



(11) **EP 1 853 863 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
28.03.2012 Bulletin 2012/13

(21) Application number: **06710984.3**

(22) Date of filing: **28.02.2006**

(51) Int Cl.:
F25D 21/04^(2006.01) F25D 17/06^(2006.01)

(86) International application number:
PCT/IB2006/050622

(87) International publication number:
WO 2006/092759 (08.09.2006 Gazette 2006/36)

(54) **A COOLING DEVICE**
KÜHLVORRICHTUNG
DISPOSITIF DE REFROIDISSEMENT

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR

(30) Priority: **01.03.2005 TR 200500702**

(43) Date of publication of application:
14.11.2007 Bulletin 2007/46

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- **PATENT ABSTRACTS OF JAPAN** vol. 014, no. 364 (M-1007), 7 August 1990 (1990-08-07) & JP 02 130381 A (SANYO ELECTRIC CO LTD), 18 May 1990 (1990-05-18)
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Description

[0001] The present invention relates to a cooling device comprising an air channel which is prevented from being blocked due to frost formation.

[0002] In state-of-the-art, there are cooling devices comprising two compartments, one being a freshfood and the other a freezer. In this type of cooling devices, some of the air cooled by being passed over the evaporator with the help of a fan, is circulated in the freezing compartment and the rest in the freshfood compartment. The air, after completing its circulation in the freshfood compartment, passes through an air channel and reaches the freezing compartment again.

[0003] In especially low ambient temperatures, as the fan stops, the cold air in the evaporator chamber flows towards the air channel, and lowers the temperature here to below the freezing point of water. When the fan starts operating again, the relatively humid and hot air in the freshfood compartment starts to be directed towards the evaporator through the air channel. However, as hot air passes through the channel that becomes cold during the non-operation period of the evaporator, the humidity of air condenses and consequently freezes on the cold surfaces, and after a while, the amount of frost accumulated in the air channel increases. This in turn results in a reduction of the amount of air being carried from the freshfood compartment to the evaporator chamber, hence an insufficient cooling of the freshfood compartment.

[0004] In the Unites States Patents nos. US3826103, and US5255536, and EP644385, cooling devices comprising heaters in the air channel are disclosed.

[0005] A cooling device according to the preamble of claim 1 is known from US-A-4 122 687. A similar cooling device is known from JP-A-02 130 381.

[0006] The aim of the present invention is to design a cooling device wherein the frosting problem in the air channel is eliminated.

[0007] The cooling device of the present invention comprises the features of claim 1.

[0008] The cooling device designed to fulfill the aim of the present invention is illustrated in the annexed drawings, where :

[0009] Figure 1- is the side schematic view of a cooling device.

[0010] Figure 2 - is the side schematic view of another embodiment of the cooling device.

[0011] Elements shown in the figures are numbered as follows:

1. Cooling device
2. Freezing compartment
3. Freshfood compartment
4. Compressor
5. Evaporator
6. Air channel
7. Anti-frost unit

8. Fan
9. Control unit
10. Evaporator chamber
11. Heater

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[0012] In the preferred embodiment of the present invention, the cooling device (1) comprises an evaporator chamber (10) in which the evaporator (5) is situated, separated from the freezing compartment (2) by a wall and connected to the freshfood compartment (3) by way of the air channel (6).

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[0013] The cooling device (1) comprises a control unit (9) which gathers information on the ambient temperature directly or indirectly.

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[0014] In one embodiment of the present invention, the control unit (9) comprises a heat sensor that measures the ambient temperature directly. When the temperature (T) falls below a certain value (T_{set}), for example 1-5°C, the control unit (9) decides that there is a risk of frosting in the air channel (6).

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[0015] In another embodiment of the present invention, the control unit (9) measures the off time (toff) and run time (ton) of the compressor (4), and when the run time ratio (ton/(ton+toff)), that is the quotient of the run time (ton) to the total time (ton+toff) falls below a certain value, for example 30 - 40 %, decides that the ambient temperature is so low to cause frosting in the air channel (6).

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[0016] In one embodiment of the present invention, the anti-frost unit (7) comprises at least one fan (8) which is operated during the off period of the compressor (4), when the control unit (9) decides that the ambient temperature can cause frosting in the air channel (6), thus preventing the cold air in the evaporator chamber (10) from flowing into the air channel (6). This fan (8) may also provide air circulation while the compressor (4) is operating. The fan (8) can be operated at the same rotational speed both while the compressor (4) is on and off, or it can be operated at a lower speed after the compressor stops (4).

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[0017] If the ambient temperature is below a certain value (T<T_{set}), the anti-frost unit (7) is switched on after the compressor (4) stops. The anti-frost unit (7) actuates the fan (8) during the off period of the compressor (4), thus preventing the air in the freezing compartment (2) from flowing into the air channel (6) and causing the temperature of this channel to fall down. The fan (8) circulates the air from the freshfood compartment (3) to the air channel (6) and towards the evaporator (5) from there. In this way, when the compressor (4) and the fan (8) start operating together again, the moisture in the hot air coming from the freshfood compartment (3) is prevented from condensing and forming frost.

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[0018] In yet another embodiment of the present invention, the anti-frost unit (7) comprises a heater (11) which starts operating after the compressor (4) stops, on the condition that the control unit (9) has decided that the ambient temperature may cause frosting in the air chan-

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nel (6). The heater (11) is positioned in the air channel (6). The heater (11) can be actuated either alone or together with the fan (8).

[0019] When the ambient temperature (T) falls below a certain value ($T < T_{set}$), the anti-frost unit (7) starts operating after the compressor (4) stops, heating up the air channel (6) during the off period of the compressor (4), and hence preventing the air flowing from the evaporator chamber (10) to cool the air channel (6). In this manner, the temperature of the air channel (6) is prevented from falling under the freezing temperature of water, and the moisture of the hot air flowing from the freshfood compartment (3) is prevented from condensing and forming frosting when the compressor (4) and the fan (8) start operating together again.

[0020] In the cooling device (1) of the present invention, the frosting in the air channel (6) in low ambient temperatures is prevented by operating either the fan (8) or the heater (11) during the off period of the compressor (4). Consequently the problem of blocking of the air channel (6) is solved.

Claims

1. A cooling device (1) comprising a compressor (4) which compresses and circulates refrigerant fluid in a cooling cycle, a freshfood compartment (3) in which the food is stored for cooling purposes, a freezing compartment (2) in which the food is stored for freezing purposes, being kept at lower temperatures than those of the freshfood compartment (3), at least one evaporator (5) for transferring heat from the medium to the refrigerant fluid, and at least one air channel (6) for passage of air between the freshfood compartment (3) and the evaporator (5) and an anti-frost unit (7), which prevents the temperature of the air channel (6) from falling below the freezing temperature of water and **characterized by** a control unit (9) which gathers information on the ambient temperature directly or indirectly, and switches on the anti-frost unit (7) when the ambient temperature (T) is under a certain value (T_{set}), during the off period of the compressor (4).
2. A cooling device (1) according to Claim 1, **characterized by** an evaporator chamber (10) in which the evaporator (5) is situated, separated from the freezing compartment (2) by a wall and connected to the freshfood compartment (3) by way of the air channel (6) and by the anti-frost unit (7) comprising a fan (8) operated during the off period of the compressor (4), circulating the air from the freshfood compartment (3) into the air channel (6) and from there towards the evaporator (5), thus preventing the cold air in the evaporator chamber (10) from flowing into the air channel (6) when the compressor (4) does not operate.

3. A cooling device (1) according to Claim 2, **characterized by** the anti-frost unit (7), comprising the fan (8), the rotational speed of which is decreased after the compressor (4) stops.
4. A cooling device (1) according to Claim 1, **characterized by** the anti-frost unit (7), comprising a heater (11) that starts operating after the compressor (4) stops and heats the air channel (6).
5. A cooling device (1) according to any one of the previous Claims, **characterized by** the control unit (9) which measures the off time (toff) and run time (ton) of the compressor (4), and when the run time ratio ($\text{ton}/(\text{ton} + \text{toff})$), that is the ratio of the operation time (ton) to the total time (ton+toff) falls below a certain value, decides that the ambient temperature is so low to form frosting in the air channel (6).

Patentansprüche

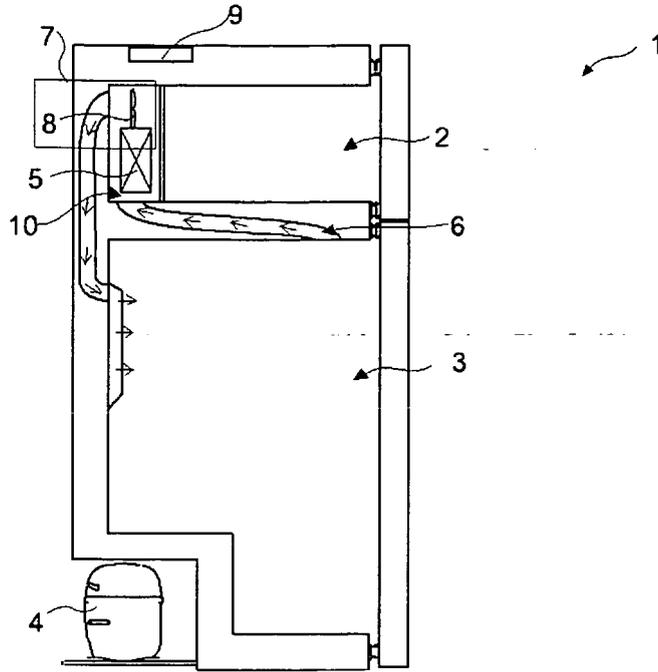
1. Kühlvorrichtung (1), umfassend einen Kompressor (4), der Kühlfluid in einem Kühlzyklus verdichtet und zirkuliert, ein Fach (3) für frische Lebensmittel, in dem Lebensmittel zu Kühlzwecken gelagert werden, ein Gefrierfach (2), in dem die Lebensmittel zu Einfrierzwecken gelagert werden und bei einer niedrigeren Temperatur aufbewahrt werden als diejenigen im Fach (3) für frische Lebensmittel, wenigstens einen Verdampfer (5) zum Übertragen von Wärme von dem Medium auf das Kühlfluid, und wenigstens einen Luftkanal (6) zum Durchleiten von Luft zwischen dem Fach (3) für frische Lebensmittel und dem Verdampfer (5), und eine Frostschutzeinheit (7), die verhindert, dass die Temperatur des Luftkanals (6) unter die Gefrieretemperatur von Wasser fällt, und **gekennzeichnet durch** eine Steuereinheit (9), die direkt oder indirekt Informationen zur Umgebungstemperatur sammelt und die Frostschutzeinheit (7) einschaltet, wenn die Umgebungstemperatur (T) während der Ausschaltzeit des Kompressors (4) unter einem bestimmten Wert (T_{set}) liegt.
2. Kühlvorrichtung (1) nach Anspruch 1, **gekennzeichnet durch** eine Verdampferkammer (10), in der der Verdampfer (5) angeordnet ist, und die **durch** eine Wand vom Gefrierfach (2) getrennt ist und über den Luftkanal (6) mit dem Fach (3) für frische Lebensmittel verbunden ist, und **durch** die Frostschutzeinheit (7), die ein Gebläse (8) umfasst, das während der Ausschaltzeit des Kompressors (4) betrieben wird und die Luft vom Fach (3) für frische Lebensmittel in den Luftkanal (6) und von dort aus zum Verdampfer (5) zirkuliert und auf diese Weise verhindert, dass die kalte Luft in der Verdampferkammer (10) in den Luftkanal (6) strömt, wenn der Kompressor (4) nicht arbeitet.

3. Kühlvorrichtung (1) nach Anspruch 2, **gekennzeichnet durch** die Frostschutzeinheit (7), die das Gebläse (8) umfasst, dessen Drehzahl gesenkt wird, wenn der Kompressor (4) anhält.
4. Kühlvorrichtung (1) nach Anspruch 1, **gekennzeichnet durch** die Frostschutzeinheit (7), die eine Heizvorrichtung (11) umfasst, die zu arbeiten beginnt, wenn der Kompressor (4) anhält, und den Luftkanal (6) erwärmt.
5. Kühlvorrichtung (1) nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Steuereinheit (9) die Ausschaltzeit (toff) und die Betriebszeit (ton) des Kompressors (4) misst, und die, wenn das Betriebszeitverhältnis (ton/(ton+toff)), also das Verhältnis zwischen der Betriebszeit (ton) und der Gesamtzeit (ton+toff) unter einen bestimmten Wert fällt, bestimmt, dass die Umgebungstemperatur so niedrig ist, dass sich Eis im Luftkanal (6) bildet.

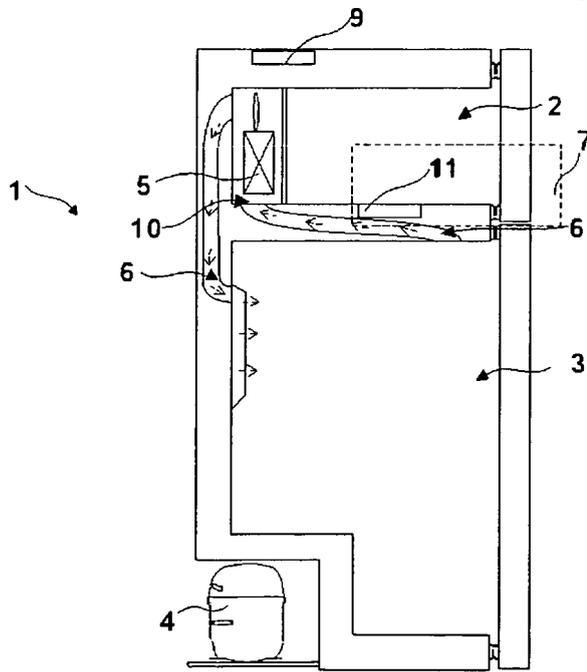
Revendications

1. Un dispositif de refroidissement (1) comprenant un compresseur (4) qui comprime et circule le fluide réfrigérant dans un cycle de refroidissement, un compartiment d'aliments frais (3) dans lequel les aliments sont stockés pour le refroidissement, un compartiment de congélation (2) dans lequel les aliments sont stockés pour la congélation, qui est maintenu à des températures plus basses que celles du compartiment d'aliments frais (3), au moins un évaporateur (5) pour transférer la chaleur du milieu au fluide réfrigérant, et au moins un canal d'air (6) pour le passage de l'air entre le compartiment d'aliments frais (3) et l'évaporateur (5) et une unité antigel (7) qui empêche la température du canal d'air (6) de tomber en dessous de la température de congélation de l'eau et **caractérisé par** une unité de commande (9) qui rassemble des informations sur la température ambiante directement ou indirectement, et qui met en marche l'unité antigel (7) lorsque la température ambiante (T) est sous une certaine valeur (Tset), pendant la période d'arrêt du compresseur (4).
2. Un dispositif de refroidissement (1) selon la Revendication 1, **caractérisé par** une chambre d'évaporateur (10) dans laquelle l'évaporateur (5) est situé, qui est séparée du compartiment de congélation (2) par une paroi et reliée au compartiment d'aliments frais (3) par le canal d'air (6) et par l'unité antigel (7) qui comprend un ventilateur (8) qui est mis en marche pendant la période d'arrêt du compresseur (4), qui circule l'air à partir du compartiment d'aliments frais (3) vers l'intérieur du canal d'air (6) et de là vers l'évaporateur (5), ainsi empêchant l'air froid dans la chambre d'évaporateur (10) de s'écouler dans le canal d'air (6) lorsque le compresseur (4) ne fonctionne pas.
3. Un dispositif de refroidissement (1) selon la Revendication 2, **caractérisé par** l'unité antigel (7) comprenant le ventilateur (8) dont la vitesse de rotation est diminuée après le compresseur (4) s'arrête.
4. Un dispositif de refroidissement (1) selon la Revendication 1, **caractérisé par** l'unité antigel (7) comprenant un appareil de chauffage (11) qui commence à fonctionner après le compresseur (4) s'arrête et qui chauffe le canal d'air (6).
5. Un dispositif de refroidissement (1) selon l'une quelconque des revendications précédentes, **caractérisé par** l'unité de commande (9) qui mesure le temps d'arrêt (toff) et le temps d'exécution (ton) du compresseur (4), et qui décide que la température ambiante est si basse pour former le glaçage dans le canal d'air (6) lorsque le rapport du temps d'exécution (ton/ton + toff), c'est-à-dire le rapport du temps d'exécution (ton) au temps total (ton+toff), tombe en dessous d'une certaine valeur.

[Fig. 001]



[Fig. 002]



REFERENCES CITED IN THE DESCRIPTION

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