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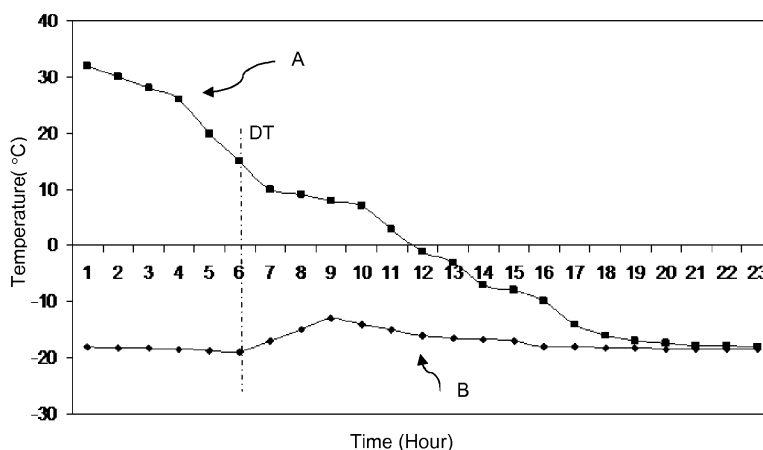
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(54) **A method of regulating defrost operation in cooling devices**

(57) The method according to the present invention is developed for cooling devices capable to detect defrost time, wherein the starting time of a defrost process is regulated by this method. In a first step of this method, the data indicating that new foodstuff is placed to the freezer compartment of a cooling device is entered to the control unit of the cooling device by a user, then in a second step following this data entry, the device keeps

continuing the cooling process, and thereafter in a third step, the user is alerted by means of a signal generator connected to the control unit after a while. In a fourth step of this method, new foodstuffs are put to the freezer compartment after said alert, and the cooling process is continued, and in a fifth step, if it is determined by the device that it is time to perform a defrost operation after new foodstuff is loaded to the compartment, the defrost operation can be delayed to a future time.



Graph - 1

Description

Technical Field

[0001] This invention relates to methods regulating the defrost operation of cooling devices.

Prior Art

[0002] The most common problem encountered in the use of cooling devices is frost formation on evaporators employed for the cooling operation. The ambient humidity in the part where evaporators are situated leads to frost formation thereon and reduces the cooling efficiency thereof. For this reason, the frost on the evaporator must be removed, i.e. it has to be defrosted. As for the defrost operation, either the cooling device is shut down, or a heating member disposed on the evaporator is used for this purpose. In both cases, the temperature in the cooling device and therefore the temperature of foodstuff stored therein are raised up accordingly. This causes a greater problem particularly for the foodstuff stored in the freezer compartment. It is important that foodstuff stored in freezer compartments is kept at the same temperature and is not subjected to any increase in temperature. Defrosting and opening/closing the door of the freezer compartment, and putting new foodstuff to be stored therein, however, negatively influence the temperature equilibrium in the freezer compartment. It is known that the defrost operation is the factor that mostly deteriorates this equilibrium. In the published patent application US4297852, representative of the prior art, is disclosed a cooling device that adjusts the defrosting time according to the duration during which a door of a cooling device is left open. That application, however, provides no solution in adjusting the defrosting time against the problem to arise when new foodstuffs are put to the freezer compartment.

Brief Disclosure of Invention

[0003] The method according to the present invention is developed for cooling devices capable to detect the defrosting time, wherein the starting time of a defrost process is regulated by this method. In a first step of this method, the data indicating that new foodstuff is placed to the freezer compartment of a cooling device is entered to the control unit of the cooling device by a user, then in a second step following this data entry, the device continues the cooling process, and thereafter in a third step, the user is alerted by means of a signal generator connected to the control unit after a while. In a fourth step of this method, new foodstuffs are put to the freezer compartment after said alert, and the cooling process is continued, and in a fifth step, if it is determined by the device that it is time to perform a defrost operation after new foodstuff is loaded to the compartment, this operation is delayed to a future time.

Objective of Invention

[0004] The objective of this invention is to maintain the temperature equilibrium of freezer compartments of cooling devices and to protect foodstuff stored in the compartment against spoilage.

[0005] Another objective of this invention is to regulate the defrost timing in the freezer compartment, thereby to increase the capacity of foodstuff to be frosted and at the same time to protect such foodstuff against spoilage.

[0006] A further objective of this invention is to delay the cooling device in starting the defrost operation after foodstuff is placed to the compartment, so that the temperature equilibrium is maintained.

[0007] Still a further objective of this invention is to provide an easily-implemented, reliable defrost regulation method.

Description of Graphs

[0008] The temperature-time graphs of the freezer compartment according to the present invention are given in annexed graphs briefly described hereunder.

Graph 1 provides temperature-time curves when the method according to the present invention is not used.

Graph 2 provides temperature-time curves when the method according to the present invention is used.

[0009] The abbreviations in the graphs are as follows.

Temperature curve of newly-loaded foodstuff versus time (A)

Temperature curve of the freezer compartment versus time (B)

Starting time of defrost operation (DT)

Description of Invention

[0010] As known, frost formation occurs sometimes on the cooling members (e.g. evaporators) disposed in the freezer compartments of cooling devices and reduce the cooling efficiency thereof. For this reason, the frost on the cooling members must be removed, i.e. it has to be defrosted. Additionally, the starting time of a defrost operation must be regulated. A defrost operation starting right after a foodstuff is placed to the freezer compartment, for instance, particularly leads to an increase in the temperature of foodstuffs previously placed to the compartment and already reached to a certain temperature equilibrium (staying at a desired constant temperature for a long time), or even causes such foodstuff to become spoiled. For this reason, the method according to the present invention allows to delay the starting of a defrost operation for a certain time (e.g. until a desired temperature equilibrium is established in the freezer compartment) in cooling devices capable of detecting the

defrost time, after foodstuffs are placed to the freezer compartment of such devices.

[0011] In the method according to the present invention, first the data that new foodstuff is placed to the compartment is entered by the user to the control unit of the device. This data entry can be made through a user interface (or a button) provided on the device. Following the data entry, the device keeps continuing the cooling operation under the operative conditions set by the user or under maximum performance.

[0012] After this operation is continued for a fixed or adjustable (via the user interface of device) time interval (this time interval may differ in each device according to their cooling performance), the user is alerted by a signal generator which is connected to the control unit of device. The signal generator is capable to provide an acoustic and/or visual alert. This alert may be continued until the door of the freezer compartment is opened by the user. Opening/closing the door of the freezer compartment by the user is signalized by means of at least one sensor disposed on the door to the control unit. After the user places new foodstuff to the compartment and closes its door, the starting of defrost operation is readjusted by the control unit.

[0013] This adjustment process is conducted in the form of delaying a potential defrost operation after new foodstuff is placed to the compartment. The time of the process of defrosting of the cooling element is detected by at least one temperature and/or humidity sensor, provided in the freezer compartment and connected to the control unit. If it is detected to start the defrost operation by the temperature sensors, the control unit delays the defrost operation to a future time thanks to the method according to the present invention. The starting of defrost operation (or the delay time) is allowed at the earliest after the temperature of newly-loaded foodstuff is lowered down to a desired (adjustable by the user interface) temperature level (e.g. the equilibrium temperature of the freezer compartment). Defrosting operation starts following this time and it is made before the temperature of previously-loaded frozen foodstuff in the compartment exceeds a certain level (the level above which it may spoil). Following the defrost operation, the device keeps running under normal or user-set conditions.

[0014] If it becomes necessary to place new foodstuff to the freezer compartment as the method according to the present invention proceeds, the method is applied back from the first step.

[0015] The results of tests performed in relation to this invention are indicated in the graphs provided in graphs annexed hereto. Accordingly, graph 1 provides temperature-time curves when the method according to the present invention is not used, whereas graph 2 provides temperature-time curves when the method according to the present invention is used. As illustrated in graph 1, the starting time of defrost operation (DT) corresponds to approximately 6 hours later than the time foodstuff is placed to the freezer compartment. Since foodstuffs are

not adequately cooled during this time interval, however, the temperature of the freezer compartment (indicated as curve "B") is increased in a prominent manner (from -18°C to -12°C). This, in turn, can lead to spoilage of any foodstuffs previously placed to the compartment. Additionally, it may give rise to the problem that any newly-placed foodstuffs are cooled later than usual (indicated as curve "A").

[0016] As illustrated in Graph 2, the starting time of defrost operation (DT) approximately corresponds to 18 hours later than the time foodstuff is loaded to the freezer compartment. Since foodstuffs are adequately cooled during this time interval, the temperature of the freezer compartment (indicated as curve "B") does not increase in a prominent manner. Since the temperature increase shall not be as high as in the case in which the method according to the present invention is not implemented (Graph 1), the amount of foodstuff to be frozen under a normal refrigeration cycle is thus increased with this method. In addition to this, since the temperature increase is on a negligible level, any spoilage of foodstuffs previously placed to the compartment is thus avoided. As a matter of fact, any newly-placed foodstuffs are cooled earlier (indicated as curve "A").

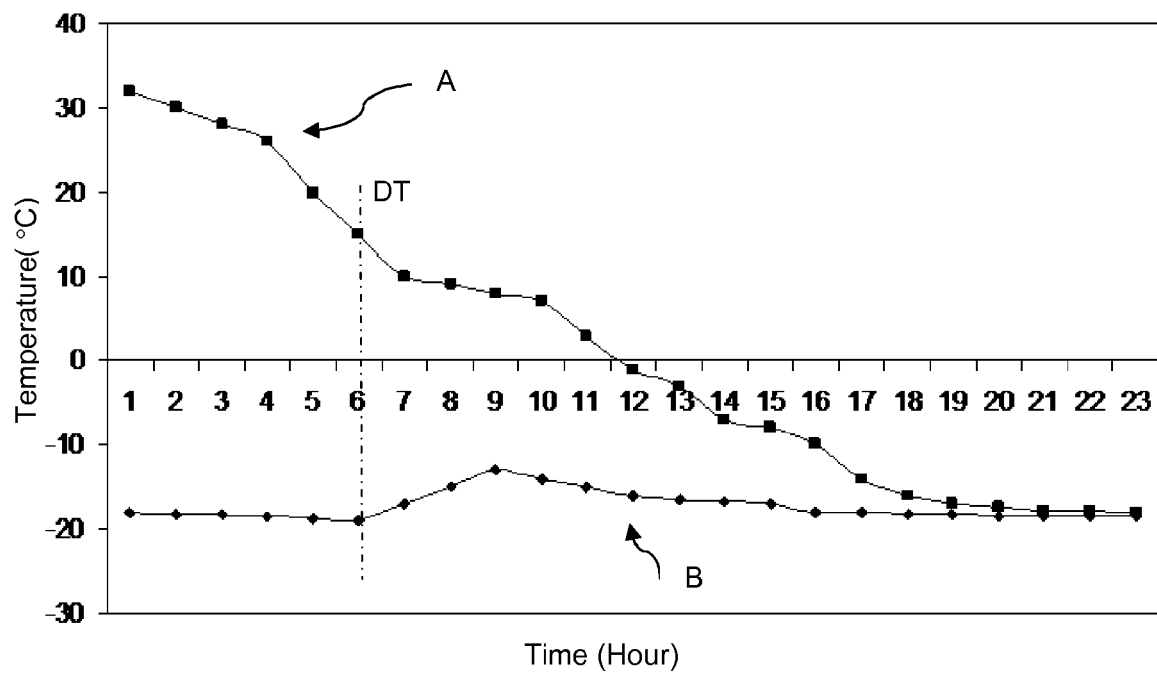
[0017] In brief, with implementing the method according to the present invention, both newly-placed foodstuffs are cooled down quicker, and no prominent increase occurs on the temperature of previously-placed foodstuffs. For this reason, the foodstuffs are stored under a better condition. Additionally, since the defrost operation is delayed, more foodstuff can be frozen now. In other words, the freezing capacity is enhanced.

Claims

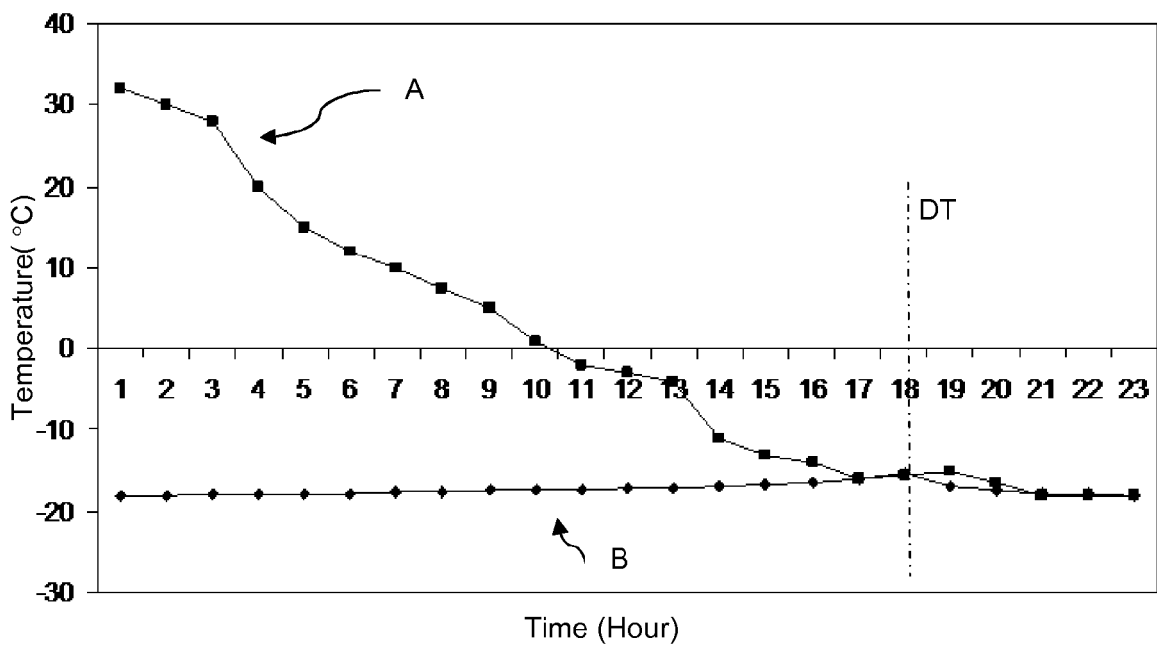
1. A method that adjusts the starting time of a defrost operation for cooling devices capable to detect the defrosting time, **characterized by** comprising respectively
 - i. a first step, at which the data that new foodstuff is placed to the freezer compartment of the cooling device is entered by the user to the control unit of the cooling device;
 - ii. a second step, at which following said data entry the device keeps continuing the cooling operation for a time interval;
 - iii. a third step, at which following the completion of said time interval, the user is alerted by a signal generator that works in connection with the control unit;
 - iv. a fourth step, at which new foodstuffs are placed to the freezer compartment after said alert and the cooling operation is kept running; and
 - v. a fifth step, at which if the device detects that it is time to start a defrost operation after new

foodstuffs are placed to the compartment, the defrost operation is delayed to a future time.

2. The method according to Claim 1, **characterized in that** the data entry in the first step is made via a user interface that is in connection with the control unit. 5
3. The method according to Claim 1, **characterized in that** in the second step, the cooling operation is kept continuing by the device under operative conditions determined by the user. 10
4. The method according to Claim 1, **characterized in that** in the second step, the cooling operation is kept continuing by the device under maximum cooling performance. 15
5. The method according to Claim 1, **characterized in that** in the second step, said time interval is adjustable on the user interface of the device. 20
6. The method according to Claim 1, **characterized in that** said signal generator provides acoustic and/or visual alert(s). 25
7. The method according to Claim 1, **characterized in that** in the third step, said alerting process is continued until the door of the freezer compartment is opened by the user. 30
8. The method according to Claim 1, **characterized in that** opening/closing the door of the freezer compartment is signalized to the control unit by means of at least one sensor disposed on the door. 35
9. The method according to Claim 1, **characterized in that** the starting time of a defrost operation is detected by at least one temperature and/or humidity sensor, provided in the freezer compartment and connected to the control unit. 40
10. The method according to Claim 1, **characterized in that** in the fifth step, the defrost operation is started at a temperature level set on the user interface. 45
11. The method according to Claim 1, **characterized in that** in the fifth step, the defrost operation is started once the temperature of the freezer compartment drops down to the equilibrium temperature. 50
12. The method according to Claim 1, **characterized in that** if it becomes necessary to load new foodstuff to the freezer compartment as the method proceeds, the method is applied back from the first step. 55



Graph - 1



Graph - 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4297852 A [0002]