to be cooled but the special compartment (4) is required to be cooled, the control unit (14) enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the special compartment evaporator (9) by passing through the third valve (16). Thus, the control unit (14) controls the thermal load in the freezing compartment (3) and the special compartment (4) and in the case the thermal load of the freezing compartment (3) is not increased, enables the refrigerant fluid to be delivered to the compressor (5) after passing through the special compartment evaporator (9). When the freezing compartment (3) temperature ( $T_{FRZ}$ ) rises above the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) while the refrigerant fluid is being delivered to the special compartment evaporator (9), the control unit (14) enables the refrigerant fluid to be directed to the freezing compartment evaporator (8) again. In the case both the freezing compartment (3) and the special compartment (4) are required to be cooled, the control unit (14) enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered first to the freezing compartment evaporator (8) so that the freezing compartment (3) is cooled

first and then delivers the refrigerant fluid leaving to the freezing compartment evaporator (8) to the special compartment evaporator (9). Thus, while the special compartment (4) is enabled to be cooled effectively, the cooling performance of the freezing compartment (3) is prevented from decreasing.

**[0027]** In another embodiment of the present invention, the control unit (14) enables the delivery of the refrigerant fluid to be stopped by stopping the compressor (5) if the fresh food compartment temperature ( $T_{FF}$ ) is lower than the fresh food compartment limit temperature ( $T_{FFlim}$ ) and the freezing compartment temperature ( $T_{FRZ}$ ) is lower than the freezing compartment limit temperature ( $T_{FRZlim}$ ) and the special compartment temperature ( $T_{SC}$ ) is lower than the special compartment limit temperature ( $T_{SClim}$ ). In this situation, the control unit (14) decides that the fresh food compartment (2) and the freezing compartment (3) and the special compartment (4) do not require to be cooled, thus stops the delivery of the refrigerant fluid to the fresh food compartment evaporator (6), the freezing compartment evaporator (7) and the special compartment evaporator (9).

**[0028]** In the cooling device (1) of the present invention, the cooling requirement of the special compartment (4) is determined by detecting the interior temperature thereof and the special compartment (4) is enabled to be cooled effectively and controllably by delivering the refrigerant fluid leaving the fresh food compartment evaporator (7) and the freezing compartment evaporator (8) to the special compartment evaporator (9).

## Claims

1. A cooling device (1) comprising a fresh food compartment (2) wherein the foods are placed to be cooled; a freezing compartment (3) that is kept at lower temperatures than the fresh food compartment (2) and wherein the foods are placed to be frozen; a special compartment (4) that is disposed inside the fresh food compartment (2) and that is kept at a temperature between the fresh food compartment (2) temperature and the freezing compartment (3) temperature; a compressor (5) providing the compression of the refrigerant fluid; a condenser (6) that enables the refrigerant fluid leaving the compressor (5) to change to the liquid phase by being condensed; at least one fresh food compartment evaporator (7) providing the cooling of the fresh food compartment (2); at least one freezing compartment evaporator (8) providing the cooling of the freezing compartment (3); a first temperature sensor (10) that measures the temperature of the fresh food compartment (2) for controlling the cooling process; a second temperature sensor (11) that measures the temperature of the freezing compartment (3) for controlling the freezing process; a first valve (13) that is disposed

at the outlet of the condenser (6), and a control unit (14) that enables the refrigerant fluid leaving the condenser (6) to be directed to the fresh food compartment evaporator (7) or the freezing compartment evaporator (8) by passing through the first valve (13) by evaluating the data received from the first temperature sensor (10) and the second temperature sensor (11), **characterized by**

- at least one special compartment evaporator (9) providing the cooling of the special compartment (4), and
- a third temperature sensor (12) that measures the temperature of the special compartment (4).

2. A cooling device (1) as in Claim 1, **characterized by** the control unit (14) that enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the special compartment evaporator (9) by evaluating the data received from the third temperature sensor (12).

3. A cooling device (1) as in Claim 1, **characterized by** the control unit (14) that enables the refrigerant fluid leaving the freezing compartment evaporator (8) to be delivered to the special compartment evaporator (9) by evaluating the data received from the third temperature sensor (12).

4. A cooling device (1) as in Claim 3, **characterized by**

- a second valve (15) disposed at the outlet of the freezing compartment evaporator (8), and
- the control unit (14) that enables the refrigerant fluid leaving the freezing compartment evaporator (8) to be delivered to the special compartment evaporator (9) or the compressor (5) by evaluating the data received from the third temperature sensor (12).

5. A cooling device (1) as in Claim 4, **characterized by** the control unit (14)

- that compares the special compartment (4) temperature ( $T_{SC}$ ) detected by the third temperature sensor (12) with the special compartment (4) limit temperature ( $T_{SClim}$ ) predetermined by the producer,
- enables the refrigerant fluid to be passed through the second valve (15) and delivered to the compressor (5) if the special compartment (4) temperature ( $T_{SC}$ ) is lower than the special compartment (4) limit temperature ( $T_{SClim}$ ),
- enables the refrigerant fluid to be passed through the second valve (15) and delivered to the special compartment evaporator (9) if the special compartment (4) temperature ( $T_{SC}$ ) is higher than the special compartment (4) limit

temperature ( $T_{SClim}$ ).

6. A cooling device (1) as in Claim 2, **characterized by**

- a third valve (16) disposed at the outlet of the fresh food compartment evaporator (7), and
- the control unit (14) that enables the refrigerant fluid leaving the fresh food compartment evaporator (7) to be delivered to the freezing compartment evaporator (8) or the special compartment evaporator (9) by passing through the third valve (16) depending on the data received from the second temperature sensor (11) and the third temperature sensor (12).

7. A cooling device (1) as in Claim 6, **characterized by** the control unit (14)

- that compares the freezing compartment (3) temperature ( $T_{FRZ}$ ) detected by the second temperature sensor (11) with the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) predetermined by the producer,
- that compares the special compartment (4) temperature ( $T_{SC}$ ) detected by the third temperature sensor (12) with the special compartment (4) limit temperature ( $T_{SClim}$ ) predetermined by the producer,
- enables the refrigerant fluid to be delivered to the special compartment evaporator (9) by passing through the third valve (16) if the freezing compartment (3) temperature ( $T_{FRZ}$ ) is lower than the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) and the special compartment (4) temperature ( $T_{SC}$ ) is higher than the special compartment (4) limit temperature ( $T_{SClim}$ ), and
- enables the refrigerant fluid to be delivered to the freezing compartment evaporator (8) by passing through the third valve (16) if the freezing compartment (3) temperature ( $T_{FRZ}$ ) is lower than the freezing compartment (3) limit temperature ( $T_{FRZlim}$ ) and the special compartment (4) temperature ( $T_{SC}$ ) is lower than the special compartment (4) limit temperature ( $T_{SClim}$ ).

8. A cooling device (1) as in any one of the above claims, **characterized by** the control unit (14) that enables the delivery of the refrigerant fluid to be stopped by stopping the compressor (5) if the fresh food compartment temperature ( $T_{FF}$ ) is lower than the fresh food compartment limit temperature ( $T_{FFlim}$ ) and the freezing compartment temperature ( $T_{FRZ}$ ) is lower than the freezing compartment limit temperature ( $T_{FRZlim}$ ) and the special compartment temperature ( $T_{SC}$ ) is lower than the special compartment limit temperature ( $T_{SClim}$ ).

Figure 1

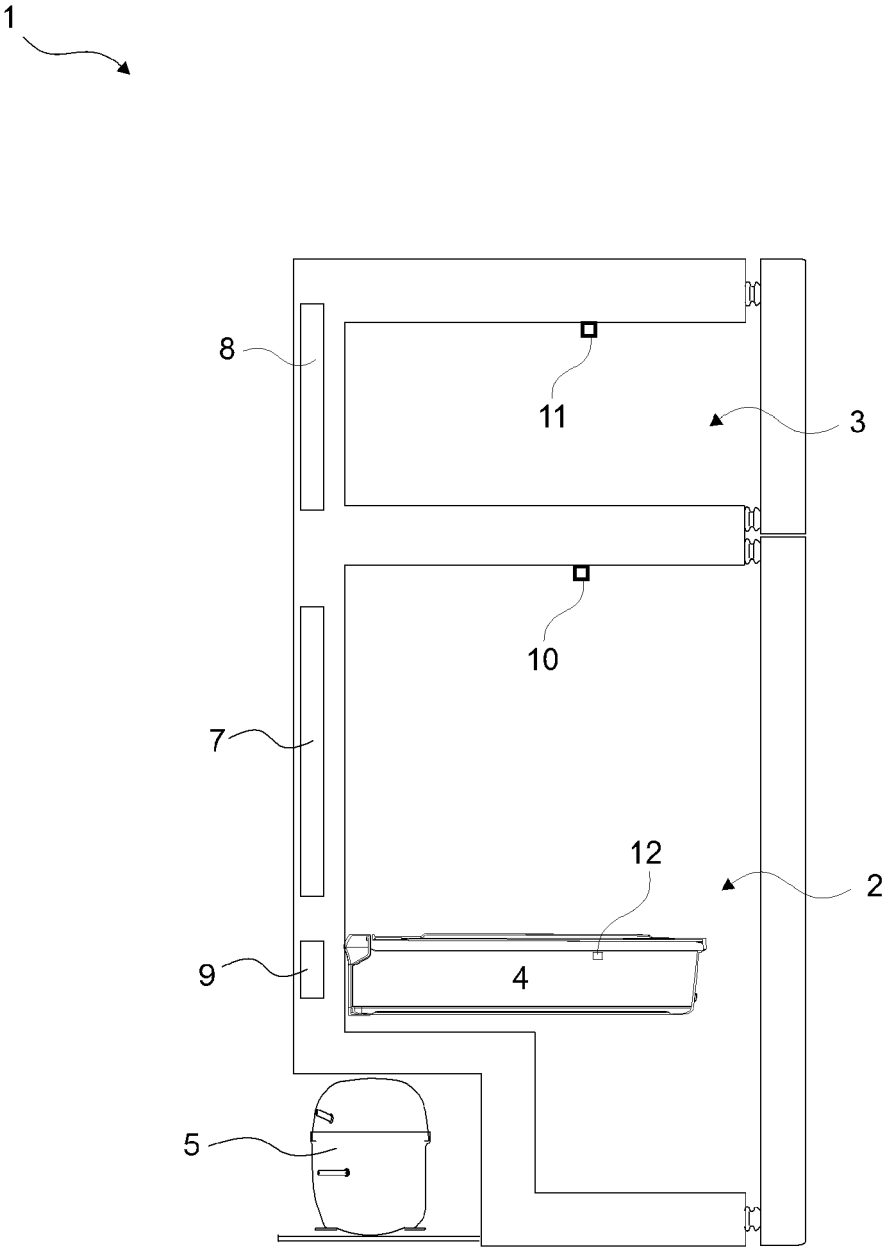
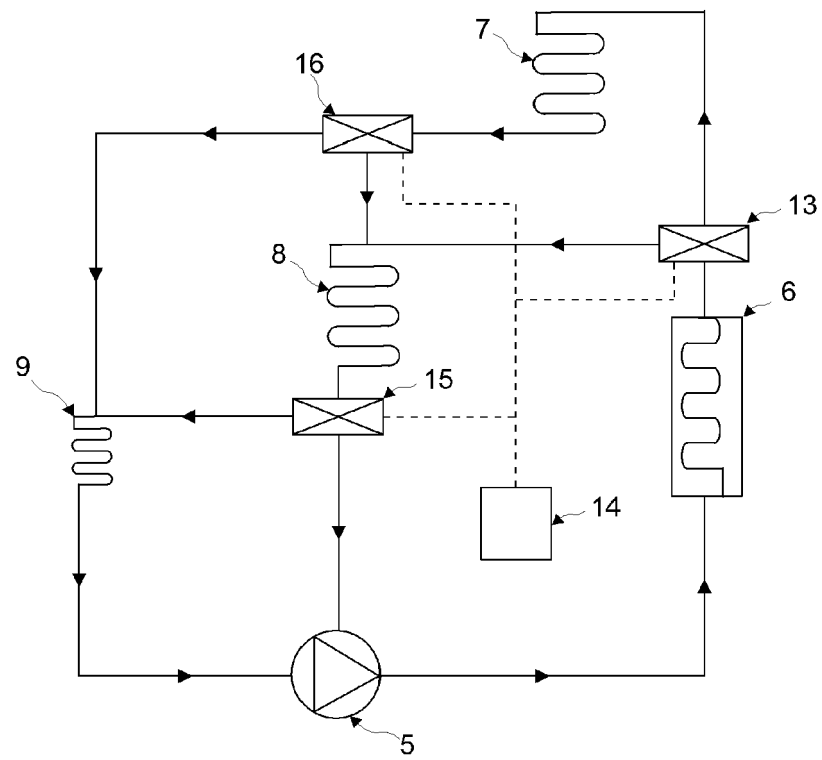


Figure 2





## EUROPEAN SEARCH REPORT

 Application Number  
 EP 16 18 4776

5

10

15

20

25

30

35

40

45

50

55

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                         |                                                                                                                                                                                                                                                                              |                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                           | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC)         |
| X                                                                                                                                                                                                                                                      | JP 2010 139218 A (TOSHIBA CORP; TOSHIBA CONSUMER ELECT HOLDING; TOSHIBA HOME APPLIANCES) 24 June 2010 (2010-06-24)                      | 1,8                                                                                                                                                                                                                                                                          | INV.<br>F25D11/02<br>F25B5/02<br>F25B5/04       |
| Y                                                                                                                                                                                                                                                      | * paragraph [0025] - paragraph [0028]; figures 1,2 *                                                                                    | 2-7                                                                                                                                                                                                                                                                          |                                                 |
| Y                                                                                                                                                                                                                                                      | -----<br>WO 2008/078876 A2 (LG ELECTRONICS INC [KR]; LEE MOO YEON [KR]; PARK JONG JIN [KR]) 3 July 2008 (2008-07-03)<br>* figures 1-2 * | 2-7                                                                                                                                                                                                                                                                          |                                                 |
| Y                                                                                                                                                                                                                                                      | -----<br>CN 104 296 454 A (HEFEI HUALING CO LTD) 21 January 2015 (2015-01-21)<br>* figure 2 *                                           | 6,7                                                                                                                                                                                                                                                                          |                                                 |
| A                                                                                                                                                                                                                                                      | -----<br>DE 10 2008 044386 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 10 June 2010 (2010-06-10)<br>* figure 3 *                            | 1                                                                                                                                                                                                                                                                            |                                                 |
| A                                                                                                                                                                                                                                                      | -----<br>EP 2 772 707 A2 (WHIRLPOOL CO [US]) 3 September 2014 (2014-09-03)<br>* figure 2 *                                              | 1                                                                                                                                                                                                                                                                            | TECHNICAL FIELDS SEARCHED (IPC)<br>F25D<br>F25B |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                         |                                                                                                                                                                                                                                                                              |                                                 |
| Place of search<br>The Hague                                                                                                                                                                                                                           |                                                                                                                                         | Date of completion of the search<br>2 December 2016                                                                                                                                                                                                                          | Examiner<br>Kuljis, Bruno                       |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                         | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                 |

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 18 4776

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-12-2016

10

15

20

25

30

35

40

45

50

55

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| JP 2010139218 A                           | 24-06-2010          | JP 5175705 B2              | 03-04-2013          |
|                                           |                     | JP 2010139218 A            | 24-06-2010          |
| -----                                     | -----               | -----                      | -----               |
| WO 2008078876 A2                          | 03-07-2008          | CN 101568780 A             | 28-10-2009          |
|                                           |                     | EP 2115366 A2              | 11-11-2009          |
|                                           |                     | KR 100826180 B1            | 30-04-2008          |
|                                           |                     | US 2010100243 A1           | 22-04-2010          |
|                                           |                     | WO 2008078876 A2           | 03-07-2008          |
| -----                                     | -----               | -----                      | -----               |
| CN 104296454 A                            | 21-01-2015          | NONE                       |                     |
| -----                                     | -----               | -----                      | -----               |
| DE 102008044386 A1                        | 10-06-2010          | NONE                       |                     |
| -----                                     | -----               | -----                      | -----               |
| EP 2772707 A2                             | 03-09-2014          | BR 102014004496 A2         | 01-12-2015          |
|                                           |                     | EP 2772707 A2              | 03-09-2014          |
|                                           |                     | US 2014238054 A1           | 28-08-2014          |
| -----                                     | -----               | -----                      | -----               |

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- US 6073458 A [0003]