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

(11) Publication number: **0 165 220**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **13.07.88**

(51) Int. Cl.⁴: **F 25 D 29/00,** F 25 D 11/02

(21) Application number: **85850192.7**

(22) Date of filing: **31.05.85**

(54) **Refrigerating unit.**

(30) Priority: **13.06.84 SE 8403158**

(43) Date of publication of application:
18.12.85 Bulletin 85/51

(45) Publication of the grant of the patent:
13.07.88 Bulletin 88/28

(84) Designated Contracting States:
DE FR GB IT

(56) References cited:
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GB-A-2 123 992
US-A-3 026 688

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EP 0 165 220 B1

Courier Press, Leamington Spa, England.

Description

The invention relates to a refrigerating unit comprising a cooling chamber with a cooling evaporator and a freezing chamber with a freezing evaporator, a first refrigerant circuit, in which the refrigerant flows in series through a compressor, the cooling evaporator and the freezing evaporator, a second refrigerant circuit, in which the refrigerant flows through the compressor, bypasses the cooling evaporator and flows through the freezing evaporator, valve means to switch off the first or the second refrigerant circuit, a first means which senses the temperature of the cooling evaporator and acts on the valve means to switch on the first refrigerant circuit at a certain higher first temperature and to switch off the first refrigerant circuit at a certain lower second temperature and a second means which senses the temperature in the freezing chamber and is arranged to start the compressor at a certain higher third temperature and to stop the compressor at a certain lower fourth temperature.

Such a refrigerating unit has the advantage that it is cheap to produce because only one compressor is needed to operate both the cooling chamber and the freezing chamber.

In such a known refrigerating unit the means which senses the temperature of the cooling evaporator is arranged in direct thermal contact with the cooling evaporator. Said means is arranged to act on the valve means so that the circulation of refrigerant through the cooling evaporator is switched off when the temperature of the cooling evaporator goes below a certain lower temperature and to re-establish the circulation, when the temperature goes above a certain higher temperature. The higher temperature is usually about +3°C so as to ensure that the evaporator shall be defrosted, and the lower temperature so low, e.g. −20°C, that a sufficient cooling effect is obtained on the goods in the cooling chamber.

When warm goods are placed in the freezing chamber for freezing the heat load on the freezing evaporator will increase. This causes the evaporation temperature in the freezing evaporator to rise which in turn results in that the evaporation temperature in the cooling evaporator, which communicates with the freezing evaporator, also rises which implies that during the freezing period, which can be relatively long, it will take a long time before the cooling evaporator reaches its lower temperature and is disconnected from the refrigerant circuit. This results in that the cooling effect in the cooling chamber becomes so large during the freezing period that the goods, e.g. milk, in the cooling chamber will freeze which, of course, is a drawback.

This drawback is eliminated in the refrigerating unit according to the invention thereby that a heat-insulating layer is arranged between the first means and the cooling evaporator and that the first means is designed to have its switchover point at the certain lower temperature set to a temperature value which is above the lowest cooling evaporator temperature reached in the case of minimum freezing evaporator load.

In this way it becomes possible to prevent that the cooling evaporator during freezing of goods in the freezing chamber is in operation for so long a time that the goods in the cooling chamber freeze, and simultaneously the arrangement maintains its function to automatically defrost the cooling evaporator.

GB—A—2,123,992, which discloses a refrigerating unit of the kind introductorily set forth, shows another solution to prevent too low temperatures from occurring in the cooling chamber. This is, however, accomplished by a further sensor sensing the air temperature in the cooling chamber. In the present refrigeration unit such a further sensor is dispensed with making the present refrigeration unit much simpler.

It is known per se to arrange temperature sensing means in a refrigerator partially thermally insulated from an element to be sensed thereby to moderate the direct influence of the element on the sensing means. US—A—3,026,688 discloses e.g. a refrigerator where over-cooling of a freezing chamber is prevented by actuating a fan controlled by a means sensing the temperature of the inside wall of the freezing chamber. The compressor of the refrigerator is controlled by a means sensing the temperature of the evaporator of a cooling chamber. Both said means are arranged partially thermally insulated from said wall and evaporator, respectively. These insulations, the reason for which being not explained in detail, seem to imply trimming measures to get the refrigerator to work properly.

An embodiment of a refrigerating unit according to the invention will be described below with reference to the accompanying drawing in which Fig. 1 shows a refrigerant circuit with one evaporator in a cooling chamber, one evaporator in a freezing chamber, a compressor to force the refrigerant through the circuit and an adjustable valve which leads the refrigerant through both evaporators, Fig. 2 shows the valve set so that the cooling evaporator is disconnected from the circuit, Fig. 3 shows how two different temperatures in the cooling chamber vary with the time at normal heat load in the freezing chamber and Fig. 4 shows how said temperatures vary when freezing takes place in the freezing chamber.

With reference to Fig. 1 10 designates a refrigerating unit with a cooling chamber 12, which shall be capable of keeping goods at a temperature of about +4°C, and a freezing chamber 14, which shall be capable of keeping goods at a temperature of about −18°C. The cooling chamber 12 is refrigerated by an evaporator 16 and the freezing chamber 14 by an evaporator 18.

The evaporator 16 is part of a circulation circuit for a refrigerant, and the circuit is constituted by a compressor 20, a condenser 21, a valve 22, restriction means in the form of a capillary tube 24, the evaporator 16 and the evaporator 18.

The evaporator 18 can also be connected to a circulation circuit for refrigerant constituted by the compressor 20, the condenser 21, the valve 22, see Fig. 2, restriction means in the form of a capillary tube 25 and the evaporator 18.

The temperature in the freezing chamber is monitored by a means 26 which at a certain higher temperature, e.g. −15°C, gives a signal to the compressor 20 to start and at a certain lower temperature, e.g. −23°C, gives a signal to the compressor to stop.

In the cooling chamber 12 the temperature is monitored by a means 28 which is in thermal contact with the evaporator 16 via a heat-insulating plate 30. When the means 28 senses a certain higher temperature, e.g. +3°C, the means 28 gives a signal to the valve 22 to switch over to the position shown in Fig. 1 so that refrigerant can circulate through the evaporator 16. When the means 28 after that senses a certain lower temperature, e.g. −15°C, the means 28 gives a signal to the valve 22 to switch to the position shown in Fig. 2, whereby the flow of refrigerant through the evaporator 16 ceases.

In Figs. 3 and 4 examples are shown of the influence of the insulation 30 on the temperature T in the cooling chamber as a function of the time t. The compressor 20 is supposed to be running during the whole course shown in Figs. 3 and 4.

Fig. 3 shows the temperature course in the cooling chamber at normal operation of the freezing chamber, i.e. when freezing does not take place in it, the continuous curve 32 showing the temperature of the evaporator 16 and the broken curve 34 showing the temperature of the means 28. At the time t_1 the means 28 gives a signal to the valve 22 to admit refrigerant to the evaporator 16. At the time t_2 the evaporator 16 has a temperature of −20°C, while the temperature of the means 28 lags behind due to the insulation 30 and is higher, −15°C. At −15°C the means 28 gives a signal to the valve 22 to switch off the supply of refrigerant to the evaporator 16. The goods in the cooling chamber, which has a temperature of about +4°C, then heat the evaporator 16 and the means 28. At the time t_3 the evaporator 16 reaches 0°C and the evaporator begins to defrost. At the time t_4 the evaporator 16 is defrosted and the course which started at t_1 is repeated.

Fig. 4 shows the corresponding temperature course in the cooling chamber when freezing of goods takes place in the freezing chamber. At the time t_5 refrigerant is admitted through the evaporator 16. As a consequence of the large heat load on the evaporator 18 the temperature in the evaporator 16 rises and it takes longer time before the means 28 reaches the lower temperature, −15°C, at which the means 28 gives a signal to switch off the circulation of the refrigerant through the evaporator 16. By the slow change of temperature the temperatures of the evaporator 16 and the means 28 will follow each other better. At the time t_6 the said lower temperature has been reached. After the time t_6 the curves 32 and 34 will get substantially the same appearance as in Fig. 3.

Without the insulation 30, i.e. when the means 28 according to the known technique is arranged in direct thermal contact with the evaporator 16, the temperature of the evaporator 16 would continue to fall according to the dotted line 36. Not until the time t_7 the means 28 would initiate switching off of the supply of refrigerant to the evaporator 16. But at the time t_7 the evaporator has taken so much heat from the goods in the cooling chamber that they have frozen, which can be prevented by the insulation 30 according to the present invention.

In order that a sufficient cooling effect and simultaneously defrosting shall be obtained in the cooling chamber 12 the temperature of the evaporator 16 at normal operation of the freezing chamber, both in the known technique and in the invention, must be lowered to substantially the same lowest temperature, −20°C, in the example above.

In the known technique this is brought about by a temperature sensing means which switches over at −20°C and according to the invention by a temperature sensing means 28 which switches over already at −15°C. By providing the insulation 30 and by changing the switch over point of the means 28 from −20°C to −15°C it can be prevented by very simple means, i.e. the insulation 30, that the goods freeze in the cooling chamber when freezing takes place in the freezing chamber.

Claims

1. A refrigerating unit comprising a cooling chamber (12) with a cooling evaporator (16) and a freezing chamber (14) with a freezing evaporator (18), a first refrigerant circuit (20, 21, 22, 24, 16, 18), in which the refrigerant flows in series through a compressor (20), the cooling evaporator (16) and the freezing evaporator (18), a second refrigerant circuit (20, 21, 22, 25, 18), in which the refrigerant flows through the compressor (20), bypasses the cooling evaporator (16) and flows through the freezing evaporator (18), valve means (22) to switch off the first or the second refrigerant circuit, a first means (28) which senses the temperature of the cooling evaporator (16) and acts on the valve means (22) to switch on the first refrigerant circuit at a certain higher first temperature and to switch off the first refrigerant circuit at a certain lower second temperature and a second means (26) which senses the temperature in the freezing chamber (14) and is arranged to start the compressor (20) at a certain higher third temperature and to stop the compressor at a certain lower fourth temperature, characterized in that a heat-insulating layer (30) is arranged between the first means (28) and the cooling evaporator (16) and that the first means (28) is designed to have its switch-over point at the certain lower temperature set to a temperature value which is above the lowest cooling evaporator temperature reached in the case of minimum freezing evaporator load.

2. A unit according to Claim 1, characterized in that the layer is constituted by a heat-insulating plate (30).

Patentansprüche

1. Eine Kühlvorrichtung mit einer Kühlkammer (12) mit einem Kühlverdampfer (16) und einer Gefrierkammer (14) mit einem Gefrierverdampfer (18), mit einem ersten Kältemittelkreislauf (20, 21, 22, 24, 16, 18), in dem das Kältemittel der Reihe nach durch einen Kompressor (20), den Kühlverdampfer (16) und den Gefrierverdampfer (18) fließt, mit einem zweiten Kältemittelkreislauf (20, 21, 22, 25, 18), in dem das Kältemittel durch den Kompressor (20) fließt, den Kühlverdampfer (16) umgeht und durch den Gefrierverdampfer (18) fließt, mit einer Ventileinrichtung (22) zum Abschalten des ersten oder zweiten Kältemittelkreislaufs, mit einem ersten Element (28), das die Temperatur des Kühlverdampfers (16) abtastet und die Ventileinrichtung (22) betätigt, um den ersten Kältemittelkreislauf bei einer bestimmten höheren ersten Temperatur einzuschalten und um den ersten Kältemittelkreislauf bei einer bestimmten niedrigeren zweiten Temperatur auszuschalten, und mit einem zweiten Element (26), das die Temperatur in der Gefrierkammer (14) erkennt und angebracht ist, um den Kompressor (20) bei einer bestimmten höheren dritten Temperatur zu starten und den Kompressor bei einer bestimmten niedrigeren vierten Temperatur anzuhalten, gekennzeichnet dadurch, daß eine Wärmeisolierschicht (30) zwischen dem ersten Element (28) und dem Kühlverdampfer (16) angeordnet ist und daß das erste Element (28) so ausgebildet ist, daß sein Umschaltpunkt bei einer bestimmten niedrigeren Temperatur liegt, die auf einen Temperaturwert eingestellt ist, der über der niedrigsten Temperatur des Kühlverdampfers liegt, die im Falle einer minimalen Auslastung des Gefrierverdampfers erreicht wird.

2. Einheit nach Anspruch 1, dadurch gekennzeichnet, daß die Schicht durch eine Wärmeisolationsplatte (30) gebildet wird.

Revendications

1. Ensemble réfrigérant comprenant une chambre de congélation (12), avec un évaporateur de congélation (16) et une chambre de surgélation (14) avec un évaporateur de surgélation (18), un premier circuit réfrigérant (20, 21, 22, 24, 16, 18) dans lequel le réfrigérant s'écoule en série à travers un compresseur (20), l'évaporateur (16) de congélation et l'évaporateur de surgélation (18), un second circuit réfrigérant (20, 21, 22, 25, 18) dans lequel le réfrigérant s'écoule à travers le compresseur (20), contourne l'évaporateur (16) de congélation et s'écoule à travers l'évaporateur (18) de surgélation, une vanne (22) pour couper le premier ou le second circuit réfrigérant, un premier dispositif (28) qui capte la température de l'évaporateur (16) de congélation et agit sur la vanne (22) pour ouvrir le premier circuit réfrigérant à une certaine première température plus élevée et pour couper le premier circuit réfrigérant à une certaine seconde température plus basse, et un second dispositif (26) qui capte la température dans la chambre de surgélation (14) et est agencé pour démarrer le compresseur (20) à une certaine troisième température plus élevée et pour arrêter le compresseur à une certaine quatrième température plus basse, caractérisé en ce qu'une couche thermiquement isolante (30) est agencée entre le premier dispositif (28) et l'évaporateur (16) de congélation, et en ce que le premier dispositif (28) est conçu pour que son point de coupure à ladite certaine température plus basse soit réglé à une valeur de température qui est supérieure à la température la plus basse de l'évaporateur de congélation atteinte dans le cas d'une charge minimale de l'évaporateur de surgélation.

2. Ensemble suivant la revendication 1, caractérisé en ce que la couche est constituée par une plaque thermiquement isolante (30).

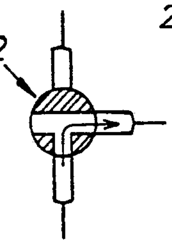

Fig. 2

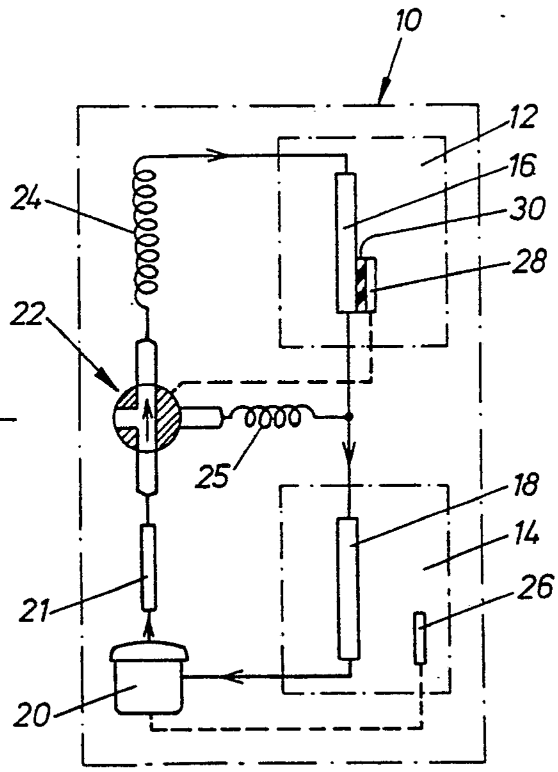

Fig.1

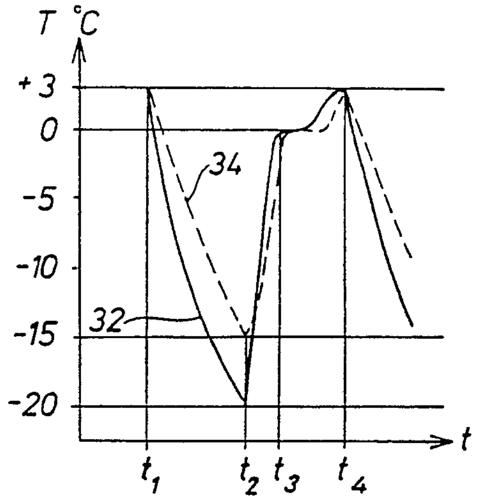
T °C
+3
0
-5
-10
-15
-20
34
32
t
t_1
t_2
t_3
t_4

Fig. 3

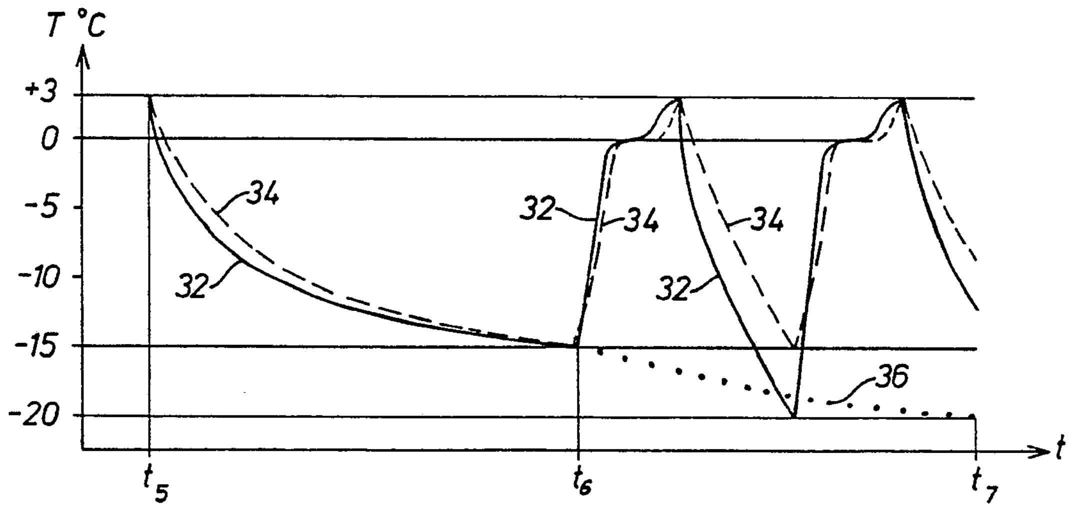
T °C
+3
0
-5
-10
-15
-20
34
32
32
34
34
32
36
t
t_5
t_6
t_7

Fig.4