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

(11) EP 0 787 961 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.08.1997 Bulletin 1997/32

(51) Int. Cl.[6]: **F25D 21/02**, F25D 21/08

(21) Application number: **97100406.4**

(22) Date of filing: **13.01.1997**

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **30.01.1996 IT MI960073 U**

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(54) Device for detecting frost formation and for eliminating it by heating, particularly for domestic refrigerator evaporators

(57) The device measures and monitors the extent of frost formed on the evaporator (4) and provides for its defrosting only when necessary.

For this purpose there are provided flat resistive elements (A,B) applied to an electrically insulating flexible substrate (1). The resistive elements (A,B) are positioned spaced apart beside each other so as to form the plates of a capacitor. Contactors (6,7) are provided enabling the resistive elements (A,B) to be converted into the plates of a capacitor, which is powered by an oscillator.

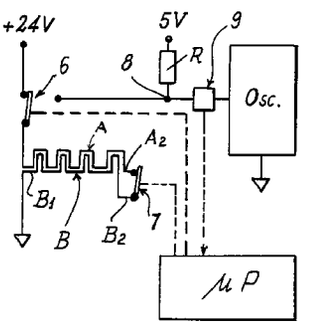

Fig. 3

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Description

This invention relates to a device for detecting frost formation and/or for eliminating it by heating, particularly for domestic refrigerator evaporators.

Devices for detecting frost formation on domestic refrigerator evaporators and devices for eliminating evaporator frost by heating have both existed for some time in the most varied forms.

The former cause the latter to operate when a given frost quantity is reached on the evaporator. Their drawback is the need to provide two totally separate devices.

Refrigerators are also known in which thermal defrosting is effected cyclically, ie independently of the quantity of frost which has formed on the evaporator. This arrangement has the drawback of consuming electricity even when defrosting is not necessary.

An object of the present invention is to provide a single means which performs both the frost detection and heating functions.

A further object of the present invention is to provide a device which both monitors and eliminates frost using the same means.

These and further objects which will be more apparent from the ensuing detailed description are attained by the invention as defined by the accompanying claims.

A preferred embodiment of the invention is described in detail hereinafter by way of non-limiting example with reference to the accompanying drawing, in which:

Figure 1 is a schematic front view of the means for frost detection and/or heating to eliminate it from the evaporator;

Figure 2 is a disassembled sectional view showing a possible location of the means of Figure 1 in relation to the evaporator region in a refrigerator;

Figure 3 is a schematic view of the circuit arrangement in which the means of Figure 1 acts as a heater, ie as a defroster;

Figure 4 is a schematic view of the circuit arrangement in which the means of Figure 1 acts as a capacitor, ie as a frost detector.

In the figures, the reference numeral 1 indicates a support of flexible insulating material, such as polyamide. A suitable material is that known commercially as KAPTON or MYLAR (or the like) manufactured for example by DU PONT and 3M.

Two physically separate resistive tracks extending mutually parallel in a substantially castellated arrangement are applied by known methods to said support.

In the refrigerator (Figure 2), which can be static or of forced air circulation type, the trackless face of the support 1 carrying the tracks A and B is in contact with a plastic wall 2 bounding the refrigerator preservation compartment 3, its opposite face being in contact with a conventional evaporator 4 of the refrigerator refrigeration circuit.

The reference numeral 5 indicates an external wall of the refrigerator and 5A indicates the refrigerator thermal insulation, for example polyurethane expanded in situ, which joins together the various described components. Before expanding the polyurethane in situ the support 1 is for example fixed to the evaporator with biadhesive tape at points on or along its periphery, the ends of the resistive tracks A and B are electrically connected, as shown in Figures 3 and 4, in the following manner.

The end A1 is electrically connected to a contactor means 6 in the form of a switching means operated and controlled by a microprocessor μP. The end B1 is connected to earth. The ends A2 and B2 are connected to a contactor means 7, the purpose of which is to connect said ends together or disconnect them from each other, and is operated and controlled by the microprocessor μP.

The contactor means 6 connects the end A1 either to a voltage source, for example at 24V, or to a node 8 to which there are connected a resistor R (connected to a voltage source at 5V) and a variable frequency oscillator OSC suitably connected to a conventional ammeter 9 feeding its signal to the microprocessor μP which processes it in known manner.

The resistive tracks A and B act as the plates of a capacitor when the contactor means (6, 7) are in the position shown in Figure 4, ie during normal refrigerator operation, in which said plates define a frost detection capacitor. This capacitor has a certain capacitance when frost is absent from the evaporator and a different capacitance as the layer of frost grows. This means that the ammeter 9 feeds differing signal values to the microprocessor μP. When the signal assumes a given value the microprocessor switches the contactor means (6, 7) into the position shown in Figure 3 in which the two tracks A and B are connected in series between the source and earth.

By this means the capacitor of Figure 4 is transformed into an electrical resistance heater by virtue of the resistivity of the tracks. The "resistor" configuration of Figure 3 varies cyclically. In other words, the microprocessor μP switches the contactor means (6, 7) alternately into the position shown in Figure 4 and that shown in Figure 3, so as to monitor the progress of defrosting via the ammeter 9.

When defrosting has reached the desired extent (preset as reference data in the processor μP) the configuration of Figure 4 becomes stabilized, whereas if defrosting is inadequate the system switches to the configuration of Figure 3 and then of Figure 4, and so on until the desired extent of defrosting is achieved.

A particular embodiment has been described, applied to a static refrigerator. Other embodiments can however be provided (such as one applied by suitable and obvious expedients to a forced air circulation refrigerator with an evaporator of radiator type) and are to be considered as falling within the scope of the present

document.

Claims

1. A device for controlling the frost layer on a domestic refrigerator evaporator, characterised by comprising, in contact with the evaporator, a switchable means which when in one state acts as a frost detecting capacitor and when in another state acts as a frost heater.

2. A device as claimed in claim 1, characterised in that the switchable means comprises an insulating support and at least two resistive tracks on said support.

3. A device as claimed in the preceding claims, characterised in that the tracks extend parallel to each other.

4. A device as claimed in one or more of the preceding claims, characterised in that the switchable means is switched by electrical contactor means controlled by a microprocessor.

5. A device as claimed in one or more of claims 1-4, characterised in that when in its capacitor state the switchable means is connected to an oscillator.

6. A device as claimed in claim 5, characterised in that the connection to the oscillator is made via an ammeter connected to the microprocessor.

7. A device as claimed in claim 6, characterised in that, during evaporator defrosting, the microprocessor cyclically alternates the closure of the contactor means during actual defrosting, so as to switch the configuration of the switchable means from heater to frost detector to establish whether the required state of defrosting has been achieved or not.

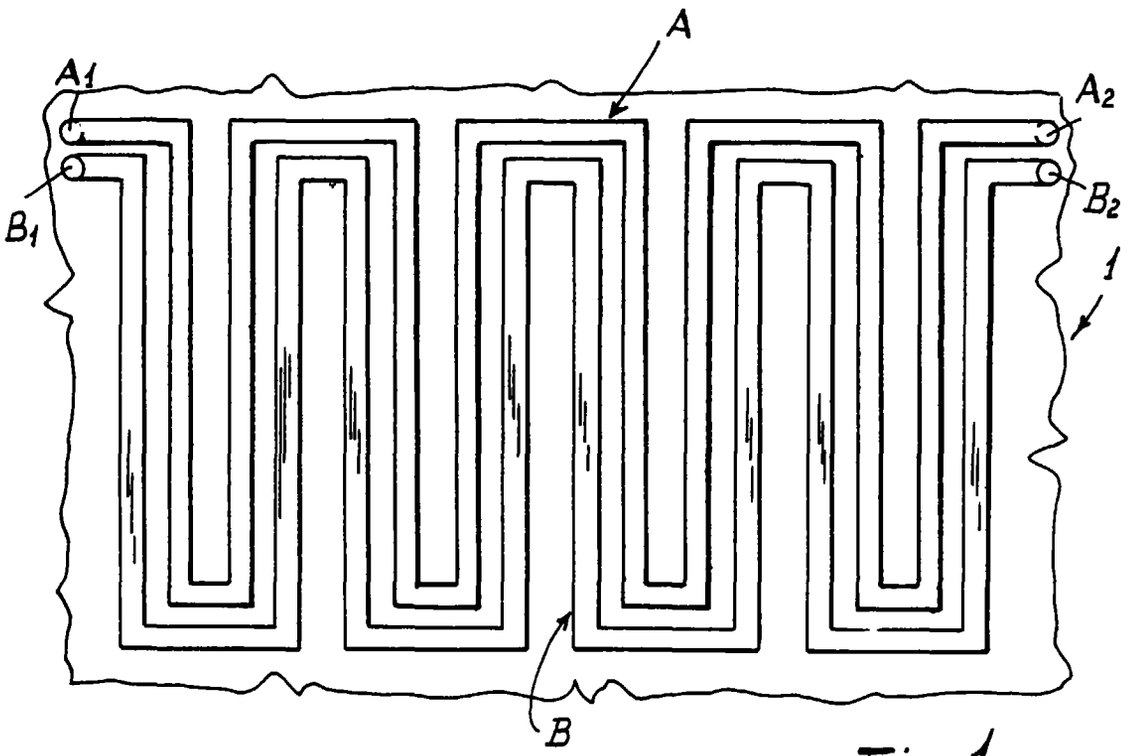

Fig. 1

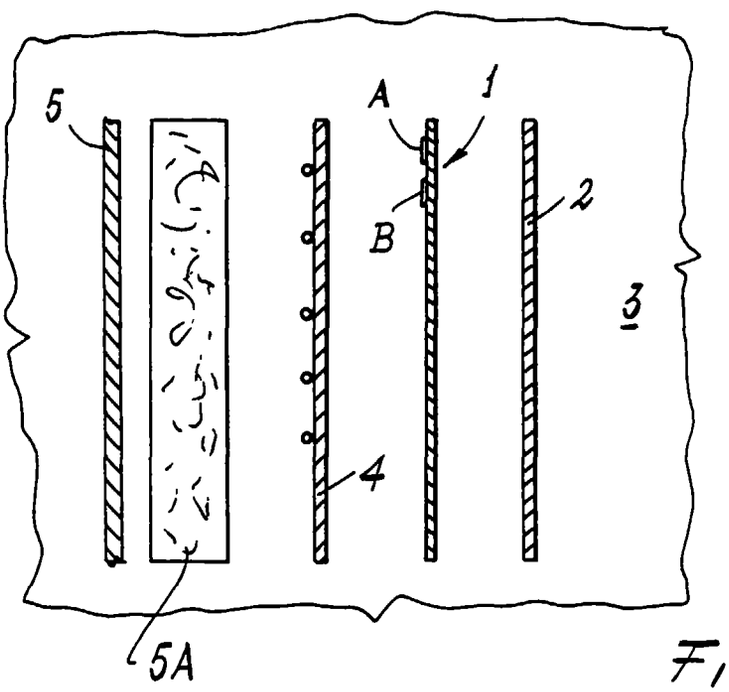

Fig. 2

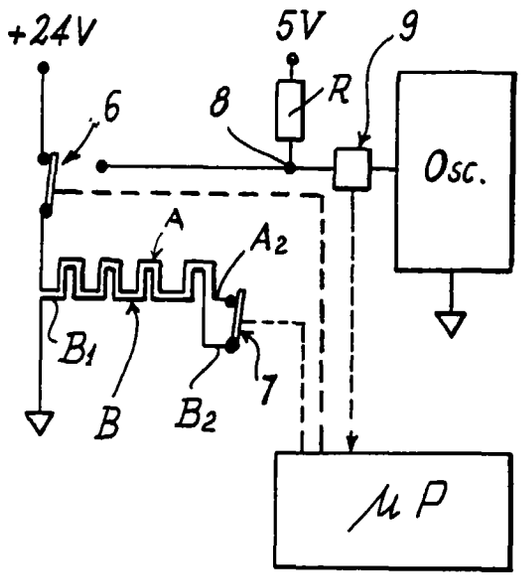

Fig. 3

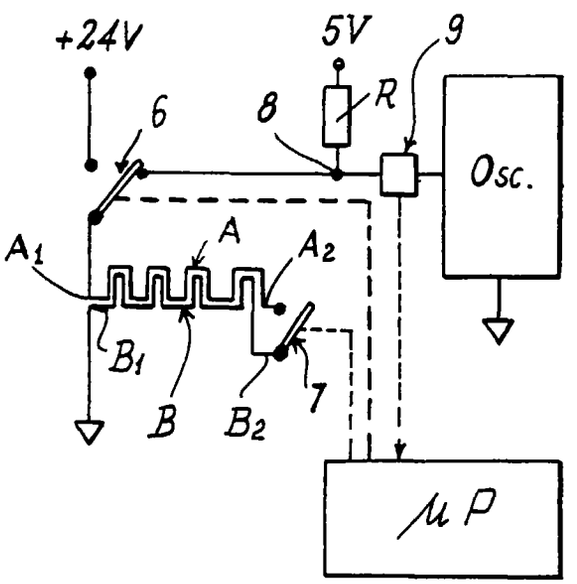

Fig. 4