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

(11) Publication number: **0 165 220**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 85850192.7

(22) Date of filing: 31.05.85

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

(30) Priority: 13.06.84 SE 8403158

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

(84) Designated Contracting States:
DE FR GB IT

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(54) **Arrangement to prevent goods from freezing in a cooling chamber.**

(57) In a refrigerating unit with a cooling evaporator (16) in a cooling chamber (12) and a freezing evaporator (18) in a freezing chamber (14) a common compressor (20) is arranged via a switchable valve (22) to force eithr refrigerant in proper order through the cooling evaporator (16) and the freezing evaporator (18) or only through the freezing evaporator (18). A means (28) is arranged on the cooling evaporator (16) to sense its temperature, the means (28) controlling that refrigerant is supplied tothe cooling evaporator (16) when the temperature goes above a certain higher value which allows the cooling evaporator to defrost and controlling that the supply of refrigerant to the cooling evaporator (16) is cut off when the temperature goes below a certain lower value which ensures that the cooling chamber gets a sufficient cooling capacity. To prevent goods in the cooling chamber (12) from freezing when freezing of goods takes place in the freezing chamber (14) a heat-insulating insert (30) is arranged between the means (28) and the cooling evaporator (16).

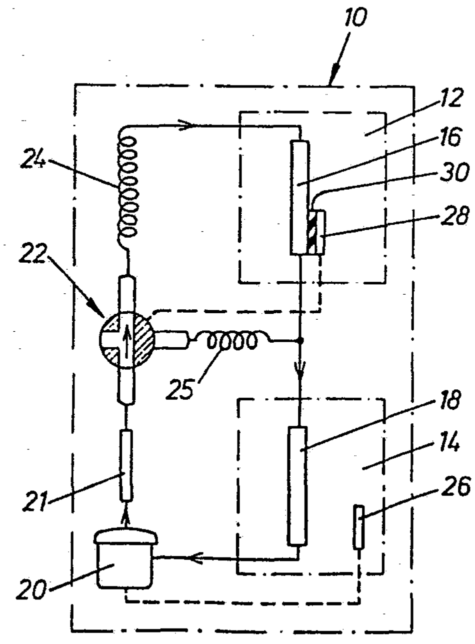

Fig.1

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Arrangement to prevent goods from freezing in a cooling chamber

The invention relates to an arrangement of the kind stated in the introductory part of Claim 1.

Such an arrangement 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 arrangement 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 cut 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 ^{o}C so as to ensure that the evaporator shall be defrosted, and the lower temperature so low, e.g. -20 ^{o}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 arrangement according to the invention thereby that a heat-insulating layer is arranged between the first means and the cooling evaporator.

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.

An embodiment of an arrangement 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 ^{o}C, and a freezing chamber 14, which shall be capable of keeping goods at a temperature of about - 18 ^{o}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 ^{o}C, gives a signal to the compressor 20 to start and at a certain lower temperature, e.g. - 23 ^{o}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 ^{o}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 ^{o}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 ^{o}C, while the temperature of the means 28 lags behind due to the insulation 30 and is higher, - 15 ^{o}C. At - 15 ^{o}C the means 28 gives a signal to the valve 22 to cut off the supply of refrigerant to the evaporator 16. The goods in the cooling chamber, which has a temperature of about + 4 ^{o}C, then heat the evaporator 16 and the means 28. At the time t_3 the evaporator 16 reaches 0 ^{o}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 ^{o}C, at which the means 28 gives a signal to cut 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 cutting 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 ^{o}C, in the example above.

In the known technique this is brought about by a temperature sensing means which switches over at - 20 ^{o}C and according to the invention by a temperature sensing means 28 which switches over already at - 15 ^{o}C. By providing the insulation 30 and by changing the switch over point of the means 28 from - 20 ^{o}C to - 15 ^{o}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. Arrangement in 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 proper order 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) and only the freezing evaporator (18), valve means (22) to cut 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 close the first refrigerant circuit at a certain higher temperature and to cut off the first refrigerant circuit at a certain lower 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 temperature in the freezing chamber and to stop the compressor at a certain lower temperature in the freezing chamber, c h a r a c t e r i z e d in that a heat-insulating layer (30) is arranged between the first means (28) and the cooling evaporator (16).

2. Arrangement according to Claim 1, c h a r a c t e r i z e d in that the layer is constituted by a heat-insulating plate (30).

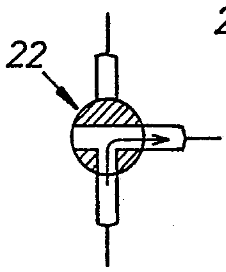

Fig. 2

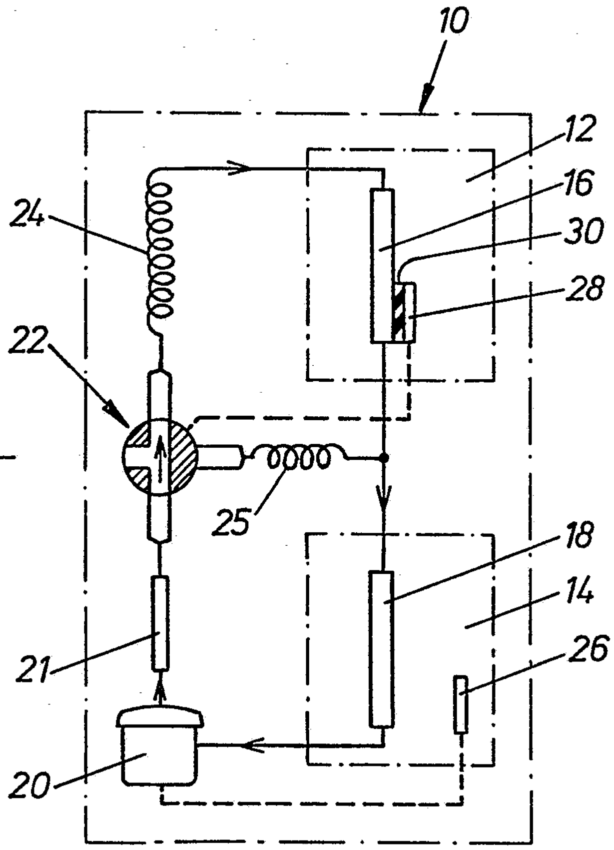

Fig.1

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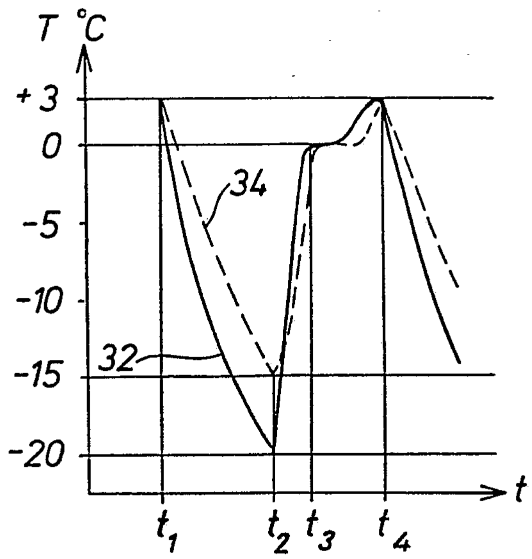
T °C
+3
0
-5
-10
-15
-20
34
32
t
t_1
t_2
t_3
t_4

Fig. 3

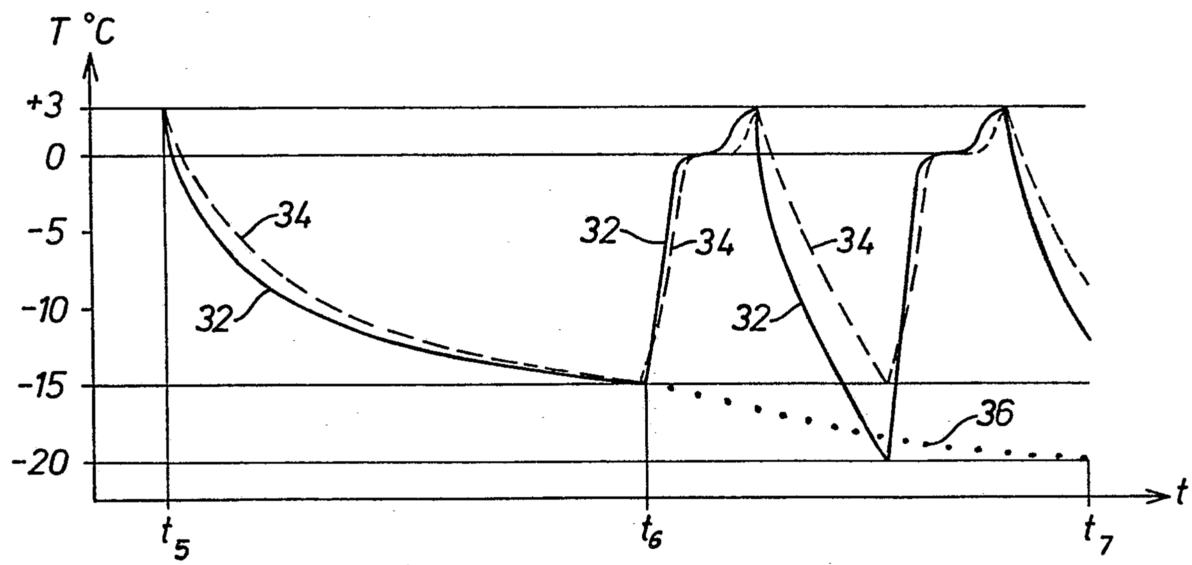
T °C
+3
0
-5
-10
-15
-20
34
32
32
34
34
32
36
t
t_5
t_6
t_7

Fig. 4