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

(11) Publication number: **0 238 015 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87103772.7**

(51) Int. Cl.4: **F25D 11/02** , F25D 21/06

(22) Date of filing: **16.03.87**

(30) Priority: **21.03.86 IT 4571286**

(43) Date of publication of application:
23.09.87 Bulletin 87/39

(84) Designated Contracting States:
AT CH DE ES FR GB IT LI SE

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(54) Refrigerator-freezer combination with automatic defrosting function.

(57) A refrigerator-freezer combination with cyclic defrosting function by natural air circulation in the refrigerator comaprtment (11) and timed automatic defrosting operation and forced air circulation in the freezer compartment (12).

The combination permits any control on the user's part of the defrosting operation to be eliminated, this operation being carried out in an automatic manner in both compartments, and ensures optimum preservation of foods in the respective compartments.

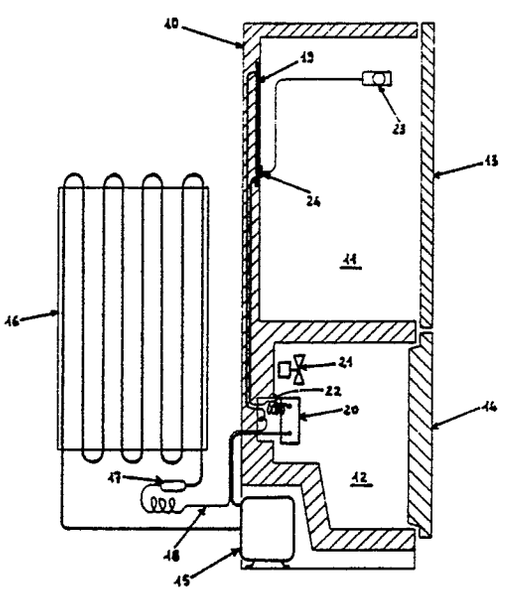

Fig. 1

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Refrigerator-Freezer Combination with Automatic Defrosting Function

The present invention relates to refrigerating apparatus comprising a compartment in which a temperature of about +5 °C is to be maintained for the preservation of fresh foods, and a compartment in which a temperature of at least -18 °C is to be maintained for freezing foods and keeping them in the frozen state. Apparatus of this type, usually referred to as "two temperatures refrigerating aparatus or fridge-freeze combinations", are conventionally provided with a wall panel evaporator in each of the two compartments, and the defrosting operation takes place in an automatic manner during each operating cycle alone with respect to the evaporator of the refrigerator compartment, while the evaporator of the freezer compartment has to be defrosted manually during an interruption of the operation of the refrigerant circuit.

For achieving an automatic defrosting function for both evaporators it has been proposed to employ a finned evaporator and an associated fan in the freezer compartment. In this case the defrosting of the evaporator in the refrigerator compartment is carried out as described above, while the defrosting of the evaporator in the freezer compartment takes place with the aid of electric resistance heaters associated to the evaporator and adapted to be periodically energized with altering the operating conditions of the freezer compartment. In practical use the resistance heaters are energized at preselected intervals of for instance 24 hours, and for a period depending on the amount of rime formed on the evaporator and determined by a program control unit on the base of the temperature sensed by a thermostatic sensor connected to the evaporator.

In apparatus of this type the refrigerant circuit may be devided so as to include two separate compressors with associated controls for cooling the refrigerator compartment and the freezer compartment independently of one another. In another construction the refrigerant circuit may comprise a single compressor for alternately supplying the refrigerant fluid to the evaporator of the refrigerator compartment and to that of the freezer compartment by means of a solenoid switch valve. Both these solutions require the installation of a thermostat in the refrigerator compartment, and another thermostat in the freezer compartment for controlling the operation of the compressor and for selecting the evaporator to be supplied with the refrigerant. The known solutions are thus rather complicated as regards the construction of the refrigerant circuit, requiring an increased number of electromechanical components for its operation and control.

A main object of the invention is to provide a refrigerator-freezer combination of simple construction and reliable operation, with cyclic defrosting by natural air circulation in the refrigerator compartment, and with timed automatic defrosting of the freezer compartment by forced air circulation.

This object is attained according to the invention in a refrigerator-freezer combination with automatic defrosting function, comprising a housing incorporating at least two completely separate compartments, namely, a refrigerator compartment provided with a wall panel evaporator, and a freezer compartment provided with a finned battery evaporator and an associated fan, said evaporators being included in a refrigerant circuit supplied by a single compressor under the control of thermostat means, wherein the evaporator of said refrigerator compartment is disposed in said refrigerant circuit upstream of the evaporator of said freezer compartment, said means for controlling said compressor comprisign a single thermostat disposed in said refrigerator compartment and connected to at least one detector means fixed to said evaporator of said refrigerator compartment.

The characteristics of the invention will become evident from the following description, given by way of example with reference to the accompanying drawings, wherein:

fig. 1 shows a diagrammatic illustration of a refrigerator-freezer combination according to the invention, and

fig. 2 shows a simplified illustration of the electric circuit of the combination shown in fig. 1

A refrigerator-freezer combination according to the invention comprises a housing 10 the interior of which is divided into two completely separate compartments, namely, an upper compartment 11 for the preservation of fresh foods, and a lower compartment 12 acting as a freezer compartment for the storage of frozen foods (fig.1).

In the upper compartment 11 the temperature is usually maintained at about +5 °C, while the temperature in the freezer compartment 12 is maintained at least at -18 °C.

The two compartments 11 and 12 are closed by separate doors 13 and 14, respectively. A refrigerant circuit includes, sequentially in the direction of refrigerant flow, a compressor 15 disposed in the base of housing 10, a condenser 16 secured to the ouer rear wall surface of housing 10, a dehydrating filter 17, a capillary 18, an evaporator 19 secured to a wall of refrigerator compartment 11, and a finned battery evaporator 20 with an associated fan 21 mounted within freezer compartment 12. In particular, evaporator 19 is of the "hidden" type compris-

ing a steel pipe coil secured to a panel likewise of steel and adhered to the interior wall surface of refrigerator compartment 11 so as to be incorporated in the insulating lining of housing 10. It is also to be noted that evaporator 19 is connected in the refrigerant circuit upstream of evaporator 20. According to a specific aspect of the invention, a capillary 22 is connected in series between evaporator 19 and evaporator 20 so as to establish a correct balance of the refrigerating potential in the refrigerator compartment 11 and freezer compartment 12. In particular, the proposed solution permits different evaporating temperatures to be simultaneously obtained in the two evaporators, thus reducing the danger of the temperature in the refrigerator compartment dropping to below 0 °C during a period in which the freezer compartment requires the maximum refrigerating capacity. This situation arises for example in the case of a freezing operation, during which the compressor operates continuously for a certain period. In this case the introduction of a charge of foods to be frozen into the freezer compartment causes the evaporating temperature in the freezer evaporator to rise,, resulting in a corresponding rise of the temperature in the evaporator of the refrigerator compartment, although the difference between the two evaporating temperatures diminishes due to the presence of capillary 22. The provision of capillary 22 upstream of evaporator 20 also facilitates the installation of the latter in the freezer compartment. To this purpose capillary 22 is formed in an extensible coil configuration permitting it to be extracted from the compartment for soldering it to finned evaporator 20 of the freezer compartment exterior of the housing. Subsequently the capillary is again coiled and inserted into a suitable open cavity formed in the wall of the freezer compartment as the evaporator 20 is installed therein.

The main characteristic of the invention provides for the employ of only a single thermostat 23 disposed in refrigerator compartment 11 and connected to a detector 24 fixed to evaporator 19 of this compartment for controlling both compressor 15 and fan 21 of evaporator 20. As shown in the electric circuit diagram of fig. 2, compressor 15 and fan 21 are connected in parallel with one another and in series between thermostat 23 and a contact of a program timer 25 acting to determine the defrosting periods of freezer evaporator 20. Program timer 25 is connected to a thermostat detecting the temperature of evaporator 20, and controls the energization of a defrosting heater element 26 of evaporator 20. In the manner described it is possible to eliminate numerous electromechanical components such as a further thermostat with associated detector element in the freezer compartment, solenoid valves in the refrigerant circuit etc., to thereby render the apparatus more simple and reliable. The performances in the two compartments of the refrigerator-freezer combination are of course interdependent, but correct dimensioning of the refrigerant circuit, in particular of the two evaporators, with a view to the overall characteristics of the apparatus such as capacity of the compartments, insulation and so forth, permits any inconveniences to be avoided. There are by contrast noticable advantages obtained as regards the construction as well as the operation of the apparatus according to the invention.

The thus constructed refrigerator-freezer combination in fact permits to eliminate any control on the user's part of the defrosting operation, which is carried out in an automatic manner in both compartments. This construction also ensures optimum preservation of foods both in the refrigerator compartment, in which the natural air circulation reduces the dehydration of fresh foods, and in the freezer compartment, in which a forced air circulation and a rapid freezing effect are obtainable when so required. This is because the fan is energized during operation of the compressor.

Claims

1. Refrigerator-freezer combination with automatic defrosting function, comprising a housing incorporating at least two completely separate compartments, namely a refrigerator compartment provided with a wall panel evaporator, and a freezer compartment provided with a finned battery evaporator and an associated fan, said evaporators being included in a refrigerant circuit supplied by a single compressor under the control of thermostat means, characterized in that the evaporator (19) of said refrigerator compartment (11) is disposed in said refrigerant circuit upstream of the evaporator (20) of said freezer compartment (12), said means for controlling said compressor (15) comprising a single thermostat (23) disposed in said refrigerator compartment (11) and connected to at least one detector means (24) fixed to said evaporator (19) of said refrigerator compartment (11).

2. Refrigerator-freezer combination according to claim 1, characterized in that said evaporator (19) of said refrigerator compartment (11) comprises a pipe coil secured to a panel adhering to the wall of said compartment and incorporated in the insulating material of said housing (10).

3. Refrigerator-freezer combination according to claim 1, characterized in that a spirally wound and extensible capillary (22) is inserted in series between said evaporator (19) of said refrigerator

compartment (11) and that (20) of said freezer compartment (12), and is located in an open cavity foremd in the wall of said freezer compartment.

4. Refrigerator-freezer combination according to claim 1, comprising a program timer connected to a thermostat associated to the evaporator of said freezer compartment for determining the defrosting periods of said evaporator, characterized in that the motor of said compressor (15) and said fan (21) associated to said evaporator (20) of said freezer compartment (12) are connected in parallel between said thermostat (23) of said refrigerator compartment (11) and said program timer (25).

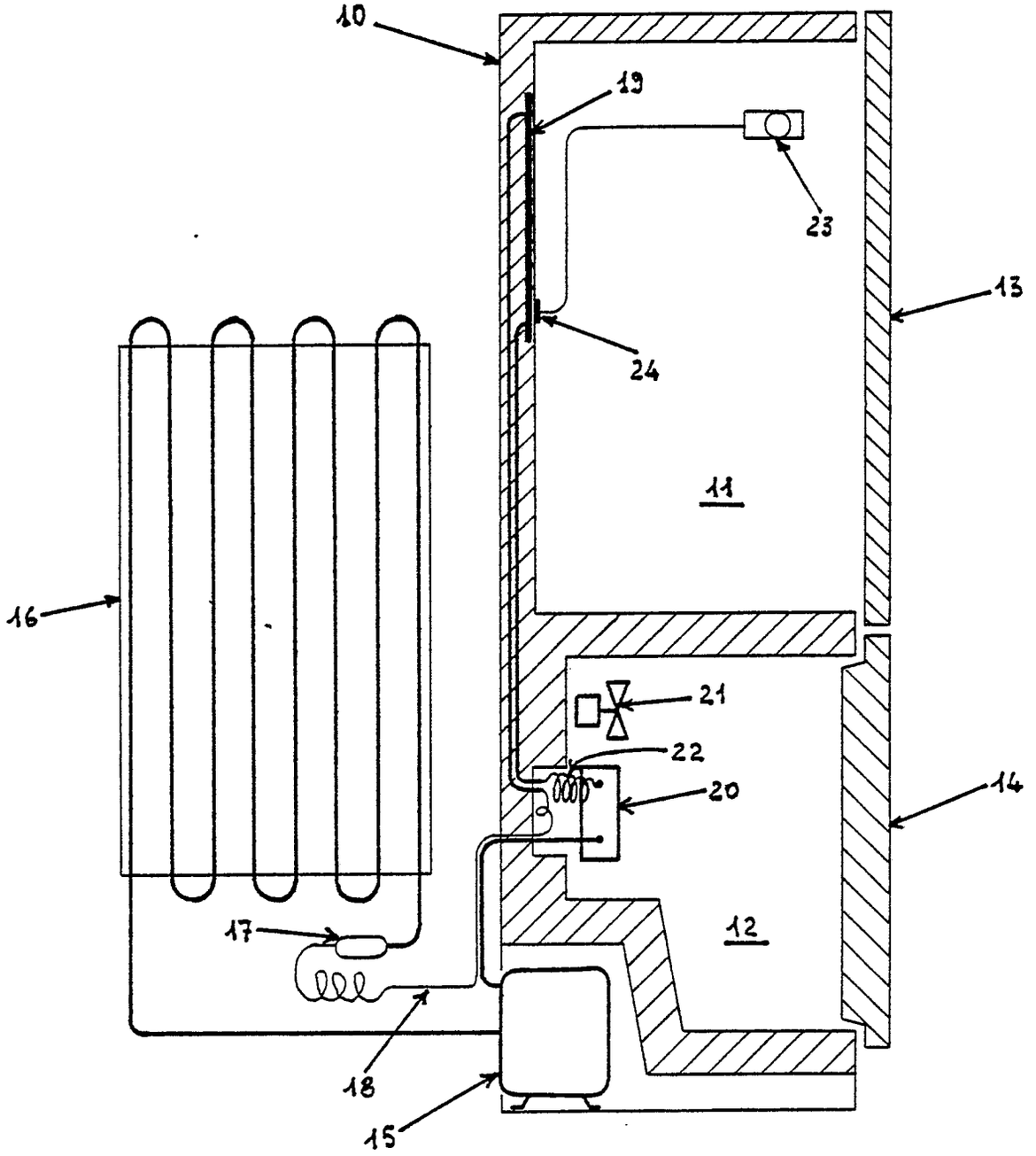

Fig. 1

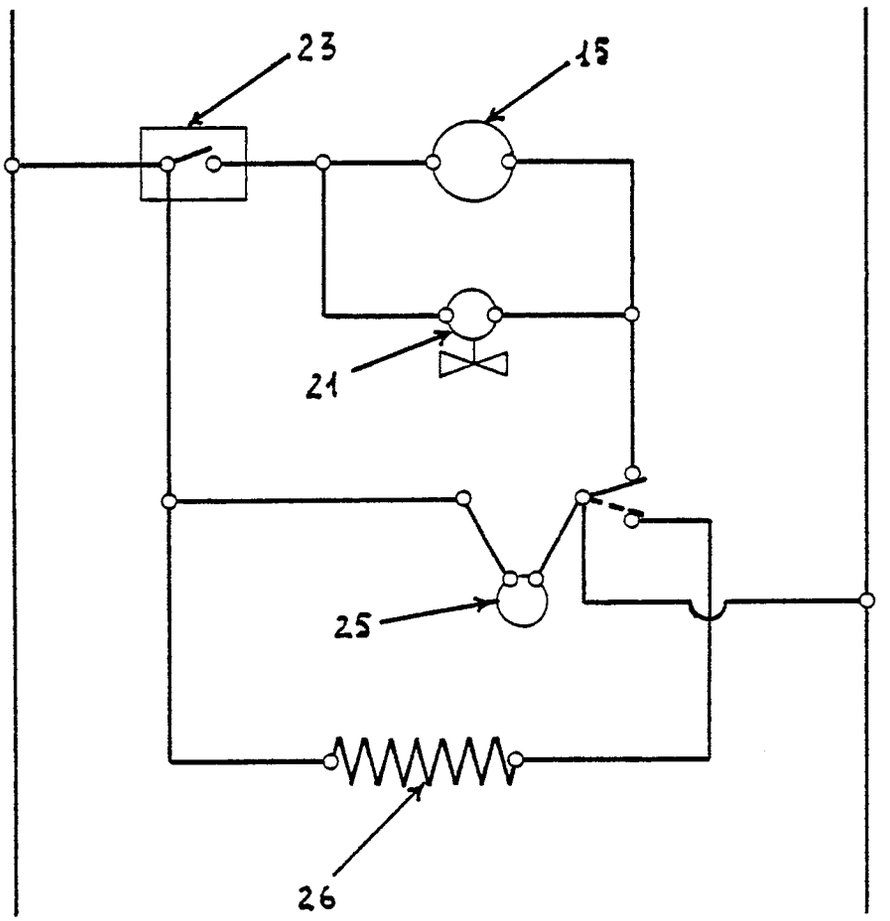

Fig. 2