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(54) Device for controlling the temperature of a chamber within the refrigeration compartment of a refrigerator

(57) Within the preservation compartment (2) of a refrigerator, in particular a static refrigerator, there is provided a chamber (10) at controlled temperature close to 0°C, in which temperature sensor means (20) are positioned connected to control means (9) for the refrigeration circuit of said refrigerator. Selector means (21) are provided enabling said control means (9) to sense when said chamber (10) is used as a temperature controlled chamber and to control the refrigeration circuit on the basis of the temperature measured by said sensor means (20), said control occurring in accordance with at least two different modes by comparing said measurement with different set temperature values depending on the presence or absence of a selection signal generated by said selector means (21). The temperature controlled chamber (10) is provided within the preservation compartment (2).

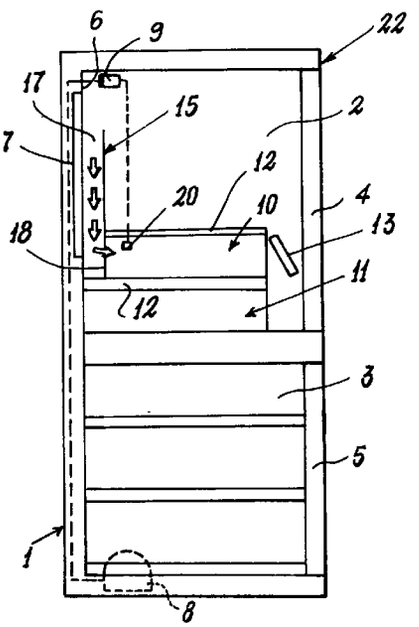

Fig. 1

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Description

This invention relates to a device in accordance with the introduction to the main claim.

Refrigerators, in particular forced air circulation refrigerators, have been known for some time provided with a chamber or drawer at a controlled temperature close to 0°C for containing food which has preferably to be preserved at this temperature, such as fresh meat and fish. Such chambers are generally provided between the preservation compartment and the freezer compartment. In the case of a completely independent chamber or of chambers at 0°C inserted in the preservation compartment, these are positioned in the upper region in proximity to the cold air ventilation ports present in the compartment. Each chamber comprises means for feeding the forced air into it and means for intercepting or throttling this air circulation when not required or desired (for example because the chamber temperature has reached the set value).

These known solutions are however of relatively complex and costly construction such as to negatively influence the refrigerator cost, the solutions sometimes being extremely approximate in terms of their operation in the sense of the operating temperature achieved.

Static refrigerators are also known provided with a chamber or drawer at controlled temperature for containing particular foods.

For example, NO-177365 describes a refrigerator the compartment of which contains several containers or drawers of the aforesaid type. In this prior patent, in one of these containers there is provided a temperature sensor which, together with a usual sensor associated with the evaporator positioned in correspondence with said compartment, ensures correct operation of the refrigeration circuit such that different appropriate temperatures exist in said drawers for preserving the food placed in them. More precisely, the temperature sensor associated with the evaporator causes the motor-compressor unit to operate only when an acceptable maximum temperature is attained at the evaporator during defrosting, whereas the other sensor positioned in proximity to the drawer or drawers controls the deactivation of the compressor to prevent the temperature in the drawer or drawers falling to a value incompatible with correct preservation of the item contained in it, for example potatoes.

These known solutions have various drawbacks, among which is the fact that the control of the refrigeration circuit operation in the prior patent under examination penalizes the control and maintenance of the required temperature in the preservation compartment, while privileging the control of the temperature in the freezer compartment. This can lead to obvious operational problems with incorrect operating temperatures in the case, for example, of quantitatively critical loads or particular environmental conditions.

In addition, the aforesaid solution is of complicated construction and high cost.

Other known solutions comprise a drawer positioned within the refrigeration compartment but without particular control systems for maintaining a required temperature within it. The temperature within this drawer is displayed by indicators positioned on the drawer and hence visible to the user only on opening the door of the refrigeration compartment (with consequent change in the temperature within this latter). Only in this manner is it possible to check whether said temperature is more or less that required, and if necessary change the parameters relative to the preservation compartment in order to achieve the required temperature in the controlled temperature chamber.

An object of the present invention is to provide an improved device for controlling the temperature within a chamber, positioned within the preservation compartment of a refrigerator, and used at a predetermined temperature for preserving particular foods such as fresh meat and fish.

A particular object of the present invention is to provide a device of the aforesaid type usable in a static refrigerator, which achieves optimum control of the temperature within the controlled temperature chamber.

These and further objects which will be apparent to the expert of the art are attained by a device in accordance with the accompanying claims.

The present invention will be more apparent from the accompanying drawing, which is provided by way of non-limiting example and in which:

Figure 1 is a schematic section through a refrigerator according to the invention;
Figure 2 is a front view of part of the refrigerator of Figure 1; and
Figure 3 is a table showing the operating temperatures of parts of the refrigerator of Figure 1.

With reference to said figures, a refrigerator, for example a static domestic upright refrigerator, comprises a cabinet 1 containing a preservation compartment 2 and a freezer compartment 3 provided with their doors 4 and 5, defining two environments which are completely different from each other in terms of their internal temperature. In correspondence with a wall 6 of the compartment 2 there is provided a (flat) evaporator 7 connected to a compressor 8 in known manner. A control unit, preferably of microprocessor type 9, controls the operation of the compressor 8 and consequently the temperature of the compartment 2 and of the freezer compartment 3.

According to the invention, within the preservation (or refrigeration) compartment 2 there is provided a controlled temperature chamber 10 for preserving meat, fish, dressed pork products or other (fresh) food requiring to be preserved at a temperature close to 0°C. This chamber is positioned above usual containers 11 (only one is shown in the figure) for containing fruit and vege-

tables. The chamber 10 is insulated both towards the freezer 11 and towards the compartment 2 by walls 12. An extractable drawer (not shown) is provided in the chamber 10, this chamber being closed frontally (ie towards the door 4) by a mobile door 13. If the refrigerator uses internal shelves of grid type (not shown), there is associated with the chamber 10 a panel 15 positioned to the front of and parallel to said wall 6. In this manner, between this latter and the panel there is created a duct 17 for the air, which moves downwards by natural convection to graze the wall 6 (cold because of the evaporator) and become cold.

The duct 17 passes along the compartment 2 and communicates with the rear part 18 of the chamber 10, to allow said cold air to enter this latter.

Finally, in the chamber 10 there is positioned a temperature sensor 20 connected to the unit 9, which by means of the data originating from said sensor 20, controls the operation or deactivation of the compressor 8, as described hereinafter. The unit 9 is also connected to a pushbutton 21 provided on an interface 22 positioned on the cabinet 1 and comprising, in addition to said pushbuttons, further pushbuttons 23, 24, 25, 26, 27 and 28. Specifically, the pushbutton 21 is arranged to select the use of the chamber 10 as a temperature controlled chamber or not, and consequently to select at least two different operating modes of the unit 9, as described hereinafter. The pushbutton 23 controls the cold in the preservation compartment, in correspondence with it there being provided a light-emitting indicator 30 indicating the operation or non-operation of the refrigerator. The pushbutton 24 enables the required temperature to be selected in the preservation compartment 2 and be displayed on a display 31. The pushbutton 25 controls the cold in the freezer compartment 3, in correspondence with it there being provided a light-emitting indicator 33. The pushbutton 26 enables the temperature in the freezer compartment to be selected, and displayed on a display 34. The pushbutton 27 activates fast freezing, the relative light-emitting indicator 35 being provided in correspondence with it. The pushbutton 28 excludes an acoustic alarm which is activated when the temperature in the freezer compartment 3 reaches an undesired predetermined value (for example too high); with this pushbutton there is associated a relative light-emitting indicator 36 indicating that a critical temperature has been reached in the compartment 3. At the pushbutton 21 there is provided an indicator 38 indicating whether the user has selected the chamber 10 as a temperature controlled chamber or not; if the selection is not made, then the temperature in the chamber is substantially not ideal for meat and fish, but suitable for other uses typical of a refrigerated compartment. By means of the pushbutton 21 it is also possible (for example by maintaining it pressed for a predetermined time period) to indicate to the unit 9 the presence or absence of the drawer within the chamber 10, this condition being displayed (indicated by 40) on the display 31.

With reference specifically to Figure 3, it will now be assumed that the refrigerator according to the invention is to be used, but without wishing to use the chamber 10 as a temperature controlled chamber set at around 0°C. In this case the pushbutton 21 is not pressed, and the user can select the required temperature in the compartment 2 and in the compartment 3.

Following this, the unit 9 measures the temperature via the sensor 20 and operates on the compressor to achieve the desired temperature in the compartment 2. This is obtained by comparing the values measured by the sensor 20 with a range (or first range) of temperatures; on the basis of the temperature of the compartment 2 (indicated in the portion A of the table of Figure 3) and the temperature measured by the sensor 20, the compressor is halted when the temperatures indicated in the portion B of said table are achieved. For example, as shown, eight possible temperatures can be obtained in the compartment 2.

If instead the pushbutton 21 is pressed to select the use of the chamber 10 (the temperature of which depends on the selection of the temperature of the compartment 2 by the user), the unit 9 operates to compare the temperature measured by the sensor 20 with another (or second) range of temperatures (having a value less than that of the first range and shown in the portion C1 of the table of Figure 3). The temperature desired in the chamber 10 can be close to 0°C if the food placed in the chamber 10 is fresh, or can be slightly less than 0°C for other foods. All this can be selected via the pushbutton 21 by successively pressing it.

There exists a relationship between the two temperatures (of the chamber 10 and of the compartment 2) in that, substantially, the temperature of the preservation compartment is about 2°C higher than that attained in the chamber 10, as shown by the values in parentheses in the portion B of the table of Figure 3.

The operability of the chamber 10 is however limited to just a few temperatures. If the user sets too high a temperature (exceeding 5°C) for the preservation compartment 2, the unit 9 automatically passes to the configuration indicated by C2 in table 3, in which the temperature in the chamber 10 is the usual temperature for a preservation compartment.

Finally, by selecting with the pushbutton 21 the absence of the drawer from the chamber 10 by keeping it pressed for a determined time, the unit 9 can operate up to nine temperature levels, the last corresponding to a relatively high temperature (for example 6.5°C) in the chamber 10.

With the device of the invention, an optimum and reliable setting of the temperature within the chamber 10 can be achieved when it is desired to use it as a temperature controlled chamber.

Moreover its temperature is achieved and maintained without the user having to further operate on the unit 9.

A preferred embodiment of the invention has been described, applied to a refrigerator comprising two compartments 2 and 3.

However, in general the invention can be applied to any refrigerator comprising at least one compartment (and even just one compartment such as frigobars) in which a controlled temperature chamber is to be formed. This and other embodiments of the invention are to be considered as falling within the scope of the present document.

Claims

1. A device for controlling the temperature in a refrigerator comprising at least one food preservation compartment (2, 3), an evaporator (7) provided in correspondence with a wall (6) of the compartment (2), a compressor (8) connected to the evaporator (7), and means (9) for controlling the activation of said compressor on the basis of the temperature measurement effected by said sensor (20) and arranged to maintain in said compartment a temperature set by the user, said refrigerator comprising a chamber (10) to be maintained at a controlled temperature close to 0°C, characterised in that said chamber (10) is provided within the preservation compartment and is in communication with it, in said chamber (10) there being positioned the temperature sensor means (20) by which the control means (9) measure the temperature of the preservation compartment (2), selector means (21) being provided to enable said control means (9) to sense when said chamber (10) is used as a controlled temperature chamber, and to control the refrigeration circuit on the basis of the temperature measurement effected by said sensor means (20), said control being effected in accordance with at least two operating modes by comparing said measurement with different preset temperature values on the basis of the presence or absence of a selection signal generated by said selector means (21).

2. A device as claimed in claim 1, characterised in that in a first operating mode, the control means (9) maintain a predetermined temperature within the chamber (10), independently of the user-selected temperature of the preservation compartment (2), by comparing the temperature measured by the sensor means (20) with a predefined first temperature range, whereas in an at least second control mode, corresponding to the chamber (10) not being used as a temperature controlled chamber, said control means (9) maintain within the preservation compartment (2) the temperature set by the user on the basis of a comparison between the temperatures measured by the temperature sensor and a second predefined temperature range.

3. A device as claimed in claim 2, characterised in that the first comparison temperature range contains temperature values less than those of the second temperature range.

4. A device as claimed in claim 2, characterised in that the first temperature range is more limited than the second range, the control means (9) maintaining a controlled temperature within the chamber (10) only if the temperature set for the preservation compartment (2) by the user does not exceed a predetermined level.

5. A device as claimed in claim 1, characterised in that the control means are a microprocessor unit.

6. A device as claimed in claim 1, characterised in that the selector means (21) comprise a pushbutton (21) provided on an interface (22) of the refrigerator.

7. A device as claimed in claim 6, characterised in that the interface (22) comprises a plurality of selectors (23, 24, 25, 26, 27, 28) for selecting the different refrigerator functions and for setting the various operating temperatures in the refrigerator compartment, the interface comprising displays (31, 34) for the temperatures in said compartment (2, 3).

8. A device as claimed in claims 1 and 7, characterised in that the chamber (10) contains a removable drawer and is closed by its own mobile door (13), the presence or absence of said drawer within said chamber being displayed (at 40).

9. A device as claimed in claim 8, characterised in that the chamber (10) is insulated (at 12) at least on its lower and upper walls, with said chamber there being associated a panel (15) positioned spaced from and to the front of that wall (6) of the preservation compartment (2) in correspondence with which the evaporator is present, the channel (17) defined by said wall (6) and panel (15) communicating with the interior of the chamber (10) and with the preservation compartment (2).

10. A method for controlling the temperature in a refrigerator by the device claimed in claim 1, said refrigerator comprising at least one food preservation compartment (2, 3), an evaporator (7) provided in correspondence with a wall (6) of the compartment (2), and means (9) for controlling and regulating the temperature in said compartment (2, 3) on the basis of the temperature measurement effected by sensor means (20) and on the basis of temperature conditions selected by the user, said refrigerator comprising a chamber (10) to be maintained at a controlled temperature close to 0°C, provided

within the preservation compartment and in communication with it, in said chamber (10) there being positioned the temperature sensor means (20) by which the control means (9) measure the temperature of the preservation compartment (2), selector means (21) being provided to enable the control means (9) to sense when the chamber (10) is used as a controlled temperature chamber, characterised by comprising:

a) the sensing of selection signals by the control means (9);
b) comparing the temperature measured by the sensor means (20) with a first predefined temperature range when said control means sense a signal generated by the selector means (21) which corresponds to user selection of the use of the chamber (10) as a temperature controlled chamber, said control means maintaining a controlled temperature within said chamber (10) independently of the temperature of the preservation compartment (2) chosen by the user.
c) comparing the temperatures measured by the temperature sensor means (20) with a second predefined temperature range when said control means (9) sense another signal generated by the selector means (21) which corresponds to the non-use of the chamber (10) as a temperature controlled chamber, said control means (9) maintaining within the preservation compartment (2) the temperature set by the user.

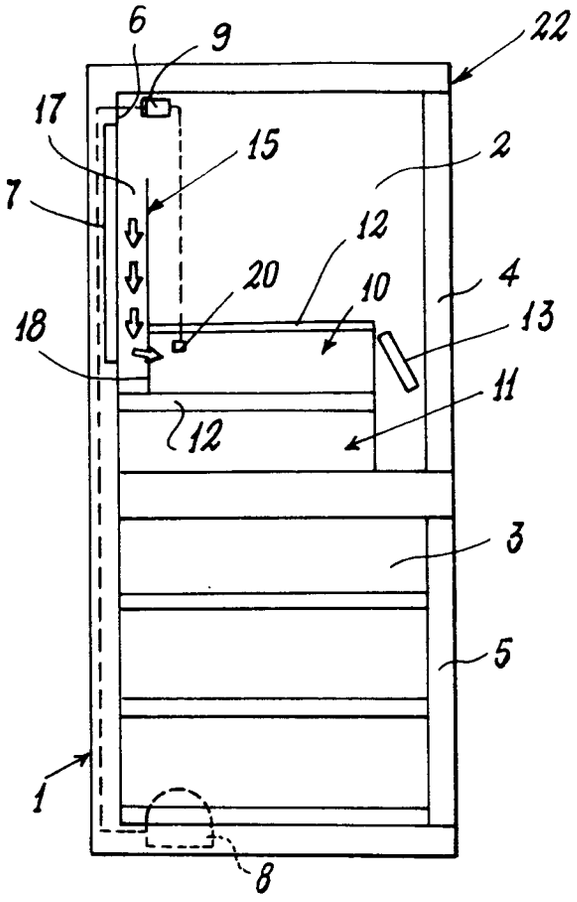

Fig. 1

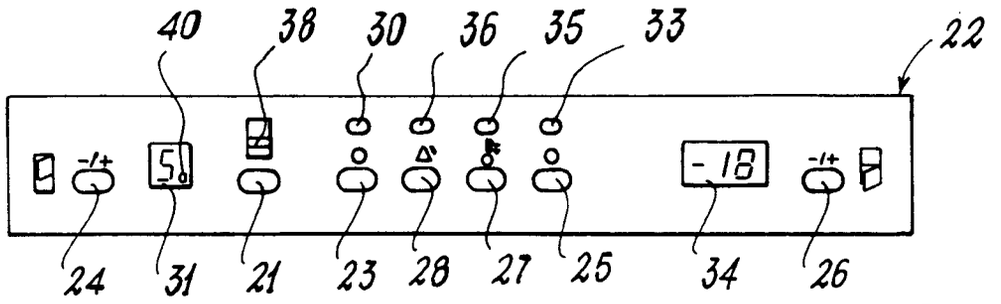

Fig. 2

B

A SELECTION	TEMPERATURE OF PRESERVATION COMPARTMENT		TEMPERATURE OF INTERNAL CHAMBER	
2	-1	(-2)	-3	C1
3	-0.5	(-1,5)	-2.5	C1
4	+0.5	(-0.5)	-1	C1
5	2	(1)	0.5	C1
6	4	(2,5)	2	C2
7	5.5	(4)	3.5	C2
8	7	(5,5)	5	C2
9			6.5	C2

Fig. 3